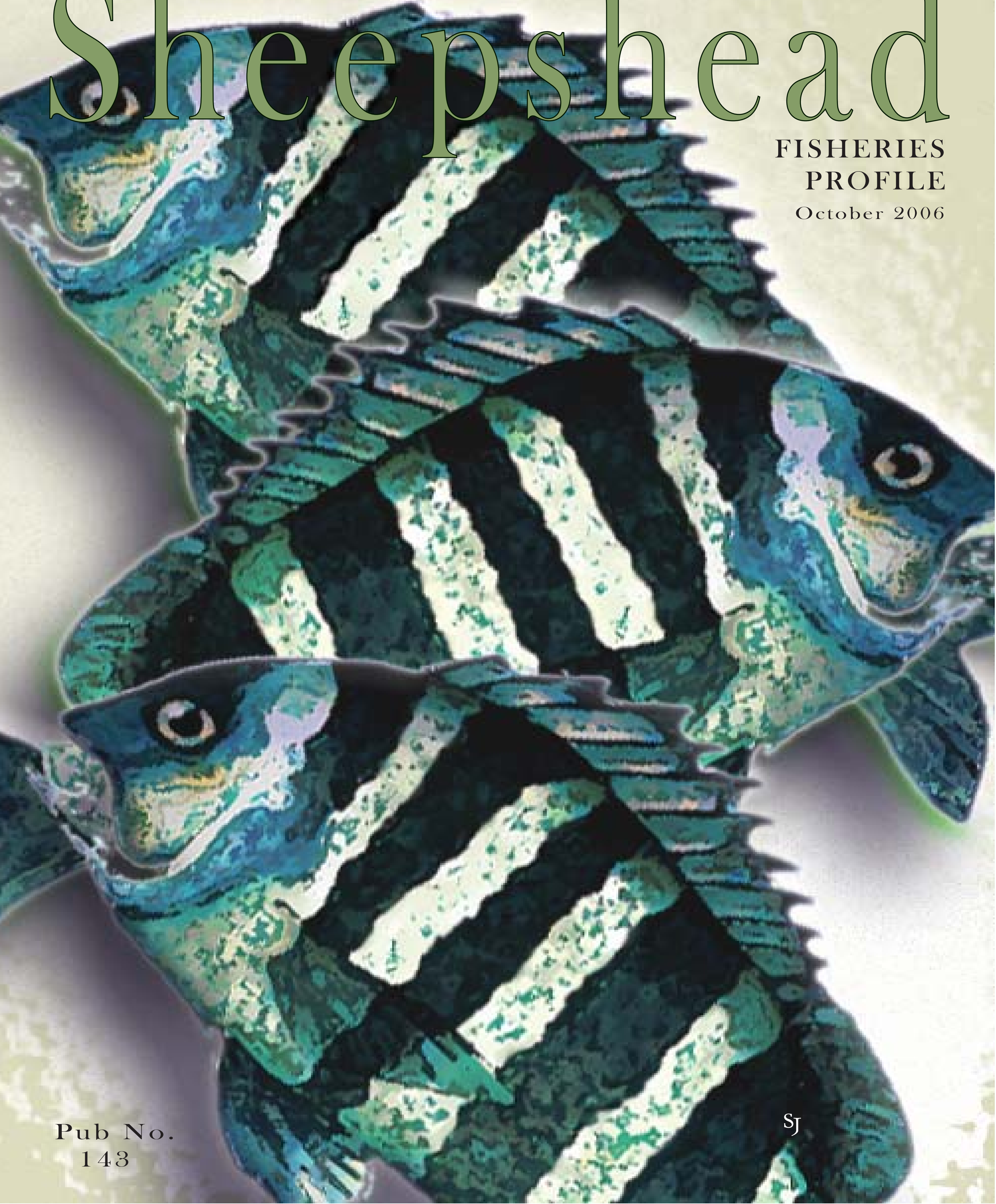
Gulf States Marine Fisheries Commission

# Sheepshead

FISHERIES PROFILE

October 2006

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# THE SHEEPSHEAD FISHERY OF THE GULF OF MEXICO, UNITED STATES:

## A Fisheries Profile

by the

Sheepshead Technical Task Force

edited by

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## Preface

The Gulf States Marine Fisheries Commission (GSMFC) was established by the Gulf States Marine Fisheries Compact under Public Law 81-66 approved May 19, 1949. Its charge is to promote 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 chairmen 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. The states, however, do not relinquish any of their rights or responsibilities to regulate their own fisheries as a result of 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 fishery management plans for important Gulf species.

The Sheepshead Profile is a cooperative planning effort of the five Gulf States under the IJF Act. Members of the task force contributed by drafting individually assigned sections. In addition, each member contributed their 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 wherever possible with the exceptions of reported landings data and size limits which, by convention, are reported in English units. A glossary of fisheries terms pertinent to this profile is provided in the appendix (Section 12.1). Recreational landings in this document are Type A and B1 and actually represent total harvest, as designated by the NMFS. Type A catch are fish that are brought back to the dock in a form that can be identified by trained interviewers and type B1 catch are fish that are used for bait, released dead, or filleted – i.e., they are killed but identification is by individual anglers. Type B2 catch are fish that are released alive – again, identification is by individual anglers and are excluded from the values in this profile.

The state of Mississippi has indicated that the reported recreational landings for several near-shore, estuarine species in the Marine Recreational Fisheries Statistics Survey (MRFSS) 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 and later MRFSS data.

# 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 |
| 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 |
| NMFS | National Marine Fisheries Service |
| NL | notocord length |
| n | number |
| 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 |
| SFFMC | 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

Sheepshead are a wide-ranging species distributed from Nova Scotia, through the northern Gulf of Mexico, and south to Brazil. Sheepshead have a long history of use along the Gulf Coast dating back to prehistoric native peoples. Sheepshead bones that date to the 1300's have been uncovered in archeological digs along the Mississippi coast. For the most part, these prehistoric fish were caught using the nets, traps, and possibly poisons available at that time. Part of their popularity is that they are euryhaline and found over most of the habitats occurring in the northern Gulf of Mexico including freshwater rivers and lakes, brackish estuaries, bayous, canals, saltwater bays, sounds, lagoons, and offshore waters. They are often found in association with oil rigs, oyster reefs, wrecks, jetties, and other structures with marine growth.

Adult sheepshead remain in inshore waters during the warmer months and move out of estuaries during periods of low temperature. They move to offshore spawning grounds in late winter and early spring, returning to nearshore waters after spawning although some adults appear to remain offshore year round.

Although their commercial and recreational value is not as great as other gulf species, they are an excellent quality food fish and anecdotal reports indicate that sheepshead are often substituted for snapper and other fish on restaurant menus. Sheepshead are primarily caught by recreational anglers in nearshore bayous, bays, rivers and other estuarine habitats, as well as offshore. Sheepshead are usually caught while fishing on or near the bottom using hook and line with rod and reel. They are most frequently found in association with structure because they graze chiefly on hard, rough reefs or in the grass. Preferred baits are cut crab and shrimp; some use hermit crabs, oysters, fiddler crabs, and sand fleas. While most anglers don't target sheepshead, very few will throw a large fish back. Sheepshead is often included as a target category in many recreational fishing tournaments.

With the reduced abundance and increased regulations on other Gulf species, more demand is being placed on sheepshead recreationally and commercially. Sheepshead landings in the Gulf of Mexico have steadily increased from 1950 to 1986, averaging 810,410 lbs, and then increased dramatically in 1987 to 3.3 million lbs, and remained relatively stable from 1987-1994 averaging 3.9 million lbs. Since 1994, however, commercial sheepshead landings have declined and almost dropped back to 1986 levels. In 1987, trawlers, particularly those off of Louisiana and west of the Mississippi River, began targeting sheepshead in late winter and early spring. This extra-targeted effort may account for some of the significant increases in landings from 1987 forward. Since 1981, commercial landings of sheepshead in the Gulf of Mexico, have averaged 89% of the total United States landings of sheepshead. Louisiana accounts for the majority of sheepshead landings along the Gulf coast.

The dockside value for sheepshead in the Gulf of Mexico exhibited an increasing trend from the mid 1970's until the mid 1990's which mirrors similar trends in commercial landings throughout the region. Overall, nominal exvessel price has increased from $0.08/lb in 1973 to $0.34 in 2003. A Gulf-wide peak of $0.36/lb was reported during 1995. Approximately two-thirds of the sheepshead purchased by wholesalers in the Gulf region was obtained directly from fishermen and another 29% was obtained from other wholesalers. The remaining volume (2%)

was obtained from other dockside buyers who purchase directly from fishermen. The majority of the sheepshead sold was in round or whole form, regardless of the source with only a small portion obtained as fillets. In addition, virtually all of the sheepshead was obtained in fresh, not frozen, form. About 38% was then sold to other wholesalers, 14% to retailers, 15% to restaurants, and 33% to retail consumers. Most sheepshead are sold to buyers within the same state. Across all respondents, only 10% of the total sheepshead marketed in 2003 was sold to buyers outside of the Gulf States.

Potential concerns in this fishery relate primarily to the actual pressure exerted on this species as other species become more limited through regulations. Considerations for this fishery include size limits, quotas and bags limits, and detailed analysis of fleet capacity. More information is required on the marketing of this species. Numerous anecdotal reports indicate that sheepshead may be the perfect substitution species. Not only has it been used in place of many other Gulf finfish, it has reportedly been steamed and used to bolster lump crab meat by blue crab processors. The flesh of the sheepshead has a very light flavor and takes on the flavor of whatever it is mixed with. As this is not a frequently targeted species by anglers and is an opportunistic fishery by commercial fishermen, it is not clear how much detailed population, age and growth, and maturity data are available. While a few states conduct stock assessments for sheepshead, the extent of the fishery may, in fact, be underestimated.

## 2.0 INTRODUCTION

On October 16, 2002, the State-Federal Fisheries Management Committee (SFFMC) agreed that sheepshead would be the next species (fishery) designated for IJF Profile/FMP development. Because of the popularity of this species, the lack of consolidated information regarding these fish and the fisheries, and the level of concern for the well being of stocks, the SFFMC concluded that a Gulf-wide species profile or FMP that includes the best available data was needed. The Sheepshead Technical Task Force was subsequently formed, and an organizational meeting was held July 22, 2003. After the initial profile was drafted in March 2005, the SFFMC reviewed the document and determined that based on the available data, a full FMP was not required at this time. Should the fishery change significantly and it become necessary to re-examine this fishery, the option exists to update the profile and implement management regulations in an FMP format.

### 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 other marine fishery commissions. The GSMFC decided to pattern its plans after those of the Gulf of Mexico Fishery Management Council (GMFMC) under the Magnuson Fishery Conservation and Management Act of 1976. This decision ensured 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 planning and approval process for the profiles and FMPs. The process has evolved to its current form outlined below:

| | | | | | | |
|---|---|---|---|---|---|---|
| **DMS** | | | | | | |
| ↕ | | | | | | |
| **TTF** | ↔ | **TCC** | ↔ | **SFFMC** | ↔ | **GSMFC** |
| ↕ | | | | ↕ | | |
| **SAT** | | | | **Outside Review** | | |

DMS = Data Management Subcommittee
SAT = Stock Assessment Team
TTF = Technical Task Force
TCC = Technical Coordinating Committee
SFFMC = 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 and is appointed by the respective state directors that serve on the SFFMC. Also, a TTF member from each of the GSMFC standing committees (Law Enforcement, Habitat Advisory, Commercial Fisheries Advisory, and Recreational Fisheries Advisory) is appointed by the respective committee. In addition, the TTF may include other experts in economics, socio-anthropology, population dynamics, and other specialty areas when needed. The TTF is responsible for development of the Profile/FMP and receives input in the form of data and other information from the DMS and the SAT.

Once the TTF completes the document, it may be approved or modified by the Technical Coordinating Committee (TCC) before being sent to the SFFMC for review. The SFFMC may also approve or modify the document before releasing it for public review and comment. After public review and final approval by the SFFMC, the document is submitted to the GSMFC where it may be accepted or rejected. If rejected, the document is returned to the SFFMC for further review.

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

## 2.2 Sheepshead Technical Task Force

| | |
|---|---|
| Jessica McCawley | Florida Fish & Wildlife Conservation Commission |
| John Mareska | Alabama Department of Conservation & Natural Resources, Marine Resources Division |
| Erick Porche | Mississippi Department of Marine Resources |
| Jason Adriance | Louisiana Department of Wildlife & Fisheries |
| Perry Trial | Texas Parks & Wildlife Department |
| Charles Adams | Florida Sea Grant College Program (economist) |
| Jeff Mayne | Louisiana Department of Wildlife & Fisheries (enforcement representative) |
| Paul Cook | Louisiana Department of Wildlife & Fisheries (habitat representative) |
| Mike Brackin | Breakaway Charters (recreational representative) |
| Michael Jepson | Impact Assessment, Inc. (sociologist) |
| Harlon Pearce | Harlon’s LA Fish LLC (commercial representative) |

## 2.3 GSMFC Interjurisdictional Fisheries Program Staff

Larry B. Simpson, Executive Director
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## 2.4 Authorship and Support for Plan Development

| | |
|---|---|
| Section 1.0 | Staff |
| Section 2.0 | Staff |
| Section 3.0 | Trial, Mareska, and McCawley |
| Section 4.0 | Cook |
| Section 5.0 | Mayne and All |
| Section 6.0 | Adriance and All |
| Section 7.0 | Adams |
| Section 8.0 | Jepson |
| Section 9.0 | All |
| Section 10.0 | All |
| Section 11.0 | All |
| Section 12.0 | All |

## 2.5 Profile Objectives

The objectives of the Sheepshead Profile are:

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

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

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

4. To ascertain optimum benefits of the sheepshead fishery of the United States Gulf of Mexico to the region while perpetuating these benefits for future generations.

## 3.0 DESCRIPTION OF THE STOCK

### 3.1 Geographic Distribution

Sheepshead are distributed from Nova Scotia, through the northern Gulf of Mexico, and south to Brazil. Sheepshead are absent from any of the Caribbean Islands.

### 3.2 Biological Description

#### 3.2.1 Classification and Morphology

##### 3.2.1.1 Classification

Phylum: Chordata
Subphylum: Vertebrata
Class: Osteichthyes
Superorder: Acanthopterygii
Order: Perciformes
Suborder: Percoidei
Family: Sparidae
Genus: *Archosargus*
Species: *probatocephalus*

The valid scientific name for the sheepshead is *Archosargus probatocephalus* (Walbaum) 1792.

*Spargus,* Schopf 1788
*Spargus probatocephalus,* Walbaum 1792
*Spargus ovicephalus,* Bloch and Schneider 1801
*Spargus ovis,* Mitchill 1814
*Diplodus probatocephalus,* Jordan and Gilbert 1882
*Archosargus probatocephalus,* Jordan and Fesler 1893

Sheepshead is the valid common name endorsed by the American Fisheries Society (Nelson et al. 2004). Other colloquial names include rondeau mouton (French), tete de mouton (Louisiana French), sargo chopa, pargo, rondeau mouton sargo (Spanish), kubinsky morskoi karaś (Russian), sargo-choupa (Portuguese), sparus owczarz (Polish), sheepshead bream, bay snapper, sheepshead porgie, convict fish, striped bandit, rondeau seabream, jailhouse snapper, silver snapper, and goats.

##### 3.2.1.2 Morphology

The following description is paraphrased or verbatim from Johnson (1978) except where noted otherwise.

### 3.2.1.2.1 Eggs

Tucker and Alshuth (1997) describe sheepshead eggs as planktonic, a clear yolk, and a single yellow oil globule. The mean diameter of live eggs 2.5 hrs after fertilization was 824 µm. Prior to hatching the embryo had sparse pigmentation on the snout and behind the eye.

### 3.2.1.2.2 Larvae

Development of adult characteristics begins at approximately 5 mm SL. The seven vertical crossbars are distinguishable and the body is covered with scales by 12 mm SL. The lateral line appears interiorly at 10-12 mm and is fully developed by 15-18 mm SL. All fin elements obtain adult counts by 18 mm. Between 18-25 mm adult proportions and coloration are obtained.

### 3.2.1.2.3 Juveniles

At 25-30 mm SL dorsal and anal spines proportionately as long as in adult, caudal fin slightly forked, and pelvic spine fully developed. Eye diameter reduces considerably in proportion to fish length with growth. Shining black crossbars are separated by silvery spaces; dorsal dusky, membranous spinous portion with a black edge; anal fin black; white pectoral fins; pelvic fins blue-black; tail white; a round humeral spot larger than pupil, partly in second crossbar and partly in first interspace, on level with upper half of eye.

### 3.2.1.2.4 Adults

Sheepshead are greenish yellow to grayish in color; sides have six black crossbars not counting the incomplete head bar and only five bars on one or both sides in the Gulf of Mexico populations west of Alligator Harbor, Florida; dorsal, anal, and pelvic fins are mostly dusky or black and caudal and pectoral fins are greenish. Body stout, deep, moderately compressed; back elevated, head short, deep, snout short; mouth horizontal, maxillary reaching about to anterior margin of eye, slipping under lacrimal for all or most of its length. Scales ctenoid. Dorsal fin continuous, with strong spines, preceded by a procumbent spine; caudal fin slightly forked; pectoral fins long, reaching beyond anal origin; pelvic fins not reaching anus.

Maximum size: Current world record is 9.63 kg (21 lb 4 oz) (IGFA 2001)
Average size: 280 up to 500 mm FL are not rare

> D. X to XII, 10-13, typically XII, 11; A. III, (9) 10-11; C. 9 + 8, procurrent rays 8-9 + 7; P. 15-17; V. I, 5, axillary process well developed; scales 44-50 in lateral series, lateral line scales 41-53; vertebra 10 + 14; gill rakers short, 6-9 on lower limb of first arch, anterior teeth incisiform, entire or slightly notched, 3 above and 4 below; posterior teeth molariform, 3 series above and 2 below; vomer and palatines without teeth.
>
> Head 3-3.3, depth *1.9-2.5,* pectoral fin *2.5-3.7* in standard length; snout 2.1-2.6, eye *2.7-4.5,* maxillary 2.7-3.3 in head.

### 3.2.2 Age and Growth

Larval and juvenile sheepshead from Bayboro Harbor, Florida, were aged using sagittal otoliths (Parsons and Peters 1989). Larvae transformed at about 8 mm SL between 30 and 40 days after hatching (dah). Forty-five dah, most were between 9 and 10 mm SL. Laboratory reared sheepshead hatchlings had mean body lengths (BL) of 1.65 mm and had reached 3.5 mm BL by 7 dah (Tucker 1987). Larvae were 5 mm BL by 15 dah and 10 mm by 30 dah when transformation to the juvenile stage was complete. Springer and Woodburn (1960) reported that juveniles from the Tampa Bay, Florida area averaged 21 mm SL, 29 mm SL, and 42 mm SL in June, July, and August respectively, while juveniles collected in Beaufort, North Carolina averaged 12.8 mm TL, 21.8 mm TL, 36.6 mm TL, and 42.1 mm TL in June, July, August, and September respectively (Hildebrand and Cable 1938).

Adult fish have been aged in Georgia and North Carolina using scales (Music and Pafford 1984, Schwartz 1990). However, because scales of sheepshead older than 2-4 yrs are difficult to read, age may be underestimated when determined by reading scales (Schwartz 1990, Wenner 1996, Dutka-Gianelli and Murie 2001). Sheepshead have been aged from Louisiana, South Carolina, Georgia, Alabama, and NW Florida using sectioned sagittal otoliths (Beckman et al. 1991, Wenner 1996, Dutka-Gianelli and Murie 2001, ADCNR/MRD unpublished data, Fortuna et al. unpublished data). The length at age relationships are described by the Von Bertalanffy equations listed in Table 3.1.

Maximum age recorded in these studies ranged from 26 yrs in South Carolina to 15 yrs in NW Florida. Maximum size collected ranged from 522 mm FL in NW Florida to 580 mm FL in Georgia. The world record sheepshead from Louisiana was 657 mm FL (25.6 inches) weighing 9.66 kg (21.3 lbs). In general, growth coefficients derived from these studies indicate that sheepshead exhibit rapid growth during the first 3-4 yrs of life, achieving approximately 80% of their theoretical maximum size by age-5. Thereafter growth slows considerably. Subsequently, length is a poor predictor of age after 2 to 3 yrs of age as an asymptotic length is approached.

Sex does not appear to influence sheepshead growth in most areas studied. Only Beckman et al. (1991) found significant differences in growth patterns between sexes with females being larger than males. However, variation in theoretical maximum size, as well as growth rate occurred across the geographic range of the areas studied. For example, sheepshead in Louisiana grew faster than in other areas, but did not reach as large of a size as did fish from Georgia, South Carolina, Florida, and Alabama (Figure 3.1). Growth curves for sheepshead from Georgia and Florida were similar, and growth curves from South Carolina and Alabama were similar. Fish from Georgia and Florida grew slightly slower than fish from South Carolina and Alabama. Fish from all four of these states reached a theoretical maximum size of about 500 mm FL compared to less than 450 mm FL for female sheepshead in Louisiana. Observed differences among geographic regions may be the result of several factors including differences in mortality rates, differences in environmental conditions, genetic variation, or sampling biases due to gear selectivity (Dutka-Gianelli and Murie 2001).

**Table 3.1** Length-at-age relationships for sheepshead. **Note:** Wenner (1996) equation was derived from Total Lengths (TL). All other equations are derived from Fork Lengths (FL).

| | |
|---|---|
| Alabama Marine Resources Div. (Unpublished data)-Alabama | Combined (FL) $L_t = 491(1-e^{-0.3237(t+0.4734)})$<br>Males (FL) $L_t = 480(1-e^{-0.3434(t+0.3545)})$<br>Females (FL) $L_t = 495(1-e^{-0.3438(t+0.2840)})$ |
| Fortuna et al. (unpublished data)-Georgia | Combined (FL) $L_t = 498(1-e^{-0.2188(t+0.8006)})$<br>Males (FL) $L_t = 495(1-e^{-0.2327(t+0.4935)})$<br>Females (FL) $L_t = 502(1-e^{-0.2121(t+0.8807)})$ |
| Dutka-Gianelli and Murie (2001)-NW Florida | Combined (FL) $L_t = 490.4(1-e^{-0.26(t+0.42)})$ |
| Wenner (1996)-South Carolina | Combined (TL) $L_t = 559(1-e^{-0.2872(t+1.109)})$ |
| Beckman et al. (1991)-Louisiana | Males (FL) $L_t = 419(1-e^{-0.417(t+0.901)})$<br>Females (FL) $L_t = 447(1-e^{-0.367(t+1.025)})$ |

### 3.2.3 Reproduction

Sheepshead are gonochoristic, group synchronous, fractional spawners (Render and Wilson 1992, Pattillo et al. 1997).

#### 3.2.3.1 Gonadal Development

Most sheepshead attain maturity by age-2 (Tucker 1987, Wenner 1996). In South Carolina, no fish less than 250 mm were mature, and all fish greater than 390 mm were mature (Wenner 1996). Gonadosomatic indices have been used to predict reproductive activity in adult sheepshead from Louisiana, South Carolina, and Georgia (Render and Wilson 1992, Wenner 1996, Fortuna et al. unpublished data). Gonadosomatic index values began increasing in January, peaked in March and April, and declined in May to baseline levels. Gonadosomatic indices are useful for predicting the onset, peak activity, and cessation of reproductive activity;

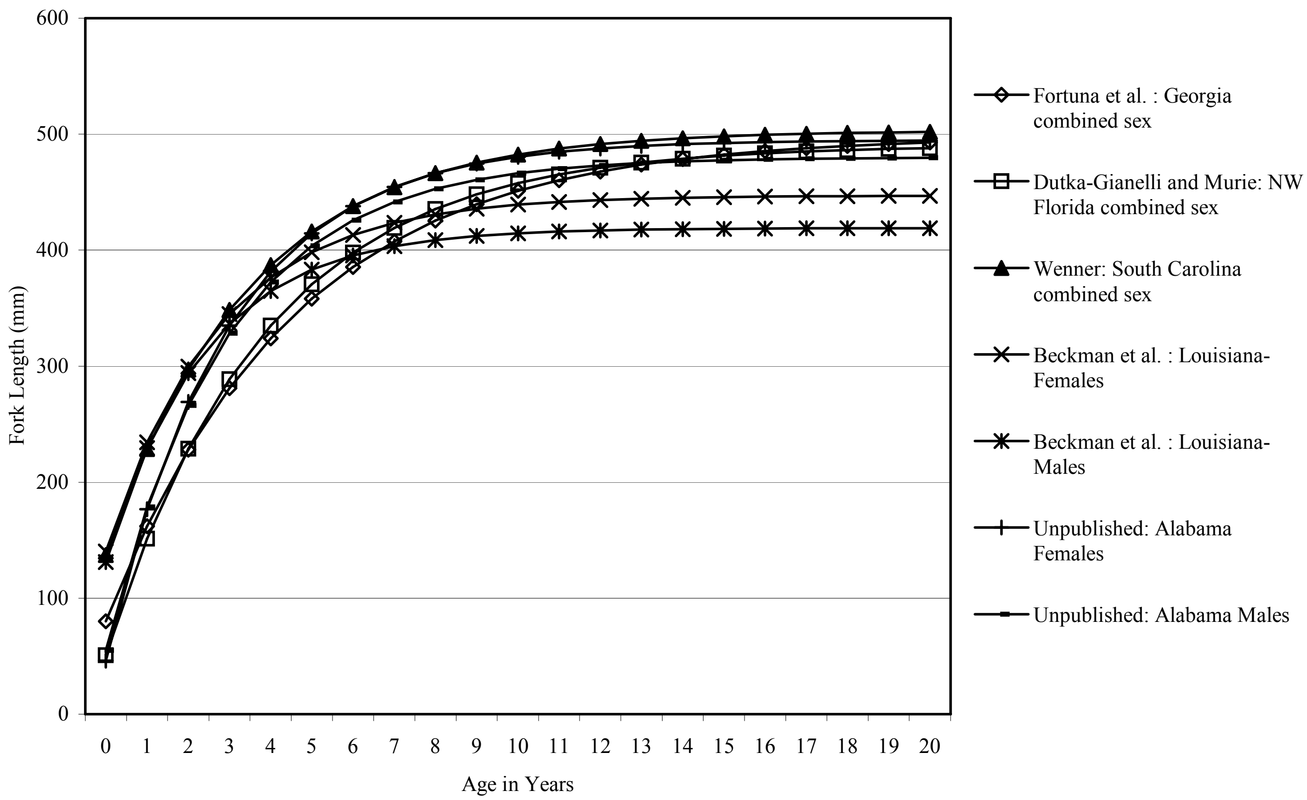


**Figure 3.1** Length-at-age relationships for sheepshead using Von Bertalanffy growth equations in Table 3.1 (lengths from Wenner 1996 were converted to FL using the conversion factor given in his report).

however histological examination of gonads is necessary for identification of specific reproductive events. The results of histological examination of the ovaries of sheepshead from Louisiana corresponded well with the gonadosomatic index values reported for sheepshead (Render and Wilson 1992). Primary growth oocytes were present in the ovaries of sheepshead from Louisiana all year and were the only developmental stage present from May through November. In December cortical aveolar oocytes were first detected and persisted through April. Vittelogenic and hydrated oocytes appeared in late February indicating that the fish were approaching spawning condition. Postovulatory follicles were present in samples collected from March through April indicating that spawning had recently occurred.

### 3.2.3.2 Spawning

Sheepshead are group synchronous fractional spawners (Render and Wilson 1992). Based on gonadosomatic indices and histological examination of sheepshead ovaries, spawning occurs in the springtime with peak activity in March and April (Render and Wilson 1992, Wenner 1996, Fortuna et al. unpublished data). Rathbun (1892) reported that spawning occurred on sandy beaches in Florida, but it appears more likely that sheepshead spawn on or near structure in offshore waters (Springer and Woodburn 1960). Large aggregations of sheepshead have been observed offshore near reefs and artificial structure prior to and during spawning season (Springer and Woodburn 1960, Jennings 1985, Fortuna et al. unpublished data), and in Florida Bay, tagged sheepshead disappeared from inshore waters in late winter (Bryant et al. 1989). Lukens (1980) observed an aggregation of sheepshead actively spawning over an artificial reef in 14 m of water offshore of Mississippi in March. In April the following year, he observed a second aggregation in the same location. They appeared to have been spent. In Georgia, 98% of spawning sheepshead were captured on or near offshore reef habitat (Fortuna et al. unpublished data). Larvae have been collected in offshore waters (<25 m) from January through May with peak abundance occurring from February through April (Ditty et al. 1988).

#### 3.2.3.3 Fecundity

Render and Wilson (1992) reported that batch fecundity for sheepshead from Louisiana ranged from 1,100 to 250,000 eggs/batch, and averaged 47,000 eggs/batch overall; however, significant differences in fecundity were observed between fish from inshore and offshore areas. Fecundity of fish from offshore areas ranged from 14,000 to 250,000 eggs/batch and averaged 87,000 eggs/batch while the fecundity of fish from inshore areas ranged from 1,100 to 40,000 eggs/batch and averaged only 11,000 eggs/batch. Because sheepshead spawn offshore, batch fecundity estimates for offshore fish may have more biological significance than those from inshore fish. Fecundity estimates from Georgia were much higher than those from Louisiana. Fish 428-591 mm TL and 4-14 yrs old had fecundities ranging from 296,000 to 963,000 eggs/batch and averaged 604,559 (Music and Pafford 1984).

#### 3.2.3.4 Incubation

Sheepshead eggs incubated in the laboratory at 23°C and 35.5 ppt, hatched 28 hrs. after fertilization (Tucker 1987). Rathbun (1892) reported that eggs required about 40 hrs. to hatch.

#### 3.2.3.5 Larval Transport

Pelagic eggs are fertilized and hatch in offshore waters (Hildebrand and Cable 1938, Ditty et al. 1988). On-shore currents transport larvae to inshore waters where transformation into juveniles is completed (King 1971, Parsons and Peters 1989, Pattillo et al. 1997). King (1971) observed larvae immigrating to Mesquite Bay, Texas, from the Gulf of Mexico through Cedar Bayou Pass from January through May with peak abundance of larvae occurring in late February and March. Juvenile sheepshead with a mean size of 10 mm TL were collected in the mouth of Biloxi Bay, Mississippi, in April (Lukens 1980).

### 3.2.4 Genetics

Caldwell (1965) suggested subspecific status for three variants of sheepshead based on the number and width of vertical stripes on the side of the body. Researchers from the Florida's Fish and Wildlife Research Institute (FWRI) used mitochondrial and nuclear DNA sequencing techniques to examine the question of whether or not such a distinction is valid (FWRI unpublished report). They concluded that gene flow was high throughout the species' range within the United States and molecular variation was not associated with stripe-count morphology.

> "Overall, there is not sufficient evidence at this time to suggest that sheepshead should be subdivided regionally for assessment" (FWRI unpublished report).

### 3.2.5 Migration and Movements

Sheepshead are not considered a true migratory species, but they do exhibit some inshore and offshore movement (Jennings 1985). Larval sheepshead are transported from offshore waters to inshore areas by currents (King 1971, Ditty et al. 1988, Parsons and Peters 1989). Following transformation from the larval phase, juvenile sheepshead settle into grassbeds (Hildebrand and Cable 1938, Springer and Woodburn 1960). They remain in these areas until late summer or early fall when they reach a size between 35-50 mm SL at which time they move to adult habitat around jetties, oyster reefs, rocks, pilings, mangrove shorelines, and other areas containing hard substrate (Hildebrand and Cable 1938, Springer and Woodburn 1960, Odum et al. 1982). Hildebrand and Cable (1938) suggested that movement from grassbeds to areas containing hard substrate might be related to an ontogenetic shift in diet associated with the development of adult dentition. In some areas, sheepshead may remain associated with grass beds as adults. Gunter (1945) and Simmons (1957) found that adult sheepshead in south Texas bays fed heavily on vegetation. In south Texas, adult sheepshead are commonly observed on seagrass beds (P. Trial personal communication). In late fall, sexually mature adults inhabiting inshore areas move offshore and congregate around reefs and other hard substrates (Springer and Woodburn 1960, Jennings 1985, Fortuna et al. unpublished data). Several authors have reported that sheepshead are commonly associated with Gulf of Mexico offshore hard bottom formations in depths up to 37 m (Springer and Woodburn 1960, Sonnier et al. 1976, Lukens 1980, Putt et al. 1986). They remain offshore until spawning is over in late spring when some portion of the adult population returns to inshore areas (Jennings 1985) although there is evidence that some adult fish remain offshore year round (Hastings et al. 1975, Sonnier et al. 1976, Lukens 1980, Sedberry 1987).

### 3.2.6 Parasites and Diseases

Sheepshead may act as a host to a myriad of parasites and pathogens, none of which are known to endanger populations of the species (Jennings 1985). Oxygen depletion in semi-open and closed canals has resulted in death in the species (Pattillo et al. 1997).

The algae *Enteromorpha intestinalis* was found by Schwartz (1992) growing on broken dorsal and anal fin spines as well as areas of abraded skin or scales lost on the body and opercle on sheepshead 350-420 mm SL. Occasionally these growths reached up to 150 mm long from the opercle or in areas where there were skin abrasions or scales had fallen off. The sheepshead made no attempt to rub off or remove these growths. No growths were observed on undamaged areas of the fish.

Infestations of the ciliate *Epistylis sp*., the agent causing "red sore disease" (Rogers 1970), have been found to cause extensive hemorrhaging and epithelial hyperplasia in the areas surrounding the ciliate colony. In some cases, the lesions become deep enough to expose bone (Overstreet and Howse 1977).

Linton (1905) observed a small white patch on the pectoral fin of a sheepshead containing spores identical to *Myxobolus sp.* found in the intestinal walls of red drum (*Scianops ocellatus*) and pompano (*Trachinotus carolinus*).

Sheepshead serve as a secondary host to the myxosporidan *Fabespora vermicola* (Overstreet 1978). This species infects a fluke inhabiting the intestine of the sheepshead. Neither sheepshead with or without the fluke has been found to have myxosporidian infections.

Many digenetic trematodes have been observed in the gut of sheepshead. *Multitestis rotundum* (Sparks 1957), *Proctoeces maculates* (Wardle 1980), and *Cotylogaster basiri* (Hendrix and Overstreet 1977) have been found in the hindgut of sheepshead. *Megasolena archosargi* has been found in the mid-intestine (Sogandares-Bernal and Hutton 1959), and *Lepocreadium archosargi* has been found in the stomach of sheepshead (Corkum 1959).

The nemotode *Hysterothylacium reliquens* (Deardorff and Overstreet 1980), formerly *Thynnascaris reliquens* (Norris and Overstreet 1975), has been recovered from sheepshead from the Mississippi Sound. Mature *H. reliquens* inhabit the intestine pyloric ceca and occasionally the stomach.

Overstreet (1978) also observed the isopod *Lironeca ovalis* on the gills of sheepshead. Claws hold the parasite to the gills or the adjacent regions of the host, often eroding away the filaments of several gills, and inviting secondary infections. Caligid copepods have also been taken from the gills of sheepshead.

### 3.2.7 Predator-Prey Relationships

Larval sheepshead are carnivorous, generally feeding on copepods, amphipods and other zooplankton. Smaller juveniles may feed on polychaetes, chironomid larvae, mysids, and zooplankton (Pattillo et al. 1997, Benson 1982). Ostracods were also found as a primary food source for fishes less than 30 mm (Hildebrand and Cable 1938). Springer and Woodburn (1960) found mostly gammarids, copepods, and polychaetes and instances of *Crepidula* in the stomachs of sheepshead under 50 mm. Odum and Heald (1972) also found small mollusks incorporated into the diet of sheepshead moving from Florida grass beds into regions with harder substrates at lengths beginning at 35-40 mm. Large juveniles and smaller adults eat young oysters, clams and other mollusks, blue crabs, other crustaceans, and small fish (Benson 1982).

Adult sheepshead are hardly fastidious eaters, feeding on a large variety of organisms. Over 113 different species were identified by Overstreet and Heard (1982) including bryozoans, ascidians, echinoderms, young oysters, clams and other bivalves, blue crabs, barnacles and other crustaceans, and small fish from the stomachs of 125 sheepshead from the Mississippi Sound. Sedberry (1987) identified 125 different species from the stomachs of 42 adult sheepshead caught offshore (23–37 m water depth). Bryozoans, pelecypod mollusks and barnacles were found in more than 70% of stomachs with food. Amphipods and ascidians were found in 50% of the stomachs. By volume, bryozoans, ascidians, echinoids and pelecypods were the most common. Hydroids, anthozoans, polychaetes and amphipods were also found. Ogburn (1984) also found foraminiferans, cnidarians, polychaetes, gastropods, and small arthropods in the stomachs of sheepshead over 350 mm SL. Adult sheepshead are typically bottom feeders, but occasionally graze on pilings and other encrusted structures and substrates, using their sharp incisors to shear off prey (Overstreet and Heard 1982). When sea-grasses or algae are plentiful, sheepshead have been known to graze heavily on the available vegetation. Vegetation has been reported as a dietary item in juveniles and adults by Overstreet and Heard (1982), Ogburn (1984), Darnell (1958), Fontenot and Rogillio (1970), Gunter (1945), and Simmons (1957).

Not only are sheepshead ontogenetic in their feeding habits, they have been observed to change diet depending on the season. Mollusks, crustaceans, and other animals remain the main food sources year round (Overstreet and Heard 1982). Fishes were also commonly preyed on in spring. Plants and detritus were fed on most commonly in the summer, with polychaetes occurring more frequently in diet during the spring, autumn, and winter than in summer (Table 3.2).

Although only a few studies have been done on the feeding habits of sheepshead, their general feeding behavior is fairly well understood. Overstreet and Heard (1982) stated that there are no regional changes in general feeding behavior. The species composition of diet did change, however, reflecting the habitat of the fish. Fish from the higher salinity, near-barrier island habitat of the Mississippi Sound contained almost twice the prey species compositionally than those collected from esturine habitats with some overlap. Overlapping prey species contained in more than three fish from both environments of the Mississippi Sound include *Nassarius acutus* (gastropod), *Mulinia lateralis* (pelecypod), and *Molgula manhattensis* (tunicate).

Because sheepshead feed heavily on live bottom, sessile invertebrates, they may be important to controlling the fouling community and contributing to the diversity of the live bottom fauna. Sedberry (1987) states that some of the most common prey species found in sheepshead [*Schizoporella errata* (bryozoan), *S. cornuta* (bryozoan), and *Styela plicata* (ascidiacid)] are also some of the most opportunistic and prolific species colonizing live bottom communities. Predation of these space monopolizing species, may reduce their abundance, allowing greater epifaunal diversity on live bottom communities.

Predation by sheepshead may also contribute to the regulation of the structure of live bottom motile epifauna communities. Some of the most abundant motile prey species found in sheepshead, such as *Erichthonius brasiliensis* (amphipod) and *Caprella equilibra* (amphipod), are very prolific and opportunistic colonizers of live bottom communities. By feeding on these opportunistic species, sheepshead may allow for more diversity of motile epifauna (Sedberry 1987).

**Table 3.2** Prevalence of dietary groups relative to season in the stomachs of *Archosargus probatocephalus* from Mississippi Sound (from Overstreet and Heard 1982, Table 5).

| | Season | | | | |
|---|---|---|---|---|---|
| | **Winter** | **Spring** | **Summer** | **Autumn** | **Total** |
| **Number of fish examined** | 29 | 48 | 37 | 28 | 142 |
| **Number of fish with food** | 22 | 41 | 34 | 28 | 125 |
| **Food Items** | **Percent Occurrence** | | | | |
| Polychaetes | 50.0 | 36.6 | 8.8 | 32.1 | 30.4 |
| Molluscs | 59.1 | 53.7 | 58.8 | 67.9 | 59.2 |
| Crustaceans | 59.1 | 75.6 | 47.1 | 57.1 | 60.8 |
| Fishes | 9.1 | 31.7 | 2.9 | 17.9 | 16.8 |
| Other animals | 54.6 | 41.5 | 61.8 | 60.7 | 53.6 |
| Plants | 0.0 | 4.9 | 20.6 | 10.7 | 9.6 |
| Detritus | 9.1 | 4.9 | 20.6 | 14.3 | 12.0 |

Little is known about predation on sheepshead, but it is likely that larvae and juveniles could be utilized as a food source by larger predatory fishes (Pattillo et al. 1997). Although it has not been observed in a natural setting, Schwartz (1992) noted the attachment of the sharksucker (*Echeneis naucrates*) on sheepshead in captivity. Released into a holding tank with three sheepshead and two sea robins, the sharksucker immediately associated itself with a 365 mm SL sheepshead. The sharksuckers attachment disc eroded and rasped away scales and skin, killing the sheepshead in 55 days.

## 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."
>
> *Federal Register* 67(12):2343-2383. Final Rule.

For the purposes of describing those habitats that are critical to sheepshead in this bioprofile, this definition was utilized; however, these areas are referred to as "essential habitat" to avoid confusion with 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 require federal agency consultation regarding proposed adverse impacts to those habitats. Essential habitats identified in the sheepshead bioprofile are not associated with the federal mandate since the species in the Gulf is not federally managed under the Magnuson-Stevens Act.

### 4.2 Gulf of Mexico

Sheepshead are basically nonmigratory (Section 4.4). Spawning occurs throughout the late winter and early spring (Section 4.5) over nearshore continental shelf waters. An overview of the prevailing Gulf circulation, sediments, and inshore nursery characteristics is key in understanding how young sheepshead 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. (1983), and the Gulf of Mexico Fishery Management Council (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 approximately 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). The Loop

Current and major episodic freshwater discharge events from the Mississippi/Atchafalaya Rivers influence oceanographic conditions throughout the Gulf. 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 the habitat for an estimated 95% of the finfish and shellfish species landed commercially and 85% of the recreational catch of finfish (Thayer and Ustach 1981). Four of the top ten commercial fishery ports in the United States are located in the Gulf and account for an estimated 1.19 billion lbs of fish and shellfish harvested annually from the Gulf (USDOC 2003). 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 2003). 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 buffer the coastal mainland from hurricanes and lesser storm events.

### 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 (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 which 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). Quartz sand sediments are found relatively nearshore from Mississippi eastward across Alabama and the Panhandle and west coast of Florida. Due to the influence of the Mississippi and Rio Grande rivers, fine sediments (i.e., silt and mud) are common in the western Gulf and south of the 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 a band of coarser quartz sand interrupts them. 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 Bay to Mobile Bay it covers the entire shelf, except the immediate flank of DeSoto Canyon. The outer 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 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), extending from Florida Bay to the Lower Laguna Madre. The Cooperative Gulf of Mexico Estuarine Inventory (GMEI) reported 5.62 million ha of estuarine habitats in the Gulf States including 3.2 million ha of open water and 2.43 million ha of emergent tidal vegetation (Lindall and Saloman 1977). Emergent tidal vegetation includes 174,000 ha of mangrove and one million ha of salt marsh; 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%) while the largest expanses of mangroves (162,000 ha) are located along the southern Florida coast (GMFMC 1998).

### 4.2.4 Submerged Vegetation

Submerged vegetation comprised an estimated 1,475,000 ha of seagrasses and associated macroalgae in the estuarine and shallow coastal waters of the Gulf (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).

### 4.2.5 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 more than 60% of the entire marsh habitat in the Gulf (GMFMC 1998). They include a diverse number of species including black mangrove, saltgrass, wiregrass, saltwort, threecorner grass (*Scirpus olneyi*), 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, Chabreck et al. 2001).

Mississippi and Alabama have a combined 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*), 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 bullwhip (*Scirpus californicus*). In addition, the Mississippi Sound barrier islands 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 Regional Area Description

### 4.3.1 Eastern Gulf

The eastern Gulf of Mexico extends from Florida Bay northward to Mobile 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. Wide, sand beaches situated either on barrier islands or on the mainland itself characterize the coast from Apalachee Bay to the Alabama border. 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. Approximately 9,150 ha of estuarine area, principally in the Tampa Bay area, have been filled for commercial or residential development.

Coastal waters in the eastern Gulf may be characterized as clear, nutrient-poor, and highly saline. Rivers that 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. Sand barrier islands and associated bays and marshes dominate the eastern and central Louisiana coasts. The most extensive coastal salt marshes in the United States are associated with the

Mississippi/Atchafalaya river deltas. Annual wetlands loss along the Louisiana Coastal Zone for the period of 1978 through 2000 is estimated to be 7,744 ha/yr (Barras et al. 2004) and accounts for 90% of the total coastal marsh loss occurring in the nation (USACOE 2004). The shoreline of the western one-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 that are characterized by high-energy sand beaches grading to saltwater marshes with interior freshwater marshes. The mainland shoreline is made up of saltwater marsh, beach, seawall, and brackish-freshwater marsh in the coastal rivers. In 1968, approximately 26,000 ha of mainland marsh existed in southern Mississippi and salt marsh on the barrier islands covers 860 ha (GMFMC 1981).

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 mainland 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). Vittor and Associates (2004) mapped coastal Alabama's submerged aquatic vegetation (SAV). Sixteen species of SAV were identified covering 2,718.2 ha. Wild celery (*Vallisneria neotropicalis*) had the greatest acreage (686.4 ha) and dominated the delta of upper Mobile Bay. Shoal grass (*Halodule wrightii*) was the dominant marine species. Continuous beds were located in Mississippi Sound and patches noted along the north shore of the western tip of Dauphin Island, bays along the Intracoastal Waterway in Baldwin County, and Little Lagoon. Consensus from this and previous studies was that species diversity, species composition, and spatial coverage has declined because of coastal development and commercial activities.

In general, estuaries and nearshore 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. Average (1930-2003) discharges for the Mississippi and Atchafalaya rivers were 13,675$m^3$/sec and 5,581$m^3$/sec, respectively (B. Baird personal communication). The Mississippi River deposits approximately 130.4 million mt of sediment annually near its mouth while the lower Atchafalaya River deposits 68 million mt annually (M. Salyer personal communication). As a consequence of the large fluvial nutrient input, the Louisiana nearshore 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 approximately 612 km (367 miles) of open Gulf shoreline and contains 3,528 km (2,125 miles) of bay-estuary-lagoon shoreline along the Texas coast. The estuaries are characterized by extremely variable salinities and reduced tidal action. Eight major estuarine systems are located in the western Gulf and include the entire Texas coast. These systems contain 620,634 ha of open water and 462,267 ha of tidal flats and marshlands (GMFMC 1998). Submerged seagrass coverage is approximately 92,000 ha.

Riverine influence is highest in Sabine Lake and Galveston Bay. Estuarine wetlands along the western Gulf decreased 10% between the mid 1950s and early 1960s with an estimated loss of 24,840 ha (Moulton et al. 1997).

Climate along the Texas coast ranges from humid on the upper coast where average rainfall is 55 inches (140 cm), to semi-arid on the lower coast where rainfall averages about 25 inches (63 cm). This wide range of annual rainfall results in a salinity gradient along the coast. For instance in Sabine Lake, salinity ranges from 4‰-14‰, but in the Laguna Madre salinity ranges from 26‰ to well over 50‰.

Upper coast bay systems are heavily influenced by the rivers that empty into them. They are typified by turbid water; silt, mud, and clay bottoms; abundant oyster reefs; and are bordered by extensive intermediate marshes with large stands of emergent vegetation. South of Corpus Christi, the hypersaline Laguna Madre with its clear water, sandy bottom, and extensive seagrass beds represents the other end of the spectrum. Along the central Texas coast lie the San Antonio, Aransas, and Corpus Christi bay systems that represent a transition between the extremes of the upper and lower Texas coast.

### 4.4 General Distribution

Sheepshead are euryhaline (Gunter 1956) with collection sites ranging in salinities from 0‰ to 45‰ (Pattillo et al. 1997). They are distributed over most of the habitats occurring in the northern Gulf of Mexico including freshwater rivers and lakes, brackish estuaries, bayous, canals, saltwater bays, sounds, lagoons, and offshore waters (Gunter 1956, Perret et al. 1971, Christmas and Waller 1973). In fishery-independent samples from Louisiana, sheepshead have been consistently taken in trawl, seine, gill and trammel net gears (R. Blanchet personal communication). Pattillo et al. (1997) presented information regarding relative abundance of sheepshead in 31 Gulf of Mexico estuaries. Sheepshead are not a true migratory species (Gilhen et al. 1976) but move to their near-offshore spawning grounds with the onset of cool weather (Gunter 1945, Kelly 1965), returning to inshore waters in the spring after spawning (McClane 1964, Jennings 1985, Shipp 1986). Apparently some adult fish remain offshore year round (Hastings et al. 1975, Sonnier et al. 1976, Sedberry 1987). After hatching, the larvae are transported to inshore estuarine nursery areas (Hildebrand and Cable 1938, Schexnayder et al. 1998). The post-larvae and juveniles generally move to areas of lower salinities (Swingle and Bland 1974, Juneau 1975) and become associated with shallow vegetated habitat (Springer and Woodburn 1960, Odum and Heald 1972, Jennings 1985) or other areas offering shelter (Shexnayder et al. 1998). When young sheepshead reach 35-50 mm in length, they move from vegetated areas to more typical adult habitats including oyster reefs, rocks, pilings, jetties, breakwaters, seawalls, piers, wrecks, and platforms (Hildebrand and Cable 1938, Odum and Heald 1972, Johnson 1978, Jennings 1985, Pattillo et al. 1997, and Murphy and MacDonald 2000). Several authors have reported sheepshead commonly associated with Gulf of Mexico offshore hard bottom formations in depths up to 37 m (Springer and Woodburn 1960, Sonnier et al. 1976, Putt et al. 1986).

## 4.5 Spawning Habitat

Detailed descriptions of sheepshead spawning habitat and conditions are not available, and specific spawning locations are not well documented. While Rathbun (1892) reported that spawning occurred on sandy beaches in Florida, most authors agree that adults migrate to offshore waters of the intercontinental shelf to spawn in late winter and early spring (Hildebrand and Cable 1938, Gunter 1945, Swingle 1977, Gallaway and Martin 1980, Jennings 1985, Wilson et al. 1989, Render and Wilson 1992, Pattillo et al. 1997). This determination is based primarily on the paucity of larvae and ripe adults found in shallow nearshore waters and estuaries during the spring (Jennings 1985). Wilson et al. (1989) and Render and Wilson (1992) identified the period of spawning in the northern Gulf of Mexico from late February through April.

During an environmental assessment of an oil and gas field located 26.8 nautical miles south-southeast of Galveston, Texas, Gallaway and Martin (1980) reported observing a spawning aggregation of sheepshead in association with offshore platforms. Population levels in April represented 17 to 19 fold increases over the population sizes estimated for each structure the previous quarter. They believed the observed concentrations represented a spawning aggregation as the fish were mostly running ripe and exhibited what the authors interpreted to be courtship behavior. Populations returned to normally observed ranges by mid-May. Lukens (1980) reported similar activity during March at an artificial reef site south of Horn Island, Mississippi where sheepshead were captured in running ripe condition over a scrapped World War II Liberty Ship placed at a depth of 14 m.

Although most recent literature points to an offshore spawn, there is some evidence of possible inshore and estuarine spawning. Murphy and McDonald (2000) collected a small number of specimens with hydrated oocytes or post-ovulatory follicles in high salinity Tampa Bay (some as far as 16 km from the Gulf) and Tucker and Alshuth (1997) caught running ripe adult sheepshead in the Indian River just west of Fort Pierce Inlet, Florida (Atlantic coast).

Sheepshead containing post-ovulatory follicles or in advanced stages of maturity have been more commonly collected from offshore waters (Music and Pafford 1984, Render and Wilson 1992). Because mean fecundity values were significantly greater for fish caught offshore and post-ovulatory follicles were identified only from fish taken in offshore samples, Render and Wilson (1992) questioned the significance of partially hydrated ovaries found in fish captured in inshore waters of Louisiana.

## 4.6 Eggs & Larval Habitat

Most evidence suggests that the buoyant eggs of sheepshead are fertilized and hatch in offshore waters (Hildebrand and Cable 1938, Jennings 1985, Ditty et al. 1988, Render and Wilson 1992, Pattillo et al. 1997) or high salinity estuaries (Tucker 1987). Tucker (1987) describes the incubation and development of laboratory-reared eggs beginning at 23ºC and 35.5‰. The eggs hatched within 28 hrs, implying that their presence and condition in the natural environment could be indicative of a spawning area. Conversely, sheepshead in Louisiana successfully spawn in lower salinity waters such as the waters surrounding the outflow of the

Mississippi River. This may be attributed to increased egg buoyancy in the lower salinity waters due to the eggs high oil content (large oil globule) (R. Blanchet personal communication).

Larvae have been noted in the northern Gulf of Mexico from January to May, with peak abundance February through April (Ditty 1986, Ditty et al. 1988). Ditty et al. (1988) also reported the primary depth distribution of sheepshead larvae (40mm SL) collected in their ichthyoplankton survey to be <25m. While numerous studies have shown that most larval movement is passive and tends to be driven by both prevailing winds and currents, Hoese (1965) suggested that it is reasonable to postulate that larval fishes actively seek the bays either by swimming or actively seeking favorable currents, possibly because of more available food.

Small pelagic larvae have been collected at the surface over sandy bottoms (Hildebrand and Cable 1938, Springer and Woodburn 1960) and from high-energy surf zones (Ruple 1984). Larvae and post larvae have also been captured in lagoons (Arnold et al. 1960), bays (Hoese 1965), and passes (Sabins 1973). Parsons and Peters (1989) collected approximately 2000 larval (5–8 mm SL) sheepshead from a seawall using a dipnet on the surface at Bayboro Harbor, Florida. They presented data that indicated that by 8 mm SL most sheepshead larvae disappeared from dipnet collections, and inferred that the disappearance may reflect their ability to avoid capture or their movement out of the pelagic environment. They postulated that a "settling" of larvae might occur as the larvae metamorphosed into a more substrate oriented fish.

## 4.7 Juvenile Habitat

### 4.7.1 General Conditions

After metamorphosis into juveniles (by approximately 30 mm SL) young sheepshead "settle out" from their pelagic stage to become more substrate oriented (Parsons and Peters 1989). Juveniles are most abundant in grass beds over mud bottoms (Springer and Woodburn 1960, Johnson 1978, Burgess 1980, Jennings 1985) but are commonly found over hard substrate habitat and other areas offering shelter (Schexnayder et al. 1998). Juveniles were found in the high salinity grass beds of Mississippi Sound (Christmas and Waller 1973) to low salinity vegetated areas in Lake Maurepas, Louisiana (Millican and Thomas 1984) and the Mississippi River Delta (Kelly 1965). Hildebrand and Cable (1938) inferred that lack of teeth forces the young to feed on tiny forms found only in grass beds.

In late summer, when juveniles are about 35-50 mm SL, they begin leaving the grass flats (Hildebrand and Cable 1938, Springer and Woodburn 1960, Odum and Heald 1972) and congregate with adults around stone jetties, breakwaters, piers, and wrecks (McClane 1964, Burgess 1980, Juneau and Pollard 1981). In an age and growth study from North Carolina, Schwartz (1990) found that an absence of sampled sheepshead within a certain size range (90-150 mm SL) may have been caused by their shifting from a seagrass habitat to piling, jetty, and other hard substrate preferred by larger young and adults.

### 4.7.2 Salinity, Temperature, and Dissolved Oxygen

Juvenile sheepshead are apparently highly euryhaline and can survive abrupt transfers from high salinity to freshwater, as noted by Tucker (1987) following his experiment to raise them under aquaculture conditions. After transformation to the juvenile stage was complete, fish were transferred from salt water (28‰) to freshwater in 1 to 2 hrs and from freshwater directly to saltwater with no signs of osmotic distress. Survival and daily growth were significantly better in saltwater than in freshwater ponds, but final weights were similar. The researcher concluded that saltwater is required only for the first two to five weeks of rearing, after which sheepshead can be raised in freshwater.

Springer and Woodburn (1960) caught young sheepshead (20.7 - 41.5 mm) in Tampa Bay in salinities ranging from 5.0‰ to 35.0‰, while Christmas and Waller (1973) took small specimens (17.0 - 31.0 mm) from Mississippi waters at 5.0‰ to 24.9‰. All specimens less than 25 mm long collected by Swingle and Bland (1974) in Alabama were taken at salinities below 5‰. In his inventory of Vermilion Bay, Louisiana, Juneau (1975) collected sheepshead (average size 118.7 mm) at salinities ranging from 0.1‰ to 9.3‰ and found them more common in less saline regions of the study area at all times of the year.

No lethal upper or lower water temperature limits for juvenile sheepshead have been reported. Tucker (1989) found optimal growth under aquacultural conditions to be around 25ºC and noted that feeding decreased sharply when water temperature dropped below 20ºC. Springer and Woodburn (1960) caught juveniles in Tampa Bay at water temperatures ranging from 12.8º to 32.5ºC and Juneau (1975) captured small sheepshead in Vermilion Bay, Louisiana at 7.5º to 29.9ºC.

Minimum dissolved oxygen tolerances for this species are not well known (Pattillo et al. 1997), but fish kills (that included sheepshead) resulting from severe low dissolved oxygen conditions were reported from semi-open and closed canals in coastal Louisiana (Adkins and Bowman 1976).

#### 4.7.2.1 Vegetation

Juvenile sheepshead (30-50mm) are often found associated with shallow water grass beds (Pattillo et al. 1997), feeding on soft-bodied invertebrates and plants (Hildebrand and Cable 1938, McClane 1964, Johnson 1978). To further stress the importance of grass beds to young sheepshead, Hildebrand and Cable (1938) inferred that lack of teeth forces the young to feed on tiny forms found only in grass beds.

In Louisiana, where grass beds are not common, young sheepshead probably depend upon small crustaceans found on “live bottoms” or in association with grasses found at the marsh-water edge (Schexnayder et al. 1998). In their drop-sample study of marsh-edge ecotone in Louisiana’s Barataria-Caminada Bay System, Baltz et al. (1993) found that sheepshead and other small fishes were concentrated near the interface between spartina marsh and open water; habitat suitability declined steadily with increasing distance from the marsh edge. Odum et al.

(1982) found that sheepshead are recruited to shallow bays and lagoons as post-larvae and enter mangrove-lined coastal streams of south Florida where they stay for several years.

Springer and Woodburn (1960) found juveniles primarily in Diplantera beds in the Tampa Bay area, while Hildebrand and Cable (1938) reported young (to about 50 mm) on Ruppia beds in North Carolina. Sedberry (1987) noted that young sheepshead taken on grass flats in North Carolina waters feed heavily on algae. In Tampa Bay, Springer and Woodburn (1960) found the stomach of an 86.0 mm specimen to be completely stuffed with filamentous algae. Lesser amounts were also found in smaller specimens.

Plant material is often found in the digestive tracts of sheepshead, particularly smaller specimens, though the level of dependence on this material is unknown. The plant material may have been ingested incidental to feeding on small crustaceans or vice-versa (Schexnayder et al. 1998).

Hildebrand and Cable (1938) and Johnson (1978) noted the dependence of the early life stages upon vegetated areas for shelter and food. Based on long-term changes in seagrass acreage in North Carolina waters, Schwartz (1990) questioned whether the historical sheepshead harvest could be correlated with seagrass abundance and just how dependent they are on that habitat for their growth and survival.

#### 4.7.2.2 Substrate

Juveniles are usually associated with grass beds until they are 35-50 mm SL, then they move to more typical adult habitats (Hildebrand & Cable 1938, Odum and Heald 1972, Pattillo et al. 1997) such as oyster beds, shallow muddy bottoms, spartina marshes, piers, rocks, and jetties (McClane 1964, Juneau 1975, Burgess 1980, Jennings 1985). In Louisiana, where grass beds are scarce, they seem to prefer hard substrate habitat or other areas offering shelter (Schexnayder et al. 1998). Those found around structure feed primarily on mollusks and crustaceans (Hildebrand and Schroeder 1928).

## 4.8 Adult Habitat

### 4.8.1 General Conditions

Sheepshead tolerate a wide range of temperature and salinities varying to some degree with developmental stages. Adults are demersal and commonly occur in nearshore waters over “live bottom” areas (Pattillo et al. 1997). They are often found in association with oil rigs, oyster reefs, wrecks, jetties, and other structures that have marine growth.

Adults generally remain in inshore waters during the warmer months and move out of the estuaries during periods of low temperature (Gunter 1945, McClane 1964, Dugas 1970, Juneau 1975, Jennings 1985). They move to offshore spawning grounds in late winter and early spring, returning to nearshore waters after spawning (Hildebrand and Cable 1938, Tucker 1987, Murphy and McDonald 2000). Apparently some adult fish remain offshore year round (Hastings et al. 1975, Sonnier et al. 1976, Sedberry 1987).

### 4.8.2 Salinity, Temperature, and Dissolved Oxygen Requirements

#### 4.8.2.1 Salinity

Gunter (1956) described sheepshead as euryhaline after capturing them at salinities ranging from 2.2‰ - 29.9‰ during his investigations in Texas waters. Springer and Woodburn (1960) collected adults in Tampa Bay at ranges of 5.0‰ - 35.0‰, and Christmas and Waller (1973) took Mississippi specimens at less than 0.3‰ - 29.9‰. Barrett et al. (1978) reported a range of 0.2‰ - 30.7‰ in their study of Louisiana's estuaries and near offshore waters.

Although sheepshead have been collected at sites ranging from 0‰ to 45‰ (Pattillo et al. 1997), several Louisiana studies suggest a possible preference for relatively low salinity conditions. During his 19-month study on the Mississippi River Delta, Kelly (1965) found average monthly salinity at sample sites to range from 0.1‰ to 15.3‰ with greatest numbers of sheepshead collected in the lower salinity portions of the study area and no specimens taken above 1.5‰. In the Vermilion/Atchafalaya Bays Complex of Louisiana, Juneau (1975) noted that sheepshead were taken in less saline regions of the study area at all times of the year, and Tarver and Savoie (1976) found the highest catch probability in the Lake Pontchartrain – Lake Maurepas Complex occurred at salinities of 5‰ - 9.9‰.

Burgess (1980) reported sheepshead not uncommon in low salinity situations, but rare in pure freshwater. However, Herald and Strickland (1949) took them from Homosa Springs, Florida, and Tagatz (1968) reported sheepshead far upstream in freshwater of the St. John's River, Florida. Millican and Thomas (1984) captured sheepshead from Lake Maurepas, Louisiana, which is considered a freshwater lake seasonally influenced by salt-water influxes (Childers 1985).

Simmons (1957) reported that sheepshead were uncommon in salinities over 40‰. However, Tabb and Roessler (1989) caught them in hypersaline Florida Bay where salinity exceeded 35‰ and reached 60‰ over wide areas. They concluded that seasonal and annual fluctuations in abundance of the dominant estuarine fishes cannot be correlated with major physio-chemical parameters, but that season of the year exerted the "overriding influence" on the tested species. They also found that it was principally a function of spawning season that caused adults to leave the estuary.

Based on the offshore nature of the suspected spawning area, it is evident that relatively high salinity is required for a successful natural spawn. Lukens (1980) observed spawning activity offshore of Horn Island, Mississippi, at a salinity of 34‰. However, specific salinity requirements have not been documented. In his experiments to raise sheepshead under aquacultural conditions, Tucker (1987) successfully incubated eggs at 35.5‰ and reared fish under a wide range of salinities, finding survival and growth to maturity better in saltwater ponds than in freshwater ponds. He also concluded that saltwater was required only during the first two to five weeks after hatching.

#### 4.8.2.2 Temperature

A general movement to offshore waters during late winter and early spring has been reported in association with spawning activity with a return to inshore and nearshore waters during warmer months (Hildebrand and Cable 1938, Gunter 1945, Kelly 1965, Jennings 1985, Render and Wilson 1992). Gunter (1945) stated that the temperature cycle was more definite than general salinity changes and was chiefly responsible for the seasonal movements and other recurrent activities of marine fishes in Texas.

Sheepshead have been collected in northern Gulf of Mexico waters at temperatures ranging from 5º (Perret et al. 1971, Christmas and Waller 1973) to 35.1ºC (Roessler 1970). Gunter (1945) reported collection site ranges of 16º to 30ºC in Texas, and fish were taken at 5º to 34.9ºC in Louisiana (Perret et al. 1971, Juneau 1975, Tarver and Savoie 1976). Christmas and Waller (1973) reported a temperature range of 5º to 34.9ºC in Mississippi, and Springer and Woodburn (1960) captured sheepshead in Tampa Bay at 12.8º to 32.5ºC.

Though no information on lethal upper or lower thermal limits has been documented, Fontenot and Rogillio (1970) noted that sheepshead catch declined during their Biloxi Marsh, Louisiana, study when water temperature reached 35ºC or fell below 11ºC. Bejarano (1984) reported on winter fish kills observed in marsh areas of coastal Louisiana. Following a severe freeze during the late winter of 1983, surface water temperature at Grand Terre Island dropped 11.5ºC over a three-day period to 1.0ºC on December 25. The fact that ice was observed in some saline marshes indicates that some surface water temperatures fell below 0.0ºC. In the shallow marsh areas surrounding Bayou Dularge in southwestern Terrebonne Parish, sheepshead appeared to be the most abundant species killed.

Lukens (1980) observed running ripe individuals south of Horn Island, Mississippi at a water temperature of 19ºC. Tucker (1989) found optimum growth in captivity at around 25ºC.

#### 4.8.2.3 Dissolved Oxygen

Although no reports were found specifically relating the distribution of sheepshead to dissolved oxygen (DO) concentrations, Brietburg 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 the estuary. Hoss and Peters (1976) found that a low of 3.0 ppm typically stressed other fish species. Barrett et al. (1978) collected sheepshead in all months in Louisiana at ranges of 3.5 ppm to 10.5 ppm. Kills attributed to very low DO conditions in semi-open and closed canals have been documented in coastal Louisiana (Adkins and Bowman 1976).

#### 4.8.2.4 Depth

Sheepshead are found at a wide range of depths from less than one meter in estuarine areas out to deeper offshore waters more commonly associated with their suspected spawning grounds. Depth preference appears to be a function of both life history stage and season, with mature fish moving to deeper waters during the spawning season and typically returning to a shallower environment post-spawn.

Sedberry (1987) found sheepshead at depths of 16 to 37 m off the coast of South Carolina, and they have been observed at similar depths in the northern Gulf of Mexico. Springer and Woodburn (1960) reported that sheepshead were common around rocky offshore reefs at depths up to 18 m and Sonnier et al. (1976) noted their presence in association with an offshore rock formation at 37 m. Putt et al. (1986) found sheepshead on hard bottom "natural reefs" off Louisiana's coast at depths of 20 to 21 m, and Jennings (1985) reported high winter concentrations at depths of 7 – 12 fathoms near oil platforms and artificial reefs off the Mississippi River Delta and Mississippi and Alabama coasts.

### 4.8.2.5 Vegetation

Sheepshead have been collected from various habitats including those associated with the 24.3 million ha of emergent vegetation (Perret et al. 1971) and 324,000 ha of water bottoms covered by submerged aquatics (GMFMC 1998) found in the northern Gulf of Mexico. It appears that the early life stages are more closely associated with vegetation, but adults are also commonly found in these types of habitats.

Darnell (1961) reported that vegetation (*Ruppia*, *Vallisneria*, and some filamentous algae) made up 54% of the diet of sheepshead collected in Lake Pontchartrain, Louisiana, and Kelly (1965) took specimens at the Mississippi River Delta that had stomachs containing large quantities of roseau cane. Partially digested green algae were found in 69.8% of the sheepshead captured in the Biloxi Marsh Complex of Louisiana by Fontenot and Rogillio (1970), though the researchers were uncertain whether the plant material was ingested purposely or indirectly.

Gunter (1945) believed sheepshead to be herbivorous due to the large amount of plant material (grass and algae) found in the long digestive tract of specimens examined in his Texas study. Although plant material is often found in the digestive system (most frequently in smaller specimens) of sheepshead, their dependence on vegetation as a food source is unknown. The ingestion of plant material may have been incidental to foraging for small crustaceans, or vice versa (Schexnayder et al. 1998).

### 4.8.2.6 Substrate

Adults frequent oyster beds, shallow muddy bottoms, *Spartina* marshes, piers and rocks, jetties, pilings, and wrecks (Johnson 1978, Burgess 1980, Pattillo et al. 1997). Their affinity for rocks and pilings, where they feed on encrusting organisms, make them difficult to capture with conventional net type sampling gear (Gunter 1945, Perret et al. 1971, Wang and Raney 1971).

Shipp (1986) reported that sheepshead were commonly found in bare surf zones where they fed on infaunual mollusks and crustaceans. Darnell (1961) found sheepshead to be the only fish that consumed quantities of sponges in a Lake Pontchartrain, Louisiana, study and further illustrated their association with the bottom by listing them as important consumers of small mollusks. Sedberry and Van Dolah (1984) found that sheepshead are probably important in controlling the structure of sessile invertebrate communities on offshore "live bottom" reefs in the South Atlantic Bight.

Following studies in offshore Louisiana waters, Sonnier et al. (1976) reported sheepshead associated with an offshore rock formation at 37 m depth, and Putt et al. (1986) found them common on offshore hard bottom sites consisting of small areas of relief (less than one to several meters) that were generally enveloped in a dense nepheloid layer (distinct regions of accumulated particulate material).

In a 16-month study of fishes associated with a petroleum platform offshore of Cameron, Louisiana, Stanley and Wilson (1997) observed sheepshead on every visual survey and found them to be one of the most common species observed, composing 10% of the fishes found. Gallaway and Martin (1980) reported a spawning aggregation of sheepshead in association with an oil and gas platform off the coast of Texas. Lukens (1980) observed a spawning aggregation schooling above a scrapped World War II Liberty Ship placed as an artificial reef offshore of Horn Island, Mississippi.

Sonnier et al. (1976) and Stanley and Wilson (1997) theorized that the proliferation of structures associated with the oil and gas industry in Louisiana has provided habitat expansion for those species dependent on hard substrate. Due to the increased structural habitat available, Schexnayder et al. (1998) postulated that the sheepshead population may be artificially high.

### 4.9 Habitat Quality, Quantity, Gain, Loss, and Degradation

The general knowledge of the importance of habitat and nursery areas to the survival of many nearshore fish species, such as sheepshead, is well known although the specific interactions of various biotic and abiotic factors are less understood. Allen and Baltz (1997) pointed out that a better understanding of estuarine-dependent species is necessary to assess the relative importance of abiotic factors, food resources, predation, and habitat quality.

Physical alterations to vegetated and non-vegetated estuarine habitats that either remove or modify such a habitat will have a negative impact on most life stages of animals that utilize the habitat for feeding, growth, predator avoidance, and/or reproduction (Hoss and Thayer 1993). 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 in Gulf coast states. Most of this loss was due to the shifting of emergent wetlands to open saltwater bays. 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 over-wintering waterfowl in the United States, and provide the majority of the recreational fishing landings (Turner 1990). Considering the wide range of habitats occupied by all life stages of sheepshead, it is difficult to determine what impacts these alterations might actually have on the species. Several more critical habitat concerns and their potential impact on sheepshead are addressed in remainder of this section.

### 4.9.1 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 DO (<2 ppm) occur in offshore Louisiana and Texas waters during the warmer summer months (Rabalais et al. 1997, Rabalais et al. 1999). 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" (Justic et al. 1993). Since few cases of mortality due to hypoxia have been documented, it appears that sheepshead are only moderately susceptible to low DO and generally move out of the affected area, resulting in displacement rather than mortality. The close association that sheepshead 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 apparently does not lead to significant sheepshead mortality as few sheepshead kills have been documented.

In contrast, high levels of DO can cause additional problems for fishes. Renfro (1963) reported mortalities of sheepshead 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.

### 4.9.2 Algal Blooms

Springer and Woodburn (1960) listed sheepshead 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; none were documented in Alabama, Mississippi, and Louisiana. A red tide event in 1986 killed an estimated twenty-two million fish and in the fall and winter of 1996 and 1997, toxic algal blooms occurred throughout the entire northern Gulf of Mexico resulting in a significant number of finfish deaths from Texas to Florida. The best estimates indicated 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 (McEachron et al. 1998). In all three events, clupeids and other schooling fishes were the main species impacted although about 100 total species were identified including recreationally and commercially important fish such as spotted seatrout, red drum, flounder sp., black drum, and Atlantic croaker. Additional fish kills were documented in other Gulf States as well. These algal blooms were caused by 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 top predators through bioaccumulation in planktivorous prey fish that ingest the cells or swim through a bloom. Other toxic algae occur in the Gulf of Mexico and include a second species of Bymnodimium that occurs occasionally in Florida; *Gonyaulax monilata* that has been documented in Mississippi Sound; four species of *Prorocentrum*; and about six *Pfiesteria*-like species that primarily occur in Florida (C. Moncreiff 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.

### 4.9.3 El Niño and La Niña

El Niño [also referred to as El Niño Southern Oscillation (ENSO)] is a change in the eastern Pacific's surface water temperatures that contributes to major changes in global weather. It is a periodic phenomenon that is caused by changes in surface trade wind patterns. The tropical trade winds normally blow east to west piling up water in the western Pacific and causing upwelling of cooler water along the South American coast. El Niño occurs when this "normal" wind pattern is disrupted. El Niño generally produces cooler and wetter weather in the southern United States and warmer than normal weather in the northern part of the country. In addition, there seems to be reduced, though no less severe, tropical activity during El Niño years (NAS 2000). The resulting increased summer rainfall can significantly increase river discharge, flow rates, water clarity, and other physical-chemical parameters which may affect sheepshead behavior or habitat choice.

The effects of La Niña are nearly opposite that of El Niño. La Niña is characterized by unusually cold ocean temperatures in the eastern equatorial Pacific Ocean. La Niña periods are characterized by wetter than normal conditions across the Pacific Northwest and very dry and hot conditions in the Southeast. Also a greater than average number of tropical storms and possibly hurricanes are likely in the Gulf from June through October. It is not known what direct impacts might be felt by sheepshead populations, their close association with structure might infer effects due to both loss of permanent structure and increase in debris-type structure following storm activity.

### 4.9.4 Anthropogenic Habitat Impacts

Many of the factors that impact sheepshead 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 that include negative, positive, and benign habitat issues.

#### 4.9.4.1 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 approximately 1% of estuarine habitats required for commercial and recreational species (Klima 1988). Human activities in inshore and offshore habitats of sheepshead 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 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).

#### 4.9.4.2 Dredge and Fill

Shallow water dredging for sand, gravel, and oyster shell directly alters the bottom and may change local current patterns. Those changes could lead to erosion or siltation of productive habitats. Destruction of wetlands by development of waterfront properties results in loss of productive habitat acreage and reduction of detrital production. Channeling or obstruction of watercourses emptying into estuaries can result in loss of wetland acreage and changes in the salinity profile. Lowered flow rates of drainage systems can reduce nutrients 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 sheepshead 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 degradation 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).

#### 4.9.4.3 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, and corresponded closely to the area delineated to the +4°C isotherm.

#### 4.9.4.4 Industrial and Agricultural Run-off

Recent algal blooms in the Gulf of Mexico have caused problems for many of the Gulf fisheries (Section 4.9.2). 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 has been blamed on agriculture and livestock activities. Excessive waste in combination with favorable meteorologic and environmental conditions elevated the densities of these organisms to near critical levels. Other events prevalent in the Gulf that can be linked, in part, to the increased influx of nutrients in the form of run-off include the red tide events of 1996-1997 and the persistent 'dead zone' off the Louisiana and Texas coasts (Section 4.9.1).

#### 4.9.4.5 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 sheepshead. Subsidence, eustatic sea-level rise, and erosion due to storms and wave/wind action are naturally occurring factors. Man-inducted 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 tributaries to the Mississippi River led to a decrease in 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 sheepshead. 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 that 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 that contribute more to the overall loss than others (i.e., Barataria Basin). In most of the basins, loss continues but at a reduce 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). This may indicate 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 77.4 $km^2$ of coastal wetlands every year (Barras et al. 2004).

In contrast to land loss throughout most of coastal Louisiana, delta development in the 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% yr), and more than 9,312 ha 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.

#### 4.9.4.6 Freshwater Diversion

Changes in the amount and timing of freshwater inflow may have a major effect on the early life history of sheepshead that use the estuary. These habitats rely on freshwater inflow to transport nutrients critical for increased production. Activities affecting freshwater inflow include leveeing of rivers (eliminating overflow into surrounding marshes), damming of rivers, channelization, and water withdrawal.

Water withdrawals for agriculture, municipal, and industrial uses have already reduced the flow in many springs, and in some cases, the flow has been totally interrupted or reversed during droughts, possibly resulting in saltwater intrusion into low salinity marshes frequented by sheepshead and other fisheries resources.

Freshwater diversion projects of various magnitudes have been implemented, primarily in Louisiana, to re-introduce nutrient rich, sediment-laden water into marsh areas. These efforts to address the continued loss of estuarine habitat may produce localized changes in fisheries production and distribution due to shifts in the salinity regime, water temperature range, and turbidity levels.

#### 4.9.4.7 Point and Nonpoint Source Pollution

The discharge of pesticides and other toxic substances into rivers flowing into the Gulf of Mexico is increasing as anthropogenic activity increases. Point sources for the 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. Approximately 5.9 million kg of toxic substances are discharged annually into the Gulf's watersheds, and approximately 2.3 million kg of pesticides were applied to agricultural fields bordering Gulf coastal counties in 1990 (USEPA 1994). The 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 et al. 1988). Lethal effects on ecosystems and individual organisms may occur with high levels of certain contaminants.

Steele (1985) investigated the latent behavioral toxicity of copper to sheepshead and sea catfish. Copper, which is found in some marine environments, was found to affect locomotor and orientation behavior. This in turn could affect schooling, movement and migration, feeding, reproduction, and predator avoidance.

#### 4.9.4.8 Methyl Mercury

Mercury is found naturally in the environment, being released from rock soils through volcanic activity. Mercury is also introduced to the environment through human activities, including incineration of solid waste, combustion of fossil fuels, and other industrial activities. Bacteria in the water convert elemental mercury into methyl-mercury (MeHg) that is then absorbed by fish as a result of feeding activities. Older fish and those higher on the food chain, are more susceptible to high levels of mercury contamination.

In the late 1970s, the FDA established an action level of 1.0 ppm for mercury contamination. This level was based on data, partly contributed by the NMFS, that indicated that exposure would not increase significantly by consumption of seafood at the 1.0 ppm level. The FDA issued a fish consumption advisory for mercury in 1995, which was revised in 2001. The revised advisory states that pregnant women and women who may become pregnant should not eat shark, swordfish, king mackerel, and tilefish. Also, the advisory states that the consumption of all other fish should average no more than about 373 g (1 lb) per week as high, prolonged exposure can cause neurological damage (B. Collette personal communication).

The Gulf States test recreationally and commercially harvested fish for mercury on a routine basis. Between 1995 and 2003 the Louisiana Department of Environmental Quality evaluated 106 sheepshead specimens for mercury toxicity. None were found to contain mercury levels above the 1.0 ppm standard (W. Tucker personal communication).

#### 4.9.4.9 Sea Level Rise

Increasing atmospheric levels of carbon dioxide and other gases released by human activities are believed to contribute to the greenhouse effect whereby the sun's radiant heat is retained within the atmosphere at higher levels. It is expected that the earth's average temperature will rise by several degrees in the next century and that while most of the United States is expected to warm, there is likely to be an overall trend toward increased precipitation and evaporation, more intense rainstorms, and drier soils (Titus and Narayanan 1995). Some of the potential impacts of global warming include stronger and more frequent tropical storms, changes in rainfall patterns that may affect agriculture, spreading of tropical diseases, melting of glaciers and land-based ice caps causing sea level rise, and increases in pollution levels.

Estimates of rising sea level rates vary considerably and are extremely controversial (Titus 1987). As sea level rises, wetland habitats may be impacted by inundation, erosion, and saltwater intrusion. Such impacts could contribute to serious wetland losses along the relatively flat coastlines of the Gulf of Mexico, depending on magnitude of sea level rise and amount of shoreline hardening that would minimize wetland retreat inland. The effects of global warming and sea level rise could both positively and negatively impact sheepshead in the Gulf of Mexico.

#### 4.9.4.10 Urban Development

The nation's coastlines continue to be one of the most desirable areas in which to live. Coastal areas across the United States have population increases five times the national average. According to the United States Geological Survey (Williams et al. 1991), 50% of the nation's population lives within 75 km of a coast, and this figure is projected to increase to 75% by the year 2010. Dredge and fill activities result in the creation of dry land used for urban development in coastal areas nationwide. Indirect effects from urban development also impact the quality and quantity of estuarine habitat utilized by sheepshead. Hopkinson and Day (1979) suggest that processes occurring at the uplands-estuary interface can have direct ecological effects such as nutrient runoff and eutrophication. While some of the direct impacts to estuaries have been somewhat curbed in recent years by coastal zone management regulations, indirect and cumulative impacts continue to be a major concern.

#### 4.9.4.11 Introductions of Non-native Flora and Fauna

According to ISFT (2000) the terms "non-native" and "introduced" are synonyms for "nonindigenous." That reference defines nonindigenous species to include "any individual, group, or population of a species, or other viable biological material, that is intentionally or unintentionally moved by human activities, beyond its natural range or natural zone of potential dispersal, including moves from one continent or country into another and moves within a country or region; includes all domesticated and feral species, and all hybrids except for naturally occurring crosses between indigenous species." Nonindigenous aquatic species are further defined as those that must live in a waterbody for part or all of their lives.

As of September 2000 a total of 399 amphibians, bryozoans, coelenterates, fishes, and aquatic crustaceans, mammals, mollusks, plants, and reptiles were considered nonindigenous aquatic species in the four Gulf States that are within the sheepshead native range (ISFT 2000). Although not all of these species have established reproducing populations, a number of them have. Of those that have become established many probably have no adverse effects on native ecosystems. However, a number of them are known to have serous impacts on native fauna and/or flora.

### 4.9.4.12 Liquefied Natural Gas (LNG) Plants

Natural gas is a limited resource in the United States and in recent years, as the demand for natural gas has increased, the US supply has declined substantially. The chemical properties of natural gas allow it to be cooled and held in insulated tanks as liquid and transported long distances. The two most common systems to warm LNG back into its gaseous form are a closed loop system, and an open loop system. Regardless of the system design, the super-cooled liquid must be warmed after transport back to a gaseous form. Open loop systems use ambient water to warm the liquefied gas resulting in decrease in water temperatures of –13 to 20 degrees F below normal. In a closed loop system, the LNG plant uses heat from the burning of natural gas to warm the LNG. The open loop system continuously pumps new water into the plant and releases the chilled water back into the environment.

The first commercial inland LNG plant in the US was built in 1941 in Cleveland, Ohio and the first estuarine based plant in the Gulf was built in Lake Charles, Louisiana in 1971 (CLNG 2004). A total of 114 LNG facilities exist around the country with only five terminals currently operating in the marine or estuarine environment. The plants currently operating in estuarine and onshore areas are closed-loop systems due to the large amount of water required for heating the LNG.

Several offshore marine LNG facilities in the Gulf of Mexico are either approved or planned to be open-loop systems. Potential negative impacts to marine fishes exist from using LNG open loop systems. Cooling water requirements in an open-loop LNG system range from 100-200 million gallons of water each day which could result in very large numbers of fish eggs and larvae of recreational and commercial species becoming impinged and entrained annually. In addition, the super-cooled outfall water from an open loop system could decrease the ambient temperatures in the receiving waters and pose a thermal shock situation for many of the early juvenile to adult fishes that are able to escape entrainment. Biocides are needed to reduce or eliminate fouling of the screens and pipes of the heat transfer system, possibly adding to environmental effects. Cumulative effects of multiple open-loop LNG terminals have not been evaluated. Information is insufficient at this time to determine the overall impact of offshore LNG terminals using open-loop technology. Monitoring of the effects of licensed facilities is required by the Maritime Administration and the U.S. Coast Guard, in consultation with NOAA Fisheries. Further planning and coordination with NOAA Fisheries and other Gulf states is needed to ensure that studies are adequate.

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

Sheepshead are not considered a true migratory species (Gilhen et al. 1976), but they do exhibit some inshore and offshore movement moving to their near-offshore spawning grounds with the onset of cool weather (Gunter 1945, Kelly 1965) and returning to inshore waters in the spring after spawning (McClane 1964, Jennings 1985, Shipp 1986). In addition, some adult fish remain offshore year round (Hastings et al. 1975, Sonnier et al. 1976, Sedberry 1987). Since they are distributed over most of the habitats occurring in the northern Gulf of Mexico including freshwater rivers and lakes, brackish estuaries, bayous, canals, saltwater bays, sounds, lagoons, and offshore waters, numerous state and federal management institutions both directly and indirectly affect them. 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 sheepshead and their habitat. Individual Gulf States and federal agencies should be contacted for specific and up-to-date state laws and regulations, which are subject to change on a state-by-state basis.

### 5.1 Federal

#### 5.1.1 Management Institutions

Although they can be found in the exclusive economic zone (EEZ), sheepshead are most abundant in state waters. As a result, the commercial and recreational fisheries are almost exclusively conducted in state management jurisdictions; consequently, laws and regulations of federal agencies primarily affect sheepshead 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 sheepshead as seafood.

##### 5.1.1.1 Regional Fishery Management Councils

With the passage of the Magnuson Fishery Conservation and Management Act (MFCMA), 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 nautical 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 Department of Commerce (DOC).

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 (MFCMA Section 301a).

The GMFMC has not developed a management plan for sheepshead. Furthermore, there is no significant fishery for sheepshead 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), Department of Commerce (DOC)

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 MFCMA 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 sheepshead in the Gulf of Mexico. It conducts some research and data collection programs and comments on all projects that affect marine fishery habitat.

The DOC, 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 sheepshead could be directly affected by such plans.

The OCRM may influence fishery management for sheepshead 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 sheepshead 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 sheepshead 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, Padre Island National Seashore in Texas, and in regulating various fishing activities in Everglades National Park in Florida. At Padre Island, fishing guides must obtain a special permit to run charters in park waters.

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

The USFWS has no direct management authority over sheepshead. The USFWS may affect the management of sheepshead 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 sheepshead 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 sheepshead and their habitat. Applications for permits to discharge pollutants into estuarine waters may be disapproved or conditioned to protect these marine resources.

The National Estuary Program is administered jointly by the USEPA and a local sponsor. This program evaluates estuarine resources, local protection and development of policies, and seeks to develop future management plans. Input is provided to these plans by a multitude of user groups including industry, environmentalists, recreational and commercial interests, and policy makers. National Estuary Programs in the Gulf include Sarasota, Tampa, Mobile, Barataria/Terrebonne, Galveston, and Corpus Christi bays.

#### 5.1.1.7 United States Army Corps of Engineers (USACOE)

Sheepshead 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 sheepshead, 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 DOC 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 sheepshead in the EEZ, enforcement of laws affecting marine pollution and fishing vessels could influence sheepshead populations.

#### 5.1.1.9 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 sheepshead. No foreign fishing applications to harvest sheepshead 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 sheepshead.

#### 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 set three new 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 EFH and definitions of overfishing.

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

The IJF 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 (P.L. 98-369)

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 acts 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 an USEPA approved 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 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 22 km of land and at depths of less than 25 m.

#### 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 (P.L. 93-205)

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 (EIS) 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 (P.L. 81-681)

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 46 km from any land; restrict discharge of victual and other recomposable waste up to 22 km 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

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, Florida 32399
Telephone: (850) 487-0554
www.myfwc.com

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 Management is empowered to manage 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, rules, and regulations of the state.

**Table 5.1**. State management institutions for the Gulf of Mexico.

| State | Administrative Body and Responsibilities | Administrative Policy-making Body and Decision Rule | Legislative Involvement in Management Regulations |
|---|---|---|---|
| FL | *Florida Fish & Wildlife Conservation Commission*<br>• administers management programs<br>• enforcement<br>• conducts research | • creates rules in conjunction with management plans<br>• seven-member commission | • responsible for setting fees, licensing, & penalties |
| AL | *Department of Conservation & Natural Resources*<br>• administers management programs<br>• enforcement<br>• conducts research | • Commissioner of department has authority to establish management regulation<br>• Conservation Advisory Board–13-member board which advises the Commissioner<br>• has authority to amend & promulgate regulations<br>• authority for detailed management regulations delegated to Commissioner<br>• statutes concerned primarily with licensing | |
| MS | *Mississippi Department of Marine Resources*<br>• administers management programs<br>• enforcement<br>• conducts research | *Mississippi Commission on Marine Resources*<br>• seven-member board<br>• establishes ordinances on recommendation of the MDMR Executive Director | • authority for detailed management regulations delegated to Commission statutes concern licenses, taxes, & specific fisheries laws |
| LA | *Louisiana Department of Wildlife & Fisheries*<br>• administers management programs<br>• enforcement<br>• conducts research<br>• makes recommendations to legislature | *Louisiana Wildlife & Fisheries Commission*<br>• seven-member board establishes policies & regulations based on majority vote of a quorum (four members constitute a quorum) consistent with statutes | • detailed regulations contained in statutes<br>• authority for detailed management regulations delegated to Commission |
| TX | *Texas Parks & Wildlife Department*<br>• administers management programs<br>• enforcement<br>• conducts research<br>• makes recommendations to the Texas Parks & Wildlife Commission | *Texas Parks & Wildlife Commission*<br>• nine-member body<br>• establishes regulations based on majority vote of quorum (five members constitute a quorum)<br>• granted authority to regulate means & methods for taking, seasons, bag limits, size limits & possession | • licensing requirements & penalties are set by legislation |

The FWC, a seven-member board 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.

### 5.2.1.2 Legislative Authorization

Prior to 1983, the Florida Legislature was the primary body that enacted laws regarding management of sheepshead 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 and provided the Commission with various duties, powers, and authorities to promulgate regulations affecting marine fisheries. Title 46, Chapters 46-48 contained regulations regarding sheepshead. On July 1, 1999 the Florida Marine Fisheries Commission (including the Florida Marine Patrol) and the Florida Game and Freshwater Fisheries Commission were merged into one Commission. Marine fisheries rules of the new Florida Fish and Wildlife Conservation Commission are now codified under Chapter 68B-48, 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 sheepshead fishery with the exception of a $5,000/year restricted species license.

### 5.2.1.4 Commercial Landings Data Reporting Requirements

Florida requires wholesale dealers to maintain records of each purchase of saltwater products by filling out a Marine Fisheries Trip Ticket (Chapter 370.02, Florida Statutes, grants rule making authority and Chapter 68E-5.002 of the Administrative Code specifies the requirements). Information to be supplied for each trip includes Saltwater Products License number; vessel identification; wholesale dealer number; date; time fished; area fished; county landed; depth fished; gear fished; number of sets; whether a head boat, guide, or charter boat; number of traps; whether aquaculture or lease number; species code; species size; amount of catch; unit price; and total dollar value which is optional. The wholesale dealer is required to submit trip tickets weekly if the tickets contain quota-managed species such as Spanish mackerel; otherwise, trip tickets must be submitted every month.

### 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 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 | |
| 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 |
| · five-ten 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 sheepshead are statewide. The following discussions are general summaries of laws and regulations, and the FWC 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 12 inches TL.

#### 5.2.1.7.2 Gear Restrictions

Sheepshead may be harvested with a beach or haul seine (under 500 sq ft), cast net (less than 14 ft in length; fishing with more than two cast nets per vessel is prohibited in state waters), hook and line gear, gig, and spear or lance. Gill nets, trammel nets, pound nets, and other entangling nets are prohibited throughout Florida territorial waters. Sheepshead may be harvested as an incidental bycatch by gears not specifically authorized for the harvest of sheepshead (e.g., trawls), provided that the number of sheepshead so harvested and in possession does not exceed 50 pounds. Additionally, possession of sheepshead 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 sheepshead in Florida with the exception of Everglades National Park, the sanctuary preservation areas (SPA) within the Florida Keys National Marine Sanctuary, and other state and national parks and reserves.

#### 5.2.1.7.4 Quotas and Bag/Possession Limits

No person shall harvest in or from state waters more than a total of 15 sheepshead per day, nor possess while in or on state waters more than 15 such fish.

#### 5.2.1.7.5 Other Restrictions

Sheepshead must be landed in a whole condition. The use of any multiple hook (e.g., treble hook) with live or dead natural bait and snagging (snatch hooking) to catch sheepshead is prohibited.

### 5.2.1.8 Historical Changes to Sheepshead Regulations in Florida

February 12-May 13, 1991:

- Prohibited use of gill or trammel nets with a total length greater than 600 yards
- No more than two nets to be possessed aboard a boat
- No more than one net to be used from a single boat

- Required net to be tended and marked according to certain specifications in the waters of Brevard through Palm Beach counties

March 20, 1991:
- Prohibited use of gill nets in state waters with a mesh size greater than six inches stretched mesh

January 1, 1993:
- Set a maximum mesh size for seines at two inches stretched mesh, excluding wings
- Set a minimum mesh size for gill and trammel nets at three inches stretched mesh beginning January 1, 1995
- Set a maximum length of 600 yards for all gill and trammel nets and seines
- Allowed only a single net to be fished by any vessel or individual at any time
- Prohibited the use of longline gear

September 1, 1993:
- Prohibited the use of gill and trammel nets in any bayou, river, creek, or tributary of waters between Collier and Pinellas counties from November 1 - January 31 each year

July 18, 1994:
- Prohibited the use of gill and trammel nets and seines in state waters of Martin County

July 1, 1995:
- Prohibited the use of any gill or entangling net in Florida waters
- Prohibited the use of any net with a mesh area greater than 500 square feet

January 1, 1996:
- 12 inch TL minimum size for all sheepshead (commercial and recreational fishermen)
- Ten fish daily limit (recreational fishermen only)
- Allowed only hook and line, cast net, beach, haul seine, and spears
- 50 lbs commercial daily vessel bycatch allowed
- Requires sheepshead to be landed in whole condition
- Prohibited use of multiple (treble) hook in conjunction with natural bait and snagging
- Sheepshead designated as a restricted species

January 1, 1997:
- Increases bag limit from ten to 15 fish per person for recreational anglers
- Commercial spearfishing allowed for sheepshead

August 31, 1998:
- Prohibits sale of sheepshead harvested in or from state waters that are less than 12 inches

### 5.2.2 Alabama

#### 5.2.2.1 Alabama Department of Conservation and Natural Resources

Alabama Department of Conservation and Natural Resources
Marine Resources Division
P.O. Box 189

Dauphin Island, Alabama 36528
(251) 861-2882
www.dcnr.state.al.us

The Commissioner of the Alabama Department of Conservation and Natural Resources (ADCNR) holds management authority of fishery resources in Alabama. 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.

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 public 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 (ACAB) 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 Alabama Marine Resources Division (MRD) 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 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 law provides that transferable commercial net and seine permits shall only be issued to applicants who purchased such licenses in two of five years from 1989 through 1993 and who show proof (in the form of an unamended Alabama state income tax return) that they derived at least 50% of their gross income from the capture and sale of seafood species in two of the five years and for annual renewal. Alabama law also provides that non-transferable commercial net and seine permits shall only be issued to applicants that purchased such licenses in all five years and who show proof through filed Alabama income tax returns in all five years and for annual renewal (unless exempt from filing Alabama income tax). Other restrictions are applicable, and the ADCNR/MRD should be contacted for details.

#### 5.2.2.4 Commercial Landings Data Reporting Requirements

Alabama law requires that wholesale seafood dealers file monthly trip ticket reports by the tenth of each month for the preceding month. Under a cooperative agreement, NMFS and ADCNR port agents now collect records of sales of seafood products jointly.

#### 5.2.2.5 Penalties for Violations

Violations of the provisions of any statute or regulation are considered Class A, Class B, or Class C misdemeanors and are punishable by fines up to $2,000 and up to one year in jail.

#### 5.2.2.6 Annual License Fees

The following is a list of license fees current to the date of publication; however, they are subject to change at any time. Nonresident fees for commercial hook and line licenses, recreational licenses, and seafood dealers licenses may vary based on the charge for similar fishing activities in the applicant's resident state.

| | |
|---|---|
| Commercial hook and line | |
| · resident | $101.00 |
| · nonresident | 201.00 |
| Commercial gill nets, trammel nets, seines* (up to 2,400 ft) | |
| · resident | 301.00 |
| · nonresident | 1,501.00 |
| Recreational gill net | |
| · resident | 51.00 |
| · nonresident | variable |
| Roe mullet/Spanish mackerel endorsement** | |
| · resident | 501.00 |
| · nonresident | 2,501.00 |
| Seafood dealer*** | |
| · resident | 201.00 |
| · nonresident | variable |
| Seafood dealer vehicle | |
| · resident | 101.00 |
| · nonresident | 101.00 |
| Recreational saltwater fishing license | |
| · resident | 16.00 |

| | |
|---|---|
| · nonresident | variable |
| Spearfishing | |
| · resident | 6.00 |
| · nonresident | 8.50 |
| · nonresident seven day | 3.50 |

*Seines 25 ft or less in length are exempt from licensing
**Required in addition to gill net license
*** Required for cast nets and gigging if used commercially

#### 5.2.2.7 Laws and Regulations

Alabama laws and regulations regarding the harvest of sheepshead primarily address the type of gear used and seasons for the commercial fishery. The following is a general summary of these laws and regulations which are current to the date of this publication and 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

Alabama has no minimum size limit TL for sheepshead in either the commercial or recreational fishery.

##### 5.2.2.7.2 Gear Restrictions

Gill nets must be marked every 100 ft with a color-contrasting float and every 300 ft with the fisherman's permit number. Recreational nets may not exceed 300 ft in length and must be marked with the licensee's name and license number. Commercial gill nets, trammel nets, and other entangling nets may not exceed 2,400 ft in length; however, depth may vary by area.

During the period January 1 through October 31 of each year, gill nets, trammel nets, and other entangling nets used to catch any fish in Alabama coastal waters under the jurisdiction of the MRD must have a minimum mesh size of 1.75 inch bar (knot to knot). A minimum mesh size of 1.875 inch bar is required for such nets used to take mullet from October 24 through December 31 of each year for all Alabama coastal waters under the jurisdiction of the MRD as provided in Rule 220-2-42 and defined in Rule 220-3-04(1), and any person using a 1.875 inch or larger bar net from October 24 through December 31 of each year shall be considered a roe mullet fisherman and must possess a roe mullet permit. Only strike nets may be used in certain waters of Bon Secour Bay during this period. These net-size restrictions do not apply to coastal rivers, bayous, creeks, or streams. In these areas, the minimum mesh size shall be 6-inch stretch mesh.

The use of purse seines to catch sheepshead is prohibited. Commercial and recreational gill net fishermen may use only one net at any time; however, commercial fishermen may possess more than one such net. No hook and line device may contain more than five hooks when used in Alabama coastal waters under the jurisdiction of the MRD except from January 1 through April 30 trotlines may be used to take legal species other than saltwater gamefish east of Mobile Ship Channel and north of a line from MSC#78 to Blakely River Ch#2 and due east to shoreline. These trotlines cannot exceed 300 ft and 50 hooks.

### 5.2.2.7.3 Closed Areas and Seasons

Gill nets, trammel nets, seines, purse seines, and other entangling nets are prohibited in any marked navigational channel, Theodore Industrial Canal, Little Lagoon Pass, or any man-made canal; within 300 ft of any man-made canal or the mouth of any river, stream, bayou, or creek; and within 300 ft of any pier, marina, dock, boat launching ramp, or certain "relic" piers. Recreational gill nets may not be used beyond 300 ft of any shoreline, and they may not extend into the water beyond the end of any adjacent pier or block ingress or egress from any of the aforementioned structures.

Year round gill nets, trammel nets, seines, haul seines, and other entangling nets are prohibited within 0.46 km of the Gulf shoreline. However, subject to other provisions, waters east of longitude 87º47’826” will be open from 6:00 p.m. to 6:00 a.m. each day from March 15 through May 7. From October 2 through December 31 the waters east of Old Little Lagoon Pass to the Florida line is open 24 hours a day. From the day after Labor Day through March 14 will be open to netting west of Old Little Lagoon Pass in Mobile and Baldwin Counties. From March 15 through the Friday before Labor Day waters west of Old Little Lagoon Pass in Mobile and Baldwin counties shall be open from 6:00 p.m. to 6:00 a.m. each day. From March 15 through the Friday before Labor Day waters west of longitude 88º11’500” are open 24 hours a day. From May 8 through Labor Day all waters in the Gulf of Mexico east of Old Little Lagoon Pass to the Florida line is closed to gill nets, trammel nets, seines, haul seines and other entangling nets. All waters of the Gulf of Mexico are closed during the following holidays: Memorial Day, Independence Day, and Labor Day. Additionally, from October 2 through December 31 these waters will be open to the taking of mullet only with 1.875-inch knot-to-knot minimum mesh nets. The minimum mesh size in the Gulf of Mexico shall be 1 9/16” bar.

From January 1 through the day after Labor Day of each year, entangling nets are prohibited in certain waters in and around Dauphin Island.

### 5.2.2.7.4 Quotas and Bag/Possession Limits

There are no quotas or bag/possession limits for the recreational or commercial sheepshead fishery.

### 5.2.2.7.5 Other Restrictions

The licensee must constantly attend all nets and no dead fish or other dead seafood may be discarded within 5.6 km of Gulf beaches; within 500 ft of any shoreline; or into any river, stream, bayou, or creek.

### 5.2.3 Mississippi

#### 5.2.3.1 Mississippi Department of Marine Resources

Mississippi Department of Marine Resources
1141 Bayview Avenue, Suite 101
Biloxi, Mississippi 39530
(228) 374-5000
www.dmr.state.ms.us

The Mississippi Department of Marine Resources (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 five members appointed by the Governor. 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 program. The MCMR is charged with administration of the Mississippi Coastal Program (MCP), which requires authorization for all activities that impact coastal wetlands. Furthermore, the state has an established Coastal Zone Management Program (CZMP) approved by NOAA. The CZMP reviews activities that would potentially and cumulatively impact coastal wetlands located above tidal areas. The Executive Director of the MDMR is charged with administration of the CZMP.

#### 5.2.3.2 Legislative Authorization

Title 49, Chapter 15 of the Mississippi Code of 1972, annotated, contains the legislative regulations related to harvest of marine species in Mississippi. Chapter 15 also describes regulatory duties of the MCMR and the MDMR regarding the management of marine fisheries. Title 49, Chapter 27 involves the utilization of wetlands through the Wetlands Protection Act and is also administered by the MDMR.

Title 49, Chapter 15 of the Mississippi Code of 1972 §49-15-2 "Standards for fishery conservation and management; fishery management plans," was implemented by the Mississippi Legislature on July 1, 1997 and sets standards for fishery management as related to the Magnuson-Stevens Act (1996).

#### 5.2.3.3 Reciprocal Agreements and Limited Entry Provisions

##### 5.2.3.3.1 Reciprocal Agreements

Section §49-15-15(h) provides statutory authority to the MDMR to enter into or continue any existing interstate and intrastate agreements, in order to protect, propagate, and conserve seafood in the state of Mississippi.

Section §49-15-30(1) gives the MCMR the statutory authority to regulate nonresident licenses in order to promote reciprocal agreements with other states.

#### 5.2.3.3.2 Limited Entry

Section §49-15-16 gives the MCMR authority to develop a limited entry fisheries management program for all resource groups.

Section §49-15-29(3), when applying for a license of any kind, the MCMR will determine whether the vessel or its owner is in compliance with all applicable federal and/or state regulations. If it is determined that a vessel or its owner is not in compliance with applicable federal and/or state regulations, no license will be issued for a period of one year.

Section §49-15-80(1B), no nonresident will be issued a commercial fishing license for the taking of fish using any type of net, if the nonresident state of domicile prohibits the sale of the same commercial net license to a Mississippi resident.

### 5.2.3.4 Commercial Landings Data Reporting Requirements

Ordinance Number 9.004 of the MDMR establishes data reporting requirements for marine fisheries' operations, including confidentiality of data and penalties for falsifying or refusing to make the information available to the MDMR.

### 5.2.3.5 Penalties for Violations

Section §49-15-63 provides penalties for violations of Mississippi laws and regulations regarding sheepshead in Mississippi.

### 5.2.3.6 Annual License Fees

The license fees required for the resident commercial harvest and sale of sheepshead in Mississippi marine waters are listed below. Also included are the fees for the recreational harvest of sheepshead. Nonresident fees may vary based on the charge for similar fishing activities in the applicant's state of residence. All license fees listed below are subject to change at any time. *The MDMR should be contacted for current license fees.*

| | |
|---|---|
| Resident Shrimp | |
| · vessel (<30 ft) | $60.00 |
| · vessel (30-45 ft) | 85.00 |
| · vessel (> 45 ft) | 110.00 |
| Nonresident Shrimp | |
| · vessel (< 30 ft) | 110.00 |
| · vessel (30-45 ft) | 160.00 |
| · vessel (> 45 ft) | 210.00 |
| · Louisiana resident vessel (1 trawl) | 570.00 |
| · Louisiana resident vessel (2 trawls) | 670.00 |

| | |
|---|---|
| · Texas commercial vessel | 1125.00 |
| · Alabama resident vessel (< 30 ft) | 60.00 |
| · Alabama resident vessel (30-45 ft) | 85.00 |
| · Alabama resident vessel (> 45 ft) | 110.00 |
| Commercial hook and line | |
| · resident vessel | 100.00 |
| · resident fisherman | 100.00 |
| · nonresident fisherman | 400.00 |
| Charter boats and party boats | |
| · resident | 200.00 |
| · nonresident | 200.00 |
| · Alabama charter boat (7-25 people) | 300.00 |
| Fishing Boat (includes use of gill nets, trammel nets and seines*) | |
| · resident | 100.00 |
| · nonresident | 300.00 |
| · Florida resident fishing boat | 635.00 |
| Seafood dealer | |
| · resident | 100.00 |
| · nonresident | 200.00 |
| · Louisiana resident | 1150.00 |
| · Alabama resident | 250.00 |
| · Florida resident | 1000.00 |
| Seafood processor (resident) | 200.00 |
| Recreational saltwater hook and line | |
| · resident annual | 4.00 |
| · nonresident annual | 25.00 |
| · nonresident 3-day | 4.00 |

*Small mesh beach seines (less than a ¼ inch bar, ½ inch stretched mesh) that do not exceed 100 ft in length are exempt from licensing.

A Mississippi saltwater fishing license is required for all recreational methods of finfish harvest in the coastal and marine waters of this state with the following exceptions:

- Any person under the age of 16
- Residents 65 years of age or older
- Residents who are adjudged totally service-connected disabled by the Veteran's Administration or 100% disabled though the Social Security Administration

### 5.2.3.7 Laws and Regulations

Mississippi laws which regulate the harvest of sheepshead are primarily limited to gear restrictions for the use of nets.

Ordinance 5.013 regulates the methods of harvest as related to the sheepshead fishery in Mississippi marine waters. The following is a general summary of regulations that apply to the harvest of sheepshead; however, the MDMR should be contacted for the most current regulations.

Title 49, Chapter 15 of the Mississippi Code of 1972 section §49-15-96 allows licensed shrimpers to retain (for personal consumption only), no more than 25 lbs of sheepshead that are caught in shrimp trawls.

#### 5.2.3.7.1 Size limits

Currently there are no commercial or recreational size limits for sheepshead in Mississippi.

#### 5.2.3.7.2 Closed Areas and Seasons

All commercial fishing is prohibited north of the CSX railroad track in coastal Mississippi. Gill nets, trammel nets, purse seines, and other commercial nets may not be used within 1,200 ft of any public pier or hotel/motel pier, and they are prohibited within 300 ft of any private piers that are at least 75 ft in length. These 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. These aforementioned nets are prohibited within 100 ft of the mouth of rivers, bays, bayous, streams, lakes, and other tributaries to Mississippi marine waters. Point aux Chenes Bay, Middle Bay, Jose Bay, L'Isle Chaude, Heron Bay, Pascagoula Bay (south of the CSX railroad bridge), and Biloxi Bay (south of a line between Marsh point and Grand Bayou). The nets must not be used in a manner to block any of these bays, bayous, rivers, streams, or other tributaries.

No gill or trammel nets, seines, or like contrivance may be used within an area formed by a line running one mile from the shoreline of the national park islands of Ship, Horn, and Petit Bois. In addition, no gill or trammel nets, seines, or like contrivance may be used within 1 mile of Cat and Round islands, or from the shoals of Telegraph Keys and Telegraph Reef (Merrill Coquille) from May 15 to September 15 of each year.

There are no closed seasons for the harvest of sheepshead. Section 49-15-78 states gill or trammel nets cannot be set within ½ mile of shoreline in the state of Mississippi.

It is illegal to use a gill or trammel net in the marine waters of Mississippi or to possess fish in, or in contact with, a gill or trammel net in a boat in the marine waters of Mississippi between 6:00 a.m. on Saturday mornings and 6:00 p.m. on Sunday evenings or on any legal holidays established by the Mississippi Legislature and as set forth in Mississippi Code Annotated §3-3-7. No gill or trammel net shall be set within ¼ mile of another gill or trammel net. Gill and trammel nets must be attended at all times from a distance of no greater than the length of the boat in use. All gill and trammel nets must be constructed of an approved degradable material. An approved degradable materials list will be on file with the Executive Director of the MDMR or his designee.

#### 5.2.3.7.3 Quota and Bag/Possession Limits

There are no quotas, bag limits, or possession limits for the commercial or recreational sheepshead fisheries in the state of Mississippi.

### 5.2.3.8 Historical Changes to the Regulations

Sheepshead are not regulated in Mississippi either commercially or recreationally.

## 5.2.4 Louisiana

### 5.2.4.1 Louisiana Department of Wildlife and Fisheries

Louisiana Department of Wildlife and Fisheries
P.O. Box 98000
Baton Rouge, Louisiana 70898-9000
Marine Fisheries: (225) 765-2384
Law Enforcement: (225) 765-2989
www.wlf.state.la.us

The Louisiana Department of Wildlife and Fisheries (LDWF) is one of 21 major administrative units of the Louisiana government. The Governor appoints a seven-member board, the Louisiana Wildlife and Fisheries Commission (LWFC). 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 Governor with consent of the Senate appoints the Secretary.

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 Department of Natural Resources is the state agency that monitors compliance of the state Coastal Zone Management Plan and reviews federal regulations for consistency with that plan.

### 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 the 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 the rules and regulations adopted by the LWFC and the LDWF that govern marine fisheries.

Section 320 of Title 56 (L.R.S.) establishes methods of taking freshwater and saltwater fish. Section 326 establishes a 10 inch minimum size for sheepshead taken commercially. Additionally, Sections 325.1 and 326.3 of Title 56 (L.R.S.) give the LWFC the legislative authority to set possession limits, quotas, places, season, 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 LWFC is also authorized to enter into reciprocal licensing agreements.

Residents of Texas 65 years of age or under 17 years of age may fish in all Louisiana/Texas border waters without a 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.

#### 5.2.4.3.2 Limited Entry

No limited entry exists to commercially take sheepshead with legal commercial gear other than with a commercial rod and reel. Louisiana has adopted limited access restriction for the issuance of a commercial rod and reel license. Sections 325.4 and 305B(14) of Title 56 (L.R.S.) as amended in 1995 provide that rod and reel licenses may only be issued to a person who has derived 50% or more of his income from the capture and sale of seafood species in at least two of the years 1993, 1994, and 1995 and has 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.

#### 5.2.4.4 Commercial Landings Data Reporting Requirements

Wholesale/retail seafood dealers who purchase sheepshead from fishermen are required to report those purchases by the tenth of the following month on trip tickets supplied by the Department for that purpose. Commercial fishermen who sell sheepshead directly to consumers must be licensed as a wholesale/retail seafood dealer or Fresh Products Licensee and comply with the same reporting requirements.

#### 5.2.4.5 Penalties for Violations

Violations of Louisiana laws or regulations concerning the commercial or recreational taking of sheepshead by legal commercial gear shall constitute a Class 3 violation which is punishable by a fine from $250 to $500 or imprisonment for not more than 90 days or both. Second offenses carry fines of not less than $500 or more than $800 and imprisonment of not less than 60 days or more than 90 days and forfeiture to the LWFC of any equipment seized in connection with the violation. Third and subsequent offenses have fines of not less than $750 or more than $1,000 and imprisonment for not less than 90 days or more than 120 days and forfeiture of all equipment involved with the violation. Civil penalties may also be imposed.

In addition to any other penalty, for a second or subsequent violation of the same provision of law the penalty imposed may include revocation of the permit or license under which the violation occurred for the period for which it was issued and barring the issuance of another permit or license for that same period.

#### 5.2.4.6 Annual License Fees

The following list of licenses fees is current to the date of this publication. They are subject to change any time thereafter. *The LDWF should be contacted for current license fees.*

##### 5.2.4.6.1 Commercial

| | |
|---|---|
| Commercial fisherman's license | |
| · resident | $55.00 |
| · nonresident | 460.00 |
| Commercial wholesale/retail license (business) | |
| · resident | $250.00 |
| · nonresident | $1,105.00 |
| Fresh Products license (Commercial Fisherman's License required) | |
| · resident | $20.00 |
| · nonresident | $120.00 |
| Vessel license | |
| · resident | 15.00 |
| · nonresident | 60.00 |
| Gear licenses (trawls, hoop nets, cast nets, set lines, flounder gigs, spear guns) | |
| · resident | 25.00 |
| · nonresident | 100.00 |

| | |
|---|---|
| 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 |

#### 5.2.4.6.2 Recreational

| | |
|---|---|
| Hook & Line (cane pole) | |
| · resident | 2.50 |
| Basic recreational fishing license | |
| · resident | 9.50 |
| · nonresident | 60.00 |
| Saltwater angling license | |
| · resident | 5.50 |
| · nonresident | 30.00 |
| Temporary basic recreational fishing license | |
| · nonresident 1-day | 5.00 |
| · nonresident 4-day | 15.00 |
| Temporary saltwater recreational license (four day) | |
| · nonresident 1-day | 15.00 |
| · nonresident 4-day | 45.00 |
| Charter Passenger (3-day) | |
| · resident | 5.00 |
| · nonresident | 30.00 |
| Non-resident Active Military Fishing | 9.50 |
| Non-resident Active Military Saltwater | 5.50 |
| LA Disabled Fishing | 2.50 |
| LA Disabled Saltwater | 2.50 |
| Senior LA Fish / Hunt | 5.00 |
| LA Sportsman's Paradise License (basic & SW fishing; basic & big game hunting, bow, muzzle, turkey and LA waterfowl license; WMA hunting permit, and all recreational gear licenses <u>except recreational trawls greater than 16 feet in length</u>) | 100.00 |

Nonresidents may not purchase any gear license for Louisiana if their resident state prohibits the use of that particular gear.

### 5.2.4.7 Laws and Regulations

Louisiana laws and regulations regarding the harvest of sheepshead include gear restrictions, season, 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

No recreational size limit. Commercial size limit is 10 inches minimum total length.

#### 5.2.4.7.2 Gear Restrictions

Licensed commercial fisherman may take sheepshead commercially with a pole, line, yo-yo, hand line, trotline wherein hooks are not less than 24 inches apart, trawl, skimmer, butterfly net, cast net, scuba gear using standard spearing equipment, and rod and reel (if permitted). It is also legal to harvest sheepshead with hoop nets with the proper gear license.

Licensed recreational fisherman may take sheepshead recreationally with a bow and arrow, scuba gear, hook and line, and rod and reel.

#### 5.2.4.7.3 Closed Areas and Seasons

Commercial activities including harvest of sheepshead are prohibited on designated refuges and state wildlife management areas.

#### 5.2.4.7.4 Quotas and Bag/Possession Limits

There is no quota on sheepshead. However, R.S.56:325.4 requires that the LDWF make an annual peer-reviewed and evaluated report to the legislature that includes the spawning potential ratio (SPR), a biological condition and profile of the species and stock assessment. If the report shows that the SPR is below 30%, the department is required to close the season within two weeks for a period of at least one year.

#### 5.2.4.7.5 Other Restrictions

The use of aircraft to assist fishing operations is prohibited. Sheepshead 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 aboard the harvesting vessel, a person shall have no more than two pounds of finfish parts per person on board the vessel, provided that the vessel is equipped to cook such finfish. The provisions shall not apply to bait species.

### 5.2.4.8 Historical Changes in Regulations

The following regulatory changes may have notably influenced the landings during a particular year and are summarized here for interpretive purposes.

Prior to 1976: Commercial regulations allowed a minimum bar-mesh size 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. No creel limits, size restrictions, or quota placed on properly licensed fishermen. Recreational fishermen were required to possess a basic fishing license.

1977: 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.

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

1983: 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: 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. Required saltwater fishing license for all anglers fishing south of the officially established "saltwater line" for saltwater species.

1986: Saltwater Seller's License discontinued.

1987: Established minimum bar-mesh sizes of 1.75 inches for saltwater gillnets, saltwater fish seines and the inside wall of saltwater trammel nets.

1988: Prohibited the use of unattended nets and established a seasonal framework for the use of "strike" gillnets.

1992: Harvest with "strike" gill nets prohibited between sunset Friday through sunrise Monday.

1995: Use of "set" gill nets or trammel nets prohibited in saltwater areas. Restricted the use of "strike" gill nets for sheepshead harvest to the period between the third Monday in October and March 1 of the following year. A "Restricted Species Permit" required to harvest sheepshead, and several criteria were established in order to qualify for that permit. Possession of Marine Resources Conservation Stamp required by all saltwater anglers (three-year period).

1997: All harvest by gill or trammel nets banned, and legal commercial gear to harvest sheepshead is limited to trawls, commercial cast nets, trotlines and commercial rod and reel.

### 5.2.5 Texas

#### 5.2.5.1 Texas Parks and Wildlife Department

Texas Parks and Wildlife Department
Coastal Fisheries Division
4200 Smith School Road
Austin, Texas 78744
(512) 389-4863
www.tpwd.state.tx.us

The Texas Parks and Wildlife Department (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, and Law Enforcement are named by the Executive Director. The Coastal Fisheries Division, headed by a Division Director, is under the supervision of the Deputy Executive Director, Operations.

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-Zone Management Program (TCZMP). The Coastal Coordination Council monitors compliance of the TCZMP and reviews federal regulations for consistency with that plan. The Coastal Coordination Council is an eleven-member group whose members consist of a chairman (the head of TGLO) and representatives from Texas Commission on Environmental Quality, TPWC, 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 must live in the coastal zone.

### 5.2.5.2 Legislative Authorization

Chapter 11, Texas Parks and Wildlife Code, establishes the TPWC and provides for its make-up and appointment. Chapter 12, Texas Parks and Wildlife Code, establishes the powers and duties of the TPWC, and Chapter 61, Texas Parks and Wildlife Code, provides the TPWC with responsibility for marine fishery management and authority to promulgate regulations. Chapter 47, Texas Parks and Wildlife Code, provides for the authority to create commercial licenses required to catch, sell, and transport finfish commercially, and Chapter 66, Texas Parks and Wildlife Code, provides for the sale, purchase, and transportation of protected fish in Texas. All regulations pertaining to size limits, bag and possession limits, and means and methods pertaining to finfish are adopted by the TPWC and included in the annual Texas Statewide Hunting and Fishing Proclamations. Additionally, the Texas Department of Health (TDH), under Chapter 436 of the Texas Health and Safety Code, has the authority to regulate the fish processing industry, and to close areas to fishing based upon contaminant sampling to protect human health.

### 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. TPWD has statutory authority to enter into reciprocal management agreements under Chapter 11 of the Texas Parks and Wildlife Code Section 11.0171.

#### 5.2.5.3.2 Limited Entry

On June 18, 1999, Governor George W. Bush signed Senate Bill 1303 into law, creating Texas' third commercial fishing limited entry program – The Finfish License Management Program. This program, which went into effect on September 1, 2000, seeks to complement traditional management measures through restricting access into the fishery to offset increased effort, and ultimately create long-term social, economic, and biological stability in the fishery. Key elements of Senate Bill 1303 included establishing: 1) eligibility requirements (based on historical participation in the finfish fishery between September 1, 1997 and April 20, 1999) to receive a license in the program; 2) a voluntary buyback program; 3) a review board of finfish license holders to review hardship and appeal cases and to advise TPWD on various aspects of the program administration; and 4) a report to the Legislature and Governor for review of the program. Other key features of the bill include restrictions on the number of licenses held, license transfers, and license suspensions for flagrant violations. Senate Bill 1303 is embodied in Chapter 47, Texas Parks and Wildlife Code. TPWC proclamations regarding the program are contained in Chapter 31 Texas Administrative Code, Section 58.301.

Additionally, under Chapter 47, Texas Parks and Wildlife Code, no person may engage in business as a commercial finfish fisherman unless a commercial finfish fisherman's license has been obtained. In order to qualify for a commercial finfish fisherman's license, a person must file an affidavit with the department at the time the license is applied for that states:

1) the applicant is not employed at any full-time occupation other than commercial fishing; and,
2) during the period of validity of the commercial finfish fisherman's license, the applicant does not intend to engage in any full-time occupation other than commercial fishing.

### 5.2.5.4 Commercial Landings Data Reporting Requirements

Chapter 66, Section 66.019, Texas Parks and Wildlife Code, provides:

a) The department shall gather statistical information on the harvest of aquatic products of this state.
b) The department shall prescribe the method or methods used to gather information and shall produce and distribute any applicable report forms.
c) Unless otherwise required by the department, no dealer who purchases or receives aquatic products directly from any person other than a licensed dealer may fail to file the report with the department each month on or before the tenth day of the month following the month in which the reportable activity occurred. The report must be filed even if no reportable activity occurs in the month covered by the report. No dealer required to report may file an incorrect or false report. A culpable mental state is not required to establish an offense under this section.
d) Unless otherwise required by the department, no dealer who purchases, receives, or handles aquatic products (other than oysters) from any person except another dealer may fail to:

1) maintain cash sale tickets in the form required by this section as records of cash sale transactions; or
2) make the cash sale tickets available for examination by authorized employees of the department for statistical purposes or as a part of an ongoing investigation of a criminal violation during reasonable business hours of the dealer.

e) All cash sale tickets must be maintained at the place of business for at least one year from the date of the sale.

f) A cash sale ticket must include:
1) name of the seller;
2) general commercial fisherman's license number, the commercial finfish fisherman's license number, the commercial shrimp boat captain's license number, the commercial shrimp boat license number, or the commercial fishing boat license number of the seller or of the vessel used to take the aquatic product, as applicable;
3) pounds sold by species;
4) date of sale;
5) water body or bay system from which the aquatic products were taken; and
6) price paid per pound per species.

#### 5.2.5.5 Penalties for Violations

Penalties for violations of Texas' proclamations regarding sheepshead are provided in Chapter 61, Texas Parks and Wildlife Code, and most are Class C misdemeanors punishable by fines ranging from $25 to $500. Under certain circumstances, a violation can be enhanced to a Class B misdemeanor punishable by fines ranging from $200 to $1,000; confinement in jail not to exceed 180 days; or both. Under Chapter 47, Section 47.003, flagrant violations by holders of a commercial finfish license may result in revocation of the license.

#### 5.2.5.6 Annual License Fees

The following is a list of licenses and fees that are applicable to sheepshead harvest in Texas as of September 1, 2005. Licenses and fees are subject to change at any time thereafter. *The TPWD should be contacted for current license fees.*

##### 5.2.5.6.1 Recreational

| | |
|---|---|
| Resident Saltwater Fishing Package | $33.00 |
| Resident All Water Fishing Package | $38.00 |
| Special Resident Saltwater Fishing Package | $16.00 |
| Special Resident All Water Fishing Package | $21.00 |
| Resident “Year-From-Purchase” All Water Fishing Package | $45.00 |
| July and August Resident Saltwater Fishing Package | $30.00 |
| July and August Resident All Water Fishing Package | $35.00 |
| Resident “Day Plus” Saltwater Fishing Package | $16.00/$4.00 |
| Resident “Day Plus” All Water Fishing Package | $21.00/$4.00 |
| Non-Resident Saltwater Fishing Package | $60.00 |

| | |
|---|---|
| Non-Resident All Water Fishing Package | $65.00 |
| Non-Resident “Day-Plus” Saltwater Fishing Package | $22.00/$8.00 |
| Non-Resident “Day-Plus” All Water Fishing Package | $27.00/$8.00 |
| Resident Fishing Guide License | $200.00 |
| Non-Resident Fishing Guide License | $1000.00 |
| Resident “Super Combo” License Package | $64.00 |
| Senior Resident “Super Combo” License Package | $30.00 |
| Resident Combination Hunting/Saltwater Fishing License Package | $52.00 |
| Resident Combination Hunting/All Water Fishing License Package | $57.00 |
| Senior Resident Combination Hunting/Saltwater Fishing License Pkg. | $20.00 |
| Senior Resident Combination Hunting/All Water Fishing License Pkg. | $25.00 |
| Lifetime Resident Fishing License | $600.00 |
| Lifetime Resident Combination Hunting and Fishing License Pkg. | $1000.00 |
| Resident Disabled Veteran “Super Combo” Hunting/All Fishing Pkg. | Free |

**5.2.5.6.2 Commercial**

| | |
|---|---|
| General commercial fisherman's license | |
| · resident | $24.00 |
| · nonresident | 180.00 |
| Commercial finfish fisherman's license | |
| · resident | 360.00 |
| · nonresident | 1,440.00 |
| Commercial fishing boat license | |
| · resident | 18.00 |
| · nonresident | 72.00 |

**5.2.5.7 Laws and Regulations**

Various provisions of the Statewide Hunting and Fishing Proclamation adopted by the TPWC affect the harvest of sheepshead 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 12 inches TL has been established for sheepshead in Texas.

**5.2.5.7.2 Gear Restrictions**

Gill nets, trammel nets, seines, purse seines, and any other type of net or fish trap are prohibited in the coastal waters of Texas. Sheepshead may be legally taken by pole and line, trotline, sail line, bow and arrow, spears, and gig. Sheepshead taken incidentally during legal shrimp trawling operations may be retained provided the total weight of aquatic products retained, in any combination, does not exceed 50% by weight of shrimp on a shrimping vessel. The bag limit for sheepshead retained incidental to a legal shrimping operation is equal to a recreational bag limit.

### 5.2.5.7.3 Closed Areas and Seasons

Possession of all species of fish and crabs is prohibited in portions of upper Lavaca Bay in Calhoun County. There are no other closed areas or seasons for the taking of sheepshead in Texas. The Texas Department of State Health Services (TDSHS) publishes an annual report of fish consumption advisories and bans in Texas' waters.

### 5.2.5.7.4 Quotas and Bag/Possession Limits

#### 5.2.5.7.4.1 Recreational

Bag limit – five
Possession limit – ten

#### 5.2.5.7.4.2 Commercial

There is not a daily bag and possession limit for the holder of a valid Commercial Finfish Fisherman's License. Non-game fish and other aquatic products taken incidental to legal shrimp trawling operations may be retained provided the total weight of aquatic products retained, in any combination, does not exceed 50% by weight of shrimp on a shrimping vessel. The bag limit for sheepshead retained incidental to a legal shrimping operation is equal to a recreational bag limit.

### 5.2.5.7.5 Other Restrictions

Sheepshead must be kept in a "whole" condition with heads and tails attached until landed on a barrier island or the mainland; however, viscera and gills may be removed.

### 5.2.5.8 Historical Changes to Regulations

The following regulatory changes may have notably influenced the landings during a particular year and are summarized here for interpretive purposes.

- 1977: TPWC adopts prohibition of weekend use of nets and trotlines in coastal regulatory county waters.
- 1979: Texas becomes the first state to prohibit the use of single strand monofilament gill nets in some situations.
- 1981: House Bill 1000 (Redfish Bill) passed which designated red drum and spotted seatrout as game fish, and prohibited their sale. An attempt by commercial finfish fishermen to overturn the law in federal court was unsuccessful. Commercial finfish fishermen subsequently redirected their fishing effort to black drum, southern flounder and other species.
- 1983: The Wildlife Conservation Act was passed giving the TPWC authority to manage fish and wildlife. Prior to the passage of this act, all hunting and fishing laws in 13 Texas counties, and certain laws in 72 counties were set by the Legislature,

while regulations set by TPWC in 30 other counties were subject to review by local county commissioners' courts.

1984: The minimum mesh size for commercial trammel nets was set at 6-inch stretched, and mainlines on trotlines were required to be fished on the bottom.

1985: The Saltwater Stamp Bill created a $5.00 stamp for saltwater anglers. This provided an estimate of the number of anglers fishing in saltwater and provided revenue for improved coastal fisheries management and law enforcement. Funding allowed for expansion of the TPWD Coastal Fisheries Division's monitoring programs and an increase in staff to support them.

1988: The TPWC voted to close Texas' waters to all gillnets, trammel nets, and drag seines. In addition, several statewide bag and size limits were set including a minimum length of twelve inches, and a daily recreational bag limit of five for sheepshead. Commercial fishermen were also required to comply with the size limits.

1989: Senate Bill 609 was passed prohibiting possession of illegal fishing devices on or near Texas' waters. House Bill 1417 passed creating a new mechanism for civil restitution cases designed to strengthen fishing laws and their enforcement. Regulations were modified to prohibit the use of top-water trotlines and to establish circle hooks as the only style of hook that can legally be used on saltwater trotlines.

1992: An exemption was provided for removing trotlines during weekend periods when small craft warnings are in effect.

1995: Senate Bill 750 was passed which granted authority to TPWC to create a limited entry fishery for bay and bait shrimpers. This may have resulted in some redirection of fishing effort, and possibly a reduction in bycatch.

1997: House Bill 2542 was passed which granted authority to TPWC to create a limited entry fishery for crabbers. This may have resulted in some redirection of fishing effort, and possibly a reduction in bycatch.

1999: On June 18, 1999, Governor George Bush signed into law Senate Bill 1303 authorizing the TPWC under Parks and Wildlife Code 47, to establish a license limitation plan for the Texas commercial finfish fishery with the goal of improving the economic stability of the commercial finfish fishery while providing long-term sustainability of finfish stocks. The Finfish License Management Program became effective September 1, 2000.

2001: The Texas Legislature granted authority to TPWC to create an abandoned crab trap removal program. This program is intended to remove derelict traps from state waters to reduce navigational hazards and mortality to aquatic organisms due to "ghost fishing." Subsequent studies have revealed that sheepshead are the most abundant vertebrate species captured in derelict crab traps.

2001: By TPWC proclamation, all species landed in Texas must meet Texas' length and bag, and possession limits regardless of where they were caught.

2002: By TPWC proclamation, a special "boat limit" was created for guided fishing trips. The "boat limit" consists of the aggregate limit of the paying customers only.

## 5.3 Regional/Interstate

### 5.3.1 Gulf States Marine Fisheries Compact (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 governor appoints the third, a citizen who shall have knowledge of and interest in marine fisheries. 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 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).

#### 5.3.2.1 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 (S) IN THE UNITED STATES GULF OF MEXICO

Sheepshead have a long history of use along the Gulf Coast. There is evidence that sheepshead were sought after as a food fish along the prehistoric Gulf Coast. Jewell (1997) notes sheepshead bones in archeological digs in Mississippi dating back to the 1300's. These sheepshead were most likely caught using the nets, traps, and possibly poisons available to native populations at that time. The first recorded annual commercial sheepshead harvest from the Gulf of Mexico was 778,800 lbs from Texas in 1890 (Higgins and Lord 1926).

Currently, sheepshead are caught commercially, recreationally, and incidentally throughout the Gulf of Mexico region. Although their commercial and recreational value is not as great as other gulf species, they are sought after for their excellent quality as a food fish. Sheepshead are often substituted for snapper and other fish on restaurant menus. With the reduced abundance and increased regulations on other gulf species more demand is being placed on sheepshead recreationally and commercially. Sheepshead are caught predominantly in state territorial waters. A wide variety of gears and vessels are employed, and fishing is pursued year-round in most areas.

### 6.1 Recreational Fishery

#### 6.1.1 History

The NMFS Marine Recreational Fisheries Statistics Survey (MRFSS) and the Texas Recreational Harvest Monitoring Program provide the most current Gulf-wide sources of recreational fishing information. The Texas program has been in place since 1974 and the MRFSS since 1979. Together they provide the best estimates of landings and effort by recreational anglers in the Gulf States. The trend toward additional economic add-ons in the MRFSS survey is beginning to improve the available information on the recreational sector. In recent years, the MRFSS and Texas programs have increased sampling efforts leading to more reliable estimates of the recreational contribution to the sheepshead fishery. Unlike commercial landings information, the reported recreational landings in the MRFSS include both kept (type A and B1 that are observed and reported catches) and released fish (type B2). These data are less affected by regulations than are commercial landings data. The recreational landings presented in these figures and tables are type A+B1 and actually represent total harvest, as designated by the NMFS. Gulf-wide recreational landings from 1981 to 2003 are summarized in Table 6.1 by total number.

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 throughout the late 1970s to early 1990s which included the designation of some species as "gamefish" and the banning of entanglement nets in some states. These actions directly impacted the commercial take of sheepshead and indirectly affected the

**Table 6.1** Total annual sheepshead recreational landings (number) by state from 1981 to 2003 (NMFS unpublished data, TPWD unpublished data). **Note**: Texas numbers do not include any "shore mode" landings which would likely increase the Texas totals for sheepshead significantly.

| Year | FL | AL | MS | LA | TX | Total |
|---|---|---|---|---|---|---|
| 1981 | 426,647 | 428 | 21,015 | 170,011 | 163,000 | 781,101 |
| 1982 | 692,556 | 53,713 | 144,829 | 279,202 | 139,400 | 1,309,700 |
| 1983 | 1,169,643 | 92,958 | 66,575 | 675,457 | 175,200 | 2,179,833 |
| 1984 | 892,412 | 35,010 | 23,960 | 265,608 | 114,455 | 1,331,445 |
| 1985 | 942,062 | 21,929 | 13,673 | 335,014 | 102,998 | 1,415,676 |
| 1986 | 500,429 | 78,352 | 25,706 | 638,610 | 61,047 | 1,304,144 |
| 1987 | 590,099 | 177,374 | 106,316 | 168,974 | 55,222 | 1,097,985 |
| 1988 | 1,582,398 | 208,453 | 215,943 | 316,658 | 111,102 | 2,434,554 |
| 1989 | 1,719,393 | 313,501 | 192,117 | 311,345 | 44,721 | 2,581,077 |
| 1990 | 889,637 | 226,099 | 47,466 | 151,159 | 37,000 | 1,351,361 |
| 1991 | 844,453 | 226,021 | 65,366 | 212,753 | 58,951 | 1,407,544 |
| 1992 | 2,041,747 | 107,330 | 148,676 | 593,397 | 52,986 | 2,944,136 |
| 1993 | 1,943,294 | 138,453 | 64,872 | 432,691 | 58,834 | 2,638,144 |
| 1994 | 905,950 | 127,723 | 250,031 | 283,401 | 60,255 | 1,627,360 |
| 1995 | 1,218,703 | 262,005 | 196,129 | 642,405 | 70,370 | 2,389,612 |
| 1996 | 675,558 | 84,805 | 65,692 | 587,396 | 63,727 | 1,477,178 |
| 1997 | 633,392 | 111,670 | 154,050 | 648,926 | 87,709 | 1,635,747 |
| 1998 | 691,723 | 89,779 | 57,536 | 476,750 | 95,108 | 1,410,896 |
| 1999 | 819,629 | 108,540 | 22,815 | 307,399 | 99,814 | 1,358,197 |
| 2000 | 721,327 | 134,285 | 43,354 | 379,203 | 79,938 | 1,358,107 |
| 2001 | 661,643 | 234,811 | 91,842 | 325,760 | 68,022 | 1,382,078 |
| 2002 | 646,779 | 158,691 | 67,973 | 590,951 | 90,351 | 1,554,745 |
| 2003 | 755,928 | 265,228 | 76,724 | 801,204 | 71,332 | 1,970,416 |

recreational take by reducing the total commercial impact on the fishery. In addition, the ability of the growing recreational fishery to access sheepshead habitats has further increased the potential recreational impact on the fishery.

However, despite increased accessibility and increased angler participation, sheepshead are still targeted by only a select group of anglers. While participation has increased steadily in the Gulf States, the number of sheepshead landed has remained relatively stable, with the exception of the Gulf coast of Florida which had several increases in the late 1980s and early 1990s (Figure 6.1). In 2003, approximately 20.9 million total trips were made by anglers in Florida, Alabama, Mississippi, and Louisiana. Of those trips, 1.6 million (7.5%) were taken by

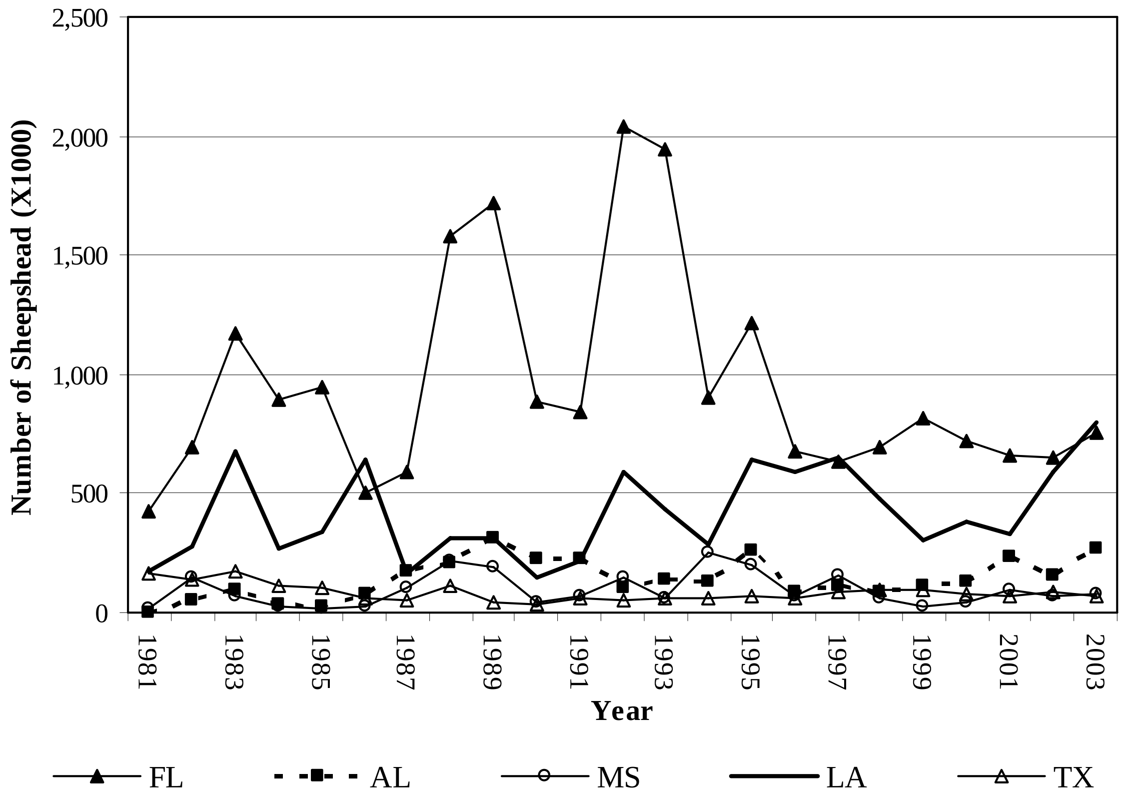


**Figure 6.1** Gulfwide total number of recreationally harvested sheepshead by state from 1981 to 2003 (NMFS unpublished data, TPWD unpublished data).

anglers specifically targeting sheepshead (NMFS unpublished data). Although targeted by some anglers, many recreational fishermen perceive sheepshead as difficult to catch and clean and therefore consider them 'less desirable.'

Sheepshead are caught by anglers in bayous, bays, rivers and other estuarine habitats, as well as offshore. Sheepshead are usually caught while fishing on or near the bottom using hook and line. A small, stout hook must be used because of the sheepshead's small but strong mouth. Sheepshead nibble at bait with their notched incisor teeth; therefore, the angler must be quick to set the hook. Viosca (1954) stated:

> "The sheepshead is essentially a bottom feeder. Sometimes it will come up to the surface alongside pilings to graze on barnacles and other attached animal growths, and it will even bite near the surface at the oil rigs; but in inland waters your best chance of catching them is when fishing near the bottom…You will not find them on plain bottoms, mud or sand. They graze chiefly on hard, rough reefs or in the grass like cows."

Preferred baits are cut crab and shrimp; some use hermit crabs, oysters, fiddler crabs, and sand fleas (Viosca 1954). Some forms of chum used to attract sheepshead include dog food, crushed crabs, shucked oyster shells, or broken barnacles scraped from nearby structures. The world record sheepshead was caught in Louisiana waters in 1982 and weighed 21.25 lbs. State records for sheepshead taken recreationally in the Gulf are provided in Table 6.2.

**Table 6.2** Sheepshead records in the Gulf of Mexico region

| State | Angler | Weight | Date | Location |
|---|---|---|---|---|
| **Florida** | Eugene Lechler | 15 lbs. 2 ozs. | 01/29/1981 | Homosassa |
| **Alabama** | Drew Parrish | 12 lbs. 15 ozs. | 11/20/2001 | Spanish Ft. |
| **Louisiana** | Wayne J. Desselle | 21 lbs. 4 ozs.* | 04/01/1982 | Bayou St. John |
| **Mississippi** | Roy Groue Jr. | 19 lbs. 10 ozs. | 1966 | Unknown |
| **Texas** | Wayne Gilstrap | 15 lbs. 4 ozs | 10/17/2002 | Laguna Madre |

* Denotes World Record

Since 1981, recreational sheepshead landings in the Gulf have varied widely, ranging from 781,000 fish in 1981 to 2.9 million in 1992 (Figure 6.2). While state landings have stabilized in the last several years (Figure 6.1), a slight increase in total recreational landings occurred from 2000 through 2003 (NMFS 2004) (Figure 6.2). In the United States, the Gulf of Mexico region comprises the largest portion of the recreational sheepshead fishery, averaging

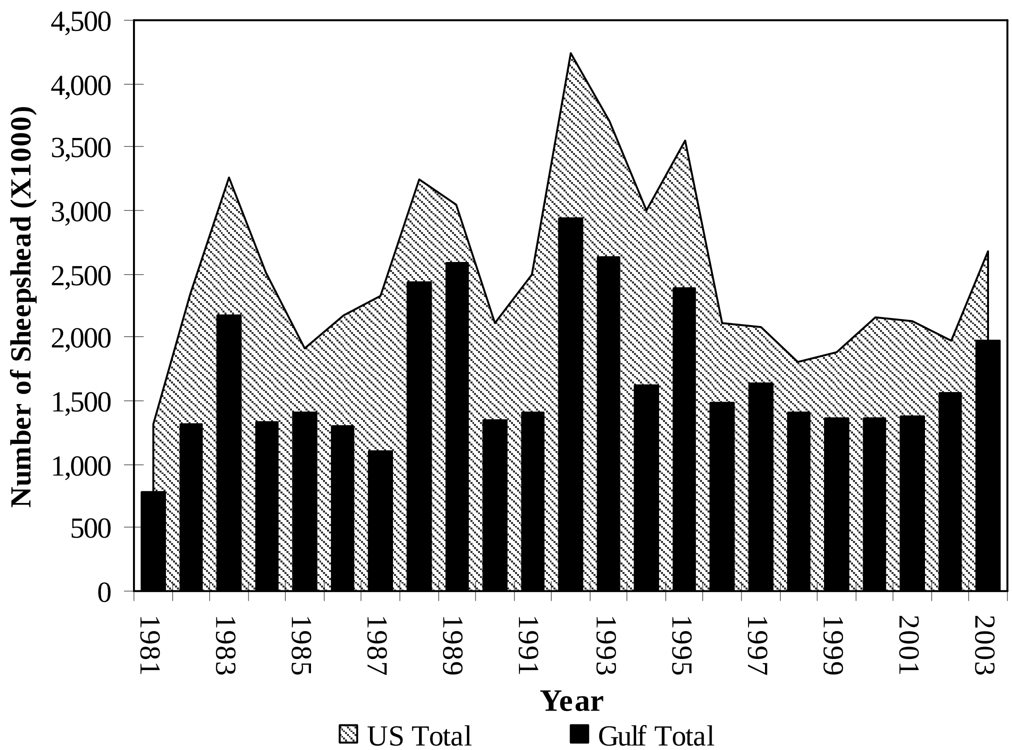


**Figure 6.2** Recreational harvest of sheepshead by number from the Gulf of Mexico and the total US including the Gulf from 1981 to 2003 in thousands of sheepshead (NMFS unpublished data, TPWD unpublished data).

66.89% of total catch since 1981. Of the 2.68 million sheepshead caught in United States waters in 2003, 1.97 million (76.3%) were harvested from the Gulf (NMFS 2004) (Figure 6.2). It should be noted that the TPWD does not survey their shore based anglers in their angler survey. Considering that the majority of the landings of sheepshead are associated with nearshore structures, it is likely that a large component of the recreational catch of sheepshead in Texas is not being accounted for which would explain the apparent low number of landings in Texas waters.

### 6.1.2 State Fisheries

Gear, vessels, seasons, fishing methods and other aspects of the recreational fishery vary from state to state. These variations are due at least in part to geographical and sociological diversity.

#### 6.1.2.1 Florida

In 2003, participation in Florida's Gulf coast saltwater recreational fishery, including non-coastal residents and out-of-state anglers, was estimated at 4.28 million. In addition, those anglers made approximately 14.5 million trips and accounted for approximately 69% of all recreational trips made in the eastern and central Gulf (Florida to Louisiana) in 2003 (NMFS 2004). The total number of recreational anglers increased steadily since the early 1990s; non-residents made up a large component of the licensed anglers in Florida. The number of sheepshead landed varied greatly with notable increases in the years 1988/1989 and 1992/1993 (Figure 6.3). Declines since 1996 could be attributed to a 12 inch minimum size limit and a 10

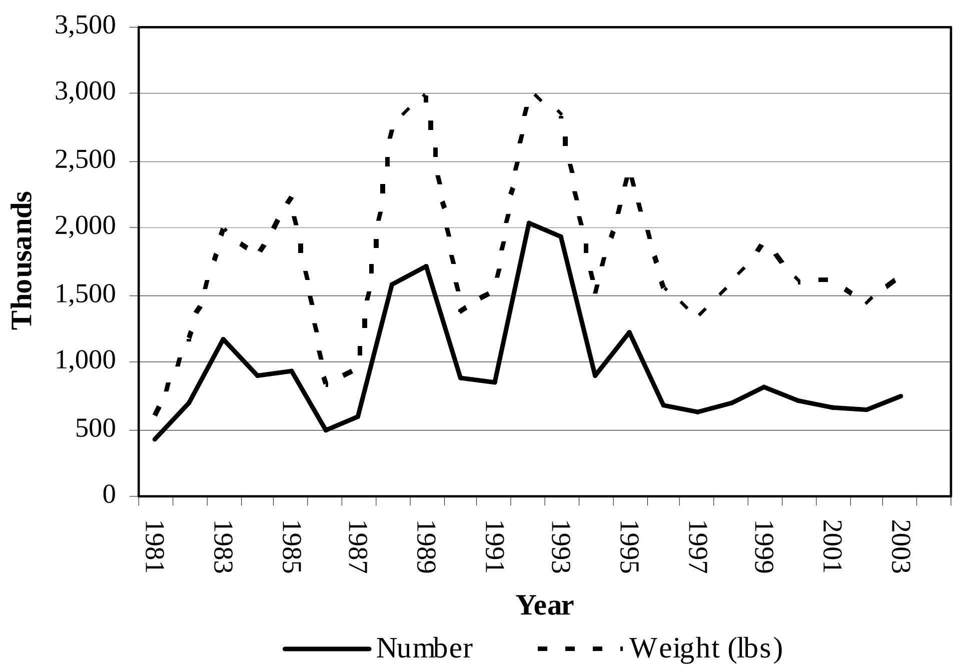


**Figure 6.3** Recreational sheepshead harvest from 1981 to 2003 along Florida's West coast by total number and weight (NMFS unpublished data).

fish bag limit. Since 1996, the number of sheepshead landed remained around 700,000 (1.6 million lbs) annually along the Florida Gulf coast.

### 6.1.2.2 Alabama

Alabama recreational anglers consistently landed (on average) 150,000 sheepshead weighing a total of 400,000 lbs annually, although a few years of higher landings have occurred (Figure 6.4). The highest landings reported for Alabama were in 1989; recreational anglers landed approximately 313,501 sheepshead weighing almost 916,000 lbs. Participation in Alabama's recreational fishery varied widely as well (Figure 6.5). In 2003, participation in Alabama, including non-coastal residents and out-of-state anglers, was estimated at 524,059 anglers making 1.2 million trips. Of those trips taken, anglers surveyed by MRFSS samplers indicated that a little over 150,000 trips were specifically taken to target sheepshead. Like most of the Gulf States, the number of trips taken by anglers has steadily increased since the early 1980s. Recreational trips in Alabama accounted for approximately 6% of all recreational trips in the Gulf (excluding Texas) (NMFS 2004).

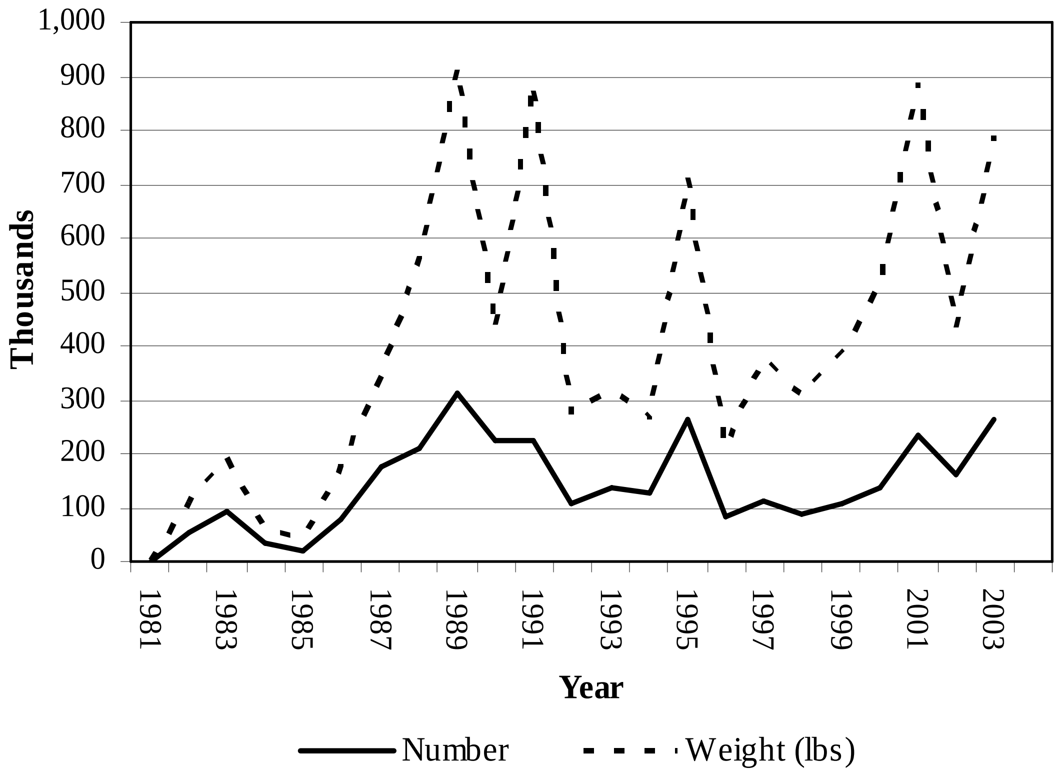


**Figure 6.4** Alabama's total recreational sheepshead harvest by total number and weight from 1981 to 2003 (NMFS unpublished data).

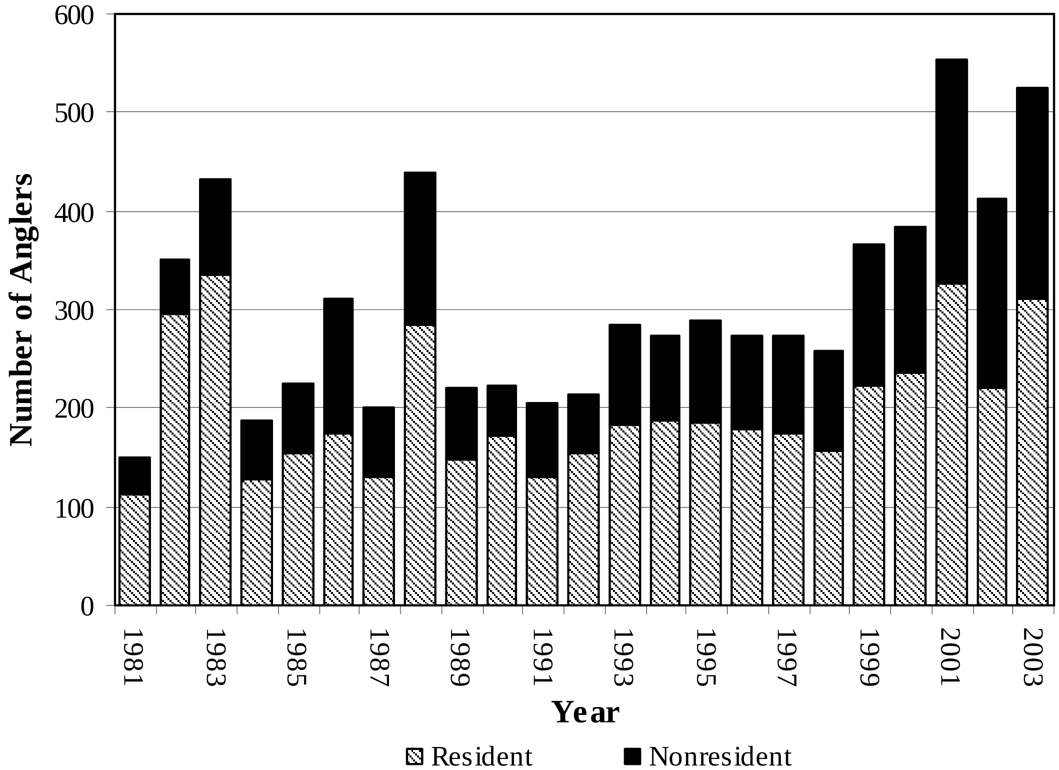


**Figure 6.5** Number of Alabama resident and nonresident saltwater anglers from 1981 to 2003 (NMFS unpublished data).

#### 6.1.2.3 Mississippi

Mississippi recreational anglers share the designation with Texas for the smallest contribution of sheepshead landings in the Gulf of Mexico. Only 4% of the 1.1 million trips taken by Mississippi anglers surveyed by MRFSS were targeting sheepshead. As a result of the low priority this species has with Mississippi anglers, the total number of sheepshead caught annually has fluctuated widely ranging from less than 14,000 in 1985 to 250,000 in 1994 (Figure 6.6). In 2003, participation in Mississippi's saltwater recreational fishery, including non-coastal and out-of-state participants, was estimated at 260,996 anglers making just over 1.1 million trips which contributed approximately 5.3% of all recreational trips in the Gulf (excluding Texas) in 2003 (NMFS 2004).

#### 6.1.2.4 Louisiana

Sheepshead are not a prime target for most Louisiana anglers. As with most of Gulf States' fisheries, sheepshead in Louisiana are generally caught incidentally in the directed recreational spotted seatrout and red drum fishery. Much of the directed recreational fishery for sheepshead may be attributed to numerous, summer-time fishing rodeos (tournaments) along coastal parishes.

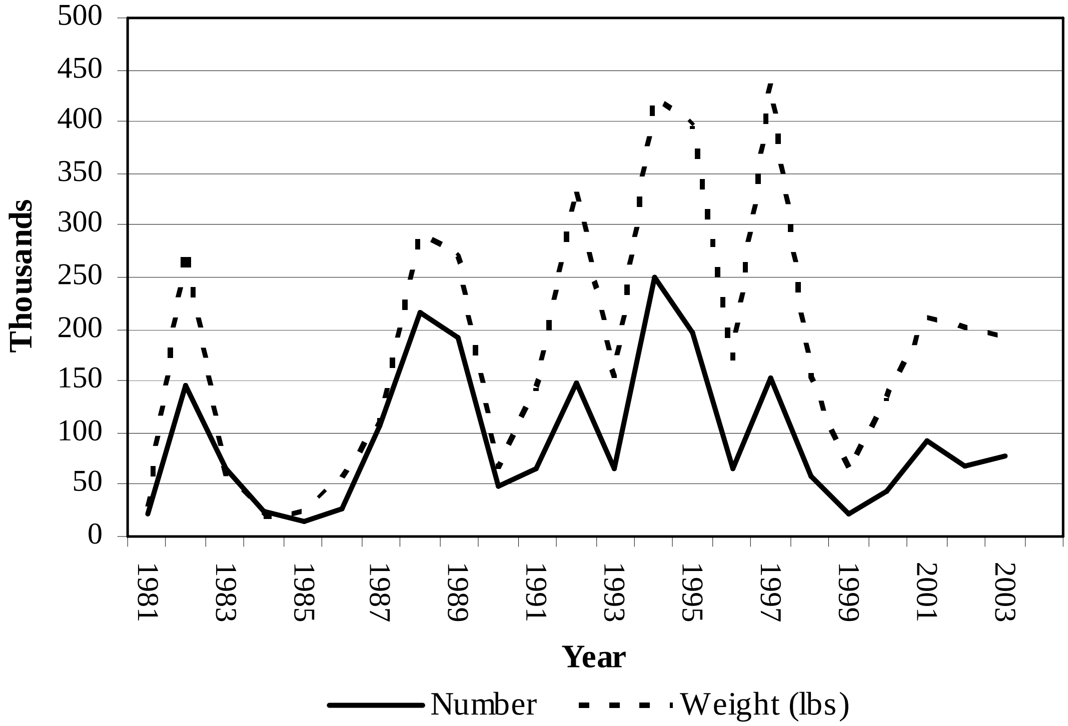


**Figure 6.6** Total number and weight of sheepshead landed in Mississippi waters by recreational anglers from 1981 to 2003 (NMFS unpublished data).

In 1984, the Louisiana Department of Wildlife and Fisheries conducted an access point creel survey that was not completely comparable to the MRFSS survey (Adkins, Guillory, and Bourgeois, 1990). That survey estimated a harvest of 93,588 sheepshead coast-wide, (s.e.=8,854) compared to an estimate of 265,608 sheepshead from the MRFSS survey of that same year. There are many differences between the methods for developing the two estimates, accounting for the differences in the final estimated values. However, sheepshead was the sixth most commonly kept species found in that creel survey, and comprised 4.1% of the harvest by number. In an earlier roving clerk survey conducted in lower Barataria Bay, Guillory and Hutton (1990) found that sheepshead was the tenth most commonly kept species in 1975-77, comprising 1.05% of the catch.

In 2003, an estimated 1.01 million anglers (including non-coastal residents and out-of-state participants) made approximately 4.15 million trips. Since the early 1990s, the number of recreational anglers and trips steadily increased. Trips in Louisiana accounted for almost 20% of all recreational trips Gulf wide in 2003 (excluding Texas) (NMFS 2004).

Recreational landings in Louisiana ranged from a low of just over 150,000 fish in 1990 to a high of 801,204 fish in 2003 (Figure 6.7). The trend in the Louisiana recreational landings has been a general increase overall in sheepshead numbers although variation from year to year has been wide. While the numbers of fish caught recreationally increased slightly, the total weight of the landings increased dramatically since the mid 1980s (Figure 6.7). This is supported by the

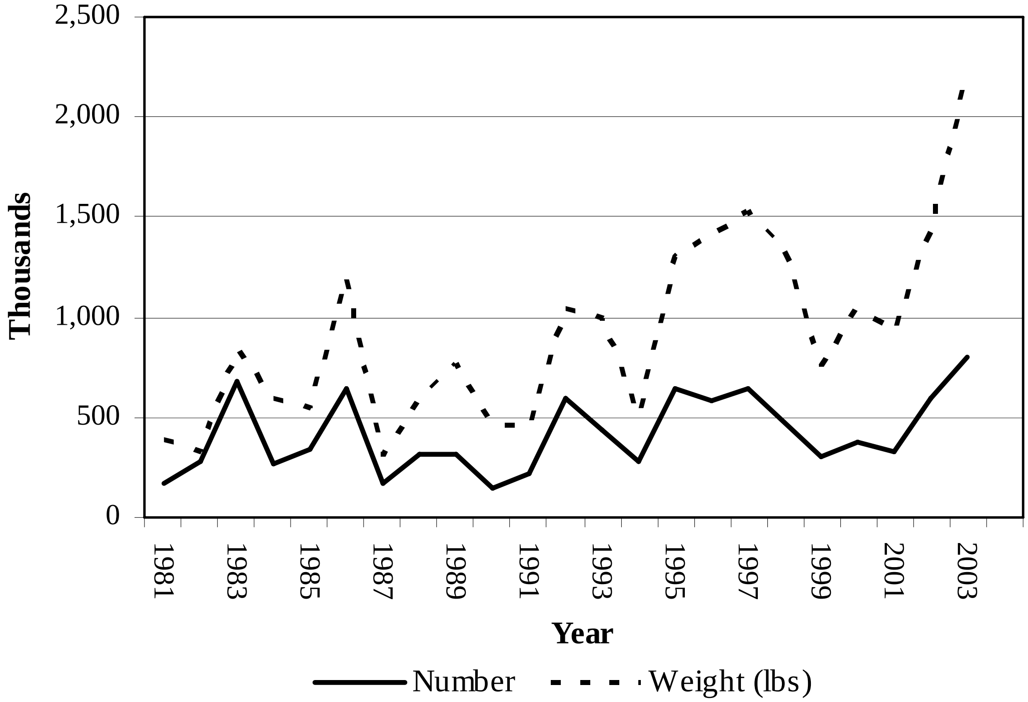


**Figure 6.7** Total number and weight of sheepshead landed in Louisiana waters by recreational anglers from 1981 to 2003 (NMFS unpublished data).

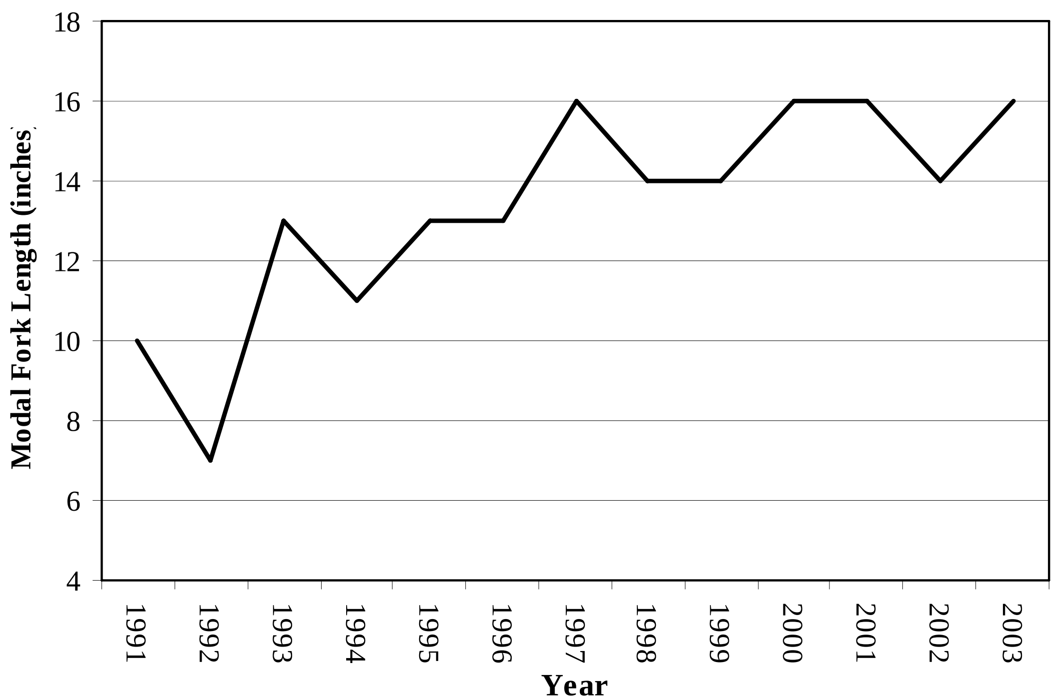


**Figure 6.8** Modal fork length of sheepshead harvested from Louisiana waters from 1981 to 2003 (NMFS unpublished data).

modal fork length of sheepshead intercepted by the MRFSS samplers in Louisiana which has increased since 1991 (Figure 6.8).

Analyses of recreationally harvested sheepshead between 1996 and 2004 from Louisiana indicate that ages from one through 14 years are found in the harvest, with ages 2-5 predominating (Figure 6.9).

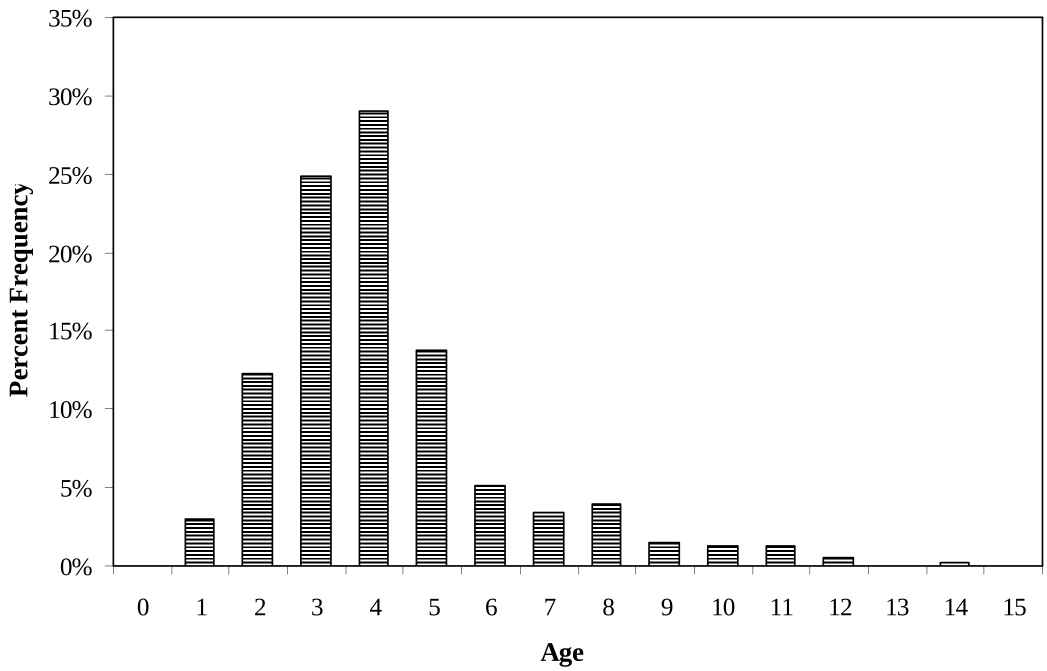


**Figure 6.9** Age frequency of recreationally harvested sheepshead from Louisiana from 1994-2004 (LDWF unpublished data).

### 6.1.2.5 Texas

In Texas, the popularity of sheepshead appears to be low by comparison to other species, and they are encountered infrequently in the Texas Recreational Harvest Monitoring Program. From 1993 to 2003, sheepshead only made up around 4% of the total recreational finfish landings in Texas (Figure 6.10) (TPWD unpublished data). Ditton et al. (1991) noted that spotted seatrout, red drum, and southern flounder were the first, second, and third choices among saltwater anglers, respectively, in Texas.

Recreational catches of sheepshead increased slightly since 1990 but are nowhere near record highs of the early 1980s (Figure 6.11). In 2001-2002, approximately 90,000 sheepshead were landed recreationally in Texas (TPWD unpublished data). Size and bag limits enacted in 1988 (Section 5.2.5.8) and a winter freeze-kill event in 1989 combined to affect annual landings.

Virtually all the sheepshead catches in Texas were inshore from Galveston and Corpus Christi bays with almost no fish caught in the Texas Territorial Sea (TTS). Sheepshead caught in these two bays were most likely caught near jetties at passes where these two bays meet the Gulf

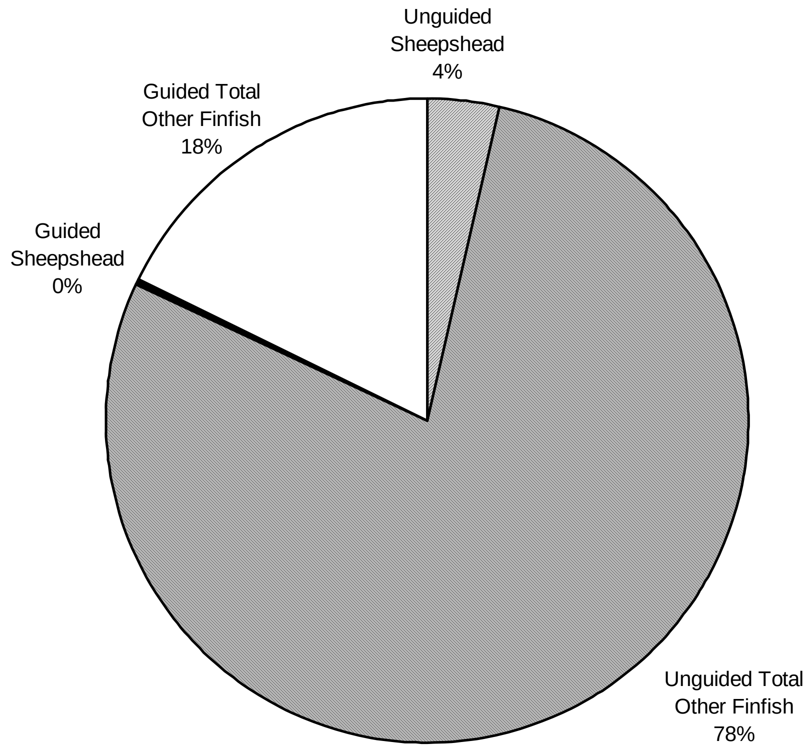


**Figure 6.10** Ten-year average (1993/1994 – 2002/2003) for sheepshead landed recreationally in Texas as a percent of total recreational landings (all other species) (TPWD unpublished data).

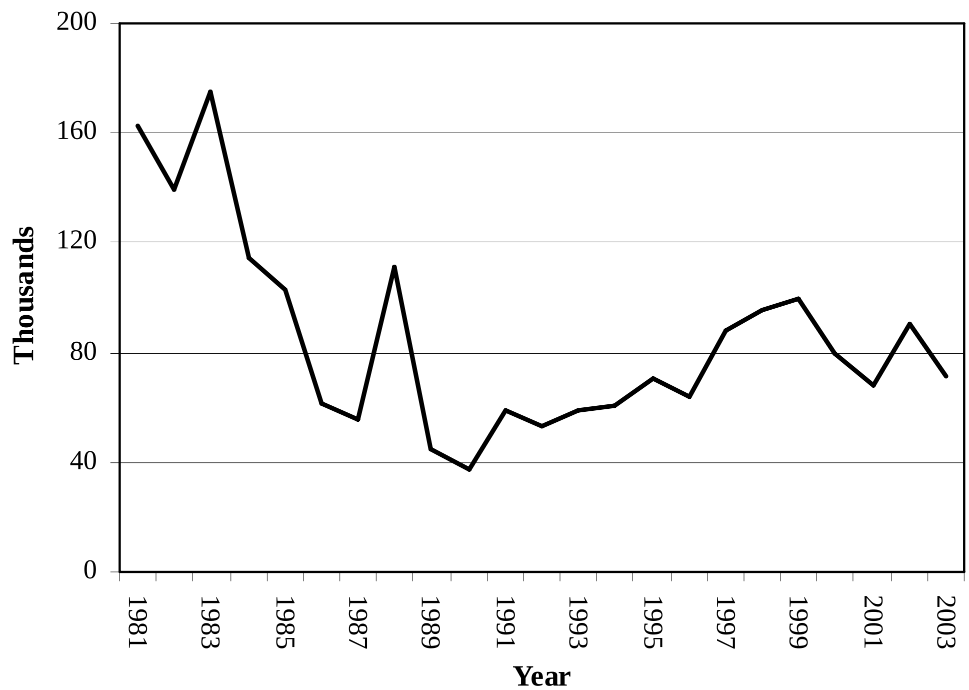


**Figure 6.11** Total number of sheepshead landed in Texas waters from 1981 to 2003 excluding shore-based anglers (TPWD unpublished data).

of Mexico (P. Trial personal communication). In addition, most of the sheepshead encountered by the Texas Recreational Harvest Monitoring Program were landed by private boats rather than charter boats (Figure 6.10). The program does not include shore based anglers which likely comprise the largest component of the sheepshead fishery in Texas. McEachron (1980) reported that sheepshead were among the most commonly landed fish from Gulf piers and jetties in Texas. Therefore, it should be noted that the landings data reported are underestimates of the actual recreational catch of sheepshead in Texas waters.

## 6.2 Commercial Fishery

### 6.2.1 History

The first recorded annual commercial sheepshead harvest from the Gulf of Mexico was 778,800 lbs from Texas in 1890 (Higgins and Lord 1926). From 1950-2003, sheepshead landings in the Gulf of Mexico averaged 84% of total United States landings (Figure 6.12) (NMFS 2004).

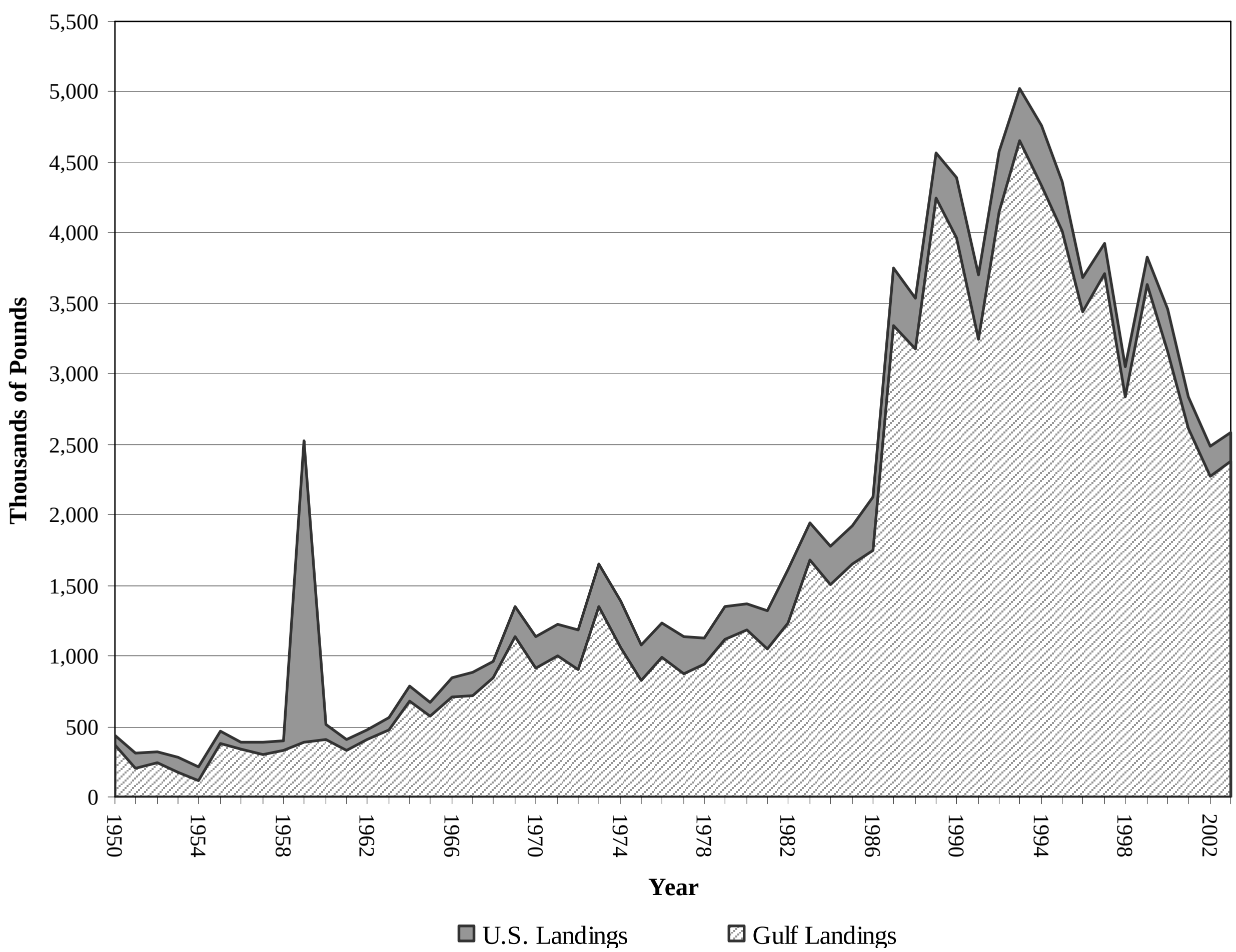


**Figure 6.12** Total US and Gulf commercial sheepshead landings from 1950 to 2003.

Sheepshead landings in the Gulf of Mexico steadily increased from 1950-1986, averaging 788,316 lbs. The landings increased dramatically in 1987 to 3.35 million lbs and continued to increase from 1987-1994, averaging 3.88 million lbs. Since 1994, commercial sheepshead landings declined and almost dropped to 1986 levels (Table 6.3) (NMFS 2004). In 1987, shrimp trawlers, particularly those off Louisiana and west of the Mississippi River, began targeting sheepshead in late winter and early spring (Schexnayder et al. 1998). This may account for a portion of the significant increases in landings from 1987 forward (NMFS 2004). Louisiana accounts for the majority of sheepshead landings along the Gulf coast (Figure 6.13) (NMFS 2004). The sheepshead landings by gear type Gulfwide are provided in Figure 6.14.

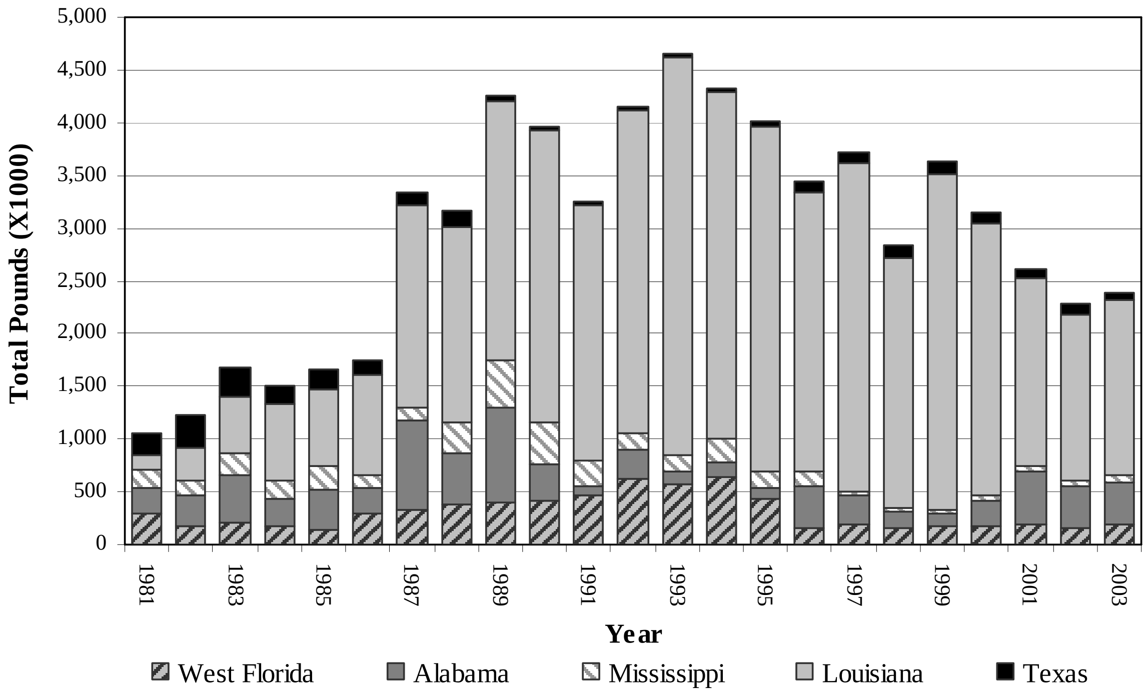


**Figure 6.13** Gulfwide commercial sheepshead landings (lbs) by state in the Gulf of Mexico from 1981 to 2003 (NMFS unpublished data).

### 6.2.2 State Fisheries

#### 6.2.2.1 Florida

In Florida sheepshead are primarily landed in the late fall through early spring (November–March). Harvest is fairly equal on both coasts (Murphy and MacDonald 2000). Most of the sheepshead landings on the Gulf side of Florida come from the central portion of the state near Tampa Bay and Charlotte Harbor (Murphy and MacDonald 2000).

Historically, entangling nets (gill nets and trammel nets) accounted for the majority of gear being used in Florida's commercial fishery. Since the net limitation amendment of July 1995, cast-nets and hook-and-line have been the primary gears. Sheepshead are not a major bycatch of trawlers working the nearshore waters of Florida (Murphy and MacDonald 2000). Prior to 1996, most commercially landed sheepshead in Florida were 7-14 inches FL. Since

**Table 6.3** Total annual sheepshead commercial landings (lbs) by state from 1950 to 2003 (NMFS unpublished data). **Note:** for unknown reasons, landings in 1954 were not included for Florida and could mean that either no landings were reported or there were no landings.

| YEAR | FL | AL | MS | LA | TX |
|---|---|---|---|---|---|
| 1950 | 184,600 | 8,200 | 6,300 | 146,000 | 20,100 |
| 1951 | 77,900 | 13,300 | 1,200 | 94,100 | 18,000 |
| 1952 | 79,000 | 9,000 | 5,400 | 78,300 | 71,500 |
| 1953 | 76,000 | 6,800 | 5,400 | 57,000 | 26,200 |
| 1954 | | 5,400 | 7,500 | 76,600 | 28,600 |
| 1955 | 173,900 | 12,500 | 11,900 | 103,600 | 80,600 |
| 1956 | 100,600 | 9,200 | 50,000 | 94,600 | 85,200 |
| 1957 | 127,100 | 7,200 | 42,000 | 81,900 | 44,200 |
| 1958 | 97,800 | 9,300 | 66,500 | 138,900 | 20,100 |
| 1959 | 113,200 | 25,700 | 63,700 | 146,100 | 43,800 |
| 1960 | 182,400 | 16,500 | 48,100 | 117,100 | 45,400 |
| 1961 | 63,600 | 20,800 | 46,300 | 144,600 | 53,600 |
| 1962 | 77,400 | 22,200 | 44,400 | 151,500 | 109,500 |
| 1963 | 138,800 | 14,500 | 29,700 | 177,100 | 119,900 |
| 1964 | 213,600 | 34,700 | 49,300 | 138,300 | 243,800 |
| 1965 | 232,800 | 15,400 | 25,600 | 103,600 | 193,500 |
| 1966 | 288,000 | 11,600 | 32,700 | 156,200 | 217,200 |
| 1967 | 264,900 | 34,400 | 50,800 | 170,100 | 199,200 |
| 1968 | 355,100 | 68,200 | 63,400 | 161,300 | 193,000 |
| 1969 | 294,300 | 154,500 | 164,900 | 312,600 | 212,600 |
| 1970 | 263,500 | 181,900 | 69,100 | 224,300 | 175,500 |
| 1971 | 248,900 | 320,600 | 58,800 | 239,400 | 133,700 |
| 1972 | 294,200 | 144,500 | 56,600 | 171,700 | 237,400 |
| 1973 | 323,700 | 532,100 | 55,200 | 169,500 | 269,400 |
| 1974 | 285,100 | 222,300 | 47,900 | 136,400 | 369,800 |
| 1975 | 268,000 | 110,800 | 32,300 | 100,800 | 318,800 |
| 1976 | 261,300 | 179,200 | 66,200 | 101,700 | 379,000 |
| 1977 | 240,300 | 173,900 | 33,500 | 133,000 | 293,900 |
| 1978 | 225,559 | 141,375 | 79,690 | 166,217 | 327,877 |

**Table 6.3** Total annual sheepshead commercial landings(Con't)

| YEAR | FL | AL | MS | LA | TX |
|---|---|---|---|---|---|
| 1979 | 196,954 | 191,884 | 76,710 | 249,495 | 406,089 |
| 1980 | 260,104 | 227,197 | 102,760 | 126,989 | 473,208 |
| 1981 | 291,611 | 245,508 | 177,430 | 129,610 | 202,601 |
| 1982 | 170,906 | 290,769 | 150,900 | 296,758 | 321,953 |
| 1983 | 214,855 | 436,836 | 206,460 | 543,416 | 275,362 |
| 1984 | 169,246 | 261,018 | 181,412 | 716,686 | 179,243 |
| 1985 | 135,008 | 376,439 | 237,916 | 719,936 | 183,153 |
| 1986 | 293,379 | 249,028 | 109,021 | 962,698 | 131,247 |
| 1987 | 335,177 | 836,763 | 124,456 | 1,917,953 | 132,924 |
| 1988 | 382,962 | 486,636 | 286,356 | 1,848,679 | 168,100 |
| 1989 | 392,526 | 899,864 | 462,772 | 2,450,139 | 43,927 |
| 1990 | 415,819 | 342,206 | 406,687 | 2,767,046 | 28,347 |
| 1991 | 469,713 | 84,748 | 241,043 | 2,425,138 | 25,851 |
| 1992 | 624,601 | 278,017 | 145,225 | 3,063,942 | 34,352 |
| 1993 | 576,415 | 122,969 | 155,618 | 3,763,796 | 36,570 |
| 1994 | 641,974 | 131,974 | 228,910 | 3,289,426 | 39,523 |
| 1995 | 425,558 | 117,420 | 145,805 | 3,266,482 | 54,117 |
| 1996 | 148,031 | 404,970 | 140,935 | 2,639,256 | 103,341 |
| 1997 | 184,753 | 280,615 | 40,840 | 3,114,532 | 94,770 |
| 1998 | 157,457 | 159,217 | 59,652 | 2,371,614 | 117,171 |
| 1999 | 167,918 | 121,570 | 53,413 | 3,192,626 | 118,202 |
| 2000 | 180,582 | 238,649 | 39,370 | 2,591,871 | 106,921 |
| 2001 | 187,236 | 503,229 | 45,043 | 1,797,963 | 81,869 |
| 2002 | 153,813 | 408,173 | 46,683 | 1,583,357 | 92,577 |
| 2003 | 195,862 | 388,970 | 73,056 | 1,654,198 | 67,647 |

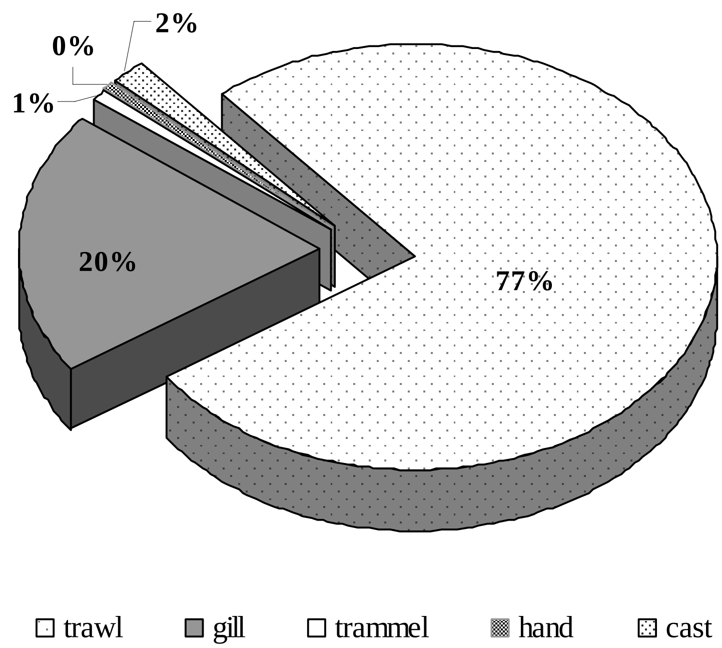


**Figure 6.14** Percent of total Gulfwide commercial sheepshead landings by major gear type for 1981 to 2003 (NMFS unpublished data).

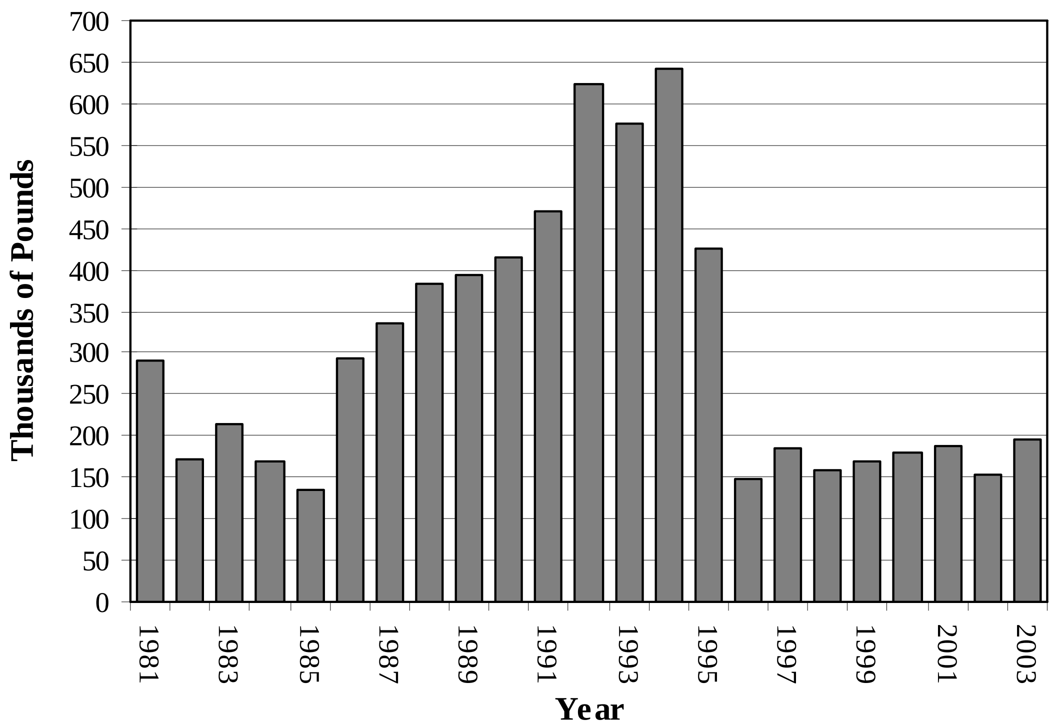


**Figure 6.15** Florida's commercial sheepshead landings from 1981 to 2003 (NMFS unpublished data).

1996, the average length of a commercially landed sheepshead in Florida has risen from 12 to 17 inches FL (Murphy and MacDonald 2000) due to the establishment of a minimum size limit.

Florida's landings averaged 196,325 lbs from 1981-1985 and increased to an average of 455,812 lbs from 1986-1995. Since the net limitation amendment and regulatory changes of 1996, Florida's landings from 1996 to 2003 decreased to an average of 171,955 lbs (Figure 6.15) (NMFS 2004). Florida ranked third in 2003 with 8.2% of all commercial Gulf landings.

### 6.2.2.2 Alabama

In Alabama sheepshead have primarily been landed in the late fall to spring (November–March); however, peaks in harvest can occur as early as September and October (NMFS 2004). Gill nets, haul seines, and hook-and-line are the preferred gears for landing sheepshead in Alabama.

Alabama landings of sheepshead have fluctuated since 1981, with distinct peaks of 836,763 lbs in 1987 and 899,864 lbs in 1989 (Figure 6.16). Significant regulatory changes may have led to these increased landings in 1987 and 1989. In 1985 Alabama declared spotted seatrout and red drum gamefish, making commercial harvest illegal. Federal waters were closed in 1986 to the harvest of red drum. Sheepshead most likely played a role in replacing the fish flesh previously supplied by spotted seatrout and red drum. Alabama ranked second in commercial sheepshead landings for 2003 with 16.3% of the Gulf harvest (NMFS 2004).

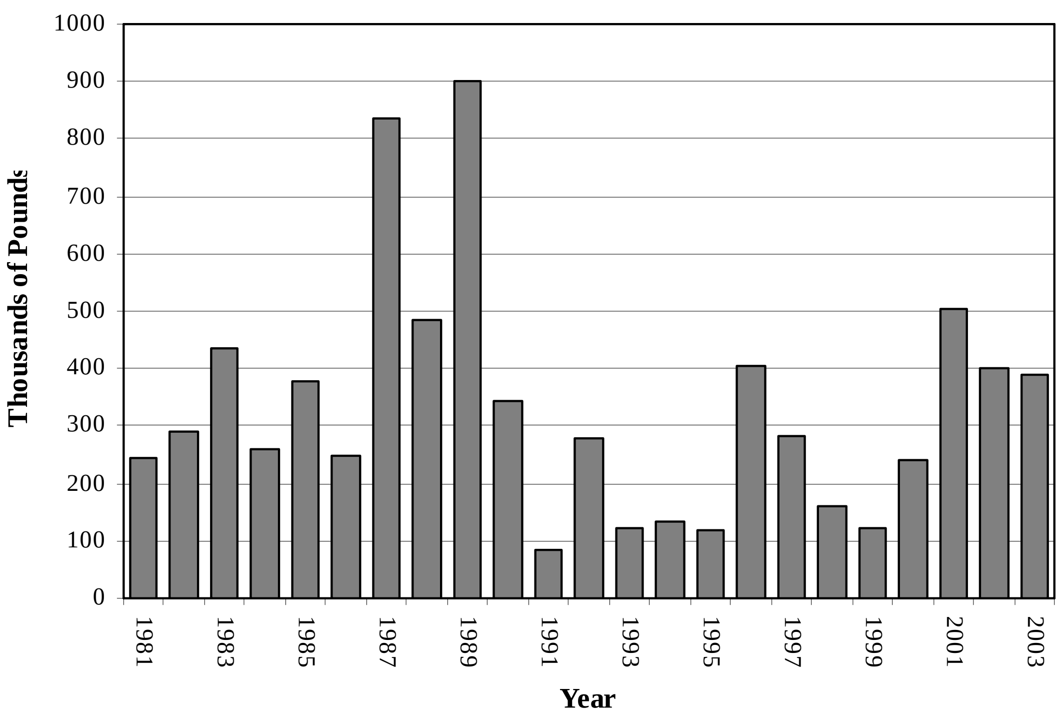


**Figure 6.16** Alabama's commercial sheepshead landings (lbs) from 1981 to 2003 (NMFS unpublished data).

### 6.2.2.3 Mississippi

In Mississippi sheepshead have primarily been landed in the early winter to late spring (December–March); however, peaks in harvest can occur as early as September and October (NMFS 2004).

Mississippi landings of sheepshead have fluctuated somewhat since 1981, with a distinct peak of 462,772 lbs in 1989 (Figure 6.17). Mississippi landings appear to have dropped to a low of 35,104 lbs in 1998 and remained low through 2003. However, the commercial landings for sheepshead since 1998 may not have decreased as the data would suggest due to improper coding of the species by a dealer (E. Porche personal communication). Mississippi ranked fourth in commercial sheepshead landings for 2003 with 3.1% of the Gulf harvest (NMFS 2004).

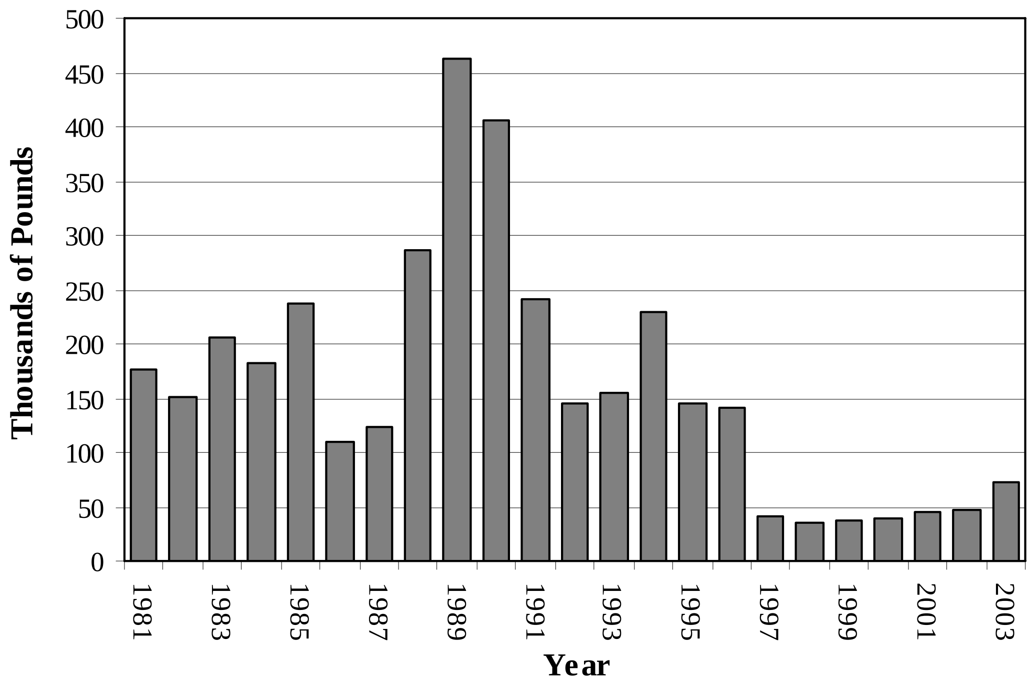


**Figure 6.17** Mississippi's commercial sheepshead landings (lbs) from 1981 to 2003 (NMFS unpublished data).

### 6.2.2.4 Louisiana

Traditionally, sheepshead have been a component of the bycatch in various fisheries in Louisiana (Schexnayder et al. 1998). Harvesters using gill nets or trammel nets retained sheepshead only if room permitted after other (more valuable) species were harvested. Historically, primary gears used to capture sheepshead in Louisiana were gill nets, trammel nets, haul seines, and trawls. In 1987 shrimp trawlers began redirecting effort to target sheepshead during winter months when the inshore shrimp fishery closed. Currently, sheepshead can only be harvested commercially in Louisiana using a pole, line, yo-yo, hand line, trotline, trawl, skimmer, butterfly net, cast net, scuba gear, or commercial rod and reel. The majority of landings, however, come from the offshore trawl fishery.

Louisiana landings of sheepshead peaked at 3.76 million lbs in 1993 (Figure 6.18). There was an increase in landings after 1986 when shrimp trawlers began to target sheepshead. After 1993, sheepshead landings in Louisiana decreased to 1.58 million lbs by 2002. Louisiana ranked first in commercial sheepshead landings for 2003 with 69.5% of the Gulf harvest (NMFS 2004).

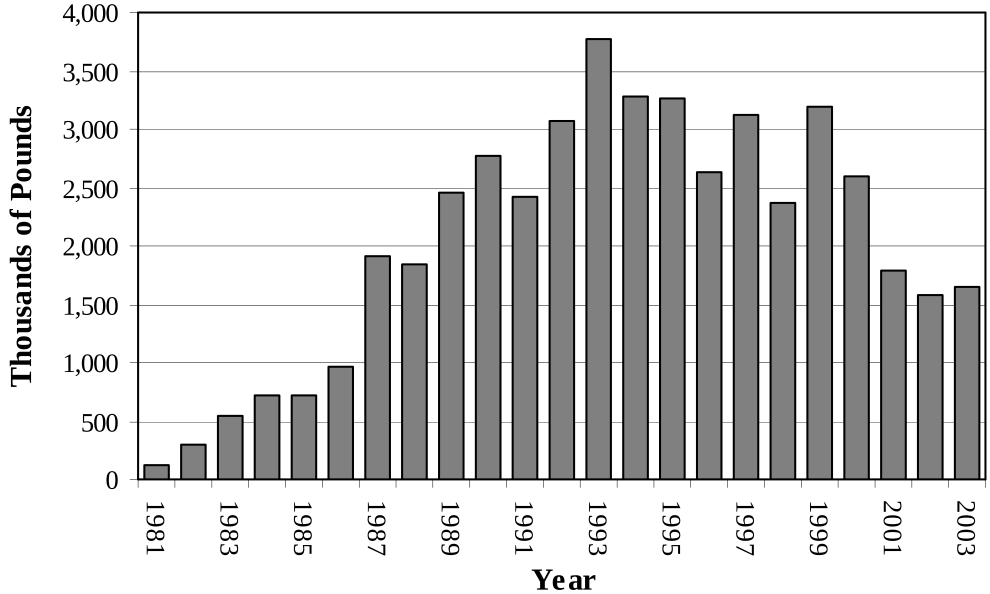


**Figure 6.18** Louisiana's commercial sheepshead landings (lbs) from 1981 to 2003 (NMFS unpublished data).

Analyses of commercially harvested sheepshead between 1994 and 2004 from Louisiana indicate that while ages from two through 17 years are found in the harvest, ages 3-7 predominate (Figure 6.19).

### 6.2.2.5 Texas

Prior to 1988, when all netting was banned and a 12 inch minimum size limit was introduced, sheepshead in Texas were landed using drag seines, gill nets, and trammel nets. Since 1988, sheepshead can only be harvested commercially by the use of trotlines, gigs, hook-and-line, trawls, spears, and bow-and-arrow. The majority of sheepshead are landed by gig (P. Trial personal communication). Texas shrimp trawlers may legally land a certain percentage of bycatch, which may include sheepshead if they meet the legal size limits. However, sheepshead have not been found to make up a large component of the inshore trawl bycatch (Fuls et al. 2002).

In Texas, most commercially landed sheepshead was harvested from Galveston, San Antonio, Aransas, and Corpus Christi bays – not the Gulf of Mexico. Since 1990, landings of sheepshead in Texas waters increased but are still well below historical highs of the 1970s (Figure 6.20). Gear restrictions from the mid to late 1980s, implementation of a minimum size

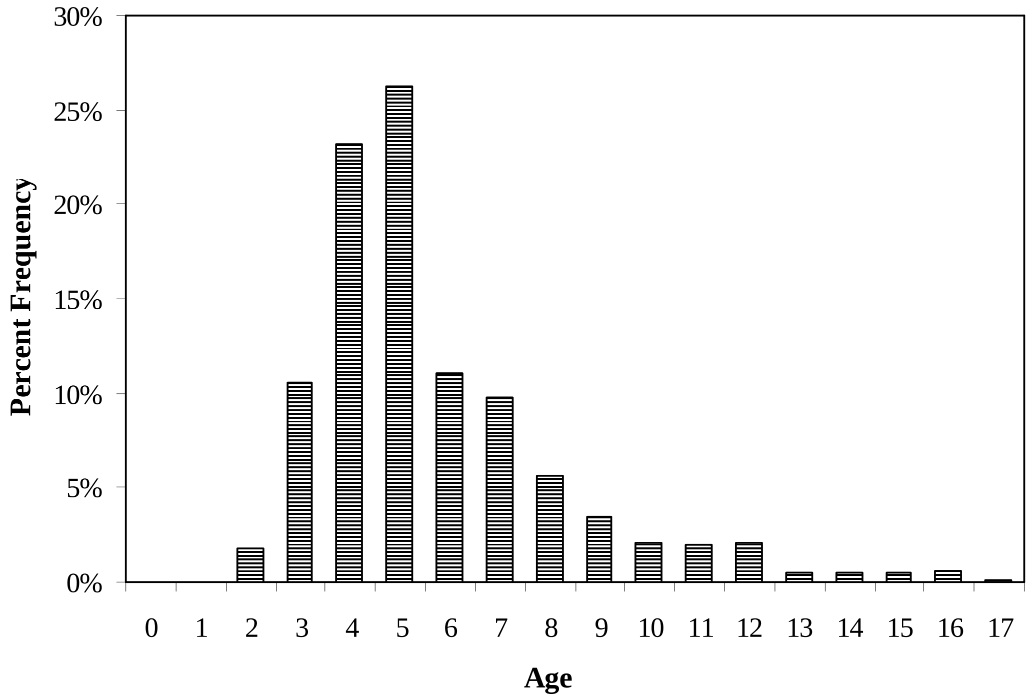


**Figure 6.19** Age frequency of commercially harvested sheepshead from Louisiana from 1994-2004 (LDWF unpublished data).

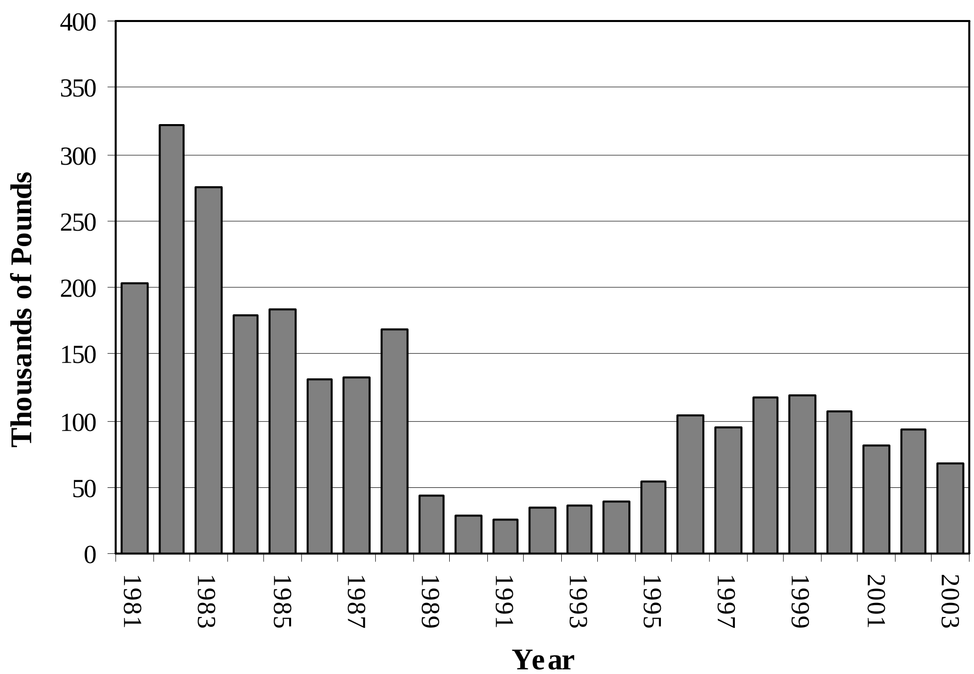


**Figure 6.20** Texas commercial sheepshead landings (lbs) from 1981 to 2003 (NMFS unpublished data).

limit in 1988, and a severe freeze in 1989 all combined to affect commercial sheepshead landings. Sheepshead comprise a very small percentage of the total commercial finfish harvest in Texas averaging only 4.0% of the total finfish landings since 1972. Texas ranked fifth in total landings of sheepshead in 2003 with 2.8% of the Gulf harvest (NMFS 2004).

## 6.3 Incidental Catch

Most recreationally harvested sheepshead is incidental catch by anglers while fishing for other targeted species. Anecdotal evidence suggests a large, directed commercial sheepshead fishery existed in the past. However, most of the historical landings appeared to be bycatch in former and remnant net fisheries in the Gulf. With the exception of the directed trawl fishery, sheepshead is caught and retained opportunistically by both recreational and commercial sectors.

Finfish can make up a significant component of shrimp trawl bycatch; however, of 108 samples taken inshore during the 1989 shrimp season in Louisiana, sheepshead accounted for only 22 of 147,994 specimens sampled or 0.0001% of the catch (Adkins 1993). Similarly, the TPWD investigated the composition and magnitude of shrimp trawl bycatch associated with the Texas bay shrimp industry in Galveston, Matagorda, San Antonio, and Corpus Christi bays on the northern- and mid-Texas coast during the 1995 spring and fall bay-shrimp open seasons (Fuls 1996). The total number of bycatch species encountered was compared to TPWD's fishery independent data as well as previous year commercial bycatch data. Sheepshead were only encountered in the San Antonio Bay samples and comprised less than 0.02% of the total bycatch during the 1995 spring season. In Florida, sheepshead are rarely caught in the shrimp trawl fishery (Coleman et al. 1993).

Passive fishing gears, including nets and crab pots, have an impact on incidental catch of sheepshead. Considerable evidence exists of sheepshead caught by ghost fishing in lost or abandoned blue crab traps (GSMFC 2003). Currently, four Gulf States have derelict blue crab trap removal programs; Mississippi, Alabama, and Texas record associated bycatch from recovered traps. It is widely reported in these cleanup efforts that sheepshead make up a significant portion of the total bycatch. In 2002, the first year of the Alabama trap cleanup, no sheepshead were encountered in 323 traps; however, in 2003, 17 sheepshead were found in 1,074 traps. In Mississippi’s 2003 cleanup, 51 sheepshead were found in 1,111 crab traps collected by volunteers and state biologists. Of these 51 sheepshead, 44 were released alive. Texas quantified most organisms found in their derelict trap cleanup and found that sheepshead made up 8.2%, on average, of all the organisms encountered. Sheepshead were the third most abundant species found in the traps after blue crabs and stone crabs, and the most abundant vertebrate (Morris 2002). However, this number should not be equated with mortality as many of the sheepshead were released alive.

## 6.4 Mariculture

Very little literature exists on the culture of sheepshead. Scientists at the Harbor Branch Oceanographic Institute have examined the potential for the farming of sheepshead and determined that it may be a suitable species for culture. While these studies have made cursory evaluations regarding techniques for spawning and rearing juveniles, it is recognized that additional research is needed for more efficient techniques (Tucker 2004, Tucker and Kennedy 2003, Tucker and Alshuth 1997, Tucker and Barbera 1987). In addition, a low market price for sheepshead may render commercial culture economically infeasible.

# 7.0 ECONOMIC CHARACTERISTICS OF THE COMMERCIAL AND RECREATIONAL FISHERIES

The sheepshead fishery represents an important component of the nearshore, commercial and recreational finfish fisheries in the Gulf of Mexico. The amount of information available to describe the fishery from an economic perspective, however, is limited.

## 7.1 Commercial Sector

The data utilized in the following discussion were obtained from the NMFS website for commercial landings and dockside value (http://www.st.nmfs.gov/st1/commercial/index.html). These data were downloaded during December 2004. Dockside value and price represent those amounts generated by the initial sale of the product from the vessel to the first buyer.

### 7.1.1 Annual Commercial Dockside Value

#### 7.1.1.1 Gulf-wide Nominal Dockside Value

The dockside value for sheepshead in the Gulf of Mexico exhibited an increasing trend from the mid 1970s until the mid 1990s (Table 7.1). This increase in dockside value mirrors a similar trend in commercial landings in the region (see Section 6.2 and Table 6.3). The total nominal (not adjusted for inflation) dockside value for sheepshead increased from approximately $85,000 in 1974 to about $173,000 in 1980. Dockside value then increased at a slow, steady pace to approximately $254,000 in 1985. From 1974 to 1985, dockside value increased by an annual average rate of 9%. However, dockside value then began to increase dramatically. For example, dockside value increased to $317,000 in 1986 and continued increasing to over $1.4 million in 1993. Dockside value remained at approximately $1.4 million through 1995. The annual average rate of increase from 1986 to 1993 was 26%. Dockside value then began a declining trend, falling from $1.1 million in 1996 to $673,000 in 2002. Dockside value decreased during 1996-2002 by an annual average rate of 9% then increased to $811,670 in 2003.

#### 7.1.1.2 Dockside Values by State

Prior to 1983, the largest share of the dockside value attributed to sheepshead landings in the Gulf was associated with Texas and the west coast of Florida. During 1983-2003, however, Louisiana generated the largest share of total dockside value associated with commercial sheepshead landings. Prior to 1983, the historical share of the total Gulf region sheepshead dockside value attributed to Louisiana was 13%. Since 1983, the Louisiana share of sheepshead dockside value increased to 64.8%. During 1983-2003, the average shares of sheepshead dockside value attributed to the west coast of Florida, Alabama, Texas, and Mississippi were 16.2%, 11.0%, 4.2%, and 3.7%, respectively.

The dockside value for sheepshead in Texas increased from $24,000 in 1973 to $79,453 in 1982 (Table 7.1). Dockside value then decreased dramatically to $7,933 in 1991 (the marked decline likely due to recent freezes and more restrictive bag/size limits) but then began increasing again to about $50,000 in 1998. Dockside value slowly decreased until 2001 ($28,333), increased to $33,850 in 2002, and then decreased to $26,129 in 2003. Dockside value for sheepshead in Texas has increased from all-time lows during the early 1990s to approximately the values observed during the mid 1970s.

**Table 7.1** Annual sheepshead nominal dockside value for the Gulf States, 1973-2003.

| Year | FWC ($) | AL ($) | MS ($) | LA ($) | TX ($) | Gulf Total ($) |
|---|---|---|---|---|---|---|
| 1973 | 36,810.00 | 32,251.00 | 4,581.00 | 11,526.00 | 24,500.00 | 109,668.00 |
| 1974 | 32,154.00 | 12,541.00 | 4,203.00 | 9,422.00 | 26,497.00 | 84,817.00 |
| 1975 | 35,853.00 | 6,936.00 | 2,785.00 | 8,787.00 | 27,246.00 | 81,607.00 |
| 1976 | 36,843.00 | 13,964.00 | 6,058.00 | 9,110.00 | 41,323.00 | 107,298.00 |
| 1977 | 39,557.00 | 10,065.00 | 3,233.00 | 11,928.00 | 28,813.00 | 93,596.00 |
| 1978 | 41,438.00 | 10,063.00 | 8,362.00 | 22,577.00 | 39,212.00 | 121,652.00 |
| 1979 | 39,701.00 | 19,363.00 | 8,360.00 | 22,832.00 | 55,768.00 | 146,024.00 |
| 1980 | 48,092.00 | 28,106.00 | 15,531.00 | 14,710.00 | 66,343.00 | 172,782.00 |
| 1981 | 66,962.00 | 35,924.00 | 24,412.00 | 27,667.00 | 41,813.00 | 196,778.00 |
| 1982 | 43,053.00 | 43,780.00 | 21,709.00 | 36,894.00 | 79,453.00 | 224,889.00 |
| 1983 | 55,193.00 | 53,451.00 | 29,991.00 | 69,542.00 | 65,726.00 | 273,903.00 |
| 1984 | 42,869.00 | 33,679.00 | 32,582.00 | 77,334.00 | 36,697.00 | 223,161.00 |
| 1985 | 39,269.00 | 58,919.00 | 34,902.00 | 79,813.00 | 40,967.00 | 253,870.00 |
| 1986 | 87,919.00 | 46,689.00 | 18,759.00 | 128,690.00 | 35,441.00 | 317,498.00 |
| 1987 | 105,173.00 | 129,041.00 | 24,061.00 | 277,753.00 | 37,301.00 | 573,329.00 |
| 1988 | 128,439.00 | 106,370.00 | 65,612.00 | 339,342.00 | 47,518.00 | 687,281.00 |
| 1989 | 136,784.00 | 183,722.00 | 93,107.00 | 475,459.00 | 13,114.00 | 902,186.00 |
| 1990 | 166,783.00 | 70,608.00 | 90,394.00 | 619,250.00 | 9,469.00 | 956,504.00 |
| 1991 | 189,128.00 | 22,605.00 | 61,201.00 | 793,568.00 | 7,933.00 | 1,074,435.00 |
| 1992 | 257,137.00 | 81,519.00 | 35,523.00 | 862,883.00 | 15,229.00 | 1,252,291.00 |
| 1993 | 249,363.00 | 37,886.00 | 38,963.00 | 1,094,911.00 | 14,757.00 | 1,435,880.00 |
| 1994 | 291,208.00 | 36,738.00 | 46,000.00 | 1,007,221.00 | 16,738.00 | 1,397,905.00 |
| 1995 | 222,479.00 | 42,583.00 | 40,408.00 | 1,100,620.00 | 25,801.00 | 1,431,891.00 |
| 1996 | 113,106.00 | 154,958.00 | 45,547.00 | 766,991.00 | 42,940.00 | 1,123,542.00 |
| 1997 | 143,071.00 | 121,100.00 | 11,466.00 | 902,011.00 | 45,425.00 | 1,223,073.00 |
| 1998 | 116,533.00 | 69,324.00 | 13,037.00 | 693,386.00 | 49,914.00 | 942,194.00 |
| 1999 | 123,139.00 | 61,670.00 | 15,843.00 | 844,366.00 | 48,023.00 | 1,093,041.00 |
| 2000 | 133,640.00 | 105,651.00 | 13,716.00 | 603,663.00 | 38,882.00 | 895,552.00 |
| 2001 | 132,193.00 | 221,000.00 | 16,642.00 | 432,929.00 | 28,533.00 | 831,297.00 |
| 2002 | 115,244.00 | 181,710.00 | 19,272.00 | 323,113.00 | 33,850.00 | 673,189.00 |
| 2003 | 136,443.00 | 203,659.00 | 30,043.00 | 415,396.00 | 26,129.00 | 811,670.00 |

The Louisiana fishery for sheepshead represents the largest component of the fishery in the Gulf. The dockside value for sheepshead landed in Louisiana increased from a low of $8,787 in 1975 to $36,894 in 1982 (Table 7.1). Dockside value increased dramatically to in excess of $1 million during 1993-1995. During this three-year period, dockside value for sheepshead averaged $1,068,000. Since 1995, the dockside value of sheepshead in Louisiana has declined from $767,000 in 1996 to about $323,000 in 2002 and then increased again to $415,396 in 2003. It should be noted that the southeastern part of the state roughly from Bayou Lafourche to the Mississippi state line makes up the majority of the sheepshead fishery. This is in part due to the location of the market for the species which is focused around New Orleans, the north shore of Lake Pontchartrain and areas of Baton Rouge. Sheepshead are harvested year round as bycatch but in the winter fisheries, December to March/April, they tend to be much more abundant which is reflected in the lower prices during this same time (Table 7.2).

The dockside value for sheepshead in Mississippi increased steadily from about $2,800 in 1975 to $93,100 in 1989. Dockside value remained at approximately $90,000 during 1990. However, dockside value for sheepshead then decreased to approximately $61,000 in 1991 and continued a general decreasing trend until 2001. Dockside value decreased to $13,700 during 2000 but increased to approximately $30,000 by 2003.

Dockside value for sheepshead in Alabama exhibited the most erratic pattern of the Gulf States. For example, the dockside value for sheepshead in Alabama decreased from about $32,000 in 1973 to less than $7,000 in 1975. Dockside value began an increasing trend until 1989 when sheepshead dockside value was reported at almost $184,000. The increase may be due to a temporary redirection of effort from red drum to sheepshead (federal waters were closed to red drum harvest in 1986). Sheepshead dockside value fell to $22,600 in 1991, during a period when the value fluctuated up and down, finally peaking at approximately $155,000 in 1996. Dockside value declined again from 1997 to 2000; however, a record dockside value of $221,000 was reported during 2001. Dockside value then fell to about $182,000 in 2002 but increased to $203,659 in 2003.

The dockside value for commercial sheepshead landings on the west coast of Florida exhibited a steady increase during 1974-1994. Dockside value increased from $32,154 in 1974 to a peak of approximately $291,000 in 1994. Dockside value for sheepshead on the west coast of Florida exceeded $200,000 during 1992-1995, with an average of $255,000 during this four-year period. Dockside value then began a declining trend, falling to about $113,000 in 1996 (likely due to the 1995 implementation of the “net ban” in state waters), becoming erratic during 1997-2001, and finally falling to about $115,000 during 2002. Dockside value then increased to $136,443 in 2003. The average dockside value during 1996-2003 was approximately $126,671.

### 7.1.2 Monthly Commercial Nominal Dockside Value

The average nominal monthly dockside value for sheepshead landings was examined for 1999-2003 (Table 7.2). The average dockside value for each state during this five-year period was computed. The monthly dockside values exhibit slightly different monthly and seasonal patterns by state. For example, dockside values for most states were highest in the fall and winter months likely due to the schooling/feeding behavior exhibited by sheepshead just prior to the offshore spawning migration in the spring. For Alabama, the highest dockside values are reported during September-March (peaking in October). The west coast of Florida had the highest dockside value during November-March (peaking in February). The dockside value for the sheepshead fishery in Louisiana was highest during a broader time period and extended virtually year round, with March being the peak month. Mississippi's fishery reported the highest dockside values during December to April, with the highest dockside value reported in March. Dockside values for the Texas fishery were highest from August to March, with the peak during October.

**Table 7.2** Average monthly dockside value (1999-2003) by state in the Gulf (nominal values in dollars).

| Month | FWC ($) | AL ($) | MS ($) | LA ($) | TX ($) |
|---|---|---|---|---|---|
| January | 21,759.40 | 19,057.60 | 2,906.20 | 55,304.60 | 3,217.40 |
| February | 23,245.40 | 15,658.00 | 3,016.40 | 49,910.40 | 3198.20 |
| March | 16,946.00 | 13,046.20 | 4,348.40 | 161,422.60 | 4.320.60 |
| April | 6,597.20 | 4,596.40 | 3,560.20 | 46,168.80 | 1,780.20 |
| May | 6,515.40 | 6,297.80 | 462.40 | 3,705.40 | 2.231.40 |
| June | 5,559.00 | 5,881.40 | 267.60 | 12,108.80 | 1,850.20 |
| July | 5,102.20 | 5,801.20 | 216.20 | 22.445.20 | 1,780.40 |
| August | 5,419.60 | 7.752.80 | 189.00 | 34,926.20 | 3,071.00 |
| September | 5,784.60 | 18,890.40 | 245.20 | 21.764.60 | 3,885.00 |
| October | 8.864.60 | 30.151.80 | 657.60 | 30.712.80 | 5.105.40 |
| November | 10,557.80 | 12,663.00 | 676.60 | 37,732.80 | 2,959.60 |
| December | 11.781.00 | 14,941.40 | 2,390.20 | 47,691.20 | 2,584.00 |

### 7.1.3 Annual Dockside Prices for Sheepshead

Dockside prices for commercial landings of sheepshead are reported from 1973 to 2003. These prices were estimated by dividing total reported dockside value by total landings. Dockside prices are reported per pound on a whole (intact fish) weight basis. Prices were computed for the Gulf in total and for each individual state. Nominal and real (adjusted for inflation) prices are reported.

#### 7.1.3.1 Gulf-wide Dockside Prices

Nominal dockside prices (per pound, round weight basis) exhibited a general upward trend during 1973-2003. Overall, dockside price increased from $0.08 in 1973 to $0.34 in 2003 (Table 7.3). An average Gulf-wide peak of $0.36 was reported during 1995. Dockside price rose from $0.08 in 1973 to $0.36 in 1995 but remained between $0.34 and $0.28 from 1996 to 2003, with an average of $0.32 since 1995.

Real dockside prices (adjusted using the Producer Price Index for all unprocessed and packaged fish, base year 1982) for sheepshead remained somewhat erratic during 1973-2003 but averaged $0.17 during the entire period. Real dockside price declined from $0.18 in 1973 to $0.14 in 1979 and then increased to $0.21 in 1981. Real dockside declined again to $0.12 in 1987, only to peak at $0.22 in 1991. Real dockside prices for sheepshead began a downward trend to $0.17 in 2003.

#### 7.1.3.2 Dockside Price by State

Nominal dockside prices for sheepshead during 1973-2003 have (in general) exhibited an upward trend among the Gulf States (Table 7.3). The highest prices are reported from the west coast of Florida, while the lowest prices are reported from Louisiana. The dockside price per pound for sheepshead landed in Florida increased from $0.11 in 1973 to a high of $0.77 in 1997. The steady price increase in Florida since the mid 1990s could be related to the net limitation amendment which occurred in 1995. Prices remained relatively stable since 1997 with an average dockside price of approximately $0.73 during the 1999-2003. In contrast, Louisiana prices increased from $0.07 in 1973 to a maximum of $0.33 in 1991 and $0.34 in 1995. Since 1995, dockside sheepshead prices in Louisiana decreased steadily to a dockside price of $0.20 in 2002. The price increased to $0.25 in 2003.

Dockside prices followed similar trends in the other Gulf States. Sheepshead prices in Texas increased from $0.09 in 1973 to $0.48 in 1995 and 1997 and then decreased to an average of $0.36 from 2000 to 2003. Dockside sheepshead prices in Mississippi exhibited more consistent upward trends that have continued virtually throughout the entire time period of 1973-2002. Dockside prices in Mississippi increased from $0.08 in 1973 to $0.41 in 2003 with a peak of $0.42 in 1999. Similarly, dockside sheepshead prices in Alabama increased from $0.06 in 1973 to $0.52 in 2003 with a peak of $0.51 also occurring in 1999.

Shifts in the dockside price of sheepshead may be linked to changes in availability of other species, since sheepshead may serve as a close substitute. When other species are unavailable, local seafood markets may raise the price of sheepshead.

### 7.1.4 Monthly Commercial Dockside Prices for Sheepshead

Average monthly dockside prices were estimated by dividing average monthly dockside value by landings volume during 1999-2003. Annual average monthly prices were computed for each state. Dockside prices for sheepshead are, in general, highest during the summer and early fall months (Table 7.4). This is true for most states in the Gulf, with Texas being a notable exception. For example, dockside prices for sheepshead were highest in the May through October for Alabama, west coast of Florida, Mississippi, and Louisiana. Prices in Texas, however, were highest from February through April with other price increases reported in December. In addition, dockside prices were relatively higher during June and July, which was somewhat consistent with monthly price patterns in the other states. Monthly dockside prices for the west coast of Florida and Texas were less variable than other states. For example, dockside sheepshead prices for Alabama and Mississippi ranged from $0.37 and $0.32 to $0.60 and $0.49, respectively. Similarly, dockside prices for Louisiana ranged from $0.18 to $0.56. In contrast,

**Table 7.3** Dockside prices for sheepshead by Gulf state and for the total Gulf region (dollars per pound whole weight, nominal unless otherwise shown).

| Year | FWC | AL | MS Nominal | LA | TX | Total Region Nominal | Total Region Real |
|---|---|---|---|---|---|---|---|
| 1973 | 0.11 | 0.06 | 0.08 | 0.07 | 0.09 | 0.08 | 0.18 |
| 1974 | 0.11 | 0.06 | 0.09 | 0.07 | 0.07 | 0.08 | 0.17 |
| 1975 | 0.13 | 0.06 | 0.09 | 0.09 | 0.09 | 0.10 | 0.19 |
| 1976 | 0.14 | 0.08 | 0.09 | 0.09 | 0.11 | 0.11 | 0.17 |
| 1977 | 0.16 | 0.06 | 0.10 | 0.09 | 0.10 | 0.11 | 0.15 |
| 1978 | 0.18 | 0.07 | 0.10 | 0.14 | 0.12 | 0.13 | 0.17 |
| 1979 | 0.20 | 0.10 | 0.11 | 0.09 | 0.14 | 0.13 | 0.14 |
| 1980 | 0.18 | 0.12 | 0.15 | 0.12 | 0.14 | 0.15 | 0.17 |
| 1981 | 0.23 | 0.15 | 0.14 | 0.21 | 0.21 | 0.19 | 0.21 |
| 1982 | 0.25 | 0.15 | 0.14 | 0.12 | 0.25 | 0.18 | 0.18 |
| 1983 | 0.26 | 0.12 | 0.15 | 0.13 | 0.24 | 0.16 | 0.15 |
| 1984 | 0.25 | 0.13 | 0.18 | 0.11 | 0.20 | 0.15 | 0.13 |
| 1985 | 0.29 | 0.16 | 0.15 | 0.11 | 0.22 | 0.15 | 0.13 |
| 1986 | 0.30 | 0.19 | 0.17 | 0.13 | 0.27 | 0.18 | 0.15 |
| 1987 | 0.31 | 0.15 | 0.19 | 0.14 | 0.28 | 0.17 | 0.12 |
| 1988 | 0.34 | 0.22 | 0.23 | 0.18 | 0.28 | 0.22 | 0.15 |
| 1989 | 0.35 | 0.20 | 0.20 | 0.19 | 0.30 | 0.21 | 0.15 |
| 1990 | 0.40 | 0.21 | 0.22 | 0.22 | 0.33 | 0.24 | 0.16 |
| 1991 | 0.40 | 0.27 | 0.25 | 0.33 | 0.31 | 0.33 | 0.22 |
| 1992 | 0.41 | 0.29 | 0.24 | 0.28 | 0.44 | 0.30 | 0.19 |
| 1993 | 0.43 | 0.31 | 0.25 | 0.29 | 0.40 | 0.31 | 0.20 |
| 1994 | 0.45 | 0.28 | 0.20 | 0.31 | 0.42 | 0.32 | 0.20 |
| 1995 | 0.52 | 0.36 | 0.28 | 0.34 | 0.48 | 0.36 | 0.21 |
| 1996 | 0.76 | 0.38 | 0.32 | 0.29 | 0.42 | 0.33 | 0.20 |
| 1997 | 0.77 | 0.43 | 0.28 | 0.29 | 0.48 | 0.33 | 0.18 |
| 1998 | 0.74 | 0.44 | 0.37 | 0.29 | 0.43 | 0.33 | 0.18 |
| 1999 | 0.73 | 0.51 | 0.42 | 0.26 | 0.41 | 0.30 | 0.16 |
| 2000 | 0.74 | 0.44 | 0.35 | 0.23 | 0.36 | 0.28 | 0.14 |
| 2001 | 0.71 | 0.44 | 0.37 | 0.24 | 0.35 | 0.32 | 0.17 |
| 2002 | 0.75 | 0.45 | 0.41 | 0.20 | 0.36 | 0.30 | 0.15 |
| 2003 | 0.70 | 0.52 | 0.41 | 0.25 | 0.39 | 0.34 | 0.17 |

prices for Texas and the west coast of Florida ranged from \$0.69 and \$0.33 to \$0.76 and \$0.43, respectively.

### 7.1.5 Dockside Prices by Type of Harvest Gear

A number of factors determined dockside prices received by commercial fishermen. Seasonal shifts in landings volumes and demand, supplies of closely-substitutable species, region of harvest, and other factors affect the per pound dockside price. In addition, the type of gear influenced dockside price. A gear that allows individually harvested fish to be handled gently (i.e., less damage from crushing, tearing, etc.) and iced while alive result in a perceived higher quality. If buyers distinguish higher quality and a market exists for higher quality, a higher dockside price result. Thus, a fish caught in a trawl pulled for a lengthy time or on an unattended line may bring a lower price than a fish caught with a seine or spear.

**Table 7.4** Nominal monthly dockside prices by state in the Gulf.

| Month | FWC (\$) | AL (\$) | MS (\$) | LA (\$) | TX (\$) |
|---|---|---|---|---|---|
| January | 0.69 | 0.37 | 0.42 | 0.21 | 0.38 |
| February | 0.70 | 0.41 | 0.43 | 0.22 | 0.41 |
| March | 0.75 | 0.45 | 0.40 | 0.19 | 0.43 |
| April | 0.75 | 0.46 | 0.32 | 0.18 | 0.39 |
| May | 0.76 | 0.53 | 0.44 | 0.22 | 0.37 |
| June | 0.75 | 0.56 | 0.45 | 0.49 | 0.38 |
| July | 0.76 | 0.57 | 0.44 | 0.51 | 0.39 |
| August | 0.75 | 0.60 | 0.47 | 0.56 | 0.37 |
| September | 0.72 | 0.57 | 0.49 | 0.48 | 0.36 |
| October | 0.75 | 0.51 | 0.46 | 0.38 | 0.34 |
| November | 0.74 | 0.46 | 0.42 | 0.29 | 0.33 |
| December | 0.69 | 0.41 | 0.40 | 0.26 | 0.39 |

Nominal dockside prices were computed for landings of sheepshead by major gear type for 2000-2003 (Table 7.5). These prices represent dockside prices for sheepshead landed across the Gulf States. The prices were computed by dividing the total nominal dockside value for each gear type by the respective landings volumes for each gear type. The gear types selected for comparison include those that account for the majority of landings reported on a gear type basis. Most states reported landings by gear type. The exception would be Texas where data were reported for all gear types combined.

**Table 7.5** Dockside prices for sheepshead by gear type for the Gulf, 2000-2003 (nominal prices are dollars per pound, whole weight basis).

| Year | Trawl | Gill/Trammel Net | Spears/Diving | Seine | Trap | Hand Line | Cast Net |
|---|---|---|---|---|---|---|---|
| 2000 | 0.24 | 0.47 | 0.64 | 0.78 | 0.70 | 0.24 | 0.67 |
| 2001 | 0.27 | 0.47 | 0.65 | 0.77 | 0.77 | 0.23 | 0.67 |
| 2002 | 0.20 | 0.45 | 0.78 | 0.77 | 0.47 | 0.27 | 0.68 |
| 2003 | 0.26 | 0.52 | 0.73 | 0.56 | 0.42 | 0.25 | 0.66 |

A variety of gear types are utilized in the commercial sheepshead fishery. The primary nets include butterfly trawls, otter trawls (fish and shrimp), fyke/hoop nets, drift and stake gill nets, trammel nets, cast nets, haul seines, and purse seines. Traps are also put to use (e.g., blue crab, spiny lobster, and fish traps). Landings are reported for hand lines and rod/reel, as well as spears and diving. On average, the highest price among gear types was for sheepshead taken by seines, cast nets, and spears. The lowest prices were reported for trawls and hand lines.

### 7.1.6 Processing and Marketing

Sheepshead is a component of the mix of finfish species handled and processed in the Gulf States. However, no specific studies were conducted to describe product sources and marketing channels associated with the fishery.

To better understand the market channel system for sheepshead in the Gulf of Mexico, a brief market survey was designed and conducted by the GSMFC in 2004. This survey solicited information on sources of sheepshead supply, product forms received and produced, and disposition of sheepshead products in and out of the region. The relative importance of various product forms demanded by wholesale distributors, retailers, restaurants, and retail consumers was also requested.

A survey instrument was designed, field-tested, and mailed to 820 seafood wholesale distributors and finfish processors in the Gulf. The list of firms was obtained from finfish wholesaler and processor lists maintained by the Gulf States and the NMFS. The firms were thought to have handled sheepshead during the previous year. Of the total number of surveys sent out, 484 went to Louisiana firms, 170 to Alabama firms, 132 to Florida firms, 27 to Texas firms, and 7 to Mississippi firms. A cover letter and questionnaire were sent out initially, and a reminder letter and another copy of the questionnaire were sent three weeks later. Thirty-two survey forms were returned as undeliverable. A total of 138 responses were returned (18%), of which 63 (8%) indicated they handled sheepshead in 2003 (indicated receipt and/or sale of sheepshead). The following discussion is based upon those respondents. A copy of the survey instrument is provided in Section 12.2.

Respondents were asked about the source of their supply of sheepshead during 2003. Approximately two-thirds of the sheepshead purchased by wholesalers in the Gulf was obtained directly from fishermen (Table 7.6). Another 29% was obtained from other wholesalers. The remaining volume (2%) was obtained from other dockside buyers who purchase directly from fishermen. The majority of sheepshead was obtained in round (gutted with or without head) or whole (intact fish) form, regardless of the source. Only a small portion was obtained as fillets. In addition, virtually all of the sheepshead was obtained in fresh form. Of the sheepshead purchased from other domestic sources, all was purchased in round or whole form; however, no information was provided whether the product was purchased as fresh or frozen form. None of the respondents indicated that sheepshead was obtained from foreign sources.

Respondents were asked to describe the product forms into which the initial supply were converted. The majority of sheepshead sold by wholesalers (69.4%) was left in the round or whole form. About a quarter of the total supply was filleted. Virtually the entire product was sold in the fresh form.

**Table 7.6** Sources and product form of sheepshead supply for finfish wholesalers in the Gulf States, 2003 (GSMFC unpublished data). Data not reported by respondent designated by (n/r).

| | | **Product Form Purchased (%)** | | | |
|---|---|---|---|---|---|
| **Source of Supply** | **Percentage** | **Round/Whole** | **Fillets** | **Fresh** | **Frozen** |
| Fishermen | 69 | 98.4 | 1.6 | 100 | 0 |
| Other Wholesalers | 29 | 96.3 | 3.7 | 99.1 | 0.9 |
| Other Domestic Sources | 2 | 100 | 0 | n/r | n/r |
| Importers | 0 | 0 | 0 | 0 | 0 |
| Total | 100 | | | | |

n/r – not reported in survey by any respondent.

Respondents were asked to describe how their sheepshead sales were distributed across buyers (both in and out-of-state) and what product forms were demanded by these buyers. The most important single purchaser of sheepshead products was the retail consumer (33%), followed by other in-state wholesale buyers (24.7%) (Table 7.7). In-state restaurant buyers represented 14.2% of total sheepshead sales, while out-of-state wholesalers and in-state retail buyers represented 13.3% and 12.2% of sheepshead sales, respectively. Across buyer types, in-state sales were most important.

For wholesalers, most sheepshead were sold in whole form; however, retailers and retail buyers purchased 26.2% and 36.8% of the sheepshead as fillets. Over 80% of sheepshead sold to restaurants was sold as fillets. Regardless of buyer type, the vast majority of sheepshead was sold as fresh product. Approximately 10% of the sheepshead sold to retailers was frozen, while frozen product represented less than 3% of sales to other types of buyers.

#### 7.1.6.1 Market Channels

The market survey found that the major source of sheepshead for wholesale buyers was fishermen (69%) with 29% obtained from other wholesalers (Table 7.6). About 38% were then sold to other wholesalers, 14% to retailers, 15% to restaurants, and 33% to retail consumers (Table 7.7). Most sheepshead were sold to buyers within the same state, and across all returned surveys only 10% of the total sheepshead marketed in 2003 were sold to buyers out of the Gulf States. However, if considering only those respondents who provided a specific response to the question on out-of-state sales, approximately 39% was sold to buyers outside the region.

**Table 7.7** Sheepshead sales by product form for wholesalers in the Gulf States, 2003 (GSMFC unpublished data). Data not reported is designated by (n/r).

| Percentage | | | | Product Form Sold (%) | | | | |
|---|---|---|---|---|---|---|---|---|
| **Market Sector** | **In-State** | **Out-of-State** | **Total** | **Round/ Whole** | **Fillets** | **Other** | **Fresh** | **Frozen** |
| Wholesalers | 24.7 | 13.3 | 38.0 | 95.5 | 4.5 | 0 | 98.8 | 1.2 |
| Retailers | 12.2 | 1.6 | 13.8 | 72.4 | 26.2 | 1.4 | 90.5 | 9.5 |
| Restaurants | 14.2 | 0.9 | 15.1 | 17.9 | 81.1 | 1.1 | 98.8 | 1.2 |
| Retail Consumers | 33.0 | n/r | 33.0 | 57.8 | 36.8 | 5.4 | 97.5 | 2.5 |
| Foreign Buyers | 0 | n/r | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 84.1 | 15.9 | 100 | | | | | |

n/r – not reported in survey by any respondent.

#### 7.1.6.2 Other Source of Sheepshead

No other source of sheepshead exists other than domestic fishermen. No foreign sources of sheepshead were reported by respondents. Sheepshead was landed by commercial fishermen in the Atlantic States; however, the survey instrument did not distinguish between any source of domestic product (i.e., mid and south Atlantic or Gulf). Therefore, the contribution of other domestic landings to the total supply of sheepshead within the Gulf could not be ascertained.

#### 7.1.6.3 Consumption Estimates

No studies documenting the per capita consumption of sheepshead in the Gulf States have been conducted. Sheepshead is known to be a popular sportfish with a reputation for being an excellent table fish. A dated study of seafood consumption patterns in Texas found that 13% of those surveyed had eaten sheepshead, while 44% had heard of sheepshead but not eaten any (Gillespie and Houston 1975). A similar study conducted in Florida did not include sheepshead in the list of species for which consumption information was solicited (Degner et al. 1994).

Respondents to the Florida study did not indicate sheepshead to be an important species omitted from the survey form query list.

## 7.2 Recreational Sector

### 7.2.1 Sheepshead Angler Expenditures

No formal studies exist that measured the economic activities associated with sheepshead sport fishing in the Gulf States. Thus, the economic importance of recreational angling for sheepshead in the Gulf is currently indeterminate. However, limited data were collected by the MFRSS that describe expenditures associated with recreational sheepshead angling trips in the Gulf and south Atlantic (GSA) (NMFS, Office of Science and Technology 2004). These data were collected during 1998-2000 and provided expenditures associated with 383 trips (a total of 17,354 sheepshead trip interviews were collected in the GSA, of which 15,482 sheepshead trips were in the Gulf) where sheepshead were targeted and/or caught. As such, the expenditure data do not reflect total expenditures for the region only, but rather expenditures for the entire GSA that were associated with trips which targeted and/or caught sheepshead. The expenditure data have been adjusted by MRFSS staff to reflect 2004 dollars.

Individuals interviewed by the survey were asked to report various costs associated with their most recent trip. These expenditures included round trip travel costs, food, lodging, bait/ice, fuel, charter fees, etc. The average expenditure associated with trips on which sheepshead were targeted and/or caught was $73.16 (Table 7.8). The largest component of the average trip cost was food (29%), while round trip transportation costs, fuel, charter fees, bait/ice, and lodging represented 22%, 13%, 11%, 10%, and 9% of total trip costs, respectively.

**Table 7.8** Expenditures associated with recreational sheepshead angling trips.

| Expenditure Type | Average Value ($) |
|---|---|
| Round Trip Transportation Costs | 15.82 |
| Food | 21.43 |
| Lodging | 6.40 |
| Bait/ice | 7.10 |
| Fuel | 9.59 |
| Other Transportation Costs | 2.76 |
| Charter Fees | 8.26 |
| Other | 1.80 |
| Total | 73.16 |

### 7.3 Civil Restitution Values and Replacement Costs

Values exist by which a state can assess damages for negligent or illegal activities that result in the loss of publicly-owned 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 recreational travel costs. For the purpose of damage assessment, individual states may utilize a variety of valuation methods, such as existing market prices for commercially important species and estimated willingness-to-pay values for recreationally important species. The American Fisheries Society (AFS) (1982, 1992) estimated replacement values for certain species (primarily freshwater) and provided the methods for determining these values. State civil restitution values may be linked directly with these published estimates and methods; or the state may employ methods of their own choosing.

Restitution values vary considerably by state. The values for sheepshead in Texas are a function of size (Table 7.9) (TPWD Administrative Codes). The values range from $0.14 for a 1-inch fish to $48.46 for a 28-inch fish. The record length for a sheepshead in Texas is 25¼ inches. These values are a combination of the recreational value (derived from assessments of the value of sheepshead to recreational users) and the AFS value for sheepshead. The civil restitution value associated with sheepshead in Louisiana is expressed on a per pound basis (whole weight) and is currently $0.22 per pound (LDWF Administrative Codes). The civil restitution value associated with sheepshead in Florida is $16.80, regardless of size (FDEP 2004). In Alabama and Mississippi, no ordinances are in place to assess civil restitution values.

**Table 7.9**. Texas civil restitution values for sheepshead by size of fish (TPWD Administrative Codes).

| Size (inches) | Recreation Value ($) | AFS Value ($) | Total Value ($) |
|---|---|---|---|
| 2 | 0 | 0.31 | 0.31 |
| 3 | 0 | 0.48 | 0.48 |
| 4 | 0 | 0.63 | 0.63 |
| 5 | 0 | 0.79 | 0.79 |
| 6 | 0.53 | 1.1 | 1.63 |
| 7 | 1.06 | 1.35 | 2.41 |
| 8 | 1.59 | 1.6 | 3.2 |
| 9 | 2.13 | 1.86 | 3.98 |
| 10 | 2.66 | 2.11 | 4.77 |
| 11 | 3.19 | 2.36 | 5.55 |
| 12 | 3.72 | 2.62 | 6.33 |
| 13 | 4.25 | 4.01 | 8.26 |
| 14 | 4.78 | 4.96 | 9.74 |

**Table 7.9**. Texas civil restitution values (Con't)

| **Size (inches)** | **Recreation Value ($)** | **AFS Value ($)** | **Total Value ($)** |
|---|---|---|---|
| 15 | 5.31 | 6.05 | 11.36 |
| 16 | 5.84 | 7.28 | 13.12 |
| 17 | 6.37 | 8.66 | 15.03 |
| 18 | 6.91 | 10.2 | 17.11 |
| 19 | 7.44 | 11.91 | 19.35 |
| 20 | 7.97 | 13.8 | 21.77 |
| 21 | 8.5 | 15.88 | 24.38 |
| 22 | 9.03 | 18.14 | 27.18 |
| 23 | 9.56 | 20.61 | 30.17 |
| 24 | 10.1 | 23.29 | 33.38 |
| 25 | 10.63 | 26.18 | 36.81 |
| 26 | 11.16 | 29.3 | 40.46 |
| 27 | 11.69 | 32.65 | 44.34 |
| 28 | 12.22 | 36.24 | 48.46 |

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

Like so many species of fish, the social and cultural framework for the harvest and distribution of sheepshead has not been studied in any detail. While sheepshead may not rank high as the catch of choice for either commercial or recreational fishermen, under many circumstances this species does satisfy both. Although sheepshead may lag in terms of total landings, it is a frequently encountered and highly-recognizable species. Its importance is varied because it can play a key role in subsistence fishing and is often masqueraded as more popular fare on restaurant menus. Overall, it may be an opportunistic fishery for both recreational and commercial fishermen when preferred species are not available. Its widespread abundance in most inshore habitats makes it an easy target for people from every social and economic station.

With the addition of National Standard 8 to the Magnuson-Stevens Act, the role of ‘community’ in social impact analysis for federal fishery management agencies has become a focal point. Identification of fishing communities and data collection at the community level has only recently been initiated for Gulf of Mexico coastal communities.

### 8.1 Commercial Harvest

Little is known about the characteristics of the commercial harvest of sheepshead since there appears to be only a limited directed fishery. Some economic information exists regarding market channels and the distribution of sheepshead (Section 7); however, little is known about the harvesters and dealers/processors themselves. In a few states, small operations targeting sheepshead exist, but their contribution fluctuates widely from year-to-year dependent on the availability of other, more profitable species. Commercial fishermen enter the sheepshead fishery for multiple reasons (e.g., declining prices of other species, increasing trip costs, fishery closures, expanding finfish markets, gear restrictions). A number of states have designated more popular finfish species as “sport fish” which eliminated the commercial fishery. As a result, fishermen switched or adapted techniques and gear to other species such as sheepshead. The majority of the commercial harvest for sheepshead comes from the trawl fishery followed by the remnant gill net fishery, 77% and 20% respectively (Figure 6.14).

#### 8.1.1 Florida

Since a ban on the use of entanglement nets in state waters became effective in July 1995, Florida’s inshore net fishery has relied on cast nets and hook/line as the primary means of harvesting sheepshead. The commercial fishery is primarily comprised of fishermen that report only small amounts of landings of sheepshead each year (Murphy and MacDonald 2000). Commercial landings of sheepshead in Florida during 1999 were greatest along the central coast regions of the state, with the counties surrounding Tampa Bay and Charlotte Harbor contributing the most to 1999 commercial landings (Murphy and MacDonald 2000).

### 8.1.2 Alabama

In Alabama, gill nets are the primary gear for harvesting sheepshead. Commercial fishermen target sheepshead April through September with damaged nets from other fisheries. The use of damaged nets allows commercial fishermen to maximize gear expenditures on multiple species. Sheepshead have numerous spines which lend well to capture in a variety of mesh sizes and worn, damaged nets. Haul seines are expected to play an increasing role in the harvest of sheepshead. Anecdotal reports indicate that more commercial fishermen are building haul seines constructed from nylon twine. These durable seines result in larger catches per effort of sheepshead.

### 8.1.3 Mississippi

In Mississippi, commercial catches of sheepshead brought to fish houses were routinely reported until the late 1990s. Then sheepshead began to be reported as "unclassified." In 2004, sheepshead was again reported by species through the TIPs program (E. Porche personal communication). In the mid 1980s, most commercial landings for sheepshead were by trawl and gill nets. Since 1998, landings from cast nets dominated the largest component of the commercial fishery (NMFS unpublished data). This change in gears may be related to the reduction of the gill net fishery.

### 8.1.4 Louisiana

In Louisiana, net fisheries have been greatly reduced due to restrictions on the use of entanglement nets (gill, trammel and seine) other than for seasons restricted to harvest of Florida pompano and striped mullet. Most of the sheepshead taken in Louisiana are by commercial fishermen who switch species and gears depending on available species and markets. Fish trawls and handlines have become the primary gears used to produce sheepshead in the Southeastern part of the state roughly from Bayou Lafourche to the Mississippi state line, representing the primary location of the market. While sheepshead are harvested year round as bycatch, the winter fisheries will target sheepshead opportunistically as they are encountered with the majority of the landings being contributed by fish trawls operating in state and inshore waters.

Three fishing areas make up the bulk of the sheepshead grounds for the winter fish trawl fishery in Louisiana. The landings start from August to December in the Lake Borgne/Lake Pontchartrain areas until the fish move out with the onset of colder weather. In December and January, the fishery picks up in Breton Sound and Chandeleur Sound, but the majority of the sheepshead landings are in February and March off Grand Isle (H. Pearce personal communication). The February and March huge number of sheepshead landed by the Grand Isle fishery floods the markets and tends to drive down prices significantly until effort declines as trawlers redirect their efforts toward shrimp in April and May.

### 8.1.5 Texas

As a result of the elimination of the gill net and drag seine fisheries during the 1970s and 1980s, as well as the imposition of bag and size limits on commercial fishermen in 1988, there is no directed commercial sheepshead fishery in Texas. Most sheepshead is landed incidentally by participants in the flounder gig fishery. No ethnic profile for sheepshead fishermen in the Gulf of Mexico exists (VanderKooy 2000), but Texas commercial fishermen are Caucasian, Hispanic, and Vietnamese American. Caucasians are prevalent in fisheries along the entire Texas coast. Hispanics are more prevalent in fisheries along the lower Texas coast, and Vietnamese Americans are more prevalent in fisheries along the middle and upper coast of Texas (VanderKooy 2000).

The Texas finfish fishery was historically comprised of transient and part-time fishermen. During the 1979-1981 license years, a survey of Texas commercial finfish license holders revealed that only 16% of fishermen purchased licenses in all three years (Ferguson 1986). A license limitation program began in September 2000 for the Texas finfish fishery. In order to qualify for a finfish license in Texas, a fisherman must have held a license the previous year, may not hold any full time job other than commercial fishing, and must derive more than half of their income from fishing. The current fishery involves stable participation with few transient or part-time fishermen.

### 8.2 Recreational Harvest

Sheepshead is not generally targeted by most recreational anglers. Historically, sheepshead was considered less desirable, although many anglers agree that the flesh is quite good. Despite occasional disparaging comments by ‘sportfish’ anglers, sheepshead is often included as a prize category in many recreational fishing tournaments. One social organization in Louisiana near Lake Pontchartrain even adopted sheepshead as its symbol.

Beginning in 1997, the NMFS conducted add-on socioeconomic surveys of recreational fishermen through the MRFSS. Texas was not included as it does not participate in the MRFSS Survey.

#### 8.2.1 Florida

Recreational anglers take sheepshead opportunistically by hook/line, and some target sheepshead using gigs. A substantial part of the directed recreational sheepshead fishery is comprised of subsidence-type fishermen who provide food for their families and community. These anglers fish near bridges or other hard structures where they can scrape off barnacles and attached shellfish into the water enticing sheepshead to feed.

#### 8.2.2 Alabama

According to the survey for the NMFS socioeconomic add-on, Alabama recreational anglers were on average over 45 years of age, and over 75% were employed (NMFS 1997). Anglers had fished an average of 15 years, and over 55% owned a boat used for recreational saltwater fishing. About 15% of those surveyed were females. Anglers identified target species as spotted seatrout, red drum, and red snapper.

Alabama conducts a roving survey in which incomplete trip information is used to characterize the recreational hook/line fishery. Results of the survey indicate that 50% of interviews are anglers who launch their vessels from private docks or ramps. During the first quarter (January–March) of 1998-2002, 7.6% of the interviews indicated sheepshead as the target species. This percentage declined to 1.3% by the second quarter and continued downward for the rest of the year. In comparison, the percentage of interviews harvesting sheepshead is 9.6, 6.7, 3.6, and 4.8, respectively for the same time period. The tendency to harvest sheepshead regardless of target species indicates their role as an opportunistic fishery and acceptable food fish in Alabama.

### 8.2.3 Mississippi

In Mississippi, recreational harvest of sheepshead is mostly incidental catch to other, targeted species such as spotted seatrout and redfish. There are a few charter/guides that specifically target sheepshead during winter months when other species are less plentiful or weather conditions require fishing in protected waters (E. Porche personal communication).

### 8.2.4 Louisiana

No demographic characterization exists for individuals targeting sheepshead recreationally in Louisiana, but it is believed that individuals from every economic and social group participate in the fishery since sheepshead are caught easily from either shore or boat. As in the other Gulf States, the recreational sheepshead fishery in Louisiana is primarily bycatch from other targeted species. With no bag or size limits, sheepshead is fished heavily during the winter months, although no data identify these anglers clearly (J. Adriance and M. Bourgeois personal communication).

### 8.2.5 Texas

No specific demographic information exists on the recreational sheepshead fishery in Texas. A survey conducted in 1986 indicated that resident Texas recreational fishermen were predominantly 20-49 year old males from urban areas (Ditton et al. 1991). Twenty-one percent of resident anglers were females. A subsequent survey found that most (89%) were white or Anglo, 5% were African-American, and 6% were Asian-American, Native American, or other (Ditton and Hunt 1996). Ten percent indicated that they were of Spanish/Hispanic origin. The majority of Texas resident saltwater anglers indicated spotted seatrout or red drum as preferred species; however, 0.2 %, 0.3%, and 1.2% of those surveyed ranked sheepshead as their first, second, or third most preferred species, respectively.

Although there are no data to support the claim, there is anecdotal evidence that a large percentage of sheepshead landed in Texas are landed by non-resident anglers during the winter months. A survey of Texas non-resident anglers conducted in 1987 found that the largest group was males sixty years old and older (Donaldson et al. 1992). Fourteen percent were females, and more than 35% were retired. No information on ethnicity was reported. Most indicated that spotted seatrout and red drum were the preferred saltwater species. Non-resident anglers participated more, had more time to fish, and had more fishing experience than Texas resident anglers. Although non-resident anglers are fewer in number than resident anglers, non-resident anglers may have a profound impact on fisheries resources in Texas including sheepshead.

## 8.3 Organizations Associated with the Fishery

The following organizations have some interest in finfish legislation and management and therefore may have some interest in sheepshead.

### 8.3.1 National

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

National Fisheries Institute
1901 North Ft. Myer Drive
Suite 700
Arlington, VA 22209

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

Coastal Conservation Association
4801 Woodway, Suite 220W
Houston TX 77056

### 8.3.2 Regional

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

Southeastern Fisheries Association
1118B Thomasville Road
Mt. Vernon Square
Tallahassee, FL 32303

### 8.3.3 Local (State)

The following organizations are concerned with finfish related legislation and are therefore interested in the effects of sheepshead regulations and its harvest and production.

#### 8.3.3.1 Florida

Coastal Conservation Association
905 East Park Avenue
Tallahassee, FL 32301

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

Florida League of Anglers
534 North Yachtsman
Sanibel, FL 33957

Florida Fishermen’s Federation
11225 Old Kings Rd
Jacksonville, FL 32219

Organized Fishermen of Florida
225 Rockledge Dr.
Rockledge, FL 32955

Southeastern Fisheries Association
1118-B Thomasville Rd
Tallahassee, FL 32303

### 8.3.3.2 Alabama

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

Mobile County Wildlife and
Conservation Association
PO Box 16063
Mobile, AL 36606

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

Alabama Wildlife Federation
3050 Lanark Rd.
Millbrook, AL 36054

### 8.3.3.3 Mississippi

Mississippi Charter Boat Association
3209 Magnolia Lane
Ocean Springs, MS 39564

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

Mississippi Gulf Coast Fishermen’s
Association
176 Rosetti Street
Biloxi, MS 39530

### 8.3.3.4 Louisiana

Louisiana Seafood Management Council
Rt. 6 Box 285 K
New Orleans, LA 70129

Lake Pontchartrain Fisherman's
Association
Route 6, Box 285K
New Orleans, LA 70129

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

United Commercial Fisherman's
Association
2812 Violet Lane
Violet, LA 70092

Coastal Conservation Association
P.O. Box 373
Baton Rouge, LA 70821

Delta Commercial Fisherman's
Association
P.O. Box 186
Venice, LA  70091

Louisiana State Seafood Industry
Advisory Board
6640 Riverside Drive Suite 200
Metairie, LA  70003

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

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

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

Louisiana Wildlife Federation
P.O. Box 65239
Baton Rouge, LA  70896

#### 8.3.3.5  Texas

Coastal Conservation Association-Texas
6919 Portwest Drive, Suite 100
Houston, TX  77024

Professional Involvement of Seafood
Concerned Enterprizes
Rt. 3, Box 789
Dickinson, TX  77539

Recreational Fishing Alliance-Texas
P.O. Box 718
Fulton, TX  78358

Saltwater Enhancement Association
711 N. Caranchua
Corpus Christi, TX  78401

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

# 9.0 REGIONAL RESEARCH NEEDS AND DATA REQUIREMENTS

## 9.1 Biological

### 9.1.1 Genetic Stock Identification

As stated in Section 3.2.4, it has been suggested in unpublished research that the existence of genetic variants in sheepshead populations may not exist. A more rigorous genetic study of these distinct adult forms of sheepshead based on body shape and stripe-count morphology would provide a clearer picture of the actual stock being managed.

### 9.1.2 Inshore/Offshore Movement

Section 3.2.5 provides evidence of distinct offshore and inshore populations of sheepshead that only intermingle during spring spawning events. An isotope feeding study to address movement and feeding of sheepshead would assist managers in identifying specific populations in order to better protect spawning aggregations during critical times of the year.

### 9.1.3 Age Composition of Commercial and Recreational Catch

The addition of sheepshead to a secondary species list for FIN projects by port agents and MRFSS samplers would improve the ability of managers to provide meaningful in-depth age structured assessment of the population.

### 9.1.4 Reproduction

Section 3.2.3.2 highlights research indicating sheepshead spawn near or around offshore reef structures. Tagging and monitoring of sheepshead as they move to and from spawning grounds would improve managers' ability to protect vulnerable aggregations during critical times of the year.

### 9.1.5 Regional Batch Fecundity Estimates

Number of hydrated oocytes/gram in relation to length and age, in addition to hydrological parameters (salinity, DO, temperature, pH) collected at the same time would provide insight into wild spawning conditions.

### 9.1.6 Egg and Larval Development and Transport

Section 3.2.3.4 indicates that little is known about the incubation of sheepshead eggs, and Section 3.2.3.5 reflects the disconnect between the spawning event and the immigration into the estuary by early juveniles. A complete life history will foster more effective management decisions.

### 9.1.7 Feeding

Considering the propensity of the species to feed on and around structure, no studies to date have investigated the possibility of bioaccumulation of antifouling agents, arsenic, mercury, petroleum byproducts by foraging sheepshead. Copper and other antifouling compound toxicity and tissue retention in sheepshead feeding on or around pilings should be investigated. Sheepshead may play a role in the regulation of biofouling on reef communities and may actually contribute to modification of community structure in these areas by selective foraging.

## 9.2 Habitat

### 9.2.1 Habitat Utilization

It is unknown what role submerged and emergent aquatic vegetation plays in the life history of sheepshead. Likewise, it is unknown if the loss of these areas negatively impacts any sheepshead life history stages and diet of sheepshead. How these structures function in the offshore movement patterns of sheepshead has not been fully determined. Long-term survey information about the residence time of sheepshead on these reefs and their movements between reefs could be ascertained using telemetry or a tagging study. Feeding and reproductive studies of sheepshead on artificial reefs and oil and gas platforms

### 9.2.2 Habitat Alterations

More information is needed on how artificial structures affect the behavior could help determine the role of the reef in the daily activities of this species.

### 9.2.3 Dead Zone/Hypoxia

As noted in Section 4.9.1, the close association that sheepshead have with estuaries during the hot summer months tends to decrease the effects these offshore hypoxic areas have on the population. However, it is not known what impact these hypoxic areas might have on the resident offshore populations of sheepshead. Related to this issue is the increased nutrient load entering the Gulf of Mexico through coastal rivers and streams due to agricultural and municipal run-off and its effects on the sheepshead population.

### 9.2.4 Entrainment, Impingement, and Thermal Discharge

It is unknown at this time what impact offshore LNG facilities might have on sheepshead. As noted in Section 4.9.4.12, if an open loop system is utilized in the vicinity of sheepshead spawning areas and impacts waters used by sheepshead larvae for passive transport into the estuaries, the impact to this species could be substantial. Likewise, super-cooled discharge from these LNG plants could negatively affect both the juvenile and adult sheepshead population in the Gulf of Mexico through thermal shock.

## 9.3 Socioeconomic

### 9.3.1 Commercial Fleet Description

More information is needed to describe the current commercial fishing fleet that targets sheepshead. Information is needed by which the amount of effort toward sheepshead can be assessed. This would be particularly useful in assessing the degree to which effort is redistributed toward or away from sheepshead as regulatory/policy changes are imposed on those species for which sheepshead serves as substitutes in the regional market. In addition, some measure of the existing fleet capacity would help managers better anticipate shifts in effort due to regulatory or market-related stimuli.

### 9.3.2 Market Channel Characterization

A better understanding of the pathways that sheepshead products take within the local and regional seafood market will help managers better regulate the fishery for maximum benefit. Additional value is generated as sheepshead moves from the dock to the dinner plate. These values provide insight into the total economic value associated with sheepshead as a seafood product.

### 9.3.3 Other Sources of Product

The majority of the sheepshead that enters the domestic market comes from the Gulf States. However, additional supplies originate from the South Atlantic region. It is unknown what volume, if any, originates from foreign sources. Knowledge of these other sources of product is needed to fully understand the potential effect on local and regional markets of changing supplies of Gulf sheepshead.

### 9.3.4 Commercial Costs and Earnings

Effective regulation takes into consideration the effects that regulation/policy shifts have on vessel-level revenues and rents. Without quality annual and trip cost data for the commercial fleet, managers will be unable to measure the financial impacts of management change on the harvesting sector. These data currently do not exist.

### 9.3.5 Recreational Angler Valuation

Sheepshead is an important recreational fishery on the Gulf coast. The economic activities associated with sheepshead angling are not known. Managers need to know the economic values associated with sheepshead angling in order to more fully incorporate the full set of economic values into management decisions.

### 9.3.6 Consumer Profiles, Fishery Participants, Communities

An important component of current fisheries management is an understanding of the community structure associated with the targeted fishery. Information is needed to allow a characterization of the individuals participating in the commercial and recreational sheepshead fisheries, and the communities in which they reside and conduct their activities. Information such as the demographic characteristics of fishery participants and the industry infrastructure within the local community is needed.

### 9.3.7 Economic Impact Assessments

The economic impacts and activities associated with the commercial and recreational sheepshead fishery are needed to fully understand the contribution to local communities in which the fisheries are promulgated. These values will help managers understand the contribution to the local economy of new dollars created by the expenditures associated with product exports (commercial) and non-resident expenditures (recreational). The contribution by the sheepshead fishery of incomes, jobs, and economic activity will help managers better understand the full market-related impacts to the local economy. Though such information is of little use in determining an allocation of sheepshead between user groups, economic impact assessments can help local decision makers understand the degree to which the commercial and recreational sheepshead fisheries contribute to the well-being of the local community and economy.

### 9.3.8 Consumption/Demand/Product Substitutability

More information is needed on the per capita consumption of sheepshead products. Such information will allow a better understanding of the importance of sheepshead to local markets. The demand for sheepshead is also needed so that a full understanding of the economic values associated with sheepshead can be factored into management decisions. Such economic valuation information, in contrast to economic impact assessments, will provide the foundation for any allocation decisions among user groups. Also, the degree to which sheepshead serves as a substitute for other economically important species in the local and regional seafood markets is needed. Such information would assist managers in anticipating the degree to which effort might be redistributed between sheepshead and other species. In addition, an understanding of the degree to which other species may influence the market price of sheepshead (and vice versa) is needed.

## 9.4 Resource Management

### 9.4.1 Fishery Independent Sampling Techniques

More fishery independent monitoring would greatly improve our knowledge of this species.

### 9.4.2 Gear Efficiency

Data collection could involve testing of certain gears.

### 9.4.3 Fishery Dependent (see Biological 9.1)

More dockside sampling of adults would improve knowledge and management of this species.

### 9.4.4 Bycatch/Mortality Rates from Other Fisheries

Mortality rates of sheepshead caught as bycatch in other fisheries would help managers make more informed management decisions. A reliable estimate of the amount of sheepshead landed as bycatch in the shrimp trawl fishery is needed.

## 9.5 Industrial/Technological

### 9.5.1 Mariculture/Aquaculture Potential

At present, it is too costly to raise sheepshead; however, advances in mariculture/aquaculture could make this prospect more viable.

## 10.0 REVIEW AND MONITORING OF THE PROFILE

### 10.1 Review

The State-Federal Fisheries Management Committee (SFFMC) of the GSMFC will review, as needed, the status of the stock, condition of the fishery and habitat, the effectiveness of management regulations, and research efforts. Results of this review will be presented in the GSMFC for approval and recommendation to the management authorities in the Gulf States. Should it be determined that a change has occurred in the fishery requiring additional management measures, the SFFMC may direct the GSMFC to expand the profile and develop a fishery management plan for this species.

### 10.2 Monitoring

The GSMFC, the NMFS, states, and universities should document their efforts at management measure implementation for this species and review these with the SFFMC.

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# 12.0 APPENDIX

## 12.1 Glossary

## 12.2 Market Survey

## 12.1 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 brings 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, boatsize, 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 lands 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.

**Gonochoristic -** Fish that maintain the same sex throughout their entire lifespan.

**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.

**Groundfish** - 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.

## 12.2 MARKET SURVEY

# SHEEPSHEAD 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 sheepshead, do not include other species in your responses. Also, "round" refers to head-on, guts-in. "Whole" refers to eviscerated, head-on or off.)

1. *FROM WHOM AND WHERE DID YOUR SUPPLY COME FROM? IN WHAT FORM DID YOURECEIVE IT?*

**A. Of the *total volume* of sheepshead you handled in 2003, what percent (please estimate!) were obtained directly from each of the following sources?**

| | |
|---|---|
| Domestic | |
| 1. Fishermen (hook-and-line, trawlers, etc) | _______% |
| 2. Wholesaler (Distributor/Processor) | _______% |
| 3. Other Domestic Source (please describe _____________) | _______% |
| Foreign Sources | |
| 4. Imports from Mexico, etc. | _______% |
| **TOTALS =** | **100%** |

**B. Of the *total volume* of sheepshead you handled in 2003, in what form did you purchase it from the following sources?**

| | Round/Whole | | Fillets | | Fresh | | Frozen | |
|---|---|---|---|---|---|---|---|---|
| 1. Fishermen | _______% | + | ______% | **= 100%;** | ______% | + | ______% | = **100%** |
| 2. Wholesaler | _______% | + | ______% | **= 100%;** | ______% | + | ______% | = **100%** |
| 3. Other Domestic Source | _______% | + | ______% | **= 100%;** | ______% | + | ______% | = **100%** |
| 4. Imports | _______% | + | ______% | **= 100%;** | ______% | + | ______% | = **100%** |

2. *DID YOU CUT IT, LEAVE IT WHOLE, FREEZE IT, OR WHAT?*

**A. Of the total volume of *round and whole* sheepshead you purchased in 2003, what percent (please estimate!) were processed into the following product forms prior to final sale by your firm?**

| | |
|---|---|
| 1. Left in round or whole form | _______% |
| 2. Filleted | _______% |
| 3. Other (please describe _____________________) | _______% |
| TOTALS = | **100%** |

**B. What percent (please estimate!) of the following sheepshead product forms you handled in 2003 were *sold by your firm* in frozen or fresh form?**

| | | |
|---|---|---|
| 1. Round or Whole | — *Fresh* | _______% |
| | — *Frozen* | _______% |
| 2. Fillets | — *Fresh* | _______% |
| | — *Frozen* | _______% |
| 3. Other | *Fresh* (please describe_____________________) | _______% |
| | *Frozen* (please describe_____________________) | _______% |
| | TOTALS = | **100%** |

OVER ➔

*3. WHO DID YOU SELL IT TO AND HOW DID THEY WANT IT?*

**A. Of the *total volume* of sheepshead you handled in 2003, what <u>percent</u> (please estimate!) were *sold* to each of the following buyers?**

| | |
|---|---|
| 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 | ______% |
| 8. Foreign Buyer | ______% |
| TOTALS = | **100%** |

**B. For each of the following types of buyers that you sell sheepshead to, <u>please estimate</u> the percentage of each product form they buy in a typical year. Also, for each type of buyer, show the percentages of fresh versus frozen purchased.**

| | Product Forms | | | | | | |
|---|---|---|---|---|---|---|---|
| | Whole | Fillets | Other | = Total | Fresh | Frozen | = Total |
| **Example:** Retailer | (25%) | (50%) | (25%) | **100%** | (75%) | (25%) | **100%** |
| **Example:** Restaurants | (50%) | (50%) | (00%) | **100%** | (100%) | (00%) | **100%** |
| Wholesale Distributor/Processors | ( ) | ( ) | ( ) | **100%** | ( ) | ( ) | **100%** |
| Retailers | ( ) | ( ) | ( ) | **100%** | ( ) | ( ) | **100%** |
| Restaurants | ( ) | ( ) | ( ) | **100%** | ( ) | ( ) | **100%** |
| Retail Consumers | ( ) | ( ) | ( ) | **100%** | ( ) | ( ) | **100%** |
| Others (please describe________________) | ( ) | ( ) | ( ) | **100%** | ( ) | ( ) | **100%** |

**C. Of the total amounts of sheepshead you sold during 2003, <u>please estimate</u> the percent sold to buyers outside of the TX, LA, MS, AL, and FL region.**

**____________________________%**

*4. WHERE ARE YOU LOCATED?*

**In what states do you operate fish houses where sheepshead are handled? Indicate the number operated in each of the states listed.**

| | <u>Number</u> |
|---|---|
| Texas | _______ |
| Louisiana | _______ |
| Mississippi | _______ |
| Alabama | _______ |
| Florida | _______ |

*5. WHAT MARKET NAME HAVE YOU SEEN OR USED FOR THIS SPECIES?*

**Under what names have you seen sheepshead marketed? Please check all that apply.**

| | | | |
|---|---|---|---|
| bay snapper | _________ | rondeau mouton | _________ |
| convict fish | _________ | sargo | _________ |
| sheepshead bream | _________ | zebra fish | _________ |
| sheepshead porgie | _________ | rhondo seabream | _________ |
| rondeau mutton | _________ | pargo | _________ |
| sargo chopa | _________ | other (please list) ___________________ | |

*THAT'S IT!!*

***PLEASE FOLD COMPLETED QUESTIONAIRE AND PLACE IN POSTAGE-PAID RETURN ENVELOPE IMMEDIATELY. THANKS FOR YOUR WILLINGNESS TO PARTICIPATE IN THIS SURVEY.***

## About the Artists

Steve Jones is an Ocean Springs, MS native and has been doing watercolor painting and all aspects of graphic design since he was a teenager. Although he does not currently work in the design profession, he continues to express himself through artwork whenever time allows. He has lived in various places around the country but has returned to Ocean Springs for good. Steve and his wife Gayle live on Graveline Bayou and love the water, its wildlife, and the islands. Gayle works for the Gulf States Marine Fisheries Commission and is an accomplished artist in her own right tending towards wildlife illustrations more in the Walter Anderson tradition. Both Steve and Gayle contributed the cover artwork for use on the Sheepshead Profile before Hurricane Katrina swept away most of their original artwork from their waterfront home. Consequently, this cover artwork has great meaning for the Jones as well as the Commission.

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