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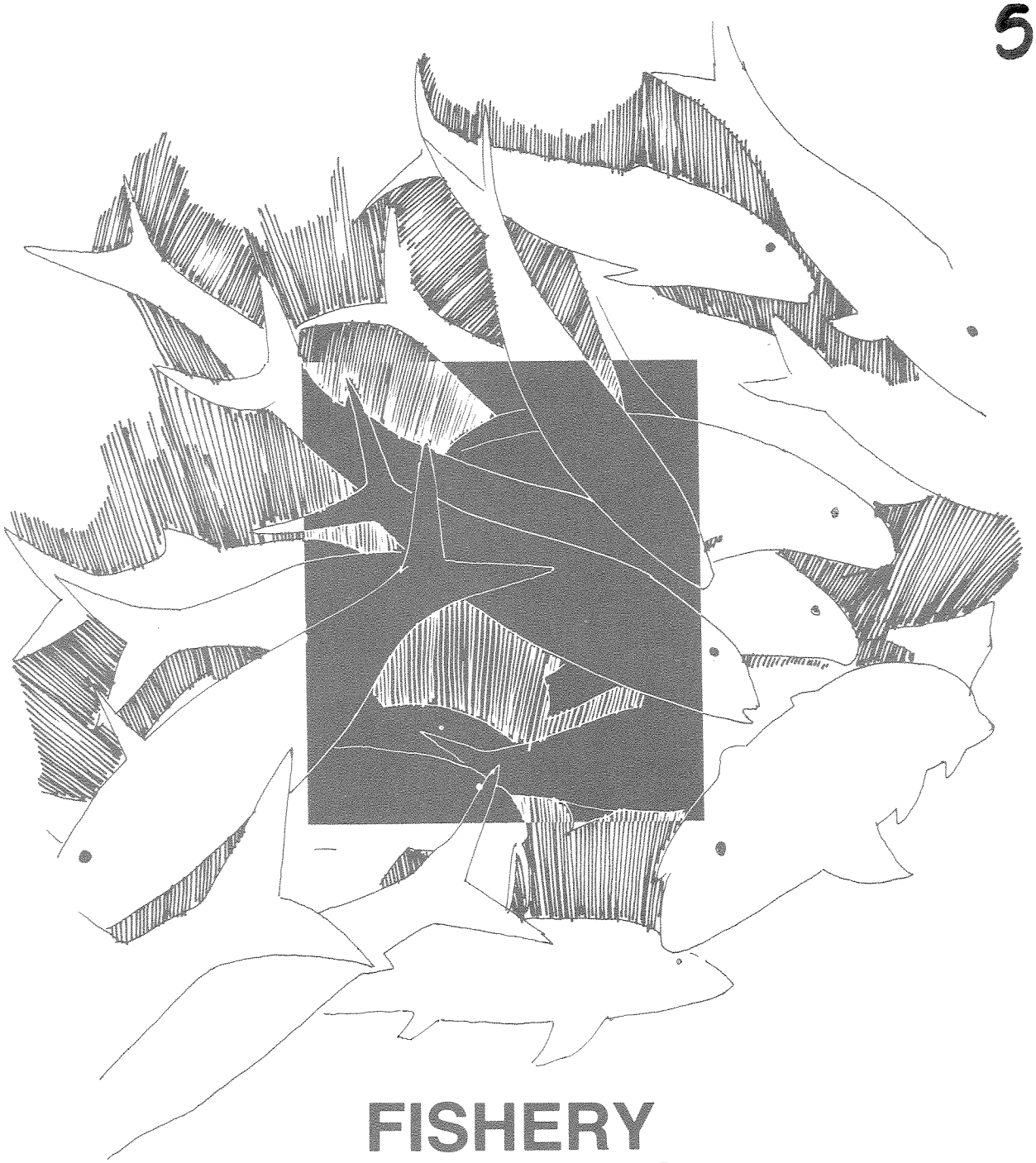

FISHERY PROFILES OF RED DRUM AND SPOTTED SEATROUT

April 1980
No. 6

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GULF STATES MARINE FISHERIES COMMISSION

FISHERY PROFILES OF RED DRUM AND SPOTTED SEATROUT

By

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Patricia L. Johansen
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Published April 1980

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PREFACE

The information contained in this publication was compiled and assembled for publication by the Red Drum-Spotted Seatrout Subcommittee of the Gulf States Marine Fisheries Commission. Dr. James E. Weaver, Texas Parks and Wildlife Department, served as chairman from December 7, 1977-December 27, 1978, and was succeeded by Mr. William S. Perret, Louisiana Department of Wildlife and Fisheries, who continues to the present time. Other members of the Subcommittee are as follows:

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Ms. Dell Griffin typed the manuscript. The cooperation of the five Gulf States in supplying the scientific personnel to prepare this document is gratefully acknowledged.

INTRODUCTION

The red drum (*Sciaenops ocellata)* and the spotted seatrout (*Cynoscion nebulosus)* support valuable commercial and recreational fisheries along the northern Gulf Coast. These two species are excellent food fishes and bring good prices to the commercial fishermen. During 1976, Gulf Coast commercial fishermen marketed in excess of eleven million pounds with a dockside value exceeding four million dollars to the fishermen. The species are also highly valued by recreational fishermen for their fighting abilities on light tackle and their delectable taste. While the annual catch by the recreational segment is unknown, it may exceed the yearly catch by the commercial group.

Since both of these species are dependent upon the estuarine and shallow Gulf waters for spawning, feeding and growing areas, it is in these areas that the greatest pressure from the commercial and recreational user groups occur. Thus, as with any species in great demand by more than one user group, conflicts develop. Unfortunately, in many instances recreational-commercial fishery conflicts are often resolved politically by administrative decision or voter preference, and these solutions have not always been assessed to determine impact on the fishery. Since the majority of the life cycle of the red drum and the spotted seatrout is spent in state waters, regulation of the fishery has been the responsibility of those state governments within whose boundaries the fisheries are conducted.

A statement made in 1923 by Welsh and Breder may be appropriate today: "A fundamental prerequisite for intelligent fisheries legislation—legislation that will serve the true interest of the fisheries and assist toward the increase and perpetuation of the prime sources of supply—is an accurate knowledge of the life histories of the species contributing to that supply. Lacking such knowledge, legislation must be largely a matter of guesswork, based on the varied and often conflicting opinions of interested parties."

Though there have been numerous studies made on these two species since the above statement was made, many unanswered questions still remain. Further studies should provide, but not be limited to, sufficient information on spawning grounds and spawning time, on natural and fishing mortality rates, on proper identification of nursery areas and on population dynamics and yield models. Additionally, better catch and effort statistics from the commercial as well as the recreational segments of the industry are needed. Even if all the necessary biological information to manage a fishery is available, there are still social, economic and political factors that enter management decisions, and these influences must be considered before a final management decision is rendered.

The recently passed Fisheries Conservation and Management Act of 1976 requires as one of its national standards that conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery. Optimum is defined as the amount of fish

> (A) which will provide the greatest overall benefit to the Nation, with particular reference to food production and recreational opportunities; and
> (B) which is prescribed as such on the basis of the maximum sustainable yield from such fishery, as modified by any relevant economic, social, or ecological factor.

In recognition of the substantial interest in these two species of fish and many associated user problems common to each of the Gulf States in varying degrees, the Gulf State Federal Fisheries Management Board (GSFFMB) voted to undertake the development of a cost estimate on initial work towards a management plan for red drum and spotted seatrout with the understanding that the Technical Coordinating Committee (TCC), as the Board's scientific advisor, report back the next day after the recess of that meeting. The TCC recommended that (1) the development of a profile on red drum-spotted seatrout be undertaken similar to that for shrimp and menhaden, commensurate with available funds; (2) that the profile be handled by a small sub-committee under the TCC and be comprised of one representative from each resource agency and one individual from the National Marine Fisheries Service; and (3) that this subcommittee be funded up to $10,000 to cover costs for transportation, loading and meals for an estimated three or four meetings. The board approved the proprosed development of a "Fishery Profiles for Red Drum and Spotted Seatrout" as presented.

DESCRIPTION OF THE RESOURCE AND FISHERY

LIFE HISTORY—*SCIAENOPS OCELLATA*—RED DRUM

REPRODUCTIVE CYCLE

The generalized reproductive cycle for red drum can be divided into offshore and inshore segments, with spawning and larval development generally believed to occur offshore (Pearson 1929). Post-larvae migrate into inshore nursery areas where they grow and remain for approximately two years (Loman 1978). As subadults they move back offshore prior to maturation and spawning.

Area and time of spawning

Along the Florida coast, red drum spawning occurs in autumn (Welsh and Breder 1924, Kilby 1955, Springer and Woodburn 1960, Yokel 1966, Roessler 1967, Jannke 1971), probably beginning in September and peaking in October. Yokel (1966) examined gonads from over fifteen hundred red drum from southwestern Florida during September 1960 through September 1961. Most were captured in estuaries, and none were ripe or ripening. The only ripe or ripening fish collected were taken in mid-October in or near the Gulf. Fish 3.18-6.80 kg caught off Longboat Pass near Bradenton by Yokel (1966) had ripening roe. Jannke (1971) collected several thousand red drum larvae during plankton sampling conducted at least monthly from January 1966 to December 1967 in Little Shark River in the Everglades National Park. He concluded that spawning occurred from mid-September through mid-February, with peak spawning in October.

The absence of ripe females in Florida estuaries suggests that spawning occurs offshore. Larvae are then apparently transported to estuaries where they grow. This assumption is reinforced by Jannke's (1971) observation that larvae were transported from the Gulf of Mexico through Little Shark River into Oyster Bay. He also found that red drum larvae were significantly more abundant in bottom plankton collections than in surface collections. Yokel (1966) believed that spawning occurred near passes and channels since the smallest larvae (5-7 mm) were always collected there.

In Alabama (Tatum, personal communication), red drum are generally open-sea spawners with spawning taking place near passes and inlets. The spawning season in Alabama appears to extend from mid-August through December with the peak in mid-September through October.

Christmas and Waller (1973) found that red drum begin spawning off Mississippi in September. Mature female red drum have been captured only on the Gulf side of the barrier islands.

Observations of commercial and sport catches in Louisiana (Perret, personal communication) over a number of years reveal a late summer through early fall spawning season. Large schools of "bull" or spawning red drum are reported to congregate around major passes from August through November. Peak populations are usually found in September and October, although some individuals are found throughout the year in these areas.

Although the exact location of red drum spawning on the Texas coast is unknown, it is thought to occur offshore in the Gulf of Mexico possibly near the mouths of passes (Pearson 1929).

Size at maturity

The smallest ripening red drum observed by Yokel (1966) in Florida was a 630 mm female. Presumably males mature at a smaller size than females. Red drum measuring 305-381 mm were reported to have reached maturity in Alabama (Tatum, personal communication). Mature male red drum 320-395 mm have been taken in Mississippi estuarine waters (Overstreet, personal communication), while mature females have been taken only in the Gulf waters off Mississippi. Simmons and Breuer (1962) reported that red drum in Texas reach maturity at the end of the third or fourth year when the fish are 700-800 mm long. Ripe fish as small as 425 mm (two years old) have been found by Gunter (1945). Miles (1950) reported that ripe males 500 mm long and ripe females 550 mm long were caught in the upper Laguna Madre in January.

Egg description

The only available description of red drum eggs was published by Johnson et al. (1977) who described eggs from Texas as follows: eggs are spherical and buoyant, containing 1-6 (usually 1) colorless oil droplets. The chorion of the eggs is clear and unsculptured; the perivitelline space is generally less than 2% of the egg diameter which ranges from 0.86 to 0.98 mm; oil droplet diameter ranges from 0.22 to 0.36 mm.

Fecundity

Fecundity estimates have been made on cultured fish in Florida and on wild fish from Texas. Red drum cultured in tanks at the Florida Department of

Natural Resources Marine Laboratory have produced from $< 2 \times 10^4$ to as many as 2×10^6 eggs in a single spawn (Roberts et al. 1978a). These artificially cultured fish spawn repeatedly over several months. Estimates of fecundity on wild fish from Texas have ranged from 0.5×10^6 to 3.5×10^6 eggs per fish (Pearson 1929, Colura 1974, Johnson et al. 1977).

Nursery areas

Estuaries are the nursery grounds for red drum, and total estuarine areas appear to limit the abundance of this species. Yokel (1966) showed that state-by-state commercial landings of red drum varied directly with the estuarine area in each state.

In general, young fish seek quiet shallow waters with grassy or slightly muddy bottoms that are not greatly affected by tides. Red drum ranging from 50 to 150 mm move to deeper waters of bays during their first winter, and many wander into Gulf waters during the spring following hatching (Simmons and Breuer 1962). After the first year there is a gradual movement of red drum into the Gulf during cold weather and a pronounced movement back into bays and lagoons in early spring. In southwest Florida, Yokel (1966) found no apparent seasonal movement of juveniles into the Gulf. Simmons and Breuer (1962) stated that young red drum on the Texas coast were carried by currents into the nursery areas of Texas bays where they remained from six months to three or four years with some movement in response to temperature changes. Similar results were reported for Cheasapeake Bay and North Carolina where juveniles left the shoals in cool weather and either moved into a deep portion of the estuary or out to sea (Yokel 1966).

AGE AND GROWTH CHARACTERISTICS

Rate of growth and influencing factors

Red drum grow rapidly, particularly in the very young stages, achieving a standard length of 5.11 mm during the first 300 hours of growth (Johnson et al. 1977). Growth continues to be rapid during the first year of life, as revealed in Figure 1 (Simmons and Breuer 1962). Parrish (1968) collected red drum juveniles in the lower Ochlockonee River in Florida and summarized his data and those of Joseph and Yerger (1956) as follows:

Date	No.	Mean Size (mm) SL	Source
March	6	71	Joseph and Yerger (1956)
5 April	1	109	Parrish (1968)
24 May	4	147	Parrish (1968)
28 June	1	216	Parrish (1968)

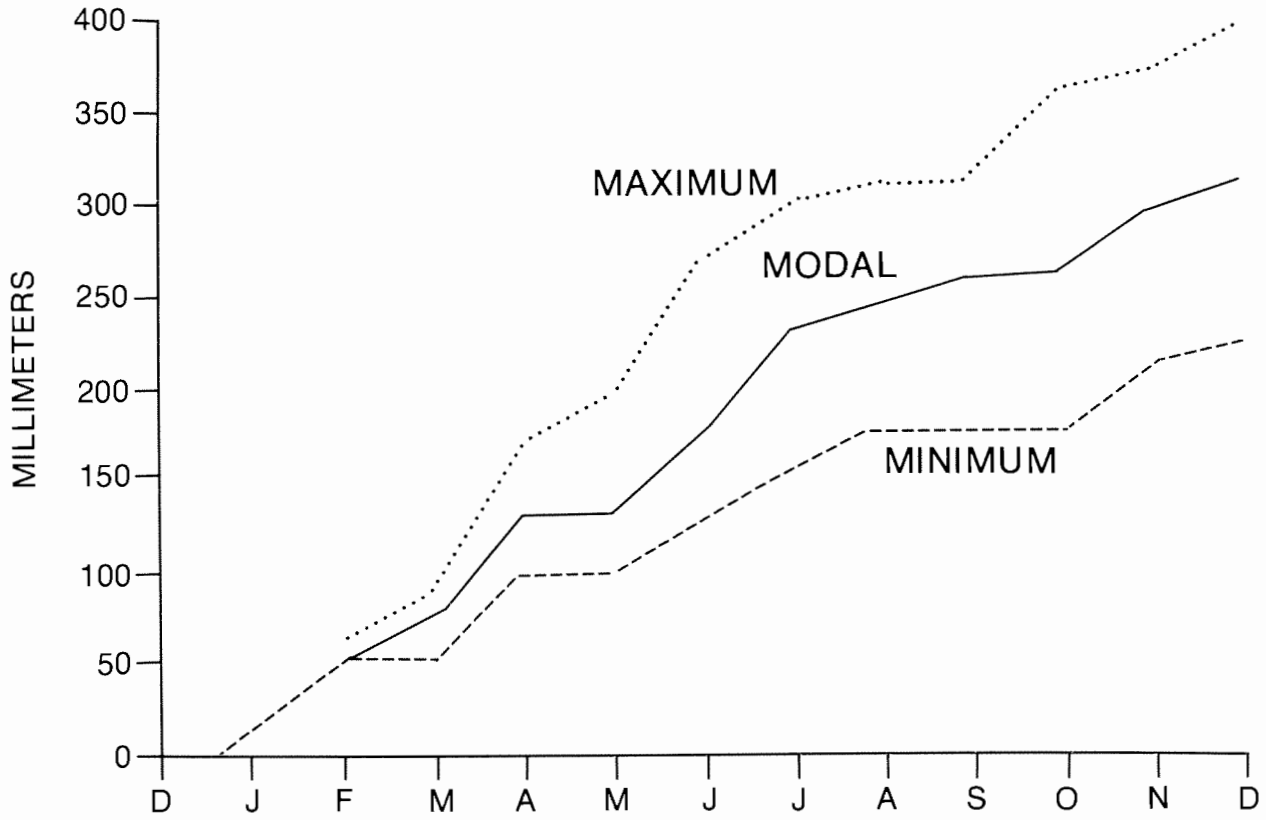


Figure 1. Maximum, modal, and minimum lengths of 2000 red drum of year class zero. (Simmons and Breur 1962).

If Parrish's (1968) data are representative, red drum should exceed 300 mm by age I. Roessler (1967) collected 106 juveniles in Everglades National Park and found them growing about 20 mm per month reaching an average of about 83 mm by March. Yokel (1966) summarized captures of juvenile red drum from Maryland to Texas; his Florida data appear similar to that of Parrish (1968). Yokel also noted that there was full recruitment of yearling (305 mm) red drum into the fall and winter Everglades National Park fishery. Welsh and Breder (1924) examined scales of twenty-one fish collected in March 1920 at Fernandina, Florida. They believed that three year old fish ranged from 390 to 590 mm. However, Pearson (1929) in Texas noted the following modal lengths for the various year classes of red drum:

Age at end of year	Length (mm) TL	Δ Length (mm)
1	350	350
2	540	190
3	640	100
4	740	100

During a 195-day growth study, Luebke (1973) found growth rates of 0.11-1.1 mm per day for red drum of beginning lengths of 220-240mm.

Considerable tagging has been done in Florida, and some growth information is available from these studies. The results of five years of tagging during 1961-65 are shown below for twelve fish free for at least 182 days.

TL (mm) at tagging	Growth in TL (mm)	Days of Freedom	Source
373	115	186	Ingle et al. (1962)
391	8	210	Topp (1963)
282	121	182	Topp (1963)
333	130	289	Beaumariage (1964)
438	37	420	Beaumariage (1964)
545	160	381	Beaumariage (1964)
350	175	497	Beaumariage (1964)
340	125	488	Beaumariage (1964)
364	42	405	Beaumariage (1964)
310	248	429	Beaumariage & Wittich (1966)
420	105	429	Beaumariage & Wittich (1966)
655	20	243	Beaumariage & Wittich (1966)

Results of these studies are varied but there is some indication (Simmons and Breuer 1962) that growth is not constant throughout the year, with the fish exhibiting a growth lag in spring, rapid growth in summer and a slight lag at the end of summer. Other factors influencing growth have been demonstrated in studies of mariculture systems where growth and survival of larvae were shown to depend on initial larvae stocking density and food density (Roberts et al. 1978b). Growth was greatest when embryo stocking density was lowest and food density was highest. However, survival was highest at intermediate embryo densities and intermediate concentrations of prey.

Standard length–total length relationships, total length–wet weight relationships, gutted and gilled weight–whole weight relationships

Figure 2 shows the standard length–weight-relationships for red drum from Louisiana (Boothby and Avault 1971, Bass and Avault 1975), South Carolina (Theiling and Loyacano 1976) and Texas (Leubke 1973, Harrington et al. 1979). Table 1 lists the various empirical formulae calculated for red drum length-weight relationships from which Figure 2 was prepared. Even though there are differences in time and area of capture, in size ranges of fish used to calculate the various formulae and in sample size, similar length-weight relationships were found across the range of the red drum. In general the length-weight relationship was similar for all samples with the exception of that from Louisiana (Bass and Avault 1975). The fish used in that study ranged from 8 to 183 mm in the first year of growth, and one would expect an accelerated growth rate during that time period. Theiling and Loyacano (1976) noted no difference in length-weight relationships between male and female red drum.

Harrington et al. (1979) also presented a standard length–total length relationship as well as dressed weight (gutted and gilled)–whole weight relationship for red drum caught in Texas. These relationships are as follows:

Range	Relationship	n	r
67-785 mm	TL = 12.87 + 1.77 SL	8982	0.995
230-4830 g	WW = –7.633 + 1.134 DW	643	0.998

TL = Total length in mm
SL = Standard length in mm
n = number of fish measured
r = Correlation coefficient
WW = Whole weight in grams
DW = Dressed weight in grams

Leubke (1973) reported a total length–standard length relationship (r = 0.99) of: TL = 25.19 + 1.13 SL for 47 fish, 283-411 mm SL.

Age and growth studies

The only age and growth study found was that by Pearson (1929) and has been summarized in the previous section **Area and Time of Spawning** (see page 2).

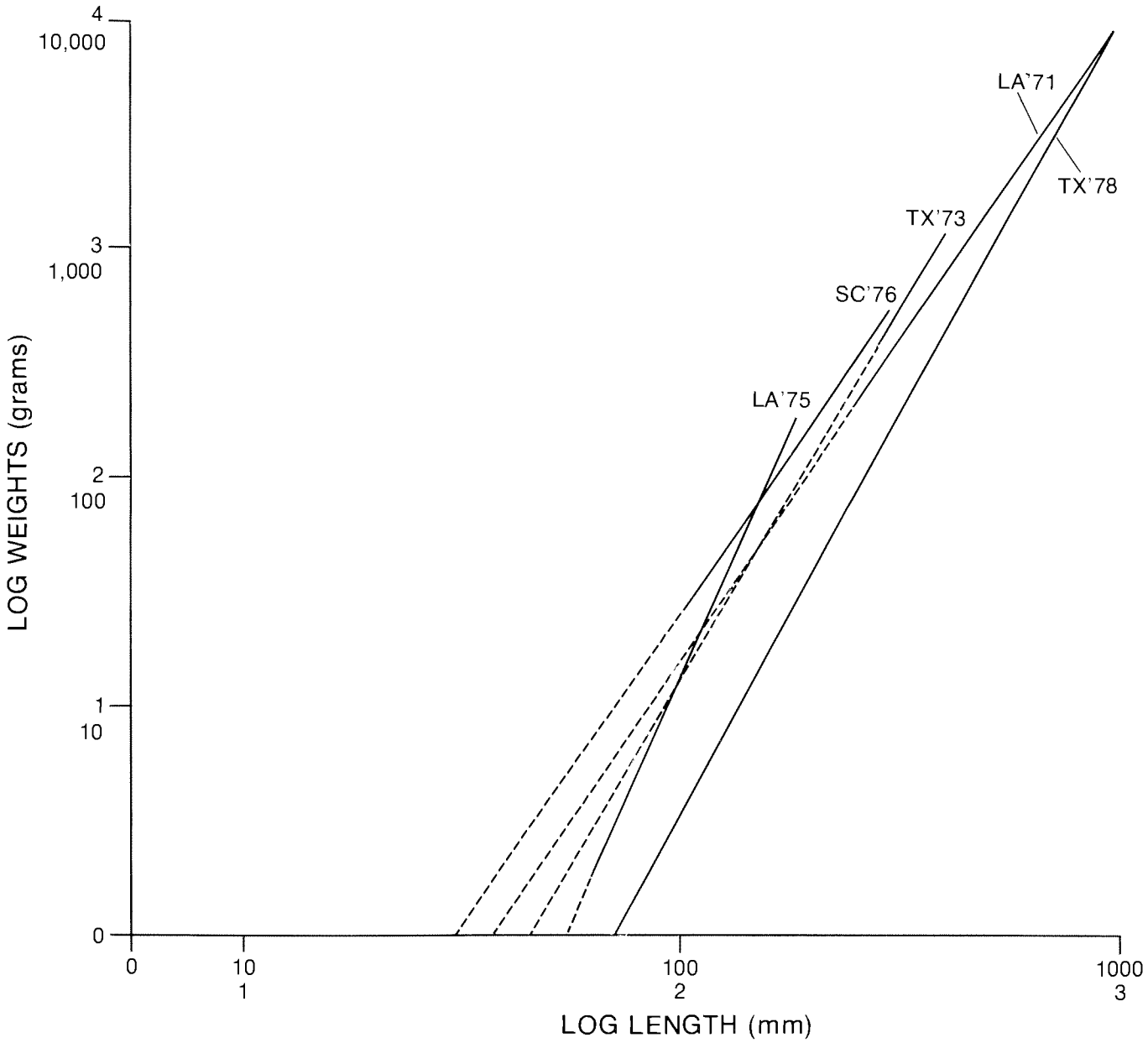


Figure 2. Standard length–whole weight relationships for red drum from Texas, Louisiana, and South Carolina. (See Table 1 for formulae).

TABLE 1. LENGTH-WEIGHT RELATIONSHIPS FOR RED DRUM

Area	Type	Relationship	Source
Louisiana	Adult red drum N = 286 240-940 mm	log W(g) = −4.42161 + (2.83284) log SL(mm)	Boothby & Avault (1971)
Texas	Adult red drum N = 47 283-411mm	log W(g) = −4.69 + (2.97) log SL(mm) (r = 1.00)	Luebke (1973)
Louisiana	Juvenile red drum N = 568 8-183 mm	log W(g) = −7.2052 + (4.1913) log SL(mm)	Bass & Avault (1975)
S. Carolina	Adult red drum N = 54 *100-300 mm	log W(g) = −1.29596 + (2.74031) log SL(cm)	Theiling & Loyacano (1976)
Texas	Red drum N = 8319 71-970 mm	log W(g) = −5.085 + (3.041) log TL(mm) (r = 0.990) Converted TL to SL using formula: TL(mm) = 12.870 + (1.177) SL(mm) Harrington et al. (1979).	Harrington et al. (1979)

N = number of fish measured SL( ) = Standard length in mm or cm TL(mm) = Total length in mm
W(g) = Weight in grams * Assumed range r = Correlation coefficient

GEOGRAPHIC DISTRIBUTION THROUGHOUT LIFE CYCLE

Range

Yokel (1966) reported the known range of red drum on the Atlantic Coast as extending from Buzzards Bay, Massachusetts, to Key West, Florida, although they occurred irregularly north of New Jersey. In the Gulf of Mexico they occur continuously from southwest Florida across the northern Gulf and south to Tuxpan, Mexico. However, Yokel (1966) stated that it was not definitely known how far south red drum extended into Mexico.

Larval, juvenile and adult distribution by area, time and depth

Red drum apparently spawn at sea, and the larvae are carried by tidal currents through inlets and passes into estuarine areas (Pearson 1929, Yokel 1966, Jannke 1971, Loman 1978). The larvae come to rest in shallow areas among submerged grasses such as *Halodule beaudettei* and *Ruppia maritima* until they are strong enough to swim. The grasses are believed to give the small fish some protection from predation and tides (Miles 1950). The smallest larvae (5-7 mm) are always found in shallow areas in or near the Gulf (Yokel 1966). As they mature, young red drum move farther into the estuary (Pearson 1929, Miles 1950, Yokel 1966).

Based on the appearance of post-larvae in inshore nursery areas along the Mississippi coast, immigration began in October 1974 and in September 1975 and 1976 (Loman 1978). King (1971) presented data indicating concentrations of 0.1 post-larval red drum/m^3 moving through the Cedar Bayou inlet of Galveston Bay, Texas, during October. Jannke (1971) collected larvae moving from the Gulf into Everglades National Park from 23 September to 14 December 1966 and 20 October to 17 December 1967.

According to Miles (1950), juvenile red drum in Texas seek the sheltered waters of primary and secondary bays where maximum abundances are reached in January through April when the fish are 85-100 mm in length. Breuer (1973) reporting abundances of juvenile red drum in Laguna Madre, Texas, as 67/ha in April 1973, 99/ha in January 1972, 17/ha in February 1971, 54/ha in February 1970 and 47/ha in January 1969, providing further evidence of the concentrations of red drum in primary bays in winter and spring.

Relative abundance

Simmons and Breuer (1962) reported that more red drum are present in Texas bays in spring and fall than in winter or summer. Yokel (1966)

states, "In Texas, Louisiana and Mississippi the period of greatest availability of red drum is in the fall of the year, whereas in Florida it is in the winter." Breuer (1973) presented spring and fall abundance data for adult red drum in lower Laguna Madre, Texas (Table 2). McIlwain (1978) reported that larger catches of red drum occurred during spring and fall in estuarine, recreational creels and that red drum were caught at other times of the year but in fewer numbers.

Movement and territoriality

Subadult red drum (< 3 years) may remain in Texas bays all year (Pearson 1929), but older fish move out into the open Gulf in late fall and winter and possibly during summer. Yokel (1966) summarized the distribution of adult red drum by reviewing the literature and adding information from his own interviews with fishermen and menhaden spotter pilots. He stated that following the first spawning, red drum spend less time in the estuary and more time at sea. In certain seasons the larger fish form schools at the surface and close to shore. In the North Carolina and Virginia area it appears that there is a seasonal north and south movement in spring and fall, respectively. Yokel did not speculate on seasonal migration in the Gulf of Mexico. Welsh and Breder (1924) suggested that red drum which enter New Jersey waters were apparently migratory and originated from populations to the south.

Across the northern Gulf, red drum do not appear to undergo extensive migrations (Beaumariage and Wittich 1966, Beaumariage 1969, Moe 1972) except for movement from bays into the Gulf. They appear to exhibit broad, random movements within bays with movement perhaps being motivated by temperature (Heffernan 1973). Tagging data presented by Simmons and Breuer (1962) suggested that certain red drum populations may live exclusively in the Gulf while others remain in particular bays. It is not known whether these represent distinct subpopulations. Simmons and Breuer (1962) also pointed out that most movement occurs at night.

Table 2. Yield of red drum (in kg/ha) collected by Texas Parks and Wildlife trammel nets from lower Laguna Madre, Texas (Breuer, 1973).

Year	Spring	Fall
1968	1.1	5.0
1969	2.9	4.8
1970	5.3	1.9
1971	3.8	4.4
1972	3.7	1.5
1973	3.8	2.2

HABITAT

Substrate preference

Simmons and Breuer (1962) observed that young fish were found in protected waters with grassy or slightly muddy bottoms. Loman (1978) noted that the smallest red drum larvae were almost always found in quiet, shallow areas usually having grass or mud bottoms. Juvenile red drum have been found to be abundant at the perimeter of marshes along the Mississippi coast (McIlwain, personal observation). Jackson (1972) indicated that most subadult red drum were caught in protected areas near the marsh rather than in the more open areas of Biloxi Bay, Mississippi. Miles (1950) reported that adult red drum are found over muddy, sandy or oyster reef substrates.

Submerged vegetation

In Texas red drum larvae are normally associated with the grasses *Halodule beaudettei* and *Ruppia maritima* (Miles 1950). Most likely they are also associated with several of the other seagrasses which occur in the Gulf, although no other species of grasses were mentioned in the literature.

Industrial, agricultural, residential and recreational demands on habitat

Yokel (1966) concluded that the abundance of red drum varies directly with the estuarine area. He reported that state commercial landings varied with estuarine areas in the state and, further, that landings in general within a state varied with the amount of its estuary. However, since red drum are not abundant in all estuaries within their range, other limiting factors must also be involved. Temperature probably limits abundance (Yokel 1966). Little is known of the impact of human encroachment into the estuarine habitat and its consequent affect on red drum. In recent years there have been increased demands on the estuaries in the way of sewage disposal, petroleum exploration, dredging, filling, laying pipelines and installation of marinas, treatment ponds for industrial plants and heated effluents from generating plants. Davis (in press), in his discussion of changes in the Everglades National Park red drum and spotted seatrout fisheries, noted that more large and mature fish were now being taken in what had been a nursery area, that catch rates of red drum had increased and that catch rates had become more consistent with less year-to-year variation. He suggested that these changes result from manipulation of environmental conditions for the benefit of man and a marked decline in major natural perturbations in that area. Although not dealing specifically with red drum, Martinez (1973) pointed out that pesticide spraying in bayous entering the Galveston Bay, Texas, area re-

sulted in numerous fish kills as did a breakdown in the Seabrook, Texas, sewage plant.

Since red drum spawn offshore and adult red drum are probably hardy animals, the most vulnerable stages in the life cycle are the larvae and juvenile forms, which spend all of their time in the estuaries. Destruction of the estuarine habitat must logically cause an ultimate decrease in red drum stocks.

Agricultural, industrial and domestic discharge (heavy metal, pesticides, eutrophication)

Data presented by Luebke (1973) show faster growth rates of red drum in heated water discharged from a power plant, and Bearden (1967) demonstrated the feasibility of increasing growth rates of red drum by keeping them in saltwater impoundments.

FOOD HABITS

Food types, food preferences (selectivity) and predator/prey relationship

Several investigations have provided extensive data on food habits of red drum: Pearson (1929), Gunter (1945), Kemp (1949), Miles (1950) and Knapp (1950) from Texas; Fontenot and Rogillio (1970) and Boothby and Avault (1971) from Louisiana; Yokel (1966) from Florida; and Overstreet and Heard (1978) from Mississippi. Stomach analyses of juvenile red drum have also been recorded from Texas by Miles (1950), from Florida by Odum (1971) and from Louisiana by Bass and Avault (1975). Other less extensive data on feeding habits have been reported by Reid (1955), Reid et al. (1956), Simmons (1957), Breuer (1957), Darnell (1958), Inglis (1959), Springer and Woodburn (1960) and Simmons and Breuer (1962). In general, crustaceans and fish account for most of the reported food items of red drum. The percentages of these various food types varied with geographic location, season and size of fish.

Roessler (1967) attempted to correlate the abundance of forage fish families (*Gerreidae, Clupeidae and Eugraulidae*) with the abundance of gray snapper (*Lutjanus griseus),* red drum, spotted seatrout *(Cynoscion nebulosus*) and snook (*Centropomus undecimalis*), but no correlation was found between red drum abundance and forage fish abundance.

Feeding habits and chronology

Yokel (1966) observed feeding habits of red drum in Florida Bay and in tanks at Miami Seaquarium. He found the fish feeding both by visual and tactile stimulation and observed that red drum use extensions of the first pelvic fin ray to orient the body in murky water. Yokel (1966) found that red drum took food into the mouth either by rapid expansion of the branchial region (thereby sucking the prey into the mouth) or by biting the substrate.

Red drum frequently feed in very shallow water and at such times can be seen "tailing" at the surface. In deeper areas they lie in sloughs behind sand bars or adjacent to grass flats and, during a falling tide, feed in the water running off the bar or flat.

The feeding habits of juvenile red drum have been investigated by Odum (1971) and Bass and Avault (1975). Juveniles 15 mm long fed selectively on copecods and copepod nauplii. Red drum 15-50 mm fed selectively on mysid shrimp when available. Fish, gammarid amphipods, decapods (grass shrimp, penaeid shrimp, young blue crabs) and polychaetes are also included in the diets of juvenile red drum. Bass and Avault (1975) found little difference between day and night feeding.

Pearson (1929), Gunter (1945), Simmons and Breuer (1962), Boothby and Avault (1971) and Overstreet and Heard (1978) agree that the primary foods of adult red drum are crustaceans (crab and shrimp) and fish. Other food items reported in the literature include annelids, echinoderms and bryozoans (probably ingested passively while feeding on another organism (Overstreet and Heard 1978)). Pearson (1929) reported that red drum feed both on the bottom and in the water column; Boothby and Avault (1971) suggested that red drum usually feed during late evening and early morning. Boothby and Avault (1971) described red drum as indiscriminate feeders and found little difference in food habits among fish 250-930 mm SL and no difference between males and females. However, they did find seasonal variation in food consumption. Overstreet and Heard (1978) suggested that red drum migrations may be regulated by optimal abundance of specific types of food organisms.

Assimilation rates

Little work has been done on feeding energetics. However, Luebke (1973) reported a food conversion range of 2.70-6.61 (feed/gain) for red drum fed trout chow stocked in heat discharge ponds of a power station.

DISEASES AND PARASITES

Yokel (1966) summarized the literature to date and reported a total of twenty-three known parasites and diseases of red drum. Since that time several new parasites and diseases have been identified from red drum.

Ectoparasites are mostly caligid copepods such as *Echetus* (Ho 1966) and *Caligus*. Simmons and Breuer (1962) reported that red drum are free of this latter copepod in water of salinity 45‰. *Caligus repax* and *C. bonito* are generally the most common ectoparasites

(Simmons 1957). Isopods of the genus *Nerocila* may also be found attached to red drum (Simmons and Breuer 1962). Since these parasites often attach to the gills, they may seriously interfere with respiration, decreasing the survival potential of the fish.

Internal parasites include both protozoa and "worms." A myxosporidian protozoan has been reported from the intestine and pyloric caeca of red drum (Iverson and Yokel 1963). Parasitic worms described from red drum include: a gasterostome (Riggin 1962), pleurocercoids (Simmons and Breuer 1962) and "spaghetti worms" (*Poecilancistrium robustum*). This last parasite is more common in larger fish but is not harmful to humans (Simmons and Breuer 1962), although Yokel (1966) noted that this worm received the most attention from fishermen because of its large size (up to 170 mm), white color and presence in the edible muscles.

Henley and Lewis (1976) reported an anaerobic bacterial infection which caused red drum to become disoriented and swim at the surface.

Gunter (1948) reported a possible case of genetic birth defect in the form of reversed scales in three red drum.

ENVIRONMENTAL TOLERANCES

Salinity, temperature, light intensity, freshwater inflow, system productivity, etc.

Red drum are euryhaline, occurring in salinities ranging from 0 to 50‰ (Herald and Strickland 1949, Odum 1953, Kilby 1955, Gunter 1959, Springer 1960, Gunter and Hall 1962, Simmons and Breuer 1962, Yokel 1966, Loman 1978), although they are rare at the higher salinities. Simmons and Breuer (1962) reported the optimum salinity range for red drum as 30–35‰. Yokel (1966) reported a direct relationship between size and salinity, small fish being more common at low salinities and large fish preferring higher salinities. Jannke (1971) found larval red drum entering Little Shark River, Florida, when salinity was at a minimum; he captured them over the range of 23.5–32.4‰. Loman (1978) reported capturing 3.0–31.0 mm (average 7.7 mm) fish over a salinity range of 8.5–26.5‰ in Mississippi. He also reported juveniles (43.0–111.0 mm) being taken over a salinity range of 0.0 to 30.0‰. The highest catches in Mississippi occurred when salinities were between 20.0 and 25.0‰ (Figure 3).

Red drum are also eurythermal. Springer and Woodburn (1960) collected 20–126 mm SL red drum in Tampa Bay, Florida, at temperatures of 10–27.5°C. Roessler (1967) collected them in temperatures of 16.1–26.7°C. Springer (1960) collected red drum from St. Lucie and Indian River in Florida at temperatures ranging from 2° to 29°C. Jannke (1971) collected larvae in Little Shark River (Everglades National Park) when temperatures were falling but before they reached the winter minimum; he found them over a temperature range of 18.3–31.8°C. Loman (1978) reported taking young red drum (3.0–31.0 mm) which averaged 7.7 mm at temperatures of 20.5–31.0°C while juveniles (43.0–111.0 mm) were taken at temperatures of 13.8–28.8°C. The highest catches occurred at temperatures of 20.0–25.0°C (Figure 3).

Jannke (1971) reviewed the effect of both day and night light intensity on the total number of larval fish he captured. He did not find a significant relationship though it appeared that concentrations of larvae were higher during darker periods.

Little data were found relating abundance or distribution of red drum to environmental factors such as dissolved oxygen concentration, system productivity, etc. Since oxygen content in most Texas bay waters is usually in excess of 4 ppm (Martinez 1973) it is unlikely that the fish are ever oxygen-limited except in local situations. Bryan (1971) reported a fish kill, apparently due to oxygen depletion, involving 320 red drum in the Arroyo Colorado of lower Laguna Madre in September 1969.

It is reasonable to assume that any deleterious effect on any component of the food web eventually involving any life stage of red drum will also ultimately have a deleterious effect on the adult red drum population. Odum (1971) and Odum and Heald (1972) presented data on the productivity of south Florida estuaries and indicated that the production of game fishes was dependent on the productivity of the estuaries.

Catastrophic events

While able to tolerate a wide range of temperatures, red drum are sensitive to rapid and sustained drops in water temperature. High red drum mortality in Texas during freezes has been documented by Gunter (1941) and Gunter and Hildebrand (1951). Storey and Gudger (1936) reported effects of nine severe cold spells and subsequent mass mortalities of fish at Sanibel Island, Florida; red drum were killed in three of these, but the kills of red drum were never severe. Storey (1937) listed red drum as a species seldom hurt during freezes at Sanibel Island.

POPULATION DYNAMICS

Models and modeling

Population dynamics and yield models are difficult to formulate for red drum. A recent paper by Matlock and Weaver (1979) listed a monthly survival estimate for red drum in Texas waters of $90.9 \pm 3.2\%$.

Effect of fishing mortality

Some inferences can be made that the fishing pressure on estuarine red drum is high. Of 690 red drum tagged in Florida waters during 1961–1965, 328 tags were returned for an overall return rate of 47.5% (Beaumariage 1969). In areas such as Tampa Bay and Charlotte Harbor on the Florida Gulf coast, return rates sometimes exceeded 70% (Ingle et al. 1962). Red drum are probably not as vulnerable to fishing after leaving the estuary. Off the Mississippi coast in the Gulf waters in recent years the catch of large mature fish has greatly increased due to new fishing techniques employed by the commercial net fishermen and charter boat fleet (McIlwain, personal observation). This may have an effect on the brood stock in that immediate area.

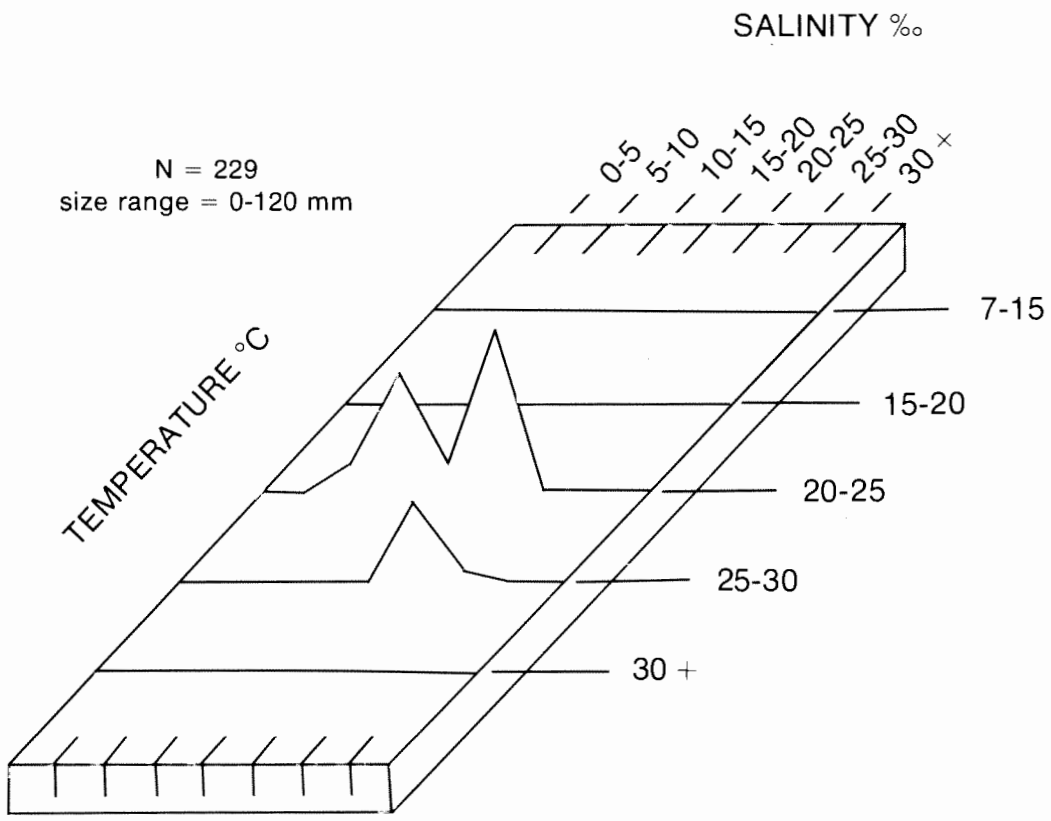


Figure 3. Distribution of red drum in relation to temperature and salinity. Viewing angle of rotation 45°, elevation 45°. Vertical scale is number of red drum and is dependent on group size. (Loman 1978).

REPRODUCTIVE CYCLE

Area and time of spawning

Throughout the Gulf of Mexico the spotted seatrout has a protracted spring and summer spawning season which peaks during late April-July (Pearson 1929, Miles 1950, Moody 1950, Simmons 1951, Guest and Gunter 1958, Klima and Tabb 1959, Springer and Woodburn 1960, Moffett 1961, Stewart 1961, Sundararaj and Suttkus 1962, Tabb 1966, Fontenot and Rogillio 1970, Jannke 1971, Christmas and Waller 1973, Rogillio 1975). The inception of spawning is variable and occasionally may occur as early as February or March. Simmons (1951) reported that spawning in Texas does not begin until the water temperature reaches 21°C. Jannke (1971) thought that 24°C was the minimum temperature necessary for large scale spawning in south Florida. Spawning generally ceases by October. In southern Florida spawning occurs in all months (Stewart 1961, Roessler 1967, Jannke 1971) and is sometimes bimodal with peak spawning about May and a lesser peak in fall.

There is no consensus on the preferred spawning habitat of spotted seatrout. Existing information is frequently conflicting and without solid evidence in the form of eggs or small larvae. Pearson (1929) found that spawning in Texas was confined to the bays and lagoons and did not occur in the Gulf or in the connecting passes. His evidence suggested that spawning occurred from the barrier islands just inside the Gulf passes to much farther inland—at least as far as 80-97 km from the Gulf. He believed that actual spawning occurred in the deeper portions of the bays in water 3.0-4.6 m deep. In Florida, Tabb (1966) characterized the preferred spawning location as the quiet portion of estuaries and lagoons, usually above the maximum reach of daily tides. Spawning occurred in the deeper channels and holes adjacent to vegetated shallows. However, Tabb (1966) also pointed out that some spawning may occur farther down in the estuary. Stewart (1961) and Tabb and Manning (1961) presented evidence of spawning outside of southwest Florida estuaries, possibly in the passes to the Gulf. Jannke (1971) later investigated this area and found inland transport of large numbers of larvae from the Gulf into the estuary. King (1971) also found larvae moving from the Gulf of Mexico into Texas estuaries. Christmas and Waller (1973) indicated that spawning in the Mississippi Sound generally occurs near the offshore barrier islands. Young-of-the-year then migrate to the inshore nursery grounds during May through October (Loman 1978).

Spawning locations may be related more to salinity and temperature than to other physical parameters. Arnold et al. (1976) reported optimal spawning salinity as 20-35 ‰ and optimal spawning temperature as 20-30°C. Taniguchi (in press) stated that the optimal salinity for survival of eggs and larvae was 28.1 ‰ and predicted that 100% survival would occur between 18.6 and 37.5 ‰. He also stated that optimal water temperature was 28.0°C and predicted 100% survival between 23.1° and 32.9°C. Tabb (1966) believed that low salinities caused by severe freshets in southern states caused mass mortalities of larvae and juveniles.

Size at maturity

Spotted seatrout are generally believed to mature at one to three years of age. Fish vary in size at maturity from estuary to estuary. Pearson (1929) found that Texas trout matured at the end of their second year but did not spawn until the third. In Louisiana, Sundararaj and Suttkus (1962) found that age I fish contributed a small percentage of eggs to the spawning but that ages II, III and IV contributed most of the eggs. At Cedar Key, Florida, Moody (1950) found that females generally matured at 210-250 mm SL although 20 of 260 ripe females were <200 mm. Most did not spawn until 240-250 mm; i.e., their second or third summer. In Apalachicola and Apalachee Bays (Klima and Tabb 1959) all females were mature at 270 mm SL and all males at 250 mm. Some males reached sexual maturity by age I, some females at age II, and all fish appeared to have spawned by age III. The smallest ripe female measured 210 mm and the smallest ripe male was 180 mm. In Florida Bay (Stewart 1961) most fish matured at 190-300 mm SL with no difference between sexes. Most were age II, III or IV at intial maturity, age III being prevalent. In Indian River Lagoon on the Atlantic coast of Florida (Tabb 1961), trout matured at larger sizes than on the Gulf Coast. Few females smaller than 350 mm SL were ripe, but most males were ripe by 350 mm. All individuals 380 mm SL were mature. Males matured at ages II and III, females at III or IV.

Egg description

Fable et al. (1978) described spotted seatrout eggs as spherical and pelagic, usually containing one yellow oil globule. The chorion is clear and unsculptured; the perivitelline space is narrow and occupies only 4% of egg diameter; the yolk is homogenous. Egg diameter ranges from 0.73 to 0.82 mm; oil globule diameter ranges from 0.18 to 0.26 mm. The eggs float with the oil globules on top and developing cells on the bottom. Taniguchi (personal communication) reports that eggs sink at a salinity of 25 ‰ and are buoyant at a salinity of 30 ‰.

Fecundity

Limited fecundity investigations were conducted by Pearson (1929) and Moody (1950) while more comprehensive studies were made by Tabb (1961) and Sundararaj and Suttkus (1962). Tabb (1961) calculated fecundities of twelve females collected in Indian River on the Florida Atlantic coast. He grouped them into four size classes and reported the fecundities to range from 1.5×10^4 to 1.1×10^6 eggs per female for the size classes which ranged from 325 to 625 mm SL. Fecundities calculated by Sundararaj and Suttkus (1962) for Louisiana fish appear to be higher than those of Florida for equivalent sized fish. The twenty-eight fish examined by them ranged from one to four years of age and had mean length per female ranging from 283 mm TL (ca. 240 mm SL) for age I fish to 504 mm TL (ca. 430 mm SL) for age IV fish. The mean fecundity per age class ranged from 1.4×10^4 to 1.14×10^6 eggs per female. The age III fish had the greatest "spawning power" producing 40.6% of all eggs; they were followed by age IV and age II fish which produced 26.8 and 24.5%, respectively.

Nursery areas

The location of small larvae is mostly supposition. From hatching at 1.30-1.35 mm SL (Fable et al. 1978) to their appearance around grass beds and other submerged vegetation at 10-15 mm they are difficult to collect. However, Jannke (1971) collected large numbers of larvae by sampling flood tides in an inlet between the Gulf and an inshore estuary. Taniguchi (personal communication) reports that seatrout larvae hatched in a salinity of 25 ‰ swim upward into the water column, but in 4-7 days they begin to move toward the bottom. Arnold et al. (1976) stated that larvae assume a head down position until the yolk-sac is absorbed (72-80 hours at 24°C) and that subsequently they disperse into the water column and begin to feed.

At sizes 10-15 mm, young fish are increasingly found in or adjacent to the submerged vegetation of bays and lagoons. They remain here during the warm months, but in winter they apparently move into deep water (Pearson 1929, Miles 1950, Moody 1950, Reid 1954, Guest and Gunter 1958, Springer and Woodburn 1960). At 20-50 mm SL (6-8 weeks) they begin schooling, a behavior they retain until age V or VI (Tabb 1961).

AGE AND GROWTH CHARACTERISTICS

Rate of growth and influencing factors

Spotted seatrout in different estuaries show a wide variation in growth rates and maximum sizes. Individual year classes within estuaries also exhibit wide ranging growth rates so that there is an overlap in size among several age classes. Growth also differs by sex, the female growth rate always exceeding that of the male.

In Texas, larval seatrout raised in mariculture systems grew from 1.5 mm at hatching to about 4.5 mm SL in fifteen days at water temperatures of 24–26°C (Fable et al. 1978). However, they noted that faster growth was achieved by larvae hatched and cultured at the University of Miami. Taniguchi (in press) cultured larval seatrout in laboratory aquaria and found that they grew faster when fed a diet of wild zooplankton collected in plankton nets than when fed laboratory cultured rotifers. He observed growth at copepod nauplii concentrations of 25, 100 and 1000 nauplii per liter at 24°, 28° and 32°C. These larvae gained weight at an average rate of 76.5% per day.

Spotted seatrout adults exhibit some variation in growth rates among Gulf Coast estuaries and considerable variation between Gulf and Atlantic coasts. Table 3 summarizes back-calculated standard length-at-age for several Gulf Coast populations and for the faster growing fish of Indian River on the Atlantic coast of Florida. Recent electrophoretic studies of spotted seatrout tissue (Weinstein 1975) showed that individual estuaries have genetically distinct populations, those of the Indian River being the most divergent. Evidently some variation in growth can be explained by genetics, but differing habitats as well as salinity and temperature regimes are probably also important (Tabb 1958, 1966).

Tabb (1958) considered water temperature to be an important factor limiting growth and production of spotted seatrout. He also noted that spotted seatrout are dependent on abundant marine grasses harboring a rich population of crustaceans, molluscs, marine worms and small fishes. Klima and Tabb (1959) attributed differences in growth rates between the Apalachee Bay and Indian River stocks to a scarcity of quiet protected areas free from marine predators and competitors in Apalachee Bay. They also listed at least fifteen predators and competitors in Apalachee Bay while Tabb (1958) found only five species preying on spotted seatrout in the Indian River.

In Florida the sex ratio of spotted seatrout generally changes with size (age), males predominating at small sizes, females at the large sizes. Klima and Tabb (1959) showed that at 175–195mm males were 3–4 times more numerous than females, but at 295 mm females were more numerous, and by 395 mm all fish were female. Tabb (1961) found that among 245 age I fish, only 19% were females; 47% of the age II fish were females and 82% of the age V fish. At age VIII and older all fish were female. Stewart (1961) found approximately equal sex ratios of Florida Bay fish through age III, followed by a predominance of females from ages IV through VII.

Standard length–total length relationships, total length–wet weight relationships, gutted and gilled weight–whole weight relationships

Harrington et al. (1979) reported the length–weight regression for 9,498 Texas coast animals ranging from 49 to 902 mm TL as: $\log W_{(g)} = -5.192 + 3.062 \log TL_{(mm)}$, $r = 0.988$ (Figure 4). The standard-length (SL)–total-length (TL) relationship for 9,857 fish ranging 36–744 mm SL was: $TL_{(mm)} = 11.804 + 1.138\ SL_{(mm)}$, $r = 0.997$. Harrington et al. (1979) also presented a dressed weight (DW)–whole weight (WW) relationship for 617 spotted seatrout ranging from 305–4595 g DW: $WW_{(g)} = -33.338 + 1.151\ DW_{(g)}$, $r = 0.995$.

Age and growth studies

Discussions of age and growth were included in the previous section **Rate of Growth and Influencing Factors** (see page no. 12). Age and growth estimates at various locations are provided in Table 3.

Spotted seatrout in the Gulf of Mexico survive to at least eight years of age (Pearson 1929, Moffett 1961). However, longevity appears to vary between estuaries. Moffett (1961) reported no fish older than age V at Cedar Key, Florida. On the Atlantic coast, Tabb (1961) found that spotted seatrout of the Indian River lived to at least ten years of age. Females generally live longer than males (Moffett 1961, Stewart 1961).

GEOGRAPHIC RANGE THROUGHOUT THE LIFE CYCLE

Range

Spotted seatrout range from Cape Cod to the Gulf of Campeche in Mexico (Tabb 1966), generally spending their entire lives in estuarine bays and lagoons. However, they may migrate to the Gulf during adverse conditions such as low salinity (5 ‰) or low water temperature (7-10°C).

Larval distribution by time, area and depth

The habitat of larvae 1.5-10.0 mm in length is generally unknown. Pearson (1929) thought that spotted seatrout eggs drifted into and hatched over shallow, grassy bottoms where the young sought protection in the vegetation. However, only a few investigators have captured many larvae <20 mm. Jannke (1971) and King (1971) collected larval spotted seatrout averaging about 5-6 mm as they were being transported on flood tides through inlets connecting the Gulf with inland bays. Tabb (1961) feels that the first several weeks of life are spent in deep channels adjacent to grass flats. He observed fish 20 mm in moderately deep water (3 m) over algae and muddy sand. Pearson (1929) and Miles (1950) reported that postlarvae seek the shelter of grass beds. By 75-100 mm juvenile trout from schools of 5-50 individuals, a habit they retain until age V or VI when most males have died and females have assumed a semi-solitary existence (Tabb 1966). During warm months juvenile fish are commonly found in, or adjacent to, grassy shallows. Adults are more likely to be found in deeper (2-4 m) water adjacent to the flats (Pearson 1929, Moody 1950). Decreasing winter water temperatures drive both juvenile and adult trout into the deep water of the bays. Fish about 250 mm may even enter the Gulf (Pearson 1929, Miles 1950, Moffett 1961, Tabb 1966). At Cedar Key, Florida, adult spotted seatrout were forced by winter cold into the river and deep streams along the coast where salinity was sometimes only 1.2 ‰ (Moody 1950). There was some indication that juveniles might also move into the lower rivers during winter.

Relative abundance

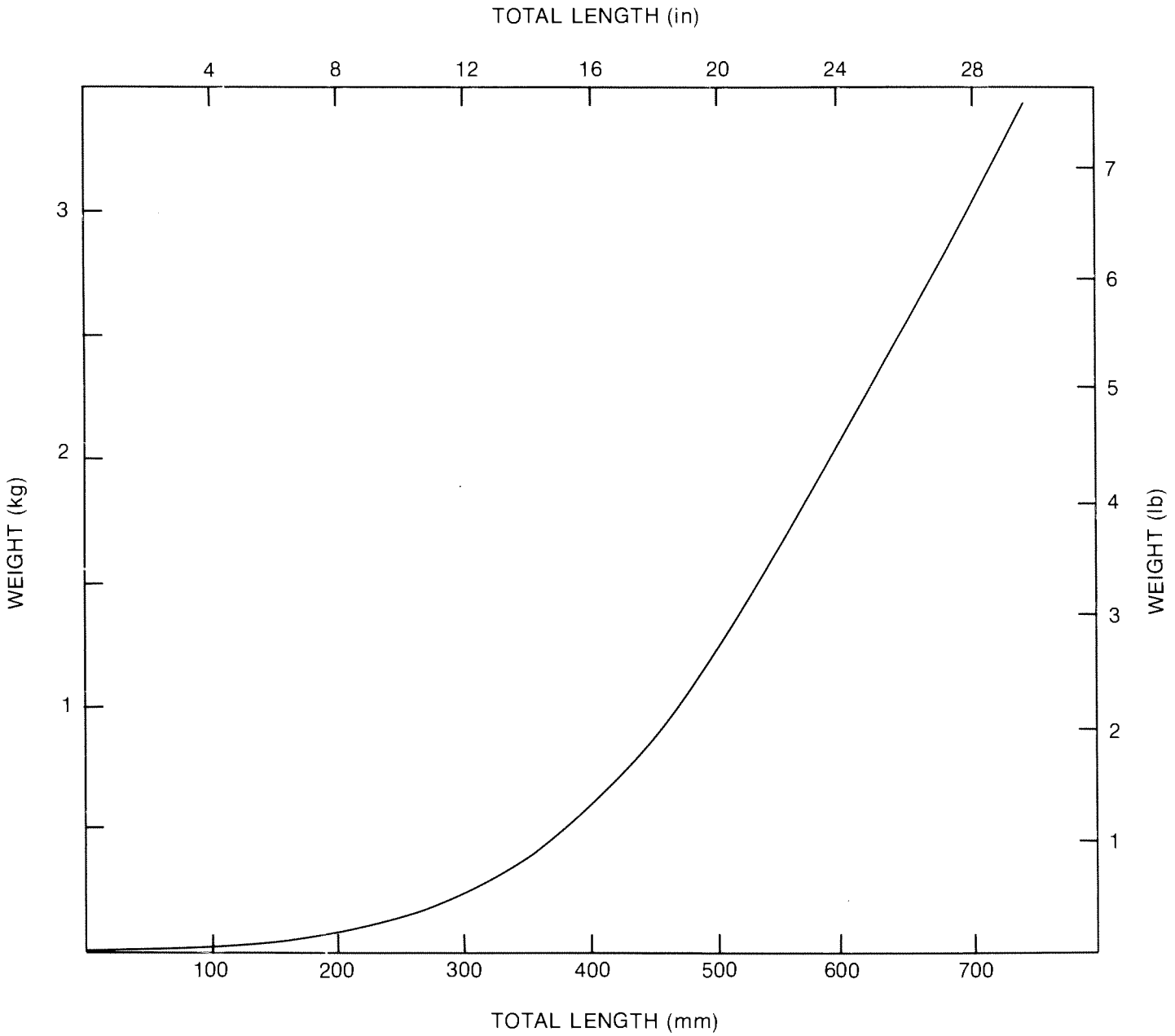
Pearson (1929) and Tabb (1958) noted that spotted seatrout are particularly abundant in spring when they migrate from their over-wintering areas through passes and channels to shallow feeding and possibly spawning areas. Breuer (1973) noted that adult spotted seatrout were most abundant during spring, av-

Table 3. Size (mm SL) at age for several populations of spotted seatrout. Standard lengths for central Texas and Punta Gorda were converted from total lengths by a formula given by Harrington et al. (1979).

Age	Central Texas[1]	Apalachicola & Apalachee Bays[2]	Cedar Key[3]	Ft. Myers[4]	Punta Gorda[5]	Florida Bay[6]	Indian River[7]
1	119	116	130	130	91	133	165
2	200	190	211	208	192	224	248
3	257	255	268	264	262	275	317
4	299	312	323	320	306	339	384
5	338	369	382	368	341	397	457
6	376	422	434	430	367	434	533
7	418	437	—	431	—	451	561
8	445	—	—	438	—	—	624

[1] Pearson 1929
[2] Klima & Tabb 1959
[3] Moffett 1961
[4] Moffett 1961
[5] Welsh & Breder 1924
[6] Stewart 1961
[7] Tabb 1961

Figure 4. Length–weight relationship of spotted seatrout (after Harrington et al., 1979.)



eraging 2.58 kg/ha during spring in 1970-72 in contrast to 1.52 kg/ha during fall of the same years. Juveniles in lower Laguna Madre, Texas, reached peak abundance in fall. Adult spotted seatrout are also relatively abundant during winter when they concentrate in deeper holes to escape the cold (Pearson 1929).

Movements and territoriality

Spotted seatrout are relatively non-migratory, seldom journeying more than 48 km from the tagging location (Moffett 1961, Ingle et al. 1962, Topp 1963, Beaumariage 1964, 1969, Beaumariage and Wittich 1966, Rogillio 1975). However, migrations as far as 507 km (Apalachicola, Florida to Grand Isle, Louisiana) have been recorded (Moffett 1961). Moffett tagged fish at three Gulf coast locations in Florida. Ft. Myers fish, the most southerly of those tagged, showed the least movement, only one of 2,538 fish marked moving >48 km. Those tagged at Cedar Key showed the greatest movement, 18 of 1,817 fish tagged moving 48 km. Only 3 of 900 fish marked at Apalachicola showed movement of >48 km, all three moving westward along northwest Florida. No correlation between fish size and distance moved was noted. There is evidence of some north-south seasonal migration, probably in response to water temperature. Most movement seems to be in response to water temperature or spawning.

Moffett (1961) and Iversen and Tabb (1962) pointed out that while the populations in Florida were not completely isolated, they should be treated as separate units for fishery management. Moffett's conclusion is supported by recent protein biosystematic analyses (Weinstein 1975, Weinstein and Yerger 1976) which indicated that each estuary in Florida has its own subpopulation.

ENVIRONMENT

Substrate preference

See **Submerged Vegetation below**

Submerged vegetation

For several weeks following their hatching, young spotted seatrout are found in bottom vegetation or shell rubble on channel bottoms and at edges of grass flats (Tabb 1966). Pearson (1929) found the preferred habitat of young trout to be quiet shallows having a heavily vegetated bottom.

The association of both juvenile and adult spotted seatrout with submerged seagrasses such as *Ruppia maritima, Halodule beaudettei, H. wrightii* (= *Diplanthera wrightii*) and *Thalassia testudinum* is well documented (Pearson 1929, Miles 1950, Moody 1950, Reid 1954, Tabb 1958). However, spotted seatrout are numerous in many areas lacking vast areas of these grasses, especially in the northern Gulf where they may be found around submerged or emergent islands, shell reefs, marshes and oil plantforms (Gerald Adkins, Louisiana Wildlife and Fisheries Comm., personal communication). They are probably found in any area offering suitable salinity and temperature regimes combined with sufficient primary productivity to support a food web suitable to their needs.

Tabb (1958) discussed the ecological characteristics which appeared to be of greatest importance in determining the abundance of spotted seatrout in Florida. His conclusions were based largely on data and observations made in Indian River Lagoon, but they can probably be generalized for most areas of the Gulf if his reference to grassy areas is replaced with a general reference to areas of primary productivity. The characteristics are: (1) large area of shallow quiet brackish water; (2) extensive grassy areas usually dominated by *T. testudinum* and *D. wrightii*; (3) areas of 3-6 m depth adjacent to grass flats to be used for refuge from winter cold; (4) an abundant food supply, viz., grazing crustaceans and suitable size fish; (5) absence of predators; (6) absence of competitors, and (7) suitable temperature of 15-27°C. In such an environment, the spotted seatrout is at the top of chain in the midst of the rich feeding ground of estuarine herbivores. The estuary also protects the fish from those competitors and predators which are not euryhaline.

Environmental tolerances

Arnold et al. (1976) reported the optimal temperature for larval seatrout to be 20-30°C. Taniguchi (in press) observed a similar optimum of 23.1-32.9°C. Tabb (1958) reported that adults fared best at temperatures of 15-27°C, and Loman (1978) reported highest catches of spotted seatrout between 25° and 30°C. Simmons (1957) pointed out that spotted seatrout live and feed actively at temperatures between 4° and 33°C if the animals are gradually acclimated to the lower and higher temperatures. However, sudden drops in temperature such as those accompanying cold fronts result in mass mortalities (Gunter 1941, Gunter and Hildebrand 1951, Moore 1976).

Arnold et al. (1976) and Taniguchi (in press) reported the optimal salinity for larvae to be 20-35 ‰ and 18.6-37.5 ‰, respectively. Loman (1978) reported highest catches of spotted seatrout at 20-35 ‰. Wakeman and Wohlschlag (1977) used maximum sustained swimming performance as an indicator of salinity stress and reported maximum sustained swimming speeds for spotted seatrout at 20-25 ‰ with reduced performance above or below that range. Gunter (1963), Gunter and Hall (1965) and Perret (1971) reported spotted seatrout in salinities as low as 0.2 ‰ while Simmons (1957) reported catching spotted seatrout in salinities as high as 75 ‰. Tabb (1966) observed that rapid, large scale decreases in salinity caused complete disappearance of postlarvae and juveniles. However, he was not able to show whether the disappearance was attributable to migration or mortality.

There are no data relating abundance and distribution of spotted seatrout to environmental factors such as dissolved oxygen, light intensity, system productivity, etc. However, the oxygen content of water must be above the minimum metabolic needs of the fish which Vetter (1977) determined to be: 210 mgO_2/kg/h at 10‰ and 28°C, 125 mgO_2/kg/h at 20‰ and 28°C, and 230 mgO_2/kg/h at 30‰ and 28°C.

Effects of catastrophic events

Catastrophic mortalities of spotted seatrout in the Gulf of Mexico have been attributed to severe cold, hurricanes, excessive fresh water, red tide and supersaturated dissolved oxygen conditions. The death of large numbers of trout following a severe cold spell has been documented by several authors (Storey and Gudger 1936, Gunter 1941, Gunter and Hildebrand 1951, Tabb and Manning 1961, Moore 1976). Cold kills are most likely to occur early in the winter when they are not preceded by mild cold weather to drive the fish out of the shallows into deeper warmer areas. There is usually only one kill per season since once

driven into deeper water the fish stay there for the remainder of the winter (Tabb 1958). Tabb and Manning (1961) reported a mortality following hurricane Donna (9 September 1960) which led to fish stranding and to turbulence which stirred the marl bottom of upper Florida Bay and packed fishes' gill chambers. Tabb (1966) suggested that run-off from tropical storms and the subsequent lower salinities may cause mortality of young fish. He observed that postlarvae and juveniles disappeared for the remainder of the year following freshets, but he was unable to prove his hypothesis by finding dead fish. Springer and Woodburn (1960) listed spotted seatrout as one of the fishes killed by a red tide (*Gymnodinium breve*) in the Tampa Bay area in fall 1957. Renfro (1963) reported a phytoplankton bloom in Galveston Bay which created supersaturated dissolved oxygen conditions and resulted in the formation of gas bubbles within the bloodstream and other body areas of seatrout.

Agricultural, industrial, residential and recreational demands on habitat

The direct effects of agricultural and industrial demands are not documented. There are increased demands on estuaries for disposal of sewage and fresh water run-off, treatment ponds for industrial plants, cooling for electric generating plants, dredge and filling for waterfront property, construction of causeways and bridges, installation of ports and marinas, oil exploration, etc. The effects of these demands are unknown. In the Tampa Bay area, commercial landings of spotted seatrout decreased from 146,951 and 241,726 kg in 1960 and 1961 to 50,883 and 73,352 kg in 1975 and 1976. Whether this decrease is principally attributable to the effects of urbanization and industrialization is unknown. Increased recreational exploitation, the possibility of overharvesting and other unknown variables cannot be eliminated.

It was found, too, that dam construction inhibits the influx of fresh water into the estuaries, thus reducing the input of nutrients (Gilmore et al. 1976). A reduction in nutrients reduces primary production with a subsequent reduction in tertiary production. Dams also interfere with the movements of fish (Bryan 1971).

Davis (in press) suggested that, in Everglades National Park, manipulation of rainwater run-off to avoid droughts and floods and affected both yearly variation in catch rates and size of fish being captured. He found the coefficient-of-variation in annual recreational catch rates decreased markedly between 1958 and 1977 and attributed this to manipulation of fresh water run-off and to the lack of a major hurricane during the twenty-year period. He also showed that in areas which once were brackish nurseries salinities had increased to form coastal marine areas supporting large mature fish.

Agricultural, industrial and domestic discharges (heavy metals, pesticides, sewage, etc.)

Although not dealing specifically with seatrout, Martinez (1973) pointed out that a breakdown in the Seabrook Sewage Plant resulted in numerous fish kills in the Galveston Bay area, as did pesticide spraying in bayous entering the area. Johnson et al (1977) reported a toxic effect of chlorinated compounds on seatrout eggs and larvae. Butler (1969) reported no evidence of successful seatrout spawning in a Texas estuary in 1968 when DDT levels in trout ovaries were as high as 8 ppm. Bryan (1971) considered DDT levels in spotted seatrout ovaries of 4.77 ppm and in eggs of 2.93 ppm to be detrimental to reproduction in lower Laguna Madre.

FOOD HABITS

Food types, food preference (selectivity) and predator-prey relationships

The food habits of spotted seatrout have been investigated by many authors (Pearson 1929, Miles 1950, Moody 1950, Darnell 1958, Springer and Woodburn 1960, Stewart 1961, Tabb 1961, Stern and Schafer 1966, Seagle 1969, Fontenot and Rogillio 1970, Rogillio 1975). In general spotted seatrout are classed as opportunistic carnivores whose food habits change with size.

At Cedar Key, Florida, spotted seatrout feeding habits progressed through four stages, each dominated by a different food item (Moody 1950). Figure 5 shows how feeding changed from copepods to caridean shrimp to penaeid shrimp to fish. Seagle (1969) also observed a change in food habits of spotted seatrout in Redfish Bay, Texas: 132-225 mm trout fed mainly on invertebrates, 226-350 mm trout fed equally on invertebrates and fish, 351-430 mm fish fed mostly on other fish and 450 mm trout fed exclusively on fish. In Florida Bay, Stewart (1961) found that pink shrimp (*Penaeus duorarum*) was the principal food item of adult trout.

Darnell (1958) observed that investigators in Texas and Florida found both juvenile and adult spotted seatrout to be commonly associated with seagrasses, and a large proportion of the food they consumed was associated with these areas of productivity. However, Lake Pontchartrain, Louisiana, is characterized by high turbidity and sparse grass beds, and spotted seatrout subsequently fed on a different fauna. Darnell also found young trout feeding on schizopods and bottom-dwelling amphipods rather than the caridean shrimp observed by Moody (1950). They

also began to feed on the enormous population of anchovies and larval fishes at an early age, bypassing Moody's penaeid shrimp stage; they had achieved the adult diet by a length of 100 mm rather than 150 mm. Darnell found adult stomachs to contain primarily bay anchovy (*Anchoa mitchilli*) and other fish remains.

Tabb (1961) considered that any apparent selectivity for food items exhibited by adult seatrout was more a function of food availability than of selectivity. Seatrout feed more on shrimp in summer and early spring because shrimp are more available then. Guest and Gunter (1958) noted that seatrout spawning coincides with the migration of postlarval penaeid shrimp into Texas bays. Darnell (1958) pointed out that both Gunter (1945) in Texas and Moody (1950) in Florida found that shrimp were more common in spotted seatrout stomachs during summer than during winter when shrimp were generally scarce.

Feeding habits and chronology

Moody (1950) noted that 54% of the spotted seatrout stomachs he observed at Cedar Key, Florida, were empty. He attributed this to the sporadic feeding habits of the trout. Darnell (1958) concluded, based on the fullness of spotted seatrout stomachs, that heavy feeding occurred in Lake Pontchartrain, Louisiana, in early to mid-morning. Little food was taken in the afternoon. Darnell (1958) also observed that spotted seatrout appeared to regurgitate food at intervals following a meal so that at times a mass of partially digested food surrounded by an oil slick appeared at the surface of the water.

Ingestion, assimilation and egestion rates

There apparently have been no studies of energetics as relating to spotted seatrout.

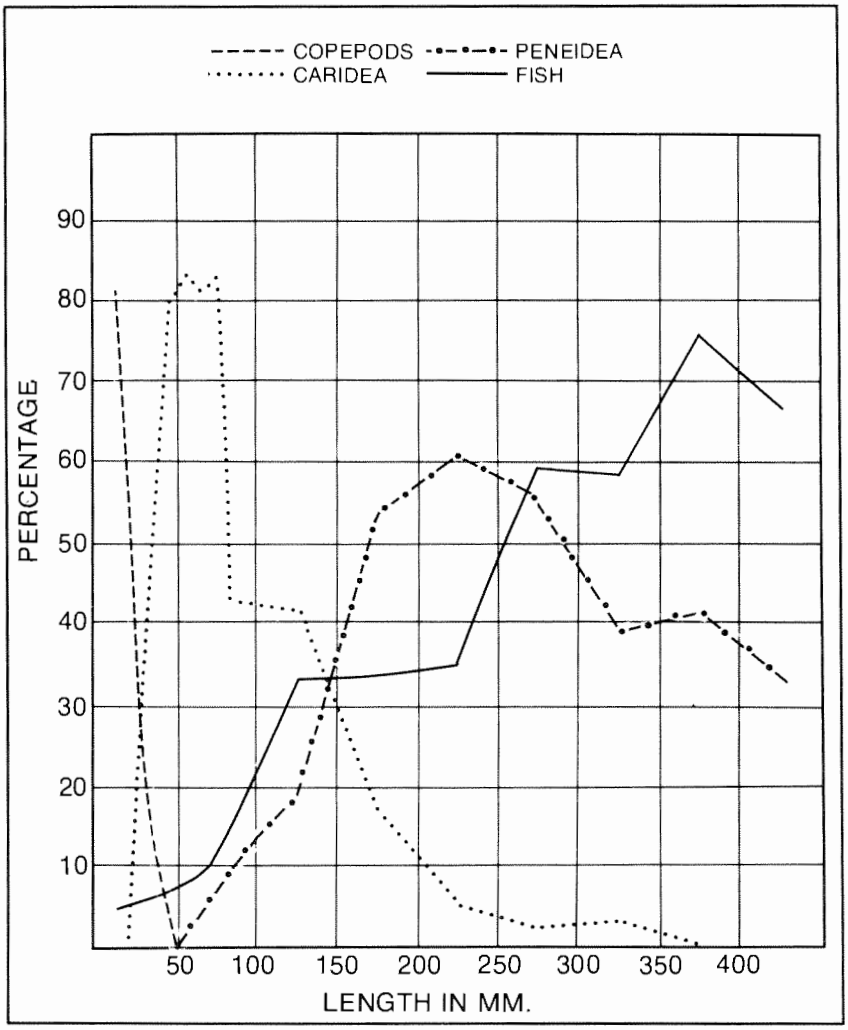


Figure 5. The percentage of occurrence of the four major food groups in the stomachs of spotted seatrout of various sizes (Moody 1950).

PARASITES AND DISEASES

Spotted seatrout are host to a number of ecto- and endoparasites most of which are not known to be harmful to man. A haemogregarine protozoan parasite has been found in leucocytes of seatrout (Saunders 1954). Platyhelminthians have been reported in the form of cestodes such as *Poecilancistrium robustum* (Hutton and Sogandares-Bernal 1960, Overstreet 1975) and in the form of trematodes (Manter 1938, Frayne 1943, Short 1953, Hargis 1956, Hopkins 1956, Sparks and Thatcher 1958, Hutton and Sogandares-Bernal 1960). Guest and Gunter (1958) reported calligid copepods from the gills of seatrout. Comeaux (1942) and Pearson (1929) reported isopod parasites which break gill filaments causing scar tissue and runting among young seatrout;older fish seem to be free of these isopods. Gerald Adkins (Louisiana Department of Wildlife and Fisheries, personal communication) reports that during cold water mortalities in Louisiana, spotted seatrout are often collected with protozoan infections in gills and lesions and abrasions of the skin.

Rose and Harris (1968) have reported a possible case of birth defect in spotted seatrout in the form of pugheadedness. In their observation, the pugheaded fish grew at a slower rate than normal fish.

POPULATION DYNAMICS

Models and modeling parameters

No estimate of maximum or optimum sustainable yield has been made for spotted seatrout from the various estuaries around the Gulf.

Iversen and Moffett (1962) estimated population sizes and mortality rates of spotted seatrout in the vicinity of Pine Island on Florida's Gulf coast. They marked 5,409 fish with internal anchor tags during a fifteen-day period in January 1961. From 21 January through 31 May they recovered 24.9% of the tags. A Petersen estimate of the weight of the adult population was 441,346 kg. They also estimated coefficients of fishing mortality (F) and natural mortality (M), following the techniques of Beverton and Holt (1957). However, their estimates are probably too high, especially that of M. The results of Iversen and Moffett (1962) have been erroneously reported by Idyll and Fahy (1970) as 60% mortality per month with a natural-to-fishing mortality ratio of 5 to 1.

Many spotted seatrout were tagged in Florida waters during an opportunistic, multi-species tagging program conducted statewide during 1961-65. The results of these programs are notable by their seemingly high tag return rates for some species, though the highest rate recorded for trout was 23% in nine months. The overall results of these programs were summarized by Beaumariage (1969) who reported that of 3,957 spotted seatrout tagged, 537 were recaptured—a return rate of 13.6%.

Recently, Tatum (in press) analyzed year-to-year mortality rates for spotted seatrout during the period 1964-77. The mortality rates were calculated from length-frequency data gathered in fishing tournaments in Baldwin County, Alabama. Age class III+ fish have appeared to be the first class fully vulnerable to the fishery. Mean annual mortality for age III+ fish was estimated to average 49.8%, ranging from 36.2% in 1968 to 58.1% in 1975. Tatum also noted that there was an inverse relationship between mean size and mean number of fish caught per tournament; i.e., in years when fish were numerous they were small, but they were large in years when they were scarce.

Effects of fishing mortality

Davis (in press) reviewed fishing success in Everglades National Park during 1958-78 and concluded that there had been a change in age structure and abundance of red drum and spotted seatrout, but it was attributable to environmental changes rather than fishing mortality.

Also see **Yield** following.

Yield

In Everglades National Park, Davis (in press) observed that from 1972 to 1977 the mean annual harvest of spotted seatrout was 0.280 kg/ha. The recreational catch for this period was 0.148 kg/ha; the commercial yield was 0.132 kg/ha. Davis noted that even though the Whitewater Bay area was closed to commercial fishing it did not have a higher recreational yield or catch rate. It thus appeared that the commercial effort in the other areas increased the total yield without decreasing the recreational yield.

In Texas, Matlock, Weaver and Green (1977) reported that catch rates from Texas Parks and Wildlife gill nets in areas closed to commercial netting for spotted seatrout and red drum were significantly higher than in areas open to netting. However, there was no difference between the mean total length of spotted seatrout from closed areas and trout from open areas, and no generalization could be made about the size of red drum and whether they were caught in open or closed areas. The study concluded that commercial netting reduced populations of spotted seatrout and red drum and that this effect was apparently localized. Both species are capable of sustaining their populations when subjected to commercial netting unless adverse environmental conditions exist.

DESCRIPTION OF COMMERCIAL INDUSTRY: HARVESTING SECTOR

FISHING METHODS

Gear Descriptions

The gear used in the red drum–spotted seatrout fishery primarily includes runaround gill nets, trammel nets, stake gill nets, haul (drag) seines, handlines, troll lines, longlines (trotlines) and otter trawls.

The runaround gill net is an entanglement net set in a circle by a skiff or other small boat. After the circle has been completed, the ends are brought together and the fishermen attempt to frighten the fish into the net. The net fishes throughout the water column with leads and corks attached to the entire length of the net. If a fish is able to get its head but not its body through the net, it is "gilled." Smaller fish go through the net while larger fish are not able to "gill" and escape capture, making this gear size-selective, depending on mesh size. After the net has been set and the fish flushed, the net is pulled into the boat by hand, any fish removed, and the net piled up in the rear of the boat for the next set.

The trammel net consists of three separate panels, a small mesh panel sandwiched between two large mesh panels. A fish is caught when it hits the small mesh panel and pushes that panel through the larger mesh panel forming a pocket which traps the fish. The gear is set from a boat and is generally fished either like a runaround gill net or is staked or otherwise anchored. With the use of leads and corks the gear fishes either throughout the water column or from the bottom to a point several feet above the bottom.

Stake gill nets are set in the manner of trammel nets with the gear staked or anchored more or less in a straight line. As with the runaround gill net, the fish are "gilled."

Haul seines, as used in the fishery, typically consist of a small mesh nylon net hung with corks and leads. For a typical set next to a beach, one end of the net is anchored to shore and the boat moves away from shore until the net is out. The free end of the net is moved parallel to the beach and then brought ashore. Both ends of the net are then pulled, and the fish are caught in a pocket next to shore. At the end of the operation, marketable fish are removed and smaller fish, as well as unwanted species, are released.

Handlines and troll lines as used in this fishery refer to a variety of hook and line gear, which may employ a cane or fiberglass pole. The gear is typically fished from a skiff while drifting over turtle-grass flats and using a variety of natural or artificial baits.

Longlines (trotlines) consist of a long piece of heavy cord with short lines attached at intervals of a few feet. The short lines have one hook and are baited with natural or artificial baits. The gear is set in a line and anchored at each end.

Otter trawls are the common gear employed by shrimpers. Red drum–spotted seatrout landings are incidental catches of the inshore and offshore shrimp otter trawl fishery.

With the exception of the otter trawl, all the gear used in the red drum–spotted seatrout fisheries are fished from a variety of small boats or skiffs. In most cases each gear catches several different commercial species of inshore fish. The gear, as described, generally represents the operation of a mixed species fishery along the Gulf Coast.

Gear use by time and area

Gear use in each area is partly a function of gear efficiency in different areas but probably is more a function of state or local laws affecting gear use. Tables 4 and 5 show that runaround gill nets, trammel nets and longlines accounted for about 90% of the spotted seatrout catch and over 80% of the red drum catch in 1974. However, these tables also show that Texas is the only state that reports significant catches by longline, since nets, particularly gill nets, are illegal gear in many Texas waters.

A complicating factor in assessing gear use by time and area is the fact that in some locations recreationally caught fish are significant in commercial catch statistics. However, Tables 4 and 5 only reflect a gear breakdown for fish caught by commercial fishermen. In this case, extrapolation of the sample to the total reported landings probably underestimates the landings by handheld gear which actually enters the commercial market and consequently overestimates the catch by commercial gear.

SEASONS AND GEOGRAPHIC LOCATION OF THE INDUSTRY

Red drum and spotted seatrout landings occur throughout the year along the Gulf Coast. Red drum landings are concentrated in September through February while spotted seatrout landings are more evenly distributed throughout the year. State-to-state variation in monthly landings may be influenced by closed seasons or seasonal gear restrictions in certain waters. No assessment of seasonal distribution of landings as influenced by biological or legal factors exists.

Extent of participation in complementary or supplemental fisheries

Most of the commercial fishermen who land red drum and spotted seatrout land a variety of other

inshore species since the boats and gear used for these two species typically take others with little or no modification. Depending on the time of year and relative abundance of commercially available inshore species, the individual fisherman may concentrate his efforts on red drum and spotted seatrout but would switch to other species at other times of the year. Exceptions to the general situation may be encountered among some Texas fishermen who are essentially limited to using trotlines which can be fished selectively to catch spotted seatrout and red drum.

Although red drum and spotted seatrout constitute only a part of the landings by fishermen involved in the inshore mixed species fishery, the income derived from these landings may be critical in keeping these fishermen in the industry. No major studies are available to document the extent to which fishermen in various coastal locations are dependent on red drum and spotted seatrout for a major or critical part of their income, but the question needs to be investigated for its economic and social implications.

Table 4. Gulf of Mexico Catch of Spotted Seatrout by Gear Type, 1974 (lbs × 1000)

Gear Type	Florida	Alabama	Mississippi	Louisiana	Texas	Total	Percent
Runaround gill net	1363.8	61.4	281.6	984.7	284.2	2975.7	42.3
Trammel net	411.6	290.1	7.5	913.0	666.4	2288.6	32.5
Long (trot) line	—[1]	—	—	8.6	1006.4	1015.0	14.4
Hand line	244.6	6.8	5.6	148.0	5.2	410.2	5.8
Haul seine, common	206.3	—	—	—	—	206.3	2.9
Stake gill net	—	—	—	67.5	20.0	87.5	1.3
Troll line	33.6	—	—	—	—	33.6	.5
Shrimp otter trawl	—	5.3	—	3.2	13.9	22.4	.3
						7039.3	100.0

SOURCE: *Fishery Statistics of the United States,* 1974, National Marine Fisheries Service
—[1]: None reported

Table 5. Gulf of Mexico Catch of Red Drum by Gear Type, 1974 (lbs × 1000)

Gear Type	Florida	Alabama	Mississippi	Louisiana	Texas	Total	Percent
Trammel net	115.7	44.4	2.1	891.7	387.4	1441.3	30.3
Long (trot) line	—[1]	—	—	1.9	1348.9	1350.8	28.4
Runaround gill net	707.9	9.1	63.8	264.1	—	1044.9	22.0
Haul seine, common	224.9	—	—	30.5	139.9	395.3	8.3
Stake gill net	—	—	—	178.2	36.6	214.8	4.5
Hand line	140.2	.3	1.8	60.0	6.5	208.8	4.4
Shrimp otter trawl	—	65.9	8.7	9.7	2.2	86.5	1.8
Fish otter trawl	—	—	12.2	—	—	12.2	.2
Troll line	2.5	—	—	—	—	2.5	.1
						4757.1	100.0

SOURCE: *Fishery Statistics of the United States,* 1974, National Marine Fisheries Service
—[1]: None reported

DESCRIPTION OF COMMERCIAL INDUSTRY: ECONOMIC STRUCTURE

HARVESTING SECTOR

Landings and value: 1950-1977

Table 6 shows the red drum and spotted seatrout landings and value for the period 1950-1977. The range of spotted seatrout landings was 3.5-7.4 million pounds. Landings exhibited a general upward trend and peaked in 1973. Values of landings, not adjusted for inflation, have increased as a result of the upward landings trend and higher prices. A maximum value of $2.7 million was reached in 1976 and has since declined because of lower landings. Prices have shown a fairly consistent upward trend and reflect the general inflationary pattern of the U.S. economy.

Red drum landings ranged from 1.3 to 5.3 million pounds during 1950-1977 and showed a general upward trend peaking in 1967. Values, not adjusted for inflation, have increased consistently with higher landings and prices.

Table 7 provides a better insight into recent price changes during 1967-1977. This period is important because most of the inflation in the general economy for the last thirty years occurred during this period and because 1967 is the index year for computation of the general level of wholesale prices in the economy.

Variable and fixed costs

Data concerning investment in fleet, total effort, efficiency, productivity and costs for the red drum and spotted seatrout fisheries do not exist. There are two primary reasons for this. First, red drum and spotted seatrout are only part (and sometimes a minor part) of the total catch of the inshore fishermen; i.e., there is no such thing as a red drum or spotted seatrout fisherman in the sense that there is a shrimp fisherman, snapper-grouper fisherman, etc. This makes the research task difficult and expensive.

The second reason for the lack of appropriate data is that the inputs and fishing methods employed by the fisheries are controlled to a greater or lesser extent by state or local laws and regulations governing the conduct of the fishery for any particular area. This means that there are several sets of variable and fixed costs, one for each combination of laws and regulations in effect for the various fishing areas. To derive the applicable cost curves is, again, a difficult and expensive research task.

Given the problems outlined above, it is doubtful if meaningful measures of variable and fixed costs for the red drum and spotted seatrout fisheries will ever be available for any reasonable cost. The best that fishery managers can probably do is to consider the multispecies problem and the effects of laws and regulations on variable and fixed costs when contemplating any given management regime.

Table 6. Gulf of Mexico Landings and Value of Spotted Seatrout and Red Drum, 1950-1977 (× 100)

Year	Spotted Seatrout		Red Drum	
	Pounds	Dollars	Pounds	Dollars
1950	4412	990	2032	358
1951	4099	963	1615	253
1952	4654	1180	1321	272
1953	3872	940	1418	250
1954	3466	865	1824	348
1955	3586	888	1668	298
1956	3724	887	1932	356
1957	4259	999	1588	262
1958	5019	1073	1798	310
1959	4821	1040	2232	354
1960	4613	1018	1998	306
1961	4289	1023	2208	346
1962	4075	985	2662	422
1963	4275	1026	2198	366
1964	4280	1073	1527	262
1965	5147	1270	1842	334
1966	5521	1388	2017	404
1967	5041	1255	2022	387
1968	5924	1536	2604	458
1969	4631	1293	2602	461
1970	4925	1374	3147	601
1971	5100	1408	3514	754
1972	5814	1718	3333	734
1973	7440	2501	4074	996
1974	7040	2366	4756	1198
1975	6247	2447	4387	1327
1976	5882	2658	5308	1747
1977	4200	2131	3459	1301

SOURCE: *Fishery Statistics of the United States,* various years, National Marine Fisheries Service and *Fisheries of the U.S.,* various years, National Marine Fisheries Service.

Table 7. Spotted Seatrout and Red Drum Ex-vessel Prices, 1967-1977 (Cents Per Pound)

Year	Spotted Seatrout		Red Drum	
	Reported[1]	Adjusted[2]	Reported[1]	Adjusted[2]
1967	24.9	24.9	19.1	19.1
1968	26.0	25.4	17.6	17.2
1969	27.9	26.2	17.7	16.6
1970	27.9	25.3	19.1	17.3
1971	27.6	24.2	21.5	18.8
1972	29.6	24.9	22.0	18.5
1973	33.7	25.0	24.4	18.1
1974	33.7	21.0	25.2	15.7
1975	39.2	22.4	30.3	17.3
1976	45.2	24.7	33.0	18.0
1977	50.7	26.1	37.6	19.4

[1] Value divided by landings
[2] Reported price adjusted by wholesale price index
SOURCE: Derived from Table 3.

PROCESSING SECTOR AND PRODUCTS

National Marine Fisheries Service (NMFS) personnel collect landing statistics from fish dealers. However, an undetermined, but perhaps significant, amount goes unreported. Virtually all of the commercial landings are sold in local markets as fresh in the round or gutted. A small percentage is sold as frozen and gutted or as fresh or frozen fillets. Some dealers own trucks and have routes which may cover from a few miles to several hundred miles. In this case, the fish are iced in 100-pound boxes and are delivered along with other fish directly to customers on the route. There are no processing plants dependent upon spotted seatrout or red drum as a major product line, and existing processing plants have more than adequate capacity to process the foreseeable supplies. There is no observable trend to increased processing, and no major shift to increased processing will occur unless landings increase dramatically.

OTHER U.S. LANDINGS AND IMPORTS

Substantial landings of red drum and spotted seatrout occur in the states bordering the South Atlantic and Chesapeake Bay. However, these landings do not appear to have a major influence on markets served by the Gulf landings. Imports from Mexico are substantial and have an impact in Texas, Louisiana, Oklahoma, and perhaps other markets supplied from Texas and Louisiana landings. Imports of spotted seatrout occasionally exceeded one million pounds while imports of red drum averaged over 0.5 million pounds for the last several years (Table 8). The net impact of imports and other U.S. landings is not known.

Not all of the red drum and spotted seatrout entering commercial channels are caught by full or part-time fishermen. Recreational fishermen make a substantial but unknown contribution to the total, and the contribution varies from state to state. Lacking any official statistics on this item, an informal survey of NMFS port agents was conducted to determine the relative contribution of recreationally caught red drum and spotted seatrout to the commercial total. This informal survey revealed that the recreational catch in Florida is quite important, less important in Alabama, Mississippi and Louisiana, and least important in Texas.

Table 8. Imports of Spotted Seatrout and Red Drum, 1950-1977 (lbs × 1000)

Year	Spotted Seatrout	Red Drum
1950	1239.6	341.1
1951	1025.3	349.2
1952	1218.4	332.4
1953	1229.9	437.8
1954	1306.4	330.3
1955	1297.5	296.0
1956	1415.8	317.4
1957	1600.2	246.8
1958	1572.8	135.3
1959	1703.6	528.8
1960	1495.7	874.0
1961	268.0	141.8
1962	322.7	360.5
1963	363.0	158.3
1964	338.8	99.4
1965	266.9	108.9
1966	228.8	31.7
1967	128.8	8.9
1968	137.4	224.3
1969	826.2	873.5
1970	1297.5	841.3
1971	1026.4	599.6
1972	699.5	623.4
1973	699.4	739.9
1974	945.7	479.0
1975	836.4	403.3
1976	805.5	393.8
1977	1390.1	560.6

SOURCE: U. S. Bureau of Customs Records Transcribed by National Marine Fisheries Personnel.

REGIONAL DISTRIBUTION OF CATCH

Landings of red drum and spotted seatrout by state during 1880–1977 is shown in Tables 9 and 10. Table 9 includes white seatrout landings prior to 1966. For spotted seatrout, the relative ranking of landings by state has been fairly consistent, with the Florida west coast and Texas showing large catches throughout the period. Louisiana landings became very important during the 1970s while Mississippi and Alabama landings have been consistently small. The overall trend in landings from 1880 to the present appears to be upward, although the last four years of data indicate a downward trend.

Red drum landings by state also show that the Florida west coast and Texas have led in catches for most of the period with Louisiana landings becoming important in the 1970s. Alabama and Mississippi landings have been relatively small throughout the period. The overall trend in landings has been mixed, with no discernible trend since the 1920s.

METHODOLOGY FOR STATISTICAL COLLECTION

Landings data have been collected from fish dealers since the inception of the program in 1880. The procedure from the late 1880s to the present has been to contact fish dealers and use their records of fish receipts. This basic procedure has not changed over the years, although the frequency of data collection has changed with time.

During 1880–1927 the survey was conducted on the average of once every five years. From 1927 to 1956 annual surveys were conducted. In 1956, it became general practice to contact dealers on a monthly basis for overall landings data, although selected dealers are contacted three times a week for current data used in the market news program. Value data are also collected and reported monthly and, along with monthly landings, are kept current on a month-to-date basis with deficiencies in prior months corrected during the year. Detailed data concerning catch by gear type and area of capture are furnished principally by the fish dealers, although the specific knowledge of the statistics agent and interviews with selected fishermen sometimes supplement data from the fish dealers.

Table 9. Gulf of Mexico Landings of Red Drum, 1880–1977 (lbs × 1000)

Year	Florida West Coast Quantity	Alabama Quantity	Mississippi Quantity	Louisiana Quantity	Texas Quantity	Total Quantity
1880	[1]	[1]	[1]	[1]	[1]	[1]
1887	[1]	[1]	141	289	1,005	[1]
1888	55	[2]	165	288	944	1,452
1889	391	64	185	314	1,063	2,017
1890	458	54	201	339	1,108	2,160
1897	236	213	199	465	1,144	2,257
1902	1,104	70	93	442	898	2,607
1908	608	151[3]	244[3]	716[3]	1,309[3]	3,028[3]
1918	995[3]	23	116	566	1,337	3,037
1923	1,398	15	177	665	878	3,133
1927	776	55	237	556	1,248	2,872
1928	889	49	208	434	1,030	2,610
1929	992	105	129	445	934	2,605
1930	937	104	122	335	873	2,371
1931	934	62	100	369	864	2,329
1932	719	44	75	282	825	1,945
1934	873	65	73	492	1,579	3,082
1936	927	34	88	347	956	2,352
1937	948	67	123	450	954	2,542
1938	1,012	32	106	522	860	2,532
1939	908	31	165	694	470	2,268
1940	647	27	55	183	265	1,177
1945	1,294	260	66	596	1,297	3,513
1948	[4]	157	54	254	621	[4]
1949	1,670	112	76	480	520	2,858
1950	942	16	52	455	567	2,032
1951	919	44	31	384	237	1,615
1952	646	56	41	328	250	1,321
1953	526	46	62	273	511	1,418
1954	752	19	61	271	721	1,824
1955	754	19	57	344	494	1,668
1956	763	50	71	407	641	1,932
1957	667	10	54	353	504	1,588
1958	627	19	65	488	599	1,798
1959	692	18	71	488	963	2,232
1960	817	9	39	428	705	1,998
1961	848	24	53	666	617	2,208
1962	1,307	13	76	567	699	2,662
1963	968	20	59	466	685	2,198
1964	699	19	50	312	447	1,527
1965	801	4	33	471	533	1,842
1966	645	6	37	532	797	2,017
1967	495	9	96	654	768	2,022
1968	707	16	215	741	925	2,604
1969	586	51	100	782	1,085	2,602
1970	667	35	70	789	1,586	3,147
1971	708	32	59	724	1,991	3,514
1972	843	77	56	889	1,468	3,333
1973	954	172	86	1,184	1,678	4,074
1974	1,191	120	88	1,436	1,921	4,756
1975	759	74	72	1,362	2,120	4,387
1976	905	67	95	2,212	2,029	5,308
1977	844	65	164	1,435	951	3,459

[1] Not available
[2] None reported
[3] Includes black drum
[4] Less than 500 reported.
SOURCE: *Fisheries Statistics of the U.S.,* Various Issues, NMFS and *Current Fisheries Statistics,* Various Issues, NMFS.

Table 10. Gulf of Mexico Landings of Spotted Seatrout 1880–1977 (lbs × 1000) (Includes white seatrout 1880–1965)

Year	Florida West Coast Quantity	Alabama Quantity	Mississippi Quantity	Louisiana Quantity	Texas Quantity	Total Quantity
1880	[1]	[2]	[2]	[1]	[1]	[1]
1887	[2]	[2]	258	524	941	[1]
1888	511	228	280	522	872	2,413
1889	517	205	370	619	1,077	2,788
1890	551	209	372	656	1,120	2,908
1897	830	296	453	567	1,012	3,158
1902	1,859	259	473	1,078	1,119	4,788
1908	1,207	208	517	1,103	1,055	4,090
1918	1,694	139	356	1,190	1,613	4,992
1923	1,590	49	410	783	1,524	4,356
1927	2,583	118	605	822	1,700	5,828
1928	2,682	125	487	885	1,160	5,339
1929	2,942	128	384	513	1,178	5,145
1930	2,722	113	232	710	1,043	4,820
1931	2,414	109	216	767	1,084	4,590
1932	2,150	109	227	633	976	4,095
1934	2,337	145	300	1,518	2,462	6,762
1936	3,483	118	293	1,037	1,836	6,767
1937	2,765	168	373	987	2,109	6,402
1938	2,917	124	284	539	2,083	5,947
1939	2,997	128	249	716	1,485	5,575
1940	3,265	167	131	262	755	4,580
1945	3,859	581	301	917	1,720	7,378
1948	[3]	396	158	503	593	[3]
1949	4,558	218	197	886	630	6,489
1950	3,214	87	115	882	584	4,882
1951	3,332	104	182	602	434	4,654
1952	3,472	146	529	602	479	5,228
1953	2,614	133	900	535	585	4,767
1954	2,298	106	1,480	437	670	4,991
1955	2,046	156	2,021	510	843	5,576
1956	2,059	113	1,441	612	835	5,060
1957	2,562	72	274	641	899	4,448
1958	3,010	70	336	654	1,158	5,228
1959	2,825	112	322	691	1,109	5,059
1960	2,843	62	143	467	1,283	4,798
1961	2,633	115	241	619	1,117	4,725
1962	2,682	100	176	424	989	4,371
1963	2,639	132	148	460	1,190	4,569
1964	2,842	130	174	356	978	4,480
1965	3,539	162	176	458	1,176	5,511
1966	3,174	47	145	647	1,508	5,521
1967	2,637	91	171	621	1,521	5,041
1968	3,065	101	268	619	1,871	5,924
1969	2,419	98	221	720	1,173	4,631
1970	2,643	84	255	786	1,157	4,925
1971	1,961	137	393	1,122	1,487	5,100
1972	2,140	220	255	1,700	1,499	5,814
1973	2,226	351	366	2,528	1,969	7,440
1974	2,260	364	295	2,125	1,996	7,040
1975	2,169	104	263	1,897	1,814	6,247
1976	2,282	43	177	1,611	1,769	5,882
1977	1,600	22	147	1,804	1,347	4,200

[1] Not available
[2] None reported
[3] Less than 500 reported.
SOURCE: *Fisheries Statistics of the U.S.,* Various Issues, NMFS and *Current Fisheries Statistics,* Various Issues, NMFS.

DESCRIPTION OF RECREATIONAL INDUSTRY: HARVESTING SECTOR

Catch data from the recreational sector is generally scarce. However, in 1974 the Texas Parks and Wildlife Department initiated the only statewide comprehensive recreational creel survey on the Gulf Coast. This survey continues to the present and supplies trend information on landings, catch rates and size of fish. This type of information is necessary for the proper management of a fishery resource.

The recreational harvesting sector referred to in this report includes hook and line fishermen only. Fishing methods consist of either live bait or artificial bait used from either shorelines, piers or boats. Fishing areas consist of front beach Gulf waters, inshore estuarine bays, lagoons, sounds, bayous and tidal streams. Information regarding recreational catch of red drum and spotted seatrout provided by the states of Florida, Alabama, Mississippi, Louisiana and Texas enabled only the compilation of seasonal catch per unit effort (CPUE) from the respective states.

METHOD

Data submitted by Alabama, Mississippi, Louisiana and Texas are summarized by season (Tables 11, 12, and 13). Seasonal catch per unit effort (CPUE) was calculated by totalling monthly CPUE from all bay systems (see footnotes 1-5, Table 11) within the respective states and arriving at a mean seasonal CPUE. Data from states which included CPUE for more than one year were reduced to seasonal CPUE by adding seasonal CPUE for all sample years and obtaining a single arithmetic mean. CPUE was expressed as both number and weight of fish caught per hour for all states. Dates of the creel surveys were not concurrent but represent the only data available.

Mean CPUE (both number and weight) for spotted seatrout and red drum for all states are provided by season; standard deviation was calculated among states and within states (Tables 11 and 12). Table 13 shows seasonal mean weight of fish caught within each state. These values were generated by dividing number CPUE into weight CPUE contained in Tables 11 and 12.

Creel survey data provided by the respective states in some instances were too few and localized to draw state-wide CPUE trends; however, it represented all that was available. Florida values, for example, were generated from ongoing creel surveys conducted by personnel with the National Park Service and were collected solely in the Everglades National Park. Applicability of these data to the entire state of Florida is questionable.

Table 11. Seasonal CPUE for Spotted Seatrout from States along the Gulf of Mexico
Winter (December, January, February); Spring (March, April, May)
Summer (June, July, August); Fall (September, October, November)

		CPUE (fish/hour; weight/hour)					
State		Winter	Spring	Summer	Fall	Mean	Standard Deviation
Alabama[1]	Number	0.29	0.18	0.18	0.29	0.24	±0.06
	Weight	0.35	0.45	0.24	0.44	0.37	±0.10
Florida*[2]	Number	0.45	0.48	0.48	0.45	0.47	±0.02
	Weight	0.44	0.47	0.49	0.43	0.46	±0.03
Mississippi[3]	Number	0.26	0.18	0.23	0.50	0.29	±0.14
	Weight	0.50	0.37	0.30	0.70	0.47	±0.18
Louisiana[4]	Number	0.27	0.20	0.53	0.19	0.30	±0.16
	Weight	0.42	0.16	0.54	0.15	0.32	±0.19
Texas[5]	Number	0.37	0.18	0.34	0.30	0.30	±0.08
	Weight	0.33	0.22	0.30	0.27	0.28	±0.05
Mean	Number	0.33	0.24	0.35	0.35	0.32	±0.05
	Weight	0.41	0.33	0.37	0.40	0.37	±0.04
St. Deviation	Number	±0.08	±0.13	±0.15	±0.13	±0.09	
	Weight	±0.07	±0.14	±0.13	±0.21	±0.10	

*Florida seasons are: winter—Jan., Feb., Mar.; spring—Apr., May, June; summer—July, Aug., Sept.; fall—Oct., Nov., Dec.
[1]Based on creel survey, Coastal Alabama—1975.
[2]Based on creel survey, Everglades National Park—1974, 75, 76, 77, and through June, 1978.
[3]Based on creel survey, Biloxi Bay; figures derived from mean CPUE—1972-73.
[4]Based on creel survey, Calcasieu and Barataria Bay, LA—December 1975 through November 1976.
[5]Data combined and averaged by season from creel surveys on Galveston Bay—1963, 1964, 1974, 1975; Matagorda Bay—1975, 1976; San Antonio Bay—1974, 1975; Aransas Bay—1974, 1975; Corpus Christi Bay—1975, 1976; Upper Laguna Madre—1974, 1975; Lower Laguna Madre—1975, 1976; Sabine Lake—1975, 1976.

Table 12. Seasonal CPUE for Red Drum from States along the Gulf of Mexico

Winter (December, January, February); Spring (March, April, May) Summer (June, July, August); Fall (September, October, November)

State		CPUE (fish/hour; weight/hour) Winter	Spring	Summer	Fall	Mean	Standard Deviation
Alabama[1]	Number	0.88	0.03	0.04	0.14	0.07	±0.05
	Weight	0.23	0.68	0.22	1.02	0.54	±0.39
Florida*[2]	Number	0.27	0.26	0.31	0.28	0.28	±0.02
	Weight	1.23	1.11	1.58	1.42	1.34	±0.21
Mississippi[3]	Number	0.02	[6]	0.03	0.06	0.04	±0.02
	Weight	0.02	[6]	0.06	0.10	0.06	±0.04
Louisiana[4]	Number	0.42	0.21	0.06	0.24	0.23	±0.15
	Weight	1.14	0.43	0.10	0.62	0.57	±0.44
Texas[5]	Number	0.06	0.03	0.03	0.05	0.04	±0.02
	Weight	0.08	0.07	0.06	0.12	0.08	±0.03
Mean	Number	0.17	0.13	0.09	0.15	0.13	±0.03
	Weight	0.54	0.57	0.40	0.66	0.52	±0.19
St. Deviation	Number	±0.17	±0.12	±0.12	±0.10	±0.12	
	Weight	±0.59	±0.44	±0.66	±0.57	±0.52	

*Florida seasons are: winter—Jan., Feb., Mar.; spring—Apr., May, June; summer—July, Aug., Sept.; fall—Oct., Nov., Dec.
[1]Data combined and averaged by season from creel surveys, Coastal Alabama—1975.
[2]Based on creel survey, Everglades National Park—1974, 1975, 1976, 1977, and through June, 1978.
[3]Data combined seasonally from creel survey, Biloxi Bay—1972, 1974.
[4]Data taken from combined means of seasonal CPUE (1976, 1977) from Calcasieu Lake and Barataria Bay.
[5]Data combined and averaged by season from creel surveys on Galveston Bay—1963, 1964, 1974, 1975; Matagorda Laguna Madre—1974, 1975; Lower Laguna Madre—1975, 1976; Sabine Lake—1975, 1976.
[6]CPUE too small for consideration in mean or standard deviation.

Table 13. Seasonal Mean Weight of Spotted Seatrout and Red Drum Taken by Recreational Fishermen from States along the Gulf of Mexico

Winter (December, January, February); Spring (March, April, May) Summer (June, July, August); Fall (September, October, November)

State	Species	Mean Weight (lbs) Winter	Spring	Summer	Fall	Mean	Standard Deviation
Alabama	Spotted Seatrout	1.21	2.50	1.33	1.52	1.64	±0.59
	Red Drum	2.88	22.5	5.50	7.43	9.58	±8.81
Florida	Spotted Seatrout	0.98	0.98	1.02	0.96	0.99	±0.03
	Red Drum	4.56	4.27	5.10	5.07	4.75	±0.40
Mississippi	Spotted Seatrout	1.92	2.06	1.30	1.40	1.67	±0.38
	Red Drum	1.00	11.10	2.00	1.67	3.94	±4.79
Louisiana	Spotted Seatrout	1.56	0.80	1.02	0.79	1.04	±0.36
	Red Drum	2.71	2.05	1.67	2.58	2.25	±0.48
Texas	Spotted Seatrout	0.89	1.22	0.88	0.90	0.97	±0.17
	Red Drum	1.33	2.33	2.00	2.40	2.02	±0.49
Mean	Spotted Seatrout	1.31	1.51	1.11	1.11	1.26	±0.19
	Red Drum	2.50	8.45	3.25	3.83	4.51	±2.68
St. Deviation	Spotted Seatrout	±0.43	± 0.73	±0.20	±0.32	±0.40	
	Red Drum	±1.42	± 8.66	±1.88	±2.39	±2.99	

RESULTS

Spotted Seatrout

Table 11 summarizes seasonal CPUE (number and weight/hour) for all states along the Gulf of Mexico. The mean annual CPUE of all states was 0.32 individual fish weighing 0.37 pounds and ranged from a low of 0.24 fish weighing 0.37 pounds in Alabama to a high of 0.24 fish weighing 0.46 pounds in Florida. Seasonal CPUE (weight) during the winter varied from 0.33 in Texas to 0.50 in Mississippi. Weight CPUE during the summer varied from a low of 0.24 in Alabama to a high of 0.54 in Louisiana.

Among all states the greatest number CPUE (0.53) occurred in Louisiana (summer) and the lowest (0.18) in Alabama (spring and summer), Mississippi (spring) and Texas (spring). The greatest weight CPUE (0.54) also occurred in Louisiana during summer and the lowest (0.15) in Louisiana during fall.

The annual mean weight for spotted seatrout landed was 1.26 lbs. and varied from a low of 0.97 lb. in Texas to a high of 1.67 lbs. in Mississippi. The mean weight from all states combined was greatest in spring, with all states except Florida and Louisiana reporting the greatest seasonal body weight in spring.

Red Drum

Table 12 summarizes CPUE (number and weight) for red drum from all states along the Gulf Coast. The overall mean CPUE was 0.13 fish/hour and 0.52 pounds/hour and ranges from a low of 0.04 fish weighing 0.06 lb. each in Mississippi, to a high of 0.28 fish weighing 1.34 lbs. each in Florida.

The greatest number CPUE occurred during winter in Louisiana (0.42), and the greatest weight CPUE occurred in Florida during the summer (1.58 lbs.). The least number and weight CPUE occurred in Mississippi during spring, the CPUE being too small for consideration in calculations of the mean.

The mean weight of red drum landed on the Gulf Coast was 4.50 lbs./fish and ranged from 2.02 lbs. in Texas to 9.58 lbs. in Alabama (Table 13). The greatest seasonal mean weight for all states occurred during spring, ranging from 2.05 lbs. in Louisiana to 22.50 lbs. in Alabama.

PRESENT MANAGEMENT SYSTEMS AND ASSOCIATED PROBLEMS

PRESENT MANAGEMENT SYSTEMS

Commercial landing statistics on spotted seatrout and red drum have been collected among the Gulf States in one form or another since 1880. The recreational statistics available are those from surveys done or contracted by the various state resource management and conservation agencies. A synoptic review of the Gulf States' management structures and other features relative to the spotted seatrout and red drum fishery are presented in Table 14. A more thorough review by state follows in the text.

FLORIDA

Administrative Organization

Department of Natural Resources, Division of Marine Resources, Crown Building, 202 Blount Street, Tallahassee, FL 32304.

The agency charged with administration, supervision, development and conservation of natural resources is the Department of Natural Resources headed by the executive director. The governor and cabinet sit as a seven-man board and approve or disapprove all rules and regulations promulgated by the department. Within the department, the Division of Marine Resources, through Section 370.02(2), Florida Statutes, is empowered to conduct research directed toward management of fisheries in the interest of all people of the state and to manage and protect the marine and anadromous fishery resources of the state of Florida. The Division of Law Enforcement is responsible for enforcement of all marine resource-related laws and all rules and regulations of the department.

Limit of state jurisdiction is shown in Figure 6.

Legislative Authorization

Laws applicable to coastal fisheries are contained in Chapter 370 of the Florida Statues Annotated. The statutes encompass (a) license and license fee provisions, (b) enforcement and (c) general gear restrictions. The legislature passes detailed statutes for fisheries resources statewide as well as special laws applicable within individual counties. The executive branch, through the governor and cabinet, can pass implementing rules and regulations only insofar as they are consistent with existing statutes. Therefore, flexibility of management is considerably limited.

Licenses and Taxes

Sales of salt water products require licenses as scheduled below.

Resident Wholesale	$100.00
Non-resident Wholesale	150.00
Alien Wholesale	500.00
Resident Retail	10.00
Non-resident Retail	25.00
Alien Retail	50.00
Alien and Non-resident Commercial Fishing License	25.00*

Dealers of smoked, salted or canned products are exempt from the above provisions.

Chapter 371, Florida Statutes, requires registration and licensing of motor boats as scheduled below.

Class 1: Less than 12 feet	$ 2.00
Class 2: 12-16 feet	6.00
Class 3: 16-26 feet	11.00
Class 4: 26-40 feet	31.00
Class 5: 40-65 feet	51.00
Class 6: 65-110 feet	61.50
Class 7: 110-+ feet	76.50
Dealer Classification	10.50

A service fee of $.50 is required for each registration. An additional $50. fee is required for non-residents and aliens.

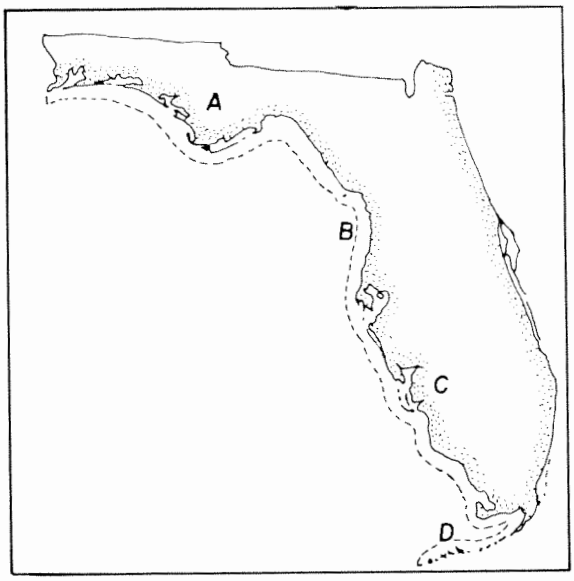
Florida issues two types of motor boat licenses, classed as "pleasure" or "commercial." Pleasure boats are registered through local county tax collectors, and commercial licenses are obtained from the Bureau of Licenses and Motorboat Registration in Tallahassee. There is no legal distinction between the two licenses; a boat used for commercial purposes may be legally registered as a pleasure craft.

There are no other license requirements for participation in the red drum and spotted seatrout fishery.

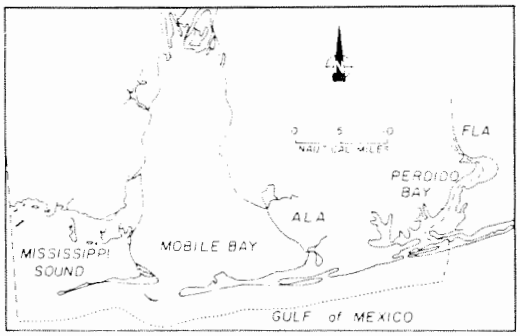
Reciprocal Agreements Among States

Authorization to enter into reciprocal agreements is provided by Chapter 370.18, F. S. This relates only to fishery access and not to fishery management in general.

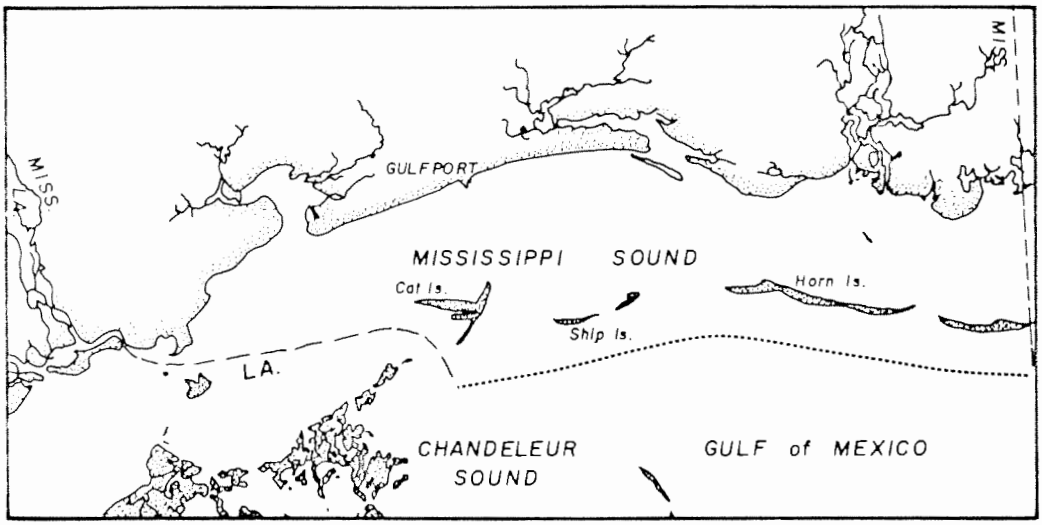
* This applies to persons engaged in the taking and sale of fisheries products but does not apply to crew or employees not involved in the sale of the catch.



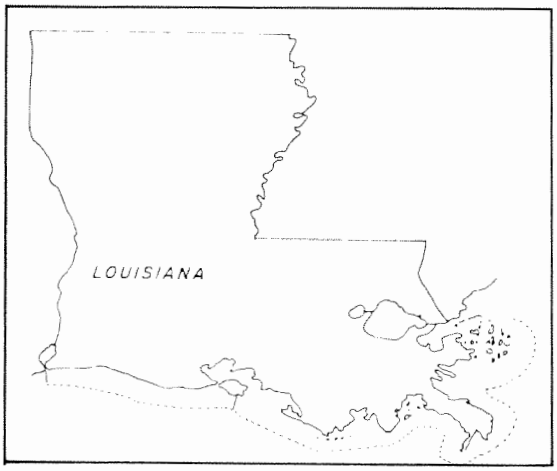
Extent (9 statute miles) of territorial waters in Florida.



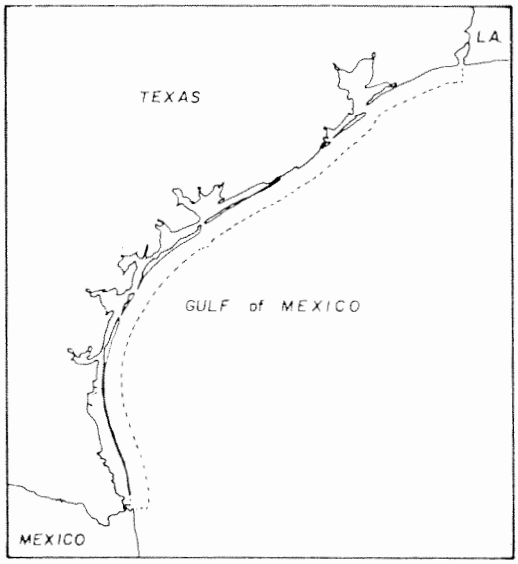
Extent (3 nautical miles) of territorial waters in Alabama.



Extent (3 nautical miles) of territorial waters in Mississippi.



Extent (3 nautical miles) of territorial waters in Louisiana.



Extent (9 nautical miles) of territorial waters in Texas.

Figure 6.

Regulations

Rules applicable to coastal fisheries are contained in Chapter 16B, Florida Administrative Code. Regulations pertaining to the red drum and spotted seatrout fisheries only reiterate or amplify existing statutory provisions.

The following is a summary of Florida Statutes that affect the taking of red drum and spotted seatrout.

> 370.11, Florida Statutes—Length of saltwater fish. Size limits: Recreation and commercial.
>
> > Spotted seatrout and red drum—12 inches from tip of nose to rear center edge of tail. Exception for spotted seatrout—No length limit in Franklin, Wakulla or Gulf Counties (Chapter 65-905, Laws of Florida).

The method of taking these fish is governed by approximately 111 special acts of local application. These laws may vary not only in the individual counties but sometimes within a particular bay, sound or river within a county. Generally, these special acts address the time or location in which nets may not be deployed or specify their construction (twine, strength of material, mesh size, bar measure, length, depth, etc.). Historically, most gear restrictions have been proposed to offer a competitive advantage to, or to discriminate against, a particular group of fishermen. The twelve inch total length size limitation (notwithstanding the exception for spotted seatrout cited above) is based on the assumption that these fish will have reached maturity at that size and will have spawned at least once. There is no bag limit in effect anywhere in Florida for either species.

Penalty for Violations

Any person violating provisions of Chapter 370, F. S., unless otherwise provided, shall be guilty of a first degree misdemeanor. The plethora of local laws, however, does not seem consistent in the amount of fines, confiscation criteria, etc.

Scientific Permits

Scientific permits are issued through the Division of Marine Resources following formal review procedure by the Divisions of Administrative Services and Law Enforcement.

Limited Entry

There are no provisions for limited entry in the red drum and spotted seatrout fisheries.

Data Reporting Requirements

The processor's license requires monthly reports of volume and price of saltwater products (Figure 7); the National Marine Fisheries Service currently collects and publishes these data.

ALABAMA

Administrative Organization

Department of Conservation and Natural Resources, Marine Resources Division, P.O. Box 188, Dauphin Island, AL 36528.

Limit of state jurisdistion is shown in Figure 6.

Legislative Authorization

Section 9-2-4-1975 Code of Alabama. All statutory laws concerning fisheries.

Licenses and Taxes

Gill and Trammel Net License

A. No more than 1200 feet	$ 5.00
B. 1200 feet–no more than 1800 feet	10.00
C. 1800 feet–no more than 2400 feet	20.00
D. 2400 feet–3000 feet	40.00

Seine License

A. Less than 30 feet	$ 7.50
B. 30 feet–300 feet	15.00
C. 300 feet–900 feet	22.50
D. Greater than 900 feet	37.50*
Wholesale Fresh Saltwater Fish Dealer	25.00
Retail Fresh Saltwater Fish Dealer	5.00

Non-residents of the State of Alabama shall pay a double fee.

Non-Resident recreational fishing license for fishing in salt and brackish water 10.25

Reciprocal Agreements Among States

The authority to enter into reciprocal agreements with respect to coastal fisheries is contained in Code of Alabama, Title 8, Section 171 (130). This section contemplates only an arrangement permitting nonresidents to fish in Alabama waters on a reciprocal basis. It does not extend to management issues.

Regulations

Statutory and considerable flexibility within the management agency.

A. *Fishing Areas:* unrestricted recreational fishing; restrictions on commercial fishing as follows:
   1. May not set gill net, trammel net or seine within 300 feet of man-made canal or launching ramp.
   2. From 15 May to 15 September no gill nets, trammel nets or seines may be used in Gulf of Mexico within one mile of Baldwin and Mobile County beaches. (This statute was recently ruled unconstitutional by a lower Alabama court. It is currently under appeal.)

* Lead line cannot exceed two feet.

MAIL IMMEDIATELY
AT END OF EACH MONTH

Figure 7.

MAIL THIS FORM TO: Department of Natural Resources
National Marine Fisheries Service
75 Virginia Beach Drive
Miami, Florida 33149

DATE .....

1 DEALER .....

ADDRESS .....

.....

2 THIS REPORT IS FOR THE MONTH OF:

.....

3 COUNTY WHERE FISH LANDED:

.....

4 NUMBER OF POUNDS OF FISH AND SHELLFISH PURCHASED FROM FISHERMAN OR PRODUCED:

	SPECIES – SHELLFISH	AVERAGE PRICE	POUNDS
300	Clams (sunray venus)		
301	Oysters (Bushels)		
301	Oysters (Gallons)		
301	Oysters (Barrels)		
302	Clams (hard) (Gallons)		
303	Scallops Bay (Gals.)		
304	Scallops Calico (Gals.)		
305	Conchs (Meats)		
403	Crawfish (Spiny Lobster)		
405	Spanish Lobster		
401	Blue Crabs (hardshell)		
402	Blue Crabs (softshell		
404	Stone Crabs (Whole)		
404	Stone Crabs (Claws)		
	Shrimp Heads-off Heads-on		
501	Squid		
502	Turtle Green		
503	Turtle Loggerhead		

	SPECIES – FINFISH	AVERAGE PRICE	POUNDS
201	Alewives (Herring)		
101	Amberjack		
100	Angelfish		
202	Ballyhoo		
102	Barracuda		
103	Bluefish		
104	Bluerunner		
105	Bonita		
106	Bottom Fish		
108	Cobia		
109	Catfish (fresh water)		
110	Catfish (salt water)		
203	Cigarfish		
112	Croaker		
113	Dolphin		
114	Drum (black)		
115	Eels		
116	Flounders		
129	Goatfish		
118	Groupers & Scamp		
119	Grunts		

	SPECIES	AVERAGE PRICE	POUNDS
208	Herring, Thread		
120	Hog Snapper (hogfish)		
121	Jack (crevalle)		
122	Jewfish		
123	Kingfish (mackerel)		
206	Ladyfish (skipjack)		
204	Menhaden (pogies)		
124	Mullet black (Lisa)		
125	Mullet, silver		
126	Mutton Snapper (muttonfish)		
131	Nile Perch		
127	Permit		
128	Pigfish		
130	Pompano		
132	Red Fish (channel bass)		
117	Sand Perch (mojarra)		
154	Sea Bass (common)		
133	Sea Trout (gray) (E. coast)		
134	Sea Trout (spotted)		
135	Sea Trout (White) (W. coast)		
136	Shad (common)		
205	Sharks		
138	Sheepshead		
139	Snapper, lane		
140	Snapper, mangrove		
141	Snapper, red		
142	Snapper, vermillion		
143	Spanish Mackerel		
156	Spanish Sardines		
144	Spot		
145	Sturgeon		
153	Swordfish		
157	Tile Fish		
146	Trigger Fish		
147	Triple Tail		
207	Trash Fish		
155	Wahoo		
148	Warsaw		
149	White Snapper (porgy)		
150	Whiting, boat		
150	Whiting, beach		
151	Yellowtail		
106	Miscellaneous Food Fish		

Please add species not listed such as: various sponges, leather jacket, tuna, Sailors Choice, Etc.

B. *Fishing Gear*

1. No nets longer than 3000 feet measured at lead line permitted in Alabama.
2. Nets in Mobile County may be no smaller than 1¼" knot-to-knot with a 2½" stretch; Baldwin County 1½" knot-to-knot with 3" stretch.
3. No net larger than 300 feet may be fished within 300 feet of any pier or boathouse.
4. Fishing Seasons: only as stated above.
5. Catch and Possession Limits: The holder of a sport fishing license may catch and retain a daily bag limit of fifty and a possession limit of a hundred spotted seatrout. The same bag and possession limit applies to red drum.
6. Size Limits: Recreational only. Minimum size of spotted seatrout is twelve inches; minimum size of red drum is fourteen inches. No more than two red drum in possession may exceed 36 inches.
7. Limited Entry—None.

Penalties for Violations

Violation of provisions of any act or regulation pertaining to aforementioned statutes is considered a misdemeanor with accompanying fines of $25-$500.

Scientific Permits

Issued by the commissioner of the Department of Conservation and Natural Resources.

Limited Entry

No specific provisions for limited entry are contained in the Alabama Code of Laws.

Data Reported Requirements

Alabama has a law (9-12-115—Acts of Alabama #587, 1943 regular legislative session) which requires wholesale dealers to file monthly reports at quarterly intervals to the commissioner, ADCNR, detailing weight (in pounds) of each species purchased from commercial fishermen during the proceeding month. Records are gathered by NMFS port agents on sales of fishery products.

MISSISSIPPI

Administrative Organization

Department of Wildlife Conservation, Bureau of Marine Resources P. O. Box 959, Long Beach, MS 39560.

The administrative organization of the state of Mississippi with respect to coastal fisheries is the Department of Wildlife Conservation through the Bureau of Marine Resources.

The power and duties related to marine resources are vested in the Mississippi Commission on Wildlife Conservation, the controlling body of the Department of Wildlife Conservation. The commission consists of five members, all appointed by the governor. The commission 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) and "said power shall be exercised through the bureau of marine resources of the Mississippi Department of Wildlife Conservation. . . ."

Legislative Authorization

Statutory provisions are set forth in Chapter 15, Art. 1, paragraphs 49-15-1 through 49-15-69 of the Mississippi Code Annotated (1972). Fishing seasons and gear types are set by the Department. Mississippi has a relatively flexible management system which would lend itself to a reciprocal or coordinated interstate fisheries management plan.

Licenses and Taxes

License requirements for fishing operations conducted in Mississippi waters are as follows:

Hook and line commercial fishing ..... $ 1.00
Boats using trammel nets, gill nets, or seines not more than 200 fathoms in length 7.50
Boats using trammel nets, gill nets, or seines over 200 fathoms in length, but not more than 300 fathoms in length..... 15.00
Boats using seines or other nets over 300 fathoms, but not over 400 fathoms in length ... 25.00
boats using seines or other nets of 400 fathoms, but not over 500 fathoms in length ... 50.00

All licenses issued shall expire on 1 July regardless of the date of issuance.

Tax

Each factory canning fish in the state of Mississippi shall pay a privilege tax of $100.

Reciprocal Agreements Among States

The Mississippi reciprocal agreement provision is found in Mississippi Code Annotated 49-15-15 (i) which provides that the department:

> may enter into advantageous interstate and intrastate agreements with proper officials, which agreements directly or indirectly result in the protection, propagation and Conservation of the seafood of the State of Mississippi, or continue any such agreement now in existence.

Unlike the reciprocal agreement authorizations in some states, this clause would refer to agreements relating to resource management as well as to reciprocation concerning access of residents to the other states' waters.

Regulations

The commission has the power to promulgate regulations not set forth by legislative act. Any regulations or ordinances, before becoming effective, are to be published in a newspaper having general circulation in counties affected by such a regulation. Right of appeal through a public hearing and the circuit court is granted to "any person aggrieved by an order or the Commission."

Ordinances regulating finfishing.

There are five ordinances which apply specifically to the catching of finfish other than menhaden. They are summarized below:

Ordinance No. 71. Required that all firms purchasing littoral species and fishermen catching littoral species keep records on those fish bought and/or caught and report same to MMCC upon request.

Ordinance No. 84. This ordinance exempts mullet fishing from certain regulations and prescribes regulations for catching mullet.

Ordinance No. 85. Delineates areas closed to all netting.

Ordinance No. 87 as amended by Ordinance No. 91. Defines saltwater sport fishermen. Sets daily bag limits in spotted seatrout and red drum, and sets size limits.

Size limits: Legal minimum size is twelve inches total length for spotted seatrout, minimum fourteen and maximum thirty inches for red drum. Recreational—Can keep only two red drum exceeding thirty inches in total length for a day's catch.

Catch and Possession Limits: Recreational—Cannot keep more than fifty spotted seatrout and ten red drum per day, with a maximum three day catch in possession.

Ordinance No. 94. Sets limits where nets may be set in relation to public and private piers, length of nets and mesh sizes, methods on how nets are to be marked and attended. Also limits their use within a one-mile radius of named islands between 15 May and 15 September each year and makes it unlawful to take commercially any red drum in Mississippi from 15 September to 15 November each year (Figure 8). It sets an annual limit of 200,000 pounds on the total number of red fish which may be harvested from Mississippi territorial waters.

Penalties for Violations

General penalties for violations are set forth in paragraph 49-15-63 of the Mississippi Code Annotated (1972). Upon conviction of a violation the offender shall be fined not less than $50 nor more than $500, or imprisoned for a period not exceeding thirty days for any subsequent offense; upon conviction of a third offense, the license of the convicted party and of the boat shall be revoked for a period of one year following the conviction.

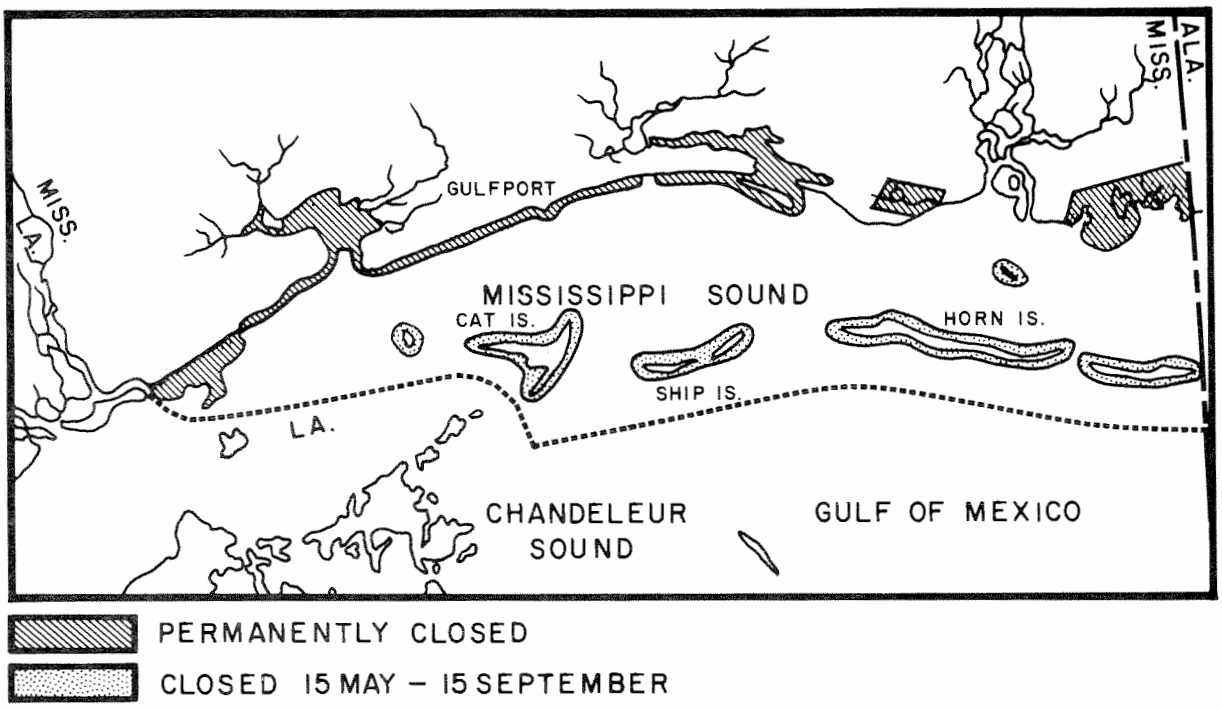


Figure 8. Areas closed to net fishing other than menhaden nets.

Scientific Collection Permits

These permits are issued by the director of the Bureau of Marine Resources.

Limited Entry

No precedents warranting a discussion of limited entry in the context of Mississippi coastal fisheries management were found.

Data Reporting Requirements

Each firm or individual, whether or not licensed by the department, purchasing fish for resale from net or hook and line fishermen will keep a record of quantity and species purchased from each fisherman. These records will be furnished to the department on request and on prescribed forms furnished by the department. Response to monthly questionnaires will be required of net fishermen each month reporting catch and area of capture when requested by the commission regardless of whether the fish were sold, given away or consumed by the fishermen. Reporting will be by questionaires mailed to each fisherman. Refusal to supply this information to the department or falsifying same is subject to a fine of $100 for each offense. NMFS port agents collect records of fish transfers from seafood buyers.

LOUISIANA

Administrative Organization

Department of Wildlife and Fisheries, 400 Royal Street, New Orleans, LA 70130

The Department of Wildlife and Fisheries is one of twenty-one major administrative units of the Louisiana state government. The secretary of the Department of Wildlife and Fisheries is "The executive head and Chief administrative officer of the department" and has "sole responsibility for the policies of the department and for the administration, control and operation of the functions, programs and affairs of the department." The secretary is appointed by the governor with consent of the Senate and serves at the governor's pleasure. The secretary may be advised by a seven-member board, the Louisiana Wildlife and Fisheries Commission, which exercises control and supervision of the wildlife of the state including all aquatic life.

Within the administrative system an assistant secretary is in charge of the office of Coastal and Marine Resources. In this office the Seafood Division, headed by the division chief, performs "the functions of the state relating to the administration, operation and law enforcement of programs, including research relating to oysters, waterbottoms and seafoods, including but not limited to the regulation of the oyster, shrimp, and marine fishing industries."

Limit of state jurisdiction is shown in Figure 6.

Legislative Authorization

Louisiana statutory law covers mesh size for nets used in the taking of commercial finfish, licensing of commercial finfishermen, nets and vessels and size limits on taking of commercial finfish. An elaborate statutory scheme exists with respect to finfish, providing little departmental discretion, except for some leeway under certain conditions, which allows the secretary of the department to set seasons, gear and possession regulations.

The constitution places the policy-making authority solely with the secretary, but because of the requisite procedures that must be followed in formulating policies, plus the existence of a substantial amount of statutory law, the state management system probably would not be very responsive to an effective coordinated fisheries management plan.

Licenses and Taxes

Louisiana annual license fees include:

A. Saltwater Fish Seines, Gill Nets, or Trammel Nets
   1. 0–600 feet in length $10.00
   2. 600–1200 feet $20.00
B. Resident Commercial Fishing License $5.00
   Each separate saltwater fish seine, trammel net or gill net or other webbing except hoop nets—$5.00 on each 300 feet or any fraction thereof.
C. Non-resident Commercial Fishing License $1,000.00
   May be purchased only during December of preceding year. (This statute is being challenged in U.S. District Court.)
D. Commercial Anglers License $250.00
   This license to be additional to any other valid license.
E. Recreational (rec.) Fishing License (resident) $2.00
F. Rec. Fishing License (non-resident) ..... $3.00 (7-day license) ....$6.00 (season)
G. Commercial Saltwater Fishing Vessel
   1. 45 feet or less $5.00
   2. Over 45 feet $10.00
   3. Non-resident Commercial Fishing Vessel $1,000.00
   May be purchased only during January. (This statute is being challenged in U.S. District Court.)
H. Resident Wholesale Dealer $50.00
   Non-resident Wholesale Dealer $150.00
I. Wholesale Agent $10.00
J. Resident Retail Dealer $5.00
   Non-resident Retail Dealer $50.00

Reciprocal Agreements Among States

The Louisiana Department of Wildlife and Fisheries has the authority to enter into "reciprocal fishing license agreements" with the authorities of any other state. Further, Louisiana Revised Statutes 57:673 authorizes the department to enter into reciprocal agreements with the states of Arkansas, Mississippi and Texas pertaining to "seasons, creel limits and all other rules and regulations pertaining to the taking or protection of any species of fish or other aquatic life" in bodies of water which form the "common boundary" with the reciprocating states. The former appears to be restricted to fishing license agreements only and would not include broader management systems. The latter statute does not seem to be applicable to coastal fisheries management agreements since the Gulf of Mexico is not a body of water which forms "the common boundary" between Louisiana and reciprocating states.

Regulations (Recreational and Commercial)

The constitution places regulation-making authority solely with the department, but there are many requisite procedures that must be followed in formulating these regulations. Louisiana is currently divided into two separate areas for ease of enforcement and management. The boundary line dividing the state has been described and established. The following described boundary line easterly from the Texas state line to the Mississippi state line shall be used for designating mesh requirements for the use of seines, trammel nets and gill nets: Louisiana Highway 82 from the Texas-Louisiana boundary to its junction with the Intracoastal Waterway at Forked Island, the Intracoastal Waterway from Forked Island to Bayou Barataria, Bayou Barataria to the Harvey Canal, the Harvey Canal to the Mississippi River, the Mississippi River to the Industrial Canal, the Industrial Canal to the Intracoastal Waterways, the Intracoastal Waterway to the Rigolets in Orleans Parish to the Louisville and Nashville railroad bridge, the Louisiana and Nashville railroad right of way from the Orleans Parish line to the Mississippi state line; except that in any areas declared open for the use of seines, trammel nets or gill nets in Lake Pontchartrain, Lake Maurepas, Lake St. Catherine, Lake Calcasieu and Sabine Lake, the minimum mesh size allowed for any of these nets shall coincide with the minimum or maximum mesh allowed south of the described boundary line.

A. *Fishing areas:* (Figure 9)
   1. Recreational—no restrictions, except for private interests.
   2. Commercial—Louisiana waters closed by (a) gear, (b) area and/or (c) season. Detailed explanation presented in Part D (closed area).

B. *Fishing gears:*
   1. Saltwater trammel net—maximum mesh size, inner wall: one inch bar or two inches stretched; minimum mesh size of outer wall: three inch bar or six inches stretched; maximum length: 1200 feet (south of saltwater-freshwater line and including Lakes Pontchartrain, Calcasieu and Sabine).
   2. Seines—minimum mesh: two inch bar or four inches stretched (north of saltwater-freshwater line); maximum mesh size: one inch bar or two inches stretched (south of saltwater-freshwater line and including Lakes Pontchartrain, Calcasieu, Sabine, Maurepas and St. Catherine), maximum length: 1200 feet.
   3. Gill nets—minimum mesh size: three inch bar or six inches stretched (north of saltwater-freshwater line); minimum mesh size: two inch bar or four inches stretched (south of saltwater-freshwater line); maximum length: 1200 feet.
   4. Hoop nets—minimum mesh size: two inch bar or four inches stretched (north of saltwater-freshwater line); minimum mesh size: one inch bar or two inches stretched (south of saltwater-freshwater line).
   5. (a) Use or possession of monofilament gill nets and trammel nets prohibited south of saltwater-freshwater line and in Lakes Pontchartrain, Toledo, Maurepas, Calcasieu and St. Catherine. Monofilament webbing may be fished south of the inside-outside shrimp line, provided a permit is issued, and for development of new fisheries.
      (b) No person may take fish by means of spears, poisons, drugs, explosives, guns, tree-topping devices, lead nets or electricity.
      (c) The free passage of fish in any body of water may not be obstructed. Additionally, no obstructions (nets or parts of nets) may be placed within 500 feet of the mouth of an inlet or pass or any water control structure.

C. *Fishing seasons:*
   1. Recreational—no restrictions

D. *Closed areas:* (Figure 9)
   1. Recreational—no restrictions
   2. Commercial—restrictions as follows:
      (a) The taking of fish from the waters of Lake Catherine, the Rigolets, Unknown Pass, Chef Menteur and a portion of Lake Pontchartrain by the use of trawls, seines, traps or other netting with the exception of cast nets, drop nets or scoop nets is prohibited.

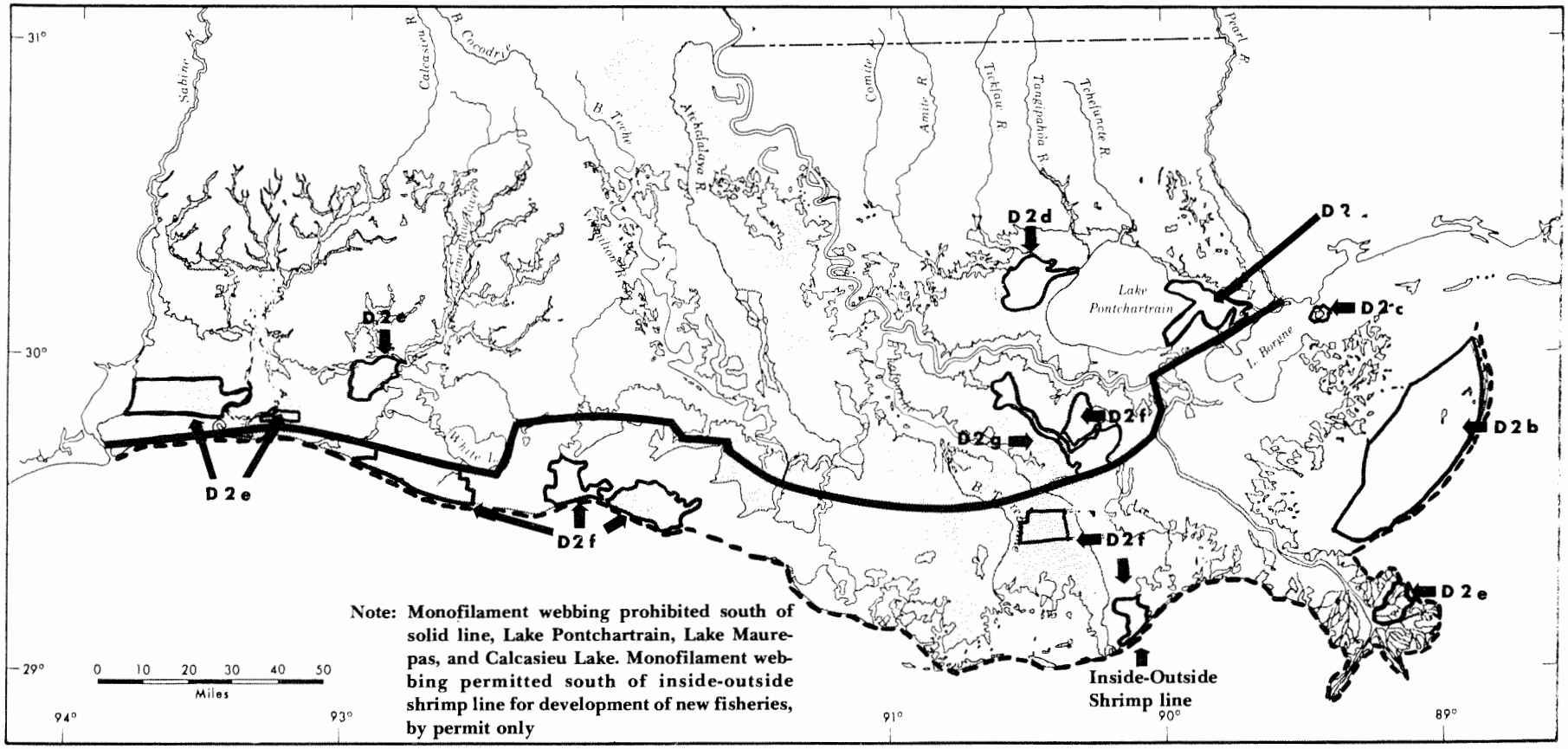


Figure 9. Map of Louisiana showing areas closed to commercial finfishing (enclosed by black lines). See text (Louisiana Section D.2.a through g) for further description.

(b) The use of any form of trammel net, seine, gill net or webbing (ordinarily used for the catching or taking of spotted seatrout, red drum or other edible fish) is prohibited in the waters surrounding the Chandeleur Islands including Breton, North, New Harbor and Free Mason Islands.

(c) No person shall use any trammel net, gill net or seine for the taking of fish within one-half mile of the shoreline of Grand Island commonly known as Half Moon Island, in Lake Borgne, or within one-half mile of the shoreline of Grassy Island in Lake Borgne.

(d) The setting of nets of any kind in Lake Maurepas within one-half mile of the beacon lights marking the mouths of the Tickfaw, Tangipahoa, Amite, and Blind Rivers, and the Amite River diversion canal and Pass Manchac is prohibited.

(e) Federal refuges (Delta, Lacassine and Sabine) are closed to commercial fishing.

(f) State refuges (Rockefeller, Paul J. Rainey and Marsh Island) and game management areas (Point-au-Chien, Wisner, Salvadore) are closed to commercial fishing.

(g) The use of seines, nets or webbing for the taking of fish in Lake des Allemands, Bayou des Allemands and Lake Salvador is prohibited, except that seines, nets and webbing with a mesh of not less than four inches square, eight inches stretched, may be used to take garfish, buffalo fish and other trash fish.

E. *Catch and possession limits:*

1. Recreational—restrictions as follows:
   (a) May not keep more than combined total of fifty spotted seatrout or red drum per day, with a maximum two day catch in possession.
   (b) May not keep more than two red drum exceeding thirty-six inches in length.
2. Commercials—no restrictions on catch and possession limits.

F. *Size limits:*

1. Recreational—may not keep more than two red drum thirty-six inches in length.
2. Commercial—spotted seatrout: ten inches minimum length, measured with the mouth closed; red drum: sixteen inches minimum length, measured with the mouth closed.

Penalties for Violations—Enforcement Operations

To secure the effective protection of fish in Louisiana waters, the Louisiana Department of Wildlife and Fisheries shall appoint wildlife agents whose entire time shall be, under the direction of the department, devoted to the performance of the official duty under Title 56, Part VII, Sub-Parts A and B, Sport and Commercial fishing, Sections 311-409, Louisiana Revised Statutes of 1950, as amended through the Acts of the 1975 session of the legislature. The department head may also appoint as many special or cooperative officers, to be designated special agents, in the enforcement of the provisions of Sub-Part A (fish), who have all the rights, powers and duties of agents, except as hereinafter mentioned. Special agents serve without expense to the state or to the department in excess of a salary of one dollar per year.

The department, agents and the various sheriffs, constables, deputy constables and other police officers may without warrant arrest any person committing a violation of Sub-Part A (fish) of the Revised Louisiana Statutes of 1950 (as amended through the 1975 legislature) in his presence or view, and may take such person into custody immediately for examination or trial before any officer or court of competent jurisdiction of the state of Louisiana or the United States.

Agents may examine records, visit or examine, with or without search warrant, any cold storage plant, warehouse, boat, store, car, conveyance, automobile or other vehicle, airplane, basket or other receptacle or any place of deposit for fish whenever they have probable cause to believe that any provisions of this Sub-Part have been violated.

Agents shall at frequent intervals visit and inspect cold storage plants, warehouses, public restaurants, public and private markets, stores and places where fish are likely to be kept and offered for sale in violation of the provisions of Sub-Part A (fish). Such visitations and inspections are lawful without search warrant. They shall take proceedings in any court of competent jurisdiction, state or federal, against any offender.

Special agents have all the rights and duties conferred or imposed upon agents but have no authority to make any contracts for the department.

Licenses and Taxes

Whoever violates any of the provisions, where no penalty has been otherwise specifically provided, shall be mandatorily fined not less than $25 nor more than $75 or imprisoned for not more than thirty days, or both, for the first offense; fined not less than $100 nor more than $200 or imprisoned not more than sixty days, or both, second offense; fined not less than $200 nor more than $300, imprisoned no less than sixty days and no more than ninety days, and loss of license for minimum of one year with confiscation of all tackle and equipment for the third offense.

Violation of Sport Fishing Provisions

First offense: Fined not less than $25 nor more than $100 or be imprisoned for not less than ten days nor more than sixty days, or both.

Second offense: Fined not less than $100 nor more than $300 or be imprisoned not less than thirty days nor more than ninety days, or both, and any tackle used may be disposed of.

Closed Areas—Commercial

In Lake des Allemands, Bayou des Allemands, and Lake Salvador the penalties are as follows:

First offense: Fined not more than $100 or imprisonment for not more than sixty days, or both.

Second offense: Fined not more than $250 or imprisonment for not more than ninety days, or both, and all equipment (nets and webbing) seized.

In Breton Islands and Chandeleur Islands the penalties are as follows:

Fined not less than $200 or more than $500 or imprisonment of not less than thirty days or more than six months. Violator's net or nets and catch shall be seized.

In Lake Maurepas the penalties are as follows:

Fined not less than $50 or more than $100 or be imprisoned not less than ten or more than thirty days, or both.

In Terrebonne and Lafourche parishes the penalties are as follows:

Fined not less than $200 or more than $500 or imprisonment of not less than thirty days or more than six months. Nets and catch shall be confiscated.

Monofilament Gill Nets Prohibited

The use or possession of monofilament gill nets or trammel nets south of the Intracoastal Waterway, in Lake Pontchartrain, Lake Maurepas, Calcasieu Lake, that portion of the Calcasieu Ship Channel which actually adjoins Calcasieu and Lake St. Catherine is prohibited. Violators shall have a mandatory fine of $500 and revocation of all fishing and gear licenses for a period of one year.

Creel Limits—Recreational

A fine of not less than $50 or more than $500, revocation of sport fishing license and confiscation of fishing tackle.

Scientific Permits

The Louisiana Department of Wildlife and Fisheries may take fish of any kind when, where and in such manner as may be deemed necessary for scientific or educational purposes and for propagation and distribution. The department may introduce or permit to be introduced live fish or fish eggs of any kind in public or private waters of the state. No person shall introduce into the state any live fish or fish eggs, other than goldfish and aquarium fish, without a permit issued by the department. The secretary may issue permits to any person to take fish for scientific or educational purposes or for propagation or for distribution. The prohibition against the taking of fish by means of any device not specifically permitted under the legal size limits provided for during any closed season or closed zone designated by the department does not apply to such persons if, in the opinion of the department, the fish are necessary for scientific or educational purposes, or for propagation or distribution to other waters of the state. These permits may be revoked at any time if abused.

Limited Entry

Louisiana law provides that "ownership of all fish . . . remains state for purpose of regulating and controlling the use and disposition within its borders." Moreover, there is judicial precedent to the effect that the taking of fish is a "privilege" subject to regulation by the state "for any . . . cause it deems sufficient." Thus, having cognizance of the fact that the state, as trustee for the people, has the obligation to assure that the marine fishery resources benefit the people as a whole, the issue is whether economic regulation via limited entry constitutes a valid recognition in the public interest. If it may be assumed that legislation providing for an adequate livelihood to fishermen, improving fisheries management efforts and eliminating economically inefficient regulations involves a public interest, limited entry in Louisiana may be a viable and legally sound approach. The presumption that "the Legislature must have acted only after a thorough investigation and upon a finding that the interest of the public required the legislation" lends credence to the validity of a limited entry statute.

Limit of state jurisdiction is shown in Figure 6.

Data Reporting Requirements

Processors or any other first purchasers must report purchases by the tenth of the month following. A statement of the quantity of fish purchased, vessels and owners thereof and other dealers from whom purchased of received shall be made under oath on blanks furnished by the department (Figure 10). All wholesalers, processors and first purchasers shall at the time and in the same report make a full statement of the disposition thereof including sales and persons to whom sold.

Figure 10

Louisiana Department of Wildlife and Fisheries

SUMMARY REPORT OF FISH AND SHELLFISH
CAUGHT OR PURCHASED FROM FISHERMEN IN LOUISIANA
DURING THE PERIOD OCTOBER 1, 1976 THROUGH
SEPTEMBER 30, 1977

INSTRUCTIONS: This report is to be filled out and submitted with the application for your 1978 license. Fish obtained from other states are not to be reported. Individual reports are strictly confidential and only summary data are released.

NOTE: If no purchases or catches of fish or shellfish were made during the period, please check the following box. ☐

SPECIES	CODE	COUNTER PUNCH	POUNDS PURCHASED/ CAUGHT	POUNDS SOLD FOR RESALE IN-STATE	POUNDS SHIPPED OUT-OF-STATE	POUNDS SOLD DIRECT TO CONSUMER	POUNDS RESERVED FOR HOME CONSUMPTION
FRESHWATER							
Bowfin (Grindle)	0360	0					
Buffalo	0420	0					
Carp	0630	0					
Catfish and Bullheads	0661	0					
Garfish	1330	0					
Paddlefish (Spoonbill)	2510	0					
Gaspergou	3530	0					
Other (Specify)							
SALTWATER							
Cabio (Ling)	0570	1					
Croaker	0925	1					
Drum, Black	1081	1					
Drum, Red (Red Fish)	1082	1					
Flounders	1235	1					
Groupers	1410	1					
Jewfish	1850	1					
King Whiting	1970	1					
Menhaden	2210	1					
Millet ("Popeye")	2341	1					
Pompano	2720	1					
Sawfish	3230	1					
Sea Catfish	3380	1					
Sea Trout, Speckled	3447	1					
Sea Trout, White	3455	1					
Sharks	3508	1					
Sheepshead	3560	1					
Snapper, Red	3764	1					
Spanish Mackerel	3840	1					
Spot	4060	1					
Tripletail	4590	1					
UNCLASSIFIED							
Bait, Reduction, and Animal Food	5290	1					
Other (Specify)							

TEXAS

Administrative Organization

Texas Parks and Wildlife Department, 4200 Smith School Road, Austin, TX 78744

The Texas Parks and Wildlife Commission is the major administrative unit of the state charged with management of the coastal fishery resources and enforcement of legislative and regulatory procedures. The six members of the commission are appointed by the Governor for up to six-year terms. The commission selects an executive director who serves as the chief administrative officer of the department. A director of the Fisheries Division is named by the executive director. The Coastal Fisheries Branch, headed by a branch chief, is under the supervision of the director of fisheries.

Limit of state jurisdiction is shown in Figure 6.

Legislative Authorization

The "Uniform Wildlife Regulatory Act" (Chapter 61, Parks and wildlife Code) specifies the authority of the Commission to manage the saltwater resources. Fifteen of the eighteen coastal counties are under regulatory authority, with the remaining counties under general law. The "Red Drum Conservation Act" extends the regulatory responsibility of the commission to all coastal counties for red drum only.

Licenses and Taxes:

Texas has the following licensing requirements for catching, selling or processing saltwater and freshwater fishes including red drum and spotted seatrout:

(A) Fishing Licenses (Sport or Commercial)
1. Combination Hunting and Sport Fishing ..... $ 8.75
2. Resident Sport Fishing 4.50
3. Non-resident Sport Fishing 10.50
4. Non-resident 5-Day Sport Fishing 4.50
5. Resident or Non-resident 3-Day Saltwater Sport Fishing 1.25
6. Resident General Commercial Fishing . 10.00
7. Non-resident General Commercial Fishing (or the amount a Texas resident would pay for a similar license in the state where the non-resident resides, whichever is larger.) 20.00
8. Resident Commercial Finfish Fishing . 50.00
9. Non-resident Commercial Finfish Fishing (or the amount a Texas resident would pay for a similar license in the state where the non-resident resides, whichever is larger.) 100.00
10. Commercial Red Drum Fishing 50.00
11. Fish Guide 25.00

(B) Boat Licenses (Commercial)
1. Fish—Tidal Waters ..... $ 6.00
2. Skiff 1.00

(C) Equipment Tags (Sport or Commercial)
1. Commercial Seine or Net ..... $ 1.00 (for each 100 feet)
2. Sport or Commercial Saltwater Trotline ..... $ 1.00 (for each 300 feet)

(D) Business Licenses
1. Wholesale Fish Dealer $250.00
2. Wholesale Fish Truck Dealer 125.00
3. Retail Fish Dealer ..... $6.00-$20.00 (depending on population size of city)
4. Retail Fish Truck Dealer 25.00

No taxes are levied on fish landed in Texas.

The commercial red drum license is required of any person who catches or transports for sale or sells red drum taken from the tidal waters of Texas. A holder of a fish dealer license is exempted from the license requirements unless the person catches red drum for sale. The department issues the annual license only during the month of September. An affidavit must be completed at the time of license issuance which affirms that:

(a) Not less than 50% of the applicant's gainful employment is devoted to commercial fishing.
(b) The applicant is not employed at any full-time occupation other than commercial fishing.
(c) During the period of validity of the Commercial Red Drum License the applicant does not intend to engage in any full-time occupation other than commercial fishing, and
(d) The applicant possesses a commercial fishing license issued by the department.

The department must revoke a commercial red drum license if the holder engages in any full-time employment other than commercial fishing, does not possess a valid commercial fishing license, falsifies a statement on the affidavit or violates any law or regulation regarding red drum more than one time. These regulations also apply to the commercial finfish fisherman's license.

Reciprocal Agreements Among States

Texas, through a reciprocal license agreement with Louisiana, allows resident sport fishermen of either state who are properly licensed or exempt to fish common boundary waters between Louisiana and Texas. There is no statutory authority to enter into reciprocal management agreements.

Regulations

The commission sets the means, manners, methods, times and places for the taking of saltwater fishes

SPECIES	CODE	COMPUTER PUNCH	POUNDS PURCHASED/ CAUGHT	POUNDS SOLD FOR RESALE IN-STATE	POUNDS SHIPPED OUT-OF-STATE	POUNDS SOLD DIRECT TO CONSUMER	POUNDS RESERVED FOR HOME CONSUMPTION
SHELLFISH et. al.							
Crabs, Hard	7000	2					
Crabs, Soft (Dozs.)	7030	2					
Crawfish, Freshwater	7210	2					
River Shrimp (Unclassified)	7305	2					
Oysters, Public (Sacks)		2					
Oysters, Private (Sacks)		2					
Terrapin, Diamd. Bk. (Dozs.)	8081	2					
Turtles, Baby (each)	8111	2					
Turtles, Sea	8112	2					
Turtles, Freshwater	8116	2					
Frogs	8140	2					
Other (List by species)							
SALTWATER SHRIMP							
Brown Shrimp	7310						
Pink Shrimp	7320						
Royal Reds	7330						
Seabob	7338						
White Shrimp	7340						
Unclassified	7360						

CERTIFICATION

I hereby certify that the above is a true and correct report.

FIRM NAME	TOWN OR CITY
SIGNATURE (Authorized Official)	PARISH
DATE	STATE ZIP CODE

Completion of this form is required in accordance with LSA-R.S. 56:345 which provides for the reporting to the Department of Wildlife and Fisheries in detail the weight in pounds of each kind of fish caught, purchased or shipped out of the state.

The definition of fish is all fish, shellfish, crustaceans, frogs, turtles, and other acquatic organisms which have a sport or other economic value.

within its jurisdiction. A proposed regulation must be published in the *Texas Register* and, within a thirty-day period after publication, a public hearing must be held in each affected coastal county with notification of the time and place of the hearing published in the county newspaper. After the thirty-day public comment period, the commisssion may adopt a final regulation which becomes effective twenty days after submission to the *Texas Register* for publication.

Many of the management procedures are established by legislative action.

(A) *Fishing areas* (Figure 11)

Fishing area regulations are mainly keyed to fishing gears. Pole and line, rod and reel and throwline are legal gears for the taking of saltwater fishes in all areas with certain specified gear restrictions. Minnow seines, cast net, dip net and perch trap may be used for the taking of bait in all areas. Trotlines, including rubber band lines and sail lines, are legal in all but a few designated trotline-free areas. Trammel nets and drag seines may be used in over 51% of the bay waters. Areas closed to the use of all forms of nets and seines in bay waters are illustrated in Figure 11. Gill nets are permitted only in portions of Nueces, Corpus Christi, San Antonio, Matagorda and Galveston Bays. Trammel nets, gill nets and drag seines are permitted in the Gulf except within one mile of a pass or certain fishing piers and within 1000 feet of Padre Island in Nueces County. Purse nets may be used only for the taking of menhaden in Gulf waters. Fish trawls are permitted only in certain Gulf areas. However, fish taken incidental to legal shrimping operations may be retained, except that red drum and spotted seatrout may not be kept during 16 December–28 February.

(B) *Fishing gears:*

Trotlines may not exceed 600 feet in length with hooks at least three horizontal feet apart. Trotlines may be baited only with natural bait (whole or cut-up portions of fish, shrimp, crab or plant material). Trotlines must be at least 500 feet apart and may be placed no closer than 200 feet from the Gulf Intracoastal Waterway.

Snag lines are unbaited trotlines legal only in Baffin Bay, Alazan Bay, and their tributaries. Snag lines must be set in waters less than two feet deep at mean low tide and must have hooks spaced not less than six inches apart.

Sail lines are special trotlines with one end on shore, pier or jetty and with the other end attached to a wind-powered device or sail and attended at all times. Only one sail line may be used per fisherman, and fish may not be sold. No sail line may contain more than thirty hooks, and no hook may be placed more than 200 feet from the sail. Sail lines may be baited with natural or artificial bait.

Drag seines and trammel nets in most areas may not exceed 1800 feet in length. Webbing may be no less than three-inch stretched mesh and, for trammel nets, the outer walls of webbing may not be more than sixteen-inch stretched mesh. In Galveston and Trinity Bays in Chambers County, trammel nets may not exceed 1200 feet in length with no less than three-and-a-half-inch stretched mesh. In the Gulf drag seines and trammel nets may not exceed 2000 feet in length with no less than three-inch stretched mesh.

Gill nets may not exceed 1800 feet in length with no less than three-inch stretched mesh except in Nueces Bay where webbing no less than six-inch stretched mesh may be used. Minnow seines may be no more than twenty feet in length and perch traps may be no greater than eighteen cubic feet.

(C) *Fishing season:*

Trotlines, trammel nets, drag seines and gill nets may not be used from 1:00 P.M. on Friday through 1:00 P.M. on Sunday of each week in most areas. Snag lines may be used each day of the week from 1 December through 31 May. In Galveston Bay in Galveston County, gill nets and trammel nets may be used from 15 August through 15 May except that nets are prohibited from sunset on Friday through sunset on Sunday beginning 15 August through sunset on Labor Day. Trotlines are prohibited from sunset on Friday through sunset on Sunday beginning the Saturday of Memorial Day weekend through sunset on Labor Day.

In Galveston Bay in Harris County, trotlines are prohibited from the Saturday of Memorial Day weekend through sunset on Labor Day and from sunset on Friday through sunset on Sunday during the remainder of the year.

In Galveston Bay in Chambers County, trammel nets and trotlines may not be used from sunset on Friday through sunset on Sunday beginning the Saturday of Memorial Day weekend through sunset on Labor Day.

In portions of Corpus Christi Bay in Nueces County, gill nets may not be used during May, June, July or August.

(C) *Catch and possession limits:*

The holder of a sport fishing license may catch and retain no more than ten red drum in one day and possess no more than twenty red drum. The Texas Parks and Wildlife Commission sets an annual commercial harvest quota on red drum for each bay system and the Gulf of Mexico in Texas waters. The quota must be between 1.4 and 1.6 million pounds per year for the entire coastal area. It is unlawful for anyone other than the holder of a commercial fishing license to catch and retain more than twenty spotted seatrout in one day or to possess more than forty spotted seatrout.

(E) *Size limits:*

The minimum size for possession of red drum for both recreational and commercial fishermen is four-

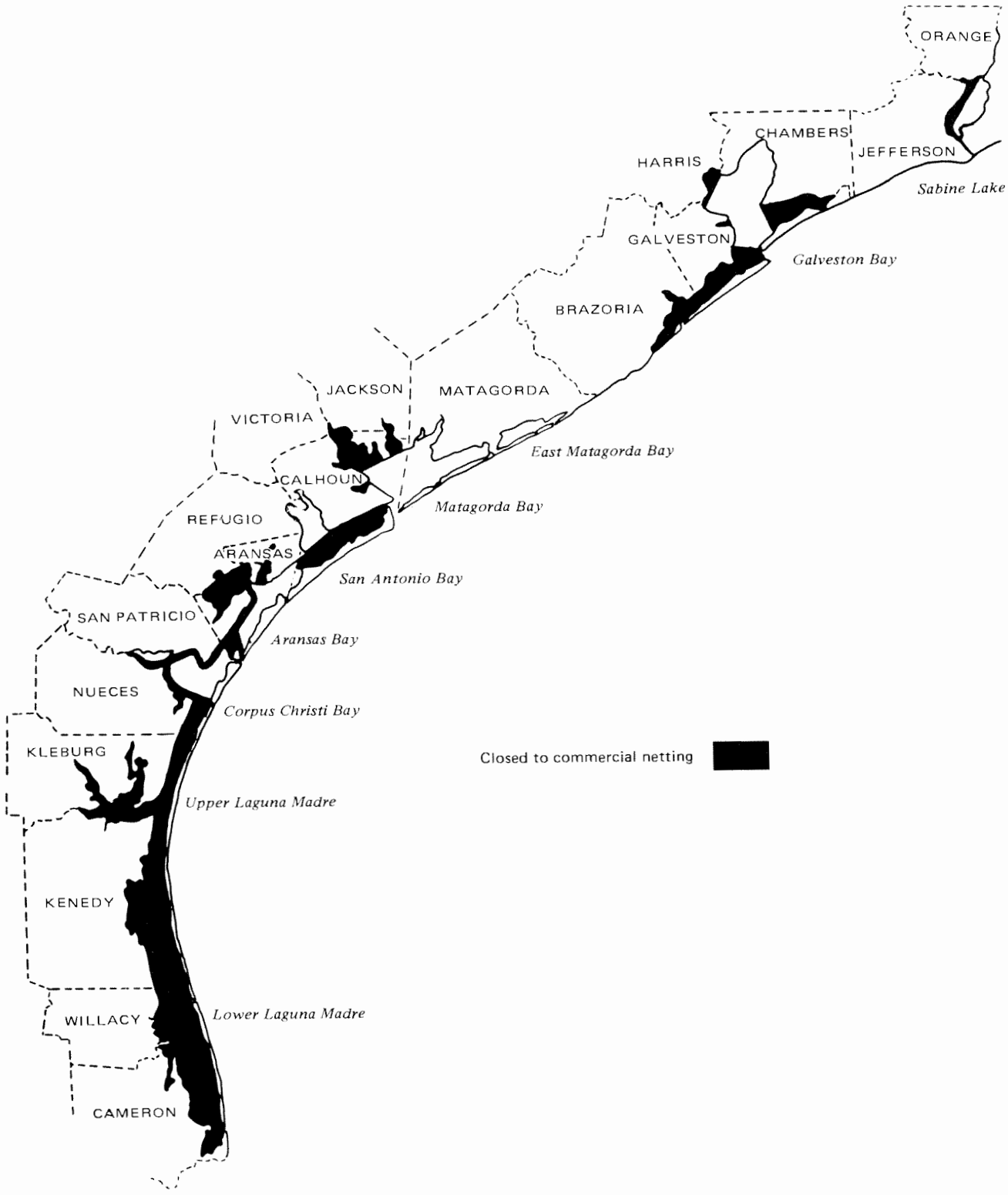

ORANGE
CHAMBERS
JEFFERSON
HARRIS
Sabine Lake
GALVESTON
Galveston Bay
BRAZORIA
JACKSON
MATAGORDA
VICTORIA
East Matagorda Bay
CALHOUN
Matagorda Bay
REFUGIO
ARANSAS
San Antonio Bay
SAN PATRICIO
Aransas Bay
NUECES
Corpus Christi Bay
KLEBURG
Upper Laguna Madre
KENEDY
WILLACY
Lower Laguna Madre
CAMERON
Closed to commercial netting

Figure 11

teen inches. The holder of a sport fishing license may possess no more than two red drum over thirty-five inches, and the holder of a commercial red drum license may possess no red drum over thirty-five inches. The minimum possession size for spotted seatrout is twelve inches.

Penalties for Violations—Enforcement Operations

The responsibility of enforcing fishing regulations in all bay systems and in the Gulf of Mexico to nine nautical miles offshore is with the Parks and Wildlife Department Law Enforcement Division.

(A) A person who violates the licensing provisions for a commercial red drum license or regulations for the use of nets and trotlines in Chambers, Galveston and Harris counties is guilty of a misdemeanor and on a first conviction is punishable by a fine of not less than $25 nor more than $200. On a second or subsequent conviction the person is punishable by a fine of not less than $200 nor more than $500. Nets, trotlines and all red drum in possession shall be confiscated on any conviction.

(B) The holder of a sport fishing license who violates the daily catch and retention limits is guilty of a misdemeanor and on a first conviction is punishable by a fine of not less than $25 nor more than $200. On a second or subsequent conviction the person is punishable by a fine of not less than $200 nor more than $500 and shall forfeit the fishing license under which he is fishing. All equipment, other than vessels, shall be confiscated upon conviction (expired 31 October 1978).

(C) A person who sells red drum from a closed bay system under the quota regulations, fails to allow access to red drum sales tickets or violates a proclamation of the Parks and Wildlife Commission regarding commercial fishing regulations is guilty of a misdemeanor and shall on the first offense be punishable by a fine of not less than $25 nor more than $200, and each fish constitutes a separate offense. A second or subsequent offense is punishable by a fine of not less than $200 nor more than $500 and forfeiture of all commercial fishing or dealer licenses.

Statutory penalties for violating general fishing regulations, such as would apply to spotted seatrout, are:

(A) A person who violates any proclamation of the Parks and Wildlife Commission is guilty of a misdemeanor and is punishable by a fine of not less than $25 nor more than $200, and each fish constitutes a separate offense.

(B) Numerous special penalties regarding specific violations are contained in the Parks and Wildlife Code.

Scientific Permits

The department may issue an annual permit to a qualified person to take protected wildlife for propagation purposes, zoological gardens, aquaria and scientific purposes. The application for a permit is made under oath and must state the species of protected wildlife to be taken or transported as well as the purpose of collection or transportation. The application must be endorsed by two recognized specialists in the biological field who have known the applicant at least five years. The holder of a permit shall file a report with the department before 11 January of the year following expiration of the permit showing the number and species of wildlife taken and their disposition. The department may cancel a permit if any violation occurs.

An employee of the department may take, transport and release any wildlife and fish in the state for investigation, propagation, distribution or scientific purposes.

Limited Entry

There are no statutory provisions for limited entry in Texas.

Data Reporting Requirements

A monthly marine products report (Figure 12) is required of all seafood dealers who purchase directly from the fisherman and must include the species, poundage, price per pound, gear used and location of capture.

Each individual sales transaction of all saltwater fishes must be recorded in triplicate at the time of the initial purchase only on an individual sales transaction form supplied by the department (Figure 13). The form must include the date of the sale, the dealer's code number and name of purchaser, the fisherman's name, the red drum license number of the fisherman (if red drum are sold), the commercial license number of the fisherman, the equipment used, the pounds of each species of fish sold and the bay system or area of the Gulf of Mexico where captured (Figure 14). The responsibility for obtaining and completing the individual sales transaction form is on the holders of wholesale or retail truck or fish dealer's licenses who initially purchase the fish from a commercial fisherman, unless the fish are sold by a commercial fisherman directly to a final consumer in which case the form is obtained and completed by the commercial fisherman. Original copies of the forms are filed with the department no later than the tenth day of the following month.

Figure 12

MARINE PRODUCTS REPORT
(Dealer's Report)

No. _____ For the Month of: _____ 19 ____

Dealer: _____

Address: _____

Code	Species Name	Name of Bay	Water Code	No. of Pounds	Price Per Pound	Name of Bay	Water Code	No. of Pounds	Price Per Pound
0570	Ling								
0925	Croaker								
1081	Drum								
1082	Redfish								
1235	Flounder								
1410	Grouper								
1970	Whiting								
2341	Mullet								
2720	Pompano								
3764	Red Snapper								
3380	Gafftop Catfish								
3447	Trout								
3560	Sheepshead								
1940	Mackerel								
4740	Warsaw								
5260	Unclassified Food								
5290	Unclassified Scrap								
7000	Crab (Live Weight)								
	Others (List)								
	Shrimp (Heads on)								
7360	Brown and Pink		9999						
7361	White		9999						
7362	Other		9999						
8030	Squid								

NOTE: If catch is from the Gulf, so indicate under "Name of Bay" columns.

Species Code	Species Name	Name of Bay	Water Code	No. of Pounds	No. of Barrels	Price Per Barrel
7891	Oysters					

NOTE: Do not complete section under "Water Code."

GEAR USED: _____

_____

TEXAS PARKS AND WILDLIFE DEPARTMENT

3615 La Paz Drive
Corpus Christi, Texas 78415

Marine Laboratory
P. O. Box 8
Seabrook, Texas77586

This report is due in one of the above offices of the Texas Parks and Wildlife Department before the 10th day of each month in accordance with H.B. 175, Reg. Ses. 44th Leg., and S.B. 624, Reg. Ses. 65th Leg.

PWD 227 (9/77) FC 3000

Figure 13

TEXAS PARKS AND WILDLIFE DEPARTMENT
4200 SMITH SCHOOL ROAD AUSTIN, TEXAS 78744
COMMERCIAL FISH LANDINGS

INDIVIDUAL SALES TRANSACTION

MONTH DAY YEAR DATE OF SALE

1 3-00007-0003
FORM NO.

FISHERMAN'S NAME

BUSINESS NAME

COMMERCIAL LICENSE NO.

NEILL BROWN SELLER
BOX 463
FULTON TX 78358

RED DRUM LICENSE NO.

BAY OR GULF WHERE FISH WERE TAKEN:
CIRCLE ONLY ONE AREA CODE - SEE MAP ON FOLDER

SABINE	GALVESTON	MATAGORDA	SAN ANTONIO	ARANSAS	CORPUS CHRISTI	UPPER LAGUNA MADRE	LOWER LAGUNA MADRE	GULF OF MEXICO
1	2 3 4	5 6 7	8 9	10 11	12 13	14 15	16 17	20 21 22 23 24

GEAR USED: CIRCLE ONLY ONE NUMBER

1 TROTLINE	5 SEINE	9 GIG	13 CRAB TRAWL
2 TRAMMEL NET	6 SNAGLINE	10 SHRIMP TRAWL	14 OYSTER DREDGE
3 GILL NET	7 LONGLINE	11 FISH TRAWL	15 OYSTER TONGS
4 ROD AND REEL	8 PURSE SEINE	12 CRAB TRAP	16 OTHER

SPECIES	CODE	POUNDS	PRICE PER LB. $	PRICE PER LB. CENTS	FOR DEALER USE
RED DRUM	01				
BLACK DRUM	02				
SPOTTED SEATROUT	03				
SAND SEATROUT	04				
FLOUNDER	05				
SHEEPSHEAD	06				
ATLANTIC CROAKER	07				
GAFFTOP CATFISH	08				
WHITING	09				
POMPANO	10				
MULLET	11				
RED SNAPPER	12				
GROUPER (WARSAW)	13				
UNCLASSIFIED FOOD	14				
UNCLASSIFIED SCRAP	15				
CRABS (LIVE WEIGHT)	80				
OTHERS (LIST):					

OYSTER SALES	CODE	QUANTITY (NO. OF UNITS)	PRICE PER UNIT $	PRICE PER UNIT CENTS	YIELD IN GALS./UNIT	FOR DEALER USE
OYSTERS IN SACKS	81					
OYSTERS IN BUSHELS	82					
OYSTERS IN GALLONS	83					

PWD 178 (10/78) FC 3000 TEXAS PARKS AND WILDLIFE COPY

Figure 14

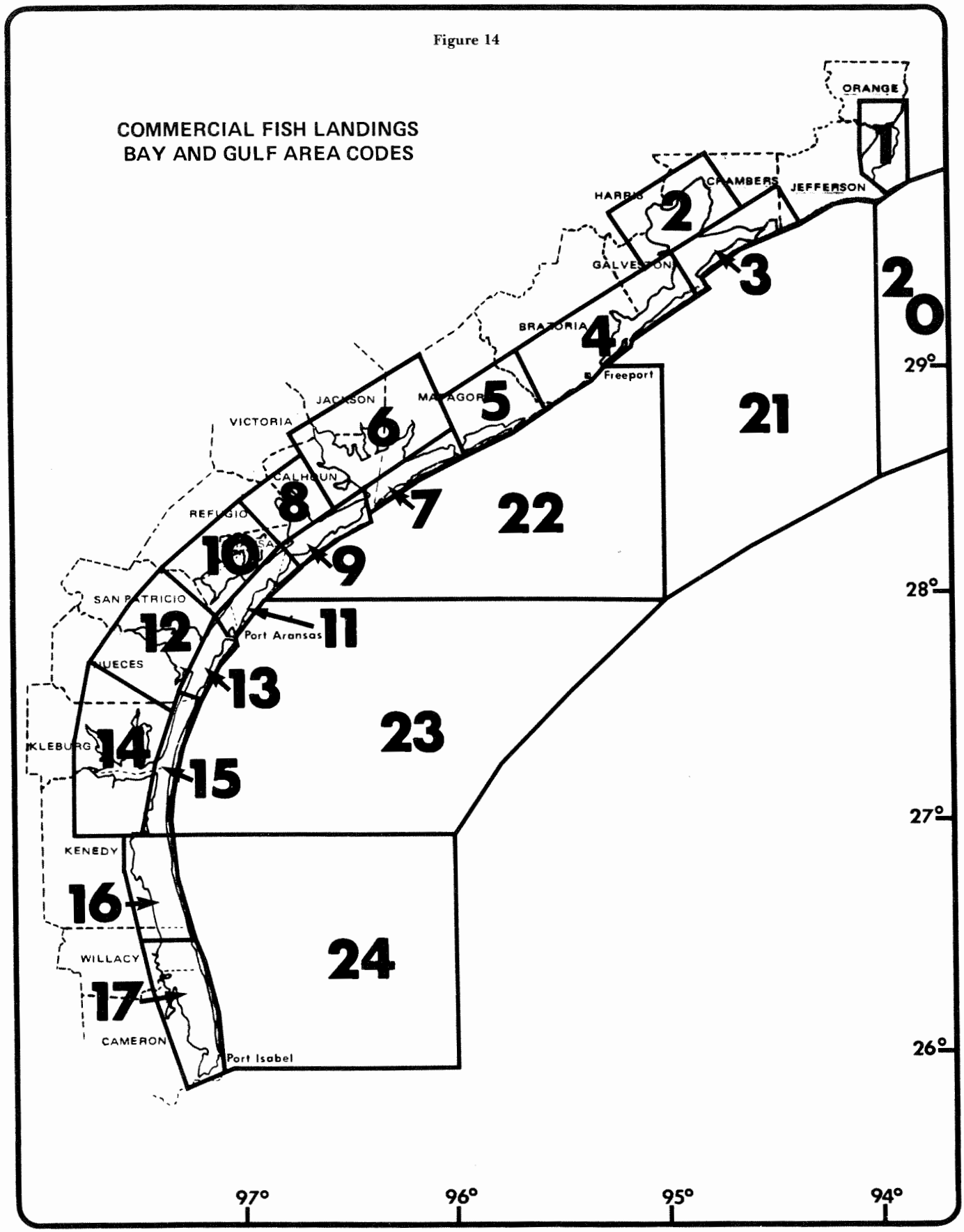

COMMERCIAL FISH LANDINGS
BAY AND GULF AREA CODES
ORANGE
1
HARRIS
2
CHAMBERS
JEFFERSON
GALVESTON
3
20
BRAZORIA
4
Freeport
29°
JACKSON
MATAGORDA
5
6
21
VICTORIA
CALHOUN
8
7
22
REFUGIO
10
9
28°
SAN PATRICIO
12
Port Aransas
11
NUECES
13
23
KLEBURG
14
15
27°
KENEDY
16
24
WILLACY
17
CAMERON
Port Isabel
26°
97°
96°
95°
94°

Table 14. Synoptic Overview of State Management Systems

	Florida	Alabama	Mississippi	Louisiana	Texas
Administrative Organization	Department of Natural Resources (FDNR), Division of Marine Resources, Crown Building, 202 Blount Street, Tallahassee 32304 (904) 488-1555	Department of Conservation and Natural Resources, (ADCNR), Marine Resources Division, P. O. Box 188, Dauphin Island 36528 (205) 861-2882	Department of Wildlife Conservation, Bureau of Marine Resources, P.O. Box 959, Long Beach, MS 39560 (601) 896-4602	Department of Wildlife and Fisheries (LDWF), Seafood Division, 400 Royal Street, New Orleans 70130 (504) 568-5685	Parks and Wildlife Department (TPWD), Fisheries Division, Coastal Fisheries Branch, 4200 Smith School Road, Austin 78744 (512) 475-4835
Legislative Authorization	Chapter 370, Florida Statutes; approximately 111 local laws.	Section 9-2-4-1975, Code of Alabama, statutory laws concerning fisheries.	Chap. 15, Art. 1, A 49-15-1 through 49-15-69, Miss. Code Ann. (1972). Some statutes concerning fisheries. Season and gear types set by the Department of Wildlife Conservation (The Department)	Louisiana Constitution, Article VI, Section 1. Some statutes concerning fisheries.	"Uniform Wildlife Regulatory Act" (Vernon's Ann. P. C. Art. 978 j-1). Three coastal counties are excluded from spotted seatrout regulations; all coastal counties are included for red drum regulations.
Reciprocal Agreements	Limited to fishery access, may not extend to management agreements.	Limited to fishery access, may not extend to management agreements.	The Department may enter into advantageous interstate and intrastate agreements with proper officials	Statutory authority to enter into "reciprocal fishing license agreements" with other states.	Statutory authority to enter into reciprocal fishing license agreements with Louisiana. No statuatory agreement to enter into reciprocal management agreements.

Table 14. (Continued)

	Florida	Alabama	Mississippi	Louisiana	Texas
Licenses	*Dealer Licenses* Resident Wholesale $100.00 Non-resident Wholesale ..... 150.00 Alien Wholesale .... 500.00 Resident Retail ..... 10.00 Non-resident Retail .. 25.00 Alien Retail ..... 50.00 Alien & Non-resident Commercial Fishermen ..... 25.00 *Boat Licenses* Less than 12' ..... $ 2.00 12'-16' ..... 6.00 16'-26' ..... 11.00 26'-40' ..... 31.00 40'-65' ..... 51.00 65'-110' ..... 61.50 More than 110' ..... 76.50 Dealer Classification . 10.50	*Gill & Trammel Nets:* 1,200 ft. or less .... $ 5.00 1,200-1,800 ..... 10.00 1,800-2,400 ..... 20.00 2,400-3,000 ..... 40.00 *Seines:* 30 ft. ..... $ 7.50 30 to 300 ft. ..... 15.00 300 to 900 ft ..... 22.50 900 to 3,000 ft ..... 37.50 Wholesale Saltwater Fresh Fish Dealer $25.00 Retail Saltwater Fresh Fish Dealer . $5.00 Non-resident—Pay double license fee Recreational Licenses Resident Non-resident $10.25	Hook and line comm $ 1.00 *Trammel nets, gill nets or seines:** 200 fathoms or less . $ 7.50 200 to 300 ..... $15.00 *Seines or other nets:** 300 fathoms—400 .. $25.00 400 to 500 ..... $50.00	*Gill, trammel nets and seimes:* To 600 feet ..... $10.00 601'-1,200' ..... 20.00 *Comm. saltwater fishing vessels:* 45 feet and less .. $ 5.00 45 feet ..... 10.00 Non resident ..... 1,000.00 *Comm. Fish License:* Resident ..... $ 5.00 Non-resident ..... 1,000.00 *Comm. Angler's License:* $250.00 *Recreational Fishing License:* Resident ..... $ 2.00 Non-resident ..... 6.00 7-Day Trip ..... 3.00 Wholesale Dealer .... 50.00 Non-resident wholesale dealer ..... 150.00 Retail Dealer ..... 5.00 Non-resident retail dealer ..... 50.00 Wholesale Agent 10.00	*Equipment Tags:* Comm. Seine of Net 100 feet ..... $ 1.00 Trot line 300 feet ..... 1.00 *Boat Licenses:* Fish Boat ..... $ 6.00 Skiff ..... 1.00 *Fishing Licenses:* Comb. Hunt & Fish $ 8.75 Res. Fish (Sport) ..... 4.50 Non. Res. Fish (Sport) 10.50 Non. Res. Fish (Sport—5 day) ..... 4.50 Res. or Non-res. 3-Day saltwater sport fish ..... 1.25 Resident Gen. Comm. 10.00 Non-resident Gen. Comm. ..... ≥20.00 Resident Comm. Finfish ..... 50.00 Non-resident Comm. Finfish ..... ≥100.00 Commercial Red Drum ..... 50.00 Fish Guide ..... 25.00 Wholesale Fish Dealer ..... 250.00 Wholesale Fish Truck Dealer ..... 125.00 Retail Fish Dealer $6.00—$20.00 Retail Fish Truck Dealer 25.00

*Ordinance No. 83, passed by the MMCC in March 1978 restricts the maximum length of trammel nets, gill nets and seines to 1000 feet.

Table 14. (Continued)

	Florida	Alabama	Mississippi	Louisiana	Texas
Taxes	None	None	Fish canning factories must pay a privilege tax of $100	None	None
Penalties	Variable, as misdemeanors.	All violations of fishery statutes considered a misdemeanor. Fines range from $25–$500.	*1st and 2nd:* $50 to $500 or up to 30 days imprisonment. *3rd:* Fishing and boat license revoked for 1 year.	All violations of fishing statutes considered a misdemeanor. Fines range from $25 to $500. Provisions for seizure and forfeiture of equipment.	All violations of proclamations of TPWC considered a misdemeanor. Fines range from $25 to $500 and provisions for forfeiture of equipment and license and confiscation of catch.
Data Reporting Requirements	License holders must report statistics monthly.	Wholesale dealers required to file monthly reports at quarterly intervals to the commissioner, detailing weights (lbs) of each species purchased from the commercial fishmen during the preceding month.	Each firm or individual purchasing fish for resale must keep a record of quantity and species purchased. These records are furnished to the department upon request.	Processors or any other first purchasers must report purchases by the tenth of the month following. A full statement of disposition thereof is also made in this report.	Wholesale dealers must provide to the department copies of Individual Sales Transaction forms and a monthly summary of marine products purchased from commercial fishermen which denotes species, poundage, price per pound, gear and location of capture.
Limited Entry	None	None	None	Provisions are available under the statutes.	None
Regulations	Statutory provisions, with little flexibility within the management agency. Size limits: Recreational and commercial. Legal size is 12 inches for spotted seatrout and red drum. No size limit for spotted seatrout in Wakulla, Franklin, and Gulf Counties.	Statutory, with flexibility within the management agency. Size limits: Recreational. Legal size is 12 inches minimum total length for spotted seatrout and 14 inches for red drum. No more than two red drum in possession may exceed 36 inches. Catch and possession limits: Recreational. Daily bag limit of spotted seatrout is 50, possession limit is 100. The same bag and possession limits apply to red drum.	The Department has power to promulgate regulations not set forth by legislative act. Departmental Ordinances—finfish *Ord. 71*—requires that all firms purchasing littoral species and fishermen catching littoral species keep records on those fish bought and/or caught and report same to the department upon request. *Ord. 85*—Delineates areas closed to all netting.	Most are statutory with some flexibility within the management agency. Size limits: Commercial. Legal size is 10 inches total length for spotted seatrout and 16 inches for red drum. Recreational—Cannot keep more than two red drum exceeding 36 inches in length. Catch and possession limits: Recreational. Cannot keep more than a combined total of 50 spotted seatrout or red drum per day, with a maximum two-day catch in possession.	Most are statutory with some flexibility within the management agency—complicated by "county option" system. Size limits: Recreational and commercial. Legal size is 14 inches total length for red drum and 12 inches total length for spotted seatrout. Catch and possession limits: Commercial, cannot retain any red drum over 35 inches in length. Recreational: Cannot keep more than two red drum over 35 inches in length.

Ord. 87 as amended by Ord. 91—defines saltwater sport fishermen, sets daily bag limits on spotted seatrout and red drum and sets size limits.

Size limits: Commercial—Legal minimum size 12 in. total length for spotted seatrout, minimum 14 and 30 in. for red drum.

Recreational—Can keep 2 red drum exceeding 30 in. in total length for a day's catch.

Catch and Possession limits: Recreational—cannot keep more than 50 spotted seatrout and 10 red drum per day, with a maximum three-day catch in possession.

Ord. 94—Sets limits where nets may be set in relation to public and private piers, length of nets and mesh sizes, methods on how nets are to be marked and attended and limits their use within a 1 mile radius of named islands between 15 May and 15 September each year and makes it unlawful to take commercially any red drum in Mississippi from 15 September to 15 November each year. It sets an annual upper limit of 200,000 pounds on the total number of red drum which may be harvested from Mississippi territorial waters.

Catch and Possession Limits: Recreational. Cannot keep more than 10 red drum in one day and possess more than 20. Cannot keep more than 20 spotted seatrout in one day and possess more than 40.

IDENTIFICATION OF PROBLEMS

The following problem areas were identified by the red drum–spotted seatrout subcommittee. The arrangement does not imply a list in terms of any priority or subsequent research timetables.

BIOLOGICAL

1. *Inadequate commercial catch and effort statistics.* Catch data on commercially caught spotted seatrout and red drum provide information on reported landings in a series that is reasonably continuous since 1880. Although "catch by waters" data for finfish are available since 1963, it remains unpublished and is not released on a timely schedule. There is a need to standardize the collection procedures and to report these data on a timely basis. Consistently collected effort data are lacking.
2. *Lack of statistical information on the extent and effect of recreational fishing on the red drum–spotted seatrout resource.* Recreational fishing makes up a substantial but unknown portion of the effort along the Gulf Coast. The need for better harvest effort and extent of fishing pressure is necessary in developing a management system.
3. *Lack of information on population dynamics.* There is very little information on stock size, age composition, size composition, natural and fishing mortality rates and other parameters required for effective management.
4. *Finfish catch in other fisheries.* Large numbers of small, unusable juveniles of many species of finfish are caught, killed and discarded in the shrimp fishery. By-catch of the shrimp fleet should be investigated to determine the impact of shrimping on the populations of red drum and spotted seatrout.
5. *Gaps in life history data.* Complete life history data for these two species are required to provide a basis for conservation regulations when such regulations are necessary. Examples of such data needs are: information on migratory patterns, proper identification of spawning and nursery areas, and identification of subpopulations and the distribution of such populations.
6. *Lack of yield models.* Available data are generally inadequate for the development of useful yield models for red drum and spotted seatrout stocks along the Gulf. In order to utilize available stocks of these two species to achieve maximum benefits, potential yield of these two species throughout their range in the Gulf must be determined.

ECONOMIC

1. *Very little is known about the economics of the commercial red drum and spotted seatrout fisheries.* The primary information needed is the nature and extent of impact on commercial fishermen if these resources are restricted or denied. The question is very complex because the fishermen are involved in a multi-species fishery and are not entirely dependent on red drum or spotted seatrout for their livelihood.
2. *Recreational fishing for these two species will probably continue to increase.* Accurate measurement of this harvest is vital to management. Economic benefits from recreational fishing, both to the fishermen (supplementary food) and to the supporters of the fishermen (bait, tackle and boat dealers, etc.) must be measured. There is a lack of an accurate account of the recreational catch entering commercial channels. Since quantity appearing on the market place is fundamental to price determination, management measures affecting recreational catch and disposition are important to the commercial fishery.
3. *Knowledge of fishermen and boats involved in the fishery as well as the cost and earning data for these boats is needed.*
4. *Data for development of maximum economic yield models to determine cost and returns of fishing effort at the industry level are needed.* Data necessary for the calculation of economic sustainable yield and open access equilibrium should be collected for the red drum and spotted seatrout fisheries.
5. *Information on the economic impact of fishery management regulations is needed.*

SOCIOLOGICAL

1. *There is a lack of sociological information on fishermen (both recreational and commercial), their preferences, traditions, value and lifestyles.* Management of the red drum and spotted seatrout fisheries under any comprehensive management goal must include an adequate knowledge of the social and cultural structures of the user groups.
2. *There is a lack of understanding of principles of planning and development of a fisheries management system.* There is also a lack of communication among professional, legislative and administrative personnel across the Gulf. Lines of communication should be established at all levels to assure full understanding among all personnel involved in the management and implementation process.

3. *There is inadequate communication and misunderstanding of management principles among competing resource users.* Failure to communicate needs and to understand renewable resource management constraints (biological, economic, social and legal) has resulted in uncompromising attitudes among competing harvesting sectors.
4. *The extent of sociological problems which may arise in the future depends on the direction of future management.* While it may be interesting to know the sociological makeup motivating fishermen, sociological problems do not become important until management actions are taken to displace/attract fishermen or to decrease/increase their income. Two classes of problems will arise in the event of change. One class of problems is associated with fishermen's acceptance of altered rules which may cause them to react in unpredictable ways. For example, some management regulations may result in tremendous enforcement costs or may not achieve desired biological consequences if the fishermen react differently than expected. The second class of problems derives from the exit/entry of fishermen as a consequence of management action.

ENVIRONMENTAL

1. *Effects of habitat alteration, both natural and man-made affect red drum and spotted seatrout populations.* Extensive losses of estuarine habitat have occurred across the Gulf, and proposed developments may result in very large future losses. Habitat alterations in river basins flowing to the coast also have far-reaching impacts on coastal fisheries resources. Advancing offshore technology and energy demands might conceivably cause deterioration of the quality of large areas to the extent that successful reproduction cannot occur. In either case, production of red drum and spotted seatrout may be reduced. Both short and long term environmental changes can adversely impact the red drum and spotted seatrout populations. Environmental changes can be positive, biologically, and yet pose serious sociological problems. For example, deep inundated dredge cuts or burrow areas can provide refuge for spotted seatrout during extremely cold weather and short-term freshets, but these refuges, with many fish concentrated in small areas, are a source of conflict between user groups.
2. *Pesticides and other pollutants (industrial, agricultural and domestic) entering estuarine systems have detrimental effects on red drum and spotted seatrout populations.*

ADMINISTRATIVE

1. *Administrative problems occur when laws and regulations affecting the fishery are passed without consideration of scientific evidence.* The resource management staff may feel that their efforts are meaningless; resource users may distrust management agencies and feel that resource managers are inept in their endeavors. Administrative problems also arise when administrators are forced to implement management programs (laws and regulations) without adequate funding and staff. This problem is brought about by a general feeling among users that the resource does not need management and can take care of itself. Again, it is only when a resource is faced with extirpation that resource management is appreciated.
2. *There is inadequate coordination among data-gathering and analysis programs, implementing agencies and user groups.* Coordination and communication among these groups have not been adequate to define data needs or to eliminate duplication of effort among groups interested in the red drum and spotted seatrout fisheries of the Gulf. As a result, these efforts have sometimes been diluted and have become less effective.
3. *There is a lack of a formal system of information collection and display for monitoring the effects of management policies, decisions and implementation.* Many of the effects and ramifications of management alternatives and action, both detrimental and beneficial, may go undetected or uncommunicated in the absence of a formal mechanism for this display.
4. *The administration lacks the authority to act in emergency situations.*

OTHER

1. *Clarity of jurisdiction in fishery management.* Alteration of jurisdiction in fisheries management is eminent unless the states' positions are clarified and maintained. Interpretation of PL 94-265 to establish jurisdiction over specified areas is required.
2. *Inability to convert biological and environmental data to a retrievable and utilizable computerized format.*
3. *Lack of information on fishing gear and technique efficiency.*
4. *Lack of information on the effects of marine resource marketing programs.*

ONGOING AND PROJECTED RESEARCH AND MONITORING

INTRODUCTION

Proper management of a fishery resource requires constant research and monitoring. Information must be obtained concerning life history, behavior, response to environmental perturbations, and information on standing stocks and harvest by both recreational and commercial fisheries. Research on basic biology usually entails independent or cooperative programs of universities and state and federal agencies. Estimates of abundance and harvest are usually made by state and federal agencies. Following is a summary of the research and management activities of the various agencies in the Gulf States.

FLORIDA

Universities

1. A. Keith Taniguchi at the University of Miami is working on a doctoral research project which involves the investigation of the effects of temperature, egg stocking density and food types upon the survival and growth of spotted seatrout eggs and larvae.
2. William E. S. Carr of St. Augustine and Jack R. Smith at the University of Florida, Gainesville, are using ultrasonic transmitters to study the spawning movements and spawning sites of red drum.

State Agencies

1. Daniel E. Roberts of the Florida Department of Natural Resources Marine Laboratory, St. Petersburg, is conditioning red drum to spawn on demand and is refining methods to increase larval survival.
2. Mark M. Leiby, John E. Darovec and Kevin M. Peters are describing the eggs, larvae and osteology of red drum from maricultured adults.

Federal Agencies

Gary E. Davis and Vivie Thue of the National Park Service (U.S. Department of Interior), Everglades National Park, Homestead, Florida, are involved in the Everglades National Park Fisheries Survey which has been collecting yearly catch and effort data since 1958. Currently they are gathering catch, effort and size-frequency data for both recreational and commercial fisheries. Red drum and spotted seatrout are two of the principal species exploited.

MISSISSIPPI

1. PL 88-309 project 2-262-R involves tagging studies on red drum and spotted seatrout and investigations of the spawning season, size of spawning fish and areas of spawning of red drum and spotted seatrout in Mississippi.
2. PL 88-309 project 2-296-R is designed to monitor recruitment, growth and survival of larval and juvenile fish in Mississippi estuaries. Red drum and spotted seatrout are two of the primary target species.
3. Mississippi Sea Grant project R/LR-1 is investigating the relative impact of commercial netting and sport fishing on red drum and spotted seatrout in Mississippi.

LOUISIANA

Universities

The Cooperative Fishery Research Unit of Louisiana State University, Baton Rouge, is determining the preferred habitat of juvenile spotted seatrout.

State Agencies

1. Besides a study of red drum and spotted seatrout in Calcasieu Lake, Louisiana, the Louisiana Department of Wildlife and Fisheries is conducting several research programs involving these two species. The programs include: stomach analyses, tag retention studies involving 0.1/ha ponds, hormone-induced artificial spawning and studies of the effects of salinity and temperature on eggs and sac-fry.
2. PL 88-309 project 2-270-R involves studies on the relative abundance (by season and by area) of red drum and spotted seatrout as well as studies on their movement and migrations.
3. PL 88-309 project 2-343-R involves efficiencies of mono- and multifilament gill nets of various mesh sizes for red drum and spotted seatrout. Data concerning catch rates, size and weight of fish caught, species caught, and relative abundances (by season and by area) will be collected.

ALABAMA

1. Length-weight relationships and length-frequency data are being derived from historical (since 1964) catch records from local spotted seatrout fishing rodeos.
2. Juvenile red drum and spotted seatrout time of appearance and frequency are being monitored through ongoing shrimp monitoring and assessment programs.
3. PL 88-309-R project 2-330-R involves tagging, recapture and spawning studies with a number of marine finfish, including red drum and spotted seatrout.

TEXAS

Universities

1. David A. McKee of Corpus Christi State University, Corpus Christi, is preparing a master's thesis entitled *"Growth Rate, Length-Weight Relationship and Condition Factor of Red Drum* (Sciaenops ocellata) from the Natural Environment and Electric Generating Station's Cooling Lake."
2. Donald E. Wohlschlag at the University of Texas Marine Science Institute, Port Aransas, is working in conjunction with the Texas Department of Water Resources to study the effects of salinity on the respiration of small (< 12.7 cm. in length) spotted seatrout and red drum. Experiments are being run at 15°C and 28°C. He proposes to continue working with small fish and to investigate the rate of fish acclimatization to high and low salinities.
3. Connie Arnold at the University of Texas Marine Science Institute, Port Aransas, is involved in red drum spawning, feeding and mariculture. He is attempting to induce spawning in red drum by altering temperature, salinity and photoperiod. Feeding studies involve evaluation of the nutritional value of various food sources for cultures of juvenile red drum. He is investigating the use of enclosed system raceways for the mariculture of red drum for the purpose of stocking selected Texas bays.

State Agencies

The Texas Parks and Wildlife Department is involved in several major programs dealing with red drum and spotted seatrout. These programs include the following:

1. Red drum and spotted seatrout population monitoring programs (DJ project F-32-R).
   a. Trends in abundance of large fishes in eight Texas bay systems are being monitored by gill net and trammel net collections. The gill nets used are 188.9 m long with individual 45.7 m long sections of 7.6, 10.2, 12.7, and 15.2 cm stretched mesh. The trammel nets used are 365.8 m long.
   b. Trends in the abundance of juvenile or small fishes from eight Texas bay systems are being monitored by bag seines.
   c. Estimates of the abundance of large fishes and evaluation of trammel net catch efficiencies in eight Texas bay systems are being affected by rotenone samples of 1.66/ha areas surrounded by a trammel net. Rotenone sampling has recently been eliminated from the TPWD program due to high cost of the chemical and the number of personnel required for the sampling.
   d. Placement of internal abdominal anchor tags in red drum and spotted seatrout will continue in order to determine fishing mortality, growth and movement for each species. At present, return rates average 11.6% for red drum tags and 10.8% for spotted seatrout tags.
2. Red drum and spotted seatrout sport and commercial harvest monitoring program. (PL 88-309 project 2-310-R).
   a. Sport creel surveys of weekend boat anglers are being conducted and will continue to be conducted in order to determine the seasonal harvest of red drum and spotted seatrout in the bay systems, average length and weight of the species, species composition of the catch, catch per unit effort, angling pressure in man-hours, number of trips, home residence of anglers, proportion of successful fishing parties and catch-ability of different bait types. Recently, surf, jetty, inshore Gulf, charter boat and "head" boat fishermen have been included in the sport creel census.
   b. Commercial harvest of red drum and spotted seatrout is determined through interviews with commercial fishermen and with owners of fish houses, and through submission of monthly marine product reports and individual sales transaction reports from dealers. Information gained includes fisherman's name and license number, date of sale, weight of fish sold, bay system where the fish were caught and type of gear used. From these data, species and size composition of the harvest can be determined as well as catch rate by gear type and relative fishing pressure for each bay. Fish house visitations to monitor the quality of the catch data provided by fishermen and fish houses will be continued.
   c. A special trotline study was conducted in upper and lower Laguna Madre to determine the relative catch rates for natural baits and plastic worms. This study terminated 14 August 1978.
1. Marine culture and enhancement program.
   a. Techniques are being developed to determine the age of red drum and spotted seatrout using fish scales.
   b. Red drum are being captured and held in two 22,000-l tanks at Palacios and Port Aransas for brood stock. Biologists are trying to induce spawning by altering temperature and photoperiod. The fingerlings produced by such a spawn will be tagged with magnetic nose tags and released into Texas bays.

GULF COAST

NMFS has a contract with Human Science Research Incorporated for a creel survey along the Gulf Coast. This survey was begun in October 1978.

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