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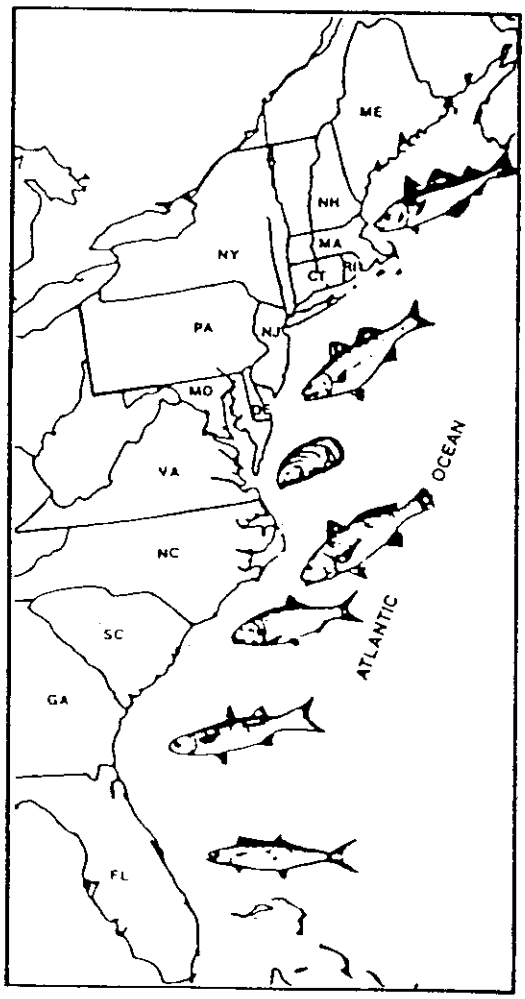

FISHERY MANAGEMENT PLAN FOR SPANISH MACKEREL

NOVEMBER 1990

FISHERY MANAGEMENT PLAN

FOR

SPANISH MACKEREL

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FISHERIES MANAGEMENT REPORT NO. 18

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We thank the Spanish Mackerel Technical Committee and Board for their input, guidance, and comprehensive reviews of the Spanish Mackerel Fishery Management Plan (FMP). Development of the text of this plan relied heavily on the Gulf of Mexico and South Atlantic councils' joint Coastal Pelagics FMP and subsequent amendments. We thank the authors of this plan for their comprehensive treatment of the data. Portions of the text were paraphrased and often quoted verbatim for the original FMP and amendments without due credit indicated. Finally, we thank Dee Willis for typing the numerous drafts and final documents.

1.0 EXECUTIVE SUMMARY

Spanish mackerel is an important commercial and recreational species along the Atlantic coast of the United States. The commercial fishery is concentrated along the southern coast of Florida (81% in 1988), whereas the recreational fishery is coastwide. Prior to the development of this Atlantic States Marine Fisheries Commission (ASMFC) interstate fishery management plan (FMP), management of Spanish mackerel was under the jurisdiction of the Gulf of Mexico, South Atlantic, and Mid-Atlantic Fishery Management councils. Federal regulations pursuant to the FMP for the Coastal Migratory Pelagic Resources (Mackerels) apply to the Exclusive Economic Zone, and not to the territorial sea and internal waters of the various states. The purpose of developing an interstate FMP is to conserve the Spanish mackerel resource and to achieve compatible management among the states that harvest Spanish mackerel, and between the states and the federal government.

Spanish mackerel inhabit coastal waters of the western Atlantic Ocean from the Gulf of Maine to the Yucatan Peninsula. On the Atlantic coast they are most abundant from Chesapeake Bay to southern Florida. Spanish mackerel are migratory, moving northward each spring, spending summer in the northern part of their range, and migrating south in fall. Spanish mackerel become sexually mature in their second and third year of life when about 250 to 350 mm fork length (FL). Their spawning season is protracted, and larvae have been collected from April through September. Some juveniles use estuaries as nursery grounds, but most remain in nearshore ocean waters. The maximum life span of Spanish mackerel is about 11 years, and females grow faster than males.

Spanish mackerel is of major commercial importance to the gill net fishery in southern Florida where the main fishing areas are the Florida Keys and the Atlantic coast between Palm Beach and Cape Canaveral. A small directed gill net fishery exists off the coast of North Carolina for Spanish mackerel. Smaller fisheries involve incidental catches in the North Carolina and Virginia pound net fisheries, the North Carolina long haul seine fishery and to a lesser extent in Georgia and South Carolina.

Spanish mackerel are also an important species for the private boat and charter boat sport fishery along the South Atlantic coast. Most anglers fish from private boats, although good catches are made from charter boats and fishing piers.

Sharp declines in the abundance of Spanish mackerel in the late 1970s led to the development of state and federal fishing regulations to restrict the catch and allow rebuilding of the stocks. Recent stock assessments indicate that management measures have been effective in starting to rebuild the Spanish mackerel stocks. The effectiveness of cooperative management efforts, in conjunction with the fact that Spanish mackerel are harvested predominantly in state jurisdictional waters, led to development of this interstate fishery management plan.

A flexible plan is proposed which will track the federal Coastal Migratory Pelagic Resources FMP. Problems identified in the fishery include overfishing; allocation concerns due to seasonal migration and availability patterns; non-uniform regulations among the states, and between

the states and federal government; biological and statistical data gaps; and early season closures and disruption of traditional fisheries and markets.

The following objectives are specified to address the aforementioned problems:

1. To allow recovery of the overfished population and stabilize the stock at a level capable of producing maximum sustainable yield

2. To achieve compatible management throughout the range

3. To provide a flexible management system for the resource which is adaptable to changes in resource abundance, new scientific information, and changes in fishing patterns among user groups or by area

4. To promote cooperative interstate research and comprehensive monitoring activities that furnish information for effective management, and establish a mandatory and timely reporting system for monitoring catch and quotas

5. To minimize disruption of traditional fisheries and markets for Spanish mackerel

6. To minimize waste in the fisheries

The plan recognizes the Mackerel Stock Assessment Panel, a group appointed by the Councils, as the official group which makes annual determinations of Acceptable Biological Catch (ABC) for Spanish mackerel, and recommends that one or more technical representatives from the states be represented on the panel and on ASMFC's Spanish Mackerel Plan Review Team. The report and recommendations of the stock assessment panel will provide the basis for annual adjustments in Total Allowable Catch (TAC), bag limits, and other management options (size limits, gear restrictions, trip limits, etc.), as necessary to limit the catch of each user group to its allocation. The ASMFC Plan Review Team will conduct annual reviews of this FMP and will recommend amending the FMP through the ASMFC Advisory Committee to the Interstate Fishery Management Program (ISFMP) Policy Board. Upon approval of recommendations by the ISFMP Policy Board, individual states will be asked to implement the specified management actions.

The following fishery regulations apply to federal waters and are recommended for adoption by states in state waters:

Fishing Year - April 1 - March 31

Management Area - From the boundary of Dade/Monroe counties in south Florida along the Atlantic north through New York.

Minimum Size - 12 inches fork length (FL) or 14 inches total length (TL).

Quotas - Catch levels for both the commercial and recreational fisheries set by the Council each fishing year. When quotas are reached, harvest of mackerel in federal waters shall be zero for the remainder of the fishing year.

Recreational Fishery Regulations - 10 fish daily possession limit except for Florida which presently has a 4 fish daily possession limit. The Florida possession limit will be raised to 5 fish in January, 1991. Annual permits issued by NMFS are required for charter boats fishing for Spanish mackerel for hire in federal waters.

Commercial Fishery Regulations - Annual permits are required for vessels fishing in federal waters under commercial quotas. All fishermen who apply for federal permits must demonstrate a specified portion (presently 10%) of their earned income is derived from commercial fishing. States also should require permits as a mechanism for separating commercial and recreational fishermen. In addition, gear restrictions, trip limits, and landing restrictions have been employed by the Council and some states to allow achievement of target quotas while preventing season closures and disruption of traditional markets/fisheries.

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2.0 INTRODUCTION

The Spanish mackerel *(Scomberomorus maculatus)* (Robins et al. 1980) is an important component of the commercial and recreational fisheries along the Atlantic coast and throughout the Gulf of Mexico. In 1986, Spanish mackerel ranked 16th in the Gulf subregion and 4th in the South Atlantic in estimated total number of fish caught by recreational fishermen (NMFS 1987). The commercial fishery is predominantly centered in southern Florida, whereas recreational fishing occurs throughout the species' range. Increased catches of Spanish mackerel in the northern part of the range have occurred in the most recent years.

Sharp declines in abundance of Spanish mackerel in the late 1970's led to the development of state and federal fishing regulations to restrict the catch and allow rebuilding of the stocks. Recent stock assessments indicate that management measures have been effective in allowing the continued recovery of Spanish mackerel stocks. The effectiveness of cooperative management efforts in conjunction with the fact that Spanish mackerel are harvested predominantly in state jurisdictional waters, make it appropriate to develop an interstate fishery management plan. Compatible management throughout the range is essential to continue the strides made by management efforts to date in rebuilding the stocks. This document is intended to provide up-to-date scientific information on the status of the Atlantic Migratory Group of Spanish mackerel, fishing effort, and regulatory situations in the Atlantic states. Important information gaps are identified and management measures compatible with federal regulations are recommended for implementation by participating states.

2.1 Commission and Council Management Activities

The Atlantic States Marine Fisheries Commission (ASMFC) is a joint agency of the fifteen Atlantic coastal states. It was officially established in 1942 to promote better utilization of the fisheries of the Atlantic seaboard by the development of a joint program for the promotion and protection of such fisheries. The ASMFC is a recommendatory body composed of three representatives from each state. In 1980 the ASMFC Interstate Fisheries Management Program (ISFMP) was established as a result of cooperative management efforts between the states and the National Marine Fisheries Service (NMFS). A number of interstate fishery management plans have been developed since the program's inception, including plans for shad and river herring, menhaden, striped bass, northern shrimp, summer flounder, bluefish, weakfish, red drum, spotted seatrout, spot, Atlantic sturgeon, and croaker. Because ASMFC has no regulatory authority, implementation of ISFMP fishery management plans must take place through regulatory action by individual states. States have management authority within their internal waters and the territorial sea which extends three nautical miles off the Atlantic coast.

The Magnuson Fishery Conservation and Management Act (MFCMA) of 1976 provides for the conservation and exclusive management by the federal government of all fishery resources within the U.S. Exclusive Economic Zone (EEZ). The EEZ extends from the territorial sea to 200 nautical miles from shore. Fishery management in the EEZ is based on fishery management plans developed by eight

regional fishery management councils. The U.S. Secretary of Commerce has the responsibility for implementing the plans through federal fishing regulations.

2.2 Brief History of Council and Interstate Mackerel Management

The South Atlantic and Gulf of Mexico Fishery Management Councils prepared a joint fishery management plan for coastal migratory pelagic resources of the Gulf of Mexico and the South Atlantic, which includes Spanish mackerel, king mackerel, cero mackerel, cobia, dolphin, little tunny, and bluefish (Gulf of Mexico only) (GMFMC and SAFMC 1983). This plan, hereinafter referred to as the Coastal Pelagics FMP, was approved in November of 1982 and was implemented by federal regulations in February 1983. In September, 1985, Amendment 1 to the Coastal Pelagics FMP was approved to address new problems and issues and to provide more flexible and timely management response, particularly for king mackerel (GMFMC and SAFMC 1985). Amendment 2, implemented in March, 1987, resulted from the need for a substantial reduction of catch of Spanish mackerel to allow the stock to recover from a population decline (GMFMC and SAFMC 1987). Amendment 2 clarified the intent of the Councils to set total allowable catch (TAC) for mackerels within framework guidelines, revised maximum sustainable yield, modified the fishing year, delineated Spanish mackerel groups, established allocation procedures for Spanish mackerel, regulated mackerel fishing gear, and provided for fishing permits. Amendment 3 prohibited the use of drift gill nets in the Spanish mackerel fishery (GMFMC and SAFMC 1989a). Amendment 4 reallocated Atlantic Migratory Group of Spanish mackerel between commercial and recreational fishermen from the previous 76% commercial and 24% recreational to 50% each based on catches that occurred during the early to mid-1970s (GMFMC and SAFMC 1989b). Amendment 5 extended the management area of the Atlantic Migratory Group of Spanish mackerel through the Mid-Atlantic Council's area of jurisdiction, revised the definition of "overfishing," redefined recreational bag limits as daily limits instead of trip limits, required that coastal pelagic fish regulated by minimum size limits must be landed with head and fins intact, and established a $23 annual fee for commercial and charter permits beginning April 1, 1991 (GMFMC and SAFMC 1990).

Spanish mackerel was identified as a high priority species by ASMFC and in 1988, development of a Spanish mackerel interstate fishery management plan was initiated, the purpose of which was to further conserve the resource and enhance compatibility between state and federal regulations. A Spanish Mackerel Technical Committee was established with members from North Carolina, South Carolina, Georgia, Florida, NMFS, the U.S. Fish and Wildlife Service (FWS), and ASMFC. The North Carolina Division of Marine Fisheries prepared this plan under a FWS contract through the ASMFC. The South Atlantic State-Federal Board, and the Spanish Mackerel Board and Technical Committee provided general guidance, policy, and technical expertise in the development of the plan. Dr. John R. Maiolo, Chairman, Department of Sociology and Anthropology, East Carolina University, prepared the socioeconomic section (7.0) of this plan.

3.0 DESCRIPTION OF SPANISH MACKEREL STOCKS

Compilations of biological and fisheries data on Spanish mackerel were presented in species profiles prepared by Berrien and Finan (1977), Godcharles and Murphy (1986), and Lukens (1989).

3.1 Distribution and Seasonal Movements

The Spanish mackerel, as redefined by Collette and Russo (1979, 1984), is restricted to the western Atlantic coast of the U.S. and the Gulf of Mexico. While the stock structure of Spanish mackerel is poorly known, there is some evidence of separate Gulf and South Atlantic subpopulations with a mixing zone off south Florida (Williams et al. 1985). Amendment 2 to the Coastal Pelagics FMP delineated two groups of Spanish mackerel based on evidence from electrophoresis studies, distributional patterns, spawning areas, and the history of exploitation (Skow and Chittenden 1981; GMFMC and SAFMC 1987). The Dade/Monroe County, Florida boundary was accepted as a practical boundary, because both recreational and commercial catch data for the Gulf and Atlantic have used this boundary.

The Atlantic Migratory Group of Spanish mackerel ranges from the Florida Keys northward to New York or southern New England, although occasional strays are found to the Gulf of Maine (Berrien and Finan 1977). Spanish mackerel make seasonal migrations along the Atlantic coast and appear to be much more abundant in Florida during the winter. They move northward each spring to occur off the Carolinas by April or May, off Chesapeake Bay by May or June, and some years, as far north as Narragansett Bay by July (Berrien and Finan 1977). Results of tagging studies in North Carolina have confirmed a southern movement to Florida in the winter and movement north to Virginia in the summer and fall (Phalen 1989).

3.2 General Behavior

Spanish mackerel are fast-moving, surface-feeding fish that form immense schools of similar sized individuals. Schools are often known to pass very near to the beach on their seasonal migrations. They frequently enter tidal estuaries, bays, and lagoons (Berrien and Finan 1977), and most commonly occur within the jurisdictional waters of the Atlantic and Gulf states.

3.3 Age and Growth Parameters

Age and growth rates of Spanish mackerel have been estimated from fish collected along the east coast of Florida, 1956-1958 (Klima 1959); from throughout Florida, 1968-1969 (Powell 1975); from the South Atlantic and Gulf coasts 1977-1981 (Fable et al. 1987), and 1988 (Schmidt and Collins 1989); and from Alabama, 1986 (Helser and Malvestuto 1987). Annulus formation in otoliths reportedly occurs between March and July (Powell 1975; Fable et al. 1987). Klima (1959) described both summer and winter growth rings; however, the "first winter" growth mark was not discerned in later investigations and the small sizes calculated for age 1 (186 mm for females and 178 mm for males) in his study do not agree with later studies.

Spanish mackerel size at age varies between sexes, areas, and years (Table 3.1). Female Spanish mackerel grow faster and reach a larger size than males. Schmidt and Collins (1989) documented the oldest female was 11 years old, while the oldest male was 10 years old. The oldest fish reported by Fable et al. (1987) were an age 9 female and an age 7 male. Powell's (1975) oldest fish was an age 8 female. Schmidt and Collins (1989) reported larger mean sizes at age for Spanish mackerel in the Atlantic than in the Gulf. Faster growth occurred in South Florida than in Northwest Florida or Louisiana (Fable

Table 3.1 Mean back-calculated fork length (mm) at ages, from Powell (1975), Fable et al. (1987), and Helser and Malvestuto (1987). Powell's data were transformed from standard length to fork length by his formula FL = 1.0728 SL + 2.4267.

	Males				Females			
		Fable et al.		Helser and		Fable et al.		Helser and
Age	Powell	(Southeast)	(Fla.)	Malvestuto	Powell	(Southeast)	(Fla.)	Malvestuto
1	337	301	299	305	373	345	348	332
2	421	400	399	359	481	469	475	430
3	459	490	494	413	542	544	557	489
4	489	556	561	452	580	588	607	533
5	511	604	631	486	621	643	654	-
6	-	657	657	489	-	651	665	-
7	-	672	672	-	-	664	682	-
8	-	-	-	-	-	698	698	-
9	-	-	-	-	-	731	730	-

et al. 1987). Mean sizes at age increased for both males and females from 1978 to 1981 (Fable et al. 1987).

Growth rates of individual Spanish mackerel vary widely. Powell (1975), Fable et al. (1987), and Schmidt and Collins (1989) found a wide range of lengths within an age group, with some Spanish mackerel of age 0-5 in the same size interval. Growth equations developed by Powell (1975), Fable et al. (1987), and Helser and Malvestuto (1987) are presented in Table 3.2. Differences between Fable et al.'s (1987) estimates and the other studies may be due in part to the inclusion of older fish (age 9) in their study.

Catch at age data indicate that age 1 and age 2 Spanish mackerel predominate in both the recreational and commercial fisheries. Powell's (1975) data indicated that 42.7% of his sample (2,060 fish) were age 1, 93% were fish age 3 or younger, and 98.1% were fish age 5 and younger. Catch at age tables from the 1989 report of the Mackerel Stock Assessment Panel indicate that, for the Atlantic Migratory Group of Spanish mackerel, 85-96% of the catch from 1984 to 1988 were fish age 3 or younger.

The Coastal Pelagics FMP (GMFMC and SAFMC 1983) based its estimate of instantaneous total mortality (Z) of 0.97^{-1} yr on Powell's (1975) age frequency data. Doi and Mendizabal (1979) calculated a Z of 0.90 yr^{-1} on the Mexican coast.

3.4 Reproduction

Data from the 1989 Mackerel Stock Assessment Report (Mackerel Stock Assessment Panel 1989) indicate an approximate 50:50 sex ratio for Spanish mackerel between 300 and 400 mm. Females predominated at larger sizes. Klima (1959) found that 51% of the gill net catch and 80% of the hook and line recreational catch in south Florida were females. He suggested that the predominance of females in hook and line catches was due to more aggressive feeding behavior by females. More recent studies have indicated similar differences in sex ratio for Spanish mackerel caught with the two gear types. Klima (1959), Fable et al. (1987), and Helser and Malvestuto (1987) established that female Spanish mackerel have a faster initial growth rate than males, and thus recruit to the fishery earlier than males. Data from Fable and Nakamura (1986) indicated two out of 13 purse seine catches of Spanish mackerel had a sex ratio significantly different from a one-to-one ratio, with a preponderance of males. No explanation of these divergent sex ratios was given.

Although some variability of size at maturity has been reported, most Spanish mackerel are fully mature at 350-375 mm FL. Klima (1959) found in his study of south Florida fish that the smallest mature female and male were 250 mm FL and 280 mm FL, respectively. Both sexes were fully mature at 350 mm FL. Finucane and Collins (1986) reported differences in size at maturity between areas. Spanish mackerel males and females from Georgia-Carolinas were first mature at 275-299 mm FL, and all were mature by 400 mm FL and 425 mm FL, respectively. Most males and females from southeast Florida matured at 325-349 mm FL, and all were mature at 375 mm FL. In the Gulf of Mexico all males >350 mm FL and all females >500 mm FL were mature.

Table 3.2 Spanish mackerel growth equations developed by Powell (1975), Fable et al. (1987), and Helser and Malvestuto (in press). All lengths are fork length (mm).

	Male	Female
Powell 1975*	$L_t = 554(1-e^{-0.48(t+1.12)})$	$L_t = 694(1-e^{-0.45(t+0.78)})$
Fable et al. 1987 (southeast)	$L_t = 794(1-e^{-0.24(t=0.94)})$	$L_t = 739(1-e^{-0.33(t+0.99)})$
Fable et al. 1987 (Florida only)	$L_t = 776(1-e^{-0.27(t=0.73)})$	$L_t = 731(1-e^{-0.38(t+0.73)})$
Helser and Malvestuto 1987	$L_t = 552(1-e^{-0.29(t=1.66)})$	$L_t = 604(1-e^{-0.45(t+0.75)})$

* Converted from Standard Length (SL) to Fork Length (FL) using the formula FL = 1.0728 SL + 2.467 (Powell 1975).

Fecundity of Spanish mackerel generally increases with fish size. Earll (1883) reported a 2.7 kg (6 lb) mackerel from the Chesapeake Bay area carried 1,500,000 eggs. An immature female, 823 g (1 lb. 3 oz) and 470 mm (18.5 in) in length, contained approximately 525,000 eggs. Finucane and Collins (1986) estimated fecundity for 52 mackerel ranging from 312-664 mm FL. Fecundity ranged from 100,000 eggs for a 328 mm FL (295 g) female to 2,113,000 eggs for a 626 mm FL (2,415 g) female.

The following relationships of fecundity (F) to fork length (FL) and total weight (TW) were presented by Finucane and Collins (1986):

Georgia-Carolinas	$F = 1.685 \times 10^{-5}(FL)^{3.915}$	$r^2=0.936$, n=11
	$F = 6.346 \times 10^{-1}(TW)^{1.314}$	$r^2=0.953$, n=11
Southeast Florida	$F = 1.027 \times 10^{-2}(FL)^{2.863}$	$r^2=0.926$, n=11
	$F = 9.076 \times 10^{-2}(TW)^{0.919}$	$r^2=0.941$, n=11

The major spawning period of Spanish mackerel in the South Atlantic ranges from May through September (Finucane and Collins 1986; Collins and Stender 1987). Small Spanish mackerel larvae (≤4 mm) occurred from May to September, with largest catches in July (no June collections) (Collins and Stender 1978). Spawning in southeast Florida may extend from April to October (Finucane and Collins 1986). Gonad maturation data from south Florida indicated some spawning throughout the year. Spanish mackerel apparently spawn over the inner continental shelf based on indirect evidence from larval distribution studies. Collins and Stender (1987) collected Spanish mackerel larvae (2-9 mm) along the inner shelf (11-29 m) between Cape Canaveral, FL and Cape Fear, NC. Larval studies in the Gulf of Mexico also indicate that spawning of Spanish mackerel takes place over the inner continental shelf (<34 m) as compared with king mackerel which spawn over the middle to outer continental shelf (Wollam 1970; Dwinell and Futch 1973; Houde et al. 1979; McEachran et al. 1980).

3.5 Larval Distribution

Spanish mackerel larvae were found in nearshore shallow water environments (11-29 m) from Cape Canaveral, Florida to Cape Hatteras, North Carolina by Collins and Stender (1987). No areas of concentrations were found, perhaps because larvae are concentrated at depths less than 9 m, the shallowest sampling depth in this study. Vertical migration to the surface at night was indicated. Spanish mackerel larvae have been collected in neuston samples taken at Breech Inlet, South Carolina, between 23 May and 19 June, 1984-1988, with the exception of one additional Spanish taken 23 October 1984 (B. Stender, S.C. Mar. Resour. Cntr., Charleston, SC, pers. commun.).

3.6 Ecological Relationships

Predator-prey relationships, food chains, and competitive or mutualistic interactions are the most important factors to consider in developing an understanding of biological relationships of fishery species. The following description gives the specific prey and predator organisms for Spanish

mackerel followed by a general discussion of the food chains involved, including larval food chains.

3.6.1 Predator-Prey Relationships of Spanish Mackerel

Spanish mackerel is a major predator on small schooling fishes of the families Cleupidae, Carangidae, and Engraulidae in the coastal pelagic ecosystems of the Gulf of Mexico and the southern U.S. Atlantic coast (Saloman and Naughton 1983). Menhaden have frequently been cited as a principal food of Spanish mackerel (Earll 1883, Miles and Simmons 1951). Klima (1959) reported that 76% of 190 Spanish mackerel stomachs from southeast Florida contained herring-like fishes, principally the scaled sardine and Atlantic thread herring. In Texas, Kemp (1950) examined 611 Spanish mackerel stomachs and found that 13% contained shrimp; 5%, squid; 9%, ribbonfish; 1%, menhaden; and 1%, other species. Anderson and Gehringer (1957) listed the round scad (*Decapturus punctatus*) as a food of the Spanish mackerel.

Spanish mackerel are carnivorous, primarily piscivorous, as juveniles and adults. Fishes occurred in 95% of the stomachs of juvenile (117-432 mm FL) trawl-caught fish, and represented 97% of the total volume of the stomach contents (Naughton and Salomon 1981). Relative frequencies of occurrence and percent volumes, respectively, by taxon, were: Engraulidae (*Anchoa* sp.) 32% and 47%: Clupeidae, 3% and 16%; Sciaenidae, 2% and 2%; unidentified fish, 59% and 33%. Invertebrates (squid) had a frequency of occurrence of 6% with a 2% volume.

Salomon and Naughton (1983) compared food habits of Spanish mackerel between areas, fish sizes, and seasons. Engraulidae were dominant in North Carolina and South Carolina, based on volume and frequency of occurrence. Prominent fish taxa were anchovies (*Anchoa* spp.), Spanish sardines (*Sardinella aurita*), Atlantic bumper (*Chloroscombus chrysurus*), and round scad. Shrimp or squid were second in importance in the diet of Spanish mackerel. Small Spanish mackerel preyed mainly on anchovies, while larger Spanish mackerel consumed other fishes, mainly clupeids and carangids. Seasonal differences were found in North Carolina and South Carolina, where clupeids were present only during summer and engraulids accounted for over one-third of the volume in the fall.

Parasites, namely nematodes, occurred frequently (19%) in stomachs from North Carolina and South Carolina. Trematodes had a frequency of occurrence of less than 1%.

Sharks are major predators of Spanish mackerel. Spanish mackerel has been listed among the stomach contents of the dusky shark (*Carcharhinus obscurus*) in Florida (Clark and von Schmidt 1965) and the smooth hammerhead (*Sphyrna zygaena*) (Bigelow and Schroeder 1948). The mackerel in general are referred to as a component of the diet of bull sharks (*Carcharhinus leucas*), porbeagles (*Lamna nasus*), and tiger sharks (*Galeocerdo cuvieri*) (Bigelow and Schroeder 1948). Sharks commonly attack Spanish mackerel gilled in gill nets causing considerable damage to total destruction of the nets (R. Williams, FL Mar. Fish. Comm., Tallahassee, FL, pers. commun.).

Bottle-nosed dolphins (*Tursiops truncatus*) are thought to be major predators of Spanish mackerel due to their common occurrence around mackerel schools. Bottle-nosed dolphins are a problem for gill net mackerel fishermen on the

Florida east coast because they tear fish out of nets (Cato and Prochaska 1976).

3.6.2 Principal Prey Species of Spanish Mackerel and Their Food Habits

Salomon and Naughton (1983) listed engraulids (anchovies) as the principal prey group for Spanish mackerel, followed by the families Clupeidae and Carangidae. Following the fishes, penaeid shrimp and squid were recorded.

Engraulids and clupeids, the principal prey for Spanish mackerel, feed on zooplankton, particularly copepods (Low 1973, Hildrebrand 1963, Bohlke and Chaplin 1968). Preferential rather than nondiscriminant feeding is apparent in those species of clupeids for which food habits have been determined (Low 1973). Clupeids are capable of feeding in either the picking or the filtering mode. They filter feed when dense concentrations of food of a suitable size is available (O'Connell 1972). Penaeid shrimp are bottom feeders, consuming isopods, and some plant material (Eldred et al. 1961). Squid are carnivores feeding on a range of prey items including crustaceans and anchovies depending upon their age and size. Many of the prey species listed depend, either directly or indirectly, on estuarine and nearshore areas for survival.

3.7 Estimate of MSY, Abundance, and Present and Future Condition

3.7.1 Assessment and Specification of MSY

The best estimate of MSY for the U.S. Spanish mackerel stock is 18 million pounds (GMFMC and SAFMC 1987). There are no separate estimates of MSY for the Atlantic and Gulf of Mexico migratory Groups of Spanish Mackerel.

Based on 1975 commercial landings and the adjusted estimate of recreational catch from the 1970 Saltwater Angling Survey, the original FMP and Amendment 1 set MSY for Spanish mackerel at 27 million pounds in a range of 13.5 to 49.1 million pounds. This wide range was due to data limitations, and MSY was set too high. The procedure used yield-per-recruit values calculated from data on growth rates, maximum size, and rates of fishing, and natural mortality. An estimate was made of the number of recruits entering the fishery for 1970 and 1975. Yield was also calculated by multiplying yield-per-recruit values by the number of recruits. The MSY was selected from the 1975 estimates which were considered to be more accurate. The natural mortality rates used were 0.5 to 0.9.

Eldridge (1986) provided estimates of Spanish mackerel MSY using stock production and yield per recruit methods. He suggested 15 to 19 million pounds as a reasonable range of sustainable yield. He repeated the original work using mortality rates of 0.2 to 0.4 and new growth data. He found the two major effects of lowering the annual instantaneous natural mortality rates were to decrease substantially the estimate of recruits and to raise slightly the yield-per-recruit values. Also the age/size at first capture increased when the lower mortality rates were used. The overall effect of lowering the natural mortality rate was to decrease the MSY estimate.

The Council's Mackerel Stock Assessment Panel reviewed Eldridge's work and analyses using virtual population analysis, revised mortality estimates, and recent catches to determine MSY for the U.S. stock, Nichols (1986). The Panel

recommended a range of 15.7 to 19.7 million pounds with the best estimate of 18 million pounds.

3.7.2 Assessment and Specification of Present and Probable Future Condition

An annual assessment of Spanish mackerel stocks is made by the NMFS Southeast Fisheries Center Miami Laboratory and reviewed by the Mackerel Stock Assessment Panel. The analyses include virtual population analyses using catch and size frequency data and catch-per-unit-effort indices from throughout the Gulf and Atlantic. The 1990 assessment for the Atlantic Migratory Group indicated that the spawning biomass has been reduced to levels that are less than occurred in the 1970s and less than that which will produce maximum sustainable yield. Fishing mortalities since 1984 appear to have decreased, but this has not yet resulted in large increases in spawning biomass. There appears to be strong recruitment entering the fishery. If these fish are allowed to survive, then spawning biomass could benefit. The range in Acceptable Biological Catch (ABC) for the 1990-91 season was estimated to be 5.0 million pounds, which is equivalent to the yield produced when fishing at $F_{0.1}$. There is a 32% chance that the ABC is outside the range of 4.2-6.6 million pounds (cv=0.24). Estimates of ABC for previous fishing years are presented in the Appendix.

4.0 DESCRIPTION OF HABITAT

4.1 Condition of Habitat

4.1.1 Adult Habitat

Adult Spanish mackerel inhabit coastal waters out to the edge of the continental shelf in the Atlantic Ocean (Collette and Nauen 1983), and also enter tidal estuaries (Hildebrand and Schroeder 1928). Temperature and salinity are believed to be the most important factors governing their distribution. According to Earll (1883), Spanish mackerel prefer water temperatures of 21 to 27°C, and they are rarely observed in waters cooler than 18°C. Spanish mackerel usually inhabit waters with salinities of 32 to 36 ppt.

Spanish mackerel spend most of their life cycle in the ocean where environmental conditions are more stable and man's effect is less severe. Adverse effects of habitat degradation on adult Spanish mackerel have not been demonstrated. Adults may be impacted through predator-prey relations.

4.1.2 Larval Habitat

The larval habitat of Spanish mackerel is the water column in inshore waters (Dwinell and Futch 1973; Houde et al. 1979; McEachran et al. 1980; Collins and Stender 1987). Juveniles have been found in salinities as low as 4.7°/oo in the Neuse River, North Carolina (Tagatz and Dudley 1961).

Offshore areas used by Spanish mackerel eggs and larvae appear to be the least affected by nearshore habitat alterations and water quality degradation. Oil pollution from offshore oil spills is a potential danger to the spawning grounds of Spanish mackerel. The water soluble aromatic hydrocarbon component of crude oil is damaging to fish eggs and larvae. Other pollutants such as

pesticides, may act synergistically with oil to produce deleterious effects on young stages of fish (Struhsaker et al. 1974). Oil dispersants with water soluble aromatic hydrocarbon fractions have also been found to be damaging to eggs and larvae, although second generation dispersants are less toxic, due to the reduction in aromatic hydrocarbons (Wilson 1977).

4.1.3 Habitat of Prey Species

Spanish mackerel migrate and feed on seasonally abundant local resources. Many of the prey species are estuarine dependent, in that they spend all or part of their lives in estuaries. Accordingly, Spanish mackerel are to some degree dependent upon estuaries as a source of prey. Diminishing the productive capabilities of estuaries may therefore have a detrimental affect on Spanish mackerel.

4.2 Habitat Areas of Particular Concern

Critical habitat of Spanish mackerel are spawning grounds and areas where eggs and larvae develop. Such areas are still poorly known and require further delineation before specific critical habitats can be designated. Collins and Stender (1987) collected Spanish mackerel larvae at depths between 11 and 29 m, but suggested that the small sample in their collections was probably due to the lack of sampling effort between the surf zone and 9 m. Larvae have been collected annually in Breech Inlet, SC in neuston samples since 1984 (B. Stender, S.C. Mar. Resour. Cntr., Charleston, SC, pers. commun.). Estuarine habitats may therefore serve as nursery areas as well as provide prey species along migration pathways.

4.3 Habitat Threats

All of the Atlantic coast estuaries have been impacted to some degree by natural and man-induced changes which have altered freshwater inflow and removed much habitat. Natural wetland losses have resulted from forces such as erosion, sea level rises, subsidence, and accretion. Major man-induced activities that have impacted environmental gradients in the estuarine zone are: construction and maintenance of navigation channels; discharges from wastewater plants and industries; dredge and fill for land use development; agricultural runoff; ditching, draining, or impounding wetlands; oil spills; thermal discharges; mining, particularly for phosphate, and petroleum; entrainment and impingement from electric power plants; dams; marinas; alterations of freshwater inflows to estuaries; saltwater intrusion; and non-point-source discharges of contaminants.

4.4 Habitat Protection Programs

Comprehensive state coastal zone management programs have been developed that focus on protecting and enhancing estuarine environments along with other coastal areas. Indirectly these programs will have a positive affect on the productivity of the management unit. State habitat protection programs are summarized in Table 4.1

The National Environmental Policy Act (NEPA) requires that all federal agencies recognize and give appropriate consideration to environmental

Table 4.1. State habitat protection programs.

State	Administrative organization	Legislative authorization	Regulations
Virginia	Virginia Marine Resources Commission; County wetlands boards	Section 61.1-13.4 Code of Virginia, Wetlands Act	Regulates alterations to tidal marshes, sand and mud flats, subagueous bottoms, and sand dunes.
North Carolina	North Carolina Department of Environment, Health, and Natural Resources Division of Coastal Management; Coastal Resources Commission; Coastal Resources Advisory Council	NC Dredge and Fill Law. (GS 113-229), Coastal Area Management Act (CAMA) (GS 113A100)	Requires permits to dredge or fill in or about estuarine waters. Establishes areas of environmental concern. Permits required for coastal zone development.
	Division of Marine Fisheries; Marine Fisheries Commission	NC Administrative Code Code, Chap. 3, Sect. .1400	Prohibits the use of bottom-disturbing gears and severely restricts or prohibits excavation and/or filling activities in nursery areas for young finfish and crustaceans.
South Carolina	South Carolina Coastal Council	Coastal Zone Management and Planning Act	Directs permit activities in areas of wetlands, beaches, and dunes.
Georgia	Georgia Department of Natural Resources, Coastal Resources Division	Coastal Marshlands Protection Act of 1970 (Gs. L. 1970, p. 939, 1.)	Requires permits to dredge, fill, remove, drain, or otherwise alter any marshlands.
		Shore Assistance Act of 1979 (Gs. L. 1979, 1).	Required permits for a structure, shoreline engineering activity, or land alteration in beaches, sand bars, and sand dunes in Georgia.
Florida	Florida Department of Natural Resources	Chapter 253, Florida Statutes	Regulates dredge, fill, and structures on state submerged lands (below mean high water). Provides for acquisition of conservation lands and tidally influenced areas.
		Chapter 258. F.S.	Established aquatic preserves and regulates activities within reserves.
	Florida Department of Environmental Regulation	Chapter 403, F.S.	Permitting of activities (including dredge and fill) which affect water quality).
	Florida Department of Community Affairs	Chapter 380, F.S.	Administer and set standards for "Development of Regional Impact." Protects regional or statewide resources from poorly conceived development activities.

amenities and values in the course of their decision-making. NEPA requires that federal agencies prepare an environmental impact statement (EIS) prior to undertaking major actions which might significantly affect the quality of the human environment. At the federal level, the importance of the habitat to the survival of marine organisms is recognized and expressed in the National Marine Fisheries Service policy on habitat, the U.S. Fish and Wildlife Service series of Habitat Suitability Indices, and the mandate by the MFCMA that habitat be given critical consideration in fishery management plan development. A marine sanctuary program was established by the Marine Protection, Research, and Sanctuaries Act. It permits the designation of specific marine sanctuaries by the office of Coastal Zone Management of NOAA. Existing and proposed marine and estuarine sanctuaries may have a positive effect on Spanish mackerel stocks.

5.0 FISHERY MANAGEMENT JURISDICTION, LAWS, AND POLICIES

Management institutions currently regulating Spanish mackerel include the Mid-Atlantic, South Atlantic, and Gulf of Mexico Fishery Management Councils and the various states within the range of the stocks. Until recently, Spanish mackerel were caught almost entirely within the South Atlantic and the Gulf of Mexico regions. Recovering Spanish mackerel stocks have expanded their range and increased in abundance in areas where they historically occurred but had declined or disappeared in recent years. Amendment 5 to the Coastal Pelagic FMP extended the management area through the Mid-Atlantic Council's area of jurisdiction. Recent data indicate that the majority of the commercial and recreational harvest is within state jurisdictional water (Table 5.1).

5.1 Management Institutions

The ASMFC, a compact of the 15 Atlantic coastal states, administers the Interstate Fisheries Management Program, which has the goal of achieving regional management and conservation of coastal fisheries resources and maintaining viable commercial and recreational fishing industries. Although the states determine all policy in their respective jurisdictions, the ASMFC provides a forum for discussion and resolution of common problems and assists the states in developing joint programs. The authority for establishing state management regulations varies from state to state. While some South Atlantic states, such as North Carolina and Florida, utilize administrative bodies for establishing management regulations, others such as South Carolina and Georgia, require legislative approval. The Georgia Board of Natural Resources has regulatory authority for seasons, size limits, and bag limits, within ranges set by the legislature. The characteristics of the state institutions included in this management plan are summarized in Table 5.2.

5.2 Federal Laws, Regulations, and Policies

The following federal laws, regulations, and policies may directly or indirectly influence the management of Spanish mackerel.

Table 5.1. Commercial landings and recreational catch of Spanish mackerel from the South Atlantic by distance from shore.

	< 3 miles	> 3 miles	Total	% caught < 3 miles
Recreational (x 1,000 fish)				
1979	727	120	847	86
1980	809	176	885	91
1981	542	759	1,301	42
1982	1,351	178	1,529	88
1983	74	48	122	61
1984	329	840	1,169	28
1985	418	293	711	59
1986	880	186	1,066	83
Commercial (x 1,000 lbs)				
1979	6,836	11	6,847	99
1980	11,630	34	11,664	99
1981	7,760	16	7,776	99
1982	7,223	13	7,236	99
1983	8,072	4	8,077	99
1984	2,337	3,664	6,001	39
1985	4,344	1,989	6,333	69
1986	6,816	5	6,821	99
1987	5,229	22	5,251	99

Table 5.2 Overview of present state management systems and regulations pertaining to Spanish mackerel.

State	Administrative organization	Legislative organization	Licenses	Size restrictions	Bag limits/ quotas/ seasons	Gear restrictions	Conservation regulations
North Carolina	N.C. Department of Environment, Health, and Natural Resources Division of Marine Fisheries	N.C. Administrative Code, Title 15, Chapter 3	Vessels without motors, any length, when used with other licensed vessel - no license Vessels, <18'5" -$1/foot Vessels, 18'6" to 38'5" - $1.50/foot Vessels, >38'3" - $3/foot Non-resident vessels -$200 in addition to above fee requirement Finfish processor - $100 Unprocessed finfish dealer - $50	None	10 fish/person/ trip taken by hook and line. Unlawful to possess aboard or land more than 3,500 lb from a single fishing operation in any one day.	None	Fisheries Director may by proclamation specify areas, seasons, quantity, means/methods, and size, on the harvest of Spanish mackerel.
South Carolina	South Carolina Wildlife and Marine Resources Department	Section 50-5-20	Land and sell - $25 Commercial boat licenses <18' - $20 >18' - $25 Gill nets haul seines - $10/100 yds	12 inch FL minimum	10 fish/person trip. Season closes when the fishery in the EEZ closes.	Trammel, pound fyke, stopnets, and purse seines prohibited. Gill nets prohibited except gill nets ≤100' and mesh ≥3" used in Atlantic Ocean and designated areas of bays and sounds.	
Georgia	Georgia Department of Natural Resources	Georgia Code 27-4-110, 391-2-4.04	Commercial fishing license (personal)-$10.00 for any sales of catch. Nontrawler license ≤18' - $5 >18' - $5 + $.50/foot Trawler license-$50 for 18' + $3/additional foot No license for seines ≥300'.	12 inch FL minimum (5% tolerance by weight of total catch of Spanish mackerel on board a trawler)	10 fish/person/ day Open season 3/16 - 11/30	Gill netting prohibited in Georgia waters. Seine mesh restrictions: minimum of 1-1/4" for seines <100'; minimum mesh size of 2-1/2" (s.m.) for 100-300 maximum length.	

Table 5.2 (Continued).

State	Administrative organization	Legislative organization	Licenses	Size restrictions	Bag limits/ quotas/ seasons	Gear restrictions	Conservation regulations
Florida	Florida Marine Fisheries Commission		Licenses to sell: Resident-$25 annully Non-resident-$100 annually Alien-$150 annually Wholesale seafood dealer Resident-$300 annually Non-resident-$500 annually Alien-$750 annually Retain seafood dealer Resident-$25 annually Non-resident-$200 annually Alien-$250 annually	12 inch FL minimum	5 fish/person/ day 1,850,000 lb quota for power-assisted gill nets; season: Dec 15-Oct 31. 205,000 lb quota for all other forms of commercial fishing gears; season: Nov 1-Oct 31.	3-1/2 inch minimum stretched mesh. Net fishing prohibited in state waters on weekend.	No purse seining for food fish in state waters.

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

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

Marine Protection, Research and Sanctuaries Act of 1972 (16 U.S.C. 1431-1434)

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

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

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

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

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

Coastal Zone Management Act of 1972 (16 U.S.C. 1451)

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

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

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

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

The National Environmental Policy Act (NEPA) requires that all federal agencies recognize and give appropriate consideration to environmental amenities and values in the course of their decision making. In an effort to create and maintain conditions under which man and nature can exist in productive harmony, NEPA requires that federal agencies prepare an environmental impact statement prior to undertaking major activities which might significantly affect the quality of the human environment. Within these impact statements, alternatives to the proposed action which may better safeguard environmental values are to be carefully assessed.

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

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

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

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

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

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

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

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

Plastics Pollution Research and Control Act (MARPOL Annex 5)

The Marine Plastics Pollution Research and Control Act of 1987 implements Annex V of the International Convention for the Prevention of Pollution by Ships and prohibits all vessels, including commercial and recreational fishing vessels, from discharging plastics in U.S. waters and severely limits the discharge of other types of refuse at sea. This legislation also requires ports and terminals receiving these vessels to provide adequate facilities for in-port disposal of non-degradable refuse, as defined in the Act.

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

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

imposed on permit issuance on a case-by-case basis in order to protect valuable resources in the discharge area (US DOC 1986).

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

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

The National Aquaculture Improvement Act of 1985 (P.L. 99-198) (An amendment to the National Aquaculture Act of 1980)

The intent of the National Aquaculture Act, was to stimulate development of the domestic aquaculture industry while creating jobs, replenishing depleted fisheries and reducing the trade deficit in fishery products.

The Coastal Barrier Resources Act of 1982

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

5) The exclusion of Coast Guard and military lands until such time as they become available for development.

The Marine Mammal Protection Act Amendments of 1988

The Marine Mammal Protection Act of 1982 (MMPA) prohibited the taking of marine mammals incidental to commercial fishing unless authorized by a general incidental take permit or a small take exemption. The MMPA also established a ban on the importation of marine mammal products. The MFCMA amended the Act to extend its requirements throughout the EEZ. The NMFS has responsibility for implementing the MMPA and issuing permits relative to the taking of marine mammals. On November 23, 1988, PL 100-711 was signed into law reauthorizing and amending the MMPA. The amendments replace existing provisions for granting incidental take authority by commercial fisherman with an interim exemption system valid until October 1, 1993. This will supply information to NOAA Fisheries so a long-term program to manage the incidental take of marine mammals in commercial fisheries can be developed. Amendments direct the Secretary to publish a list of fisheries and number of vessels in these fisheries which fall into the following categories: (I) A frequent incidental taking of marine mammals; (II) An occasional incidental taking a marine mammals; or (III) A remote likelihood of, or no known incidental taking of marine mammals. If a commercial fishing vessel is classed Category I or II, owners of the vessel are required, by law, to register with the Secretary to obtain an exemption and submit periodic reports to NMFS. Vessels in Category I must also take on-board a natural resource observer if requested by the Secretary. Owners in Category III are not required to register with the Secretary for an exemption but must report any lethal incidental takings. The exemption system is available only to U.S. vessels or foreign vessels with valid fishing permits issued under Section 204(b) of the MFCMA.

5.3 State Laws, Regulations, and Policies

Spanish mackerel are regulated by all states bordering the South Atlantic. Each state has jurisdiction extending three nautical miles from shore. Existing laws, regulations, and policies, of each South Atlantic state as of 1989 are presented in Table 5.2.

6.0 DESCRIPTION OF FISHING ACTIVITIES AFFECTING SPANISH MACKEREL

6.1 History of Exploitation

The commercial and recreational fisheries for Spanish mackerel from 1880 to 1976 were reviewed by Trent and Anthony (1979). The Spanish mackerel commercial fishery began about 1850 along the Long Island and New Jersey coasts, and was well established in the Mid-Atlantic and Chesapeake Bay areas by the late 1870s (Goode 1884; Earll 1887). In 1880, the Chesapeake Bay area produced about 86% of the total catch of about 1.9 million pounds, while less than 2% of this catch was recorded from the South Atlantic and Gulf of Mexico. By 1887 the areas of major production had changed and about 64% of the commercial catch of Spanish mackerel was landed in the South Atlantic and Gulf areas. This trend continued and by 1945 over 97% of the total production occurred in these areas. Florida landings have accounted for greater than 92% of the Spanish mackerel produced in the U.S. each year from 1950 through 1986.

Troll lines, gill nets, and pound nets were the main methods used to capture Spanish mackerel in the 1800s. Trolling was the most important early method used in the Long Island and New Jersey areas in the early 1800s (Earll 1887). Pound nets were first introduced into the Sandy Hook region about 1855, in the inshore areas, but were relatively unsuccessful in capturing Spanish mackerel until about 1873 when larger pound nets were placed along the ocean shore (Earll 1887). By 1880 pound nets were used throughout the Middle Atlantic and Chesapeake Bay states and accounted for most of the Spanish mackerel landings. Gill nets were first used for capturing Spanish mackerel in 1866 in Sandy Hook, New Jersey, but did not gain acceptance in the Chesapeake Bay area until about 1872 (Earll 1883). Gill nets were 150 to 200 yds long, 100 meshes deep, had stretched-mesh sizes of 3 1/2 to 4 inches, and were made of tarred cotton twine. The gill nets became the principal gear in the Spanish mackerel fishery by 1920 and the center of the fishery had shifted from Chesapeake Bay to south Florida. The typical gill net was 150 to 175 yds long, 7 yards deep with stretched-meshes of 3-3/8 to 3-5/8, and the webbing was 6-thread tarred cotton twine. The nets were often joined to form one that was 500 to 1,800 yds long. The boats in the fishery were 30 to 50 feet long, gasoline powered, and carried a large search light to fish at night.

Major technological changes have occurred to increase the efficiency of capturing Spanish mackerel since the beginning of the fishery. Gill nets have remained the dominant gear in the commercial Spanish mackerel fishery and have accounted for over 83% of the total catch since 1950. Austin et al. (1977) categorized the Spanish mackerel gill-net fishery in Florida as shallow water and deep water fisheries. In the shallow water fishery, many of the boats are 30 to 40 feet long, equipped with power rollers and are fished mostly along the Florida Keys and southwest coast. Smaller boats (19 to 25 feet long) are also used. Runaround nets, which accounted for most of the landings are made of monofilament webbing, and are about 800 yds long, 7 yds deep, with stretched-meshed sizes of about 3-5/8 inches. Drift nets are up to 1,500 yds long, 7 yds deep, with stretched-mesh sizes between 3-7/8 and 4-1/4 inches. Both are usually fished in water depths of 8 to 10 feet. In the deep-water fishery, the boats are 42 to 63 feet long and sometimes used to catch king mackerel. Runaround gill nets, 600 yds long and up to 30 yds deep with mesh sizes of about 3 1/2 inches have been used for deepwater fishing since about 1973. The larger boats use spotter planes to locate fish and direct the setting of the nets. Austin et al. (1977) estimated that about 250 shallow-water and 67 deep-water vessels were involved in the Spanish mackerel fishery in Florida in 1977.

Saltwater sport fishing has been a major recreational activity in the South Atlantic for many years. As transportation systems improved and as leisure time increased with affluence, the demand for recreational opportunities grew dramatically, which led to improvements in recreational equipment. Sales of boats and motors that could be used for offshore fishing climbed and fishing tackle became more elaborate.

Recreational fishing by private boat for Spanish mackerel has taken place for many years. Until the 1950s, activity was primarily shore-based or took place from boats relatively close to shore. In the late 1950s, small boats capable of catching this species became available to large numbers of people. These boats met a growing demand from recreational fishermen with growing incomes and increased leisure time and brought the opportunity to fish for Spanish

mackerel to large numbers of people. Between 1967 and 1974, the number of private boats of 16-foot length and greater increased at an average annual rate of 10.3% (GMFMC and SAFMC 1985).

Spanish mackerel has been an important entity of South Carolina's marine recreational fisheries at least since the early 1950s, as indicated by its inclusion as a category in the first Grand Strand Fishing Rodeo held in 1953 in Myrtle Beach (Don Hammond, S.C. Mar. Resour. Cntr., Charleston, SC, pers. commun.). A 1968 postal survey of boat owners and random households in South Carolina showed Spanish mackerel to be the sixth most-frequently caught fish by saltwater anglers in the state (Bearden 1969). A survey conducted in Murrell's Inlet during 1972 and 1973 found that Spanish comprised 90 percent of the total catch by fishermen trolling for pelagic game fish in coastal waters (Buchanan et al. 1974). Hammond et al. (1977), in a study of the effectiveness of mid-water reefs in coastal waters off Charleston, SC, showed Spanish mackerel to comprise 74.5% of the total catch of fish taken utilizing standard trolling techniques. Spanish mackerel are also harvested by the South Carolina pier fishermen, ranking 26th out of the 43 species documented in 1974 (Hammond and Cupka 1977).

The Spanish mackerel fishery off Georgia has historically been and remains entirely recreational, except for incidental catches taken by trawlers (Duane Harris, GA Dept. Nat. Resour., Brunswick, GA, pers. commun.). During the 1960s and early 1970s, Spanish mackerel were generally caught within six nautical miles offshore, generally in June through September, with anglers fishing north and south between sea buoys along Georgia's coast. Georgia's small charter fleet then depended on Spanish mackerel as the mainstay of their offshore trips. Participation in the Spanish mackerel fishery steadily increased after 1974 when the placement of Artificial Reef F off Brunswick, GA, encouraged coastal anglers to target large schools of Spanish mackerel off St. Simons and Jekyll islands.

6.2. Landings/Catch

6.2.1 Commercial Landings

Atlantic coast landings of Spanish mackerel fluctuated between 1.9 and 11.0 million pounds from 1950 to 1988 (Figure 6.1). Years of peak landings were 1958 (7.5 million pounds), 1976 (9.6 million pounds), 1977 (11.0 million pounds), and 1980 (9.9 million).

Florida accounts for most of the Atlantic Coast landings (Table 6.1). From 1970 through 1987 the east coast of Florida averaged 97% of the total South Atlantic Spanish mackerel landings. During 1950-1959, the east coast of Florida produced an average of 3.6 million pounds, annually. For unknown reasons the east coast production averaged only 2.6 million pounds in the 1960s. Landings rose sharply from 1975 (5.1 million pounds) to 1977 (11.0 million pounds). From 1975 through 1983 the Florida east coast averaged 6.4 million pounds. Much of this increase in production was due to increased effort. The large boat gill net fleet expanded rapidly during the 1970s. Ex-vessel price was also increasingly rapidly during this period and may have stimulated additional effort (Austin et al. 1977).

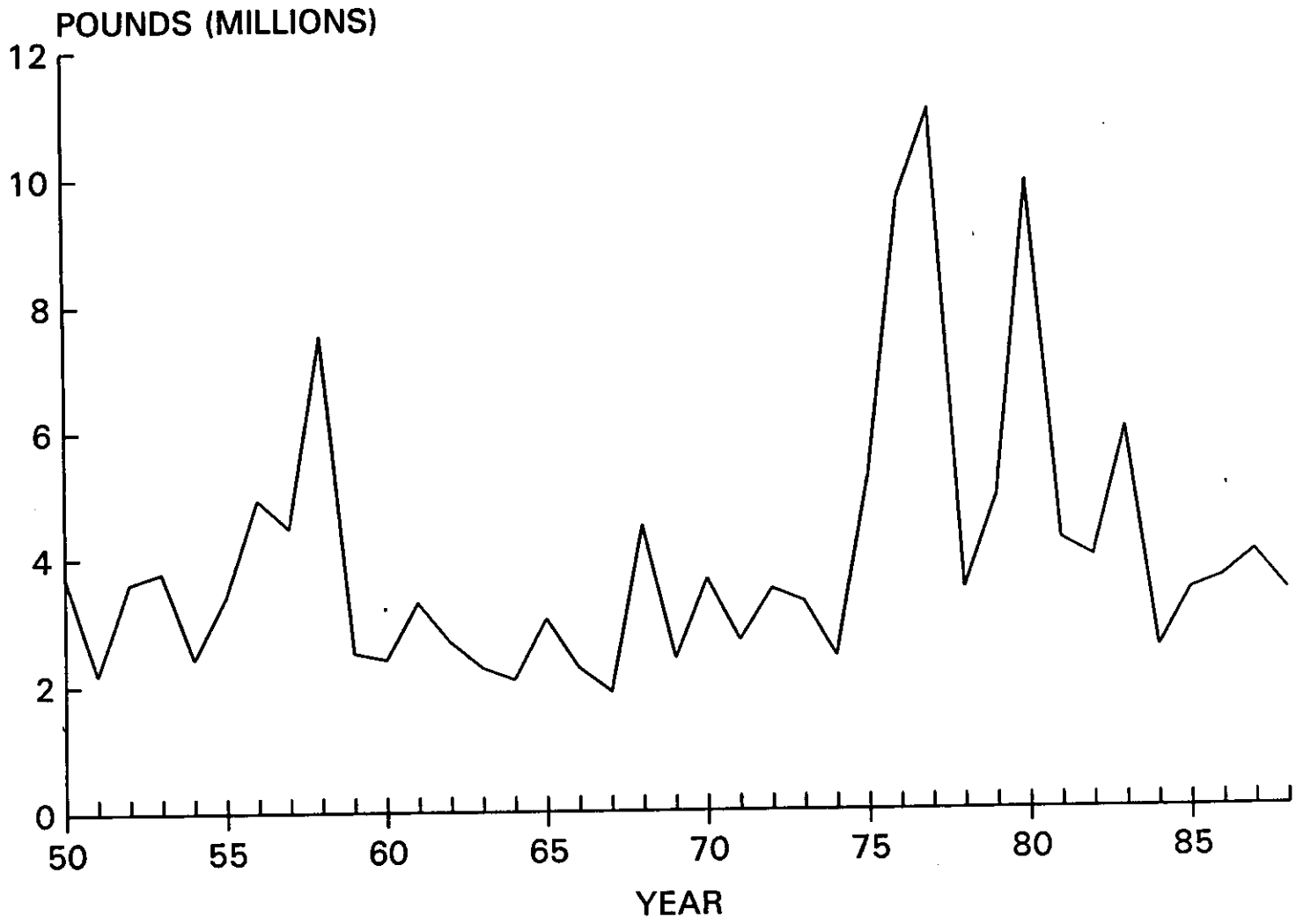

Figure 6.1. Total Atlantic coast commercial landings of Spanish mackerel, 1950-1988.

Table 6.1 Commercial landings of Spanish mackerel by state on the Atlantic coast of the United States, 1978-1988.

Year	New York	New Jersey	Maryland	Virginia	North Carolina	South Carolina	Georgia	Florida	Total
1978		100	100	1,600	39,851	608	211	5,510,538	5,553,008
1979				700	12,721	150	2,201	4,885,628	4,901,400
1980	100	600		8,300	75,306	6,769	1,491	9,811,053	9,903,619
1981	500	500		3,500	51,639		518	4,174,432	4,231,089
1982	1,000	200		12,700	189,217	1,081	745	3,758,603	3,963,546
1983	600	100		3,500	41,336	706		5,947,102	5,993,344
1984	300	100		10,000	127,467	1,321		2,397,373	2,536,561
1985	100			15,300	173,186	847		3,244,980	3,434,413
1986	3,200	1,500		168,400	232,197	6,375	1,335	3,386,640	3,779,647
1987	16,600	24,000	4,800	251,200	504,063	961	255	3,501,071	4,302,950
1988	19,200	16,900	4,300	291,600	314,980	78		3,071,562	3,718,620

The other South Atlantic states contribute little to the commercial production of Spanish mackerel. North Carolina landings ranged from 12,700 pounds in 1979 to 504,100 pounds in 1987. South Carolina and Georgia commercial landings of Spanish mackerel are small. There is no directed fishery for Spanish mackerel in these states and most of the landings are incidental catches in the shrimp trawl fishery. Landings in South Carolina peaked in 1962 and 1965 (13,300 pounds) and have ranged from 100 to 6,400 pounds since 1980. Georgia landings were highest in 1975 (5,700 pounds) and have ranged from 0 to 1,500 pounds since 1980. Landings to the north, particularly Virginia, have increased since 1985 (Table 6.1).

6.2.2 Recreational Catch

Results of the Marine Recreational Fishery Statistics Survey (MRFSS), 1980-1988, indicate recreational catches of Spanish mackerel have fluctuated without trend. Catches in areas north of North Carolina increased from 1986 to 1988 (Tables 6.2 and 6.3). North Carolina's recreational catch accounted for greater than 50% of the total annual catch in 1982 and from 1984 to 1990. North Carolina, South Carolina, and Florida accounted for an average of 97% of the recreational catch of Spanish mackerel in the South Atlantic.

6.3 Fishing and Landings Areas

6.3.1 Commercial

Total U.S. commercial landings of Spanish mackerel take place almost entirely in Florida. The Spanish mackerel fishery is a local fishery in the sense that the catch is generally landed at ports in proximity to the fishing grounds. On the Florida coast, typical one-way trip lengths between fishing and landing areas average about 20 miles. Major fishing areas are located along the narrow continental shelf just inside the Gulf Stream from about Palm Beach north to Sebastian. During the winter season, schools of Spanish mackerel will migrate and congregate in certain areas, such as over reef outcroppings, for a period of time. Specific areas and times at which fish are available will vary from year to year due to ocean and weather conditions. The main traditional Florida east coast landings areas for Spanish mackerel have been Indian River, St. Lucie, Martin, and Palm Beach counties. In recent years, however, this pattern had changed. Since 1986, power-assisted gill nets have been prohibited off Palm Beach County which has significantly reduced landing ports in that area. On the Florida east coast major ports are now Port Salerno and Ft. Pierce.

The main traditional North Carolina landing areas for Spanish mackerel have been Carteret, Dare, New Hanover, Pender, and Onslow counties. Gill net catches are made along the beaches, while pound net and long haul seine catches are made within the sounds.

Spanish mackerel primarily occur in the lower Chesapeake Bay, Virginia, but may penetrate into Maryland waters, at least in years of abundance. Virginia landings have generally made up 97 to 99% of the Chesapeake Bay catch. Earll (1883) reported greater abundance on the Eastern Shore than on the Western shore; however, recent sampling indicated that abundance was greatest along the Western Shore (O'Reilly 1990; Chittenden et al. in prep.).

Table 6.2 Total estimated number of Spanish mackerel caught on the U.S. Atlantic coast by state and region, 1980-1988, from the NMFS Marine Recreational Fishery Statistics Survey.*

	Mid-Atlantic					South Atlantic					
Year	New York	New Jersey	Maryland	Virginia	Region total	North Carolina	South Carolina	Georgia	Florida	Region total	Annual total
1980						218,828	104,412	33,660	528,328	885,228	885,228
1981						236,945	515,214	1,742	546,721	1,300,622	1,300,622
1982						1,176,312	126,939	346	141,511	1,445,108	1,445,108
1983							10,126	1,948	80,296	92,370	92,370
1984						660,956	212,234	5,999	290,280	1,169,469	1,169,469
1985						531,981	56,951	8,051	144,045	741,028	741,028
1986		1,908	477	5,287	7,672	659,524	163,479	23,991	219,055	1,066,049	1,073,721
1987	1,400		13,688	15,907	30,995	612,282	68,847	24,132	112,259	817,520	848,515
1988				163,528	163,528	1,274,308	102,568	7,815	309,756	1,694,447	1,857,975

* Estimates prior to 1987 were not subject to the intensive scrutiny that the 1987 and 1988 were, and therefore, are higher than would be produced using current procedures (John Witzig, personal communication).

Table 6.3 Total estimated pounds of Spanish mackerel landed recreationally by state and region, 1980-1988, from the NMFS Marine Recreational Fishery Statistics Survey.*

	Mid-Atlantic					South Atlantic					
Year	New York	New Jersey	Maryland	Virginia	Region total	North Carolina	South Carolina	Georgia	Florida	Region total	Annual total
1980						872,691	117,859	114,486	1,219,365	2,324,400	2,324,400
1981						327,161	643,193	2,306	832,328	1,804,988	1,804,988
1982						1,553,834	94,856	1,067	261,567	1,911,324	1,911,324
1983							13,798	1,876	167,651	183,325	183,325
1984						887,631	272,033	9,105	512,117	1,680,885	1,680,885
1985						817,587	42,162	8,811	270,942	1,139,503	1,139,942
1986		4,206	1,052	5,364	10,622	602,644	257,149	46,462	269,695	1,175,950	1,186,572
1987	5,249		23,274	2,721	31,244	1,053,191	109,517	39,603	199,999	1,402,310	1,433,554
1988				244,876	244,876	1,907,696	140,312	7,357	816,488	2,871,854	3,116,730

* Estimates prior to 1987 were not subject to the intensive scrutiny that the 1987 and 1988 were, and therefore, are higher than would be produced using current procedures (John Witzig, personal communication).

6.3.2 Recreational

Unlike the commercial harvesting of Spanish mackerel, recreational fishing activity is widely distributed throughout the South Atlantic region. Fishing occurs out of virtually all coastal marinas and boat docks. Similarly, anglers can be found on most accessible beaches and shore-based locations such as bridges, piers, or jetties.

In the South Atlantic during typical years, recreational fishing for Spanish mackerel occurs heavily in North Carolina and along the eastern coast of Florida. In North Carolina areas such as Morehead City, Oregon Inlet, Harker's Island, or Hatteras are often frequented by anglers. Along the Florida east coast there is considerable recreational fishing activity out of the Jacksonville, Palm Beach, Fort Lauderdale, and Miami areas. In South Carolina considerable fishing occurs out of Charleston and Murrell's Inlet. The fishery is primarily conducted by boat fishermen from the mouth of the bays to about 15 miles offshore. A small boat fishery inside bays and sounds for Spanish mackerel has been growing since the early 1980s (Don Hammond, South Carolina Marine Resources Center, Charleston, SC, pers. commun.). In Georgia popular offshore angling sites are off the St. Simons Island area, Brunswick, and Savannah.

6.4 Vessels and Gear

6.4.1 Commercial

Spanish mackerel are caught primarily with gill nets. Anchored gill nets are primarily used in North Carolina along with some drift gill nets. However, the use of run-around gill nets replaced drift gill nets in 1985 in North Carolina. Run-around gill nets are primarily used off the east coast of Florida.

The small commercial gill net boats have a capacity of about 2,500 to 6,000 pounds (Cato et al. 1978), and some of those in Florida typically use a spotter plane to locate fish. These boats are frequently operated by one man although they may have one or two crewmen on board for some trips during the year. Both strike or run-around gill nets and drift gill nets are used by these boats. The use of drift gill nets for coastal migratory pelagic resources is prohibited by Amendment 3 to the Coastal Pelagics FMP (GMFMC and SAFMC 1989a).

According to the survey of Cato et al. (1978), the average capacity of the larger gill net boats is 29,000 pounds, ranging from 15,000 to 50,000 pounds. A large number of these boats in Florida typically use a spotter plane to locate fish. Typically these boats are manned by a captain and from one to five crewmen.

6.4.2 Recreational

Recreational fishermen use rod and reel when they fish for Spanish mackerel. Both natural and artificial baits are used, and two different fishing methods are generally employed. Trolling is the most commonly used technique by charter and private boat fishermen. Charter boats often use four lines, two

weighted lines for fishing at the surface and two weighted lines at some depth below. Private boats generally troll with fewer lines and remain closer to shore. Boats troll in a straight line or in a random pattern until fish are hooked, and then trolling continues in circles until fish are no longer being caught. Trolling often is used when circling surface structures or underwater reefs. A second technique, jigging, involves casting a lure or bait into the water and retrieving it with a jerking motion. This method is often used from fixed platforms such as bridges or piers. Jigging is also employed from boats when the boat is near a surface or underwater structure (Brusher et al. 1978, Manooch 1979).

7.0 SOCIAL ORGANIZATIONAL AND ECONOMIC FRAMEWORKS OF THE FISHERY

7.1 Domestic Commercial Harvesting Sector

7.1.1. Value of Landings

Table 7.1 indicates the commercial landings and values for the South Atlantic states from 1984 through 1988. The Florida East Coast dominates with about 95% of the catch and value, historically, but North Carolina's commercial fishery is seen to have expanded dramatically in 1987. Commercial Spanish mackerel fishing is virtually non-existent in the states of South Carolina and Georgia. Data obtained from NMFS, as of July 1989, indicates that only five commercial federal permits were issued in Georgia (one for the Gulf stock only), and 42 in South Carolina for the 1989 season. The number of charter vessel permits was 22 for Georgia and 59 for South Carolina, however (Tables 7.2, 7.3 and 7.4).

7.1.2 Characteristics of the Fleet

A separate commercially based social organizational framework for Spanish mackerel does not exist in the South Atlantic region. In the Florida Keys, where fishermen fish both on the Gulf and Atlantic groups of Spanish mackerel, the organizational framework relating to Spanish mackerel fishing is embedded within a larger framework of multiple species fishing. Spiny lobster (late July to late March), along with stone crab, snapper, grouper, pompano, dolphin, swordfish, grunt, sponge, shark, tropical fish, shrimp and king mackerel, are the species of preference (Orbach and Johnson 1987). Spanish is the species of preference in late fall to early spring for about 300 boats (Maiolo and Jendrasiak 1989). For the large gill net vessels, the fishing season is essentially six weeks (middle of November to Christmas).

The Jacksonville area commercial fishermen prefer shrimping (June to December) and king mackerel fishing (January to May), along with trout, redfish and grouper, with some Spanish taken on an opportunistic basis. The market is not set up to handle large quantities of Spanish mackerel in northeast Florida. The price has been considered to be too low, according to local fishermen, and other finfish and shrimp dominate the market (Maiolo and Jendrasiak 1989). Thus, the marketing system there has no special organization and the landings of Spanish are fairly light. Incidental catches are processed through the system within the context of the market for shrimp and other finfish.

In the Fort Pierce/Port Salerno area, netters target Spanish mackerel, king mackerel, bluefish, some groundfish, and pompano. Hook and line Spanish

Table 7.1 Commercial landings and value of Spanish mackerel in the South Atlantic.

	Year	Pounds	Value
Florida (East Coast)			
	1984	2,397,373	$ 669,777.00
	1985	3,244,980	$ 887,523.00
	1986	3,386,640	$ 973,309.00
	1987	3,501,071	$1,191,211.00
	1988	3,071,687	$1,412,976.00
South Carolina			
	1984	1,321	$ 561.00
	1985	847	$ 517.00
	1986	6,344	$ 1,502.00
	1987	681	$ 243.00
	1988	1,008	$ 467.00
Georgia			
	1984	114	$ 84.50
	1985	1	$ .80
	1986	1,335	$ 864.45
	1987	255	$ 125.42
	1988	726	$ 240.25
North Carolina			
	1984	127,467	$ 42,043.00
	1985	173,186	$ 67,127.00
	1986	232,197	$ 81,184.00
	1987	504,063	$ 145,141.00
	1988	438,222	$ 140,815.00

Table 7.2 Number of vessels with charter permits only by regulatory group of Spanish mackerel, by state, and by coast of Florida as of July 20, 1989.

Name of State	Migratory Group of Spanish Mackerel	
	Gulf of Mexico	Atlantic
TX	67	-
LA	31	-
MS	33	-
AL	60	-
FL West Coast	395	-
East Coast	-	180
GA	-	22
SC	-	59
NC	-	105
MD	-	2
NJ	-	1
OH	-	1
DE	-	1
CT	-	0
VA	-	2
PA	-	2
Total	586	375
Grand total	962	

Source: Fishery Operations Branch, Fisheries Management Division. Southeast Regional Office, National Marine Fisheries Service, 9450 Koger Boulevard, St. Petersburg, FL 33702

Table 7.3 Number of vessels permitted to fish as a charter and a commercial vessel under the recreational and commercial quotas for the Gulf of Mexico and Atlantic migratory groups of Spanish mackerel by migratory group, by state, and by coast of Florida as of July 20, 1989.

Name of State	Migratory Group of Spanish Mackerel		
	Gulf of Mexico	Atlantic	Both
TX	7	0	0
LA	8	0	6
MS	1	0	0
AL	0	0	0
FL West Coast	15	17	45
East Coast	3	1	56
GA	0	2	0
SC	0	10	3
NC	0	144	16
MD	0	0	0
NJ	0	0	2
OH	0	0	0
DE	0	0	1
CT	0	1	0
VA	0	0	0
PA	0	0	0
Total	34	175	129
Grand total	338		

Table 7.4 Number of vessels permitted to fish only under the commercial quotas for the Gulf of Mexico and Atlantic migratory groups of Spanish mackerel by migratory group, by state, and by coast of Florida as of July 20, 1989.

Name of State	Migratory Group of Spanish Mackerel		
	Gulf of Mexico	Atlantic	Both
TX	3	0	0
LA	61	0	7
MS	7	0	4
AL	0	0	1
FL West Coast	31	2	146
East Coast	0	64	346
GA	1	1	1
SC	0	25	4
NC	0	268	17
MD	0	1	0
NJ	0	0	2
OH	0	6	0
DE	0	0	1
CT	0	0	0
VA	0	0	0
PA	0	1	0
Total	103	361	531
Grand total	995		

Source: Fishery Operations Branch, Fisheries Management Division. Southeast Regional Office, National Marine Fisheries Service, 9450 Koger Boulevard, St. Petersburg, FL 33702.

mackerel fishermen also fish for tilefish, shark, and swordfish. The area is organized to receive Spanish mackerel at five fish houses, apparently as a result of the well-developed market for king mackerel. Spanish mackerel has been targeted on an opportunistic basis during the mid-1980s in response to markets and stock abundance, etc (Maiolo and Jendrasiak 1989).

Several recent events have pushed the fishery toward a more directed one, however. First, some fishermen and dealers perceive the average size of the fish to have increased in the past few years, resulting in higher prices. This has happened in the Miami area, too, where, because of state restrictions on gear, hook and line, live bait fishing for about 30 small (25 feet) boats has become a routine in late fall. Second, the size of the fish has allowed dealers to market Spanish at good prices during the Lenten season, which has extended the period in which king mackerel vessels fish for Spanish mackerel. This involves as many as 14 vessels in the 34 foot plus range, and about 136 in the 24 to 34 foot class (of which 35 are hook and line). As such, the fishery is evolving more into a directed one than an opportunistic one, which had characterized the fishery during the turbulent years of stock decline and increased restrictions.

Potentially 611 boats fish commercially on the Atlantic stock of Spanish mackerel on the Keys to the Jacksonville area, if one includes the 228 vessels which are based in the Gulf, but which have permits to fish on the Atlantic stock, including vessels permitted to fish both under the recreational bag limits and the commercial quota (Michael Justen, NMFS, St. Petersburg, FL, pers. commun.). In 1989, 467 Atlantic stock permits were issued for small and large gill net, and hook and line boats combined (Tables 7.3 and 7.4). Three quarters of those permits were issued for fishing on both the Atlantic and Gulf stocks. Another 210 Florida West Coast vessels, and six Gulf state vessels were federally permitted to fish on the Atlantic stock. Another 180 charter boats were permitted (East Coast) to fish on the Atlantic stock (bag limit permit only).

Florida East Coast crew sizes on commercial vessels were found to be five (including the captain) for large vessels, and one to two for the smaller vessels (Maiolo and Jendrasiak 1989). These boats and fishermen are located within organizational networks framed by other fishing activities, not Spanish mackerel.

Georgia and South Carolina commercial fishermen do not target Spanish mackerel other than on an opportunistic basis. Commercial interest is low, and Spanish mackerel taken commercially are caught incidentally by shrimp trawls. As indicated in Tables 7.3 and 7.4, only 4 and 42 commercial federal permits were issued in 1989, respectively (Atlantic stock). But, 24 and 72 charter permits were issued, as well (two vessels in Georgia, and 13 in South Carolina were charters, but also acquired commercial permits). There do not appear to be any special organizational networks to which the fishermen belong which are framed by activity in the Spanish mackerel fishery.

Some North Carolina commercial fishermen do target Spanish mackerel. In the Morehead City area, a few fishermen have adopted special gear for some of the small vessels (roller rigs), and have included such activity as a normal part of the annual round. Approximately 445 vessels have the necessary permits, including 150 charters with both recreational and commercial permits

(another 105 permits have been issued to the charter fleet for recreational fishing only), but a relatively small number consider Spanish fishing to be a significant contributor to their annual incomes on a regular basis. The commercial fleet consists of vessels 35 feet and under, and are organized to be fished by two people with nets. Other fishing styles include setting nets without the use of roller rigs, pound nets and long haul seines (Pamlico Sound) (Maiolo and Jendrasiak 1989). In the latter cases, Spanish mackerel are not targeted, but caught incidentally along with other species (flounder, trout, croaker, bluefish, spot). Many of the North Carolina fishermen were found to be mainly inlet and ocean "sink-netters" who depend on fall fishing in the ocean for a significant part of their incomes. Relationships they have with each other, and with dealer/processors are couched in terms of a variety of fisheries, with the Spanish mackerel fishery playing a comparatively small role. A discussion of fishery networks and linkages with processor/dealers is presented in Maiolo et al. (1981), Johnson and Maiolo (1986), and Maiolo and Johnson (1988a, b).

Thus, there are no special linkages which are defined by fishermen's participation in the Spanish mackerel fishery in North Carolina, other than the requirements associated with the permits. Interactions among the fishermen are framed by community and occupational linkages which exist independently of the Spanish mackerel fishery. The most appropriate way to interpret the social structure of the fishery is to consider it as one of many facets of small scale, nearshore multiple species fishing (Maiolo and Jendrasiak 1989).

Research by Maiolo and Jendrasiak (1989) indicates that in North Carolina, some fishermen feel that the nature of the federal permitting system has had a depressing effect on the incentive to fish commercially for Spanish mackerel, although the number of licenses issued in 1989 would indicate otherwise. In some cases, the necessary records are not kept in order for one to qualify; in others, fishermen are reluctant to subject their records to the examination required. Along with this, there seems to be some uncertainty about the condition of the stock, and the future actions of state and regional managers in regard to regulations governing quotas and gear. This was found to be the case in Florida as well, where state permits are required in addition to the federal permit. Nevertheless, 1122 permits were issued for fishing commercially for Spanish on the Atlantic stock in those two states. Further, there were 1,186 permits issued in total for fishing on the Atlantic stock, including 228 for Gulf based vessels and 15 for vessels licensed as far away as Connecticut. A total of 405 permits were issued to Florida East Coast fishermen, and 33 to North Carolinians to fish on both stocks for the same year. Another 375 permits were issued to charter boats for bag limit fishing only to fish on the Atlantic stock.

With Spanish mackerel fishermen pursuing a variety of species and within the context of a fairly regular annual round to rotate through those species, North Carolina fishermen operate on a small scale basis with Spanish mackerel contributing between 5 and 10% of total income. In Florida, Spanish mackerel fishing has contributed between 30 and 50% of total fishing income for the large gill net vessels, but only 1 to 15% for the smaller net, and hook and line boats.

7.2 Recreational Fishing

As is the case in commercial fishing, it would be inaccurate to view even a segment of recreational fishermen as "Spanish mackerel" anglers. Saltwater recreational anglers are multiple species fishermen, and can be divided into groupings of onshore, nearshore and offshore (Johnson et al. 1986; Kitner and Maiolo 1988). Some fishermen, especially those who fish from boats, do target Spanish mackerel more frequently than others, and identify the species as the preferred target. There is a great deal of overlap, too, between king and Spanish mackerel sportfishing, as indicated by data from North Carolina and interviews with key informants through the Southeastern states (Doug Mumford, N.C. Div. Mar. Fish, Washington, NC, pers. commun., Johnson et al. 1986, Maiolo and Jendrasiak 1989). Charter boats target larger fish (king, wahoo), and fish for Spanish mackerel on an opportunistic basis. It is the half day charter trips which tend to target Spanish throughout the Southeast.

In South Carolina and Georgia, Spanish are targeted by recreational fishermen and charter patrons in May through August following the Spring and early Summer run of king mackerel. Georgia recreational activity continues through October. Information is transmitted on the presence and abundance of Spanish mackerel through well established fishermen communication networks (Johnson and Maiolo 1986; Maiolo and Johnson 1986, 1988a, b). King mackerel and cobia are the most preferred species because of their size and the desire for a lively fight. Spanish mackerel fishing becomes popular when the schools of the larger size fish (more than three pounds) become available. Charter boats experience a good business with patrons targeting Spanish of all sizes, with the smaller sizes kept for bait for large pelagic fishing.

Small boat, bank, and pier fishermen target Spanish mackerel in Florida, particularly in the late Fall and early Spring. Unlike the other South Atlantic states, Florida has a significant shore-based recreational Spanish mackerel fishery. Live bait fishing for Spanish mackerel has gained popularity in recent years. Large, privately owned and charter boats target Spanish mackerel on an opportunistic basis when the larger sizes are available, or when conditions prevent the harvest of more desired species. As is the case in the other three South Atlantic states, the preferred species for privately owned and charter boats are king mackerel, cobia, and other larger species because of the possibility of a lively fight.

The social organizational framework for anglers who fish for Spanish mackerel is best seen as a loose amalgam of people and organizations with an interest in fishing for a variety of species. Many own or have access to boats in the small to intermediate size (up to the mid-thirties in feet). Some of these anglers are connected through sportfishing clubs, most are not. Those that are, and are active, also are fishing network leaders (Maiolo and Johnson 1986, 1988a, b); those that are not involved in sportfishing clubs are connected mainly through occupational or community ties. Included in the latter are the "vacation" communities which form in coastal areas by those who own beach cottages and condominiums.

7.2.1 Economic Impacts

It is difficult to isolate specific economic values associated with the Spanish mackerel fishery, insofar as recreational anglers are multiple species

fishermen, Even on a trip specifically targeting Spanish mackerel, other species are caught incidentally. By the same token, it would not be appropriate to exclude expenditures which are not wholly attributable to a particular activity (e.g., Spanish mackerel fishing). Thus, prorating expenditures in proportion to the amount of time the equipment is used for a specific activity would seem to be a reasonable approach.

Species specific estimates have been made by prorating total economic activity (GMFMC and SAFMC 1987). In 1987, the estimate for the South Atlantic region was 289 million dollars in sales, using 1975 data, relating to all saltwater angling of which 15% was attributed to coastal pelagic fishing. Fourteen million (5%) was directly attributed to Spanish mackerel fishing (GMFMC and SAFMC 1987). Application of a constructed Consumer Price Index of .70 from 1978 to 1988 (Webb 1988, Wall Street Journal 1989; Randall Parker, pers. commun.) would add 9.8 million dollars to sales value, bringing it to an estimated 23.8 million dollars. These estimates assume the same rate of expenditures, i.e., no increase or decrease, which must be kept in mind. They point to the amount of money required to purchase the same goods and services in 1988 dollars.

Recent estimates by Rockland (1989) targeted sales related to all marine recreational angling in the South Atlantic to be over one billion dollars, with $12,496,300 accounted for by sales related to Spanish mackerel angling. However, he noted that the estimates are extremely conservative due to the method of calculation.

Purchases by anglers create and sustain employment and income in the production, distribution and retail sale of goods and services bought. Wages and salaries pertaining to Spanish mackerel in the South Atlantic have been estimated to be 2.84 million dollars, using 1975 data (GMFMC and SAFMC 1987). Application of the .70 CPI would add 1.99 million to the wages and salaries to bring the value to an estimated 4.8 million dollars in 1988.

It should be noted that such direct economic benefits accrue to the entire nation, not just to the South Atlantic. The estimates include purchases of durable goods (boats, motors, trailers, fishing tackle), and non-durable goods (fuel, bait, fees associated with charters, headboats, and marinas, plus food and lodging) Also, it should be noted that many purchases made by anglers are not for the sole purpose of fishing. A boat is used for many activities, not just fishing; and, as noted in regard to fishing, it is used for a variety of species.

7.2.2 The Charter Fleet

Few charterboat owners and captains rely on boat charters as a source of total income. As one moves from North Carolina south to Florida, the likelihood of full time employment in this sector increases. A recent study by Perdue (1988), covering North and South Carolina, and Georgia indicated that 80% of the patrons interviewed did not specify a target species. Of those who did, Spanish mackerel was not reported as a preferred species.

Charterboat captains, interviewed by Maiolo and Jendrasiak (1989) indicated that Spanish is a popular and, therefore, important "alternative" to fishing for large gamefish when the latter are unavailable. Historical abundance,

taste, the ease with which they can be filleted, and the association with king mackerel seem to be the contributing factors to their popularity as an alternative.

Manooch and Laws (1979) found that Spanish mackerel ranked third (14.8%) in regard to the number of fish caught on charter boats in North Carolina in 1977. King mackerel was first (36.7%), followed by bluefish (28.2%). Research for the entire region is dated, but 1970 data indicate that about 13% of all fish caught on party and charter boats are Spanish mackerel.

There seems to be a sizeable recent increase in the number of charterboats operating in the South Atlantic. Data from 1977 indicated 130 vessels operating in North Carolina, 35 in South Carolina, 20 in Georgia, and 230 in Florida (East Coast)(GMFMC and SAFMC 1983). Data for 1989 (M. Justen, NMFS, St. Petersburg, FL 33702, pers. commun.) indicate a considerable gain, based on permits issued to charterboats which allow them to fish for Spanish mackerel under the quota system as well. Two hundred and ninety-nine permits were issued in Florida, 24 in Georgia, 72 in South Carolina, and 265 in North Carolina (Tables 7.2 and 7.3). It is reasonable to assume that the number of vessels is larger than the number of permits. At least 660 are fishing for Spanish commercially; 664 if one includes the four vessels permitted to fish the Atlantic stock, but which are licensed in the states of New Jersey (2), Delaware (1), and Connecticut (1) (Table 7.3). Another nine charter vessels are licensed for the bag limit only in the states of Maryland (2), New Jersey (1), Ohio (1), Delaware (1), Virginia (2), and Pennsylvania (2) (Table 7.2).

Economic values associated with the charter fleet in the South Atlantic are difficult to estimate due to the unavailability of data reflecting trends in the 1980s. In the South Atlantic in 1977, charter boats fishing for Spanish mackerel, presumably as charters and not as commercial vessels, accounted for about 1.5 million dollars in gross revenues and $520,000 in charter operators' incomes (GMFMC and SAFMC 1985). Using the .70 CPI discussed in 9.2.1., and assuming a constant rate of expenditures, but in 1988 dollars, the values in the South Atlantic would be 2.5 million dollars in gross revenues; and $884,000 in charter operator incomes (Maiolo and Jendrasiak 1989).

7.3 Employment

7.3.1 Employment Associated with Commercial Harvesting

Research conducted in the late 1970s indicated that 576 commercial vessels were operating in Florida which directed effort toward king and Spanish mackerel. Utilizing the crew size to boat size and gear type data obtained by Maiolo and Jendrasiak (1989), the number of fishermen would have been approximately 1025. Utilizing the same ratios of boat size and gear type with the 1989 federal permit data (558) would yield a slight decrease, to approximately 976. This assumes that the composition of the fleet has remained constant, which cannot be determined at present. Assuming 1.5 crew members per vessel for the remaining licensed boats in the South Atlantic states of North Carolina, South Carolina, and Georgia (327), it is estimated that the number of additional fishermen is 490. Additionally, with 298 commercial permits issued to charter boats, and applying a 1.5 multiplier, approximately 447 people can be added, bringing the total to a number approximating 2,100

people with some employment dependency on the Spanish mackerel fishery under the commercial quota.

Interviews with fishermen and dealers in Florida (Maiolo and Jendrasiak 1989) indicated that fishermen are catching fewer, but larger Spanish mackerel which has yielded, for some in the Fort Pierce/Port Salerno and Miami areas, an optimistic outlook for the fishery recently, and has sustained the commercial fishermen in the fishery. The presence of state and federal regulations, especially those which require evidence of income from commercial fishing (10%), is viewed by some as a positive contribution to the commercial side of the fishery. For others, the outlook appears to be gloomy. There was some concern over amendments which prohibit drift gill nets, and those which reduce the allocation dedicated to commercial fishing. Further, concern was expressed over the advantage of charter boats which can be permitted to fish both under the bag limit and the commercial quota.

Employment is generated in the brokerage/process/distribution sectors as well as in industries providing inputs to fish harvesting (gear, boat building, repairs, supplies). Data are not available to estimate the number of employees who benefit in this sector in the South Atlantic.

7.3.2 Employment Associated with Recreational Angling

Current data on this topic are not available at this time. Data from 1977 indicated that 360 person years of employment were associated with Spanish mackerel angling in the South Atlantic, generating nearly three million dollars in wages and salaries (GMFMC and SAFMC 1983). Assuming that work related to Spanish mackerel fishing would occupy between 5 and, and 20% of any one person's time, the number of people who would have benefited from the fishery would fall between 1800 and 7200 (Maiolo and Jendrasiak 1989). As discussed in 9.2.1., if one were to assume that the rate of expenditures would remain the same from 1978 to 1988, and apply a Consumer Price Index value to the 1977 data, the following estimate can be made. The 1977 data of 2.84 million would be multiplied by .70 (Webb 1988, Wall Street Journal, 1989, Randall Parker, pers. commun.), yielding an additional 1.99 million, for a 1989 value of 4.8 million dollars (Maiolo and Jendrasiak 1989). With the increase in the number of recreational anglers during the early 1880s (Kitner and Maiolo 1988), it is reasonable to assume that the values presented on employment and expenditures may be conservative. These estimates need to be viewed with extreme caution. A comparison of data from the SAFMC with those made in the Gulf in 1980 (GMFMC and SAFMC 1983) indicates an increase of about 25% in wages and salaries, which is reasonable, but a decline in person year employment during the same period.

Added to the employment numbers would be charter boats with only permits to fish under the bag limit, estimated to be 375 (recall that 298 fish under both the commercial quota and the bag limit, and are included in the commercial fishing employment narrative). With an average captain/crew size of 1.5, another 563 people must be added to the employment list of those who receive some compensation from the Spanish mackerel fishery in the South Atlantic.

7.4 Domestic Processing

The social organizational framework of the Spanish mackerel market, handling and processing was examined by Maiolo and Jendrasiak (1989). The Fort Pierce/Port Salerno area now has five fish houses available to handle Spanish mackerel during the height of the season. Interviews with fish house management personnel indicated that the recent surge in the availability of larger Spanish mackerel has fostered the development of restaurant and retail outlets of fresh Spanish mackerel, particularly those caught with hook and line, which are preferred over those caught with nets. Spanish mackerel which are captured on hook and line can bring as much as twice the price of those caught with nets, e.g., $2.50 vs. $1.25 per pound in the Spring of 1989. The fish are considered to be fresher than those which are left in nets in the water, and then on the vessels until they are offloaded. Sales are reported to be brisk during the Lenten season in the Fort Pierce/Port Salerno and Miami markets.

In the Keys, some boats target Spanish, while others, which target lobster, yellowtail snapper, and stone crab, sell Spanish caught incidentally. Maiolo and Jendrasiak (1989) were not able to locate any hook and line fishing for Spanish in Key West. Spanish are packed and shipped to processors throughout the state.

In both the Fort Pierce/Port Salerno area, and the Keys, the presence of the king mackerel market has provided the framework for the handling of Spanish mackerel. The Jacksonville area, as noted previously, does very little handling of Spanish, all of which is packing and shipping to other markets.

North Carolina's marketing system does not involve processing of Spanish mackerel. The fish are either sold directly to restaurants, sold in retail outlets, or packed whole and shipped to Northern markets.

7.5 International Trade

International trade of king and Spanish mackerel occurs on a relatively small scale (GMFMC and SAFMC 1985). Some imports originate from Latin America, mainly Mexico, Venezuela, and Ecuador. Foreign markets include Canada and Venezuela.

U.S. imports of mackerel totalled less than 50,000 pounds of frozen product in 1977. Another 150,000 pounds of canned mackerel entered the U.S. from Peru, but is is believed the product was of the Pacific mackerel varieties. The largest importer of canned mackerel was Japan in the 1970s. These fish sell at a lower price than king and Spanish mackerel and are sold canned, and probably have little effect on king and Spanish mackerel markets.

Mackerel is imported from the European countries of Holland, Poland, Germany, Great Britain, Denmark, Norway, Spain, and Portugal, but it is not believed to be Spanish mackerel. The small quantities are not believed to affect the U.S. Spanish mackerel market.

Records on king and Spanish mackerel are aggregated making it difficult to estimate each separately. Canned products are included with other mackerel and frozen products and are aggregated with non-mackerel species. Exports of

king and Spanish mackerel in canned form are small, since only 1.2 million pounds of all types of canned mackerel were reported to have been exported from the U.S. The majority of this was believed to be Atlantic mackerel. Receiving countries were Guatemala, the Bahamas, and the Dominican Republic in 1977 (GMFMC and SAFMC 1985).

Tariffs on mackerel products do not appear to be restrictive to international trade, with the exception of Venezuela. That country imposes a 300% tariff on the value of canned products. Canada has no tariff on frozen products, and a 15% tariff on canned products. This is comparable to the U.S. tariff of 12.5%, which phased out in 1985.

7.6 Description of Business, Markets, and Organizations Associated with the Spanish Mackerel Fishery

7.6.1 Relationships Among Harvesting, Brokering, and Processing Sectors

Historically, Spanish mackerel are sold by fishermen to local fish dealers who, in turn, sell to retail outlets, restaurants, freezer companies, and secondary wholesalers. The major market for fresh Spanish mackerel has been the Southeast, including Florida. Cafeteria chains and restaurants are the most important outlets for fresh Spanish mackerel, followed by retailers who service home consumers. Products sold to retailers consist of fresh and frozen fillets, as well as whole fish (both fresh and frozen). More than three quarters of Spanish mackerel have been sold as frozen fillets (Centaur Associates 1981). Some companies ship whole frozen fish, larger than three pounds to Puerto Rico. A third market outlet consists of product for animal feeding (zoos, aquaria), and for bait for both commercial and recreational fishermen. These involve smaller Spanish, less than desirable size for consumer acceptance.

Maiolo et al. (1981) have examined the relationships which exist between fishermen, dealer/processors, and secondary wholesalers. They discovered that the role of the dealer, or any middleman in a marketing system, has been an area of considerable discussion. Wilson (1980) has outlined the importance of stable relationships between fishermen and buyers. In some respects they resemble those found in integrated firms, that is, reciprocal agreements form in a way to coordinate effort. Unlike integrated firms, however, fishermen/buyer relationships are constrained by the expectation that, over time, the accounts of the agreement, which include many immeasurable aspects of the process of reciprocity, such as personal favors, loans, etc., need to maintain a rough balance. Maiolo et al. (1981) found this to be the case among North Carolina shrimp fishermen, the strength of which was rooted in what they termed "multi-stranded" relations. That is, the relationships between fishermen and dealer/processors were found to be rooted in many activities, tied to community, kinship, organizations, and so on, and imposed themselves upon the relationship involving the exchange of fish for money. Further, the variety of transactions which occur, under a number of economic conditions, prevailed upon the relationship in a way to protect the buyer in times of scarcity, and the seller in times of resource abundance. A give and take was found to occur in the shrimp fishery from harvester to primary buyer, and on to restaurants, wholesalers and other secondary buyers, and accounts roughly balanced on a regular basis (Maiolo et al. 1981). Assurances to buy and sell were given under poor conditions to maintain product flows under

better conditions. This reciprocity was found to stabilize the product flow under varying conditions of product availability and price changes and to contribute to mutual economic security.

Maiolo and Jendrasiak (1989) found evidence that the relationships described above prevail in the Spanish mackerel fishery in the Southeast. Dealers accommodate fishermen who harvest Spanish mackerel opportunistically, even if they (dealers) prefer not to, because of the other transactions in which they are involved with the fishermen; and fishermen accommodate dealers who can market Spanish mackerel during certain periods by harvesting Spanish mackerel. The relationship is not perfectly symmetrical, however, insofar as fishermen can, or will harvest Spanish only on an opportunistic basis if they choose not to direct effort to Spanish mackerel; whereas the dealer always finds a way to accommodate "his" fishermen. In other cases (e.g., Fort Pierce/Port Salerno), both the buyers and the sellers are established enough in the fishery to pursue transactions involving Spanish mackerel on a regular basis. In the Florida Keys, multi-stranded, informal, bilateral agreements are made between the fish houses and the vessels' captains, whereby dockage and other expenses are paid by the fish houses in exchange for the assurance that the vessels will sell their catches to the fish house with whom the arrangement has been made.

7.6.2 Labor Organizations

There are no known labor organizations in the harvesting or processing sector in the Spanish mackerel fishery. However, counterparts in the form of the Organized Fishermen of Florida (OFF), the North Carolina Fisheries Association (NCFA), and the Carteret County Watermen's Association (CCWA, Morehead City, North Carolina) are actively involved in the protection of what are perceived to be the interests of the commercial fishermen in their respective states. The OFF is the larger of the three, involving nearly 2,000 members, a full-time executive director, and a secretary. The organization publishes a monthly magazine of about 40 pages. The NCFA has about equal proportions of fishermen and dealers, a full-time executive director, and a secretary. Membership floats around 1,000. The CCWA has a membership of about 250, with a full time executive director, and a part time secretary. Georgia has two organizations to advance the interests of commercial fishermen, the Georgia Fishermen's Association, consisting primarily of shrimpers; and the Georgia Watermen's Association, oriented primarily to the interests of crabbers and other shellfishermen. South Carolina has the Shrimper's Association, the Georgetown Bateau Fishermen's Association, and the South Carolina Crabber's Association. Membership in these types of organizations averages just under 300.

Even though none of the associations is considered to be a labor organization in the traditional sense, they perform similar functions. For one thing, they exist to promote the economic interests of their members, just as recreational fishing clubs promote their members' special interests. Like any voluntary association in American society, they take on social functions over time, such as the exchange of personal favors among members, the provision of social support in times of crisis. They are also active in fisheries management in that they vocalize their collective interests at public hearings, resource agency meetings and in private communications. These types of activity appear

to have become more frequent over time, which might have been considered predictable, given the examination of changing patterns of participation in newly emerging fishery management systems (Maiolo and Orbach 1982; Pollnac and Littlefield 1983). The nearly 100 sportfishing clubs in the South Atlantic can be considered to be functional counterparts in the recreational sector.

7.6.3 Foreign Investments

The GMFMC and SAFMC (1985) has reported that there is no significant foreign investment in the domestic sectors of the fishery.

7.7 Social and Cultural Organization of Domestic Fishermen

Coastal fishing communities are no longer isolated coastal littorals, populated with fishermen/crofters (farmers). To be sure there are still relatively isolated communities dominated by those who mainly fish for a living along the Southeast coast of the United States. These are found mainly in North Carolina, South Carolina, and Georgia. Most communities in the 1980s were some combination of fishing, perhaps some farming, tourism, retirement, industry, in some cases shipping, and in others military in scope (Acheson 1981; Maiolo 1981a; Maiolo and Tschetter 1981, 1982; Maiolo and Orbach 1982). Even communities which, on first appearance, appear to the outsider to be traditional and similar in nature, have been found to be quite different in regard to internal structure, and linkages to the surrounding environment (Ellis 1986). Traditional values predominate among those who have grown up in coastal communities, but these are often existing alongside new and changing ideas and values transported by the new arrivals who come to recreate and retire. Often the two clash (Maiolo 1981, Maiolo and Tschetter 1981a). Thus, the culture of the coastal communities, generally, and the South Atlantic communities specifically, may be seen as an amalgam of the traditional and the new, with further change and a new synthesis on the horizon. Currently, 75% of the American people live within fifty miles of the Atlantic, Gulf, Great Lakes and Pacific shorelines. By the turn of the century, 80% will live within this narrow coastal strip, many of whom will be in-migrants. The private sector has invested billions of dollars in coastal industries and development during the past two decades. Government agencies have spent tens of billions on coastal infrastructure support. It is within this context that commercial and recreational fishing occur. Spanish mackerel fishing is an important commercial and recreational activity, the nature of which affects, and is affected by such a context.

7.7.1 Commercial Fishermen

7.7.1.1 Ethnicity, Family and Community Organization

Commercial fishermen can spend long periods away from their homes and communities, which distinguishes them from other American workers, and creates unique problems among this class of working men (Orbach 1977; Maiolo 1989a). As a result, traditional family roles familiar to most Americans do not characterize the families of fishermen. Women participate in much more of the family decision-making than in families of other workers in American society. The structure of child rearing among fishing families is unique in American society as well, with women playing the dominant role in families where the father is absent for extended periods of time (Orbach 1977; Smith 1977a, b;

and Ellis 1986). Further, they participate, on their husbands' behalf, in community activities (Smith 1977a, b). This is a major reason why studies have found community organizational participation and participation in public hearings to be low among fishermen (Maiolo and Bort 1981). They simply do not have the time, nor are they available when many of the organizational meetings will occur. Those that do find the time for such activities are usually the central figures in fishing community networks, probably because they are the bearers of information from those groups which affect their livelihoods (Maiolo and Johnson 1986).

Most of the fishermen who target coastal pelagics do not appear to be different in these respects from their counterparts who pursue other species, with the following exceptions. First, the communities in which they reside are mostly on the "change" end of the continuum in North Carolina and Florida, opposite from the remaining relatively isolated fishing communities. As such, their families and communities will be characterized, in varying degrees, by the descriptions outlined above.

Second, Cuban-Americans are involved in the fishery in South Florida which is characteristic of many of the fisheries in that area (Orbach and Johnson 1987), but atypical of North and South Carolina, and Georgia. How their community and family structures uniquely relate to commercial fishing is not known. Acheson (1981), Smith (1977a, b, 1978) and others would lead one to conclude that the nature of the activity (fishing) creates more similarities across cultures, than cultures create differences, however. Further, to the extent that the fishermen and their communities become "modernized," i.e., in the sense of coping with newly created management structures, the Cuban-Americans would exhibit more similarities than differences on behavioral variables crucial to understanding the social organization of their fishing experiences (Maiolo and Orbach 1982).

Other than the Cuban-American involvement in South Florida, the ethnic structure of the Spanish mackerel fishery is mainly white, Anglo-Saxon in origin. Vietnamese immigrant fishermen have been involved in other fisheries in the Savannah, Georgia area (mainly in shrimping and, to some extent, king mackerel fishing) and were found to total 100 in 1987 (Kitner and Maiolo 1987). No evidence has been found to indicate their involvement in the Spanish mackerel fishery, however, and recently gathered information indicates that all but two Vietnamese owned vessels have migrated to the Gulf (Susan Shipman, GA Dept. Nat. Resour., Brunswick, GA, pers. commun.).

While the vast majority of Spanish mackerel fishermen conduct most of their fishing near their communities of residence, the distribution of permits previously discussed indicates the potential for migration to other areas for purposes of harvesting Spanish; or, the migration of vessels from outside of the region to the South Atlantic. The nature of their integration into the host areas has not been researched to date. Therefore, no information is available on problems, if any.

7.7.1.2 Demographic Characteristics

Previous research which reported on demographic characteristics of Spanish mackerel fishermen (in conjunction with king mackerel fishermen) focused on

Florida Atlantic coast fishermen (GMFMC and SAFMC 1985). Such fishermen were found to have considerably more experience than other fishermen. Large boat fishermen were found to have the most experience (near 34 years.). Spanish mackerel fishermen were found to be slightly younger than their king mackerel counterparts (46 vs. 49). Research conducted by Maiolo and Johnson (1987) indicated that the age structure of Florida king mackerel fishermen who are influential in the network was identical to the GMFMC and SAFMC data. However, insofar as the research was conducted a decade later, and the age structure remained similar, the indication is that younger fishermen entered the network during the 1980s, and that a replacement regime is operating.

King mackerel fishermen in North Carolina, South Carolina, and Georgia were about six years younger than those in Florida in the decade of the 1980s (Maiolo and Johnson 1987). In regard to organizational activity, in North Carolina, the central figures in the fishing network were found to be the most active in fishing related organizations, the most widely read in regard to fishing related periodicals, and the most highly educated (Maiolo and Johnson 1986). Research in the other South Atlantic states pointed to similar results, but the data were not as conclusive (Maiolo and Johnson 1987).

7.7.1.3 Economic Dependence on Fishing and Employment Configurations

Not all people employed in both the commercial and recreational fishing domains are wholly dependent upon fishing for all of their disposable income. The seasonality of fishing activity makes it necessary to combine fishing and fishing related activity with other employment. Maiolo and Bort (1981) found that commercial fishermen find employment in the off season, but, in many instances, the work was maritime related (e.g., construction). Some fishermen were found to hold salaried jobs elsewhere, but still considered themselves to be commercial fishermen. They would structure vacations and sick leave to match up with seasonal stock abundance.

A survey of Florida commercial fishermen in 1977 found a diversity of other types of employment to include educators and other professionals (Prochaska and Cato 1977). Similar findings were found among part-time commercial shrimpers in North Carolina (Maiolo and Bort 1981; Maiolo 1989). In 1974, 48% of Florida commercial fishermen fished full time; 52% reported that some of their income was earned from employment outside of fishing (Prochaska and Cato 1977). Most shrimp fishermen in North Carolina earn 88% of their incomes from commercial fishing (64% earn all of their incomes from fishing) (Maiolo and Bort 1981).

The GMFMC and SAFMC (1985) found that Spanish and king mackerel fishermen are more dependent than the average Florida commercial fishermen on fishing for a livelihood. Research in 1976 of small boat Spanish mackerel gill net fishermen indicated that 71% of total income was earned from fishing, while the percentage was 92% for large boat fishermen (Cato et al. 1978). Research in North Carolina indicates that commercial fishermen who fish for Spanish mackerel probably earn most of their income from fishing, even though the percentage earned from Spanish mackerel fishing is relatively low (Maiolo and Jendrasiak 1989). Charter operator's earn about 50% to two-thirds of their incomes from charter fishing (Ditton et al. 1977).

Little has been determined about the dependence of those employed in the processing, distribution and sales of fishery products, and of those involved in producing and selling recreational fishing goods and services. Seasonal fishing probably does affect employment (P.Tschetter, East Carolina Univ., Greenville, NC pers. commun.). Maiolo and Bort (1981) found this to be the case in North Carolina in regard to the wives of commercial fishermen, and school aged children who supplement family incomes by working in fish houses. Research in North Carolina has shown that, in some communities, Blacks are disproportionately impacted (negatively) by seasonal employment in processing plants (Maiolo 1981 b). It is unclear as to what the dependency would be in regard to Spanish mackerel. In North Carolina, it probably would not be very significant.

In the boat building and sales area, along with gear and tackle, most of these items are not built specifically for Spanish mackerel fishing. A decline in the fishery would have some impact, but the exact nature has not been determined. An instructive data set has been developed by Tschetter in regard to the number of licensed vessels, the growth of which has been impacted mostly by the manufacture and sale of recreational boats. Between 1970 and 1985, in Carteret County, North Carolina, the number of licensed boats increased from 26,000 to 62,000 (138%). During the same period, Broward County (Florida) showed an increase from 168,000 to 340,000 (102%). This pattern holds up in every coastal county in the two states for which data were analyzed (P. Tschetter, East Carolina Univ., Greenville, NC, pers. commun., Tschetter and Maiolo 1981).

Within the South Atlantic region, the poorest and most rural counties are those with the highest percentages of commercial fishermen, if there isn't a recreational community within the county (Tschetter and Maiolo 1981; P. Tschetter, East Carolina Univ., Greenville, NC, pers. commun.). Per capita income is highest in Palm Beach County ($14,000), followed by Dade County with $11,200. Dare County, North Carolina, has a $10,400 per capita value. North Carolina had the highest percentage of employees in forest and fisheries, Florida the lowest, in 1980. In Florida, Monroe County had the highest (4.8%), Broward, Dade and Palm Beach counties the lowest (0.1%). In Georgia, McIntosh County had the highest (9.2%) and Chatham County the lowest (0.2). In South Carolina, Georgetown County had the highest (2.1) and Horry County the lowest (0.3). North Carolina's highest and lowest percentages came from Hyde County (11) and Camden County (<0.1).

The trend is that the percentage of those employed in commercial fishing to the total employment structure is declining, with the exception of Hyde county North Carolina, which experienced an increase from 6.9 to 11 from 1960 to 1980. The most important factor influencing this trend is the development of trades related to recreational and retirement expansion (P. Tschetter, East Carolina Univ., Greenville, NC, pers. commun.).

7.7.1.4 Psychological and Social Benefits of Commercial Fishing

Occupational roles vary in regard to non-remunerative psychological and social returns. It has been determined by occupational sociologists that the more latitude one has, the more intrinsically satisfying one's job is. This argument dates back to the origins of Industrial Sociology (Miller and Form 1951). Researchers have argued for years that, with the exception of the

bureaucratically organized industrial European trawlers, commercial fishing has associated with it a great deal of latitude (Tunstall 1976; Norr and Norr 1978; Acheson 1981), and satisfaction beyond financial remuneration. In addition, social interaction with friends and kinsmen is not limited to work, but is multi-stranded and based in community, neighborhood, and family organization as well as work (Acheson 1981, Maiolo and Bort 1981). Risks and uncertainty associated with fishing for a living provide for an egalitarian work environment, which is highly valued and satisfying in a democratic society, in comparison to many other occupations. They also provide a bonding among the participants, whether they work side by side, or work under similar conditions (Norr and Norr 1978; Acheson 1981). These factors help explain why intergenerational commercial fishing occurs in fishing families (Acheson 1981).

Spanish mackerel fishing contains all of the elements described above to provide for a fulfilling experience beyond financial remuneration. Risks come with the weather and equipment, uncertainty with the resource and its management, and these exist alongside of other types of fishing, and other types of relationships. These social forces reinforce the choice of entering and maintaining participation. It has been reported by the GMFMC and SAFMC (1985) that a considerable number of coastal pelagic fishermen have come from families where the father was a fisherman operating in the same or similar fisheries; and that a number of father/son combinations fish in the South Atlantic for mackerel.

Two recent and general sociological trends bear upon the Spanish mackerel fishery in the Southeast. The first is the entrance into commercial fishing of retirees, and people coming from other regions and occupations (Maiolo et al. 1981; Johnson and Orbach in press). The second is the transition in the styles of participation to cope with modern management systems (Maiolo and Orbach 1982). The future is likely to bring fishermen who are more conversant with modern management concepts (Maiolo and Orbach 1982), who will find the wherewithal to be present and effectively participate in panels and public hearings, and who will look for ways to become more effective through organizational affiliation. This configuration has been examined by Maiolo and Johnson (1988a, b) in the king mackerel fishery in the Southeast.

To the extent that informed collective action will become more pronounced in the future, it can be hypothesized that psychological and social payoff will find such action as a new source of support (Miller and Form 1951; Norr and Norr 1978; Acheson 1981; Maiolo and Orbach 1982). The reason is that the fishermen will find the strengthening of effective participation through such collective action which, in turn, broadens the basis for continuation in fishing as an occupation in spite of resource uncertainty, and management agency responses to such uncertainty.

There are a number of social benefits the local community, region, and nation receive from the presence of commercial fishing beyond those normally assumed, such as food, expenditures, and employment for remuneration. Coastal communities are popular tourist attractions. The presence of commercial fishing may have aesthetic drawbacks for some. But, for others, boats passing through the channels on their way out or back from work is aesthetically pleasing; those lined up at the docks, waiting for the next day, or offloading the day's catch complement the beach, bar and restaurant activity. Shopping

for fresh fish in a local market is anticipated by those who plan their vacations at the coast, and has as much to do with the intrinsic aspects of the activity as the nutritional and taste benefits (Maiolo 1981a; Ellis 1986).

Commercial fishing is one of the last frontiers in American society, still fraught with excitement, legends (Stick 1958), risk, danger and uncertainty. It is a link to the past many parents want their children to see, and want to join to the extent that billions of dollars are spent annually in this country to provide the opportunity to be near it in the form of coastal development and preservation. Often, the former precludes the latter (Ellis 1986). Local communities and governments respond by the creation of historic associations, and legislation to preserve not only that which can be seen, but that which cannot, yet known to be present (e.g., the Looe Key Sanctuary in the Florida keys, the Gray's Reef National Marine Sanctuary off of the coast of Georgia, and the funding efforts associated with the preservation of the Civil War's Monitor off of the coast of North Carolina).

7.7.2 Recreational Fishermen

As diverse as coastal fishing communities have become, they share at least two important characteristics. The first is that they are coastal; the second is that they contain within them visible signs of commercial fishing activity, even though many tend to have become "colonized" by waves of in-migrants (Maiolo 1989). Unlike such communities, from which virtually all commercial fishermen come, recreational fishermen come from about as many community types as exist. To be sure, the level of activity is related to proximity to the marine resources, but recreational fishermen are not defined in terms of how many times they fish, but whether they fish. Fishermen have been observed to migrate from an inland state on an overnight bus trip, immediately step on board a charter boat, fish all day, immediately get back onto the bus, and travel the 10 hours home (Maiolo and Jendrasiak 1989). Others migrate for the weekend, a week, or a month or more. Some fish once a year, others hundreds of times. They come from blue and white collar backgrounds, large and small cities; to small and isolated coastal villages; and to large, diverse, mega-resorts with fishing, golf, tennis, and so on. With the diversity in backgrounds comes the diversity of motives to visit the coastal zone. But, those who put the line (or net) in the water all have one thing in common, namely the enjoyment of catching a fish, alone or with someone with whom they want to share the experience.

7.7.2.1 Ethnicity, Family, and Community Organization

Historically, saltwater sportfishing from boats is associated with white, Anglo-Saxon Americans (Johnson et. al 1986, Kitner and Maiolo 1988, FWS 1972, 1977a, b). Historically, blacks and other minorities have been seen to fish on river banks, and to some extent piers and bridges. More than a little of such activity is for subsistence rather than sport. This is neither a racial nor cultural phenomenon, but an economic one. Many minorities have not been able to participate in sports which require even a modest capital outlay, let alone golf, tennis (equipment and lessons), saltwater fishing with boats and expensive rods and reels, skiing and so on. These sports are not on the top of the list in families who have difficulty meeting the basic needs of food, shelter, education, and clothing (Bassis et al. 1988). As (if) economic conditions improve for American minorities, one can expect their increased

participation in all leisure activities which require financial outlay. Spanish mackerel fishing, for the most part, requires access to boats, and rods and reels which cost more than many minorities can afford. It is for this reason that few minorities participate in the fishery at present.

Saltwater angling is an active, not a passive sport. For the most part, those who pursue it are also engaged in occupations which require aggressiveness (Kitner and Maiolo 1988). "Experiencing tension..." (i.e., challenge) was ranked first among six categories of reasons for fishing recreationally in a study conducted in Rhode Island (Spaulding 1970; Kitner and Maiolo 1988). It can be hypothesized that the number of saltwater anglers will increase to the extent that our coastal states are experiencing steady growth in population, but, also, to the extent that the occupational structure in the United States undergoes transition (i.e., involving more people in occupations which require manipulative skills and aggressiveness) (Bassis et al. 1988; Kitner and Maiolo 1988).

One of the important trends in American society is the increased number of women in occupational roles which can provide both the financial support, and the leisure incentives to engage in active sports such as saltwater fishing (Orbach et al. 1986; Bassis et al. 1988, Kitner and Maiolo 1988). To the extent that the numbers of anglers, generally, and women, specifically, increase, the Spanish mackerel fishery will be affected. For one thing, it is a fairly easy resource from which to gain sport, food, and satisfaction. For another, it is within the "career" path many sportfishermen experience (Bryan 1977; Kitner and Maiolo 1988).

Saltwater recreational fishermen may come from a variety of communities, and some of those who regularly participate in fishing belong to fishing clubs. Those who are the most active, are also centrally located in communication networks. They are also the ones most likely to read literature related to the subject, belong to more than one organization, and be the most experienced. These are the findings of research by Maiolo and Johnson (1986, 1987) in the four South Atlantic states in regard to the king mackerel fishery. But, the anglers were determined to be multiple species fishermen, including Spanish mackerel fishing. The results varied somewhat by state, but were consistent enough to support the conclusions stated. It should be noted that some resource managers in all four states were considered to be central figures in the king mackerel fishery.

Family variables impact sportfishing, generally, and Spanish mackerel fishing, specifically, insofar as fishing is considered to be an experience to be shared historically by father and son. With gender roles in transition in American society (Bassis et al. 1988), one can expect female family members to participate more heavily in the future.

7.7.2.2 Demographic Characteristics

Recreational angling is a sport for all ages. Over half, however, have been found to be in their most productive years occupationally, further evidence of the relationship between occupation and leisure (FWS 1972, 1977a, b). A third of the anglers were found to be under 25, perhaps indicating the family involvement alluded to in 7.7.2.1. Sixteen percent were 55 or older. A third of the anglers were found to be female.

Fishing communication network leaders were found to average in the mid-forties in the South Atlantic, with the exception of Florida, where the mean age was 52 (Maiolo and Johnson 1986, 1987). None of the communication leaders was found to be female.

Anglers who charter boat fish in the Gulf of Mexico have been found to have higher incomes than anglers in general (Ditton et al. 1977). Johnson et al. (1986) found the same pattern in North Carolina.

7.7.2.3 Economic Dependence on Fishing and Employment Configurations

Some recreational fishermen sell their catches which involve a number of species. Maiolo and Bort (1981) found that recreational shrimpers actually considered themselves as part time commercial fishermen, and could earn several thousand dollars during a good year in fishing activity. Most that did sell their catches would only earn several hundred dollars, however. The GMFMC and SAFMC (1985) have reported substantial earnings from fishing on the part of charter captains in the Gulf. Data from the Spanish mackerel fishery are not available. Research on recreational king mackerel fishermen who are central to the communication networks indicates that in North Carolina, a small portion of the variance explaining network centrality is attributable to those who participate in the fishery by selling a percentage of the catch (Maiolo and Johnson 1986). This indicates that network centrality has some relationship to economic dependence even among recreational fishermen.

Spanish mackerel fishermen have been reported to have sold catches in North Carolina, but the federal permitting system seems to have brought such a practice virtually to a halt. Some recreational king mackerel fishermen have successfully acquired a permit and currently sell king mackerel under the 10% eligibility rule (i.e., the ability to acquire the license since 10% of income comes from the sale of seafood products). They also sell incidental catches of Spanish (Maiolo and Jendrasiak 1989).

As discussed in 7.7.1.3., with a few exceptions, boats and tackle are not species specific in the king and Spanish mackerel fisheries. Data are not available to allow for the development of specific estimates in regard to the region's dependence on the Spanish mackerel fishery, other than those indicated in 7.3.2. It would seem reasonable to assume that it is an important fishery to the region, given those estimates.

7.7.2.4 Psychological and Social Benefits of Recreational Fishing

Research has demonstrated the psychological benefits of recreational fishing, including the experience of catching fish, the scenery, and the challenge (Bryan 1977; GMFMC and SAFMC 1985; Johnson et al. 1986; Kitner and Maiolo 1988). A recent study of tournament billfishermen (Orbach et al. 1986, Kitner and Maiolo 1988) found the emergence of social and cultural supports of such a strength that the number and size of billfish caught were not determined to be as important to participation as social structural variables such as friendship networks, social activities surrounding the tournaments, and the norms and customs governing participation in the tournament activity.

From a societal point of view, the sport is available to all ages, sexes, races and ethnic groups. With few exceptions, the only constraint is

monetary. It is an activity which can be carried out as a solitary or group effort. A key measure of success for most is personal satisfaction; group affiliation can greatly affect such a judgement (Kitner and Maiolo 1988). As such, the activity is important in a society in which access to public resources has a high value placed upon it, and one in which outdoor activity is valuable for health and aesthetic reasons beyond its economic value.

Spanish mackerel fishing is accessible to sportfishermen in the South Atlantic because of the comparative abundance and location nearshore of the resource, as well as the comparatively low cost and skill level required to catch the species. Further, Spanish mackerel resemble king mackerel, a very popular species in the Southeast, in terms of type of fishing required, sport, ease of preparation for eating, and taste (Johnson et al. 1987).

7.8 User Group Competition and Conflict

One of the four original reasons for developing the Coastal Pelagic FMP for the South Atlantic region was competition and conflict in Florida between and among the users of the mackerel resources (GMFMC and SAFMC 1983). The assessment of the difficulty was largely determined by reports from fishermen. Problems associated with such testimony are discussed by Griffith and Maiolo (1989). Within the commercial domain, competition was believed to have become intense between the large and small scale net fishermen, and net and hook and line fishermen. Sportfishermen complained that commercial fishermen interfered with their attempts to capture Spanish mackerel. Charter boat captains complained that they could not service their customers with net fishermen in the same area. Other complaints from recreational anglers included the perceived waste of fish in the net fishery due to spoilage, and an overexploitation of a declining resource.

Commercial fishermen have complained of interference by recreational anglers in their attempts to set nets; and the scattering of schools of fish making it more difficult to make a successful net set. They also complained about each other. Prior to 1975, the Florida east coast fishery was entirely a small boat fishery. The development of deep water netting in the mid-1970s led to intense competition for the Spanish mackerel resource. From the standpoint of landings, the fishery is now dominated by the large boat net fishery.

The regional response to these problems was the approval of regulations separating the users in space and time, as well as quotas and bag limits (GMFMC and SAFMC 1983, 1985, 1987). The state of Florida has prohibited net fishing for Spanish during weekends when recreational fishing is most intense.

Complaints have been registered about the incidental catches of Spanish mackerel by the trawl fishery. Keiser (1977) reported modest but regular landings of Spanish mackerel by shrimp trawlers. Collins and Wenner (1988) felt that the impact of tongue trawl nets on mackerel stocks may be significant.

Multiple use competition involving mackerels occurred in 1985 in the state of North Carolina when sportfishermen complained about commercial menhaden fishing. The former argued that, since mackerels feed on menhaden, excessive exploitation of the menhaden stocks would harm the sportfishing industry directed toward king and Spanish mackerel. A coalition of recreational

mackerel fishermen and coastal community tourism interests caused two bills to be introduced in the North Carolina General Assembly that, essentially, would have eliminated the menhaden industry in the state. The bills were not successful, but pointed out the importance of the mackerel fishery to a vocal constituency (Orbach in press).

Data on ethnic hostilities specific to the Spanish mackerel fishery are not available. In Florida, hostilities have been reported in regard to the spiny lobster fishery (Orbach and Johnson 1987). Cuban-Americans are perceived incorrectly as participating in poaching, gear theft, and illegal fishing. Further, complaints have been registered about their numbers, with the predominant perception being that many of the Hispanics are boat-lift immigrants. In fact, Orbach and Johnson (1987) found this not to be true. Many of the Cuban-Americans have been in the fishery longer than the Anglo-Americans. The report did not provide data on such problems in the Spanish mackerel fishery, but the Cuban-Americans do participate in the fishery alongside of Anglo-Americans.

Vietnamese fishermen near Savannah have experienced problems with native Georgians in the shrimp fishery and, to some extent, in the king mackerel fishery (Kitner and Maiolo 1988). Many of the same complaints have been registered toward them as those indicated toward the Cuban-Americans in Florida, to wit, they don't follow the rules, they're intruders, they aren't good fishermen, etc. Orbach (1989) presented an excellent discussion of culturally based problems associated with Vietnamese immigrant fishermen.

Substantiation of charges and counter charges among user groups by domain and ethnic, social and area groups in the Spanish mackerel and other fisheries has become increasingly important as gear becomes more efficient, more people enter commercial fishing, and increased pressure comes from the recreational community for a limited resource. Informed management policies emanate from accurate data. Griffith and Maiolo (1989b) have documented the problems associated with defining conflicts in fisheries on the basis of user group testimony alone. Maiolo (1989) has raised questions of jurisdiction in the resolution of problems associated with competition and conflict, suggesting that resource managers often are called upon to solve issues in these areas which might be better left to law enforcement agencies and the courts. Further, he has called for a reconceptualization of competition and conflict in a way to better examine their sources and, therefore, more effectively find solutions, where appropriate (Maiolo 1981a, b, 1989). Johnson and Pollnac (in press) have developed a model to sort out sources of conflict, and suggest that conflict resolution measures depend, to a great extent, on the nature of the problem, and the types of groups involved. The authors then estimate the "tractability" of the problem (i.e., the chances for successful resolution), and the sensitivity to solutions based on popular measures such as space, time and resource allocation. Public and private processes in the resolution of conflict are discussed in terms of their effectiveness, based on the nature of the conflict, the types of users, and so on.

It is clear that as allocation schemes have become more refined (GMFMC and SAFMC 1989a, b), and to the extent that they are based on assumptions of conflict, research on the topic has become an issue of high priority.

8.0 MANAGEMENT PROGRAM

Spanish mackerel are presently managed under the Coastal Pelagics FMP and by individual states. The majority of the Atlantic Spanish mackerel harvest comes from waters under state jurisdiction. The purpose of this management program is to conserve the Spanish mackerel resource and achieve coordinated management regulations among the states involved in the harvest of Spanish mackerel and between the states and the federal government. A flexible plan is proposed that will track the Coastal Pelagics FMP and provide the needed control to restore and maintain the Atlantic Migratory Group of Spanish mackerel.

8.1 Definition of the Fishery

The fishery consists of the commercial and recreational harvest of the Atlantic Migratory Group of Spanish mackerel as specified below.

8.2 Management Unit and Fishing Year

The Atlantic Migratory Group of Spanish mackerel is that group of Spanish mackerel on the Atlantic coast of the United States whose southern boundary has been defined in the Coastal Pelagics FMP as the Dade/Monroe County line (25^{o} 20.4'N latitude) in south Florida. Amendment 5 to that plan extends the management area through the Mid-Atlantic Council's area of jurisdiction (New York to Cape Hatteras, NC). Regulations adopted by states will apply to the territorial sea and internal waters and will be compatible with federal regulations in the EEZ.

The fishing year for Atlantic Migratory Group Spanish mackerel will coincide with the fishing year in the EEZ. (At present the fishing year is April 1 through March 31).

8.3 Problems in the Fishery

1. The Atlantic Migratory Group of Spanish mackerel was reduced by overfishing and is below the level producing MSY. Although the stock is now recovering through management by quotas and bag limits, strong year classes entering the fishery should be adequately protected to allow strong gains in subsequent spawning biomass.

2. Management strategies and regulations pertaining to the Atlantic Migratory Group of Spanish mackerel vary among the Atlantic coast states.

3. Seasonal migration and availability patterns of Spanish mackerel along the coast create allocation concerns. Management strategies are needed which will ensure access to the resource by all states.

4.a. Additional biological and statistical data on both the recreational and commercial fisheries are needed. Also, economic information that assesses the impact of regulations and allocations is not available.

b. Available recreational catch statistics track only gross trends and were not designed to monitor catch for quota purposes.

5. The combination of low quotas and excessive effort has resulted in early season closures in the EEZ and disruption of traditional fisheries and markets in some states. Current fishing technology and excessive capacity can result in harvest and catches that exceed the commercial quota.

8.4 Specific Management Objectives

To achieve the goal of this plan, the following objectives have been specified.

1. To allow recovery of the overfished population and stabilize the Atlantic Migratory Group of Spanish mackerel at a level capable of producing MSY.

   Rationale: This objective addresses Problem 1. The spawning biomass of the Atlantic Migratory Group of Spanish mackerel is at levels that are less than occurred in the 1970s and less than that which will produce MSY. However, fishing mortalities since 1984 appear to have decreased, and there appears to be strong recruitment entering the fishery in the most recent years.

2. To achieve compatible management of the Atlantic Migratory Group of Spanish mackerel throughout its range.

   Rationale: This objective addresses Problem 2. Compatible management measures among states and the Federal government will facilitate enforcement of regulations and will promote conservation of the stock throughout its range.

3. To provide a flexible management system for the resource which is adaptable to changes in resource abundance, new scientific information, and changes in fishing patterns among user groups or by area.

   Rationale: This objective addresses Problems 1, 2, and 3. Annual review of the status of the stock and evaluation of management measures are necessary to monitor recovery of the resource. Adjustments of management measures on an annual basis will enhance the recovery and stabilization of the stock.

4. To promote cooperative interstate research and comprehensive monitoring activities that furnish information for effective management, and establish a mandatory and timely reporting system for monitoring catch and quotas.

   Rationale: This objective addresses Problem 4. The plan will focus attention on areas of inadequate information, encourage research into those areas, and provide a mechanism which will ensure that all available information can be incorporated into the stock assessment as quickly as possible. The ASMFC Plan Review Team will consult with the councils in monitoring specific aspects of the fishery, will review the Mackerel Stock Assessment Panel Report annually, and will make recommendations to

the Interstate Fishery Management Program Policy Board on amending the fishery management plan.

5. To minimize disruption of traditional fisheries and markets for the Atlantic Migratory Group of Spanish mackerel.

   Rationale: This objective addresses Problem 5. A high degree of flexibility is needed to adjust to changing conditions in the fishery and minimize conflicts through allocation of the resource. For example, disruption of fisheries north of Fort Pierce, Florida, has occurred due to excessive harvest to the south, followed by closure of the fishery. This excessive harvest early in the Florida fishing season (December) has led to a loss of supply to the traditional Lenten market. A continuity of supply for fresh fish markets in Florida should be maintained. Adequate bag limits for the recreational sector and trip limits for the commercial sector should be established to avoid seasonal closures of the fishery.

6. To minimize waste in both the commercial and recreational fisheries.

   Rationale: This objective addresses Problem 1. Waste in the fisheries due to discarded bycatch in nondirected fisheries, decreased fish quality and value in large volume catches, and losses in yield by harvesting prior to attaining the specified minimum size should be reduced.

8.5 Assessment of Optimum Yield

Optimum yield (OY) from a fishery is defined in the MFCMA as the harvest of fish which will provide the greatest overall benefit to the Nation with particular reference to food production and recreational opportunities, and which is prescribed as such on the basis of the maximum sustainable yield (MSY) from that fishery as modified by any relevant economic, social, or ecological factors.

8.5.1 Specification of OY and TAC

The long-term goal of OY for Spanish mackerel is defined as maximum sustainable yield (MSY). The OY which may be harvested annually, defined as total allowable catch (TAC), may vary due to fluctuating recruitment, fluctuating abundance by area or unit of stock, intensity of fishing effort by area or unit of stock, social, economic, or ecological factors, and improving estimates of MSY.

The best available estimate of MSY for the U.S. Spanish mackerel resources (Atlantic and Gulf) is 18 million pounds, within a range of 15.7 to 19.7 million pounds (Eldridge 1986; Nichols 1986). These estimates were derived using stock production and yield per recruit methods. There is no separate estimate of MSY for the Atlantic Migratory Group of Spanish mackerel.

An annual assessment of the Spanish mackerel stock is made by the Mackerel Stock Assessment Panel to determine whether or not the stock is overfished, and to calculate the allowable biological catch (ABC) for the next fishing year. ABC is a biological determination on which TAC is based. It is expressed as a range which corresponds to the uncertainty in the calculations of stock abundance and rates at which managers want to allow stock recovery.

The definition of "overfishing" is revised in Amendment 5 of the Coastal Pelagics FMP as follows:

(a) A mackerel stock shall be considered overfished if the spawning stock biomass per recruit (SSBR) is less than the target level percentage recommended by the assessment group, approved by the Scientific and Statistical Committee, and adopted by the Councils. The target level percentage SSBR shall not be less than 20 percent.

(b) When a stock is overfished (as defined in (a)), the act of overfishing is defined as harvesting at a rate that is not consistent with a program that has been established to rebuild the stock to the target level percentage, in which case the assessment group will develop ABC ranges consistent with the program that has been established to rebuild an overfished stock.

(c) When a stock is not overfished (as defined in (a)), the act of overfishing is defined as a harvest rate that if continued would lead to a state of the stock that would not at least allow a harvest of OY on a continuing basis, in which case the assessment group will develop ABC ranges based upon OY (currently MSY).

8.6 Management Measures

8.6.1 Mechanism for Annual Determination of MSY, ABC, TAC, and Non-Quota Restrictions

This plan recognizes the Mackerel Stock Assessment Panel, a group appointed by the SAFMC and GMFMC, as the official group which makes annual determinations of ABC for Spanish mackerel. It is recommended that one or more technical representatives from the states be represented on the panel and ASMFC's Spanish Mackerel Plan Review Team to assure continuity and consistency in reviews. Each state involved in the interstate management of Spanish mackerel is encouraged to provide information to the Mackerel Stock Assessment Panel, particularly catch-per-unit-of-effort indices and data on age and size distribution of the commercial and recreational catches. Items addressed by the panel include the following:

1. Stock identity and distribution. This includes situations where there are groups of fish within a stock which are sufficiently different that they should be managed as separate units. If several possible stock divisions exist, the assessment group describes the likely alternatives.

   Amendment 2 of the Coastal Pelagics FMP delineated two groups of Spanish mackerel with the Dade/Monroe County, Florida boundary separating the Atlantic group from the Gulf group.

2. MSY for the stock.

3. Condition of the stock which includes:

   a. Fishing mortality rate relative to F_{MSY} or $F_{0.1}$

   b. Abundance relative to an adequate spawning biomass

c. Trends in recruitment

d. Acceptable Biological Catch (ABC) which will result in long-term yield as near MSY as possible.

e. Calculation of catch ratios based on catch statistics using procedures defined in the Coastal Pelagics FMP.

4. Overfishing

5. Management Options. In order to achieve allocations, the assessment group will delineate possible options for non-quota restrictions on harvest, including effective levels for such actions as:

a. Bag limits

b. Size limits

c. Gear restrictions

d. Trip limits

e. Other options as requested by the Councils and ASMFC.

The report and recommendations of the stock assessment group will provide the basis for annual adjustments in TAC and bag limits, as necessary, to limit the catch of each user group to its allocation.

8.6.2 Allocations

Allocation of TAC for the Atlantic Migratory Group of Spanish mackerel was divided between commercial and recreational fishermen based on the average ratio of the catch for the period 1979 through 1985. The ratio was 76% for the commercial fishermen and 24% for the recreational fishermen. Amendment 4 reallocated the ratio to 50/50 based on the catches that occurred during the early to mid-1970s, which is prior to the development of the deep water run-around gill net fishery and when the resource presumably was not overfished. This reallocation will be implemented only for the total allowable catch increase above the level which results in a 3.04 million pound commercial quota, by providing 90% of the increase to the recreational allocation and 10% of the increase to the commercial allocation until the new ratio is established. A group's quota could be reduced only if the TAC were reduced, in which case the allocation ratio existing at that time would apply. However, the ratio will automatically adjust to 50/50 by 1994. According to these procedures, commercial and recreational allocations for the 1990/91 fishing year were set at 3.14 and 1.86 million pounds, respectively, yielding a 63/37 ratio.

8.6.3 Permits

Under the Coastal pelagics FMP, annual permits issued by the NMFS are required for charterboats fishing for Spanish mackerel for hire. Permits are currently issued for an April through March permit year and are available at any time and are valid through the following March. Annual permits are also required

for vessels fishing in the EEZ under the commercial quotas for Spanish mackerel. These vessels are exempt from the recreational bag limit. All fishermen who apply for permits must be able to show they derive more than a specified portion (presently 10%) of their earned income from commercial fishing, i.e., the sale of one's catch during the previous calendar year. Qualifying charterboat owners may obtain commercial permits to fish under the commercial quotas, but must adhere to bag limits when under charter or when more than three persons are aboard. States should consider requiring the use of permits as a mechanism for separating commercial and recreational fishermen.

8.6.4 Seasonal Closures

Boats with commercial permits for Spanish mackerel must cease directed fishing for the remainder of the fishing year when the commercial quota is reached. Catch allowances in State waters should be designed to prevent seasonal closures.

8.6.5 Bag Limits

The recreational allocation of Spanish mackerel will be controlled by a daily bag limit for anglers. Bag limits should be implemented to prevent a seasonal closure. Different bag limits may be set for anglers on charter or private recreational vessels. The bag limit is intended to reduce the individual/locally high recreational catch and distribute it fairly throughout the fishing year. If overfishing is occurring in the stock, the bag limit will revert to zero in the EEZ when the recreational quota is caught.

The daily bag limits for Spanish mackerel in the EEZ are 10 per person for North Carolina, South Carolina, and Georgia; and 4 per person for Florida. Compatible state regulations are recommended throughout the range. No state should allow any increase in bag limits until enough yield is available to allow an equal bag limit for all states. Any adjustments in state bag limits should parallel recommended changes in bag limits for the EEZ.

8.6.6 Size Limits

The minimum size limit for Spanish mackerel in the EEZ is 12 inches fork length. Compatible state regulations are recommended throughout the range. This size corresponds to a fish less than one year old and a weight of 0.5 lb.

8.6.7 Gear Restrictions

The recommended minimum mesh size for gill nets used for directed Spanish mackerel harvest may not be less than 3-1/2 inches stretched mesh. This mesh size will direct commercial fishing to the preferred commercial size. Mean retention lengths from gill net mesh selectivity studies (3-1/2 inch stretched mesh) were 15.6 + 2.0 in (Trent and Pristas 1977) and 18.1 + 1.4 in (Erhardt and Die 1988). Current state regulations are referenced in Table 5.2.

8.6.8 Trip Limits and Landing Restrictions

States should use trip limits and landing restrictions to allow achievement of target quotas while preventing season closures and disruption of traditional markets or fisheries. Current state regulations are referenced in Table 5.2.

8.6.9 Statistical Reporting Measures

Improvements in the current systems of collecting fisheries statistics are needed to obtain more accurate catch and effort data and to monitor quotas. Commercial landings data are, in most cases, collected by state and federal port samplers from fish dealers on a voluntary basis under the NMFS Cooperative State-Federal Statistics Program. Recreational catch data are collected under the NMFS MRFSS in which most states participate to collect intercept data. Both of these surveys need to be improved so that data is collected at the level of precision needed to estimate catches. Also, data from the MRFSS are not available as needed for timely quota monitoring.

It is recommended that a mandatory reporting system for collecting commercial landings data be adopted by all states to obtain more accurate estimates of total catch. States are encouraged to require a license to sell. Each state should implement a saltwater recreational fishing license to identify the recreational fishing universe for survey purposes. In addition, each state should enhance the intercept portion of the survey to the needed level of statistical precision to accurately estimate catches. The NMFS should provide increased support to the MRFSS to provide the data to managers on a more timely basis.

9.0 SPECIFICATION AND SOURCE OF PERTINENT FISHERY DATA

9.1 General

One of the major problems in managing the Spanish mackerel fishery is lack of data needed to estimate MSY and monitor user group allocations. Certain key data are vital to effective prudent fishery management. Better statistics on catch and effort are needed to provide more precise management information for the Spanish mackerel fishery. Commercial and recreational fisheries statistics are presently collected by the states and the National Marine Fisheries Service. In addition to statistical data collection, areas of needed research are specified in the following sections to encourage appropriate groups to undertake efforts to improve the information base for effectively managing the fishery.

9.2 Domestic and Foreign Harvesters

Landings data are routinely collected from dealers by NMFS and state port samplers. Additional biological and catch/effort data are collected under the NMFS Trip Information Program (TIP). Recreational catch data are also collected by the NMFS and cooperating state agencies, under the MRFSS. The NMFS Panama City laboratory collects catch data from a portion of the charter boat fishery through a voluntary logbook survey.

The Coastal Pelagics FMP requires that commercial and charterboat permit holders, who are selected to report, must provide information regarding any

fishing trip including poundage of catch by species, depth and area fished, fishing methods and type of gear, hours fished, and number of fishermen.

There are currently no foreign fishermen participating in the fishery for Spanish mackerel. No TALFF (total allowable level of foreign fishing) is available under the Coastal Pelagics FMP. However, foreign fishermen taking species in the management unit as a bycatch must cooperate in reporting the amount of such catch.

9.3 Processors

Processors are required to report at monthly intervals under the provisions of the Coastal Pelagics FMP. Such reporting includes the duty to cooperate in gathering commercial catch and trip ticket data for those who purchase directly from fishermen.

9.4 Areas of Research Needed to Improve the Management Information Base

Improved management of the Spanish mackerel resource will result as improved research information becomes available. Research needs should be met in priority order:

1. Provide better estimates of recruitment, natural mortality rates, fishing mortality rates, and standing stock. Specific information should include an estimate of total amount caught and distribution of catch by area, season, and type of gear.

2. Conduct migration studies to determine normal Spanish mackerel migration routes and changes therein, and the climatic or other factors responsible for changes in the environmental and habitat conditions which may affect the habitat and availability of stocks.

3. Determine the relationship, if any, between migration of prey species (i.e., engraulids, clupeids, carangids), and migration patterns of the Spanish mackerel stock.

Better estimates of recruitment, natural mortality, fishing mortality, and size of standing stocks are important to provide more precise estimates of MSY. A better understanding of the annual patterns of Spanish mackerel migrations and the possible relationship to migration of prey species is needed for rational management.

The following economic information (in priority order) was identified by the SAFMC in its 1989/90 Operations Plans for improved management of the Spanish mackerel resource:

1. Compile Spanish mackerel price data by gear type (hook and line, large scale run around gill nets, small scale run around gill nets, drift gill nets and purse seines).

2. Estimate supply and demand functions for Spanish mackerel at the wholesale level. This would best be done as an equation system so that reasonable estimates of consumer and producer surpluses which result from the commercial harvest of mackerel can be made.

3. Conduct a survey to determine costs and returns in the Spanish mackerel fisheries. The survey form and methodology reported by M. Raizin, "Available Data From the 1986 King Mackerel Economic Coasts and Returns Study," can form the basis for a new survey. Both the sampling methodology and questions need to be modified/updated and the Council staff economists should be involved so that the results will provide the needed information.

4. Revise the MRFSS survey form to obtain more accurate estimates of recreational value.

9.5 Specific Research Requirements

Flexibility in management of the Spanish mackerel resource will be provided through annual assessments of stock size and condition, and annual implementation of the management measures needed to assure that the stocks are maintained near a MSY level. This section delineates the data collection and research requirements needed to manage the fishery.

9.5.1 Stock Assessment Requirements

9.5.1.1 Catch and Effort Information

To improve upon or modify MSY estimates and other stock assessment parameters, a time series of catch and effort statistics is required on a timely and continuous basis. Most of these data are currently being collected, but the timeliness of data availability must be improved and some refinements of the data collected will be required. The data requirements will necessitate some changes in data collection programs or new programs, i.e., a coastwide mandatory reporting system.

A. Total Commercial Catch and Landings Statistics by Area and by Month

Landings data are currently collected by NMFS and state port agents and are available by county, by month. This program should continue and be expanded to include any commercial sales not currently monitored. Catch data by statistical grid is collected through general canvas surveys. Data entry format should allow disaggregation of catch information by month or season.

B. Commercial Effort and CPUE Data by Gear Type, by Area and by Season

Determine the number of vessels and fishermen by gear in the commercial Spanish mackerel fishery. Port agents conducting general canvas surveys should collect individual vessel CPUE data. Effort data for the commercial harvest of Spanish mackerel are generally not available and are needed for stock assessment.

C. Timely, Total Recreational Catch and Landings by State (or Area) and by Season (or Bimonthly Interval)

The annual national recreational surveys conducted by NMFS collect catch and landings information and should be continued. The timeliness of data availability should be improved. Specific consideration should be given to producing more rapid preliminary estimates of mackerel catch by state and by season or bimonthly sampling interval.

D. Recreational Effort and CPUE by Area and by Season (or Bimonthly Interval)

Data currently collected by intercept creel clerks for the national recreational survey should be analyzed to provide CPUE for mackerel caught by persons fishing from private recreational and charter boats. The regional charterboat survey should be expanded to adequately sample each area for CPUE on both a man-hour and vessel-hour basis.

E. Age Data by Area, Season, and Fishery

Participants in the NMFS TIP and state sampling programs should measure sufficient Spanish mackerel and collect sufficient hard parts so that the age composition of the catch can be determined.

9.5.1.2 Mortality, Age, and Growth Information

Estimates of mortality are critical to setting ABC and TAC for the stocks, and age and growth parameters are used in establishing mortality estimates. Mortality estimates are required on a continuous, annual basis and should be available for various geographical areas throughout the range of the stocks. Data needed for these estimates are as follows:

A. Size Frequency and Sex Information for Fish Harvested by Gear Type, Area, and Season

These data are particularly needed for mackerel harvested in areas outside of Florida and should be collected on a seasonal basis. Port agents or technicians should periodically subsample commercial catches for length frequency data. Recreational catches should be periodically monitored by NMFS intercept survey creel clerks or state biological personnel, possibly under the cooperative statistical program with NMFS.

B. Size/Age Information

Federal and state personnel should continue to collect length frequency data on Spanish mackerel and otoliths from all fisheries for stock assessment purposes.

9.5.1.3 Year Class Strength Prediction Requirements

The management strategy for Spanish mackerel is to maintain the stock at near MSY levels adjusting the management measures to compensate for smaller (more restrictive measures) or larger (less restrictive measures) year classes entering the fishery. Methodology for predicting year class strength should

be developed. The relationship between larval abundance and subsequent year class strength should be examined and defined. Temporal and spatial sampling to delineate spawning areas and areas of larval abundance should be initiated. Such sampling should be included in SEAMAP, MARMAP or other annual surveys. Length frequency and bycatch information from shrimp trawls, in particular, should be examined for usefulness in predictions of year-class strength.

10.0 RELATIONSHIP OF THE RECOMMENDED MEASURES TO EXISTING APPLICABLE LAWS AND POLICIES

10.1 Fishery Management Plans

The Coastal Pelagics FMP (GMFMC and SAFMC) has a direct impact on the management of Spanish mackerel. Management measures formulated in that plan are effective in the EEZ. Under this ASMFC plan, states are encouraged to adopt compatible regulations for territorial waters. Other existing or anticipated fishery management council plans which affect the management area (snapper-grouper, shrimp, stone crab, surf clam, billfish, bluefish, and summer flounder FMPs), have little effect on the Fishery Management Plan for Spanish Mackerel. The Shrimp FMP, currently being developed by the SAFMC, could affect Spanish mackerel management through gear restrictions, i.e., TEDs or finfish separator devices, or other management measures.

Other existing or anticipated ASMFC interstate fishery management plans have little effect on the Fishery Management Plan for Spanish Mackerel. ASMFC plans which affect the management area include FMPs for weakfish, spotted seatrout, red drum, croaker, spot, bluefish, summer flounder, Atlantic menhaden, striped bass, and shad and river herring. Fishing for, or regulation of, these species generally has no significant impact on Spanish mackerel. The fishery management plans for weakfish, spot, and croaker may affect Spanish mackerel management by promoting the development and use of TEDs in the shrimp fishery.

Implementation of this FMP will have little impact on other management plans. Harvest of Spanish mackerel has little, if any, impact on species regulated by other FMPs. There is substantial overlap of fishermen and vessels between Spanish mackerel and spiny lobster, stone crab, and reef fish in Florida. However, this FMP is not expected to result in any displacement of user groups or major changes in availability of Spanish mackerel. Therefore, it is not likely that the FMP will substantially affect fishing activity for other species.

10.2 Treaties or International Agreements

There is no foreign participation in the Atlantic Migratory Group Spanish mackerel fishery. There are no specific treaties or international agreements applicable to this management unit other than the general governing international fishery agreements. These are general bilateral agreements in which the participating nations agree to abide by the fishing regulations of the other nation when fishing in their waters.

10.3 Federal Laws and Policies

Many federal laws and policies relate to this management unit in a peripheral way. However, there are no applicable federal laws or policies which will significantly constrain any of the measures of this plan.

10.4 State and Local Laws and Policies

State laws concerning the management of Spanish mackerel are presented in Table 5.2.

The purpose of this FMP is to provide more effective management of the Atlantic Migratory Group of Spanish mackerel through improved state and federal coordination. Compatible regulations such as bag limits and seasonal closures when quotas are filled will facilitate enforcement and effective management. Because regulatory flexibility is proposed to adjust the federal management measures to the status of the stock, state regulatory authority should be similarly responsive under ideal circumstances.

In the future, effective and equitable management may require a workable means of differentiating true commercial and true recreational fishermen. This could be particularly important in implementing allocations to user groups. Therefore, the Commission recommends that each state give consideration to requiring all persons who sell fish to have a commercial license, that the commercial license be of significant dollar value and that severe penalties be levied against any commercial operator purchasing fish from an individual not possessing a commercial license and against persons selling commercially without a license.

11.0 ASMFC REVIEW AND MONITORING OF THE PLAN

11.1 General Approach

This FMP is based on the best and most recent scientific information available. Annual reviews of this FMP will be conducted by a Plan Review Team designated by the ASMFC Advisory Committee and will consist of representatives from the SAFMC, states, and NMFS. The Plan Review Team will review the adequacy of the ASMFC plan and evaluate its role in coordinating management with the SAFMC plan. To accomplish this, the Plan Review Team will publish a short plan review summary which will include:

1. Plan status relative to FMP objectives
2. Stock status
3. Review of research and monitoring activities
4. Status of individual states' management measures relative to FMP measures
5. Recommendations for FMP modifications and adjustments

The Plan Review Team will recommend amending the FMP through the ASMFC Advisory Committee to the Interstate Fishery Management Program (ISFMP) Policy

Board. If the recommendations are approved by the ISFMP Policy Board, individual states will be asked to implement management actions specified in the recommendations.

11.2 Specific Monitoring Considerations

The ASMFC Plan Review Team will consult with the SAFMC in monitoring specific aspects of the fishery. In particular, the Plan Review Team will coordinate its activities with the SAFMC Mackerel Stock Assessment Panel, which makes the annual determinations of Acceptable Biological Catch (ABC) for Spanish mackerel. The report and recommendations of the SAFMC Mackerel Stock Assessment Panel provides the basis for annual adjustments in the Total Allowable Catch (TAC) and commercial and recreational quotas for the Spanish mackerel fishery. It is recommended that several ASMFC Spanish Mackerel Plan Review Team members also will be participants/members of the SAFMC Mackerel Stock Assessment Panel, thereby providing continuity between the Council's and Commission's annual appraisal and recommendations.

The ASMFC Plan Review Team will place special emphasis on the SAFMC concern with "standardization of management measures" (SAFMC 1985). This specific monitoring concern is stated as follows: "The Council will continue to work with the affected states to attempt to standardize regulations for the fishery in the EEZ and state territorial waters, where such standardization will serve a useful purpose." In this regard, the ASMFC Plan Review Team in consultation with the SAFMC, will evaluate the effectiveness of specific management measures proposed in this FMP. These management measures include size limits, bag limits, quotas, trip limits, gear restrictions, and other options as requested by the states and the Councils.

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13.0 APPENDIX: STOCK STATUS AND PAST CATCHES

STOCK STATUS

Spawning stock biomass for Atlantic Spanish mackerel has been reduced to levels that are less than that which will produce maximum sustainable yields. Increases in spawning biomass are expected to be occurring, but the stock has not recovered to the point that there is no longer a risk to recruitment. Until that risk is no longer a concern, Spanish mackerel should be considered overfished. For the purpose of stock assessments, the stock should be considered overfished when Spawning Stock Biomass Per Recruit (SSBR) is less than 35% relative to the maximum spawning potential of an unfished stock. For the most recent fishing year (1989-90), fishing mortalitites increased slightly from the previous year, and the present SSBR is estimated at 24%.

PAST CATCHES

ABC - Acceptable Biological Catch - Range of catches considered to be acceptable in rebuilding the stock.
TAC - Total Allowable Catch - an annual catch level set by the Council.
M - Millions of pounds.

	Fishing year			
	1987-88	1988-89	1989-90*	1990-91
ABC	1.7 - 3.1 M	1.3 - 5.5 M	4.1 - 7.4 M	4.2 - 6.6 M
TAC	3.1M	4.0 M	6.0 M	5.0 M
Recreational	0.74 (24%)	0.96 M (24%)	2.76 M (46%)	1.86 M
Commercial	2.36 (76%)	3.04 M (76%)	3.24 M (54%)	3.14 M
TOTAL CATCH	5.0 M	6.1 M	5.0 M	
Recreational	1.4 M	2.7 M	1.7 M (1,091,600 fish)	
Commercial	3.6 M	3.4 M	3.3 M	
DATE FISHERY CLOSED				
Recreational	9/19/87	10/02/88	-	
Commercial	12/29/87	12/30/89	12/23/90	

*Atlantic Spanish Mackerel allocation ratio revised October 14, 1989 under Amendment 4 of South Atlantic Council Plan. The amendment adjusts the allocation of TAC until 50:50 shares are reached for the commercial/recreational allocation ratio. Adjustments are made under a specified formula and will continue until parity is achieved or until 1994 when the 50/50 split becomes effective automtically. An additional change starting in the 1989/90 fishing year is that the recreational quota will be monitored as numbers of fish rather than pounds. As a result, the 2.76 M recreational quota can be expressed as 1.725 million fish based on an average weight of 1.6 pounds per fish. For the 1990-91 fishing year, the recreational quota is 1.216 million fish (or 1.86 M based on an average weight of 1.5 pounds per fish).