Additional information on managed species use of offshore fish habitat was generated cooperatively by the South Carolina Department of Natural Resources, NOAA/Biogeographic Characterization Branch, and the South Atlantic Fishery Management Council. Plots of the spatial distribution of offshore species were generated from the Marine Resources Monitoring, Assessment, and Prediction Program (MARMAP) data (Figures 35-41) .

This fishery-independent survey program has been collecting data in the South Atlantic Bight region since 1973. The program began 25 years ago as an ichthyoplankton and groundfish survey of shelf and upper slope waters from Cape Fear to Cape Canaveral, however, since 1978, efforts of the South Carolina MARMAP program have concentrated on fishery-independent assessments of reef fish abundance and life history. The spatial distribution of sampling effort has varied considerably by gear type. Traps, which have constituted the bulk of the sampling effort (n=7458), were deployed randomly on confirmed hard bottom habitat during 1979-1997. Longline sampling (n=445) has usually been restricted to the deepest regions in the sampling area. Sampling strategy for trawls (n=2249) varied during 1973-1987. From 1973-winter 1977, a stratified random sampling strategy was employed. During summer 1977 to 1980, trawling was conducted over sand bottom habitat along offshore transects. From 1978 to 1987, a trawl survey targetted only live bottom areas at known hard bottom locations. MARMAP also conducted a trawl survey in 1982 to 1983 and 1985-1987 at depths < 18 m. Sampling effort with the different gear types varied seasonally, increasing during spring Months (n=205) to a peak in June (n=2301) and then declining by October (n=454) through the winter months.

Maps portraying the distribution of offshore species were created with this temporal and spatial variability in fishing effort in mind (Figures 36-42). The marine species EFH products requested by the SAFMC were catch-density plots. No attempt was made to interpret seasonal or habitat-specific catch distributions for individual species due to the low number of observations for many species and the sampling bias towards summer months and hard bottom habitat. Therefore, catch data for each species were pooled across all years, months, and gear types for each species and then plotted against regional bathymetry. Catch distributions for each species are a function of spatio-temporal distribution of sampling effort for each gear and susceptibility of individual species to each gear. Therefore, each plot should not be interpreted as a comprehensive portrayal of an individual species' distribution. Certainly, many of the species presented here exhibit seasonal trends in abundance while others are more residential (Grimes et al. 1982; Chester et al., 1984; Sedberry and Van Dolah, 1984; Wenner and Sedberry, 1989). Instead, the plots should be considered as point confirmation of the presence of each species within the scope of the sampling program. As importantly, the plots identify the occurrence of the snapper grouper complex over hard bottom habitats. These plots, in combination with the hard bottom habitat distributions presented in Appendix E, can be employed as proxies for offshore snapper grouper complex distributions in the south Atlantic region.

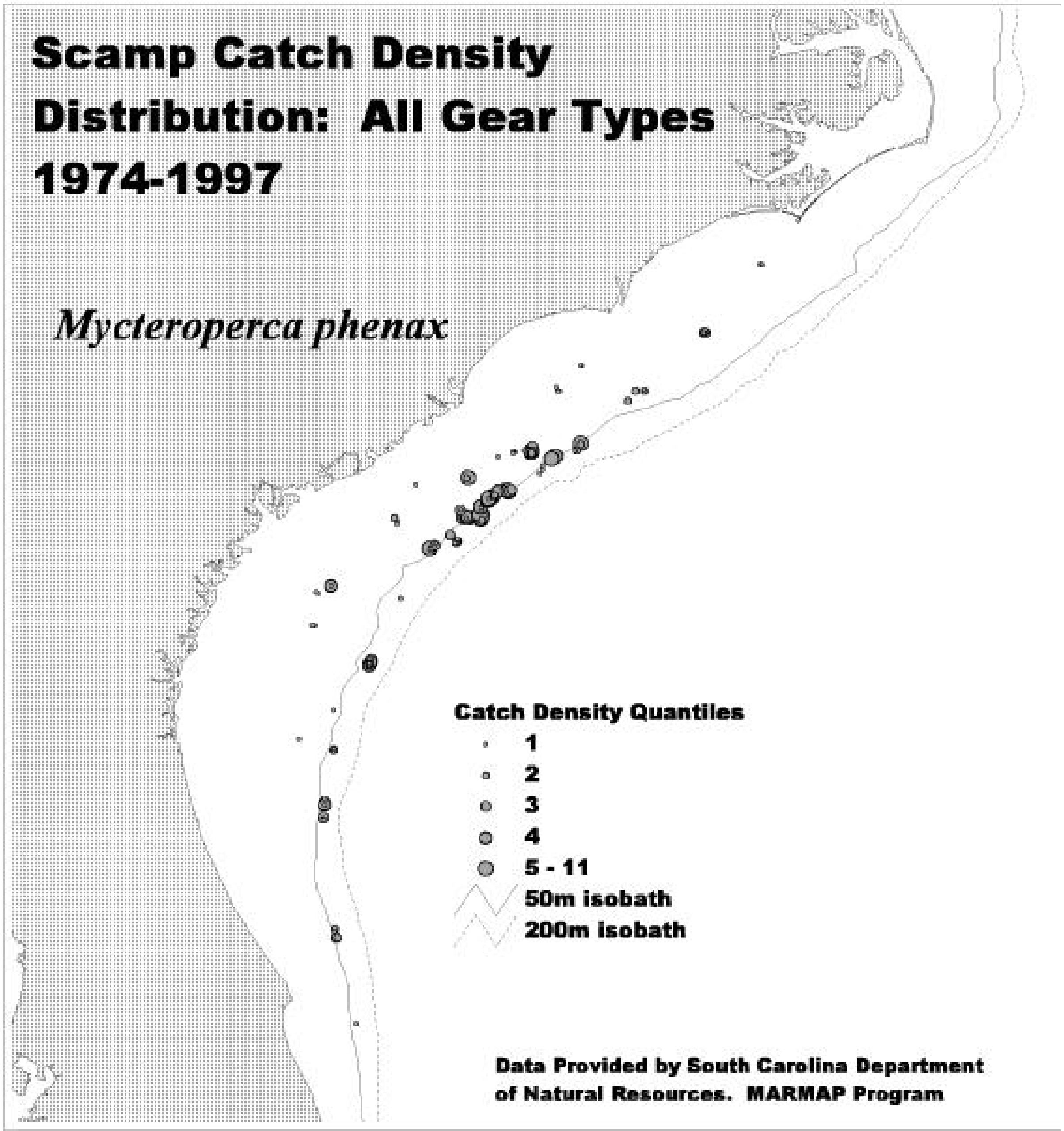


Figure 35. Scamp catch associated with hard/live bottom habitat (Data Source: MARMAP 1998).

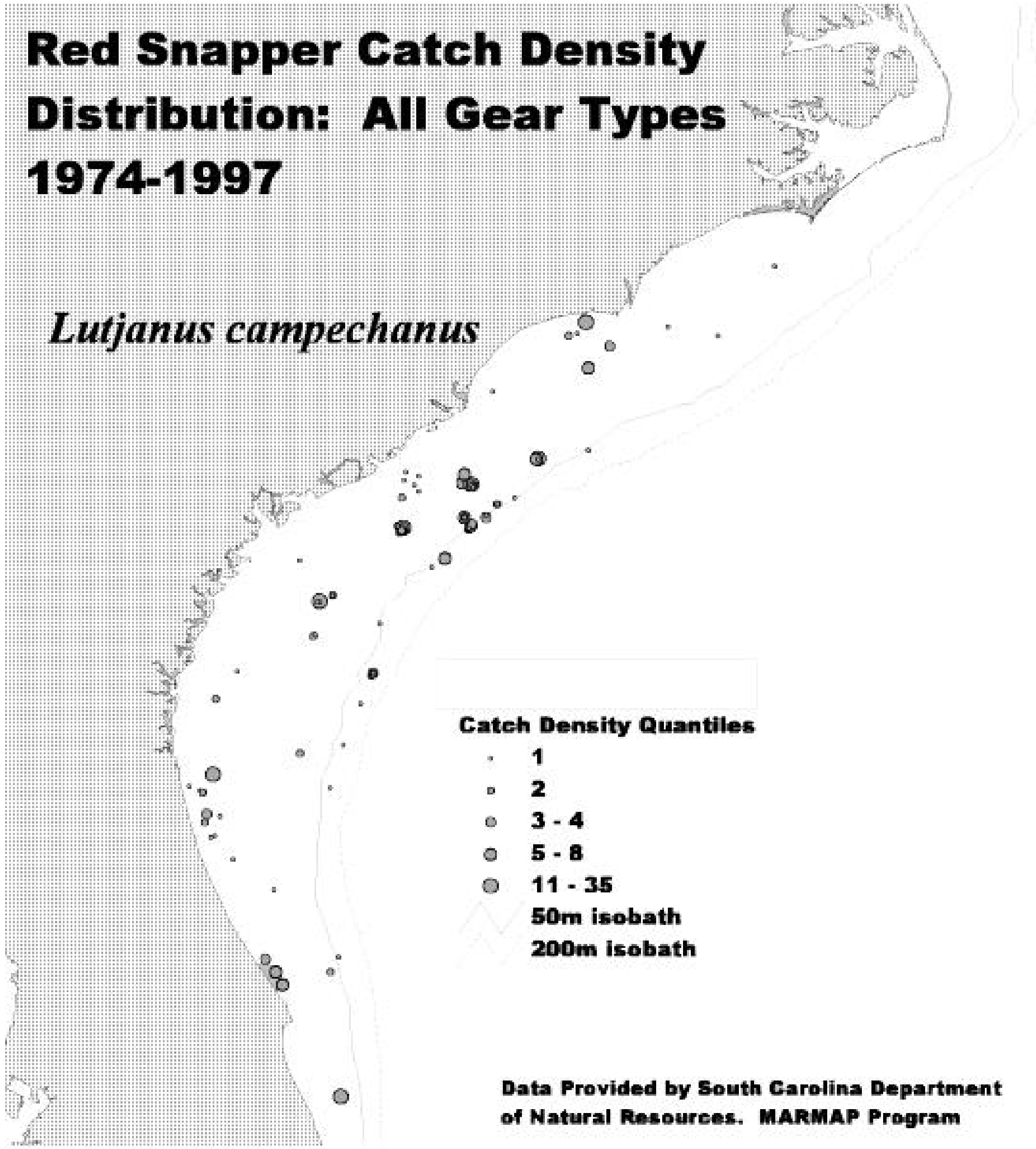


Figure 36. Red snapper catch associated with hard/live bottom habitat (Data Source: MARMAP 1998).

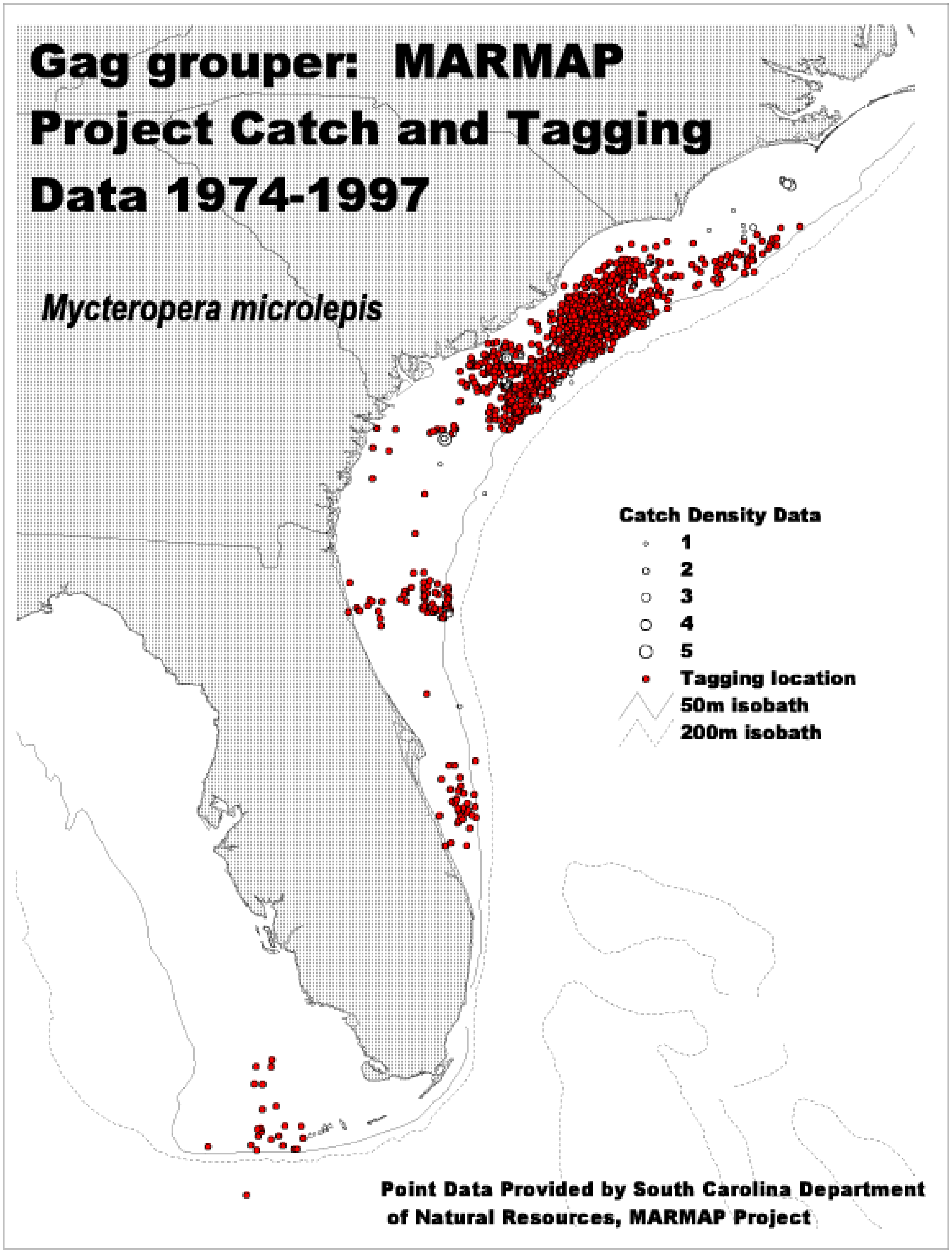


Figure 37. Gag catch associated with hard/live bottom habitat (Data Source: MARMAP 1998).

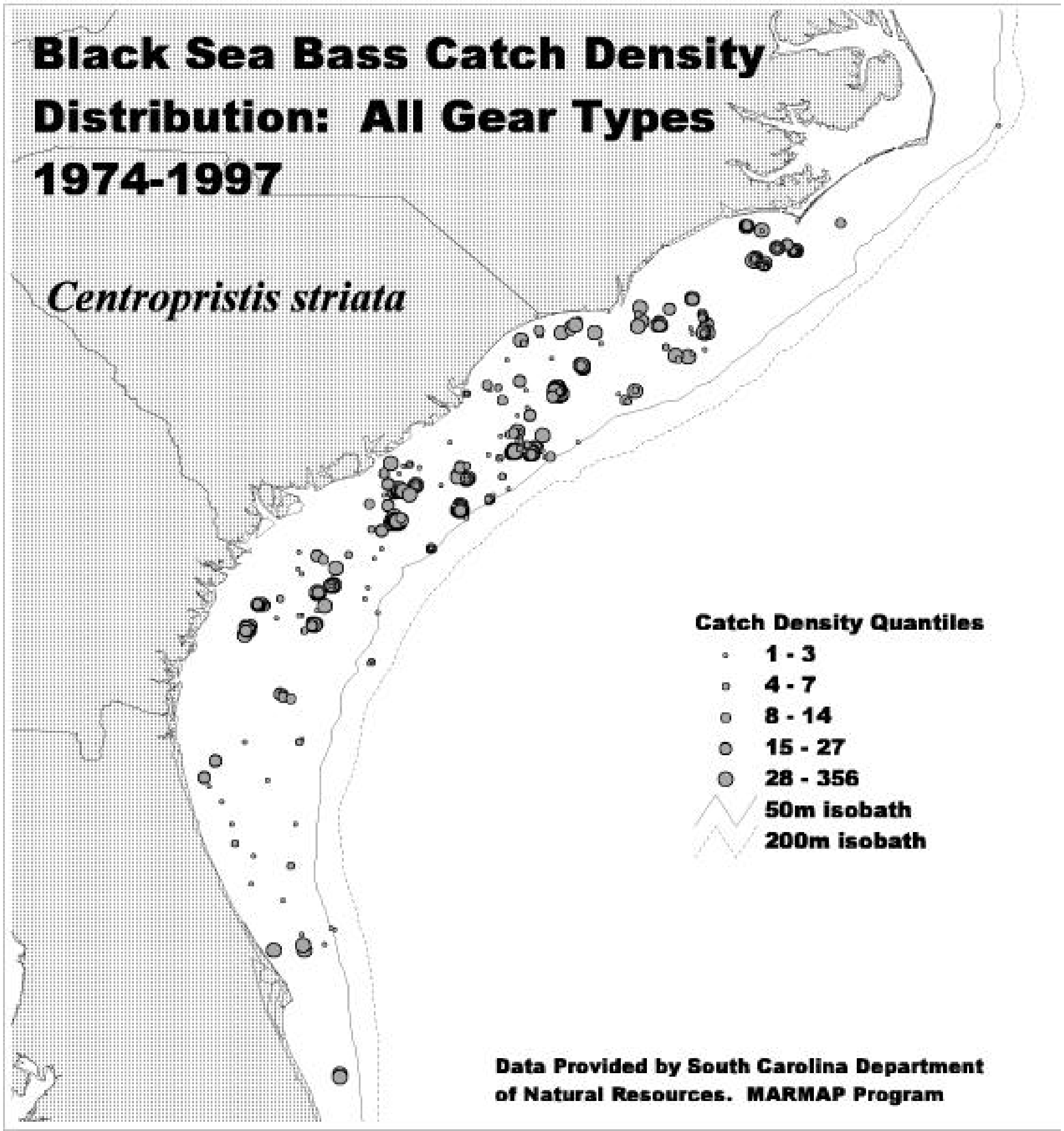


Figure 38. Black Sea Bass catch associated with hard/live bottom habitat (Data Source: MARMAP 1998).

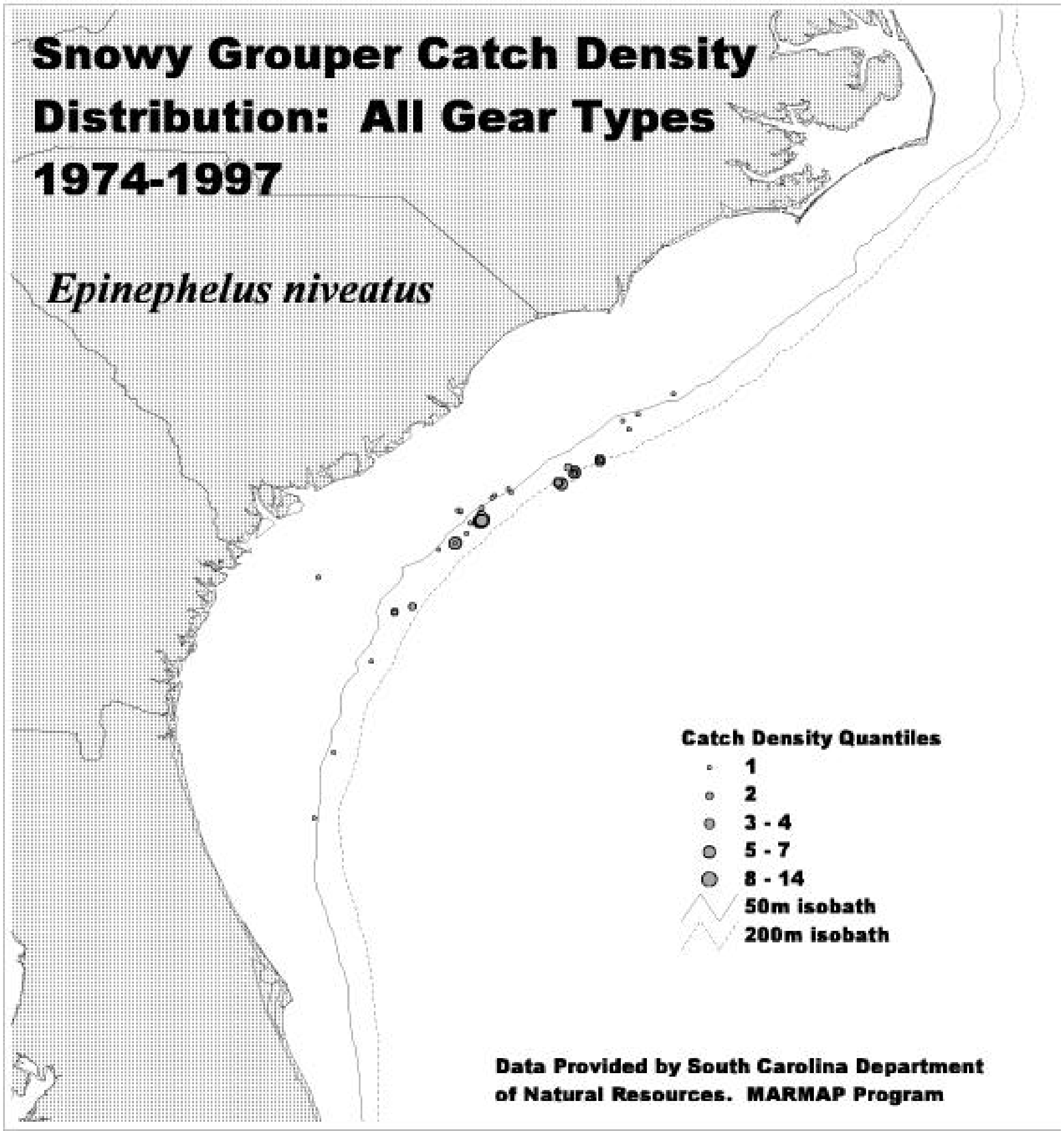


Figure 39. Snowy Grouper catch associated with hard/live bottom habitat (Data Source: MARMAP 1998).

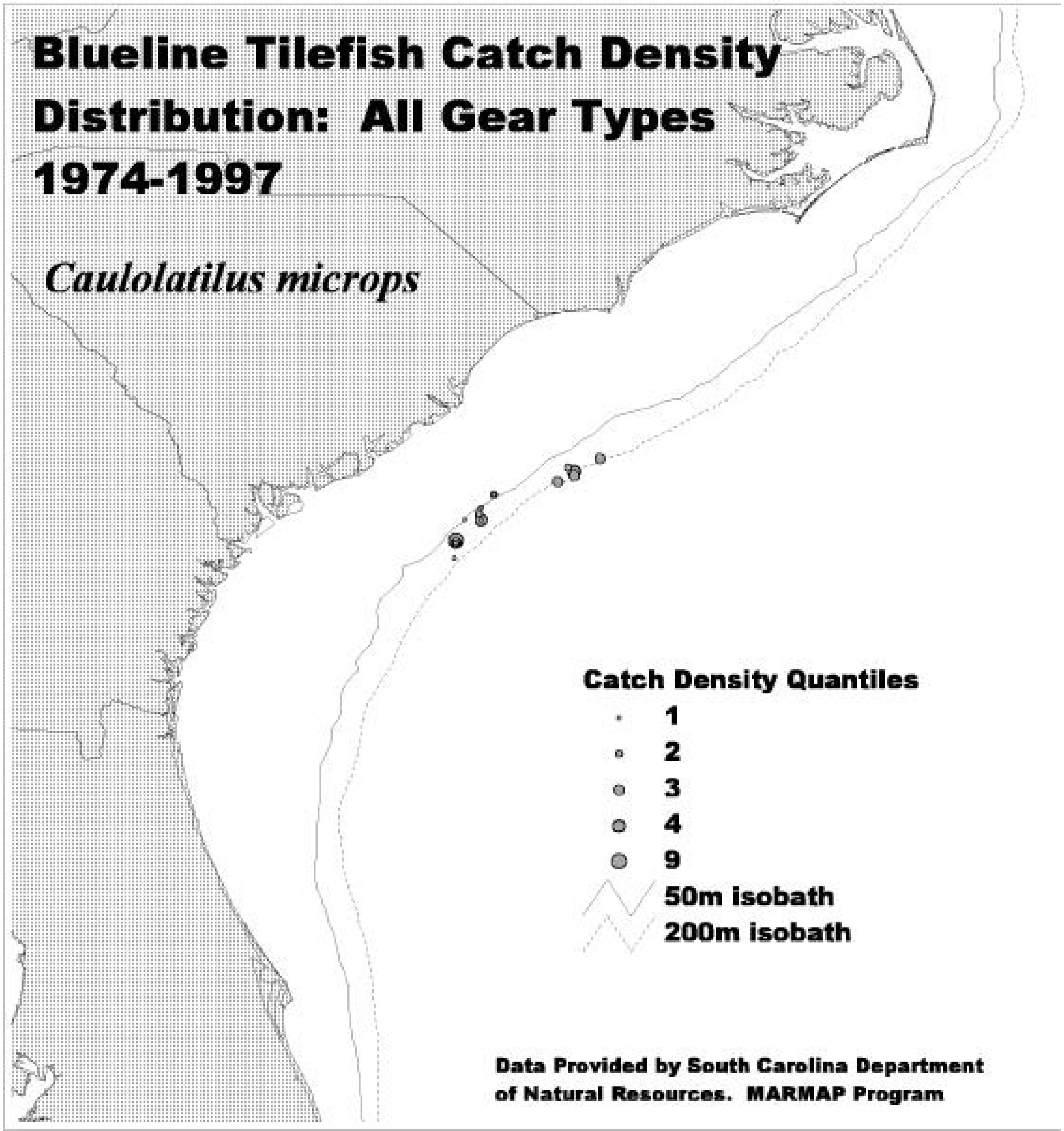


Figure 40. Blueline Tilefish catch associated with hard/live bottom habitat (Data Source: MARMAP 1998).

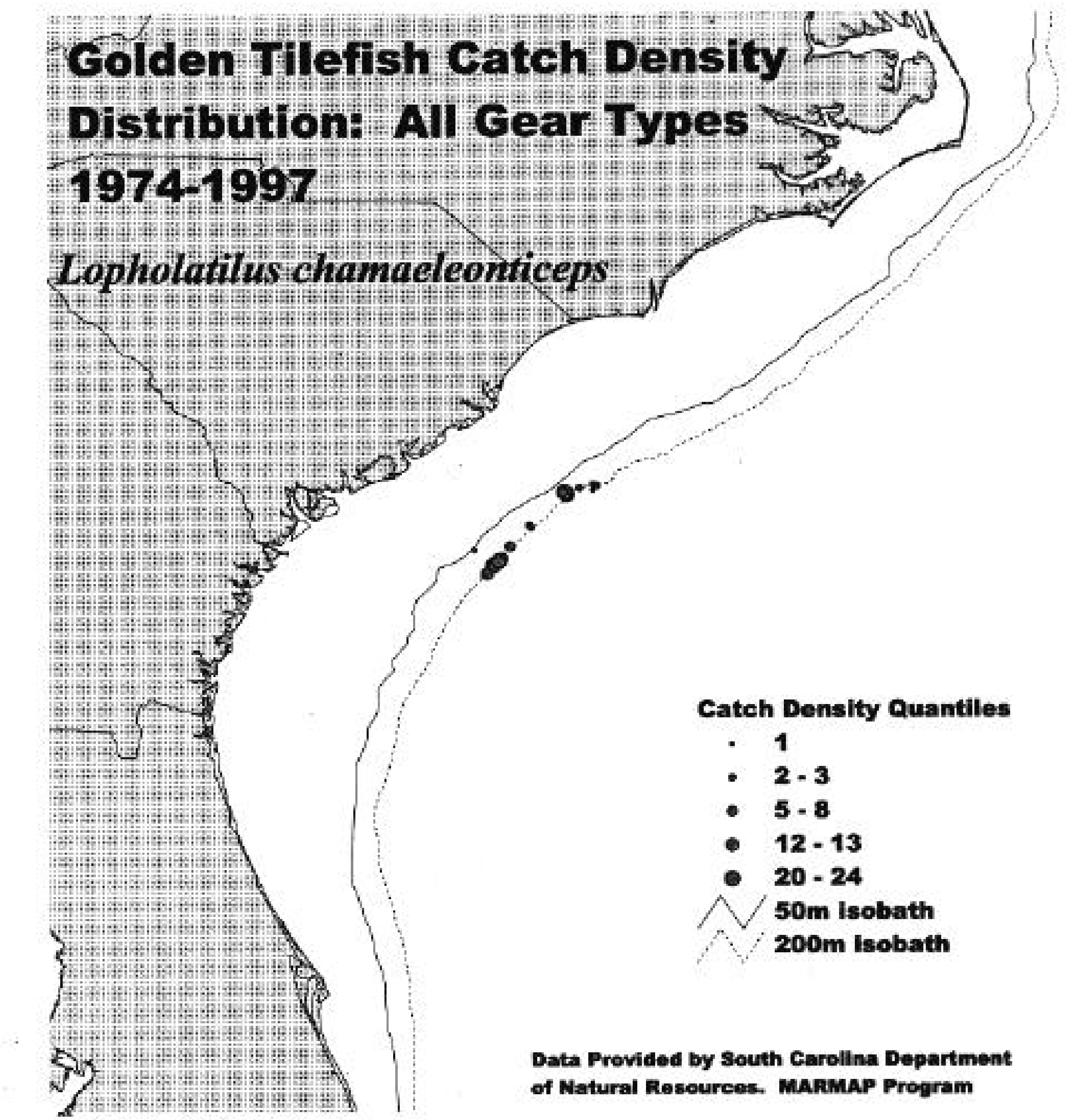


Figure 41. Golden Tilefish catch associated with hard/live bottom habitat (Data Source: MARMAP 1998).

3.3.3.3.2 Snapper Grouper Species and the Deepwater Community
(summarized from Parker and Mays, In press)

There are 19 economically important species of reef fish in the deepwater (100-300 m) fishery of the southeastern United States (Figure 42). The five species that make up over 97% of the catch by weight are tilefish, *Lopholatilus chamaeleonticep*s, snowy grouper, *Epinephelus niveatus*, blueline tilefish, *Caulolatilus microps*, warsaw grouper, *Epinephelus nigritus*, and yellowedge grouper, *E. flavolimbatus*. Less is known of the life histories of deep reef fishes than for any other group supporting a major fishery. The depth and strong currents, often to 3 knots, preclude observations by SCUBA divers and make submersible observations difficult. Distance from shore of these open ocean habitats and usually inclement weather make incidental and anecdotal observations and reports about the fish and their habitat extremely rare. Although hook and line and longline gear have been used successfully to capture some deepwater reef fishes, little is known about rare or hard to catch species.

Overall, the deep reef fish community probably contains less than 100 species. From submersible operations off NC, Parker and Ross (1986) observed 34 species of deepwater (98 to 152 m) reef fishes representing 17 families and described the behavior of species from eight families. Gutherz et al. (1995) observed 27 species of deepwater (185 to 220 m) reef fishes from submersibles off South Carolina in 1982. There were obvious differences (probably depth related) in abundance of the most common species of fish observed from the submersible from North Carolina to South Carolina. Parker and Mays (In press) present life history summaries including species composition, distribution, preferred habitat, spawning periodicity, and associated fishes and benthos for 14 species.

Observations during three submersible dives in May 1992 on the abundance and distribution of deepwater reef fishes important to fisheries were compared to the above surveys. At the Big Rock or Charleston Lumps there were apparent increases in abundance (fish/ha) over time of scamp, *Mycteroperca phenax* (5 to 45), blueline tilefish (<1 to 14), and southern hake, *Urophycis floridana* (<1 to >23). Also in the Charleston Bump area, there was an apparent decrease in snowy grouper (9 to 2). Although the recent data are sparse, they show that at least seven of nine economically important species, previously observed from submersibles, have survived intense fishing pressure at these locations.

Twenty active or retired fishermen (headboat operators and commercial fishermen who employed vertical hook and line or longline gear) from Cape Hatteras, NC to Key West, FL described the deep reef fishery in their areas. According to fishermen, coast wide stocks (usually at depths between 100 and 175 m) of yellowedge grouper, *Epinephelus flavolimbatus,* warsaw grouper, bigeye, and barrelfish were depleted before snowy grouper. Snowy grouper were most often caught between 110 and 155 m, but were sometimes taken from shallow water (<30 m) as they spawned off the Florida Keys. Tilefish usually produced monospecific catches from deeper waters, 175 to 300 m. Three areas have been unproductive for tilefish: the areas from 1) just below Cape Hatteras, NC to Cape Romain, SC, 2) Bellville, GA to St. Augustine, FL, and 3) Marathon, FL to Key West, FL. Some fishermen believe this is because they have not yet determined when tilefish migrate through these areas, although tagging studies and submersible observations of tilefish and their burrows do not give evidence of migration (Grimes et al., 1983). There is little commercial fishing by United States fishermen for deepwater species between Ft. Pierce and Homestead, FL because the area is congested with domestic recreational and Bahamian (commercial and recreational) fishermen. Florida fishermen feared revealing "secrets" and were particularly vague about descriptions of the fishery in their area.

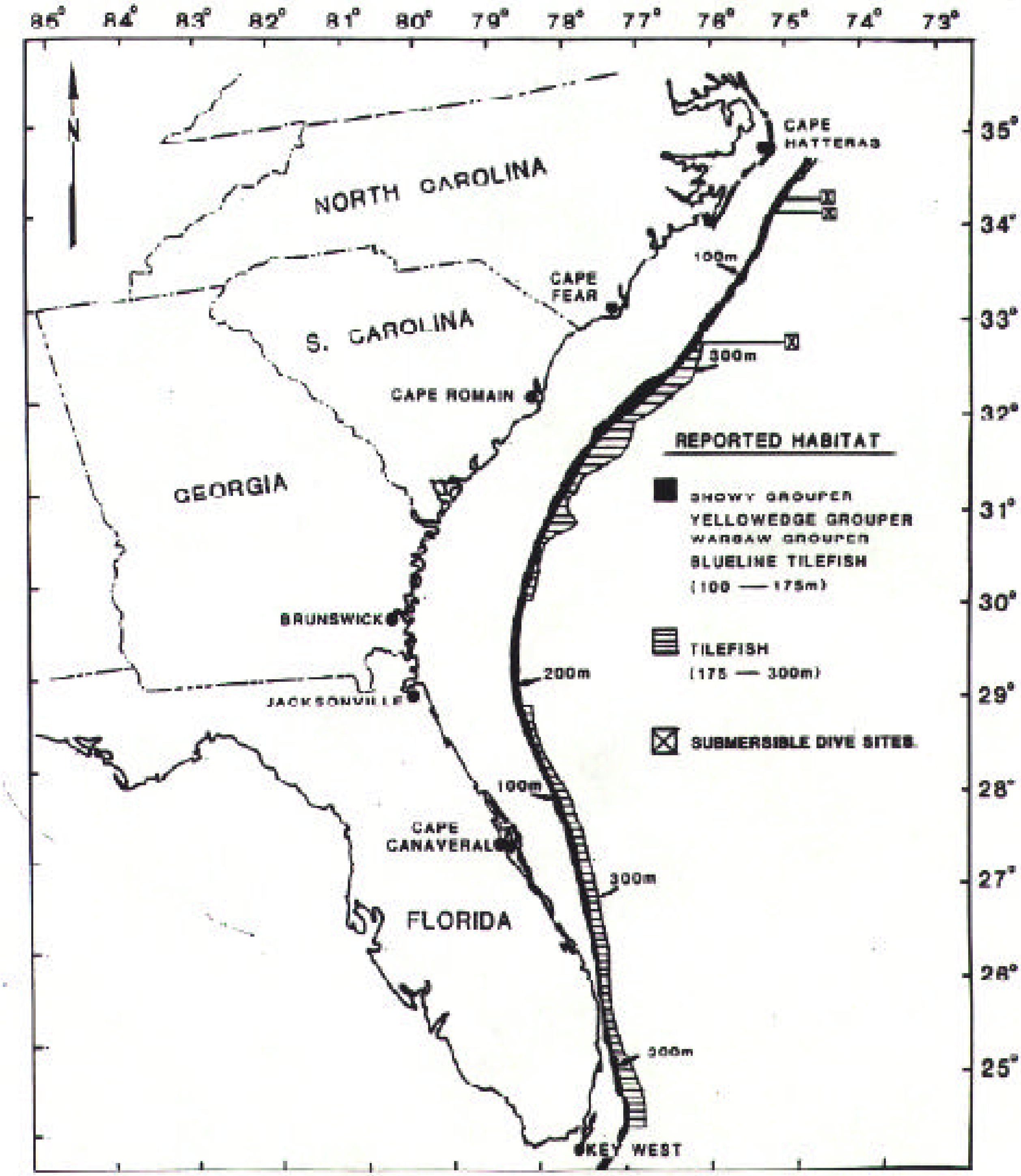


Figure 42. Deep Reef Fish Habitat (Source: Parker and Mays, In press).

3.3.3.3.3 Spawning Habitats of Snapper Grouper Species

Along with recruitment, spawning is a key demographic attribute of reef fish species. The protection of spawning habitats is an unquestionably logical component of managing essential fish habitat. Specific information on the spawning sites and component habitats for snapper grouper species is limited. Most studies of reef fish reproduction have focused on the seasonality of spawning using fishery-dependent data. *In-situ* information on the habitat characteristics of key spawning areas is uncommon. However, limited information can be obtained for individual species from reviews of spawning information by Thresher (1984), Grimes (1987), Colin and Clavijo (1988), Garcia-Cagide et al. (1994) and Domeier and Colin (1997).

Temporal patterns of spawning are more documented for snapper grouper species than spatial patterns. Several temporal patterns are present: a) spawning is concentrated over one or two winter months (as in many groupers); b) spawning occurs at low levels year-round with one or two peaks in warmer months; c) spawning occurs year-round with more than two significant peaks. In addition, spawning can occur in pairs or in various types of aggregations. Increasing amounts of evidence suggest that many species of grouper and snapper can form sizeable spawning aggregations (Domeier and Colin, 1997). However, this pattern may not be universal among all of the species within the snapper grouper management unit. In fact, some species that spawn in aggregations may also pair-spawn under certain conditions.

The site specificity of spawning aggregations may be high, on the scale of decades (Colin and Clavijo, 1988; Garcia-Cagide et al., 1994). Many explanations of the choice of spawning sites have focused on the avoidance of egg predation. This assumes that the upward rush culminating the spawning act is executed at structural features positioned in a manner favorable for immediate offshore advection of eggs away from predators on the reef (Johannes, 1978). However, this hypothesis suffers from limited (Shapiro et al., 1988) and sometimes contradictory (e.g., Appeldoorn et al., 1994) experimental evaluation.

Due to the intense constraints on studying spawning and associated habitats (e.g., gathering *in situ* behavioral data in deep waters during dusk or night), determining the combinations of key habitat attributes that favor spawning will be a protracted process for many species. However, this need not impede proactive management. Spawning sites within SAFMC jurisdiction have been identified for certain grouper and snapper species (Gilmore and Jones, 1992; Domeier and Colin, 1997). Available information for other species suggests that shelf edge environments of moderate to high structural relief are sites of spawning for many species, perhaps through the entire southeastern U. S. region. In addition, shallow areas may also be spawning sites for some snapper grouper species (see jewfish summary in Section 3.3.3.1). As new information becomes available, maps of all documented spawning areas will be created for the key species of the snapper grouper complex. In addition to pinpointing existing spawning information, this approach will allow the assessment of the spawning value of similar habitat types within SAFMC jurisdiction.

3.3.3.4 Essential Fish Habitat and Environmental Requirements

Essential fish habitat for snapper-grouper species includes coral reefs, live/hard bottom, submerged aquatic vegetation, artificial reefs and medium to high profile outcroppings on and around the shelf break zone from shore to at least 600 feet (but to at least 2000 feet for wreckfish) where the annual water temperature range is sufficiently warm to maintain adult populations of members of this largely tropical complex. EFH includes the spawning area in the water column above the adult habitat and the additional pelagic environment, including *Sargassum*, required for larval survival and growth up to and including settlement. In addition the Gulf Stream is an essential fish habitat because it provides a mechanism to disperse snapper grouper larvae.

For specific life stages of estuarine dependent and nearshore snapper-grouper species, essential fish habitat includes areas inshore of the 100-foot contour, such as attached macroalgae; submerged rooted vascular plants (seagrasses); estuarine emergent vegetated wetlands (saltmarshes, brackish marsh); tidal creeks; estuarine scrub/shrub (mangrove fringe); oyster reefs and shell banks; unconsolidated bottom (soft sediments); artificial reefs; and coral reefs and live/hard bottom.

3.3.3.5 Essential Fish Habitat-Habitat Areas of Particular Concern for the Snapper Grouper Species Complex

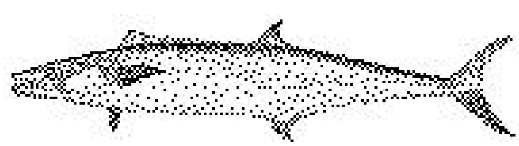
Areas which meet the criteria for essential fish habitat-habitat areas of particular concern (EFH-HAPCs) for species in the snapper-grouper management unit include medium to high profile offshore hard bottoms where spawning normally occurs; localities of known or likely periodic spawning aggregations; nearshore hard bottom areas; The Point, The Ten Fathom Ledge, and Big Rock (North Carolina); The Charleston Bump (South Carolina); mangrove habitat; seagrass habitat; oyster/shell habitat; all coastal inlets; all state-designated nursery habitats of particular importance to snapper grouper (e.g., Primary and Secondary Nursery Areas designated in North Carolina); pelagic and benthic *Sargassum*; Hoyt Hills for wreckfish; the Oculina Bank Habitat Area of Particular Concern; all hermatypic coral habitats and reefs; manganese outcroppings on the Blake Plateau; and Council-designated Artificial Reef Special Management Zones (SMZs).

Therefore, areas which meet the criteria for designating essential fish habitat - habitat areas of particular concern include habitats required during each life stage (egg, larval, postlarval, juvenile, and adult stages.)

3.3.4 Coastal Migratory Pelagics

3.3.4.1 Description of the Species and Distribution

The habitat of adults in the coastal pelagic management unit, except dolphin, is the coastal waters out to the edge of the continental shelf in the Atlantic Ocean. Dolphin is an oceanic species that may be found on the shelf. Within the area, the occurrence of these species is governed by temperature and salinity. All species are seldom found in water temperatures less than 20° C. Salinity preference varies, but these species generally prefer high salinity. Dolphin are seldom found in waters with salinity less than 36 ppt. The scombrids prefer high salinities, but less than 36 ppt. Salinity prefence of little tunny and cobia is not well defined. The larval habitat of all species in the coastal pelagic management unit is the water column. Within the spawning area, eggs and larvae are concentrated in the surface waters.



King Mackerel, *Scomberomorus cavalla*

Estuaries are important habitats for most prey species of coastal pelagics. For this reason, estuarine habitats and factors which affect them should be considered as part of the coastal pelagic management unit. All the coastal pelagic species, except dolphin, move from one area to another and seek prey whatever local resources happen to be abundant. Many of the prey species of the coastal pelagics are estuarine-dependant in that they spend all or a portion of their lives in estuaries. Accordingly, the coastal pelagic species, by virtue of their food source, are to some degree also dependant upon estuaries and, therefore, can be expected to be detrimentally affected if the productive capabilities of estuaries are greatly degraded.

3.3.4.2 Essential Fish Habitat and Environmental Requirements

Essential fish habitat for coastal migratory pelagic species includes sandy shoals of capes and offshore bars, high profile rocky bottom and barrier island ocean-side waters, from the surf to the shelf break zone, but from the Gulf stream shoreward, including *Sargassum*. In addition, all coastal inlets, all state-designated nursery habitats of particular importance to coastal migratory pelagics (for example, in North Carolina this would include all Primary Nursery Areas and all Secondary Nursery Areas).

For Cobia essential fish habitat also includes high salinity bays, estuaries, and seagrass habitat. In addition, the Gulf Stream is an essential fish habitat because it provides a mechanism to disperse coastal migratory pelagic larvae.

For king and Spanish mackerel and cobia, essential fish habitat occurs in the South Atlantic and Mid-Atlantic Bights.

Spatial and Temporal Distribution and Relative Abundance of Spanish Mackerel in Estuarine Habitat

NOAA's Estuarine Living Marine Resource Program (ELMR), through a joint effort of National Ocean Service and NMFS, conducts regional compilations of information on the use of estuarine habitat by select marine fish and invertebrates. A report prepared through the ELMR program (NOAA 1991b) and revised information (NOAA 1998), provided the Council during the Habitat Plan development process, present known spatial and temporal distribution and relative abundance of fish and invertebrates using southeast estuarine habitats. Twenty southeast estuaries selected from the National Estuarine Inventory (NOAA 1985) are included in the analysis which resulted from a review of published and unpublished literature and personal consultations. The resultant information emphasizes the importance and essential nature of estuarine habitat to all life stages of spanish mackerel.

Regional salinity and relative abundance maps for use in determining EFH for two estuarine dependant coastal migratory pelagic species included in the data, Spanish mackerel and Cobia. These map coverages were prepared for the Council by NOAA SEA Division (Appendix F). Figures 43-46 present a representative sample of the distibution maps for juvenile Spanish mackerel. The remainder of the coverages and additional information on species and habitat distribution are available over the Internet on the Council web page under the habitat homepage (www.safmc.noaa.gov). These maps portray salinity and species relative abundances for estuaries and coastal embayments on state and/or regional maps. Depending on data availability, maps were produced at various scales: 1:24K, 1:80K, and 1:250K. For species relative abundances, these maps were developed only for juveniles of estuarine species (Nelson et al. 1991) showing the highest juvenile relative abundance in any salinity zone by season for each estuary. These maps will eventually be provided to the Council as ArcView shape files with associated data for inclusion into the Council's GIS system.

Spatial and Temporal Distribution and Relative Abundance of Cobia in Estuarine Habitat

Regional salinity and relative abundance maps were developed to aid the Council in determining EFH for Cobia. These map coverages were prepared for the Council by NOAA SEA Division (Appendix F). Figures 47- 50 present a representative sample of the distibution maps for juvenile Cobia. The remainder of the coverages and additional information on species and habitat distribution are available over the Internet on the Council web page under the habitat homepage (www.safmc.noaa.gov). Depending on data availability, maps were produced at various scales: 1:24K, 1:80K, and 1:250K. For species relative abundances, these maps were developed only for juveniles of estuarine species (Nelson et al. 1991) showing the highest juvenile relative abundance in any salinity zone by season for each estuary. These maps will eventually be provided to the Council as ArcView shape files with associated data for inclusion into the Councils GIS system.

Dolphin, *Coryphaena hippurus*

See Section 3.2.3.1.1 for a detailed description of *Sargassum* as essential fish habitat for dolphin.

Dolphin are fast aggressive predators that feed on actively swimming fish (MMS 1990). Fish are the most important items in the diet, becoming increasingly important as dolphin grow from 300 mm (12 in) to 1,500 mm (59 in). Flyingfish are important in the diet of adult common dolphin. Flyingfishes appear to be especially important in the diet of large dolphin; fish and invertebrates on *Sargassum* appers to be most important to small female dolphin. In general, many dolphin prey are associated with *Sargassum,* and most of the fishes that were found associated with *Sargassum* in the Florida Current are eaten by dolphin (MMS 1990). Dolphin probably spend a relatively large amount of time feeding on small animals associated with *Sargassum* because, although adapted for fast short-range pursuit, dolphin lack the adaptation of fishes such as tunas for long-range pursuit of prey. Dolphin in the Gulf Stream ate 32 species of fishes. Additional food included the crab *Portunis sayi* (common in *Sargassum*), shrimp, and cephalopods. Although *Sargassum* appears frequently in dolphin stomachs, it is probably ingested incidentally with assiciated small fishes and crustaceans. Off Cape Hatteras, most fish in the diet were those typically associated with *Sargassum*. The most frequently found genera wre *Hippocampus* (seahorse), *Monacanthus* (filefish), and *Aluterus* (filefish). Other prey of dolphin include balistids and fast moving fishes such as Spanish mackerel and carangids, and at night perhaps mesopelagic fishes. The presence of other smaller dolphins in the diet indicates cannibalism, and smaller dolphin may find shelter in *Sargassum* from predators, including their own species (MMS 1990).

3.3.4.3 Essential Fish Habitat - Habitat Areas of Particular Concern for Coastal Migratory Pelagics

Areas which meet the criteria for essential fish habitat-habitat areas of particular concern (EFH-HAPCs) include sandy shoals of Cape Lookout, Cape Fear, and Cape Hatteras from shore