Estimating Catches and Fishing Effort of the Southeast United States Headboat Fleet, 1972-1982

by

Robert L. Dixon

and

Gene R. Huntsman

United states Department of Commerce National Oceanic and Atmospheric Administration National Marine Fisheries Service Southeast Fisheries Center
Beaufort Laboratory
Beaufort, NC 28516-9722

CONTENTS

ABSTRACT

Catches and headboat fleet fishing effort were estimated of for the southeast United North Carolina and states South Carolina, 1972-1975; North Carolina to Ponce Inlet, Florida, 1976- 1977: and North Carolina to Key West, Florida, 1978-1982. For 224 species reported in estimated from daily the catches, catch logs numbers of kept by individuals were Estimated total vessel personnel. weight by species was calculated from estimated catches and average weights obtained from dockside samples. 1979-1982, an average of 367,000 angler days/year applied From from approximately 95 vessels resulted in an average catch of 1,928 mt per year. Importance of species to the headboat fishery varied by area. By weight, red porgy and black sea bass were most important in North Carolina and South Carolina: vermilion snapper and black sea bass in Georgia, northeast Florida and Cape Canaveral, Florida; king mackerel and yellowtail snapper in southeast Florida: yellowtail snapper and white grunt in the Florida Keys.
and

INTRODUCTION

Estimates of catch and effort expended by anglers fishing from headboats operating along the southeast coast of the u.s. since 1972 are presented as an update and expansion of data reported earlier by Huntsman (1976 a,b). collected in the southeast These estimates resulted from data headboat survey conducted by Beaufort Laboratory, Southeast Fisheries Science Center, National Marine Fisheries Service. The survey was designed to provide indices of the quality of reef fishing based on annual catch, catch unit of Additionally, effort, length survey personnel frequencies, and mean weight. collected biological materials to support studies on growth, species of reef fishes.

Headboats are vessels diet and reproduction of for hire which transport 15 important or more anglers. Operators of these vessels primarily pursued reef fishes, although some vessels in southeast Florida and the Florida focused on king mackerel. Included in our study were headboats that primarily operated in than in sounds and inlets.

METHODS

Acquisition of Data

Survey coverage varied with time and geographical location. From 1972 through 1975 we estimated catches only for vessels operating from ports in North Carolina and South Carolina. From 1976 through 1977 the study included ava Inlet, Florida. In 1978, geographic coverage was expanded to include all vessels from Cape Hatteras to Key West, Florida (Table 1). Sampling intensity in southeast Florida and the Florida Keys was low in 1978 (0.5 man-year/55 vessels), somewhat higher in 1970 and 1980 (1 man-years/55 vessels).

Estimates of headboat catches were based on: (1) weights of individual fishes, and (2) recors of the number of each species taken each trip. Survey samplers, who were on duty throughout the local fishing season, collected with data directly from catches made in an assigned region of responsibility (Table 2) (Fig. 1).

The regions were:

1. North Carolina – An average of 11 vessels operated principally from Morehead City to Southport, NC. A headboat operated at Hatteras Village, NC from 1973 through 1976 and catches there were samples by a cooperative crew member.
2. South Carolina – An average of 18 vessels operated principally from Little River to Charleston, SC although vessels at Calabash, NC operated through Little River Inlet and were included as vessels from South Carolina.
3. Georgia, northeast Florida and Cape Cannaveral – An Average of 12 vessels operated principally from Jacksonville to Sebastain, FL although there was sporadic headboat at Savannah and Brunswick, GA.
4. Southeast Florida – An average of 34 vessels operated from numerous ports along the coast from Fort Pierce to Miami, FL.
5. Florida Keys – An Average of 20 vessels operated from Key Largo to Key West, FL.

Because of unpredictable sailing schedules resulting from weather conditions, mechanical breakdowns and insufficient passenger bookings, a predesigned sampling schedule was never used in the survey and would not have been optimal for obtaining the required data. Sampling efficiency increased when the sampler adjusted the daily schedule to maximize sampling opportunities. Guidelines from sampling were that each vessel be visited one more times in 10

to 14 days, and that highly repetitive sampling from any vessel be avoided. Weekly activity reports submitted by samplers were monitored to ensure that the guidelines were followed. Fish sampled for weight were taken most often from catches of vessels that landed the largest numbers of fish. We opted for a loosely rather than a rigidly defined sampling schedule because transportation costs (mostly time spent traveling) representing about half of the sampling represent about half of the sampling costs. For instance, southeast Florida sampler drove almost 64,000 km in 1984.

The majority of samples were obtained from dockside during unloading or at nearby fish houses where catches were cleaned. Occasionally sampling occurred at sea during fishing. Samplers worked on board to allow more time for gathering biological materials and for educating crew members of the importance of cooperation in the program.

From 1972 to 1975, samplers weighed as many fish as possible all species available. Individual fish weights from spring balances were recorded to the nearest 0.1 pound (0.05 kg) but were later converted to grams. Beginning in 1976, different spring balances were used and weights were recorded to the nearest gram. To avoid size-selection bias, samplers were instructed to include all fish belonging to any angler whose fish were selected for sampling. Also, samplers were instructed to choose the catches of individuals who had taken less common species including groupers, red snapper and tilefish. Individual catches containing uncommon or rare species almost invariably included an abundance of the more common species.

In 1976, when collection of biological materials for history studies of the red porgy Pagrus pagrus (Manooch life and Huntsman 1977 were not needed, we imposed a sample quota of 10 red porgies per vessel per day. This greatly increased time available for sampling rarer species. We later imposed identical quotas on sampling other common species including white grunt, Haemulon plumieri (Manooch 1977), vermilion snapper, Rhomboplites aurorubens (Grimes 1978), and black sea bass, Centropristis striata (Mercer 1978). Despite quotas, we maintained a requirement that all fish of a species from a fisherman's catch be measured if any of species in the fisherman's catch were measured.

Samplers were trained to identify approximately 60 of the most common species in each region, and were provided with numerous guides and keys to assist them in species identifications. Fish weights and other pertinent data were recorded on a form (Fig. 2) and subsequently mailed to the Beaufort Laboratory for processing.

On almost every headboat, the daily catch was recorded by a crew member, usually a mate. Using a form (Fig. 3a,b) modified for each region, the recorder had only to enter the number taken and an approximate total weight of the catch of each species. We requested that actual counts be made, but realized that demands on a crew's time would allow them only to estimate the numbers of some abundant accuracy species (e.g., vermilion snapper). Our test of the recorded numbers suggested that these might be overestimates (Huntsman, Colby and Dixon 1978). Catches of black sea bass have always been recorded as an estimate of total weight because this species is commonly landed in large (>1000) numbers of small individuals. Most of the vessel crew members have experience in estimating the weight of black sea bass in units of the commercial fishery (boxes of 100 lbs (45 k)).

We trusted the species identifications of catch recorders. Although some were unfamiliar with the accepted common names for all species, the recorders were experienced and astute observers, and usually were aware of even subtle differences between species. We established mutually agreed-on names to begin communicating descriptions of the catches. For a very few species (e.g. small(<500 mm) Seriola), vessel personnel were unable to make trustworthy separations. We treated such troublesome groups as an aggregate "species".

Coverage of trips from catch records, though intended as a census, was incomplete. Some vessel crews were uncooperative and even cooperative recorders occasionally omitted or lost records. The proportion of missing records varied. Coverage usually improved after the first

year our program was established and once stabilized, averaged about 60% of all trips.

We paid recorders for keeping records. The amount of payment was related to the length of a trip, which in turn affected the size and complexity of the catch. We paid $1.50 for each record of a "full day" trip, $1.25 for a "three-quarter" day trip and $1.00 for a "half" day trip. The duration of a full day trip varied from 8 to 12 hours depending on the amount of time needed to reach the reefs, but fishing time of 5 to6 hours remained relatively constant throughout the region. Similarly, half day trips throughout the region were only to nearshore reef areas and provided 3 hours of fishing, while three-quarter day trips (only in South Carolina and Florida) provided about 4 hours of fishing. In Florida, trips from 24 to 72 hours in duration were made to the Dry Tortugas. The total time required for these trips was divided into 12-hour segments and each segment was paid for as a "full day" trip although only one catch record was submitted for each trip.

Data Processing

Data were sent to the Beaufort Laboratory, where they were edited and analyzed. Although all data were eventually coded, key- entered and stored in ASCII files on a mainframe computer (Grimes Hollingsworth 1979), from 1972 to 1976, all data manipulations were done with hand-operated calculators. Analytic programs written in IBM FORTRAN IV were used to calculate mean weights from 1977-1982, but were not used to sum catch and effort until 1980. Analytic program written in PL/I was used for all catch estimates in 1981 and 1982.

Catch Estimation

The catch of each vessel was estimated by species in each time stratum and then grouped by geographical stratum (area). Time strata were established to allow description of seasonal patterns in catches. From North Carolina to Cape Canaveral, Florida less frequent fishing in spring and fall led to the long January-May and September-December strata with monthly reporting for June, July and August. Monthly strata were used for southeast Florida to Tortugas Dry, Florida due to more regular year-round fishing.

Areas were the reporting districts and three of these: Cape Lookout, North Carolina: Cape Fear, North Carolina; and Cape Romain, South Carolina, were further divided into inshore offshore strata. The inshore and offshore strata were designed to separate those vessels which normally fish the outer shelf shelf break (depth=50-200 m) for snappers and groupers from those vessels which normally fish the inner shelf (depth=20-50 m) black sea bass and various inshore porgies (Diplodus, Stenotornus, Archosargus) (Chester et. al. 1984). The distinction between inshore and offshore was obvious in the North Carolina fleet at the beginning of the survey, but became less so after the late 1970's when high fuel costs caused many operators to exchange their normal long trips to the shelf edge for less costly trips to the midshelf (depth=30-70 m). In South Carolina, some vessels fished either offshore or inshore, but several vessels fished on the midshelf their catches were a mixture of snapper, grouper, black sea bass and inshore porgies. We assigned catches of the North Carolina and South Carolina midshelf vessels to the inshore strata.

Georgia and Florida were not divided into inshore and offshore areas. Off Georgia, northeast Florida and Cape Canaveral, Florida the shelf is extremely broad but snapper fishing is available nearshore and most headboat fishing is within 30-50 km of land in water 20-50 m deep. Off southeast Florida and the Florida Keys the shelf is very narrow and fishing occurs within 1-16 km of land in water 20-200 m deep. All fishing around Dry Tortugas, Florida occurs in depths from 15 m to 25 m.

Occasionally, areas would be combined to protect the confidentiality of information

provided by headboat crews. Federal regulations prohibit the disclosure of confidential statistics (e.g. catch and effort data) in combinations of less than three distinct parties (businesses). These combinations resulted slight irregularities in the year to year sequence of strata.

We estimated the catch by number and by weight for each species except black sea bass for which only the catch in weight was estimated. When there were no missing catch records and an ample number of fish sampled for weight ($n \geq 10$), we estimated the weight of each species taken in each time-area stratum by summing the number of that species listed in the catch records by vessel for the stratum and multiplying the sum by the mean weight for that species and stratum. The catch in numbers was the summed number from the catch records. The catch for the entire region was the sum of the catches by each vessel in each stratum.

There were almost always some missing catch records and sometimes there was an insufficient number of individual weights. Numerous approaches were employed to estimate missing data. If comparison of catch records with a separate headboat activity report maintained by the field sampler indicated that there were trips for which we had no records, we estimated the catch for each vessel in a stratum by multiplying the reported catch for each species by the ratio of angler days actually fished to the number of angler days reported on catch records. This adjustment was used to estimate the catches of 80% or more of the vessels. The actual number of angler days was derived from the headboat activity report maintained by the sampler, ticket purchase records, or both. The expansion based on angler days and catch. Linearity may not be perfect (Bannerot and Austin 1983) but the asuption of linearltiy is an accepted technique when estimating catches from crell surveys (Schupp 1964). If a record of total angler days was unavailable we expanded the reported catch by multiplying it by the ratio of the total number of trips to the number of trips with records. This expansion required the assumption that mean catch per reported trip estimated the mean catch per unreported trip. We similarly estimated total effort by multiplying the mean number of angler days per reported trip by the total number of trips.

Where catch record were available for part of a time stratum for any vessel and the only other information available was that the vessel made some trips beyond those reported, we estimated the total number of trips as the total run by a vessel docking nearby, which had about the same size, popularity, fishing pattern and other similarities as perceived by the port sampler. The estimated total number of trips was used to expand the reported catch and fishing effort to estimates of total catch and effort. Finally for the worst cases of missing data, not catch records and only knowledge that the vessel made some trips, we attributed catch and effort to the vessel without records equal to that associated with a similarly-operated nearby vessel for which we had good reports. This crudest of all procedures was used for less than 10% of all estimates. Our rationale for adopting this last procedure was that an estimate of no catch or effort was certainly wrong, and that catch of a "matched" vessel was nearer the truth than was zero.

We had a similar array of contingency procedures to account insufficient or missing observations of individual fish weights. If there were fewer than 10 observations by area of individual weights for any species in a time stratum, we augmented the observations with those in the previous or subsequent time stratum, or both. If one of those combinations did not provide 10 weight observations, we usually continued adding observations by time stratum increments until at least 10 observations were available. For some species the observations from an entire season were required to provide 10. Occasionally, additional needed weight observations were obtained from different areas rather than time strata. The added measurements were taken from adjacent areas in the same time strata. time and area strata observations. For a few species, combinations of both time and area strata were required to provide 10 weight observations.

Individual weights for some rare and usually large species, e.g. Warsaw grouper, Epinephelus nigritus, were often taken by the vessel crew and entered in the estimated weight column of the catch log (Figure represented 3 a,b) . Often more fish (of these that weights obtained by the crew species) than our sampler encountered and we combined both types of observations to estimate the stratum mean. While some bias may have resulted from this procedure, we thought the increase in sample size would dampen the effects.

Finally, for the very rarest species from which very few weights were recorded, we used whatever sample was available no matter how small - or if weights were unavailable we used an average weight based upon visual observation of the fishery and our knowledge of the species. Fortunately, only the rarest species required those measures, and rarity precluded any major impact on our estimates of total catch. Again, our philosophy was that no fish is weightless and an estimate based on observation was far more accurate than zero.

Because of the complexity of the estimation process and our uncertainty as to the correct procedure, variances were not calculated for our estimates. Were the survey to have operated in ideal fashion with a complete census of catch, there would have been no variance in the catch by numbers and the variance in the catch by weight would have been only that attached to the estimates of mean weight. Preliminary analyses suggest variances about mean weights for the common species contributing most of the weight were very small (coefficient of variation $\leq$ 10%). For a few strata the ideal situation of complete reporting was obtained, but for most, a second undefined variance component attached to estimating the catch by number existed. This second component varied both by estimation procedure used and species.

The finite population correction factor was important for the estimates of numbers caught. The ratio of trips with records to total estimated trips was about 60% and for the vessels contributing the bulk of the catch, record keeping was even more frequent. Thus, we assumed the variances were small enough to allow reasonable confidence in our estimates.

Species Categories

Although catches were estimated, almost without exception, by species, the tables present the catches, in part, by groups of species. These groups allow a reduction in the size and complexity of the tables. Species included in each group were:

Group	Species
Red Porgy	red porgy, pagrus paqrus
Other Porgies	sheephead, Archosargus probatocephalus sea bream, Archosargus rhomboidalis grass porgy, Calamus arctifrons whitebone porgy, Calamus leucosteus (most common porgy other than red porgy north of Cape Canaveral, FL) knobbed porgy, Calamus nodosus sheepshead porgy, Calamus Qenna spottail pinfish, DiQlodus holbrooki pinfish, Lagodon rhomboides longspine porgy, Stenotomus caprinus scup, Stenotomus chrysops (usually not found south of South Carolina) jolthead porgy, Calamus bajonado (usually not found north of Cape Canaveral)

	saucereye porgy, Calamus calamus (usually not found north of Cape Canaveral) littlehead porgy, Calamus Qroridens (usually not found north of Florida)
White Grunt	white grunt Haemulon p1umieri
Other Grunts	tomtate, Haemulon aurolineatum (most common grunt north of Cape Canaveral) pigfish, Orthopristis chrysoptera black margate, Anisotremus surinamensis (usually not found north of Cape Canaveral) porkfish, Anisotremus virainicus margate, Haemulon album black grunt, Haemulon bonariense caesar grunt, Haemulon carbonarium smallmouth grunt, Haemulon chrysarvqreum French grunt, Haemulon flavolineatum Spanish grunt, Haemulon macrostomum cottonwick, Haemulon melanurum sailors choice, Haemulon parrai burro grunt, pomadasvs crocro bluestriped grunt, Haemulon sciurus (usually not found north of Florida)
Vermilion Snapper	vermilion snapper, Rhombonlites aurorubens (most common snapper north of Cape Canaveral)
Red Snapper	red snapper, Lutjanus campechanus
Silk Snapper	silk snapper, Lutjanus vivanus
Yellowtail Snapper	yellowtail snapper, ocyurus chrvsurus (most common snapper south of Cape Canaveral)
Lane Snapper	lane snapper, Lutjanus synaaris
Gray Snapper	gray snapper, Lutjanus griseus
Mutton Snapper	mutton snapper, Lutianus analis
Schoolmaster Snapper	schoolmaster, Lutjanus apodus
Other Snappers (South Atlantic Bight =Cape Hatteras, NC to Cape Canaveral, FL)	Includes the following snappers listed above: silk, yellowtail, lane, gray, and mutton as well as blackfin snapper, Lutianus buccanella cubera snapper, Lutjanus cyanopterus wenchman, Pristipomoides aguilonaris
Other Snappers (South of Cape Canaveral, FL)	black snapper, ApSilus dentatus blackfin snapper, Lutianus buccanella cubera snapper, Lutianus cyanouterus dog snapper, Lutjanus jocu

Grouper: Epinephelus	graysby, Epinephelus cruentatus speckled hind, EpineDhelus drummondhavi yellowedge grouper, EpineDhelus flavolimbatus coney, Epineohelus fulvus red hind, Epineohelus guttatus rock hind, Epineohelus adscensionis marbled grouper, Epineohelus inermis red grouper, Epineohelus morio misty grouper, Epineuhelus mystacinus warsaw grouper, Epineuhelus nigritus snowy grouper, Egineuhelus niveatus jewfish, Eginenhelus itaiara (usually not found north of Florida) Nassau grouper, Eginenhelus striatus (usually not found north of Cape Canaveral)
Grouper: Mycteroperca	gag, Mycteroperca microlepis (most grouper in south scamp, Mycteroperca phenax yellowmouth grouper, Mycteroperca interstitialis yellowfin grouper, Mycteroperca venenosa black grouper, Mycteroperca bonaci (usually not found north of Cape Canaveral) tiger grouper, Mycteroperca tiaris (usually not found north of Cape Canaveral)
Gray Triggerfish	gray triggerfish, Balistes capriscus
Gray Tilefishes	blueline tilefish, Caulolatilus microps goldface tilefish, Caulolatilus chrysops
King Macerel	king mackerel, Scomberomorus cavalla
Others	We have recorded 156 additional species caught by anglers from headboats in the U.S. south Atlantic. species from the families Scombridae (tunas) and carangidae (jacks) account for approximately 80% of this group.
Black Sea Bass	black sea bass, Centropristis striata bank sea bass, Centropristis ocyurus (<10%) rock sea bass, Centropristis philadelphica (<1%)

RESULTS

Between 1978 and 1982, an estimated average of 367,000 angler days/year, applied from approximately 95 vessels fishing from ports in North Carolina to the Florida Keys, yielded an estimated catch 1,928 mt per year. Numbers of fish caught (excluding black sea increased from 1.5 million 1978) to 1.8 million (1982) while associated weight increased from 1,212 mt 1978) to 1,736 mt (1982) (Tables 3-71). Black sea bass catches varied from 249 mt (1978) to 339 mt (1981)with 1982 catches being only slightly smaller at 334 mt. Fishing activity increased from 305,330 angler days 1978) to 388,949 angler days (1979) and remained high with 390,244 angler days in 1982.

Fishing methods varied only slightly throughout the region and remained those described by Huntsman (1976a) Single or double hook bottom rigs were used for reef fishing and single hook weightless rigs for drift fishing for king mackerel.

Characteristics of the headboat catch varied along the U.S. southeast coast. By weight, red porgy and black sea bass were the commonly caught species in the North Carolina and South Carolina headboat fishery. In these two states, catches of reef fish, other than black sea bass, ranged from 334 mt kg (1978) to 723 mt (1973) and black sea bass catches oscillated between 166 mt kg and 347 mt (1975). The number of fishermen participating e Carolina headboat fishery increased over the years of the survey and reached a record high of 94,456 angler days in 1982.

The most obvious trends in the Carolina headboat fishery were large decreases in mean weight for eight of the most common species: black sea bass, red porgy, vermilion snapper, gag, scamp, speckled hind, snowy grouper and red snapper (Huntsman and Willis 1989).

Fishermen in Georgia, northeast Florida and Cape Canaveral, FL caught more vermilion snapper and black sea bass than other species. Total catch fluctuated between 286 mt (1977) and 435 mt (1976). Fishing activity increased from 58,404 angler days to 69,616 angler days (1982) but peaked at 78,099 angler (1978)

King mackerel and yellowtail snapper were the dominant species in southeast Florida headboat catches. Total catch decreased from 891 mt (1980) to 631 rot (1981). Angler activity remained almost constant between 1979 and 1982 with an average of 156,906 angler days.

Anglers fishing on vessels from the Florida Keys, which include the Dry Tortugas fishing area, caught mostly yellowtail snappers and white grunts. Total catch declined from 467 mt (1979) to 218 mt (1980) but this decrease was probably caused by a major reduction of effort (84,716 angler days to 52,683 angler days). In 1980, many vessel owners suspended their fishing activities to ferry refugees from Cuba to the United States. Fishing effort stabilized at approximately 71,650 angler days (1981-82) and total catch averaged 312 rot (1981-82).

The headboat survey has continued past 1982 and provides the only long term data base for u.s. southeast reef fish catch trends and stock assessment for resource management by the South Atlantic Fishery Management Council.

List of Catch Tables

The following tables provide in chronological order the headboat survey results. Annual estimates are followed by time strata and areas are arranged geographically north to south.

3. Headboat catches from North Carolina and South Carolina, (annual only).

4. Headboat catches from North Carolina and South Carolina, 1973 (annual only).

5. Headboat catches from North Carolina and South Carolina, 1974 - Annual.

6. Headboat catches from North Carolina and South Carolina, - January through may.

7. Headboat catches from North Carolina and South Carolina, 1974 - June.

8. Headboat catches from North Carolina and South Carolina, - July.

9. Headboat catches from North carolina and South Carolina, 1974 - August.

10. Headboat catches from North Carolina and South Carolina - September through December.

11. Headboat catches from North Carolina and South Carolina, - Annual.

12. Headboat catches from North Carolina and South Carolina- January through May.

13. Headboat catches from North Carolina and South Carolina, 1975 - June.

14. Headboat catches from North Carolina and South Carolina, 1975 - July.

15. Headboat catches from North Carolina and South Carolina, 1975 - August.

16. Headboat catches from North Carolina and South Carolina; 1975 - September through December.

17. Headboat catches from South Atlantic Bight, 1976 - Annual.

18. Headboat catches from South Atlantic Bight, through May. 1976 - January

19. Headboat catches from South Atlantic Bight, 1976 - June.

20. Headboat catches from South Atlantic Bight, 1976 - July

21. Headboat catches from South Atlantic Bight, 1976 - August.

22. Headboat catches from South Atlantic Bight, 1976 - September through December.

23. Headboat catches from South Atlantic Bight, 1977 - Annual.

24. Headboat catches from South Atlantic Bight, 1977 - January

25. Headboat catches from South Atlantic Bight, 1977 - June.

26. Headboat catches from South Atlantic Bight, 1977 - July.

27. Headboat catches from South Atlantic Bight, 1977 - August.

28. Headboat catches from South Atlantic Bight, 1977 - September through December.

29. Headboat catches from South Atlantic Bight, 1978 - Annual.

30. Headboat catches from South Atlantic Bight, 1978 - January

31. Headboat catches from South Atlantic Bight, 1978 - June.

32. Headboat catches from South Atlantic Bight, 1978 - July

33. Headboat catches from South Atlantic Bight, 1978 - August.

34. Headboat catches from South Atlantic Bight, 1978 - September through December.

35. Headboat catches from southeast Florida, 1978 - Annual (includes Florida Keys and Dry Tortugas).

36. Headboat catches from South Atlantic Bight, 1979 - Annual

37. Headboat catches from South Atlantic Bight, 1979 - January through May.

38. Headboat catches from South Atlantic Bight, 1979 - June

39. Headboat catches from South Atlantic Bight, 1979 - July

40. Headboat catches from South Atlantic Bight, 1979 - August

41. Headboat catches from South Atlantic Bight, 1979 - September through December.

42. Headboat catches from southeast Florida, 1979.

43. Headboat catches from Florida Keys, 1979 (annual only).

44. Headboat catches from Dry Tortugas, 1979 (annual only).

45. Headboat catches from South Atlantic Bight, 1980 - Annual

46. Headboat catches from South Atlantic Bight, 1980 - January through May.

47. Headboat catches from South Atlantic Bight, 1980 - June.

48. Headboat catches from South Atlantic Bight, 1980 - July.

49. Headboat catches from South Atlantic Bight, 1980 - August.

50. Headboat catches from South Atlantic Bight, 1980 - September through December.

51. Headboat catches from southeast Florida, 1980.

52. Headboat catches from Florida Keys, 1980 (annual only).

53. Headboat catches from Dry Tortugas, 1980 (annual only).

54. Headboat catches from South Atlantic Bight, 1981 - Annual.

55. Headboat catches from South Atlantic Bight, 1981 January through May.

56. Headboat catches from South Atlantic Bight, 1981 - June

57. Headboat catches from South Atlantic Bight, 1981 - July

58. Headboat catches from South Atlantic Bight, 1981 - August.

59. Headboat catches from South Atlantic Bight, 1981 - September through December.

60. Headboat catches from southeast Florida, 1981

61. Headboat catches from Florida Keys, 1981

62. Headboat catches from Dry Tortugas, 1981(annual only)

63. Headboat catches from South Atlantic Bight, 1982 – Annual.

64. Headboat catches from South Atlantic Bight, 1982 - January through May.

65. Headboat catches from South Atlantic Bight, 1982 - June

66. Headboat catches from South Atlantic Bight, 1982 - July.

67. Headboat catches from South Atlantic Bight, 1982 - August

68. Headboat catches from South Atlantic Bight, 1982 - September through December.

69. Headboat catches from southeast Florida, 1982

70. Headboat catches from Florida Keys, 1982

71. Headboat catches from Dry Tortugas, 1982.

Bannerot, S. P., and C. B. Austin. 1983. Using frequency distributions of catch per unit effort to measure fish-stock abundance. Trans. Am. Fish. Soc. 112:608-617.

Chester, A. J., G. R. Huntsman, P. A. Tester, and C. S. Manooch, III. 1984. South Atlantic Bight reef fish communities as represented in hook and line catches. Bull. Mar. Sci. 34: 267-279.

Grimes, C. B. 1978. Age, growth and length-weight relationship of vermilion snapper, Rhomboplites aurorubens (cuvier) from North Carolina and South Carolina waters. Trans. Am. Fish. Soc. 107:454-456.

Grimes, C. B. and J. E. Hollingsworth. 1979. An automatic data processing system for storage and manipulation of life history, catch, and angler effort data. Estuaries 2(2): 123-126.

Huntsman, G. R. 1976a. Offshore headboat fishing in North Carolina and South Carolina. Mar. Fish. Rev. 38(3) :13-23.

Huntsman, G. R. 1976b. Offshore bottom fisheries of the United states south Atlantic coast. In H. R. Bullis and A. C. Jones (ed.). Proc. Colloquium on snapper-grouper fishery resources of the western central Atlantic ocean, p. 192-221. Fla. Sea Grant Progr. Rep. 17.

Huntsman, G. R., D. R. Colby, and R. L. Dixon. 1978. Measuring catches in the Carolina headboat fishery. Trans. Am. Fish. Soc. 107:241-245.

Huntsman, G. R., and P. W. Willis. 1989. status of reef fish stocks~off North Carolina and South Carolina as revealed by headboat catch statistics. In R. Y. George and A. W. Hulbert (ed.). North Carolina coastal oceanography symposium, p. 387-454. NOAA Nat. Undersea Res.
Frog. Res. Rep. 89-2.

Manooch, C. S., III. 1978. Age, growth and mortality of the white grunt, Haemulon 2lumieri Lacepede (Pisces: Pomadasyidae) , from North Carolina and South Carolina. Proc. Annu. Conf. Southeast. Assoc. Game Fish. Corom. 30:58-70.

Manooch, c. S., III, and G. R. Huntsman. 1977. Age, growth and mortality of the red porgy, Paqrus paqrus. Trans. Am. Fish. Soc. 106:26-33.

Mercer, L. P. L978. The reproductive biology and population dynamics of black sea bass, Centrouristis striata. Ph.D. Thesis" College of William and Mary, Williamsburg, Va., 195 p.

SchUpp, D. H. 1964. A method of creel census applicable to large lakes. Minn. Div. Game Fish. Invest. Rep. No. 274, 10 p.

Table 1. Number of headboats operating from ports along the U.S. South Atlantic coast, 1972-82. Data unavailable for northeast Florida, 1972-1975 and Cape Canaveral to Key West, FL 1972-77.

Port	Number of Headboats										
	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Hatteras Village, NC	0	1	1	1	1	0	0	0	0	0	0
Morehead City, NC	3	3	3	2	1	1	1	1	1	1	2
Atlantic Beach, NC	1	1	1	1	1	1	1	1	1	1	0
Sneads Ferry, NC	1	1	1	1	1	1	1	1	1	1	1
Topsail Island, NC	2	2	2	2	2	1	1	1	1	1	1
Wrightsville Beach, NC	1	1	1	1	0	0	0	0	0	0	0
Carolina Beach, NC	5	5	5	5	5	6	4	3	3	3	2
Southport, NC	1	1	1	1	1	1	1	1	1	1	1
Calabash, NC	0	0	0	0	0	0	0	0	1	1	2
Little River, SC	6	6	6	6	5	6	5	6	5	8	8
Murrell's Inlet, SC	7	7	7	7	9	8	7	8	8	7	8
Charleston, SC	4	3	3	3	3	3	4	4	5	4	3
Hilton Head Island, SC	0	0	0	0	0	0	0	0	1	1	1
Savannah, GA					1	1	3	2	1	0	0
Brunswick, GA					0	0	0	0	1	0	0
Mayport, FL (Jacksonville)					3	4	4	2	2	1	1
St. Augustine, FL					0	0	0	0	1	1	1
Ponce Inlet, FL (Daytona Beach)					7	9	8	8	7	7	6
Cape Canaveral, FL							3	3	2	2	2
Fort Pierce, FL							2	2	2	2	2
Port Salerno, FL							1	1	1	2	2
Jupiter, FL							1	1	1	1	1
Riviera Beach, FL							6	6	6	5	5
Palm Beach, FL							1	0	0	0	0
Lake Worth, FL							1	1	1	0	0
Lantana, FL							1	1	1	2	2
Hypoluxo, FL							0	1	1	1	2
Boynton Beach, FL							3	3	3	3	4
Pompano Beach, FL							4	4	5	5	4
Fort Lauderdale, FL							3	3	3	3	3
Dania, FL							1	1	1	0	0
Hollywood, FL							2	1	1	1	1
Miami Beach, FL							5	9	7	7	5
Miami, FL							2	2	2	2	2
Key Largo, FL							3	2	2	2	1
Plantation, FL							0	0	1	1	1
Plantation Key, FL							2	2	2	2	2
Islamorada, FL							2	3	3	3	3
Key Colony Beach, FL							0	0	1	0	0
Marathon, FL							6	6	6	6	6
Big Pine Key, FL							1	1	1	1	1
Stock Island, FL							1	1	1	1	1
Key West, FL							3	4	4	5	4
Total	31	31	31	30	40	42	94	96	98	95	91

Table 2.

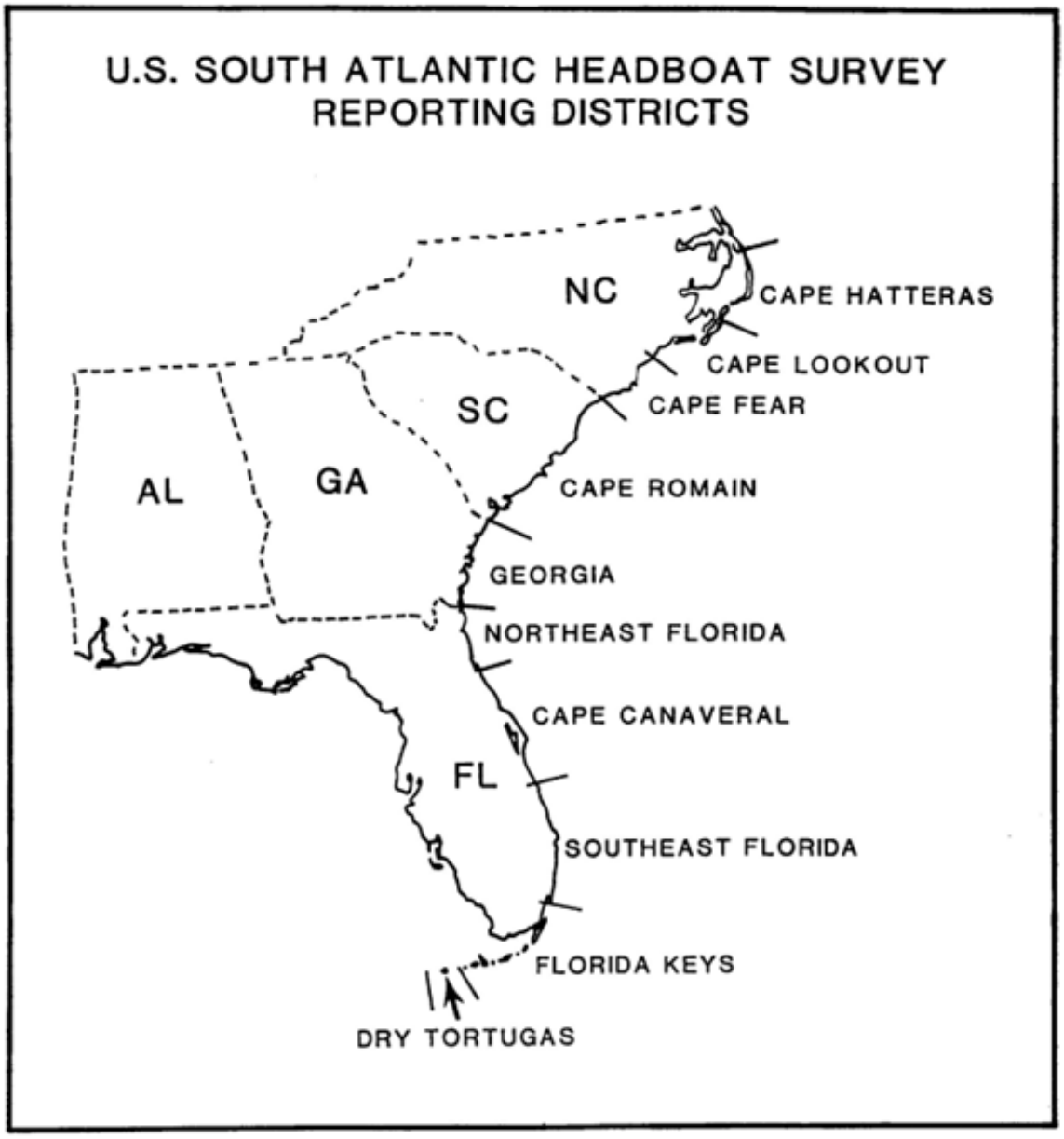
Boundaries of the geographic strata.

Stratum	Northern Boundary	Southern Boundary
Cape Hatteras	Hatteras Inlet, NC	Ocracoke Inlet, NC
Cape Lookout Inshore and Offshore	Ocracoke Inlet, NC	New River Inlet, NC
Cape Fear Inshore and Offshore	New Topsail Inlet, NC	Southport, NC
Cape Romain Savannah, GA Inshore and Offshore	Calabash, NC	Hilton Head Island, SC
Georgia	Savannah, GA	Brunswick, GA
Northeast Florida	Fernandina Beach, FL	St. Augustine, FL
Cape Canaveral	Daytona Beach, FL	Sebastian Inlet, FL
Southeast Florida	Fort Pierce, FL	Miami, FL
Florida Keys	Key Largo, FL	Key West, FL
Dry Tortugas	Dry Tortugas, FL - fishing area[1]	

The Dry Tortugas stratum represents fishing in the remote and highly productive Dry Tortugas region by vessels operating from Marathon and Key West Florida.

Tables 3-71. Estimated catches and fishing effort of the southeast United States headboat fleet, 1972-1982.

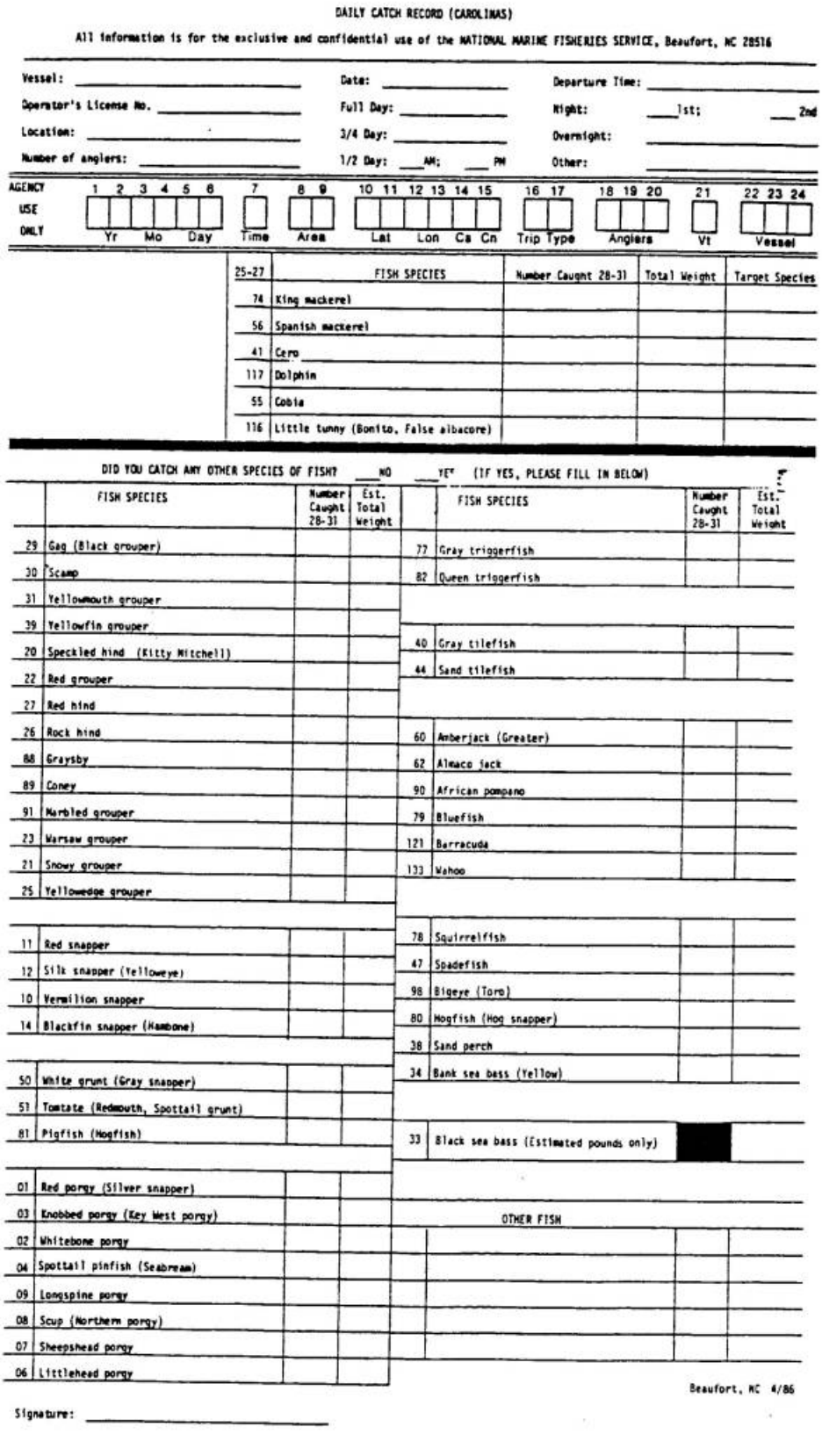
Figure 1. U.S. South Atlantic headboat survey reporting districts



U.S. **SOUTH ATLANTIC HEADBOAT SURVEY REPORTING DISTRICTS**

Figure 2.

Form used for recording data of individual fish caught by fishermen on headboats. The form was designed so the data could be key entered into a computer without recording the data onto another form.



DAILY CATCH RECORD (CAROLINAS)

All information is for the exclusive and confidential use of the NATIONAL MARINE FISHERIES SERVICE, Beaufort, NC 28516

Vessel: _____ Date: _____ Departure Time: _____

Operator's License No. _____ Full Day: _____ Night: ___1st; ___2nd

Location: _____ 3/4 Day: _____ Overnight: _____

Number of anglers: _____ 1/2 Day: ___AM; ___PM Other: _____

AGENCY USE ONLY	1 2 3 4 5 6	7	8 9	10 11 12 13 14 15	16 17	18 19 20	21	22 23 24
	Yr Mo Day	Time	Area	Lat Lon Ca Cn	Trip Type	Anglers	Vt	Vessel

25-27	FISH SPECIES	Number Caught 28-31	Total Weight	Target Species
74	King mackerel			
56	Spanish mackerel			
41	Cero			
117	Dolphin			
55	Cobia			
116	Little tunny (Bonito, False albacore)			

DID YOU CATCH ANY OTHER SPECIES OF FISH? ___NO ___YES (IF YES, PLEASE FILL IN BELOW)

	FISH SPECIES	Number Caught 28-31	Est. Total Weight
29	Gag (Black grouper)		
30	Scamp		
31	Yellowmouth grouper		
39	Yellowfin grouper		
20	Speckled hind (Kitty Mitchell)		
22	Red grouper		
27	Red hind		
26	Rock hind		
88	Graysby		
89	Coney		
91	Marbled grouper		
23	Warsaw grouper		
21	Snowy grouper		
25	Yellowedge grouper		
11	Red snapper		
12	Silk snapper (Yelloweye)		
10	Vermilion snapper		
14	Blackfin snapper (Hambone)		
50	White grunt (Gray snapper)		
51	Tomtate (Redmouth, Spottail grunt)		
81	Pigfish (Hogfish)		
01	Red porgy (Silver snapper)		
03	Knobbed porgy (Key West porgy)		
02	Whitebone porgy		
04	Spottail pinfish (Seabream)		
09	Longspine porgy		
08	Scup (Northern porgy)		
07	Sheepshead porgy		
06	Littlehead porgy		

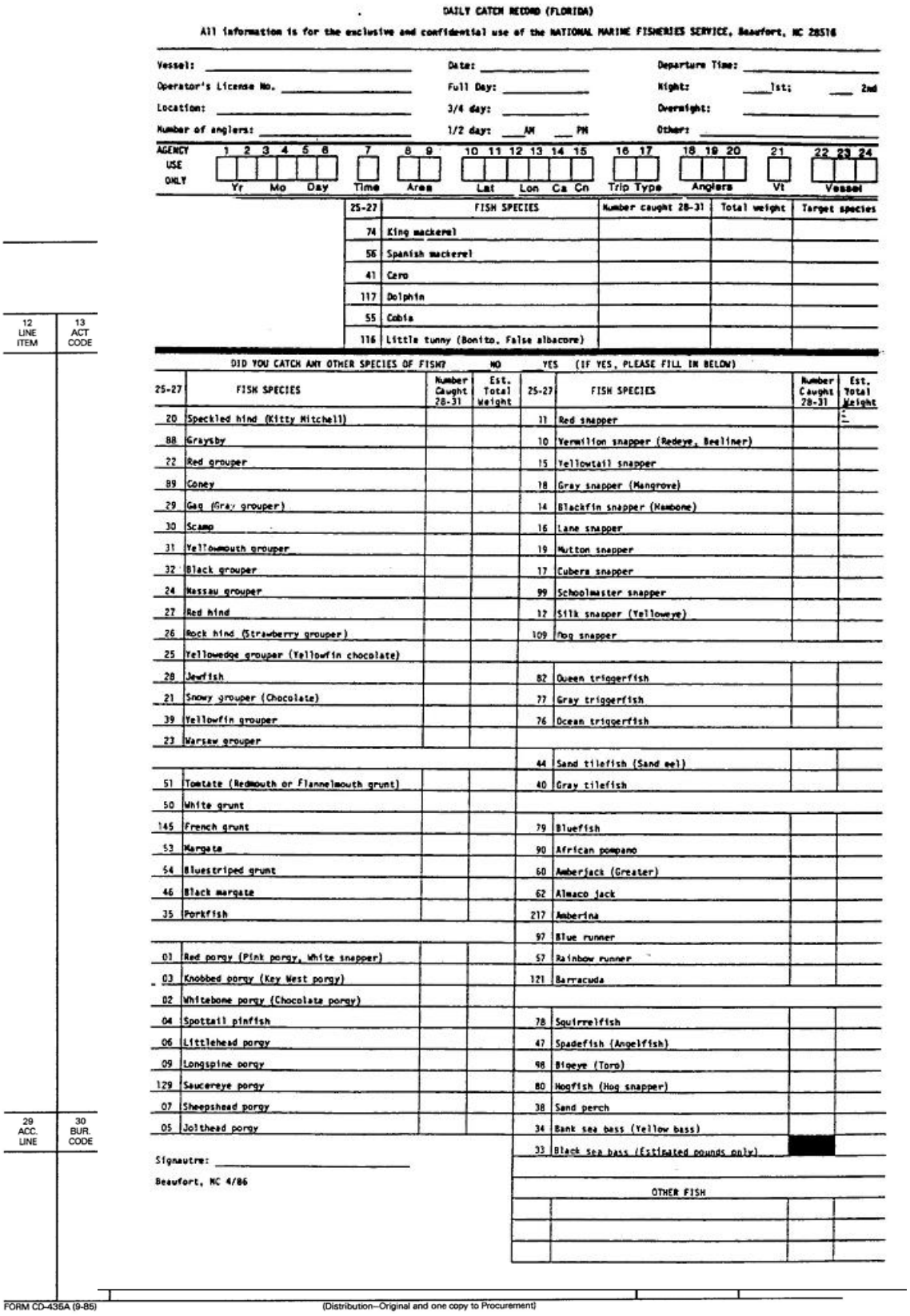
	FISH SPECIES	Number Caught 28-31	Est. Total Weight
77	Gray triggerfish		
82	Queen triggerfish		
40	Gray tilefish		
44	Sand tilefish		
60	Amberjack (Greater)		
62	Almaco jack		
90	African pompano		
79	Bluefish		
121	Barracuda		
133	Wahoo		
78	Squirrelfish		
47	Spadefish		
98	Bigeye (Toro)		
80	Hogfish (Hog snapper)		
38	Sand perch		
34	Bank sea bass (Yellow)		
33	Black sea bass (Estimated pounds only)		

OTHER FISH

Beaufort, NC 4/86

Signature: _____

Figure 3a - 3b. Forms given to headboat personnel for recording their catches (a. North Carolina and South Carolina b. Florida). The forms were designed so the data could be key entered into a computer without recording the data onto another form.



DAILY CATCH RECORD (FLORIDA)

All information is for the exclusive and confidential use of the NATIONAL MARINE FISHERIES SERVICE, Beaufort, NC 28516

Vessel: _____ Date: _____ Departure Time: _____

Operator's License No. _____ Full Day: _____ Night: ___1st; ___ 2nd

Location: _____ 3/4 day: _____ Overnight: _____

Number of anglers: _____ 1/2 day: ___AM ___PM Other: _____

AGENCY USE ONLY | 1 2 3 4 5 6 Yr Mo Day | 7 Time | 8 9 Area | 10 11 12 13 14 15 Lat Lon Ca Cn | 16 17 Trip Type | 18 19 20 Anglers | 21 Vt | 22 23 24 Vessel

25-27	FISH SPECIES	Number caught 28-31	Total weight	Target species
74	King mackerel			
56	Spanish mackerel			
41	Cero			
117	Dolphin			
55	Cobia			
116	Little tunny (Bonito, False albacore)			

DID YOU CATCH ANY OTHER SPECIES OF FISH? NO YES (IF YES, PLEASE FILL IN BELOW)

25-27	FISH SPECIES	Number Caught 28-31	Est. Total Weight
20	Speckled hind (Kitty Mitchell)		
88	Graysby		
22	Red grouper		
89	Coney		
29	Gag (Gray grouper)		
30	Scamp		
31	Yellowmouth grouper		
32	Black grouper		
24	Nassau grouper		
27	Red hind		
26	Rock hind (Strawberry grouper)		
25	Yellowedge grouper (Yellowfin chocolate)		
28	Jewfish		
21	Snowy grouper (Chocolate)		
39	Yellowfin grouper		
23	Warsaw grouper		
51	Tomtate (Redmouth or Flannelmouth grunt)		
50	White grunt		
145	French grunt		
53	Margate		
54	Bluestriped grunt		
46	Black margate		
35	Porkfish		
01	Red porgy (Pink porgy, White snapper)		
03	Knobbed porgy (Key West porgy)		
02	Whitebone porgy (Chocolate porgy)		
04	Spottail pinfish		
06	Littlehead porgy		
09	Longspine porgy		
129	Saucereye porgy		
07	Sheepshead porgy		
05	Jolthead porgy		

25-27	FISH SPECIES	Number Caught 28-31	Est. Total Weight
11	Red snapper		
10	Vermilion snapper (Redeye, Beeliner)		
15	Yellowtail snapper		
18	Gray snapper (Mangrove)		
14	Blackfin snapper (Hambone)		
16	Lane snapper		
19	Mutton snapper		
17	Cubera snapper		
99	Schoolmaster snapper		
12	Silk snapper (Yelloweye)		
109	Hog snapper		
82	Queen triggerfish		
77	Gray triggerfish		
76	Ocean triggerfish		
44	Sand tilefish (Sand eel)		
40	Gray tilefish		
79	Bluefish		
90	African pompano		
60	Amberjack (Greater)		
62	Almaco jack		
217	Amberina		
97	Blue runner		
57	Rainbow runner		
121	Barracuda		
78	Squirrelfish		
47	Spadefish (Angelfish)		
98	Bigeye (Toro)		
80	Hogfish (Hog snapper)		
38	Sand perch		
34	Bank sea bass (Yellow bass)		
33	Black sea bass (Estimated pounds only)		

OTHER FISH

Signature: _____

Beaufort, NC 4/86

12 LINE ITEM | 13 ACT CODE

29 ACC. LINE | 30 BUR. CODE

FORM CD-436A (9-85) (Distribution--Original and one copy to Procurement)