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Information on Commercial Removals of the Yellowfin Grouper, *Mycteroperca venenosa*, in Puerto Rico from 1983 through 2005 with notes on nominal catch per unit of effort

Prepared

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Introduction and Fishery Background

Descriptions of the historical fisheries off Puerto Rico exist from several studies. Cummings and Matos-Caraballo (2003) provided a review of the literature describing the early fisheries off Puerto Rico. Other descriptions of the Puerto Rico fisheries can be found in Doucet et al. (2006), CFMC (2004) and Matos-Caraballo, (1998). The earliest accounts of commercial fishing date back to the 1930's. Most of the early reports indicate that although fishing occurred in Puerto Rico during the late 1800's that prior to about 1900's it was mainly for subsistence purposes (see Wilcox 1899, 1900, Jarvis 1932 as cited in Cummings and Matos-Caraballo 2003a). This is further supported by Jarvis's work (1932), who under the sponsorship of the U.S. Department of Commerce, Bureau of Fisheries, conducted a detailed survey in 1931 of the marketing and economic aspects of the fisheries and was one of the earliest to document Puerto Rico's commercial fishery. Jarvis described fishing methods, number of fishermen and number of boats operating, number of different gear being used (nets, pots, lines, etc.) and provided comprehensive descriptions on the regional differences of Puerto Rico's fisheries.

Recent studies, since the late 1990's, of the Puerto Rico commercial reef fish fisheries have expressed a general concern as to the condition of several species or species groups commonly reported in these fisheries including several snappers and groupers (see Matos-Caraballo 2002). Declining landings in some fisheries off Puerto Rico (i.e. pot fisheries) and increasing landings in other gears (i.e., hand lines, gill nets, and diver operations) have been reported. Matos-Caraballo (2002) also reported declines in total landings from the west coast of Puerto Rico and for the first time since 1972 a trend of increasing landings from the south coast of Puerto Rico. Matos-Caraballo (1998, 2004) reported that several species and shellfish species, previously considered as trash fish by most commercial fishers in Puerto Rico are now being landed and sold. These included the squirrelfish species *Holocentrus ascensionis* and *H. rufus* and also *Carpilius corallinus* and *Mythrax spp.* In addition, Matos-Carabollo (2004) reported a decline in the number of active fishermen as well as the number of vessels participating in the deep water snapper fishery.

Matos-Caraballo (2004, 2002, and 2001) noted the historical importance of groupers to Puerto Rico's commercial fisheries. Several studies have focused on the life history characteristics which groupers share that tend to make them vulnerable to exploitation (Sadovy, 1994, Manooch, 1987). Most groupers are carnivores, exhibit slow growth, have relatively long life spans, have large size at sexual maturity, change sexes, form schools at the time of spawning, and are relatively easy to catch, particularly during times of aggregation (see Matos-Caraballo, 2004). In addition, several investigators have noted the tendency for larger individuals to be more aggressive and less cautious in taking baits and entering traps thus particularly vulnerable especially during spawning seasons when many grouper species are believed to form aggregations (Bohnsack, 1992; Thompson and Munro 1974, 1983; Munro 1987). In addition, declines in overall commercial grouper landings throughout the Caribbean have been reported (Matos-Caraballo, 2006; Bohnsack 1987, Bannerot et al., 1987; Sadovy, 1994). Matos-Caraballo (2006) documented declines in commercial landings and in fishery catch rates in another larger grouper species, which has similar life history characteristics to the yellowfin grouper, the tiger grouper at Vieques Island (Puerto Rico) from 1995-1999.

Detailed information pertaining to the commercial yellowfin grouper, Mycteroperca venenosa, fisheries in Puerto Rico has not been presented for the U.S. Caribbean. The majority of information contained in the literature on this species has mainly been of life history type subject material and this information has been obtained indirectly, from studies most often directed at other species (e.g., tiger grouper for Puerto Rico (Matos-Caraballo 1997 or from Nassau grouper studies in the U.S. Virgin Islands (see Nemeth 2004a, b; Olsen and LaPlace 1978) or from studies of aggregating groupers in other regions (e.g.,Whaylen et al., 2004). Nemeth et al. (2003) citing Beets and Friedlander (1992, 1999) and Olsen and LaPlace, 1978) reported that overfishing in the 1970's off St. Thomas led to a decline in the population of yellowfin grouper. However, none of the studies cited in Nemeth et al.'s study (2003) reported quantitative information to substantiate a decline in the yellowfin grouper resource off St. Thomas (US Virgin Islands), but did address declines in the Nassau grouper and red hind stocks. In fact, Olsen and LaPlace (1978) noted that although, the yellowfin grouper was "an excellent eating fish" that off St. Thomas, yellowfin grouper were experiencing near zero fishing effort at least at that time, likely due to the belief that it was a frequent cause of fish poisoning. However, Beets and Friedlander (1992) reported that anecdotal information from fishers indicated that the yellowfin grouper spawning aggregation off St. Thomas's south coast did not take place during 1989. As Puerto Rico lies on the same geological platform as St. Thomas, St. John, and the British Virgin Island, the condition of the yellowfin grouper resource throughout these neighboring islands is relevant. Off Puerto Rico, the yellowfin grouper has historically not contributed significantly to the total combined shellfish and finfish landings (by weight) in Puerto Rico. The average annual contribution of the total combined fish and shellfish landings has been about 0.6% by weight. Of the fisher reported commercial grouper landings only, the annual reported commercial landings of yellowfin grouper have averaged about 8% since 1987 (Cummings and Matos-Caraballo, 2004, Matos-Caraballo 2004, 2002, 2001, 1998). It is thought by many that the yellowfin grouper has not been a targeted species by the commercial fishery at least in part, due a concern that this species causes fish poisoning (i.e., ciguatera) (Halstead et al., 1990; Olsen and LaPlace, 1978).

The primary focus of this report is to present updated information on the commercial yellowfin grouper, Mycteroperca venenosa, off Puerto Rico including updated landings statistics for 1983 through 2005 and summary information on commercial nominal catch per unit of effort. This type of information is critically needed to quantitatively evaluate the status or condition of the yellowfin grouper resource and to examine temporal and spatial trends in the population. In addition, summary information is presented on the economic value of the yellowfin grouper commercial fishery in Puerto Rico.

Data Sources and Methods

Commercial Landings

Statistics for the commercial fisheries of Puerto Rico were collected by the Fisheries Research Laboratory (FRL) of the Puerto Rico Department of Natural and Environmental Resources (DNER). Since 1967, the Puerto Rico Fisheries Statistics Program (FSP) has collected data on the commercial fishery through primarily cooperative agreements. The FSP was administered through the Department of Agriculture of Puerto Rico from 1966 to 1979. The Commercial Fisheries Statistics Program (CFSP) was implemented in 1967 under the

Commercial Fisheries Research and Development Act of 1964 (PL 88-309) (see Matos-Caraballo 2004, Collazo and Calderon 1988). From 1979 through the late 1980's, the FSP program was administered by the Corporation for the Development and Administration of the Marine, Lacustrine and Fluvial Resources of Puerto Rico (CODREMAR) and during this period, the CFSP statistics program was supported contractually by NOAA. Since the early 1990's the CFSP, FSP has been supported through a cooperative agreement with NOAA, NMFS through the State/Federal (SF) Cooperative and Inter-jurisdictional Fisheries Program (IJ). Through the SF/CSP/IJ program, commercial fishery landings data were collected form Puerto Rico's fishers, fish buyers and fishing associations, whom voluntarily cooperate with the CFSP, FSP. However, not all participants in the fisheries (i.e., fishers, dealers, cooperatives, fisher helpers) always cooperate in all years (Table 1).

In addition to collecting data on landings, fisheries port samplers in Puerto Rico routinely visited the coastal municipalities (n=42) including the islands of Vieques and Culebra, and the fishing centers (n=88, Figure 1). Matos-Caraballo (2002) presented details of the data collection program in Puerto Rico. Briefly, information is recorded for each fisher sale as to the date of sale, name of fish buyer, fisherman identification, information on fisher helper identification, the municipality and the fishing center of sale, the number of trips (ntrips) representing a unique sale, gear type used, amount of fishing effort (e.g., hours fishing, number of gear, number of traps, number of hours soaked, number of lines), weight in pounds of the species sold, taxonomic identification (species or family), and market value (dollars). Sometimes information is recorded on the minimum and maximum depth of the fishing area that resulted in this catch but not always. Not all data records contained information on gear quantity or effort and for many records the 'ntrips' data variable exceeded one, indicating that some fishers perhaps retained their catch over several trips and were later sold or values GT 1 could have resulted from key punch errors or from errors in completing the sales forms. In Puerto Rico's commercial fisheries, the majority of the finfish are landed in the round except for the deep water snappers (e.g., queen, silk, and wenchman) which are usually gutted. Lobster, oyster and octopus were also landed in the round, and according to Matos-Carabollo (2002) conch landings include the meat only. Apparently, beginning around 2003, about 50% of the conch fishers began dressing the conch meats prior to landing and by 2004, all at-sea cleaning was done by all conch fishers, so trends in landings of that species should account for changes in fishing operations that took place (Puerto Rico DNER, FRL, CFSP, FSP Pers. Com.). For some sales in nearly all years, finfish were classified as to first, second, or third class fish, or trash fish as defined by Matos-Caraballo and Sadovy (1990). According to Matos-Caraballo and Sadovy (1990), the definitions of these four categories varied somewhat by region but in general were broadly defined as: "first class fish included large snappers, grouper, grunt, trunkfish and hogfish; second class fish included small snapper and grouper, parrotfish, goatfish, and triggerfish; third class fish included smaller individuals of second class fish and large squirrelfish. The "trash fish" category included butterfly fish, angelfish, surgeonfish, small squirrelfish and small fishes of a number of other species."

It was not possible to identify individual fishing trips in the total commercial landings dataset with complete accuracy since unique trip identification was not maintained at the time of computer processing by the PR FRL, CFSP, FSP for the data collected through 2002. Beginning in 2003, the CFSP, FSP staff implemented the addition of a unique trip identification number on

each separate fishing trip, at the time of data entry. A unique tripid variable was computer generated according to an algorithm constructed from unique combinations of date of sale (year, month, day), fishing center, fisherman id, gear code, and the 'ntrips' variable that was recorded on each sales record. These unique trip records were used in subsequent calculations that required information at the trip level (e.g., catch per unit of effort by trip, total pounds sold by trip across all species, pounds sold of yellowfin grouper by trip and so on).

In addition, as mentioned above it should be noted that the Puerto Rico commercial landings sales records represent only a portion of the total commercial removals as noted by Matos-Caraballo (2002). Not all active fishermen in Puerto Rico report their sales as discussed in that report (Table 1). Matos-Caraballo (2004) provided updated information on the number of active commercial fishers in Puerto Rico, the number of full time or part time fishers, and the number and size (length) of active commercial vessels. Information from Matos-Caraballo (2004) and from Cummings and Matos-Caraballo (2003) is provided here for purposes of calculating total expanded commercial landings in Puerto Rico (Table 1). In 2004, a fisherman licensing system was implemented in Puerto Rico.

The economic value, measured in U.S. dollars ($), of yellowfin grouper by year, month, and gear was calculated using the reported data from the commercial fishing sales records from 1983-2003. Information is presented in this report on total annual value of yellowfin grouper for all fisheries combined and also for the two primary gears used to catch yellowfin grouper, dive operations, lines, and pots. The average value, price per pound (US $), was also calculated by year and by fishery and is presented for yellowfin grouper.

The reported commercial landings records were also reviewed and nominal catch per unit of effort values calculated for the 23 year time period.

Summary Findings

Commercial Sales of Yellowfin grouper in Puerto Rico- Overall Trends

Computerized data documenting levels of commercial sales of fish and shellfish in Puerto Rico were available through the PR DNER, FRL, CFSP, FSP for 1983 through 2005. Computerized data documenting species specific sales of fish and shellfish in Puerto Rico are not currently available prior to 1983 although this information was collected by the CFSP since 1966. Reported pounds of yellowfin grouper sold in Puerto Rico from 1983 through 2005 ranged from about 80 pounds (1987) to 6,900 pounds annually (2002) (Table 1, Figure 2a, 2b). 1987 was the first year that yellowfin grouper was reported in the Puerto Rico fisheries statistics database although the CFSP, FSP program has collected data since the early 1960's. 1983 is the first year that CFSP, FSP data are available in computerized form. The information for 2005 calendar year should be considered as preliminary.

The number of individual fisher sales of yellowfin grouper varied over the 23 year period from 2 reported sales in 1987 to 154 sales in 2003, over the same period as the landings reports. Peak years in the total pounds of yellowfin grouper sold and the number of individual fisher sales were 2003 and 2002 respectively. The reported statistics on commercial sales from the FRL, CFSP, FSP indicates an overall increasing trend of fisher reports of sales of yellowfin grouper pounds in Puerto Rico from 1987 continuing through 2002 (Figures 2a, 2b). A large decline in reported

landings occurred in 2003 followed by an increase in 2004. The 2005 data should be considered as preliminary in all subsequent discussions pertaining to trends in commercial landings of the yellowfin grouper in Puerto Rico. The reader is reminded when examining trends in the reported landings to be cautious and to take into account annual reporting rates (Table 1) as well as changes in landings classifications of various species and/or finfish groups (i.e., 'first class', 'second class' fish, 'third class' fish, etc.) during the early years of the statistical data collection, particularly in the discussions below that pertain to trends. "First class" fish included large snappers, grouper, grunt, trunkfish and hogfish; second class fish included small snapper and grouper, parrotfish, goatfish, and triggerfish; third class fish included smaller individuals of second class fish and large squirrelfish. The "trash fish" category included butterfly fish, angelfish, surgeonfish, small squirrelfish and small fishes of a number of other species".

Trends in Sales of Yellowfin grouper in Puerto Rico by Major Gear Category

The individual reported commercial sales records of yellowfin grouper were summarized by fishing gear, as recorded on the fisher sales ticket, and by calendar year to identify the primary gears used to catch yellowfin grouper off Puerto Rico over the 23 year time series and also to identify possible trends in fisher sales by gear over time (Table 3a, Figure 2b). The Puerto Rico commercial sales records indicate that yellowfin grouper were caught mainly by fishers taking part in diving operations (free dive, spear, scuba), or employing some type of line gear (e.g., rod and reel, hand line, bottom line, silk haul, troll), or were caught using pots (Tables 3b and Figures 2a, b). These three capture gear categories are referred to in this report as the "major" gears involved in the commercial removals of yellowfin grouper off Puerto Rico. Dive operations took about 50% on average (across all years) of the commercial landings of yellowfin grouper (range = 20% to 78%) (Table 3b, Figures 2a,b). Line gear, referred to in this document, as 'rod and reel' in data categorizations, contributed from on average 26% by weight of the total annual commercial landings (range = 8% to 90%) and pot landings of yellowfin grouper averaged 21% by weight across all years (range = 5% to 66%) of the total annual reported sales of the yellowfin grouper between 1983 and 2005 (Table 3b, Figures 2b,c). On average, the percentage by weight that pots contributed ranged from about 4% to 36% (Table 3b). Unlike, the annual trends observed for mutton snapper (Cummings and Matos-Caraballo, 2007a) and for yellowtail snapper (Cummings and Matos-Caraballo, 2004) the percentage contribution by gear within a year showed large variation (Table 3c, Figures 2c, d).

Other gears that were reported to catch yellowfin grouper off Puerto Rico were: nets, cast nets, seines and vertical lines although not in large quantities were these reported (Table 3a). Across all years, these "minor" gears contributed less than five percent of the annual total weight landed of yellowfin grouper (Table 3b). Nets, followed by vertical lines were the main gears in the "minor" gears involved in capture of this species (Table 3a, b).

Temporal Trends in Yellowfin grouper Sold in Puerto Rico

The commercial landings data were also examined to identify temporal trends in the reported commercial sales of yellowfin grouper in Puerto Rico (Table 4). Sales of the yellowfin grouper in Puerto Rico by month, ranged from about 3 % to 13% with peak reported landings being reported during February and March in many years. The reported landings data showed large intra annual variation in landings (Table 4 and Figures 3a, b). The variability in reported landings could also be a result of variability in fisher reporting (Table 1). Matos – Caraballo

(2004) noted that not only has the rate of reporting varied in Puerto Rico, but also noted that regional variability existed in fisher reporting. Unfortunately, sufficient quantitative information does not exist to correct the reported landings by area or individual fishing center. Although the landings suggest large variation in intra annual landings of the yellowfin grouper, there was some tendency for two peaks in landings- between February and May and again during late summer/early fall (Figure 3a). The spring peak in landings could coincide with the presumed time of spawning for yellowfin grouper off Puerto Rico. On the Grammanik Bank south of St. Thomas (U.S. Virgin Islands) spawning occurs from February through April, apparently with peaks occurring in March with full moon (Nemeth, 2004a). The literature also indicates that this spawning in the yellowfin grouper may be variable over its spatial distribution. Yellowfin grouper from the northern part of the distribution, off Bermuda, have been reported to spawn during July (Bullock and Smith, 1991; Heemstra and Randall, 1993) while individuals off Belize apparently spawn between February and June (Heyman and Requena, 2003).

Spatial Trends in Yellowfin grouper Sold in Puerto Rico

The commercial sales records of yellowfin grouper were summarized by major fishing reporting center and calendar year to identify the primary municipalities of sale for yellowfin grouper in Puerto Rico. The tabled summary data were organized beginning from the most northeast located municipality (Isabela) moving eastward along the north coast to the municipality of Ceiba, then along the east coast of Puerto Rico to Humaco off the southeast coast, then southwest to Cabo Rojo and finally to the last municipality at the northwest coast of Aquadilla (Figure 1). Unfortunately, the PR, DNER, CFSP, FRL does not request exact information on the capture location on the sales ticket (e.g., latitude/longitude of fishing location). In this study, municipality was considered as a very general proxy for approximate fishing location.

The 23 year time series of fisher sales statistics from 1983-2005 indicates that yellowfin grouper have been caught and landed in many of the major island municipalities in Puerto Rico, however the percentage distribution of landings within a region, was not consistent across years within a region (Tables 5a, b and Figure6). In some years, yellowfin were not reported landed at all in a particular region (fishing center), or the percentage distribution was very different, from the year prior or the following year for this region. This suggests that this species is not a frequently caught finfish in many regions in Puerto Rico or at least is not frequently reported caught and landed. In addition, the levels of landings within a region showed large variability from year to year (Tables 5a, b).

These data indicated that historically over the 23 year period, yellowfin grouper have been landed in only two major regions in Puerto Rico- mainly in the southeast and the southwest. Only within these regions, the eastern part of the island continuous to the southeast and west to the area off Mayaguez was yellowfin grouper landed at levels of 1% or more by weight annually (Table 5b). Very few fishing centers produced more than 5% annually by weight of the total yellowfin grouper landings. The area dominating the landings was off the southeast- the fishing centers in the municipalities of Vieques (13%), Patillas (7%) and further to the southwest- the fishing centers in Cabo Rojo (10%), Mayaguez (11%) and Rincon (11%) (Table 5b). Lesser important areas of landings included, the area off the north coast from the municipalities of Toa Baja Cantano and San Juan but in general these area contributed about 2-3% annually by weight

of the total yellowfin grouper landed. The reported landings data indicate large variation exists in the trend of landings within a region (fishing center or municipality) from year to year.

Reported Value ($) of Yellowfin Grouper sold in Puerto Rico

Descriptive information pertaining to the value of the commercial fishery in Puerto Rico for yellowfin grouper is provided in Tables 6 through 10. Extreme caution is urged when evaluating the total economic value of the yellowfin grouper to the total combined commercial fish and shellfish fishery in Puerto Rico for several reasons. First, there is known uncertainty in the level of reporting rates by the fishers in Puerto Rico (Table 1). Since 1969 the estimated reporting rates have varied from about 50% to 86 % annually thus, both reported landings and estimated value are no doubt severely under reported. Matos-Caraballo (2004) presented information regarding the variability in reporting rates between regions for 2002 however, the lack of year specific regional and fishery specific (gear) estimates of reporting precludes, corrections being made to the basic reported sales records. In addition, the official data collection system was under development in the mid to late 1980's thus procedures and protocol for obtaining reliable information from fishers and their associations were still being developed. Lastly, groupers were sometimes reported as "first class" fish by fishers when selling the catch, thus the accuracy of landings levels at the individual species level is unknown.

The estimated value (U.S. $) of the Puerto Rico commercial fishery for yellowfin grouper, *Mycterperca venenosa*, ranged from around 150 $ in 1987 to 15,000 $ in 2002 (Table 6). Not unexpected, maximum values contributions by fishery were diving operations, then lines followed by pots (Tables 7a, b). Monthly percentage value estimates for the fishery, combined across region and gears, suggested that maximum value was received usually during April and May (Table 8). Similarly, the southeast and southwest coastal fishing centers dominated spatially as would be expected since these centers annually reported the maximum landings levels (Tables 9a, b). Table 10 and Figure 7 presents average price per pound information by year and gear type over the 23 year period, 1983-2005, for yellowfin grouper. The data suggest that average price per pound of yellowfin grouper showed more variability from 1.20$ to 2.50 $ per pound between 1987 and 1995 than after 1996, varying from about 1.80 $ to 2.50$ per pound. During the latter years, 1996 to 2005, fish landed from dive operations brought higher prices per pound, average about 20-30 cents more per pound (Table 10, Figure 7)

Nominal Catch per Unit of Effort (CPUE)

The 23 year time series of yellowfin grouper landings records were also summarized and reviewed for calculating nominal CPUE of yellowfin grouper yellowfin grouper in the Puerto Rico commercial fishery. CPUE was calculated for each sales (landing) record as the pounds landed divided by the number of trips as indicated by the 'ntrips' data variable which was recorded on each recorded. As described in the materials and data section above, other attributes recorded for each sales record included: date of sale (year, month, and day), fishing center and major municipality of sale, gear used in the capture, total weight sold, fisherman identification, and the 'ntrips' variable. The number of fishing trips variable, 'ntrips', was further evaluated to aid in the selection of trips or sales records to be used to calculate CPUE. Although the Puerto Rico, CFSP, FSP landings data collection system was intended to collect information from commercial fishers at the trip level, often fishers recorded values greater than 1. Summary

attributes of the calculated catch per tri p and the ntrips variable are presented, in Table 11 and Figure 5.

In total, there were 1,389 positive sales records for yellowfin grouper in the total combined all fish and shellfish data set which contained some 1,811, 170 individual records of species specific landings. These include data observations from all year, 1983-2005, all fishing centers and all gear categories. After excluding records for which the ntrips variable was codes as 'zero' or was missing or for which non-numeric values occurred some 1,278 records remained from the original file containing 1,389 positive trip records (Table 11). Table 11 indicates that about 64 % (892 records) of the records landing yellowfin grouper, indicated a landing representing a single fishing trip (i.e., ntrips=1). Casual inspection of the information in Table 11 and Figure 8a,b indicates that as 'ntrips' increased, the standard deviation of the mean also increased, somewhat counter intuitive to what might be expected as number of observations increases. This was a similar observation in reviewing the individual sales records of yellowtail snapper (see Cummings and Matos-Caraballo, 2004, Table 12 and Figure 14) and also in the preliminary CPUE analyses for mutton snapper, this workshop (Cummings and Matos-Caraballo, 2007). In addition the basic pattern of the StdDev (of CPUE) variable is not consistent in the data but rather shows both increasing and decreasing trends. In the categories where the StdDev variable increases, very large increases are observed in these simple data attributes, often many fold larger than the mean was the standard deviation of the mean. Therefore, subsequent calculation of nominal CPUE of yellowfin grouper only considered landing records on which the 'Ntrips' data variable equaled 1; as mentioned previously this included some 64% (892 records) of the entire dataset of 1,389 positive landings records for the yellowfin grouper.

Calculations of nominal CPUE for yellowfin grouper for the ntrips = 1 observations and for each major and minor gear category (rod and reel, pot, net, seines, dive, cast net, vertical line) used to capture this species over the 23 year period are presented in Table 12a and Figure 9. CPUE calculations were made and presented for all the gears capturing this species however the reader is reminded that the major gears responsible for the majority of yellowtail snapper landings in Puerto Rico are dive operations, lines (coded as rod and reel here) and pots. Tables 12 a- represent the positive or successful trips landing yellowfin grouper which were coded for the ntrips variable as '1', thus the percentage contribution across categories differs slightly from the un-filtered data and percentages from Table 3c. It should be noted that after excluding data records in which the Ntrips variable was coded as either 'zero' or as 'greater than 1', the dominant gears remaining in the CPUE set were pots (41%) followed by dive operations (25%) and lines (22%) (Table 12b). Caution should be exercised when evaluating trends from prior to about 1987 or so, as these were the early formative years of the data collection system in Puerto Rico.

The summarized CPUE calculations from the 'ntrips' = 1 data set show large variation in general for yellowfin grouper commercial CPUE from pots, dive operations and lines over the 23 years (Figure 9). CPUE from pot gear landings, the dominant contributor in terms of number of samples (n=367 trips) ranged from 6 pounds to 36 pounds, and was 10 pounds in 2005. Nominal CPUE of dive caught yellowfin grouper varied from 3 pounds to 47 pounds and was 13 pounds in 2005. Line caught yellowfin grouper averaged 10 pounds over the entire time series and ranged from 2 pounds to 42 pounds (Figure 9). The calculated CPUE values show large

increases in CPUE in 1998 in each of the three major gear categories (pots, dive and lines). Figure 9 also indicates that the three CPUE trends are somewhat dissimilar.

Table 12b and c provide a breakdown of the sample sizes available for the yellowfin grouper 'Ntrips=1' CPUE dataset for use in evaluating the data sufficiency for subsequent analyses related to CPUE trends. This information indicates that for each of the major gears which landed the yellowfin grouper in Puerto Rico over the 23 year time period, 1983-2005, in very years were there greater than 25 CPUE samples (i.e., individual trip reports) as indicated by the ''N column. In addition, Table 12b indicates that very few continuous years were there more than 25 samples for a gear. The 'All Gear's column indicates that across all three major gear categories more than 25 CPUE samples existed in 1996 afterwards (except for 1998 with n=24 trips). Table 12c provides more detail as to sample size contribution within a gear category across the time period.

From Table 12b it is clear that for the dominant contributing gear in terms of CPUE sample sizes, i.e., pot gear, for only three of the 18 years (2002, 2004 and 2005), were there more than 25 CPUE samples reported. Figure 9 suggests dissimilar trends in the nominal CPUE data as well, between the three major gears. Clearly a time trend in pot CPUE can not be estimated with confidence from this dataset due to extremely low sample size. The low sample size could be related to fisher reporting or to low catches of the yellowfin grouper. Table 3b indicated that pot gear on average caught about 25% of the total annual yellowfin grouper landings, line gear about 26% and dive gear about 50% by weight. Similarly, the number of samples per year seems quite low for quantifying a trend for line caught yellowfin grouper. In addition, combing the limited number of samples across gears is not justified without further information given the disparate trends observed in Figure 9. Combining the separate gear CPUE samples would result in a largely un-balanced data set in which in some years dive CPUE would dominant, in others years-in particular, the later years from 200-2 forward, pot samples would dominate. However, if combining sample across differing gear types is considered appropriate, then the 'All Gears' trend would result (Table 12a, Figure 9). Without additional information regarding selectivity of the three different gears, pots, dive operations, and lines, for this species it is not recommended to combine the separate gears to use in any type of standardization analysis. Because of the clearly low number of annual samples on a gear-year basis, further standardization analyses of the CPUE samples were not attempted. Clearly, most year-gear combinations would not allow partitioning the samples by temporal (month or season) or spatial groups, to evaluate changes or impacts on CPUE by region or by time period. The basic landings data revealed two important or major landings zones, the east-southeast area and the southwest area off Mayaguez and Cabo Rojo. Depending on future reporting rates and landing reports for this species, more area specific CPUE analyses might be considered in the future.

Concerns

1. Evaluation of trends in landings for the yellowfin grouper is somewhat hampered by the belief that this species can cause ciguatera poisoning. Haalstead et al. (1990 cited in Froese and Pauly 2007) and Bohlke and Chaplin (1968 cited in Brownell and Rainey 1971) reported this species being ciguatoxic.. Although, individuals from the Bahamas and the Virgin Islands have been recognized as ciguateric, this species traditionally was a desirable food fish and even large individuals, 5 to 10 kgs in size, from locales considered safe were sold and consumed. Some

researchers consider this species to be more frequently associated with ciguatera poisoning that other groupers.
2. Non-reporting--It should also be noted that the Puerto Rico commercial landings sales records represent only a portion of the total commercial removals as noted by Matos-Caraballo (2002). Not all active fishermen in Puerto Rico report their sales as discussed in that report. Matos-Caraballo (2004) provided updated information on the number of active commercial fishers in Puerto Rico, the number of full time or part time fishers, and the number and size (length) of active commercial vessels. Information from Matos-Caraballo (2004) and from Cummings and Matos-Caraballo (2003) is provided here for purposes of calculating total expanded commercial landings in Puerto Rico (Table 1). In 2004, a fisherman licensing system was implemented in Puerto Rico.

3. There have been observed increases in landings of some species. Matos- Carabalo 2004 (Job 1) noted also that there had been an increase in the reporting rates both overall and as well that groupers were being 'more' broken out. Apparently early on many species were lumped – some groupers, e.g., red hind were included as 'first class' fish. Matos reports that by late 1980's much of the red hind were not lumped. .Matos further noted that in light of some gear reductions (traps) that landings continued to increase and felt this was at least partially due to reporting and to breaking out the species in the data. It is unknown whether the yellowfin grouper may have been included in any of the other categories.

4. Management issues that affect reporting need to be considered, in particular spawning season closures.

Important References

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Table 1. Estimated correction factiors (fromMatos-Caraballo pers. Com. and Cummings and Matos-Caraballo, 2004).

Number Fishermen	Calendar Year1	Reporting Rate	Range	Standard Deviation	Cummings Value	Cummings Rationale	Source of Information
991	**1969**						ND
	1970						ND
994	**1971**						ND
968	1972	0.6			0.6	Not Changed	PR DNR Annual Report
927	1973	0.6			0.6	Not Changed	PR DNR Annual Report
1182	1974	0.6			0.6	Not Changed	PR DNR Annual Report
1230	1975	0.6			0.6	Not Changed	PR DNR Annual Report
1230	1976	0.6			0.6	Not Changed	PR DNR Annual Report
1368	1977	0.6			0.6	Not Changed	PR DNR Annual Report
1442	1978	0.68			0.68	Not Changed	Weiler and Suzrex-Caabro 1980
1442	1979	0.75			0.75	Not Changed	
1447	1980	0.75			0.75	Not Changed	same as above
NK	1981	0.75			0.75	Not Changed	same as above
1872	1982	0.75			0.75	Not Changed	same as above
1415	1983	0.61			0.61	Not Changed	same as above
1295	1984	0.59	0.56 - 0.61		0.59	Not Changed	Garcia-Moliner 1986
1585	1985	0.56			0.56	Not Changed	Garcia-Moliner 1988
1135	1986	0.75			0.75	Not Changed	
1731	1987	0.75			0.75	Not Changed	
1731	1988	0.56		0.19	0.56	Not Changed	
1822	1989	0.51			0.51	Not Changed	
1332	1990	0.51			0.51	Not Changed	same as above
1219	1991	0.51		0.16	0.51	Not Changed	Matos and Sadovy 1991
1155	1992	0.6		0.18	0.6	Not Changed	Matos 1993, pg. 5
1363	1993	0.6		0.18	0.6	Not Changed	Matos 1994, pg. 4
1380	1994	0.64		0.11	0.64	Not Changed	PR DNR Annual Report
1959	1995	0.71			0.71	Not Changed	Matos-Caraballo, 1998
1758	1996	0.71			0.71	Not Changed	Matos-Caraballo, 1998
NK	1997	0.78			0.78	Not Changed	Matos-Caraballo, 1998
NK	1998	0.78			0.78	Not Changed	Matos 2000 Coop. SF Rpt.
NK	1999	0.78			**0.78**	**1997 value**	PR DNR Annual Report
NK	2000	0.57			0.57	Not Changed	
NK	2001	0.68			0.68	Not Changed	same as above
1163	2002	0.86			0.86	Not Changed	same as above
NK	2003	0.56			0.56	Not Changed	Matos 2004
NK	2004	0.61			-	-	Matos 2007, email to J. Bennett
NK	2005	0.5			-	-	Matos 2007, email to J. Bennett

Table 2. Summary of commercial landings (pounds) of yellowfin grouper**,** *Mycterperca venenosa*, in Puerto Rico, 1987-2005, by calendar year. 2005 Preliminary data. Data available beginning in 1983.

	pounds	
	N	*Sum*
Calendar Year		
1987	2	78
1988	21	460
1989	33	1249
1990	33	559
1991	61	1702
1992	48	921
1993	49	1483
1994	21	448
1995	38	827
1996	72	1617
1997	63	2088
1998	65	1793
1999	98	3350
2000	103	2208
2001	148	3661
2002	145	6916
2003	154	1693
2004	134	2189
2005	101	753
All	1389	33995

Table 3a. Reported commercial yellowfin grouper landings (pounds) in Puerto Rico by major gear category and calendar year, from 1983-2005. 2005 Preliminary data. Data available beginning in 1983.

	Agear								
	Cast Net	*Dive, Spear, Scuba*	*Net*	*Other*	*Pot*	*Rod and Reel*	*Seine*	*Verticcal Line*	*All*
	pounds	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*
	Sum	*Sum*	*Sum*	*Sum*	*Sum*	*Sum*	*Sum*	*Sum*	*Sum*
cyear									
1987	.	.	.	.	8	70	.	.	78
1988	.	165	.	33	45	217	.	.	460
1989	.	548	.	.	479	199	.	23	1249
1990	.	341	.	.	115	103	.	.	559
1991	.	564	10	.	452	676	.	.	1702
1992	.	328	52	.	352	189	.	.	921
1993	.	1160	14	.	185	124	.	.	1483
1994	13	224	.	.	74	137	.	.	448
1995	.	158	58	.	116	399	22	74	827
1996	.	375	28	.	444	770	.	.	1617
1997	.	797	19	.	669	603	.	.	2088
1998	.	655	115	.	156	831	.	36	1793
1999	.	2515	63	.	148	624	.	.	3350
2000	.	888	144	.	775	373	.	28	2208
2001	.	1710	191	.	530	1230	.	.	3661
2002	.	5144	82	.	1011	679	.	.	6916
2003	.	560	55	.	579	499	.	.	1693
2004	.	787	34	.	433	935	.	.	2189
2005	.	122	8	.	494	129	.	.	753
All	13	17041	873	33	7065	8787	22	161	33995

. = No Landings Reported for this cell.

Table 3b. Reported percentage of commercial landings (% of pounds) of yellowfin grouper by gear category across years, in Puerto from 1983 through 2003. 2005 Preliminary data. Data available beginning in 1983. Rows sum to 1.0

	agear								
	Cast Net	*Dive, Spear, Scuba*	*Net*	*Other*	*Pot*	*Rod and Reel*	*Seine*	*Verticcal Line*	*All*
	pounds	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*
	RowPctSum	*RowPctSum*	*RowPctSum*	*RowPctSum*	*RowPctSum*	*RowPctSum*	*RowPctSum*	*RowPctSum*	*RowPctSum*
cyear									
1987	.	.	.	.	10.3	89.7	.	.	100.0
1988	.	35.9	.	7.2	9.8	47.2	.	.	100.0
1989	.	43.9	.	.	38.4	15.9	.	1.8	100.0
1990	.	61.0	.	.	20.6	18.4	.	.	100.0
1991	.	33.1	0.6	.	26.6	39.7	.	.	100.0
1992	.	35.6	5.6	.	38.2	20.5	.	.	100.0
1993	.	78.2	0.9	.	12.5	8.4	.	.	100.0
1994	2.9	50.0	.	.	16.5	30.6	.	.	100.0
1995	.	19.1	7.0	.	14.0	48.2	2.7	8.9	100.0
1996	.	23.2	1.7	.	27.5	47.6	.	.	100.0
1997	.	38.2	0.9	.	32.0	28.9	.	.	100.0
1998	.	36.5	6.4	.	8.7	46.3	.	2.0	100.0
1999	.	75.1	1.9	.	4.4	18.6	.	.	100.0
2000	.	40.2	6.5	.	35.1	16.9	.	1.3	100.0
2001	.	46.7	5.2	.	14.5	33.6	.	.	100.0
2002	.	74.4	1.2	.	14.6	9.8	.	.	100.0
2003	.	33.1	3.2	.	34.2	29.5	.	.	100.0
2004	.	36.0	1.6	.	19.8	42.7	.	.	100.0
2005	.	16.2	1.1	.	65.6	17.1	.	.	100.0
All	0.0	50.1	2.6	0.1	20.8	25.8	0.1	0.5	100.0

.= No Landings Reported for this cell.

Table 3c. Reported percentage of commercial landings of yellowfin grouper by gear category within a year, in Puerto from 1983 through 2003. 2005 Preliminary data. Data available beginning in 1983. Columns sum to 1.0.

	agear								
	Cast Net	*Dive, Spear, Scuba*	*Net*	*Other*	*Pot*	*Rod and Reel*	*Seine*	*Verticcal Line*	*All*
	pounds	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*
	ColPctSum	*ColPctSum*	*ColPctSum*	*ColPctSum*	*ColPctSum*	*ColPctSum*	*ColPctSum*	*ColPctSum*	*ColPctSum*
cyear									
1987	.	.	.	.	0.1	0.8	.	.	0.2
1988	.	1.0	.	100	0.6	2.5	.	.	1.4
1989	.	3.2	.	.	6.8	2.3	.	14.3	3.7
1990	.	2.0	.	.	1.6	1.2	.	.	1.6
1991	.	3.3	1.1	.	6.4	7.7	.	.	5.0
1992	.	1.9	6.0	.	5.0	2.2	.	.	2.7
1993	.	6.8	1.6	.	2.6	1.4	.	.	4.4
1994	100	1.3	.	.	1.0	1.6	.	.	1.3
1995	.	0.9	6.6	.	1.6	4.5	100	46.0	2.4
1996	.	2.2	3.2	.	6.3	8.8	.	.	4.8
1997	.	4.7	2.2	.	9.5	6.9	.	.	6.1
1998	.	3.8	13.2	.	2.2	9.5	.	22.4	5.3
1999	.	14.8	7.2	.	2.1	7.1	.	.	9.9
2000	.	5.2	16.5	.	11.0	4.2	.	17.4	6.5
2001	.	10.0	21.9	.	7.5	14.0	.	.	10.8
2002	.	30.2	9.4	.	14.3	7.7	.	.	20.3
2003	.	3.3	6.3	.	8.2	5.7	.	.	5.0
2004	.	4.6	3.9	.	6.1	10.6	.	.	6.4
2005	.	0.7	0.9	.	7.0	1.5	.	.	2.2
All	100	100	100	100	100	100	100	100	100

Table 4. Monthly distribution of reported commercial landings (percentages) of yellowfin grouper snapper sold in Puerto Rico from 1983 through 2003. 2005 Preliminary data. Data available beginning in 1983.

	Month												
Cyear	1	2	3	4	5	6	7	8	9	10	11	12	All
1987	.	.	.	.	.	.	.	.	89.7	10.3	.	.	100.0
1988	6.7	11.3	15.0	36.1	2.2	.	1.3	4.6	.	22.8	.	.	100.0
1989	0.2	3.4	4.5	3.2	38.4	2.4	3.0	10.9	2.0	22.0	.	10.0	100.0
1990	16.1	.	2.9	.	4.8	6.1	2.1	7.5	41.3	2.5	13.4	3.2	100.0
1991	6.2	18.9	13.8	8.5	13.3	3.6	8.0	16.4	.	7.5	3.2	0.5	100.0
1992	13.9	9.3	6.1	12.8	16.3	9.7	13.8	3.3	11.6	3.0	0.2	.	100.0
1993	.	45.1	1.5	9.2	12.2	4.3	9.0	5.3	6.5	5.7	1.2	.	100.0
1994	4.2	.	10.9	10.7	23.9	13.2	5.6	4.9	8.0	.	3.6	15.0	100.0
1995	4.2	2.2	7.9	16.7	9.9	27.1	10.5	1.0	0.7	2.4	4.8	12.6	100.0
1996	8.4	4.9	16.0	2.0	0.6	9.5	5.8	26.0	5.4	5.5	0.7	15.2	100.0
1997	22.0	17.0	11.3	1.9	3.2	3.8	2.5	13.6	1.8	10.8	9.1	3.0	100.0
1998	15.7	2.5	9.8	8.6	16.9	6.9	12.8	6.0	2.4	14.4	3.6	0.4	100.0
1999	2.7	8.8	9.5	13.7	9.4	5.9	1.8	2.4	8.8	5.0	4.7	27.2	100.0
2000	5.9	10.7	7.7	8.9	7.7	4.3	7.9	6.8	13.8	7.1	5.6	13.5	100.0
2001	9.8	7.6	16.7	5.8	12.5	5.0	6.0	9.8	9.3	5.4	2.2	9.8	100.0
2002	10.7	19.5	15.9	6.1	5.7	9.8	5.9	10.4	7.3	4.9	2.6	1.2	100.0
2003	9.9	6.4	5.0	5.1	10.6	19.1	5.1	5.2	13.7	14.6	1.8	3.5	100.0
2004	16.2	18.0	10.6	11.1	18.1	3.4	2.8	5.0	1.0	10.3	2.9	0.6	100.0
2005	6.5	2.8	4.9	9.6	14.6	11.0	8.4	14.7	9.6	9.0	7.0	1.9	100.0
All	9.4	12.8	11.1	8.0	10.8	7.5	5.9	9.0	7.4	7.8	3.4	7.0	100.0

. = No Landings Reported for this cell.

Shading denotes peaks outside presumed time of spawning of yellowfin grouper based on the literature

Table 5a. Reported commercial landings (pounds) of yellowfin grouper sold in Puerto Rico by area (fishing center) of sale from 1983 through 2005. 2005 Preliminary data. Data available beginning in 1983.

	cyear																			
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
FishingCenter																				
Isabela	.	.	.	2	.	.	.	.	.	.	.	14	.	9	.	.	.	.	.	25
Arecibo	.	.	.	.	.	.	.	.	.	.	.	36	.	.	.	.	32	.	.	68
Barcelo-neta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15	.	15
Manati	.	.	19	12	14	.	.	.	.	.	.	140	302	153	307	74	35	.	.	1056
Vega Baja	.	.	.	.	.	31	11	.	.	.	81	19	.	40	91	8	.	.	.	281
Vega Alta	8	.	31	.	.	.	12	.	12	.	3	20	.	.	25	.	.	30	.	141
Dorado	.	.	11	4	10	.	.	.	.	45	.	.	13	.	108	64	109	5	4	373
Toa Baja	.	.	.	.	46	.	.	.	.	.	.	.	.	20	.	.	.	.	.	66
Catano	.	.	.	274	25	105	142	49	66	3	3	30	.	24	22	48	4	.	.	795
San Juan	.	.	.	8	.	.	.	67	57	52	321	458	99	.	.	40	23	16	.	1141
Carolina	70	.	.	.	.	.	.	.	13	.	10	.	.	.	55	.	.	.	.	148
Loiza	.	.	.	.	.	.	.	.	140	.	.	.	.	.	.	.	.	.	.	140
Rio Grande	.	41	.	52	.	163	96	2	54	176	7	38	25	28	.	7	.	.	.	689
Fajardo	.	19	96	.	.	.	.	.	5	12	28	85	38	87	50	25	15	24	.	484
Ceiba	.	.	.	.	.	.	.	.	.	18	.	24	.	6	23	22	.	.	.	93
Naguabo	.	.	6	.	.	.	.	15	.	.	72	.	368	5	6	45	35	69	15	636
Humacao	.	.	.	.	17	.	.	.	4	27	.	61	63	95	436	139	515	494	483	2334
Yabucoa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	56	.	.	16	72
Maunabo	.	.	15	.	.	.	.	.	.	7	13	35	38	.	3	.	97	.	.	208
Culebra	.	40	.	.	.	.	.	.	.	.	161	.	.	.	.	.	.	.	.	201
Vieques	.	.	.	.	562	.	115	.	.	754	158	70	14	37	950	1736	.	21	.	4417
Patillas	.	157	.	.	69	299	.	.	89	10	90	.	250	442	246	793	.	6	32	2483
Arroyo	.	.	.	.	9	.	.	23	.	.	87	21	.	.	.	.	.	.	.	140
Guayama	.	.	37	12	.	45	60	.	.	.	130	30	7	18	7	42	.	12	.	400
Salinas	.	.	40	.	15	.	.	.	.	.	.	.	.	.	144	.	.	.	.	199
Santa Isabel	.	.	145	72	143	.	.	.	177	112	56	.	28	41	20	.	.	6	.	800
Juana Diaz	.	.	.	.	.	.	.	59	.	.	.	.	.	.	.	20	11	.	.	90
Ponce	.	.	.	.	.	.	.	36	53	.	288	.	20	554	113	138	86	54	.	1342
Penuelas	.	6	452	.	28	.	658	.	.	.	19	90	.	.	.	.	.	.	44	1297
Guayami-lla	.	.	.	.	.	.	.	.	.	44	19	90	63	151	144	82	55	4	8	660
Guanica	.	.	.	.	23	.	.	50	45	.	27	80	.	.	.	17	.	.	.	242
Lajas	.	168	.	.	30	3	.	10	20	51	2	.	30	19	103	21	.	.	.	457
Cabo Rojo	.	.	.	2	.	31	104	.	8	255	288	30	487	239	559	1252	110	77	61	3503
Mayaguez	.	29	265	22	658	210	285	102	54	51	161	148	969	212	127	325	76	91	.	3785
Anasco	.	.	65	30	16	.	.	12	30	.	.	.	.	.	.	12	.	17	55	237
Rincon	.	.	.	.	23	20	.	9	.	.	.	200	518	28	20	1880	490	651	35	3874
Aguada	.	.	.	6	.	.	.	14	.	.	54	.	.	.	2	30	.	.	.	106
Aguadil-la	.	.	67	63	14	14	.	.	.	.	10	74	18	.	100	40	.	597	.	997
All	78	460	1249	559	1702	921	1483	448	827	1617	2088	1793	3350	2208	3661	6916	1693	2189	753	33995

. = No Landings Reported for this cell.

Table 5b. Percentage annual Puerto Rico reported commercial landings summary by fishing center for Yellowfin Grouper proportion of pounds,1983-2005, 2005 data are preliminary.

	Calendar Year																			
fishcent	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
Isabela	.	.	.	0.4	.	.	.	.	.	.	.	0.8	.	0.4	.	.	.	.	.	0.1
Arecibo	.	.	.	.	.	.	.	.	.	.	.	2.0	.	.	.	.	1.9	.	.	0.2
Barcelo-neta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.7	.	0.0
Manati	.	.	1.5	2.1	0.8	.	.	.	.	.	.	7.8	9.0	6.9	8.4	1.1	2.1	.	.	3.1
Vega Baja	.	.	.	.	.	3.4	0.7	.	.	.	3.9	1.1	.	1.8	2.5	0.1	.	.	.	0.8
Vega Alta	10.3	.	2.5	.	.	.	0.8	.	1.5	.	0.1	1.1	.	.	0.7	.	.	1.4	.	0.4
Dorado	.	.	0.9	0.7	0.6	.	.	.	.	2.8	.	.	0.4	.	3.0	0.9	6.4	0.2	0.5	1.1
Toa Baja	.	.	.	.	2.7	.	.	.	.	.	.	.	.	0.9	.	.	.	.	.	0.2
Catano	.	.	.	49.0	1.5	11.4	9.6	10.9	8.0	0.2	0.1	1.7	.	1.1	0.6	0.7	0.2	.	.	2.3
San Juan	.	.	.	1.4	.	.	.	15.0	6.9	3.2	15.4	25.5	3.0	.	.	0.6	1.4	0.7	.	3.4
Carolina	89.7	.	.	.	.	.	.	.	1.6	.	0.5	.	.	.	1.5	.	.	.	.	0.4
Loiza	.	.	.	.	.	.	.	.	16.9	.	.	.	.	.	.	.	.	.	.	0.4
Rio Grande	.	8.9	.	9.3	.	17.7	6.5	0.4	6.5	10.9	0.3	2.1	0.7	1.3	.	0.1	.	.	.	2.0
Fajardo	.	4.1	7.7	.	.	.	.	.	0.6	0.7	1.3	4.7	1.1	3.9	1.4	0.4	0.9	1.1	.	1.4
Ceiba	.	.	.	.	.	.	.	.	.	1.1	.	1.3	.	0.3	0.6	0.3	.	.	.	0.3
Naguabo	.	.	0.5	.	.	.	.	3.3	.	.	3.4	.	11.0	0.2	0.2	0.7	2.1	3.2	2.0	1.9
Humacao	.	.	.	.	1.0	.	.	.	0.5	1.7	.	3.4	1.9	4.3	11.9	2.0	30.4	22.6	64.1	6.9
Yabucoa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.8	.	.	2.1	0.2
Maunabo	.	.	1.2	.	.	.	.	.	.	0.4	0.6	2.0	1.1	.	0.1	.	5.7	.	.	0.6
Culebra	.	8.7	.	.	.	.	.	.	.	.	7.7	.	.	.	.	.	.	.	.	0.6
Vieques	.	.	.	.	33.0	.	7.8	.	.	46.6	7.6	3.9	0.4	1.7	25.9	25.1	.	1.0	.	13.0
Patillas	.	34.1	.	.	4.1	32.5	.	.	10.8	0.6	4.3	.	7.5	20.0	6.7	11.5	.	0.3	4.2	7.3
Arroyo	.	.	.	.	0.5	.	.	5.1	.	.	4.2	1.2	.	.	.	.	.	.	.	0.4
Guayama	.	.	3.0	2.1	.	4.9	4.0	.	.	.	6.2	1.7	0.2	0.8	0.2	0.6	.	0.5	.	1.2
Salinas	.	.	3.2	.	0.9	.	.	.	.	.	.	.	.	.	3.9	.	.	.	.	0.6
Santa Isabel	.	.	11.6	12.9	8.4	.	.	.	21.4	6.9	2.7	.	0.8	1.9	0.5	.	.	0.3	.	2.4
Juana Diaz	.	.	.	.	.	.	.	13.2	.	.	.	.	.	.	.	0.3	0.6	.	.	0.3
Ponce	.	.	.	.	.	.	.	8.0	6.4	.	13.8	.	0.6	25.1	3.1	2.0	5.1	2.5	.	3.9
Penuelas	.	1.3	36.2	.	1.6	.	44.4	.	.	.	0.9	5.0	.	.	.	.	.	.	5.8	3.8
Guayami-lla	.	.	.	.	.	.	.	.	.	2.7	0.9	5.0	1.9	6.8	3.9	1.2	3.2	0.2	1.1	1.9
Guanica	.	.	.	.	1.4	.	.	11.2	5.4	.	1.3	4.5	.	.	.	0.2	.	.	.	0.7
Lajas	.	36.5	.	.	1.8	0.3	.	2.2	2.4	3.2	0.1	.	0.9	0.9	2.8	0.3	.	.	.	1.3
Cabo Rojo	.	.	.	0.4	.	3.4	7.0	.	1.0	15.8	13.8	1.7	14.5	10.8	15.3	18.1	6.5	3.5	8.1	10.3
Mayaguez	.	6.3	21.2	3.9	38.7	22.8	19.2	22.8	6.5	3.2	7.7	8.3	28.9	9.6	3.5	4.7	4.5	4.2	.	11.1
Anasco	.	.	5.2	5.4	0.9	.	.	2.7	3.6	.	.	.	.	.	.	0.2	.	0.8	7.3	0.7
Rincon	.	.	.	.	1.4	2.2	.	2.0	.	.	.	11.2	15.5	1.3	0.5	27.2	28.9	29.7	4.6	11.4

Aguada	.	.	.	1.1	.	.	.	3.1	.	.	2.6	.	.	.	0.1	0.4	.	.	.	0.3
Aguadil-la	.	.	5.4	11.3	0.8	1.5	.	.	.	.	0.5	4.1	0.5	.	2.7	0.6	.	27.3	.	2.9
All	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

. = No Landings Reported for this cell.

Table 6. Reported total anual value (US $) of reported commercial Yellowfin Grouper commercial landings in Puerto Rico since 1987. Data for 2005 preliminary, data available beginning in 1983.

	Value
	Sum
cyear	
1987	152
1988	518
1989	2010
1990	1020
1991	2863
1992	1912
1993	2647
1994	869
1995	1849
1996	3055
1997	3704
1998	3589
1999	7170
2000	4620
2001	8027
2002	14960
2003	3690
2004	4079
2005	1569
All	68301

Table 7a. Annual value (US $) of annual yellowfin grouper commercial sales in Puerto Rico by gear category, 1983-2005. 2005 Preliminary data. Data available beginning in 1983.

	Agear								
	Cast Net	*Dive, Spear, Scuba*	*Net*	*Other*	*Pot*	*Rod and Reel*	*Seine*	*Verticcal Line*	*All*
	value	*value*	*value*	*value*	*value*	*value*	*value*	*value*	*value*
	Sum	*Sum*	*Sum*	*Sum*	*Sum*	*Sum*	*Sum*	*Sum*	*Sum*
cyear									
1987	.	.	.	.	12	140	.	.	152
1988	.	221	.	50	74	173	.	.	518
1989	.	1011	.	.	659	295	.	46	2010
1990	.	683	.	.	220	117	.	.	1020
1991	.	1042	13	.	771	1037	.	.	2863
1992	.	604	108	.	885	315	.	.	1912
1993	.	2010	28	.	320	289	.	.	2647
1994	39	478	.	.	82	270	.	.	869
1995	.	347	154	.	240	923	55	130	1849
1996	.	676	33	.	849	1497	.	.	3055
1997	.	1473	24	.	1110	1097	.	.	3704
1998	.	1305	170	.	327	1679	.	108	3589
1999	.	5376	75	.	288	1432	.	.	7170
2000	.	2032	174	.	1498	860	.	56	4620
2001	.	3918	313	.	1021	2775	.	.	8027
2002	.	11351	108	.	2020	1481	.	.	14960
2003	.	1273	72	.	1174	1172	.	.	3690
2004	.	1688	81	.	872	1439	.	.	4079
2005	.	301	10	.	988	270	.	.	1569
All	39	35788	1362	50	13408	17260	55	340	68301

Table 7b. Percentage value of reported annual yellowfin grouper reported commercial sales in Puerto Rico by gear category, 1983-2005. 2005 Preliminary data. Data available beginning in 1983.

	Cast Net	Dive, Spear, Scuba	Net	Other	Pot	Rod and Reel	Seine	agear Verticcal Line	All
	value	value	value	value	value	value	value	value	value
	RowPctSum	RowPctSum	RowPctSum	RowPctSum	RowPctSum	RowPctSum	RowPctSum	RowPctSum	RowPctSum
cyear									
1987	.	.	.	.	7.9	92.1	.	.	100.0
1988	.	42.7	.	9.6	14.3	33.4	.	.	100.0
1989	.	50.3	.	.	32.8	14.7	.	2.3	100.0
1990	.	67.0	.	.	21.6	11.4	.	.	100.0
1991	.	36.4	0.4	.	26.9	36.2	.	.	100.0
1992	.	31.6	5.6	.	46.3	16.4	.	.	100.0
1993	.	75.9	1.1	.	12.1	10.9	.	.	100.0
1994	4.5	55.0	.	.	9.4	31.1	.	.	100.0
1995	.	18.8	8.3	.	13.0	49.9	3.0	7.0	100.0
1996	.	22.1	1.1	.	27.8	49.0	.	.	100.0
1997	.	39.8	0.6	.	30.0	29.6	.	.	100.0
1998	.	36.4	4.7	.	9.1	46.8	.	3.0	100.0
1999	.	75.0	1.0	.	4.0	20.0	.	.	100.0
2000	.	44.0	3.8	.	32.4	18.6	.	1.2	100.0
2001	.	48.8	3.9	.	12.7	34.6	.	.	100.0
2002	.	75.9	0.7	.	13.5	9.9	.	.	100.0
2003	.	34.5	1.9	.	31.8	31.8	.	.	100.0
2004	.	41.4	2.0	.	21.4	35.3	.	.	100.0
2005	.	19.2	0.7	.	63.0	17.2	.	.	100.0
All	0.1	52.4	2.0	0.1	19.6	25.3	0.1	0.5	100.0

Table 8. Percentage value of reported commercial landings value of Yellwofin Grouper by month (proportion) and year in Puerto Rico.

	Month												
Cyear	1	2	3	4	5	6	7	8	9	10	11	12	All
1987	.	.	.	.	.	.	.	.	92.1	7.9	.	.	100.0
1988	9.5	15.1	15.3	25.1	2.1	.	1.4	6.1	.	25.3	.	.	100.0
1989	0.3	3.6	6.7	3.6	41.3	2.2	1.8	9.7	2.5	16.1	.	12.3	100.0
1990	16.4	.	3.0	.	5.3	6.7	2.9	8.0	44.6	2.7	8.2	2.1	100.0
1991	6.8	17.0	12.3	8.3	16.8	5.3	8.7	13.3	.	7.5	3.5	0.5	100.0
1992	10.1	7.2	7.0	13.6	17.3	10.2	18.1	3.1	11.0	2.0	0.4	.	100.0
1993	.	44.5	1.4	8.0	15.1	4.8	6.2	5.1	8.3	5.4	1.1	.	100.0
1994	3.9	.	15.4	13.3	22.7	6.8	7.3	5.1	8.2	.	2.1	15.4	100.0
1995	5.0	2.1	6.7	20.1	9.8	26.3	11.2	0.2	0.8	2.2	4.5	11.1	100.0
1996	6.1	4.8	19.4	2.4	0.4	7.7	5.6	26.2	6.2	5.6	0.5	15.1	100.0
1997	19.5	11.3	12.1	1.9	2.8	5.2	2.9	16.3	1.5	12.2	11.1	3.3	100.0
1998	16.3	2.5	8.8	8.7	18.5	6.7	11.6	5.4	2.9	14.5	3.8	0.2	100.0
1999	2.4	9.7	10.3	13.1	9.4	5.7	1.6	2.5	8.9	5.6	5.0	26.1	100.0
2000	7.5	12.2	8.9	9.3	6.8	3.9	7.7	6.4	13.5	7.3	5.4	11.0	100.0
2001	10.0	8.0	16.1	6.0	12.5	4.9	5.8	9.6	9.4	5.1	2.8	10.0	100.0
2002	9.8	20.6	16.1	5.3	5.5	10.8	6.4	9.6	6.8	5.1	2.6	1.3	100.0
2003	10.3	6.8	5.1	5.3	10.4	21.1	5.1	5.1	13.1	12.7	1.6	3.3	100.0
2004	16.1	15.8	9.6	8.3	20.2	3.6	3.0	5.4	1.2	11.5	4.4	1.0	100.0
2005	8.4	3.6	4.7	10.1	14.0	10.6	8.0	14.0	9.4	8.9	6.5	1.8	100.0
All	9.1	12.6	11.5	7.6	11.0	8.0	6.1	8.6	7.6	7.4	3.6	7.0	100.0

. = No Landings Reported for this cell.

Table 9a. Reported annual summary of value (US $) Puerto Rico commercial by fishing center yellowfin grouper, all years, all gears.

	cyear																			
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
Isabela	.	.	.	2	.	.	.	.	.	.	.	18	.	23	.	.	.	.	.	42
Arecibo	.	.	.	.	.	.	.	.	.	.	.	108	.	.	.	.	40	.	.	148
Barcelo-neta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15	.	15
Manati	.	.	48	30	35	.	.	.	.	.	.	336	720	387	745	185	88	.	.	2573
Vega Baja	.	.	.	.	.	78	28	.	.	.	212	57	.	111	219	16	.	.	.	720
Vega Alta	12	.	59	.	.	.	30	.	36	.	9	30	.	.	54	.	.	75	.	305
Dorado	.	.	22	10	30	.	.	.	.	68	.	.	36	.	308	160	271	15	12	931
Toa Baja	.	.	.	.	92	.	.	.	.	.	.	.	.	20	.	.	.	.	.	112
Catano	.	.	.	547	50	274	376	133	182	6	9	90	.	48	44	140	10	.	.	1908
San Juan	.	.	.	12	.	.	.	172	137	156	695	992	272	.	.	120	54	38	.	2648
Carolina	140	.	.	.	.	.	.	.	33	.	20	.	.	.	138	.	.	.	.	330
Loiza	.	.	.	.	.	.	.	.	380	.	.	.	.	.	.	.	.	.	.	380
Rio Grande	.	62	.	104	.	324	205	4	116	440	18	95	63	70	.	18	.	.	.	1516
Fajardo	.	28	196	.	.	.	.	.	6	24	67	160	76	158	95	50	30	43	.	933
Ceiba	.	.	.	.	.	.	.	.	.	36	.	48	.	15	58	54	.	.	.	210
Naguabo	.	.	9	.	.	.	.	23	.	.	144	.	904	8	6	98	88	192	33	1503
Humacao	.	.	.	.	30	.	.	.	8	46	.	139	144	225	1089	278	1035	1034	978	5005
Yabucoa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	112	.	.	32	144
Maunabo	.	.	23	.	.	.	.	.	.	7	20	70	110	.	5	.	243	.	.	476
Culebra	.	40	.	.	.	.	.	.	.	.	306	.	.	.	.	.	.	.	.	346
Vieques	.	.	.	.	842	.	173	.	.	1472	278	140	28	74	1929	3734	.	42	.	8712
Patillas	.	209	.	.	173	781	.	.	178	20	180	.	668	1201	696	2128	.	18	96	6349
Arroyo	.	.	.	.	14	.	.	40	.	.	167	47	.	.	.	.	.	.	.	267
Guayama	.	.	65	18	.	90	120	.	.	.	300	53	9	33	11	85	.	30	.	812
Salinas	.	.	63	.	30	.	.	.	.	.	.	.	.	.	330	.	.	.	.	423
Santa Isabel	.	.	290	144	336	.	.	.	387	230	140	.	56	104	50	.	.	15	.	1752
Juana Diaz	.	.	.	.	.	.	.	59	.	.	.	.	.	.	.	30	33	.	.	122
Ponce	.	.	.	.	.	.	.	71	93	.	288	.	40	980	303	400	251	143	.	2568
Penuelas	.	8	752	.	49	.	1152	.	.	.	38	135	.	.	.	.	.	.	106	2239
Guayami-lla	.	.	.	.	.	.	.	.	.	57	24	113	75	183	198	108	72	6	10	844
Guanica	.	.	.	.	46	.	.	100	113	.	53	153	.	.	.	32	.	.	.	496
Lajas	.	108	.	.	38	3	.	20	12	54	3	.	45	24	155	30	.	.	.	491
Cabo Rojo	.	.	.	3	.	64	172	.	4	344	359	60	929	478	1104	2487	220	154	122	6499
Mayaguez	.	63	294	39	1027	260	394	204	123	95	309	250	1938	424	274	669	152	182	.	6696
Anasco	.	.	129	30	28	.	.	15	42	.	.	.	.	.	.	18	.	34	110	406
Rincon	.	.	.	.	29	25	.	14	.	.	.	400	1036	56	60	3925	1105	1445	70	8164
Aguada	.	.	.	6	.	.	.	14	.	.	54	.	.	.	1	35	.	.	.	110
Aguadil-la	.	.	62	76	16	14	.	.	.	.	13	98	23	.	160	50	.	601	.	1111
All	152	518	2010	1020	2863	1912	2647	869	1849	3055	3704	3589	7170	4620	8027	14960	3690	4079	1569	68301

. = No Landings Reported for this cell.

Table 9b. Annual summary of Puerto Rico Commercial Landings value (percentage) by fishing center for Yellowfin Grouper, all years, all gears.

	cyear																			
fishcent	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
Isabela	.	.	.	0.2	.	.	.	.	.	.	.	0.5	.	0.5	.	.	.	.	.	0.1
Arecibo	.	.	.	.	.	.	.	.	.	.	.	3.0	.	.	.	.	1.1	.	.	0.2
Barcelo-neta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.4	.	0.0
Manati	.	.	2.4	2.9	1.2	.	.	.	.	.	.	9.3	10.0	8.4	9.3	1.2	2.4	.	.	3.8
Vega Baja	.	.	.	.	.	4.1	1.0	.	.	.	5.7	1.6	.	2.4	2.7	0.1	.	.	.	1.1
Vega Alta	7.9	.	2.9	.	.	.	1.1	.	1.9	.	0.2	0.8	.	.	0.7	.	.	1.8	.	0.4
Dorado	.	.	1.1	1.0	1.0	.	.	.	.	2.2	.	.	0.5	.	3.8	1.1	7.3	0.4	0.8	1.4
Toa Baja	.	.	.	.	3.2	.	.	.	.	.	.	.	.	0.4	.	.	.	.	.	0.2
Catano	.	.	.	53.7	1.7	14.3	14.2	15.4	9.8	0.2	0.2	2.5	.	1.0	0.5	0.9	0.3	.	.	2.8
San Juan	.	.	.	1.2	.	.	.	19.8	7.4	5.1	18.8	27.6	3.8	.	.	0.8	1.5	0.9	.	3.9
Carolina	92.1	.	.	.	.	.	.	.	1.8	.	0.5	.	.	.	1.7	.	.	.	.	0.5
Loiza	.	.	.	.	.	.	.	.	20.6	.	.	.	.	.	.	.	.	.	.	0.6
Rio Grande	.	11.9	.	10.2	.	16.9	7.7	0.5	6.3	14.4	0.5	2.6	0.9	1.5	.	0.1	.	.	.	2.2
Fajardo	.	5.4	9.8	.	.	.	.	.	0.3	0.8	1.8	4.5	1.1	3.4	1.2	0.3	0.8	1.1	.	1.4
Ceiba	.	.	.	.	.	.	.	.	.	1.2	.	1.3	.	0.3	0.7	0.4	.	.	.	0.3
Naguabo	.	.	0.4	.	.	.	.	2.6	.	.	3.9	.	12.6	0.2	0.1	0.7	2.4	4.7	2.1	2.2
Humacao	.	.	.	.	1.0	.	.	.	0.4	1.5	.	3.9	2.0	4.9	13.6	1.9	28.0	25.3	62.3	7.3
Yabucoa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.7	.	.	2.0	0.2
Maunabo	.	.	1.1	.	.	.	.	.	.	0.2	0.5	2.0	1.5	.	0.1	.	6.6	.	.	0.7
Culebra	.	7.7	.	.	.	.	.	.	.	.	8.3	.	.	.	.	.	.	.	.	0.5
Vieques	.	.	.	.	29.4	.	6.5	.	.	48.2	7.5	3.9	0.4	1.6	24.0	25.0	.	1.0	.	12.8
Patillas	.	40.4	.	.	6.0	40.9	.	.	9.6	0.7	4.9	.	9.3	26.0	8.7	14.2	.	0.4	6.1	9.3
Arroyo	.	.	.	.	0.5	.	.	4.6	.	.	4.5	1.3	.	.	.	.	.	.	.	0.4
Guayama	.	.	3.2	1.8	.	4.7	4.5	.	.	.	8.1	1.5	0.1	0.7	0.1	0.6	.	0.7	.	1.2
Salinas	.	.	3.1	.	1.0	.	.	.	.	.	.	.	.	.	4.1	.	.	.	.	0.6
Santa Isabel	.	.	14.4	14.1	11.7	.	.	.	20.9	7.5	3.8	.	0.8	2.3	0.6	.	.	0.4	.	2.6
Juana Diaz	.	.	.	.	.	.	.	6.8	.	.	.	.	.	.	.	0.2	0.9	.	.	0.2
Ponce	.	.	.	.	.	.	.	8.2	5.0	.	7.8	.	0.6	21.2	3.8	2.7	6.8	3.5	.	3.8
Penuelas	.	1.4	37.4	.	1.7	.	43.5	.	.	.	1.0	3.8	.	.	.	.	.	.	6.8	3.3
Guayami-lla	.	.	.	.	.	.	.	.	.	1.9	0.6	3.1	1.0	4.0	2.5	0.7	1.9	0.1	0.7	1.2
Guanica	.	.	.	.	1.6	.	.	11.5	6.1	.	1.4	4.2	.	.	.	0.2	.	.	.	0.7
Lajas	.	20.9	.	.	1.3	0.2	.	2.3	0.6	1.8	0.1	.	0.6	0.5	1.9	0.2	.	.	.	0.7
Cabo Rojo	.	.	.	0.3	.	3.3	6.5	.	0.2	11.3	9.7	1.7	13.0	10.3	13.8	16.6	6.0	3.8	7.7	9.5
Mayaguez	.	12.2	14.6	3.8	35.9	13.6	14.9	23.5	6.7	3.1	8.3	7.0	27.0	9.2	3.4	4.5	4.1	4.5	.	9.8
Anasco	.	.	6.4	2.9	1.0	.	.	1.7	2.3	.	.	.	.	.	.	0.1	.	0.8	7.0	0.6
Rincon	.	.	.	.	1.0	1.3	.	1.6	.	.	.	11.1	14.4	1.2	0.7	26.2	29.9	35.4	4.5	12.0
Aguada	.	.	.	0.5	.	.	.	1.6	.	.	1.5	.	.	.	0.0	0.2	.	.	.	0.2
Aguadil-la	.	.	3.1	7.4	0.6	0.7	.	.	.	.	0.3	2.7	0.3	.	2.0	0.3	.	14.7	.	1.6
All	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

. = No Landings Reported for this cell.

Table 10. Annual Puerto Rico reported commercial landings average price per pound ($) of Yellowfin Grouper by gear, years combined.

	cyear																		
agear	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	All
Cast Net	.	.	.	.	.	.	.	3.00	.	.	.	.	.	.	.	.	.	.	.	3.00
Dive, Spear, Scuba	.	1.42	2.14	2.04	1.88	1.73	1.80	2.23	2.13	1.97	1.97	2.00	2.41	2.42	2.32	2.36	2.33	2.24	2.56	2.17
Net	.	.	.	.	1.25	2.50	2.00	.	1.75	1.17	1.25	1.33	1.19	1.21	1.43	1.31	1.30	2.00	1.30	1.38
Other	.	1.50	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.50
Pot	1.50	1.62	1.61	1.83	2.10	2.44	1.82	1.25	1.87	1.92	2.02	2.11	1.92	2.12	1.99	2.02	2.03	2.01	2.00	2.00
Rod and Reel	2.00	0.85	1.48	1.19	1.55	1.68	2.33	1.94	2.23	1.78	1.99	1.89	2.22	2.27	2.28	2.28	2.45	1.97	2.25	2.03
Seine	.	.	.	.	.	.	.	.	2.50	.	.	.	.	.	.	.	.	.	.	2.50
Verticcal Line	.	.	1.75	.	.	.	.	.	1.75	.	.	3.00	.	2.00	.	.	.	.	.	2.05
All	1.75	1.21	1.75	1.80	1.82	1.94	1.84	2.06	2.11	1.86	1.97	1.90	2.18	2.10	2.16	2.15	2.09	2.04	2.05	2.02

Table 11. Summary statistics for yellowfin grouper snapper commercial sales records in Puerto Rico, 1983-2004, all gears and years combined by unique 'Ntrips' category as recorded on each landings record. Q1 and Q3 =lower25th and upper 75th percentiles on variable CPUE (pounds per trip).

Ntrips	# samples	CumN	Cum%N	Mean	Min	Max	StdDev	Q1
1	892	892	0.698	18.1	2	288	24.5	5
2	40	932	0.7293	11.5	1.5	47	9.3	5.8
3	22	954	0.7465	4.6	1	26.7	5.4	1.7
4	44	998	0.7809	2.8	1.3	6.5	1.4	1.8
5	61	1059	0.8286	4	0.3	41.6	6.8	1.6
6	28	1087	0.8505	4.1	0.3	29.3	5.5	1.7
7	12	1099	0.8599	14	0.4	119	33.2	1.9
8	10	1109	0.8678	2	0.5	4.8	1.3	0.8
9	5	1114	0.8717	3.4	1	6.7	2.6	1.3
10	24	1138	0.8905	3.1	0.5	20	4	1.1
11	7	1145	0.8959	4.7	0.6	22.7	8	0.8
12	15	1160	0.9077	5.3	0.3	32.7	8.8	1
13	5	1165	0.9116	1.7	0.9	3.3	1	0.9
14	8	1173	0.9178	2	0.9	4.1	1.1	1.2
15	26	1199	0.9382	2.4	0.6	14	2.6	1.1
16	8	1207	0.9444	7.4	0.8	30	10	1.5
17	6	1213	0.9491	2	0.6	4.4	1.7	0.8
18	11	1224	0.9577	2.5	0.2	8.2	2.3	0.9
19	4	1228	0.9609	2.2	1.2	4.2	1.4	1.3
20	19	1247	0.9757	3	0.4	20	5.3	0.6
21	2	1249	0.9773	2	1.8	2.1	0.3	1.8
22	6	1255	0.982	3.9	0.5	18.6	7.2	0.5
23	4	1259	0.9851	7.7	0.9	24.7	11.4	1.4
24	4	1263	0.9883	2.3	0.8	5.8	2.4	0.9
25	5	1268	0.9922	11.7	3.6	20.4	7.3	8
26	4	1272	0.9953	1.7	1.2	2.4	0.5	1.3
27	3	1275	0.9977	4.4	2.2	8.5	3.6	2.2
28	2	1277	0.9992	1.8	1.7	1.9	0.1	1.7
43	1	1278	1	0.8	0.8	0.8	.	0.8
All	1278			14	0.2	288	21.9	4

Table 12a. Nominal unadjusted catch per unit of effort (CPUE) for yellowfin grouper commercial catches in Puerto Rico, 1988-2005, by gear and year for fisher sales where the 'ntrips' variable was coded as ntrips=1 trip. CPUE calculated as pounds per landed trip.

	agear															
	Dive, Spear, Scuba		*Net*		*Other*		*Pot*		*Rod and Reel*		*Seine*		*Verticcal Line*		*All*	
	cpue		*cpue*		*cpue*		*cpue*		*cpue*		*cpue*		*cpue*		*cpue*	
	N	*Mean*	*N*	*Mean*	*N*	*Mean*	*N*	*Mean*	*N*	*Mean*	*N*	*Mean*	*N*	*Mean*	*N*	*Mean*
cyear																
1988	3.0	55.0	.	.	1.0	8.0	6.0	7.4	9.0	21.8	.	.	.	.	19.0	21.8
1989	6.0	17.0	.	.	.	.	9.0	21.2	4.0	20.0	.	.	2.0	11.6	21.0	18.9
1990	14.0	20.5	.	.	.	.	2.0	36.0	1.0	2.0	.	.	.	.	17.0	21.3
1991	11.0	15.0	.	.	.	.	8.0	16.6	12.0	50.6	.	.	.	.	31.0	29.2
1992	7.0	13.6	.	.	.	.	3.0	24.3	6.0	20.7	.	.	.	.	16.0	18.3
1993	22.0	20.5	.	.	.	.	3.0	6.7	1.0	42.0	.	.	.	.	26.0	19.8
1994	8.0	23.4	.	.	.	.	1.0	15.0	3.0	19.8	.	.	.	.	12.0	21.8
1995	7.0	14.4	.	.	.	.	6.0	19.3	7.0	26.6	1.0	22.0	1.0	74.0	22.0	22.7
1996	11.0	17.1	2.0	10.5	.	.	7.0	9.2	8.0	11.3	.	.	.	.	28.0	13.0
1997	9.0	44.9	2.0	9.5	.	.	6.0	58.5	13.0	37.1	.	.	.	.	30.0	41.9
1998	10.0	42.6	1.0	35.0	.	.	3.0	14.3	10.0	14.3	.	.	.	.	24.0	26.9
1999	38.0	21.7	.	.	.	.	7.0	9.9	9.0	9.9	.	.	.	.	54.0	18.2
2000	25.0	21.6	1.0	8.0	.	.	11.0	13.5	10.0	15.6	.	.	.	.	47.0	18.1
2001	47.0	23.2	6.0	10.2	.	.	7.0	18.9	25.0	17.2	.	.	.	.	85.0	20.1
2002	30.0	39.1	.	.	.	.	20.0	26.0	21.0	15.3	.	.	.	.	71.0	28.4
2003	16.0	35.0	9.0	6.1	.	.	103	5.6	26.0	19.2	.	.	.	.	154	11.0
2004	24.0	32.8	2.0	17.0	.	.	81.0	5.3	27.0	34.6	.	.	.	.	134	16.3
2005	9.0	13.4	2.0	4.0	.	.	84.0	5.9	6.0	21.4	.	.	.	.	101	7.4
All	297	25.8	25.0	9.6	1.0	8.0	367	9.5	198	23.1	1.0	22.0	3.0	32.4	892	18.1

.= No Data in this cell

1983= first year data available.

Table 12b. .Relative contribution (number of positive landings) of yellowfin grouper from Puerto Rico commercial landings within year by gear, for 1983 through 2005 (data from Table 12a).

	agear															
	Dive, Spear, Scuba		Net		Other		Pot		Rod and Reel		Seine		Verticcal Line			
	cpue		cpue		cpue		cpue		cpue		cpue		cpue			
	N	RowPctN	N	RowPctN	N	RowPctN	N	RowPctN	N	RowPctN	N	RowPctN	N	RowPctN		
cyear															All	Gears
1988	3.0	15.8	.	.	1.0	5.3	6.0	31.6	9.0	47.4	.	.	.	.	19.0	100
1989	6.0	28.6	.	.	.	.	9.0	42.9	4.0	19.0	.	.	2.0	9.5	21.0	100
1990	14.0	82.4	.	.	.	.	2.0	11.8	1.0	5.9	.	.	.	.	17.0	100
1991	11.0	35.5	.	.	.	.	8.0	25.8	12.0	38.7	.	.	.	.	31.0	100
1992	7.0	43.8	.	.	.	.	3.0	18.8	6.0	37.5	.	.	.	.	16.0	100
1993	22.0	84.6	.	.	.	.	3.0	11.5	1.0	3.8	.	.	.	.	26.0	100
1994	8.0	66.7	.	.	.	.	1.0	8.3	3.0	25.0	.	.	.	.	12.0	100
1995	7.0	31.8	.	.	.	.	6.0	27.3	7.0	31.8	1.0	4.5	1.0	4.5	22.0	100
1996	11.0	39.3	2.0	7.1	.	.	7.0	25.0	8.0	28.6	.	.	.	.	28.0	100
1997	9.0	30.0	2.0	6.7	.	.	6.0	20.0	13.0	43.3	.	.	.	.	30.0	100
1998	10.0	41.7	1.0	4.2	.	.	3.0	12.5	10.0	41.7	.	.	.	.	24.0	100
1999	38.0	70.4	.	.	.	.	7.0	13.0	9.0	16.7	.	.	.	.	54.0	100
2000	25.0	53.2	1.0	2.1	.	.	11.0	23.4	10.0	21.3	.	.	.	.	47.0	100
2001	47.0	55.3	6.0	7.1	.	.	7.0	8.2	25.0	29.4	.	.	.	.	85.0	100
2002	30.0	42.3	.	.	.	.	20.0	28.2	21.0	29.6	.	.	.	.	71.0	100
2003	16.0	10.4	9.0	5.8	.	.	103	66.9	26.0	16.9	.	.	.	.	154	100
2004	24.0	17.9	2.0	1.5	.	.	81.0	60.4	27.0	20.1	.	.	.	.	134	100
2005	9.0	8.9	2.0	2.0	.	.	84.0	83.2	6.0	5.9	.	.	.	.	101	100
All	297	33.3	25.0	2.8	1.0	0.1	367	41.1	198	22.2	1.0	0.1	3.0	0.3	892	100

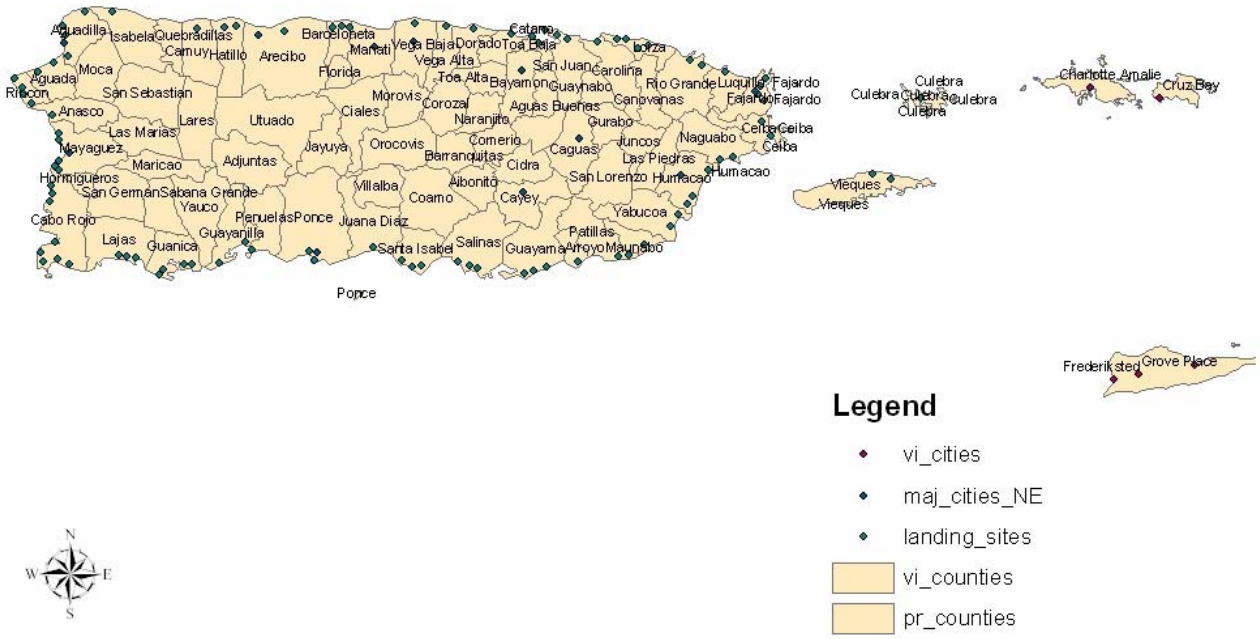
.= No Data in this cell.

1983= first year data available

.Table 12c. .Relative contribution (number of positive landings) of yellowfin grouper from Puerto Rico commercial landings by gear across years for 1983 through 2005 (data from Table 12a).

	agear															
	Dive, Spear, Scuba		Net		Other		Pot		Rod and Reel		Seine		Verticcal Line		All	
	cpue		cpue		cpue		cpue		cpue		cpue		cpue		cpue	
	N	ColPctN	N	ColPctN	N	ColPctN	N	ColPctN	N	ColPctN	N	ColPctN	N	ColPctN	N	ColPctN
cyear																
1988	3	1	.	.	1	100	6	2	9	5	.	.	.	.	19	2
1989	6	2	.	.	.	.	9	2	4	2	.	.	2	67	21	2
1990	14	5	.	.	.	.	2	1	1	1	.	.	.	.	17	2
1991	11	4	.	.	.	.	8	2	12	6	.	.	.	.	31	3
1992	7	2	.	.	.	.	3	1	6	3	.	.	.	.	16	2
1993	22	7	.	.	.	.	3	1	1	1	.	.	.	.	26	3
1994	8	3	.	.	.	.	1	0	3	2	.	.	.	.	12	1
1995	7	2	.	.	.	.	6	2	7	4	1	100	1	33	22	2
1996	11	4	2	8	.	.	7	2	8	4	.	.	.	.	28	3
1997	9	3	2	8	.	.	6	2	13	7	.	.	.	.	30	3
1998	10	3	1	4	.	.	3	1	10	5	.	.	.	.	24	3
1999	38	13	.	.	.	.	7	2	9	5	.	.	.	.	54	6
2000	25	8	1	4	.	.	11	3	10	5	.	.	.	.	47	5
2001	47	16	6	24	.	.	7	2	25	13	.	.	.	.	85	10
2002	30	10	.	.	.	.	20	5	21	11	.	.	.	.	71	8
2003	16	5	9	36	.	.	103	28	26	13	.	.	.	.	154	17
2004	24	8	2	8	.	.	81	22	27	14	.	.	.	.	134	15
2005	9	3	2	8	.	.	84	23	6	3	.	.	.	.	101	11
All	297	100	25	100	1	100	367	100	198	100	1	100	3	100	892	100

Figure 1. Puerto Rico fishing center locations used by the PR DNER, CSP, FSP in data recording. [Landing site location GIS shape file, courtsey of Holly Stone, 2004].



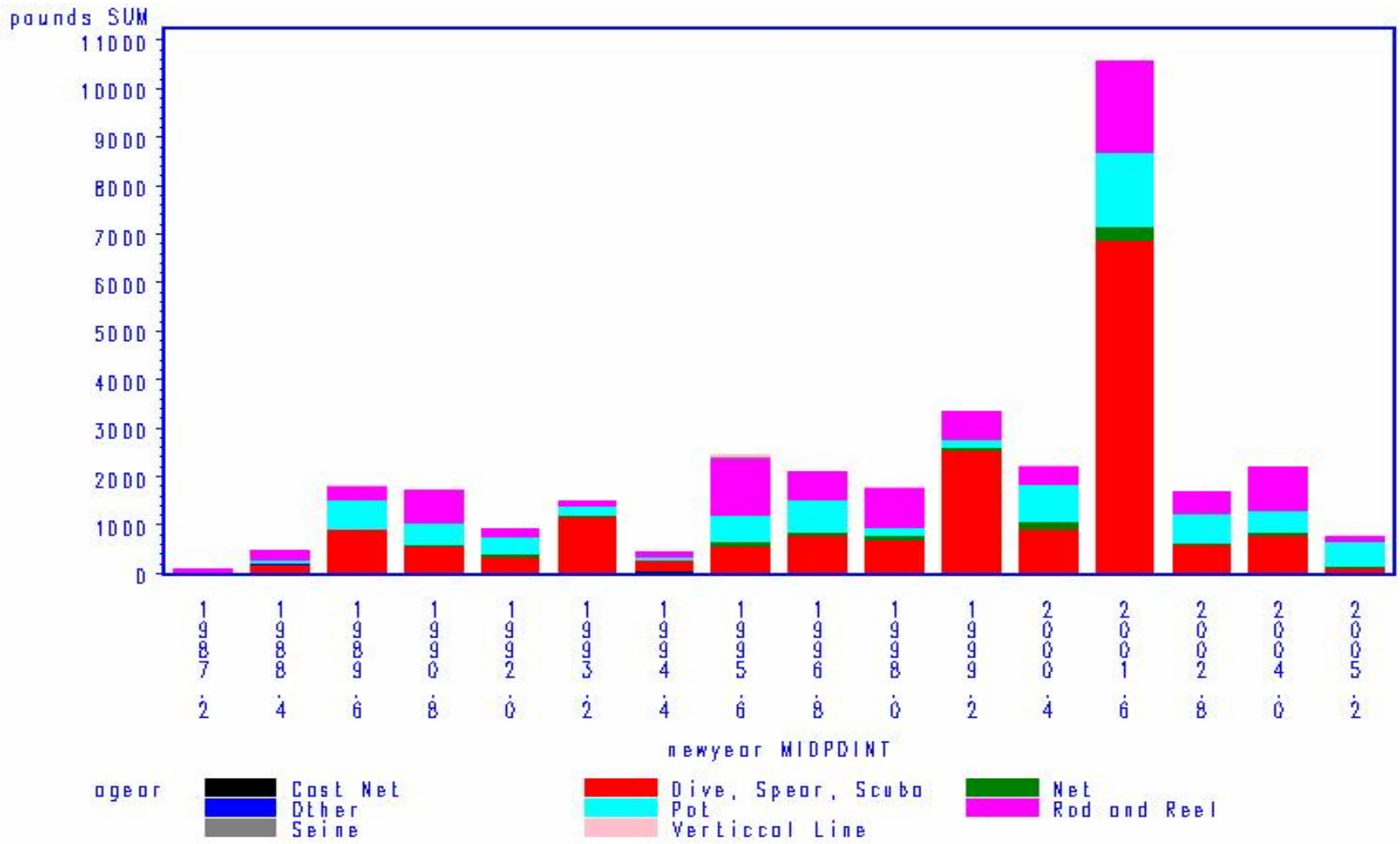
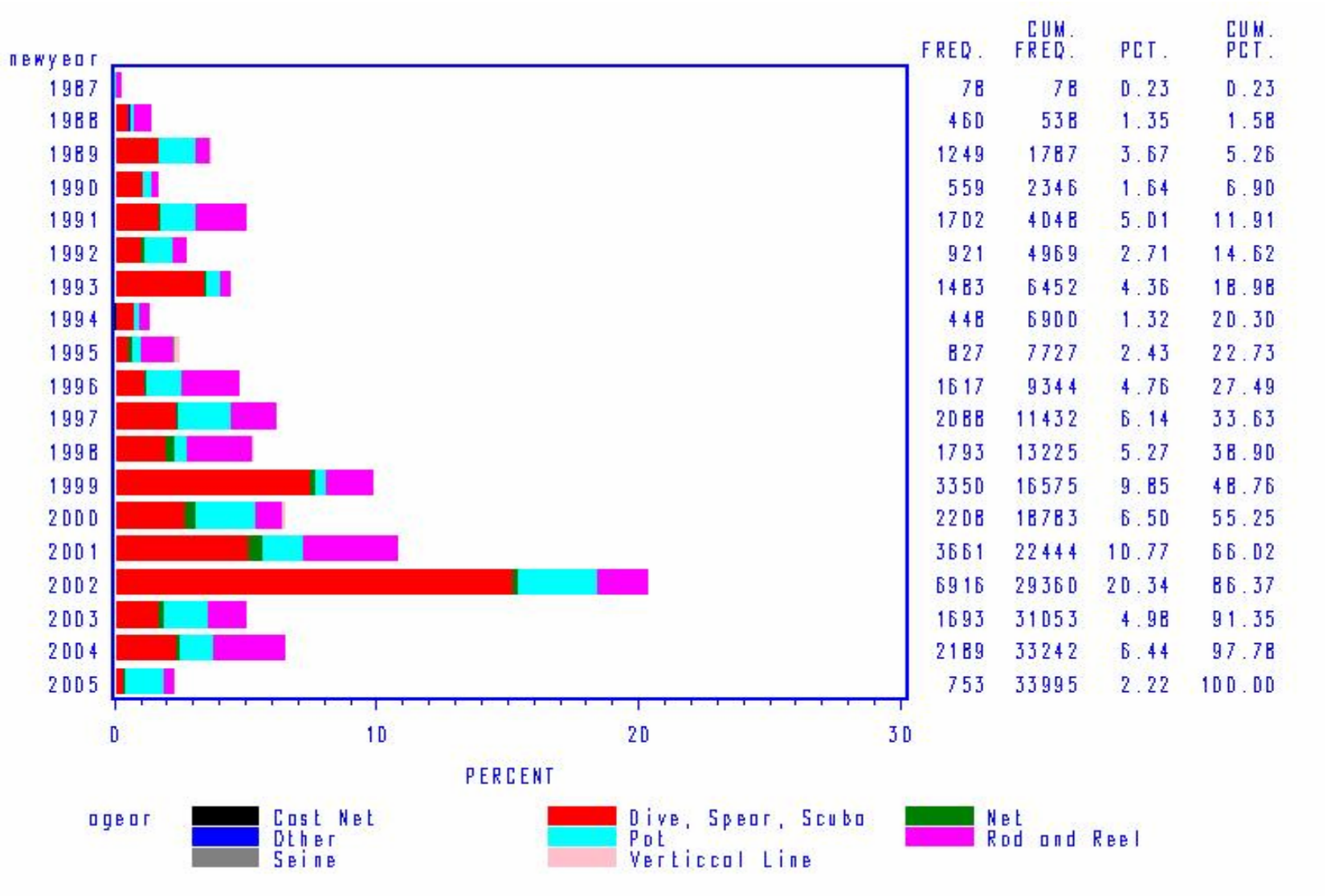


Figure 2a. Reported annual commercial landings (pounds) of Yellowfin grouper in Puerto Rico, 1987-2005, by year. 1983=First year of data availability, 2005 is preliminary.



	FREQ.	CUM. FREQ.	PCT.	CUM. PCT.
1987	78	78	0.23	0.23
1988	460	538	1.35	1.58
1989	1249	1787	3.67	5.26
1990	559	2346	1.64	6.90
1991	1702	4048	5.01	11.91
1992	921	4969	2.71	14.62
1993	1483	6452	4.36	18.98
1994	448	6900	1.32	20.30
1995	827	7727	2.43	22.73
1996	1617	9344	4.76	27.49
1997	2088	11432	6.14	33.63
1998	1793	13225	5.27	38.90
1999	3350	16575	9.85	48.76
2000	2208	18783	6.50	55.25
2001	3661	22444	10.77	66.02
2002	6916	29360	20.34	86.37
2003	1693	31053	4.98	91.35
2004	2189	33242	6.44	97.78
2005	753	33995	2.22	100.00

Figure 2b. Reported annual commercial landings (pounds) of Yellowfin grouper in Puerto Rico, 1987-2005, by gear. 1983=First year of data availability, 2005 is preliminary.

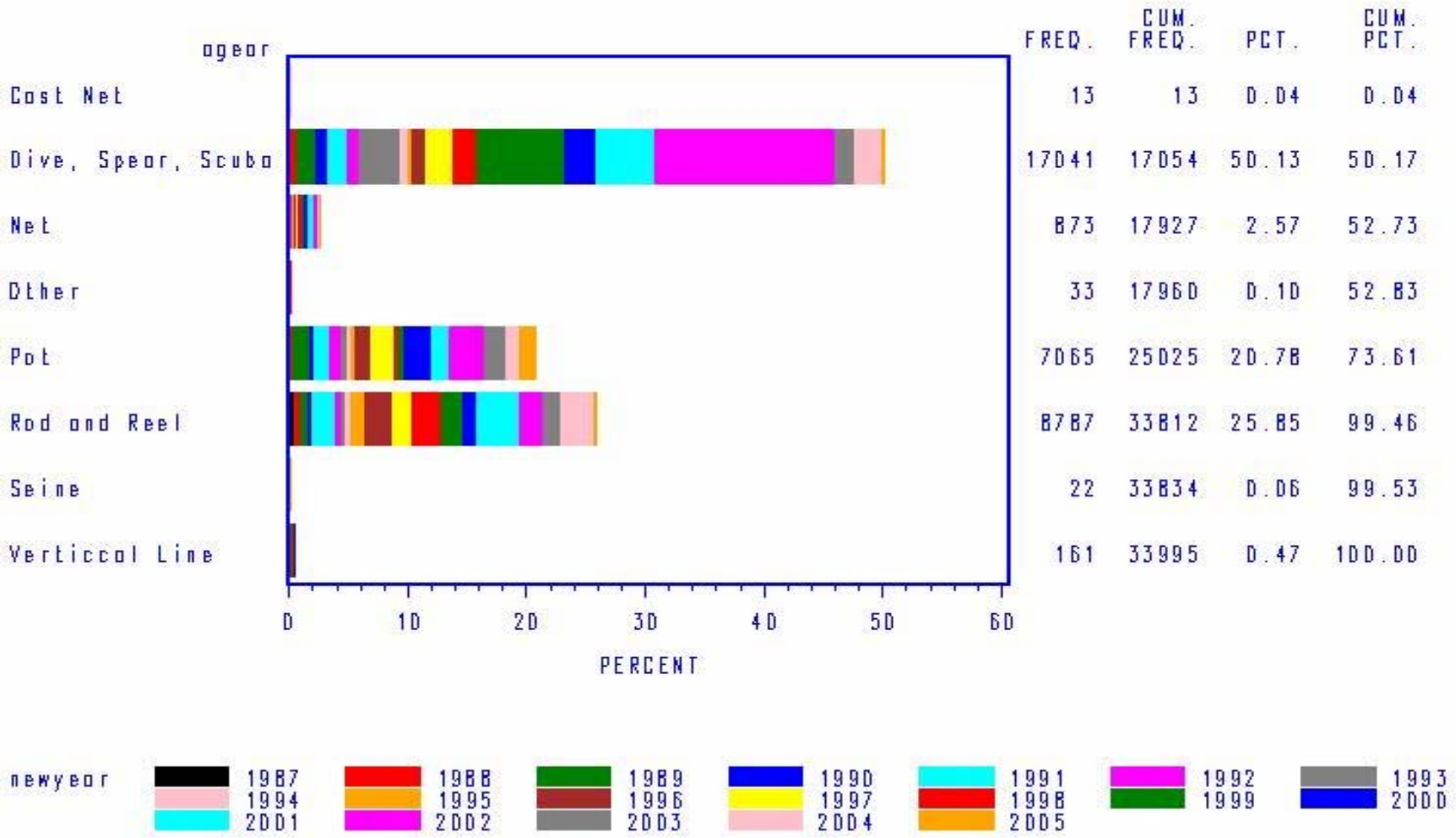
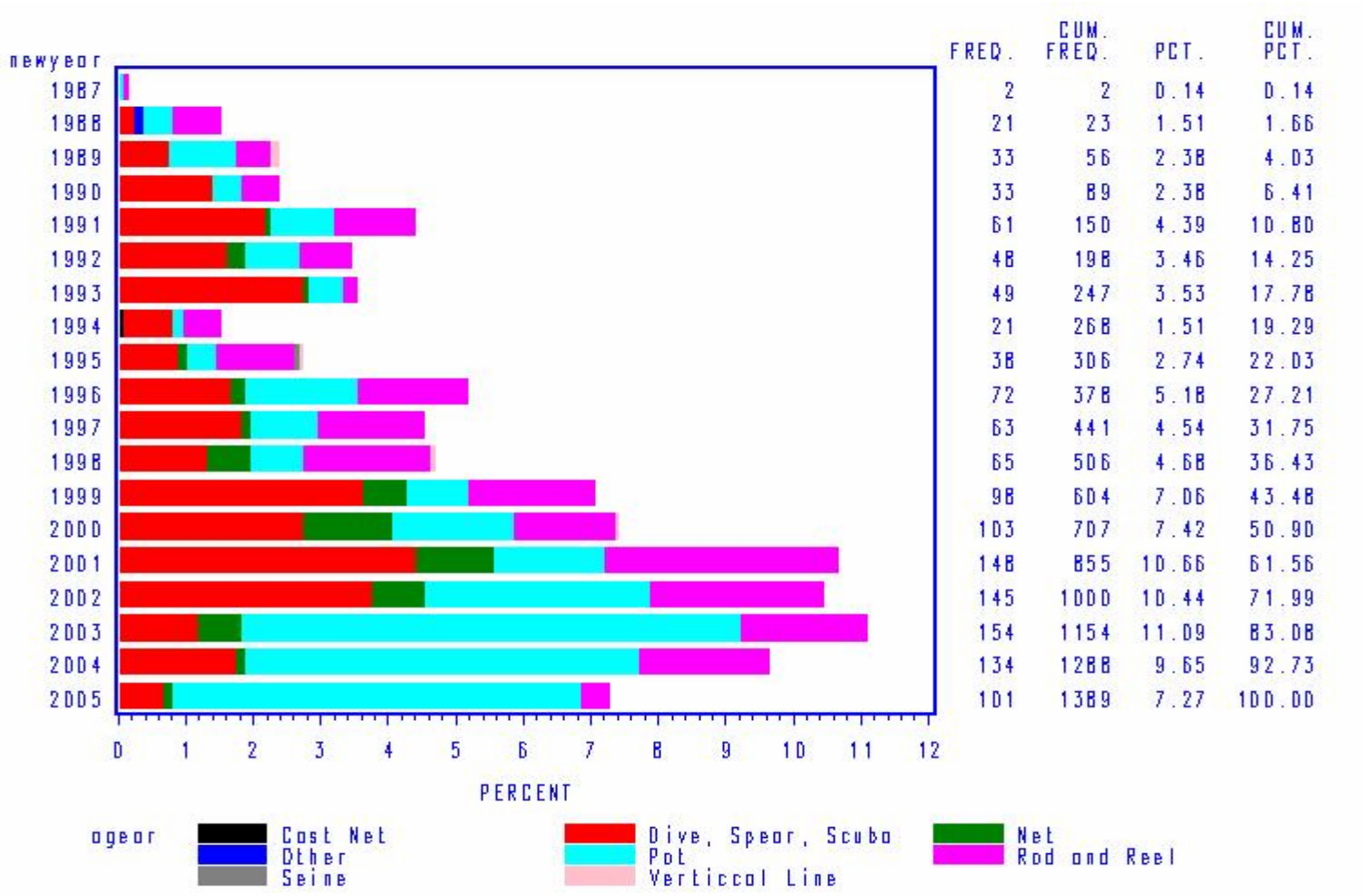
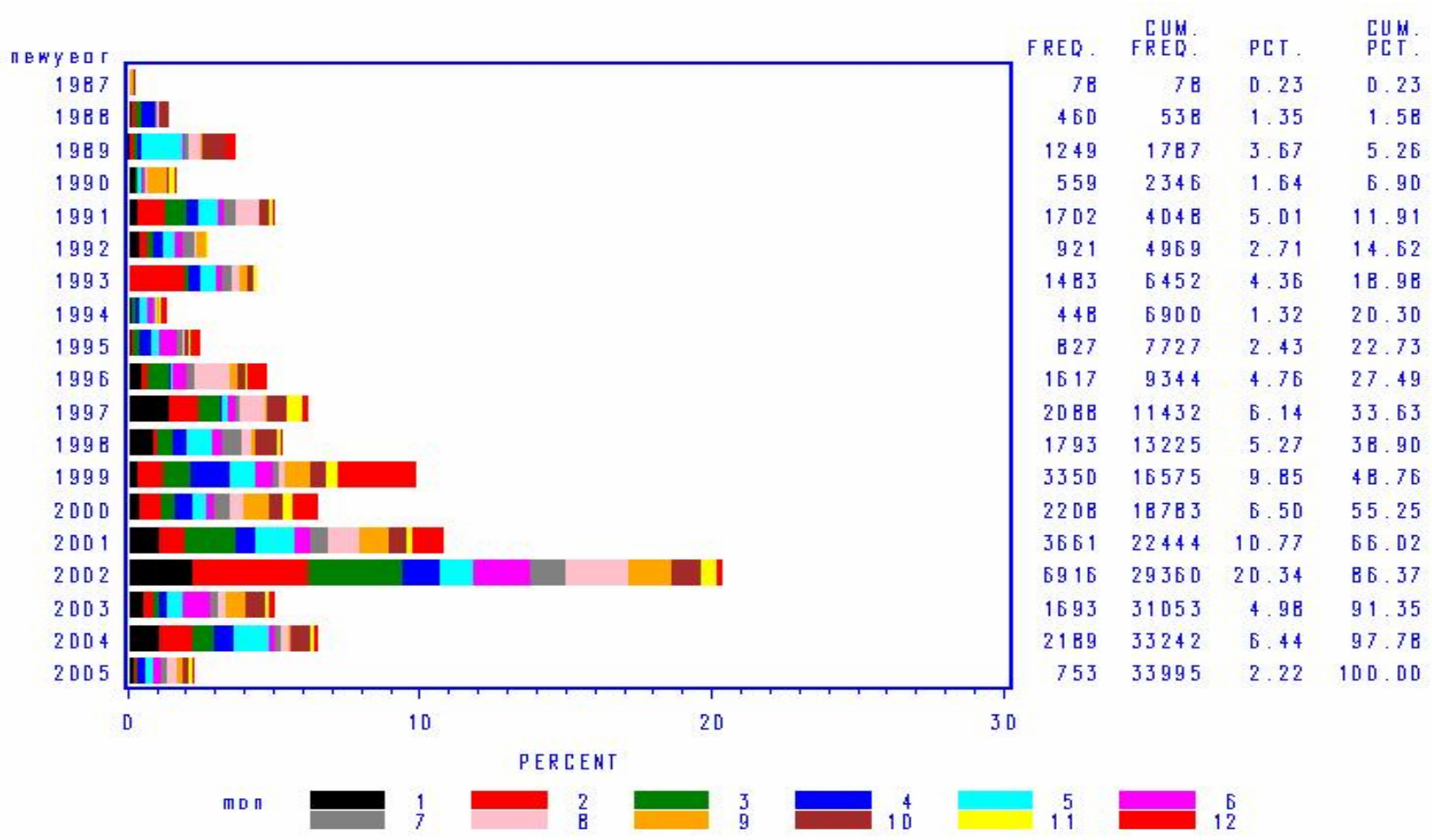


Figure 2c. Distribution of reported commercial landings of yellowfin grouper, 1983-2005, in Puerto Rico by gear category. 1983=First year of data availability, 2005 is preliminary.



newyear	FREQ.	CUM. FREQ.	PCT.	CUM. PCT.
1987	2	2	0.14	0.14
1988	21	23	1.51	1.66
1989	33	56	2.38	4.03
1990	33	89	2.38	6.41
1991	61	150	4.39	10.80
1992	48	198	3.46	14.25
1993	49	247	3.53	17.78
1994	21	268	1.51	19.29
1995	38	306	2.74	22.03
1996	72	378	5.18	27.21
1997	63	441	4.54	31.75
1998	65	506	4.68	36.43
1999	98	604	7.06	43.48
2000	103	707	7.42	50.90
2001	148	855	10.66	61.56
2002	145	1000	10.44	71.99
2003	154	1154	11.09	83.08
2004	134	1288	9.65	92.73
2005	101	1389	7.27	100.00

Figure 2d. Distribution of reported commercial landings of yellowfin grouper, 1983-2005, in Puerto Rico by gear category within year. 1983=First year of data availability, 2005 is preliminary.



	FREQ.	CUM. FREQ.	PCT.	CUM. PCT.
1987	78	78	0.23	0.23
1988	460	538	1.35	1.58
1989	1249	1787	3.67	5.26
1990	559	2346	1.64	6.90
1991	1702	4048	5.01	11.91
1992	921	4969	2.71	14.62
1993	1483	6452	4.36	18.98
1994	448	6900	1.32	20.30
1995	827	7727	2.43	22.73
1996	1617	9344	4.76	27.49
1997	2088	11432	6.14	33.63
1998	1793	13225	5.27	38.90
1999	3350	16575	9.85	48.76
2000	2208	18783	6.50	55.25
2001	3661	22444	10.77	66.02
2002	6916	29360	20.34	86.37
2003	1693	31053	4.98	91.35
2004	2189	33242	6.44	97.78
2005	753	33995	2.22	100.00

Figure 4. Monthly distribution of reported commercial landings of yellowfin grouper in Puerto Rico, 1987-2005. 1983=First year of data availability, 2005 is preliminary.

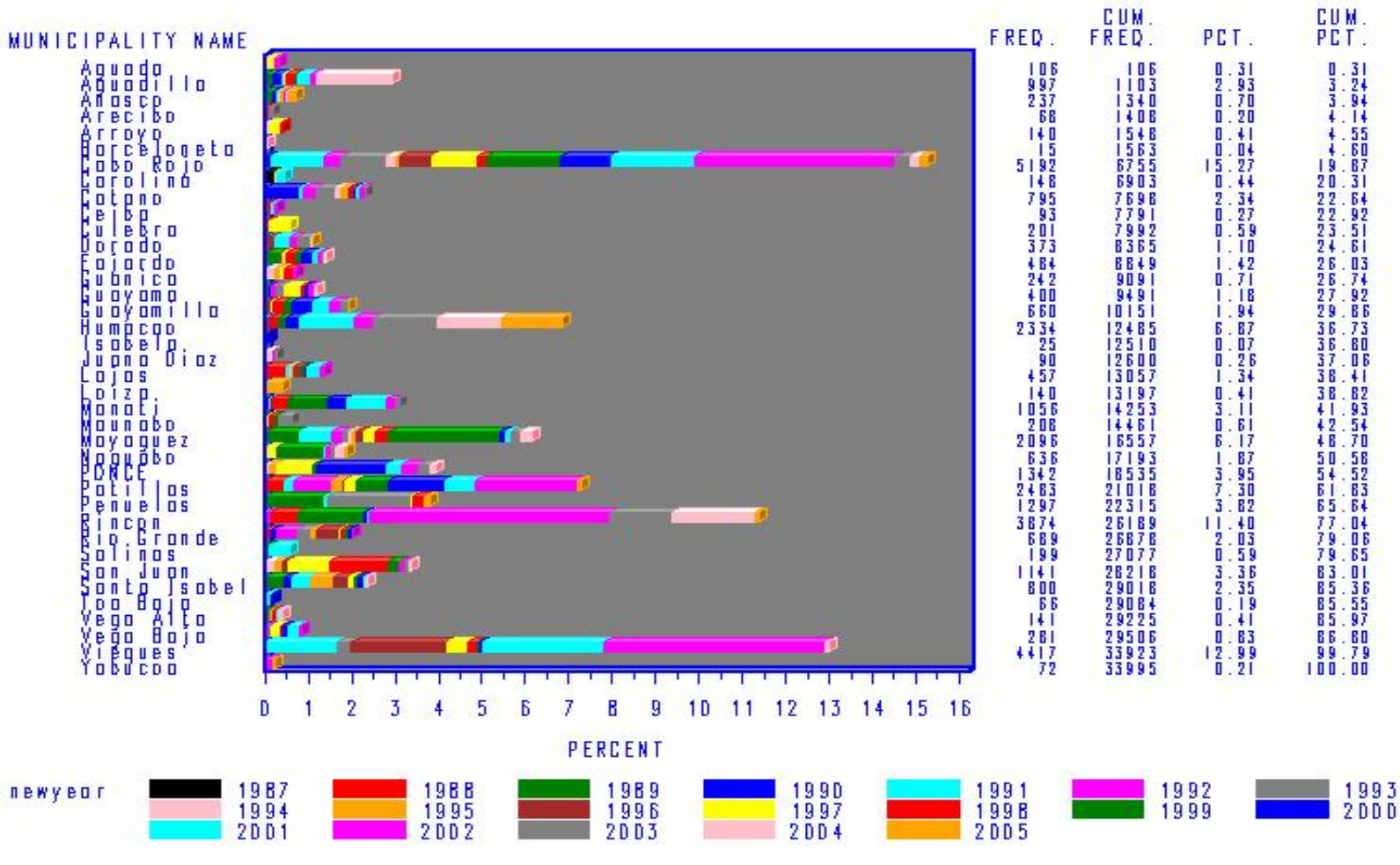


Figure 6. Distribution of reported commercial landings by municipality in Puerto Rico, 1983-2005. 1983=First year of data availability, 2005 is preliminary.

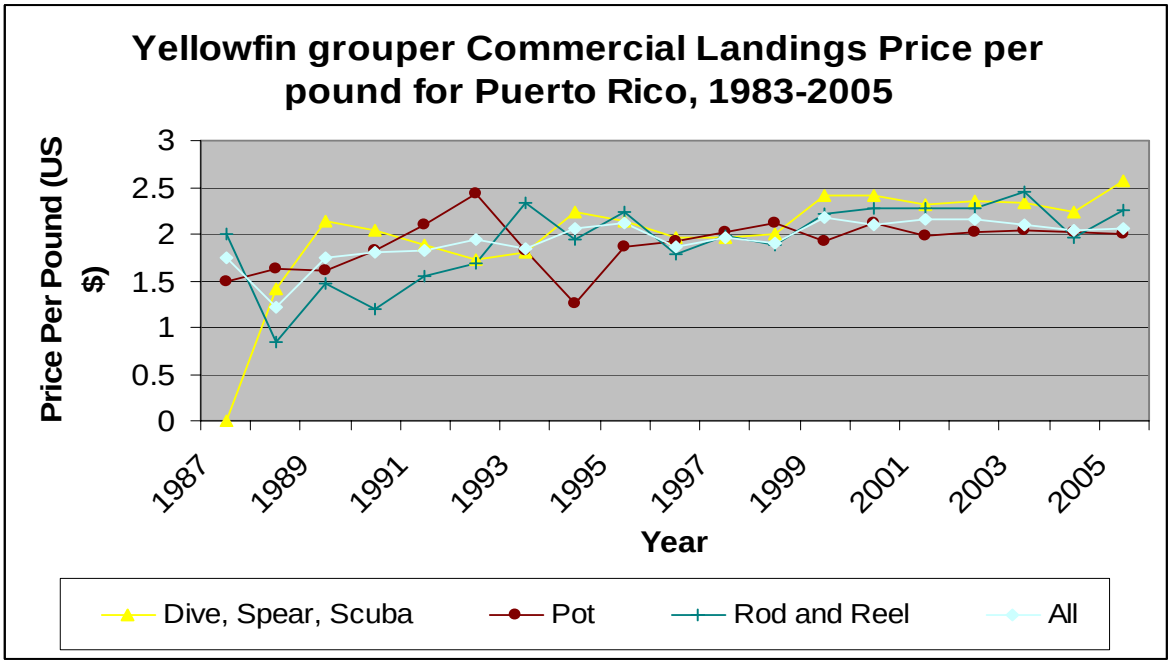


Figure 7. Average price per pound of commercially cauthg and landed yellowfin grouper in Puerto Rico, 1987-2005. 1983=First year of data availability, 2005 is preliminary.

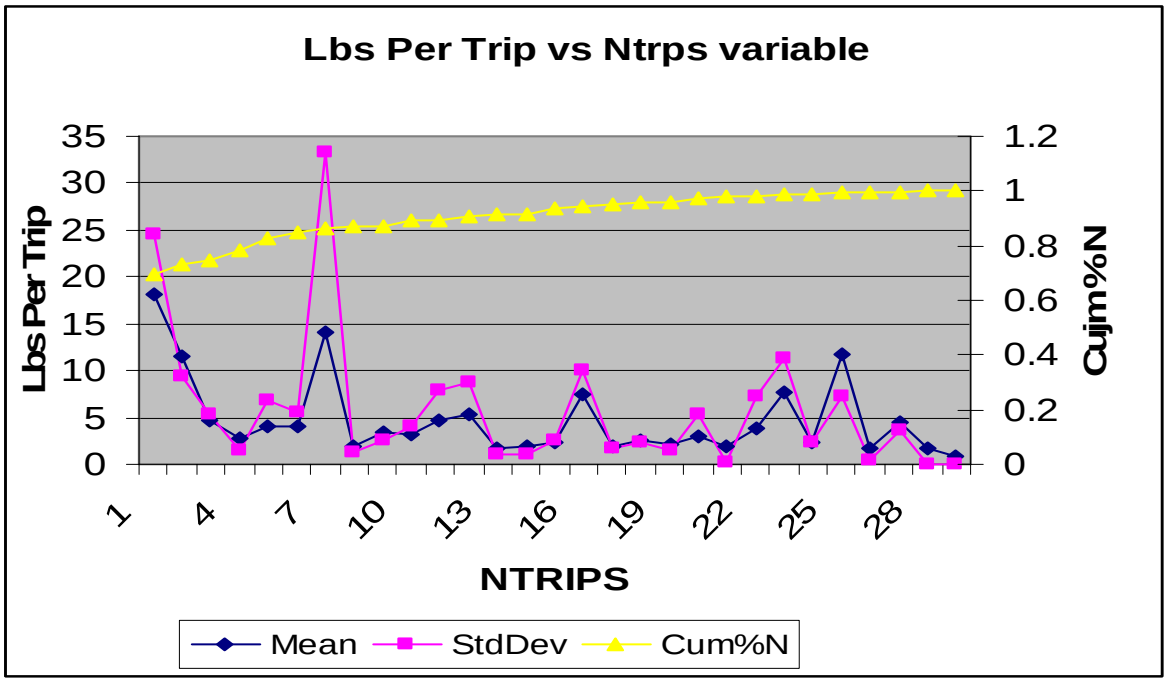


Figure 8a. Mean CPUE (Pounds per Trip), Standard deviation of CPUE and Cumulative Percent of total observations for each unique category of the ntrip variable.

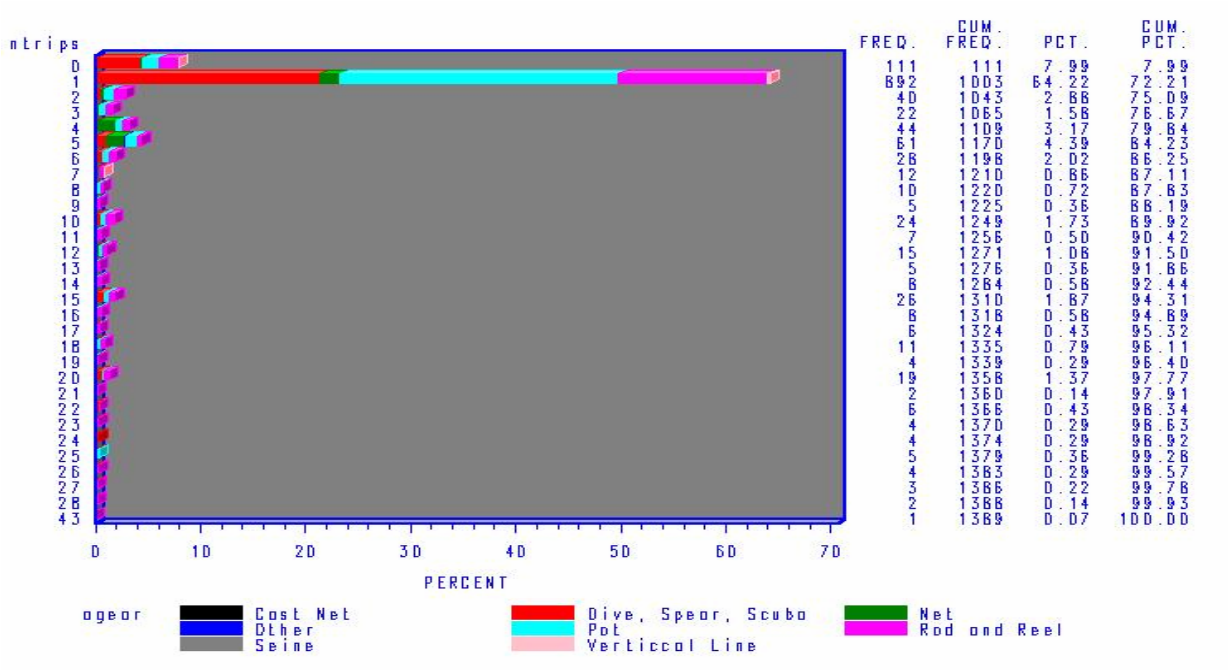


Figure 8b. Distribution of the 'ntrips' variable in the commercial reported landings records of yellowfin grouper from Puerto Rico, 1983-2005. 1983=First year of data availability, 2005 is preliminary. Approximately 72% of the data records indicated ntrips=1, 8 % were coded as ntrips=0 and 20% as ntrips GT 1 trip per landing report.

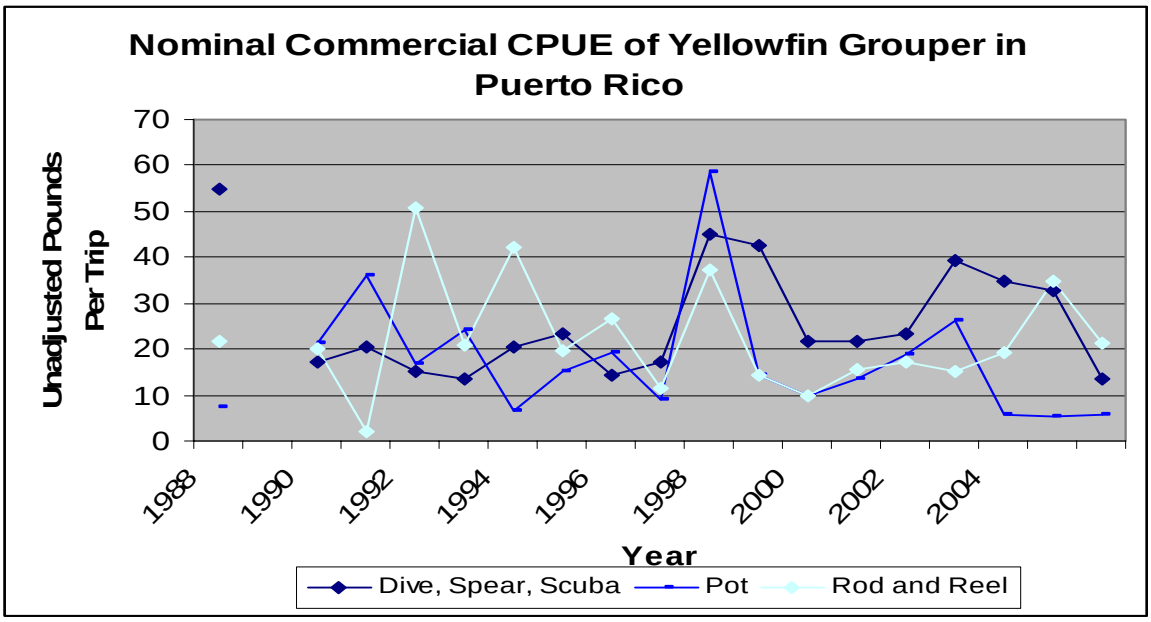


Figure 9. Calculated nominal commercial catch per unit of effort of yellowfin grouper in Puerto Rico, 1983-2005. 1983=First year of data availability, 2005 is preliminary.