Quantitative Historical Analysis of the United States and Cuban Gulf of Mexico Red Grouper Commercial Fishery

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INTRODUCTION

The fishery for grouper in the Gulf of Mexico (hereafter "Gulf") can be traced back to the mid 1800's, when grouper were harvested as bi-catch at the start of the red snapper fishery (Collins 1887b; Townsend 1900; Jarvis 1935). Due to the early start and development of the grouper fishery, there are signs that grouper stocks were depressed prior to the inception of the National Marine Fisheries Service Accumulated Landings System (ALS) in the early 1960's (Jarvis 1935). As a result, a clear, quantitative understanding of the historical population dynamics that have resulted from the start and development of this fishery is necessary. Past assessments of the grouper fisheries in the Gulf have only included landings as far back as the early 1960's, due to the fact that the water body from which the catch was taken was not consistently recorded, and because of gaps in the time series during years that funding for sampling was not available (Goodyear and Schirripa 1991, Goodyear and Schirripa 1993, Schirripa et al. 1999, SEFSC Staff 2002).

An attempt was made by Schirripa et al. (1999) to partially reconstruct grouper catch history back to 1940 made by both the U.S. West Florida fleet and the Cuban fleet that fished on the West Florida shelf. Population models were run using this longer catch series and using a shorter catch series truncated in 1986, the year in which individual species information was available in the catch data.[1] The modeling results using the longer time series were compared to the results obtained using the truncated data and though both scenarios suggested red grouper to be overfished and experiencing overfishing, the severity of the problem portrayed by each set of results was very different. Thus the following work attempts to statistically reconstruct the development of the commercial Gulf of Mexico grouper fishery by thoroughly examining the history and evolution of this fishery. Information was obtained from the earliest literature available and by interviewing various individuals knowledgeable on the subject.

[1] The catch records were not broken out into individual species until 1986, before which the data was aggregated at the family level (i.e. all groupers together, all snappers together, etc.). Often, estimations of individual species composition are made using additional data and anecdotal information.

An exhaustive literature search and interviews with various knowledgeable individuals were conducted in search of quantifiable, qualitative and anecdotal information regarding catch, effort and fishing fleet for both the United States fleet and the Cuban vessels which fished off of the West Coast of Florida in what is now United States federal waters. The earliest literature describing the fisheries of the Gulf of Mexico date to the mid 1800's and can be found in the reports of the commissioner of fish and fisheries. This early literature served to document various newly found fishing grounds and, recognizing the fishing resources of the Gulf, sought ways to develop a viable fishery. Subsequent commissioner reports, documents in Fishery Industries of the United States, and the series Fishery Statistics of the U.S. provided sufficient information on the early fishery that can be used to reconstruct the historical catch made by the U.S. fleet. Information on the Cuban fleet, which primarily fished for grouper on the West Florida shelf and on Campeche Banks, was found in the few available papers on the subject, articles published in Mar y Pesca (Cuban fishing trade magazine), and through interviews with various knowledgeable individuals.

UNITED STATES DOMESTIC FISHING FLEET

The Gulf of Mexico grouper fishery in the United States began in the 1830's out of Key West in order to supply groupers to the Havana market. Fishing took place off the Florida West Coast from Charlotte Harbor to Cedar Key in 7 or 8 fathoms (Goode 1887). Grouper were also taken as bi-catch in conjunction with the red snapper fishery, which began in the 1840's (Collins 1887b, Townsend 1900, Jarvis 1935). Red grouper, and groupers in general, along with porgies were reportedly used as bait for red snapper, however the grouper attracted snapper with only limited success. Exploratory fishing expeditions in the Gulf of Mexico were conducted at the end of the 19th century in order to locate healthy red snapper fishing grounds in hopes of developing the fishery (Collins 1887a). Prior to this time, red snappers were fished from the Gulf solely on a subsistence level. An attempt was made to develop the red snapper fishery once ice was available to the south to ensure proper food preservation and transport. Vessels called "live-well smacks" were used to keep the fish alive until landed. In the early 1870's the red snapper

and grouper fishery began operating on a commercial scale with the creation of the first fish house for these species in Pensacola, Florida. By 1932, the red snapper and grouper fishery in the United States employed about 575 fishermen and 75 larger vessels (called "smacks"), which primarily fished on Campeche Bank; smaller motorized boats (called "chings") were used to fish the Gulf waters adjacent to the United States. Although considered a byproduct, groupers increasingly became an item of importance, the red grouper (*Epinephelus morio*) the most abundant and therefore the most important of the groupers (Jarvis 1935).

As the red snapper fishery began to suffer declines during the early and mid twentieth century, grouper became more important and became recognized as a marketable commodity. Consequently, the price of grouper began to increase (Jarvis 1935; Camber 1955). Despite the increasing importance of grouper (specifically red grouper) and decline in red snapper, red snapper and grouper continued throughout the history of the fishery to be fished for and captured on the same trip and using the same gear (Townsend 1900; Jarvis 1935; Camber 1955; NMFS 1979; Arreguin-Sanchez 1987). The fact that grouper and red snapper fisheries are so closely correlated allows us to use evidence in the literature originally intended for red snapper and apply this information to the grouper fishery. From this, various important assumptions can be made which otherwise would not be possible. The only fleet that targeted grouper specifically was the Cuban fishing fleets (NMFS 1979).

For the United States fleet, the National Marine Fisheries Service (NMFS) and its preceding agencies (U.S. Bureau of Fisheries, U.S. Commission of Fish and Fisheries) have collected historic catch statistics on groupers in the Gulf of Mexico. Statistics go back to 1880, however due to funding availability, sampling was not carried out each year in the early portion of this time series. Historical quantitative data on the early U.S. fleet was computerized and landings were estimated for years when no landings survey was completed in the Gulf region. The time periods when port sampling did not occur are frequent in the very early years between 1880 and 1927, and become much less frequent beyond 1927. For the late 1800's, Jarvis (1935) reports that the red snapper fleet was growing, however the average catch remained the same. Although Jarvis (1935) as well as the collection Fishery Statistics of the U.S. provides counts of vessels used, these

counts come from the same censuses as the landings data and therefore are already implicit in the catch. It can be inferred that technological innovation, including the use of steam and diesel powered motors (1920 and 1930), ice, and other gear advances did not change rapidly enough from one census to the next to merit adjustment. Thus, when Porch et al. (2006) reconstructs the historical red snapper catches, they argue that linear interpolation of landings serves as a reasonable approximation. Consequently, estimations were calculated by stratifying the data by state and year, calculating a linear regression between known points, and using this calculated relationship to estimate the missing years. The data was then re-aggregated in order to form total grouper landings Gulf-wide (Table 1).

The U.S. fleet fished for grouper and red snapper both off of the Gulf coast of the United States in what are now federal waters, and off of the Yucatan Peninsula, Mexico, over the Campeche Banks. The U.S. landings statistics therefore contain both fish captured in federal waters as well as fish taken from waters that are presently owned by Mexico. In order to make an accurate assessment of the marine resources that lie exclusively within United States waters, adjustment ratios were constructed using the methodology implemented by Porch et al. (2006) to approximate the catch that was taken from the Campeche Banks and remove this quantity. Two types of vessels fished in the grouper and red snapper fishery: larger vessels called “smacks” or vessels, which primarily fished on Campeche Bank, and smaller motorized boats called “chings” or boats, which were used to fish the Gulf waters adjacent to the United States. Therefore according to Porch et al. (2006), the proportion of the total catch (both smacks and chings combined) that came from federal waters can be estimated from the proportion of total landings made by smacks and the proportion of the smacks landings coming from U.S. waters using the following formulation:

$$p(US) = 1 - p(smacks) * (1 - p(US|smacks))$$

Equation 1: Porch et al. 2006

Jarvis (1935) provides information on how much grouper was landed from each of the two vessel types within the U.S. fleet, however this information specific to grouper is only available for a limited number of years: 1897, 1902, 1923 and 1927 through

1932. These values are used to determine the proportion of the grouper catch from the U.S. fleet that was smacks. For the remainder of the time period (1933 to 1962) during which this type of information is not available, the value for this proportion was set constant using the value calculated for 1932.

According to Jarvis (1935) "operators of large smacks estimate that until recently 75 percent of their production of both red snappers and groupers came from the Campeche Bank, but today about 50 percent of the catch is estimated as coming from the United States side of the Gulf." Thus, it can be assumed that the 25% of all landings made by the smacks came from the U.S. until about 1933 (when the paper was written) when the proportion went up to 50 percent (Jarvis 1935; Camber 1955). Camber (1955) provides estimates of the proportion of smack landings that came from Mexico between the years 1934 and 1951. The proportions that Camber provides are based on the number of vessels and not catch. Consequently, though these proportions were originally intended for red snapper, they can be accurately applied to grouper. A summery of the results discussed in the above paragraphs and the calculations made using equation one for the years 1880 to 1951 is provided in Table 2.

For the time period 1952 until 1963 (the year when landings information is provided by water body), there is little information on the proportion of red grouper catch that originated from foreign waters. A Gulf-wide summary is available describing the proportion of total red snapper landings from the Gulf of Mexico as a whole that came from foreign waters. Porch et al. (2006) used this information to approximate state-specific proportions describing the fraction of the catch that came from foreign waters for the years 1952 to 1963. Given the fact that red snapper and groupers are captured on the same trip, and due to the lack of information regarding catch location for grouper, the methodology and proportions calculated by Porch et al. (2006) for red snapper are applied to grouper. For Alabama, Mississippi and Louisiana, linear transitions are assumed between known values and 1963, the first year data included information on where catch was captured. The proportions for Florida and Texas were calculated from the Gulf-wide statistics using the "landings by state (C), interpolated fractions for Louisiana, Mississippi and Alabama as described above, and the assumption that the ratio

of the fractions for Texas and Florida r was constant, set as the 1963-1966 average (0.89)" (Porch et al. 2006).

$$F_{Fl,y} = \frac{F_{total,y}C_{total,y} - F_{Al,y}C_{Al,y} - F_{Ms,y}C_{Ms,y} - C_{La,y}}{C_{Fl,y} + rC_{Tx,y}}$$

$$F_{Tx,y} = rF_{Fl,y}$$

Equation 2: Porch et al. 2006

Values obtained using this equation and the methods as presented by Porch et al. (2006) for the years 1952 through 1962 can be found in Table 3.

Two additional adjustments were made to the landings data to make it comparable with the landings data found in recent years: calculating the proportion of the landings that are specifically red grouper and completing a weight type conversion to make the landings gutted weight. The historical record of catches provides specific landings information for grouper in three categories: goliath grouper (formerly known as jewfish), Warsaw grouper (after 1950), and all other grouper species together under the family name "grouper." Historical U.S. fisheries literature states that red grouper is the most abundant of groupers and therefore most important (Jarvis 1935). For the time period when Warsaw grouper was identified separately from all the other grouper species, it was found that Warsaw grouper constituted an average 3.7% of the catch (confidence interval plus or minus 0.77%). This percentage was used to adjust the landings prior to 1950 to account for and remove Warsaw grouper catch.

The remaining catches classified as "grouper" are further refined by assuming that 90% of the general grouper catch is red grouper. This assumption is based on anecdotal information suggesting that red grouper is the most prominent species captured in the Gulf of Mexico (Jarvis 1935) and numerical information, which argues that between 80 and 90 percent of the Gulf of Mexico grouper catch, consists of red grouper (Arreguin-Sanchez 1987; Klima 1976). For the year 1950 and later, when the Warsaw grouper (3.7% of the catch on average) has already been excluded from the overall grouper catch, landings are adjusted by 93.7% in order to estimate which portion of the catch is specifically red grouper. With the resulting numbers, a final adjustment is made to convert the estimated weights of what is now exclusively red grouper from whole to

gutted weight; this adjustment was done by multiplying the catch by 0.954 (Goodyear and Schirripa 1993). Final estimated Gulf of Mexico red grouper historical landings from U.S. waters in gutted weight can be found in Table 4.

CUBAN GULF OF MEXICO FISHING FLEET

During the 1800's, a fish trade was carried out between Key West and Cuban fisherman in order to supply grouper to Havana. By the late 1800's, Cubans began fishing the grouper fishery in the Gulf off the West coast of Florida, from Charlotte Harbor to Cedar Key in water deeper than 7 or 8 fathoms and no deeper than 10 fathoms. Once full, the ships cleared customs in Key West and landed their catch in Havana (Goode 1887). According to Martinez (1948), Havana continued to receive "mostly Gulf of Mexico catch, consisting of red grouper, red snapper and kingfish." Martinez (1948), however does not specify how much of the Gulf catch comes from the Campeche Banks and how much from the West Florida shelf. It is known that the Cuban fleet continued to fish off of West Florida (beyond 3 miles of shore) until the United States expanded its exclusive economic zone to 200 miles in 1977 (Muniz 1958; Fuss 1972).

Data Sources

Information on the Cuban fleet that fished for grouper in the Gulf of Mexico prior to the expansion of the United States exclusive economic zone has been challenging to procure. "Mar y Pesca," a Cuban trade magazine is one of the few published sources with quantitative information available on the subject. From the publication's inception in 1956 until the revolution in 1959, the magazine made public much of the catch data, at times including information on individual species. After the revolution, however publication of catch data became sparse with the magazine primarily composed of articles written about fishing. Various other historical publications on the Cuban fished Gulf of Mexico fisheries were considered. Interviews were conducted with various individuals in an attempt to gather anecdotal information on the quantity and location of fishing activity that used to take place by the Cuban fleets on the West Florida Shelf. The following individuals were among those consulted:

- Edward Little – NMFS port agent and head of the Key West Maritime Historical Society
- Senor Torres/Roberto Torres (nephew) - former Cuban fisherman in the 1940's and former fish house owner in Cuba
- Kenyon Lindeman – Environmental Defense
- Rodolpho Claro – Ministry of the Environment, Republic of Cuba
- Julio Baisre – Ministry of Fisheries, Republic of Cuba
- Georgina Bustamante – Nature Conservancy, former scientist for Cuban Ministry of Fisheries
- Doug Gregory – Florida Sea Grant, Monroe County, Florida
- Andres Rodriguez – Cuban Ministry of the Environment, Republic of Cuba

The quantitative and qualitative information gathered from the literature and the individuals listed above are documented within this report. In many cases it was difficult to obtain information from individuals working within the Ministry of Fisheries and Ministry of the Environment for the Republic of Cuba due to the present day political climate.

Historical Cuban catches from what are presently federal waters of the United States were estimated from 1937 until 1977, at which time the United States exclusive economic zone was expanded out to include 200 nautical miles and the Cuban fleet was expelled. Table 5 lists the source of the quantitative information for each year in the time series, or whether the catch for that year was estimated. For years when specific red grouper catch was unknown, the calculated proportion of red grouper to overall grouper (all species in the grouper family combined) was used to estimate red grouper catch. These calculated proportions, ranging from about 80 to 90 percent, could be corroborated with anecdotal information found in the literature. Estimates for the Campeche Banks off the Yucatan Peninsula in Mexico approximate that red grouper made up between 80 and 90 percent of total catches made by Mexican, Cuban and U.S. fleets in 1981 (Arreguin-Sanchez 1987; Klima 1976; Suarez Caabro 1957). For the Cuban fleet it is reported that about 90 percent of their total catches from the Gulf of Mexico was red grouper (Abascal 1966; Leal 1971). During years when no catch information was available, landings were

estimated by assuming a linear transition between known years and filling in the catches accordingly. The following details how information for each year was obtained:

- 1937 – 1945: Martinez (1948) documents specifically red grouper catch in Fishery Leaflet 308 entitled "The Cuban Fishing Industry." In this document, the author notes that the highest catch of fresh fish landed in Havana was red grouper and that it is all caught in the Gulf of Mexico. Consequently, any red grouper catch made by Cuba can be assumed to originate from the Gulf of Mexico (Martinez 1948).
- 1946 – 1955: No information could be found regarding grouper catches in Cuba. Consequently, landings for this period were linearly estimated.
- 1956 – 1959: The year 1956 marks the first issue of the Cuban fishing trade magazine entitled "Mar y Pesca." In addition to articles on fishing, this publication provided specific information on catches of grouper in general, and for two years (1956 and 1957), red grouper specifically.
- 1960 – 1963: The Cuban Revolution occurred during this time period and as a result, issues of Mar y Pesca and other publications are not available. Catches are estimated linearly.
- 1964 – 1966: Mar y Pesca resumed publication, however the format and style of the magazine had changed. Specific numerical data was no longer frequently included and the magazine was used more specifically as a tool for recruiting individuals to a career in fishing and developing a government operated, large scale fishing operation. Some quantitative information was found for grouper in general during this time period and this information is included.
- 1967 – 1969: No quantitative information is available for these years hence catches are estimated linearly.
- 1970 – 1973: An assessment of fish stocks and fisheries on Campeche Bank done by the Food and Agriculture organization provided quantitative information on both groupers in general and specifically red grouper catches made by Cuba. Catches were given for all grouper species Gulf-wide, red grouper Gulf-wide, and all grouper species on Campeche Bank (Klima 1976).

- 1974 – 1977: No published information is available for these years, however it was known that Cuban fishing vessels were fishing in waters adjacent to the U.S. Catches for the years 1971 to 1973 were very stable and given the lack of any additional information, an average of these three years was calculated and applied to represent the catch for the years 1974 through 1977.

Catch Origin: Campeche Bank or West Florida Shelf

Using the information sources and methodology described above it was possible to estimate the catches made by the Cuban fleet for each year in the time series. This information however represents the Cuban fleet catches for the entire Gulf of Mexico and therefore includes what was captured within and outside of preset day federal waters. Consequently, the data needs to be transformed so that the catches represent only that which was taken from what are presently federal waters, and not the catch from Campeche Bank. Information provided by Klima (1976) presents catch information from the Cuban fleet for both specifically Campeche Bank and for the entire Gulf. Using this information, ratios were established, however this information is only available for four years in the time series: 1970 to 1973. As a result, anecdotal information must be relied upon for the subsequent years in order to determine and successfully eliminate the proportion of the grouper landings from the Cuban fleet that came from Campeche Bank. The problem is that conflicting qualitative information exists on how much fishing effort was exerted by the Cuban fleet on Campeche Bank and the West Florida Shelf, making it difficult to determine an accurate proportion.

During the late 1930's and early 1940's, Cuba had a fleet of deep-water fishing vessels used for fishing in Gulf of Mexico waters (Martinez 1948). Despite this, however, ice and refrigeration were not readily available to all vessels, markets and suppliers, and consequently, product turn over had to occur quickly. In the literature, it also states that at this time, fishing off the coast of Yucatan had caused some political difficulty from the Mexican government. In addition, the literature also states that fishing also occurred off of the United States coast, which is much closer than traveling out to Campeche Bank (Martinez 1948). This information suggests that due to the proximity of Campeche Bank, only a limited amount of effort was applied to those stocks, and much

of the Gulf of Mexico fishing effort was therefore exerted in waters off the west coast of Florida.

Anecdotal information from a retired Cuban fisherman who fished out of Havana in 1940 and 1941, and owned a fish house in Havana until 1960, suggests that before the Cuban Revolution, most of the fishing was done off of the West Coast of Florida. When presented a map of the Gulf of Mexico, he pointed to the area right off the W. Florida coast from the Sanabel and Marco Island area down to, but not including the Dry Tortugas (Torres 2006). According to Torres (2006) all fishing occurred in depths of 18 to 20 fathoms and a trip would last from 7-8 days. Vessels were typically about 50 feet long and held a fleet of 7 individuals; catch per vessel averaged about 18,000 pounds each trip. The interviewee stated that at this time, very few individuals traveled to Campeche to fish because it was too far. Once the Cuban Revolution took place (1960), it had become more difficult to fish near the United States coast and therefore, much of the fishing activity moved to Campeche Bank (Torres 2006).

During the mid 1950's, Suarez Caabro (1957) reports that the Cuban grouper Gulf of Mexico fleet fishes mainly at Campeche Bank, however fishes the West Coast of Florida sometimes during the summer and often during hurricane season. No quantitative measure is provided of how frequently the Cuban fleet fished waters adjacent to West Florida, however the author suggests that fishing occurred "mainly at Campeche Bank" (Suarez Caabro 1957). By this time, ice, refrigeration and engine power were available to most of the vessels and thus product spoilage was less of an issue (Suarez Caabro 1957). The information from Suarez Caabro (1957) conflicts with the anecdotal information from Torres (2006), who suggests that substantive fishing pressure was not applied by the Cuban fleet to Campeche Bank until the establishment of a nationalized foreign fishing fleet in the early 1960's.

When the Cuban Revolution occurred, the government took rigorous steps to develop a Cuban fishing industry by subsidizing the development of the Fishing Co-operative and long distance fishing fleets. The Fishing Co-operative, founded by Castro, consisted of cooperatively owned vessels and gear, and the establishment of self-sufficient fishing communities; fishermen are paid on a profit-sharing basis. The Co-operatives fished only inshore within the Cuban Archipelago shelf. The long distance

foreign-built vessels held large crews trained by experienced Soviet fishermen (Young 1966). The Gulf of Mexico long distance fishing fleet began operating in 1963 however did not start substantially producing until 1965 (Abascal 1968; Chang 1971). According to Torres (2006), much of the Gulf of Mexico fishing activity post revolution once the long distance fishing fleet was established took place on Campeche Bank.

Therefore, according to Martinez (1948) and Torres (2006) it can be assumed that the proportion of catches that came from the West Florida coast were initially relatively high (assumed to be 90%) for the time period between 1937 and 1941. Suarez Caabro (1957) indicates that by 1955, the majority of the catch made by the Cuban Gulf fleet originated from Campeche Bank. Consequently, the ratio of the catches originating from U.S. waters in 1955 through 1958 is set constant at 0.35, the average of the proportions calculated from Klima (1976) for the years 1970 to 1973. Proportions are estimated linearly between the years 1941 and 1955. When the Cuban Revolution occurred in 1959, Fidel Castro nationalized all fishing operations through the establishment of Co-operatives and new distant water fishing operations. The Co-operatives did not fish any foreign waters and the Gulf of Mexico distant water fishing fleet was not established until 1963, consequently the catches from waters outside of the Cuban platform can be assumed to be zero for the years 1959 to 1962 (Young 1966). The Gulf of Mexico long distance Cuban fishing fleet began operating in 1963 however did not begin catching substantially until 1965 (Abascal 1968). The ratio of the catches originating from U.S. waters 1965 to 1969 and 1974 to 1977 is set constant at 0.35, the average of the proportions calculated from Klima (1976) for the years 1970 to 1973. The proportion for the years 1963 and 1964 was estimated linearly between zero and 0.35 in order to capture the development of the Gulf of Mexico long distance Cuban fishing fleet. A summary of these ratios and the estimated catch is provided in Table 6.

Additional Sources of Information Considered

A few additional documents describing potential grouper catches from the Cuban fleet are available, however the origin of the quantitative information contained in these documents is not clear and therefore this information was not included in this report. During a National Marine Fisheries Service assessment of red grouper in 1999, the authors similarly attempted to reconstruct historical red grouper landings from the U.S.

and Cuban fleets. In the assessment report, however, the origin of the quantitative information present for Cuba was not well documented (Schirripa et al. 1999). In addition, when contacted, the authors did not provide sufficient information on how the obtained the values within the report (Schirripa 2006; Legault 2006; Kenchington 2000).

The Gulf of Mexico Environmental Impact Statement and Fishery Management Plan for Reef Fish Resources (Gulf of Mexico Fishery Management Council 1980) provided information on grouper catches made by the Cuban fleet between 1965 and 1974, however the origins of these numbers are again in question and not well documented in the text of this report. An unpublished report (Zuboy 1978) is cited for providing the Cuban fleet catch, however this report cannot be located. A peer review paper published in Marine Fisheries Review (Tashiro and Coleman 1977) describes the Gulf of Mexico Cuban grouper and snapper fishery and provides estimates of catches from the West Florida and Campeche Shelves. These authors took a similar approach using data found in issues of Mar y Pesca, to which they applied proportions in order to estimate the quantity of the catch that is from the West Florida shelf and that from the Campeche shelf. The problem with these numbers, however is that they contain both snapper and grouper catches combined, and that the methods used to decide on these proportions are documented generally but not specifically, and were calculated by multiple individuals (Tashiro and Coleman 1977).

CONCLUSIONS

Attempts to reconstruct quantitative historical landings information from sparse historical records and qualitative accounts contain an inherent amount of subjectivism that is important to address. When no other information is available for use as an indicator of historical catch, a linear estimation between known catches in the literature is assumed. It is important to note however that events such as technological improvements (use of ice and improved navigation capabilities) or political instability (times of war when vessels had to fish closer to shore to avoid submarines) may affect the effort that can be applied during a given time or in a given area (Jarvis 1935). Without information

quantifying the effect of these historical events on catch rates, the best that can be assumed between periods of known catches is a linear transition.

The high catches made by the Cuban fleet in the early few years in the time series, 1937 to 1941 as reported by Martinez (1948) (they are an average for those four years), are suspect as they represent the highest catches on record for the entire time series. When considering the increase in technology over time and the high government subsidy funding the development of the long distance Gulf of Mexico fleet in 1963, it does not seem likely that these catches are accurate. The literature also suggests that fishing outside of Cuban waters ceased during the revolution until the Gulf of Mexico distant fishing fleet was reorganized and nationalized, however catches by the Cuban fleet for all water bodies 1959 through 1962 remain relatively consistent with those years before 1959 and after 1962 (Table 6). Thus, this assumption based on evidence in the literature may not be accurate; there is no quantitative data available for the years 1960 through 1963 to support or deny this claim.

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Year	Florida	Alabama	Mississippi	Texas	Louisiana	Eastern Gulf	Western Gulf	TOTAL
1880	1,764,000	0	0	0	0	1,764,000	0	1,764,000
1881	1,591,500	1,111	0	571	0	1,592,611	571	1,593,183
1882	1,419,000	2,222	0	1,143	0	1,421,222	1,143	1,422,365
1883	1,246,500	3,333	0	1,714	0	1,249,833	1,714	1,251,548
1884	1,074,000	4,444	0	2,286	0	1,078,444	2,286	1,080,730
1885	901,500	5,556	0	2,857	0	907,056	2,857	909,913
1886	729,000	6,667	0	3,429	0	735,667	3,429	739,095
1887	556,500	7,778	0	4,000	0	564,278	4,000	568,278
1888	384,000	8,889	0	7,000	9,000	392,889	16,000	408,889
1889	418,000	10,000	0	0	18,000	428,000	18,000	446,000
1890	399,000	11,000	0	0	18,000	410,000	18,000	428,000
1891	453,594	19,286	0	495	15,429	472,879	15,923	488,803
1892	508,187	27,571	0	989	12,857	535,759	13,847	549,605
1893	562,781	35,857	0	1,484	10,286	598,638	11,770	610,408
1894	617,374	44,143	0	1,979	7,714	661,517	9,693	671,210
1895	671,968	52,429	0	2,474	5,143	724,396	7,616	732,013
1896	726,561	60,714	0	2,968	2,571	787,276	5,540	792,815
1897	781,155	69,000	0	3,463	0	850,155	3,463	853,618
1898	682,703	182,200	1,174	10,804	952	866,077	11,757	877,833
1899	584,251	295,400	2,348	18,145	1,905	881,999	20,050	902,049
1900	485,798	408,600	3,522	25,487	2,857	897,921	28,344	926,264
1901	387,346	521,800	4,696	32,828	3,810	913,843	36,637	950,480
1902	437,089	635,000	5,870	40,169	4,762	1,077,959	44,931	1,122,890
1903	569,407	594,833	7,045	38,961	5,714	1,171,285	44,675	1,215,961
1904	701,726	554,667	8,219	37,753	6,667	1,264,611	44,420	1,309,031
1905	834,045	514,500	9,393	36,545	7,619	1,357,937	44,164	1,402,101
1906	966,363	474,333	10,567	35,337	8,571	1,451,263	43,908	1,495,171
1907	1,098,682	434,167	11,741	34,129	9,524	1,544,589	43,652	1,588,242
1908	1,231,000	394,000	12,915	32,921	10,476	1,637,915	43,397	1,681,312
1909	1,670,533	379,000	14,089	31,713	11,429	2,063,622	43,141	2,106,763
1910	2,110,066	364,000	15,263	30,504	12,381	2,489,329	42,885	2,532,214
1911	2,549,599	349,000	16,437	29,296	13,333	2,915,036	42,630	2,957,666
1912	2,989,132	334,000	17,611	28,088	14,286	3,340,743	42,374	3,383,117
1913	3,428,664	319,000	18,786	26,880	15,238	3,766,450	42,118	3,808,568
1914	3,868,197	304,000	19,960	25,672	16,190	4,192,157	41,863	4,234,020
1915	4,307,730	289,000	21,134	24,464	17,143	4,617,864	41,607	4,659,471
1916	4,747,263	274,000	22,308	23,256	18,095	5,043,571	41,351	5,084,922
1917	5,186,796	259,000	23,482	22,048	19,048	5,469,278	41,096	5,510,374
1918	5,626,329	244,000	24,656	20,840	20,000	5,894,985	40,840	5,935,825
1919	5,354,177	256,120	24,952	23,217	18,000	5,635,249	41,217	5,676,466
1920	5,082,025	268,240	25,248	25,594	16,000	5,375,513	41,594	5,417,107
1921	4,809,873	280,360	25,545	27,971	14,000	5,115,778	41,971	5,157,749
1922	4,537,721	292,480	25,841	30,348	12,000	4,856,042	42,348	4,898,390
1923	4,265,569	304,600	26,137	32,725	10,000	4,596,306	42,725	4,639,031
1924	4,321,092	264,497	29,149	33,856	11,500	4,614,738	45,356	4,660,094
1925	4,376,615	224,394	32,161	34,988	13,000	4,633,170	47,988	4,681,158

1926	4,432,138	184,291	35,173	36,120	14,500	4,651,602	50,620	4,702,222
1927	4,487,661	144,188	38,185	37,251	16,000	4,670,034	53,251	4,723,285
1928	3,971,341	198,501	49,300	21,617	500	4,219,142	22,117	4,241,259
1929	4,145,290	154,006	24,930	15,998	4,000	4,324,226	19,998	4,344,224
1930	3,064,802	177,945	71,093	20,855	3,500	3,313,840	24,355	3,338,195
1931	2,612,515	107,876	24,092	45,831	4,170	2,744,483	50,001	2,794,484
1932	3,163,878	99,746	16,117	18,301	3,400	3,279,741	21,701	3,301,442
1933	3,243,239	125,473	35,559	11,001	10,900	3,404,270	21,901	3,426,171
1934	3,322,600	151,200	55,000	3,700	18,400	3,528,800	22,100	3,550,900
1935	4,061,050	173,800	102,500	18,900	11,200	4,337,350	30,100	4,367,450
1936	4,799,500	196,400	150,000	34,100	4,000	5,145,900	38,100	5,184,000
1937	5,173,000	219,200	128,600	19,600	6,100	5,520,800	25,700	5,546,500
1938	4,396,300	222,300	157,600	31,600	6,000	4,776,200	37,600	4,813,800
1939	6,522,500	244,100	21,300	64,200	10,300	6,787,900	74,500	6,862,400
1940	4,810,600	264,700	18,100	84,600	4,000	5,093,400	88,600	5,182,000
1941	5,567,160	245,480	15,940	71,120	3,800	5,828,580	74,920	5,903,500
1942	6,323,720	226,260	13,780	57,640	3,600	6,563,760	61,240	6,625,000
1943	7,080,280	207,040	11,620	44,160	3,400	7,298,940	47,560	7,346,500
1944	7,836,840	187,820	9,460	30,680	3,200	8,034,120	33,880	8,068,000
1945	8,593,400	168,600	7,300	17,200	3,000	8,769,300	20,200	8,789,500
1946	8,458,275	198,067	16,533	45,267	3,433	8,672,875	48,700	8,721,575
1947	8,323,150	227,533	25,767	73,333	3,867	8,576,450	77,200	8,653,650
1948	8,188,025	257,000	35,000	101,400	4,300	8,480,025	105,700	8,585,725
1949	8,052,900	180,000	29,200	130,000	5,200	8,262,100	135,200	8,397,300
1950	5,376,600	130,300	14,500	93,600	7,300	5,521,400	100,900	5,622,300
1951	5,582,800	225,300	300	36,700	17,000	5,808,400	53,700	5,862,100
1952	4,355,200	172,600	4,150	84,900	200	4,531,950	85,100	4,617,050
1953	4,111,800	103,700	8,000	65,100	700	4,223,500	65,800	4,289,300
1954	4,654,700	206,000	20,800	61,000	1,900	4,881,500	62,900	4,944,400
1955	4,640,000	150,000	16,800	88,900	2,000	4,806,800	90,900	4,897,700
1956	5,876,500	155,600	16,600	14,000	0	6,048,700	14,000	6,062,700
1957	6,482,600	111,300	19,000	48,300	300	6,612,900	48,600	6,661,500
1958	4,154,800	172,000	35,400	30,700	0	4,362,200	30,700	4,392,900
1959	5,750,300	231,400	75,500	111,700	11,900	6,057,200	123,600	6,180,800
1960	5,922,700	235,900	115,200	43,200	24,200	6,273,800	67,400	6,341,200
1961	6,370,500	221,300	135,400	56,100	15,800	6,727,200	71,900	6,799,100
1962	6,976,700	237,400	246,100	113,900	52,700	7,460,200	166,600	7,626,800

Table 1: Data from the literature with linear interpolation of missing years in blue. Values and estimates presented above in pounds.

Year	Florida			Alabama			Louisiana			Mississippi			Texas		
	p(vs)	*p(US|vs)*	*p(US)*	*p(vs)*	*p(US|vs)*	*p(US)*	*p(vs)*	*p(US|vs)*	*p(US)*	*p(vs)*	*p(US|vs)*	*p(US)*	*p(vs)*	*p(US|vs)*	*p(US)*
1880		1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00
1881		1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00
1882		1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00
1883		1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00
1884		1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00
1885		1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00
1886		1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00
1887		1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00
1888		1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00
1889		1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00
1890		1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00
1891		1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00
1892		1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00
1893		1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00
1894	0.77	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00
1895	0.77	0.95	0.96	1.00	0.95	0.95	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.95	0.95
1896	0.76	0.91	0.93	1.00	0.91	0.91	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.91	0.91
1897	0.78	0.86	0.89	1.00	0.86	0.86	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.86	0.86
1898	0.76	0.81	0.86	1.00	0.81	0.81	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.81	0.81
1899	0.73	0.77	0.83	1.00	0.77	0.77	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.77	0.77
1900	0.71	0.72	0.80	1.00	0.72	0.72	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.72	0.72
1901	0.69	0.67	0.77	1.00	0.67	0.67	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.67	0.67
1902	0.66	0.63	0.76	1.00	0.63	0.63	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.63	0.63
1903	0.66	0.58	0.72	1.00	0.58	0.58	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.58	0.58
1904	0.66	0.53	0.69	1.00	0.53	0.53	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.53	0.53
1905	0.66	0.48	0.66	1.00	0.48	0.48	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.48	0.48
1906	0.66	0.44	0.63	1.00	0.44	0.44	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.44	0.44
1907	0.66	0.39	0.60	1.00	0.39	0.39	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.39	0.39
1908	0.65	0.34	0.57	1.00	0.34	0.34	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.34	0.34
1909	0.65	0.30	0.54	1.00	0.30	0.30	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.30	0.30
1910	0.65	0.25	0.51	1.00	0.25	0.25	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.25	0.25
1911	0.65	0.25	0.51	1.00	0.25	0.25	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.25	0.25
1912	0.65	0.25	0.51	1.00	0.25	0.25	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.25	0.25
1913	0.65	0.25	0.51	1.00	0.25	0.25	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.25	0.25
1914	0.65	0.25	0.51	1.00	0.25	0.25	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.25	0.25
1915	0.65	0.25	0.51	1.00	0.25	0.25	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.25	0.25
1916	0.65	0.25	0.52	1.00	0.25	0.25	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.25	0.25
1917	0.64	0.25	0.52	1.00	0.25	0.25	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.25	0.25
1918	0.64	0.25	0.52	1.00	0.25	0.25	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.25	0.25
1919	0.64	0.25	0.52	1.00	0.25	0.25	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.25	0.25
1920	0.64	0.25	0.52	1.00	0.25	0.25	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.25	0.25
1921	0.64	0.25	0.52	1.00	0.25	0.25	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.25	0.25
1922	0.64	0.25	0.52	1.00	0.25	0.25	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.25	0.25
1923	0.64	0.25	0.52	1.00	0.25	0.25	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.25	0.25
1924	0.66	0.25	0.51	1.00	0.25	0.25	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.25	0.25
1925	0.68	0.25	0.49	1.00	0.25	0.25	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.25	0.25
1926	0.70	0.25	0.47	1.00	0.25	0.25	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.25	0.25

1927	0.73	0.25	0.46	0.96	0.25	0.28	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.25	0.25
1928	0.64	0.25	0.52	0.68	0.25	0.49	0.00	0.00	1.00	0.00	0.00	1.00	0.96	0.25	0.28
1929	0.58	0.25	0.57	0.95	0.25	0.29	0.00	0.00	1.00	0.00	0.00	1.00	0.86	0.25	0.35
1930	0.69	0.25	0.48	0.88	0.25	0.34	0.00	0.00	1.00	0.00	0.00	1.00	0.83	0.25	0.38
1931	0.64	0.25	0.52	0.97	0.25	0.27	0.00	0.00	1.00	0.00	0.00	1.00	0.93	0.25	0.30
1932	0.57	0.25	0.57	0.94	0.25	0.30	0.00	0.00	1.00	0.00	0.00	1.00	0.62	0.25	0.53
1933	0.57	0.50	0.71	0.94	0.50	0.53	0.00	0.00	1.00	0.00	0.00	1.00	0.62	0.50	0.69
1934	0.57	0.43	0.67	0.94	0.17	0.22	0.00	0.00	1.00	0.00	0.00	1.00	0.62	0.43	0.65
1935	0.57	0.45	0.68	0.94	0.18	0.23	0.00	0.00	1.00	0.00	0.00	1.00	0.62	0.45	0.66
1936	0.57	0.48	0.70	0.94	0.19	0.24	0.00	0.00	1.00	0.00	0.00	1.00	0.62	0.48	0.68
1937	0.57	0.50	0.71	0.94	0.20	0.25	0.00	0.00	1.00	0.00	0.00	1.00	0.62	0.50	0.69
1938	0.57	0.58	0.76	0.94	0.20	0.25	0.00	0.00	1.00	0.00	0.00	1.00	0.62	0.58	0.74
1939	0.57	0.65	0.80	0.94	0.19	0.24	0.00	0.00	1.00	0.00	0.00	1.00	0.62	0.65	0.78
1940	0.57	0.58	0.76	0.94	0.18	0.23	0.00	0.00	1.00	0.00	0.00	1.00	0.62	0.58	0.74
1941	0.57	0.49	0.71	0.94	0.18	0.23	0.00	0.00	1.00	0.00	0.00	1.00	0.62	0.49	0.68
1942	0.57	0.52	0.72	0.94	0.21	0.26	0.00	0.00	1.00	0.00	0.00	1.00	0.62	0.52	0.70
1943	0.57	0.44	0.68	0.94	0.18	0.23	0.00	0.00	1.00	0.00	0.00	1.00	0.62	0.44	0.65
1944	0.57	0.47	0.70	0.94	0.17	0.22	0.00	0.00	1.00	0.00	0.00	1.00	0.62	0.47	0.67
1945	0.57	0.42	0.67	0.94	0.15	0.20	0.00	0.00	1.00	0.00	0.00	1.00	0.62	0.42	0.64
1946	0.57	0.53	0.73	0.94	0.26	0.30	0.00	0.00	1.00	0.00	0.00	1.00	0.62	0.53	0.71
1947	0.57	0.55	0.74	0.94	0.24	0.29	0.00	0.00	1.00	0.00	0.00	1.00	0.62	0.55	0.72
1948	0.57	0.52	0.72	0.94	0.26	0.30	0.00	0.00	1.00	0.00	0.00	1.00	0.62	0.52	0.70
1949	0.57	0.57	0.75	0.94	0.25	0.30	0.00	0.00	1.00	0.00	0.00	1.00	0.62	0.57	0.73
1950	0.57	0.52	0.72	0.94	0.20	0.25	0.00	0.00	1.00	0.00	0.00	1.00	0.62	0.52	0.70
1951	0.57	0.63	0.79	0.94	0.31	0.35	0.00	0.00	1.00	0.00	0.00	1.00	0.62	0.63	0.77

Table 2: Estimated proportion of the total catch from the U.S. fleet made in Gulf of Mexico waters currently under United States jurisdiction (*p(US)*) as estimated by the fraction of total landings made by vessels, also known as smacks (*p(vs)*), and the fraction of the vessel landings that came from United States waters (*p(US|vs)*) as calculated by equation one. Color code for values:
Black = value from cited source, such as historical literature (not estimated)
Blue = estimated by linear interpolation
Green = calculated using equation one
Orange = values for Texas borrowed from Florida values

Year	Florida	Alabama	Louisiana	Mississippi	Texas	TOTAL
1952	0.63	0.38	1.00	1.00	0.56	0.58
1953	0.52	0.38	1.00	1.00	0.46	0.49
1954	0.41	0.37	1.00	1.00	0.36	0.40
1955	0.38	0.37	1.00	1.00	0.34	0.39
1956	0.43	0.37	1.00	1.00	0.38	0.44
1957	0.48	0.36	1.00	0.89	0.42	0.48
1958	0.76	0.36	1.00	0.79	0.67	0.70
1959	0.73	0.36	1.00	0.68	0.64	0.65
1960	0.82	0.35	1.00	0.58	0.73	0.70
1961	0.75	0.35	1.00	0.47	0.66	0.64
1962	0.79	0.35	1.00	0.37	0.70	0.65
1963	0.80	0.34	1.00	0.26	0.74	0.57

Table 3: Estimated proportion of the total catch from the U.S. fleet made in Gulf of Mexico waters currently under United States jurisdiction (*p(US)*) as estimated by Porch et al. (2006) for red snapper. Color code for values:
Black = value from cited source, such as historical literature (not estimated)
Blue = estimated by linear interpolation
Green = calculated using equation one

Year	Florida	Alabama	Mississippi	Texas	Louisiana	Eastern Gulf	Western Gulf	TOTAL
1880	1,514,570	0	0	0	0	1,514,570	0	1,514,570
1881	1,366,462	954	0	491	0	1,367,416	491	1,367,907
1882	1,218,353	1,908	0	981	0	1,220,261	981	1,221,243
1883	1,070,245	2,862	0	1,472	0	1,073,107	1,472	1,074,579
1884	922,136	3,816	0	1,963	0	925,952	1,963	927,915
1885	774,028	4,770	0	2,453	0	778,798	2,453	781,251
1886	625,919	5,724	0	2,944	0	631,643	2,944	634,587
1887	477,811	6,678	0	3,434	0	484,489	3,434	487,923
1888	329,702	7,632	0	6,010	7,727	337,334	13,738	351,072
1889	358,895	8,586	0	0	15,455	367,481	15,455	382,936
1890	342,581	9,445	0	0	15,455	352,026	15,455	367,481
1891	389,455	16,559	0	425	13,247	406,014	13,672	419,686
1892	436,329	23,673	0	850	11,039	460,002	11,889	471,891
1893	483,204	30,787	0	1,274	8,831	513,990	10,106	524,096
1894	530,078	37,901	0	1,699	6,623	567,979	8,323	576,301
1895	554,849	42,764	0	2,018	4,416	597,613	6,433	604,047
1896	581,263	47,438	0	2,319	2,208	628,701	4,527	633,228
1897	597,236	50,949	0	2,557	0	648,186	2,557	650,743
1898	501,739	126,714	1,008	7,514	818	629,461	8,332	637,792
1899	416,974	195,295	2,016	11,996	1,635	614,285	13,632	627,917
1900	334,242	252,593	3,024	15,756	2,453	589,859	18,209	608,068
1901	257,371	300,172	4,032	18,885	3,271	561,575	22,155	583,730
1902	283,508	343,483	5,040	21,728	4,089	632,032	25,817	657,848
1903	353,401	296,220	6,048	19,402	4,906	655,670	24,308	679,978
1904	415,956	252,406	7,057	17,180	5,724	675,418	22,904	698,322
1905	471,209	212,040	8,065	15,061	6,542	691,313	21,603	712,916
1906	524,646	179,196	9,073	13,350	7,359	712,914	20,709	733,623
1907	566,143	145,382	10,081	11,428	8,177	721,606	19,605	741,211
1908	600,448	115,018	11,089	9,610	8,995	726,555	18,605	745,160
1909	778,394	97,623	12,097	8,169	9,813	888,113	17,981	906,095
1910	925,503	78,133	13,105	6,548	10,630	1,016,741	17,178	1,033,919
1911	1,120,083	74,913	14,113	6,288	11,448	1,209,109	17,736	1,226,845
1912	1,315,282	71,693	15,121	6,029	12,266	1,402,096	18,295	1,420,391
1913	1,511,099	68,473	16,129	5,770	13,083	1,595,702	18,853	1,614,555
1914	1,707,536	65,254	17,137	5,511	13,901	1,789,927	19,412	1,809,339
1915	1,904,591	62,034	18,145	5,251	14,719	1,984,771	19,970	2,004,741
1916	2,102,266	58,814	19,153	4,992	15,537	2,180,233	20,528	2,200,762
1917	2,300,559	55,594	20,162	4,733	16,354	2,376,315	21,087	2,397,402
1918	2,499,471	52,375	21,170	4,473	17,172	2,573,015	21,645	2,594,660
1919	2,382,338	54,976	21,424	4,984	15,455	2,458,738	20,438	2,479,176
1920	2,264,822	57,578	21,678	5,494	13,738	2,344,078	19,231	2,363,309
1921	2,146,923	60,179	21,933	6,004	12,020	2,229,035	18,024	2,247,059
1922	2,028,640	62,781	22,187	6,514	10,303	2,113,608	16,817	2,130,425
1923	1,909,975	65,382	22,441	7,024	8,586	1,997,798	15,610	2,013,409
1924	1,873,771	56,774	25,027	7,267	9,874	1,955,573	17,141	1,972,714
1925	1,835,998	48,166	27,613	7,510	11,162	1,911,778	18,672	1,930,450
1926	1,796,656	39,558	30,200	7,753	12,450	1,866,414	20,203	1,886,616
1927	1,755,744	34,785	32,786	7,996	13,738	1,823,315	21,734	1,845,048

1928	1,761,198	83,271	42,329	5,230	429	1,886,798	5,659	1,892,457
1929	2,020,038	37,814	21,405	4,857	3,434	2,079,257	8,292	2,087,548
1930	1,273,484	52,403	61,040	6,814	3,005	1,386,927	9,819	1,396,746
1931	1,174,304	25,380	20,685	11,930	3,580	1,220,370	15,511	1,235,880
1932	1,545,659	25,281	13,838	8,372	2,919	1,584,778	11,291	1,596,069
1933	1,984,501	57,112	30,531	6,517	9,359	2,072,143	15,876	2,088,019
1934	1,918,300	28,563	47,223	2,054	15,798	1,994,086	17,852	2,011,938
1935	2,384,720	34,234	88,006	10,694	9,616	2,506,961	20,310	2,527,271
1936	2,889,396	40,271	128,790	19,839	3,434	3,058,457	23,273	3,081,730
1937	3,165,300	46,714	110,416	11,612	5,237	3,322,431	16,849	3,339,280
1938	2,863,585	47,375	135,315	20,067	5,152	3,046,275	25,218	3,071,494
1939	4,473,796	50,051	18,288	43,161	8,844	4,542,136	52,004	4,594,140
1940	3,133,444	52,140	15,541	53,723	3,434	3,201,125	57,157	3,258,282
1941	3,379,013	48,354	13,686	41,755	3,263	3,441,053	45,018	3,486,070
1942	3,931,818	50,045	11,832	34,762	3,091	3,993,694	37,853	4,031,547
1943	4,122,729	40,782	9,977	24,751	2,919	4,173,488	27,671	4,201,159
1944	4,679,268	35,481	8,122	17,686	2,748	4,722,871	20,433	4,743,304
1945	4,918,990	29,129	6,268	9,457	2,576	4,954,387	12,033	4,966,420
1946	5,300,728	51,799	14,196	27,540	2,948	5,366,723	30,488	5,397,211
1947	5,298,183	55,834	22,123	45,397	3,320	5,376,140	48,717	5,424,857
1948	5,090,963	67,212	30,051	61,152	3,692	5,188,226	64,844	5,253,070
1949	5,205,622	45,622	25,071	81,861	4,465	5,276,316	86,325	5,362,641
1950	3,480,371	28,910	12,962	58,769	6,525	3,522,243	65,294	3,587,538
1951	3,929,321	70,807	268	25,280	15,196	4,000,396	40,477	4,040,872
1952	2,452,656	58,629	3,710	42,499	179	2,514,995	42,678	2,557,673
1953	1,911,275	35,225	7,151	26,769	626	1,953,652	27,394	1,981,046
1954	1,705,939	68,133	18,593	19,630	1,698	1,792,665	21,328	1,813,993
1955	1,576,121	49,611	15,017	27,019	1,788	1,640,750	28,807	1,669,557
1956	2,258,786	51,463	14,839	4,756	0	2,325,089	4,756	2,329,844
1957	2,781,496	35,817	15,116	18,134	268	2,832,428	18,402	2,850,830
1958	2,822,615	55,350	24,999	18,387	0	2,902,964	18,387	2,921,351
1959	3,752,333	74,465	45,893	63,903	10,637	3,872,691	74,540	3,947,231
1960	4,341,318	73,805	59,727	28,190	21,632	4,474,849	49,822	4,524,671
1961	4,270,933	69,237	56,886	33,097	14,124	4,397,056	47,221	4,444,277
1962	4,926,802	74,274	81,396	71,270	47,108	5,082,472	118,379	5,200,851

Table 4: Estimated red grouper U.S. fleet landings from United States federal waters of the Gulf of Mexico adjusted for gutted weight. Estimates presented above in pounds.

Year	Source
1937	Martinez 1948
1938	Martinez 1948
1939	Martinez 1948
1940	Martinez 1948
1941	Martinez 1948
1942	Martinez 1948
1943	Martinez 1948
1944	Martinez 1948
1945	Martinez 1948
1946	Estimated by linear interpolation
1947	Estimated by linear interpolation
1948	Estimated by linear interpolation
1949	Estimated by linear interpolation
1950	Estimated by linear interpolation
1951	Estimated by linear interpolation
1952	Estimated by linear interpolation
1953	Estimated by linear interpolation
1954	Estimated by linear interpolation
1955	Estimated by linear interpolation
1956	Mar y Pesca: August 1958
1957	Mar y Pesca: August 1958; May 1958
1958	Mar y Pesca: July 1959
1959	Mar y Pesca: August 1960
1960	Estimated by linear interpolation
1961	Estimated by linear interpolation
1962	Estimated by linear interpolation
1963	Estimated by linear interpolation
1964	Mar y Pesca: November/December 1968
1965	Mar y Pesca: November/December 1968
1966	Mar y Pesca: November/December 1968
1967	Estimated by linear interpolation
1968	Estimated by linear interpolation
1969	Estimated by linear interpolation
1970	Klima 1976 (FAO Report)
1971	Klima 1976 (FAO Report)
1972	Klima 1976 (FAO Report)
1973	Klima 1976 (FAO Report)
1974	Estimated by taking average of previous three years
1975	Estimated by taking average of previous three years
1976	Estimated by taking average of previous three years
1977	Estimated by taking average of previous three years

Table 5: Source of quantitative red grouper Cuban landings information each year.

Year	Grouper: All Gulf Waters	Proportion Red Grouper	Red Grouper: All Gulf Waters	Proportion US Waters	Red Grouper: US Waters
1937			7,207,000	0.90	6,486,300
1938			7,207,000	0.90	6,486,300
1939			7,207,000	0.90	6,486,300
1940			7,207,000	0.90	6,486,300
1941			7,207,000	0.90	6,486,300
1942			3,068,000	0.86	2,640,994
1943			2,470,000	0.82	2,029,448
1944			3,834,000	0.78	2,999,945
1945			2,245,000	0.74	1,668,658
1946			2,545,055	0.70	1,791,966
1947			2,845,110	0.66	1,891,760
1948			3,145,165	0.63	1,968,042
1949			3,445,220	0.59	2,020,812
1950			3,745,275	0.55	2,050,069
1951			4,045,329	0.51	2,055,813
1952			4,345,384	0.47	2,038,044
1953			4,645,439	0.43	1,996,763
1954			4,945,494	0.39	1,931,969
1955			5,245,549	0.35	1,843,662
1956			5,545,604	0.35	1,949,123
1957	10,290,317	0.77	7,891,289	0.35	2,773,565
1958	7,797,400	0.78	6,062,568	0.35	2,130,822
1959	7,937,300	0.79	6,255,842	0.00	0
1960		0.80	6,859,615	0.00	0
1961		0.81	7,463,388	0.00	0
1962		0.82	8,067,161	0.00	0
1963		0.83	8,670,934	0.12	1,015,863
1964	11,023,113	0.84	9,274,707	0.23	2,173,199
1965	14,109,585	0.85	12,021,836	0.35	4,225,336
1966	16,534,670	0.86	14,264,117	0.35	5,013,435
1967		0.87	14,998,087	0.35	5,271,405
1968		0.88	15,732,058	0.35	5,529,375
1969		0.89	16,466,029	0.35	5,787,345
1970		0.91	17,200,000	0.33	5,625,305
1971		0.84	11,200,000	0.28	3,144,358
1972		0.85	11,600,000	0.28	3,207,059
1973		0.85	11,600,000	0.52	6,050,765
1974		0.86	11,466,667	0.35	4,030,210
1975		0.86	11,466,667	0.35	4,030,210
1976		0.86	11,466,667	0.35	4,030,210
1977		0.86	11,466,667	0.35	4,030,210

Table 6: Estimated red grouper catch made by Cuban vessels fishing within present day federal waters. Color code for values:
Black = value from cited source, such as historical literature (not estimated)
Blue = estimated by linear interpolation
Green = calculated using ratios
Red = average of values

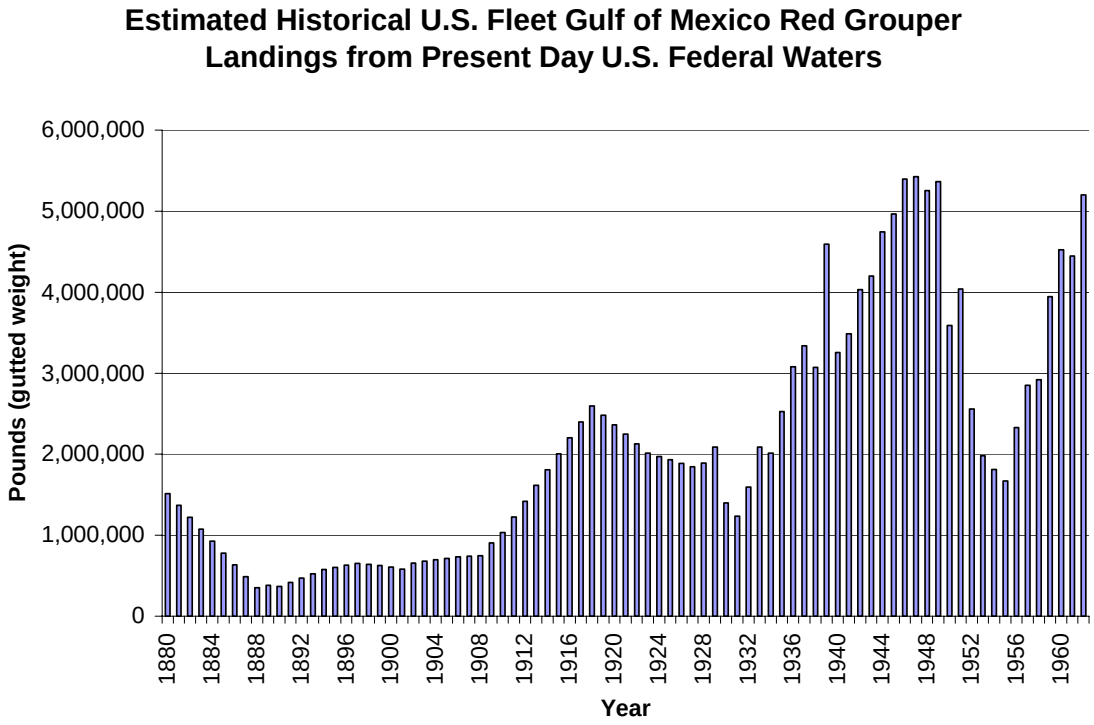

Figure 1: Estimated historical U.S. fleet red grouper landings from present day U.S. federal waters in the Gulf of Mexico.

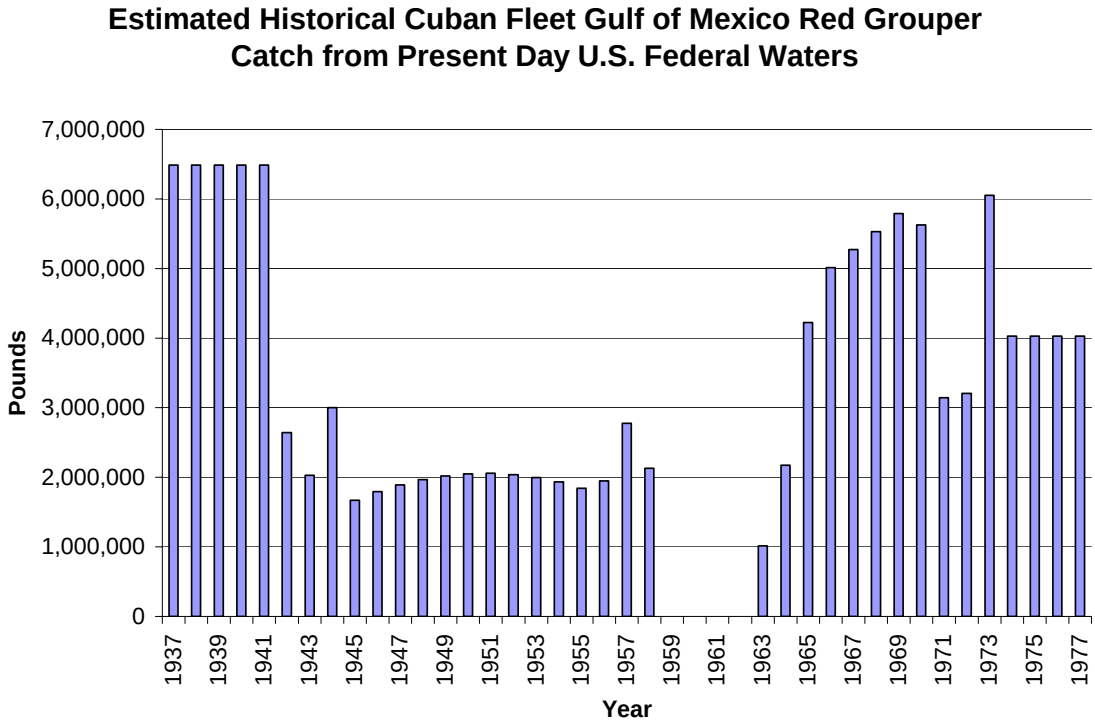

Figure 2: Estimated Cuban Gulf of Mexico fleet red grouper landings from present day U.S. federal waters.