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COMMERCIAL FISHERY DATA FROM A PROPOSED OCEAN THERMAL ENERGY CONVERSION (OTEC) SITE IN PUERTO RICO

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PREFACE

The U.S. Department of Energy is conducting environmental studies at several proposed Ocean Thermal Energy Conversion (OTEC) sites to identify the potential impacts from commercial scale operation of ocean thermal power plants in tropical waters (United States Department of Energy, 1979). As part of these studies the Lawrence Berkeley Laboratory is investigating the fishery resources at potential OTEC sites. At this time, the two main efforts of the ichthyological survey are:

- A compilation and analysis of fishery data from OTEC regions to determine the sizes of fish stocks in the OTEC regions through time.
- A literature survey of fish species occuring in the OTEC regions to establish their distribution, abundance and ecology.

PURPOSE

This report describes the fish resources at a proposed OTEC site based upon commercial fisheries data from Puerto Rico. Records of commercial landings and relative fishing effort are used to examine temporal fluctuations in the abundance of exploited fish stocks at a proposed OTEC site located off the southeast coast of Puerto Rico (PROTEC, $17^{o}57'N$, $65^{o}52'W$) (Figure 1). Such data are useful as a first approximation of natural flucuations in the fish populations so that initial potential impacts of plant operations may by considered. The information will provide OTEC plant designers with an idea of the economic value of the fisheries in the vicinity of the proposed site. Further work is required on specific fish attraction mobility and depth distribution to more precisely quantify impacts.

ACKNOWLEDGMENTS

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INTRODUCTION

Fish are of economic and ecological significance. The economic importance of fish lies in their commercial and recreational values. Commercially, they are a source of food and industrial products. Recreational fisheries result in a great circulation of money as anglers purchase gear, boats and motors, and as they expend money on travel, food and lodging (Bond, 1979). Ecologically, fish are an intergral part of marine ecosystems and play a wide variety of roles within these systems (States, et al., 1978).

The operation of Ocean Thermal Energy Conversion (OTEC) power plants may alter fish populations in the regions surrounding the OTEC plants. Alterations may be the result of direct impacts on the fish (e.g. entrapment, impingement and biocides) or of impacts on the environment upon which the fish depend (e.g. disturbance of temperature structures, salinity gradients and nutrient levels) (United States Department of Energy, 1979; Wilde, 1979). Identification of the potential effects of OTEC operations on fishery resources requires knowledge of the fish species in the area, their life histories, their ecological roles and their environmental restraints, as well as, knowledge of the distribution, abundance, structure and dynamics of the fish populations. The first step in estimating OTEC's possible impacts on fishery resources is to determine the species composition and the population sizes of fish within the OTEC region.

Information on the species present in an area and their population sizes is often available from scientific collections and from commercial and recreational fishery records. Scientific collections generally provide exhaustive species lists, but rarely provide information on the population sizes of the list's components. Commercial and sport fishery records may include data on the kinds, numbers, sizes, weights, and selling prices of the fishes landed. Commercial and sport fishery records do not however, reflect the true species composition of an area; they include only those species which are of commercial value or are prized as food- or game-fish (Pope et al., 1975; Gulland, 1977). In this report, commercial fishery data are used to identify common commercially important species, and to obtain a general impression of the abundance of those species in Puerto Rico and at the OTEC site off Puerto Rico (PROTEC).

THE FISHERY

The primary fishery in Puerto Rican waters is a shallow inshore fishery which uses traditional gear (ie. fish pots, troll lines, hand lines) and small fishing craft (less than 20 feet in length). As is common of islands throughout the Caribbean region, no major commercial offshore fishery exists near Puerto Rico. (Holmsen, 1967; Suarez-Caabro, 1970).

Puerto Rico's fish fauna is extremely diverse with some 400 species reported (Erdman, 1956). Many of these species are captured by the inshore fishery, and nearly 130 are commercially important (Suarez-

Caabro, 1970). Table 1 lists the fish most commonly reported in commercial landings.

Commercial landings include both demersal and pelagic fishes. Demersal and reef fishes dominate the landings because the types of gear used in the fishery inherently select for these fishes. Even if pelagic fishes are seasonally abundant in nearshore waters, they may not be captured in great numbers. The fish pot is the most common type of fishing gear used in Puerto Rico (Table 2). In 1976, there were 8,191 fish pots reported operating in Puerto Rico; this represents 65% of the total fishing gear units on the island, and accounts for over two million pounds of the fish caught (62% of the total catch). Fish pots capture demersal or bottom fish such as snappers (Lutjanidae), groupers (Serranidae), grunts (Haemulidae), and goatfish (Mullidae). The average depth fished with fish pots is 38.4 meters (21 fathoms) (Juhl and Suarez-Caabro, 1973). Pelagic species such as mackerels and tunas (Scombridae), barracuda (Sphyraenidae), and dolphin fish (Coryphaenidae) are caught primarily with troll lines beach seines, and gill nets.

SOURCE OF THE DATA

A program to gather statistical information on Puerto Rico's inshore fisheries began in July of 1967. The Puerto Rico Department of Agriculture compiles and publishes the landing records. The landing records are published in two forms, monthly or quarterly "Information Bulletins" and annual reports entitled "The Status of Fisheries in Puerto Rico". These publications (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar 1976; Volmar, 1978) provide the data for this report.

Landing data is gathered by statistical agents working with fish dealers and fishermen. The dealers and fishermen record the species, weight, and selling price of landed fish. Because of the great species diversity in the catches, many fishermen and dealers group species and report them collectively. For example, silk snapper (Lutjanus vivanus), blackfin snapper (L. buccanella) and vermilion snapper (Rhomboplites aurorubens) are all reported as "red snapper". To determine more precisely the species composition of the landings statistical agents periodically sample the landings (Juhl and Suarez-Caabro 1972a).

Puerto Rico is divided into four regions for the gathering and the reporting of commercial fishery statistics: the North Coast, the South Coast, the East Coast, and the West Coast (Figure 1). The PROTEC area off Punta Tuna lies near the boarders of the South and East Coasts. The East Coast region covers the shelf area from Fajardo in the north to Maunabo in the south and includes Culebra, Vieques and numerous small islands to the east. The South Coast region includes the shelf area from Lajas east to Patillas (Juhl and Suarez-Caabro, 1972a).

FISHERY DATA: PRESENTATION & DISCUSSION

Figures 2 through 23 and Table 3 present the landing records of the major fish groups from 1969 to 1978. Table 3 and the upper graphs in Figures 2 to 23 show the weight (80% actual production) of commercial landings for each fish group. It is estimated that the reported landings represent 80% of the actual landings (i.e. 80% actual production).

The reported annual commercial landings of most fish groups (Figures 2-23; Table 3) show a dramatic increase from 1969 to 1970. The increase probably represent improvements in data collection rather than an actual increase in production (Juhl and Suarez-Caabro, 1972a). Therefore, the following examination and discussion of the inshore fishery in Puerto Rico does not include the 1969 landing data.

The annual landings from 1970 to 1978 often exhibit wide fluctuations (Figures 2-23; Table 3). For example, the 1972 reported grunt landings in Puerto Rico (Figure 2) were 355,000 pounds, in 1977 grunt landings reached a high of approximately 1,013,000 pounds, more than twice the 1972 landings. In most cases the fluctuations follow a general pattern with the smallest landing reported in 1973, 1974 or 1975, and the largest landing reported in 1970, 1971, 1977 or 1978 (e.g. Lane Snapper, Figure 5; Yellowtail Snapper, Figure 6; Mackerel, Figure 10; Jack, Figure 18). The total fish landings reflect this trend, exhibiting a somewhat u-shaped curve (Figure 24). The total landing weight falls from 3,938,930 pounds in 1970 to 2,916,000 pounds in 1973 then steadily rises for the next 5 years, reaching a high of 5,100,600 pounds in 1978. The combined total fish landings on the South and East Coasts also form a u-shaped curve with highs at the beginning and the end of the data period, and lows in the middle (Figure 24).

Landing records cannot indicate the size of a fish stock or its temporal fluctuations in abundance. Variations in landing weights may be due to factors other than population dynamics. One major factor altering landings is fishing effort (i.e. the total fishing gear in use for a specified period of time); another factor is the effectiveness of that fishing effort (i.e. the percentage removal of fish from a stock) (Ricker, 1975). Catch per unit of effort (i.e. the catch of fish, in numbers or in weight, taken by a defined unit of fishing effort) can be used as an index of abundance (Ricker, 1975). Catch per unit effort reflects the effectiveness of a unit of gear or fishing method, the fishing time, and the availability of fish.

Reports available on Puerto Rico's commercial inshore fishery do not provide sufficient information to determine annual fishing effort or to calculate the catch per unit of effort. First, there is no information on fishing time or fishing power. Thus, fishing effort cannot be calculated. Second, production data is based on landings and not catch. Commercial landings rarely represent the actual weight or species composition of the catch. For a number of reasons only a portion of the catch is landed for sale. Fish may be discarded at sea because of governmental regulations or because they are not readily marketable. Some of the catch may be kept for consumption by the fisherman and his family or exchanged for goods and services (Williams, 1977).

Though statistics on fishing effort are not readily available, data on the number of fishermen fishing craft, and units of gear used in the fishery are available. These data provide an indication of the intensity of the fishing effort. They are presented in Figures 25 to 29 and in Tables 2 and 4, and discussed below.

Fishermen participate in Puerto Rico's commercial inshore fishery on both a regular and casual basis. Commercial fishermen who receive more than 50% of their income from fishing, or spend more than half of their working time catching or selling fish or shellfish are defined as regularly working in the fishery. While casual fishermen are those commercial fishermen who receive less than 50% of their income from fishing, or spend less than half of their working time in that occupation (Suarez-Caabro, 1970). In 1970, 1,082 fishermen participated in the inshore fishery; 38% (406 fishermen) fished regularly, and 62% (676 fishermen) fished on a casual or part-time basis (Juhl and Suarez-Caabro, 1971). This high percentage of casual fishermen is indicitative of an artisanal fishery. However, as Table 4 shows, there appears to be a shift toward a fishery which is less artisanal in nature. There has been an increase in both the number of fishermen and the percentage of licensed fishermen practicing their trade on a regular basis.

From 1969 to 1976 the number of fishing craft active in Puerto Rico's commercial inshore fishery varied annually (Figures 25 and 28; Table 2). The average number of registered boats was 806, with a low of 785 craft in 1973 and a high of 901 craft in 1976. Annual variations in the number of boats working on the South and East Coasts were slight, and form a shallow u-shaped curve (Figures 26 and 28). The combined South and East Coast yearly average was 389 boats.

The inshore fishery has traditionally used small craft (e.g. in 1976 over 80% were less than 18 feet long) equipped with few labor saving devices, and having short fishing radiuses. Recently larger well-equipped vessels have been entering the fishery. By the end of 1976, 36 vessels in the 25 to 51 foot length-range (8-16 meters) furnished with fish detection devices, hydraulic reels, and refrigeration or ice boxes were active in the inshore fleet. These vessels permitted the fishery to enter deeper (100-200 fathoms; 180-365 meters) more productive waters farther from shore. While representing 4% of the fishing fleet in 1976, the modern vessels were responsible for 7.6% of the reported production of fish and shellfish that year (Table 5) (Volmar, 1978).

The amount of fishing gear used throughout Puerto Rico has remained fairly constant during the data period (Figures 25 and 29; Table 2). The annual average was 12,678 units. The South and East Coasts experienced some fluctuations in the amount of gear operating (Figure 26). The differences were mainly due to changes in the number of fish pots in use.

If the number of fishermen, the proportion of fishermen regularly fishing, the number of craft, the type of craft, the amount of gear and the type of gear are indicators of fishing pressure, then fishing pressure was not constant over the eight year period examined. The number of fishermen and the proportion regularly fishing varied considerably.

The number of boats used in the fishery changed yearly. However, the amount and types of gear used remained fairly constant.

There appear to be correlations between landings and some of the factors which affect fishing pressure. The fluctuations in landings may be due to varations in fishing pressure. However, it must be emphasized that correlation does not imply causation, and that without statistics on fishing effort and catch per unit of effort it is impossible to know whether the variations in landings reflect changes in stock density or changes in fishing effort or both. Some of the correlations between landings and factors which may alter fishing pressure are examined below.

It is reasonable to assume that the number of fishermen participating in a fishery influences the fishing effort, since an increase in the number of fishermen probably means an increase in the number of man-hours spent fishing (i.e. an increase in fishing time). The changes in the total landings roughly correspond to changes in the number of fishermen participating in the fishery. Both the curve for weight of the landings and the number of fishermen are u-shaped with a low in 1973; however, the following year the weight of the landings exhibit a far more gradual increase than does the number of fishermen.

The percentage of fishermen regularly participating in the fishery would also be expected to influence fishing time. From 1969 to 1976 the percentage of fishermen fishing on a regular basis tended to increase annually.

The kinds and number of boats in the fishery would be expected to effect fishing pressure. From 1970 to 1976 the number of boats active in the fishery varied. The fluctuations in the number of boats show a correspondence to variations in number of fishermen and to the fish landed. Throughout the data period the majority of the fishing fleet was composed of traditional types of fishing craft. Various government-sponsored programs encourage the entrance of modern well-equipped vessels into the fishing fleet. The modern vessels appear to be more effective than other vessels in the fleet, but their apparent effectiveness (4% of the fleet v.s. 7.6% of the production) may also be due to increased man-power per boat or to their ability to exploit previously hard to reach resources.

The amount of fishing pressure will be altered when the effectiveness of the gear changes. If the same type of gear is used in the same manner to fish a population, the effectiveness of the equipment is expected to be similar, unless there are variations in the fish availability. During the study period the gear and fishing methods did not change substantially, so it is assumed that the only changes in fishing pressure due to gear were those resulting from changes in the amount of time the gear was in use.

The lower graphs in Figures 2 through 23 compare the landing of each fish group on the South and East Coasts with the total Puerto Rican landings of that group. The graphs show the relative importance of the area in terms of Puerto Rico's total commercial fish production. For

example, compare the production of porgy and silk snapper. On the average 85% of the porgy landed in Puerto Rico is landed on the South and East Coasts (Figure 13) while the South and East Coasts are generally responsible for less than 25% of Puerto Rico's silk snapper production (Figure 4).

The composition (by percent weight) of the combined South Coast and East Coast commercial landings between 1970 and 1978 is shown in Figure 30. Grunt (Pomadasyidae), grouper (Serranidae), goatfish (Mullidae), mackerel (Scombridae), and snapper (Lutjanidae) were the most commonly landed groups. The nine most common groups annually comprise more than 80% of the landings.

Despite considerable flux in the annual landing weights of most species groups (See Table 3 and Graphs 2 to 23), the composition of the landings in the South and East Coasts remained fairly consistent. No group's relative contribution to the total landing weight varied more than 10 percent. If the relative fishing effort for each group was constant during this time period, the consistency of the landing compositions may indicate that the relative abundance of the fish groups was constant.

CONCLUSIONS

The fishery has traditionally been and artisanal fishery utilizing the inshore resources. In recent years, with the increase in the number of fishermen and the percentage fishing on a regular basis, the fishery has become less artisanal. Modern well-equipped vessels have been added to the fishing fleet enabling the expansion into deeper, offshore waters.

Annual landings of fish varied in weight during the eight year period examined. The fluctuations could not be attributed to any one parameter. It is not known whether any significant changes in the fish stock have occured during the period because information on catch per unit of effort was unavailable.

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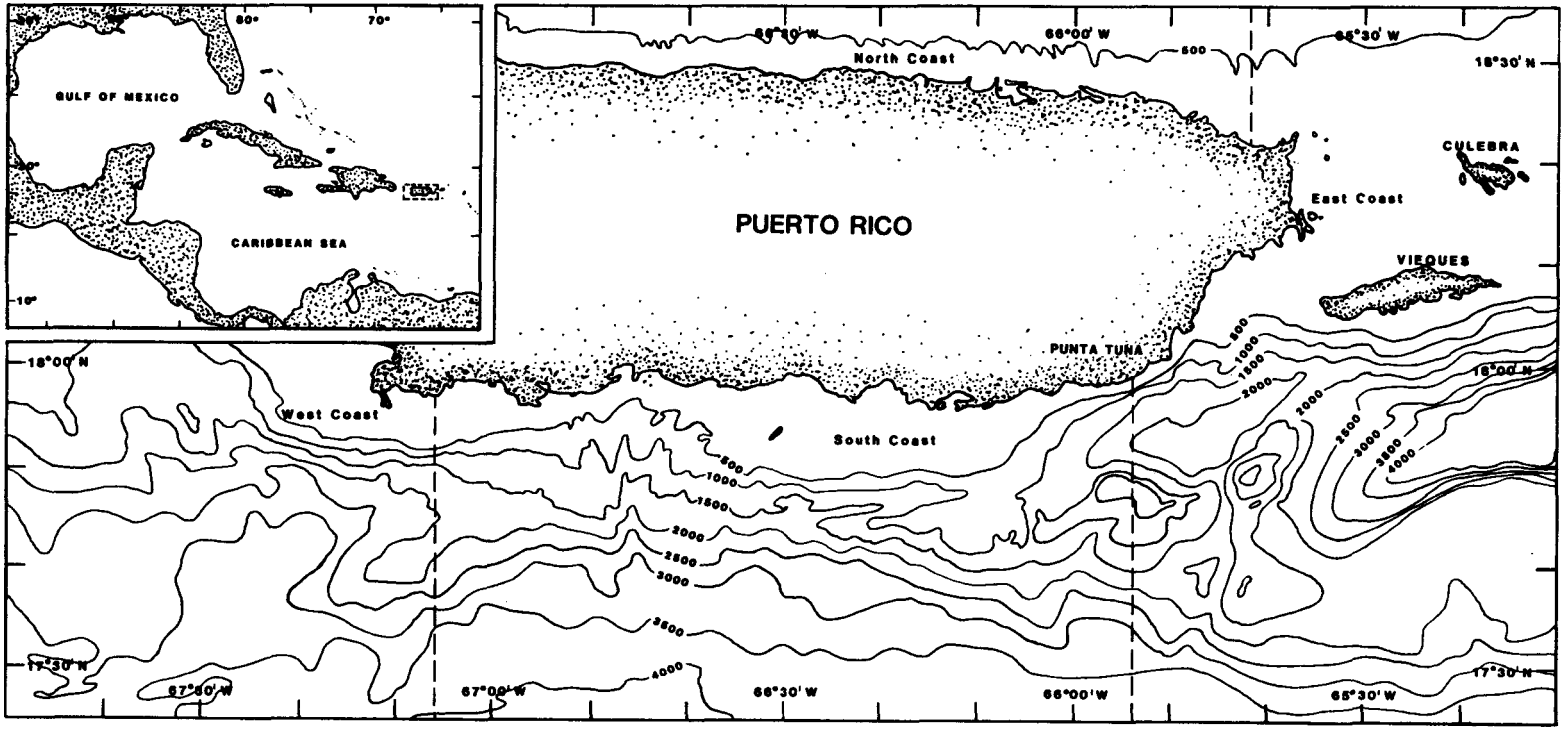

Figure 1. Map of Puerto Rico and its fishing areas.

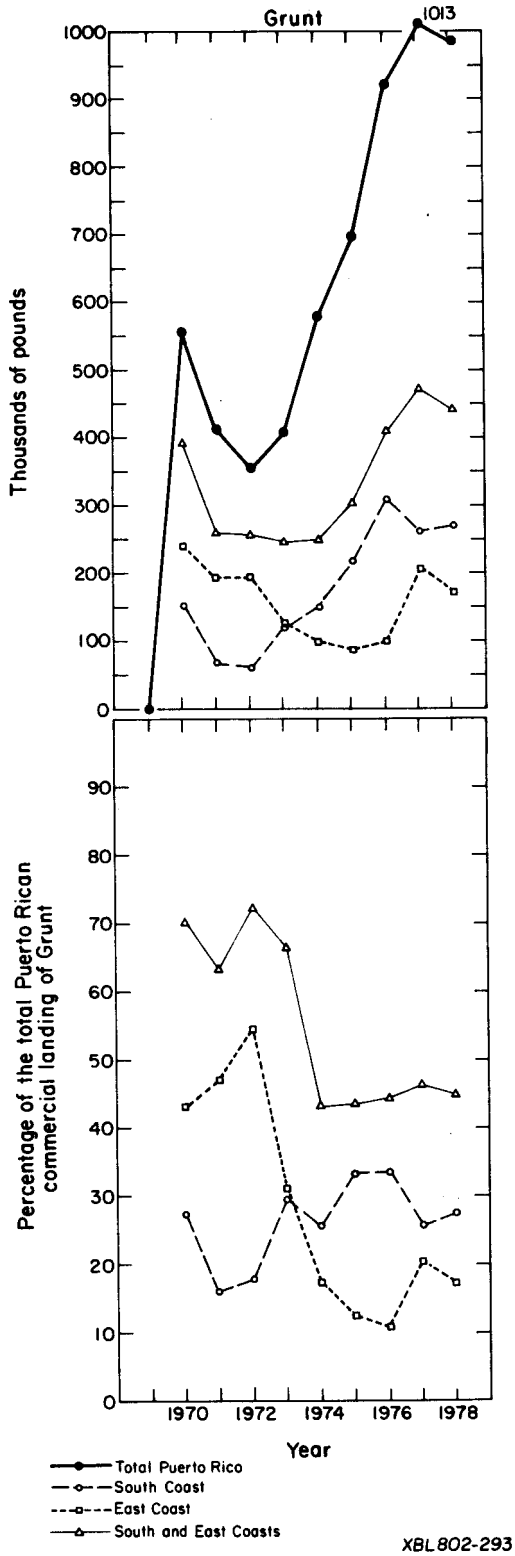

Figure 2. Commercial landings of grunt, Haemulon spp. (Family Pomadasyidae) in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of grunt to the total Puerto Rican commercial landing of grunt. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

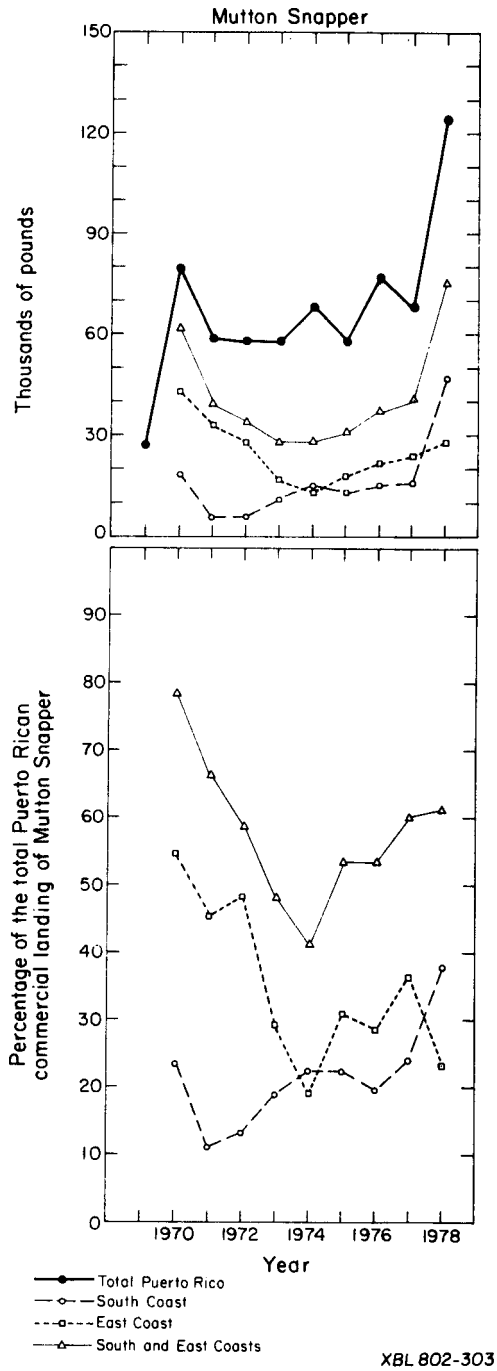

Figure 3. Commercial landings of mutton snapper, Lutjanus analis (Family Lutjanidae), in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of mutton snapper to the total Puerto Rican commercial landing of mutton snapper. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

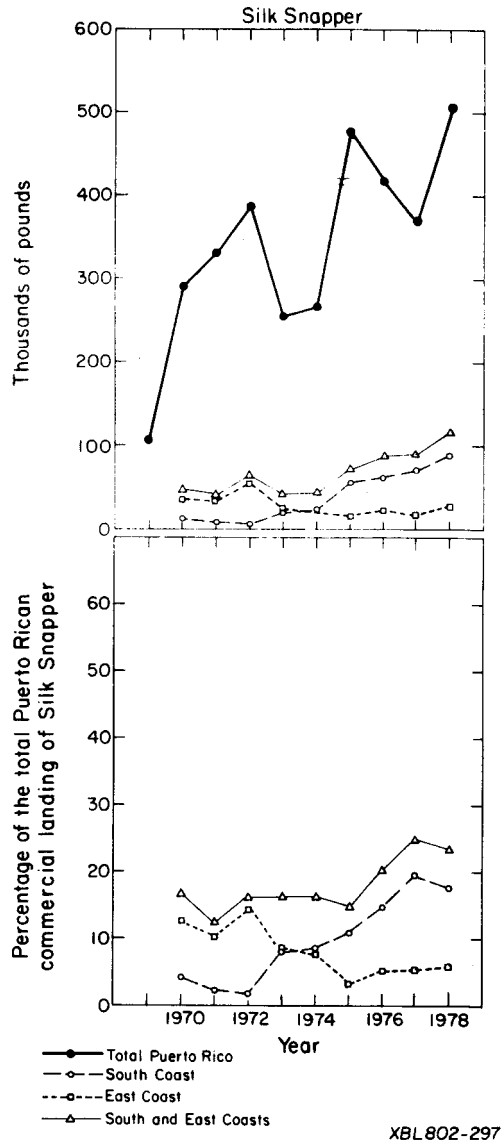

Figure 4. Commercial landings of silk snapper, Lutjanus vivanus (Family Lutjanidae), in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of silk snapper to the total Puerto Rican commercial landing of silk snapper. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

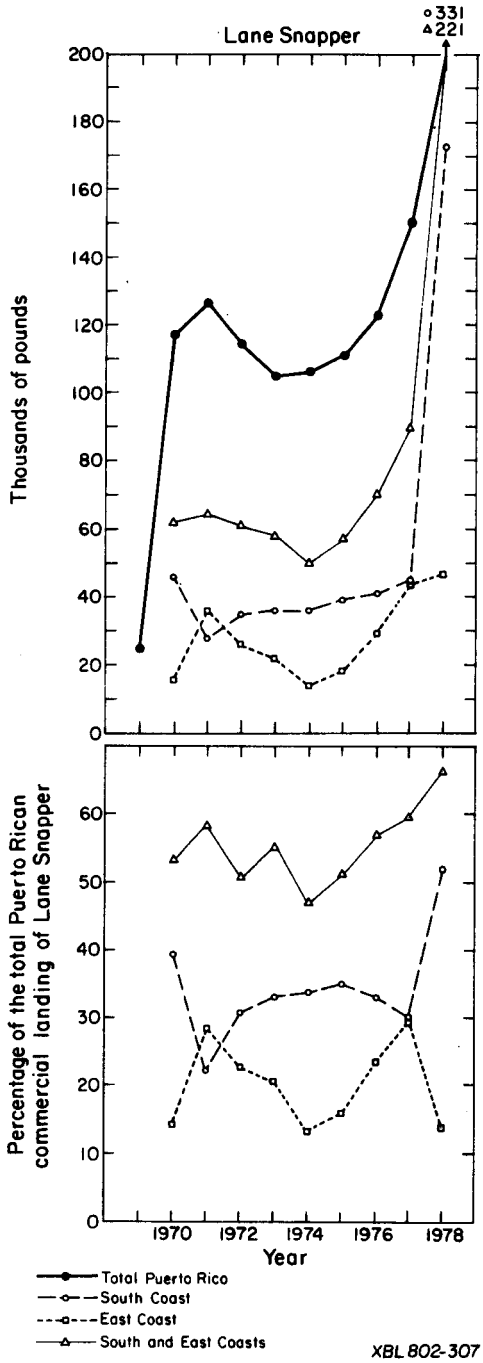

Figure 5. Commercial landings of lane snapper, Lutjanus synagris (Family Lutjanidae), in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of lane snapper to the total Puerto Rican commercial landing of lane snapper. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

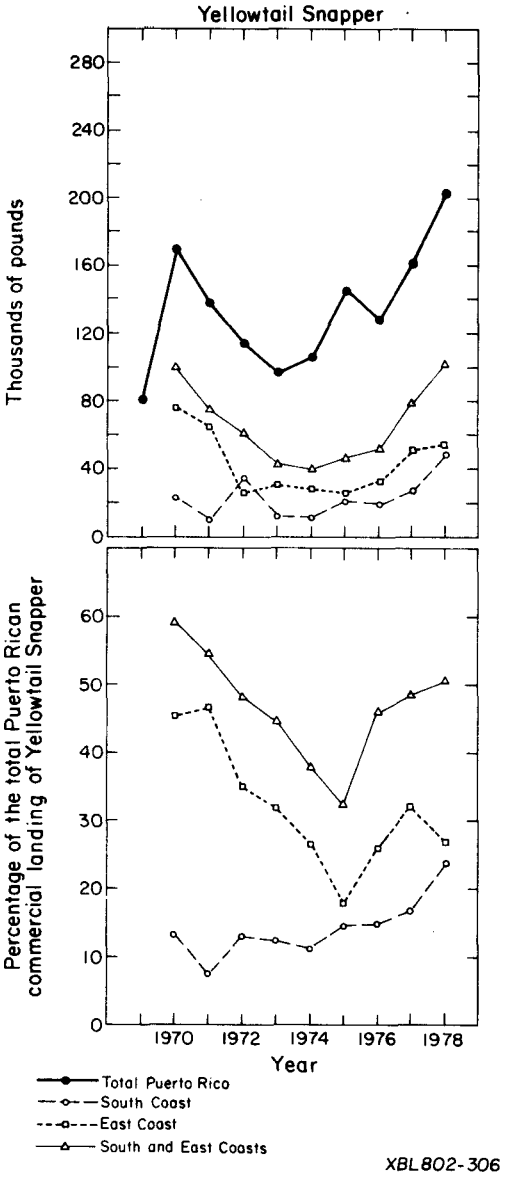

Figure 6. Commercial landings of yellowtail snapper, Ocyurus chrysurus (Family Lutjanidae), in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of yellowtail snapper to the total Puerto Rican commercial landing of yellowtail snapper. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976 Volmar, 1978)

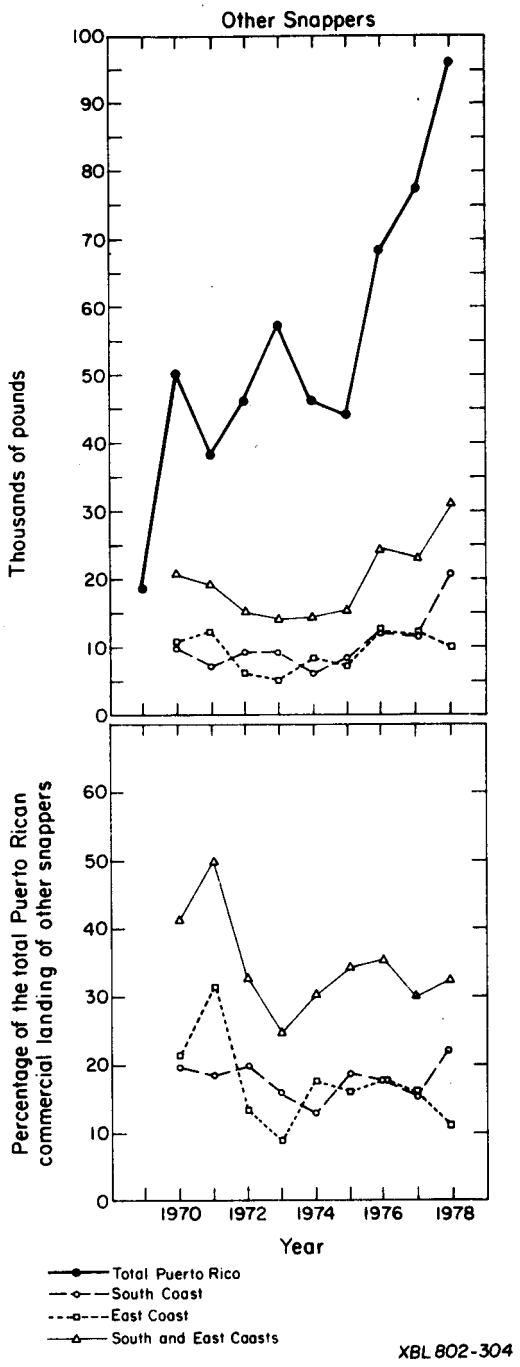

Figure 7. Commercial landings of other snapper, Family Lutjanidae, in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of other snapper to the total Puerto Rican commercial landing of other snapper. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

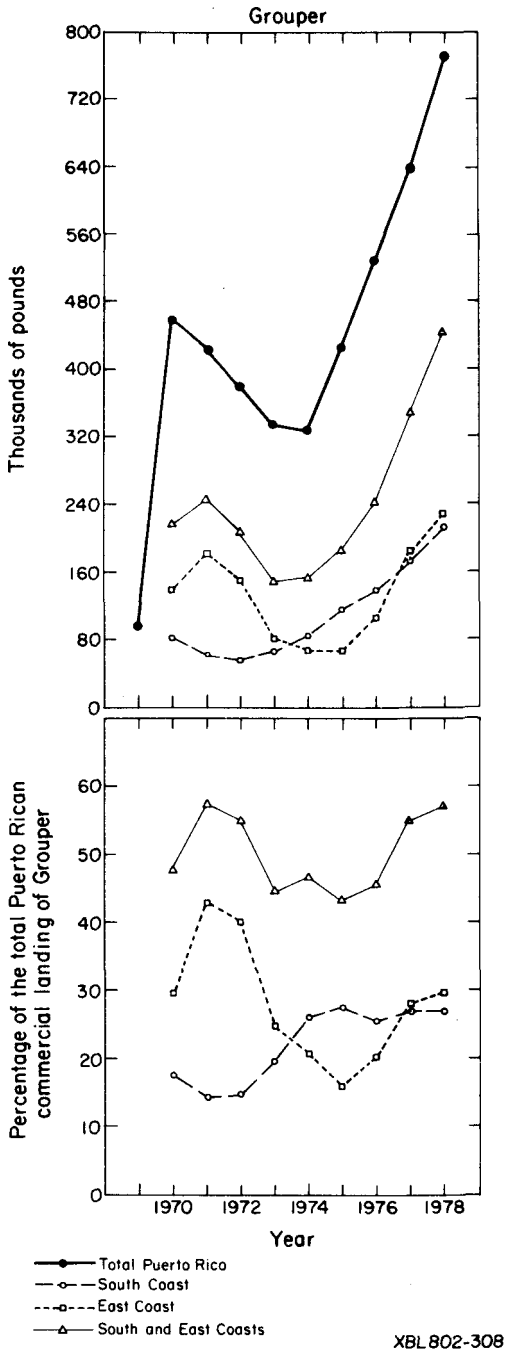

Figure 8. Commercial landings of grouper, Family Serranidae, in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of grouper to the total Puerto Rican commercial landing of grouper. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

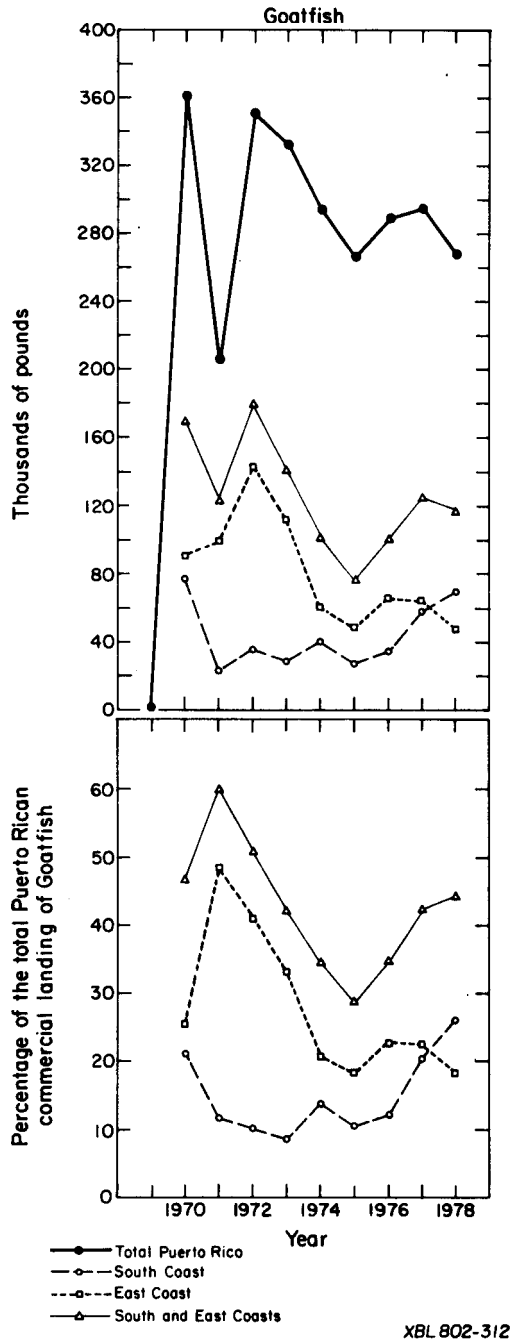

Figure 9. Commercial landings of goatfish, Family Mullidae, in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of goatfish to the total Puerto Rican commercial landing of goatfish. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

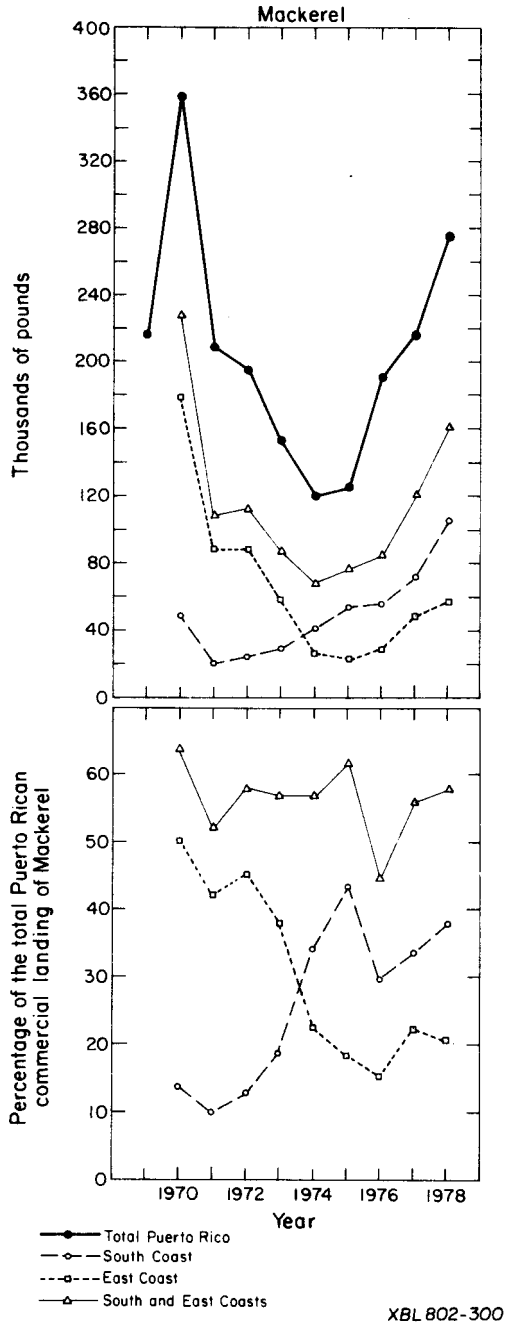

Figure 10. Commercial landings of mackerel, Scomberomorus cavalla and S. regalis (Family Scombridae), in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of mackerel to the total Puerto Rican commercial landing of mackerel. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974: Suarez-Caabro and Volmar, 1976; Volmar, 1978)

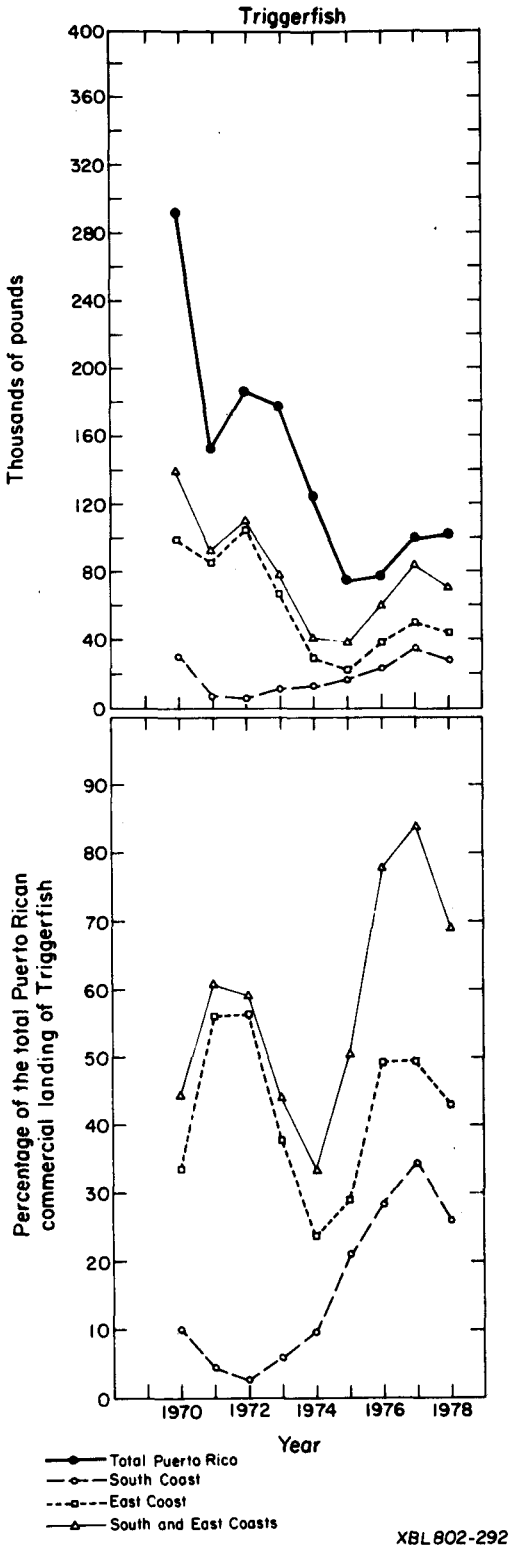

Figure 11. Commercial landings of triggerfish, Balistes vetula (Family Balistidae), in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of triggerfish to the total Puerto Rican commercial landing of triggerfish. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

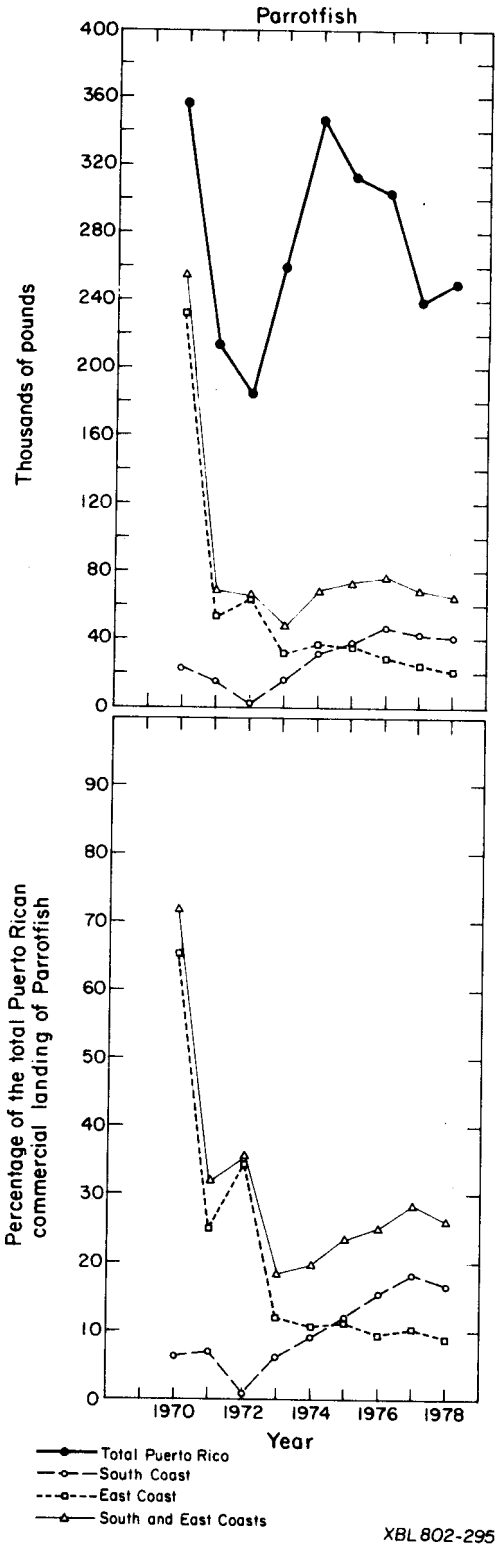

Figure 12. Commercial landings of parrotfish, Sparisoma spp. (Family Scaridae), in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of parrotfish to the total Puerto Rican commercial landing of parrotfish. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

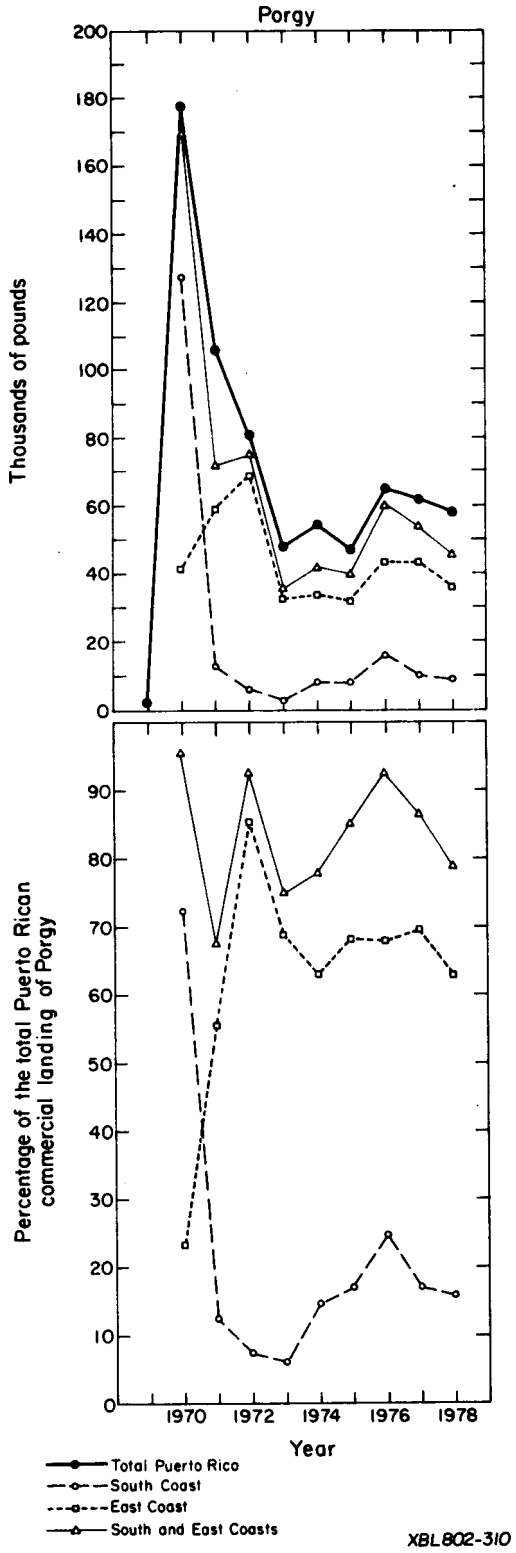

Figure 13. Commercial landings of porgy, Family Sparidae, in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of porgy to the total Puerto Rican commercial landing of porgy. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

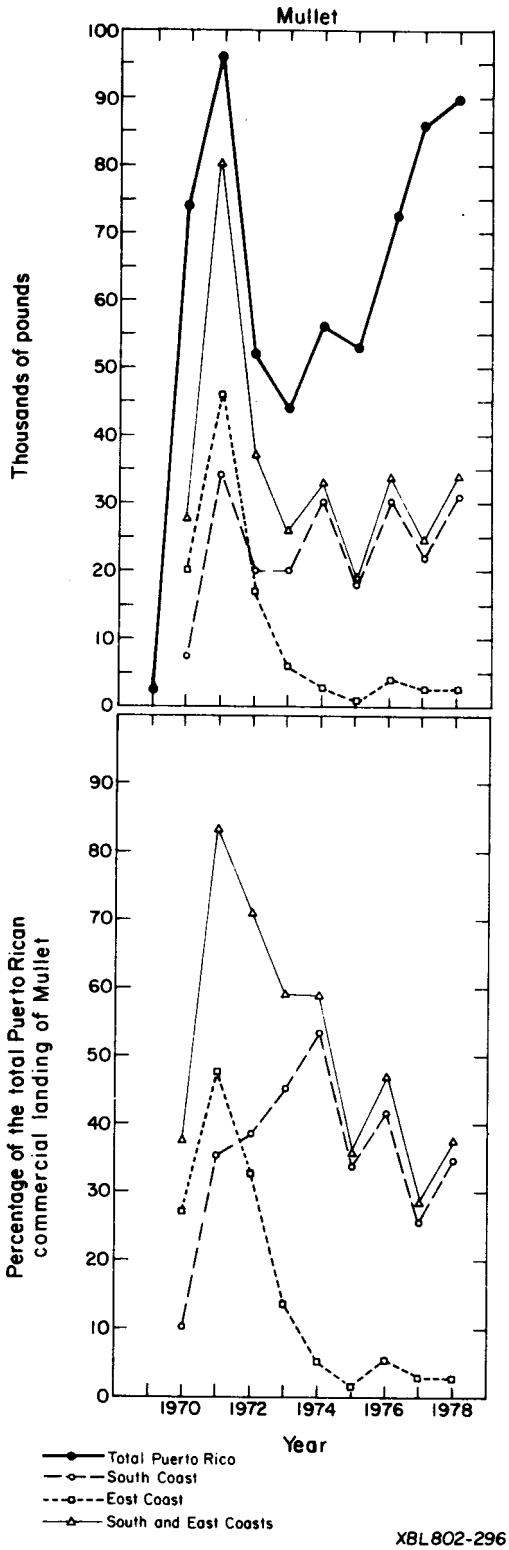

Figure 14. Commercial landings of mullet, Mugil spp. (Family Mugilidae), in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of mullet to the total Puerto Rican commercial landing of mullet. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

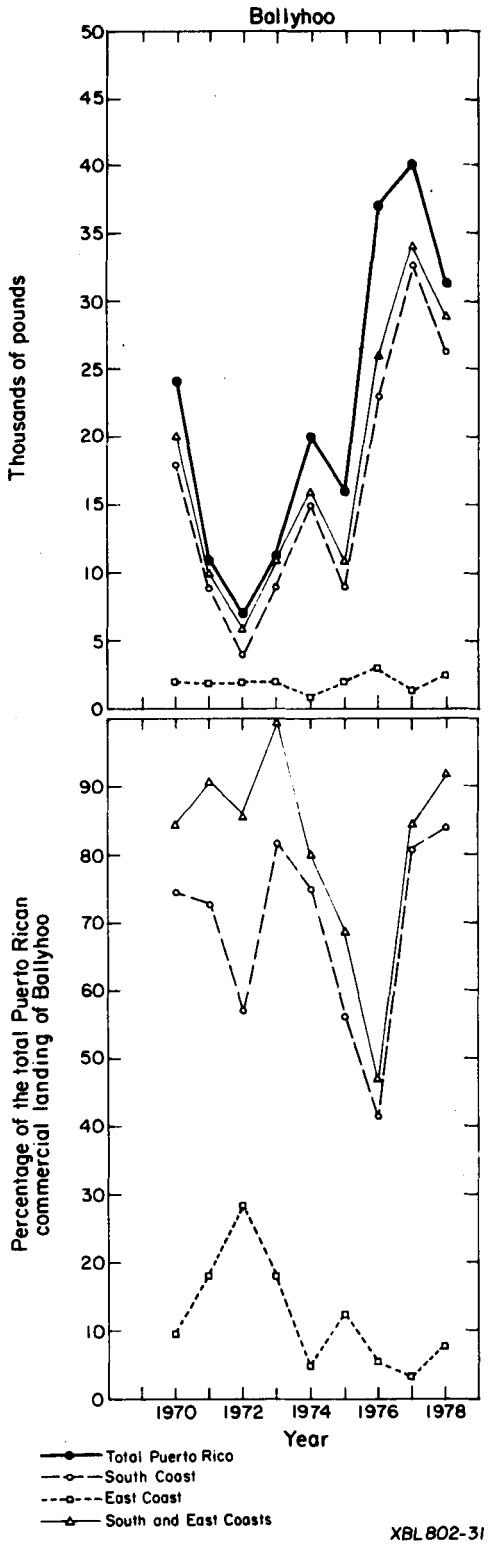

Figure 15. Commercial landings of ballyhoo, Hemiramphus brasiliensis (Family Hemiramphidae), in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of ballyhoo to the total Puerto Rican commercial landing of ballyhoo. (Juhl and Suarez-Caabro, 1971 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978: Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

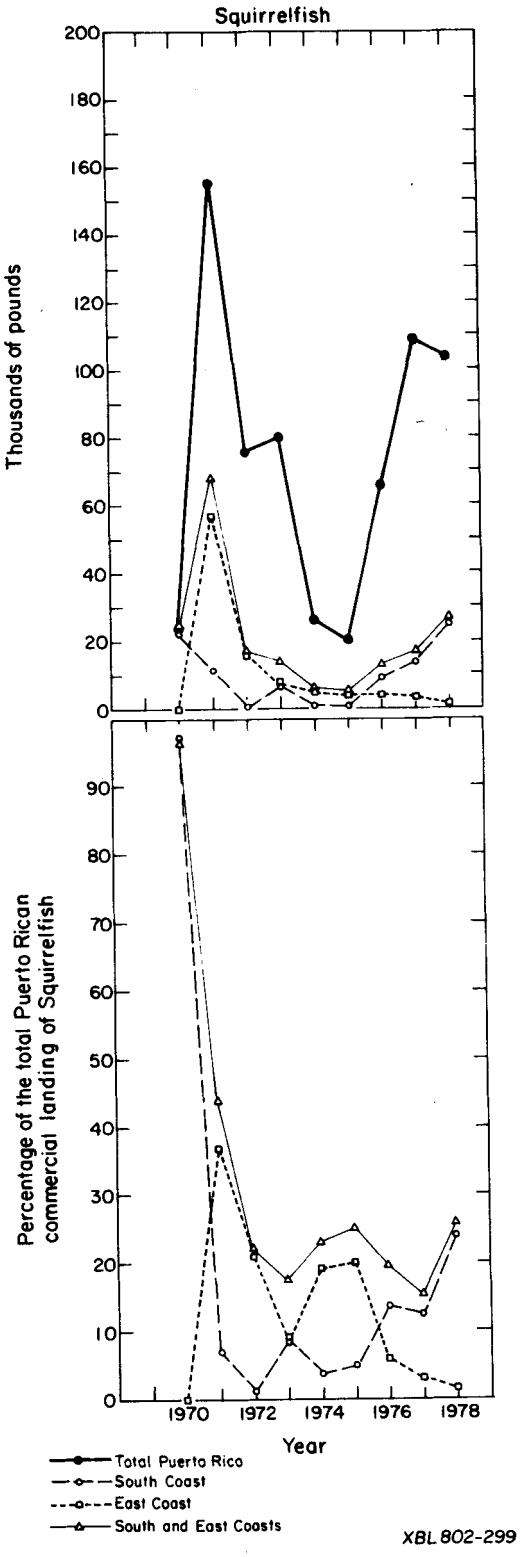

Figure 16. Commercial landings of squirrelfish, Holocentrus spp. (Family Holocentridae), in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of squirrelfish to the total Puerto Rican commercial landing of squirrelfish. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

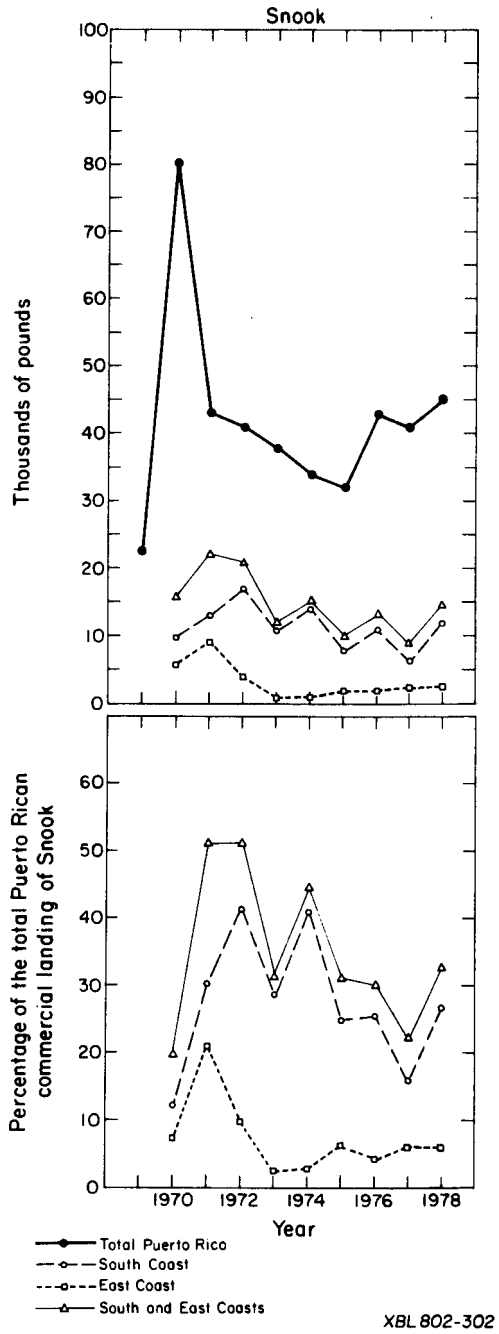

Figure 17. Commercial landings of snook, Centropomus undecimalis (Family Centropomidae), in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of snook to the total Puerto Rican commercial landing of snook. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975: Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

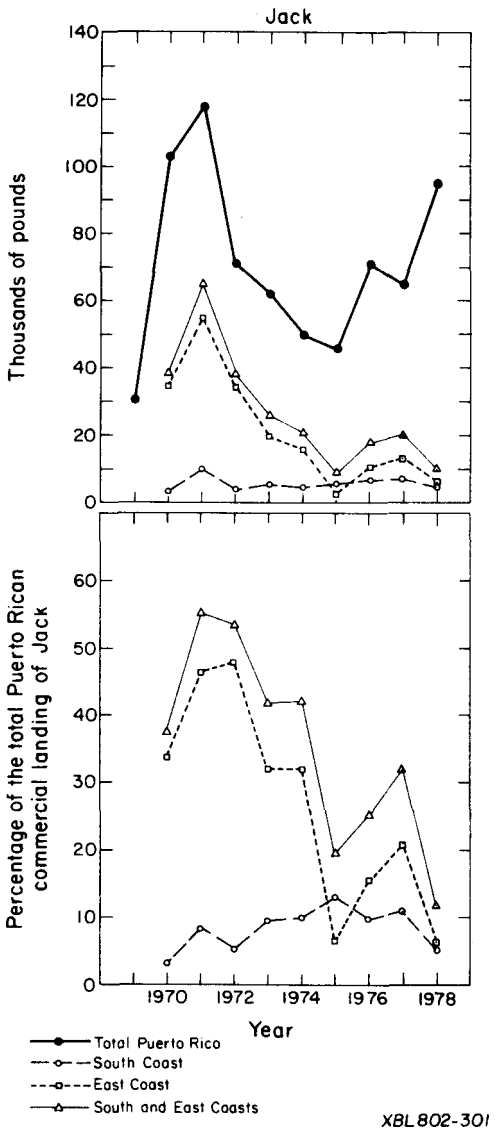

Figure 18. Commercial landings of jacks, Family Carangidae, in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of jacks to the total Puerto Rican commercial landing of jacks. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

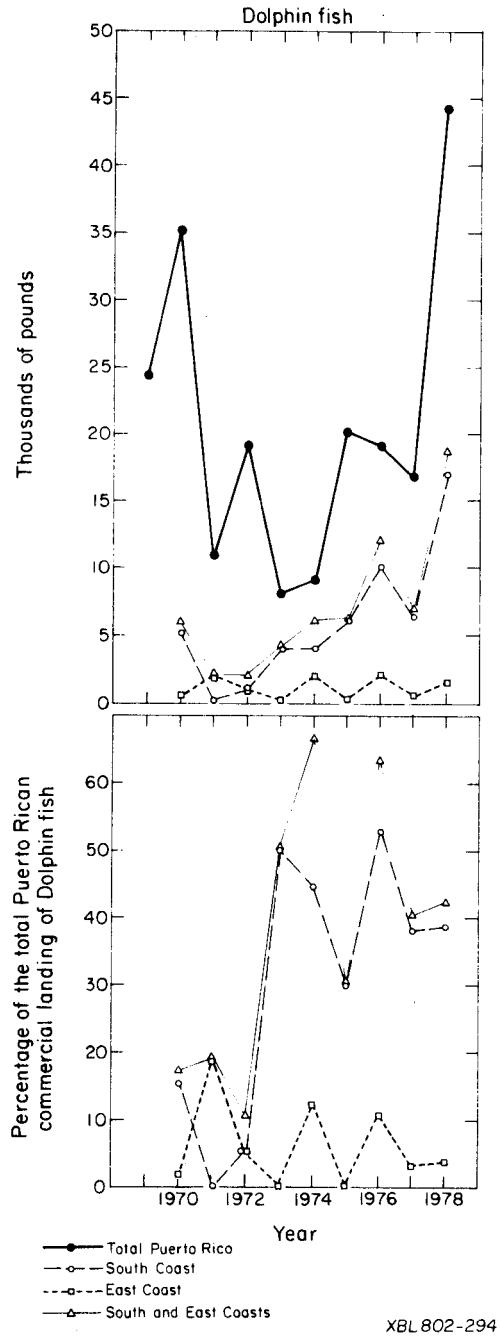

Figure 19. Commercial landings of dolphin fish, Coryphaena hippurus and C. equisetis (Family Coryphaenidae), in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of dolphin fish to the total Puerto Rican commercial landing of dolphin fish. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

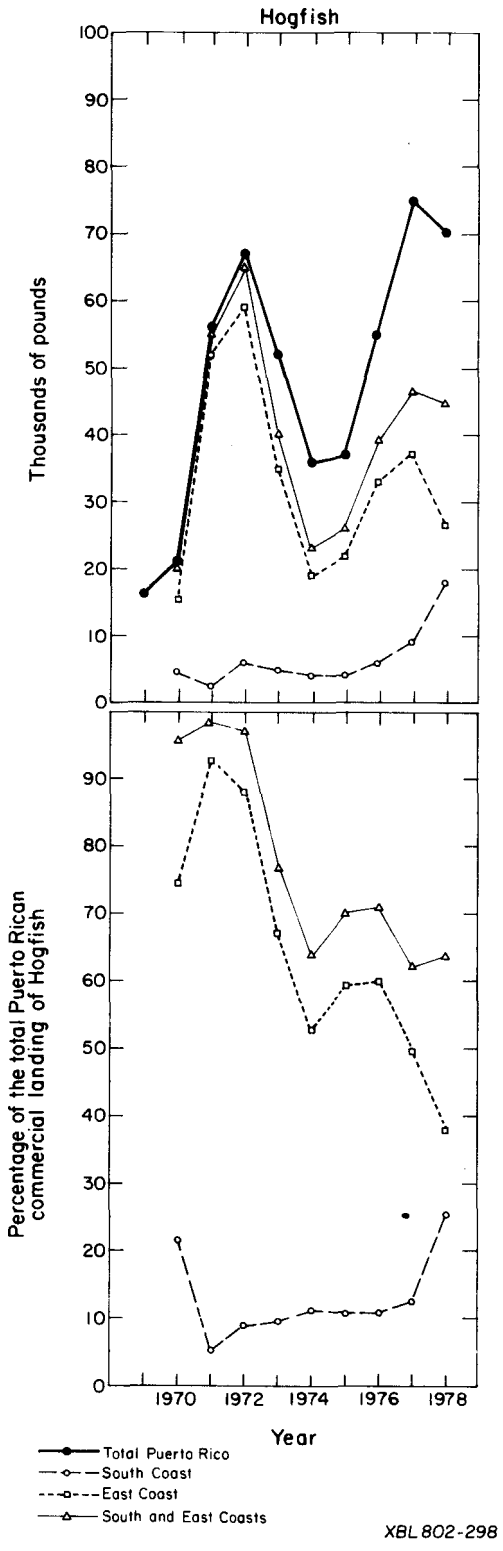

Figure 20. Commercial landings of hogfish, Lachnolaimus maximus (Family Labridae), in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of hogfish to the total Puerto Rican commercial landing of hogfish. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

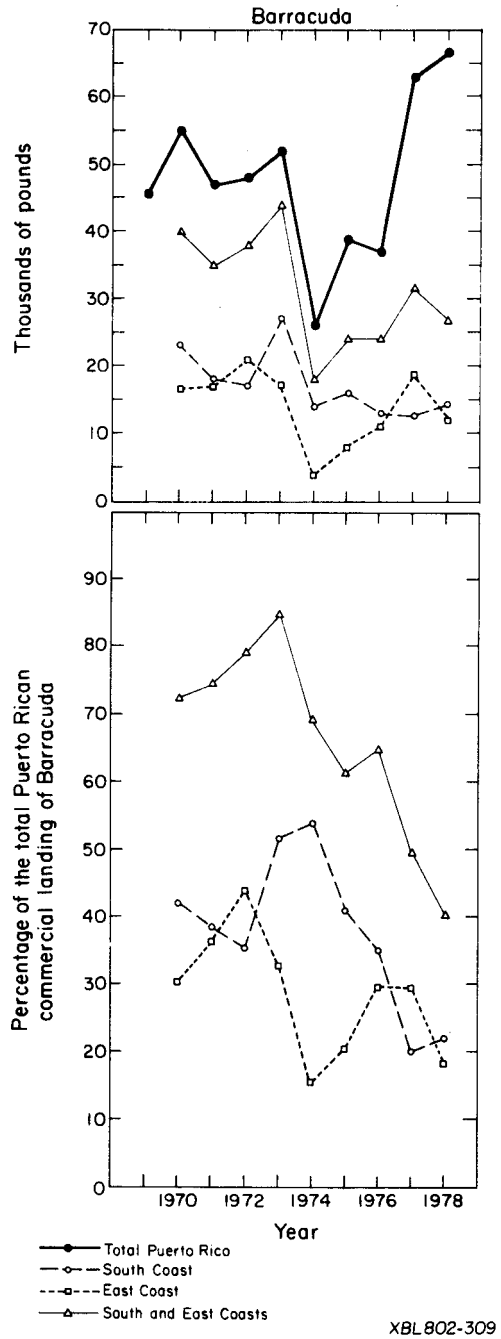

Figure 21. Commercial landings of barracuda, Sphyraena barracuda and S. guachancho (Family Sphyraenidae), in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of barracuda to the total Puerto Rican commercial landing of barracuda. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

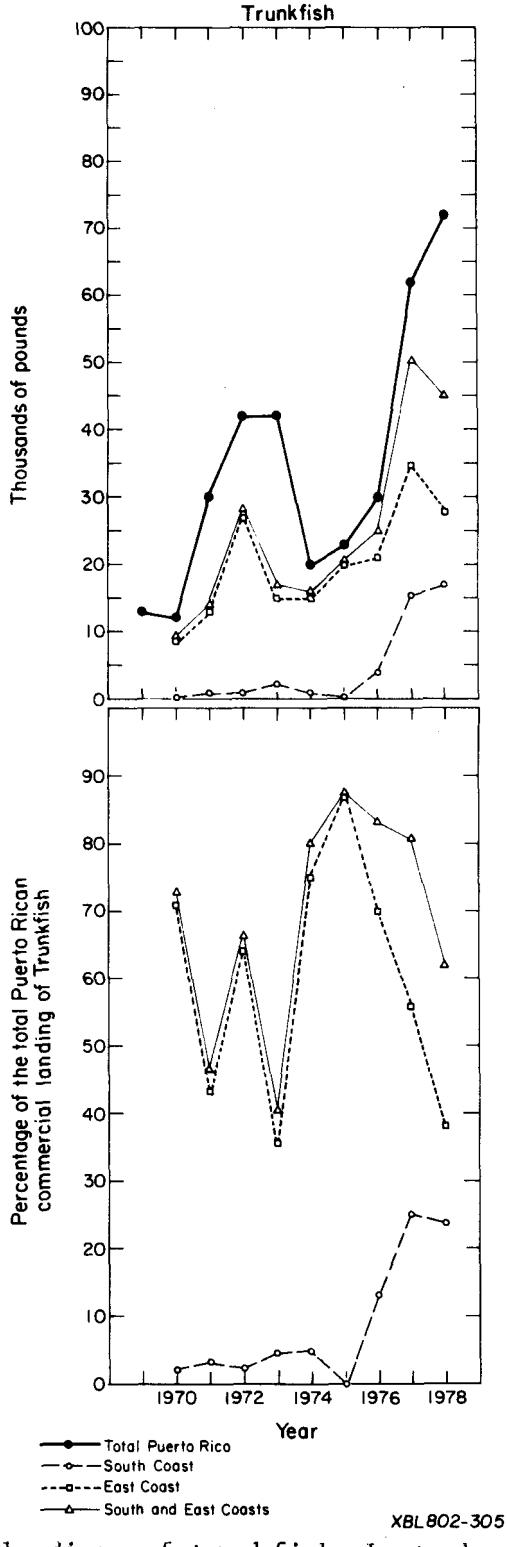

Figure 22. Commercial landings of trunkfish, Lactophrys spp. (Family Ostraciidae) in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower: Relationship of the South Coast's and the East Coast's commercial landings of trunkfish to the total Puerto Rican commercial landing of trunkfish. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

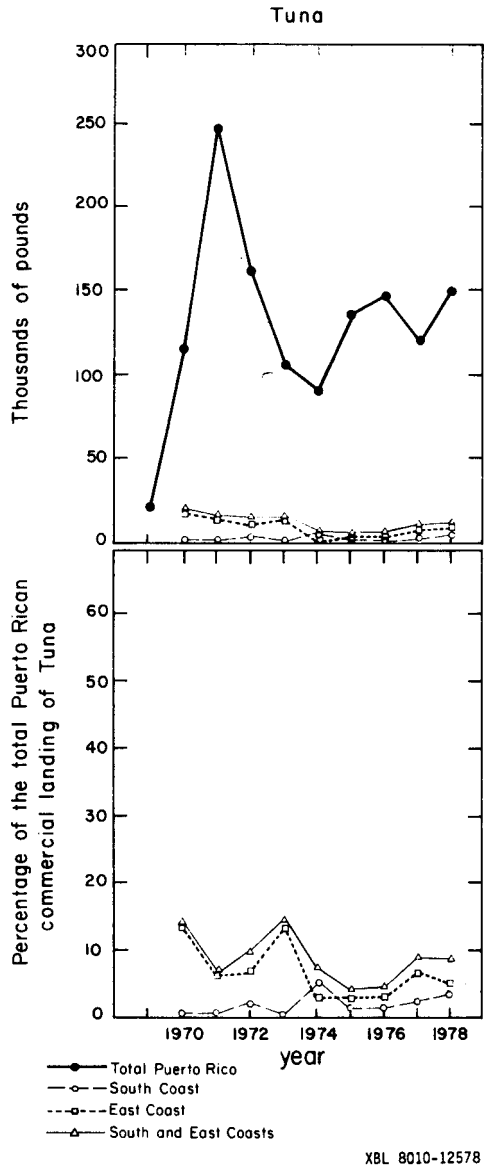

Figure 23. Commercial Landings of tuna, Family Scombridae, in Puerto Rico, 1969 to 1978. Upper: Weight of annual commercial landings (80% actual production). Lower Relationship of the South Coast's and the East Coast's commercial landings of tuna to the total Puerto Rican commercial landing of tuna (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

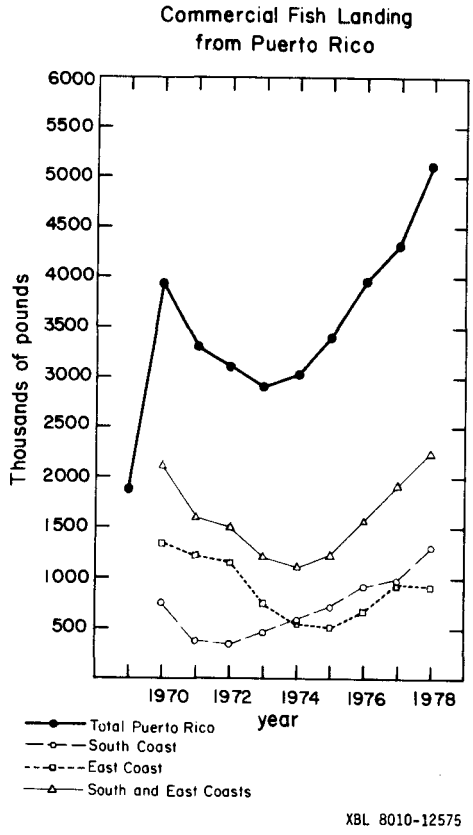

Figure 24. Commercial fish landing from Puerto Rico, 1969 to 1978. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

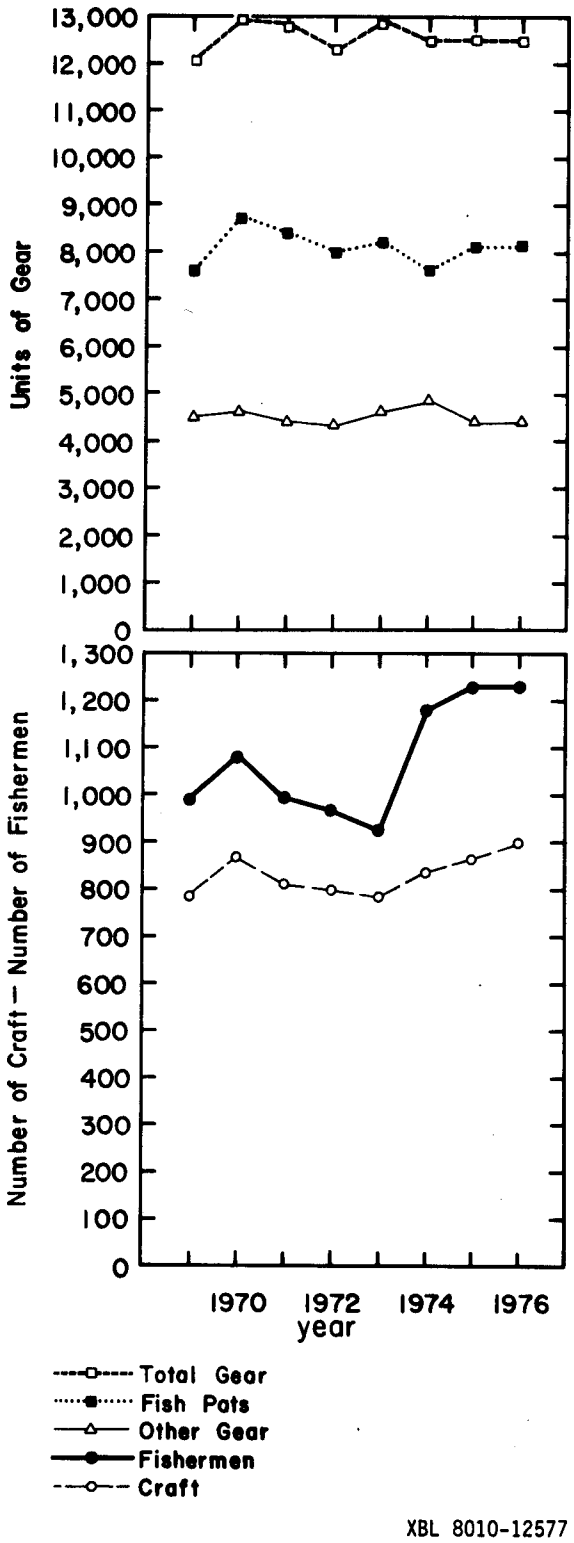

Figure 25. The number of fishermen, fishing craft and units of fishing gear operating in Puerto Rico's commercial fishery, 1969 to 1976. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973: Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

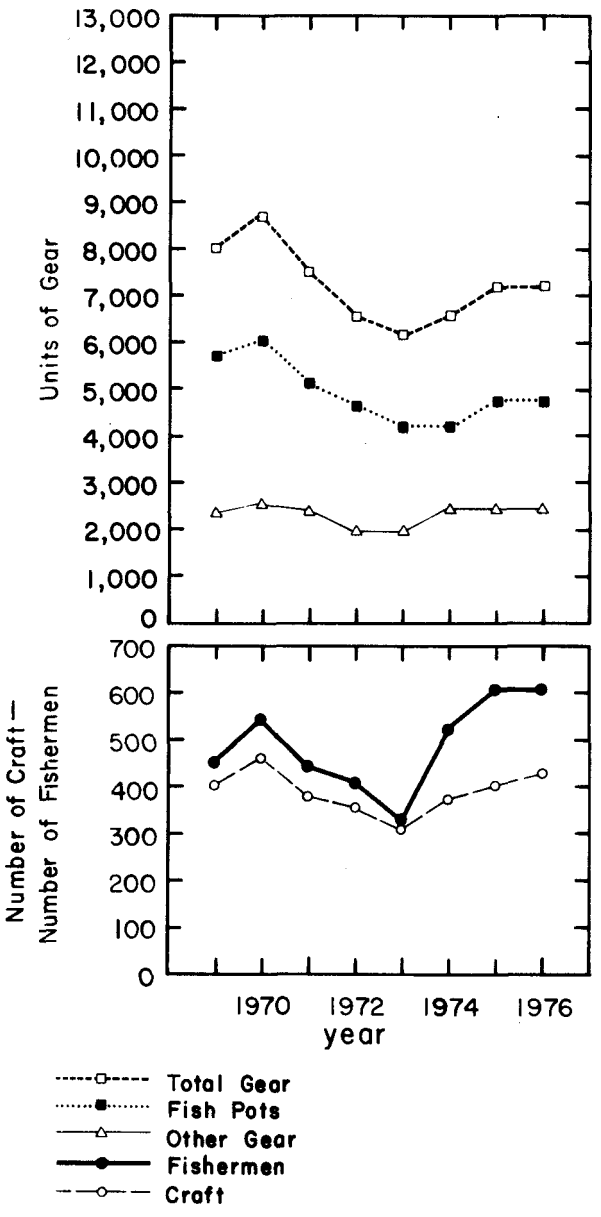

Figure 26. The number of fishermen, fishing craft, and units of fishing gear operating in the commercial fishery on the South and East Coasts of Puerto Rico from 1969 to 1976 (Juhl and Suarez-Caabro, 1971, 1972a; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978).

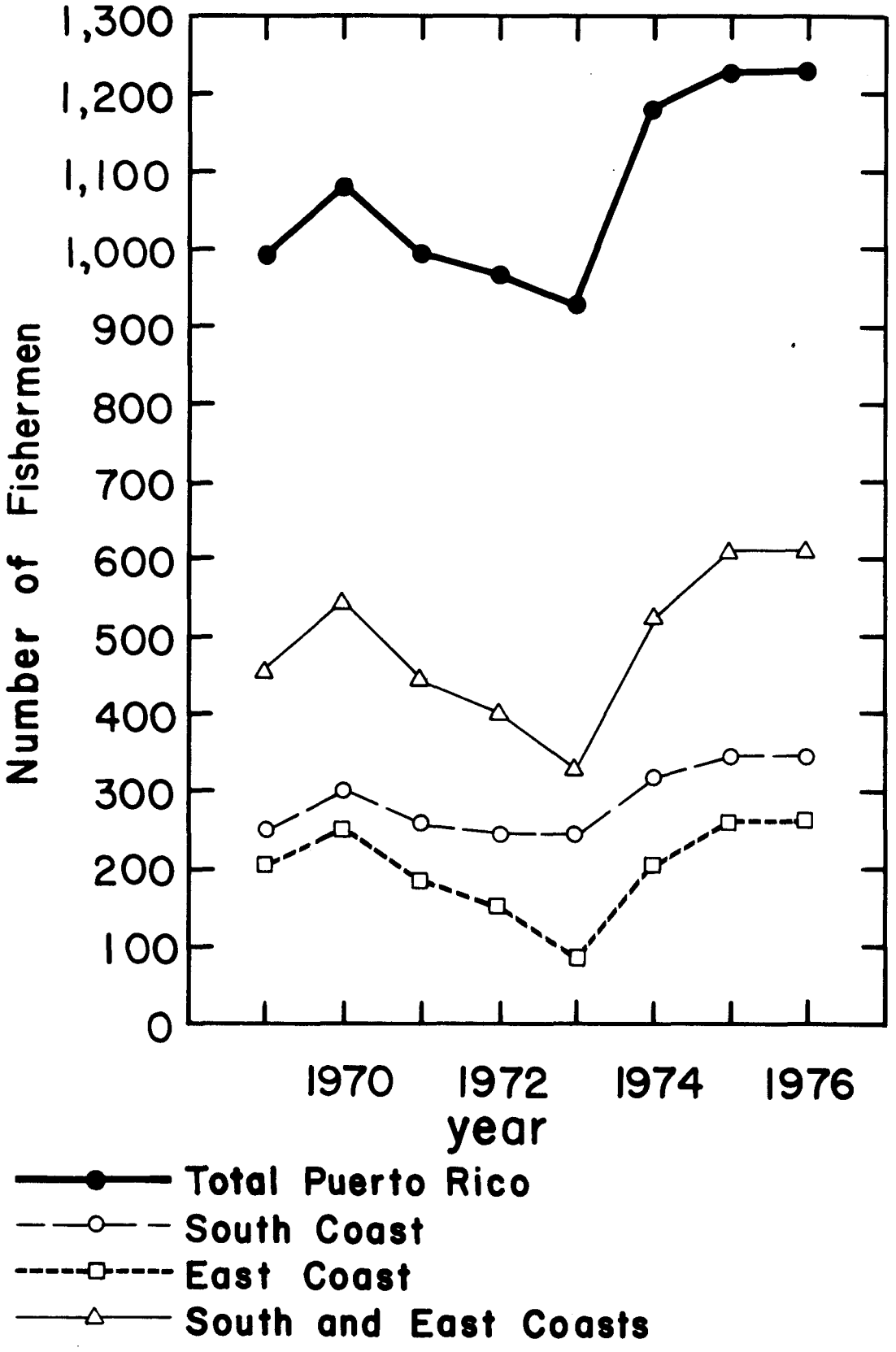

Figure 27. The number of fishermen participating in Puerto Rico's commercial inshore fishery, 1969 to 1976. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

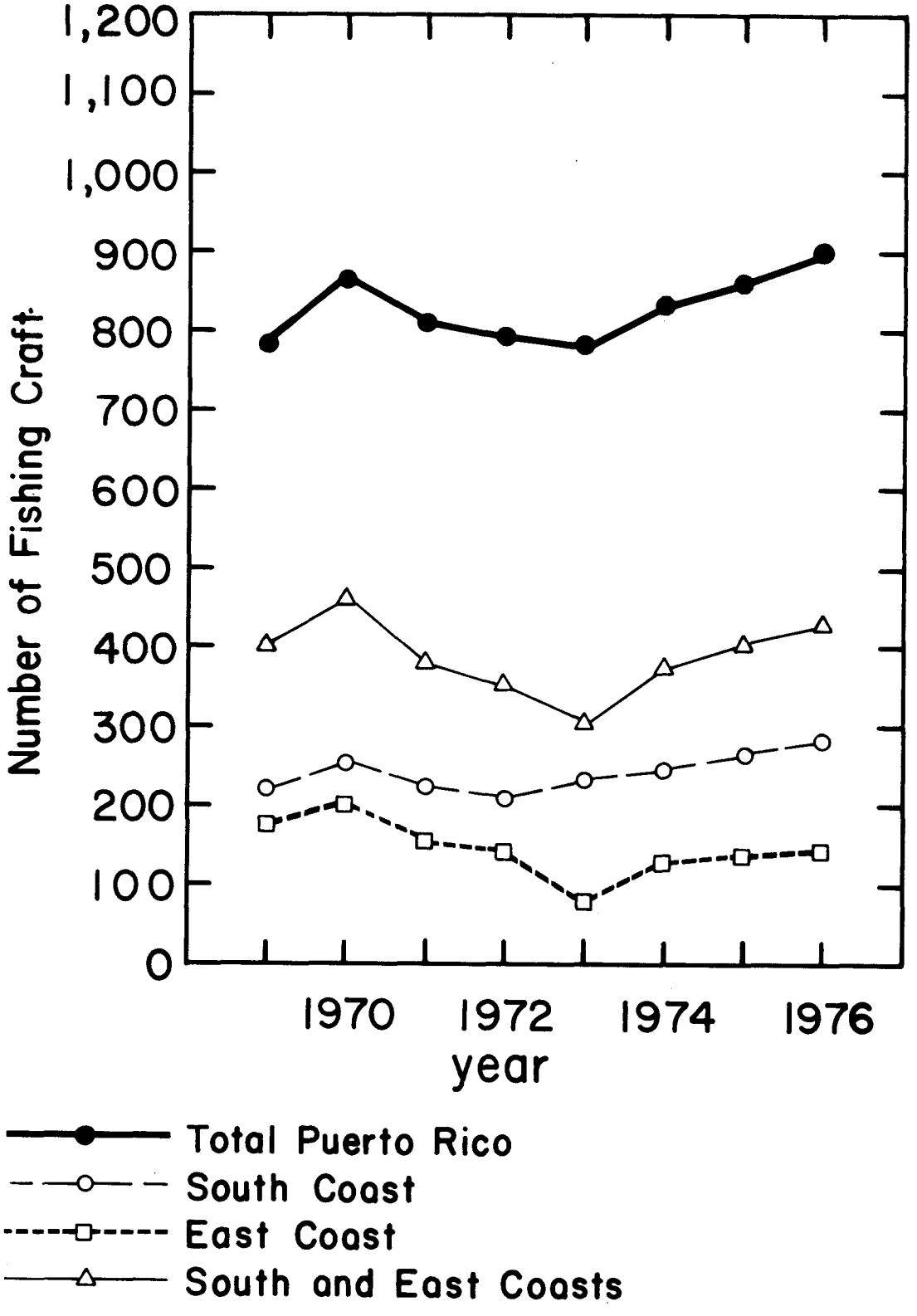

Figure 28. The number of fishing craft in Puerto Rico's commercial inshore fishery, 1969 to 1976. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970 1973; Suarez-Caabro and Rolon 1974; Suarez-Caabro and Volmar, 1976 Volmar, 1978)

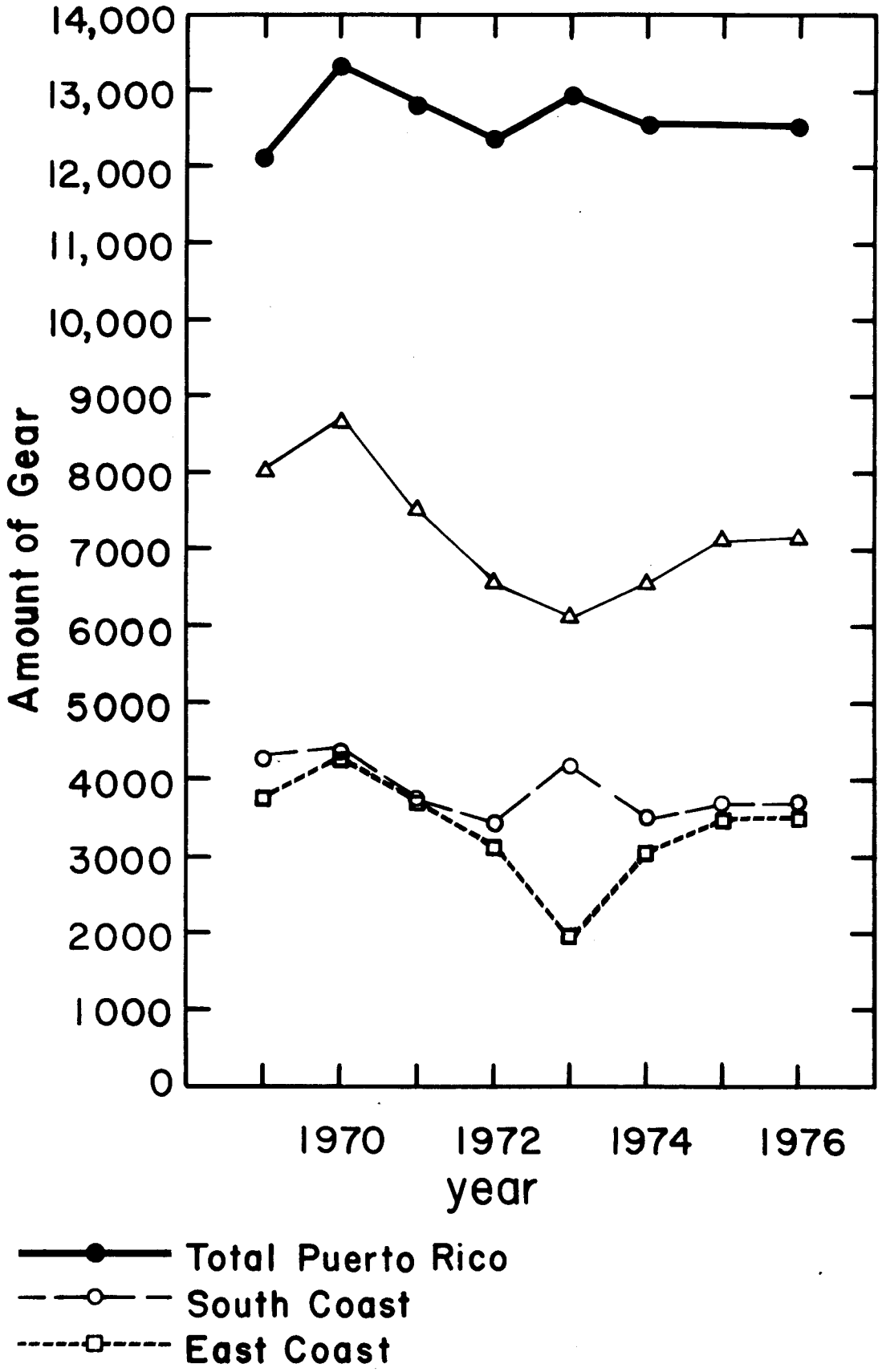

Figure 29. The amount of gear used in Puerto Rico's commercial inshore fishery, 1969 to 1976. (Juhl and Suarez-Caabro, 1971, 1972a, 1972b; Puerto Rico Department of Agriculture, 1977, 1978; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

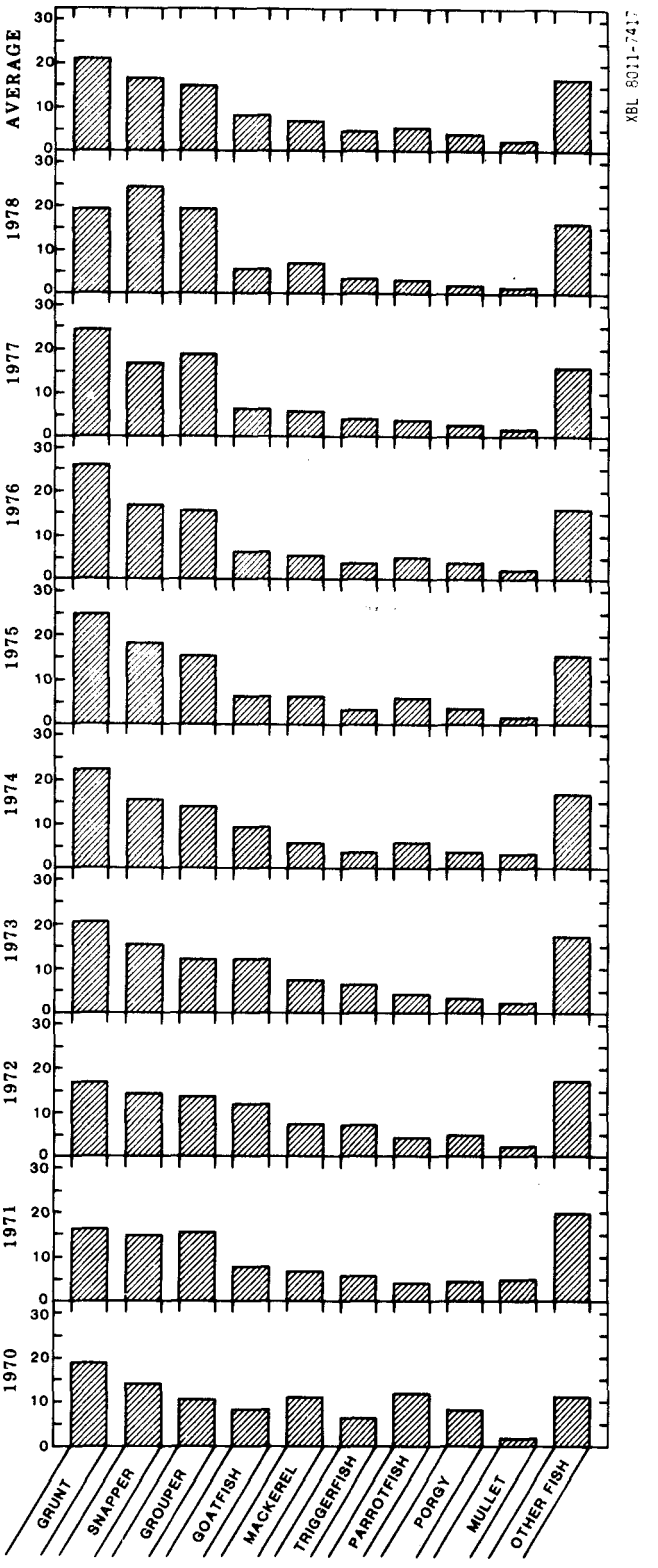

Figure 30. Composition (by percent weight) of the combined commercial fish landings on the South and East Coasts of Puerto Rico. 1970 to 1978.

Table 1. Fish commonly reported in Puerto Rico's commercial inshore fishery. (Adapted from Suarez-Caabro and Rolon, 1974).

COMMON NAME		
PUERTO RICAN	ENGLISH	SCIENTIFIC NAME
Pargo:	Snapper:	
Chillo	Silk	Lutjanus vivanus
Negra	Blackfin	L. buccanella
Arrayado,Rayado,Manchego	Lane	L. synagris
Sama	Mutton	L. analis
Pargo colorado	Dog	L. jocu
Pargo prieto	Gray	L. griseus
Guasinuco	Cubera	L. cyanopterus
Besugo	Vermilion	Rhomboplites aurorubens
Colirrubia	Yellowtail	Ocyurus chrysurus
Sierra:	Mackerel:	
Sierra	King	Scomberomorus cavalla
Alasana,Pelicán	Cero	S. regalis
Mero:	Grouper:	
Mero,Guajil	Yellowfin	Mycteroperca venenosa
Cherna	Nassau	Epinephelus striatus
Cabrilla	Red hind	E. guttatus
Mora Cabra	Rock hind	E. adscensionis
Guasa	Misty	E. mystacinus
Mantequilla	Coney	Cephalopholis fulva
Jurel:	Jack:	
Cojinúa	Blue runner	Caranx crysos
Jurel	Crevalle	C. hippos
Jurel negrón	Black	C. lugubris
Guaymen	Yellow	C. bartholomaei
Medregal	Greater amberjack	Seriola dumerili
Salmón	Rainbow runner	Elagatis bipinnulatus
Corcobado	Lookdown	Selene vomer
Palometa	Palometa	Trachinotus goodei
Pámpano	Permit	T. falcatus
Barbudo	Barbu	Polydactylus virginicus
Robalo	Snook	Centropomus undecimalis
Picúa	Barracuda	Sphyraena barracuda
Guaguanche	Guaguanche	S. guachancho
Capitán	Hogfish	Lachnolaimus maximus
Peto	Wahoo	Acanthocybium solanderi
Machete, Sable	Atlantic cutlassfish	Trichiurus lepturus
Atun:	Tuna:	
Vaca	Little	Euthynnus alletteratus
Bacora,Bonito	Skipjack	E. pelamis
Albacora	Blackfin	Thunnus atlanticus
Aletas amarillas	Yellowfin	T. albacares
Dorado	Dolphin	Coryphaena hippurus
Pluma	Porgy	Calamus spp.
Chopa	Sheepshead	Archosargus rhomboidalis
Boquicoloradi,amarilla,		
Cachicata	Grunt	Haemulon sp.
Loro	Parrotfish	Sparisoma sp.
Peje puerco	Triggerfish	Balistes vetula
Salmonete colorado	Goatfish,spotted	Pseudupeneus maculatus
Salmonete amarillo	Goatfish,yellow	Mulloidichthys martinicus
Gallo	Squirrelfish	Holocentrus sp.
Macaco	Bonefish	Albula vulpes
Mojarra,Muniama	Yellowfin mojarra	Gerres cinereus
Marlín azul,Aguja	Blue marlin	Makaira nigricans
Vela,Abanico	Sailfish	Istiophorus platypterus
Sardina	Sardine	Harengula sp.
Arenque	Atlantic thread herring	Opisthonema oglinum
Balajú	Ballyhoo	Hemiramphus brasiliensis
Jarea	Mullet	Mugil sp.
Chapin	Trunkfish	Lactophrys sp.

Table 2. The number of fishermen, fishing craft and units of fishing gear operating in Puerto Rico's commercial inshore fishery from 1969 to 1976 (adapted from Juhl and Suarez-Caabro, 1971, 1972a; Rolon, 1975; Suarez-Caabro, 1970, 1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978).

Year	South Coast	East Coast	South & East Coasts	Total
1969				
Fishermen	250	205	455	991
Fishing Craft	222	179	401	787
Fish Pots	3118	2608	5726	7619
Other Gear	1190	1181	2371	4506
Total Gear	4308	3789	8097	12125
1970				
Fishermen	302	241	543	1082
Fishing Craft	259	202	461	869
Fish Pots	3112	2932	6044	8766
Other Gear	1297	1361	2658	4603
Total Gear	4409	4293	8702	13369
1971				
Fishermen	259	187	446	994
Fishing Craft	223	158	381	811
Fish Pots	2652	2501	5153	8451
Other Gear	1137	1259	2396	4411
Total Gear	3789	3760	7549	12862
1972				
Fishermen	245	156	401	968
Fishing Craft	211	141	352	797
Fish Pots	2449	2196	4645	8029
Other Gear	1010	938	1948	4342
Total Gear	3459	3134	6593	12371
1973				
Fishermen	246	84	330	927
Fishing Craft	232	80	312	785
Fish Pots	3081	1142	4223	8260
Other Gear	1120	830	1950	4659
Total Gear	4201	1972	6173	12919
1974				
Fishermen	317	209	526	1182
Fishing Craft	247	128	375	835
Fish Pots	2331	1862	4193	7687
Other Gear	1209	1237	2446	4893
Total Gear	3540	3099	6639	12580
1975				
Fishermen	348	262	610	1230
Fishing Craft	266	138	404	865
Fish Pots	2577	2184	4761	8191
Other Gear	1132	1300	2432	4408
Total Gear	3709	3484	7193	12599
1976				
Fishermen	348	262	610	1230
Fishing Craft	282	146	428	901
Fish Pots	2577	2184	4761	8191
Other Gear	1132	1300	2432	4408
Total Gear	3709	3484	7193	12599

TABLE 3. Puerto Rican Annual Commercial Fish Landings (80% Actual Production) in Pounds, 1969-1978 (Juhl and Suarez-Caabro, 1971,1972a; 1972b; Rolon, 1975; Suarez-Caabro, 1970,1973; Suarez-Caabro and Rolon, 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978; Puerto Rico Department of Agriculture, Fisheries Statistics Project, Information Bulletin 1977-1978)

	1969**	1970	1971*	1972*	1973*	1974*	1975*	1976*	1977	1978
SILK SNAPPER										
Puerto Rico Total	115,400	290,404	330,000	388,000	255,000	266,000	478,000	419,000	369,416	504,098
South Coast	-	11,310	7,000	6,000	20,000	22,000	55,000	62,000	72,523	88,232
East Coast	-	36,042	33,000	55,000	21,000	20,000	16,000	22,000	18,783	28,711
South & East Coasts	-	47,352	40,000	61,000	41,000	42,000	71,000	84,000	91,306	116,943
YELLOWTAIL SNAPPER										
Puerto Rico Total	81,000	169,546	138,000	100,000	97,000	106,000	145,000	128,000	161,952	203,913
South Coast	-	22,531	10,000	13,000	12,000	12,000	21,000	19,000	27,037	48,119
East Coast	-	77,187	65,000	35,000	31,000	28,000	26,000	33,000	51,575	54,840
South & East Coasts	-	99,718	75,000	48,000	43,000	40,000	47,000	52,000	78,612	102,959
LANE SNAPPER										
Puerto Rico Total	25,000	116,968	126,000	114,000	105,000	106,000	111,000	123,000	150,910	331,691
South Coast	-	46,035	28,000	35,000	36,000	36,000	39,000	41,000	45,329	173,517
East Coast	-	16,427	36,000	26,000	22,000	14,000	18,000	29,000	44,872	47,674
South & East Coasts	-	62,462	64,000	61,000	58,000	50,000	57,000	70,000	90,201	221,191
MUTTON SNAPPER										
Puerto Rico Total	27,000	79,174	59,000	58,000	58,000	68,000	58,000	77,000	68,708	124,075
South Coast	-	18,644	6,000	6,000	11,000	15,000	13,000	15,000	16,369	47,003
East Coast	-	43,128	33,000	28,000	17,000	13,000	18,000	22,000	24,850	28,725
South & East Coasts	-	61,862	39,000	34,000	28,000	28,000	31,000	37,000	41,219	75,728
OTHER SNAPPER										
Puerto Rico Total	19,000	50,009	38,000	46,000	57,000	46,000	44,000	68,000	77,050	96,379
South Coast	-	9,896	7,000	9,000	9,000	6,000	8,000	12,000	11,808	21,044
East Coast	-	10,685	12,000	6,000	5,000	8,000	7,000	12,000	11,872	10,408
South & East Coasts	-	20,581	19,000	15,000	14,000	14,000	15,000	24,000	23,680	31,452
MACKEREL										
Puerto Rico Total	216,600	358,052	209,000	195,000	153,000	120,000	125,000	190,000	215,331	275,015
South Coast	-	49,039	21,000	25,000	29,000	41,000	54,000	56,000	72,613	104,853
East Coast	-	179,570	88,000	88,000	58,000	27,000	23,000	29,000	48,731	57,105
South & East Coasts	-	228,609	109,000	113,000	87,000	68,000	77,000	85,000	121,344	161,958
GROUPER										
Puerto Rico Total	94,500	457,934	425,000	379,000	334,000	327,000	426,000	531,000	643,077	774,694
South Coast	-	81,201	61,000	56,000	66,000	85,000	116,000	135,000	173,693	214,011
East Coast	-	136,990	183,000	152,000	83,000	68,000	68,000	107,000	182,290	229,619
South & East Coasts	-	218,191	244,000	208,000	149,000	153,000	184,000	242,000	355,983	443,630

TABLE 3 (continued). Puerto Rico Annual Commercial Fish Landings (80% Actual Production) in Pounds, 1969-1978.

	1969**	1970	1971*	1972*	1973*	1974*	1975*	1976*	1977	1978
PORGY										
Puerto Rico Total	2,100	177,655	106,000	81,000	48,000	54,000	47,000	65,000	62,732	58,262
South Coast	-	128,053	13,000	6,000	3,000	8,000	8,000	16,000	10,730	9,127
East Coast	-	41,581	59,000	69,000	33,000	34,000	32,000	44,000	43,556	36,781
South & East Coast	-	169,634	72,000	75,000	36,000	42,000	40,000	60,000	54,286	45,908
GRUNT										
Puerto Rico Total	1,100	556,668	413,000	355,000	408,000	578,000	697,000	924,000	1,012,613	985,325
South Coast	-	153,200	67,000	63,000	120,000	150,000	212,000	310,000	262,437	269,803
East Coast	-	240,449	195,000	194,000	127,000	100,000	87,000	101,000	207,909	172,747
South & East Coasts	-	393,649	262,000	257,000	247,000	250,000	304,000	411,000	470,346	442,550
PARROTFISH										
Puerto Rico Total	-	365,305	214,000	185,000	260,000	346,000	313,000	303,000	240,655	250,313
South Coast	-	22,691	15,000	2,000	16,000	32,000	38,000	47,000	43,718	42,094
East Coast	-	232,807	54,000	64,000	32,000	37,000	36,000	29,000	25,150	23,317
South & East Coasts	-	255,498	69,000	66,000	48,000	69,000	74,000	76,000	68,868	65,411
TRIGGERFISH										
Puerto Rico Total	-	293,158	153,000	186,000	177,000	122,000	75,000	77,000	99,398	101,366
South Coast	-	30,254	7,000	5,000	11,000	12,000	16,000	22,000	34,450	26,628
East Coast	-	99,225	86,000	105,000	67,000	29,000	22,000	38,000	49,204	43,948
South & East Coasts	-	129,479	93,000	110,000	78,000	41,000	38,000	60,000	83,654	70,576
GOATFISH										
Puerto Rico Total	1,000	361,957	206,000	351,000	333,000	294,000	267,000	290,000	292,005	269,295
South Coast	-	76,960	24,000	36,000	29,000	41,000	28,000	35,000	59,712	70,021
East Coast	-	92,050	100,000	143,000	112,000	61,000	49,000	66,000	65,987	49,330
South & East Coasts	-	169,010	124,000	179,000	141,000	102,000	77,000	101,000	125,699	119,351
SQUIRRELFISH										
Puerto Rico Total	-	23,423	155,000	76,000	80,000	26,000	20,000	66,000	109,487	104,211
South Coast	-	22,690	11,000	1,000	7,000	1,000	1,000	9,000	13,540	25,053
East Coast	-	-	57,000	16,000	7,000	5,000	4,000	4,000	3,404	1,413
South & East Coasts	-	22,690	68,000	17,000	14,000	6,000	5,000	13,000	16,944	26,466
BLUE MARLIN										
Puerto Rico Total	2,000	842	(1)	-	-	(1)	1,000	2,000	6,909	7,113
South Coast	-	89	(1)	-	-	(1)	(1)	1,000	653	327
East Coast	-	319	(1)	-	-	-	-	(1)	805	387
South & East Coasts	-	408	(1)	-	-	(1)	(1)	1,000+	1,458	714

TABLE 3 (continued). Puerto Rican Annual Commercial Fish Landings (80% Actual Production) in Pounds, 1969-1978.

	1969**	1970	1971*	1972*	1973*	1974*	1975*	1976*	1977	1978
JACK										
Puerto Rico Total	30,800	103,166	118,000	71,000	62,000	50,000	46,000	71,000	65,288	95,238
South Coast	-	3,623	10,000	4,000	6,000	5,000	6,000	7,000	7,189	4,993
East Coast	-	34,925	55,000	34,000	20,000	16,000	3,000	11,000	13,739	6,309
South & East Coasts	-	38,548	65,000	38,000	26,000	21,000	9,000	18,000	20,928	11,302
SNOOK										
Puerto Rico Total	22,000	80,369	43,000	41,000	38,000	34,000	32,000	43,000	41,199	45,652
South Coast	-	9,984	13,000	17,000	11,000	14,000	8,000	11,000	6,629	12,043
East Coast	-	5,901	9,000	4,000	1,000	1,000	2,000	2,000	2,466	2,880
South & East Coasts	-	15,885	22,000	21,000	12,000	15,000	10,000	13,000	9,095	14,923
BARRACUDA										
Puerto Rico Total	45,500	55,150	47,000	48,000	52,000	26,000	39,000	37,000	63,809	66,731
South Coast	-	23,150	18,000	17,000	27,000	14,000	16,000	13,000	12,807	14,691
East Coast	-	16,745	17,000	21,000	17,000	4,000	8,000	11,000	18,829	12,267
South & East Coasts	-	39,895	35,000	38,000	44,000	18,000	24,000	24,000	31,636	26,958
HOGFISH										
Puerto Rico Total	16,200	21,148	56,000	67,000	52,000	36,000	37,000	55,000	74,931	70,298
South Coast	-	4,506	3,000	6,000	5,000	4,000	4,000	6,000	9,334	18,003
East Coast	-	16,788	52,000	59,000	35,000	19,000	22,000	33,000	37,202	26,779
South & East Coasts	-	20,294	55,000	65,000	40,000	23,000	26,000	39,000	46,536	44,782
MOJARRA										
Puerto Rico Total	-	558	1,000	1,000	-	7,000	17,000	17,000	23,924	26,218
South Coast	-	-	(1)	-	-	1,000	1,000	1,000	1,411	1,646
East Coast	-	-	1,000	1,000	-	(1)	1,000	4,000	3,813	2,912
South & East Coasts		-	1,000+	1,000	-	1,000+	2,000	5,000	5,224	4,558
TUNA										
Puerto Rico Total	22,400	114,859	247,000	163,000	107,000	92,000	137,000	148,000	119,892	152,609
South Coast	-	707	1,000	4,000	(1)	5,000	2,000	2,000	2,954	5,123
East Coast	-	19,935	16,000	12,000	15,000	2,000	4,000	5,000	7,804	8,218
South & East Coasts	-	20,642	17,000	16,000	15,000+	7,000	6,000	7,000	10,758	13,341
DOLPHIN										
Puerto Rico Total	24,400	35,166	11,000	19,000	8,000	9,000	20,000	19,000	16,718	44,088
South Coast	-	5,390	(1)	1,000	4,000	4,000	6,000	10,000	6,278	16,984
East Coast	-	638	2,000	1,000	(1)	2,000	(1)	2,000	521	1,535
South & East Coasts	-	6,028	2,000+	2,000	4,000+	6,000+	6,000	12,000	6,799	18,519

TABLE 3 (continued). Puerto Rican Annual Commercial Fish Landings (80% Actual Production) in Pounds, 1969-1978.

	1969**	1970	1971*	1972*	1973*	1974*	1975*	1976*	1977	1978
SARDINE										
Puerto Rico Total	-	32,537	5,000	9,000	13,000	19,000	24,000	23,000	25,587	27,188
South Coast	-	-	-	-	-	(1)	(1)	(1)	290	334
East Coast	-	1,595	2,000	1,000	-	(1)	(1)	(1)	31	52
South & East Coast	-	1,595	2,000	1,000	-	(1)	(1)	(1)	321	386
BALLYHOO										
Puerto Rico Total			11,000	7,000	11,000	20,000	16,000	37,000	40,477	31,458
South Coast	-	18,113	8,000	4,000	9,000	15,000	9,000	23,000	32,841	26,449
East Coast	-	2,392	2,000	2,000	2,000	1,000	2,000	3,000	1,456	2,596
South & East Coasts	-	20,505	10,000	6,000	11,000	16,000	11,000	26,000	34,297	29,045
MULLET										
Puerto Rico Total	800	74,157	96,000	52,000	44,000	56,000	53,000	72,000	86,392	89,697
South Coast	-	7,687	34,000	20,000	20,000	30,000	18,000	30,000	22,048	31,155
East Coast	-	20,253	46,000	17,000	6,000	3,000	1,000	4,000	2,559	2,484
South & East Coasts	-	27,940	80,000	37,000	26,000	33,000	19,000	34,000	24,607	33,639
TRUNKFISH										
Puerto Rico Total	13,200	12,395	30,000	42,000	42,000	20,000	23,000	30,000	62,402	72,912
South Coast	-	265	1,000	1,000	2,000	1,000	(1)	4,000	15,644	17,330
East Coast	-	8,771	13,000	27,000	15,000	15,000	20,000	21,000	34,808	27,955
South & East Coasts	-	9,036	14,000	28,000	17,000	16,000	20,000+	25,000	50,452	45,285
OTHER FISH										
Puerto Rico Total	1,115,800	93,061	68,000	75,000	122,000	206,000	182,000	159,000	188,372	278,071
South Coast	-	21,905	6,000	14,000	12,000	28,000	24,000	23,000	23,733	27,673
East Coast	-	23,171	20,000	7,000	16,000	35,000	39,000	45,000	39,420	55,923
South & East Coasts	-	45,078	26,000	21,000	28,000	63,000	63,000	68,000	63,153	83,596
TOTAL FISH										
Puerto Rico Total	1,875,800	3,938,930	3,305,000	3,109,000	2,916,000	3,034,000	3,433,000	3,974,000	4,321,234	5,100,600
South Coast	-	767,923	371,000	351,000	465,000	582,000	708,000	910,000	985,770	1,316,300
East Coast	-	1,356,664	1,236,000	1,167,000	742,000	542,000	508,000	677,000	941,636	935,000
South and East Coasts	-	2,124,587	1,607,000	1,518,000	1,207,000	1,124,000	1,216,000	1,587,000	1,927,406	2,251,300

*Original data reported in thousands of pounds.
Figures in parentheses mean less than 500 pounds.

**July 1968 through June 1969

Table 4. Fishermen in Puerto Rico's inshore fishery 1969 to 1976. (Juhl and Suarez-Caabro, 1971, 1972a; Suarez-Caabro 1970,1973; Suarez-Caabro and Rolon 1974; Suarez-Caabro and Volmar, 1976; Volmar, 1978)

		Fishermen			
Year	Total Number	Number Regular	Number Casual	Percentage Regular	Percentage Casual
1969	991	376	615	38	62
1970	1082	406	676	38	62
1971	994	486	508	49	51
1972	968	469	499	48	52
1973	927	640	297	69	31
1974	1182	935	247	79	21
1975	1230	1059	171	86	14
1976	1230	1059	171	86	14

Table 5. Comparative production between "modern boats" and total production in Puerto Rico during 1976 (Adapted from Volmar. 1978).

Month	Modern Boats Production	Total Production (80%)	% of Production by Modern Boats	Boats Registered	% of Registered Boats Actively Fishing
January	13,951	335,252	4.16	22	68
February	10,813	316,055	3.42	25	72
March	17,442	356,665	4.89	25	80
April	42,379	420,950	10.06	27	78
May	33 690	410 306	8.21	31	48
June	31 944	367,766	8.68	31	61
July	37,857	410,040	9.23	31	57
August	26,791	426,472	6.28	33	76
September	26,954	458,825	5.87	33	61
October	47,536	423,320	11.22	35	83
November	32,828	390,308	8.41	36	72
December	32,566	378,271	8.61	36	56
TOTAL	354,751	4,694,230	-	-	-
Average per Month	29,563	391,186	7.56	30	68