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Shrimp Industry of Central America, Caribbean Sea, and Northern South America

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INTRODUCTION

The warm-water shrimp fishery of the Western Hemisphere can be divided naturally into six areas that have a minimum of overlap: (1) the South Atlantic Coast of the United States; (2) the Gulf of Mexico (United States and Mexico); (3) the Pacific coast of Mexico; (4) the Pacific coast from Guatemala to Ecuador, inclusive; (5) the Caribbean Sea; and (6) the Atlantic coast of northeastern South

America. The present report describes the fisheries of the last three named areas.

The fishery on the Pacific coast of Central America began at Panama and spread both north and south, whereas the Caribbean and Guiana fisheries are outgrowths of United States fishing in the Gulf of Mexico. U.S. fishermen, vessels, plant operators, importers, and investors have been involved in nearly all the shrimp fisheries in Latin America. There has also been some partici-

pation by French, Japanese, Portuguese, and Mexicans. To a considerable extent local personnel and investment have replaced the foreign involvement.

The shrimp fisheries of Latin America are based on numerous species of large warm-water shrimps of the genus *Penaeus*, generally of three types: white, brown, and pink. Commercially most important on the Pacific side are three white species, one brown, and one pink. The Atlantic and Gulf coasts have two white species, two brown, and one pink that dominate the catches.

Although priced somewhat differently and attaining varying maximum sizes, all are readily acceptable to the U.S. consumer.

In some areas, several smaller species of shrimp, known as sea bobs, are abundant. They are taken in growing amounts as new markets for them are being developed. Although the larger penaeid shrimps dominate the fishery, the sea bobs form a resource in reserve for future use.

All the white, brown, and pink shrimps have similar life histories, and their occurrence in significant quantities depends on their strict habitat requirements. They spend their adult lives on muddy sea bottoms in depths of 1 to 50 fathoms, depending on the species. They spawn at sea. The very young shrimp move into coastal lagoons or estuaries where they spend varying periods of time in brackish water. As subadults they move from the lagoons to nearby ocean waters, where they finish out their life span of a little over a year. Hence, fishing areas are confined to open waters over a mud bottom that are adjacent to large brackish lagoons, and to the lagoons themselves. A classic example is the tremendous nursery area of Lake Maracaibo, Venezuela, where the subadult shrimp are harvested in the lake by beach seines and cast nets, and the large shrimp are taken by trawling in the adjacent open waters of the

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Gulf of Venezuela. No substantial shrimp fisheries have been developed over rocky or clean sand bottoms, nor distant from brackish water lagoons.

On the Pacific coast, the large penaeid shrimps are found in a relatively continuous band all along the coast from northern Mexico to northern Peru, with only a few gaps along stretches of rocky and sandy shores. On the Atlantic side they are found from the southern coast of the United States to Brazil, including the Gulf of Mexico and the Caribbean Sea. However, they are not plentiful along the shores of the Greater and Lesser Antilles, and there seem to be long gaps in their occurrence in apparently favorable areas along the mainland coast of the Caribbean.

Throughout this report, weights are given in pounds, and prices and values are expressed in U.S. dollars. Although most of the countries in the area use the metric system of weights and have different currencies, the industry is tied so closely to U.S. practices and the U.S. market that even the fishermen and plant workers talk in terms of pounds and dollars.

THE SHRIMP FISHERY OF THE PACIFIC COAST OF CENTRAL AND SOUTH AMERICA

General

Shrimp fishing on the Pacific coast started in northern Mexico as early as 1941, but it was not until the 1950's that any large-scale fishing began elsewhere on the coast. Commercial shrimp fishing in Panama began in 1950 and within a few months had become an important industry.

The Panamanian industry expanded so rapidly that many producers left for less crowded waters. From Panama, the industry spread south to Colombia and Ecuador, particularly the latter, as U.S. operators expanded their operations. Development northward was somewhat slower, although small-scale operations began in Costa Rica as early as 1952 and had expanded considerably by 1958, when the commercial fishery in El Salvador began. Development of the fisheries in Guatemala and Nicaragua followed. Meanwhile, the

Mexican fishery in the Gulf of Tehuantepec developed in the early 1950's and reached its peak in 1959.

As of 1972, the shrimp fishery of the Pacific coast from Mexico to Ecuador has been developed to about maximum capacity, with the following possible exceptions:

- a. Fishing in deeper water principally for pink shrimp, could increase production in some areas;
- b. Greater utilization of the smaller species of shrimp (as in Panama) could increase landings in Central America;
- c. Development of suitable smallcraft harbors would result in the expansion of the fishery in Guatemala;
- d. Use of larger boats and additional ports could result in an increase in Costa Rican production; and
- e. Catches in Colombia could be increased if more vessels were permitted to enter the fishery.

Otherwise, harvesting of known shrimp stocks appears near maximum, and future fluctuations in catches will be due to changes in the natural abundance of shrimp, or to changing market conditions.

Shrimp are found in commercial quantities along most of the Pacific coast of Central America. The Guatemala grounds are actually an extension of the Mexican grounds in the Gulf of Tehuantepec. In fact, several incidents have occurred involving the trawlers of both countries fishing off the coast of the other as fishing success varies north or south of the border. In turn, the Guatemala grounds merge into those off El Salvador, which are probably the most productive of any along the Central American coast. Surprisingly, the Gulf of Fonseca produces little shrimp. Accordingly, Honduras, which faces the Pacific on only part of the Gulf, has only a small-scale fishery. The Nicaraguan coast, lacking suitable lagoons and offshore habitat, contributes in only a minor way to the total production. Costa Rican fishing grounds are mostly in or near the Gulf of Nicoya, but relatively unused grounds exist in the Gulf of Dulce. The highly productive fishery of Panama is located in the Gulf of Chiriqui and the Gulf of Panama. Shrimp are caught along most of the Colombian coast, particularly near

Buenaventura. Ecuador's most important shrimp grounds are near Esmeraldas and in the Gulf of Guayaquil.

Along the Pacific coast, the large white shrimp is dominant. Actually the "white" shrimp consists of three species: *Penaeus stylirostris* (sometimes also called blue shrimp), *P. vannamei*, and *P. occidentalis* (the most important species in Panama, Colombia, and Ecuador). The latter two are sometimes dark in color and are then called brown shrimp, along with *P. californiensis*, the true brown. The pink shrimp, *P. brevivirostris*, is of considerable importance in El Salvador and Panama. This deeper water species is fished when it is plentiful and readily available (during dry season). This time coincides with the time when whites are not plentiful. The whites are larger and command a higher price.

In addition to the big penaeid shrimps, which are the mainstay of the export shrimp industry, significant quantities of four species of smaller shrimps contribute to the catches, particularly in El Salvador, Panama, Ecuador, and Costa Rica. These are: the purplish brown *Xiphopenaeus riveti* and the yellow and orange *Protrachypene precipua*, which are known as sea bob or "titi;" and *Trachypenaeus byrdi* and *T. faoe*, which are variously called "tigre," "indio," "zebra" (or "cebra"), and "carabali." In some areas, all the small shrimps are collectively called "chacalin"; elsewhere they are known as "camaroncillo."

Guatemala

Guatemala has a Pacific coastline of about 155 miles. The two ports, Champerico and San Jose, are open, unprotected roadsteads with piers but no harbors. Champerico is about 25 miles from the Mexican border. San Jose is about 80 miles to the southeast, some 50 miles from the border with El Salvador. Both towns are shrimp ports.

Shrimp are fished along the entire coast, except for a few rocky spots. The fleet based in Guatemala ranges all the way from the Mexican border to El Salvador. Guatemalan vessels sometimes fish beyond the frontiers, and vessels from the neighboring countries stray at times into Guatemalan waters.

At the end of 1970, Guatemala's shrimp fleet consisted of 26 vessels, 20 fishing out of Champerico for Pesca, S.A., and 6 fishing out of San Jose for El Ganadero, S.A., a new firm that entered the shrimp business in May 1970. Both companies are increasing their production of peeled and deveined shrimp.

Neither Champerico nor San Jose has a harbor, which means that lightering is required between shrimp boats anchored in the open sea and the commercial piers at the two ports. This causes delays, inconvenience, and high costs.

The Guatemalan Government is studying plans for a protected harbor, probably at Champerico, but construction is 5 to 10 years away.

The operation at Champerico is a joint venture of two companies, each of which owns 10 boats. Pesca, S.A., and Copeagua, S.A., operate the freezing plant at Champerico and share a headquarters office in Guatemala City. The ownership of both companies is 51 percent Guatemalan and 49 percent Japanese (Mitsubishi and Nichiro). Sharing management with Guatemalans are two Japanese in Guatemala City and several in Champerico, all of whom live in Guatemala with their families.

Fishing trips are generally 12 or 13 days. The boats occasionally fish out to 55 fathoms, but most stay inside 35 fathoms. The catches are principally whites (blancos) and pinks (rojos). The whites are *Penaeus stylirostris* and *P. vannamei*. The whites and pinks are both seasonal, and alternately predominate in the catches. Because of the high cost of operations, the lower priced sea bobs are fished only when the large shrimp are scarce.

Exports destined for the eastern United States are shipped by refrigerated truck-and-trailer to the new port at Puerto Matias de Galvez on Guatemala's Caribbean coast, and thence direct to Miami on the trailer ferry. Shipments for the United States and Canadian Pacific coast and Japan go directly from Champerico by steamer. The distributor in the Miami area is Latin American Distributors, Inc. Mitsubishi International, Inc., handles distribution on the Pacific coast and in Japan. Puerto Rico is a

growing market for Guatemalan shrimp; Cerra Commercial is the distributor.

Table 1.—United States imports of shrimp from Guatemala, 1961-71

Year	Volume 1,000 pounds	Value \$1,000 U.S.
1961	743	405
1962	2,298	1,491
1963	1,943	1,062
1964	2,207	1,135
1965	1,515	962
1966	2,481	1,968
1967	1,924	1,589
1968	1,315	1,135
1969	1,693	1,705
1970	2,948	2,796
1971	2,338	2,392

El Salvador

The fishing grounds that lie off the 175-mile coastline of El Salvador produce more shrimp than any comparable area between Mexico and Panama. The otherwise undistinguished little tropical village of El Triunfo is one of Central America's most active shrimp ports.

From northwest to southeast, the four fishing ports of El Salvador are Acajutla, La Libertad, Puerto El Triunfo, and La Union. Of these, the first two support only small-scale fresh-market fisheries, whereas the latter two are primarily shrimp ports. The shrimp trawling grounds extend along most of the ocean coast; those in the eastern half are the most extensive. Very few shrimp are taken in the Gulf of Fonseca in the eastern part of the country.

Although it had long been known that there were shrimp off El Salvador, no serious effort was made to fish them commercially until 1955. Previously, the only shrimp fishery was in the lagoons and estuaries where canoe fishermen took juvenile shrimp with cast nets and traps. Although the "inside" fishery still exists, it has diminished as the fishermen have turned to trawling in the ocean.

Following initial studies by foreign experts, the Government limited shrimp fishing to 18 vessels. As a result of further surveys that showed very large populations of shrimp, the limit was raised to 73 vessels in 1962. This limit was still in effect in December 1971.

The first exports of shrimp to the United States began in late 1957 and

grew rapidly. The industry was, and is, well organized, has governmental support, uses only good vessels and plant equipment, and has established high-quality standards from the start. Consequently, it has thrived ever since its inception.

The \$4 to \$5 million of foreign exchange earned by the shrimp industry is important to the economy of El Salvador. Shrimp ranks third in importance, behind coffee and cotton, among non-manufactured exports from El Salvador. The government receives substantial revenue from the export tax of 6 cents per pound.

The center of shrimp industry is Puerto El Triunfo, a small village on a large lagoon known as Bahía de Jiquilisco that opens into the ocean about 125 miles south of Guatemala and 35 miles west of the Gulf of Fonseca. The principal shrimp trawling areas lie within 10 miles of the coast and extend 40 miles west and 30 miles east from the entrance to the lagoon, which is one of the principal nursery areas for young shrimp.

The two shrimp freezing plants in El Triunfo supply nearly all El Salvador's production. Pesca, S.A., handles 80 percent of the national pack and is one of the largest and best equipped plants in Latin America. It is located on a mangrove marsh, and the boats unload at a pier that traverses the tide flats. Pickup trucks transport the shrimp in metal tubs from dockside to plant. Pesca is constantly adding new equipment. In June 1965 it began operating the most modern peeler-deveiner for producing individually quick frozen (I.Q.F.) peeled and deveined shrimp. The machine is used for sea bobs and the smaller sizes of white, brown, and pink shrimp. Some of the larger sea bobs are prepared "butterfly" style. Pesca is owned and operated jointly by Portuguese and Salvadoran interests, with some Panamanian capital.

Atarraya, the other plant in El Triunfo, is equally modern and well equipped but lacks a peeler-deveiner. The plant has a complicated three-way ownership and management, and any or all of three names are used on equipment, trucks, and packages: Atarraya, S.A.; Congeladora Ballena, S.A.; and Consolidated Sea Foods of New York. Most of the capital is Salvadoran. This

plant is making a special effort to develop a domestic market, particularly for frozen and packaged sea bobs, and reports good success.

The other shrimp plant in El Salvador is located at La Union on the Gulf of Fonseca. Pesquera Nacional, S.A., is affiliated with another plant with a similar name in Puerto Somoza, Nicaragua, and at one time froze and packed shrimp for that concern, until the Nicaraguan company built its own freezer.¹ Because La Union is located on a shallow bay it was necessary to construct a long pier for the trawlers. La Union is rather far from the trawling grounds, which lie to the west on the open coast. Surprisingly, there is little or no shrimp fishing in the Gulf of Fonseca.

The ownership of the Salvadoran shrimp fleet is divided among 15 fishing companies. By law, only vessels of Salvadoran ownership and registry may fish shrimp within the 200-mile fishery zone claimed by El Salvador. The number of boats per company varies from one to 12 (the legal limit for any one company); the two largest packing companies own the largest fleets. The other fishing companies are owned by corporations or individuals, many of whom are associated with the packing plants. As noted above, the total number of vessels is limited to 73. Some of the licensed boats are inactive for one reason or another; at any one time the number of boats in actual operation averaged 71 during 1970-71.

In practice, the vessels fishing for the plants at El Triunfo operate as two fleets, one for each plant, even though many owners are involved. Sixteen vessels fish for Atarraya, and over 40 deliver to Pezca, all equipped with brine tanks.

Pezca and Atarraya jointly built and operate a boatyard across the bay from El Triunfo. The yard has marine ways, shops, and a parts depot. The vessels of both fleets undergo regularly scheduled overhauls.

The white shrimp are seasonal in abundance in the areas now fished by the fleet. In general, the fleet concentrates on white shrimp from October through April and avoids pinks during that time. The catch-per-day for whites is highest in October to March, and the best months are November through

February. However, the largest whites are taken in April to July when the catches of that species are lowest.

All of the large white, pink, and brown shrimp go by the general name of "camaron." The juveniles of all species, when caught in the lagoon fishery, are called "chacolin." The proportions of the three white shrimp (known as "blancos") vary greatly from time to time; the average percentages are: *Penaeus vannamei*, 46; *P. stylirostris*, 31; and *P. occidentalis*, 23. The pink shrimp, known in El Salvador as "rojos," consist almost entirely of *P. brevis*. All of the brown shrimp, which are called "cafe," are brown specimens of the white shrimp, *P. occidentalis*.

The sea bobs taken in El Salvador consist of four species, all called "camaroncillo" by the industry. Two of the species, *Trachypenaeus byrdi* and *T. faoe*, are indiscriminately called "tigre," "carabali," or "cebra." The two smaller species, which are often discarded at sea, are the "titi," *Xiphopenaeus riveti*, and the "pomada," *Protrachypene precipua*.

Based on careful sampling at the plants, the Fisheries Section, Ministry of Economy, has calculated the catches of the various species by the trawl fleet in the past 10 years (Table 2):

Table 2.—El Salvador shrimp catches, heads off weight, 1961-70

Year	White	Pink	Brown	Large shrimp subtotal	Sea bob	All species total
Thousand pounds						
1961	3,856	1,652	960	6,468	2,037	8,505
1962	3,485	1,212	254	4,951	3,310	8,261
1963	3,632	1,054	205	4,891	2,820	7,711
1964	3,851	831	228	4,910	2,715	7,625
1965	2,338	966	143	3,447	3,503	6,950
1966	3,497	1,090	207	4,794	5,288	10,082
1967	2,313	922	174	3,409	4,299	7,708
1968	2,217	786	152	3,155	2,987	6,142
1969	2,515	813	200	3,528	3,567	7,095
1970	2,336	913	387	3,636	4,772	8,408

Table 3.—Local sales of shrimp and sea bobs in El Salvador, 1963-70

Year	Sea bobs	Regular shrimp
	1,000 pounds	1,000 pounds
1963	27,000	—
1964	269,000	—
1965	267,000	66,000
1966	135,000	120,000
1967	110,000	5,000
1968	441,000	121,000
1969	442,000	410,000
1970	—	1,508,000

(The tremendous increase in 1968-70 is attributable to the growth of retail supermarket outlets in San Salvador).

As noted above, the domestic market for shrimp, particularly sea bob, is growing rapidly. The following amounts of sea bobs and regular shrimp taken by the trawl fishery were sold mostly in San Salvador (Table 3).

The outlook for the shrimp industry of El Salvador is excellent. It should be possible to maintain the production of white and brown shrimp with the present fleet. Some observers favor cutting the number of vessels, believing a smaller fleet could catch the same amount more profitably. Some in industry believe the present flat-rate export tax of 6 cents should be modified to provide for a lower tax on the lower priced small sizes. They argue that there is now no incentive to produce pinks and sea bobs, and only a tax cut will result in better utilization of these species. A new tax structure is under study.

Honduras

Honduras has no developed shrimp fishery on the Pacific nor is one likely, since Honduras has no coastline on the open ocean. Its entire 40 miles of coast lie at the head of the Gulf of Fonseca. Although the tributary estuaries are nursery grounds for juvenile shrimp,

Table 4.—United States imports of shrimp from El Salvador, 1961-71.

Year	Volume	Value
	1,000 pounds	\$1,000 U.S.
1961	8,093	5,505
1962	7,156	4,982
1963	6,667	4,279
1964	6,296	3,918
1965	5,376	3,581
1966	6,955	5,431
1967	6,724	5,626
1968	4,639	4,236
1969	5,026	5,069
1970	6,689	5,521
1971	6,707	6,155

¹In 1970 this company operated six boats.

the Honduran portion of the gulf has no suitable trawling grounds.

El Salvador and Nicaragua have jurisdiction over most of the outer part of the gulf and over the ocean coastline on either side, and their laws do not permit fishing by foreign-based boats.

A subsistence fishery has always existed along the shores of the gulf and in the tributary estuaries and lagoons, using cast nets for juvenile white shrimp. In 1956 the annual catch was estimated at 50,000 pounds, heads-on weight.

Nicaragua

Nicaragua has a Pacific coastline of about 190 miles. Three ports are available for shrimp operations: Corinto in the north; Puerto Somoza, about 65 miles down the coast; and San Juan del Sur, near the Costa Rican border.

Shrimp are found along the entire coast. However, rocky bottom near shore limits the boats to depths greater than about 10 fathoms along much of the coast. In most of their range, the white shrimp are fished heavily in less than 10 fathoms; hence the unsuitable bottom near shore probably limits the catch.

The extent of the Nicaraguan shrimp fishery is indicated by United States Customs figures on imports (Table 5), because practically all the production is exported to the United States. The following table shows imports of shrimp from both coasts. The figures are mostly heads-off, shell-on weights; however, an increasing proportion is shipped peeled and deveined.

The plant at Corinto established by other interests some years ago was in

Table 5.—United States imports of shrimp from Nicaragua, 1961-71

Year	Volume 1,000 pounds	Value \$1,000 U.S.
1961	803	341
1962	1,971	979
1963	1,611	889
1964	2,520	1,786
1976	3,154	2,296
1966	3,914	3,147
1967	5,053	4,148
1968	5,626	5,049
1969	7,206	6,833
1970	6,146	6,021
1971	5,639	6,915

1971 operated under the name ALINSA, a 100 percent Nicaraguan-owned company. The production averages about one million pounds of shrimp per year, plus 100,000 pounds of fish for local consumption.

The fleet at Corinto consists of nine modern steel trawlers, plus 10 older boats individually owned, all under Nicaraguan flag. A parts depot and service facility recently have been added. Annual production of the newer steel boats averages about 85,000 pounds per boat.

The fishing grounds extend from the Gulf of Fonseca south to San Juan del Sur. The estimated annual production of these grounds, including "titis" and pinks, is 3.6 million pounds.

Most of the large shrimp or "camarones" are whites. All three species are caught. *Penaeus occidentalis* and *P. stylirostris*, both known locally as either "white #1" or "white #2", are taken only in the large sizes. They run mostly under 10 to the pound, with some 11 to 15.² The fishery takes all sizes of *P. vannamei*, which is called "blanco" only; about 40 percent are 16 to 20, the rest smaller. All three species are packed together; sorting is based only on size.

Some of the large shrimp are browns, *P. californiensis*, called "cafe." There are two color phases, brown and white. They are taken in all sizes. Most are under 30 per pound, many are under 10.

Pinks are called "rosados," *P. brevisrostris*. Increasing quantities are being fished.

Two species of "camaroncillos" are taken, the "titi," *Xiphopenaeus riveti*, and the "tigre," *Trachypenaeus byrdi*. Both are called "chacalin" in the Gulf of Fonseca.

San Juan del Sur has a new plant called NICAMAR, operated by Booth Fisheries, with a daily capacity of 20,000 pounds and a fleet of 14 steel trawlers. Average annual production of this plant is 1 million pounds.

All shrimp operations, for export, are under exclusive concessions granted by the government. The concessions are granted only to companies owned partly by Nicaraguans and which can demonstrate that they are physically and financially capable of operating.

²Number of shrimp per pound pertain to shrimp with heads-off.

The concessionaires may import boats, machinery, parts, and equipment duty-free. The vessels may remain under their own flag, as long as they fish for the concessionaire. If the owners desire, they may transfer to Nicaraguan registry. Local fishermen who wish to fish for shrimp (except for domestic consumption) must deliver their catches only to the concessionaires.

The export tax on all shrimp, regardless of size or species, is 3 cents a pound.

Present indications are that Nicaragua's Pacific coast fishery can produce about 3 million pounds of shrimp and 50,000 pounds of lobsters annually. Local industry sources report "unlimited" quantities of shrimp considered too small for the present commercial market. Deep-water red shrimp have been caught occasionally, and exploratory work is being carried on for this species, which is reported to average about 100 tails to the pound.

Costa Rica

The Pacific coastline of Costa Rica differs from the coasts of the Central American countries to the north in several respects. First, it is by far the longest, over 360 miles. Second, it is broken by a series of peninsulas and gulfs, unlike the virtually straight coast of the other countries. Finally, in all its length, Puntarenas, which is located midway between the borders with Nicaragua and Panama, is the only fishing port of any consequence. Although Golfito in the south has potentialities for fishing it is now only a shipping point for bananas.

Shrimp are found along most of the coast, but the fishing grounds are interrupted by stretches of rocky bottom. Although it has a long coastline, its fishing area is determined by the size of the Continental Shelf. In this respect, unfortunately, Costa Rica is one of the poorest in Central America. The narrow shelf explains why Costa Rica does not produce half as much shrimp as the much smaller El Salvador. The extensive Gulf of Nicoya is the center of abundance. Other grounds are to the south in the open Bay of Coronado and in the Gulf of Dulce. Elsewhere, the precipitous nature of the coastline limits both nursery grounds and trawl-

ing areas. The inner part of the Gulf of Nicoya is reserved as a nursery area for juvenile shrimp, and trawling therein is prohibited.

Only Costa Rican boats may fish for shrimp. Until recently, all new boats had to be constructed in Costa Rica with domestically produced materials, but new laws now permit the importation of steel hulls provided the superstructure is built in Costa Rica.

The following data show the rapid growth of the active fishing fleet in the last 5 years:

	1965	1970
Large vessels (56-75 feet)	15	35
Medium vessels (45-55 feet)	22	16
Small vessels (30-44 feet)	15	10
	52	61

All of the large vessels fish with nets in the typical double outrigger manner. Each is equipped with depth finders. All 16 medium-sized vessels fish two nets, and 12 have depth finders. Most of the small boats still fish single nets and make a relatively small contribution to total production.

The boats are owned by local fishing companies and the Borden Company, and modernization of others has brought the fleet up to the efficient standards of neighboring countries. The improvement of vessels capable of fishing in deeper water and farther from port, has increased production to about its natural limit.

The several boatyards in Puntarenas not only build shrimp boats but provide adequate maintenance service for the fleet.

A smaller freezing plant, locally owned, is Compania Industrial de Mariscos. An American firm, Henderson Portion Pak, which became an affiliate of Borden Foods in 1965, is planning to enlarge its already modern freezing plant.

Table 6 shows the growth in Costa Rica's export shrimp industry.

Shrimp taken for export are predominantly large whites. By far the most important species is *Penaeus occidentalis*. In 1959 this species accounted for about two-thirds of the production of whites. The remaining one-third was almost all *P. stylirostris*, with a very few *P. vannamei* and *P. californiensis*. The industry and the fishermen do not

Table 6.—United States imports of shrimp from Costa Rica, 1961-71.

Year	Volume	Value
	1,000 pounds	\$1,000 U.S.
1961	1,620	743
1962	1,738	786
1963	1,790	766
1964	2,471	1,133
1965	1,753	868
1966	1,779	1,070
1967	1,679	1,234
1968	2,351	1,696
1969	1,344	1,107
1970	2,534	1,889
1971	2,323	2,250

Note: The above weights are heads-off, mostly shell-on. Increasing quantities, particularly of the smaller sized shrimp, are shipped peeled and deveined.

distinguish between the species, which are all called whites ("blancos") or large shrimp ("grandes"). The whites run from 40/50 to 7 to the pound; most are 10/15 and 16/20.

In 1960, the fleet began taking pink shrimp, *P. brevisrostris*, on a small scale. Extensive grounds for pinks are located north of Puntarenas and in the south near the island of Canas. The production of pinks has doubled since the introduction of modern fishing gear by the new Borden plant. Pinks are considerably smaller than whites, from 16/20 to 70/80, with a considerable proportion at 40/50 and 50/60.

The abundant sea bobs are taken mostly for the domestic market. With the increasing popularity of peeled and deveined shrimp, these small varieties are bound to play a larger part in the export industry. All four species are taken: *Xiphopenaeus riveti*, *Protrachypene precipua*, *Trachypenaeus byrdi*, and *T. faoe*. It was estimated in 1959 that the first named of these made up most of the production. All are grouped together by the fishermen and plant operators as "brown shrimp," a terminology not used elsewhere. Government statistics refer to them as small shrimp ("pe-

quenos"). The sea bobs are very small; their tails average 50/70.

Table 7 demonstrates the usual history of the Pacific coast shrimp fisheries: a rapid growth based on production of whites, followed by a partial substitution of pinks when the catches of whites level off. Later the production of sea bobs increases to take care of growing domestic consumption and to augment exports. It would appear that with the present fleet and fishing practices, both catches and exports are about at their maximum.

Costa Rican shrimp are shipped to the United States in a variety of ways. Some are shipped directly from Puntarenas by refrigerated cargo ship. Until recently, most were shipped to Miami by air. Now a considerable portion goes by refrigerated truck and trailer to Puerto Matias de Galvez on Guatemala's Caribbean coast, a road distance of about 935 miles, and thence to Miami by ferry.

The export tax is 2 percent ad valorem, plus about one-quarter of a cent per pound (\$0.00226). The ad valorem tax has the effect of an incentive for exporting the smaller, lower priced pink shrimp and sea bob.

In 1970 the American firm Borden Foods began to fish for a new type of shrimp found in deep water (150 fathoms). These shrimp, as yet unidentified, are locally called "camel" and "fidel" and are characterized by a bright pink color. FAO was the first to discover this resource and Borden was the first to use it in an attempt to alleviate the intense fishing effort on shallow water resources. This shrimp is very small (averaging 120/140). Borden hopes to use new processing methods to develop this industry. The processing costs are quite high, but Borden will begin constructing a new plant in 1972 to process this shrimp.

Table 7.—Costa Rican shrimp catches, heads off weight, 1961-69

Year	Large ("blanco")	Pink ("rosado")	Brown ("pequeno")	Total
				1,000 pounds
1961	848	141	1,211	2,200
1962	604	445	1,228	2,277
1963	671	374	1,362	2,407
1964	1,165	188	1,360	2,713
1965	600	321	1,617	2,538
1966	774	330	1,415	2,519
1967	772	561	1,272	2,605
1968	843	484	2,042	3,369
1969	345	746	1,346	2,437

Panama

The most extensive and most productive shrimp fishing grounds along the Pacific coast south of Mexico are those off Panama. They were also the first south of Mexico to be fished on a large scale. Shrimp are found along most of Panama's sinuous and island-studded coastline of 700 miles, the longest coast under one jurisdiction between Mexico and Peru. The principal fishing grounds are in the Gulf of Panama and the Gulf of Chiriqui, the two principal indentations in the coast. The rocky 100-mile stretch between the two gulfs and the 80-mile stretch near the Colombian border are largely unproductive. Some of the best fishing is within sight of Panama City, and tourists flying in or out of Tocumen International Airport or visiting the ruins of Old Panama can often see the shrimp fleet in action. Panama City is the nation's largest shrimp port, and one of the most important shrimp centers of the world. The other port is Pedregal, the harbor town for David, near the Costa Rican border.

Six freezing plants operate in and near Panama City. All of these are owned entirely by Panamanians. Four are located downtown on the waterfront near the municipal market: Compania de Mariscos Islas de Las Perlas, S.A.; Panama Packing Corporation; Carlos Cambra e Hijos, S.A.; and Cambra Hermanos, S.A. Another, Empacadora Nacional, S.A., is located on the bay at Paitilla in the suburbs. The sixth, Compania de Productos Crustaceos, S.A., is near the mouth of Rio Juan Diaz, close to Tocumen Airport. The plant in David, 230 miles west of Panama City, is Frigorificos de Chiriqui, S.A. This company is a U.S.-owned subsidiary of Henderson Portion Pak, which became affiliated with Borden in 1965. About 200 shrimp vessels operated in 1970; the size of the fleet is controlled by law.

Nearly all of the plant owners, most of the individual boat owners, and some of the boatyards and ship chandlers have organized a national association to promote the fishing industry and to sponsor helpful legislation—Asociacion Nacional de la Industria Pesquera Panamena. Because the fishing industry is centered in the shrimp fishery, which

accounts for almost all of its total value, shrimp interests dominate the association. However, the growing fish meal industry is represented and works closely with members from the shrimp industry.

Because the greatest part of the Panamanian shrimp production is exported to the United States, official United States import statistics (Table 8) give an accurate picture of the growth and present size of the industry that provides Panama's second most important export product (bananas being first).

Table 8.—United States imports of shrimp from Panama, 1961-71.¹

Year	Volume		Value \$1,000 U.S.
	1,000 pounds		
1961	9,982	6,521	
1962	10,117	7,787	
1963	10,571	7,164	
1964	12,247	8,533	
1965	10,264	6,910	
1966	9,733	7,875	
1967	11,126	9,345	
1968	10,730	10,607	
1969	9,927	10,171	
1970	11,633	11,966	
1971	9,316	9,938	

¹Includes Canal Zone production.

The white shrimp include three species which are not separated by the industry, all called "langostinos" or "blancos." *Penaeus occidentalis* is reported to constitute 85 to 90 percent of the catch of whites; the rest of the catch is fairly equally divided between *P. stylirostris* and *P. vannamei*. Some of the *P. occidentalis* are brownish or rusty color and are called "browns" but are not separated.

The pink shrimp, *Penaeus brevirostris*, is known in Panama as "camaron rojo." Most of this medium-sized species ranges from 26 to 50 to the pound; some are as large as 21 to 25. Because of its smaller size, the pink does not command as high a price as the whites and also requires more work in packing. Because it is a deeper water species it costs more to catch. Hence, in Panama, this species is considered as merely a supplement to the white, albeit a valuable one.

Four small species of shrimp or sea bobs, known collectively in Panama as "camarones," constitute an important part of the shrimp catch. Two of these are called "titi": *Xiphopenaeus*

riveti and *Protrachypene precipua*. The "titis" are very small, usually 60 or more to the pound, heads-off. All but the largest individuals are packed as peeled and deveined.

The other two small species are *Trachypenaeus byrdi* and *T. faoe*, which are known by the names of "tigre," "carabali," "indio," or "zebra." The "tigres" are slightly larger than the "titi," generally running "under 60" to the pound. Although most of the "tigres" are peeled and deveined, a specialized market exists in Miami for these shrimp with their striped shells intact.

A bright colored "royal red" shrimp is taken in waters somewhat deeper than the similar pink or "rojo." This shrimp, which is probably *Sicyonia florea*, is not particularly desired by the packers because of the poor yield of meat when cooked. However, a considerable potential resource of these "fidels" exists.

All species are taken throughout the fishing grounds, but at different depths. The whites are found close to shore and near islands, at depths from 3 to 15 fathoms, usually along the 12-fathom line. The pinks are taken at about 30 fathoms, with some out to 45 fathoms, especially the "fidels." The "titis" and "tigres" are caught in shallow waters, particularly near river mouths. There has been little exploratory fishing deeper than 50 fathoms. It is possible that the deeper waters have additional resources.

The trawlers based in Panama City fish the entire Gulf of Panama, to a depth of 45 fathoms, from Punta Garchine in the east to Punta Mala in the west, often within sight of the packing plants. When fishing is poor, many of the boats go as far as the Gulf of Chiriqui. The vessels based at David confine their activities to the Gulf of Chiriqui and nearby waters. Even when fishing close to home, the boats make trips of at least 5 to 7 days, and trips to the Gulf of Chiriqui last 10 to 14 days.

Considerable amounts of spiny lobster are taken by the shrimp trawlers, particularly those fishing in and near the Gulf of Chiriqui. The lobsters are headed aboard the boats and delivered along with the shrimp. They were formerly sold on the domestic market. Beginning in 1966, the fishermen improved

the handling techniques to such an extent that the lobsters could meet export standards. Lobsters now constitute a small-scale but valuable fishery.

At present, all the shippers in Panama City send their shrimp to New York City by Grace Line Sea-Trailer. Shipping costs are about 4 cents a pound. Formerly, the plant in David shipped entirely by air, using the northbound, nearly empty, flights of cargo lines that make most of their money hauling southbound general freight. Flights go direct from David to Miami. Later, however, the plant started making shipments by refrigerated trailer to Puerto Matias de Galvez on Guatemala's Caribbean coast, whence the trailers are carried by ferry to Miami. Although the road distance from David to the port is 1,250 miles, not all of it paved, the total cost is comparable to air transport (about 5 cents per pound). This method has proven so satisfactory that most of the shipments from David now go by trailer.

The shrimp industry has a considerable impact on the economy of Panama. It provides direct employment to thousands of people in Panama City, and the business generated through purchases made by the industry provides jobs for many others. To a casual observer this can be lost sight of in a large city, but those who follow the economy and the unemployment statistics know that the shrimp fishery is vital to the well being of the city and the country.

Realizing the value of the shrimp industry, the government has offered it various inducements. The operating companies have 25-year concessions and are free from corporation taxes. There are no export taxes. As in other fields, foreigners may operate in the shrimp fishery by setting up Panamanian corporations and by using vessels built in Panama. There is no restriction against foreigners as plant officials or employees.

Colombia

Shrimp are found along most of Colombia's 500 miles of Pacific coastline. The shrimp industry is concentrated at Buenaventura, which is located about midway between Panama and Ecuador. Buenaventura is also Colombia's princi-

pal port for commercial shipping. A very small shrimp fishery is carried on at Tumaco, a port near the southern border.

Beginning with the first trawler in 1943 and fluctuating since, the Buenaventura shrimp fleet consisted of 154 registered vessels plus 31 small unregistered boats in 1970. All craft are of Colombian registry.

In recent years Colombia has developed a boat building capacity at Barranquilla, financed by the Instituto de Fomento Industrial (IFI) to make Colombia self-sufficient in its need for fishing vessels. As of 1970, this agency had financed construction of 89 new shrimp boats for Colombia and, with the Fondo de Promocion y Exportacion, financed 37 boats for export.

Ownership is of two kinds, company and private; the larger and better boats are company owned. The 1971 Pacific shrimp fleet consisted of 154 vessels, about half wood, of which about 125 operated at any one time. A recent survey by FAO and the Colombian Institute for the Development of Renewable Natural Resources (INDERENA) recommended a limit of 125 operating shrimp boats for this fishery. Vessels range from 33 to 82 feet long; new boats are being built in the 65 to 78-foot range and some equipped with freezers.

Nine firms on the Pacific Coast operate shrimp processing and freezing plants; six are in Buenaventura. Recent figures indicate that about 75 percent of the shrimp catch is exported and the rest consumed domestically. Although most exports are to the United States,

Japan has recently been bidding for a share. The plants are as follows:

Buenaventura:

Alianza Colombiana de Pesca, Ltda. (ACOPESCA)
Pesqueros Unidos de Colombia, Ltda.
Pesquerias del Pacifico, S.A.
Empresa Colombiana de Pesca, Ltda. (LA POLAR)
Asociacion Pesquera Arlibia, Ltda.
Industria de Pesca sobre el Pacifico (INPESCA)

Tumaco:

Productos del Mar Ltda. (PRODEMAR) Grupo Mancchini
Pesquera de Tumaco, Ltda. (PESMACO)

Guapi:

Recursos del Mar Ltda. (REDMAR)

Most of the catch is white shrimp, called "camaron blanco" or "langostino," and the three species are not separated in the industry. In all fishing areas and seasons, *Penaeus occidentalis* constitutes about 82 percent of the landings. *P. vannamei*, *P. brevivirostris*, *P. californiensis*, *Xiphopenaeus riveti*, and *Trachypenaeus byrdi* account for most of the remaining catch. Occasionally, especially in the dry season, these species constitute up to 18 percent of the landings.

The fleet operates along most of the coast of Colombia south of Cabo Corrientes, about 150 miles south of the border with Panama. Trawling is carried on at 3 to 15 fathoms, mostly less than 8 fathoms.

The fishery operates in four well-defined areas (known for research and statistical purposes as zones). They are separated by stretches of deep water and rocky coast where fishing is not possible. From north to south, the fishing zones are as follows:

Zone I. Zone of Cabo Corrientes. This area extends south from the cape to Punta de Piedra, which is near Buenaventura. This area has numerous excellent nursery grounds, including the estuary of Rio San Juan and Juan-chaco. The heaviest fishing is near Puerto Pizarro. The best season is May to December. Most fishing is in

Table 9.—United States imports of shrimp from Colombia, 1961-71.

Year	Volume	Value
	1,000 pounds	\$1,000 U.S.
1961	1,873	1,237
1962	2,207	1,592
1963	1,870	1,256
1964	1,774	1,343
1965	1,796	1,366
1966	2,212	1,695
1967	2,726	2,031
1968	3,018	2,895
1969	3,703	3,659
1970	4,802	4,643
1971	4,841	4,891

Note: The above figures are almost entirely heads-off, shell-on shrimp. A small proportion in the later years is peeled and deveined.

the daytime, because strong winds and a heavy surf make fishing close to shore at night very dangerous. This zone is primarily a feeding area for the shrimp, which are larger than elsewhere in Colombia. Presumably they move in from the south; the area has no extensive lagoons for nursery grounds.

Zone II. Zone of Tortugas and Timpique. This important area, from Punta de Soldado to Timpique, has the excellent nursery grounds of the rivers Raposo and Cajambre and extensive shallow mud flats. The Bahía de Tortugas is especially good. The grounds are only 2 hours from port, and fishing is good all year. Most fishing is in the daytime, although it is not dangerous to fish at night.

Zone III. Zone of Tumaco. This area extends from Guapi to Ecuador. The best production area is immediately north of Tumaco. With innumerable rivers and estuaries, this region has the best nursery grounds of all. Perhaps for this reason, the shrimp are smaller in the Tumaco area than elsewhere. With many dangerous shallow bars, even daylight fishing is hazardous, and little fishing is done at night. The area is fished heavily all year. In 1963 it was estimated that 57 percent of the production originated in Zones III and IV.

Zone IV. Zone of North Pacific. This area extends from Cabo Corrientes northward to Panama. The FAO-INDERENA survey found small shrimp grounds in Bahía de Humboldt, Bahías de Cupico y Chirichiri, and Ensenada de Utria. At present the resource is little fished.

All exports to the United States move directly from Buenaventura on the scheduled refrigerated ships of the Flota Mercante Grancolombiana and the Grace Line.

The processing plants operate under licenses which contain no specific time limits and which specify that they should export 90 percent of their production and sell 10 percent domestically. As producers of "minor exports," they are exempt from income and inheritance taxes; import taxes on fixtures, refrigeration machinery, vessels, parts and engines, nets and fishing gear, elec-

trical equipment, and processing machinery; and various harbor taxes. They may also import various necessities that are otherwise prohibited entry. Required bureaucratic procedures involved in importing and in obtaining these exemptions are time-consuming.

There is no export tax as such, but the required method of payment and the artificial rate of foreign exchange result in a de facto tax. All dollar payments for shrimp exports are made through the government bank (Banco de la Republica). The bank pays the packers in pesos at the rate stipulated for all minor or small exports (of which shrimp is one, as opposed to coffee, a major export), which is less than the open market exchange. For example, in April 1966, when the free exchange rate was about pesos 18.00 per \$1.00 U.S., the rate for shrimp sales was 15.50 to \$1.00. This is equivalent to a tax of nearly U.S. \$0.14 on every dollar. This is far more than the direct export taxes in any other country.

Since 1967 Colombia has had a Fisheries Development Project supported by the Special Fund of the United Nations and operated jointly by FAO and INDERENA. Surveys in the shallow waters of the Pacific are almost completed. Additional shrimp surveys are being made in 100-fathom water. Investigations are also in progress in the Atlantic. Basic work has been done in marketing and processing and legal problems. Work on oysters and freshwater shrimp is also included in the project. Training has been given to numerous biologists, who will continue to work after the project closes at the end of 1972.

The nine freezing plants on the Pacific coast also process and sell frozen finfish in the interior of Colombia. The high cost of transportation by truck and air, however, makes fish from the Pacific coast a high-cost protein in the population centers. Freshwater fish are much cheaper. However, the quality of the ocean fish marketed is good and people in the upper income brackets are willing to purchase a certain amount as a variation in diet. One dollar or more per pound is common for snook, snapper, mojarra, sea catfish, and sea bass. The nine plants cited could expand their production for the export market.

Ecuador

The Ecuadorian shrimp fishery is one of the best developed in Latin America and is a consistent high producer; exports average over 5 million pounds. Along the 500 miles of coastline, shrimp fishing is confined to the 100 miles near Esmeraldas in the extreme north and to the Gulf of Guayaquil in the extreme south. Landings are made at Esmeraldas, Playas, Posorja, and Guayaquil; the last is by far the most important.

The 1971 shrimp fleet was estimated at 195 vessels, of which 145 fish out of Guayaquil and 50 out of Manta. About 75 of the boats are wooden, 65 feet or more long. Only two have steel hulls, and are 75 feet long. About 70 percent of the fleet has brine refrigeration. The average trip of the larger vessels is 2 weeks; the smaller boats in Manta and Playas return to port daily.

In 1971 nine plants packed shrimp in the port of Guayaquil:

Empacadora Nacional, C.A. (ENACA), producing 1 million pounds per year from 49 boats, of which 6 are company-owned, 32 under contract, and 11 individually owned.

Industria Pesquera Ecuatoriana, S.A. (IPESA), production capacity 150,000 to 200,000 pounds per month from 40 boats, part company-owned, part privately owned.

Corporation Pesquera Ecuatoriana, S.A. (COPESA), an older plant being rebuilt.

Six plants smaller than any of the above three are:

Conservas Alimenticias Ecuatorianas Cia. Ltda. (CONALEC);

Compania Distribuidora Nacional, S.A., (CODINASA);

Empacadora Alberti of Ecuador, C.A.;

Ecuadorian Seafoods, C.A. (ESCA), *Empacadora Frigorifica de El Oro (FRIGORO)*; and

Productos Marinos Industrializados "Inca" del Ecuador (PROMAINDE).

The combined annual production of the six small plants is less than the total of the first three.

In Esmeraldas, Mariscos de Esmeraldas Cia., Ltda., and Pesquera del Golfo, C.A., were packing shrimp in 1971.

Ecuador's exports of shrimp to the United States are shown in Table 10. While most exports are heads-off, shell-on, part of the exports in recent years have been IQF and part peeled, de-veined, and block frozen.

Table 10.—United States imports of shrimp from Ecuador, 1961-71.

Year	Volume	Value
	1,000 pounds	\$1,000 U.S.
1961	4,684	2,986
1962	5,121	4,082
1963	5,631	4,374
1964	5,759	4,265
1965	5,667	4,428
1966	5,239	4,507
1967	5,986	5,359
1968	6,289	5,916
1969	8,901	9,165
1970	5,992	5,735
1971	5,332	6,054

In Ecuador, the name "camaron" is applied generally to all shrimp. In the packing plants, the large shrimp of any species are called "langostinos," and the sea bobs and small specimens of the white shrimp are called "camarones." Almost all the "langostinos" are the white shrimp of three species, also called "blancos." Of these, *Penaeus occidentalis* accounts for 60 percent of the production. Most of the rest are *P. stylirostris*, along with some *P. vannamei*. The whites are taken in 4 to 14 fathoms.

The fishery takes very few pinks, or "rojos," *P. brevistrostris*; and browns, or "cafes," *P. californiensis*. The fishery scientists believe that a good resource of pinks exists in deeper waters, but little exploratory fishing has been done. The commercial fishery is strictly in shallow water, close to shore, and as yet the fishermen feel no need to fish offshore. The research vessel of the National Fisheries Institute, while making other studies, had excellent incidental catches of royal red shrimp on an offshore shelf 400 to 500 meters deep.

The small sea bobs are a very important part of the fishery. Two species dominate the shallow-water fisheries at Playas and Esmeraldas: the "pomada," *Protrachypene precipua*, and the "titi," *Xiphopenaeus riveti*. Ecuadorian scientists recognize three species of the

striped "tigres" or "zebras": *Trachypenaeus byrdi*, *T. faoe*, and *T. similis pacificus*. The "tigres" spend part of their life histories in the lagoons and estuaries like the whites, whereas the "pomadas" and "titis" do not enter estuarine waters.

The trawlers catch some spiny lobsters incidental to shrimp. They bring in the tails, which are frozen for export. The tails are wrapped individually in polyethylene and packed in cartons. The shrimp plants, and an additional plant that deals only in lobsters, buy whole live lobsters from other fishermen. The tails are frozen raw. The heads are cooked and then frozen for export (to yield picked lobster meat). Eventually, when adequate and sanitary facilities for this work are constructed, it is expected that this work will be done locally.

Almost all the shrimp and lobsters are shipped by refrigerated cargo ship direct to New York. One or two plants ship some by air, via A.P.A., to Miami. The shipping rates are a little over 5 cents per pound by ship and 6 cents by air.

There is no direct export tax on shrimp. However, the exporters are required by the Central Bank to exchange their dollars for sucres at an artificial rate which is lower than the free market and results in a de facto tax. Packers and fishermen pay a variety of small port and local taxes and fees.

Peru

Peru is at the extreme southern edge of the range of the warm-water species of shrimp, and consequently has but a small fishery. Most of Peru's very long coastline is bathed by the cold waters of the Humboldt Current. Although this nutrient-rich body of water supports the world's largest fishery—for the Peruvian anchovy—it is too cold for the penaeid shrimp, which support the Hemisphere's shrimp industry.

The Humboldt Current moves offshore where it meets tropical waters, near Cabo Blanco. Just north of Cabo Blanco are the fishing towns of Puerto Mancora and Caleta Cruz. The entire shrimp fishery is centered in the 30-mile-long area from Caleta Cruz to the border with Ecuador. The trawling grounds

are actually an extension of the Ecuadorian grounds of the Golfo de Guayaquil. The only Peruvian nursery areas are the estuaries around Puerto Pizarro, and these are not particularly extensive.

About 80 percent of the production is exported to the United States. Hence, Table 11, which presents official U.S. import figures, gives a good idea of the size of the industry. Weights are mostly heads-off, shell-on, which is the principal type of product.

Table 11.—United States imports of shrimp from Peru, 1961-71.

Year	Volume	Value
	1,000 pounds	\$1,000 U.S.
1961	358	277
1962	387	335
1963	367	312
1964	308	240
1965	446	419
1966	539	514
1967	254	243
1968	269	292
1969	698	686
1970	309	307
1971	370	371

As of late 1971, the industry consisted of two freezing plants and 25 boats. All boats are based at the open-sea port of Caleta Cruz. Nineteen are small 30- to 40-footers, and six are modern 60-footers. The small boats use single otter trawls. The large vessels, which are converted anchovy and tuna boats, use the double-rigged Gulf of Mexico style shrimp trawls. All are refrigerated with ice.

One small freezing plant (Promarsa) is located in Caleta Cruz. Twelve small trawlers fish for this plant. The other plant (Conulsa), an affiliate of a United States company whose principal operation in Peru is fish meal, is located in Mancora. Its vessels deliver in Caleta Cruz, and their catches are shipped to Mancora by truck.

All three species of white shrimp are caught in the Peruvian fishery. Neither fishermen nor processors distinguish them; all are called "blancos." Probably *P. occidentalis*, *Penaeus stylirostris*, and *P. vannamei* are about equally distributed in the catches. Only the largest sizes are used. About 85 percent of the pack is under 15 to the pound (heads-off), and many are under 10. Fishing is carried on out to 15 fathoms, but apparently the shrimp are most

abundant close to shore in 3 to 6 fathoms.

Under the 1970 reorganization of Peru's fisheries, an agency called Empresa Publica de Servicios Pesqueros (EPSEP) was created to develop the food fisheries. Although, as noted above, Peru's shrimp potential is limited, some development work can be expected as part of the nation's overall goal of increasing its food fish and shellfish production.

THE SHRIMP FISHERY OF THE CARIBBEAN SEA

General

The shrimp export fishery of the Caribbean Sea developed much later than on the Pacific Coast. Cuba began exporting in a small way in 1953, but the fishery never became important. Venezuelan exports began in 1957 but were of no real importance until 1961. Export fisheries began in both Honduras and Nicaragua in 1958.

Unlike the nearly continuous shrimp resource of the Pacific Coast, Caribbean shrimp occur in significant quantities only in restricted areas. Only three areas appear to have the environment essential for large populations of penaeid shrimp, i.e., extensive brackish water lagoons as nursery areas for the juvenile shrimp, and open-sea areas with a muddy bottom where the adult shrimp feed and spawn. A relatively level muddy bottom is also necessary for trawling operations.

One of the three areas is in the extreme western Caribbean, from the northern tip of the Yucatan Peninsula at Cabo Catoche southward toward Isla de Cozumel. This extremely limited area is fished by Mexican trawlers based in Ciudad del Carmen and Campeche, by United States vessels based in Florida, and by Cuban boats. The limited fishery is of recent origin. No catch statistics are available, and catches made in this small fishery are not included in any of the production figures presented in this report.

The second area encompasses the extreme eastern part of mainland Honduras, the offshore islands of Honduras, and the coast and islands of Nicaragua.

This area is fished by vessels based in Honduras and Nicaragua, and by United States trawlers based in Florida. The United States vessels, some of which pick up their crews at Honduran and Nicaraguan ports, deliver their catches to their home ports in Florida. Hence, their production is not included in any of the statistics presented in this report. As many as 50 or more U.S. vessels may be in the area at any one time. These vessels transfer their catches to home-bound boats so they can remain at sea and continue fishing for long periods.

The third and most productive area is in western Venezuela, in Lake Maracaibo and the adjacent Gulf of Venezuela. An enormous fleet of canoes fishes for juvenile shrimp in the lake, and a locally based fleet of trawlers fishes adult shrimp in the Gulf.

The Caribbean shrimp fisheries are based almost entirely on four species of large penaeid shrimp: the white, *Penaeus schmitti*; the pink, *P. duorarum*; the spotted pink, *P. brasiliensis*; and the brown, *P. aztecus*. These occur in differing proportions, depending on area, depth, and season.

Honduras

The Honduran shrimp fishery began in 1958 when United States operators brought in trawlers and established freezing plants. Exports that year were 836,000 pounds, a figure not equalled again until 1963. Ever since its inception the fishery has been unstable, starting and failing in response to a variety of changing conditions.

The Caribbean coast of Honduras runs east and west for about 365 miles. Lying 10 to 30 miles offshore, near the middle of the coastline, are the Bay Islands, consisting of three major islands and numerous small keys. Strung out for many miles east and northeast of the eastern part of the coast are dozens of small uninhabited keys and reefs.

Shrimp are found in quantity only along the 100-mile stretch between Punta Patuca and Nicaragua, and around the keys and reefs offshore. This is the area with suitable trawling bottom and favorable shrimp feeding grounds, and it is adjacent to a series of large lagoons that serve as nursery areas. The 265 miles to the west of

Punta Patuca, as well as the Bay Islands, are largely without shrimp. The water is deep, the bottom rough, and the lagoons apparently produce few shrimps.

The physical problem faced by those attempting to establish a shrimp fishery is that the part of Honduras that is near the shrimp grounds is both uninhabited and inaccessible. All the harbor and service facilities, supplies, and sources of labor are to be found in the towns far to the west, on both the mainland and the Bay Islands. Within reasonable reach of the shrimp grounds there are no towns, harbors, roads, railways, or airfields (except the air strips that the shrimp producers build for themselves). The choice lies between establishing plants in towns far away from the fishing grounds or in remote and primitive spots lacking all service facilities and amenities. Both approaches have been tried. In either case, costs of operations have been high, which alone has been enough to keep the industry from expanding to the extent that the available resources warrant.

Another deterrent to greater development has been the constantly changing official attitude toward the participation of foreign investment, vessels, and personnel in the shrimp industry. For example, the boom of 1958 was ended abruptly by the enactment of the Fisheries Law of 1959, which virtually barred foreign participation. It required 51 percent Honduran capital, which was not forthcoming in view of the otherwise risky nature of the business. Subsequently, the Minister of Natural Resources was given authority to grant temporary permits to foreigners.

Since 1959, operations have been partly by Honduran corporations and partly by United States enterprises working under temporary permits. Some permits have called for delivering the catches to shore plants; others allow the transfer of catches to carrier vessels, under supervision, and upon payment of the export taxes. Enforcement of regulations, supervision of plant operations, and collection of statistics are all difficult because the fishery is equally inaccessible to government officials and plant owners.

Two plants pack shrimp on the mainland Caribbean coast of Honduras.

The older of these, Alimentos Marinos Hondureños, is located at Barra Caratasca and is a joint United States-Honduran operation. It is a small plant, fully self-sufficient, and supplied by seven boats. The second is basically a meat packing operation, handling some shrimp in season, at Puerto Castilla.

On Roatan Island, the largest of the Bay Islands of Honduras, Mariscos de Honduras has built up a substantial shrimp operation in the town of Oak Ridge. Principal U.S. interest is International Oceanographic Corporation of New York. The plant produces about 1 million pounds of headless shrimp a year with 20 modern trawlers.

Guanaja Island, the second largest of the Bay Islands, has two shrimp plants. Caribbean Products (75 percent owned by Alberti Foods of Chicago) packs both headless green, peeled, and deveined, and IQF shrimp. Annual volume is about 750,000 pounds of shrimp, plus between 60,000 and 100,000 pounds of lobster tails. A fleet of 35 boats supplies this plant. An older and larger plant on the same island is that of Industria Pesquera Hondureña, Spanish owned and managed. This plant is reported to have a capacity of 2 million pounds of shrimp production per year, and is supplied by 36 boats, of which 15 are company owned.

Practically all of the Honduran shrimp production is exported to the United States. Hence, Table 12, which gives official United States import figures, summarizes the growth and size of the industry based in Honduras.

Table 12.—United States imports of shrimp from Honduras, 1961-71.

Year	Volume	Value
	1,000 pounds	\$1,000 U.S.
1961	227	150
1962	379	259
1963	835	472
1964	698	493
1965	1,632	1,069
1966	2,107	1,670
1967	1,922	1,751
1968	2,981	2,819
1969	3,925	3,983
1970	2,415	2,346
1971	3,942	3,967

The Honduran shrimp fishery is based on two species: the white shrimp, *Penaeus schmitti*, and the pink shrimp, *P. duorarum*. The catches consist of about

equal amounts of the two species, with most of them in the 26/30 size range (heads-off weight).

The following information is a summary of the findings of a FAO biologist who observed the fishery in 1959, 1960, and 1961:

White Shrimp. The fishery grounds are from Punta Patuca to Nicaragua. The whites are taken in less than 20 fathoms. In 1959, two-thirds were taken in depths of 11 to 20 fathoms and one-third in less than 5 fathoms. In 1960, 90 percent was taken in less than 10 fathoms, the rest in 16 to 20. The whites are most abundant from August to mid-November. Although the sizes vary from year to year and within a season, they run mostly 21/40, with none under 15.

Pink Shrimp. The fishing grounds extend from longitude 84° W. (several miles east of Punta Patuca) to the Nicaraguan border. Practically all pinks are taken in 16 to 25 fathoms. (As of 1961, little exploration had been conducted beyond 25 fathoms, and the fishery around the offshore keys had not developed.) Pink shrimp become abundant in late September or October, then gradually decrease after November until March or April, when fishing for them ends. The sizes run mostly 21/40, varying from month to month.

Brown Shrimp. Very few browns are taken. They are mostly 26/30 to the pound.

Since 1959, the export tax has been 50 cents per metric ton, plus 10 percent ad valorem, established on a basic price of 40 cents per pound. In total, this amounts to a little over 4 cents a pound.

Nicaragua

Nicaragua has a 285-mile Caribbean coastline. The only port where shrimp are landed is Bluefields, 200 miles south of Honduras and 85 miles north of Costa Rica. The eastern part of the country, referred to as Costa Atlantica, had long been isolated from the rest of the country because of a lack of communication across the jungle and wilderness that lie between the coast and the capital at Managua. Several years ago, regular airline service was provided that now connects the two parts of the country. Furthermore, an all-weather road has

been built eastward from the capital to the head of navigation on the Rio Escondido, which empties into the Mar de Las Antillas (Caribbean) at Bluefields.

The Caribbean coast is blessed with an excellent series of large brackish water lagoons and estuaries that provide outstanding nursery areas for young shrimp. Annual rainfall of some 200 inches assures adequate fresh water. Good shrimp feeding grounds, with excellent trawling bottom, are found along almost the entire coast from the mainland beach out to beyond the many offshore keys and islands.

At El Bluff, which is a port of entry at the entrance to Bahia Bluefield, Booth Fisheries de Nicaragua, S.A., took over a French-built shrimp plant that failed in 1962. Using U.S. capital and management, Booth rebuilt the plant into one of the most modern in Central America. The company is partly owned by the government corporation known as the National Institute of Development (INFONAC). The plant produces about 3.5 million pounds annually.

Later, another plant, Pescanica, S.A., started operations on Schooner Key, an island in the bay. This plant has a potential production capacity of 1.5 million pounds and is owned partly by Atalanta Trading Company of New York.

Still another plant, PROMARBLU, recently opened up on Corn Island, a few miles off the coast in the Caribbean. This plant has a production capacity of about 1 million pounds annually and operates 20 modern steel trawlers.

Although starting operations without any company-owned boats, Booth operated 12 steel trawlers in 1971 and Pescanica had 10 steel trawlers. As the fishery is seasonal, the size of the total fleet varies as U.S. and Mexican vessels come to the area to fish for the two plants. During the peak of the fishing season, Booth may have over 40 boats fishing and Pescanica over 20.

Recent government restrictions limit shrimp drying to sea bobs. Two small companies dry shrimps for export, Kai Yun Chan on Laguna de Perlas, a few miles north of Bluefields, and Ernesto Hooker on Rio Huahua, near Puerto Cabezas on the North Coast. They buy

the catches of canoe fishermen who use cast nets in the nearby lagoons and estuaries.

Most of Nicaragua's shrimp production is exported to the United States (Table 5).

Of the four species taken by the freezing plants, the two varieties of pink shrimps are by far the most important. The pink, *Penaeus duorarum*, and the spotted pink, *P. brasiliensis*, are taken together in about equal proportions. They are not separated in the plants. The most numerous size range is 21/25 (heads-off, shells-on).

Both of the pinks are offshore species, occurring around the keys and islands. They are usually fished at depths of about 25 fathoms.

The pinks usually appear in October and are caught into the following May. The best grounds lie within the triangle formed roughly by Punta de Perlas (Pearl Point), Islas del Maiz (Corn Islands), and Punta del Mono (Monkey Point, also called Punta Mico). The points of this triangle are (from El Bluff): Pearl Point, 30 miles north; Monkey Point 30 miles south; and the Corn Islands, 50 miles northeast. The slowest season for all species is mid-May through July, when most fishing is south of El Bluff.

The white shrimp, *Penaeus schmitti*, is important seasonally. The adult whites leave the lagoons for the ocean when the heavy rains begin in June. They are fished August through December. The fishing grounds are separate from those for the pinks, and extend from Cabo Gracias a Dios past Puerto Cabezas to Prinzapolea, about 130 miles. From Prinzapolea to El Bluff is a run of 95 miles. The whites, fished only in daytime, live in very shallow water. Sometimes the trawlers operate just outside the breaker line in 1.5 to 2 fathoms. Occasionally the whites are so close to the beach and in such great quantities that the local residents can catch them in sacks, screens, and buckets. In recent years increasing quantities of brown shrimp, *P. aztecus*, have been taken in the same area and season as the whites. They are caught a little farther from shore and are fished at night.

All frozen shrimp are shipped to the United States by refrigerated ships, mostly in the standard 5-pound cartons

and master cartons. As of 1971, about 50 percent exports were IQF.

The export tax on all shrimp, regardless of species or size, is 3 cents a pound.

Venezuela

Venezuela's modern shrimp fishery began about 1959, in Maracaibo. Large-scale exports began in 1961. After a preliminary shakedown, the industry underwent a meteoric expansion, on a scale never seen elsewhere. With a smaller fishing area than most countries, the Venezuelan fishery by 1965 was producing more shrimp than any other fishery south of Mexico. The explanation of the enormous catches (16 million pounds in 1965) lies in the tremendous productivity of Lake Maracaibo, probably the greatest nursery area for white shrimp in the Americas.

Venezuela has a 1,750-mile coastline, including gulfs and islands; over three-fourths of the coast faces the Caribbean Sea and the remainder the Atlantic Ocean. As noted below, shrimp have been caught in commercial quantities only in the extreme west, and the fishery is essentially confined to the Gulf of Venezuela and Lake Maracaibo, close to the Colombian border.

Most of Venezuela's shrimp production is exported to the United States; Table 13 shows the growth of the industry in the last 10 years:

Table 13.—United States imports of shrimp from Venezuela, 1961-71.

Year	Volume 1,000 pounds	Value \$1,000 U.S.
1961	2,469	1,115
1962	6,341	4,067
1963	5,790	3,344
1964	7,904	4,457
1965	12,719	7,976
1966	2,881	2,432
1967	4,773	4,067
1968	5,403	4,756
1969	5,851	5,804
1970	11,563	11,288
1971	10,083	11,921

As can be seen by Table 13, Venezuela's shrimp industry declined sharply in 1966. While many factors were blamed for this, experts believe that the poor fishing was due to some cyclic change in abundance, such as has occurred in other shrimp fisheries in the past. For the next 3 years, production was less than

half that of 1966 and the industry was confronted with problems of finances and quality. These were largely overcome, however, and in 1970 production increased again to over 11 million pounds. The situation continued good through 1971.

Lake Maracaibo and its distributary system of waterways constitute an almost perfect environment for the production of shrimp. They contain excellent feeding, spawning, and nursery areas, apparently in the right proportions. Every necessary degree of salinity is present, along with water temperatures conducive to year-round spawning and growth. Furthermore, the harvest of shrimps is made possible by the existence of suitable fishing grounds for several types of gear. If a model shrimp area were to be designed, it could not improve upon the Maracaibo complex as it exists today.

The heart of the area is Lake Maracaibo itself. The lake covers about 5,500 square miles and is the largest lake in South America. Its watershed totals 35,000 square miles, much of it mountainous and with heavy rainfall. Most of the lake is shallow, but a maximum depth of 115 feet is reached in the southeast portion. The waters of the lake are a mixture of fresh water from the outflow of many rivers and sea water entering from the mouth of the lake. Until 1958 the salt content had fluctuated around one part of sea water to 25 parts of fresh water, but recently salinity has risen to more than double the former amount. This has been due to the construction of a deep-water channel to permit the passage of oil tankers to and from the petroleum installations that ring the lake. A counter-clockwise circulation, driven by the wind, brings sea water to the surface in the middle of the lake and provides for a uniform surface salinity throughout. The shore areas of the lake, particularly the northwestern portions, are splendid nursery areas for white shrimp. Temperatures in the lake range from 28° to 31°C.

The lake drains into the small, shallow Bahia de Tablazo through the Estrecho de Maracaibo, on the west shore of which lies the city of Maracaibo. The bay is a typical transition zone, abounding in mangrove habitat, with hydrographic conditions changing seasonally.

Both the bay and the strait are excellent nursery areas for juvenile white shrimp.

The bay empties into the Gulf of Venezuela through a series of channels, one of which has been dredged for the passage of tankers. The gulf covers an area of about 6,500 square miles. It is protected from the open waters of the Caribbean by the Peninsula de Paraguana on the east and the Peninsula de la Guajira on the west. (The outer extremity of the latter peninsula is in Colombia). The gulf is subdivided into two parts, the gulf proper on the east, and the Ensenada de Calabozo in the west, lying south of the Peninsula de la Guajira. A shallow ridge, running north and south, divides the two parts. Calabozo has a maximum depth of 15 fathoms, whereas the outer gulf is as deep as 44 fathoms at its mouth. As could be expected from the depth pattern, white shrimp are found in Calabozo, and browns and pinks are taken in the open gulf. Surface water temperatures vary seasonally from 25° to 28°C.

Completing the environmental complex is a small protected gulf, the Golfete de Coro, which is an indentation of the main gulf on the east, completely protected by the Peninsula de Paraguana. This shallow bay, along with the nearby shores of the gulf itself, is the principal nursery area for juvenile brown and pink shrimp.

Nine species of shrimp are found in the Maracaibo area. Seven are penaeid species, of which four are important commercially. The two caridean species are of minor importance. In general terminology, the local fishermen refer to all large shrimp, regardless of species, as "langostinos." The smaller shrimp are called "camarones," and the smallest are "camaroncitos."

By far the most important species is the white shrimp, *Penaeus schmitti*. Known as "langostino blanco" or "camaron blanco," this species may account for as much as three-fourths of the total production. Apparently the whites spawn throughout the year on their principal feeding grounds in the Ensenada de Calabozo. The postlarvae apparently migrate to the nursery areas of the Bahia de Tablazo and the adjacent shores of the open gulf, the strait, and the lake itself. As subadults they return to Calabozo where they later enter the fishery as the predominant species. As

adult shrimp, the whites constitute about 50 percent of the total catch made in the Gulf of Venezuela. In the fishery in Lake Maracaibo, the juvenile whites account for 90 percent or more of the catch, depending on place and season.

Three other species of penaeid shrimp inhabit the eastern or open, deep water part of the Gulf of Venezuela. Most important of these is the pink shrimp, *P. duorarum* known as "camaron rosado." This species constitutes 50 to 75 percent of the catch made in the outer part of the gulf. The spotted pink shrimp, *P. brasiliensis*, is found mostly just outside the gulf proper, north of Cabo San Ramon; because little fishing has been done in this area, the true abundance of this shrimp is not known. This species is known locally as "camaron rosado con mancha." The third species is the brown shrimp, *P. aztecus*, known locally by the specific name of "camaron marron." The brown shrimp contributes about 20 percent of the catches made in the outer gulf. The fishermen group all three species together and give them the general name of "camaron marron." (Scientists also group them for convenience and call them grooved shrimp, as distinct from the whites.) Some of the plants pack them all indiscriminately as browns; some separate them as pinks or browns, depending on color (which is variable). The nursery grounds for all three species are in the Golfete de Coro, where a small fishery exists, and along the nearby shores of the main gulf. At times, these species appear in the catches in Lake Maracaibo in appreciable quantities, so this area is probably a fairly important nursery area for them also.

Because of the confusion of local nomenclature, and because of the difficulty of accurate identification of the younger stages, which are quite similar, it is difficult to say precisely what proportion of the catch in the lake is composed of the various species of grooved shrimp. However, it has been estimated that *P. aztecus* accounts for nearly 10 percent of the total lake catch.

Completing the list of penaeid shrimps are the sea bobs, *Xiphopenaeus kroyeri* and *Trachypenaeus similis*, and a rock shrimp which has been identified tentatively as *Sicyonia stimpsoni*. The latter two are of no commercial importance.

X. kroyeri is taken in small quantities in the Calabozo fishery. Known as the "siete barbas," it is also called "camaron blanco," and the larger individuals are marketed along with the true whites. It does not appear to be very abundant.

The two caridean shrimp are found in the lake, particularly in the more southerly parts that are influenced by the many rivers. *Macrobrachium acanthurus*, or "brazo largo," is of little commercial importance. However, *M. amazonicum*, or "camaroncito del rio," is often caught in considerable quantities. It sometimes constitutes as much as 15 percent of the catches in the lake. Also known as "camaroncito blanco," it is marketed along with the juvenile whites. In fact, the lake fishermen remain convinced that it is the same species. Because they often catch *M. amazonicum* in the egg-bearing stage, they believe that the spawning grounds of the white shrimp are in the southern part of the lake. The government biologists have tried in vain to explain that the true white shrimp (like all penaeid species) is a free spawner and does not carry its eggs attached to its swimmerets.

The Maracaibo shrimp fishery really consists of several types of fisheries. Two different trawl fleets operate in the Gulf of Venezuela. Three kinds of canoe fisheries are active along the shores of the gulf, in the Golfete de Coro, Bahia de Tablazo, the Estrecho de Maracaibo, and particularly in Lake Maracaibo. It has been estimated that the trawl fisheries of the gulf account for two-thirds of the total production, and the canoe fisheries the rest.

The larger of the two trawl fleets, and the first to be established, is based at Punto Fijo on the Peninsula de Paraguana. In 1969 this fleet consisted of 116 boats. While many of these are the Italian boats that entered the shrimp fishery a number of years ago, newer Florida-style vessels are also included in this fleet. All use the double rig.

The second trawl fleet, 18 vessels in 1969, is based at Maracaibo. All are Florida-style boats ranging from 62 to 65 feet in length, with some larger. The rest of the total shrimp fleet of 159 vessels consists of a handful of boats at each of the ports of Cumana, Puerto La Cruz, Carupano, Guiria, and Punta Piedras.

About 3,200 canoe fishermen fished shrimp in the Maracaibo area, using 636 small boats. During periods of exceptionally good shrimping, other fishermen join them, so that at times over 4,000 men are taking shrimp.

After the various ups and downs experienced by Venezuela's shrimp industry in earlier years, the number of shrimp processing plants has settled down to 10. Three of these in the Maracaibo area are Lacustre de Pesca, Congeladora de Venezuela, and FIAVESA, all modern and well run. In Punto Fijo the two principal plants are FIVECA, owned by a U.S. firm, and AVENCASA, whose freezing capacity is 50,000 pounds per day.

Shipments are made to the United States by both air and sea. Two local airlines offer rates of 4 cents per pound gross, while several steamship lines offer service with better refrigerated temperature control at 4.5 cents per pound net.

Venezuela has no export tax on shrimp; however, plant owners must pay import duties on such items as equipment and machinery, most of which comes from the United States.

Colombia

Colombia's shrimp fishery along its 630-mile Caribbean coastline is relatively recent. In 1966 its shrimp fishery was described as of only local interest, but with considerable potential. At least some of this potential is now being realized.

In Barranquilla, 15 miles up the Magdalena River, three companies, PESCAMAR, COPECOL, and Pesquera del Atlantico, are in the shrimp business. The first was undergoing a rebuilding program in late 1971 involving all new equipment, including freezers and ice plant; it operates two 72-foot boats in addition to other smaller ones. The second company, COPECOL, had a small shore plant packing the shrimp from the five vessels of PESCAMAR. Production at Barranquilla should increase when the third plant, Pesquera del Atlantico, has completed its modernization.

Also at Barranquilla is the shipyard Astilleros Magdalena, Ltd., an impressive establishment building 72-foot steel shrimp boats both for the domestic

fleet and for export. In late 1971 it was completing an order for 10 of these vessels for Nicaragua.

Further west in Cartagena, the shrimp processing firm of Vikingos de Colombia dominates the scene. This is a good, clean, and fairly modern plant with daily freezing capacity of 70,000 pounds. Most of its production is headless unpeeled shrimp, with some peeled and deveined for block freezing. All production goes to a firm in Miami.

The Cartagena fleet fishing for Vikingos consists of 53 shrimp boats, of which 22 are U.S. flag, mostly from Tampa. Future plans call for increasing this fleet to 72 boats, including 10 new boats to be built in the shipyard at Barranquilla.

A Colombia license costs 50 pesos (about US \$2.00) per gross ton annually, and is issued only when there is a local plant contact.

The Cartagena fleet fishes year round, from the Venezuelan border to Panama in 20 to 40 fathoms. The best months are October to January. Average catch of a 14- to 15-day trip is 3,000 to 5,000 pounds, heads-off.

Other Countries

As noted in Section III-A, the shrimp fisheries of the Caribbean area are concentrated in a few localities, particularly off Honduras, Nicaragua, and a small part of Venezuela. Trawlers based in the United States and Mexico fish off Mexico, and United States vessels fish off Honduras and Nicaragua. Otherwise, the shrimp fisheries are sporadic and are largely small-scale operations for local markets. The primary reason for the lack of fishing is that no great quantities of shrimp are to be caught, largely because the combination of favorable nursery areas, feeding grounds, and a sea bottom suitable for trawling is missing. Throughout the entire Caribbean, with the exception of Honduras, Nicaragua, and Venezuela, the spiny lobster fishery is far more important than shrimp fishing. Some of the mainland countries (including Nicaragua), and nearly all of the islands, have flourishing lobster fisheries based on exports to the United States and Europe.

The waters around the Bahamas support a small-scale shrimp fishery, mostly

to supply the local market and the tourist hotels. Occasionally, small quantities are shipped to the United States.

Cuba was one of the first countries to develop a shrimp fishery based on exports to the United States. The industry began in 1953, reached its peak in 1957, and ceased abruptly in 1960 when the United States suspended all trade. Revival began again in 1969, when the first of 90 shrimp boats ordered from Spain entered the fishery. Since then, all of these vessels have operated in the Gulf of Mexico, the Caribbean, and off northern South America. Most of the production of both shrimp and lobsters is exported to Europe, Canada, and Japan.

Jamaica has a small-scale fishery for shrimp to supply the domestic market. Most of the shrimp are taken incidentally in the fishery for finfish, but they find a ready market. Small quantities are exported to the United States from time to time, along with lobster. Recorded United States imports of shrimp from Jamaica are 6,000 pounds in 1967, 30,000 pounds in 1968, and 3,000 pounds in 1971. Normally, Jamaica imports frozen shrimp from the United States to supplement its own small catches.

Haiti and the Dominican Republic have only small-scale local fisheries for the domestic market. However, Haiti manages to export some shrimp, as indicated by United States import figures of 1,000 pounds in 1967 and 3,000 pounds in 1971. In 1969 imports rose briefly to 54,000 pounds.

Puerto Rico has a small-scale shrimp fishery that cannot supply the local demand. Hence, considerable quantities of frozen shrimp are imported.

Throughout the Lesser Antilles are numerous small shrimp fisheries, but none of any importance. These mostly supply local markets, but occasionally some shrimp are exported.

The maze of keys and islands lying off the coast of British Honduras is the site of a very important spiny lobster fishery. Although the area appears suitable for shrimp, considerable exploratory fishing has failed to locate any substantial resources. Small quantities are taken off the southern coast, near the border with Guatemala. From time to time, small amounts are shipped to the United States (Table 14).

Table 14.—United States imports of shrimp from British Honduras, 1961-71.

Year	Volume	Value
	1,000 pounds	\$1,000 U.S.
1961	1	n.a.
1962	20	n.a.
1963	7	n.a.
1964	5	n.a.
1965	n.a.	n.a.
1966	39	40
1967	385	347
1968	506	439
1969	297	276
1970	18	28
1971	34	45

The Caribbean coast of Costa Rica is noted for its valuable, if erratic, spiny lobster fishery; however, there is no shrimp fishing.

The environment appears to be satisfactory for shrimp, but there has been little or no exploration. Nicaraguan trawlers that have fished their coast almost as far south as the Costa Rican border report shrimp in some abundance. The area near the border with Panama also appears to hold some promise. No shrimp fishing has been carried on along the Caribbean coast of Panama. Exploratory work has not disclosed adequate shrimp resources to interest anyone. Furthermore, the continually stormy weather has tended to discourage operations. The Panamanian shrimpers are content to fish in the storm-free waters of the Pacific, where a constant supply of shrimp is assured. It is suspected by some that additional exploratory fishing among the bays and islands around Bocas del Toro, near the Costa Rican border, would disclose the existence of a commercially fishable resource.

THE SHRIMP FISHERY OF THE ATLANTIC COAST OF NORTHEASTERN SOUTH AMERICA

General

The waters off northeastern South America have been called the greatest shrimping grounds in the Western Hemisphere. The description is not exaggerated. First exploited on a large scale in 1959, they supplied the U.S. market with almost 22 million pounds of shrimp in 1971.

This shrimping area lies off the coast of South America between the mouths of the Orinoco and Amazon Rivers. Shrimp bases have been established (in approximate chronological order) in Surinam, Guyana, French Guiana, Barbados, and Trinidad and Tobago. Fleets from all these places mingle on the fishing grounds, which by mid-1965 had been developed to encompass the areas described.

In general, fishing is carried on 50 to over 100 miles from shore, in depths of 15 to 34 fathoms. The sea bottom is characterized by a gently sloping shelf from shore out to 32 to 34 fathoms. At this depth, the shelf drops off abruptly. This dropoff is about 50 miles from the coast off Guyana and extends farther offshore until off the mouth of the Amazon it is over 100 miles from land. The best catches are made along the dropoff, and nearly all fishing is concentrated at that depth.

Fishermen have given names to each of the five fairly well-defined fishing areas, as follows:

- The West Grounds*: these lie off the coast of Guyana. They were the first to be harvested and are still popular.
- The Middle Grounds*: these are off the coast of Surinam (54°W. to 56°30'W.)
- The East Grounds*: these are off the coast of French Guiana, west of Cayenne (54°30'W. to 54°W.)
- The Rock*: these grounds are near two small islands offshore from Cayenne, between 52°W. and 52°15'W. This is a favorite area for boats to transfer their catches to home-bound vessels.
- The Gullies*: these grounds, in the Amazon area, extend eastward from Cabo Orange (westernmost point on the Brazilian coast) to 47°30'W. At Cabo Orange there is some fishing as close to shore as 30 miles, but the dropoff veers away from land to over 100 miles at the eastern part of the fishing area. The usual limit of fishing is at 48°W., 1°N. The bottom is featured by many mud hills and gullies, where the best fishing is encountered.

All of the fishing grounds are characterized by heavy seas and strong currents. The currents flow west, and as most of the fishing is east of the respective home ports, the vessels buck into the current outbound (and are hard put to exceed 6 knots) but can ride the current home when laden. Initially typical Florida-style 62- to 63-foot vessels were used in the fishery, but they were not suited for operation in the heavy seas and currents. Many of them did not last long, and neither did their crews. Replacement with 72- to 75-footers, and later up to 86-footers, heavily powered, proved satisfactory, and the whole complexion of the fleet changed. The larger vessels can fish every day of the year.

The most abundant shrimp, and the basis of the fishery, is the spotted pink shrimp, *Penaeus brasiliensis*. Also occurring is the somewhat similar pink shrimp, *P. duorarum*, which is not distinguished by the fishermen (and often not by the scientists); consequently, it is not possible to estimate the proportion of this species in the catch. The brown shrimp, *P. aztecus*, is caught in some quantities. The white shrimp, *P. schmitti*, occurs in shallow waters. The boats seldom fish in the shallows, where shrimp are scarce and trash fish are plentiful. (Throughout this section, the word shrimp without any qualifying adjective refers to the spotted pink shrimp.)

The sea bob, *Xiphopenaeus kroyeri*, is extremely abundant, particularly around river mouths. It is the object of local fisheries, but it is an important reserve resource of enormous size, if and when it becomes profitable to fish for it. Two very small species, *Palaemon schmitti* and *Hyppolysmata oplothoroides*, are also important in the local fisheries, particularly in Guyana. The National Marine Fisheries Service's research vessel *Oregon* discovered fairly good quantities of various species of deep-water shrimp, but these are not expected to form the basis for a fishery as they are scattered and not readily accessible.

The several enterprises established in the various countries to harvest the shrimp of the Guiana-Amazon grounds all follow the same general operating pattern. Each consists essentially of a fleet of far-ranging trawlers; a shore

base which includes a freezing plant, shops, parts depot, etc.; and a distribution system for the finished product in the United States. They all require, within reasonable propinquity to the fishing grounds, a source of good labor and vessel crews, boatyard facilities, ice-making plants, fuel supplies and groceries, hospitals, electric power, living quarters for supervisory personnel and boat captains, air service for flying in replacements on rotation, shipping facilities for the frozen shrimp, and above all, government permission to operate under terms that will permit them to make a profit and at the same time provide a boost to the local economy.

The problem of unauthorized transfers of catches at sea, and sale or barter by the skippers, is serious in the Guiana fishery, as elsewhere. In self defense, operators have banded together to prevent this practice, hiring undercover agents and offering rewards.

The shrimp fishery of the Guianas is described in the following subsections, country by country. Information given was obtained in late May 1971. Because of the problems created by Brazil's claims to extended jurisdiction, some United States flag vessels withdrew from the area late in 1971. Production figures and fleet sizes are therefore subject to revision, mostly downward.

On May 9, 1972, the United States and Brazil signed an agreement which would remain in effect at least until January 1, 1974. The agreement establishes a shrimp conservation zone off the coast of Brazil within which the activities of shrimp vessels of the two countries will be regulated.

On May 19, 1972, Brazil and Trinidad and Tobago signed an agreement providing for continued fishing by Trinidad and Tobago vessels in the waters adjacent to Brazil during the period May 1, 1972, to November 30, 1973.

Barbados

Barbados is the easternmost island of the West Indies and the closest port in the Antilles to the Guiana shrimp grounds. From 1963 to 1970 it enjoyed a flourishing shrimp industry. Peak production was 2.3 million pounds in 1968 from 32 boats. Commencing in 1969, however, problems of poor maintenance

of the shore facilities, demands of labor groups and the Barbados Government, and failure by certain groups to meet commitments led to the shutdown of the industry by the end of 1970. Twenty-six shrimp boats shifted their operating base to Port of Spain, Trinidad, and the few others returned to the United States.

Trinidad and Tobago

Trinidad's principal fishery is shrimp. For political and economic reasons, its capital, Port of Spain, offers a desirable base from which as many as 115 shrimp vessels have fished the grounds off the Guianas and northeast Brazil. In 1970, these vessels, of which 76 were U.S. flag, caught 4.8 million pounds of heads-off shrimp valued at U.S. \$5.5 million. International Foods, Ltd. (U.S. interest—15 percent) provides all of the shore facilities for this fleet in two locations. The first and oldest location processes and freezes various food products and has a storage capacity of 2,500 tons. The second, a new installation called "Sea Lots," is modern, large, and complete in every respect, including a number of buildings that fleet operators use for such activities as net and engine repairs. The Government of Trinidad and Tobago built three large piers at this location, and the Texaco Company has installed a fuel tank "farm". However, because of problems created by Brazil's claim to a 200-mile territorial sea, the bulk of the United States shrimp fleet left Trinidad in 1971, reducing the Trinidad-based shrimp fleet to about 20 boats. The Sea Lots plant continued, therefore, to be unused. Future plans call for it to be used when the size of the fleet justifies its opening. Then the old freezer plant, with a total storage capacity of 2,500

tons, will be used for processing and freezing other food and for handling tuna.

About 80 percent of Trinidad's shrimp production is exported to the United States, 10 percent to Japan, 4 percent to other Caribbean countries, and 6 percent consumed locally. Table 15 shows imports to the United States.

Guyana

Of the several countries fishing the Guianas area, Guyana, formerly British Guiana, has by far the greatest production. In 1970 its shrimp production was 11.8 million pounds, heads-off, with a value of US \$14.76 million. In addition, Guyana produced 13,000 tons of finfish, consisting of snapper, grouper, croaker, mullet, and sea trout. The small-boat fleet comprises some 1,200 boats, many of them either inboard or outboard powered, and 175 trawlers, of which 171 are offshore shrimp trawlers. Of the offshore vessels, 122 fly the U.S. flag. Chinese seines, Cadell lines (a type of longline), pin seines, and gill nets are used to catch fish on the broad shallow flats that fringe Guyana's 300-mile coast line.

Georgetown has two shrimp plants: Georgetown Seafoods (100 percent United States owned), from which four United States fleet owners operate 83 vessels; and Booker's plant (British owned and operated), from which 88 vessels, 29 of them United States flag, are managed. Georgetown Seafoods can freeze and process 60,000 pounds of shrimp per hour and store 500,000 pounds. The Booker's plant has the capacity of freezing and processing 70,000 pounds per hour and holding 250,000 pounds.

Georgetown also has the Government

Table 15.—United States imports of shrimp from Trinidad and Tobago, 1961-71.

Year	Volume 1,000 pounds	Value \$1,000 U.S.
1961	15	10
1962	—	—
1963	—	—
1964	—	—
1965	180	137
1966	1,228	1,233
1967	1,710	1,875
1968	3,076	3,589
1969	2,643	3,112
1970	3,895	4,129
1971	2,434	2,878

Table 16.—United States imports of shrimp from Guyana, 1961-71.

Year	Volume 1,000 pounds	Value \$1,000 U.S.
1961	3,506	2,305
1962	4,129	3,582
1963	5,509	4,668
1964	5,502	4,020
1965	7,972	6,128
1966	8,780	7,306
1967	9,452	6,676
1968	8,349	7,692
1969	8,155	7,533
1970	10,165	11,705
1971	8,981	12,396

Fish Market and Center, serving as a local fish freezing and distribution center. The center has a freezing capacity of 35,000 pounds and holding capacity of 40,000 pounds. Farther along the coast at New Amsterdam is also a Fish Center with a freezing capacity of 17,000 pounds and a holding capacity of 90,000 pounds.

Although Georgetown serves as an important base for the Guianas shrimp fishery, very little shrimp fishing is done off Guyana. The principal grounds are to the east, off Surinam, French Guiana, and northeast Brazil.

As a result of a study carried out by a UNDP/FAO Fisheries Development Project, the Government of Guyana has ordered 10 new shrimp boats, five from a Mexican yard and five from Colombia, at a cost of US \$1.25 million. These vessels were expected to be delivered in late 1971 to form the nucleus of what was expected to be a Government-operated fish industry. A second step of the plan, subject to financing being arranged, calls for a \$1.5 million shore plant to handle both shrimp and finfish; the fish are to be used both for local consumption and for export to other Caribbean countries.

About 90 percent of Guyana's shrimp production goes to the United States, the rest to Japan.

Surinam

Although Surinam had the first shrimp processing and freezing plant in the Guianas, it now ranks third in importance in the Guianas fishery. The single shore plant at Paramaribo, Surinam American Industries, Ltd. (SAIL), was acquired from the former owners in 1969 by Bumble Bee Seafoods. The plant is modern, well equipped, and has a processing and freezing capacity of 50,000 pounds of shrimp per day, with a holding capacity of 600,000 pounds. Under an arrangement made in 1956 by the former owners, SAIL enjoys exclusive rights in Surinam to process and export shrimp. This exclusive privilege expired August 31, 1971, at which time other entrepreneurs could enter the field.

To supply SAIL, 49 shrimp vessels operated out of Paramaribo in mid-

1971. Of these, 14 flew the United States flag, 15 were Japanese, five Korean, and 15 registered in Surinam. Production of this fleet in 1970 was 4 million pounds of heads-off shrimp, valued at US \$5 million.

Expansion plans call for a new operating base and processing plant to serve a fleet of 65 Japanese shrimp vessels, 35 of which would be transferred from Trinidad and 15 from Georgetown.

In recent years about 85 percent of Surinam's shrimp production has been exported to the United States (Table 17).

Table 17.—United States imports of shrimp from Surinam, 1961-71.

Year	Volume	Value
	1,000 pounds	\$1,000 U.S.
1961	447	278
1962	1,036	969
1963	1,205	1,154
1964	1,323	1,049
1965	1,409	1,112
1966	2,080	1,967
1967	2,129	2,340
1968	3,212	3,857
1969	2,886	3,654
1970	2,582	3,066
1971	2,128	2,656

French Guiana

French Guiana is the closest of the three Guianas to the most productive shrimp grounds. Cayenne, the capital, is the largest of the two coastal ports. Here the most important operation is that of PIDEG (Pecheries Internationales de Guyana Francaise), owned by Henderson's Portion Pak, a division of Borden's (80 percent), and by local French interests (20 percent). PIDEG has a processing and freezing capacity of 40,000 pounds. A total of 42 shrimp vessels supply this plant, all of them U.S. flag. Production of this fleet in 1970 was 3.67 million pounds of heads-off shrimp, valued at U.S. \$4.75 million. French Guiana, a prefecture of France, exports little else but shrimp; the shrimp industry represents some 80 percent of the local economy.

A new operation recently started on a small scale is France Peche, affiliated with similar seafood operations in Dakar, Senegal, and Abidjan, Ivory Coast. Starting with two trawlers, with two more expected later in 1972, this company has a small packing room in the public freezer warehouse in Cayenne

and handles seabobs and finfish, mainly for export to France.

St. Laurent, the second coastal port, is located near the western border. It served as a base for 30 shrimp boats which supplied a modern and well-equipped processing plant with a capacity of 25,000 pounds daily. Operating and management problems, however, caused this plant to cease operations in 1970. Reportedly, 16 U.S. flag vessels moved from Georgetown to St. Laurent in late 1971, and the plant reopened under new U.S. management.

Table 18.—United States imports of shrimp from French Guiana, 1963-71.

Year	Volume	Value
	1,000 pounds	\$1,000 U.S.
1963	2,789	1,952
1964	2,961	1,956
1965	3,960	2,958
1966	4,668	4,228
1967	6,717	5,621
1968	7,820	7,624
1969	6,037	6,607
1970	5,802	5,802
1971	3,808	5,561

All of French Guiana's shrimp production is exported to the United States (Table 18).

Brazil

Shrimp are abundant at the northern and southern extremes of the coast. A large fishery exists for the domestic market, but an export industry has been slow in developing.

In a previous regional report from the U.S. Embassy, Mexico City, Milton Lindner, writing in 1956, stated that the annual Brazilian shrimp catch was estimated at 20 to 25 million pounds, live weight. This tremendous production was entirely for domestic consumption. Three separate fisheries account for most of the production. The northern fishery, which contributes about half of the catch, is carried on east of the mouth of the Amazon to near Sao Luiz by means of trap nets and seines, in the estuaries and along the beaches. About 60 percent of the catch is seabobs. The rest is juvenile white and brown shrimps. The finfish trawlers from Rio de Janeiro and Santos take large quantities of adult white, brown, and spotted pink shrimps along the south-central coast, between Rio Doce and Laguna. The large southern fishery is near Rio Grande and is

based on the run of young spotted pink shrimp out of Lagoa dos Patos. This fishery is seasonal and varies from year to year. More than half of the total catch is sold partially dried and heavily salted.

The potential production of Brazil's shrimp resources cannot be determined precisely. According to industry sources, the Brazilian Government, and FAO scientists who have studied the resource, the available resources (especially those in the north which have contributed significantly to the fishery based in the Guianas) should be able to support increased fishing.

The status of the shrimp industry at Belem is described below:

Government Organization: As in the rest of Brazil, the government agency dealing with fisheries is SUDEPE (Superintendency for Fisheries Development). SUDEPE'S Northern Region Office is in Belem. Under the investment incentive plan adopted in Brazil in 1967, the Government of Brazil will invest \$3 for every \$1 of private capital invested in a SUDEPE-approved fishery project. If the project is also one approved by SUDAM (Superintendency for Development of the Amazon Region), the Government can invest an additional \$3. In other words, fishery projects with both SUDEPE and SUDAM approval are eligible for \$6 of Brazilian Government money for every \$1 of private capital.

In addition to the companies that are already in operation and listed later, SUDEPE has approved two other projects: CAMBELL, an operation involving both shrimp and finfish; and CONORPE, also dealing in shrimp and fish. Both of these projects are expected to be operational in the middle of 1972, and will involve some U.S. capital.

One of the problems limiting fishery development in Belem (and in Brazil as a whole) is the high cost of diesel fuel—about US 25 cents per gallon. This compares with 13 to 15 cents per gallon in the Guiana-area countries to the westward. Legislation has been passed to provide an exemption from the federal tax on diesel fuel for fishing vessel use, thus bringing the price to about that of neighboring countries. The legislation has not been implemented, however, pending the design of a system of

control. No date has yet been set for the elimination of the tax.

Shrimp Companies in Belem: At the end of May 1971, the following companies were engaged in the shrimp industry in Belem:

PESCOMAR—Companhia Nacional de Pesca began operations in October 1970; controlling interest is held by Rowan Industries of New Jersey. (Note: This control is accomplished by holding the major part of the common, or voting, stock. SUDAM has 75 percent of the investment.) This is a large, very modern, and well-equipped shrimp processing plant with a freezing capacity of 60,000 pounds per day and storage capacity of 600,000 pounds. Ice-making (flake) capacity is 60,000 pounds per day, with a 150,000-pound storage capacity.

The plant is supplied by six U.S.-built shrimp vessels 86 feet long with on-board freezing equipment. If additional funds requested from SUDAM are forthcoming, this fleet will be increased to 20. In the meantime the company has ordered five smaller shrimp boats from a shipyard in Colombia and plans to operate them on grounds closer in for cheaper operation.

PRIMAR—Productos Industrializados do Mar, S.A., associated with CRUSTOMAR in Santos, Brazil and with Seacrest, Ltd., of the Bahamas. (The company has taken over the plant formerly operated by W.R. Grace and Company.) Like PESCOMAR, this plant is large, modern, and well equipped. Its freezing and processing capacity is 70,000 pounds of shrimp per day, with a storage capacity of 700,000 pounds. Most of its production is exported to the United States, some to Japan.

PINA—Intercambio Comercial, Industria e Pesca, S.A. is internationally connected, with associated operations in Italy, Canary Islands, Spain, and Africa. A site has been acquired, and the building shortly to be constructed will have a freezing capacity of 60,000 pounds per day and a storage capacity of 1,200,000 pounds and will process both shrimp and fish. Plans call for a fleet of 25 vessels to be built in the United States, the first of which was delivered by mid-1971 and two more scheduled for delivery at intervals of

50 days. The vessels are Bender-built in Mobile, Ala., 75 feet long, diesel-powered, and equipped with on-board freezing. Crews and captain will be all Brazilian.

COPESBRA—Companhia de Pesca Norte do Brazil. This company is basically a Japanese operation, with Brazilian participation. It operates three shrimp vessels crewed by Japanese, each with two co-captains, Brazilian and Japanese. Shore facilities consist of a dock, ice plant, and processing and freezing plant.

As an operating base for fisheries, the port of Belem offers a great deal—excellent harbor facilities, shipyard and repair facilities, and propinquity to rich shrimp grounds and to river and marine fish. Under the SUDEPE and SUDAM programs there are attractive incentives for fishery development and investment. As in most Latin American countries, however, built-in bureaucratic customs and delays often present problems to the U.S. citizen not accustomed to doing business in this part of the world. Good business practice obviously calls for a careful and thorough investigation of all aspects of any proposed venture before making a commitment.

Table 19 shows imports from Brazil into the United States and reflects the slow beginning of Brazil's shrimp export industry and its substantial rise during the past 4 years:

Table 19.—United States imports of shrimp from Brazil, 1961-71.

Year	Volume	Value
	1,000 pound	\$1,000 U.S.
1961	40	28
1962	57	46
1963	7	4
1964	35	19
1965	473	172
1966	486	400
1967	176	155
1968	1,619	1,499
1969	3,707	4,397
1970	2,605	2,707
1971	4,405	5,159

ACKNOWLEDGEMENT

This report is an up-dating and revision of the 1967 original report carrying the same title prepared by Richard S. Croker, the Regional Fisheries Attache for Latin America from 1963 to

1968. In an effort to shorten the report, much admittedly useful and interesting background and historical information has been omitted. Apologies are extended to Richard Croker for this condensation and with grateful acknowledgment for the tremendous amount of work and research that went into the original report.

Thanks are due, too, to the several American Embassies whose Economic and Commercial Officers were so helpful in providing up-dated information when personal visits were not possible. In the countries that the reporting officer visited, these officers and many Government and private people provided valuable help and cooperation.

In the interest of brevity, the list of references contained in the original report will not be repeated here. For those interested, this list can be obtained from the International Activities Staff, National Marine Fisheries Service, U.S. Department of Commerce (Page Bldg.2, Room 249), Washington, D.C. 20235.

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California's ocean shrimp industry had over 2 million pounds of landings in 1972, most of it coming from the northern part of the state.

Status of the California Ocean Shrimp Resource and Its Management

W.A. DAHLSTROM

HISTORY OF THE FISHERY

One of the youngest commercial fisheries in California is that for ocean shrimp, *Pandalus jordani*. This species was first fished in California off Morro Bay on April 28, 1952. Later on in the 1950's, fisheries developed off Bodega Bay, Fort Bragg, Eureka, and Crescent City in California and also along the coast of Oregon and Washington.

During 1950 and 1951, exploratory fishing by marine biologists of the California Department of Fish and Game laid the groundwork for utilizing this latent resource. During cruises off the California coast on the research vessel, *N.B. Scofield*, five dense concentrations

of ocean shrimp were charted. Regulations for the new fishery were established by the California Fish and Game Commission in 1952, and the first catches were made later that year. Three regulatory areas were designated, catch quotas were established for each area, mesh size restrictions were initiated, and a season was set. The three regulatory areas were Area A, Oregon border south to False Cape; Area B, False Cape south to Pigeon Point; and Area C, Pigeon Point south to Rincon Point (Santa Barbara-Ventura County line). By 1956 it had become apparent that a portion of one of these areas (B) was not being fully utilized. Therefore, it was divided into two areas; B-1 extending from False Cape to Point Arena, and B-2 from Point Arena to Pigeon Point (Figure 1). Each area was allotted separate quotas. Another change occurring in the 1960's was the extension of the

Area C boundary from Rincon Point to the Mexican border.

The fishery off Morro Bay in Area C was first to develop. Landings of 197,944 and 198,505 pounds were made in 1952 and 1953 respectively (Table 1). Fishing also took place in Areas A and B (later to be designated B-2), but during

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