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SHRIMP EXPLORATION BY THE M/V OREGON ALONG THE NORTHEAST COAST OF SOUTH AMERICA ^{1/}

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SUMMARY

Two cruises of the U. S. Bureau of Commercial Fisheries exploratory fishing vessel Oregon were made, during the fall of 1957 and the late summer of 1958, off the Northeast Coast of South America. The primary objective was to obtain preliminary data on the shrimp resources of that region. The first cruise covered the general region extending from Trinidad to the mouth of the Amazon River, and the second cruise was largely devoted to a more detailed investigation of a smaller area off the coasts of British Guiana, Surinam, and French Guiana.

Commercial quantities of pink shrimp were found off the Guianas with optimum catches near the 30-fathom curve. The best night's fishing resulted in 576 pounds (heads-on) 6-10 count pink shrimp, off the Surinam River, obtained by dragging two 40-foot flat trawls simultaneously.

Brown shrimp were less common and scattered. Best catches amounted to 30 to 40 pounds (heads-on) per one-hour drag. Sea bobs were prevalent in waters shallower than 16 fathoms.



Fig. 1 - The U. S. Bureau of Commercial Fisheries exploratory fishing vessel Oregon.

Only small amounts of deep-water shrimp species were taken, although three species, royal-red shrimp, "scarlet" shrimp, and Solenocera vioscai, were found to inhabit the entire deep-water region.

Limited quantities of small red snapper were found in 31 percent of the drags made inside 50 fathoms. Lane snapper and a variety of other fishes, including sea catfish, sea trout, and croaker-like species, were also found in abundance in shallow waters.

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Good trawling bottom is present in most areas of the coast out to the 50-fathom curve. The bottom generally consists of soft mud out to 20-25 fathoms and a mixture of mud and sand from 25 to 50 fathoms. Beyond 50 fathoms an extensive zone of rough coral and rock bottom extends, in many localities, to the edge of the continental shelf.

BACKGROUND

The long-range operating capability and over-all efficiency of the shrimp fleet of the Gulf and Southeastern States has been steadily increasing in recent years, as has the number of vessel units involved. Up to the present time, with few exceptions, this dual increase in fishing power has been absorbed by the present established fishery on previously delimited fishing grounds. Many vessel operators have expressed alarm over what they term the "excessive fishing pressure" exerted on the grounds by these factors and have sought ways of easing the situation. One way of alleviating that pressure seemed to lie in the discovery of new shrimp grounds. By 1957, however, most trawlable areas of the continental shelf along the Gulf and southeastern United States coasts, in waters of less than 25 fathoms, had been explored for shrimp by Federal, state, or commercial vessels. There seemed little indication that extensive new areas would be added following the discovery of the Tortugas (Idyll 1950) and Campeche pink-shrimp beds. It thus became clearly apparent that, if new shrimp beds were to be found, exploration must be conducted outside the present range. The lessening importance of previously-imposed limitations of time and distance, brought about by increased range and working ability of modern vessels, made such a step practicable. Exploratory fishing, outside the existing commercial range, can take two forms; vertical and horizontal extension.

Work in the Gulf of Mexico and off the southeast coast of the United States by the U. S. Bureau of Commercial Fisheries extended vertical exploratory and production-type shrimp coverage out to depths of roughly 180-350 fathoms, using Bureau owned and chartered vessels Oregon, Pelican, Combat, and Silver Bay. That work resulted in the discovery of a new potential, the royal-red shrimp (Bullis 1956, Bullis and Rathjen 1959).

Geographically, the waters over the continental shelf of the northeast coast of South America, roughly from Trinidad to the Amazon River, constitute a vast region which has received, at best, only meager shrimp investigation. Accounts of the limited surveys that had been made in restricted areas off the Amazon River and the Guianas varied, and, in most cases, could not be traced. The U. S. Bureau of Commercial Fisheries exploratory fishing vessel Oregon therefore completed two cruises in international waters off this coast to obtain preliminary information on possible shrimp resources. Oregon cruise 47, made in the late fall of 1957, covered the region from Trinidad to the Amazon Delta with 113 exploratory drags. A total of 71 drags was made in the 10- to 100-fathom-depth range and 42 drags were made in 100- to 400-fathom depths.

Depth Interval	No. of Drags
<u>Fathoms</u>	
0- 50	218
51-100	21
101-150	22
151-200	14
201-250	10
251-300	6
301-350	3
351-400	1

The work carried out on cruise 53, during the late summer of 1958, was more restricted in depth and area, and it extended from Trinidad to the coastal waters of Cayenne, French Guiana, with major emphasis on explorations off the coast of the Guianas. Ninety percent of the 182 drags were made in water of less than 50 fathoms.

The number of drags made in various depths during both cruises is shown in table 1. Figure 2 shows the location of the drags made during both cruises.

GEAR AND FISHING METHODS

Most of the trawling was carried out with 40-foot-flat shrimp trawls, using either bracket or chain doors on 15- to 25-fathom bridles. Tickler chains were used during most of the work on the second trip with encouraging results. A single trawl was used for most exploratory dragging, but double-trawl rigs also were operated in a few areas to more closely tie in the results with accepted Gulf of Mexico commercial trawling practices. Larger trawls, varying from 65 to 100 feet in head-rope size, were also tried; but resulting catches did not compare favorably with catches made with two 40-foot nets towed simultaneously on the same grounds, and use of the large nets was discontinued.

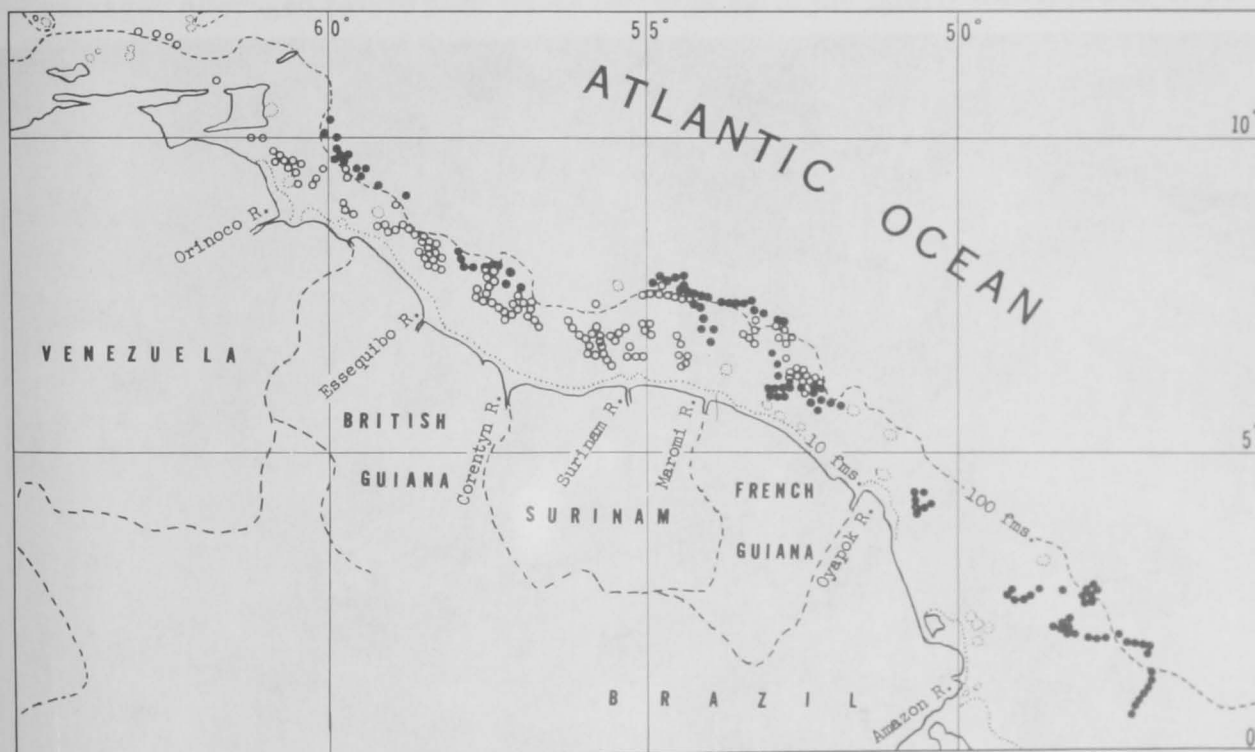


Fig. 2 - Exploratory trawling drags by the M/V *Oregon* off northeastern South America. Black dots show positions fished on first cruise. Circles, positions on second cruise.

During exploratory trawling it was noted that length of drag resulted in a noticeable change in catch rate. Although the varying trawling conditions did not allow proper statistical evaluation of the catches, the rates from one-, two-, and three-hour drags, in most cases, showed a marked shrimp-catch increase per hour between the one- and three-hour drags. This, presumably, might result from the length of time it took the net to reach a "stabilized" fishing position.

The amount of warp used in relation to water depth was not constant, as strong and variable currents necessitated constant drag-to-drag modifications of this factor.

FISHING CONDITIONS

Current created the most important trawling problem encountered. Strong currents occurred in the more desirable fishing depths, between the 20- to 40-fathom curves. Conditions were poorest off Cayenne, where estimated current speeds of 5 to 6 knots permitted only countercurrent dragging. In spite of promising signs of shrimp in the Eastern French Guiana area, time did not permit an adequate solution to the problem of trawling in the strong current.

Sea and weather conditions during both cruises were favorable for shrimp trawling; and information received from authorities in Surinam indicates that heavy seas, which would stop fishing activities, are infrequent. The period of worst weather extends from January through March, when the fresh to strong northeast trade winds are said to blow continuously.

Bottom types varied from area to area, but generally conformed to soft mud inside of 20 to 25 fathoms; sand, mud, and broken shell out to 50 or 60 fathoms; and rock, coral, gravel, and sand extending from there to the limits of the continental shelf. Occasional patches of hard bottom were encountered in the more desirable shrimp ranges (inside of 50 fathoms), but the entire range was, for the most part, trawlable. During the extensive work carried out during cruise 53, no gear was lost due to bad bottom.



Fig. 3 - Sorting out the shrimp from a trawl catch off the Surinam coast aboard the M/V Oregon.

Shore facilities for taking on ice and fuel, and for freezing and storing the shrimp catches are, at present (1959), not sufficient to withstand the sudden influx of a large fleet. Surinam, British Guiana, and Trinidad are presently increasing their capacities in this direction, and all three, in addition to Cayenne, French Guiana, would make suitable bases for shrimp operations if future developments substantiate the indications of a potentially large, year-round fishery.

FISHING RESULTS

PINK SHRIMP: The South American pink shrimp (Penaeus brasiliensis), is very closely related to the pink shrimp of the southern United States, P. duorarum. Pink shrimp represented the largest commercial potential observed during the two cruises. The species was found over a broad area extending from Venezuela, along

the Guianas, to the Brazilian coast north of the Amazon River, in waters ranging in depth from 16 to 50 fathoms. While apparently not present in the dense concentrations which marked the early Campeche shrimp fishery, the pink shrimp, nevertheless, seemingly, could provide the basis for a steady, year-round fishery. Local authorities have noted that there is apparently little seasonal variation in catch rate, but they believe that additional work on a year-round basis is desirable to verify this.

Best Oregon catch rates were obtained in close proximity to major drainage systems of the coast; the Orinoco, Essequibo, Corentyn, Surinam, and Maroni River systems. The areas off the Oyapok and Amazon Rivers were not sufficiently explored to determine their importance. Catch rates in areas extending out from these drainages averaged two to four times as large as in the intermediate areas.



Fig. 4 - Pink shrimp from the Guianas. These shrimp averaged 16-20 count, heads-off.

Best fishing was found as the 30-fathom curve was approached, and shrimp catches dropped sharply on either side of this depth. Almost all catches were composed of medium to large (21-25 to 6-10 count^{1/}) shrimp. A general tendency toward increase in size of individual shrimp with increasing depth was noted. From 16 to 25 fathoms, catches of less than 10 pounds of 21-25 and 16-20 count shrimp per hour were usual; whereas in the depths between 25 and 35 fathoms, the average for all exploratory drags rose to over 20 pounds per hour of mostly 16-20 count shrimp. In the latter depth range, in three areas--off the Essequibo, Surinam, and Maroni Rivers--nightly catch rates using two 40-foot flat trawls usually amounted

^{1/}Counts represent the number of heads-off shrimp per pound.

to about 500 pounds of heads-on shrimp (16-20 count). The best night-long catch was off the Surinam River when 576 pounds (heads-on) of 6-10-count pink shrimp were landed. In 45 to 50 fathoms only small numbers of large (6-10 count) female shrimp were caught.

In general the pink shrimp grounds, from the Orinoco to the Oyapok Rivers, afforded good trawling bottom consisting chiefly of a mixture of mud and sand. Small patches of coral and sponge were occasionally encountered, but gear damage was slight, as those areas were easily detected on the depth recorders. The bottom in most areas changed character in waters deeper than 50 fathoms and became considerably rougher; however, pink shrimp were apparently absent, or only infrequently met with, in the deeper area. Inside 10 to 15 fathoms, the great quantity of industrial fish interfered with shrimping operations. The best trawling grounds, thus, correspond well with the highest observed pink-shrimp concentration. The shrimp grounds extend quite far from the coastline. The position of the 20-fathom curve lies from 20 to 35 miles offshore, in most cases.



Fig. 5 - Removing heads from shrimp preparatory to boxing and freezing.

oms the quantity caught was considerably less. In the 25- to 30-fathom range they were frequently taken along with pink shrimp. In contrast to the catch rates for brown shrimp in United States waters, the catch rates for brown shrimp along the South American coast did not show any marked fluctuation between day and night catches. They were found predominantly on muddy bottoms. Best catches amounted to 30 to 45 pounds per hour (heads-on) with a 40-foot flat trawl off the coast of British Guiana. The largest night-long catch of brown shrimp was made in 28 to 30 fathoms off the Essequibo River when about 325 pounds (heads-on) were caught mixed with about 175 pounds (heads-on) of pink shrimp. In size, the brown shrimp ranged from 56-60 to 16-20 count, averaging about 26-30 count.

SEA BOBS AND MISCELLANEOUS SMALL INSHORE SHRIMPS: Very little exploration in less than 10 fathoms was made by the Oregon due to time limitations and the earlier indications of offshore concentrations of brown and pink shrimp.

As in the Gulf of Mexico, pink shrimp catches fell off at, or before, daylight; and daytime trawling was unproductive for this species. Major attention was, therefore, focused on fishing from late afternoon to dawn.

While it is probable that the pink shrimp grounds have been roughly delimited by these cruises, considerable additional work would be necessary to accurately define the boundaries of the most productive fishing areas.

BROWN SHRIMP: Sporadic catches of brown shrimp (Penaeus aztecus), were made at widely scattered points along the North-eastern South American coast. Brown shrimp were included in Oregon drags over a total depth range extending from 10 to 50 fathoms, although beyond 40 fath-

The sea bob (*Xiphopeneus kroyeri*), forms the basis of a very important local fishery in Surinam. It is caught locally by means of set nets suspended from stakes in the river mouths. Sea bobs apparently are seasonally available in vast quantities, in the estuarine areas and coastal regions, out to a depth of approximately 15 fathoms. The major portion of the present production is dried and packaged for export. A small number are headed, hand-peeled, and frozen at Paramaribo. The Oregon obtained catches of sea bobs over a depth range of 7 to 15 fathoms. The prevalence of large quantities of "trash," including a high percentage of such undesirable elements as jellyfish, sting rays, and saw fish, might cause a sea-bob trawl fishery to meet with serious drawbacks.

A few other shallow-water shrimp species are present in the region and are utilized to some extent as a source of dried shrimp. These, however, are even smaller than the sea bob, varying in size from 100 to 500 (heads-on) shrimp to the pound. In this group are included *Hippolysmata* sp. and *Palaeomon* sp. One Oregon drag resulted in 130 pounds of the two small shrimp species. Apparently these forms are most concentrated in the areas around large river mouths. Oregon catches of the small shrimp known locally as "fine shrimp," were made along the Brazilian coast off Maraca Island at the mouth of the Amazon River and off the Surinam River.

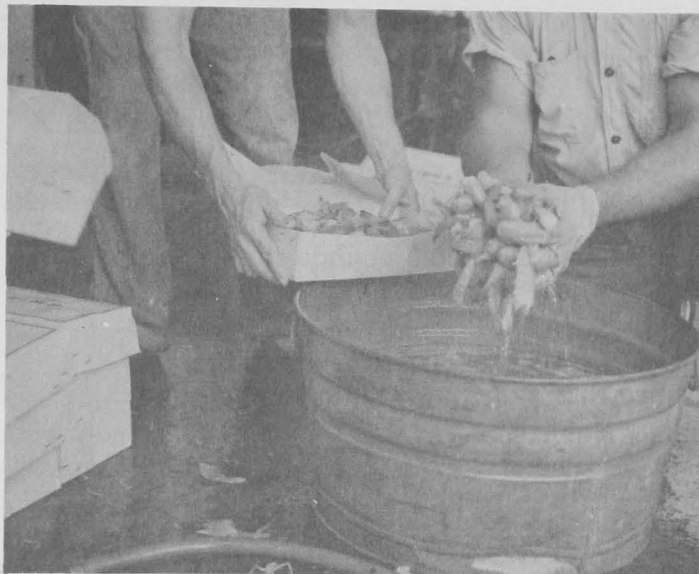


Fig. 6 - Washed shrimp tails being packed in 5-pound freezer cartons.

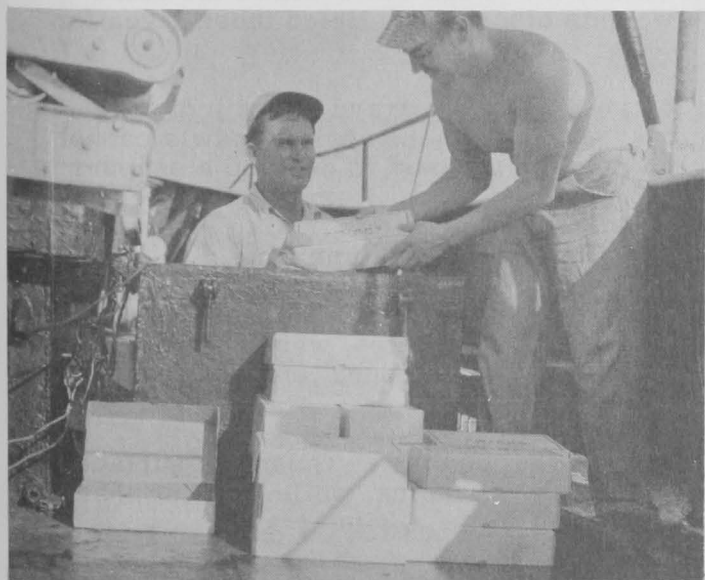


Fig. 7 - Storing the boxed shrimp in one of the Oregon's 15-ton freezers.

Penaeus schmitti: Similar to its counterpart (*P. setiferus*) in the Gulf of Mexico and southeastern United States, the South American *P. schmitti* is closely restricted to shallow-water areas and is an inhabitant of the bays and estuarine regions that were inaccessible, for the most part, to the Oregon. Small amounts of these shrimp were taken at four Oregon stations in 15 to 26 fathoms. This species apparently is commonly found in the tilapia culture ponds of Surinam where it reportedly reaches a large size. It is known locally as a white or blue shrimp and has the general appearance of the white shrimp common to southeastern United States coastal areas except that it has a purple "tail."

Deep-Water Shrimp: The previously-mentioned shrimp are considered shallow-water or coastal in relation to a second group of deeper, offshore dwellers. The two groups are more or less sharply separated by a band lying between 50-60 fathoms and 85-100 fathoms, in which few shrimp of any commercial, or potential-

ly-commercial, importance have been found. Among the numerous species of shrimp inhabiting the deeper waters, three stand out as possible commercial resources: Solenocera vioscai, Plesiopenaeus edwardsianus, a large scarlet shrimp; and Hymenopenaeus robustus, the royal-red shrimp.

Solenocera vioscai were found over a range of from 95 to 160 fathoms. Only subcommercial catches were found during the present explorations with best catches running from 6 to 10 pounds (heads-on) per one-hour drag. The area of greatest concentration, as found by these limited explorations, was off the Surinam coast within the depth range mentioned. These shrimp averaged around 55-60 count.

Few royal-red shrimp were taken, although the stations made in the royal-red shrimp depth range (roughly 185-350 fathoms) pointed to the existence of that species along the entire coast. The best catch occurred north of Trinidad in 185 to 200 fathoms. A total of 75 pounds (heads-on) of large 16-20 count royal-red shrimp was taken in a one-hour drag with a 40-foot shrimp trawl on a blue-mud bottom in that area.

Plesiopenaeus edwardsianus, large deep-water scarlet shrimp, were taken in small amounts over a total depth range extending from 185 to 400 fathoms. Best catches were made in the 300- to 400-fathom range where catch rates ranged from 10 to 25 pounds (heads-on). This species is an active swimmer and it is likely that the standard flat trawl with its relatively low vertical opening is not suited to cope with a species displaying this ability.

FISH: Small numbers of red snapper (Lutianus aya) and lane snapper (L. synagris) were taken in shrimp trawls along the entire coast within a depth interval of 15 to 52 fathoms. Thirty-one percent of the stations occupied within that depth range included small catches of red snapper. Average snapper catches ranged from two and one-half to three pounds, with individual fish ranging generally from one-half to two pounds. Largest single catch was 20 pounds.

Lane snapper were present in 29 percent of the drags made within the same depth range. Catches and individual fish weights closely paralleled those given for red snapper.

The presence of snapper in this percentage of shrimp-trawl drags indicates commercial possibilities on neighboring rough bottom where shrimp trawls cannot be used. Sporadic local attempts have been made in the past to develop a snapper fishery along the coast; but lack of continuing interest, lack of experienced personnel, and lack of suitable vessels interfered with most previous trials. An active snapper fishery has been in existence off British Guiana for some time.

Miscellaneous fish species caught in the shrimp trawls included several marketable varieties. Sciaenids, so far unidentified as to species, were common. They included croaker-like fishes that averaged about one pound, and sea trout that weighed from 2 to 4 pounds.

Spanish mackerel were observed along the coast of British Guiana in surface schools over the 20- to 40-fathom range. On a few occasions, while working that section of the coast, Spanish mackerel were caught in the shrimp trawls.

Depth recorder traces of several other schooling species were observed. Identity of the school components was checked by trawl catches and they included; thread herring (Opisthonema), scad (Decapterus), Spanish sardines (Sardinella), and several species of anchovies.

CONCLUSIONS

The work carried out by the explorations has established the fact that marketable shrimp species of valuable sizes are found over most of the coastal region of Northeastern South America, and that concentrations appear in several broad areas. Additional exploration will be required before the areas of highest production can be precisely delineated.

Pink shrimp constituted the most important species found, from a commercial standpoint, with brown shrimp and *P. schmitti* secondary. Since the basic objective of these trips was of an exploratory-survey nature, and the area that was involved was large, intensive work in any restricted region within the time allotted was precluded. The results obtained should, therefore, be reviewed with the thin exploratory coverage necessarily accorded the area in mind. The possibility exists of heavier concentrations, particularly of pink shrimp, on yet-to-be-discovered grounds.

The major trawling problems include a strong and variable current over most of the trawling grounds, and the general unfamiliarity with bottom conditions.

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The Agriculture report is based on a survey of operating policies and practices of some leading institutional wholesalers who are suppliers of food-service establishments. This study analyzes some of the many changes that are under way or can be initiated by the wholesalers to make their operations more effective and more profitable by reducing costs.

A free copy of the report is available from the U. S. Department of Agriculture, Office of Information, Washington 25, D. C. It is Market Research Report No. 335, "Policies and Practices of Some Leading Institutional Wholesale Grocers."