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## **Another Look at the Royal Red Shrimp Resource**

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SOME 12 YEARS have elapsed since the discovery that a new commercial species of shrimp (*Hymenopenaeus robustus*) was available in the upper slope zone in the Gulf of Mexico. Since then extensive effort has been devoted to an evalua-

tion of the commercial potential of these royal red shrimp and periodic reports have covered various aspects of this work (in the Gulf, Springer and Bullis, 1952, 1954, and Bullis 1956a; on the east coast, Bullis, 1956b, Bullis and Rathjen, 1959; and in the Caribbean and off northeastern South America, Bullis and Thompson, 1959). In addition, some fishing trials have been conducted by commercial shrimp trawlers and the results of their work have provided valuable information supplemental to the exploratory results. The question now at hand is — in summarizing all of our knowledge on royal red shrimp, what predictions can be made regarding a potential yield and an implementation of a successful fishery for this species?

Little is known of the life history of royal red shrimp but extensive data has been accumulated on distribution, areas of availability, and seasonal occurrence. We know that royal reds are distributed continuously along the upper continental slope zone in the western Atlantic from Cape Hatteras to Brazil. Maximum and minimum depths range from 150 to 500 fathoms. Population density varies widely throughout this total distributional range and several areas of concentration have been located. Three of these stand out in importance: the east coast of Florida from St. Augustine to Ft. Pierce; south to southwest of Dry Tortugas; and off the Mississippi Delta from southeast of the Mississippi Passes to off Mobile. All of these areas contain concentrations of royal red shrimp that well exceed the minimums of availability for full scale shallow-water shrimping operations.

Of particular interest has been the determination of a depth-temperature relationship in these three areas of concentration. Red shrimp are commonly found through a temperature range of 5 to 15 C, however, catch rates exceeding 25 lbs. per hr have been confined to a range of 9 to 12 C. This has been dramatically portrayed by two observed heavy incursions of cold bottom water on the Florida east coast, at which time the shrimp immediately responded by moving inshore and shallowing their depth by some 40 fathoms within one or two days. Exploration in the Bahamas and the Antilles has not been extensive but the indications are that royal reds are rare to non-existent within most of the island range. It indeed seems confined to the true continental zone. Possibly the reason for this is an apparent preference for mud bottom, but here our data is biased by poor trawl coverage on rock and coral bottom. The Gulf of Mexico grounds are on a blue-black terrigenous silt and on green mud. The Tortugas grounds are on a whitish, gritty calcareous mud, similar to the bottom off the east coast of Florida which also contains some sand and is probably slightly more compact. This does indicate that bottom type may not be a critical factor. Throughout the exploratory fishing phases of royal red shrimp studies a 40-foot shrimp trawl was used as the basic sampling gear. Designs which varied from flat to balloon trawl produced no discernible differences in catch rate or composition. Nevertheless, there have been some enigmatic aspects of the results that seem to require a subjective approach in an evaluation. For example, we feel that direct comparisons of trawl drags can only be made by disregarding to a degree a list of variables so imposing that details could be quite meaningless. Here the important considerations are degree of bottom contact of trawl and doors and rate of speed over the bottom, which are influenced by a combination of factors including vessel speed, warp length, sea condition, and current speed. To these must be added behavioral aspects of the shrimp that would affect capture by trawls. It now seems certain that red shrimp spend some time burrowed in the substrate as do the shallow-water

*Penaeus aztecus* and *P. duorarum*. Periodically trawls will be retrieved with massive bundles of red shrimp antennae tangled in the tickler chain, on the trawl doors, and along the footrope, and the codend will contain a very small catch of shrimp. To date no predictable rhythm has been established for this occurrence. For purposes of discussion we have reduced our data into some rather gross summaries, and, keeping the foregoing in mind, some interesting average figures have been evolved. Under tow the 40-foot shrimp trawl covers an average path of 25 feet in width. Bottom towing speeds of the Bureau of Commercial Fisheries' vessels that conducted this work have averaged close enough to 2 knots over the bottom to use this speed as an average rate. Therefore an hour tow with a 40-foot trawl samples approximately 2.8 hectares or 6.9 acres or 300,000 square feet of bottom. Density as determined by availability of shrimp by weight can then be approximated as follows:

Catch rate of 10#/hr	=	density of 3.5#/hectare
20#/hr	=	" " 7.1#/hectare
30#/hr	=	" "10.6#/hectare
50#/hr	=	" "17.8#/hectare
100#/hr	=	" "35.7#/hectare
150#/hr	=	" "53.6#/hectare
200#/hr	=	" "71.4#/hectare

To put this last figure into another perspective, the density of 15-count heads-on shrimp would be one shrimp per 11.1 square yards (9.3 square meters).

This density factor is particularly interesting considering the claims of some manufacturers of sonic shrimp locating equipment which imply the ability to determine the location of shrimp in densities as low as one or two per square foot. Such concentrations fished with a 40-foot trawl would produce 15-count (heads-on) shrimp at a rate of 333 to 666 pounds per minute. Such densities are in the magnitude of 100 times greater than are experienced on the best shallow water grounds.

The Mississippi Delta royal red shrimp bed covers approximately 80 square miles; the Tortugas bed some 50 square miles; and the east coast bed some 150 square miles, for a total of 280 square miles. By adjusting the complete record of catches by the vessels OREGON, SILVER BAY, and COMBAT and omitting only those tows when the gear was lost, these areas yielded a gross average catch of some 30 lb per hour, which in turn would indicate a gross availability of some 770,000 pounds in the unfished stock. By eliminating those drags that obviously were malfunctioning (such as evidence of severe bogging, partial water hauls, and various types of fouling) the gross average catch approximates some 50 lb per hour which in turn would indicate an availability of some 1,290,000 pounds. By continuing to eliminate the drags made under adverse conditions these figures could be further escalated. In short, our data at the point of present analysis very roughly indicates an availability of between one-half and two million pounds of royal red shrimp on the three beds presently delineated. But it must be remembered that these figures are based on the cumulative exploratory fishing effort, and not on the more selective commercial-type trawling, which centered on zones of apparent maximum density within the beds which had an appreciably higher yield.

This total, of course, is not a lot of shrimp when viewed within the framework of total production in the southeastern United States. Also, assuming these

figures have some semblance of validity there is no reliable way to predict the change in density that would take place with sustained commercial production which in turn would affect the point where profitable production would end.

Prior to this year, few commercial ventures were attempted on royal red shrimp. In August, 1956, three vessels attempted to trawl the newly discovered east coast bed and suffered only fouled gear for their efforts. Later that year one vessel obtained catches of 4 to 5 boxes per day for the period of four short trips. In early 1957, a fleet varying from one to five vessels produced an unconfirmed total of 55,000 to 65,000 pounds of tails. These shrimp were sold at a premium price and met with good consumer acceptance. However, a long period of bad weather kept these vessels at dockside for an extended period whence they eventually departed for Campeche and later to the new grounds off northeastern South America. Another attempt was made with a single boat in 1960. Little difficulty was experienced in production and about 56 boxes of royal red shrimp were landed on a single 8-day trip. However, due to the price received, which was well below the current market for other species, the vessel operator discontinued deep water shrimping.

In January, 1962, in the middle of a period of very poor shrimp production, a special cruise was scheduled for the SILVER BAY to demonstrate the availability of royal red shrimp on the east coast bed. The results of this cruise stimulated interest to the extent that a nucleus of fishermen at St. Marys, Georgia, began outfitting their vessels for deep-water trawling. SILVER BAY cruise schedules were revised so the vessel could work with the first contingent of vessels, providing technical advice and assistance where needed. Encouraged by early favorable results a total of 19 vessels from several ports attempted to fish the east coast bed between early February and early June. Accurate statistics are available only for landings made at St. Marys but it is known that some catches were landed at the Florida ports of Mayport, Fernandina Beach, and Port Canaveral. For the four month period, a total of 69,150 pounds were landed at St. Marys by 13 vessels. Individual landings ranged from a low of 27 pounds to a high of 2,350 pounds per trip. The number of trips per boat ranged from 3 to 15 and the total landings per boat varied from 907 to 13,833 pounds. The size of the shrimp landed ranged from 21/25 to over 60 count with about two-thirds in the 26/30 count size range. It is of interest to note that 6 vessels accounted for some 55,000 pounds or about 80% of the total landings while putting in approximately 58% of the fishing effort.

We can compare the results of these vessels only in general terms with the earlier exploratory findings. Each fisherman used his own particular trawl which varied in size from vessel to vessel. The gear employed varied from 40- to 70-foot trawls. Vessel size ranged from 52- to 66-foot length over all (LOA). Among the 6 highliners mentioned above, daily catch rates ranged from 2 to 8 boxes of royal reds, in keeping with the exploratory findings. During the four month period the fleet worked closely together and gradually moved from the starting position off St. Augustine down to the offings of Ft. Pierce. Early in June the entire fleet departed from red shrimp trawling to follow the promising white shrimp run that was then beginning in northern Florida. Further details on the commercial trials for red shrimp off the Florida east coast are given by Cummins and Rivers (1962).

Neither the Tortugas nor the Delta grounds have been subjected to similarly intensive experimental fishing by commercial vessels. Occasional attempts to fish the Delta grounds have generally resulted in fouled gear, the result of

inadequate winch equipment. One vessel reportedly landed 10 boxes of royal reds taken in 7 drags east of the Delta during midsummer but was forced to stop fishing due to winch failure. Another vessel landed a total of 30 boxes from 6 days of fishing in the same area. This seems to be the extent of the available information on commercial trials.

The experience that has been gained up to the present points to some problems that must be met, as well as a few special requirements that have to be satisfied. Most important seems to be the calibre of fishermen. Deeper water trawling presents additional problems in adjustment of warp-depth scope that has to be changed with changing tidal conditions. More sophisticated navigation than what is now standard in the inshore fleet is needed. Good deep-water depth recorders are mandatory unless a sizable fleet plays follow the leader to a few well equipped vessels, which would be patently undesirable. Loran is essential for proper positioning. Techniques have been developed for using a single wire and bridle from both drums of the ubiquitous shallow water trawl winch, but this is certainly second-best to a powerful winch capable of holding the necessary warp on individual drums. It has been readily demonstrated that the contemporary trawler in the 52- to 66-foot range is capable of running the necessary gear. However, vessel size, power, and seaworthiness are prime factors in determining how many fishing days will be lost due to weather.

We have experienced a slow but increasing industry interest develop in royal red shrimp exploitation. This interest has been definitely focused on periods of low shrimp production on the inshore grounds. The several fishing trials have produced encouraging results and we can presume that in the future more effort will go into developing the red shrimp grounds as an "off-season" alternative for a segment of the fleet. We can provide some foundation for this development with the admittedly crude figures that indicate an available stock of royal red shrimp that could supply a fleet of perhaps 20 to 25 vessels in year-around production and probably twice that many in intermittent seasonal production.

#### REFERENCES

BULLIS, HARVEY R., JR.

1956. Preliminary results of deep-water exploration for shrimp in the Gulf of Mexico. *Commercial Fisheries Review*, Vol. 18, No. 12, pp. 1-12.

1957. Royal red shrimp — a new South Atlantic resource. *Proc. Gulf and Carib. Fish. Instit.*, 9th ann. sess., 1956, pp. 56-60.

\_\_\_\_\_ AND W. F. RATHJEN

1959. Shrimp explorations off the Southeastern Coast of the United States (1956-1958). *Commercial Fisheries Review*, Vol. 21, No. 6, pp. 1-20.

\_\_\_\_\_ AND J. R. THOMPSON

1959 Shrimp explorations by the M/V OREGON along the Northeast Coast of South America. *Commercial Fisheries Review*, Vol. 21, No. 11, pp. 1-9 — "How's Shrimping off Guianas?", *Fishboat*, July 1959.

CUMMINS, ROBERT, JR., AND JOAQUIN B. RIVERS.

1962. New deep water shrimp fishery developed off Florida's East Coast, *Fishboat*, November 1962, pp. 19-23, 33, 34.

SPRINGER, S.

1954. Exploratory shrimp fishing in the Gulf of Mexico, summary report for 1952-54. *Commercial Fisheries Review*, Vol. 16, No. 10, pp. 1-16.

SPRINGER, S. AND HARVEY R. BULLIS, JR.

1952. Exploratory shrimp fishing in the Gulf of Mexico. *Commercial Fisheries Review*, Vol. 14, No. 7, pp. 1-12.