the interest that currently exists in this new development apparent throughout the Gulf area and on the east and west coasts of the United States. In September the first commercial catch of Gulf tuna was made by the *Santo Antonino,* a west coast purse seiner converted to multi-purpose tuna fishing.

Starting out with 15 baskets of long line gear and fabricating new gear each day until some 45 baskets were being fished during the final week, 25,000 pounds of yellowfin were landed. This catch took place within 100 miles of the Mississippi Delta. At the present time there are two additional longliners working this area. Another is being rigged and should be on the grounds within the next few weeks. The success or failure of these pilot fishing ventures and finding answers to the exploratory objectives previously outlined will play an important part in determining the rate at which this potential Gulf tuna fishery will develop.

Exploraciones Recientes para Atunes de Aleta Amarilla en el Golfo de México

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Abstracto

Se presenta un resúmen de las exploraciones por atún, hechos por el Fish and Wildlife Service, en el Golfo de México en los últimos tres años. Pesca por medio de redes, cebo vivo y espineles fué llevada a cabo durante los veranos de 1952, 1953 y 1954 respectivamente. Los resultados, con redes y con carnada viva, fueron malos y no se hicieron pescas que se pueden llamar comerciales. Las pescas exploratorias hechas con espineles en 1954 han producido más de 43,000 libras de atún de aleta amarilla, y han despertado interés en el Golfo para empezar producción en pequeña escala.

Exploitation of Deep-Water Shrimp of the Gulf of Mexico

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Commercial shrimp fishing fleets of the Gulf of Mexico operate in inshore waters of fifty fathoms or less, and most of the present shrimp production comes from a relatively small portion of the area of the Gulf's broad continental shelf. Some shrimp of one or more of the commercially important species are found in all waters of the Gulf out to fifty fathoms or more, but there are large areas in which shrimp are not present in sufficient concentration to permit profitable catches. Since 1950 the U. S. Fish and Wildlife Service's exploratory fishing vessel *Oregon* has carried out a systematic search for shrimp concentrations on the Gulf continental shelf (Springer and Bullis, 1951 and 1954) which has resulted in important discoveries. This phase of

shrimp exploration of the shallower waters of the Gulf using conventional gear is now complete.

The total shrimp landings by the American fishery have increased steadily until their value exceeds that of any other fishery product of the United States. Characteristically the industry has been able to absorb increasing landings of good quality shrimp without resorting to production quotas or to devastating price cuts.

Since there has been an apparent reduction in the catch of Gulf shrimp per unit of effort during 1954, the shrimp fishing industry has shown a strong interest in the discovery of new shrimp fishing grounds. Plans for a search for new profitable areas of operation for the Gulf of Mexico shrimp fishing fleet by the *Oregon* in 1955 will emphasize exploration of deep water.

The potential fishery resources of deep waters of the Gulf of Mexico or of most open ocean are little known. However, the long-line fishery for tunas in the Pacific and the recent discovery of deep-swimming yellowfin tunas in the Gulf of Mexico (that may lead to the establishment of a tuna fishery there) are examples pointing to the importance of the offshore areas of the oceans as a source of fishery products. In the Gulf of Mexico, shrimp trawl drags by the *Oregon* have been made out to a depth of 500 fathoms. One of the surprising results was the comparatively high volume of catches from the bottom in 200 to 300 fathoms. Recent chemical studies carried out at the U. S. Fish and Wildlife Service laboratory at Galveston, Texas, on samples of water collected by the Service's biological research unit on cruises of the M/V *Alaska,* have shown the presence of significant concentrations of carbohydrates in Gulf samples taken from depths of approximately 50 to 270 fathoms. The presence of carbohydrates is theoretically associated with photosynthetic activity. This has special importance considering other findings of both the biological and exploratory units. Surface waters of the Gulf of Mexico beyond the continental shelf have been observed irregularly and infrequently. Nevertheless, there is evidence of a rich and varied fauna beyond the limits of the shelf, as shown by exploratory fishing with long-lines and trawls. The comparative scarcity of sea birds over the central Gulf of Mexico may be associated with poor supplies of suitable food at the surface. During searches by the *Oregon* for tuna in the central Gulf, flocks of feeding birds, such as Audubon's Shearwater, were found to be usually reliable indicators of the presence of tuna near the surface. However, many schools of tuna were found at the surface without accompanying birds. Furthermore, whale sharks, a form feeding on the larger plankton, have been seen at the surface only a few times, but they have been observed in numbers sufficient to suggest that the species is not rare in the Gulf, but is ordinarily down out of sight. Observations of whales in summer, both sperm whales and fin-backs, as well as the occasional appearance of large numbers of jacks and unidentified schooling fishes under night-lights over the deep water of the Gulf are inconsistent with a concept of the near-sterile sea, and point to the need for investigation of the deeper water where our knowledge of the distribution of plankton organisms basic to the food chain is inadequate.

It seems reasonable under these circumstances to give more attention to the possibilities for harvesting deep-water shrimp taken from waters beyond the 100-fathom curve.

The commercial species of shrimp of the continental shelf are caught on or near the bottom. These shrimp occasionally swim upward to the surface layers of water but the frequency of movements away from the bottom is not known. Solely on the evidence of the depth location of capture of commercial shrimp we can regard them as primarily bottom dwellers. The deep waters of the Gulf support a greater number of kinds of shrimp than the shallow waters. For convenience in this discussion we may classify the deep-water shrimps into two groups, based in part on the presence or absence of structures such as very large swimmerets apparently adapting them to mid-water life. For present commercial use large shrimp are desirable. An example of a large midwater dwelling shrimp is *Plesiopenaeus edwardsianus*. We know very little of the distribution and abundance of this form in the Gulf, and since gear for catching midwater forms is less effective in its present stage of development than gear for catching bottom dwellers, we expect to emphasize investigation of the availability of bottom-dwelling shrimp.

Hymenopenaeus robustus is a bottom-dwelling shrimp, large enough to be desirable for present markets. Concentrations of this species have been found by the *Oregon* in the 200 to 250 fathom depth range, and catches have been reported in two accounts of *Oregon* shrimp exploration work (Springer and Bullis, 1951 and 1954). This species will be a principal objective in exploratory searches by the *Oregon* in 1955.

The deep-water shrimp *Hymenopenaeus robustus* has been given the vernacular name "red shrimp" in previous reports, but it now appears that the name may not be a good one because of the probability of confusion. Some of the commercial shrimps taken on the continental shelf have occasionally been referred to as red shrimp, and although *Hymenopenaeous robustus* is more strongly colored than any of the shallow-water shrimps of the Gulf, another distinctive common name would be desirable. Furthermore, some of the other shrimps of deep water have stronger red pigmentation than *Hymenopenaeus*, so that if there is future commercial utilization of many of these shrimps, the market supply would include shrimps of many shades of red. In the case of *Hymenopenaeus* the red color appears to be advantageous. Frozen packages of these "heads-off" shrimp, whether peeled or not, are very attractive. Also, these shrimp have excellent flavor and texture, so marketing problems do not appear formidable.

The heads of *Hymenopenaeus* are large, approximately half the total weight, and it is necessary to remove the heads immediately after catching to prevent juices from the head discoloring the body. Some of the catches made by the *Oregon* have been very muddy, in spite of the long haul to the surface, but it seems likely that the accumulation of quantities of mud can be avoided with properly working gear.

Toward the shallower part of the Gulf range of the species, in depths of 200 fathoms and less, another related but smaller shrimp, *Penaeopsis megalops*, is abundant. Drags by the *Oregon* in this depth range have usually produced mixed catches of *Penaeopsis* and *Hymenopenaeus*. Both forms are excellent as food but the small size of *Penaeopsis* makes sorting desirable.

Fishing for deep-water shrimp is attended by a number of problems new to the shrimp industry. The depth range of the species is a relatively narrow band along the slope of the continental shelf. Recording depth sounders are necessary for keeping the net on the bottom at the proper depth. Only the

larger and more expensive models of the commercial depth sounders have sufficient range to cover the 200 to 300 fathom depths. Usually the 200 to 300 fathom band in the Gulf area lies more than 50 miles offshore, and accurate determination of position is desirable, if not necessary. Loran receivers provide the most convenient method of keeping on position in those areas where shore stations are in operation. But they are expensive, and comparatively few shrimp fishing vessels are equipped with them.

The dragging done by the *Oregon* up to the present time for deep-water shrimp has not been sufficient to give a basis for precise recommendations as to wire size, trawl construction, or the best wire scope. A large part of the Gulf area in the 200 to 300 fathom depth range has a soft mud bottom, so that the greatest hazard to gear comes from bogging. This difficulty has been overcome to some extent by use of a mud rope, but the use of the Weems trawl door (a door having its lower half an arc of a circle with a very wide iron shoe on the curved portion) has been most effective in reducing gear losses. In most of the exploratory drags made by the *Oregon* the trawls have been used on a bridle from a single towing warp of 3/8ths to 1/2 inch wire, with a scope of 2-1/2 to 3-1/2 times the depth. The trawl seems to work very well on a bridle provided the latter is long enough (25 fathoms or more, depending on the size of the rig), and provided the rig is properly balanced. Ordinarily, in making our drags, the wire has been streamed out at near full speed after the net has been put overboard and settles and spreads in the water. As the amount of wire paid out approaches the desired scope, the vessel has to be slowed down to a trawling speed of 2-1/2 to 3-1/2 knots to prevent sudden strains on the gear, and, of course, to maintain some tension on the wire to keep the net spread. In planning for explorations in 1955 it has been recognized that study of the operation of gear in deep water is necessary.

Summary

1. The important shrimp fishery of the Gulf of Mexico has demonstrated its long-range ability to find increasing markets and should be able to continue its development toward maximal utilization of all Gulf of Mexico shrimp stocks, including those in deep water beyond the continental shelf.

2. A combination of theoretical reasoning, based on determinations of the distribution of carbohydrates in the Gulf of Mexico and on empirical data from catches made by shrimp trawls, points to the existence of a rich shrimp fauna beyond the continental shelf edge down to depths of 270 fathoms. Exploratory drags have produced relatively large quantities of bottom-dwelling invertebrates, including shrimp, between depths of 150 and 300 fathoms. Gear limitations have prevented the accumulation of empirical data on midwater-dwelling shrimp, but the depth zone from 50 to 270 fathoms is of interest as a potential source for shrimp.

3. In earlier explorations by the *Oregon* catches of *Hymenopenaeus robustus*, a shrimp of good size and quality for marketing, have been made in promising quantity on the bottom with shrimp trawls at depths from 200 to 300 fathoms.

4. The program of operation of the exploratory fishing vessel *Oregon* in the Gulf of Mexico for 1955 emphasizes exploration for *Hymenope-*

naeus robustus, with work on the difficult problem of the development and methods of use of effective and economical gear in deep water.

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Nueva Información Sobre los Camarones Rojos en el Golfo de Méjico

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Abstracto

Se discute la importancia de las poblaciones de camarones, tanto los que están en uso ahora, como los que se encuentran en cantidades potenciales. Se resumen los resultados de dragas hechos en aguas profundas por el bajel Oregon, incluyendo el trabajo hecho cerca de Dry Tortugas, Florida, en profundidades de 200 a 300 brazas, donde las pescas de camarones de aguas profundas, *Hymenopenaeus robustus,* indicaron una distribución irregular y la posibilidad de que ocurren en grandes concentraciones.

A Practical Method of Dispersing Aureomycin* Chlortetracycline In Ice

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The obvious commercial and economic advantages to be gained by the use of any agent which would extend the storage period of organic materials liable to spoilage, has directed the interest of many workers toward this field. After several years of extensive work Dr. H. L. A. Tarr[1] and colleagues have concluded "that chlortetracycline was more effective in preserving such foods (meats and fish) than any other of fourteen antibiotics studied". Others who have worked in this field are E. A. Fieger[2], C. P. Idyll[3], and F. E. Deatherage[4]. Early investigators demonstrated that when

* *The trade mark of the American Cyanamid Company for the Antibiotic Chlortetracycline is Aureomycin.*