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## PRELIMINARY REPORT ON EXPLORATORY LONG-LINE FISHING FOR TUNA IN THE GULF OF MEXICO AND THE CARIBBEAN SEA

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#### Part I - Exploratory Fishing by the Oregon

By Harvey R. Bullis, Jr.\*

### INTRODUCTION

Concurrently with other explorations in the Gulf of Mexico, chiefly for shrimp, the U. S. Fish and Wildlife Service has been engaged since 1952 in a program of tuna exploration. Several types of commercial gear and fishing methods have been used on the Service's exploratory fishing vessel Oregon to investigate the possibility of the presence of commercially-valuable stocks in these waters. This report gives an account of results to the present time, but exploratory work is being continued and a final report with detailed information and station lists will appear at a later date.

Prior to the start of the exploratory fishing program in the Gulf there was little information to suggest the existence of fishable tuna stocks. Observations made from the Oregon during the summer months of 1950 and 1951,



Fig. 1 - Baiting the long-line gear prior to setting. Both woven bamboo baskets and galvanized-metal tubs are used to store the gear.

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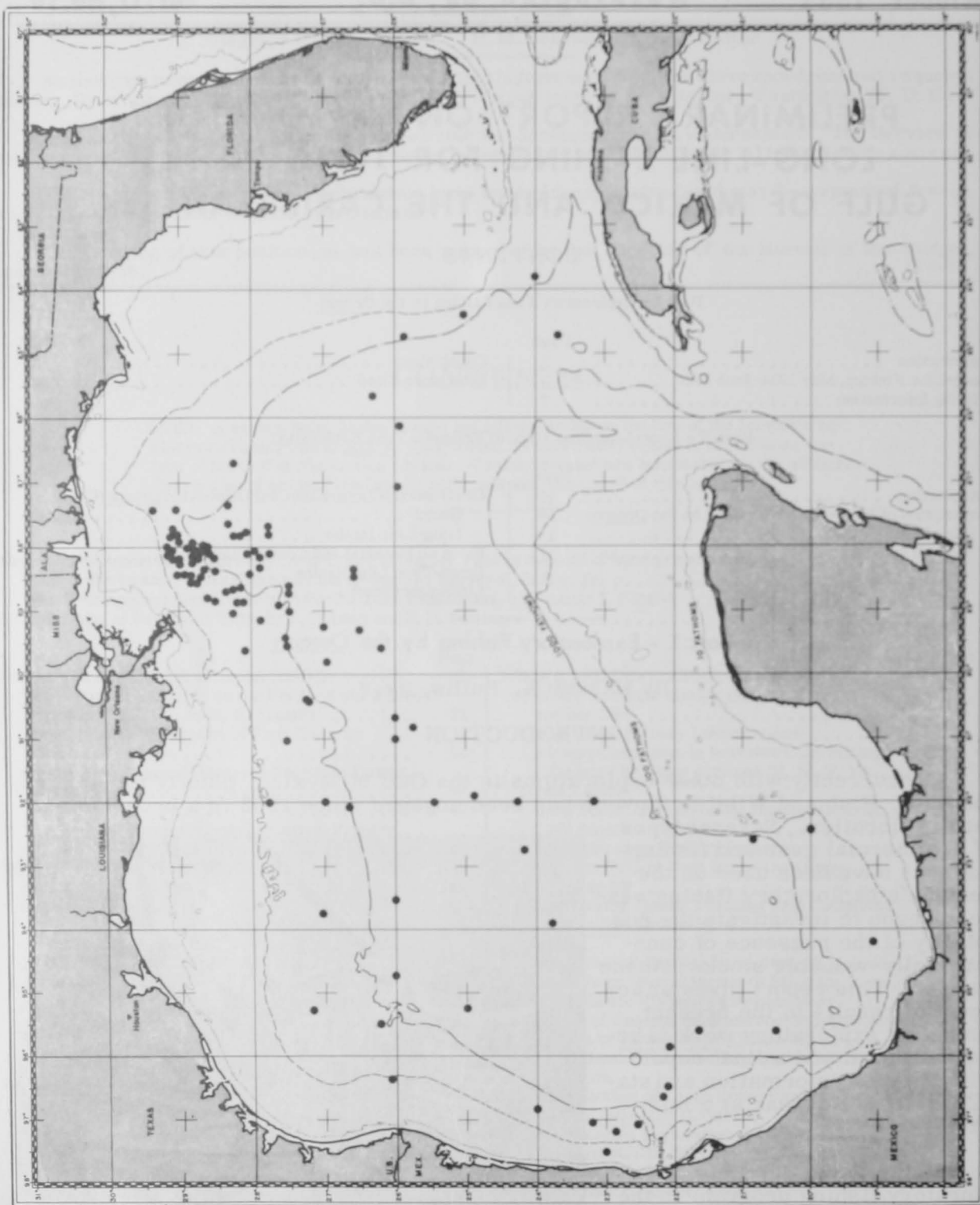


Fig. 2 - Long-line fishing stations (indicated by black dots) in the Gulf of Mexico through June 1955.

while the vessel was engaged in deep-water shrimp explorations along the edge of the continental shelf in the northern Gulf and while traveling through the central Gulf, provided a basis for an active exploratory program. During these periods scattered schools of small tuna were commonly seen in calm weather. Trolling captures from these schools yielded blackfin tuna (*Thunnus atlanticus*) weighing from 3 to 18 pounds each and skipjack tuna (*Katsuwonus pelamis*) weighing 5 to 20 pounds each. In early September 1951,



Fig. 3 - Setting the gear from the stern of the Oregon. Two men are used to keep the mainline and branch lines running clear. The third man stands by to heave the buoys.

several large schools of blackfin tuna were observed off the Mississippi and Louisiana coasts. In one day 9 schools, estimated at 100 to 500 tons per school, were seen along the 200-fathom curve. A few weeks earlier, while the Oregon was running a northerly course between the Campeche Banks and the Mississippi Delta, small wild schools of tuna were seen throughout the day. These tuna appeared to range from 30 to 70 pounds and were tentatively identified as yellowfin tuna (*Thunnus albacares*) although no trolling captures were made. Many of these schools responded to the spray of the fire hose and came up to the vessel.

The gradual accumulation of observation records provided encouraging evidence that exploratory fishing for tuna in the Gulf might be fruitful and suggested a variety of exploratory approaches. A two-phase program was instigated in 1952 to expand our knowledge of the Gulf-tuna potential and to furnish information on applicable gear and fishing methods. Phase one had two principal objectives: to determine the species present in commercial quantities; and to employ fishing techniques as suggested by the observed behavior of the tuna schools. To achieve these objectives,

one year (May to October) of part-time fishing effort was devoted to each of the three major commercial tuna-fishing methods; purse seining, live-bait fishing, and long-lining, in that order. The second phase was to be dependent on the previous results with a basic objective of year-round application of the gear found to be most successful.

In general, the results from the first two years of part-time work (1952-1953) using purse seines and live-bait techniques were inconclusive. Unfavorable weather during 1952 greatly hampered seining and the additional factor of fast-moving schools in clear water prevented successful fishing. Live-bait fishing the following year met with slightly more success although fewer tuna were sighted during this period. Several schools of mixed skipjack and blackfin tuna were fished but could not be held at the stern long enough to permit satisfactory catches. Occasionally large yellowfin tuna would appear momentarily with the smaller fish and accounted for several lost rigs. None appeared while 3- and 4-pole rigs were in use. Several small bluefin tuna (*Thunnus thynnus*) were caught from a school of mixed species off the Louisiana coast. Baiting operations throughout this period with a trap lift net (Siebenaler 1953) in the south, east, and north Gulf demonstrated a readily-available supply of tuna bait. Further work using the live-bait pole- and line-fishing technique is scheduled for the future.

#### LONG-LINE FISHING, MAY 1954-JUNE 1955

The first catches of commercial promise were made in May 1954 using Japanese long-line gear. Exploratory fishing was carried out during May-July using the long-line equipment employed in the Gulf of Maine bluefin tuna exploratory program (Murray 1953). In the western Gulf 37 large yellowfin were caught during Cruise 23 at 14 out of 20 long-line stations. In July, 112 yellowfin, averaging 99 pounds each, were caught during a two-week cruise (No. 24) in the northeastern Gulf of Mexico.

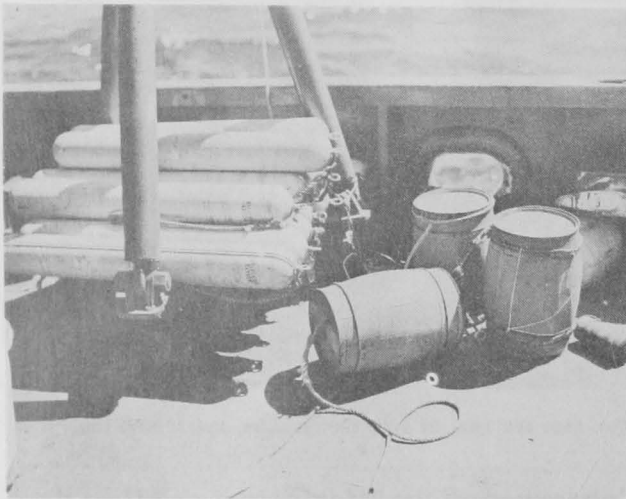


Fig. 4 - Surplus oxygen cylinders and kegs make excellent long-line buoys and are relatively inexpensive. Glass floats and airplane-tire inner tubes are also used and have been found to be entirely satisfactory.

Gulf and Caribbean area. During two cruises, primarily conducted for deep-water shrimp explorations, a few long-line sets were made to help provide information on seasonal continuity. A brief resume of the long-lining results of the individual trips is as follows:

Cruise 25 in August continued work in the northeastern Gulf with minor modifications of the gear. Twenty-one sets, averaging 340 hooks each, yielded a catch of 127 yellowfin. Four of these sets failed to catch tuna; two were afternoon sets and one an overnight set. The rest of the sets were made in the early morning and all but one caught yellowfin.

Throughout these two cruises a large number of tuna were lost owing to the worn condition of the lines. It is estimated that approximately 90 percent of the 134 broken branch lines were due to yellowfin tuna. Broken branch lines were often found in groups adjacent to caught tuna, and on several occasions yellowfin were seen parting the line when they could get a straight pull against the line hauler. Fabrication of new gear with modification of materials greatly reduced losses due to breakage on subsequent cruises.

Following the initial success of the first two long-lining cruises during May-July 1954, five of the Oregon's subsequent trips (to June 1955) were devoted to increasing the knowledge of the seasonal range of yellowfin in the



Cruise 26 in September-October was an east-to-west transect through the central Gulf along the 26th parallel, starting off the edge of the continental shelf on the west coast of Florida and terminating at the edge of the shelf off Brownsville, Tex. A total of 102 yellowfin were caught on the 11 sets (averaged approximately 420 hooks each)--72 fish were taken on 4 sets between 88° W. and 90° W. in the central Gulf northbound current.

Cruise 27 in November was concerned with other objectives, but two sets were made in the southeastern Gulf on the return leg of the trip. Five large yellowfin were taken on the 715 hooks fished. Cruise 27A in December continued the season-

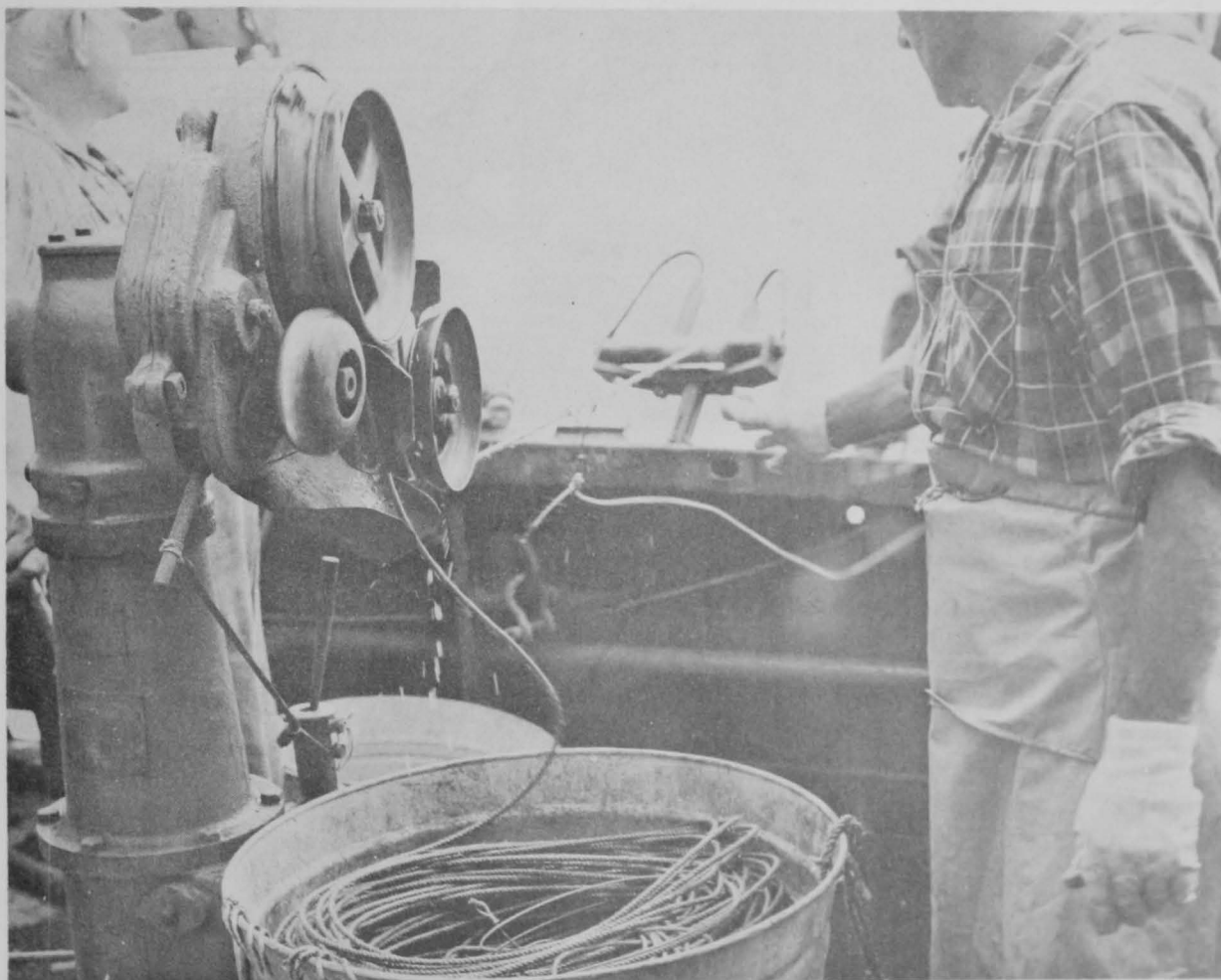


Fig. 5 - View of the Japanese long-line hauler. One man stands at the hauler, clearing the swivels through the pulleys and coiling the branch lines.

al coverage with three sets (fishing 390 hooks each set) in the north-central Gulf. Twenty-five yellowfin were landed and an additional nine were lost due to gear failures as the fish were being brought to gaff.

Cruise 28 in January 1955 was spent long-line fishing on a line between the Mississippi Delta and Tampico, Mexico. Seventy-two yellowfin were landed in seven sets beyond the 1,000-fathom curve. Two sets in shallower water at either end of the transect failed to catch yellowfin. Sets varied from 50 to 74 baskets with an average of 600 hooks per set. The best set of the trip caught 17 yellowfin in the vicinity of the Sigsbee Deep.

Cruise 29 in February-March was concerned primarily with deep-water trawling in the northeastern Gulf. Two long-line sets were made in early March between the Mississippi Delta and Cape San Blas but no yellowfin were taken. The tuna catch consisted solely of a 300-pound bluefin.

Cruise 30 during April-May was designed to give some preliminary information on the continuity of yellowfin stocks between the Gulf of Mexico and the Caribbean. An apparent disappearance of yellowfin in the Gulf during March and reports of promising long-line tuna catches in the vicinity of St. Croix changed the objective of the

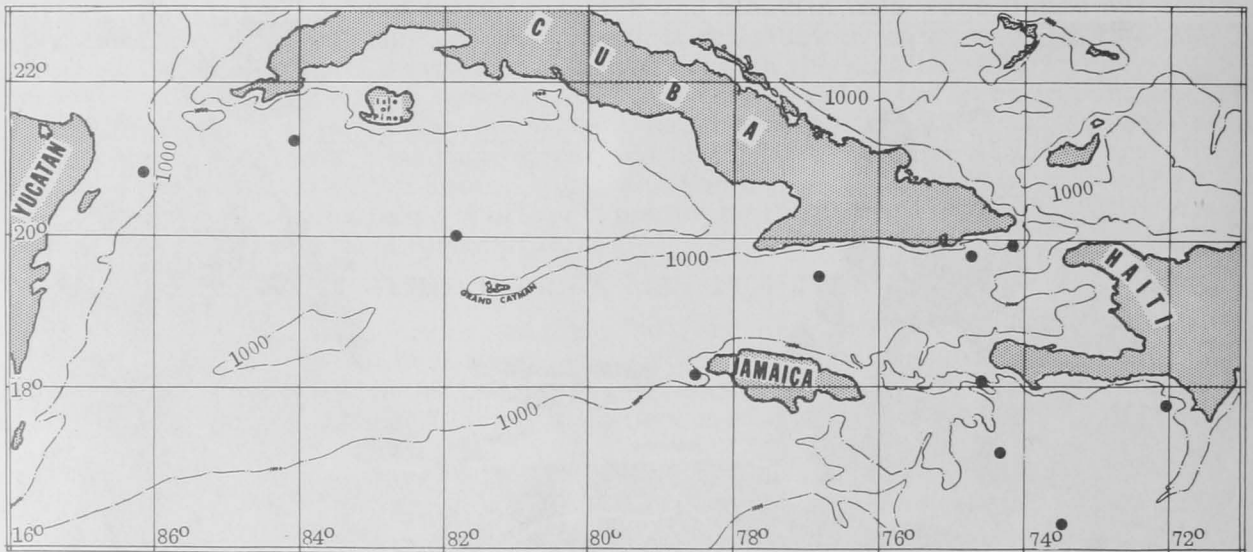


Fig. 6 - Position of long-line fishing stations in the Caribbean during Cruise 30, April-May 1955.

cruise to establishing the westward limits of fishable stocks in the northern Caribbean. Yellowfin tuna were caught on 6 of the 7 sets made east and north of Jamaica



Fig. 7 - A large yellowfin tuna is brought to gaff.

and in the Windward Passage. Of particular interest in this area was the capture of one to six large albacore (*Thunnus alalunga*) at the same stations and two big-eyed tuna (*Thunnus obesus*) on a set east of False Cape, Haiti—the first verified records for these two species from the western north Atlantic. Large numbers of giant bluefin tuna in the Windward Passage area caused considerable trouble. At each of the two stations made in the Passage, eight bluefin were landed, and judging by broken gear at least that many more were caught and lost. On several occasions the main line was parted, necessitating a search for the remaining gear. By supplementing the regular long-line floats with large aircraft-type inner tubes, gear losses were confined to an occasional basket or two. Four sets made between the Yucatan Channel and the western tip of Jamaica caught no yellowfin. One large bluefin was caught north of Grand Cayman and another was caught east of Cozumel Island. Three sets were made in the Gulf of Mexico; one on the beginning leg of the trip in April and two on the return leg. A single yellowfin (weighing 190 pounds) was caught 180 miles south of Mobile on May 1.

Cruise 31 from mid-May to mid-June was spent in the northeastern Gulf to provide an area-seasonal comparison for the work carried out during this period in 1954 in the western Gulf. Fishing was generally poor, though showing an increase in catch rate between the beginning and end of the trip. A total of 29 yellowfin were landed on the eleven 300-hook sets. These fish were in spawning condition and averaged 149 pounds each. Of particular interest was the first successful night fishing for yellowfin. Three fish were caught on a 250-hook night set 60 miles southeast of the Mississippi Delta.

#### FISHING INFORMATION

Morning, afternoon, and night sets were tried. The best catches resulted from morning fishing. Most exploratory sets were put out shortly before dawn, using from 30 to 75 baskets of gear, each basket having 10 hooks. The long line was buoyed-off and allowed to "soak" until 10 a. m. or 12 noon, depending upon the amount of gear out. Hauling was usually completed by mid-afternoon.

The number of men required to handle the long-line gear would vary with the size of the vessel used and its adaptability to long-line fishing. On the Oregon a basic crew of six men handles setting and hauling the lines.

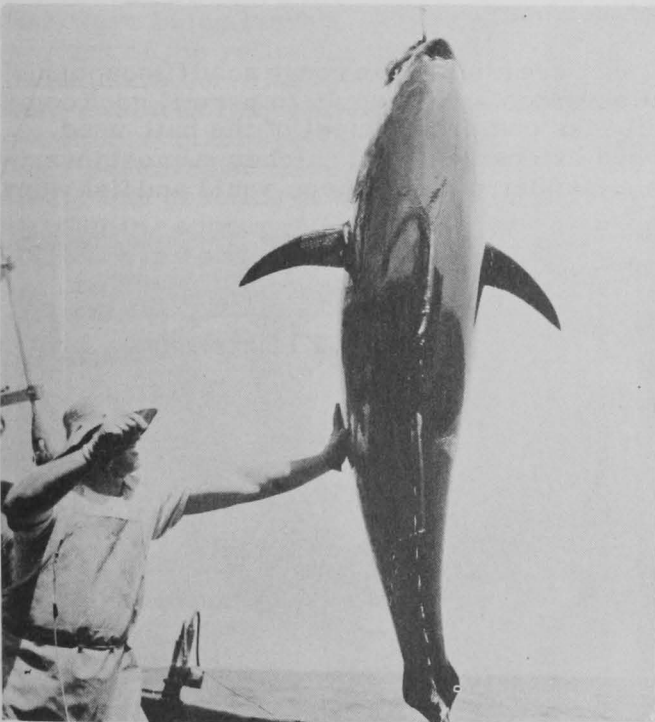


Fig. 9 - One of the large bluefin tuna caught in the Windward Passage being hoisted aboard. Large numbers of these giant fish caused considerable gear snarling and damage.



Fig. 8 - While the line is being pulled in, an accurate record is maintained of the catch and gear performance.

While setting the lines, one man works at the wheel and engine controls, two men work at the stern to clear the mainline and branch lines while paying them out, two men bait the hooks, and one man attaches and heaves the buoys.

For hauling in the line, one man stands at the rail and clears branch lines over the rollers, removing unused bait from the hooks. Two men work at the line-hauler clutch and regulate its speed. Two men stand by to pull in and coil buoy lines, remove baskets of gear into position for the next set, and assist in landing the fish. Another man steers the vessel.

Since the Oregon is employed for other fishing programs requiring the operation of quite different gear, full conversion of deck arrangements to make them most efficient for long-line work is neither practical nor economical.



As a general rule sets are made across the current, but consideration has to be given to the strength and direction of the wind and the way the seas are running. These factors together with knowledge of how the vessel handles under varying weather and current conditions will affect the choice made by the captain in selecting a



Fig. 10 - During the hauling of long-line gear, float lines are unsnapped from the mainline and the buoys are pulled in by hand.

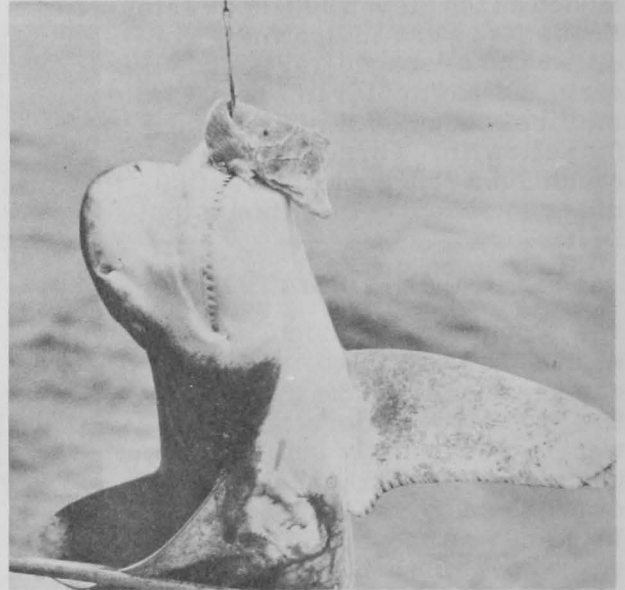


Fig. 11 - A white-tip shark caught on a hand line during the long-line hauling operation. This species of shark is responsible for the majority of shark damage to the tuna catch.

course for the set. It has generally been found practical to make sets from the Oregon with wind velocities up to 25 miles per hour.

A large variety of potential bait species were tried. The rough scad (Decapturus punctatus) was the most successful, but was in too short supply to permit good comparative tests. Mullet, herring, and halfbeaks comprised most of the bait used. Through the summer of 1954 squid was used extensively, but catches almost invariably were poorer than with fish bait. On a number of sets where squid and fish were

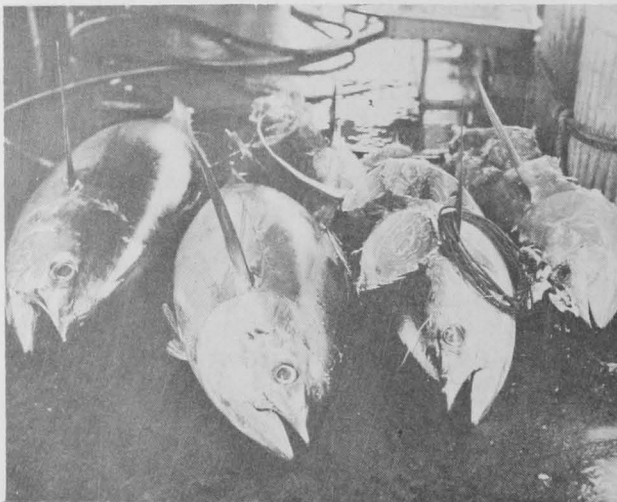


Fig. 12 - A large percentage of the catch taken by the Oregon was badly mutilated by sharks. The two large yellowfin on the right have no value for canning.

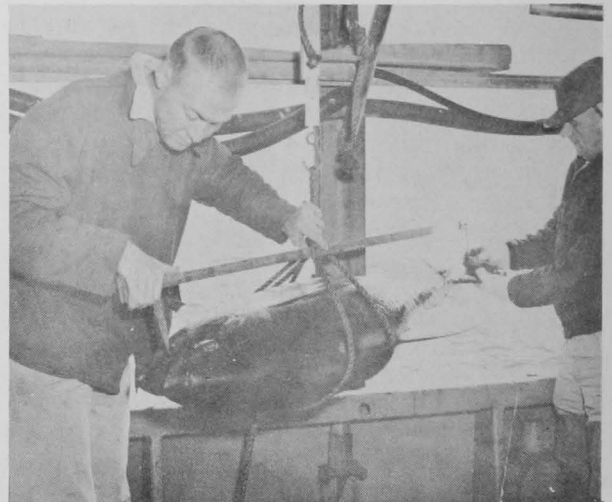


Fig. 13 - Weights and measurements are recorded for the entire catch.



used alternately, the catch on fish approximately doubled that on squid. This was surprising in view of the fact that a large majority of the yellowfin stomachs contained both squid and octopus.

Many other species of fish were tried to some extent, including menhaden, pinfish, porgies, flyingfish, and all caught some yellowfin. Scrap from deep-water trawling was tried, including gempylids, bercoids, and hake, each catching some yellowfin in the limited trials.

Yellowfin ranged from 9 to 190 pounds each, averaging 115 pounds throughout the year. Most of the catch consisted of fish between 60 and 150 pounds each. Size-frequency records were collected and will be presented in a later report.

Considerable trouble was experienced with sharks. During the hauling operation from 2 or 3 to as many as 25 white-tip sharks (*Pterolamiops longimanus*) were usually observed following the vessel, and when left unmolested the sharks attacked the tuna as the fish were being landed. About 30 percent of the yellowfin catch was damaged to some extent; 20 percent was unfit for canning. Less commonly, other species of sharks were observed striking the hooked fish. The practice of throwing garbage or unused bait overboard just before or during hauling appeared to attract more sharks and was abandoned. Several shark-killing techniques were tried to eliminate the problem. Most successful were chumming the sharks with mutilated tuna and shooting them with a high-powered rifle, or hang-

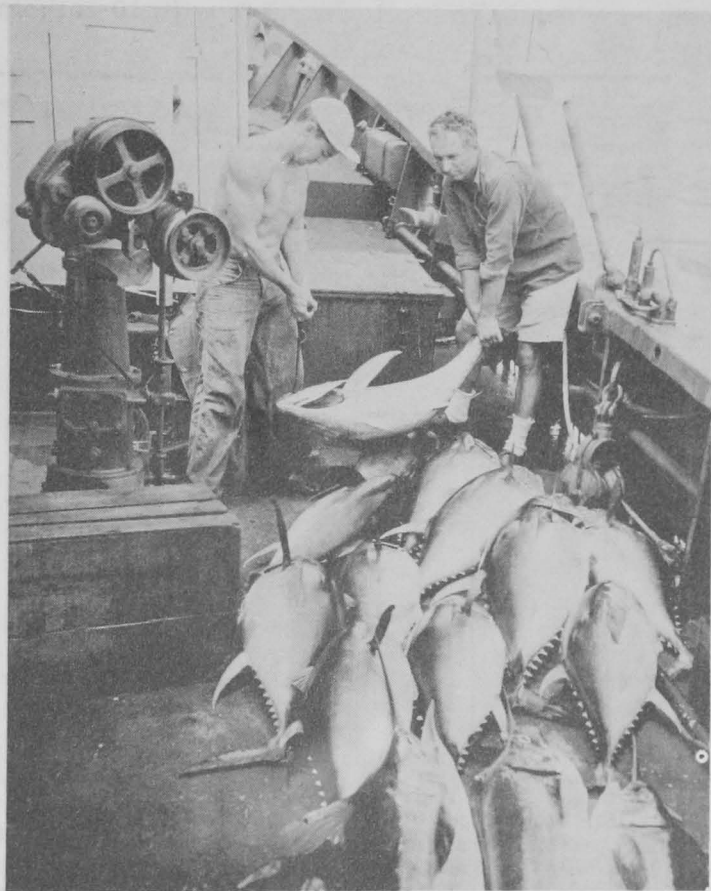


Fig. 14 - Part of a catch of yellowfin tuna and marlin.

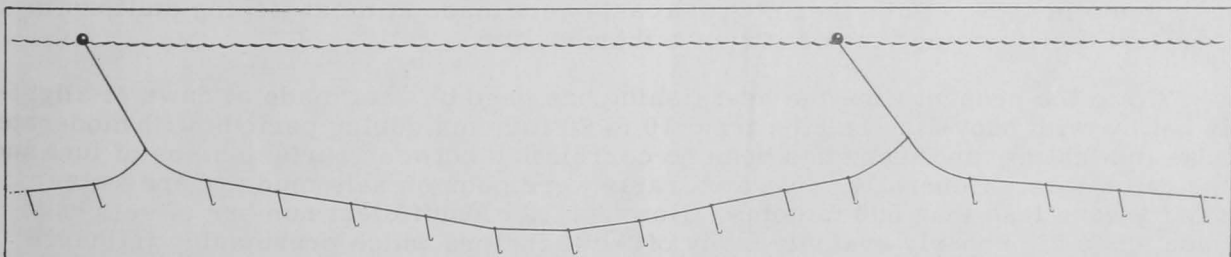


Fig. 15a - Diagram of the long line showing the sixth basket from the left in Figure 15b drawn with equal vertical and horizontal scales. The 4-fathom branch lines have been added to show spacing.

ing a row of baited shark hooks in the water at the stern. Sharks caught on hand lines were hung over the rail at the stern until they could be hoisted aboard where fins and livers were removed. Although the livers of the white-tip shark generally run low in vitamin A potency and are perhaps not marketable under present conditions, there is a market for fins and these may prove to be a valuable byproduct.

Exploratory sets were made from the Oregon using buoy lines of varying lengths to determine the best fishing depth. For most of the 1954 sets, 5 baskets were sets with buoys attached close up to the mainline, the following five baskets with 5-fathom buoy lines, the following five with 10-fathom buoy lines, and so on down to 40

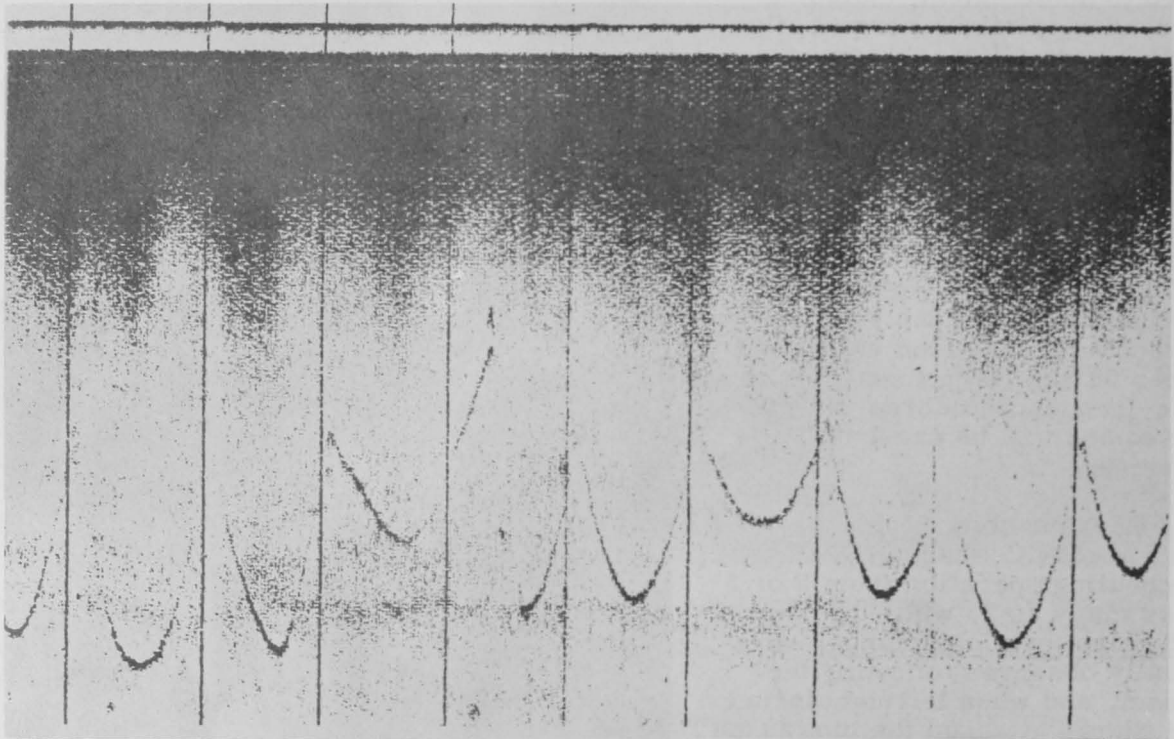


Fig. 15b - Depth-recorder tracing of long line just prior to hauling. The vertical lines mark the points where the buoys were passed on the surface while running along the line. The mainline is suspended on 20-fathom buoy lines and shows sag varying from 5 to 12 fathoms. The erratic appearance of the fifth basket from the left was caused by tuna on the line. This basket caught one yellowfin and 4 blackfin tuna. There was no catch on the other baskets shown. The black portion at the top of the recorder paper was produced because the sensitivity or gain of the "Echograph" Depth Recorder was increased. Note that such a nearly-complete record is only possible when the wind and current conditions hold the line in a vertical plane.

fathoms. Only a few sets were made at greater depths, and only a few afternoon or night sets were made. One yellowfin was taken from a basket set with 70-fathom buoy lines, and catches on afternoon sets were low. No tuna were taken on night sets made in 1954. Bathythermograph casts were made at most fishing stations in an effort to determine the position of a thermocline.

Up to the present time the best fishing has been on sets made at dawn or slightly before with buoy-line lengths from 10 to 20 fathoms during periods with moderate seas (not calm), and there has been no correlation between surface signs of tuna and the catch rate. Generally, the catch rates were poor on sets made where water depths were less than 500 fathoms. However, an insufficient number of sets have been made to properly evaluate many of these factors which presumably influence the catch.

Mainline sag is an important factor in determining fishing depths. On some occasions it has been possible to get excellent depth-recorder tracings of the mainline which in turn have given considerable information on the amount and variation of sag (see fig. 15b). The amount of downward sag is influenced chiefly by the distance between buoys and the factors which tend to stream the gear, such as current and wind (pushing the buoys). Varying the amount of slack in the mainline while setting will change the depth of the gear. There is a tendency for the buoys at either

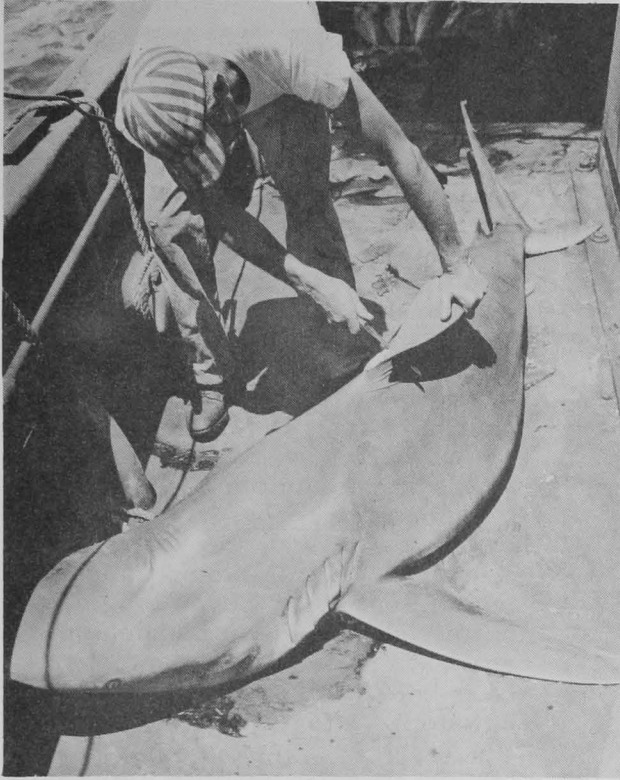


Fig. 16 - Removing fins from a medium-size dusky shark. Such byproducts in long-line fishing may provide substantial additional income.

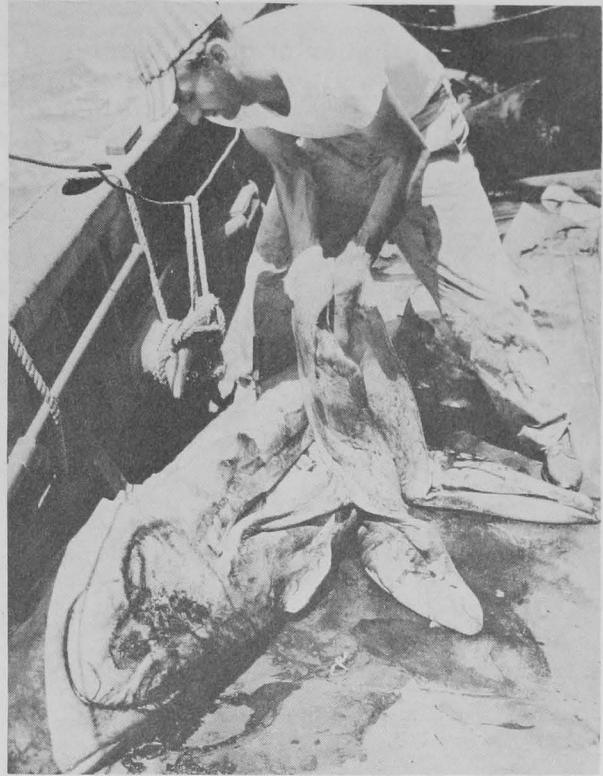


Fig. 17 - Removing the liver from a dusky shark caught on the long line. Samples of liver from all of the species of shark commonly caught are being tested for potentially-valuable byproducts.

end of the line to come together, greatly increasing the sag. When the line is set with little slack, the sag per basket averages about 8 to 10 fathoms (level of attachment of buoy line to mainline to the level of the bottom of the catenary) except for the end baskets. Often the buoys on either end will bunch up and the mainline will sag to over 60 fathoms. The presence of fish on the line can usually be detected by the erratic picture of the mainline. Fish may pull the line to one side or another, out of range of the depth sounder.



Fig. 18 - A deck scene during long-line hauling operations. A medium-size bluefin tuna has just been landed and is being hauled out of the way.

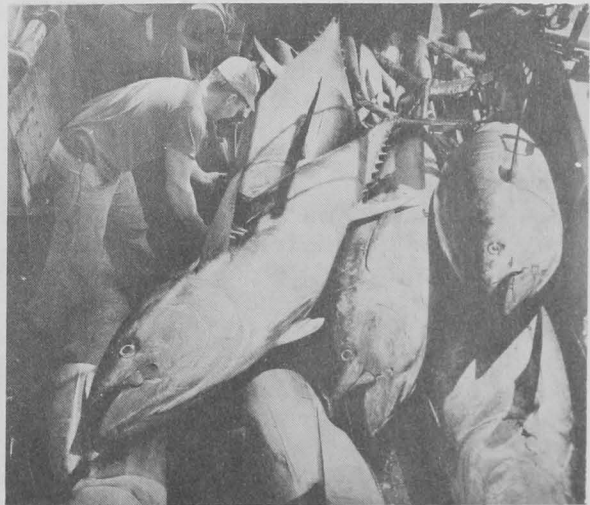


Fig. - 19 - A catch of large bluefin tuna from the Windward Passage.



A large number of other species of fish were caught on the long lines. White marlin (*Makaira albida*) were caught on the majority of the sets. Blue marlin (*Makaira nigricans ampla*) appeared less commonly. Sailfish (*Istiophorus americanus*) were rarely taken. During the early months of long-lining these fish were landed and the possibility of their being a salable byproduct was investigated. Since April 1955, a tagging program has been underway in cooperation with the Woods Hole Oceanographic Institution and all spearfishes in good condition have been tagged and released. One small swordfish (*Xiphias gladius*) was caught in June 1954.



Fig. 20 - Night-light dipnetting for young tuna in the offshore waters of the Gulf.

A large number of lancetfish (*Alepisaurus ferox*) have been caught throughout the year. Individuals are commonly caught containing six or seven long-line baits and this species undoubtedly accounts for a large share of the bare hooks, which reduces the amount of effective gear on a set.

In cooperation with biologists from the Service's Branch of Fishery Biology and the Woods Hole Oceanographic Institution, some information has been gathered on the spawning and feeding of yellowfin in the Gulf. The capture of ripe fish in the Gulf of Campeche in May 1954 and in the northern Gulf in June 1955, and collections of young yellowfins at widely scattered night-light dipnet stations during the summer and early fall shows

the Gulf to be one of the spawning areas for this species. Stomach analyses indicate a year-round feeding on deep-water pelagic fish, squid, and octopus. Occasionally, a yellowfin stomach has been found to contain bits of sargassum weed and small carangids, showing some degree of surface feeding.

### CONCLUSIONS

The lack of information needed to make year-by-year comparisons of seasonal catch rates and distribution precludes a comprehensive analysis for the present. The coverage to date does indicate the presence of deep-swimming tuna stocks distributed throughout the Gulf beyond the 500-fathom curve. Catches by the Oregon and several commercial vessels have been made during every month except April. (A single yellowfin was caught in the eastern Gulf on May 1 and several small landings were made during the following two weeks in the northern Gulf.) However, catches of commercial promise have been made only during May through January.

Starting in the fall of 1954 the owners of several fishing vessels rigged with varying quantities of long-line gear carried out supplementary exploratory fishing in the Gulf of Mexico and northern Caribbean. Their catch records have been communicated to the Service's office in Pascagoula and have provided valuable additional data.





Fig 21 - At the completion of the hauling operation the catch is placed in a refrigerated brine well. Twenty-four hours later the frozen fish are transferred to dry cold storage.

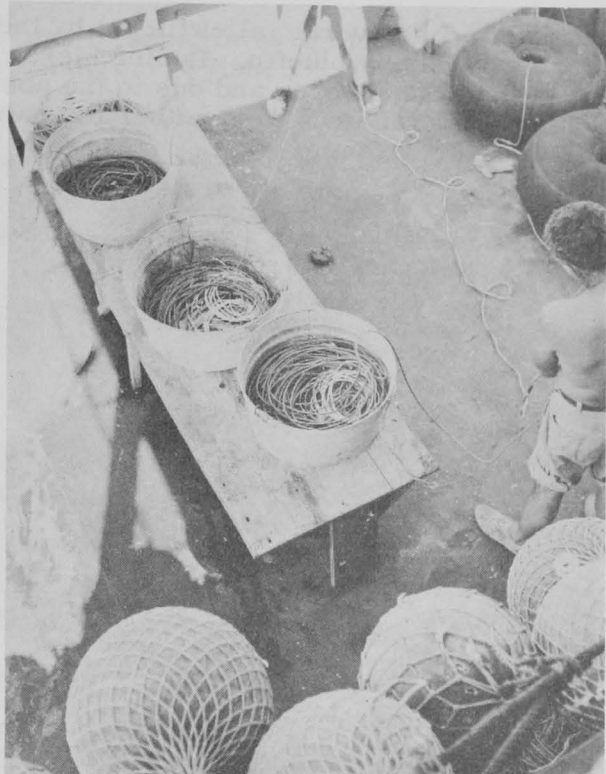


Fig. 22 - Successful fishing and strong currents usually result in large amounts of twisted and fouled gear. It generally takes one or two hours to straighten out the gear after each set. Upper right; two airplane-tire inner tubes are used as additional floats in areas where large bluefin are known to be present. Bottom: basketball-type floats are also being tried.

As yet no commercial boat has fished the Gulf with a full complement of long-line gear. Converted trawlers and snapper schooners have run up to 60 baskets (600 hooks), which is perhaps half the amount of gear an experienced crew could handle. Thus, while some trips are statistically encouraging from the numbers of yellowfin caught per 100 hooks fished, they have generally failed to produce profitable trips. The largest catch to date was made in September of last year when the M/V Santo Antonio, fishing 120 miles south of the Mississippi Delta, landed over 13 tons of yellowfin on a two-week trip while fishing less than 400 hooks per day.

In late February 1955, a sudden decline in the yellowfin tuna catch coincided within a week with the appearance of large bluefin tuna weighing from 300 to more than 700 pounds each. At first an occasional bluefin was

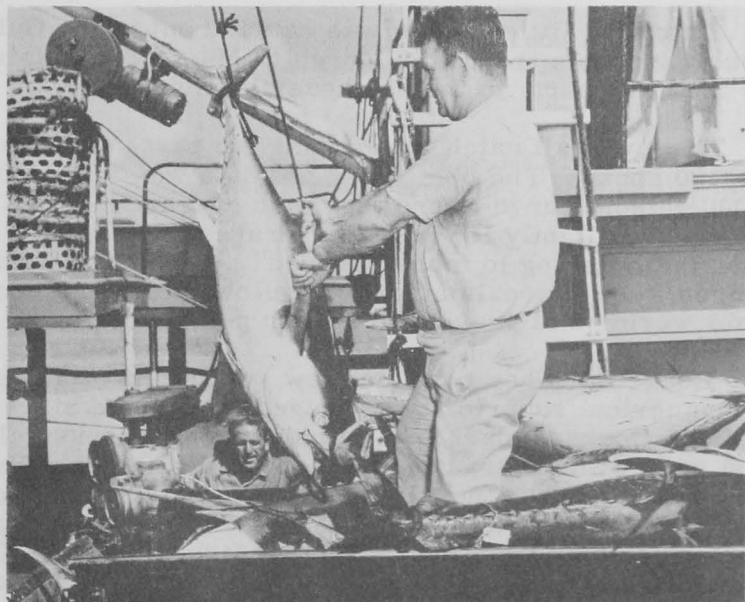


Fig. 23 - Unloading yellowfin at the completion of the cruise.

captured with several yellowfin but by the second week in March the catches had become exclusively bluefin. During March and April gear damage and loss due to these large fish was severe, and due to the absence of a market for large bluefin the pilot commercial ventures were either temporarily suspended or transferred to the north-eastern Caribbean.

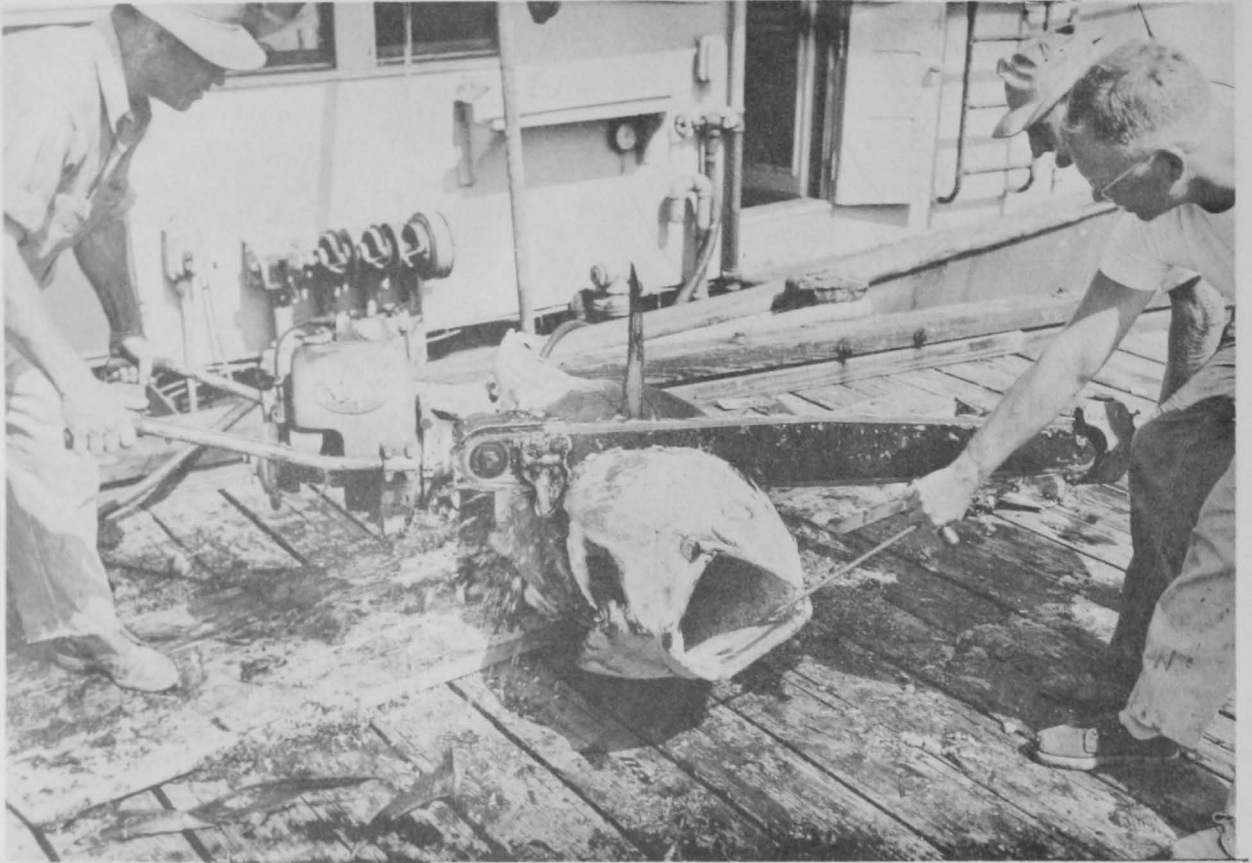


Fig. 24 - The problem of handling giant bluefin tuna ashore is partly solved by butchering them with a power saw.

Actually, little fishing was carried out in the Gulf by either the Oregon or commercial vessels from mid-March to May. The relatively few sets were confined, for the most part, to the northeastern Gulf.

The over-all catch rate during the past year was approximately 1.2 yellowfin per 100 hooks. The best fishing to date was in the north central Gulf beyond the 1,000-fathom curve where the catch averaged about 2.7 fish per 100 hooks. These averages are slightly lower than averages of some of the commercial boats that confined their fishing to more "proved" areas. The highest individual catches on the Oregon were approximately 6.5 yellowfin per 100 hooks. Catches on the Santo Antonio were as high as 10 to 12 fish per 100 hooks.

Long-lining has produced few small tuna of any species in spite of their apparent numerical superiority as judged by surface signs. The earlier records of surfacing schools of blackfin tuna have been impressively augmented throughout the past year with observations of schools during each month at sea. Still, catches have been small, generally one or two blackfin tuna on a set. The largest number of blackfin taken on a set was 7, and often none was caught even when surfacing schools were commonly seen throughout the fishing areas. Often sharks caught on the long lines contained whole blackfin that showed signs of having been torn from a hook,

but the small catch has been assumed to be due to selectivity of the gear (primarily in hook size) that has been designed for capturing large fish. This then leaves open,



Fig. 25 - Drying the shark fins ashore.

for the present, the question of the blackfin tuna potential which has been estimated to be greater than that of any of the other species in the Gulf.

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