The Modified Tuna Long-Line In Bermuda Waters

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BERMUDA, situated in mid-ocean 650 miles from the nearest land, offers many things which are not readily available off a main land coast. Foremost among these is the fact that really deep water is within a few miles of the shore, and from some of the small harbors it is less than four miles to waters 1,000 fathoms deep. With these conditions prevailing, it was decided that experimental fishing with the tuna long-line might possibly uncover information concerning an unexpected offshore fishery.

The Bermuda plateau, or reef, has an area of about 300 square miles, to which may be added the two off-lying banks to the southwest, giving a total of just over 400 square miles of fishing bottom. This is not large, and with the ever increasing population (40,000 in 1950) the normal annual catch of 1,000,000 pounds of fish is not sufficient to supply the demand. A transient tourist population of 110,000 persons puts further demands on the industry. It is elementary to figure that further exploitation of the existing grounds could well lead to over-fishing, and, therefore, probably present a most serious problem for the future of the industry as a whole.

For a number of years the presence of such species as the blackfin and yellowfin tuna, wahoo, and blue and white marlin has been known but their potential not understood. In addition, the large bluefin tuna and the longfin albacore had been recorded on rare instances. No attempt to fish any of these species commercially had ever been made, though some good catches of blackfin tuna *(Thunnus atlanticus)* and wahoo *(Acanthocybium solandri)* were brought in by the game fishing boats. Seasonally, the yellowfin or Allison tuna *(Thunnus albacares)* had been observed in large numbers and in varying sizes, but very few could be taken by the normal methods of trolling.

It is highly probable that many islands in the Caribbean have conditions similar in many respects to those prevailing in Bermuda, and the main purpose of this paper is to tell of our experiment in Bermuda waters with this type of gear, giving a description of its make-up and approximate cost, along with some important data not usually considered in printed reports.

A modified version of the Japanese tuna long-line was prepared and used in Bermuda waters for the first time during May, 1955. As is frequently the case when fishing the open sea the results were surprising. This was evident even on the initial set of the line, made specifically for getting familiar with the handling of the gear. Two extremely large true, or long-finned albacore *(Thunnus alalunga)*, were taken on the first set. One weighed fifty-one pounds and the other fifty-six pounds. The large size of these albacore tends to indicate that there may be a heretofore unexpected fishery for a species which is usually associated with Pacific Ocean operations.

In order to have comparative data, the long-line was constructed with 100 hooks. Also, and most important for the local industry, the gear was assembled in a length that could be operated successfully from small craft, there being few in the business in excess of forty feet in length. The first set of the gear was made just before daylight, about four miles offshore, in approximately 1000 fathoms of water. The hooks in one basket were baited with garfish (balao) and pilchard in the next. The hooks were fished at a minimum of 21 fathoms and a maximum of 30 fathoms from the surface. The gear took one hour and forty minutes to set and three hours ten minutes to retrieve. This time has now been reduced to fifty minutes to set and about two and a quarter hours to haul.

Since we found immediately that tuna could be taken by long-line locally, it was decided that the next steps in the experiment would be to attempt to ascertain the types of bait most effective, the depth at which most fish were obtainable, and the effect, if any, of the moon phase, tides, and sea temperatures on the fishing. While insufficient sets were possible during the summer to form definite conclusions, (due to pressure of other work and the unusually early hurricane season) there are very definite indications of the following:

1. The best weather for catching fish is when the surface has a moderate

swell, regardless of the strength of the wind. A calm sea produces nothing.

2. The dark phases of the moon definitely produce more fish. The full moon period is the poorest, new moon the best.

3. It is apparent that baits fishing between 20 and 30 fathoms are the most successful in these waters. Shallower (15 fath.) and deeper lines were tried (40 fath.) but no catches were made at those depths. It was also found that setting in water shallower than about 750 fathoms was not productive, while from 1,000 to 1,500 fathoms seemed to be the best.

4. Best temperatures for fishing the open sea appear to be between 70 and 80 degrees Fahrenheit. It was found that temperatures are constant from the surface to a depth of at least 35 fathoms.

5. The following species of fish were tried as baits: pilchard (*Harengula callolepis*), round-robin (*Decapterus*), balao or garfish (*Hemiramphus brasiliensis*), anchovy (*Sardinella anchovia*), bream (*Diplodus*), grunt (*Haemulon*), yellowtail (*Ocyurus chrysurus*), and shad or mojarra (*Ulaema*). The only bait which caught fish consistently was the pilchard, and whenever possible the entire line is now baited with that species.

6. The duration of the set can be shortened if it is practicable to run the gear about an hour before low tide and pull it after about an hour of the rising tide. There are definite indications that a minimum catch will result from setting the long-line when an easterly wind is blowing. This, of course, would obviously not be the case in areas within the N.E. trade wind belt.

The experimental line had to be comparatively short in order to be stowed properly on the boat being used for the work. This craft is one which has been used at the Bermuda Aquarium for many years for the purpose of collecting live exhibits for the tanks. While there is more than sufficient room for hand-line fishing or fish trapping, the cockpit layout is not ideal for handling long-line gear. Overall length of the boat is 36 feet. The raised top of the fish well and the long engine cover considerably reduce the deck space. However, ten tubs of line, 100 drop lines, and the required buoys, flags, and ropes can be stored reasonably well, leaving some room on deck for the catch.

While excellent information may be had on this subject from Fishery Leaflets published by the U.S. Fish & Wildlife Service, I think a brief description of the make-up of the line might be useful.

The main, or long-line, is made up of ten sections, which are joined just prior to setting. Each section is carefully coiled into a galvanized iron wash tub, with the end to be attached to the next section coiled in first. The actual tail end of the line is left clear of the tub so that it may be attached to the other before all of the line in the tub has been run out. Each section of the line consists of 200 fathoms of quarter-inch diameter best Italian hemp fishing line, obtainable from the Belfast Ropeworks, Belfast, Ireland, at forty-one shillings per 130 yard hank, or about 1.25 cents (U.S.) per foot. Hard laid cotton twine of a suitable diameter will do equally well. At intervals of 20 fathoms a flag halyard clip is served to the line, to take a similar swiveled clip on the upper end of the drop or hook line. At the beginning of the line there is a float, with bamboo pole and flags attached as markers, and at each section or tub of line there is a similar float and marker, making a total of 11 floats for the 10 tubs of gear. If thought desirable, intermediate floats may be added in each section, but this is not essential.

The drop or hook-lines are 10 fathoms long, with another six feet of stainless steel cable of 3/32 inches in diameter on one end, and to which a size 9/0

Mustad tuna hook is attached. In order to prevent wear at the point where the line and wire are attached it is well to have chafing gear. In our case we use about eight inches of 3/16 inch inside diameter rubber hose which serves as a thimble in the wire loop. The loop is attached to an eye splice at the end of the hook-line. The wire is not spliced, but clamped with No. 18-2-G Nicopress Sleeves by a tool known as No. 51-G-887, as supplied by The National Telephone Supply Co., Cleveland, Ohio. We have never had a clamp pull out, and they are so much easier and quicker to handle than a splice. As all sections of the line are identical it is necessary to describe but one. Each is made up of 200 fathoms of long-line, ten 10 fathom long hook-lines, ten 6 ft. long wire leaders with size 9/0 hooks attached, one float, a 14 ft. long thin bamboo pole with flag attached to upper end, and a length of buoy rope. This latter rope governs the depth at which the long-line hangs. Ours are 10 fathoms long so that the main line sets in a horizontal position that far below the surface, and the hook-line and leader hang vertically another 11 fathoms, the baits fishing a minimum depth of 21 fathoms below the surface. Naturally, the long-line will not remain taut, and, therefore, through its sagging some baits will fish deeper. Sag may be kept to a minimum by increasing the number of floats. Several depths of hook-lines may be tried in one section. It is far cheaper to regulate the depth of the long-line by lengthening or shortening the buoy lines than by changing the lengths of the hook-lines.

One of the nicer features of the long-line is the fact that it lends itself so readily to modification. There are no hard and fast rules as to how it should be made up, or at what depth it should be fished, or the size or quality of the rope to be used.

Buoys or floats are very important, and consideration should be given to the type of fishing to be done before the selection is made. Wood is cheaper than most materials, but becomes logy with use and it does not float high above the surface. Metal floats are excellent, but it is quite possible that one or more may be crushed by the pressure of the water if they are pulled well below the surface by a large fish. The inner tubes of tires are also suitable. These also may be burst by the pressure of the depths if they are inflated too much on the surface. A pressure of about three pounds is sufficient. This will permit the air to become greatly compressed without too much danger of bursting the tube. One tube of a size used on a car or two of wheelbarrow wheel size, enclosed in old fish netting, make suitable flotation equipment. It is not necessary to have a pole and flag to every float, but one must be used at each end of the line, and sufficient between to enable the gear to be spotted at some distance. It is often possible to set the gear and leave it for several hours while trolling or setting traps, etc., but it is very important that the line be well marked and visible for at least two miles. Strong currents will move it at a considerable rate.

Generally, the strength of the wind will determine the direction in which the gear is set. In light winds it may be run either to windward or to leeward with equal speed, but in fresh winds it is more practical to set it down wind and haul it while going to windward. We have found no difference in results whether the line was run out straight or zig-zagged. The line may be patrolled so as to spot any float being towed or submerged, and the fish taken up immediately, or the whole left for a predetermined time and then retrieved. In most instances it will probably be found to be more practical to set the gear

down wind, leave it, and then begin the haul to windward, the first section in the water being the last to be taken out.

In hauling the line with the assistance of a winch or capstanhead it will have a tendency to twist. This may be kept to a minimum by hauling the rope in at an angle of about 45 degrees. The twisting of any one part of the line is not very serious, but that twist is generally enlarged so as to affect the hook-line as well, with the result that much time may be lost in the process of untangling the gear. The angled haul tends to keep the two parts of the gear separated until fairly close to the side of the vessel. If the upper portion of the hook-line is served with cotton twine for a distance of about six feet then the liability of entanglement is further minimized. Of course, fish will also make a shambles of the gear at times and there is no remedy other than patience while disentangling. In such instances it is generally better to coil the whole mess in the tub and clear the gear ashore next day, or later on deck. Sharks are also a problem at times, when hooked and when attacking a fish on the line. A sure remedy for this, if the shark is alongside, is a bayonet attached to an eight-foot pole. One or two jabs near the snout will usually take the fight out of the shark and then it can be handled with ease.

Shark trouble has been surprisingly small, only one fish having been mutilated during the whole experiment.

To date (October, 1955), the following species of commercially important fish have been taken on our long-line: blackfin tuna, yellowfin tuna, wahoo, true albacore, white marlin, and blue marlin. It is not anticipated that the catch of blackfin and wahoo will be great by this method unless sets are made over the continental shelf. These fish are generally taken in from 35 to 50 fathoms of water.

The largest catch consisted of four yellowfin tuna averaging 160 pounds, one mako shark, one blue marlin (82 lbs.), and one white marlin (80 lbs.), on a nine tub set of ninety hooks, using pilchard as bait. Twelve other baits were lost. This set was at new moon. The poorest results were obtained when the line was left out over night. There were three great blue sharks on the line, only one of which had been on more than a couple of hours. All other baits were intact. A total of four large albacore have been taken on four sets made in one area. These fish weighed 65, 56, 51 and 51 lbs. in the round. It is hoped that some intensive fishing may be carried out in this area in the near future with a view to ascertaining the potential of the albacore fishery.

The long-line is usually associated with large vessels, but with a little ingenuity almost any small craft can be utilized for the purpose. Under certain conditions it is possible to coil down the entire main line into one container. In the West Indies it will probably be far cheaper and better to use palm leaf baskets as containers for the coiled rope rather than galvanized iron tubs. They stow better and take up less space. Some of the Japanese lines are as long as twenty miles. Ours is only two and one-quarter miles in length. This does not mean that the lines have to be really long. In areas surrounding Barbados, for instance, where small boats are used to catch flying-fish, it might well be practicable to use a line of about one-quarter mile in extent and using about 25 hooks. In this area yellowfin tuna are frequently taken with live flying-fish bait, and it should be an excellent method of supplementing the annual catch. Such a line could be constructed for as little as £10, or about $27.50 U.S. currency. There would be no difficulty in hauling a short line by hand. Where a line is longer than one mile in extent it will be found more practicable to

have some mechanical means of retrieving the gear. A belt or chain driven capstan head, operated via a pulley from the main engine, is quite suitable. It is not even necessary that it be possible to disengage the "winch" when not in use, though this is preferable, of course. A simple roller on the gunwale of the boat will serve to minimize friction and, therefore, lengthen the life of the gear. This will apply equally to line hauled in by hand.

Experience is the best teacher, and it takes little time to learn that the line should be paid out over the stern, and hauled in from some point forward of midships. The latter makes it easier to keep head to the wind and swell, thereby making working conditions easier. Experience has also proven that the Japanese type of tuna hook is superior in holding power to that of our conventional hook. Due to the increasing demand for such a hook in the United States, O. Mustad & Son, Oslo, Norway, now manufacture this type in several sizes—from about 4/0 to 10/0. In ordering from them or from dealers elsewhere it is necessary to quote Qual. 9202, and the size required, in order to get the correct type. Size 8/0 is an excellent all-round size. It is small enough to get a 5 lb. fish, and strong enough to hold a 300 pounder. These hooks cost about 9d. (10c U.S.) each, for size 9/0, but are well worth the expenditure.

The cost of making up the 2¼ miles of long-line, 1000 fathoms of hook-line, all of best Italian hemp, plus the 700 feet of 3/32″ diameter stainless steel cable, 100 size 9/0 tuna hooks, 11 floats and poles with flags, and the 11 float lines of sisal rope, exclusive of labor, was about £100, or $280 U.S. currency. The labor entailed in making the splices is considerable, but in most fishing communities this can be done in a leisurely fashion during spells of bad weather. One set of gear, with reasonable care, will last about three years. Some wire leaders and hooks will have to be replaced at times, but the general wear and tear is surprisingly small. The rope should be well dried and stored in a ventilated spot if it is to be kept out of use for any lengthy period. Care should be taken to wash blood or bits of flesh from the rope before storage to minimize damage by rot or rats.

To sum up, the experimental fishing to date indicates that a successful commercial long-line fishery can be set up in Bermuda for yellowfin tuna, and possibly albacore. The industry will have to be introduced to this method of fishing and, should they be willing to accept the addition, the annual catch should be doubled, at least. The short run to the fishing grounds eliminates the necessity of expensive refrigeration, and it can be a one-day operation on each occasion. Within one year the experimental stage will reach its conclusion, at the end of which a full report will be rendered to the Government and copies of this will become available to all interested persons.