Part II - Long-Line Gear Used in Yellowfin Tuna Exploration

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INTRODUCTION

The long-line gear used on the Oregon for the capture of deep-swimming tunas is essentially the same as that used by Japanese fisherman in the Pacific Ocean (Shapiro 1950). The first units of gear tried by the Oregon were made up in Japan and used for bluefin-tuna explorations in New England waters during 1952-1953. This gear was described in detail by Murray (1953-1954). After preliminary trials it was found necessary to incorporate certain changes which were based on the results of extensive long-line experimentation of the U. S. Fish and Wildlife Service's Pacific Oceanic Fisheries Investigations (Niska 1953). Further modifications were made later to fit the conditions in the Gulf of Mexico.

Fig. 26 - A 10-hook "basket" of long-line gear used on the Oregon.

If tuna in the Gulf of Mexico and adjacent waters are to form the basis for a strong fishery, the methods used must be adapted to local conditions and the primary objective in the development of the method is to find the one that will land tuna at the lowest cost per ton taking into consideration labor, materials, and equipment. Experimental studies of long-line gear in the Gulf have not progressed to the point where recommendations can be made about the relative merits of (1) conventional Japanese-style gear, (2) all nylon gear using a drum hauler, and (3) all wire gear. Continuing studies by Pacific Oceanic Investigations on wire gear may indicate a clear superiority of this type of gear. Or, as seems probable, several kinds of long-line gear may prove useful depending on types of vessels available.

DESCRIPTION OF LONG-LINE GEAR USED ON THE OREGON

Long-line gear consists of three basic components: the mainline, the branch lines (gangions), and the buoys with buoy lines. The basic unit of long-line gear is the "basket" which contains a section of mainline and the attached branch lines as shown in figure 26. (Grad-

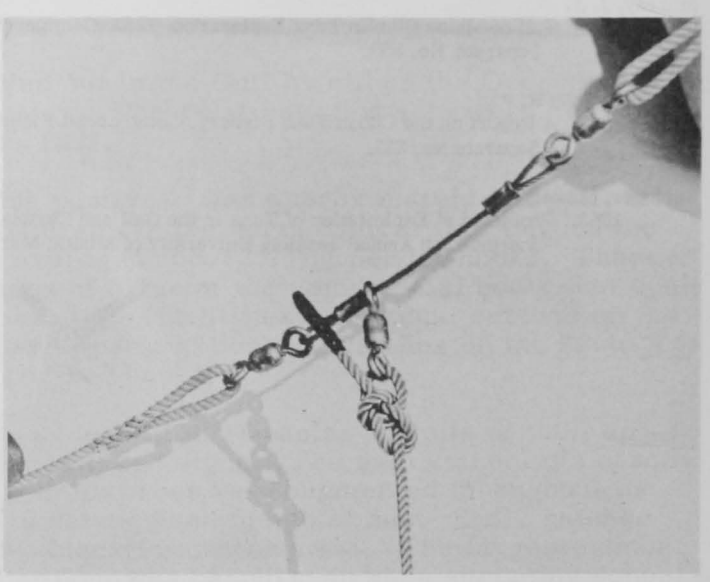

Fig. 27 - The swivelled becket used for spacing branch lines on the mainline.

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ually we have replaced the traditional woven bamboo baskets with No. 2 galvanized tubs which are less expensive, stronger, and nest better.) A Japanese-designed line hauler retrieves and coils the line into the basket.

MAINLINE: The mainline of a typical basket is 138 fathoms of 132-thread type-E filament nylon made up in nine 12-fathom sections with a 15-fathom section on each end. The various sections are joined together with swivelled beckets as shown in figure 27.

BRANCH LINES: The branch lines are all of equal length, and are made up of 4 fathoms of 11/64" diameter "Gulf-lay" nylon line (or 132-thread type-E filament nylon), one 8/0 McMahon barrel swivel, one fathom of 3/32" diameter 7 x 7 preformed stainless steel wire, and a 9/0 Japanese-style tuna hook. A branch line is tied to the sliding swivel on each becket using a "figure 8" knot or a standing bowline. A fathom of wire is required near each hook because the rough hide of sharks quickly chafe through cordage, particularly nylon.

Fig. 28 - A side view of the Japanese long-line hauler in operation.

BUOYS: A buoy and buoy line is used with each basket for suspending the mainline at the desired level. The lines are $\frac{1}{4}$"-diameter manila or 261-thread cotton line. Several types of buoys have been found satisfactory: 16-inch diameter rubber and canvas-covered seine floats have given satisfactory performance in all respects, but their cost is relatively high. Surplus 1,000 cubic-inch oxygen cylinders, 5-gallon wooden kegs, and airplane-tire inner tubes have worked well. In areas of good fishing or where large bluefin are present there is some loss of kegs and oxygen cylinders caused by collapsing due to pressure when submerged.

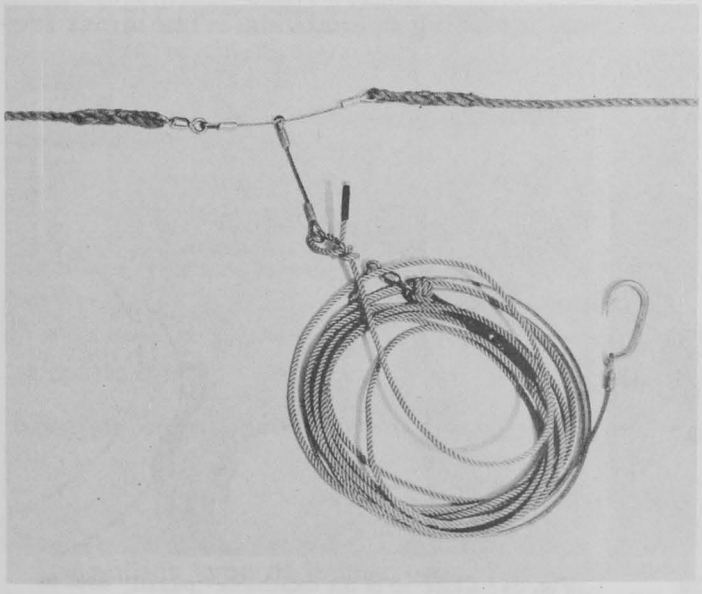

Fig. 29 - Another variety of wire becket employing only one swivel.

Flag buoys are attached to every tenth buoy and at the end of the line. These are made up of 16-foot bamboo poles floated by cork slabs lashed 4 feet above the butt. Sufficient weight is added to the butt to keep it floating in an upright position. They may be lighted for night fishing.

LONG-LINE HAULER: The Japanese line hauler used for picking up the line is shown in figure 28. The mainline is coiled automatically and can be retrieved at a rate of 12 to 15 baskets per hour depending on the catch and the amount of fouled gear. The branch lines, however, must be coiled by hand.

Fig. 30 - A deck view of the Mike Flechas, a commercial long-line vessel, showing the long-line reel developed by Captain Charles Kaufman. In the foreground are buoys and buoy lines. In the upper left are trays with branch lines.

NOTES ON MATERIAL AND CONSTRUCTION

Due to the considerable stress that is exerted on the mainline and branch lines during fishing operations, it is necessary to use line of sufficient strength to minimize the chances of the gear parting. Completely satisfactory results were not obtained on the Oregon until line of approximately 1,000-pound test was used. Lines of many different materials were used with most of them performing satisfactorily: 132-thread type-E filament nylon has worked the best of those tried to date because of its high tensile strength, resistance to deterioration, and qualities of stiffness and size that have worked well in the long-line hauler.

Lines made up with natural fibers should be treated with a suitable cordage preservative.

Tangled lines often slow down fishing operations. The most fre-

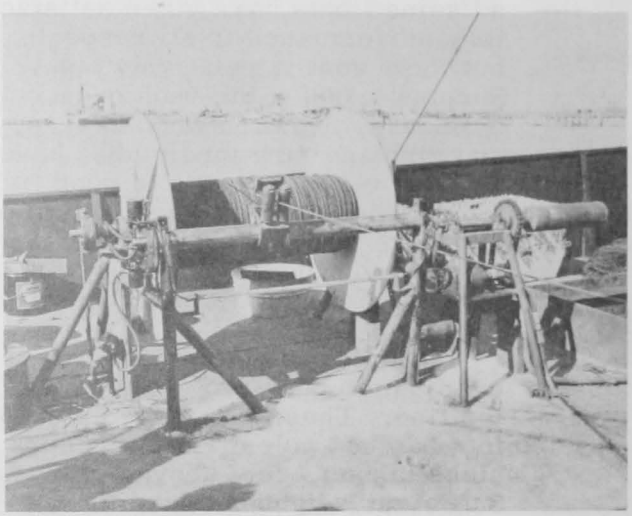

Fig. 31 - A close-up view of the long-line reel on the Mike Flechas showing the level wind gear.

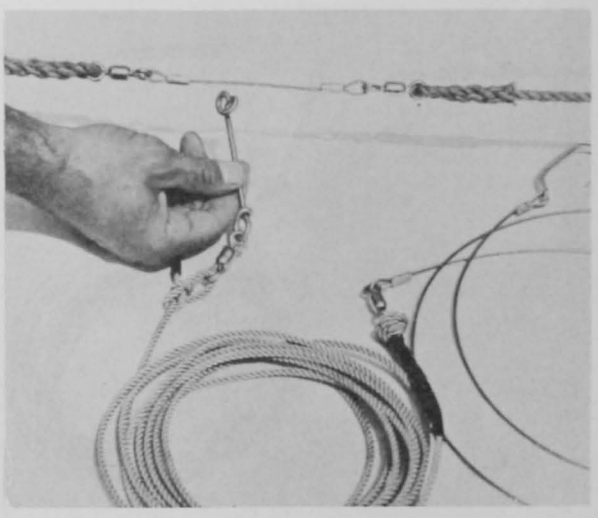

Fig. 32 - Close-up of the detachable "pigtail" used to connect the branch line to the mainline. This is being used on the reel-type line hauler. The "pigtail" was designed by Ben Sholtes of Pascagoula, Miss.

quently encountered tangle, known as a "wrap-around," occurs when a branch line wraps around the mainline. These appear to be caused in several ways. Tangles brought about by insufficient slack in the mainline while setting and too much strain on the mainline during hauling can be minimized by proper setting and hauling technique. Stretching the new mainline before assembling will reduce the number of "wrap-arounds" on new gear. Tuna, shark, and other large fish often tangle the entire basket on which they are caught. The use of swivelled beckets in the mainline has also reduced the number of wrap-a-rounds. This becket has been slightly modified from the original design developed by Pacific Oceanic Fishery Investigations because the branch lines of our gear are not removed from the mainline at any time during the fishing operations. They are made up of three #8 McMahon barrel swivels and 9 inches of 3/32" diameter 7 x 7 preformed stainless steel wire. The wire eyes are clamped by 28-2-G Nico-press sleeves. The beckets are joined to the mainline using eye splices.

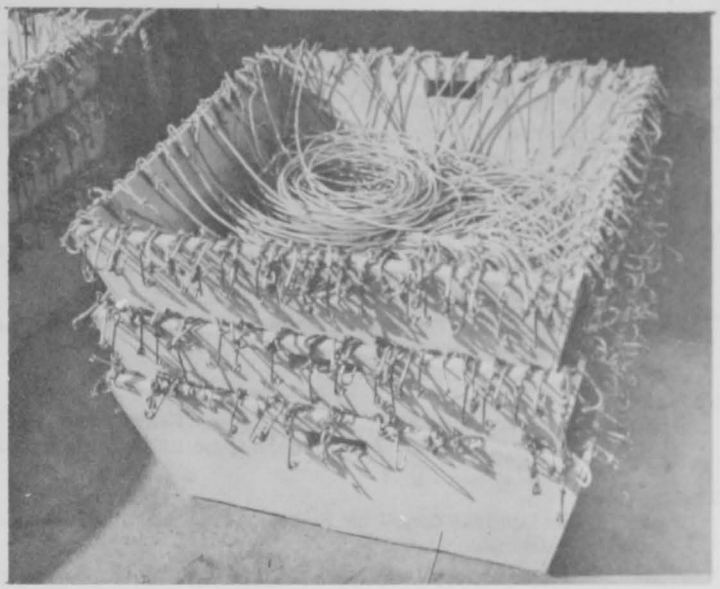

Fig. 33 - Storage of branch lines used on the power long-line reel. The branch lines are fastened to the mainline by twisting on the "pigtails."

Fishermen in the Gulf have further modified the swiveled becket. A less expensive type employing only one swivel is shown in figure 29. The only disadvantage to this type comes from the tendency of the wire eye to chafe the eye splice in the main line.

Table 1 - Approximate Cost of Materials Per Basket for Long-Line Gear

Quantity	Materials	Function	Weight or Length	Approximate Cost	Approximate Tensile Strength
138 fms.	(a) 132thd. Type-E Filament Nylon Line	Mainline	7 lbs.	$23.00	1,010 lbs.
	(b) 261thd. Hard-lay Cotton Line	Mainline	13 lbs.	13.00	600 lbs.
	(c) ¼" Diameter Italian Hemp (40-lb. line)	Mainline	18 lbs.	15.00	750 lbs.
	(d) 7/32" Diameter Fine Yarn Manila Tuna Ground Line	Mainline	14 lbs.	10.50	525 lbs.
40 fms.	(a) 132thd. Type-E Filament Nylon Line	Branch Line	2 lbs.	6.50	1,010 lbs.
	(b) 11/64" Diameter Gulf-lay Nylon Line	Branch Line	2 lbs.	6.50	1,100 lbs.
	(c) 361thd. Hard-lay Cotton Line	Branch Line	4 lbs.	4.00	600 lbs.
	(d) ¼" (40-lb. line) Italian Hemp	Branch Line	5 lbs.	4.50	750 lbs.
	(e) 7/32" Diameter Manila Tuna Ground Line	Branch Line	4 lbs.	3.00	525 lbs.
20 fms.	261thd. Hard-lay Cotton Line	Buoy Line	2 lbs.	2.00	600 lbs.
11 fms.	3/32" Diameter 7 x 7 Preformed Stainless Steel Wire	Leaders and Beckets	66 feet	5.94	920 lbs.
10 ea.	Japanese-Type Tuna Hooks	Hooks	-	2.00	-
40 ea.	#8 McMahon Barrel Swivels	Leaders and Beckets	-	2.40	1,000 lbs.
40 ea.	Nico-press Sleeves (28-2-G)	Leaders and Beckets	-	1.40	-
1 ea.	16" Diameter Canvas-Covered Seine Buoy	Buoy	-	7.68	-
1 ea.	No. 2 Galvanized Tub	Stowage	-	1.50	-

Cost per basket using 11/64"-diameter Gulf-lay nylon line for branch lines:

Type of Main Line	Total Approximate Cost
(a) Type-E Filament Nylon	$52.42
(b) 261thd. Hard-lay Cotton Line	42.42
(c) ¼" Diameter Italian Hemp	44.42
(d) 7/32" Diameter Fine Yarn Manila	39.92

NOTE: The cost per basket can be materially reduced by using other types of buoys.

DRUM-TYPE LINE HAULER

Another type of becket has been developed by Captain Charles Kaufman who uses a drum-type long-line hauler (figures 30 and 31). This method brings in the mainline as one continuous piece and not separated into "baskets." Each branch line is attached as the line is payed out while setting, and each branch line is removed as

the line comes in. This becket uses a "pigtail" for attaching the branch lines to the main line and has been reported to be very successful (figure 32).

Table 1 gives the weight and approximate cost per basket of several types of gear patterned on the preceding descriptions. Mainline material other than that listed has been used successfully, but has not been included here as the cost is thought to be prohibitive.

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"RED TIDE" REPRODUCED ARTIFICIALLY

The causative organism (Gymnodinium brevis) of the periodic outbreaks of "Red Tide" has been reproduced under laboratory conditions, reports the Service's Fishery Biologists at the Fort Myers (Fla.) laboratory.

Cultures of Gymnodinium brevis at concentrations of 3,000,000 cells per liter were used to kill a number of fish experimentally, and the fish so killed were permitted to remain in the open cultures (beakers) for about 2 hours after death. When they were removed from the beakers the fish were gently squeezed so that the body fluids would drop back into the culture. This stimulated the dinoflagellate to make such rapid division that it effected a threefold increase in 4 days--a concentration that had not been attained previously in laboratory cultures.

The findings of this experiment confirmed those of earlier experiments in which increased growth of the microorganism was secured by using sterile juices that had been extracted from the muscles of fresh fish.