has demonstrated potential that must be limited because of size. In the Windward Islands, the Grenada Shelf has shown some moderate potential. Good potential was observed off eastern Venezuela, Guyana, and Surinam. Excellent potential was found off French Guiana.

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Exploratory Tuna Longline Fishing in the Caribbean and Adjacent Waters

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ABSTRACT—This report gives the results of tuna longline exploration conducted by the Caribbean Fisheries Development Project. All such fishing was conducted in the Caribbean Sea and adjacent Atlantic Ocean waters in 1966 and 1967. Background information, including the fishing history, topography, oceanography, fishing grounds, and seasons, is given. Vessels and gear are described, after which fishing results are presented by geographic region. Overall results were generally poor and below commercial catch rates observed in the same regions for a variety of reasons. In summary, the resource was considered insufficient for the establishment of a continuous tuna longline fishery in the Project region.

INTRODUCTION

This report is one of a series on exploratory fishing activities of the Caribbean Fisheries Development Project which became operational in August 1965. Although the tuna resources in the Caribbean waters had already been explored by the United States (since 1954) and by Japanese research vessels and commercial vessels (since 1955), the fishery is utilized only seasonally by foreign vessels. This type of fishing was adopted by the Project to evaluate its potential for fishermen of the Caribbean Region.

BACKGROUND OF TUNA LONGLINE FISHING IN THE CARIBBEAN

History

The U.S. Fish and Wildlife Service's exploratory fishing vessel *Oregon* carried out tuna longline fishing in April and May 1955, January 1956, and August, September, and October 1957, to determine the extent of subsurface tunas in the northern, western, and eastern Caribbean, and to gain information on the possible continuity of yellowfin tuna stocks between the Gulf of Mexico and the Caribbean.

Several Japanese longliners conducted commercial feasibility operations in the Caribbean between 1955 and 1958. The results were encouraging in catch rate and there was less distance to vessel bases when compared with the Pacific or Indian Ocean operations. In 1958, 51 vessels caught 30,984 tons during 131 cruises. In 1961, total vessels operating in the Atlantic were 86 with 82,251 tons caught during 258 cruises.

This increase continued until about 1964 with a final total of over 100 vessels involved. Some of these vessels, however, started to move to the Indian and Pacific oceans due to uneconomical operating conditions. Factors included a change of market, labor problems, and decrease in catch rate. In 1968, the vessels operating in the Atlantic decreased to about 25. Dominant size of those Japanese tuna longliners in the Atlantic is about 300 to 400 gross tons (GT). The larger sized vessels—more than 500 GT—usually carried one or more catcher boat(s) which could independently operate 200 to 250 baskets of longline gear each. Longline gear used by those vessels was mostly the same type as that used by the Project vessels mentioned in this report—400 to 450 baskets set per day by the commercial vessels.

Some of those vessels worked in the Caribbean during seasons when higher catch rates of tuna were possible. In the earlier stages of fishing, landing bases existed at Trinidad, Panama, Haiti, Cuba, Colombia, and Brazil. Recently there has been only one land-and operating base—St. Maarten.

In Venezuela, some of the local fishing vessels started tuna longline fishing in the eastern Caribbean about 1954. As a result of the *Bosu Maru* exploratory tuna longline fishing based at Venezuela, a Venezuelan-Japanese company was established in 1957 to initiate the fishing with two Japanese-built longliners which were manned by mixed crews. Successful operations of this company and favorable demands for tuna in Venezuela stimulated local vessel owners to increase modifications to longliners. In 1966, there were about 43 vessels, mostly 3 to 45 tons in capacity, fishing with an average of 100 to 120 baskets of Japanese-type longline. Annual landings in Venezuela from 1960 to 1966 ranged from 1,940 to 3,540 tons. The seasonal and annual change of yellowfin and albacore in the Caribbean and western Atlantic was studied, based on data collected from three longliners from 1960 to 1963.

In Cuba, a Japanese commercial longliner (462 GT) started demonstra-

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tion tuna longline fishing from Havana in 1957. Three similar vessels joined the following year. After the new government took over, the Cuban Fishing Fleet Enterprise started tuna longline fishing with five medium sized tuna longliners acquired from Japan in 1962, and a continuous increase of this type of vessel—250 to 600 GT—brought the number of longliners to 28 in 1967. These vessels are equipped with Japanese-type longline gear of 280 to 330 baskets (5-hook) and operate in the Gulf of Mexico for yellowfin tuna, the Atlantic and Caribbean for tunas and marlins, or east of the Florida coast for bluefin tuna. Working rate trip norms for the tuna longliner in 1967 showed 85 to 90 days at sea with 62 to 66 days fishing to produce 115 tons per trip.

In Puerto Rico, a research vessel, *Carite*, conducted exploratory tuna fishing in the Mona Passage and northern waters of the island from August 1963 to June 1965. A total of 13 longline sets with 100 to 300 hooks per set in the eastern part of Mona Passage captured no tunas. A more satisfactory result was obtained by trolling for blackfin, skipjack, and small yellowfin tunas. A few sets north of San Juan and east to the Virgin Islands resulted in one fish/100 hooks for yellowfin and albacore tunas. Other data from around Puerto Rico indicates a catch rate of 0.38 fish/100 hooks calculated from a total of 20 tunas from 5,236 longline hooks fished by MV *Crawford*, MV *Oregon*, MV *Elmer*, etc., since 1957. In 1958, there were 18 tuna purse seiners based in Mayagüez and Ponce, Puerto Rico. They fished primarily from northern Chile and northern Mexico in the eastern Pacific and the Atlantic off Africa from the Gulf of Guinea to Angola, with some seasonal fishing from Cape Hatteras to Cape Cod.

Topography

The Caribbean is bordered by Central and South America, and the Greater and Lesser Antilles. The sea is separated from the Atlantic proper by ridges of the Antilles arc. The region is divided into two major regions by the Jamaica Rise which extends from Hispaniola to Honduras. The eastern region of the sea is partially separated into two basins: Colombia Basin in the west, Venezuela Basin in the east, and by the Beata Ridge which extends south to about lat. 15°N. The Aves Swell, which extends from lat.16°N to 12.5°N at about long.63.5°W, separates the Grenada Trough in the east, and beyond the ridges of the Lesser Antilles, farther east, a small trough, the Tobago Trough, exists between the Grenadines and Barbados. The Los Roques Trench in the south of the basin is closely adjacent to the Venezuelan Shelf. The Cayman Trough and Yucatan Basin are in the western region of the Caribbean Sea. The major openings with great sill depths are the Yucatan Channel between Cuba and Yucatan, Windward Passage between Hispaniola and Cuba, Anegada and Jungfern Passage between the Virgin Islands and the Leeward Islands, and between the north Virgin Islands and St. Croix. The Mona Passage between Hispaniola and Puerto Rico has a very shallow sill depth and there are many narrow openings between the islands on the Lesser Antilles arc from the Leeward Islands to the coast of South America with relatively shallower depths.

Oceanography

The main ocean currents in the Caribbean Sea and the adjacent waters are the North Equatorial Current, South Equatorial Current, Equatorial Countercurrent, Antilles Current, Florida Current, and Gulf Stream. The North Equatorial Current flows to the west from Africa and near the Antilles divides into two parts, one of which flows into the Caribbean and joins the Florida Current passing through the Gulf of Mexico; the other branch becomes the Antilles Current proceeding northward, rejoining the Florida Current north of Cuba. In the winter, the south boundary of this current is about lat. 5°N in the northern waters of Brazil. In summer, the boundary moves up to about lat.10°N. The Antilles Current is stronger in the summer. The South Equatorial Current flows west with a northern boundary of about lat.5°N in winter, and splits where some of the current changes direction to northwest and runs along the northeast coast of South America to join the North Equatorial Current in the Caribbean. The rest becomes the Brazil Current which runs south along the southeast coast of the continent. In summer, the northern boundary of the South Equatorial Current goes south to about lat.3°N and in between the North and South Equatorial Currents or about lat.3°N and 10°N, the Equatorial Countercurrent appears and flows from west to east.

Accordingly, the main current in the Caribbean is formed by both the North and South Equatorial Currents and both sides of the main current have many eddies. One of the eddies is between Nicaragua and Colombia and another between Cuba and Jamaica. This main current flows into the Gulf of Mexico through the Yucatan Channel and becomes the Florida Current which runs clockwise around the Gulf and flows north to Cape Hatteras after passing through the Straits of Florida. The Florida Current and the Antilles Current join together and make the Gulf Stream.

The species of tunas living in these currents are as follows:

Current	Tuna species
N. Equatorial Current	albacore, bigeye tuna
S. Equatorial Current	yellowfin tuna and albacore
Equatorial Countercurrent	yellowfin tuna, bigeye tuna, and bluefin tuna
Gulf Stream	albacore
Brazil Current	albacore and blue marlin

Fishing Grounds and Seasons in the Caribbean and Adjacent Waters

Although there are some differences in the catch rates and distances to Atlantic fishing grounds from the Caribbean Islands, the seasonal migration of tuna is more regular than that in the Caribbean. Fishing effort in number of hooks set by Japanese tuna longliners and catch rates by number of fish for tuna species in the Atlantic from 1956 to 1962, are shown as follows:

	Number of fish per hundred hooks			
Year	Albacore	Bigeye tuna	Yellowfin tuna	No. of hooks
1956	0.8	0.1	0.9	0.13×10^6
1957	0.9	0.2	7.6	3.37×10^6
1958	1.2	0.2	9.3	7.98×10^6
1959	2.3	0.3	7.1	15.23×10^6
1960	2.2	0.3	5.6	20.90×10^6
1961	1.6	0.9	3.7	26.40×10^6
1962	2.0	0.7	1.8	54.10×10^6

[1]1965	2.4	0.4	0.6
[1]1966	2.2	0.3	12.
[1]1967	3.8	0.3	0.8

[1] Catch rate for the area between lat. 10°N and 40°N and from long. 40°W calculated from the Graphic Report of Recent Fluctuation Trends of Tuna Hooking Rate by Area (Tuna Fishing, No. 78).

According to the above statistical data provided in the *Annual Report of Every Ten-days' Tuna Fishing News*, 1964 to 1968, and data of *Tuna Fishing* for the last several years, the general movement of albacore, yellowfin tuna, and bigeye tuna in the Caribbean and adjacent waters can be outlined as follows:

Albacore—The season starts in April northeast of Puerto Rico, about lat. 25°N to 30°N, then moves southwest and in May to June reaches the Puerto Rico Trough, then moves southeasterly along the Atlantic side of the Lesser Lesser Antilles arc from July to September. About October or November some albacore fishing grounds are found in the water north of Guyana and Recife, Brazil, then they disappear to the south. During the movements from June to September some influx of albacore into the Caribbean occurs over the deeper sill openings. Accordingly, during a year when this influx has taken place the albacore season begins in the northeastern region of the Caribbean about May to June for a short period, then resumes again in the southern waters of Hispaniola and Jamaica in about October to November mixed with yellowfin tuna. It moves southeasterly and about January disappears from the Caribbean Sea.

Yellowfin tuna—The season starts in the south about April to May from off Guyana then moves to the southeast region of the Caribbean about May or June, the catch being mixed with some albacore. It may last as late as December. In some years good fishing occurs between Colombia and Nicaragua. This may occur from August to September or in January to February. Meanwhile, in the Gulf of Mexico, a high catch rate of yellowfin tuna is expected for a few months around July.

Bigeye tuna—Though it is not common in the Caribbean, some catches are expected in the eastern and southern water of the Lesser Antilles during the winter months.

Bluefin tuna—In May to June, bluefin tuna appear in the northern waters of the Bahama Islands or eastern waters of Florida with a high catch rate by weight.

Other—There is an abundance of white marlin in the Caribbean from February to October with a peak about June, and blue marlin are present in the longline catch in the Caribbean from June to October.

Trends of the daily total catch in weight by longliners (about 2,000 hooks per day per vessel) for 4 years in the Caribbean and adjacent waters are as follows:

Tuna catch in metric tons/day

Month	1964	1965	1966	1967
Apr.-May	3.6-3.0	2.6	1.6	2.4-2.6
Jun.-July	3.0-2.6	2.4-2.2	1.9-2.8	2.2-2.8
Aug.-Sep.	2.1-2.3	2.8	2.9-3.0	1.8-1.2
Oct.-Nov.	2.8-2.6		1.9-2.3	1.0-1.4
Dec.-Jan.			2.0	1.6

EXPLORATORY LONGLINING BY PROJECT VESSELS

From December 1966 to August 1967, two Project vessels, *Calamar* and *Alcyon*, conducted 10 cruises for tuna with longline gear, fishing in the Caribbean Sea and adjacent waters.

Vessels and Gear

Calamar and *Alcyon* are sister vessels with the same dimensions and equipment, being built in 1966 for multipurpose exploratory fishing and training.[1] They are equipped with radar, direction finder, radio, automatic pilot, and with hydrographic winch, trawl winch, tuna longline hauler, and portable live bait tanks. The *Calamar* normally operated from Barbados while *Alcyon* was based in Jamaica.

The longline gear utilized was of Japanese design. It consisted of a 210-fathom main line with six branch lines placed at 30-fathom intervals. Each such unit is called a basket. The branch line has a total length of 13 fathoms which is composed of 8 fathoms of line (the same material as the main line), 3½ fathoms of sekiyama wire (consisting of a wire core served with cotton twine), and 1½ fathoms of leader wire with a hook at one end. A brass box swivel connects the line and the sekiyama. The main line and branch lines are made of Kuralon (Polyvinylalchol) 20'S/55 × 3 × 3 (about ¼ inch in diameter) rope, treated with coal tar. The sekiyama wire has a Standard Wire Gauge (SWG) 26 no. × 3 × 3 core wire rope and is served with Kuralon twine 20'S/5 × 3. The leader wire is of the same material as that of the sekiyama wire core. The swivel is 3 inches long and the hook is 4½ inches in total length (No. 38 by Japanese standard) of Birmingham Wire Gauge (B.W.G.) 6 in diameter at the thickest part. Breaking strain of the line is about 500 pounds and that of the wire about 420 pounds.

[1] See paper by Wolf and Rathjen, this number, for photographs and specifications.

Many baskets of longline are connected end to end to make a long continuous line for a set while shooting the line from the moving vessel. The longline is suspended from the surface by buoys and tied to a 15 foot bamboo pole marker at each junction of the baskets.

Typically, setting of the gear takes place early in the morning, then retrieving begins about midday after 4 or 5 hours drifting. The hooks are baited with herring (*Clupea harengus*), fourwing flyingfish (*Hirundichthys affinis*), or Pacific saury (*Cololabis saira*).

Fishing Regions and Seasons

From December 1966 to August 1967, the *Calamar* covered the southeast area of the Caribbean and the adjacent Atlantic water north of Guyana and Surinam. The *Alcyon* worked the central to northeast area of the Caribbean, the adjacent Atlantic water, and the northern half of the Lesser Antilles. Since the areas were mostly covered in different months, the results by regions are presented in two periods: January-June and July-December.

In view of topographic characteristics and oceanic currents in the Caribbean and adjacent waters, the water covered was divided into five

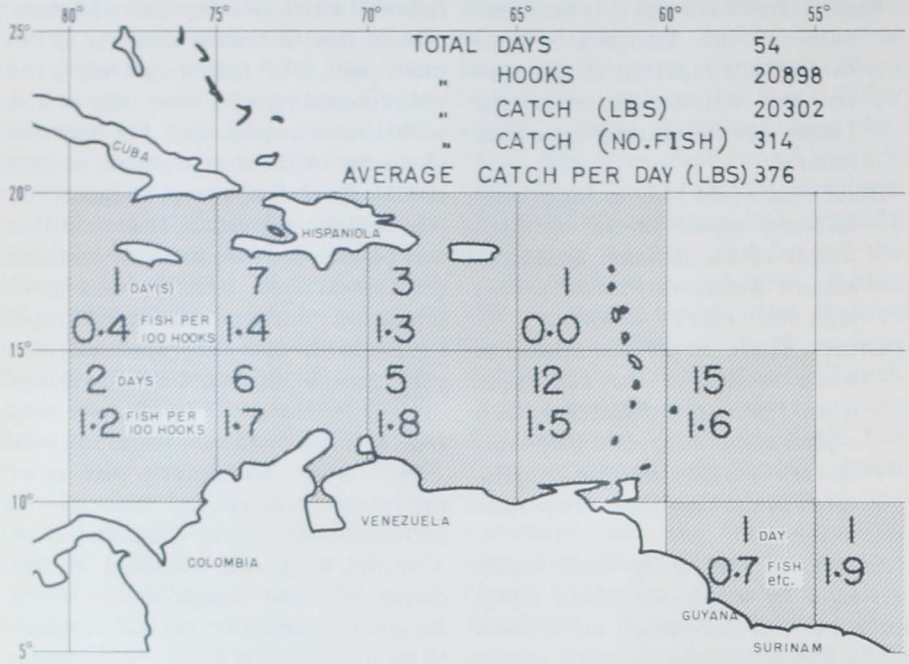

Figure 1.—Project tuna longline catch rates by area for January through June.

regions, namely: Jamaica North; Central North; Central South; Northeast Region; and Southeast Region; and adjacent waters covered were classified into five sections as: West Haiti; Northeast of Dominican Republic; Anegada Passage; Atlantic water east of northern half of the Lesser Antilles; and Atlantic water east of southern half of the Lesser Antilles section.

Catch rates by Project vessels are shown in Figures 1 and 2. Catch rates are given as the number of fish per 100 hooks of gear set. All catch rates in the succeeding text are in number of fish per 100 hooks.

Jamaica North Region

In December 1966 a total of four longline sets utilizing 516 hooks was made by the *Alcyon*. Two sets were in deep water near the Cayman Islands, one set off the north coast of Jamaica and one set in the south opening of the Windward Passage. These produced only six tunas (four yellowfin, one bigeye, and one bluefin tuna) at an average rate of 1.2 tuna, or at the rate of 0.8 fish for yellowfin tuna. Two of the four yellowfin tuna were caught near the Cayman Islands and two were caught in the Windward Passage. One bluefin tuna weighing 462 pounds was caught off the north coast of Jamaica. Surface water temperatures in this region ranged from 81.0 to 81.7°F, and the currents observed were mostly easterly. A total of three blue marlin weighing 499 pounds was captured along with the tuna during the period. One set of 250 hooks in February caught no tuna, but caught one white marlin weighing 40 pounds. The surface water temperature was 80.5°F and the current was observed to be northeasterly.

Caribbean Central North Region

A total of three longline sets was made by the *Alcyon* in December 1966 in the southern water off Haiti, and four sets were made in February 1967 off the east and south coasts of the Dominican Republic. The December sets with a total of 555 hooks captured four tunas: three yellowfin tuna and one albacore, at an average of 0.7 fish or 0.5 yellowfin tuna only. The surface temperature was 81.9° to 82.4°F, and the currents observed were northeasterly near the coast and westerly offshore. In February, three sets with a total of 1,170 hooks captured only one yellowfin tuna south of Pta. Beata, Dominican Republic. The surface temperature ranged from 79.7° to 80.2°F and a strong easterly current was observed south of Pta. Beata. One blue marlin weighing 235 pounds and two white marlins of 112 pounds total weight, were caught from one set southwest of the Mona Passage.

West Haiti/Northeast Dominican Republic Region

In the waters adjacent to Jamaica's North region, five tuna longline sets utilizing 1,590 hooks were made by *Alcyon* in Gonave Gulf, west of Haiti, in February. Fourteen yellowfin tuna were captured at catch rates from 0.3 to 1.2 fish. The surface water temperatures were higher than those in other areas during this month at 81.1° to 81.9°F, and the salinity ranged from 35.70°/$_{oo}$ to 35.84°/$_{oo}$ at surface and 36.48°/$_{oo}$ (at 70°F) to 36.91°/$_{oo}$ (at 71°F) at about 600 ft depth. Thermocline depths were from 220 to 310 feet. The sizes of yellowfin tuna were smaller ranging from 114 to 132 cm but mostly less than 130 cm. Seven blue marlin weighing 1,004 pounds, four white marlin weighing 195 pounds, and three longbill spearfish weighing 112 pounds were also taken from the five sets.

Northeast of the Dominican Republic, one set of 260 hooks took only one yellowfin tuna and one longbill spearfish. The surface water temperature was low at 78.8°F with a salinity of 36.14°/$_{oo}$ and the thermocline existed at about 380 feet. The salinity at about 600 feet was 36.70°/$_{oo}$ at 70°F. The size of the yellowfin tuna was 131 cm and the longbill spearfish weighed 33 pounds.

During January 1967, *Alcyon* made nine sets utilizing 2,405 hooks and *Calamar* completed three sets with a total of 1,230 hooks during the same month. The *Alcyon* caught seven (plus two lost) yellowfin tuna, four bigeye tuna, and one albacore, for a total average catch rate of 0.5 tuna. *Calamar* produced five yellowfin, one bigeye tuna, and one albacore at the rate of 0.6 tuna from the eastern end of the region. The yellowfin tuna taken were comparatively larger ranging from 126 to 160 cm. Four of them were over 154 cm, and bigeye tuna ranged from 143 to 148 cm in fork length. The surface water temperature ranged from 78.1° to 80.9°F, with lower temperatures in the southwestern area of the region. The depths of thermocline ranged from 90 to 300 feet with some correlation of lower surface temperature to shallower thermocline. The salinities in the western area of the region ranged from

35.89°/$_{oo}$ to 36.14°/$_{oo}$ at the surface and 36.13°/$_{oo}$ (19.4°C) to 36.65°/$_{oo}$ (at 18.7°C) at approximately the 600-foot layer. Additionally, from those sets *Calamar* caught 12 white marlin and the *Alcyon* took four blue marlin, four Atlantic sailfish, and six long-bill spearfish.

Caribbean Northeast Region (Anegada Passage)

The *Calamar* made one set of 354 hooks in January 1966 in the southern area of this region but caught no fish. The surface water temperature was 79.5°F and thermocline depth was about 260 feet. In August 1967, *Alcyon* made a set of 540 hooks west of Dominica Island and another set of 588 hooks further southwest of Puerto Rico on the way back from Atlantic tuna fishing operations. Near Dominica, no tuna was caught in comparison with seven tunas caught at almost the same distance east of Dominica. The surface water temperatures were the same (80.2°F) at both locations, but the thermocline depth was 130 feet on the Caribbean side and 240 feet on the Atlantic side. Further westward a set took 12 tunas—7 yellowfin, 2 bigeye, 2 albacore, and 1 blackfin tuna—for an average of two fish. The color of the water was bluish/dark green and the surface water temperature was 82.8°F. The thermocline depth was about 160 feet from the surface. In the Anegada Passage, the *Alcyon* made three sets utilizing 1,680 hooks close to Sombrero Island in August 1967, and caught 16 tuna—5 yellowfin tuna, 9 albacore, and 2 large skipjack tuna—a total tuna catch rate of one fish. The surface temperatures were 82.9°F and the thermocline depth was 160 to 180 feet. The current was west-northwesterly.

Caribbean Southwest Region

In December 1966, four sets utilizing 930 hooks, and in January 1967, six sets utilizing 2,328 hooks were made by the *Calamar* in this region. In the December sets, four yellowfin tuna and one albacore were taken at rates of 0 to 1.2 fish around lat. 13°N west of St. Vincent. In the six sets in January, three yellowfin tuna, two bigeye tuna, and two albacore were caught at the rates of 0 to 1.4 tuna. Five sets out of the total 10 sets took no tuna in this region. Surface water temperatures ranged from 81.2° to 82.5°F in December and from 79° to 79.7°F in January and the thermocline existed at about 100 feet in December and 100 to 180 feet in January.

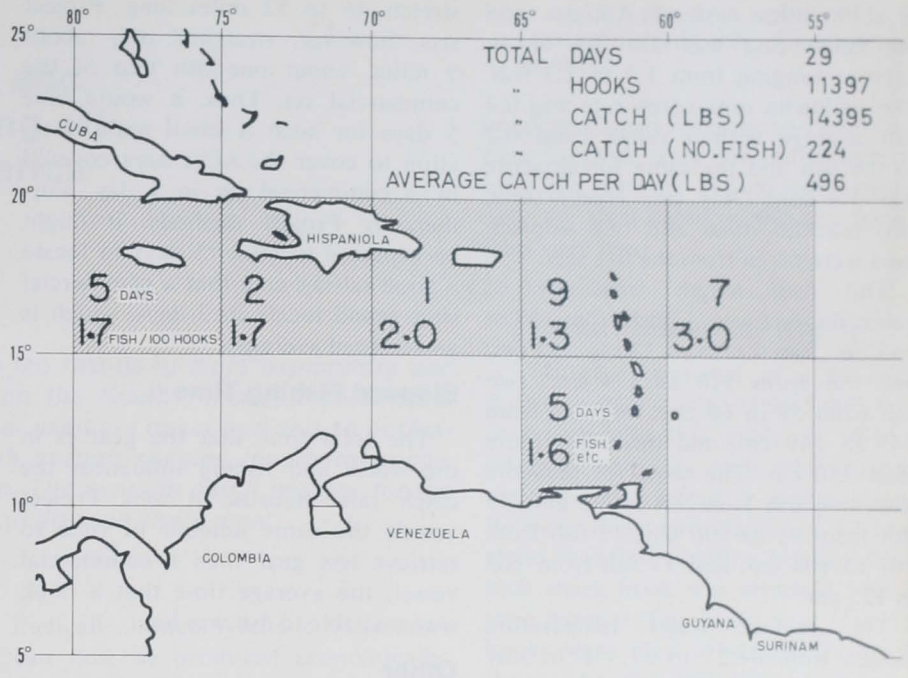

Figure 2.—Project tuna longline catch rates by area for July through December.

Atlantic Windward Islands Region

During December 1966, one 180-hook set took no fish just east of St. Vincent. The surface water temperature was 83°F and a thermocline existed at about 100 feet. In January, the *Calamar* made another set of 420 hooks south to lat. 12°N east of Grenada and caught six tuna: four yellowfin tuna and two bigeye tuna together with seven white marlin, at a rate of one yellowfin and 0.5 bigeye tuna. The surface water temperature was 79.9°F and thermocline depth was about 120 feet. A current in the area was west-northwesterly. The sizes of the yellowfin were relatively small at 124 cm and 129 cm. In February, 10 sets utilizing 4,002 hooks between southern Lesser Antilles arc and long. 55°W, were taken. Out of the 10 sets, one set in almost the same position as January's took two yellowfin tuna and two bigeye tuna at a rate of 0.4 fish for either species, the surface water temperature being lower at 78.1°F with a shallower thermocline at about 70 feet from the surface. Another three sets around the position caught no tuna and those surface water temperatures and thermoclines from near the Antilles Ridge to offshore were 78.8°F - 110 feet, 79.7°F - 210 feet, and 79.9°F - 260 feet, respectively. One set further east on lat. 12°N took only one albacore for 378 hooks, where the surface water temperature was 79.7°F and thermocline was 250 feet deep. Five of the 10 sets along lat. 13°N caught five yellowfin tuna and one bigeye tuna at rates from 0 to 0.7 fish. The lowest surface water temperature was 79.2°F.

Atlantic Leeward Islands Region

In this region, from 25 July through 16 August 1967, the *Alcyon* made six sets in July and five sets in August. The sets in July ranged in distance from 17 miles northeast of Barbuda Island to 180 miles east of Guadeloupe, the average catch being 2.4 fish for tuna, ranging from 1.0 to 4.6 fish. The average catch rate for yellowfin tuna was 0.5 fish with a range of 0 to 1.0 fish and the same for albacore was 1.7 fish. Among the species, only two bigeye tuna and two blackfin tuna were caught from all of the sets. The five sets in August ranged from 30 miles east of Dominica Island

to 210 miles east of Antigua and the catch rate was 2.0 fish at an average ranging from 1.3 to 2.3 fish. The yellowfin tuna catch rate was 0.4 fish average with a range from 0.2 to 0.6 fish and the same for albacore was 1.4 fish. Only one bigeye tuna, two blackfin tuna, and one skipjack tuna were taken from the five sets.

The fork length frequency of yellowfin tuna was: 14 fish from 137 to 145 cm; two fish from 130 to 135 cm; one fish from 110 to 114 cm; two fish from 58 to 60 cm; four fish from 145 to 149 cm; and three fish more than 150 cm. The same for albacore was: five fish from 89 to 92 cm; 37 fish from 93 to 100 cm; 27 fish from 101 to 104 cm; and 17 fish from 105 to 122 cm.

The surface water temperature ranged from 81.2° to 81.5°F in July and 81.3° to 82.4°F in August, and the thermocline's depth ranged from 100 to 160 feet in July and 130 to 240 feet in August.

FACTORS AFFECTING CATCH RATE

There are a number of factors which affect longline catch rates. These include (1) amount of gear set, (2) total time gear is fishing, (3) fish behavior, (4) oceanographic conditions, (5) bait, and (6) gear arrangement. The following generalities were observed when Project longlining efforts were compared with those used in regular commercial practice.

Amount of Gear Set

The amount of gear set seems to be the most influential factor on the catch rate. Not only is there an expected rise in the total catch, but also a rise in the catch rate has been observed as the amount of gear set (and fished) over a given time period is increased. Typically, commercial tuna longliners of 200 GT and over operate 400 to 450 baskets (about 2,000 hooks) per day. This is about maximum considering the time required for hauling and setting. Project vessels, however, were able to average only 68 baskets and 390 hooks per day while expending the same time setting and retrieving the gear.

Depending on surface and subsurface currents, a commercial set would stretch 46 to 52 miles long. Project sets, however, stretched only about 9 miles, about one-fifth that of the commercial set. Thus, it would take 5 days for such a small scale operation to cover the same area covered by a commercial set in 1 day. Further, by Project methods, it might be expected to take 15 days to locate a good setting area that a commercial ship would locate in 3 days, which is an accepted average.

Elapsed Fishing Time

The total time that the gear is in the water and fishing influences the catch rate. Because it took Project vessels the same amount of time to retrieve less gear than a commercial vessel, the average time that a hook was available to fish was less.

Other

There should be no difference in individual fish behavior as it relates to commercial or Project longlining. This applies also to oceanographic conditions, bait (all purchased from the same source), and gear arrangement.

SUMMARY

Considering the recent standstill trend of the commercial tuna longline fishery in the world and the disappointing results from the Project vessels, the Project has come to the conclusion that for subsurface tuna and related species in the Caribbean, only a limited quantity of these species exists throughout the year. Some increase in quantity takes place on a seasonal basis, but with an uncertain large annual variation which only sometimes falls within the limits of a commercial quantity available to the tuna longline method. In general, the resource is considered insufficient for establishing a continuous tuna longline fishery in the Project region.

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