Status and Potential of the Fishery in the Caribbean

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INTRODUCTION

As is generally known, the Caribbean region is fairly complex ecologically, which understandably applies also to its fishery resources and their utilization. As can be surmised, the information available on these resources, especially the catch statistics, is more often than not unreliable. It is only recently, with the advent of several fishery development projects sponsored by the United Nations (FAO) Special Fund Development Program and those initiated by a few Caribbean countries, that more exacting catch statistics are available.

In relation to this, Table I shows the latest available total landings and estimates of the countries bordering the Caribbean. These are taken from the FAO *Yearbook of Fishery Statistics* (United Nations, 1969). The production figures for 1958 are also shown as a basis for comparison.

It can be readily seen from the foregoing table that four countries (Venezuela, Cuba, Colombia, and Jamaica) produce about 80% of the total. The main reasons for this are availability of richer fishing grounds, in the case of the first three, and greater fishing effort spent in harvesting by the latter.

So as to gain some familiarity with the Caribbean fishery resources a short description will follow of the three major zonal fishery classifications: (a) island arc and reefs, (b) continental shelf, and (c) pelagic. The last two conform with coastal and oceanic groups of the general description given previously. A suggested fourth classification, midwater, is not included owing to the present lack of information. These classifications are arbitrary and were only chosen for convenience rather than conventionality.

ISLAND ARC AND REEF RESOURCES

The island arc and reef fishery which amounts to about 35% of the regional production, or 100-metric tons, is essentially carried out, except for Cuba and Venezuela, from coastal fishing craft of simple design and construction, ranging in size and type from 14-foot row boats to 40-foot sloops. Over two-thirds of these are motorized, largely by outboard motors, and lack mechanical labor saving equipment and electro-acoustical aids. The most important fishing gear is the fish pot. However, a variety of other gear is also used, including the bottom trawl, haul (beach) seine, gill net, turtle net, cast net, set line and bottom and trolling lines. The overall production as well as the catch per unit of effort is low, probably one-fifth to one-tenth of the average taken by the more developed fishing nations.

TABLE I
Total Reported Fish Landings of the Caribbean for 1958 and 1968. Source: Food and Agricultural Organization Yearbook of Fishery Statistics 1968 (Weights in 1,000 Metric Tons)

South and Central America	1958	1968	Greater Antilles	1958	1968	Lesser Antilles	1958	1968
Brit. Honduras	.9	.5				Antigua	.8	.8
Costa Rica*	.3	1.0	Cuba	21.9	66.0	Barbados	4.5	3.5
Honduras	1.1	3.4	Dom. Rep.	2.0	3.1	Dominica	.4	.4
Nicaragua*	2.2	3.5	Haiti	1.5	2.5	Grenada	.7	1.3
Panama*	1.0	10.0	Puerto Rico	2.8	1.4	Guadeloupe	3.0	3.6
Venezuela	78.3	126.1	Jamaica	7.8	17.2	Martinique	3.7	4.6
Colombia*	6.1	23.0				Montserrate	.1	.1
Guatemala*	.1	.4				St. Kitts, Nieves Anguila	.5	.8
						St. Lucia	.4	.4
						St. Vincent	.6	.4
						Trinidad, Tob.	4.2	13.0
						Virgin Is. UK	.4	1.2
						Virgin Is. US	.4	.8
						Bahama Is.	1.5	2.3
Totals	90.1	167.9		36.0	90.2		21.2	33.2
Grand Total:	147.2	291.3						

* Amounts shown are estimates of Caribbean landings only; total landings for countries bordering the Atlantic and Pacific for 1968 are: Costa Rica, 5.0; Nicaragua, 6.9; Panama, 71.6; Colombia, 93.0; Guatemala, 1.9.

The groups of fishes and shellfish most commonly taken, in relative order of importance include: Lutjanidae (snappers), Serranidae (groupers), Carangidae (jacks), Scombridae (mackerels), Labridae (labrids), Scaridae (parrot fishes), Mugilidae (mullets), Pomadasyidae (grunts), Clupeidae (sardines), Sphyraenidae (barracudas), Carcharhinidae and Lamnidae (sharks), *Panulirus* sp. (spiny lobster), molluscs, octopus (octopii), Loligo (squids), *Crassostrea* sp. (oysters) and *Strombus* sp. (conch).

Of these groups only the spiny lobster and to a limited extent the conch enter the export trade. In general most of the island group produce only half or less of the fishery products they consume.

CONTINENTAL SHELF RESOURCES

The second area, continental shelf, covers the northeast part of South America and Central America to the Yucatan Peninsula. The most productive areas of the Caribbean lie in the Guianas to Panama region, owing mostly to large river outflows, fairly wide shelf and in part, limited upwelling. This latter occurs in the Margarita Island area and off Barranquilla, Colombia. Except for the coastal section of Panama and Costa Rica, the marine environment and its species composition from Nicaragua to Yucatan resemble more the island arc type. At least 56% of the total Caribbean production is taken here, Venezuela producing the lion's share, followed by Colombia.

The predominant commercial species in the Guiana-Trinidad area are Sciaenidae (weakfish and croakers), Scombridae (mackerels), Clupeidae (sard-

ines), Pomadasyidae (grunts), Ariidae (cat fishes), Ephippidae (spade fish) and Gerridae (mojarras). In the Trinidad to Panama region, the species listed above to a lesser degree plus Characins (fresh water fish), Lutjanidae (snappers), Pomacentridae (snooks), Carangidae (jacks), Mugilidae (mullets), Megalopidae (tarpon) and Engraulidae (anchovies).

From Nicaragua (and in part Costa Rica) to Yucatan the composition of the commercially important species is similar to that of the island arc. In the Guiana to Colombia region four species of penaeid shrimp are an important resource. Fisheries for these are centered in the Gulf of Venezuela-Lake Maracaibo and Guianas. Spiny lobster is important off the Central America shelf from Yucatan to Panama. Fishing methods vary widely, but the most common methods used in commercial harvest include trawling, beach seining, gillnetting, pound netting, cast netting, trolling, handlining, longlining, and pot fishing.

PELAGIC RESOURCES

The third and largest, the pelagic area, is the least productive, both in volume and number of species composition. The fisheries here are exploited by Cubans and Venezuelans, in addition to the Japanese, South Koreans and Taiwanese through the use of large vessels and modern equipment. Other countries participate to a limited degree during periods when migratory fish concentrations move within a day's round trip from home port. Less than 9% of the total Caribbean production is derived from the pelagic area. In order of importance the following group of fishes include the main commercial species: Scombridae (tuna, tuna-like and mackerels), Coriphaenidae (dolphin), Istiophoridae (marlins), Carcharinidae and Lamnidae (sharks) and Exocoetidae (flying fishes).

Three main fishing methods are employed to take pelagic species: (a) the longline method, which includes a main line and branch lines with hooks, suspended at a desired depth, used to great extent by Cubans, South Koreans, and Taiwanese, Japanese and Venezuelans to take large tunas and shark; (b) live bait fishing and trolling, used by the Cubans to capture skipjack and blackfin tunas; and (c) gillnetting for flying fish, which is practiced mainly in Barbados and to a lesser degree in the St. Vincent Island group.

As a further general guide to the distributional pattern of the Caribbean fishes I refer in part to Robins (1969). Studies of the island chain and reef fishes of the Caribbean show that, although most species enjoy a wide distribution, few are common to all segments of the region. Patterns of distribution can be defined geographically; such geographic divisions are not specifically defined by latitude, longitude or deep water barriers, but by ecologically similar environments.

Continental species require environments where changes are common and often drastic, such as changes due to seasonal shifts in climatic conditions, changes due to run off from large rivers, and changes due to turbidity caused by winds that stir silt rich bottom sediments. The continental species fall into two groups, northern and southern, with some species occurring in both areas. The northern species are distributed along the estuary-rich islands of Cuba, Hispaniola and in part Jamaica. Southern species are found along the coasts of the Guianas, Trinidad, Venezuela and pockets near river mouths from Colombia to Nicaragua.

Contrasting with the continental forms, the distinctive species-rich island arc and reef fauna exist in environments where water is clear, conditions buffered and sediments are largely composed of calcium carbonate. This group occurs from the Bahamas chain southward through the Greater and Lesser Antilles, and

broad stretches of Central America where the continental shelf is not bathed by land run-off. As Robins (1969) further says, "not all shore-fish species may be thus categorized. Some are distributed through all the divisions". The commercially important species of the pelagic region are distributed evenly throughout the Caribbean with possible separation by vertical temperature gradients, as in the case of the tunas where albacore *(Thunnus alalunga)* as an example, is generally taken in deeper colder water.

Much of the following information on potential resources is taken from summary papers presented at the FAO-UNESCO sponsored Cooperative Investigation of the Caribbean and Adjacent Regions (CICAR) and general comments derived from past exploratory fishing surveys (Bullis and Thompson, 1969). It was determined by consensus there that the living resources of present and/or potential commercial importance fall into the following general grouping: tunas and tuna-like (Scombroids), sardines, herring and anchovies (Clupeoids), demersal fishes (snappers, groupers, weakfishes and croakers and catfishes), crustaceans (lobster, shrimp, crabs), and miscellaneous resources (molluscs, cephalopods and sharks). The same sequence will be followed here owing to the probable "fit" this will have into the ongoing CICAR program.

TUNA AND TUNA-LIKE RESOURCES

Tuna and tuna-like fishes comprise about nine commercially important species in the Caribbean, the most important being yellowfin *(Thunnus albacares)*, big eye *(T. obesus)*, blackfin *(T. atlanticus)* and skipjack *(Katsuwonus pelamis)*. The first two are taken mostly by longline and are considered fully exploited. The latter two, skipjack and blackfin tuna, are harvested by the live bait method in Cuba and to a lesser extent by trolling and "drifting" in the Lesser Antilles. It is estimated that between 1,000 and 2,000 tons are taken yearly of these two species. Prospects for expansion of the fishery of this group are good, but will depend largely on the development of specialized surface fisheries in many areas of the Caribbean coastal waters. Recent surveys conducted by the Puerto Rican Government in the area with the use of tuna purse seiners showed that the most common surface occurring tunas in the Caribbean were skipjack and blackfin. However, their erratic behavior and limited concentrations precluded purse seining; nevertheless, other fishing methods would be feasible (Juhl, Bartlett and Maghan, 1970). Although supporting data is needed, it is estimated this resource could support a five or more fold increase (5 to 10 thousand tons).

CLUPEOID RESOURCES

The Caribbean harbors a variety of commercially important species of the Clupeoids and related sardine-like fishes. The largest concentrations are understandably found along the continental coastal waters. Important genera include *Sardinella, Harengula, Opisthonema, Cetengraulis* and *Anchoa*. Venezuela with a total catch of about 40,000 tons per year is by far the greatest producer. The existence of important clupeoid resources off the coast of Surinam particularly and other specific places throughout the region suggest that substantial increases in the utilization of this resource can be expected. At the CICAR meetings it was emphasized that the real abundance of these species (clupeoids) has not been correctly assessed because observational techniques have not been adequate; in fact, previous attempts to estimate the volume of

these resources in specific reef areas of the Gulf of Mexico and Caribbean have produced discouraging estimates. Conversely, test-fishing by night-light and fish pump methods have yielded significant quantities of sardine-like fish. It was recommended that full advantage must be taken of newly developed sounding equipment and remote sensing apparatus to obtain reliable quantitative estimates of these resources (Bullis and Roithmayr, 1969). This being the case with many of the clupeoids and related schooling resources of the Caribbean, it would be presumptuous to make a valid estimate of its potential at this time.

DEMERSAL RESOURCES

On the demersal fish groups, we again refer to the CICAR meetings. These resources are divided into the continental and insular fauna. The latter is extremely diverse and the fishery is adopted to the capture of a wide variety of species. Island fisheries, operating mainly with pots and hook and line, obviously have limited prospects and, as mentioned earlier, would only continue to supply local markets. Several papers presented at the CICAR meetings reflected the large amount of work carried out in exploratory fishing with various types of gear over extended period of years. These papers indicate that a large snapper, grouper and grunt (Pomadasyds) potential exists in the insular environment. The United States Bureau of Commercial Fisheries estimates this resource potential at 40,000 metric tons (Carpenter and Nelson, 1969). This is at least twice the present commercial production. Consequently, there seems to be ample margin for expansion. Already the U.S. snapper fleet and other foreign nations are increasing their fishing efforts. The fish taken at present by the U.S. fleet is unloaded in home ports located in the Gulf of Mexico.

CONTINENTAL AREA RESOURCES

The continental fauna group seems to hold, at present, the greatest potential for expansion. This group is typified by the Sciaenids (sea-trout and croakers) (Rathjen, Yesaki and Hsu, 1968). The area within the continental faunal zone to which specific reference is made covers from Trinidad to French Guiana. It is outside the Caribbean, but included with it because of its close biotic relationship. Rathjen et al summarized the results of more than ten independent fishing investigations conducted in the last 25 years, the most significant ones being the M/V *Coquette* explorations sponsored by Surinam and the M/V *Calamar* work under the United Nations Development Program/FAO Caribbean Fishery Development Project. The Guiana-Trinidad area is strongly influenced by the fresh water run-off from the Amazon-Orinoco and a dozen lesser, but significant rivers. Out to 15-20 fathoms the bottom is composed of soft sticky mud and beyond this it changes to a mixture of sand and mud and finally to pure sand off-shore. It is inside the 15-20 fathom line that holds the greatest potential. The marketable species, in order of importance, include sea trout *(Cynoscion sp.)*, croaker*(Micropogon)*, Surinam butter fish *(Nebris)*, silver perch *(Larimus)*, whiting *(Macrodon)*, moonshine *(Selene)*, bumper *(Chloroscombrus)*, mojarra *(Gerres)* and harvestfish *(Peprilus)*. Results of the fishing tests mentioned by Rathjen et al show that the first two species make up from 70% to 75% of the total catches in this area. It would be apparent then that these sea trout and croaker species would enter the export trade, should thyindustry develop. At present about 7,000 tons of these fishes are landed annually within the Trinidad-Guiana area. It is estimated that this area could support a 200,000

ton per year fishery, which would allow for a substantial export margin. Through the efforts of the United States Bureau of Commercial Fisheries and United Nations Development Program, FAO Caribbean Fishery Development Project (Millerd and Vidaeus, 1969) it is anticipated that industry will soon capitalize on these resources. It must be emphasized that the foregoing applies to resources of known existence and known market value. Further analysis of existing information and expanded investigations may uncover additional utilizable resources, not just in the Trinidad-Guiana area, but elsewhere in the Caribbean.

CRUSTACEAN RESOURCES

Crustaceans, our next subject, are richly represented in the Caribbean, especially in penaeid shrimp and spiny lobster. The Gulf of Venezuela and the shelf of the Guianas support some of the important shrimp fisheries in the world; however, concentrated fishing efforts being expended there at present place a question on further expansion until the dynamics of the stocks are fully understood. The papers presented at the CICAR meetings on this indicated that significant fluctuations in abundance without known reasons indicated the need for concerted studies in order to formulate effective management measures.

The spiny lobster *(Panulirus argus)* is widely distributed in the Caribbean, especially in the island arc and continental shoal areas of similar environmental characteristics, such as the Nicaragua-Yucatan area. As pointed out by Idyll (1969), the exploitation of the spiny lobster is not well developed except in a few particular cases. Catches are largest in Cuba, British Honduras, Nicaragua, Puerto Rico, Jamaica and Mexico. Idyll contended that although catch statistics for the area are available, these are not considered reliable. It may be possible, he believes, to expand a few lobster fisheries especially in the southern edge of the Caribbean Sea, which would include the Grenadine-St. Vincent Is. group; however, most lobster stocks are fully exploited. Although several fishing methods are used, such as diving, bull net and night-lighting, the most common is the use of traps. As reported by Windley (1968) approximately 12,000 metric tons of lobster are produced in the Caribbean. Other species of minimal importance include the sand lobster *(Scyllarus)* and related species of the spiny lobster such as *P. guttatus, Paninustus,* and *Justitia.* Deep water forms have appeared often in exploratory fishing catches, but except for the deep water prawn (Pleasiopenaeus) very little is known of their potential.

MOLLUSCAN RESOURCES

In the CICAR meetings, reviews were presented of resources which at present are relatively unimportant generally, but of considerable importance locally, and of great potential value if developed. These are the mangrove oyster *(Crassostrea mangle)* and mussel *(Perna perna).* The introduction of effective cultivation methods and the adoption of measures against pollution and destruction of mangrove stands could lead to a substantial industry and consequent export trade. This would apply specifically, at this time, to the extensive estuarine coastal areas of the continent and the islands of Cuba and Hispaniola.

A comprehensive review of the cephalopod fishing industry given at the CICAR meeting by Voss (1969) demonstrated the great importance of this group in the world fisheries and its relative present unimportance in the

Caribbean. Voss informed that although the region contained many species of cephalopods only six of squid and four of octopus were being harvested to a limited degree in selected areas.

Based on what Voss considers unreliable figures, the total cephalopod catch recorded for the Caribbean, including Mexican (Gulf) landings in 1967, was approximately 2,500 metric tons valued at about $500,000. This is believed to be insignificant in relation to the potential of the area. The species of squid of commercial importance include *Loligo, Doryteuthis, Lolliguncula, Sepioteuthis, Illex* and *Ommastrephes.* Four species of the genera *Octopus* are also considered important, *O. vulgaris, O. briareus, O. macropus* and *O. maya.*

The potential of this resource is best explained by a quotation from Voss' paper, "The potential of the fishery itself is difficult to determine. Observers repeatedly report large concentrations of squid throughout the Caribbean, and several fisheries officers with whom I have corresponded have considered that the stocks were sufficient to consider an export oriented fishery. The loliginid squids in particular are found almost throughout the entire region and in areas school in large quantities. Unfortunately, at the present time reliable figures as to distribution, numbers, places of concentration and abundance are almost completely lacking."

Recommended methods for catching squid are by trawling with nets, night lighting and dip net, and jigging. Octopus can be taken by trotline in which the branch line holds a clay "jug" or other type of container.

It can be gleaned from the foregoing that this cephalopod resource, especially squid, will undoubtedly become an important fishery product, for local use and export as well, as soon after more knowledge is gained and fishing technology applied.

SHARK RESOURCES

Shark resources are found in varying concentrations in all the Caribbean, however, known commercially significant numbers are found only in the Guiana-Panama continental shelf area. A small fishery exists in Venezuela, Surinam and Cuba. The total annual production is estimated to be about 7,000 tons. At present the UNDP/FAO Caribbean Fisheries Development Project has undertaken a study of the resource and its development. Preliminary results are encouraging with indications that the shark resources could support a substantial fishery (United Nations, 1970).

At least twenty species of shark were taken by the UNDP/FAO exploratory vessel M/V *Calamar;* however, three species predominated, black tip, bull and silky shark. *(Carcharhinus limbatus, C. leucas* and *C. falciformis* respectively.) The harvesting gear for taking shark is relatively simple, either multi-hook set lines or individual hand lines. Existing fishing vessels can easily be adapted to shark fishing, consequently, it is probably that the resource will receive greater attention soon. Once adequate processing and marketing procedures are introduced, shark is expected to enter the export trade, probably sooner than the previously described cephalopods, owing to existing consumer acceptance.

In summary, the following table is a compilation of the (additional) potential resources of the Caribbean described in this paper.

Resource	Estimated Potential 1000 metric tons
Tuna and tuna like group	10
Clupeoids	50+
Demersal	
Snapper and grouper	40
Seatrout group	200
Crustaceans (lobster)	4+
Molluscs (cephalopods)	50+
Sharks	10+
Total	364

+These are considered "uneducated guesses" and are included only for the sake of reference.

As you may recall from the statistics shown earlier, the total production of the Caribbean countries was 291.3 thousand metric tons. Based on this total the additional potential harvestable tonnage of the groups shown above, which by no means represent all the existing commercially significant species, is appreciably greater than the current production. It must be reiterated, however, that much more knowledge about these resources must be gained before more reliable assumptions can be drawn.

As a whole the people of the Caribbean are substantial fish eaters, nontheless, as a rule half or more of the fish is imported, especially in the Antillean Islands. This has been well documented by Millerd and Vidaeus (1969). It is apparent then that the demand for a large amount of fish exists, consequently as the Caribbean fisheries develop it is expected that any rise in production at present will be absorbed locally, especially in the island chain. The export trade in fishery products can gain importance in the higher resource potential areas as the local demand is satisfied and the production and marketing requirements are modernized. We believe that these requirements will be met in step with continuous overall development of the Caribbean area.

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