

Lastly, there is the never ending search for shrimp. There was a company there by the name of the B. G. Fisheries, which spent quite a sum of money and built a rather elaborate shore establishment. It had very little success until Harry Sahlman and several others moved in with good equipment and now this has become quite a satisfactory operation.

Potentialities for an Octopus and Squid Fishery in the West Indies¹

GILBERT L. VOSS

The Marine Laboratory, University of Miami

OCTOPUS AND SQUID, with their close relatives, the cuttlefishes, are heavily exploited for human consumption in many parts of the world. In the Mediterranean, India, China, Japan, the Philippines, Indonesia and Oceania they are considered to be one of the major delicacies obtained from the sea. Except for the first, these regions are mostly within the temperature boundaries found in the West Indies and with much the same habitat, yet, as we know, this source of food is hardly touched within the Caribbean region. The total world catch of cephalopods according to Walford (1958) is 1,800,000 metric tons, including all species. This is probably a low figure for a very large percentage of the catches are not included in the statistics from many countries. The largest producer of cephalopods is Japan which in 1952, its peak year, caught 646,000 tons, the average annual yield since World War II leveling off at about 600,000 tons of which nearly all are the common Japanese squid, *Todarodes pacificus*. The annual catch in North America is about 11,000 tons of which about 4,500 tons are taken in Newfoundland for codfish bait and are *Illex illecebrosus*. The United States catch consists of *Loligo pealei* and *Lolliguncula brevis* on the east coast and *Loligo opalescens* in California.

The author has made a rather extensive search of the literature and has questioned a number of individuals in an effort to determine the annual catch of cephalopods in the West Indies. Even considering that the majority of the catch is unreported, the fisheries must be considered negligible. Dr. Perez-Farfante of the Centro de Investigaciones Pesqueras in Cuba states (personal communication) that the 1958 production of squid and octopus in Cuba amounted to 20,472 pounds or roughly 10 tons. Mr. Erdman (personal communication) estimates the annual catch of octopus in Puerto Rico at about 50 tons, but squid are not obtained in commercial quantities. There are, apparently, no statistics from the island of Hispaniola. The Virgin Islands, with ample bottom and suitable habitat, are undoubtedly rich in octopus and squid, but Randall and Kump state (personal communication), after a year of underwater observations and fisheries survey work at St. John, that they have never seen an octopus or squid in the market or in local catches. Furthermore, a great fear and repugnance was shown by a native fisherman when confronted with a "sea cat" or octopus caught by the survey team. No mention is made, as nearly as can be determined,

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of the occurrence of octopus or squid in the catches in the Leeward and Windward islands, although they are common there. If they are caught, it is probable that they are incidental to the other fisheries.

Drew (1919) reported that in 1912 there was a considerable fishery for octopus or "sea cats" at Montego Bay, Jamaica. However, both Stevens and Goreau of the University College of the West Indies (personal communication) state that they have never seen an octopus or squid in a commercial catch, although they thought that they might be caught on Pedro Banks. It is likely that the fishery has collapsed through lack of interest and the inroads of Canadian salt cod, highly esteemed by the natives.

Along the east coast of Central America no statistics are available. However, Hildebrand, in a personal communication, stated that in 1954 he saw two tons of octopus landed in a single day at a small town south of Vera Cruz, Mexico, where two Italians had started a local octopus fishery in the Mediterranean fashion. No further data are available to me on this region although the author was informed by reliable sources that the fishery is thriving.

Bermuda, although geographically outside the area under consideration, faunistically is a part of the West Indies. Squid are not taken commercially in the Bermudas but octopus are caught in small quantities and are eaten by the inhabitants of Portuguese descent. There are no established fisheries.

From this survey, two questions naturally arise. Are cephalopods worth eating? and, Do they occur in sufficient numbers to warrant a fishery? The answer to both of these questions is a qualified yes.

Cephalopods have been eaten in the Mediterranean and in the Orient for centuries. People of northern European extraction in general do not relish eating them due to an ingrained repugnance born of popular opinion. That this can be easily overcome, however, can be vouched for by the writer who relishes them whenever they are available. Akin to scallops or abalone in flavor, they are easily prepared in a number of interesting dishes. According to Leung, Pecot and Watt (1952) raw squid has 78 gram calories and dried squid 305 gram calories. Tanikawa (1952) analyzed the food value of seasoned and canned squid and found that 28.8 per cent of the whole animal was canned and that it had a food energy content of 117 gram calories.

Octopus differ considerably from squid in flavor, being much sweeter and, when properly prepared, very tender. Squid may be sold fresh, dried or canned in olive oil, and the flavor varies considerably. Octopus is usually sold fresh, but also may be dried. Octopus and squid figure prominently on the menus of most restaurants in Cuba and Puerto Rico, but their cephalopods largely come from Spain and Portugal in cans, called *Calamares en su Tinta*. Cuba imports about 606,157 pounds of canned squid annually from these two countries, valued at about \$223,590.76 in 1958, a not inconsiderable sum in an island with an unfavorable import-export exchange. Erdman has no figures on imports in Puerto Rico but states that they are large and that both Spanish and Portuguese squid are found in the larger grocery stores, and that they are advertised on restaurant menus. He considers the Portuguese product to be superior in flavor. In Mexico, in the larger city groceries, octopus are packaged in cardboard containers wrapped in cellophane and sold fresh at the fish counters.

Cephalopods have always demanded a considerable price to the fisherman. Miss Thelma Jutare of the Bureau of Fisheries of the Philippines, presently at The Marine Laboratory at Miami, informed the author that squid in those

islands bring about two pesos per kilogram, or about 50 cents per pound fresh, or three pesos or 75 cents per pound dried. The fisheries there are still young and undeveloped and much of their dried squid is imported from Japan, although immediately after World War II the Monterey Bay, California, fishery supplied much of the demand.

While the price is not high in the West Indies, it still is higher than for many other marine species. In Cuba fresh octopus costs 40 cents per pound in the market (no figures are available for the price paid to the fisherman). In Puerto Rico the wholesale price according to Erdman was 12 cents per pound in 1954 but by 1959 had risen to 25 cents per pound. We can assume from the figures given here and above that there is a market for cephalopods. The next question is, Do they occur in sufficient quantities to support a larger fishery?

This is a difficult question to answer. It would seem, from the lack of statistics, that Cephalopoda do not occur in large enough numbers to encourage fishermen to hunt for them, and that the numbers taken are so small that the fishery statisticians ignore them. Let us take a look at the methods presently in use in the West Indies for capturing octopus and squid.

In Cuba, most of the squid are taken in fish trawls incidental to the scale fish. A few are caught using the cast net or "atarraya" and in Cienfuegos the "poteras" is employed. This is a lead, cone-shaped jig with upward directed barbless hooks at one end. This is sometimes baited with salt pork or a piece of cloth, and is jigged in the same fashion as in Newfoundland in the fisheries for *Illex*. Octopus are occasionally caught in fish traps but more often they are hooked out of their holes in the rock by means of a pole with a short hook which is thrust into a likely spot, turned and quickly pulled out along with the octopus. This is the same primitive type of fishery that is carried out in Polynesia, the Orient and along the coast of France and Italy. As in these other areas, when the surface is rippled by a breeze, the Cuban fisherman scatters a few drops of oil on the water to smooth it and aid in sighting the octopus. The octopus is killed by "turning the cap" or inverting the mantle by placing the fingers in the opening under the head and wrenching the mantle inside out, ripping loose the adductor muscles. This same method is universal wherever octopus are fished.

In Puerto Rico, according to Erdman, a few squid are caught in shore seines, but the largest catch noted was at Playhuella, Aguadilla, and amounted to only some 20 to 30 pounds of three to four inch squids. Octopus are caught in some quantity. At La Parguera there are about six part time octopus fishermen who make each about \$1000.00 per year or about half the average annual income of a Puerto Rican fisherman. Their catch averages about 60 pounds a day. A good fisherman may catch as much as 100 pounds per day during the season.

The Puerto Rican octopus fisherman uses a crawfish grain or two tined spear which he pushes into a hole, twists and usually comes out with an octopus. They mainly fish along the windward side of the reef in about two to three feet of water. On the north coast the reefs are more cave like and a three foot iron rod is used with a barbless hook at the end. The catch here is much lower.

In the West Indies and Florida the season for octopus is from about October to March when the females come into shallow water to spawn. Erdman says that in Puerto Rico the season starts in July when small octopus occur on the reef weighing about 1/3 to 1/2 pound. By October octopus may weigh one pound or more and by February a number may weigh two pounds or better. From March to July the octopus fishery in Puerto Rico is nonexistent. November and

December are the months of greatest abundance.

As can be seen, the octopus fishery in the West Indies is extremely primitive and unproductive, and is limited to shallow water. In order to suggest better fishing methods, the octopus fishery in two distant areas might be mentioned. In Italy (Hornell, 1950) the octopus fisherman uses the *nassa* or *mummarella*. The *nassa* is a wicker lobster-pot like trap which the octopus can enter but cannot leave. It is baited with crabs and set in water down to 250 feet. The catch is fairly regular and large. The *mummarella* consists of a large number of earthenware pots (*lancelle*) tied at intervals of about 6 feet to a long line by means of short drop lines and staked or buoyed in likely areas. They are not baited but depend for their effectiveness on the proclivity of octopus to search out dark hiding places. The lines are hauled daily. In nearby Africa, earthenware drain pipes are laid side by side for over half a mile along the bottom (Lane, 1957).

In the Palk Strait area of India (Hornell, *loc. cit.*) a variation of the *mummarella* is used. The five finger conch, *Pterocera lambis*, is used in place of the pots. The long finger-like projections are knocked off, the apex broken off, and the shells tied to branch lines at intervals of 5 to 6 feet. As many as seven to nine hundred shells are tied to a single long line. These are set in a depth of 15 to 18 feet of water and hauled daily. As many as two to three hundred small octopus are caught each day in this fashion (Lane, *op. cit.*).

In the West Indies the queen or pink conch, *Strombus gigas*, is plentiful in many places and in most fishing villages the discarded shells are lying about in heaps in shallow water, a favorite haunt for octopus. These shells would, with no cash outlay, provide much better than the equivalent of the Palk Strait conch, and would be nearly as good as the Italian *mummarella*. Long lines of two to three hundred shells should be set outside the reef or in the deeper water of the lagoon from about six to about twenty or thirty feet, and after seasoning, should be pulled about every other day. It should be expected, in good areas, to have an octopus in about a quarter of the shells or even higher, after the proper depth and the right type of bottom have been ascertained. In the Florida Keys, Capt. William Grey of the Miami Seaquarium sets about 24 conch shells from which he receives about six octopus at a haul. He believes that the shells should be set out on broken shell or sand bottom away from the reef where too many natural holes are at hand. Personal observation leads the author to suggest that in the winter months the shallow grass beds would offer the best fishing areas. An energetic fisherman with his conch long line and only a rowboat could expect to triple or quadruple his output in this fashion, and the fishery would not be limited to the reef tract, permitting more fishermen to be employed. In addition, it would permit the industry to flourish throughout the year since fishing could be carried out in deeper water during the summer months, when the octopus move off shore.

Octopus are usually sold fresh locally and require good icing. When refrigeration is not available they may be dried. In France (Hornell, 1950), they are pegged out on lines in the fishermen's yards until dry, when they can be held for considerable periods of time. In California they are dried and exported to the Orient.

Squid may be taken in some areas by means of beach seines. The writer has seen commercial catches taken in this fashion from Piscadera Bay, Curacao. Along the south coast of Cuba squid are taken in shrimp and fish trawls. The

Florida fishing fleet, especially the shrimp fleet, takes them in considerable numbers on the Tortugas grounds, off Campeche and Honduras but they are considered trash and usually thrown overboard, except those that are saved for shipboard meals. The squid sold in the markets at Miami are shipped down from the north where they are taken in considerable quantities in the pound nets from Virginia northward. The catch is usually *Loligo* or *Lolliguncula*, but the writer has also purchased *Illex* in chain stores in Miami.

In Monterey Bay, California, there has long been a large squid fishery. In 1946 the annual catch was about 20,000 tons. In this fishery the squid are caught by means of the lampara net and also by purse seiners (Fields, 1950).

In areas where lampara nets and large purse seines are too costly, and simpler fishing gear is required, the former Monterey fishing method could profitably be used. In this fishery a skiff with a blazing torch in the bow was rowed about until a school of squid collected. The two accompanying skiffs or rowboats would set a small purse seine of about 180 feet in length and 18 feet deep. Considerable numbers may be taken in this way especially during the spawning period on the spawning grounds (Collins, 1892).

In Japan, where the fishery is carried out in a way more suitable to the West Indies, the vessels fish at night with 1000 watt lights over the side. The squid are attracted to the circle of light and then are either netted or, more usually, caught by swishing an artificial shrimp or other lure through the water. In this fashion a fisherman may catch thousands of squid in a single night. In the Philippines, lights are also used but the squid are caught in nets set around it or they are speared. The intensity of the light plays a large part in attracting squid. In the Philippines the light is alternately brightened and then dimmed. Harvey Bullis on board the *Oregon* using his fish bait trap beneath an outboard light found that for a few minutes after a red light was flashed on, following a white light, that the squid *Illex* came darting in under the light in great profusion. In a few minutes they would disappear and the red light had to be replaced by the white one for a short period of time.

Fresh squid require good icing or refrigeration in order to keep them for any length of time. Whereas fresh squid are largely eaten in Europe and America, throughout the Orient the squid are preferred dried, and most of the Japanese catch is sundried and then marketed both in Japan and abroad. This method is still carried out in a small way in California. This seems to be the best method for a small fishery such as could be developed in the West Indies, and might very conceivably be as profitable or more so than such fisheries as the dried conch exported from the Caicos Islands to Haiti. Squid are among the most numerous of all macroscopic animal life in the sea and the supply seems almost inexhaustible.

Six species of octopus are known from the shallow waters of the West Indies: *Octopus vulgaris*, *briareus*, *macropus*, *hummelincki*, *joubini* and *burryi*. Nothing is known about the edibility of the last three species, all of which are small. The larger species are *vulgaris*, *briareus* and *macropus*. The last named is apparently not numerous and seldom enters into the catches. *O. briareus* is common throughout the West Indies but is not very well liked. It has longer arms than the others and the body tends to be rather soft and flabby even when fresh. In Puerto Rico it is known as the "*madre de pulpo*" and while eaten it has no commercial value. In Cuba, *briareus* is known as "*fabianna*" and is considered to be somewhat toxic according to Dr. Aguayo (in lit.) who stated

that the fishermen believe that some persons have been made ill from eating it. *Octopus vulgaris* is variously known as "pulpo," the "common octopus," the "rock scuttle" and the "sea cat." It is nearly cosmopolitan in distribution and is eaten wherever it occurs. It has a rather short life span, perhaps only two or three years. There is some evidence that it may live only for about one spawning season. Thus the supply should be good, and in areas where octopus are common, a heavy fishing effort may even be beneficial to the spiny lobster industry since they are known to eat lobsters and in years of heavy infestation of octopus on the English coast the lobster industry has very nearly been wiped out for several years (Rees and Lumby, 1954).

There are six potential commercial squids in the West Indies. These are *Loligo pealei* (the common squid), *Lolliguncula brevis* the brief or thumbstall squid, *Doryteuthis plei*, *D. brasiliensis*, *Sepioteuthis sepioidea*, and *Illex illecebrosus* the common squid north of Cape Cod and the mainstay of the Canadian fisheries (Squires, 1957). *Illex* is a surface dwelling squid in northern waters but follows an isotherm downward and in the Caribbean region is found at depths of around 350 fathoms. Night lighting however might be productive for this species offshore as Bullis has found in his bait fishing on the Oregon. It occurs in tremendous numbers in the open sea and is the American counterpart of the common Japanese commercial species. *Loligo pealei* is found from Cape Cod to Venezuela but may be scarce in the Antilles. *Doryteuthis brasiliensis* is the commercial squid of Cuba, while *D. plei* may also occur. *Sepioteuthis sepioidea* is a compact, fleshy tropical species that has good possibilities. *Lolliguncula brevis* is smaller than the others, compact, fleshy and very common from Maryland to Argentina (Voss, 1955, 1956). It has good possibilities for canning purposes.

The commercial exploitation of the cephalopods is practically untouched in the West Indies and offers excellent opportunities to the small fisherman who cannot afford the large offshore gear for the scale fisheries. There seems to be a ready market in many of the islands, especially those with Spanish and French background. They are abundant in nearly all areas and small scale exploratory work should show that a sizeable industry can be developed.

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