

Survey of the Commercial Fishery of the Virgin Islands of the United States¹

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Abstract

During January through June of 1968, the staff of the Virgin Islands Ecological Research Station conducted a survey of the commercial fishery of the Virgin Islands of the United States. Sixty-nine per cent of the full-time fishermen and 25% of the part-time fishermen were interviewed. All the grocery stores and more than 90% of all other commercial outlets handling seafood were interviewed. A total of 1,843,863 pounds of seafood valued at \$963,010 was landed during 1967 by local commercial fishermen. A total of 1,274,385 pounds of seafood was brought in from Puerto Rico and the U.S. mainland during 1967. This seafood was valued at \$1,234,856. In addition 514,202 pounds of seafood valued at \$192,330 was imported from 24 foreign countries during 1967. Also included in this study were the kind and amount of gear, capital investment, baits, species of fish, data on ciguatera and consumer data.

INTRODUCTION

PAST SURVEYS of the commercial fishery of the United States Virgin Islands are considerably out-dated, not comprehensive or do not include all three of the major islands. The only previous study that included St. Thomas, St. John and St. Croix occurred in 1930 (Fiedler and Jarvis, 1932). In 1959 (Idyll and Randall), a survey of the commercial fishery of St. John was made at the request of the U.S. National Park Service. A brief summary of the St. Croix fishery was presented in 1961 (Anon.) to a meeting of Caribbean Fisheries officers in San Juan, Puerto Rico. The present survey was undertaken to provide up-to-date information on various aspects of the fishery in all of the American Virgin Islands and on the consumption of seafood products.

INVESTIGATION PROBLEMS AND PROCEDURES

The absence of any organized distribution system for the fishery, coupled with the lack of licensing or registration requirements for fishermen or their gear, makes the procurement of accurate catch statistics impossible. The fishery is composed of many individual efforts and there is little intercommunication; fishermen are seldom acquainted with the overall fishery, with persons or techniques in the other islands or with fisheries in other sections of their own island. The Virgin Islands Code, the territorial "constitution," does not

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provide for salaried enforcement officers to check on seafood catches. Seafood caught by foreign flag vessels may be landed freely in the U.S. Virgin Islands ports with minimum cargo identification. Therefore, customs information is not very useful in determining species and quantities landed.

These problems made random sampling techniques inappropriate. Consequently, the sampling procedure consisted of interviews with commercial fishermen, boat captains importing freshly-caught seafood and seafood-handling outlets. The data from this sample were expanded, when appropriate, to correspond to the whole population.

Non-professional divers, who occasionally harvest lobsters and fish for profit, were completely excluded from this survey. Another group that contributes fresh finfish to the local market is composed of the charterboat operators. Their production is not included in the statistics because virtually no usable data were forthcoming from them.

Aerial counts were made of fish pot buoys and fishing craft in U.S. Virgin Islands waters. From these aerial surveys, and from interviews, areas of concentrated fishing effort were determined for each of the three islands. Each such area and each marketing location was then visited regularly to interview fishermen. Each fisherman was asked to suggest other fishermen who might be interviewed and to indicate where other fishermen could be found.

The Virgin Islands Department of Commerce recently estimated the number of fishermen in the population for the FAO of the United Nations from sampling and census figures. We used different methods (boats, pot counts and fisherman interviews) to arrive at corroborative figures.

Approximately 400 persons were engaged in commercial fishing activities in the American Virgin Islands in 1967. Of the estimated 120 full-time fishermen, eighty-three (69%) were contacted during this survey, as were 70 (25%) of the 280 part-time fishermen. Fishermen were questioned regarding personal data, income, gear, fishing effort, catch, handling and marketing, *ciguatera*, the need for government services or regulations and any general observations and comments pertaining to recent changes in the fishery. Only one fisherman had records; information from other fishermen was estimated.

Interviews were also conducted with 34 fishermen operating from the British Virgin Islands; this represented all but two of the known boats that regularly brought local seafood into the U.S. Virgin Islands from the British Virgin Islands.

All wholesale and retail grocery stores in the American Virgin Islands were contacted. Operators of private restaurants and of government-supported dining halls were interviewed. Thus, more than 90% of the major commercial seafood outlets were questioned about their consumption of seafood. The information was separated into three categories according to place of origin: local (including imports from the British Virgin Islands), Puerto Rican and United States imports and foreign (all other). Canned seafood products were excluded from all categories. These outlet operators were also questioned about their seafood sources, prices paid for seafood, adequacy of supply, local seafood preferences, desirability of additional local seafood availability, extent and types of processing and preservation of local seafood purchased and their willingness to pay increased prices for additionally-processed seafood. When available, records of seafood purchases by these outlets were utilized; otherwise the data provided were based on estimates made by purchasing personnel at each establishment.

The survey was conducted during the first half of 1968. This report covers a 12-month period, almost all of which was in 1967, with the small balance in 1968. In some cases, statistics for the calendar year 1967 were used. No significance is attached to these period differences. Data concerning fisherman population, boat registration and census were obtained from the U.S. Virgin Islands government. Import statistics were procured from the U.S. Bureau of Customs, unless otherwise noted.

Sampling was done by biologists of the Virgin Islands Ecological Research Station with occasional assistance from biology students attending the College of the Virgin Islands.

RESULTS

Description of the fishery

The fishery of the Virgin Islands is primarily based on the use of fish traps ("pots," in local terminology). These pots are usually constructed of heavy gauge, pre-woven poultry netting, and are made in the form of a chevron, with a single entrance, or "funnel," located at the apex of the concave side. Mesh sizes vary from 3/4-inch to 2-inch, depending on the choice of the individual fisherman. Pots are braced with "sticks" of local wood on the top, bottom and sides. A door is provided for removal of the catch. This might be termed the "classical" construction, since it has been used for several generations, and is prevalent throughout the Caribbean area.

A few hand-woven, unbraced "hard-wire" pots are still made, but these are very rare due to difficulty in obtaining materials. Their construction is very time-consuming and few of the present generation of fishermen know how to make this type of pot.

A few fishermen are using new materials for the mesh—especially the welded-mesh chicken-cage wire, both plastic-covered and galvanized. The latter may be protected by a replaceable zinc anode. Reinforcing steel is occasionally used for bracing in place of wooden sticks. One fisherman used 1/2-inch galvanized steel pipe for the main bracing.

Pots are set on the bottom of the sea, usually with a line and one or more buoys attached. They are hauled at regular intervals by hand or by winch from boats that are small, open and locally built. Pots are set with and without bait.

Nets used in the Virgin Islands fishery are primarily haul seines. Sets are made near a beach and the net is hauled ashore. No purse seines or gill nets were in use in the Virgin Islands fishery at the time of this survey. A very small modified tangle net is sometimes used to catch turtles. The haul seine catches are predominately bait, little tuna, *Ethynnus alletteratus*, or jacks, *Caranx crysos* and *Caranx ruber*. The harvest of migrant schooling fish is extremely limited due to the nature and location of net sets.

Many fishermen use hook and line techniques in conjunction with other gear but very few use this method of fishing exclusively. Hand lines are the rule. The use of rod and reel is exceptional. Lines are occasionally trolled; however, most handling occurs while boats are at anchor and the fishermen are "banking" for fish in deep water (600-1200 feet) or bottom fishing in shallower water while "chumming" the fish.

Another fishing technique is "fundering." This consists of lowering a thoroughly baited fish pot (often baited on the outside as well as the inside of the pot, to induce a "feeding frenzy") to depths of 600 feet or more. After

a suitable interval of time the pot is hauled, the catch is removed and the operation is repeated. Often, several pots may be used to make the operation continuous. Spectacular catches by this method were reported (up to 200 lbs. of fish per pot per set). The technique is rarely used anymore because the effort is considerable and the reward is less than that realized from other fishing practices. Although these other types of fishing activities frequently yield good catches, fishing with pots in shallow water is still the principal method of harvesting seafood in the Virgin Islands.

The fishery is a continuous operation, engaged in by a small number of persons, generally with a limited amount of gear and a limited capital investment. Although almost every species of fish is salable, the landings fall far short of satisfying the local demand, and large quantities of seafood products are imported.

Frequent incidents of *ciguatera* poisoning limit the sale of some species and sizes of fish. Some commercial purchasers of seafood refuse to buy local fish for fear of poisoning. The price for locally-caught fish is high by U.S. mainland standards, but fish remains a highly regarded staple in the diet of Virgin Islanders.

Fishermen generally sell their catches directly to the consumer, although some sell directly to commercial outlets. There are no fishermen's cooperatives and few commercial distributors. Their absence makes it nearly impossible for the commercial outlets to obtain local seafood consistently so these outlets tend to rely on imports supplemented with local products.

Modern techniques of handling and of portion and quality control are lacking in the Virgin Islands fishery. Local fish are sometimes sold live, but usually dead and seldom gutted or scaled. Ice is used consistently by a few fishermen. These practices, based to some extent on customer preference, result in a certain amount of spoilage, loss of fish and consumer poisoning. There is little likelihood of change in current handling practices, since fishermen can readily sell their catches without the additional effort or expense involved in further processing or preservation.

Statistics and discussion

There were 405 fishermen in the American Virgin Islands in 1930, in a population of 22,012 (Fiedler and Jarvis, 1932). The population had increased to approximately 55,000 by 1967, but the estimated number of fishermen was still about the same (400). This is a 60% decrease in fishermen, relative to the entire population.

The majority of fishermen in the 1930 survey were American Virgin Islanders. The present survey showed that about half (56.3%) of local fishermen were American Virgin Islanders by birth, indicating that the percentage of native-born fishermen in the entire population had decreased by about two-thirds during the 38 year period between surveys. In addition, the average American Virgin Island fisherman was almost 45 years old and had been fishing for 19 years. Commercial fishing is attracting fewer of the younger generation.

This is undoubtedly related to the spectacular rise in tourism in the Caribbean area and the attendant increase in related business activity as well as to the increase in local industrial enterprises and greatly expanded government employment. The younger generation is turning to these occupations rather

than to strenuous and hazardous fishing; the monetary return is much higher and little or no physical risk is involved.¹

Substantiation for this is that St. John, which has been less affected by tourism than St. Thomas and St. Croix, had a fisherman population almost entirely native (92.3%) to that island. St. Thomas, on the other hand, which has been most affected by tourism, increased government activity and where the market for seafood is many times greater than in the neighboring British Virgin Islands, had almost as many fishermen who were born in the British Virgin Islands (36.4%) as it had native St. Thomian fishermen (42.5%).

The vast majority of boats used in the Virgin Islands fishery are small and open (14 to 20 feet). They are almost always locally built by the fishermen. Propulsion is predominately outboard gasoline engine ranging from 72.9% in St. Croix to 97.1% in St. Thomas. Engines averaged less than 20 horsepower. Less than 7% of the fishing boats in St. Thomas and St. John are inboard-powered; more than 21% of the St. Croix fishing vessels have inboard power. The difference is that many of the St. Croix vessels are large, venturing up to 100 miles to catch and sell seafood. Almost half of the British Virgin Islands fishing vessels are powered by inboard diesels and some are sailboats with diesel auxiliaries. This is to be expected, due to the longer distances these boats travel to the St. Thomas market. Diesel engines are also more dependable and the fuel is cheaper.

Table 1 shows the value and quantities of fishing gear, boats and motors used by interviewed fishermen in 1967-68. The fish pot is the basic unit of gear in the Virgin Islands fishery. Of the 187 fishermen interviewed, 155 used pots, 71 used pots exclusively. Fish pots are popular because they are easily and inexpensively built and little skill is required to fish them. Hook and line fishing, while requiring a small investment, requires considerable ability and knowledge of fish habits. The successful use of nets also requires skill and the cooperation of many people. The initial cost of the average net is large; a fisherman can begin fishing with only a few pots but not with a small piece of net. The use of nets has declined in recent years as more beaches become hotel property. The Virgin Islands National Park in St. John has closed many other beaches to seining.

Frequency of gear use and average catches for fulltime fishermen are given in Table 2. Interpretation of these data is complicated by the probable low values of some catch reports and the lack of specific data relating catches to type of gear. Nevertheless, the catch per unit of effort value, assuming the total catch is from pots, may be used for comparative purposes.

The St. Thomas fishermen hauled their pots more often and also caught more fish per man than the other two American Virgin Islands. Apparently fishing was better here as the catch per unit of effort was above the average for the American Virgin Islands. On St. Croix, the catch per unit of effort and the annual catch per man were lower than the average; fishing here was only fair. St. John had a low annual catch per man and a high catch per unit of effort, indicating good fishing but sporadic, or seasonal effort.

¹Personal and financial data for commercial fishermen landing catches in the American Virgin Islands has been omitted from this text due to the fishermen's hesitancy to report figures accurately. They were considered to be lower than the actual values. However, the data can be obtained from the author—Wayne Swingle, Alabama Department of Conservation, Seafoods Division, Alabama Marine Resources Laboratory, Dauphin Island, Alabama 36528.

In the British Virgin Islands, fishing effort was greater than in the American Virgin Islands. The annual catch per man was also higher, but the catch per unit of effort was lowest.

TABLE 1
Capital Investment of Interviewed Commercial Fishermen Landing Catches
in the American Virgin Islands

Capital investments	St. Thomas	St. Croix	St. John	Total A.V.I. ¹	B.V.I. ²
Boats & motors:					
number	36	37	16	89	13
ave. value (\$)	1,170	4,550	1,095	2,562	6,115
total value (\$)	42,114	168,368	17,520	228,002	79,490
Fish pots:					
number	340	443	55	838	408
ave. value (\$)	32	25	21	28	13
total value (\$)	10,995	11,184	1,160	23,339	9,396
Lobster pots:					
number	-	425	-	425	100
ave. value (\$)	-	9	-	9	13
total value (\$)	-	3,770	-	3,770	1,300
Nets:					
feet	7,090	5,930	240	13,260	5,728
value (\$)	9,500	7,946	336	17,782	7,676
Total value (\$)	62,609	191,268	19,016	272,893	97,862
ave. value/fisherman (\$)	1,043	2,657	906	1,784	2,878
Fishermen interviewed	60	72	21	153	34

¹ A.V.I. = American Virgin Islands.

² B.V.I. = British Virgin Islands.

St. Croix has suffered from the dredging operation along its south shore, particularly in the Harvey-Hess industrial area, so fishing was not as good there as St. Thomas. Numerous reports from scientists have indicated it may be as long as 40 years before the effects of these dredging operations subside completely. The British Virgin Islands, which were relatively unspoiled, yielded consistently poorer catches per unit of effort. The reason for this is unknown.

Twenty-two different types of bait were used in pot fishing including such non-marine items as sage brush (*Lantana* sp.), doctor grass, bread and several tropical fruits. Considering this great variety, it appears that choice of bait was based on availability and fisherman preference rather than fish-attracting qualities. There were three notable exceptions. Sprat (genus *Harengula*) and conch were proven fish baits; both were relatively abundant and were also used in hook and line fishing. The third exception was that an appreciable number of pot fishermen used no bait. Fishermen explained that the catch from a baited pot seldom exceeded the catch from an unbaited one. Others suggested that when the pot became "fishy," or algae-covered, small reef fishes were attracted and the bigger fish went into the pots after the smaller fish. Some fishermen took advantage of this by leaving a few small live fish in the pot but this was not considered "baiting."

Fishermen's observations of the trends of catches and monetary returns were surveyed. The vast majority reported that the catch per unit of effort had

either remained the same or decreased (where a double opinion was reported, both were included), but there was general agreement that the monetary return had increased. The latter is to be expected since the price of fish has increased from \$0.10 per pound maximum in 1930 (Fiedler and Jarvis, 1932) to an average of \$0.50 per pound in 1967-68.

There is an apparent disinterest on the fishermen's part to employ modern techniques. However, many modern techniques cannot be employed without sizable investments beyond the means of local fishermen. Modern practices which could be utilized with relatively small capital outlay are often difficult—or impossible—to put into practice due to a local tendency to resist changes, lack of or difficulty in obtaining specialized gear and the government's apparent lack of interest in improving the fishery.

Loss or theft of gear and weather were the problems reported most frequently. Loss of gear occurs when larger vessels cut or foul buoy lines, and, in St. Croix, this was a real problem for many fishermen. Some St. Croix fishermen requested action which would alter navigation routes of the Harvey-Hess vessels for this reason. These large tankers and freighters also seemed to take varying routes, and fishermen were hard put to find fishing areas over 5 fathoms in depth where the large vessels did not travel. This situation applied all around the islands.

Weather was a problem since rough seas frequently continue for several weeks at a time. Although this did not prevent all fishermen from tending their pots, it did make the locating and hauling of pots much more difficult. Bad weather also accounted for some large losses of gear—particularly during the hurricane season. Buoy lines chafe and are cut on bottom coral, pots are tumbled, smashed and sometimes swept away.

TABLE 2

Gear and Average Catch per full-time Commercial Fisherman in the Virgin Islands

Location	Average Number		Fish Catch	
	Fish pots/ man	Pot hauls/ wk.	lbs/pot/ haul	lbs/man/ year
St. Thomas	8.1	20.9	8.7	9,520
St. Croix	7.5	14.0	6.6	4,770
St. John	1.7	5.0	10.1	2,635
American Virgin Islands (average)	7.3	16.3	7.8	6,619
British Virgin Islands	12.3	27.9	5.1	7,400

Loss and theft of gear are related. There were known cases of gear theft but, until better government enforcement is available, little can be done. The same applies to loss of fish when pots are hauled and emptied by people other than the owner. Theft was apparently on the increase as Idyll and Randall (1959) reported theft as almost non-existent on St. John.

Engine trouble and spoilage were considered problems by the fishermen. These were basically caused by poor maintenance and lack of ice. Only fishermen can overcome this.

Marketing was considered a problem, chiefly by those who traveled longer distances to sell their catches, or when large catches were made. Marketing practices have changed little from 1930, when Fiedler and Jarvis observed that the fishermen in St. Croix preferred to "sell a small quantity at a high price rather than a large quantity at a lower price." In addition, many marketing problems were eliminated by the very nature of the marketing system in effect at the time of the present survey. It was common practice to sell fish in groups—various species of fish on the same string. This insured the sale of the entire catch. The same result was achieved (particularly in St. Croix) by the fishermen insisting the customers "mix" the fish being purchased. Generally, all species were sold whole and uncleaned for \$0.50 per pound. The price was sometimes lowered for large purchases or to encourage a quick sale.

It is surprising that pollution was reported as a problem by only one fisherman. This may have been due to the lack of knowledge of the pollution that did exist, or that the effects of pollution are not so dramatic or immediate as those caused by severe weather or theft. Pollution abatement regulations were requested only by St. Croix fishermen, reflecting the fact that the dredging at the Harvey-Hess complex had caused a more dramatic and readily visible pollution than existed in most other areas. Some fishermen had found it no longer profitable to fish on the south and southwest shores of St. Croix, but did not request that the Harvey-Hess pollution be controlled because they had moved their fishing operations.

Apparently, the fishermen were satisfied with the types of gear being used; only one reported cost of equipment as being a problem. A few individuals reported no problems at all.

Fishermen were asked what government services or regulations might be helpful. Almost a quarter of them felt the government should neither assist nor regulate the fishing activities. It is worth noting that almost half of the St. John fishermen held this opinion. The majority felt that some type of government assistance would be desirable. A loan program was listed first, with improved marketing facilities second. While some did not consider marketing a problem, they still felt that better marketing facilities would be beneficial. The government of the Virgin Islands had begun construction of a market-storage facility for St. Thomas at the time of the survey and had appropriated \$40,000 for renovation of existing market-places in St. Croix. The third-rated request was for a government-operated cooperative, similar to that in Puerto Rico, where fishermen could purchase gear and materials at reduced costs.

A third of the St. John fishermen requested that the National Park beaches be opened to seining operations.

The fish most frequently reported ciguatoxic by local fishermen were: bar-

racuda, *Syphraena barracuda*; amberjack, *Serida dumerili*; horse-eye jack, *Caranx latus*; bar jack, *C. ruber*; crevalle jack, *C. hippos* and dog snapper, *Lutjanus jocu*. Some fishermen reported that all fish were occasionally ciguatoxic. Since these reports were based on unconfirmed fishermen opinion, their authenticity is questionable. Many species preferred by customers were also listed as being commonly ciguatoxic. The major factor which explains this anomaly is fish size. The larger specimens are highly suspect but most persons eat the smaller specimens; another factor is the location where the fish were caught.

Most fishermen considered barracuda over 5 pounds to be ciguatoxic. Eight members of the jack family were considered ciguatoxic—especially amberjack and horse-eye jack. In general, resident piscivorous species appeared to be most commonly suspected of being ciguatoxic; oceanic pelagic species, except large kingfish, were never suspected. Schooling jacks were considered safe, but the same species were considered dangerous if caught without evidence of having been part of a school. The majority of fishermen interviewed had been poisoned by ciguatoxic fish at one time or another. Ciguatoxic fish can come from any area and ciguatera is believed by fishermen to be caused by many factors, such as the time of year (primarily spring), copper from mines and sunken ships or the ingestion of moss (algae). Areas of the American Virgin Islands where ciguatoxic fish are most frequently reported are from the south sides of St. Thomas and St. John or near small islands south of St. Thomas. No particular area near St. Croix was especially identified as producing ciguatoxic fish.

Methods used to identify ciguatoxic fish are so varied and so infrequently reported that the techniques cannot be given much credence. The majority of fishermen reported there was no method of identifying ciguatoxic fish at the time of sale. Customers purchasing suspect fish fed a portion of it to a cat to see if the cat rejected the fish or became ill; if neither occurred, the fish was presumed safe for human consumption.

Landings of local types of seafood are given in Table 3. Of the 922 short tons of seafood landed annually, at the time of this report, 747 tons (81%) were landed by American Virgin Islands fishermen. The value of the total annual landings was just under \$1 million.

Total annual seafood landings by American Virgin Islands fishermen in 1930 was 616 thousand pounds valued at \$49 thousand and had increased to 1.5 million pounds valued at \$782 thousand in 1967. While the total catch increased about 150%, the value of the catch increased 1500%. Landings in the U.S. Virgin Islands, by British Virgin Island fishermen, in 1930 were 13 thousand pounds worth \$1,100 (Fiedler and Jarvis, 1932) and in 1967 landings had increased to 326 thousand pounds valued at \$172 thousand. Hence the British Virgin Islands fishermen have increased their share of the American Virgin Islands market from about 2% in 1929 to about 18% in 1967. This excludes the fact that 36.4% of the St. Thomas fishermen in 1967 were actually British Virgin Islanders by birth.

Annual consumption of local seafood products by local commercial outlets is approximately 206 tons, valued at just over \$240,000. This is approximately 22% of the landings. The annual per capita consumption of local seafood in 1967 was approximately 34 pounds; this figure excludes consideration of the approximately 750,000 tourists, so the true figure is undoubtedly lower.

TABLE 3

Annual Local Seafood Landings in the American Virgin Islands (1967)

Product	Landings by American Virgin Islands Fishermen ¹		Landings by British Virgin Islands fishermen ¹		Total pounds	Total value (\$)
	Pounds	Value (\$)	Pounds	Value (\$)		
Fish	1,382,400	691,200	290,000	145,000	1,672,400	836,200
Lobster	85,900	73,015	18,640	15,844	104,540	88,859
Conch	15,100	8,909	11,760	6,938	26,860	15,847
Whelk ²	-	-	-	-	22,305	8,922
Turtle	11,280	8,460	5,880	4,410	17,160	12,870
Squid	390	168	-	-	390	168
Octopus	208	144	-	-	208	144
Total	1,495,278	781,896	326,280	172,192	1,843,963	963,010

¹ Excluding whelks; see note 2, below.

² Whelks (West Indian Topshell) are normally harvested from shore and the landings of this item were not detected in the survey of fishermen. Whelk figures were obtained from the commercial outlet survey, and are included in "total pounds" and "total value" only.

This compares with 28 pounds per capita reported by Fiedler and Jarvis in their 1932 report.

A summarization, comparing all seafood imports (except canned goods) with local landings, appears in Table 4.

Local landings accounted for more than half of the total fish consumption during the time of the present survey, but for only about one-third of the "other seafood." Salted and smoked fish accounted for almost all foreign finfish imports. Kingfish was the biggest single item imported from Puerto Rico and the U.S. mainland and accounted for about 40% of the finfish imported from those areas.

Shrimp accounted for almost 50% of the total "other seafood" imports, with lobster tails (and some whole lobster) 25% and crab 16%. The local supply of shrimp and crab was virtually non-existent. Local commercial fishermen were able to supply slightly more than half of the total weight of the lobster and lobster-tails consumed. However, if the weight of the lobster from which the tails came was considered, it is doubtful that local supply would have constituted more than one-fourth of the total amount used.

The great majority of commercial outlets purchased processed frozen fish from Puerto Rico and the U.S. mainland. Two-thirds of these outlets using local fish bought fish which had not been gutted, scaled or even iced, while the other third received uniced, gutted but seldom scaled fish. Some fishermen used ice for preservation during transportation of the catch but removed the ice before selling them because many customers were prejudiced against iced fish. Others may have followed similar practices but use of any ice is definitely the exception.

Over two-thirds of the restaurants purchasing seafood indicated a willingness to pay higher prices for local fish if the fishermen would process and ice the catch. However, this seems of little importance, since fishermen had no dif-

TABLE 4

A Comparison of Locally Caught and Imported Seafood
(Thousands of pounds and thousands of dollars)

Product	Local landings	P.R.-U.S. imports	Foreign imports	Total
Fish				
Lbs.	1,672.4	926.1	485.8	2,881.4
Value	836.2	524.8	155.4	1,516.3
Other seafood				
Lbs.	171.4	348.2	28.4	548.1
Value	126.8	719.0	36.9	882.8
Total seafood				
Lbs.	1,843.8	1,071.4	514.2	3,429.5
Value	963.0	1,243.8	192.3	2,399.2

ficuity selling their catches at retail prices without the additional handling or icing. More than 70% of the restaurants and more than 60% of the groceries indicated a desire for additional local seafood. This is to be expected, since local seafood is often requested by island visitors and commercial outlets were receiving only a small part of the local catch.

Commercial outlet preferences for local seafood are red snapper, grouper, lobster, kingfish and potfish.

CONCLUSION

The Virgin Islands fishery is characterized by lack of change and lack of desire for change. The demand for local seafood products will continue to exceed production unless rigorous development of the fishery is undertaken. If proper attention is given to upgrading the present techniques, more modern fishery techniques are utilized, conservation practices followed and adequate government services and a good marketing system established, the Virgin Islands fishery may be able to meet the demand for increased and safer seafood. Although there is a problem with *ciguatera*, research will hopefully overcome it.

RECOMMENDATIONS

1. There is almost no control of fishing activities in the Virgin Islands. The local government should give serious consideration to the enactment of ENFORCEABLE legislation providing for the regulation and protection of the fishery resources, for the upgrading of the fishery itself and for more modern and sanitary seafood handling practices. Particular emphasis should be placed on: (A) Appointment of control officers to: (1) Control theft, (2) Control pollution, (3) Enforce conservation legislation, (4) Regulate shipping routes, (5) Maintain basic fishery statistics; (B) Establishment

- of modern, sanitary marketing centers capable of handling and holding fresh seafood; (C) Consumer education to dispel prejudices against iced and frozen fish; (D) Assistance to fishermen: (1) Loans for upgrading the fishery, (2) A co-operative outlet to provide gear at less expensive prices, (3) Education courses to acquaint fishermen with modern fishing gear and its uses, seamanship, boat mechanics and seafood handling practices.
2. Although the number of fishermen remains essentially the same as it was in 1930, the catch has increased, indicating that the fishery stocks are not being endangered by overfishing. Bottom fishing activities can probably be increased without endangering the fishery stocks. The adverse effects of increasing pollution are becoming more evident.
 3. Due to an almost complete absence of change in fish pot design in past decades, it cannot necessarily be concluded that this design is the best one. Investigation into the optimum design for a fish trap combined with studies of bait types and fish behavior would seem worthwhile.
 4. Fishing with seines can undoubtedly be expanded. This would require the opening of private and National Park beaches. Seining does little damage to resident fauna since migratory species are those normally harvested. Seining would also offer an interesting event for hotel or park visitors and it could be regulated so that there would be no detracting from the scenic beauty of beach areas.
 5. The demand and limited effort to catch several species of deep water snapper indicate that a fishery for those species has considerable market potential and should be investigated.
 6. The use of gill nets may be a profitable technique for catching schooling jacks, mackerels and oceanic tunas.
 7. Multiple-line trolling is successful in other tropical areas, but has not been utilized in the Virgin Islands. The potential of this fishing method should be investigated.
 8. Research on ciguatera, currently being conducted by the Virgin Islands Ecological Research Station, should be continued, with the ultimate goal being to determine a rapid, cheap, individual-fish type of test.
 9. The green turtle population has declined almost to the point of extinction due to inadequately enforced conservation practices. Vigorous enforcement of known conservation measures can aid this fishery.
 10. Either the lobster population in the St. Thomas-St. John-area is non-existent, the lobsters in these areas do not enter fish pots (as they do in other areas) or fishermen did not report lobster catches from this locale. The actual reason should be determined.

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