Demonstration of Advances in Virgin Islands Small Boat Fishing Techniques

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Introduction

Virgin Islands fishery development has been forced to face several difficult problems. The first and most important is a growing suspicion that the fishery resources of the Virgin Islands-Puerto Rico shelf may already be overexploited. At present this suspicion is based on incomplete data, but as more information becomes available from a 1975-instituted catch reporting program (Olsen et al., 1975), quantitative statements may be possible.

The second problem is, in part, derivative from the first. The investment potential of local fishermen is not much greater than present levels. Previous development attempts to introduce new techniques for fishing red snapper and grouper resources (Brownell and Rainey, 1972) were unsuccessful because local fishermen felt that they required larger fishing platforms and expensive equipment.

As a consequence, Virgin Islands development programs have concentrated in the areas of diversification and technology introduction at the traditional boat size. The goals of the former (reduction of effort on any single resource) have been met by the development of a deepwater snapper and grouper fishery (Brownell and Rainey, 1972) and more recently by investigations into the resource potential of a portunid crab population (Olsen et al., 1978).

The goal of technology introduction is more complex. Since the assumption of full- or overutilization of the resource is being made, this aspect of the program seeks to make the economics of present exploitation levels more advantageous to the fisherman and the local community. In the Virgin Islands, this aspect of the program has taken the direction(s) of improving marketing from the current roadside sales (Fig. 1) through encouraging formation of cooperatives (Williams, 1976), testing small boat designs and construction techniques, and measuring catch improvements resulting from intensified and diversified fishing formats.

Development efforts have also been taken to introduce new techniques which have already undergone rigorous field testing in local conditions. In this manner local government can save the fishing community the expense of gear testing. Successful techniques (Olsen et al., 1975) can be passed on to the fisherman and unsuccessful methods can be discarded.

This report is a summary of a project in which a new (to the Virgin Islands) boat design was constructed locally and fished on a full-time basis. The records of catch and expense were compiled and extrapolated to supply a financial picture equivalent to local commercial operations. The gross and net incomes were then compared with reported gross catches from Virgin Islands commercial fishermen for 1974-75 and with records from a successful local fisherman for the period from 1963 until 1974.

Material and Methods

Fishing was undertaken from two boats. The first was a 12-year-old, 20 foot × 5

Figure 1.— Virgin Islands fishermen generally spend as much as one-third of their time marketing their catch on the street.

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foot boat of local design and construction. It was powered by an 85 horsepower outboard engine. The second was a 14 foot 10 inch × 7 foot modified Oregon dory (Fig. 2) designed by John Palmer (Anonymous, 1972). The design was based on welded aluminum construction which we modified to double-hulled, ½-inch marine plywood with foam core and coated with epoxy and polypropylene cloth. All joints were epoxy glued; fasteners were Monel[1] boat nails and bronze screws. Materials are listed in Table 1. It was powered by a 50 horsepower outboard engine. This design was chosen because it was a rough-water boat that could be rowed, had low power requirements, and a high load capacity. Additionally, we felt that it could be easily constructed by relatively unskilled craftsmen.

These boats were used on regularly scheduled fishing trips between January 1975 and July 1976. By prescheduling the trips, bias in weather conditions was avoided. Each single day's activities were devoted to full-time fishing without experimental or gear testing activities. The activities employed were:

1) Fish traps: Between 10 and 20 fish traps were hauled daily. West Indian fish traps (Brownell and Rainey, 1972) were generally set unbaited.

2) Handline: Two hookrigs with frozen sprat, fry, or cut bait were used when weather permitted.

3) Longline and set lines were set with 20-50 hooks and the same bait as handlines.

4) Trolling with artificial baits was employed running in and out from the fishing grounds and for aggregations of tunas and kingfish.

5) Lobsters were caught in traps, by free diving, and with scuba.

6) Portunid (*Portunus spinamanus*) crabs were caught in small wire traps.

7) Electric reels were employed in deep water for snappers and groupers.

8) Conch, *Strombus gigas*, were captured by diving.

9) Nets were used in three manners:

[1]Reference to trade names or commercial firms does not imply endorsement by the National Marine Fisheries Service, NOAA.

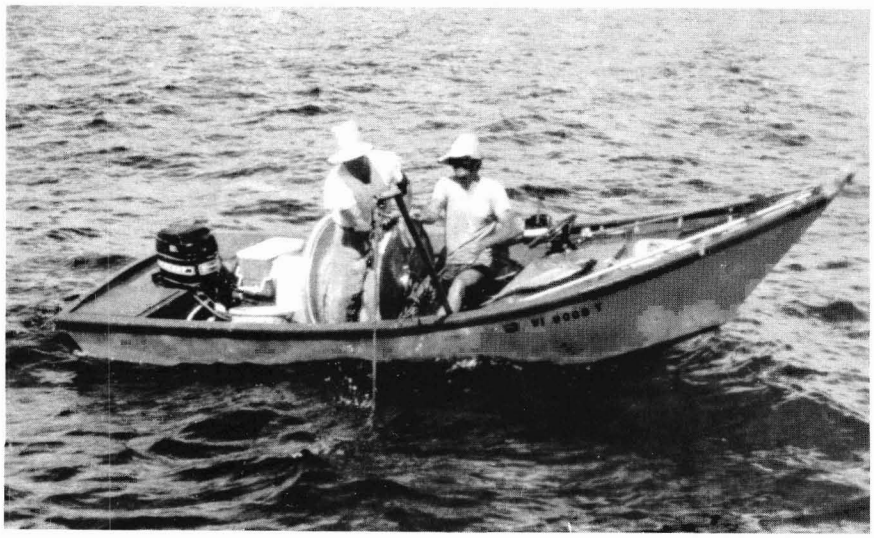

Figure 2.—Hauling fish traps by hand from project dory. Hydraulic net hauling equipment can be seen behind fisherman on the left of the photograph.

a) Gill nets were set on the bottom and around schools of jacks and tunas, b) haul seines were set around schools of jacks and tunas, and c) trammel nets were set on the bottom in likely locations for reef fish.

Catch and effort were recorded using each of these methods during each trip. Expenses recorded were: Fuel, oil, ice engine repairs, and fishing gear lost. Capital outlay was depreciated according to the following schedule: 1) Boats were depreciated over 5 years, 2) engines and fish traps depreciated over 2 years, 3) nets and other fishing gear (except traps) were depreciated over 3 years.

The success or failure of the fishing was measured by converting the catch to its cash value (fish = $1.25/pound, lobster = $2.00/pound, crabs = $1.50/pound, conch = $1.00/pound) to obtain a gross daily income. Fish prices in the Virgin Islands are stable over the year. This daily income was then converted to an annual income by multiplying it by the number of days fished by local commercial fishermen (4.5 days/week or 234 days/year). Daily expense records, repairs, and capital expenditures were deducted to obtain a net income.

The average daily catch was compared with 12 years' catch records from the project's master fisherman, Joseph A. LaPlace. His catch was converted to

Table 1.—Construction costs for experimental 15-foot dory-type boat.

Hull construction	
Marine plywood (9 sheets)	$ 450.00
1 × 4 inch lumber for gunnels (72 feet)	
1 × 2 inch framing lumber	
2 × 4 inch lumber for stronback & jig	90.00
Labor on hull construction	1,273.00
Hardware, screws, cleats, etc.	50.00
Aluminum molding for gunnel	25.00
Foam for hull (6 gallons at $20 each)	120.00
Epoxy glue (6 quarts)	100.00
Glass work	
24 feet polypropylene cloth	100.00
Epoxy resin	150.00
Fiber glass marco matte (3 yards)	12.00
Fiber glass gas tank	370.00
Labor	433.79
Paints, etc.	
Hull paint (1 gallon)	21.00
International orange	21.00
Bottom paint	36.00
Boat gear	
Anchor and line	100.00
Engine with steering controls (50 hp)	1,530.00
Fishing gear	
Fish traps ($80 each)	1,520.00
Hydraulic net hauler	2,700.00
Haul seine	2,300.00
Gill net	280.00
Trammel net	131.75
Bait nets	172.00
Electric reels ($500 each)	1,000.00
Set line	100.00
Hooks, lines, sinkers, misc.	200.00
Total	13,285.54

1975-76 prices for purposes of the comparison. A further comparison was made to the 1974-75 results of the fisherman's catch reports (Olsen et al., 1975).

Results

The results for all fishing in the time period by each method are listed in Table 2. The location and types of effort are shown in Figure 3. We made 64 full-time fishing trips in the 18-month study period (18 percent of the number reported by commercial fishermen). Sea and wind conditions averaged 18-25 knots (estimated) and 4- to 6-foot seas. Several trips were made in 30-45 knot winds. Catch was recorded on every trip. The average trip was 9.7 hours long (19.4 man-hours).

The traditional boat was a hazard during high wind and sea conditions (estimated up to 50 knots and 12- to 14-foot seas). Any attempts at net setting led to near swampings. The dory, on the other hand, did not exhibit these limitations.

The value of the average daily catch (Table 3) was $173.29 (SD = 124.55) with daily operating expenses of $20.67 (SD = 3.55). The per fisherman gross income would have been $20,274.93. The net income ($15,394.59) is $1,703.59 greater than the average adjusted gross income ($13,691.00/man) reported by the project's master fisherman (Table 4). It is almost $13,500 higher than the average (adjusted for a 234-day fishing year) gross income reported in Olsen et al. (1975), which was $6,786/man for the local fishing community. The gross catch was around $3,750 higher than the highest catch reported by fishermen in 1974-75 or 1975-76. We do know of at least one unreported catch valued in excess of $25,000 greater than ours.

Discussion and Conclusions

The results from the first 18 months' fishing activities do offer encouragement for the local industry. Admittedly, our higher catch came, in part, from our longer fishing days (almost twice as long as fished normally by commercial fishermen) that were permitted by the absence of marketing considerations. Over 80 percent of Virgin Islands fishermen use only fish traps. Recent increases in

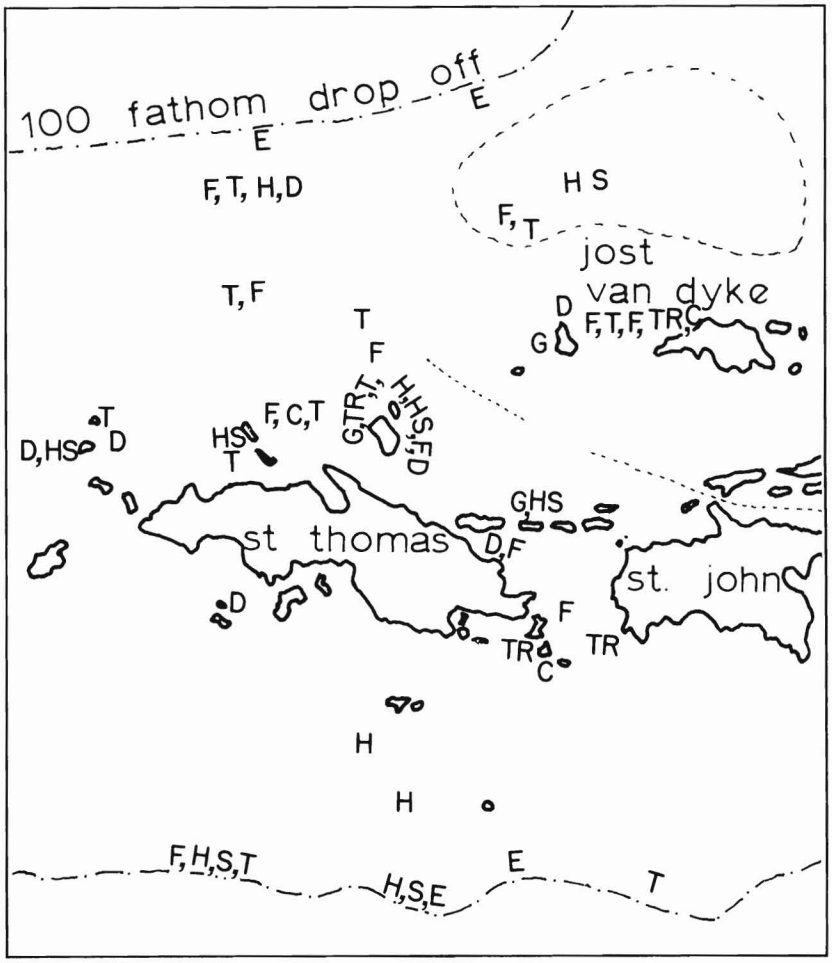

Figure 3.—This study took place on the Puerto Rico-Virgin Islands shelf. Activities included: West Indian fish traps (F), handlining (H), set lines and longlines (S), electric reel fishing (E), diving for lobsters and conch (D), crab trapping (C), trolling (T), and net fishing. Nets employed were: Gill nets (G), haul seines (HS), and trammel nets (TR).

Table 2.—Total catch and catch per unit effort (CPUE) for each of the fishing methods employed during the study period. Results are given in pounds per unit effort.

Method	Units	Total catch (lb)	Total effort	CPUE	Percent of total
Traps	set	5,154	1,016	5.07	43.2
Handline	man-hours	3,006	567	5.30	25.2
Trolling[1]	man-hours	110	74.5	1.48	0.9
Trolling[2]	man-hours	192	69	2.78	1.6
Lobsters (traps)	set	104	48	1.33	0.9
Lobsters (diving)	man-hours	274	31	8.84	2.3
Crabs	set	538	470	1.14	4.5
Electric reels	man-hours	211	35	6.03	1.8
Conch	man-hours	11	0.5	22.00	<0.1
Gill net	set	4	10	0.40	0.1
Trammel net	set	393	12	32.75	3.3
Haul seine[3]	set	1,400	4	365.0	11.7
Bait net	set	173	3	56.67	1.4
Longlines and set lines	sets	362	50	7.25	3.0
Total		11,932			100.0

[1]Trolling while running to and from fishing grounds.
[2]Trolling where fish are observed or reported.
[3]An average of 7.5 man-days are spent for setting each haul seine.

materials prices have made this fishery marginally profitable. Although 43 percent of our catch came from traps, handlining and net fishing (relatively low-overhead fisheries) may well offer a guide to future directions to be taken. This is presently occuring in Puerto Rico for the same reasons.

The experimental boat design worked exceedingly well. Boats currently in use in the Virgin Islands have evolved slowly from the carvel planked longboats of the 18th century. Construction techniques currently in use bear close resemblance to those used 200 years ago. Presently, local artisans build boats and sell them for US$2,000-3,000. Except for a small number of plywood-constructed boats in St. Thomas, most of the fishing boats in the U.S. Virgin Islands are carvel planked over natural grown and sawn frames. They are powered by outboard engines up to 175 horsepower. Because they are basically displacement hulls, fuel consumption may be as high as 12 gallons/hour (US$9.00/hour at 75 cents/gallon).

The 15-foot dory design was basically a rough-water dory. We constructed it of premium materials with commercial yacht carpenters but it is apparent that the construction cost could possibly be cut in half. Fuel consumption ranged from 1.3 to 3 gallons/hour, depending on load.

In summary, this project demonstrated that a variety of fishing techniques can be employed out of a boat design that is new to the Virgin Islands. If marketing problems can be solved, longer fishing days can result in a good income at no significant increase in capital outlay.

Table 3.—Projected income from project fishing effort.

Item	Subtotal	Debit	Credit
Full time fishing year	234 days		
Number of days fished 64	(18% of 1.5 years)		
Average daily catch	$ 173.29		
Total projected income			$40,549 86
Average daily operating expenses	$ 20.67		
Annual projected operating expenses		$4,836.78	
Boat (5-year depreciation)	$2,881.79	578.36	
Outboard engine (2-year depreciation)	1,530.00	765.00	
Nets & hauler (3-year depreciation)	3,940.65	1,313.55	
Traps (19 at $80 each)	1,520.00		
Traps (2-year depreciation)		760.00	
Repairs and maintenance	412.17		
Repair costs/day of use	6 44		
Adjusted repairs for 234-day year		1,506.99	
Total		$9,760.68	$30,789 18

Acknowledgments

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Addenda

Because 5 years have passed since these data were collected, we have recal-

Table 4.—Summary of catch statistics and value of catch of a master fisherman, 1963-74.

Year	Caught	Pounds	Price ($/lb)	Total	Number of fishermen	Gross income per fisherman (at 1975-76 prices)
1963	Lobsters	5,800	$0.70	$ 4,060.00	3	$ 7,533.12
	Net	9,800	0.35	3,430.00		
	Spearing	600	0.35	210.00		
Total		16,200		7,700.00		
1964	Lobsters	8,000	0.70	5,600.00	3	11,550.00
	Net	14,000	0.35	4,900.00		
	Traps	3,000	0.35	1,050.00		
Total		25,000		11,550.00		
1965	Lobsters	8,900	0.75	6,675.00	3	12,183.84
	Net	10,500	0.40	4,200.00		
	Traps	4,500	0.40	1,800.00		
Total		23,900		12,675.00		
1966	Lobsters	9,600	0.75	7,200.00	3	14,733.30
	Net	17,000	0.40	6,800.00		
	Traps	3,000	0.40	1,200.00		
Total		29,600		15,200.00		
1967	Lobsters	7,500	0.85	6,375.00	2	$26,312.00
	Net	20,500	0.50	10,250.00		
Total		28,000		16,625.00		
1968	Lobsters	8,600	0.90	7,740.00	2	21,100.53
	Net	20,000	0.50	10,000.00		
Total		28,600		17,740.00		
1969	Lobsters	9,000	1.00	9,000.00	3	13,500.00
	Net	18,000	0.60	10,800.00		
Total		27,000		19,800.00		
1970	Lobsters	9,800	1.00	9,800.00	3	7,575.00
	Net	2,500	0.60	1,500.00		
Total		12,300		11,300.00		
1971	Lobsters	15,000	1.00	15,000.00	3	17,916.67
	Net	19,000	0.75	14,250.00		
Total		34,000		29,250.00		
1972	Lobsters	8,300	1.50	12,450.00	3	13,366.67
	Net	18,800	0.90	16,920.00		
Total		27,100		29,370.00		
1973	Lobsters	4,000	1.75	7,000.00	2	13,375.00
	Net	15,000	1.00	15,000.00		
Total		19,000		22,000.00		
[1]1974	Lobsters	3,800	2.00	7,600.00	3	10,283.00
	Net	14,600	1.00	14,600.00		
	Traps	4,000	1.00	4,000.00		
Total		22,400		26,200.00		

[1]Began working for government.

Table 5.—Comparison of 1975 and 1978 prices and total income.

Item	Catch (lb/day)	Price ($) 1975	Price ($) 1980	Total Value ($) 1975	Total Value ($) 1980
Finfish	127.96	1.25	1.80	159.95	230.33
Lobster	2.69	2.00	3.50	5.38	9.41
Conch	0.17	1.00	3.67	0.17	0.62
Crabs	5.20	1.50	2.00	7.80	10.40
		Total/day		$173.30	$250.76
		Annual total		$40,552.20	$58,677.84

Table 6.—Projected income in 1975 and 1980 from fishing effort.

Item	1975 Subtotal	1975 Credit	1975 Debit	1980 Subtotal	1980 Credit	1980 Debit
Catch value		$40,549.86			$50,937.12	
Daily operating expenses	$ 20.27			$ 39.54		
Annual operating expenses			$4,837.47			$ 9,252.97
Boat (5-year depre.)[1]	2,281.79		578.36	4,641.15		928.23
Engine (50 hp, 2-year depre.)	1,530.00		765.00	2,052.00		1,026.00
Nets & hauler (3-year depre.)[1]	3,940.65		1,313.55			2,115.49
Traps cost/traps	80.00			125.00		
	1,520.00			2,375.00		
Total (2-year depre.)	760.00		760.00			1,187.50
Repairs and maintenance[1]			1,506.99			2,426.97
Total		$40,549.86	9,761.37		$50,937.12	16,937.16
Net profit		30,788.49			33,999.96	
Increase from 1975					3,211.47	
Annual increase from 1975					642.29	

[1]1980 prices calculated at 10 percent annual inflation.

culated some of the cost and benefit figures to see if there have been changes in the relative profitability of the experimental fishing operation. These recalculations are shown in Table 5 where the changing value of the projected catch was calculated based on changes in the value of the catch. It should be noted that fish prices in the Virgin Islands do not follow seasonal trends as the market demand is greatly in excess of the supply. The increase in fish prices between 1975 and 1980 would have provided around $10,500 in additional revenue for the fishing operation.

In Table 6 we calculated the profitability by obtaining 1980 prices for most purchased items and assuming a 10 percent annual inflationary increase for the boat construction, net fishing gear, and maintenance services. During this 5-year period, there was a 74 percent increase in operating expenses as compared with a 26 percent increase in the value of the fish landings. These results clearly indicate the decreasing profitability of this type of fishing in the Virgin Islands.

Literature Cited

Anonymous. 1972. Oregon dories bring new life to fisheries of Pacific Islands. Natl. Fisherman 53(7):16-17.

Brownell, W. N., and W. E. Rainey. 1971. Research and development of deepwater commercial and sport fisheries around the Virgin Islands and sport fisheries around the Virgin Islands plateau. Carribb. Res. Inst., V.I. Ecol. Res. Stn., Contrib. 3, 88 p.

Olsen, D. A., A. E. Dammann, and D. Neal. 1974. A vertical longline for red snapper fishing. Mar. Fish. Rev. 36(1):7-9.

_____, _____, and J. A. LaPlace. 1975. Results of fishermen's information forms for 1974-75. V. I. Fish Wildl. News V(1):2-3.

_____, _____, and _____ 1978. *Portunus spinamanus* Latrielle, a portunid crab with resource potential in the U.S. Virgin Islands. Mar. Fish. Rev. 40(7):12-14.

Williams, R. 1976. St. Thomas-St. John Fishermen's Cooperative. U.S. Dep. Agric., Farmer Coop. Serv., Serv. Rep. 152, 44 p.