The Marine Resource Base for Marine Recreational Fisheries Development in the Caribbean

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MARINE RECREATIONAL FISHERIES IN THE EASTERN CARIBBEAN

Marine recreational fisheries within the eastern Caribbean are inextricably involved with the biological and economic realities of the region. Resource exploitation strategies have evolved with these realities from pre-Columbian times, as available information (Price, 1966) indicates that the Carib Indians exploited virtually the same range of species currently harvested. As the region developed, the pre-Columbian subsistance fishery has become a less significant feature of the exploited environment, as gradual evolution towards a commercial fishery and eventually fishing for supplemental income and purely recreational fishing have replaced it.

In the following discussion we will attempt to describe the Caribbean marine recreational fishery both in terms of user groups and the resource. Much of this discussion is based on a generalization of the situation in the U.S. Virgin Islands to the broader region. In part the U.S. Virgin Islands can legitimately serve as a model to other developing island nations. Rampant and unplanned development in the territory has led to a tripling of the population since 1960 (V.I. Department of Commerce, 1982) due largely to massive in-migration. As a result, the native Virgin Islander is now a minority in a cosmopolitan population of immigrants from throughout the region and the hemisphere: native born (39%), West Indians (29%), continentals (12%), Puerto Ricans (10%) and others (10%). Nearly 80% of the population is made up of persons of Caribbean origin, and we assume that preferred patterns of resource exploitation and recreational utilization of the resource may provide an adequate model for other Caribbean countries. That model, simply stated, is that the evolution of the fishery from subsistance to recreational has several identifiable stages in the continuum. These stages are: (a) subsistance fishing for protein; (b) commercial fishing for profit; (c) fishing as a source of supplemental income; and (d) recreational fishing. As a nation's economy develops, jobs are created which allow fishermen to gain a "better" standard of living with less work. In the leisure time created in the developed society, the former fisherman may supplement his income with his former trade. Eventually, he may not have to supplement his income and he may fish for nonquantifiable returns, only selling his catch when it exceeds his personal need.

Resources may be limited, leading to competition between user groups. This competition for resources between recreational and commercial fishermen frequently poses an acrimonious problem for resource managers. Recreational fishing effort is not driven by profit and has displaced commercial effort in other areas. It is important to remember that each economic situation may dictate the degree of displacement that is desirable. Island governments, with their notoriously bad balance of payments situations, may not desire development of an economically inefficient harvest of resources, except where it serves to enhance a tourist destination or some other source of income.

One of the most difficult aspects of analysis of recreational fisheries is to determine what constitutes the recreational fisherman. It is generally not possible to sep-

Table 1. Economic analysis of Virgin Islands fishery

Item	Boat size (feet) (<22)	(22-30)	(>30)	Recreational (27)
Returns:				
pounds	9,765	16,559	30,599	-
dollars	19,530	33,118	61,197	598.15
Costs (Variable costs):*				
fuel	1,643	3,285	4,696	1,312.08
groceries	324	559	435	955.92
bait	306	814	1,716	166.32
ice	133	134	340	379.68
transportation†	96	156	268	566.16
crew wage‖	4,883	8,280	15,299	-
gear loss	1,526	356	-	0
equipment	-	-	-	428.00
vessel repair	2,434	3,517	17,642	99.16
Total Variable cost	11,345	17,101	40,396	3,907.32
Fixed costs (Depreciation):§				
traps	1,625	2,080	11,750	-
hull	220	849	1,830	1,220.84
engine	237	718	1,125	226.00
other fishing gear	93	27	0	107.60
Total Depreciation	2,175	3,674	14,705	1,554.44
Interest on Loan	46	152	648	1,464.00
Insurance	320	321	0	320.00
Total Fixed costs	2,541	4,147	15,353	3,338.44
Total All costs	13,886	21,248	55,749	7,245.76
Total Costs/Gross Returns	0.711	0.642	0.911	12.113
Net Returns:				
above variable costs	8,185	16,017	20,801	-3,308.85
above total costs	5,644	11,870	5,448	-6,617.29
Net Return/Total Costs	0.406	0.559	0.098	-0.917

*Annual variable costs are determined by daily costs multiplied by the average number of days fished times 52.
†Transportation costs are determined by the number of miles to and from home to boat multiplied by .20/mile.
‖Crew wage is one-fourth gross income.
§Depreciation was determined as straight line depreciation of initial cost minus salvage value (10% of initial cost at end of life expectancy) divided by the life expectancy in years (hull = 10 years, motor = 5 years, net = 5 years).

arate the recreational and commercial resource user on the basis of species caught or sale of catch. One reasonably clear indicator of the difference between the commercial and the recreational fisherman is a cost return analysis. Table 1 provides one such comparison based upon survey work in the U.S. Virgin Islands. The data are from a 1981-1982 cost/return analysis of the Virgin Islands commercial fishery and a 1977 survey (results are given in 1982 dollars) of recreational fishermen. What these analyses indicate is the obvious economic statement. Commercial fishermen try to generate revenue that is in excess of their costs. If a fisherman remains in business over some given time period and does not generate this excess, he is subsidizing his fishery from some other source. He is to some degree or another a recreational fisherman. This degree of subsidy depends upon the type of exploitation employed by the recreational fisherman. Table 2 lists the recreational exploitation strategies employed in the Virgin Islands. It should be noted that nearly 30% of the effort surveyed was invested in nonextractive resource utilization (with an economic "return"

of zero). Of the remaining portion, approximately 24% was directed towards coastal and oceanic pelagic species, 17% towards lobster resources, 7% each towards conch *(Strombus gigas)* and whelk *(Cittarium pica)* resources and 10% towards shallow-water reef fish resources.

Table 2. Recreational activities and landings in the Virgin Islands

Method/ species	% Total Recreational activity	CPUE (lb/day)	Days/ month	value ($US/lb)	Monthly value ($US/lb)
Trolling	18.3	9.3	3.0	$2.00	$55.80
Bottom	4.9	11.3	4.9	2.00	110.74
Spear	12.7	10.5	4.4	2.00	92.40
Diving					
Lobster	17.3	7.6	2.6	5.00	98.80
Conch	7.3	5.6	1.4	3.25	25.48
Whelk	7.3	6.9	1.4	5.00	48.30
Snorkel	23.5		8.0		
Photos	6.4		9.3		
Other	2.3				

Annual Average = [Σ (% of total x days/month x monthly value)] x 12 = $598.15.

The taxonomic composition of these efforts can be compared to the commercial landings in Table 3. This table illustrates the similarity in the kinds of fish targeted by both recreational and commercial effort. Table 4 summarizes this overlap in terms of the basic resource groups present in the Eastern Caribbean. In the Virgin Islands the recreational fishery emphasizes pelagic resources to a greater degree than does the commercial fishery. This probably holds true for most of the islands with large island platforms. For islands which have small island platforms the commercial fishery also emphasizes pelagic resources. The commercial catch in Barbados, for example, is made up of over 90% pelagic species (Hunte and Mahon, 1982). Coastal pelagic, mollusk and crustacean resources are all harvested with similar emphasis by both recreational and commercial fishermen.

Resource seasonality is an important component of Eastern Caribean recreational fisheries. On islands with significant fisheries for shallow-water reef fish some of this seasonality is damped. This is shown by the percentage of the trap catch in St. Thomas from 1974 to present which only fluctuated from 7 to 9% of the total catch. Traps harvest shallow-water reef species almost exclusively. The catch is made up of 60 to 70 different species, each with a different annual cycle of abundance which may serve to compensate another species' cycle of abundance. The lack of seasonality in the trap fishery is really a function of the multi-species nature of the fishery. Both recreational and commercial effort targets breeding aggregations and other seasonal cycles of individual species.

Coastal migratory pelagic species are primarily harvested by seine nets in the Virgin Islands. The fishery is dominated by four species *(Caranx ruber, C. fusus,*

Table 3. Species composition of Virgin Islands' recreational and commercial fish catch(%)

Family	Recreational catch	Commercial catch
Coryphaenidae (Dolphins)	6.9	0.1
Istiophoridae (Billfish)	0.8	-
Belonidae (Hound Fish)	.3	0.6
Holocentridae (Squirrel Fish)	1.0	4.3
Sphyraenidae (Barracuda)	8.6	0.1
Serranidae (Groupers)	12.5	13.9
Priacanthidae (Big Eyes)	0.3	0.1
Carrangide (Jacks)	2.5	10.3
Scombridae (Mackerals, Tunas)	26.7	8.9
Lutjanidae (Snappers)	17.4	5.7
Pomadasydae (Grunts)	2.6	6.5
Sparidae (Porgies)	0.6	2.4
Bothidae (Flounders)	0.3	-
Mullidae (Goatfish)	-	0.7
Chaetodontidae (Angelfish)	0.6	3.7
Scoridae (Parrotfishes)	-	5.3
Labridae (Wrasses)	0.3	0.8
Balistidae (Triggerfish)	4.9	21.0
Acanthuridae (Surgeonfish)	-	3.5
Ostraciodontidae (Boxfish)	-	0.8
Crustacea (Lobster)	2.0	7.9
Mollusca (Whelks)	1.3	0.1
Mollusca (Conch)	1.3	3.3
Other Finfish	5.8	-
Unrecognizable Response	3.3	-

Table 4. Comparison of resource utilization between recreational and commercial fishermen in the U.S. Virgin Islands (Values given in percentage of landings)

Resource	Recreational	Commercial
Pelagic	12.2	0.2
Coastal Pelagics	15.9	9.6
Shallow Water Reef Fish	67.3	78.9
Lobster	2.0	7.9
Conch	1.3	3.3
Whelk	1.3	0.1

Ocyurus chrysurus (a shallow-water reef fish) and *Euthyunus alleteratus)*, although the hook and line fishery lands some coastal pelagics in addition to their reef fish catch. The landings are strongly seasonal with most of the harvest between March and July. Some of the seasonality results from weather-related variables which reduce effort during the other months. Months of peak abundance may vary from year to year. It has been reported that small coastal pelagics may be overharvested in the eastern Caribbean (WECAFC, 1982).

Lobster resources also show seasonality with a period of peak abundance between October and February; catch is generally highest at the start and finish of the period.

Pelagic seasonality is best documented from Barbados (Hunte and Mahon, 1982) because of the emphasis in that country on pelagic species. In the Virgin Islands data on pelagics from 1967 to 1979 is available from the daily log of John Harms, who pioneered game fishing in the Virgin Islands. Mr. Harms certainly targeted his effort, but the data clearly indicates seasonal abundance. In all, Mr. Harms fished a total of 2,485 days and caught 16,152 fish. These results are presented in Figure 1 for the 12-year average for the major components of the landings. Peaks for billfish and blue marlin occurred during the summer, and the winter for sailfish. Among the Scombridae both wahoo and kingfish were most abundant from January through May. There was a November peak of wahoo that was not present for kingfish. Yellowfin tuna and bonito were most frequently landed between October and April, with low catches in June. Blackfin tuna were most abundant in May and again in October. Among the other species, dolphin fish were caught most frequently in the March-to-May period and again in November, with lows in the summer, a pattern similar to barracuda. Although these figures indicate average trends, there is great variability from one year to the next. This is shown in Figure 2 for dolphin fish from 1967 to 1979. The magnitude of annual peaks varies substantially, and there is also some variation in the months in which the peaks occur.

Sustainable yield in the Caribbean is comprised of two elements. The first element is the productivity associated with the island platforms. A first approximation of this potential can be calculated by multiplying the shelf area by some productivity

Table 5. The marine resource base for MRF development in the Caribbean

	Fish Landings (Metric tons)	Available* Yield (Metric tons)	Demand (Metric tons)
Bahamas (Nassau only)	2,800	124,800	5,681
Dominican Republic	6,435	864	137,406
Haiti	2,500	-	125,231
Jamaica	7,227	2,080	146,231
Cuba	43,186	25,600	247,222
Bermuda (shellfish only)	468	331	1,556
Turks & Caicos	1,050	768	220
Puerto Rico	1,819	2,553	29,461
U.S. Virgin Islands	1,272	1,262	3,905
British Virgin Islands	692	2,930	664
Anguilla	760	2,875	218
St. Martin	N/A	2,875	1,097
St. Barthelemy	N/A	2,875	130
Saba	40	2,686	26
St. Christopher-Nevis	27	564	1,293
St. Eustatius	30	564	37
Antigua-Barbuda	800	1,621	2,189
Montserrat	126	90	397
Guadeloupe	4,990	1,205	8,642
Dominica	500	301	27
Martinique	2,167	814	8,734
St. Lucia	2,200	349	3,027
Barbados	1,579	205	7,238
St. Vincent & Grenadines	379	832	2,872
Grenada	900	1,280	2,940
Aruba	700	132	4,494
Curacao	850	61	1,769
Bonaire	100	52	278
Trinidad & Tobago	4,322	13,056	31,115
Caymen Islands	N/A	160	440
	87,199	193,785	774,540

*Available yield = shelf area x 0.64 mt/km^2 (CFMC, 1981).

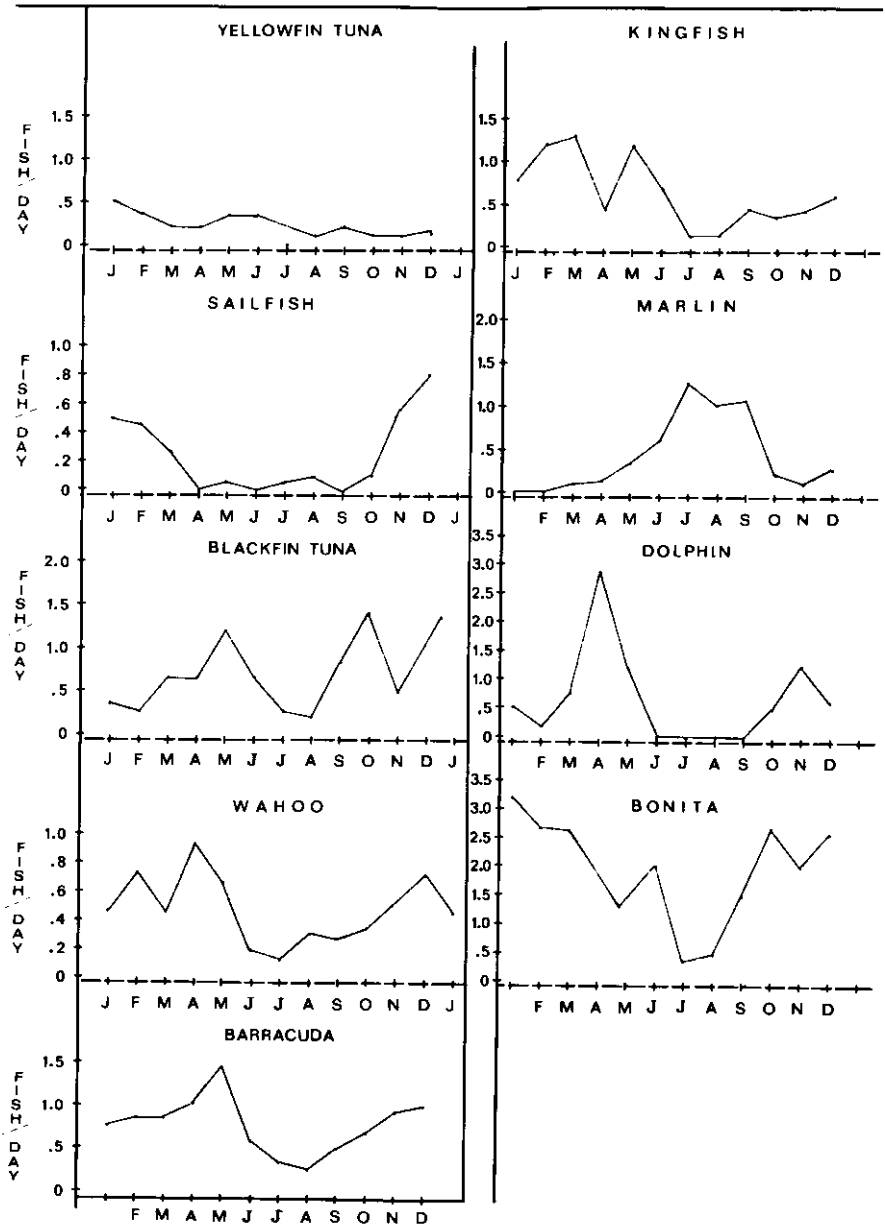

Figure 1. Seasonality of pelagic game fish caught from 1967 to 1979 by Mr. John Harms in the U.S. Virgin Islands.

constant. In Table 5 these calculations indicate that 12 of the island nations are landing in excess of the potential yield of the shelf. For islands which are dependent to a high degree on shelf related resources this table indicates a current need for management if the resource is to continue to be productive. These results also indicate the other elements of productivity, pelagic harvest. Many of these islands are character-

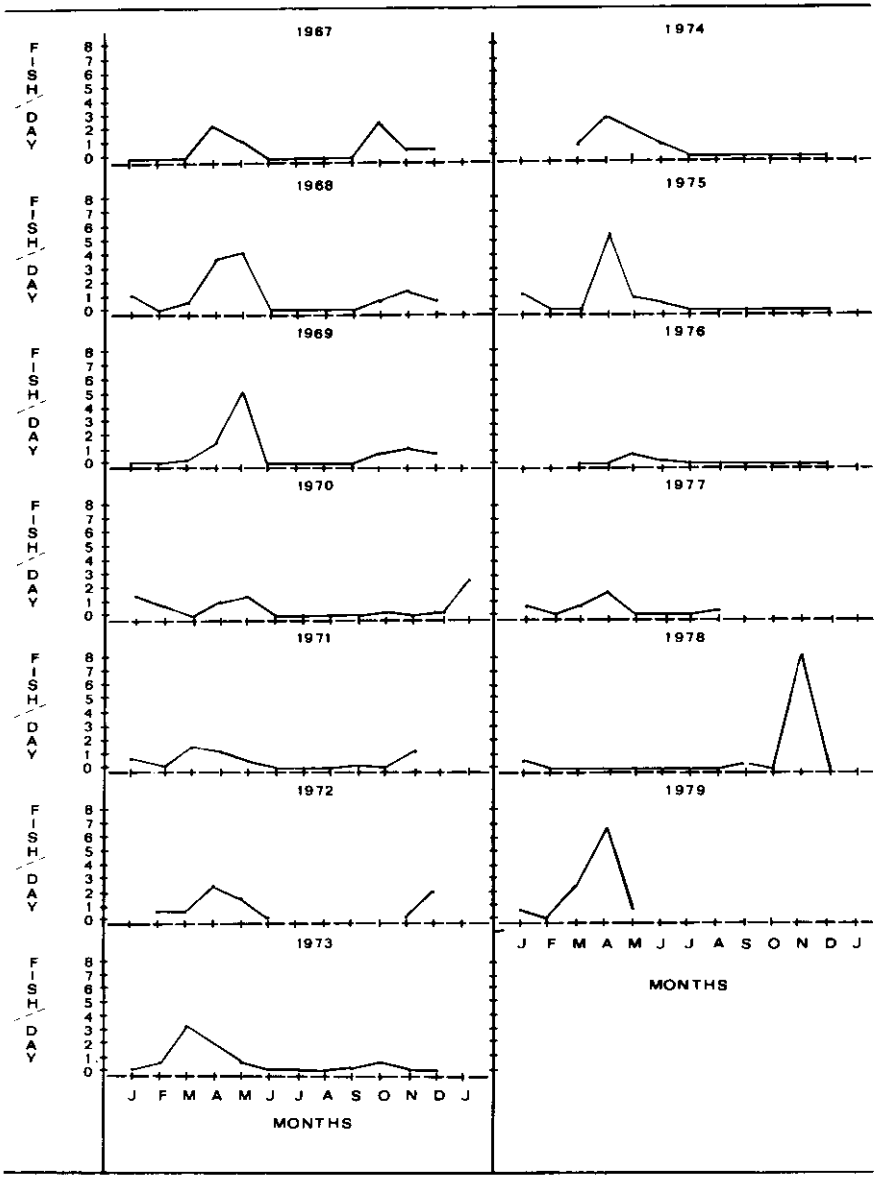

Figure 2. Seasonal variations in dolphin fish landings from 1967 to 1979 in the U.S. Virgin Islands.

ized by small island platforms whose productivity cannot meet the population's demand for seafood. Yield of these resources cannot currently be estimated because of the highly migratory nature of the species involved and the sketchy catch and effort data available in the region. Available information does not indicate overfishing. In Barbados, for example, catch per trip of dolphin has been increasing over the last 20 years; despite the fact that year-to-year variability is great.

The final element in our discussion involves the role of ciguatera fish poisoning. Figure 3 shows the distribution and intensity. Ciguatera is a significant problem throughout the region. Generally, it is less common in the islands south of

Dominica. Epicenters of high incidence exist at Redondo, east of the Saba Bank; the south end of the Anguilla Bank, south of St. Barthelemy, and south of Piler Island in the British Virgin Islands. In the U.S. Virgin Islands 50% of the species (comprising 56% of the landings by weight) have been implicated in fish poisoning. Ciguatera can be considered to affect recreational fisheries less than commercial because recreationally caught fish may produce "enjoyment" return even if not consumed.

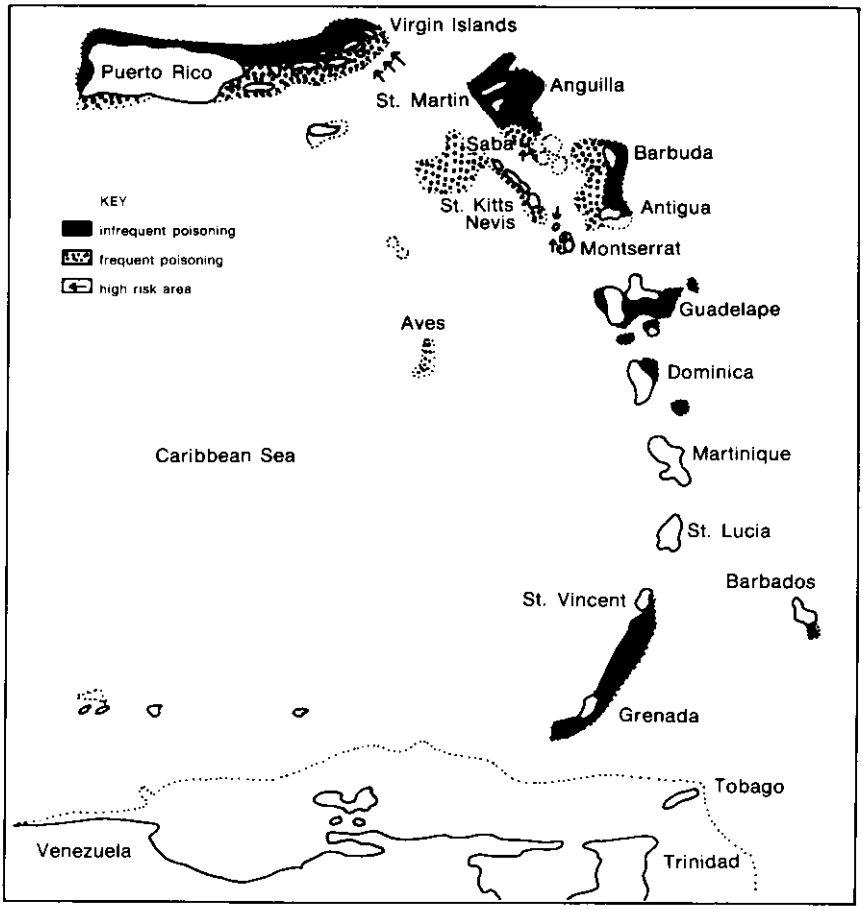

Figure 3. Distribution of ciguatera fish poisoning in the eastern Caribbean.

SUMMARY

Recreational fishing in the eastern Caribbean is not currently a major component of the eastern Caribbean fishery. The developmental status of many of these islands may not lead to the development of economically inefficient harvest strategies unless secondary benefits may accrue to the island economy.

Where recreational fisheries occur, there is competition for the major resource groups found in the region. Competition is most pronounced for shallow-water reef fish, although both groups exploit coastal pelagics, lobster and mollusk resources, as well. In the U.S. Virgin Islands there is little commercial exploitation of pelagic resources which are prized by recreational fishermen.

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