

ACTIVITIES OF TRADING VESSELS AND SUPPLYING FISHERS IN THE GRENADINE ISLANDS, LESSER ANTILLES

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ABSTRACT

The Grenadine Islands in the Lesser Antilles lie on the Grenadine Bank, an extensive shallow platform (about 3000 km²), consisting of predominantly coralline habitat, exposed to the influence of open oceanic water. The population of the Grenadines (about 12,000 people) is sustained primarily by fishing and tourism. However, within the Grenadines the market for fish is small and export markets in neighboring islands (mainly Martinique) are accessed by 'trading vessels'. The trading vessel marketing system was studied by means of questionnaires to fishers, and trading boat operators/owners, by key informant interviews, by direct observation in all islands and by examination of Grenadine export records and Martinique import records.

Bequia, in the St. Vincent Grenadines and Petit Martinique in the Grenada Grenadines are the main ports of operation for the trading vessels. Bequia-based vessels move around in the northern Grenadines, while Petit Martinique-based vessels typically remain stationary while supplying fishers from the southern Grenadine islands bring fish to them. Most vessels purchase fish for 5-7 days before heading to Martinique. The trip typically takes 13-15 hours and offloading takes between 1-3 days. Vessels typically make 2-4 trips per month. Predominantly reef fishes and occasionally conch, coastal pelagics and large pelagics are exported by trading vessels. Estimates of total annual reef fish yield from the Grenadine Bank based on interview data range from 636 to 1182 mt, while total annual fish yield based on export and import data range from 288 to 422 mt.

INTRODUCTION

The Grenadine islands are one of the few areas in the Lesser Antilles with a large shelf area. They are surrounded by an extensive shallow platform, the Grenadine Bank, extending over an area of approximately 3000 km² exposed to the influence of open oceanic water (Figure 1). They belong to two nations, St. Vincent & the Grenadines (Bequia, Mustique, Canouan, Mayreau, Tobago Cays, Palm

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Island and Union Island) and Grenada (Carriacou and Petit Martinique). These islands (Figure 1) are particularly interesting from a fisheries perspective. Their economies are marine based, depending mainly on fishing and tourism. Some 85-95% of adult males in the Grenadines are fishers or active in related sectors (CCA 1991). A household survey (1990-1991) conducted in the Grenadine communities of Paget Farm (Bequia), Canouan and Union Island found that fishing was the main source of income for 33%, 25% and 8% for residents in each of these communities respectively (CAN. & SVG Fisheries Development Project, 1991a).

In the Grenadines, deep-slope and shallow-shelf reef fish, lobsters, conch and schooling coastal pelagics are the resources most extensively fished; with deep slope and bank fish (deepwater demersals) and shallow reef fisheries being predominant. Deepwater demersals were found to be the most important species for 75% of St. Vincent and the Grenadines fishers interviewed during a baseline data survey (CAN. & SVG Fisheries Development Project, 1991d). The majority of the demersal fisheries in the Grenadines are carried out on a small-scale artisanal basis with fishers typically operating independently on a subsistence level with little or no organization. Fishers utilize simple gear, mainly fish traps, spear guns, handlines, trolling lines, gill nets, beach seines, trammel nets and longlines.

Morris et. al. (1988) estimated that 60% of the combined demersal trap and line, seine (coastal pelagic) and oceanic pelagic catch from the St. Vincent Grenadines is sold directly to trading vessels mainly for export to Martinique, with approximately 10% reaching local consumers. Finlay (1990) estimated that 85% of finfish production from the Grenada Grenadines is exported to Martinique, 10% goes to hotels, supermarkets and restaurants; and the remaining 5% goes to local consumers. This system of direct marine trans-shipment of fish from fisher to trading vessel in the Grenadine islands' fish export operations is unique in the wider Caribbean region. As a result of the nature of the fish trade (diffuse, vessel-based fish landings) in the Grenadines area, there are no reliable data on the amount of fish landed or of fishing effort. Therefore information on the impact of exploitation and on the stock status of fishery resources is largely anecdotal. Also information on the modes of operation of activity of Grenadine trading vessels is minimal and lacking in detail.

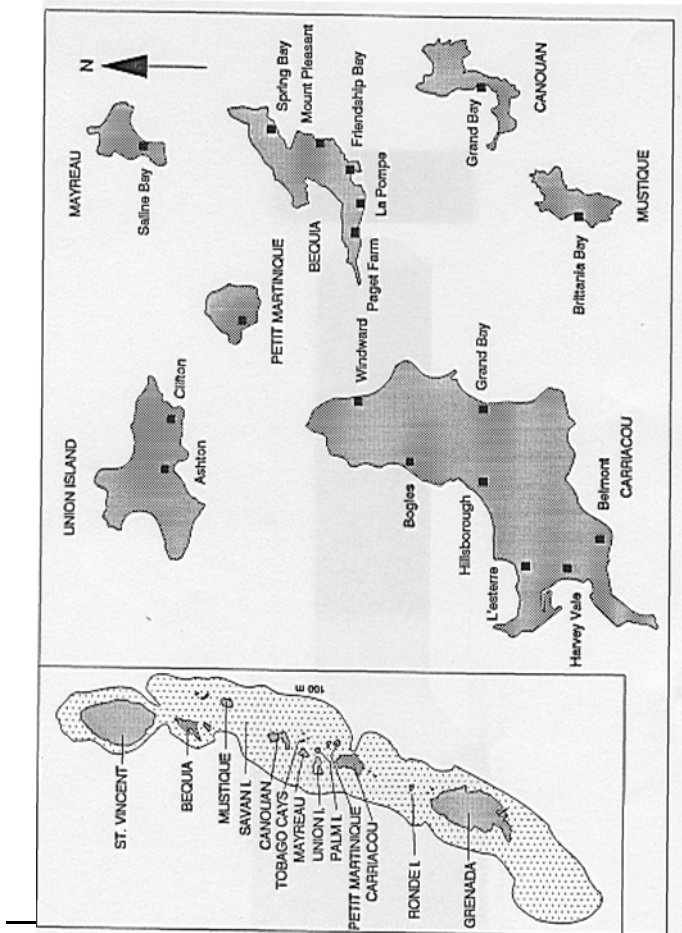


Figure 1. The

Grenadine Bank (inset) and main fishing sites on surveyed islands

The objective of this study was to acquire better information on the fisheries sector of the Grenadines, through an investigation of the activities of trading vessels and supplying fishers. Specifically, the objectives were: to collect and analyse new and existing data to obtain an estimate of fish taken off the Grenadine Bank; and to obtain baseline information on the pattern of activity of fishers and trading vessels which would indicate how a fisheries data collection

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system could be set up. This paper provides an overview of the results of the study. A full account can be found in Chakalall et. al. (1994).

MATERIALS AND METHODS

A multifaceted approach to information gathering was employed, where the same questions/issues were investigated using different methods and the results cross-checked. The techniques employed were: survey questionnaires; informal key informant interviews and weekly phone contacts; direct observation; and analysis of existing available data. The approach is similar to that of Rapid Rural Appraisal in which research is usually compressed in time and respondent sampling is normally less than that required for statistical confidence (Grandstaff et. al. 1985).

The islands surveyed were Bequia, Mustique, Canouan, Mayreau, Tobago Cays and Union Island (St. Vincent Grenadines) and Carriacou (Grenada Grenadines) (Figure 1). Fishers were interviewed by initiating a general dialogue to build respondent confidence and trust of interviewer. This was followed by a period in which questionnaire information was subtly elicited by purposeful manipulation of casual/general conversation. Survey questions were memorized and delivered by the interviewer without the physical presence of the questionnaire document. The questionnaire was then completed from memory after the interview session.

Trading vessel operators were interviewed on an opportunistic basis, with five out of a total of 12 active vessels being interviewed.

Structured Key Informant interviews were conducted informally with non-fishing individuals who have been established in the island communities for many years, and who were knowledgeable about fishery and trading boat activity (e.g. civic leaders, extension officers, shop-keepers, school teachers, and fishery cooperative personnel). An informant system of telephone contacts was also established in all islands except Petit Martinique (where hostility and a high level of suspicion was encountered) and was polled weekly (August 18 to September 22) for patterns of movement of trading vessels. Trading vessel turnover data from Petit

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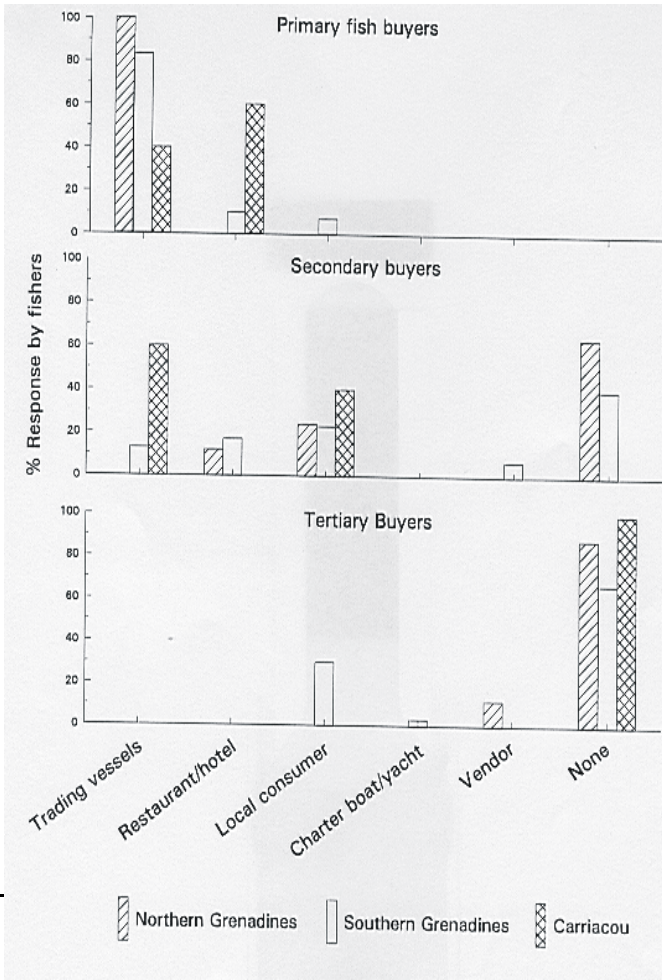


Figure 2.
Percent

age responses from fishers regarding the primary, secondary and tertiary fish buyers in each of the three main areas of operation.

Martinique were collected by the fisheries extension officer from Carriacou during his weekly visit. This information was supplemented by personal observation.

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(1993) were analysed to determine trends in activity. Export data from St. Vincent and the Grenadines are derived from health certificates and include all exports both by plane and by trading vessel.

Fisher interview data were tested using the G test (conducted with chi-square statistic) to determine if specific characteristics defining pattern of activity of trading vessels were independent of area of operation. Since the sample size of

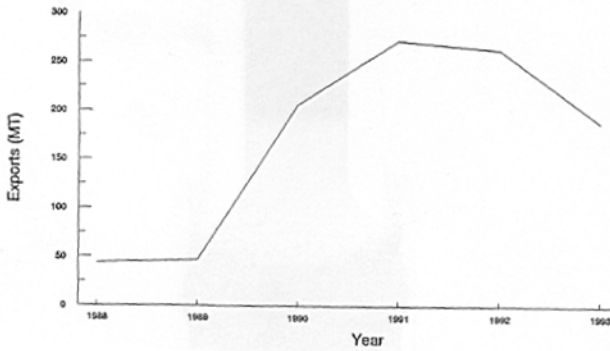
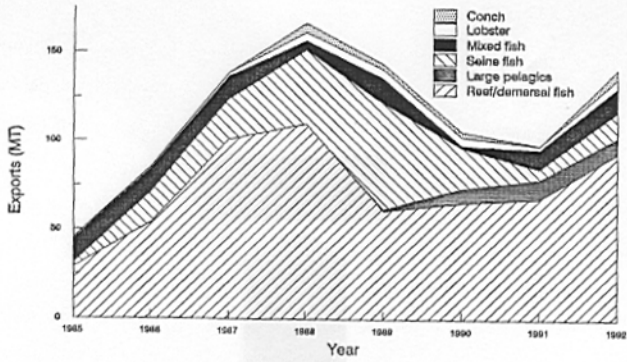
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Carriacou (Grenada Grenadines) respondents was small (N=5) compared with other islands, the data were pooled with the southern St. Vincent Grenadines.

Export data were tested using the Kruskal-Wallis non-parametric method to test for significant differences in the median size of exports by category from St. Vincent & the Grenadines. The categories reef/demersal, large pelagics, seine fish, lobster, conch, mixed fish and others are used. Category reef/demersal refers to shallow demersal/reef fish species such as parrot fish (*Scarus* spp., *Sparisoma* spp.), squirrelfish (*Holocentrus* spp.), hind (*Ephinephelus* spp.) and deep demersal species such as snapper (*Lutjanus*) and grouper (*Mycterperca* spp., *Epinephelus* spp.).

Category large pelagics refers to large migratory pelagic species such as tuna (*Thunnus* spp.) and dolphinfish (*Coryphaena* spp.). Category seine fish refers to schooling coastal pelagic species such as jack (*Caranx* spp.), bigeye scad (*Selar crumenophthalmus*), robin (*Decapterus* spp.) and mackerel (*Scomberomorus* spp.). Lobster, conch and 'other' categories refer to *Panulirus argus*, *Strombus gigas* and other aquatic invertebrates such as the sea urchin, *Tripnuestes ventricosus* respectively. Category mixed fish is used in reference to shipments of seine fish, large pelagic and reef/demersal categories combined.

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Figure 3. Annual fish exports (mt) by category for St. Vincent and the Grenadines, 1985-1992

Figure 4. Annual fish exports (mt) for the Grenada Grenadines (Carriacou and Petit Martinique), 1988-1993. NB: data for 1989 and 1993 were incomplete. Missing monthly values were therefore filled using other years to pro-rate months based on their mean percentage contribution to annual totals.

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Fish yield from the Grenadine Bank was estimated in two ways. The first was from key informant, supplying fisher and trading vessel data using the two basic formulae given below:

$$(1) \quad Y = VC \times TM \times AV \times MA$$

$$(2) \quad Y = VC \times (365/DP + DT + DO) \times AV$$

where: Y = Fish yield (mt), VC = Avg. vessel capacity (mt), TM = Avg. # of trips to Martinique per month by vessel, AV = Total # of active trading vessels, MA = # of months per year during which vessel active, DP = Duration of fish purchase (days), DT = Duration of travel time per trip (days), DO = Duration of fish offloading (days).

Minimum and maximum yield estimates from the northern and southern Grenadines area of the Grenadine Bank were calculated separately for data provided by key informants, supplying fishers and trading vessel operators using both formulae. For key informant yield estimates (YKI), MA was assumed to be 12 months, since no values for this were given. This assumption was considered justifiable since both trading vessels and supplying fishers reported that vessels actively purchased fish over an entire year (although, with higher frequency in some months). For supplying fisher yield estimates (YSF), values for DO, DT and VC provided by key informants were used, since no values for these could be given by the fishers. For trading vessel yield estimates (YVO), all parameters were provided by the vessel operators.

Minimum and maximum estimates using Formula 1 were based on the values of the least and most (average) number of trips per month (TM) reported by a majority of informants. Minimum and maximum estimates using Formula 2 were based on the least and most (average) number of days spent offloading fish (DO).

The second method of estimating total annual fish yield from the Grenadine Bank was to use the actual recorded values of annual exports, and data on annual fish imports to Martinique.

RESULTS

Fifty-two fishers were interviewed in Bequia, Mustique, Canouan, Mayreau, Petit Tabac (Tobago Cays) Union Island, and Carriacou. For comparison, the interview results (survey questionnaire responses) were separated into three main areas: northern St. Vincent Grenadines (Bequia, Mustique and Canouan), southern St. Vincent Grenadines (Mayreau, Petit Tabac (Tobago Cays) and Union Island) and southern Grenada Grenadines (Carriacou). No interviews could be conducted in Petit Martinique because of high levels of hostility and suspicion.

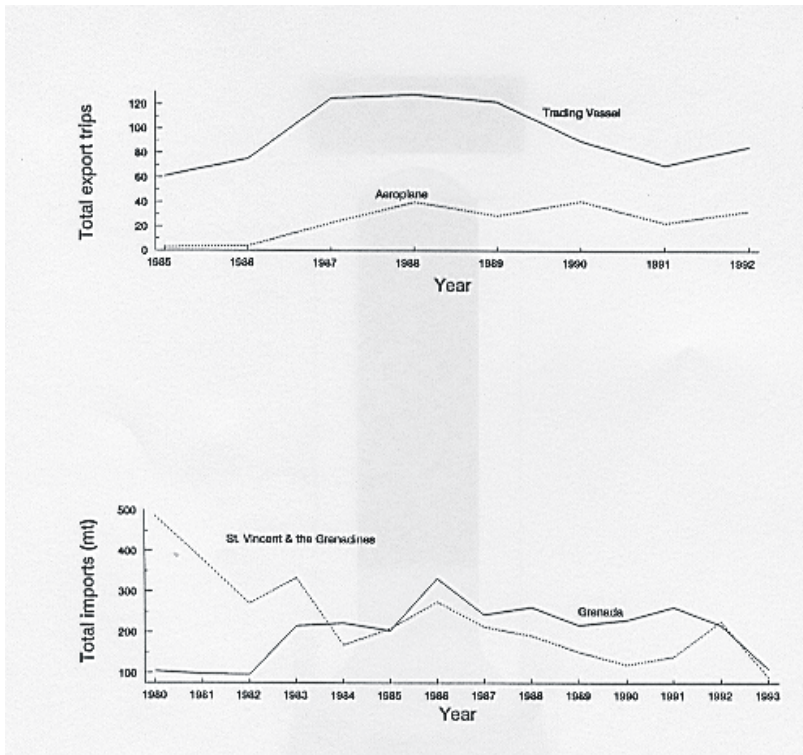
Of a total of 15 trading vessels for the entire Grenadines area (as reported by fishers in survey questionnaire responses; see Table 1) 12 were confirmed as operationally active at present. Five were interviewed: three from the southern

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Grenadines, based in Petit Martinique and two from the northern Grenadines, based in Bequia.

Figure 5. Total annual export trips by trading vessel and aeroplane from St. Vincent and the Grenadines, 1985-1992

Figure 6. Total annual finfish and shellfish imports into Martinique from



Grenada and St. Vincent and the Grenadines, 1980-1993

Eight key informants were interviewed in the Grenadines: two each for the islands of Bequia, Carriacou and Union and one each for Canouan and Mayreau. No key informants were found in Petit Martinique or Mustique. Three key

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informants were interviewed in Martinique.

SUPPLYING FISHER CHARACTERISTICS

Fishers, except Bequians, operate primarily around their own islands or community of residence. The ports of operation or main fishing sites for fishers are presented in Figure 1.

Bequian fishers appear to travel to and operate in other islands as far as Mustique in the northern zone and Petit Tabac in the southern zone. The majority (47%) of Bequian fishers interviewed fish out of Mustique, and 19% fish out of Petit Tabac in the Tobago Cays while the remaining 28% and 5% respectively, fish out of Paget Farm, and Friendship Bay in Bequia itself.

The proportion of full-time fishers is higher in the northern St. Vincent Grenadines (82%) than in the southern St. Vincent Grenadines (67%). In Carriacou 60% of fishers are full-time.

For half of the fishers in the southern St. Vincent Grenadines the primary fishing method was spear gun, while 18% used seines and an additional 18% used lines. Trap fishing was the least used method in the southern St. Vincent Grenadines. In the northern St. Vincent Grenadines 48% of fishers indicated that their primary fishing method was seine with 40% and 12% of fishers respectively fishing by spear gun and by line. In Carriacou fishers predominantly used lines (60%). Gill netting and spear fishing were the only other primary methods of fish capture reported there.

In the northern St. Vincent Grenadines average quantity of fish caught daily was reported by fishers as ranging between 10-20 kg for demersal and reef fish and 40-1000 kg for coastal pelagic fish (although most (84%) reported coastal pelagic catches of 500-1000 kg per day). In the southern St. Vincent Grenadines the average quantity of fish caught daily ranges from 5-30 kg for demersal and reef fish species and 40-500 kg for coastal pelagics. In all St. Vincent Grenadine islands the average quantities of fish caught varies with the target species and method of capture. Higher quantities were reported by fishers targetting coastal pelagic species.

Supplying fishers go out early in the morning and return during early to mid afternoon (6.00 am - 3.00 pm.). Fish is sold in the vicinity of the home port of operation if trading vessels are nearby. If no trading vessels are in the vicinity of the home port of operation, fishers travel to those islands where trading vessels are buying fish. This is a common occurrence for Union Island and some Carriacou fishers who frequently travel to Petit Martinique to sell their catch, if no vessels are present at Union Island, nearby Palm Island or at Carriacou respectively. Supplying fishers do not fish if trading vessels are absent or are not actively purchasing fish.

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During purchasing transactions fishers typically come alongside and transfer their catch to trading vessels. The catch is then laid on deck and fish that can be taken are selected and weighed whole (i.e. without being gutted first). Fishers are then paid for the fish selected.

TRADING VESSEL CHARACTERISTICS

Trading vessels constitute the single most important market for Grenadine fishers. In the southern St. Vincent Grenadines, 83% of respondents reported trading vessels as the primary fish purchasers. In the northern St. Vincent Grenadines trading vessels were reported as the only major primary purchaser of fish, whilst in Carriacou (southern Grenada Grendadines) restaurants/hotels and trading vessels were both reported as important primary purchasers (Figure 2). Furthermore, a majority of respondents in both the southern and northern St. Vincent Grenadines indicated that there were no major secondary or tertiary buyers of fish catch (Figure 2). In Carriacou, trading vessels were reported as the most significant of the secondary purchasers, and there were no tertiary purchasers (Figure 2). Over all the Grenadine islands, primary fish purchasers were ranked as follows: trading vessel ' restaurant/hotel' local consumer. All vessels sell their fish in Forte de France, Martinique.

Vessels interviewed from the southern Grenadines only purchased fish within the Grenadine islands. In all of the Grenadine locations vessel names were seldom known by fishers, instead fishers typically referred to vessels by the names of their captains or owners. Fisher response on the vessels to which catch is sold is given in Table 1.

Fishers, trading vessel operators and key informants were generally only aware of 5-6 active trading vessels in their area. This is because vessels servicing northern St. Vincent Grenadines, southern St. Vincent Grenadines and Carriacou locations basically operate within discrete, spatially separated areas, with only one vessel from each area occasionally overlapping in its area of operation (Table 1; Figure 1).

Northern St. Vincent Grenadine vessels all make several purchasing stops per trip before leaving for Martinique. These typically include: Paget Farm, Petit Nevis & Friendship Bay in Bequia; Britannia Bay in Mustique and Kingstown in mainland St. Vincent (Figure 1). One vessel also services Canouan. Southern Grenadine vessels are based in Petit Martinique, and only one vessel makes multiple purchasing stops (i.e. in Union Island, Palm Island, Mayreau, and Canouan as well as Petit Martinique; Figure 1). Fish is generally purchased from fishers daily, primarily during late morning and early afternoon (10.00 a.m.-4.00 p.m.). None of the trading vessels appear to do any fishing of their own.

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Trading vessels consistently purchase fish a fixed number of times each month; although not necessarily keeping to a fixed time table. Availability of fish to trading vessels and market demand in Martinique are both important factors affecting trading vessel schedules across all main areas of operation. Schedule affecting factors were found to be independent of area of operation ($G = 0.451$ $p > 0.50$). Vessels from the southern and northern Grenadines purchase fish on a rotational basis, so that all vessels are never either purchasing fish or absent at the same time. Usually only one, but occasionally two or more vessels (when fish availability is good) ever purchase fish at the same time. This pattern of operation is arranged among trading vessel operators.

The duration of purchase by trading vessels is reported as ranging between three and eight days per trip (for Southern Grenadine vessels: 3-4 days; for Northern Grenadine vessels: 5-8 days). This is corroborated by 84% of fishers from the southern St. Vincent Grenadines who reported it to be between five and eight days, and by 50% of northern St. Vincent Grenadine fishers and 60% of Carriacou fishers who reported it to be eight and six days respectively.

The average number of trading vessel marketing trips per month was found to be between two and three in both the northern Grenadines and southern Grenadines from key informant accounts and telephone contact polling. Again this was corroborated by the majority of fishers and vessel operators in the northern and southern Grenadines who reported number of trips per month as two to four.

Trading vessel purchasing activity was reported to vary with time of the year. The months of highest vessel purchasing activity are from July to November/December, the season when importation of all fish species in Martinique is permitted. The months of lowest vessel purchasing activity are from January to June, the season when only importation of reef and demersal species is permitted in Martinique, and controlled by limited quotas.

Trading vessel loading capacity was reported by vessel captains as ranging between 1.8 and 5.4 mt. Fishers reported average loading capacities of 2 to 2.5 mt and the majority of informants reported capacities of 2.5 mt.

Fullness of hold, availability of fish, condition of cargo and telephone communication from Martinique fish purchasing agents requesting stated quantities of certain species, appear to be the primary factors determining when a trading vessel ceases loading and departs for Martinique.

Fishers in all areas indicated that reef/demersal species, conch and small pelagics are purchased by the trading vessels. These results confirm that trading vessels trade predominantly in these species groups and that there is apparently negligible trade in lobster, large pelagics and turtles. Sea urchins appear to be only taken in the southern St. Vincent Grenadines. Categories of fish taken by trading

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vessels varied with area of operation ($G = 8.911$, $p < 0.001$) between northern and southern Grenadine areas. Fish species groups of choice by trading vessels indicated by fishers are given in Table 2. In all three major areas of operation, the deep demersal species, the shallow demersal species, and some reef fish species are the “preferred” species of trading vessels. Small pelagics species, in particular jacks, robins and mackerel are also taken frequently, but are more commonly listed as “accepted” or “sometimes taken”. This was again corroborated by trading vessel captains and key informants who also pointed out that small pelagics are only purchased when sale in Martinique is permitted (i.e. from July-December).

Trading vessels pay different prices for different species categories but not different sized fish. A majority (35%) of all fishers interviewed, indicated that they were aware of three main species categories (red fish/deep demersals; white fish/seine fish; reef fish) for which different prices are paid. 25% of respondents indicated that they were only aware of two categories; (red fish and seine fish), while 32% of respondents indicated that they were only aware that trading vessels purchased red fish and reef fish species.

Both fisher and trading vessel operators indicated, for the redfish/deep demersals category minimum prices are about EC \$7.00 per kg, while maximum prices are usually about EC \$8.00 per kg, but may be as high as EC \$10.00. For the reef fish category a price range of EC \$7.00-8.00 is reported. A single standard price of EC \$7.00 per kg was paid for white fish/seine fish.

The trip from the Grenadines to Martinique typically takes 13-15 hours. Offloading in Martinique usually takes between 1-3 days but may take slightly longer if there are many vessels waiting to offload. Much of the ice used in transportation is purchased in Martinique. Northern St. Vincent Grenadine vessels also purchase flake ice from Kingstown and Bequia while southern Grenadine vessels purchase ice from Windward, Carriacou and Petit Martinique.

All five of the trading vessels interviewed reported that they were owned by individuals or families. None were owned by companies, cooperatives or other entities.

ACTIVITY AT DESTINATION MARKET

Trading vessels are required to pay docking fees upon arrival in the port at Fort de France. These fees are based upon the tonnage of the vessel, time in port and frequency of trips. If vessels travel to Martinique frequently the cost of docking for these vessels is lower. Export clearance and health certification are required from Grenadine trading vessels by Martinique customs agents before any retail transactions can occur. Sanitary health inspectors board vessels and assess the condition of the cargo.

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Trading vessels sell to fish purchasing agents in Martinique, who are the primary fish distributors there. They retail and wholesale fish to vendors, supermarkets and local fish shops in Martinique. Purchasing agents are subject to fish purchasing quotas in the 'Miquelon' season (January-June). During this period they are not allowed to purchase imported large or small pelagic species and have different limited quotas for other species including demersal and reef fish species.

Informants at the Forte de France dock indicate that Grenadine trading boats come to Martinique about twice a month and typically take one to five days to sell their fish. Fish is sold to those fish purchasing agents who offer the best prices.

HISTORICAL PERSPECTIVES

The Grenadine fish trade with Martinique is reported to have started in the late 1970's with vessel trading activity peaking by the early to mid 1980's and declining subsequently to the present level. Informants identified poor financial management and overcapitalization as the principal factors causing the decline in fish trading boat activity from the early years of the trade. It appears that the number of trading vessels increased beyond that which the supply of fish could economically sustain. Reductions in fish availability due to overfishing was cited as another long-term causative factor responsible for the decline in Grenadine fish trading activity.

Key informants indicated that competition in Martinique from Venezuelan fish traders (who are reportedly capable of supplying large quantities of size-sorted fish at lower prices than Grenadine fish traders) may be a major contributing factor to the declining trend currently perceived as occurring in the trade. However, observations indicate that trading vessel operators may be benefitting financially more from the return leg of the trip from Martinique, than from the sale of fish. Trading vessel operators purchase consumer goods for retail at home bases and in some instances are supplying commercial establishments. The profits generated as a result of the return leg from Martinique may now represent a greater driving force for the current existence of the Grenadine fish trade.

EXPORT DATA

St. Vincent Government Fishery Division records indicate that 17.5% of total fish export shipments are from mainland St. Vincent, and 82.5% are from the St. Vincent Grenadines. The total amount of fish (shellfish included) exported annually from St. Vincent & the Grenadines increased steadily from 47 mt in 1985 to a peak of 167 mt in 1988, then declined in subsequent years to 98 mt in 1991 before increasing again to 142 mt in 1992 (Figure 3).

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Reef/demersal fish are by far the most important category of exported fish accounting for between 42 and 73% of all exports (Figure 3). Exports of reef/demersal fish increased steadily from 29 mt in 1985, reaching a peak in 1988 at 110 mt, then declined in subsequent years with export levels ranging from 61 to 68 mt, until 1992 when they rose again to 94 mt. Exports of large pelagic species have only become significant since 1990, now accounting for around 10% of the total annual exports. Exports of seine fish increased from 2 mt in 1985 to a maximum of 60 mt in 1989 and have since declined to 15 mt by 1992. Lobster and conch are of relatively minor importance throughout the time series, generally accounting for less than 2.5 % combined.

Grenada Government Fishery Division (Carriacou Office) records show that total exports of fish and shellfish from the Grenada Grenadines (Carriacou and Petit Martinique) rose from 44 mt in 1988 to 263 mt in 1992 with a maximum quantity of 272 mt being recorded in 1991 (Figure 4). No data are available on species composition of Grenada Grenadine exports.

The total annual number of trading vessel export trips from St. Vincent & the Grenadines rose to a peak of 168 in 1988 and has since declined to around 100. The median size of shipments of reef/demersal species increased from 953 kg in 1985, remained constant at 1000 kg through 1986-1990 and peaked at 1100 kg in 1991 and 1992. Median size of annual shipments of reef/demersal species were not significantly different (Kruskal Wallis Test: $H = 63.9167$, $p < 0.001$) for the years 1985 to 1992. Median shipment size of large pelagics increased approximately 11 fold, from 125 kg in 1986 to 1362 kg by 1989 and declined to 681 kg by 1992. Median size of annual shipments of large pelagic species were significantly different (Kruskal Wallis Test: $H = 7.785$, $p > 0.10$) between the years 1985 to 1992. Median shipment sizes of seine fish fluctuated over the period 1985-1992, with annual shipments of 1589 kg in 1985, declining to 200 kg in 1986, then rising again to 1362 kg, 1362 kg, 1453 kg, and 3000 kg in 1987, 1988, 1989, and 1991 respectively. Median shipment sizes of seine fish species were significantly different (Kruskal Wallis Test: $H = 15.289$, $p = 0.054$) from each other for the years 1985 to 1992. For mixed fish, median shipment size fluctuated over the period 1985-1992, with exports in 1985, 1986, 1988, and 1992 exceeding 1000 kg. The lowest median shipment sizes were recorded from 1989-1990 when exports were 854, 454, and 800 kg respectively. For annual shipments of mixed fish, median shipment sizes were significantly different (Kruskal Wallis Test: $H = 12.047$, $p > 0.15$) in the years 1985 to 1992. Median shipment size of lobster increased from 45 kg in 1985 to 295 kg in 1992 with a peak in 1986 of 635 kg. Median shipment size of lobster was not significantly different (Kruskal Wallis Test: $H = 42.939$, $p < 0.001$) from 1985 to 1992. Median shipment sizes of conch were low in early years

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(1985-1987) and have increased up to 386 kg in 1992. Median shipment size of conch was not however, significantly different (Kruskal Wallis Test: $H = 24.221$, $p < 0.001$) between the years 1985 and 1992.

The number of trading vessel trips per year for Carriacou and Petit Martinique has risen sharply from 44 in 1988 to 127 in 1993 with a peak of 170 in 1992. The median size of shipments has also increased from around 1000 kg to 1350 kg over the years 1988-1993, with a peak of 1500 kg per shipment in 1991. However, median size of annual fish shipments were not significantly different (Kruskal Wallis Test: $H = 132.098$, $p < 0.001$) from each other for the years 1988 to 1993. Shipment data for the Grenada Grenadines are not available separately by species category.

The total number of trips by air and sea carriers for fish shipments from St. Vincent & the Grenadines and their relative importance is shown in Figure 5. Trading vessels are the most important carriers, taking between 95 and 72% of all fish exports, although their relative importance appears to have been declining steadily from 1985, with shipments by aeroplane becoming more frequent. The number of individual trading vessel carriers in the St. Vincent Grenadines has remained around 10-12 for most of this time (1985-1992), although their numbers did peak around 1988-1989 when 17-18 vessels were recorded (Table 3). Only two vessels (Puma & Stranger Man) have remained in operation throughout the period of recording (1985-1992). Many new vessels have entered into the trade, whilst older ones appear to have dropped out (Table 3).

For Carriacou and Petit Martinique only records for fish shipments by trading vessel were available. The number of operationally active vessels has increased from 11 in 1988, to 15 in 1993, and reached a maximum of 20 in 1990 (Table 4).

For St. Vincent & the Grenadines, the total number of fish exporters increased from 13 in 1985 to 23 in 1992, peaking at 29 and 28 in 1987 and 1988 respectively. No reliable or complete data on the number of fish exporters were available for the Grenada Grenadines.

Export shipments from St. Vincent & the Grenadines from 1985 to 1992 show seasonality with exports of reef/demersal species being highest in the last six months of each year and for seine fish species, highest during the first five to six months of the year. No seasonal data were available for the Grenada Grenadines.

IMPORT DATA

Martinique imports the largest quantity of fish exports from St. Vincent and the Grenadines. Trinidad and Tobago, Barbados, U.S.A. and St. Lucia are the next most important importing countries (Table 5).

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Imports of finfish and shellfish to Martinique from Grenada and St. Vincent & the Grenadines, recorded by the Statistics Bureau of Martinique Customs from 1985-1993 are given in Figure 6. Import data for Grenada are predominantly from the Grenada Grenadines but also include data from Grenada, while import data for St. Vincent & the Grenadines includes imports both from mainland St. Vincent and the St. Vincent Grenadines.

FISH YIELD FROM THE GRENADINE BANK

Maximum and minimum estimates of annual fish yield from sections of the Grenadine Bank using data derived from various sources are presented in Table 6. Values used in Formulae 1 and 2 for calculating yield estimates from the southern Grenadines (sg) and the northern Grenadines (ng) are given below:

Key Informant Data:

Avg VCsg = 2.5, Avg VCng = 2.3, Min TMsg = 2, Max TMsg = 3,
Min TMng = 2, Max TMng = 3, AVsg = 6, AVng = 5, DPsg = 7, DPng = 9,
DTsg & ng = 1, Min DOsg & ng = 1, Max DOsg & ng = 3.

Supplying Fisher Data:

Avg VCsg = 2.25, Avg VCng = 2.25, TMsg & ng = 3, AVsg = 6, AVng = 4,
DPsg = 5, DPng = 8, DTsg & ng = 1, Min DOsg & ng = 1, Max DOsg & ng = 3.

Trading Vessel Data:

Avg VCsg = 1.8, Avg VCng = 3.6, Min TMsg = 3, Max TMsg = 4,
Min TMng = 3, Max TMng = 4, AVsg = 5, AVng = 4, DPsg = 3.5, DPng = 7,
DTsg & ng = 1, Min DOsg & ng = 1, Max DOsg & ng = 3, MAsg & ng = 12.

Minimum estimates of the total annual fish yield from the Grenadine Bank (St. Vincent Grenadines only) by key informants, trading vessel operators and supplying fishers ranged from 636 to 916 mt while maximum estimates ranged from 810 to 1182 mt (Table 6). Minimum estimates from key informant data of the total fish yield from the Grenadine Bank (St. Vincent Grenadines) were lower than other minimum estimates made by trading vessel operators and supplying fishers. Trading vessel operators, followed by supplying fishers suggested the highest estimates for the total annual fish yield from the Grenadine Bank (Table 6).

DISCUSSION

Information gathering from fishers and trading vessel operators was sometimes difficult. Grenadine fishers in particular tended to be suspicious of strangers, and trading vessel operators overly cautious of sharing information. This was probably in part due to the fact that cargos other than fish (some of which may be illicit or at least undeclared) are often carried. As a result, much of the information had to be collected subtly and almost covertly. Interestingly however,

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the results of interviews of fishers, key informants and vessel operators almost always corroborated each other.

Bequia fishers appear to be the most mobile of all the Grenadine fishers. Apart from fishing around Bequia, they fish from Mustique in the northern St. Vincent Grenadines (where accommodation is available at a minimal fee) and from Petit Tabac (Tobago Cays) in the southern St. Vincent Grenadines (where they are able to camp).

Spear fishing is more popular as a primary fishing method in the southern St. Vincent Grenadines than in the northern St. Vincent Grenadines, since reef and demersal species are targetted in the south. Seine fishing is more popular in the northern Grenadines, where coastal pelagics are targetted.

Fishers fish on a daily basis and travel to the nearest trading vessel for direct sale of their catch. This may involve crossing national boundaries. If no trading vessels are in the area, fishers do not fish.

Supplying fishers, key informants and trading vessel operators all reported that Martinique is the main market for Grenadine fish catch. This was consistent with Government export records from both St. Vincent & the Grenadines and the Grenada Grenadines. This was also consistent with the findings of Vidaeus (1969), Anderson et. al. (1982), Matthes (1984), Finlay (1990), and the CAN. & SVG. Fisheries Development Project (1991). The majority of the catch is purchased and transported by trading vessels which represent the main marketing system. Local hotels, restaurants and local consumers are the other purchasing entities in order of importance. The trading vessel marketing system is a principal contributor to the economies of the Grenadine islands and upon which large numbers of the population appear to be dependent. Although fish is at the centre of this marketing system, additional spin-off trade in retail goods has evolved over time, in association with the fish trade, which also contributes to the economies and may now be the primary earner for trading vessel operators.

The total number of vessels reported active was equal or just slightly lower than the number reported in the literature (e.g. Scott (1988) reported 11 trading vessels, Matthes (1984) reported 13, and Czekaj (1984) reported 12-15). The number of trips to Martinique reported (1-3 per month) agreed with the two trips a month assumed by the CAN. & SVG Fisheries Development Project (1991b), on the basis of a reported trading vessel loading time of 7 days and a market turnaround of 7 days.

There are two main home bases for trading vessels in the Grenadines, Bequia in the northern St. Vincent Grenadines and Petit Martinique in the Grenada Grenadines. Vessels sharing a home base also share fish purchasing sites, whereas vessels from different home bases tend to service different islands. Vessels based

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in Bequia (4) typically visit multiple fish purchasing sites within Bequia and Mustique and at Kingston in mainland St. Vincent, and one vessel also visits the more southerly islands of Canouan, Mayreau and the Tobago Cays. Vessels based in Petit Martinique (8) typically remain stationary to purchase fish, although at least one vessel also purchases from Canouan, Mayreau and the Tobago Cays, and occasional trips are made to Carriacou, Palm Island and Union Island.

Estimates of the average vessel capacity provided by key informants and supplying fishers were close, with key informants suggesting that it ranged from 2 to 2.5 mt and fishers suggesting that it ranged from 2 to 3 mt. These estimates corresponded well with the estimates of 1.5 to 3 mt reported by Scott (1988), but were much lower than the average capacity of 9.07mt reported by Matthes (1984).

Demersal and reef fish species such as snappers, groupers, hinds and parrot fish are the species most preferred by trading vessels for resale in Martinique and are purchased year round. Small coastal pelagics are also important but have lower preference and are only purchased seasonally (July-December) when importation into Martinique is not restricted by quotas.

The disparity in total annual yield estimates from the Grenadine Bank based on data provided by various informants is probably attributable to the fact that key informants are the least likely to accurately know the amount of fish taken off the Grenadine Bank since they are usually not involved in direct daily contact with vessels.

Minimum (636-916 mt) and maximum (810-1182 mt) estimates of the total annual amount of fish taken off the Grenadine Bank from trading vessel operator, and supplying fisher perspectives may be inflated because of the non-specific nature of some of the assumptions used in the formulae. However, they are well within the ranges of annual fish landings estimates recorded in the literature for both St. Vincent & the Grenadines and Grenada & the Grenada Grenadines.

For example, Formula 2 does not factor in number of trips to Martinique per month, but instead assumes that every possible opportunity is taken to trade fish during the year and that this activity is constant for 12 months a year. This may be unrealistic, given the time requirements for maintenance and recreation/vacation. Furthermore, both Formula 1 and 2 use the total number of active vessels (AV), assuming this to be constant throughout the year. Estimates of annual fish yield from the Grenadine Bank based on Formulae 1 and 2 may therefore be slightly inflated since both TM and AV are likely to vary with season.

Estimates of total annual fish yield from the Grenadine Bank based on recorded average annual fish exports from St. Vincent & the Grenadines and the Grenada Grenadines, and average annual imports into Martinique also differ; with the former (288 & 344 mt) being lower than the latter (422 mt). This could occur

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if Grenadine trading vessels understate the amount of fish they export so as to minimize export fees and the possibility of being required to pay income or other Government taxes. However, the fish purchasing agents in Martinique must pay taxes on fish imports and so also have an incentive to under-report the amount of fish imported. As a consequence, the estimates derived from both export and import records are likely to be biased downward.

Historically, the collection of good catch data (i.e. data including species composition, quantities landed and size distributions) and effort data in the Grenadines has been minimal or negligible. This is not surprising given that fish landing sites are dispersed over several islands, that catches are often transhipped directly to trading vessels without ever being landed, and that the Fisheries Divisions have generally lacked adequate manpower.

A successful fisheries data collection programme for the Grenadines will need to take not only the activities of the fishers, but also of the trading vessels into consideration, and could benefit from sampling trading vessels directly. A real-time telephone network of key informants could be used to increase the probability of vessel interception. Onboard sampling could be supplemented by using a system of purchase slips, export licenses and logbooks as suggested by Finlay et al. (1988).

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TABLE 1: Percentage response of fishers in each major area of operation on their vessels of choice for selling fish catch.

VESSEL	AREA OF OPERATION		
	NORTHERN GRENADINES (St. Vincent)	SOUTHERN GRENADINES (St. Vincent)	CARRIACOU (Grenada)
Comment	2	21	8
Gipsy Moth	0	8	8
Dowline*	2	10	0
Clariann B.	2	29	0
Minnerva	0	6	39
Deliver Us	0	6	39
Matthew*	0	2	0
Leonora S.	0	0	39
Jeffery	0	0	0
My Kindness	0	0	0
Racio	23	0	0
Content II	23	0	0
Five Nails	23	8	0
Stranger Man	21	0	0
Trafalgar Star	3	0	0
<i>Don't know all names</i>	0	2	0
<i>Sell to all vessels</i>	0	0	0
<i>Don't know</i>	0	2	0

* - Vessel names unknown. Known by names of captains.

TABLE 2: Numbers of fishers ranking fish species as "preferred", "accepted" or "sometimes" taken by trading vessels, in each of the three main areas of operation (Southern St. Vincent Grenadines (SG); Northern St. Vincent Grenadines (NG); Carriacou (Carr)).

CATEGORY	FISH SPECIES GROUPS	AREA OF OPERATION															
		PREFERRED						ACCEPTED						SOMETIMES			
		NG	SG	CARR	NG	SG	CARR	NG	SG	CARR	NG	SG	CARR				
Reef/ Demersal	snapper	25	25	19													
	hind	27	22	19													
Parrotfish	grouper	2	8	15													
	butterfish				6	3	8										
	coney	2		15													
Squirrelfish (morrion/redman)	(caca belly)	6	20	8													
	barracuda		10	4	24	15	23										13
Squirrelfish (morrion/redman)	goatfish/mullet		4		24	9	31										
	porgy		1		6	13	23										
Coastal Pelagic	kingfish							2									13
	mackerel	8	7	4	6	13											25
	cavalli	4	2					9									
	jacks	14			6	11	25										50
	robins	14			6	7											38

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TABLE 3: Number of export trips per year for named trading vessels from St. Vincent & the Grenadines (1985-1992). Data are from St. Vincent & the Grenadines Government Fisheries Division

VESSEL NAME	1985	1986	1987	1988	1989	1990	1991	1992
Boreas	2							
Lyra Kris	3							
Trait	1		6					
Zulia O	2	1	3					
Ground Dove	4	8	12					
One Way	11	9		4				
Outward Bound	15	8		2				
Belinda O	12	4	16	5				
Puma	8	4		8	13	4		1
Stranger Man	3	18	18	15	15	23	22	17
Undetermined		1						
Let Me Live	1					23		
Good Fortune		8	21	1				
Five Nails		1	4		2			
Three Stars		1	11	6	2			
Lady Jacinta				7	8			
Agatha Kerry				10	9			
Janick				3		8		
Whit				15	2	1		
Sailor				1				
Persia II				8				
Maxann O				14				
St. Martin de P.				9	9	4		
Good News				9	10	7		
Nehtry				1	17	18	3	
Clariann B				14	9	19	3	5
Baldhead II					1			
Lady Ann					3			
Georgia L.					3			
Perica					3			
Becoya I					4			
Leontine					13	3		
Janet					4	3	1	
Godspeed						1		
La Gibonne						2		
Agrionderon						1	2	
Content II						2	29	23
United Blossom							1	
Still Trying I							1	
Kate							1	5
Determined							4	1
Redstorm								1
Give Thanks &								1
Still Trying II								7
Racio								10

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TABLE 4: Number of export trips per year by named trading vessels from Carriacou and Petit Martinique (1988-1993). Data are from records collected by Grenada Government Fisheries Division Extension Officer in Carriacou.

NAME OF VESSEL	FREQUENCY OF EXPORTING TRIPS					
	YEAR					
	1988	1989**	1990	1991	1992	1993**
Content II	3	2	9	5	5	7
Georgia L.	1		8	4	2	1
Clariann B.	5		3			6
Let Me Live	5	5	8	7	5	3
Lady Antoinette	7	2	18	7	4	2
Minnerva Pride	3	7	11	5	4	4
Leonora S.	8	13	12	19	21	17
Rose Crest	5		10	9	4	5
Gypsy Moth	3		3		1	7
Vaeta	2		12	12	18	
Determination	2	6	7	6	3	6
Black Fin		3	22	20	4	1
Amanda C.			5	16	17	
Mine Rum			3			
United Blossom			10	8	5	
Comment			6	12	20	7
Janick			2	2		
Deliver Us			5	15	20	6
Minnerva			8	7	14	10
F.H.C.			5			
My Kindness				8	11	6
Contempt				5	1	
Dignity				12	8	

** Data for 1989 and 1993 are incomplete. For 1989 only data from January to May were available and for 1993 only data from January to August were available.

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TABLE 5: Distribution of all fish shipments per year from St. Vincent and the Grenadines by importing country (1985-1992). Data are from St. Vincent & the Grenadines Government Fisheries Division and show the recorded number of shipments.

COUNTRY	YEAR								Avg./yr
	1985	1986	1987	1988	1989	1990	1991	1992	
Martinique	48	71	140	160	140	118	77	85	105
Trinidad	13	4	2	5	4				4
Barbados	3	2	6			3	1	9	3
U.S.A.						1	6	14	3
St. Lucia				1	7	1	1	2	2
Dominica							6	6	2
Tortola						6	1		1
Antigua						2		1	<1
Curacao		2							<1
St. Croix				1				1	<1
Guadelope				1					<1
Grenada							1		<1

TABLE 6: Minimum and maximum estimates of the total annual fish yield (mt) from the Grenadine Bank, calculated from data given by key informants (KI), supplying fishers (SF), trading vessel operators (VO), SVG & Grenada Grenadine export records (EXP) and Martinique import records (IMP). The first given value of yield based on fisher, trading vessel operator and key informant responses is derived from Formula 1, and the second values are derived from Formula 2. The first given value of yield based on export and import data is an average for the entire period of record; the second value is an average for the last two years.

SOURCE OF ESTIMATE	PERIOD	ESTIMATED YIELD (MT)							
		SOUTHERN ST. VINCENT GRENADINES		NORTHERN ST. VINCENT GRENADINES		TOTAL ST. VINCENT GRENADINES		GRENADA GRENADINES	ALL GRENADINES
		MIN	MAX	MIN	MAX	MIN	MAX		
Y _{KI}	1993	350	540	276	414	636	954		
		498	608	322	382	820	990		
Y _{SF}	1993	486	486	324	324	810	810		
		548	704	274	329	822	1033		
Y _{VO}	1993	324	432	518	691	842	1123		
		438	598	478	584	916	1182		
Y _{EXP}	1985-1992					118		170	288
	1991-1992					118		201	319
Y _{IMP}	1988-1993					221		201	422
	1992-1993					183		239	422