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ST. VINCENT AND THE GRENADINES: RECONSTRUCTED FISHERIES CATCHES, 1950-2010

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Abstract

St. Vincent and the Grenadines is a small Caribbean island country in the southern part of the Windward Isles. Fisheries are predominantly artisanal and subsistence-based, with an industrial element only beginning in the 1990s with the introduction of a multi-gear fleet. This report is an update to a previous study that reconstructed catch data for the country from 1942-2001 and extends the time series to cover 1950-2010. Reconstructions are made for the industrial, artisanal, subsistence and recreational sectors and the total estimated catch is compared to the data officially reported to the FAO. Overall, the reconstructed catch was 1.6 times the data reported to FAO. Artisanal fisheries and subsistence fisheries contributed almost all of the fish removals, making up 98% of the catch in St. Vincent and the Grenadines, with the artisanal sector contributing 62.1% of the total.

Introduction

Study area

St. Vincent is the youngest of the major volcanic islands in the Windward group of the Lesser Antilles (Figure 1.). It lies between Grenada and St. Lucia, due west of Barbados (UNEP/IUCN 1988). Dependencies of St. Vincent include some 28 rocky islands extending south and including Bequia, Mustique, Canouan, Union and Little Vincent. The Exclusive Economic Zone of St. Vincent and the associated Grenadines occupies an area of 36,000 km² (www.seararoundus.org). Total reef habitat is estimated at 140 km² (Oliver and Noordeloos 2002) and slope and shelf area at 1,800 km² (Mahon 1993).

Fishery development

Fisheries in St. Vincent and the Grenadines are multi-gear and multi-species. Detailed descriptions are provided in Brown (1945), Vidaeus (1969), Chakalall (1982) Matthes (1984) and (Morris 1991, 1992, 1993, 1995). The reef, slope and shelf fisheries are targeted by handlines, bottom-set longlines, fish pots, spear guns and trammel nets. These capture species such as snappers (Lutjanidae), groupers (Serranidae), parrotfish (Scaridae), squirrelfish (Holocentridae), grunts (Haemulidae), surgeonfishes (Acanthuridae) and triggerfish (Balistidae). The small coastal pelagic fishery utilizes beach seines and cast nets, and captures species such as jacks (Carangidae), herrings (Clupeidae), silversides (Atherinidae), anchovies (Engraulidae), ballyhoo

(*Hemiramphus* spp.) and robins (*Decapterus* spp.). Large pelagics like tunas (Scombridae), billfishes (Istiophoridae), dolphinfish (*Coryphaena hippurus*), wahoo (*Acanthocybium solandri*), sharks (Carcharhinidae) and swordfish (*Xiphias gladius*) are caught by troll and surface longlines. Non-fish species such as lobster (*Panulirus argus*), conch (*Strombus gigas*) and sea urchins (*Tripneustes ventricosus*) are taken by divers. A small traditional whaling industry utilizing gun harpoons is also operating out of Barrouallie and Bequia (Grenadines), targeting mainly short-finned pilot whales (*Globicephala macrorhynchus*) and humpback whales (*Megaptera novaeangliae*), respectively (Brown 1945; Rack 1952; Vidaeus 1969; Adams 1971; Caldwell and Caldwell 1971; Adams 1973; Caldwell and Caldwell 1975).

There is a clear distinction between the various fisheries of importance to St. Vincent and the Grenadines. The dominant fisheries in St. Vincent are the trolling and longline fisheries targeting large pelagics, the beach seine fishery targeting small coastal pelagics and the taking of humpback whales, which are landed at Barrouallie (Chakalall 1982). Handlining for snappers and groupers, the lobster and conch fisheries and whaling for short-finned pilot whales, which are landed in Bequia, are more popular in the Grenadines (Chakalall 1982).

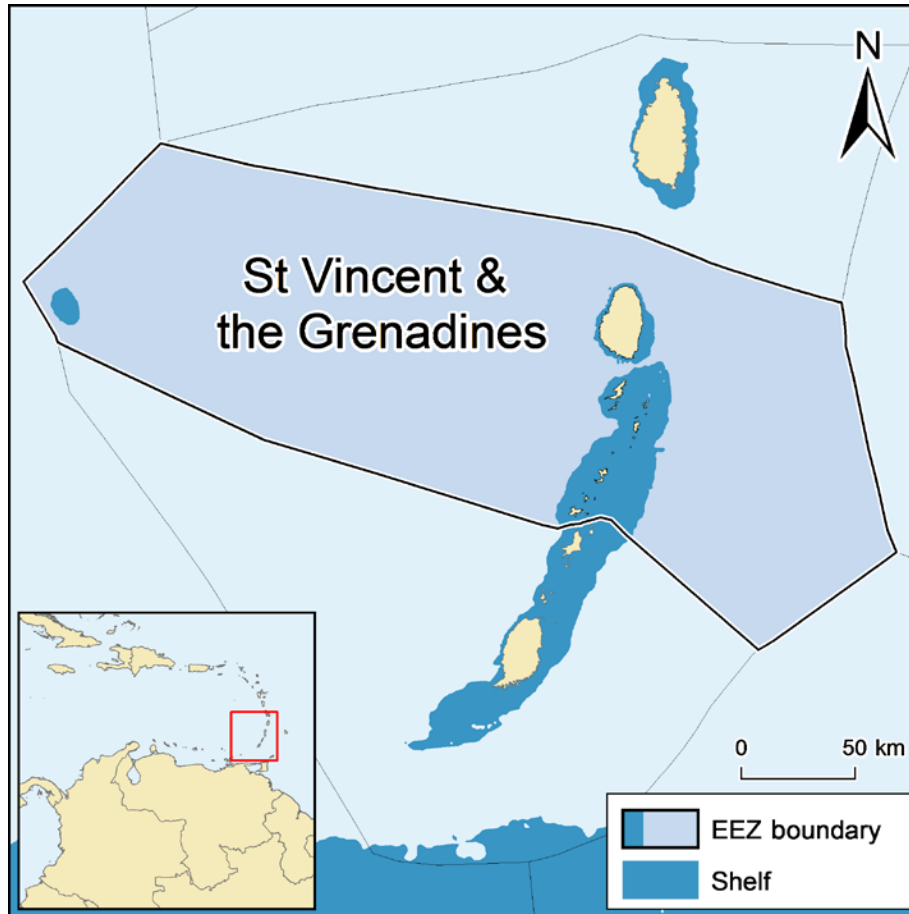


Figure 1. Exclusive Economic Zone (EEZ) and shelf area (to 200 m depth) of St. Vincent and the Grenadines in the Lesser Antilles.

Pre 1950s

Little is documented on fisheries in St. Vincent and the Grenadines prior to the 1950s. Whaling was the first important fishing industry, which was established by Americans in the early 1860s (Adams 1971), and by 1875 a local whaling station was established in Bequia, one of the Grenadine islands. Although the industry declined in the 1920s, it contributed substantially to the knowledge and technology of boat building and sailing, later required for exploiting fin fish (Adams 1971). Commercial exploitation of fish and shellfish was insignificant until the 1940s, mainly because of small and unreliable markets. The main source of protein was derived from cheap, salted cod from Newfoundland (Kurlansky 1997). The small demand for fish in Bequia resulted in little momentum to develop the fishing industry (Adams 1980). Canouan exported small quantities of processed fish to Kingstown, but transport difficulties associated with the distance between the islands limited trade. Fishing was mainly at the subsistence level in Union Island, although there was some export of turtle shell to Trinidad and processed fish to Grenville (Adams 1980).

In 1940 the government enacted a price control on fish (Adams 1985), whereby wholesale and retail prices were set according to a grading system for landed fish. The measure was implemented to ensure the affordability of fish to low income people. However, it was thought to encourage a black market in the selling and buying of fish and to act as a hindrance to the development of the industry (Adams 1985).

Fishing activity declined considerably during World War II as fishers sought alternative employment on military bases. At the end of the war, there was a mass entry to the fishing industry (Adams 1980), the only readily available employment. Under the jurisdiction of the Agriculture Department, a 'fisheries administration' was created in 1946 with the hiring of one person. This situation prevailed until 1982, when the Fisheries Division was created. Tremendous dissatisfaction with marketing conditions at the main market in Kingstown resulted in the sale of catches, particularly by fishers from the Grenadine island of Canouan, to Grenada. The higher prices and fewer restrictions in Grenada were added incentives to this activity (Anon. 1949). At the time retailing activities by fishers were prohibited in St. Vincent and the Grenadines, a regulation that was later rescinded. The price control on fish was lifted in 1946.

By the end of the 1940s, Canouan emerged as an important island for salting of fish catches (Anon. 1949), mainly demersal species caught with bank lines and fish pots. Several reports of fish trading between the Grenadines islands and Martinique indicate this activity as commencing in the late 1940s (Adams 1971) or early 1950s (Anon. 1951). Lobster, conch, turtles and demersal fish were sold to boats from Martinique.

In early 1946, an assistance scheme for the development of the shark industry in Barrouallie was implemented, but this was short lived (3 months) due to lack of technical supervision. By the end of the 1940s, there were also demonstrations on the use of trammel nets and construction of the first purse seine net (Anon. 1948). Though trammel nets later became very important in the Grenadines demersal fishery, purse seines were limited to beach seining (Chakalall 1982).

1950s to 1980

Grenadines

Little is documented on fisheries during the 1950s. However, the trade between the Grenadines and Martinique acted as an incentive to increased fishing. Between 1955 and 1958 nearly 227 t of fish was exported to Martinique (Adams 1980). Conch fishing became an important activity on Union Island (Grenadines), stimulated by the strong demand in Grenada and Trinidad, growing unemployment and the observed high abundance in nearby waters (Adams 1970). Throughout most of the 1950s and 1960s conch caught at Union Island was sold to Grenada (Adams 1980) and Trinidad (Adams 1970). During the 1960s this fishery was the most important economic activity on Union Island (Mahon 1987), although, by the early 1970s virtually all conch was sold to Martinique (Adams 1980). The resource was rare in the northern Grenadines (Bequia and Mystique) and by 1966 the resource was already showing signs of depletion in established fishing areas due to overfishing (Adams 1970).

Fishing in the 1960s was still mainly a subsistence activity with most fishers operating on a part-time basis (Vidaeus 1969). Activities at Canouan received government support through the introduction of a cold storage facility and construction of a loading jetty in Canouan in 1960 (Anon. 1961). Iced and salted fish were purchased from the island and sold in the main market at Kingstown in St. Vincent and in Grenada. An auxiliary sloop was introduced in 1962 to transport ice to Canouan and purchase iced fish from the island. The sloop also transported fish to neighbouring islands of St. Lucia and Dominica (Lewis 1964). By 1964 however, fishers had reverted to drying and salting fish for sale in St. Vincent or Grenada. Bequia had emerged as an important trading island for lobster and demersal fish and two trading schooners from Martinique were sent to the Grenadines each month for this purpose (Lewis 1964).

The government's policy of increased fish production was manifested in its participation in a joint program sponsored by the United Nations Development Program (UNDP) and the Food and Agriculture Organization (FAO). The Caribbean Fishery Development Project supported market development and the training of fishers (Vidaeus 1969). Financial assistance was provided through a loan scheme initially implemented by the Agricultural Department in the early 1960s which was taken over by the St. Vincent Agricultural and Co-operative Bank in 1969. This offered duty-free privileges for the purchase of engines, timber (for boat construction) and gear. However, there were problems with the efficient implementation of the scheme (Vidaeus 1969). In 1963, a four-fold increase in the catches of blackfish (short-finned pilot whale) over the previous year was attained through the introduction of mounted harpoon guns (Lewis 1964).

A fisheries development program was instituted in association with the Ministry of Overseas Development in the United Kingdom in the early 1960s, which included infrastructure development in Canouan and cold storage and ice facilities at Kingstown. The government also granted licenses to companies in the French Antilles facilitating the purchase of fish from the Grenadines at guaranteed prices. This arrangement did not last very long, however, and was eventually abandoned. In addition to Martinique, fish from the Grenadines (Canouan and Bequia) were sold to Guadeloupe (Vidaeus 1969).

St. Vincent

Most fishing off St. Vincent was conducted off the west and south coasts at which there were ten 'fishing centers'. Facilities at the 'fishing centers' included, at most, a shed used as the fish market and running water. No fuel facilities were available. Fishing on the windward (east) coast was insignificant and there were no fishing centers. Three of the fish markets (Chateau Belair, Layou and Calliaqua) were the property of the Town Board, while the main market in Kingstown was administered by the St. Vincent Marketing Board. The price control implemented in 1940 was discontinued (Vidaeus 1969). However, a new fish marketing scheme was implemented in the Kingstown market in 1969: the market had the sole buying authority and guaranteed a fixed price to fishers, based on a new pricing structure. The intention was to relieve the fishers of dependency on 'middle-men' and thereby promote increased fishing and a better supply of fish to the public.

In the early 1970s, only 6 percent and 14 percent of the fleets in St. Vincent and the Grenadines, respectively, were motorized (Cecil 1972). Although it is reported that engines were being used 15-18 years previously, the bulk of the engines were acquired from the early 1960s.

The blackfish (pilot whale) industry also started to decline in the 1970s (Adams 1973). This was attributed to reduced interest by potential fishers, increased evasion of whales from the sounds of motorized boats, world inflation and associated high fuel and equipment costs as well as the 1972 U.S. Marine Mammal Protection Act which prohibited the export of high priced melon oil to the U.S. Depletion of lobsters and turtles was apparent by the mid-1970s (Anon. 1975) and consideration was being given to the extension of closed seasons for these resources.

In the 1970s, the government sought to decrease the substantial imports of processed fish by increasing local fish catches. In addition to increasing the number and technical capability of staff, improved methods of fish harvesting, greater monitoring of duty-free importation and other incentives such as fuel subsidies, establishment of fishing co-operatives and revitalization of the blackfish (pilot whale) industry were also to be introduced. International assistance was sought to address inadequate cold storage and processing capabilities (Anon. 1975). Efforts to set up fishing co-operatives continued throughout the late 1970s (Anon. 1979). The smuggling of lobsters, fish and conch from the Grenadines by boats from Martinique was a major on-going problem, especially since the activity was supported by local fishers who obtained high prices for their catch (Anon. 1979).

1980s

In August 1980 Hurricane Allen caused fleet and gear damage of about US\$ 26,000. Altogether, 31 boats were affected and beach seines and fish pots were destroyed (Anon. 1980). At this time fishers were also complaining about the sharp increases in fuel prices and the lack of a proportional increase in fish prices (Anon. 1980). This resulted in a decline in fishing activity. Exports from the Grenadines were particularly affected as only 2 boats operated in 1980. Apart from high fuel costs, the high costs of engines and scarcity of spare parts were also contributing factors to the substantial decline in fishing activity. At this time, several resources were already showing signs of over-exploitation (Matthes 1984). Conch catches were limited, with exports going primarily to Martinique (Mahon 1987). The use of Scuba gear and faster boats utilized in the fishery suggested that greater effort was required to extract the catch from depleted populations (Chakalall 1982). Smaller sizes of lobsters in the catch and unavailability in shallow waters suggested a similar fate of this resource. Fishers responded by fishing in deeper waters. The whaling industry was also in decline.

The general consensus was that demersal resources, excluding lobster and conch, could withstand an increase in artisanal fishing effort (either by increasing the number of boats or the efficiency of existing methods).

However, industrialization of the fleet was not recommended until the status of the resource was determined. It was felt that the pelagic fishery could accommodate an increase in fishing effort, though under controlled conditions to avoid population declines in trans-boundary stocks. Unlike neighbouring islands, the flying fish fishery was not important in St. Vincent and the Grenadines. This fishery was seen as another avenue for development (Chakalall 1982).

Most attempts to set up fishing co-operatives failed, except for those under the guidance or control of the fisheries administration. A loan scheme was still in effect, and engines and gear were provided free of duty. However, facilities at the major fish market in Kingstown were in disrepair and there was no organized marketing scheme. Wholesale and retail prices were still under government control (Morris 1984). Fishing activity was still largely for subsistence as most fishers operated part-time, and had alternative sources of employment (Matthes 1984).

Japanese assistance commenced in 1987 and was aimed at development of offshore fisheries, domestic distribution, export systems, and training of fishers (St. Vincent Fisheries Department 1999). These came to fruition in the 1990s.

1990s

A joint project funded by the government of St. Vincent and the Grenadines and the Canadian International Development Agency was implemented in the early 1990s (St. Vincent Fisheries Department 1999). The project aimed to support and enhance the St. Vincent and the Grenadines fisheries institutional capacity, community self-help activities and organizations, and to allow sustainable growth of the industry.

Significant development was also achieved through a Japanese Grant Aid Program. This included the upgrade of facilities at the main market at Kingstown (Morris 1992) and construction of fisheries centers at Union Island, Canouan, Bequia and Calliaqua (St. Vincent Fisheries Department 1999). In 1991, five new 12.5 m multi-gear boats equipped with longline and trolling gear were acquired from Japan (Mahon and Singh-Renton 1992) This marked the establishment of a tuna longline fleet resulting in escalation of the importance of large pelagic resources such as tuna, billfish and shark in the 1990s (Morris 1992, 1995). Research and management support to assess the status of pilot whales and the bottlenose dolphin were also sought from the Japanese Grant Aid Program. Another program in collaboration with St. Lucia and Grenada aimed at assessing the status of the Warsaw grouper (*Epinephelus nigitus*).

Fisheries were still predominantly small-scale and artisanal (Morris 1995) with most boats being open and powered by outboard engines. However, by the end of the 1990s considerable infrastructural development had occurred in the Grenadines (Paget Farm, Britannia Bay, Mystique, Friendship, Clifton) and Calliaqua in St.

Vincent (Straker 2001). Similar facilities were planned for Barrouallie and Chateaubelair. The improvement and establishment of facilities as well as the increased harvesting of off-shore fisheries are indicative of the future developments in the fisheries sector.

Fisheries statistical data collection

Prior to 1992 data collection was confined to landings at the major market at Kingstown and exports from the Grenadines to Martinique. The Barrouallie Fisherman's Co-operative Society had historically recorded captures of whales and porpoises (Adams 1973). In the 1960s fish landings at the market represented 60 percent of total landings throughout St. Vincent and the Grenadines (Vidaeus 1969). In 1988 plans were formulated under the Organization of Eastern Caribbean States (OECS) for a revised data collection system (Morris *et al.* 1988). This revised data collection system was implemented in 1992 under the CARICOM Fisheries Resource Assessment and Management Program (CFRAMP) and is still in effect. A system of random stratified cluster sampling was implemented at seven zones, with catch and effort data recorded at representative sites within each zone. Landing sites are categorized into primary, secondary and tertiary sites based on the number of fishing boats landing regularly at the site, the amount of fish landed and the level of infra-structure development (Straker 2001). At Kingstown and Barrouallie there are two primary sites, 14 secondary sites and 20 tertiary sites. Data are also collected from trading boats operating in the Grenadine/Martinique fish trade. Total landings are estimated by applying a raising factor to account for days when data are not recorded. A licensing and registration program is in effect and an inventory of distant water fishing boats registered with St. Vincent and the Grenadines is maintained. The Trip Interview Program (TIP), a data management program introduced under the CFRAMP, is presently being used for data entry, management and analysis.

Fisheries policy

The fishery policy in the 1980s focused on the provision of jobs in the industry by upgrading the performance of existing fishers and improving services and facilities (Andersen *et al.* 1983). St. Vincent, and the Grenadines, being a member of the Organization of Eastern Caribbean States (OECS), has also enacted associated harmonized fisheries legislation. Presently the three pieces of legislation governing fisheries management include: the Maritime Areas Act No. 15/1983 declaring an Exclusive Economic Zone; the Fisheries Act No. 8/1986 for the promotion and management of fisheries and related matters and the Fisheries Regulations for controlling foreign fishing and the use of fish aggregation devices, establishment of fish processing plants, implementation of fishery conservation measures and the conduct of fisheries research (St. Vincent Fisheries Department 1999). The aim of policy in the 1990s was to promote sustainable utilization of all fishery resources within the EEZ (Morris 1992), through the gradual development and expansion of a national offshore fleet, while ensuring the existence of a legal framework for protection of the smaller artisanal boats that traditionally targeted the same species. Details of the current fisheries management policy, objectives and regulations are provided in Table (1).

Table 1. Management policy, objectives and regulations of the St. Vincent and the Grenadines fisheries. (FAO 2007)

Fishery	Target Species & Gear	Stock status	Management policy and objectives	Regulations
Shallow shelf and reef fish	Species: groupers, seabasses, parrotfishes, squirrelfishes, grunts, surgeonfishes and triggerfishes Gear: fish traps and demersal hand lines	Over-exploited due to increasing fishing effort, destructive fishing practices and habitat degradation and destruction	To promote stock recovery	Prohibition of use of dynamite, poisons and other noxious substances. Restricted use of spear guns. Restricted size and types of gear. Closed seasons and areas. Effort reduction. Co-management promoted.
Deep-slope fish resources	Species: Snappers and groupers Gear: demersal handlines and bottom set longlines	Anecdotal evidence suggests that the fishery is under-exploited	To maximize catches within limits of the potential yield To apply a precautionary approach to management due to unquantified foreign illegal fishing and the high vulnerability to overexploitation during spawning aggregations	Restriction on mesh size of traps
Coastal pelagics	Species: Jacks, herrings, silversides, anchovies, ballyhoo, robins and scads (<i>Decapterus</i> spp.) and small tunas Gear: seine and SCUBA divers, gillnets	Anecdotal information suggests moderate exploitation	To encourage co-management and maintain the artisanal nature of the fishery	Minimum mesh size restriction on seines, trammel nets prohibited and restrictions on the use of ballyhoo nets. Fishing prohibited in marine reserves (being expanded) and land based pollution as well as coastal development are controlled.
Large pelagic fish resources	Species: Tunas, billfishes, dolphinfish, wahoo, sharks, swordfish, whales and porpoises Gear: troll lines and by "multi-purpose" boats (assumed using pelagic lines such as longlines)	Status of small tunas, dolphinfish and mackerels is unknown. ICCAT assessments indicate that large tunas and billfishes are either fully exploited or over exploited.	To cooperate with members of ICCAT, particularly Caribbean states, to assess, protect and conserve large pelagics and to promote development of the commercial and sport fisheries.	To continue negotiations leading to ratification of an OECS common fishing zone agreement (a National Boundary Negotiating Committee exists). To draft a regional management plan with other Caribbean states to manage the fishery. To continue participation in ICCAT and to adopt ICCAT conservation measures. To cooperate regionally in monitoring, control and surveillance. To improve data quality and to expand markets by increasing value added products. St. Vincent and the Grenadines became Contracting Party to ICCAT in 2006
Lobster	Species: Caribbean Spiny Lobster Gear: SCUBA diving with wire nooses	Considered overexploited in near shore areas	To manage the resources on a sustainable basis and to rebuild stocks in depleted areas	Closed season, minimum size limits, restrictions on fishing gear and restrictions on taking berried females or moulting individuals.

Table 1. Management policy, objectives and regulations of the St. Vincent and the Grenadines fisheries. (FAO 2007)

Fishery	Target Species & Gear	Stock status	Management policy and objectives	Regulations
Conch	Species: Queen conch (based on species harvested in other islands) Gear: free diving, hand collection	Unknown, however conch is over-exploited in other countries in the Caribbean	To manage on a sustainable basis by preventing resource depletion where it has not already occurred and by controlling fishing effort	Size restrictions, minimum shell length and meat weight. Harvesting of conch with a flared lip is prohibited.

Objectives

This report is an update and extension to a previous study by Mohammed *et al.* (2003) that assembled a time series of catch and effort data for St. Vincent and the Grenadines for 1942 to 1999 to enable assessment of the ecosystem impacts of fishing. The present extension covers the time period 1950-2010 and provides a sector analysis as well as comparing the reconstructed catches with the data officially reported by the FAO. Furthermore, small updates were made to the Mohammed *et al.* (2003) data to comply with *Sea Around Us* database definitions.

METHODS

Catches

Most available data were from recorded landings at the fish market in Kingstown. Fish from throughout St. Vincent (but mainly the leeward coast) and the Grenadines were transported to this market. Information in Brown (1945) and Vidaeus (1969) was used to disaggregate recorded catches into the respective components for St. Vincent and the Grenadines. Landings attributed to St. Vincent accounted for 50 percent in the early 1940s to 60 percent from the late 1950s to late 1960s (Vidaeus 1969). It was assumed that minimal landings from the Grenadines were transported to St. Vincent after the late 1960s as the fish trade with Martinique was well established after this point (Chakalall *et al.* 1997). Landings at the Kingstown market were reported to represent 50 percent of the overall landings in St. Vincent during the early 1940s to mid-1960s; 60 percent from the mid to late 1960s and declined steadily from 45 percent in the late 1960s to 29 percent in 1995.

St. Vincent

Anchor Points

1948-1949: Recorded landings at the Kingstown Fish Market were available in the annual reports of the Agricultural Department. Data were adjusted accordingly to represent total catches in St. Vincent only, assuming that the recorded data represented 50 percent of total landings in St. Vincent. The report of 1949 also provided data for landings at Layou and Calliaqua which were estimated to represent 3.4 percent and 6.4 percent of the total, respectively.

1958-1968: Recorded landings at the Kingstown market were available in Vidaeus (1969). Data for 1959 to 1964 matched those in the Colonial Report (Part I) of 1964/65 (Anon. 1965). Data for 1962 to 1964 matched those in the Fisheries Report of Lewis (1964). Recorded data in the Colonial Report exceeded that from other sources for 1965. This higher estimate was used in calculations. It was assumed that 60 percent of recorded landings were from catches by the St. Vincent fleet and that recorded catches represented 60 percent of the overall total for the island.

1975-1981: Chakalall (1982) provided data on fish landings at the Kingstown Fish market. He assumed this represented 45 percent of the total fish catch in St. Vincent, which was used in estimation of the associated annual total catch. The St. Vincent Fisheries Department's Statistical Database also provided data on landings at the Kingstown Fish Market from 1979 to 1981. However, these estimates were lower than those stated in Chakalall (1982) and were also lower than estimates from the Agricultural Department for 1979 and 1980. The higher estimates were used in subsequent analyses.

1982-1999: Data were obtained from the St. Vincent Fisheries Department's Statistical Database. Prior to 1993, data consisted solely of landings at the Kingstown Fish Market and exports, mainly from the Grenadines Islands. Beginning in 1993, data sources consisted of 1) a total census of landings at the Kingstown Fish Market; 2) data from 36 additional landings sites obtained from a random stratified cluster sampling system; and 3) fish exports. It was assumed that landings at the Kingstown Fish Market accounted for 45 percent of total landings in St. Vincent prior to 1985. Since data on landings at the Kingstown market were not available for 1993 and 1994, the estimated total landings for 1995 (which utilized data for both the Kingstown market and other landing sites) was used to estimate the relative contribution of catches from the Kingstown Fish Market (46.6 percent) to the overall total. The relative contribution of landings at the Kingstown Fish Market to overall total landings in St. Vincent between 1986 and 1994 was estimated by interpolation between the 1985 and 1995 values. This was used to derive estimates of total annual catch for 1985 to 1992 from recorded data at the market.

First interpolation: Total catches

Total catches were interpolated between the anchor points above to estimate catch for the periods 1950 to 1957 and 1969 to 1974.

Second interpolation: Species composition

There was no documentation on species composition prior to 1967. (Brown 1945) derived a crude estimate of total catch by fleet. Although the estimate was not used in the actual catch reconstruction because of

uncertainties associated with the magnitude of total catch and respective fleet catches, it was used to apportion the 1942 catch into the respective offshore and inshore components. It was assumed that catches from part-time fishing comprised solely of inshore species, harvested during the pelagic off-season (Vidaeus 1969) provided information on the species composition of landings at the Kingstown Fish Market in 1967 and 1968. This comprised of 12 species: robin (*Decapterus macarellus*), jacks (*Selar crumenophthalmus*), skipjack tuna (*Katsuwonus pelamis*), redfish (Serranidae and Lutjanidae), hind (*Epinephelus guttatus*), dolphin (*Coryphaena hippurus*), sprat (*Harengula jaguana*), ballyhoo (*Hemiramphus brasiliensis*), dodger (*Decapterus punctatus*), bonito (*Thunnus atlanticus*) and barracuda (Sphyraenidae). All other species were grouped in an aggregate category accounting for 6-14 percent of the total. The species composition between 1969 and 1978 was estimated by interpolation between estimates for 1968 (Vidaeus 1969) and 1979 (based on the Fisheries Department's Statistical Database on recorded catches at the Kingstown Fish Market). The proportion of total catch attributed to the offshore and inshore fisheries between 1943 (Brown 1945) and 1966 was estimated by interpolation between 1942 (Brown 1945) and 1967 (Vidaeus 1969) estimates. The corresponding estimates of offshore and inshore catch were calculated as the product of the respective annual proportion of total catch and the total catch estimated previously. Between 1979 and 1992 the species composition from recorded data at the Kingstown Fish Market was assumed representative of total catches. In all instances, the actual species weights were estimated using the associated species composition and estimated total catch. Estimated annual total landings by species were available for 1993 to 1999 from the St. Vincent Fisheries Department.

The Grenadines

Anchor points

1949: Assuming the same relative contributions of St. Vincent and the Grenadines to the 1942 total catch, and using the 1949 estimate of total catch for St. Vincent (Anon. 1949), an estimate of 265 t was derived for the Grenadines.

1958-1968: Vidaeus (1969) provided data on recorded landings at the Kingstown Fish Market, 40 percent of which was assumed to be landed by boats from the Grenadines. Based on a crude estimate of total annual landings of the respective fleets using assumed catch rates for the respective islands (Vidaeus 1969), St. Vincent and the Grenadines accounted for 55 percent and 45 percent of the total landings, respectively. Total annual landings in the Grenadines were estimated using the relative percentage contributions and estimates of total landings derived for St. Vincent. It was assumed that Grenadine landings at the Kingstown market were also accounted for using this method. Recorded landings at the Kingstown market accounted for 35-49 percent of total annual catches in the Grenadines using this method.

1975-1980: Chakalall (1982) gave exports of fish from the Grenadines derived from statistics of the Fisheries Division, Ministry of Agriculture, Trade and Tourism. Specific limitations of the data include the non-

inclusion of fish consumed locally as well as unofficial exports and the inaccuracy of weights which are usually estimated by eye rather than measured directly. Export data for 1979 was taken from the Annual report of the Agricultural Department for the respective year (120 t) as this slightly exceeded the estimate for the corresponding year in Chakalall (1982). Export data for this period represent minimum estimates as these include exports from Union Island but exclude exports from Bequia and Canouan. Fish exports represented about 60 percent of total catch (Matthes 1984), hence recorded exports were adjusted accordingly to represent total catch. Based on raised estimates for 1993 (provided by the St. Vincent Fisheries Department), Union Island accounted for 38.54 percent of total catches from the Grenadines. Export data were adjusted accordingly to account for landings at Bequia and Canouan in total catch estimates for 1979 and 1980.

1981-1994: Data were available from two main sources. Firstly, the Statistics Bureau of Martinique Customs summarized in Chakalall *et al.* (1997) gave estimates of fish imports from St. Vincent and the Grenadines from 1981 to 1993. Secondly, records of the St. Vincent Fisheries Department statistical database provided data on fish exports from 1984 to 1994. Based on Matthes (1984) and Morris *et al.* (1988), fish exports were assumed to account for 60 percent of total landings of seine and demersal fish caught in the Grenadines. Exports from St. Vincent were assumed negligible. Annual catch was estimated by adjusting export data accordingly. Except for 1989 and 1993, data from Chakalall *et al.* (1997) exceeded corresponding estimates in the Fisheries Department Statistical Database. In all instances the higher estimates were used, consistent with a precautionary approach to assessment.

1995-1999: Estimates of total catch were provided by the St. Vincent Fisheries Department for 1995 to 1999. These estimates were derived from recorded data for 15 sites in the Grenadines (Admiralty Bay; Friendship Bay; Lapompe Bay; Lower Bay; Paget Farm; Shipping Bay; Trading Boats; Ashton; Canouan; Clifton; Palm Island; Petit Martinique; Petit St. Vincent; Saline Bay and Union Island). Recorded data were adjusted to account for non-enumerated days.

First interpolation: Total catches

Annual total catches for 1943 to 1948 were estimated by interpolation between the 1942 estimate (Smyth 1957) and the 1949 estimate (Anon. 1949). Similarly, estimates were derived for 1950 to 1957 and 1969 to 1974 using the anchor points described previously.

Second interpolation: Species composition

1984-1991: Export data were disaggregated for specific groups only. These included lobster, conch, whelk (*Cittarium pica*), turtle and tri-tri (*Sicydium plumieri*), while all other fishes were aggregated into one category. No data were available from which the aggregate fish category could be disaggregated into its species components. Based on Chakalall *et al.* (1997) the species preferred by trading boats from Martinique are

snapper, red hind, grouper, butterfly/coney (*Cephalopholis fulva*), caca belly/parrotfish (*Sparisoma aurofrenatum*), mackerel, cavalli (*Caranx* spp.), jacks and robins.

1993-1999: Export data are disaggregated into the respective species groups according to Morris (1995). There is however, a high level of aggregation in 1993. Exports of large pelagics, including yellowfin tuna (*Thunnus albacares*), swordfish and bigeye tuna (*Thunnus obesus*) were assumed to have originated from St. Vincent.

Update

Calculating totals

2000-2010:

For the update, catches were extrapolated forward to 2010. This was achieved by first calculating the ratio of overall reconstructed catches to the FAO total for each year and taking an average of the ratios 1995-1999. The average ratio was applied to the FAO total for each year 2000-2010 to estimate an overall catch for the islands in each year. This estimation was split by the average percentage contribution of St. Vincent and the Grenadines to the total reconstructed catch for 1995-2000 to give an estimated catch total for each of the areas in 2000-2010.

Species breakdown

St. Vincent:

1950-1966

As no species composition was documented prior to 1967, a taxonomic breakdown was estimate using the average proportion of species in 1967 and 1968. These percentages were applied to the totals for offshore and inshore catches for 1950-1966.

2000-2010

A taxonomic breakdown was estimated by applying the average catch contribution of each species in 1998 and 1999 to the total catches in each year 2000-2010.

Grenadines:

1950-1993

There was no taxonomic data prior to 1984 and information was only disaggregated for certain taxonomic groups prior to 1993, so an estimation of breakdown was applied to each year's catch totals based on the average taxonomic composition for 1994-1996.

2000-2010

A taxonomic breakdown was estimated by applying the average catch contribution of each species in 1998 and 1999 to the total catches in each year 2000-2010.

Marine Mammals and Turtles

Mohammed *et al.* (2003) reported on reconstructed catches of marine mammals and turtles. However, the *Sea Around Us* does not include these taxa, thus marine mammal and turtle catches were excluded from the database and final reconstruction totals.

Large oelagics

For the purposes of this reconstruction, industrial-scale tuna catches were not included and are considered by the *Sea Around Us* elsewhere.

Sector breakdowns

Industrial

Catch data for St. Vincent and the Grenadines did not contain information on sectorial contributions, so an industrial component had to be estimated. Industrial catches were assumed to begin with the introduction of the larger multi gear boats in 1991 and restricted to the offshore element of the catch. Therefore, the total separate offshore catches for St. Vincent and the Grenadines were split by percentage from 0% industrial catch in 1990, and conservatively assuming that 50% of offshore catches were industrial by 2010. The proportion of industrial contribution to the offshore catch was interpolated for each year 1990-2010 and applied to the annual offshore catch total to estimate a catch for the sector in each year.

Artisanal

It was assumed that all inshore catches and the proportion of offshore catches that were not classified as industrial were from the artisanal sector.

Subsistence

The reconstruction may already address part of the subsistence contribution for the islands, in terms of parts of reported catch that was landed through reporting stations but taken home, but it is likely that fishing purely for subsistence by passed the reporting process. Using case studies from Martinique, Dominica, Guadeloupe, Montserrat and St Kitts and Nevis (Frotté *et al.* 2009a, 2009b; Ramdeen *et al.* 2012; Ramdeen *et al.* 2014a; Ramdeen *et al.* 2014c), an approximate average *per capita* subsistence rate of 0.013 t·person⁻¹·year⁻¹ in 1950 and 0.006 t·person⁻¹·year⁻¹ in 2010 was calculated and an interpolation applied for the intervening years. We conservatively applied 50% of this to the population for St. Vincent and the Grenadines for the 1950-2010 time

period to estimate a subsistence catch. This is a highly simplified approach and it is likely that subsistence catches are underestimated.

Taxonomic breakdown

A taxonomic disaggregation was achieved by assuming that the subsistence catch composition was proportionally similar to the inshore catch and applying the same percentage breakdown for each year to the estimate subsistence annual totals.

Recreational

Recreational participation in Antigua and Barbuda was found to be 0.23% of the total population (Cisneros-Montemayor 2010; Cisneros-Montemayor and Sumaila 2010) and the same rate was assumed to be true of St. Vincent and Grenadines. It was assumed that the vast majority of recreational fishers were tourists, so the rate was applied to the tourist population. Tourist arrivals data was only available from 1995¹, so estimated tourist numbers for 1950-1994 were calculated by interpolating from 60,000 tourists in 1995 to an assumed 0 tourists in 1945. Recreational participation was then calculated by applying the 0.23% participation rate to the tourist numbers. Ramdeen *et al.* (2014b) estimated a consumption rate of 0.001 t·tourist⁻¹·year⁻¹ for the British Virgin Islands, which we assumed to be the same for St. Vincent and the Grenadines and applied it to the estimated participation total for each year 1950-2010 to obtain a recreational catch for both islands combined.

Taxonomic breakdown

Mike and Cowx (1996) reported on the domestic recreational fishery in Trinidad and Tobago and estimated the percentage of each fish taxa sold. This was used as a proxy for the composition of recreational catches in St. Vincent and the Grenadines. The proportion of each taxa sold was estimated from Mike and Cowx (1996) and then all percentages were normalised to give a species breakdown for the recreational sector, which was applied to the estimated total for each year.

Discards

No discards were calculated for this study.

RESULTS

Fisheries catches

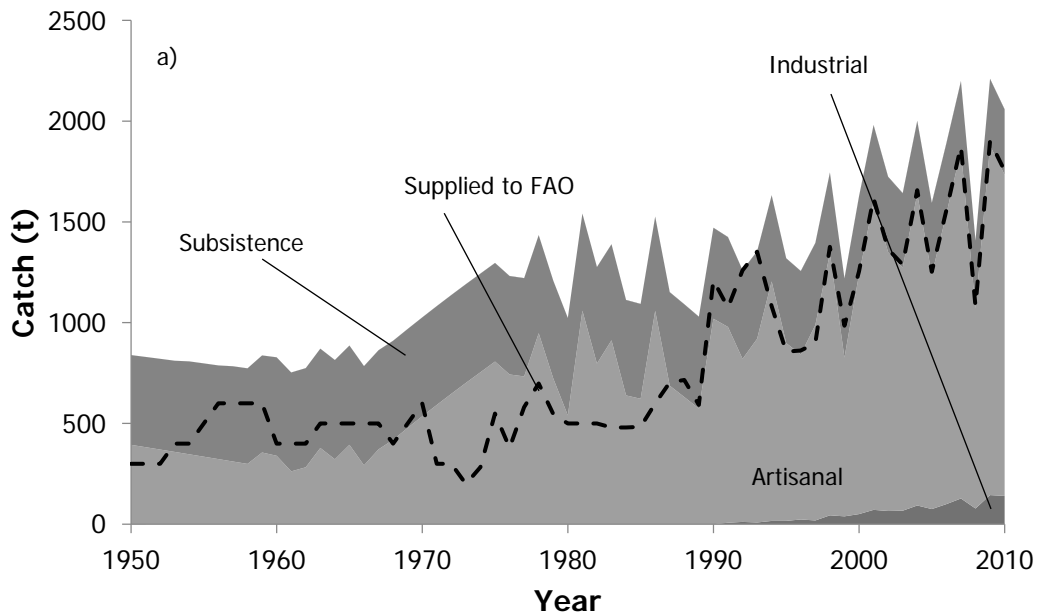
Reconstructed total catches for St. Vincent and the Grenadines were 1.6 times the total reported to the FAO for the period 1950-2010. The majority of the reconstructed catch was artisanal, making up 62.1%, with subsistence fishing contributing a further 36.2%. Industrial fisheries and recreational fisheries made up only 1.6% and 0.1% of the total catch, respectively.

¹ <http://data.worldbank.org/indicator/ST.INT.ARVL?page=3>

The reconstructed catch followed an overall increasing trend during the time period, with total catches remaining relatively static throughout the 1950s and most of the 1960s, averaging 810 t·year⁻¹ for 1950-1967, followed by a steady increase until the late 1970s. Catches again levelled out, averaging 1,300 t·year⁻¹ for 1980-1995, with periodic spikes every few years. Overall, catches increased to the end of the time period, but with significant fluctuations, particularly a large decrease in 2008 where catches dropped to 1,410 t, which was followed by an immediate recovery to 2,210 t, the maximum catch for the time period (Figure 2a).

The mackerel scad (*Decapterus macarellus*) was the most prevalent species in the catch, making up 22.3%, followed by bigeye scad (*Selar crumenophthalmus*) with 12.9%, red hind (*Epinephelus guttatus*) with 7.1% and the Caribbean spiny lobster (*Panulirus argus*) at 7% (Figure 2b).

St. Vincent contributed almost two thirds of the catch for the country, with 63% of total catches through the time period, with the Grenadines making up 37% (Figure 3). Catch trends in St. Vincent largely followed the overall catch, although there was a significant drop from the late 1970s until 1990 when catches recovered to mid-1970s levels, around 1,100 t·year⁻¹ (Figure 3). In the Grenadines, catches decreased from 1950 to the late 1970s, before dramatically increasing with a large spike in the early 1980s, before decreasing again until the late 1990s. The reconstruction shows a recovery at the start of the 2000s and relatively stable catches throughout (Figure 3).



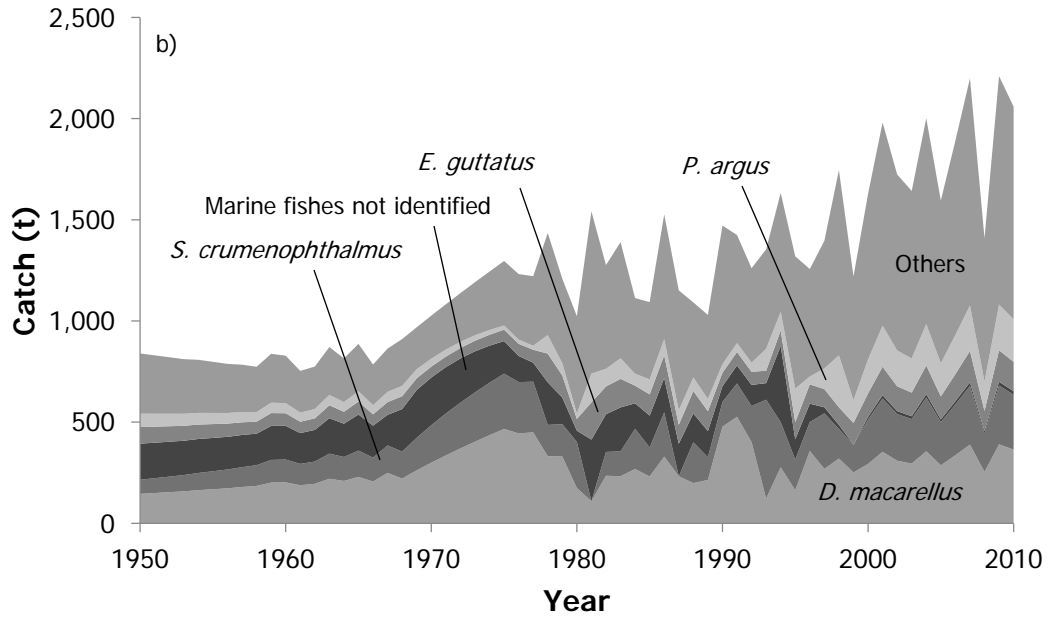


Figure 2. Reconstructed catches for St. Vincent and the Grenadines from 1950-2010 by a) fishing sector, with data officially reported to FAO overlaid as line graph; and b) major taxa, with 'others' accounting for an additional 84 taxa.

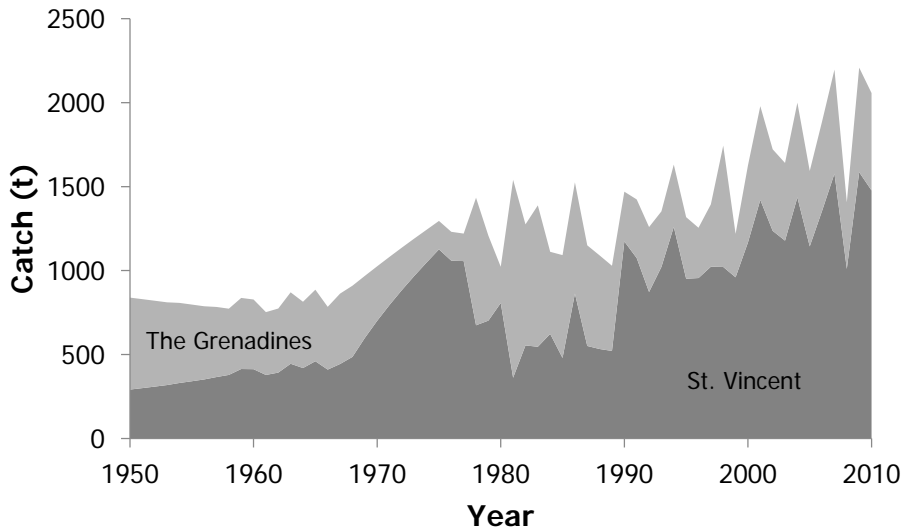


Figure 3. Contribution of St. Vincent and the Grenadines to the overall reconstructed catch total, 1950-2010.

Industrial

Reconstructed industrial catches began in 1991 and rose steadily from 7 t in 1991 to a maximum of 145 t in 2009. The most prevalent fish in the sector were dolphinfish (*Coryphaena hippurus*, 33%), Wahoo (*Acanthocybium solandri*, 28%), and halfbeaks (Hemiramphidae, 28%), making up over 88% of the total industrial catch.

Artisanal

Artisanal catches made up the majority of the catch and followed the overall trend for the country, beginning at almost 400 t in 1950, with a slight decrease to 260 t in 1961, before steadily rising with several fluctuations to almost 1,600 t in 2010. Mackerel scad (20%), bigeye scad (13%) and spiny lobster (7%) were the most important components of the sector.

Subsistence

Catches in the subsistence sector were relatively stable over the time period, averaging 480 t·year⁻¹ from 1950-1980 and then slowly decreasing to 320 t in 2010. Mackerel scad (26%), bigeye scad (16%) and red hind (8%) were the largest contributors.

Recreational

The recreational fishery was minimal throughout the time period and, although catches gradually increased each year, the sector contributed less than 1 t·year⁻¹ until the early 1980s. Throughout the 2000s, catches averaged 1.9 t·year⁻¹. Serra Spanish mackerel (18%), king mackerel (16%), snappers (13%) and jacks (12%) were major contributors.

Other catches

Since St. Vincent operates an open register for foreign boats, catches are reported for several regions, including the north Atlantic and Pacific regions. Thus, St. Vincent is essentially a Flag-of-Convenience country. Only catches in the western central Atlantic region are presented here, since these reflect catches of the local St. Vincent and the Grenadines fleet.

DISCUSSION

Fisheries catches

Reconstructed catches were consistently larger than the reported totals and the update of Mohammed *et al.* (2003) to extend the time period demonstrates a continued increasing trend with annual fluctuations. The catch reconstructions indicate a general growth in catches from the mid-1960s onwards, with an increase of almost

275% between 1962 and 2010. This growth was attributed mainly to increased landings in the St. Vincent inshore fishery. Boat mechanization began in the late 1950s (Cecil 1972), and throughout the 1960s there were financial incentive programs to encourage fishery development. Reconstructed data for the late 1950s and throughout the 1960s in the artisanal fishery was lower than data in FAO FISHSTAT for corresponding years. This may be due to underestimation in this study, but is more likely due to the inclusion of catches by foreign fleets in data submitted to the FAO. Vidaeus (1969) reported on activities of foreign boats during this time, however, there was no documentation on the magnitude of the catches or the associated fishing areas. Despite tremendous inter-annual variability, increasing catches throughout the 1980s reflect the government's efforts to increase local fish catches and employment in the fishing industry (Chakalall 1982). The higher catches reported to the FAO in the 1990s, compared to reconstructed data in the artisanal fishery can only be accounted for by inclusion of catches of foreign boats registered in St. Vincent but fishing in the western central Atlantic. St. Vincent has an open boat registry, with foreign boats fishing in the Pacific, and North and South Atlantic.

Despite reports of the greater importance of the offshore fishery to St. Vincent (Brown 1945; Vidaeus 1969; Chakalall 1982; Morris 1984) results suggest that the inshore fishery, which comprised most of the artisanal sector, is the greater contributor to overall catches, especially throughout the late 1960s and 1970s as well as the late 1990s. The inshore fishery comprises both the small coastal pelagic fishery and the demersal, reef, slope and shelf fishery. Small jacks (Carangids) dominated catches between 1950 and 2010. Traditionally the small coastal pelagic fishery has contributed significantly to catches landed at the main market in Kingstown (Vidaeus 1969). Catches in the offshore fishery have increased since the early 1970s. However, their magnitudes in the 1990s do not reflect the considerable developments in the industry, such as the introduction of semi-industrial longliners, at that time. Reconstructed catches for the Grenadines indicate considerable decline from 1982 until a recovery in the 2000s.

The reconstruction represents a longer time series of catch data, disaggregated by the respective species components, than current data for St. Vincent and the Grenadines in the FAO FISHSTAT. Reconstructed catch data was disaggregated into the respective species components with an increase in species information occurring in the late 1960s while all reported data between 1950 and the late 1980s incorporated in FAO FISHSTAT were assigned to a single aggregate, unidentified category. Reconstructed catch data are also disaggregated into a greater number of species groups (up to 84 for St. Vincent and the Grenadines combined) compared to reported data in FAO FISHSTAT for St. Vincent and the Grenadines (a maximum of 24 species/species groups represented in any given year). A smaller percentage of annual total catch is attributed to the aggregate, unidentified category in reconstructed data compared to current catch statistics in FAO FISHSTAT. This level of disaggregation is attributed mainly to the fisheries of St. Vincent, since the species composition of catches from the Grenadines, prior to the early 1980s, have not been quantified in the literature examined. Nevertheless, reconstructed data in general, represent a considerable improvement in terms of the

number of species groups reported and breakdown of the aggregate, unidentified fish category, compared to current data in FAO FISHSTAT for St. Vincent and the Grenadines.

The reconstructed catches represent preliminary estimates at this time, as several limitations in the data exist. These limitations pertain to recreational fishing, discarding, quantities caught as bait, landings of fish caught in St. Vincent and the Grenadines at other islands, foreign fishing and under-estimation of catches in components of the inshore fishery.

In the 1980s, at least 8,000 tourists visited St. Vincent and the Grenadines each year (Matthes 1984). A considerable portion was involved in unlicensed sport fishing with fishing rods, spears and nets (Matthes 1984). Some tourists fished commercially and sold the catch to local and foreign hotels. These catches, however, are not documented. Unlike other Caribbean islands, there were no charter boat operations in St. Vincent or the Grenadines in the 1990s (Morris 1991), although there were several private sport fishing boats. The catches from these boats are also not documented. The reconstruction contains only an estimation of tourist participation and associated catches and therefore is likely very conservative.

Several species of fish are discarded at sea (Adams 1985), either because of size or preference for other species. Based on the types of species discarded, it appears that this practice is common in all fisheries. The trammel net fishery which targets snapper, grouper, cavalli, shark, barracuda and turtle off the Grenadines is regarded as unsustainable (Chakalall 1982). Since these nets capture everything in their path and are lifted every 12 hours, fish caught early are unfit for export. This accounts for about 50 percent of the catch, of which one-fifth is unfit for human consumption and discarded, while the rest is sold locally or processed by salting and drying (Chakalall 1982). There are no records of the quantities of fish discarded and this aspect was not included in the reconstruction. In the Grenadines, preference for specific species by Martinique traders may result in up to 40 percent of the landings remaining unsold, and much may be dumped because of lack of suitable transport to St. Vincent (Andersen *et al.* 1983). Historically, only export data have been recorded and therefore the quantities dumped are not incorporated in the data.

Bait is utilized in the longline, pot and handline fisheries. Usually dwarf herring (*Jenkinsia* spp.), pilchards (*Harengula* spp.), round scad (*Decapterus* spp.), sardines (*Sardinella* spp.), silversides (Atherinidae) and thread herring (*Opisthonema oglinum*) are used as bait in St. Vincent and the Grenadines (Mahon 1993). Although catch rates from directed exploratory fishing in the 1970s are available (Wagner 1974) these do not indicate the associated quantities utilized as bait.

Apart from the finfish, lobster, conch and whelks caught in the Grenadines that are traded illegally with Martinique, catches of lobster and conch are also sold in St. Lucia. Catches from Bequia are also taken to

Kingstown market in St. Vincent, and a portion of catches from boats operating off the north leeward and northeast coasts (Fancy, Owia, Sandy Bay) of St. Vincent are sold in St. Lucia (Matthes 1984). Records of these catches, if they do exist, are incorporated in the landing statistics of the island to which the catch was sold. Ryan (1999) noted trading of beach seine catches in St. Vincent with boats of Martinique, Dominica and St. Lucia and trading of catches in the Grenadines with boats from Martinique and seine boats or charter boats from Grenada or Carriacou. The associated data are however, not recorded.

Records of catches from foreign fleets within the region which fish in the waters of St. Vincent and the Grenadines either do not exist or are incorporated in the landing statistics of the country to which the fleets belong. In the 1960s, boats from Martinique fished off the Grenadines and supplied entrepreneurs from Martinique (Chakalall *et al.* 1997). The activity was illegal and there are no accompanying records. Such activity is also known off Grenada and Carriacou (Peña and Wirth 1979). Fishers from Martinique also fish for large pelagics (especially tunas) in the EEZ of St. Vincent and the Grenadines (Andersen *et al.* 1983), as do distant water longliners such as U.S. swordfish boats, as well as Venezuelan pole and line boats, and purse seiners (Morris 1991). Large, deep-water snappers (*Etelis oculatus*) occurring on the slopes, at 80-180 m, were fished occasionally by boats from Barbados (Morris 1991). In the Grenadines, fishers from Grenada have traditionally fished for demersal finfish, lobster and conch in the waters of St. Vincent and the Grenadines, continuing until the early 1990s (Morris 1991). Boats from Barbados and St. Lucia also target flyingfish and large pelagics within the EEZ of St. Vincent and the Grenadines.

This reconstruction demonstrates that catches in the inshore fishery, specifically the demersal component, as well as lobster and conch are under-estimated. Data were particularly lacking for the Grenadines where, until the mid-1990s, data were available only on fish exports to Martinique. The quantity of catches consumed locally was not recorded. The species composition of the catch was not known, though it was possible to separate exports of finfish from shellfish. Export weights were estimated by eye. Exports of processed fish were not adjusted to whole weight since the associated species was not known. Also, exports of conch pertain to meat only, i.e., data were not corrected to represent whole weight. There are also reports of ongoing illegal trading with Martinique confirming that export data are minimum estimates at best. This made detailed analyses on the Grenadines fishery impossible.

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Appendix Table A1. FAO landings vs. reconstructed total catch (in tonnes), and catch by sector with discards shown separately, for St Vincent and Grenadines, 1950-2010.

Year	FAO landings	Reconstructed total catch	Industrial	Artisanal	Subsistence	Recreational
1950	300	839	0	394	445	0
1951	300	830	0	382	448	0
1952	300	821	0	370	450	0
1953	400	811	0	359	452	0
1954	400	808	0	347	461	0
1955	500	798	0	335	463	0
1956	600	788	0	323	465	0
1957	600	784	0	311	472	0
1958	600	774	0	299	474	0
1959	600	838	0	356	481	0
1960	400	828	0	340	488	0
1961	400	753	0	262	490	0
1962	400	775	0	282	492	0
1963	500	871	0	378	492	0
1964	500	815	0	322	492	1
1965	500	887	0	394	492	1
1966	500	785	0	292	492	1
1967	500	864	0	371	491	1
1968	400	910	0	419	491	1
1969	500	969	0	478	490	1
1970	600	1,026	0	536	490	1
1971	300	1,082	0	592	490	1
1972	300	1,138	0	647	490	1
1973	200	1,191	0	701	489	1
1974	283	1,244	0	754	489	1
1975	549	1,297	0	807	489	1
1976	379	1,232	0	743	488	1
1977	581	1,221	0	733	487	1
1978	698	1,435	0	948	486	1
1979	547	1,209	0	723	484	1
1980	500	1,023	0	540	483	1
1981	500	1,541	0	1,060	481	1
1982	500	1,276	0	797	478	1
1983	480	1,389	0	913	476	1
1984	480	1,113	0	639	473	1
1985	483	1,093	0	622	470	1
1986	599	1,526	0	1,059	466	1
1987	703	1,151	0	687	463	1
1988	716	1,091	0	631	459	1
1989	592	1,030	0	574	455	1
1990	1,210	1,471	0	1,019	450	1
1991	1,075	1,425	7	971	445	1
1992	1,259	1,261	11	809	439	1
1993	1,353	1,354	9	911	433	1
1994	1,082	1,632	16	1,188	426	1
1995	857	1,319	16	882	420	1
1996	861	1,256	24	819	413	1
1997	898	1,396	19	970	406	1
1998	1,376	1,745	44	1,301	399	2
1999	985	1,220	39	787	392	2
2000	1,254	1,627	50	1,190	386	2
2001	1,618	1,981	71	1,529	379	2
2002	1,365	1,724	66	1,283	373	2
2003	1,288	1,643	67	1,207	367	2
2004	1,657	2,002	93	1,545	361	2
2005	1,252	1,595	75	1,163	355	2
2006	1,557	1,891	100	1,440	349	2
2007	1,875	2,199	128	1,726	343	2
2008	1,082	1,408	78	992	337	2
2009	1,900	2,210	145	1,734	330	2
2010	1,754	2,059	140	1,593	324	2

Appendix Table A2. Reconstructed total catch (in tonnes) by major taxa for St. Vincent and the Grenadines, 1950-2010. 'Others' contain for 81 additional taxa.

Year	<i>Decapterus macarellus</i>	<i>Selar crumenophthalmus</i>	<i>Epinephelus guttatus</i>	<i>Panulirus argus</i>	Others
1950	146	70	82	66	476
1951	150	73	79	64	464
1952	154	77	77	62	452
1953	158	80	74	59	440
1954	164	85	71	58	430
1955	168	89	68	55	417
1956	173	93	65	53	404
1957	179	98	63	50	394
1958	185	102	59	48	380
1959	201	112	63	51	410
1960	202	113	62	50	401
1961	188	106	56	45	358
1962	195	110	57	46	366
1963	220	124	64	51	412
1964	209	119	59	48	380
1965	229	130	64	51	412
1966	206	118	56	45	360
1967	249	136	63	51	365
1968	221	133	63	51	442
1969	262	161	58	45	444
1970	300	185	54	39	448
1971	335	207	52	35	454
1972	370	226	51	31	460
1973	403	244	52	27	466
1974	435	259	54	24	472
1975	466	273	57	20	480
1976	444	253	60	21	453
1977	449	250	64	20	438
1978	331	155	142	92	715
1979	330	160	109	61	549
1980	174	228	58	26	537
1981	109	0	184	142	1,106
1982	235	118	137	87	699
1983	233	123	141	102	791
1984	268	199	87	59	500
1985	231	143	105	74	540
1986	330	218	112	80	787
1987	232	0	94	72	754
1988	199	201	111	67	514
1989	214	112	98	61	545
1990	477	122	67	42	764
1991	526	165	66	44	623
1992	401	178	65	45	571
1993	122	489	61	108	574
1994	277	223	76	92	964
1995	163	151	84	166	755
1996	357	142	95	39	622
1997	269	274	90	102	660
1998	320	146	87	257	935
1999	251	136	107	112	614
2000	293	219	116	167	832
2001	353	263	140	203	1,021
2002	309	231	123	177	885
2003	295	220	117	169	842
2004	356	265	142	205	1,034
2005	286	214	114	164	818
2006	336	251	134	193	976
2007	389	290	155	224	1,141
2008	254	189	100	145	720
2009	390	291	156	225	1,148
2010	364	271	145	210	1,068