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**St. Lucia: Reconstructed Fisheries Catches, 1950-2010**

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# ST. LUCIA: RECONSTRUCTED FISHERIES CATCHES, 1950-2010

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## ABSTRACT

St Lucia is a small island country in the Eastern Caribbean Sea. The island is volcanic in origin, resulting in a narrow shelf area compared to the extent of its Exclusive Economic Zone. Its fisheries are largely artisanal and subsistence based, with an industrial element beginning in the 1990s with the introduction of longliners and larger boats capable of exploiting the offshore pelagic fisheries. This report is an update of an earlier study that reconstructed the historical catch and effort of fishing in St. Lucia over 1942-2001. The update revised and extended the time period to 1950-2010 and found that the reconstructed total catch was the same as the total reported to the FAO. However, for several years within the time period, the catch reported to the FAO was more than the reconstructed total. This was considered to be a reporting error, so the FAO baseline was adjusted to match the reconstructed total in each of the years with discrepancies. When compared with the adjusted reported total, the reconstruction was 1.15 times the data reported to and by FAO. Artisanal fisheries made up 59% of the total catch, with subsistence contributing 32% and the industrial sector 8.5%. Almost a quarter of the catch consisted of tuna and mackerels (Scombridae), with jacks and pompanos (Carangidae), dolphinfish (*Coryphaena hippurus*) and flyingfish (Exocoetidae) also important.

## INTRODUCTION

### *Study area*

Saint Lucia, situated between 30° and 40°N and 61° and 62°W is one of the northern Windward Islands. The island is separated from Martinique in the north and St. Vincent in the south by channels about 30 km wide (Figure 1). The submerged insular shelf is very narrow along the western coast (about 0.1 km) and wider (5 km) to the east, north and south (UNEP/IUCN 1988). The associated Exclusive Economic Zone covers an area of 15,400 km$^2$(www.seaaroundus.org), while the coastal shelf covers an area of 522 km$^2$ (Mahon 1993). Reefs are found on all coasts, but are generally small and most numerous around the east and south coasts, especially around Laborie Bay, Anse Galette and between Savannes Bay and Maria Islands (Villegas 1979). Those on the windward coast (east) are mainly small patch reefs or broken fringing reef systems and those on the mid-leeward coast (west) are diverse, coral-dominated communities forming an almost solid fringing reef along the narrow slope (Villegas 1979). The total reef area is 160 km$^2$ (Oliver and Noordeloos 2002).The volcanic nature of the island has resulted in reef restriction to the narrow, steeply sloping shelf area. The degree of exposure to the rough Atlantic waters and coastal extent of the shelf determine the physical structure and community composition of the reefs (Anon. 1995). Those on the windward coast are mostly small patch reefs or broken

fringing reef systems while those along the mid-leeward coasts are diverse, coral-dominated communities providing an almost solid fringe long the extremely narrow slope (Anon. 1995). Until 1995, no serious attempts at accurately determining the extent of the reef habitat had been made (Anon. 1995).

***Fishery development***

The fisheries of St. Lucia comprise several components. These include the offshore pelagic fishery targeting flyingfish and large migratory pelagics with gillnets, handlines, troll lines and longlines; the small coastal pelagic fishery targeting mainly small jacks (Carangidae) with beach seines and gillnets; the shallow and deep demersal fishery targeting mainly snappers (Lutjanidae) and groupers (Serranidae) with fish pots and handlines, and the lobster and conch dive fishery. Turtles are caught incidentally in nets, and cetaceans are targeted with harpoons, while seaweeds and sea urchins are harvested by hand.

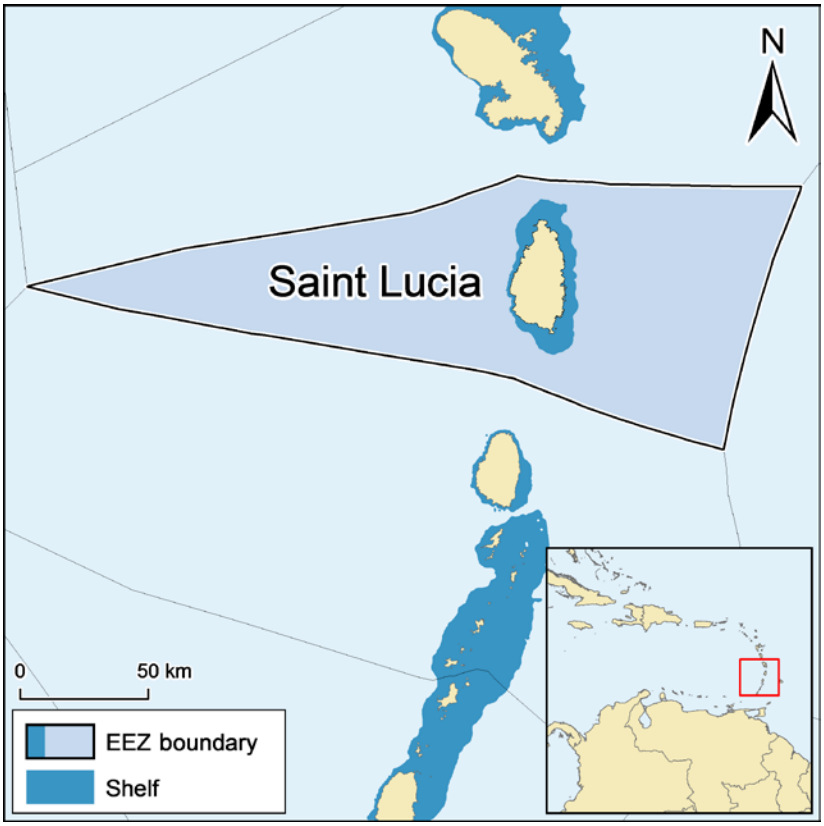


**Figure 1.** The Exclusive Economic Zone (EEZ) and shelf waters (to 200 m depth) of St. Lucia, part of the Lesser Antilles island chain in the south-eastern Caribbean.

Pre 1950s

Very little is documented on fisheries prior to the 1950s. Fishing was mainly for subsistence and all boats were un-mechanized. There are however, unpublished reports of export trade in hawksbill turtle shells, lobster and whale oil from as early as 1928, 1937 and 1918, respectively.

1950s to 1970s

In the early 1950s, a turtle export trade was established with the United Kingdom (Anon. 1955). The lobster trade was revived, following transportation problems in the 1940s, as Trinidad increased its lobster imports from St. Lucia (Anon. 1955). Reports of the capability to supply the total demand for lobster in Trinidad attest to the possible high catches at the time. The first attempt at boat mechanization, through the introduction of outboard engines, occurred at the end of the 1950s (Scholz 1980). The fleet consisted mainly of canoes but the few existing whaleboats were considered more advanced (Smyth 1957).

Development of the offshore pelagic fishery was promoted to satisfy the local demand for fish, though it was felt that the existing fleet was not operating at its full potential. The government's policy focused on development of all sectors of the fishing industry through the provision of credit for improvement of fishing crafts and gear, granting of duty free concessions on engines and specific fishing gears and improvement of marketing facilities (Vidaeus 1969). The Fisheries Department, comprising just two staff members, also facilitated the granting of loans to fishers through the Agricultural Development Bank (Vidaeus 1969).

St. Lucia also allowed the offloading of catches from foreign boats duty-free (Vidaeus 1969). As a result, boats from Venezuela, Martinique and even the U.S.A. landed their catch in St. Lucia. By the late 1960s, crustaceans were exported to Puerto Rico, Barbados and the U.S.A., and frozen snapper to Puerto Rico. It is presumed that this trade was linked to activities of foreign boats. The local retail trade in fresh fish, as well as wholesale and retail trade for frozen and processed fish was regulated by maximum prices enforced by the Government (Vidaeus 1969). The Caribbean Training and Development Project implemented by the United Nations Food and Agriculture Organization (FAO) between 1965 and 1971 provided technical training in all aspects of industrial fishing and highlighted the possibility of increased catches from the Guyana banks.

In 1967, surface gillnets were introduced to the flyingfish fishery. Previously, dipnets and handlines were utilized (Brown 1945). About 50 percent of existing boats were already mechanized, using mainly outboard engines (15-18 hp). However, rising fuel prices in the late 1960s and early 1970s, affecting about 70 percent of the fleet (Walters 1981), along with the fixed fish prices introduced by the government, were limiting factors to fisheries development. It became necessary to introduce more fuel-efficient boats. Assistance was obtained from FAO to train fishers at Vieux Fort to use inboard powered boats and to construct and operate improved fishing gear (Scholz 1980; Walters 1983). The associated project also conducted exploratory multi-gear fishing and introduced three boats designed specifically for this purpose. However, despite this support, fishers were reluctant to adopt the new inboard-powered boats because they were slower than those powered by outboard engines and also required a higher initial capital outlay. Further, the lack of market facilities was a discouragement to fisheries development and traditional ties to the canoe were strong (Scholz 1980). Fishers resorted to using outboard engines of higher horsepower, but rising fuel prices, high maintenance costs and low lifespan of these engines continued to inhibit development.

During the early 1970s, the government requested assistance from the Canadian International Development Agency (CIDA) to review the fishing industry and make recommendations for development. The latter included the establishment of cold storage facilities and establishment of a Fisheries Management Unit (in 1976) with responsibility for development of the fisheries sector and the conduct of stock assessment and management research (Walters 1984). Organization of fishers into co-operatives was encouraged to assist with marketing of catches, supply of subsidized fuel and duty-free acquisition of fishing materials. Nine such co-operatives were set up in the 1970s (Walters 1981).

1980s and 1990s

The early 1980s was marked by considerable destruction of fishing boats, engines, and equipment due to hurricane Allen (Anon. 1981). At the time, the fishery was still in the early development phase, mainly artisanal and inshore in nature, utilizing hook and line, beach seines and pots (Walters 1983). Though a dramatic change in the industry was not envisaged or advised, efforts focused on careful planning, identifying, and addressing major constraints to development (Matthews 1983). Existing constraints included the low potential of fishers to adopt new technology, inadequate onshore infrastructure (landing, cold storage, processing), lack of a marketing structure, lack of effective organization among fishers, inefficient boats and fishing techniques and government's price control on fresh fish (Matthews 1983).

Although the canoe was still the main boat type used, a more efficient boat to target the offshore pelagic fishery was required. Fiberglass pirogues were imported from Trinidad and St. Vincent (Walters 1981) and the Windward Island Fishing Boat Construction Project, funded by the Caribbean Food Corporation, constructed fiberglass pirogues for sale to St. Lucia, Dominica, St. Vincent and Grenada (Matthews 1983). Through this project, 100 fiberglass pirogues, fitted with either outboard or inboard engines were introduced to the St. Lucia fleet. The marketing system was improved and with assistance from CIDA a fisheries complex containing cold storage facilities, was constructed.

The protection of reef and coastal resources has been a major concern. Extensive coral reef management has been undertaken through the co-operative efforts of the Eastern Caribbean Natural Area Management Program (ECNAMP), the St. Lucia Fisheries Department and local groups (UNEP/IUCN 1988). A 1981 project sought to find solutions to conflicts among various users and to the stresses on critical resources while promoting healthy and sustainable development through a multi-disciplinary approach in the southeastern region (UNEP/IUCN 1988). This has been used as a case study in integrated coastal zone management.

Through collaboration with other members from the Organization of Eastern Caribbean States (OECS) a Harmonized Fisheries Bill (Walters 1984) was prepared. This outlined co-operation in fisheries surveillance and enforcement of regulations in the region and mandated that Governments develop and manage fisheries in harmony with the fishing communities. At this time also St. Lucia embarked on a project of diversification of its fishing industry. Through assistance from CIDA, aquaculture projects using tilapia (*Oreochromis mossambicus* and *O. niloticus*), prawns (*Macrobrachium rosenbergii*) and seamoss (*Gracilaria* spp.) were introduced (Walters 1981) Conservation oriented measures to sustain inshore resources were also introduced. These included a system of marine reserves and fishing priority areas, set up in 1986, and implementation of co-management schemes for the sea urchin (*Tripneustes ventricosus*) fishery (George and Joseph 1994).

In 1986, a number of coastal marine reserves and fishing priority areas were established. However, prohibition of traditional fishing while allowing Scuba diving resulted in tremendous resource user conflicts. In addition, the level of protection to reef resources was affected by a lack of proper demarcation of fishing priority areas and enforcement (Anon. 1995). In 1992, a coordinated approach between the Department of Fisheries and the Soufrière Foundation, with technical assistance from the Caribbean Natural Resources Institute (CANARI) resulted in the formation of the Soufrière Marine Management Area (SMMA) (Anon. 1995). The SMMA was zoned according to its multi-sectoral uses and involvement of user groups in management was encouraged. A similar exercise was to be conducted at the Anse la Raye/Canaries coastal areas with financial support from the U.S. Agency for International Development (USAID) under an Environmental and Coastal Resources Project (ENCORE) implemented by the Caribbean Environmental Health Institute (CEHI). By the early 1990s, there were 20 marine reserves comprising turtle nesting beaches, coral reef areas and mangrove habitats with the use of resources being strictly controlled (Anon. 1992). The SMMA is a well-documented success story on the usefulness of marine reserves (Hatcher *et al.* 1995; Roberts *et al.* 1996; Goodridge *et al.* 1997). Scuba diving was permitted in these areas, but fishing was prohibited. A joint project with France aimed at conservation and sustainable use of the marine resources within the SMMA was also launched. The project assisted in the construction of a jetty and the introduction of fish attraction devices off the west coast to promote aggregation of offshore pelagic species for the fishery (Pierre 1999).

By the late 1980s, development of the offshore fishery was evident. Between 1989 and 1992, five 15 m longliners were introduced and an additional 20 boats of 9 m length began exploiting the pelagic fishery (Mahon and Singh-Renton 1993). Japan assisted with the introduction of fiberglass boats equipped with longlines. Some fishers were trained in the construction and operation of sub-surface tuna longlines, bottom horizontal and vertical longlines with assistance from the Governments of Japan and France (George 1999). This has resulted in increased interest in the adaptation and use of these gears from fiberglass pirogues (George 1999). The fishery is considered as being in a transitional stage, with the capacity and efficiency expected to increase with adoption of improved boats and gear technology (George 1999). Considerable government subsidies are still provided and a fisheries complex was constructed with financial assistance from Japan. However, fishers are still limited by their ability to self-finance larger boats with advanced gear.

In the 1990s, a limited entry system in the conch fishery was implemented through a licensing system, trammel nets were banned for the capture of lobsters, a buy-back scheme for bottom gillnets was implemented and small meshed pots were replaced with larger mesh (George 1999). The sea urchin fishery is also controlled by a licensing system and a co-management system set up for this fishery (Smith and Walters 1991). Further details on management efforts are available in George (1999) and Anon. (1995).

***Fisheries statistical data collection***

The first data collection system, set up in the 1960s, sought to resolve disputes between fishers and vendors over selling commission at the main market in Castries rather than management of the resources (Brown 1945). Data were aggregated across all species so it was not possible to examine species specific changes in the catch. Fish sold at the market was supplied mainly from landing sites predominantly out of town. Only about 25 percent of fish caught off Castries was actually sold at the market. This system of data collection remained unchanged until the late 1970s (Villegas 1979).

Between the late 1970s and mid-1980s, the data collection system was expanded to include landings at nine of the 13 major landing sites (Goodwin *et al.* 1985; Walters and Oxenford 1986; Murray *et al.* 1988). A correction procedure, accounting for non-recorded sites and days in the estimation of total catches from recorded data, was also instituted (Murray *et al.* 1988) together with a boat registration system (Anon. 1981). During the late 1980s the OECS instituted a data computerization system to member countries for entry of fisheries catches, fishing effort and other management related data. Currently, information for the 1980s is available only from the Annual Agricultural Reports, based on data submitted by the Fisheries Department. Two relocations of the Fisheries Department and a major fire have contributed to the loss of data collected prior to the 1990s. At an OECS hosted workshop (Mahon and Rosenberg 1988) plans for upgrading the data collection system were presented (Murray *et al.* 1988). However, these were not implemented due to financial and human resource constraints.

By the mid-1990s, a revised data collection system was implemented (Joseph 1996) under the CARICOM Fisheries Assessment and Management Program (CFRAMP). CFRAMP introduced two new databases for computerization of catch and effort data: the Trip Interview Program (TIP) and the Licensing and Registration System (LRS), respectively. Selected landing sites (primary and secondary) were the target of data collection and a system for raising the recorded catch to account for non-enumerated fishing days (at recorded sites) and non-enumerated boats (at non-recorded sites) was derived (Joseph 1999). Estimates of total catches from 1995 onwards are available from this system. Though reporting is still confined to estimate total catches of the major categories listed previously, with the inclusion of an additional group for snappers, dis-aggregation into the respective species groups is now possible.

### *Fisheries policy*

The general policy in the 1960s and 1970s was to decrease imports of processed fish by development of the local industry through credit schemes for fishers and duty-free concessions on engines and fishing gear in the 1960s and 1970s (Vidaeus 1969; Anon. 1981). However, the approach was unsuccessful in meeting the policy objectives. In the 1980s the government embarked on a similar program, but focused on improvements in gear and boat technology (Walters 1981) as well as diversification of the industry into aquaculture production (Walters 1984). It was the intention to reduce the quantities of fish imported. There were also improvements in infra-structural facilities, cold storage, marketing and distribution of fish. The fisheries policy since the 1990s is to "promote self-sufficiency through increased production of marine and aquaculture products, and to develop the fishing industry and implement measures to ensure its sustainability"[1]. Details of the current fisheries management policy, objectives and existing regulations for each fishery are provided in Table 1. Since the inshore resources are found to be depleted, the offshore large pelagic fishery is seen as the avenue for future development (George 1999). A conservative approach to development also includes the establishment of marine reserves and fishing priority areas and a co-management approach to assessment and management of the sea urchin (*Tripneustes ventricosus*) resources.

[1] www.slumaffe.org

The two main bodies of legislation are the Fisheries Act of St. Lucia (Statutory Instrument No. 10 of 1984) and the Fisheries Regulations of St. Lucia (Statutory Instrument No. 9 of 1994). The latter represents a comprehensive package of revised legislation which was put into effect in 1994[2]. The Fisheries Act provides for the formation of Local Fishery Management Areas to facilitate more effective management of shelf resources.

**Table 1.** Management policy, objectives and regulations of St Lucia fisheries.

| Fishery | Target Species & Gear | Stock status | Management policy and objectives | Regulations |
|---|---|---|---|---|
| Shallow shelf fishes | Species: groupers, surgeonfishes, parrotfishes, triggerfishes, squirrelfishes, snappers and grunts<br>Gear: fish traps and demersal handlines | Possibly over-exploited due to substantial reductions in mean fish size at all fishing areas since 1991. | To promote stock recovery and ensure sustainable resource use | Prohibition of use of dynamite, poisons and other noxious substances, trammel nets and SCUBA. Restricted use of spear guns. Size restrictions on meshed gear. Regulation of aquarium fish catches. Fishing prohibited in designated MPAs. Restricted use of gear (e.g., gillnets) in coastal areas. |
| Deep slope and bank fishes | Species: snappers and grouper<br>Gear: vertical longlines, fish traps (or fish pots) | Moderately exploited on offshore banks south of island and lightly exploited in all deep slope areas and north of the island. | Exploit at optimal sustainable yield and restrict access | Mesh sizes of fish traps are regulated and a management framework is being developed for the pot fishery |
| Large pelagics | Species: tunas, dolphinfish, king mackerel and wahoo, sharks, billfishes, swordfish, whales dolphins and porpoises<br>Gear: troll lines and non-mechanized longlines (not for marine mammals) | The status of all species is unknown except for large tunas and billfishes which are assessed by ICCAT | To promote sustainable development of the commercial sport fisheries for pelagic fishes, cooperate with other Caribbean states to manage smaller, regional pelagic fish species and to manage the cetacean fishery on a sustainable basis | No regulations currently exist |
| Coastal pelagics | Species: jacks (Carangidae), herrings, silversides, anchovies, ballyhoo, robins and scads (*Decapterus* spp.), small tuna species and juveniles of yellowfin tuna<br>Gear: beach seines, fillet nets (gillnets), castnets | A general decline in abundance attributed by fishers to pollution and overfishing of juveniles | To exploit at maximum sustainable yield, minimize land-based sources of marine pollution and support appropriate traditional user rights mechanisms | Mesh sizes of seines, fillet (gillnet) and cast nets are regulated. Trammel nets are prohibited and the soak time of nets is restricted. |
| Lobster | Species: Caribbean spiny lobster<br>Gear: traps or pots, free diving with hand collection, free diving with wire loops | Considered overexploited in nearshore areas, fishers report scarcity in traditional fishing areas. | Sustainable exploitation of stocks | Minimum size limits, restrictions on fishing gear and taking berried females or moulting individuals, closed season, prohibition of use of spear gun, hooks and SCUBA, limited entry of pot fishers and deployed fish pots must be identified by fisher |

[2] www.slumaffe.org

**Table 1.** Management policy, objectives and regulations of St Lucia fisheries.

| Fishery | Target Species & Gear | Stock status | Management policy and objectives | Regulations |
|---|---|---|---|---|
| Conch | Queen conch | Heavily exploited off the north and south coasts (based on fishers observations) | To rebuild stocks, particularly near shore and to ensure sustainable use of the resource | Size restrictions (minimum shell length and meat weight; harvesting only individuals with a flared lip i.e., mature), closed season, exports in accordance with CITES restrictions and EU and HACCP standards, licensed use of SCUBA |
| Sea urchins | Species: White sea urchin<br>Gear: skin diving and hand collection | Highly vulnerable to overfishing, abundance highly variable from year to year | Stock recovery and sustainable management of the resource | Limited entry via a licensing system, closed season and fishing zones, minimum size restriction and co-management system implemented |
| Seamoss | Species: seamoss (*Rhodophyta*)<br>Gear: free diving and hand collection | Highly vulnerable to overharvesting. Depletion of wild stocks due to harvest method, destruction and pollution of marine habitats | Promote cultivation and enforce existing regulations | Permission to harvest required |
| Flyingfish | Species: four-winged flyingfish<br>Gear: gillnets, handlines and dipnets | Status unknown but high inter-annual variability in abundance due to changes in spawning stock biomass, environmental factors and predation mortality | Ensure sustainability of the fishery | Mesh size restriction on gillnets |

**Objective**

This report is an update and extension of a previous study that assembled a time series of catch and effort data for St. Lucia from 1942 to 2001 to enable assessment of the ecosystem impacts of fishing (Mohammed and Joseph 2003). 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 to the FAO. Small updates were made to the Mohammed and Joseph (2003) data to comply with *Sea Around Us* database definitions.

METHODS

***Catches***

The major sources of information were published and unpublished documents, including reports of the St. Lucia Agricultural Department, the St. Lucia Game Fishing Association, the National Archives, and the St. Lucia Fisheries Department Statistical Database. Where estimates from different sources differed, those derived from the most recent methodology to estimate total landings by accounting for unrecorded landing sites and fishing days (e.g., Joseph 1999) were used.

Anchor points:

1942: Smyth (1957) provided an estimate of total catch (341 t) for 1942, but gave no details on the methodology for arriving at this figure. This estimate however does not agree with the 1,555 t total catch in (Brown 1945) . Brown computed a gross estimate of total catch for each boat/fishery type using the associated number of boats, the associated weekly catch rate and number of weeks fishing per year. It is unlikely however, that the estimated catches for the 1940s, derived from an artisanal, non-mechanized fleet, would be similar to catches in the 1990s from a still largely artisanal, but fully mechanized fleet. This would be the case if Brown's estimate was considered. Thus, the estimate of Smyth (1957) was used in the analysis. However, if over-fishing has occurred (due to industrialization and increased effort), it is possible that declines in catch per unit effort may result in estimates of recent catches that are comparable in magnitude to catches from the early pre-industrialized period.

1956: A total catch of 500 t for 1956 (Salmon 1958) was used as an anchor point for the respective year.

1960–1968: Catches delivered to the fish market at Castries are available for 1960 to 1968 and range from 80-177 t (Vidaeus 1969). Cecil (1966) also provided annual recorded landings at Castries for 1961 to 1964 and this was thought to represent one third of total landings. Using this raising factor and data in Vidaeus (1969) and Cecil (1966), total catches were estimated for 1960 to 1968 as 531, 432, 504, 525, 471, 240, 255, 267 and 483 t, respectively.

1981–1994: Estimated total catches by five major species categories: tuna (Scombridae); dolphinfish (*Coryphaena hippurus*); shark (Carcharhinidae); kingfish (*Acanthocybium solandr*i and *Scomberomorus cavalla*); flyingfish (mainly *Hirundichthys affinis*) and snapper (Lutjanidae), and one aggregate category ('other fish') were provided by the St. Lucia Fisheries Department. These were derived by adjusting recorded data to account for non-recorded fishing days and landing sites, using the methodology in Joseph (1999)

1995–2001: The St. Lucia Fisheries Department provided detailed estimates of annual catch for 1995 to 2001, following the methodology of Joseph (1999). Catches were disaggregated into 153 to 171 species or groups in each respective year

First interpolation: total catches

Annual catches for 1950 to 1955 were estimated by interpolation between estimates for 1942 (Smyth 1957) and 1956 (Salmon 1958). Similarly, annual total catches for 1957 to 1959 were estimated by interpolating between estimates for 1956 and 1960 (Vidaeus 1969). Annual catches for 1969 to 1980 were estimated by interpolation between estimates for 1968 (Vidaeus 1969) and 1981 (Fisheries Department unpublished statistics). The relative contribution of the offshore and inshore fisheries to overall catches was estimated for 1942, 1960 to 1969 and 1981 to 2001 from actual catch estimates as described above. Similar estimates were derived for missing years by interpolation. Along with the overall reconstructed catches for 1943 to 1959 and 1970 to 1979 (estimated by interpolation) the corresponding offshore and inshore components were estimated as the product of the respective proportional contribution to overall catches and reconstructed total annual catch.

Species composition

The species composition of catches in St. Lucia has not been documented in the past (Vidaeus 1969). As a result, this is either inferred from descriptions of the fishery (Brown 1945) or assumed to be the same as for neighboring islands, e.g., St. Vincent (Cecil 1972).

1950: Brown (1945) estimated catches by fleet type, from which the percentage contribution of each fishery type to total catch was computed. Canoes target flyingfish; whaleboats target large pelagics; haul seines and gillnets target coastal pelagics, and troll and pot canoes target both the reef and large pelagic fisheries. It was assumed that 75 percent of the catch of the troll and pot canoes was attributable to the pelagic fishery since this is the main fishery over 7-8 months of the year, with the other 25 percent being assigned to the pot fishery. The percentage contribution of the flyingfish, large pelagic, small coastal pelagic (beach seine and gillnet) and reef fisheries were 44 percent, 16 percent, 35 percent and 4.8 percent respectively. Using the species listed for the large pelagic and small coastal pelagic fishery in Brown (1945), and the list of common and local names in the same document, the species composition of the catches of the respective fisheries was inferred. It was assumed that species caught in each fishery were listed in decreasing order of importance, with the first accounting for 50 percent of the catch of the fishery. The major species in the small coastal pelagic fishery and corresponding proportional contribution to the total catch are: *Selar crumenophthalmus* (50 percent); halfbeaks (20 percent); *Euthynnus alletteratus* (15 percent); *Thunnus atlanticus* (10 percent); Cavalli (5 percent; comprising of equal portions of *Caranx ruber*, *C. latus* and *C. crysos*). The major species in the large pelagic fishery and corresponding contribution to the total catch are: *Coryphaena hippurus* (50 percent); *Scomberomorus cavalla* (15 percent); *Acanthocybium solandri* (10 percent); *Thunnus albacares* (10 percent); *Thunnus atlanticus* (5 percent); *Katsuwonus pelamis* (5 percent); *Makaira nigricans* (2.5 percent) and *Istiophorus albicans* (2.5 percent). No information on the species composition of the reef fishery was available. However, consistent with the observation that the species taken in the early stages of fisheries are usually those of higher trophic levels (Pauly *et al.* 1998) it was assumed that catches comprised 50 percent each of the major snapper and grouper groups.

1960-1969: Cecil (1972) provided a crude estimate of species composition based on personal communication with the Fisheries Officer at the time. Tuna (Scombridae), bonito (*Sarda sarda*) and dolphinfish (*Coryphaena hippurus*) accounted for 40 percent of the catch; flyingfish (*Hirundichthys affinis*) accounted for 30 percent; jackfish (*Selar crumenophthalmus*) accounted for 20 percent and the remaining 10 percent comprised all other species (mainly reef species). A more detailed species composition was provided for landings in 1966 at the Kingstown market in St. Vincent (Cecil 1972) At the time the markets at Castries and Kingstown were the only markets existing in the respective neighboring islands. To further disaggregate catches of the broad species groups above, the same species composition at the Kingstown market was assumed. Species were identified by local names. Based on Brown (1945) the associated scientific classification was identified as follows (the name of the species or group used is given in brackets): jackfish – *Trachurops crumenophthalma* (*Selar crumenopthalmus*); gar – *Tylosurus* spp. (Needlefishes- Belonidae); hind – *Petrometropon cruentatus* (*Epinephelus cruentatus*); ocean gar – sailfish, *Istiophorus americanus* (*Istiophorus albicans*); robin (*Decapterus punctatus*); yellowtail – yellowtail snapper (*Ocyurus chrysurus*). Based on the author's general knowledge of local names, dodgers were identified as bigeye scad, *Selar crumenopthalmus* (data combined

with jackfish), and red fish assumed to be the queen snapper *Etelis oculatus*. Similarly, amber cavalli was assumed to be the greater amberjack (*Seriola dumerili*) and cavalli was assumed to be the crevalle jack, *Caranx hippos*. Catches of anchovy (Engraulidae) and sprats (Clupeidae) were included under 'herrings and sardines'. This process resulted in disaggregation of tuna catches into yellowfin tuna (*Thunnus albacares*), referred to as 'albacore' and skipjack (*Katsuwonus pelamis*) and the 'other species' category into 21 groups.

1981-1994: The 'other fish' category from 1981 to 1990 was disaggregated into its species components assuming the same species composition of this category for 1990. It was assumed that this species composition remained unchanged over the period.

1990-1994: Recorded data for 1990, 1992 and 1993 were extracted from a discontinued database system introduced under an OECS data management project. The 'other fish' category comprised between 39 (1990) and 81 (1992) species groups in this database. It was used to disaggregate the estimated total catch of the corresponding category into the species components for the respective years. The major assumption is that the species composition of the recorded catches is reflective of the true species composition of catches in the fishery as depicted by the estimated figures obtained from the St. Lucia Fisheries Department. Similarly catches of the aggregate tuna, shark and snapper categories were disaggregated into the respective species based on the species composition of these groups from recorded data for the respective years. Data for 1991 and 1994 were available in the aggregated form mentioned previously. The respective 'other' categories were disaggregated by species using the mean species composition of the same category for 1993 and 1995 as representative of 1994; and for 1990 and 1992 as representative of 1991. Since sharks were not recorded as a separate category in 1991, it was assumed that the species composition of 1990 and 1991 was the same as for 1992. Further, the total shark catches for 1991 was estimated by interpolation between the 1990 and 1992 estimates available from the Fisheries Department.

1995-2001: Data provided by the St. Lucia Fisheries Department was disaggregated into 235 possible species or species groups.

It was difficult to compare reconstructed catches given the vast differences in the species groups represented for the different time periods. Hence, species were aggregated into 61 broad groups across the 1942 to 2001 period. A list of species (local and scientific names) and the associated broad species grouping can be obtained from the senior author. Lobsters and sea turtles were included but cetacean catches are represented separately.

Second interpolation: species composition

Using the aggregated catches represented by 61 species groups, catches of the following species, from 1943 to 1959, were estimated by interpolation between estimates for 1942 and 1960: groupers; halfbeaks; reef jacks; jacks (small coastal pelagics); snappers; billfishes; dolphinfish; flyingfish; pelagic jacks; mackerels; pelagic sharks and tunas. Similarly, catches for the following species between 1970 and 1979 were estimated by interpolation between estimates for 1969 and 1980: barracudas; groupers; reef jacks; jacks (small coastal pelagics); snappers; billfishes; dolphinfish; flyingfish; pelagic jacks; mackerels and tunas. Estimates of marine turtle and lobster catches for missing years were derived as described below. Since it was not possible to

estimate catches for all species by interpolation, the difference between the sum of interpolated catches and estimated total catches across all species was attributed to the aggregate category 'miscellaneous marine fish' in the respective years.

Species catch adjustments

Catches of billfishes, tunas, kingfish/wahoo and dolphinfish from 1991 to 2001 were adjusted to incorporate landings from the annual main fishing tournament in St. Lucia. Mahon *et al.* (1994a) and Mahon *et al.* (1994b) conducted a detailed analysis of the pelagic fishery, and estimated annual catches of yellowfin tuna for 1980 to 1990. These estimates were used instead of those derived from methods outlined previously. Queen conch (*Lobatus gigas*[3]) catch in 1990 was based on Mulliken (1996). The 1993 catch estimate was based on data in (George 1997) which incorporated sales at local markets, purchases at the fish market complex (7.54 t) and authorized exports to Martinique (1.95 t). Queen conch catches from 1994 to 1997 were taken from (George 1999). A comparison of estimated catches based on George (1997), George (1999) and those estimated from the St. Lucia Fisheries Department statistical database is given in Table 2.

**Table 2**. Estimated catch of Queen conch (*Lobatus gigas*) in St. Lucia, 1993-1997, compared between sources.

| Year | Catch (t) | |
|---|---|---|
| 1993 | 15.91[a] | 9.76[c] |
| 1994 | 19.75[b] | 9.95[c] |
| 1995 | 31.92[b] | 8.28[c] |
| 1996 | 26.80[b] | 19.79[c] |
| 1997 | 24.53[b] | 11.09[c] |

a: George (1997); b: George (1999) c: St. Lucia Fisheries Department Statistical Database

Catches from sport fishing tournaments

The annual number of fish landed, and associated species composition for 1991 to 1994 (DeBeauville-Scott 1994), and the weight of individual fish species landed for 1996, 1998 to 2000 were available from the unpublished records of the St. Lucia Game Fish Association. The mean individual weight of the landed species was estimated from data for the latter period and used to convert numbers of fish to the corresponding weight for the earlier period, assuming no change in the sizes of fish landed during the 1990s. Species catches for 1995 and 1997 were estimated by interpolation using the catch of the previous and following years.

Estimation of lobster catches

The quantity of live lobster exported in 1937 and 1938 was obtained from the 1938 report of the Agricultural Department of St. Lucia. The associated value of the export trade was also provided for 1936 to 1938. Assuming the same average price per unit weight for 1937 and 1938 the weight of live lobster exported in 1936 was estimated. Exports for 1935 to 1941 (Anon. 1948), estimated catch for 1965 to 1967 (Idyll 1971) and exports in 1968 (Vidaeus 1969) were also available. Estimated lobster catches between 1981 and 1991 were obtained from the St. Lucia Fisheries Department statistical database. Joseph (2000) gave data on the annual purchases of

[3] Previously *Strombus gigas*

lobsters at the St. Lucia Fish Marketing Cooperative between 1992 and 1999. A crude estimate of total catch for 1997 was given in (George 1999). The ratio of this estimate and the purchase of the Cooperative for the same year was assumed to be the same for each year from 1992 to 1999. Therefore, using data from Joseph (2000) and George (1999), estimates of annual catch of the species for the 1992-1999 period were derived.

**Update**

**Calculating totals**

2002-2010:

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 1997-2001. The average ratio was applied to the FAO total annually for 2002-2010 to estimate an overall catch for the country in each year.

Species breakdown

2002-2010

A taxonomic breakdown was estimated by applying the average catch contribution of each species in 1997-2001 to the total catches in each year 2002-2010.

Marine mammals and sea turtles

Earlier work by Mohammed and Joseph (2003) contained reconstructions of marine mammals and turtles. However, the *Sea Around Us* does not consider these taxa, thus, marine mammals and turtles were removed from the database and final reconstruction totals.

**Sector breakdowns**

Industrial

Catch data for St. Lucia did not contain information on contributions to specific fishing sectors, so an industrial component had to be estimated. Industrial catches were assumed to begin between 1989 and 1991 with the introduction of the longlining boats and larger vessels capable of exploiting the pelagic fisheries. Therefore, the total offshore catches were split by percentage from 0% industrial catch in 1990, and conservatively assuming 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 bypassed 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 $t \cdot person^{-1} \cdot year^{-1}$ in 1950 and 0.006 $t \cdot person^{-1} \cdot year^{-1}$ in 2010 was calculated and an interpolation applied for the intervening years. We conservatively applied 50% of this to the population for St. Lucia 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 estimated subsistence annual totals.

Recreational

A study on recreational participation in Antigua and Barbuda (Cisneros-Montemayor 2010; Cisneros-Montemayor and Sumaila 2010) documented a participation rate of 0.23% of the total population, and this rate was assumed to also hold for St. Lucia. It was assumed that the vast majority of recreational fishers were tourists, so the participation rate was applied to the tourist population only. Tourist arrivals data was only available from 1995[4] so estimated tourist numbers for 1950-1994 were calculated by interpolating from 231,000 tourists in 1995 to an assumed 0 tourists in 1945. Recreational participation for 1950 to 2010 was than calculated by applying the 0.23% participation rate to the tourist numbers. Ramdeen *et al.* (2014b) estimated a consumption rate of 0.001 $t \cdot tourist^{-1} \cdot year^{-1}$ for the British Virgin Islands, which we assumed to be the same for St. Lucia 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. Lucia. 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.

Adjustment to FAO total

In several years, there was a discrepancy between the reconstructed total and the total reported to the FAO. This was particularly large in the years 1964-1978, to a magnitude between 130 t – 1,400 t. It also occurred to a much lesser extent, no more than 125 t (in 1994), but typically between 5 and 40 t, in 1984-1985, 1988, 1994-1995, 1998 and 2007-2010. The discrepancy was considered to be a reporting error and a negative adjustment was applied to each of the years to adjust the baseline to the reported total.

[4] http://data.worldbank.org/indicator/ST.INT.ARVL?page=3

Total reconstructed catches of St. Lucia for 1950-2010 were almost equal to the total reported catches originally reported to the FAO for the same time period. However, in several years throughout the time period, in particular the period 1964-1978, the reported catch total exceeded the total reconstructed catch, which was considered to be a reporting error (differences in 1964-1978 were due to catches by foreign vessels fishing in St. Lucia's waters which were deemed to be included in St. Lucia's FAO data) and therefore adjustments were made to balance the difference. When compared to the adjusted baseline, the reconstruction total was 1.15 times the adjusted data reported to the FAO (Figure 2a).

Catches increased throughout the time period, from 950 t in 1950 to 2,000 t in 2010. Total reconstructed catches remained relatively stable throughout most of the time period, averaging 950 t·year$^{-1}$ for 1950-1990. Catches increased quickly throughout the 1990s, peaking at 2,300 t in 2001 before declining again to 1,700 t in 2005, and recovering to 2,000 t by the end of the time period (Figure 2a).

Artisanal and subsistence fisheries were the most important to the total reconstructed catch, contributing more than 90% combined, with artisanal fisheries making up 59% of the total. Industrial fisheries contribute 8.5%, with the recreational sector only making up 0.3%.

Four taxa made up almost 70% of the total catch. Tunas and mackerels (Scombridae; 24%) contributed almost a quarter of the total catch, even though the majority of scombrid catches were in the later part of the time period. Jacks and pompanos (Carangidae; 18%), dolphinfish (*Coryphaena hippurus*; 15%) and flying fish (Exocoetidae; 10.5%) also contributed highly to the catch (Figure 2b).

**Industrial**

The industrial sector first began in the early 1990s and, apart from a few years of steady catches in the early 2000s, grew consistently throughout the time period. The reconstructed catch increased from 15 t in 1991, to 655 t in 2010. The catch was completely dominated by 3 species, making up 99% of the catch: Tunas and mackerels (47.5%), dolphinfish (33.3%) and flying fish (18.2%).

**Artisanal**

Artisanal catches generally increased over the time period, growing from 430 t in 1950 to 1,090 t in 2010. Catches remained relatively stable until 1970, when they increased over the decade to a peak of 920 t in 1982. A sharp decline followed, dropping to 320 t in 1987, followed be a steady recovery throughout the 1990s that peaked at 1,600 t in 2001. Catches declined sharply afterwards, stabilizing at 1,100 t·year$^{-1}$ for 2005-2010.

The same three taxa that dominated the industrial fishery were also the primary species in the artisanal sector, although to a lesser extent. Tunas and mackerels (33.3%) made up a third, with dolphin fish and flying fish contributing 20.6% and 15.1%, respectively. Jacks and pompanos added a further 9%.

**Subsistence**

Subsistence catches declined over the time period, decreasing from 520 t in 1950 to a low of 200 t in 2010. The first half of the time period was characterized by lots of annual variation with a slight overall decline, whilst the second half exhibited a consistent decline from 1983. Jacks and pompanos were the most prevalent taxa in the catch with 39.2%, followed by snappers (Lutjanidae; 9.2%), groupers (Serranidae; 6.5%) and Triggerfish (Balistidae; 6.3%). The other 40% of the catch was spread amongst 44 taxa, including a miscellaneous marine fish group.

Foreign catches

During a period of high reporting in the 1960s-1970s, part of the FAO data was assigned to foreign vessels fishing within the St. Lucia EEZ. These catches totalled just over 9,000 t from 1964-1978. Catches increased from 130 t in 1964 to 1,380 t in 1978. These catches were equally attributed to Martinique, US and Venezuelan vessels and were made up of 48% scombrids, 26% dolphinfish and 23% flying fish.

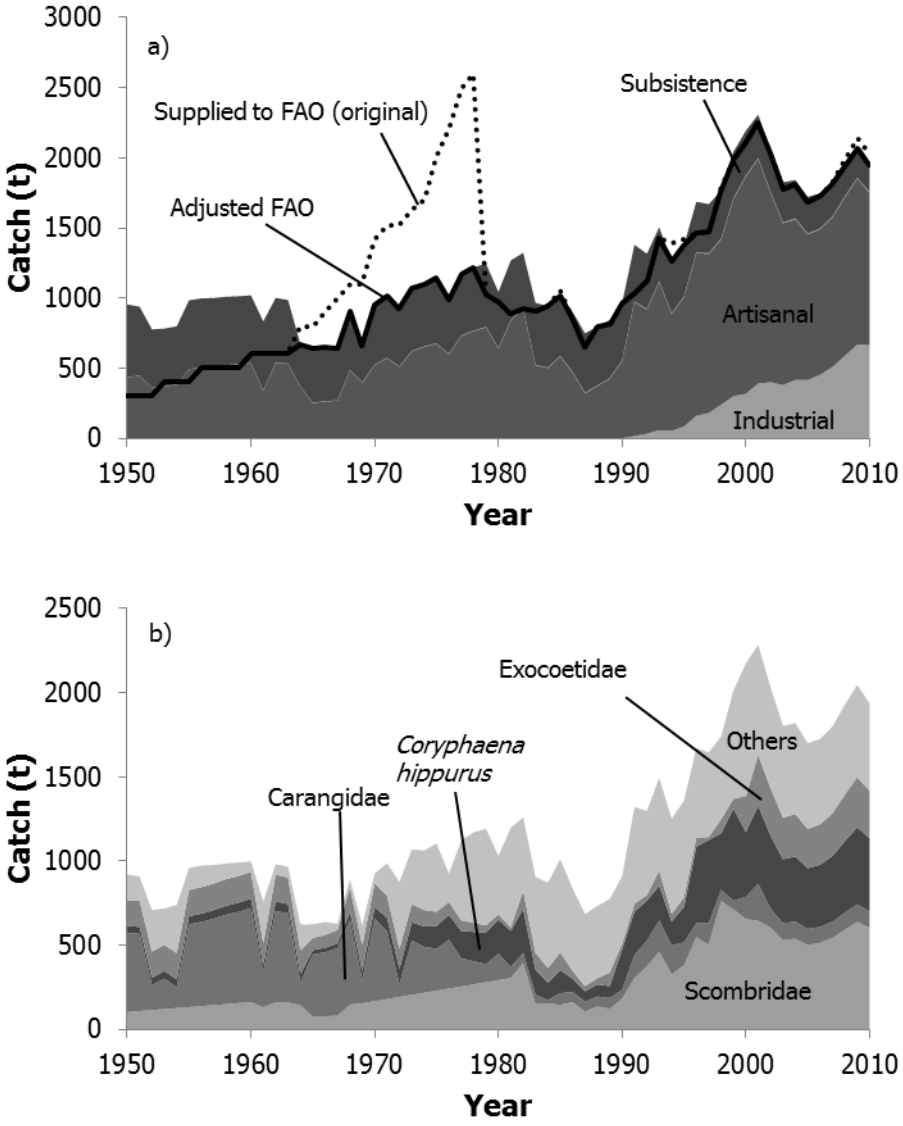


**Figure 2.** Reconstructed catch of St. Lucia for 1950-2010 by a) fishing sector with data as reported to FAO (and as adjusted here) overlaid as line graphs. Note that the recreational sector catch is included but too small to show. 'Adjusted FAO' refers to catch amounts reported to the FAO but adjusted to the reconstructed catch total to account for years when reported catch exceeded the reconstructed catch; and b) major taxa, with 'others' accounting for an additional 58 taxa not shown individually here.

## DISCUSSION

### Catches

Reconstructed fisheries catches for St. Lucia indicated a 39% increase between 1950 and 1982, a 43% decline between 1982 and 1987, and a 161% increase between 1987 and 2010.

The difference between reconstructed catches and the data originally reported to FAO between 1964 and 1978 (i.e., the period of over-reporting of truly domestic catches) is most likely due to landings by foreign boats. The local fishery was not capable of catching such vast quantities of fish, e.g., 2,600 t in 1978. Such catches are comparable to those of the present day fleet utilizing engines of higher horsepower and more technologically advanced gear. Many have reported on the stagnation of the industry during the 1970s as a result of increasing cost of production associated with rising fuel prices (Walters 1981), and a lack of cold storage, marketing and distribution facilities (Anon. 1981). Individuals were reluctant to enter the industry since the price control system, which resulted in reduction of prices to 25 percent of the allowed maximum when landings were excessive, acted as disincentives to development of the industry (Walters 1983). Vidaeus (1969) noted the lack of change in number of boats and their distribution around the island since the previous 25 years. At the time however, there were no restrictions, e.g., customs duty on landings of non-locally registered boats. This was an unusual arrangement in the region. As a result, boats from Venezuela, Martinique and freezer boats from the United States landed fish in St. Lucia (Vidaeus 1969). During the late 1960s there was also an agreement between the St. Lucia Marketing Board and a St. Lucian firm allowing for the sale of fish caught by trawlers off the Guyana's via a Guyanese firm. These were usually croaker (*Micropogonias furnieri*), whiting (*Malacanthus plumieri*), moonshine (*Selene vomer)* and sea trout (*Cynoscion* spp.).

The small differences between reconstructed data and corresponding data in FAO in the 1980s, 19990s and 2000s (1984-1985, 1988, 1994-1995, 1998, 2007-2010) are less easily explained. Personal communication with officials of the St. Lucia Fisheries Department yielded no explanation. The methodology accounting for unrecorded fishing days and landing sites (Joseph 1999) has been applied to recorded data from 1980 onwards, thereby increasing the credibility of the estimates. We assumed a simple case of mis-reported data for these years. Other sources of information for this period are based on assumptions regarding the proportion of overall catch recorded at Castries (Walters 1981; Matthews 1983; Walters 1983; Murray 1984; Walters 1984; Goodwin *et al.* 1985), and were therefore not used in the catch reconstruction. The decline in landings however, especially in the late 1980s, is supported by the literature (Mahon 1990). Similar declines in landings were observed in other islands of the eastern Caribbean, prompting an FAO study to investigate the reasons for such low catches, particularly in the 1987/88 season. Results however, were inconclusive.

The reconstructed data were disaggregated into a greater number of species or species groups than corresponding data in FAO. There was also a considerably lower proportion of overall catch attributed to the aggregate category of 'miscellaneous marine fish' in reconstructed data. Observations from 1990 onwards are, however, more reliable, as these are based on reconstruction from actual data compared to previous years where assumptions of constant species compositions, similarities in species composition with landings in St. Vincent and estimation of annual catches by interpolation were employed. The estimates of annual catches disaggregated into 32 to 57 species or species groups between 1990 and 2010 is a significant improvement on estimates in FAO, which are disaggregated into between 13 and 21 species groups.

Several limitations to existing data are apparent. These relate to incomplete records of catches in the recreational fishery, lack of data on catches by foreign fleets and the quantities of bait fish utilized locally, incomplete records of species catches in the inshore reef, slope and shelf fishery as well as the offshore flyingfish fishery and uncertainties in species identification of the catch.

Recreational fishing began in the 1950s (DeBeauville-Scott 1994). An associated club was formed in 1972 and formally registered as the St. Lucia Game Fishing Association in 1984. The Association organizes informal fishing tournaments on national holidays and a major tournament in October of each year. In 1991 the major tournament was upgraded to an international billfish tournament. Informal tournaments target dolphinfish, tuna, kingfish, wahoo, barracuda and small sharks (H. Otway, pers. comm.). The formal tournament targets larger pelagics such as blue marlin (*Makaira nigricans*), sailfish (*Istiophorus albicans*), white marlin (*Tetrapturus albidus*), swordfish (*Xiphias gladius*) and longbill spearfish (*Tetrapturus pfleugeri*). Catches at informal tournaments are not recorded, while only catches of important species (large tunas and billfishes) are recorded at the major tournament. These were found to be insignificant in this analysis.

Also, catches of small pelagics, e.g., kingfish *(Scomberomorus cavalla*), wahoo (*Acanthocybium solandri*) dolphinfish (*Coryphaena hippurus*), barracuda (*Sphyraena* spp.) and small tunas (Scombridae) taken by tourists are not recorded. In the late 1980s, 12 private charter and sport fishing boats were in operation, the present number is not known. Persons also fish with handlines from shore. The associated catches are not recorded, nor are they systematically and regularly (or at least intermittently) estimated.

Catches of foreign fleets which may have fished in the EEZ of St Lucia are not available. Vidaeus (1969) alluded to monthly consignments of about 9 t from the Guyanese firm in the 1960s but gave no estimates of landings by fleets from Venezuela, Martinique and the United States. While catches of these fleets were possibly taken outside of St. Lucia's EEZ, fishers from Martinique target demersal species, fishers from Barbados target flyingfish and large pelagics and US longliners target swordfish, all within the EEZ of St. Lucia (Murray *et al.* 1988).

The quantities of bait utilized in pot, handline and longline fisheries are not recorded. Popular bait-fish in St. Lucia include anchovy (Engraulidae), pilchards *(Harengula* spp.), sardines (*Sardinella* spp.) silversides (Atherinidae) and thread herring (*Opisthonema oglinum*) (Mahon 1993). It is not known whether flyingfish is used as longline bait, as is done in Grenada.

The inshore fishery is not well represented in the data collection system since landing activities are spread across several sites (George 1999). Important landing sites for lobster and conch are not incorporated in the system (George 1999). Catches of lobster and conch are either sold to local markets, to hotels or supermarkets directly or exported (either legally or illegally) to Martinique. Only catches sold to markets and exported legally are recorded (Nichols and Jennings-Clark 1994). Until 1993 it was illegal to export lobster and conch to Martinique (George 1997). However, up to 5 t were exported illegally in the late 1980s (George 1997). Currently exports are permitted and are carefully monitored according to regulations of the Convention for International Trade in Endangered Species. Reconstructed landings of lobsters indicate considerable increases in catch throughout the 1990s, starting from almost zero at the end of the 1980s to over 22 t in 2010. Important landing sites for reef fish are also not sampled (George 1999), resulting in underestimation of total catches. Three important landing sites for flyingfish are not incorporated in the data collection system (Murray and Jennings-Clark 1993), with similar consequences for estimated total catch as for reef fish.

Information on species composition of the catch was not available prior to 1980. Vidaeus (1969) reported the lack of associated data in the 1960s. Data from 1980 to 1989 were available for only five or six major species groups with all other fish aggregated into one category. There were also uncertainties in species identification arising from differences in vernacular names used by fishers and data (Murray 1986), and the high diversity of species landed in the demersal fisheries (Gobert 1995). The high species diversity renders it almost impossible for data collectors to record reliably the catch composition of most fishing trips at the species level (Gobert 1995). There are also differences in local names of pelagic species e.g., the blackfin tuna (*Thunnus atlanticus*) is referred to as 'bonito', a common name elsewhere used for *Sarda sarda*; wahoo (*Acanthocybium solandri*) is referred to as 'kingfish', a name normally used for the king mackerel, *Scomberomorus cavalla*. Further, the flyingfish *Cypselurus cyanopterus* is referred to as 'denn' and *Parexocoetus brachypterus* as 'tee-wai' (Murray and Jennings-Clark 1993).

Assignment of some species to the respective fisheries was difficult. This is because juveniles of pelagic species are also captured in the inshore net fisheries. The relative quantities caught in the offshore and inshore fisheries are not known. As a result, all catches of large pelagic species were attributed to the offshore fishery.

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**Appendix Table A1.** Reconstructed catch of St. Lucia by sector, 1950-2010, including data reported by FAO.

| Year | FAO landings | Reconstructed total catch | Industrial | Artisanal | Subsistence | Recreational |
|---|---|---|---|---|---|---|
| 1950 | 300 | 955 | 0 | 434 | 520 | 0.53 |
| 1951 | 300 | 938 | 0 | 446 | 491 | 0.64 |
| 1952 | 300 | 777 | 0 | 360 | 415 | 0.74 |
| 1953 | 400 | 782 | 0 | 370 | 411 | 0.85 |
| 1954 | 400 | 798 | 0 | 382 | 415 | 0.96 |
| 1955 | 400 | 984 | 0 | 493 | 490 | 1.06 |
| 1956 | 500 | 998 | 0 | 504 | 492 | 1.17 |
| 1957 | 500 | 1,001 | 0 | 512 | 487 | 1.28 |
| 1958 | 500 | 1,009 | 0 | 520 | 488 | 1.38 |
| 1959 | 500 | 1,013 | 0 | 528 | 483 | 1.49 |
| 1960 | 600 | 1,020 | 0 | 536 | 482 | 1.59 |
| 1961 | 600 | 834 | 0 | 338 | 494 | 1.70 |
| 1962 | 600 | 1,002 | 0 | 537 | 463 | 1.81 |
| 1963 | 600 | 986 | 0 | 531 | 453 | 1.91 |
| 1964 | 800 | 671 | 0 | 369 | 300 | 2.02 |
| 1965 | 800 | 638 | 0 | 250 | 386 | 2.13 |
| 1966 | 900 | 652 | 0 | 263 | 386 | 2.23 |
| 1967 | 1,000 | 644 | 0 | 267 | 375 | 2.34 |
| 1968 | 1,100 | 909 | 0 | 484 | 422 | 2.44 |
| 1969 | 1,100 | 665 | 0 | 396 | 266 | 2.55 |
| 1970 | 1,419 | 952 | 0 | 523 | 426 | 2.66 |
| 1971 | 1,519 | 1,016 | 0 | 571 | 442 | 2.76 |
| 1972 | 1,519 | 926 | 0 | 509 | 414 | 2.87 |
| 1973 | 1,627 | 1,075 | 0 | 620 | 452 | 2.98 |
| 1974 | 1,700 | 1,101 | 0 | 653 | 445 | 3.08 |
| 1975 | 2,000 | 1,148 | 0 | 674 | 471 | 3.19 |
| 1976 | 2,200 | 991 | 0 | 598 | 391 | 3.29 |
| 1977 | 2,500 | 1,171 | 0 | 730 | 438 | 3.40 |
| 1978 | 2,600 | 1,220 | 0 | 765 | 452 | 3.51 |
| 1979 | 1,024 | 1,245 | 0 | 791 | 450 | 3.61 |
| 1980 | 969 | 1,044 | 0 | 640 | 400 | 3.72 |
| 1981 | 891 | 1,268 | 0 | 840 | 425 | 3.83 |
| 1982 | 921 | 1,323 | 0 | 924 | 394 | 3.93 |
| 1983 | 910 | 966 | 0 | 520 | 442 | 4.04 |
| 1984 | 946 | 942 | 0 | 500 | 437 | 4.14 |
| 1985 | 1,052 | 1,021 | 0 | 585 | 432 | 4.25 |
| 1986 | 840 | 901 | 0 | 469 | 428 | 4.36 |
| 1987 | 651 | 749 | 0 | 320 | 424 | 4.46 |
| 1988 | 796 | 797 | 0 | 373 | 420 | 4.57 |
| 1989 | 815 | 844 | 0 | 424 | 415 | 4.68 |
| 1990 | 958 | 966 | 0 | 552 | 409 | 4.78 |
| 1991 | 1,030 | 1,380 | 16 | 957 | 402 | 4.89 |
| 1992 | 1,125 | 1,316 | 32 | 885 | 394 | 4.99 |
| 1993 | 1,424 | 1,505 | 58 | 1,057 | 385 | 5.10 |
| 1994 | 1,390 | 1,268 | 53 | 834 | 376 | 5.21 |
| 1995 | 1,414 | 1,378 | 82 | 924 | 367 | 5.31 |
| 1996 | 1,462 | 1,687 | 160 | 1,164 | 359 | 5.43 |
| 1997 | 1,472 | 1,669 | 180 | 1,134 | 350 | 5.70 |
| 1998 | 1,772 | 1,765 | 239 | 1,180 | 340 | 5.80 |
| 1999 | 1,987 | 2,043 | 300 | 1,406 | 330 | 6.07 |
| 2000 | 2,115 | 2,194 | 317 | 1,551 | 320 | 6.21 |
| 2001 | 2,250 | 2,308 | 391 | 1,603 | 309 | 5.75 |
| 2002 | 2,027 | 2,055 | 399 | 1,353 | 297 | 5.82 |
| 2003 | 1,775 | 1,825 | 379 | 1,155 | 285 | 6.37 |
| 2004 | 1,807 | 1,842 | 415 | 1,147 | 273 | 6.85 |
| 2005 | 1,682 | 1,722 | 414 | 1,040 | 261 | 7.31 |
| 2006 | 1,724 | 1,746 | 453 | 1,038 | 249 | 6.97 |
| 2007 | 1,823 | 1,819 | 509 | 1,067 | 237 | 6.60 |
| 2008 | 1,989 | 1,950 | 587 | 1,131 | 225 | 6.81 |
| 2009 | 2,142 | 2,069 | 668 | 1,183 | 212 | 6.39 |
| 2010 | 2,027 | 1,957 | 665 | 1,087 | 198 | 7.04 |

**Appendix Table A2.** Major taxa of St. Lucia reconstructed catch, 1950-2010. "Others" includes 57 taxa.

| Year | Scombridae | Carangidae | *Coryphaena hippurus* | Exocoetidae | Others |
|---|---|---|---|---|---|
| 1950 | 102 | 470 | 40 | 154 | 154 |
| 1951 | 108 | 459 | 42 | 154 | 144 |
| 1952 | 114 | 149 | 43 | 155 | 246 |
| 1953 | 120 | 181 | 45 | 156 | 216 |
| 1954 | 126 | 125 | 47 | 156 | 286 |
| 1955 | 131 | 492 | 48 | 157 | 130 |
| 1956 | 137 | 501 | 50 | 157 | 127 |
| 1957 | 143 | 514 | 51 | 158 | 110 |
| 1958 | 149 | 532 | 53 | 158 | 93 |
| 1959 | 155 | 543 | 55 | 159 | 79 |
| 1960 | 161 | 560 | 56 | 159 | 62 |
| 1961 | 130 | 207 | 46 | 129 | 245 |
| 1962 | 161 | 542 | 56 | 159 | 62 |
| 1963 | 159 | 530 | 56 | 158 | 63 |
| 1964 | 142 | 136 | 50 | 141 | 153 |
| 1965 | 73 | 372 | 26 | 72 | 81 |
| 1966 | 77 | 380 | 27 | 77 | 76 |
| 1967 | 80 | 402 | 28 | 80 | 38 |
| 1968 | 146 | 501 | 51 | 145 | 47 |
| 1969 | 155 | 138 | 54 | 153 | 117 |
| 1970 | 167 | 491 | 67 | 142 | 58 |
| 1971 | 179 | 403 | 81 | 131 | 192 |
| 1972 | 192 | 74 | 94 | 120 | 396 |
| 1973 | 204 | 323 | 108 | 109 | 326 |
| 1974 | 217 | 274 | 121 | 98 | 352 |
| 1975 | 229 | 248 | 135 | 87 | 405 |
| 1976 | 242 | 292 | 148 | 75 | 167 |
| 1977 | 254 | 168 | 162 | 64 | 475 |
| 1978 | 267 | 137 | 175 | 53 | 538 |
| 1979 | 279 | 108 | 188 | 42 | 574 |
| 1980 | 292 | 158 | 202 | 31 | 347 |
| 1981 | 304 | 66 | 215 | 20 | 592 |
| 1982 | 393 | 60 | 262 | 108 | 436 |
| 1983 | 150 | 56 | 149 | 99 | 451 |
| 1984 | 152 | 22 | 101 | 89 | 507 |
| 1985 | 145 | 70 | 136 | 106 | 554 |
| 1986 | 161 | 61 | 77 | 47 | 489 |
| 1987 | 105 | 59 | 61 | 31 | 428 |
| 1988 | 135 | 59 | 72 | 37 | 430 |
| 1989 | 121 | 64 | 71 | 81 | 437 |
| 1990 | 182 | 53 | 240 | 34 | 399 |
| 1991 | 305 | 137 | 258 | 47 | 575 |
| 1992 | 373 | 153 | 239 | 32 | 500 |
| 1993 | 462 | 184 | 208 | 89 | 551 |
| 1994 | 325 | 173 | 142 | 47 | 564 |
| 1995 | 380 | 136 | 211 | 55 | 575 |
| 1996 | 547 | 83 | 456 | 52 | 534 |
| 1997 | 501 | 129 | 496 | 17 | 502 |
| 1998 | 762 | 67 | 335 | 84 | 492 |
| 1999 | 712 | 52 | 547 | 59 | 644 |
| 2000 | 654 | 133 | 384 | 214 | 788 |
| 2001 | 644 | 222 | 464 | 301 | 654 |
| 2002 | 603 | 113 | 434 | 282 | 598 |
| 2003 | 528 | 102 | 380 | 247 | 545 |
| 2004 | 538 | 102 | 387 | 252 | 541 |
| 2005 | 501 | 96 | 361 | 234 | 510 |
| 2006 | 513 | 95 | 370 | 240 | 507 |
| 2007 | 543 | 97 | 391 | 254 | 514 |
| 2008 | 592 | 101 | 426 | 277 | 533 |
| 2009 | 637 | 104 | 459 | 298 | 548 |
| 2010 | 603 | 98 | 434 | 282 | 518 |