# Reconstructing Fisheries Catches and Fishing Effort for the southeastern Caribbean (1940-2001): General Methodology

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## Abstract

Time series of fisheries catches and fishing effort from 1942 to 2001 were reconstructed for four island nations in the southeastern Caribbean: Barbados, Grenada and the Grenadines, St Lucia, and St Vincent and the Grenadines. The magnitude and level of species dis-aggregation of reconstructed catches was also compared with existing data in the Food and Agriculture Organization global fisheries database (FAO FISHSTAT). General trends in reconstructed catches, fishing effort, catch per unit area and catch per unit effort were compared for the offshore and inshore fisheries of the respective islands. The present contribution describes the basic methodology applied, while separate, individual country reports in this volume present each country's reconstructed dataset.

## Background

Catch and effort data are the basis upon which fish stocks are assessed. These data increase knowledge of fishery operations, indicate the scale of fisheries in terms of size and value, both within and between sectors, and can be used to assess the species and populations upon which fisheries depend (Watson *et al.*, 2000). Yet, especially for developing countries, financial and human resource limitations pose a challenge, even for the collection of this most basic information. In the past, policy decisions were therefore often made in the absence of such information. Management generally aims to regulate either fish catches, fishing effort or both, depending on the future predictions of assessment studies and the social, economic and political climate. Without initial estimates of the status of fish stocks, and time series data on catches, it is very difficult to assess the success of the management strategies implemented.

During the 1980s and 1990s, many islands of the southeastern Caribbean experienced changes in the abundance of reef fish species. Informal reports from fishing communities about declines in overall catch per trip, reduction in individual sizes of fish caught and changes in species composition of the catch reflect this (Mahon, 1990, 1993; Singh-Renton and Mahon, 1996). However, in the absence of catch time series, it is difficult to measure the magnitude of any change. Furthermore, the Fisheries Departments responsible for assessment and management have suffered from staff relocations, insufficient human and financial resources, high turnover of staff, as well as structural damage and loss of important documents by fire. The loss of 'institutional memory' associated with the high staff turn-over contributes to the shifting baseline syndrome (Pauly, 1995). As a result, few existing staff have a full appreciation for the historical changes in fisheries resources prior to their employment.

Starting in 1992, the CARICOM Fisheries Resource Assessment and Management Program has assisted the islands with implementation of a structured statistical data collection system aimed at estimating total landings for assessment and management. Detailed catch, effort and species composition data have been collected, and assessments conducted for the dolphinfish (Parker *et al.*, 2001), wahoo (George *et al.*, 2000) and redhind (Straker *et al.*, 2001) fisheries in the region. It is evident that the data collected are extremely useful in assessing the present status of the fishery. However, they represent only a snapshot of the situation existing in the late 1990s. What is required is an idea of the past condition of the stocks against which the existing status can be compared, and impacts of increased fishing over the study period quantified. It is only when long-termed trends are documented and analyzed that an evaluation of whether further increases in fishing effort would be productive or not is possible.

## General developments in data collection and storage systems

Initial attempts at data collection (Brown, 1942a, b, 1945) focused only on fish sold at the major fish markets in the respective islands. An unknown proportion of catches from several landing sites was transported to these markets. Historic data therefore do not adequately reflect total catches, and there is little additional information from which a methodology for estimating total catches using recorded landings could be devised. These data limitations are documented in Hess (1961), Vidaeus (1969 a-d), Villegas (1978) and Chakalall (1982).

A coordinated approach to data collection was the focus of a workshop sponsored by the Organization of Eastern Caribbean States in 1988 (Mahon and Rosenberg, 1988). Associated islands reviewed their data collection systems, identified gaps and proposed strategies for improving coverage of different fishery types (species, gear and fleet). These included total coverage at major sites and sampling of minor sites, the acquisition of purchase receipts from hotels, restaurants and supermarkets, review of export permits/licenses and implementation of logbook programs for semi-industrial and industrial vessels. To date, improvements have been aimed mainly at increased coverage of landing sites, export data and landings from semi-industrial vessels targeting the offshore large pelagics. The project also introduced a computerized data management system. Grenada and the Grenadines, for example, implemented a system for collection of large pelagic species from local and foreign fleets in the early 1980s, a project facilitated under the Enhanced Research Program for Billfish initiated under the ICCAT (Phillip and Isaac, 1994). In 1992, under the CARICOM Fisheries Resource Assessment and Management Program, islands received support for improving their fisheries data collection systems. Data collection focused on those species identified as being commercially important under the following fishery categories (CFRAMP, 1997): large pelagic, deep slope and reef fisheries, lobster and conch fisheries, shrimp and groundfish fisheries. The Trip Interview Program (TIP) was introduced in several islands for storage and management of collected data, and standardization of reporting systems throughout the islands.

Presently, of the five island states under examination here, only St Lucia has devised a methodology for estimating total catches based on stratified sampling systems. The availability of recorded data since 1995 has facilitated the use of this methodology to estimate total catches. The other islands (St Vincent and the Grenadines, Grenada and the Grenadines, Barbados, and Trinidad and Tobago) have applied fixed raising factors to adjust recorded landings to total catches. These factors are based on general knowledge of fishery development and do not necessarily reflect changes (temporal, spatial, fleet related) in the coverage of the data collection system.

The time periods of available catch data from the Fisheries Departments for the respective islands are as follows: Barbados (1945-2000); St Vincent (1979 –1999); Grenada (1978-2001); St Lucia (1980-2000). In most instances catch data prior to the mid-1990s are highly aggregated, with details available only for those species of commercial importance. Further dis-aggregation of catch statistics is possible from review of reports and papers (published and unpublished), and country raw catch data, the latter are often available in hard copy only. Data for years prior to the time periods mentioned are interpolated using mainly data from Brown (1942 a, b, 1945) and Vidaeus (1969 a-d) as anchor points.

## Existing catch data for the region

Catch data from 1950 to the present exists in the Food and Agriculture Organization Fisheries Statistical Database (FAO FISHSTAT) for the respective countries of this study (Figure 1a). Compared to FAO data for northeastern Caribbean islands (e.g., Dominica, St Kitts and Nevis, Antigua and Barbuda, and Montserrat), where most data were reported in a single ‘marine fish nei’ category (i.e., “not elsewhere identified”), the level of species dis-aggregation in FISHSTAT is reasonable in recent times for the countries of this study (Figure 1b). Nevertheless, a considerable percentage of the overall catch is represented in the aggregate ‘marine fish nei’ category (Figure 1c), especially for catches in St Vincent and St Lucia. Further, given the numerous species caught in the inshore reef and shelf areas, the level of species dis-aggregation is too low for determining changes in species composition, indicative of over-exploitation.

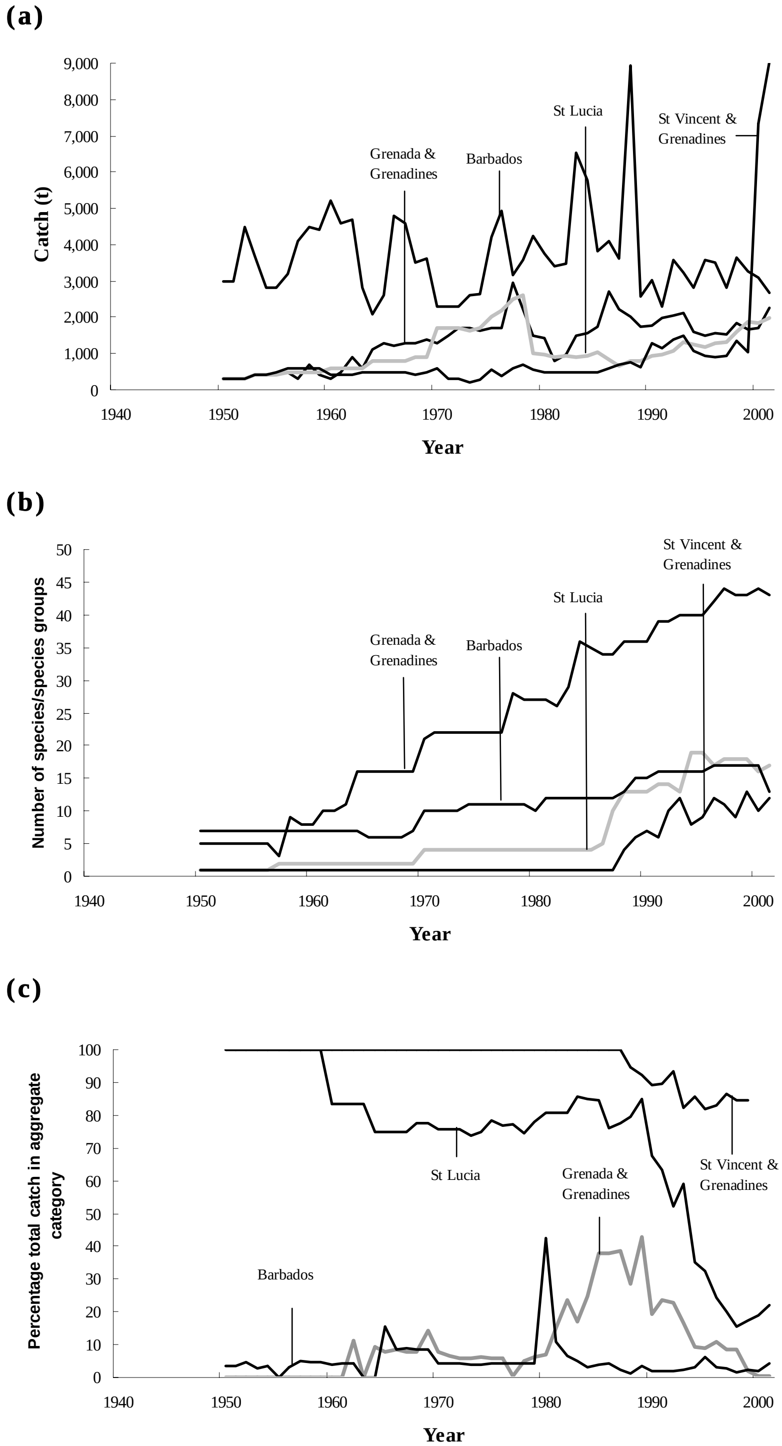


**Figure 1**: Catches reported by FAO FISHSTAT for four island nations (Grenada and the Grenadine, St Lucia, St Vincent and the Grenadines, and Barbados) in the southeastern Caribbean (a) annual trends in catches; (b) number of species/species groups reported, and (c) percentage of total catch in aggregate (unidentified) category.

The data reported by most countries reflect only nominal catches, and observed trends may be more indicative of changes in the coverage of the data collection systems rather than trends in the abundance of species exploited. Only species of major commercial importance are dis-aggregated in the reported data. Furthermore, the original data sources are often not documented. These limitations affect the utility of the data for examining the impacts of fishing on species diversity, stock assessment, and management or policy formulation. Development of fisheries, therefore, has proceeded in the absence of scientific and technical advice on stock status. This scarcity of information on resource potential and state of exploitation, and resulting difficulties in making rational development plans are not uncommon for tropical small-scale fisheries in general (Gulland, 1979).

## GENERAL METHODOLOGY

The general approach for reconstructing a time series of fisheries catches and fishing effort for the period 1942 to 2001 was to use information from historical documents, published and unpublished reports, grey literature, databases and surveys of the Fisheries Departments in the respective islands (see also Pauly, 1998). The methodology and data sources are documented for future reference and trends in reconstructed data are examined based on developments of the fishing industry. A list of Fisheries Departments, other institutions and individuals who assisted in providing data or identified and located documents is given in Appendix 1.

### Catches

The available data sources were used to identify ‘anchor points’, which reflect the actual annual total or taxa specific catches from key information sources. Where estimates from different sources varied, those derived from the most recent methodology and which accounted for unrecorded landing sites, boats and fishing days were used. Alternatively, the estimate most cited in the literature was accepted. When possible, anchor points were adjusted to account for the unrecorded components of the fishery using raising factors identified in the literature. In the absence of additional information, data for missing years were estimated by interpolation. Also, in severely data limited situations, assumptions or inferences were made based on similarities in fisheries of neighboring islands. In some instances data from the FAO FISHTAT database were used. Reconstructed total catches were disaggregated using information on species composition available in the literature, and personal communication with staff of the respective Fisheries Departments.

Where fisheries in a multi-island country differed significantly between islands (e.g., Grenada and the Grenadines), the reconstruction of catches and effort were done separately, for example, for the island of Grenada, which historically targeted mainly large pelagics, and for the islands of the Grenadines, which have historically targeted mainly inshore reef and demersal species. Since there are distinct differences in exploitation levels and resource status between inshore and offshore fisheries, reconstructed data are also analyzed separately for each fishery. The species associated with each fishery were taken from the data provided by the respective Fisheries Departments. The offshore fishery comprises the large, highly migratory pelagics captured mainly with longlines or troll lines. The inshore fishery comprises the reef, shelf and slope fisheries as well as the small coastal pelagic fishery. Attention was also given to reconstructing catches of non-fish species such as marine mammals and turtles (given international conservation concerns), as well as lobster (*Panulirus argus*), conch (*Stombus gigas*) and sea urchins, important in Barbados and St Lucia.

### *Conversion Factors*

It was often necessary to convert reported statistics to an estimate of the associated catch, e.g., in cases where the catch was processed at sea, or when the quantity of turtle shell or whale oil exported was given.

*Large Pelagics*

For the large pelagic longline fisheries in recent years, conversion factors to estimate total (live) weight were used. Stricter quality controls on the export market necessitate at-sea processing, which may vary from simple removal of gills and digestive organs to removal of fins and bills. The main species are yellowfin tuna (*Thunnus albacares*), swordfish (*Xiphias gladius*), sailfish (*Istiophorus albicans*), blue marlin (*Makaira nigricans*) and white marlin (*Tetrapturus albicans*). Based on the degree of processing (Samlalsingh *et al.*, 1995) appropriate raising

**Table 1**: Conversion factors applied for onboard processing of fish.

| Common Name | Scientific Name | Degree of Processing | Location (FAO Area) | Conversion Factor |
|---|---|---|---|---|
| Dolphinfish | *Coryphaena hippurus* | Gutted, chilled | – | 1.100[a] |
| Kingfish | *Scomberomorus* spp. | Gutted, chilled | Tobago (31) | 1.100 |
| Wahoo | *Acanthocybium solandri* | Gutted, head/tail off, chilled | St Helena (47) | 1.300 |
| Tuna | Tunas nei | Gutted, chilled | Liberia (34) | 1.100 |
| Albacore | *Thunnus alalunga* | Gutted, chilled | UK (27) | 1.125 |
| Yellowfin tuna | *Thunnus albacares* | Gutted, chilled | Mexico (31) | 1.100 |
| Atlantic bonito | *Sarda sarda* | Gutted, head off, frozen | Bulgaria (34) | 1.320 |
| Sharks/rays/skates | – | Gutted, head off, chilled | Mexico (31) | 1.500 |
| Redhind | *Epinephelus guttatus* | Gutted, chilled | Mexico (31) | 1.100 |
| Rockhind | *Epinephelus morio* | Gutted, chilled | Mexico (31) | 1.100 |
| Snappers, jobfishes nei | – | Gutted, chilled | – | 1.100 |
| White marlin | *Tetrapturus albidus* | Gutted; head and fins removed | – | 1.140[b] |
| Blue marlin | *Makaira nigricans* | Gutted; head and fins removed | – | 1.140[b] |
| Swordfish | *Xiphias gladius* | Fins/swords removed, chilled | Cyprus (37) | 1.140[b] |

a: Assumed; b: Conversion factor based on an estimate of 1.3 for removal of head and gut.

factors available for the species in FAO Area 31 (Western Central Atlantic) were used to convert to whole wet weight (Table 1).

*Marine Turtles*

Catches or exports of turtles were often reported as number of animals. The mean individual weight of respective species was used to convert numbers to their equivalent weight (Witzell, 1984). Loggerhead turtles (*Caretta caretta*) ranged between 90-180 kg, green turtles (*Chelonia mydas*) ranged between 90-136 kg, and hawksbill turtles (*Eretmochelys imbricata*) ranged between 45-57 kg. While heavy exploitation is expected to result in smaller sizes at capture this was not considered in the present analysis. Hawksbill turtles are favored for export of shell (*bekko*) to Japan. Data were often quoted in weight of shell exported. Two different conversion factors are available: 1 kg of shell per animal (Milliken and Tokunaga, 1987), and 4 kg of scutes per animal (www.tortoise.org.news/1998s28.html). The mean estimate was used along with the corresponding individual weights from Witzell (1984) to convert shell weight to animal weight.

*Marine Mammals*

Reports from the 1920s and 1930s give data on the quantity of 'blackfish' oil exported. 'Blackfish' is the local name for pilot whale (*Globiocephla macrorhynchus*). The mean quantity of oil produced per whale (13.5 gallons, Brown, 1945), was used to estimate the corresponding number of pilot whales. This estimate differs only slightly from data in Lewis (1964) from which the average quantity of oil produced per whale was 13.79 gallons between 1962 and 1964. The estimates derived are considered lower limits as whale oil was also utilized locally, but not reported, and catches were not limited to pilot whales. For example, the average quantity of oil produced per sperm whale was estimated as 289.3 gallons based on Lewis (1964). Recent estimates of catches are provided as number of animals for selected species (Table 2), and the mean individual weight was used to convert numbers of animals to equivalent weight (Trites and Pauly, 1998).

***The movement of catches and landings***

In reconstructing fisheries catches the movement of landings has to be considered in relation to the coverage of the data collection program (Figure 2). Except for trawl fisheries, by-catch and discard issues have not been considered as major problems in the region. Most of the gear utilized target specific species, e.g., troll and long lines for catching large pelagics. Though fish-pots may capture species of varying commercial importance, unless a species is poisonous, all of the catch is landed. Beach seines also target specific schools of fish and the bulk of the catch is comprised of species that are either commercially important or used as bait. Further studies are required to ascertain the proportion of the catch kept for personal use or used as bait, both in the line fisheries

**Table 2**: Mean individual weight for selected species of marine mammals. Source: Trites and Pauly (1998)

| Common Name | Scientific Name | Mean Weight (kg) |
|---|---|---|
| Bottlenose dolphin | *Tursiops truncatus* | 187.5 |
| Atlantic spotted dolphin | *Stenella frontalis* | 65.4 |
| Fraser's dolphin | *Lagenodelphis hosei* | 95.4 |
| Common dolphin | *Delphinus delphis* | 80.2 |
| Spinner dolphin | *Stenella longirostris* | 41.3 |
| Dall's porpoise | *Phocoenoides dalli* | 61.3 |
| Humpback whale | *Megaptera novaeangliae* | 30,408.0 |
| Pigmy killer whale | *Feresa attenuata* | 97.5 |
| False killer whale | *Pseudorca crassidens* | 578.0 |
| Sperm whale | *Physeter catodon* | 6,399.0 |
| Killer whale | *Orcinus orca* | 2,281.0 |
| Short-finned pilot whale | *Globicephala macrorhynchus* | 643.0 |

directed at large pelagics and the fishpot fisheries directed at reef and demersal species. Fish sold at major markets have historically been recorded, while those sold on beaches have only recently been incorporated in the data collection system of some islands.

### *Fishing Effort*

Fishing effort was reconstructed separately for the offshore and inshore fishery of each island. The inshore component was further subdivided into small coastal pelagic, and reef, shelf and slope components. This facilitated representation of vessels exploiting more than one fishery type at different times of the year.

### *Selection of the unit of effort*

The main factor influencing the selection of the unit of fishing effort was the availability of information. The most widespread reported unit of effort was 'number of boats'. Also, because of the relative prices in fuel there is a clear preference for vessels with diesel engines of higher horsepower towards exploiting the offshore fishery in recent years (Finlay and Rennie, 1998), while those carrying outboard engines of lower horsepower target inshore resources. Inclusion of engine horsepower is therefore an important factor in estimating fishing effort. There is also a tendency for vessels to target more than one resource type, e.g., those vessels targeting the offshore fishes (flyingfish and associated large pelagics) from November to June usually switch to demersal species from July to October. This switch in targeting and effort can be captured by inclusion of the number of fishing days in the unit of effort. 'Horsepower-days' was therefore selected as the unit of fishing effort. This allowed for comparison of fishing effort among years, countries and fishery types, without adjustments to account for differences in gear, vessel capacity or fishing efficiency. The unit chosen is the sum of the product of number of boats, average horsepower and number of fishing days per year for individual vessel types exploiting a particular fishery. There was no information from which changes in overall number of fishing days per year by the specified vessel types and fisheries could be determined. Hence 'fishing days' was used solely to represent the shift in effort of offshore fleets to the demersal/inshore fishery during the pelagic offseason. Fishing effort was linked to the respective fishery type based on historical information on the associated vessel design, degree of mechanization, and location of landing sites relative to fishing grounds. Temporal changes in these factors were also considered, and non-mechanized vessels utilizing oars and sails, as well as beach seines were assigned a default horsepower of one.

### *Linking fishing effort to fishery type*

The associated fishery types were: offshore (comprising large pelagics and flyingfish caught by troll lines, gillnet and more recently longlines), and inshore (comprising small coastal pelagics caught by beach seines, balahoo seine and gillnets; reef, deep slope and shelf demersals caught by traps and handlines). Specific criteria by which vessels could be assigned to a fishery were obtained from a review of the literature, and included

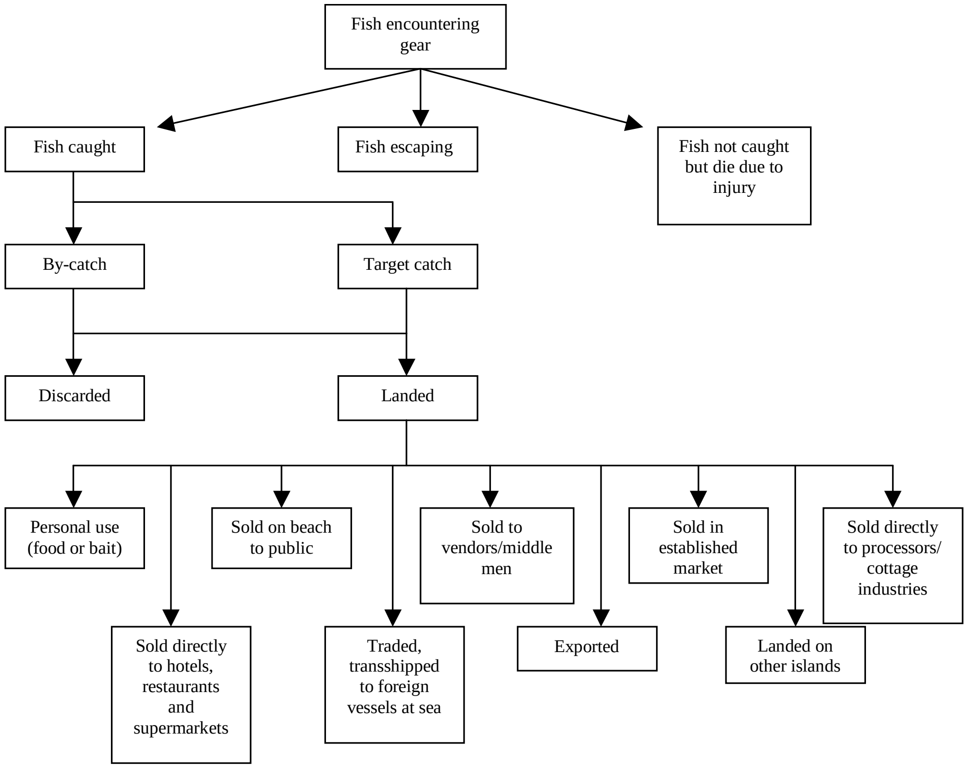


**Figure 2**: Schematic representation of the movement of catches and landings in four island nations of the southeastern Caribbean.

vessel design and length, degree of mechanization and the location of specific fisheries or fishing areas relative to the coasts, landing sites and mooring sites.

Prior to mechanization (late 1950s) virtually all vessels, regardless of design, fished for inshore and offshore species, though the latter was not yet well developed. Small boats such as canoes and dories were confined to the inshore reef areas, while the larger whalers targeted mainly pelagic fisheries and, during the pelagic off-season, reef and other demersal species. Decked sloops targeted mainly reef, slope and shelf demersals (Brown, 1945, Vidaeus, 1969 a-d). Vessel length, during the pre-mechanization period, also impacted on the fishery exploited and the duration of fishing. Hence whalers, which were typically larger and therefore more stable than canoes, could venture further offshore into rougher waters to target pelagic species, while smaller boats were confined to inshore areas and the respective fisheries. Furthermore, because of greater stability, larger vessels were more likely to fish during the hurricane season (July to October), while smaller vessels would cease fishing. In recent times, semi-industrial launches and pirogues with inboard engines target large, highly migratory pelagic species with longlines, while pirogues with outboard engines target regional large pelagics with troll lines.

Generally, from the late 1950s onwards, an unmechanized vessel was assumed to fish close to shore, either targeting small coastal pelagics with beach seines, gillnets or balahoo nets or inshore reef fisheries with traps and handlines. The degree of mechanization also impacts on the number of fishing days. A mechanized boat is less influenced by sea conditions and therefore would tend to fish during the hurricane season (July to October), when non-mechanized boats either fish closer inshore or stop fishing.

***Assigning fishing days to the respective fleets and fisheries***

Information on the seasonality of the respective fisheries were used to obtain estimates of fishing days. Vessel mechanization also proved an important factor (Epple, 1977). Non-mechanized vessels are less likely to fish during the hurricane season, especially those located on the windward coasts of the islands.

**Table 3**: Levels and percentage change in key fishery parameters between 1980 and 1999 for four island countries in the southeastern Caribbean.

| Parameter | Grenada & Grenadines | | St Lucia | | St Vincent & Grenadines | | Barbados | |
|---|---|---|---|---|---|---|---|---|
| | **Offshore** | **Inshore** | **Offshore** | **Inshore** | **Offshore** | **Inshore** | **Offshore** | **Inshore** |
| Reconstructed catch (t): 1980 | 745 | 660 | 549 | 275 | 204 | 397 | 3211 | 558 |
| Change in reconstructed catch 1980-1999 (%) | + 129 | - 12 | + 143 | + 36 | - 29 | + 64 | + 36 | - 31 |
| Reconstructed fishing effort ($10^3$ Hp-days): 1980 | 815 | 302 | 1254 | 527 | 645 | 1357 | 2255 | 1018 |
| Change in reconstructed effort 1980-1999 (%) | + 598 | + 42 | + 513 | + 133 | + 170 | + 4 | + 339 | + 134 |
| Reconstructed CPUA[a] ($t \cdot km^{-2}$): 1980 | 0.0309 | 0.3662 | 0.0341 | 0.3090 | 0.0075 | 0.2048 | 0.0181 | 1.4803 |
| Change in CPUA[a] 1980-1999 (%) | + 129 | - 12 | + 118 | + 78 | + 29 | + 64 | + 36 | - 31 |
| Reconstructed CPUE (t $10^3$ Hp-days): 1980 | 0.8435 | 2.0867 | 0.4707 | 0.3824 | 0.2952 | 0.2753 | 1.3492 | 0.5126 |
| Change in CPUE 1980-1999 (%) | - 67 | - 38 | - 65 | - 24 | - 52 | + 58 | - 69 | - 71 |

[a] CPUA stands for catch per unit area

In the earlier years, the offshore fishery targeted the regional pelagics (small tunas, dolphinfish and mackerels) using troll gear, but expanded to include large, highly migratory species (large tunas and billfishes) caught with longlines from the mid-1980s.

The pelagic fishery has traditionally been seasonal, from November to June, and the associated fleet switches to the demersal and reef fisheries during the pelagic off-season (July to October). During the pelagic season, non-mechanized vessels were assumed not to fish between November and January due to rough sea conditions. Fishing was assumed to occur 15 days per month from February to June (75 days total per year). Mechanized vessels were assumed to fish on average 10 days per month between November and January, and on average 20 days per month otherwise (130 days per year). Specifically for Grenada, vessels on the windward coast were assumed to continue targeting large pelagics from July to October (the hurricane season) on average 15 days per month (excluding one month for vessel maintenance). The total number of fishing days was therefore 175. Semi-industrial longliners operating in earlier years (1982 to 1988) were assumed to function similarly to mechanized boats (Finlay and Rennie, 1998). However, by 1989 these fished year round (Finlay and Rennie, 1998). It was assumed that fishing occurs on average 20 days per month excluding one month each year for vessel maintenance. The associated total number of fishing days was 220. A similar number of fishing days was assumed for like vessels of other islands in recent years.

Non-mechanized vessels targeting the inshore small coastal pelagic fishery were assumed to fish the same number of days each year throughout the period examined. Vessels traditionally target this fishery using beach seines and other nets year round (Finlay, 1996), but peak periods occur from May to October (Brown, 1945). It was assumed that fishing occurred 20 days per month during the peak periods and 10 days per month in non-peak periods, giving a total of 180 fishing days per year.

Generally, vessels targeting the offshore fishery on the windward coasts were also assumed to target the inshore reef, slope and shelf fishery from July to October (excluding one month for vehicle maintenance) at an average of 15 days per month (45 days per year). For fleets targeting this fishery year-round it was assumed that on average fishing occurred 20 days per month from February to October (excluding one month for vessel maintenance) and 10 days per month between November and January. The total number of fishing days was 230.

### *Analysis of reconstructed data*

Details on catch and effort reconstruction of individual island countries are presented in the individual country reports in this volume, and broad patterns are summarized in Table 3. Analyses focused on examining annual trends in reconstructed catches, catch per unit area, fishing effort and catch per unit of effort for the offshore and inshore fisheries of the respective islands. The annual trends, magnitude and level of species coverage of reconstructed catches were compared with data in the FAO FISHSTAT database for the respective islands. Catch per unit area was estimated using the parameters listed in Table 4, assuming that the offshore fishery is confined to the EEZ area and the inshore fishery is confined to the reef, shelf and slope areas.

**Table 4**: Surface areas for Exclusive Economic Zone, coral reefs, shelves and slopes for islands in the Southeastern Caribbean.

| Country | EEZ[a] ($km^2$) | Coral reef[b] ($km^2$) | Shelf and slope[c] ($km^2$) |
|---|---|---|---|
| St. Lucia | 18,002 | 160 | 522 |
| St Vincent and the Grenadines | 27,069 | 140 | 1,800 |
| Grenada and the Grenadines | 24,153 | 209[d] | 1,595 |
| Barbados | 177,346 | 100 | 277 |

a: The Global Maritime Boundaries Database, 2000 Edition. Veridian MRJ Technology Solution. Data modified to include the Territorial Seas. b: ReefBase (Oliver and Noordeloos, 2002). c: Mahon (1993). d: Mean from ReefBase (Oliver and Noordeloos, 2002) and Bacon (1984).

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**APPENDIX 1:** Institutions and individuals contributing data and literature for catch and effort time series reconstruction.

**Fisheries Departments**:

St Lucia Fisheries Department: V. Charles (Director of Fisheries); W. Joseph (Fisheries Officer).

St Vincent and the Grenadines Fisheries Department: L. Straker (Fisheries Officer); C. Jardine (Data Manager).

Grenada and the Grenadines Fisheries Department: J. Finlay (Director of Fisheries); J. Rennie (Fisheries Officer).

Barbados Fisheries Department: S. Willoughby (Director of Fisheries); C. Parker (Fisheries Officer).

**Other Institutions**:

The Organization of Eastern Caribbean States: P. Murray (Data Manager).

The CARICOM Fisheries Resource Assessment and Management Program: S. Singh-Renton (CARICOM Biologist).

The University of the West Indies Libraries at St Augustine (Trinidad) and Cave Hill (Barbados).

The National Archives: St Lucia, St Vincent.

The Library of the Bellairs Research Institute: B. Downey (Director).

The Food and Agriculture Organization: K. Cochrane (FAO Regional Representative for the Caribbean); B. Chakallal (FAO Regional Fisheries Officer for the Caribbean).

The Fisheries Management Information System of the Trinidad Fisheries Department: C. Chan A Shing (Fisheries Officer); A. Maharaj (Documentalist).

**Other individuals**:

B. Fabres (former Fisheries Officer, Trinidad).

R. Mahon (Fisheries and Environmental Consultant, Barbados)