

# Reconstructed Total Catches by the Marine Fisheries of Small Island States in the Wider Caribbean (1950 – 2010)

## Reconstrucción de las Capturas de las Pesquerías Marinas de las Islas del Caribe (1950 – 2010)

## Reconstituées des Captures Totales des Pêches Maritimes des Petits États Insulaires dans les Caraïbes (1950 – 2010)

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### ABSTRACT

Accurately recording marine fisheries catches is difficult and costly and thus under-reporting of fisheries catches occurs worldwide. Caribbean fisheries are typically small-scale operations, with a labour-intensive and dispersed nature, which make them especially difficult to monitor. To document the extent of this problem, time series of total fisheries catches by 10 island countries in the Wider Caribbean Region were estimated from 1950 – 2010 using an established ‘catch reconstruction’ methodology. This approach uses landing statistics supplied by Caribbean member countries to the FAO, and then adjusts these data for unreported components based on other accessible data and information sources. These catch reconstructions illustrate a substantial level of under-reporting. For example, the reconstructed catches of Haiti and Jamaica were on average 3 and 4.3 times higher, respectively, than landings reported by these countries to the FAO. Total unreported catches for 10 Caribbean islands over the time period 1950-2010 were over 5 million tonnes, with average annual unreported catches of 54,000 tonnes. Unfortunately, under-reported catches can lead to erroneous interpretations on fisheries trends and substantially under-value the socio-economic importance of small-scale fisheries. Comprehensive accounts of historic time series of total marine fisheries catches, including largely underestimated subsistence and recreational sectors, are needed to correctly assess the status of fisheries and their supporting resources.

KEYWORDS: Catch reconstruction, under-reporting, fisheries accounting

### INTRODUCTION

The majority of islands in the Caribbean Sea are small island developing states, that are most affected by climate change (Pauly 2010). Our seas are facing impacts from habitat degradation as coral reefs decline and seas warm; to make matters worse overfishing increases with growing seafood demand putting even greater stress on the oceans. Today there is an estimated 39 million people living in the Caribbean. Given the small land area of many Caribbean islands, most people live in close proximity to the coast. Additionally, given the popularity of these islands for sun, sand and sea, there is an influx of millions of tourists each year which causes a seasonal population swell. Thus, it is no surprise that coastal and marine resources in the region are under immense pressure.

Caribbean people highly value fish as food. Since the beginning of the 17<sup>th</sup> century, island Caribs fished with handlines from their dugout canoes, they set fish pots in streams and the sea, and they captured turtles, manatees and large fish by spears (Price 1996). Today, Caribbean countries are inhabited by the descendants of African slaves, European slave-owners, East Indian indentured labourers and Chinese and Lebanese merchants. This mixture of ethnicity is what gives the West Indies a unique culture. The vast majority of West Indians enjoy eating fish, and perceive fish to be important to their nutritional needs (Adams 1992). The same can be said for tourists visiting the region. They come to the Caribbean craving a refreshing island experience, which includes feasts of marinated ‘lambi’, grilled lobster, or seared dolphin fish. Unfortunately a key lesson learned after a century of modern fishing is that our oceans are not inexhaustible. To compound this matter, the fishery resources of the Caribbean are less abundant than those in adjacent waters, such as the Gulf of Mexico (USAID and NOAA 1987), due to warm surface waters which limit upwelling of nutrients.

The dominant marine habitats include nearshore reefs, mangroves and seagrass as well as offshore pelagic systems. The main fisheries resources in the Caribbean Sea include reef fishes, bottom fishes, pelagic oceanic fishes, and crustaceans and molluscs. Reef fishes include: grunts (*Haemulidae*), parrotfish (*Scaridae*), squirrel fish (*Holocentridae*), snappers (*Lutjanidae*) and groupers (*Epinephelus*). Bottom fish consist of: croaker (*Micropogonias* spp.), sea trout (*Cynoscion* spp.), sea catfish (*Ariidae*) and porgy (*Calamus* spp.). The oceanic pelagic resources are: tunas and billfishes, dolphinfish (*Coryphaena hippurus*), kingfish (*Scomberomorus cavalla*), sharks and flyingfish (*Exocoetidae*). Crustaceans and molluscs utilized are: penaeid shrimps, spiny lobster (*Panulirus argus*), queen conch (*Strombus gigas*), and crabs (*Callinectes* spp.) (USAID and NOAA 1987).

Generally the fisheries of the Caribbean range from small-scale artisanal or subsistence operations using open, outboard-powered vessels, 5-12 m in length, to industrial shrimp and groundfish trawl operations which utilize vessels over 20 m. Recently there has been a growing trend towards using medium-size vessels which exploit offshore species such as large

tunas and billfish (Fanning et al. 2011). Modern sport fishing facilities exist in Puerto Rico, US Virgin Islands (USVI), British Virgin Islands (BVI), Cuba, Dominican Republic, St. Lucia, Martinique, Trinidad and others (Campos 1984). The typical Caribbean fishing trip lasts for less than a day, with the exception of the tuna longliners and shrimp or groundfish trawlers, which can be at sea for more than a week. Caribbean fishers process and market catches themselves on beaches, in villages or to hotels and restaurants. In some instances a middle vendor is involved.

Here, we define ‘subsistence’ fishing as any fishing activity that does not generate an income above that needed to live at the most basic level (Teh and Sumaila 2011). We adopt the definition used by the FAO for artisanal fishing, which is that carried out by individuals or households involving low investment in technology and gear and whose catch is sold locally or exported. Whilst recreational fishing is that where the main motivation is not consumption, trade nor sale of the catch but rather for enjoyment (Cisneros Montemayor 2010).

The landings supplied to the FAO reports mainly commercial landings, which ultimately results in an underestimation of actual fish removals from the marine ecosystem. The Caribbean region has subsistence fishing for local consumption, artisanal fishing for local and tourist consumption and recreational fishing for pleasure - all of which are falling under the radar as unreported catches. The unreported catches can be illegal or simply unmonitored due to logistical barriers. In the Caribbean, these barriers are present in the form of extensive and often difficult to access coastlines, largely open-access fisheries, poor administrative practises and a general attitude of non-compliance in the fisheries sector. The widespread corruption within Caribbean governments and general attitude of non-compliance in Caribbean society infiltrates all sectors including the fisheries industry. When people think that rules are made to be broken and relish the idea that they can get away with it or, in the case of our *de facto* open-access fisheries resources, that it is a “free for all”, illegal unreported and unregulated activities are to be expected.

Globally small-scale fisheries are fundamental for the livelihood, welfare, and food security of coastal communities (Teh and Sumaila 2011), yet small-scale fisheries, including artisanal or subsistence fisheries, have been largely ignored by policy makers (Zeller et al. 2006). In the Caribbean subsistence and recreational fisheries are sparsely studied and only basic qualitative information is available. Meanwhile, illegal, unreported and unregulated (IUU) fishing is a serious issue for the Caribbean. Indeed, the focal point at the first joint meeting between 19 countries spanning the Central American and Caribbean region held in Belize during September 2012, was IUU catches taken from the Caribbean Sea. “The event was the first joint meeting to bring together as many countries to discuss the plight of their shared marine resources and the

uphill battle in fighting illegal, unreported and unregulated (IUU) fishing, which knows no borders”. Even in the case of legal fishers, official statistics only monitor main landing sites or markets, while it is commonplace for Caribbean fishers to operate in remote areas and/or to market catch themselves in villages or roadsides that are seldom monitored by officers of the local fisheries department.

Total catch is the most direct measure of the productivity of a fishery; it is the initial quantifier, the unit of value that a fisher would use, and unsurprisingly it has received a lot of attention in the fisheries research community. For instance, in terms of data gathering, both at local and global scales, a global database of catches (since 1950) has been maintained by the FAO (Garibaldi 2012). Though the limitations of catch as a stand-alone indicator of fishery status has been debated (Kleisner et al. 2012), catch is the single most important component of the various quantitative tools for fish stock management. There is no question that the catch of a fishery is what contextualises the importance of the fishery. In other words, if you want to plan a fishery you need to know how much you are catching. In view of the recognized importance of catch statistics for management and the state of data monitoring in the Caribbean, alternative methods must be sought to provide better estimates. Catch reconstructions do just this. Under the fundamental rationale that ‘unknown catch does not equal zero catch’ (Pauly 1998), the *Sea Around Us* project at the University of British Columbia are improving the accounting of historical fisheries catches for every country in the world. This is an important task since we all depend on the marine ecosystem for at least one of the following: food, livelihoods, recreation, culture or spiritual needs.

## METHODS

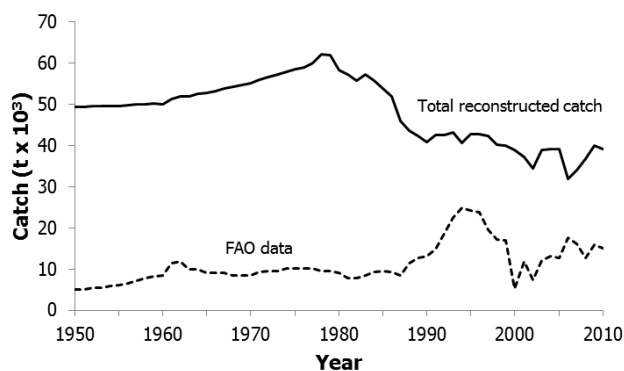
It has been established that the non-consideration of small-scale fishing sectors (artisanal, subsistence, and recreational) and industrial discards is a problem. Thus, the premise of the catch reconstruction methodology is that when it is known that catch in official datasets is deficient, but the magnitude of missing catch is unknown, a well-informed estimate should replace a dash or zero value (Pauly 1998). Information was obtained from a variety of sources including: published articles (e.g. peer-reviewed journals, Gulf and Caribbean Fisheries Institute proceedings, Caribbean Regional Fisheries Mechanism website <http://www.caricom-fisheries.com/>), unpublished articles (e.g. Ministry of Environment documents, Fisheries Division documents, recreational fishing websites records), and local knowledge (e.g. telephone conversations with local fisheries officers in every country presented in this study).

Statistics for marine fisheries catch by 10 Caribbean countries Cayman Islands, Jamaica, Haiti, Bahamas, British Virgin Islands, Anguilla, Montserrat, Guadeloupe,

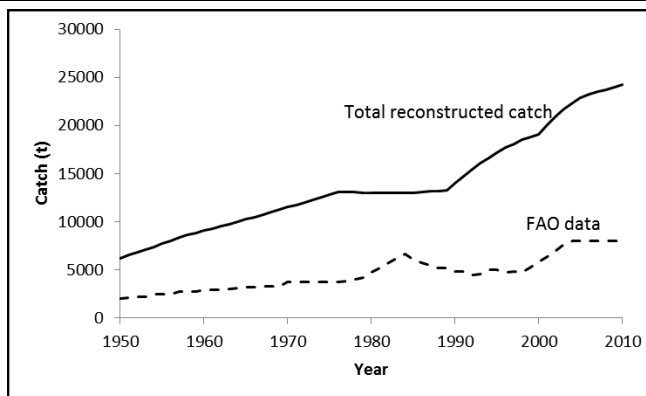
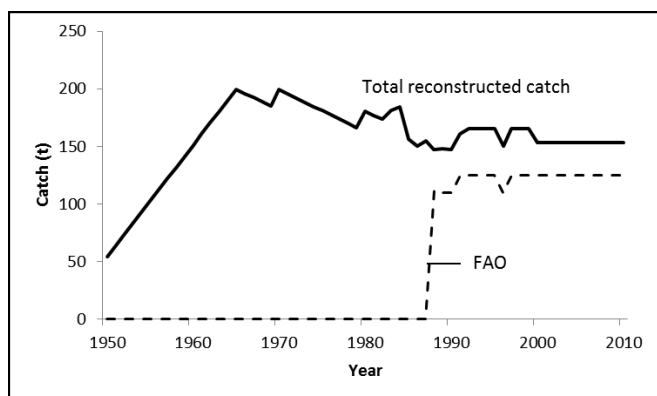
Dominica and Martinique from 1950 – 2010 were extracted from the FAO database, where catch is specified by FAO area 31 for the Caribbean Region (Available at <http://fao.org/fishery/statistics/software/fishstat/en>). In most instances, due to inconsistencies identified in national datasets, the FAO dataset forms the basis for subsequent estimations. However, there are cases where the national datasets have been validated and deemed to be the more appropriate foundation for a reconstruction.

Using information on catch (total, by species, by area, by landing site), effort (CPUE), or seafood demand (i.e., consumption [as per household surveys]) we develop ‘anchor points’ in our time series 1950 – 2010. Once we have established reliable anchor points, direct linear interpolation is used between anchor points or sometimes on a per capita basis to estimate total catches for a country based on all available and accessible information sources.

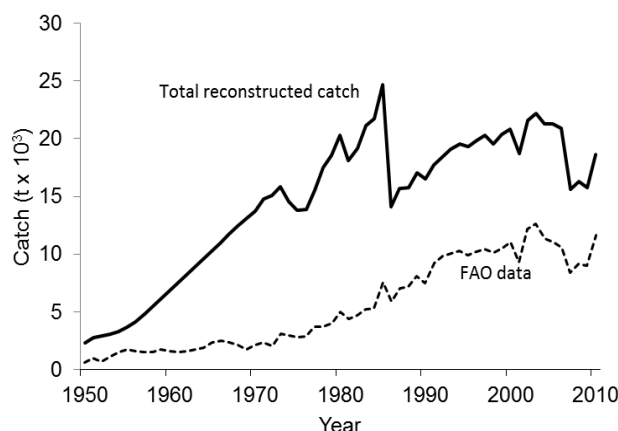
### RESULTS



**JAMAICA:** Total catches for all marine fisheries sectors, including subsistence, recreational and discards, in Jamaica, for the time period of 1950 – 2010, equated to approximately 3 million tonnes which was 4.3 times the data reported to the FAO (683,855 t). The discrepancy between our estimate and the reported data is attributable to large unmonitored non-commercial fisheries (Lingard et al. 2012).

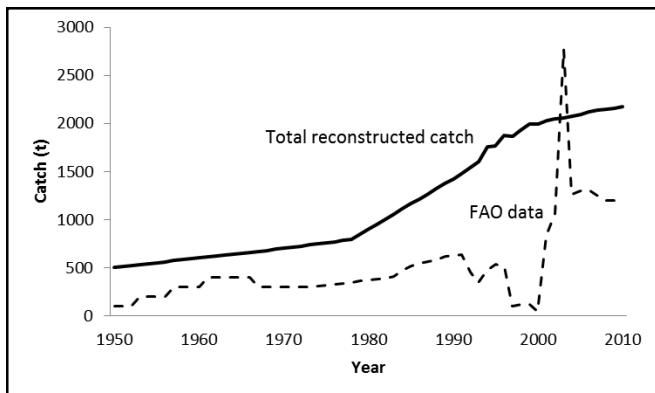


**HAITI & NAVASSA ISLAND:** The catch reconstruction for Haiti and Navassa Island for the period 1950 – 2010 combined estimates of artisanal and subsistence catches and was estimated at 846,900 t, which was approximately three times the catch reported to the FAO (280,272 t). A large part of the discrepancy was due to the inclusion of unreported subsistence catch estimates and the improved accounting of conch, lobster, crab, and shrimp artisanal fisheries in the early time period.

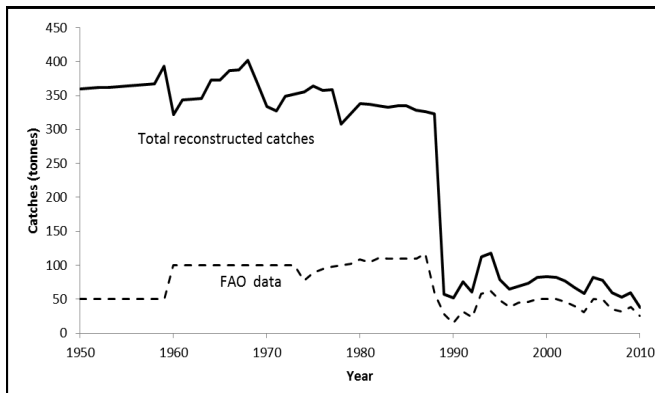


**BAHAMAS:** Reconstructed catch for the Bahamas totalled 883,064 t over the period 1950 – 2010, and was 2.6 times the official data submitted to the FAO (336,190 tonnes). This discrepancy was mainly due to unreported catches from sport and subsistence fisheries as well as the systematic underreporting of commercial fisheries (Smith, In press).

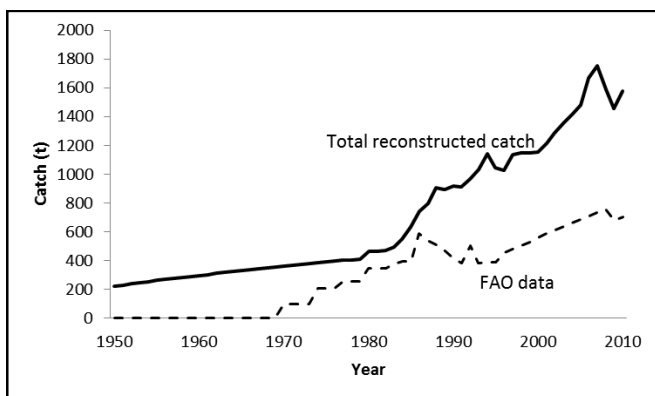
**CAYMAN ISLANDS:** Our reconstruction of total marine catches in the Cayman Islands, including artisanal, subsistence, recreational and shark catches, taken between 1950 – 2010, equated to approximately 10,000 t which was 3.4 times the catch data reported to the FAO (2,817 t). Our investigation of Caymanian fisheries illustrated the need for better reporting of fisheries catches by all fisheries sub-sectors (Harper et al. 2009).



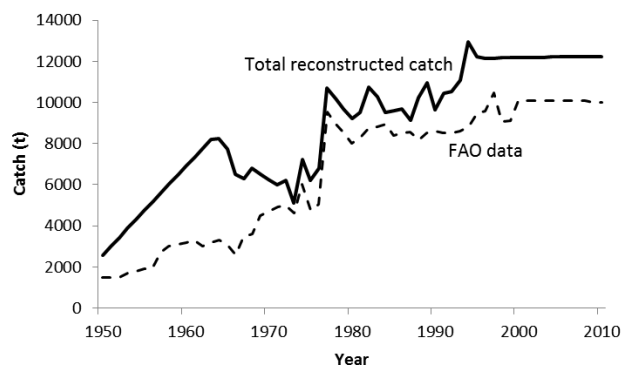
**BRITISH VIRGIN ISLANDS:** The FAO recorded catch for 2003 was a one year spike in catches, and since we could find no explanation for this sudden rise, we did not accept the FAO value for 2003 and assume no unreported catches for that year. The total reconstructed catches for the British Virgin Islands (BVI) for the period 1950 – 2010 were estimated to be approximately 72,000 t, which is 2.3 times the reported catch of 30,985 t as presented by the FAO on behalf of the BVI.



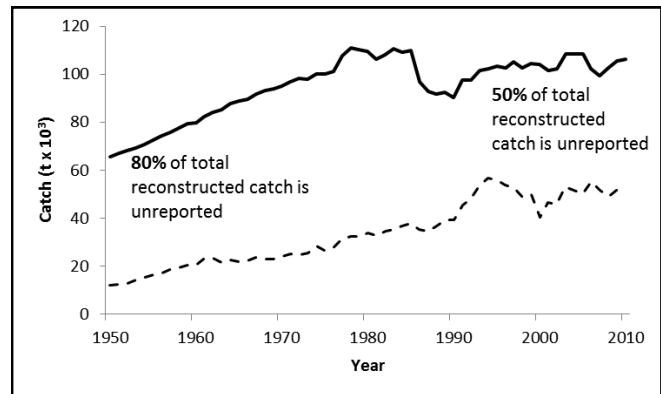
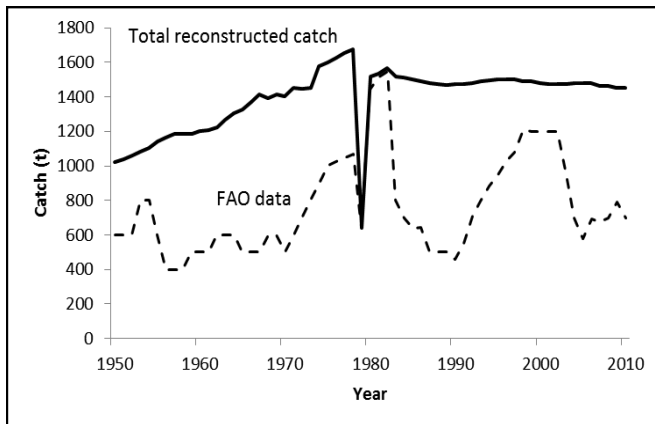
**Montserrat:** More complete time series data on total marine landings for Montserrat, from 1950 – 2010, revealed 15,307 t versus the 4,288 t officially reported to the FAO. The difference can be attributed to under-reporting of small-scale fisheries, from the subsistence and artisanal sectors in the early time period.



**ANGUILLA:** Total reconstructed catches taken for the period 1950 – 2010 in Anguilla, were approximately 42,500 tonnes which is 2.4 times the official landing of 17,854 t reported to the FAO. The difference can be attributed to under-reporting from artisanal, subsistence and recreational sectors.

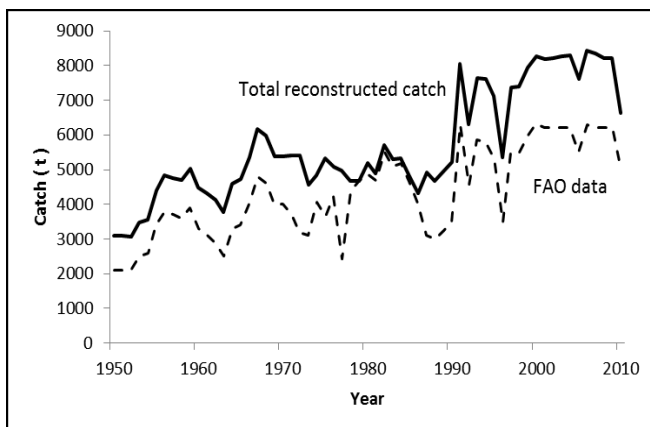


**GADELOUPE:** Total reconstructed catches taken in Guadeloupe from 1950 – 2010 were estimated to be approximately 540,000 t, which is 1.3 times the catch reported to the FAO (402,573 t). The discrepancy is due to the omission of subsistence and recreational catches in official statistics (Frotté et al. 2009a).



**Dominica:** Dominica’s total reconstructed fisheries catches for the period 1950–2010 were estimated to be nearly 85,000 t, which is 1.8 times the data officially reported to the FAO (46,523 t). The difference can be attributed to under-reporting of small-scale fisheries, from both subsistence and artisanal sectors.

**SUMMARY:** Total reconstructed catches for 10 Caribbean countries covered above were estimated to be approximately 5,798,725 t from 1950 – 2010, which is 2.8 times the catch total of 2,070,000 t supplied to the FAO. Under-reported and unreported catches from the subsistence, artisanal, recreational and industrial discards amounted to 3,728,568 tonnes for the time period 1950–2010. Unreported catches comprised 80% of total reconstructed catches in the early time period and 50% in the later time period. This improvement in reporting coverage is hopefully a sign that change is on the way.



**MARTINIQUE:** Total reconstructed catches were estimated to be approximately 35,000 t from 1950 – 2010, which is 1.3 times the catch total of 264,800 t supplied to the FAO. Fisheries in Martinique are predominately small-scale, with catches for commercial and/or subsistence purposes (Frotté et al. 2009b).

**DISCUSSION**

Fishing is essential to island communities of the Caribbean. Still many Caribbean islands, for example Montserrat, are heavily reliant on imported fish, predominantly salted cod from Canada. Even so, the importance of locally caught marine species has been understated (Vidaeus 1970). Local catches are substantially higher than what is being reported to international agencies, and contribute significantly to the food security of West Indians. A substantial portion of fresh fish demand in the Caribbean is met through subsistence fisheries, a sector that has been largely ignored in traditional data collection procedures. For instance, in Jamaica, the growing spear fishing sector made up a considerable portion of unreported subsistence catches. Since these fishers use landing sites that don’t fall within the normal locations surveyed by fisheries officers (N. Hado, Food for the Poor, Pers. comm.), they remain unconsidered. Another case: although early fishing efforts targeting nurse sharks and tiger sharks in the Caribbean Sea were documented in literature, they have not been included in the catch statistics supplied to the FAO. Thus the shark industry in the Cayman Islands was short-lived due to the high exploitation rate at which sexually mature female sharks were targeted for the size and quality of their hides. Yet another case: the fisheries statistics that are reported to

the FAO on behalf of Martinique include only commercial fisheries landings. Our catch reconstruction attempts to account more comprehensively for the total marine landings of Martinique by including estimates of subsistence and recreational catches.

Tourism is a major income earner for many of the Caribbean states including Dominica. The success of the sector is based on a healthy natural environment which includes a healthy marine ecosystem. Dominica's total reconstructed fisheries catches for the period 1950-2010 were estimated to be nearly 85,000 t, which is 1.8 times the officially reported catch. This amount is substantial and shows that local fish products contribute significantly to the island's dietary requirements, something that had previously been understated in a market analysis of the sector (Goodwin et al. 1985). Though tourism has declined due to the global economic crisis, catches supplying visitors are important and should not be overlooked. Likewise, tourism is a primary industry for the Bahamas. Fish is a source of protein for residents and tourists alike, and both groups catch and eat local fish. However, demand for fresh fish by the tourist industry in combination with similar demands from a growing local resident population raises an important question for the Bahamas and the region as a whole: can domestic small-scale fisheries satisfy current fishing and seafood consumption patterns in the long term?

Despite economic valuations of marine resources, and a growing appreciation that fisheries supply us with an array of direct and indirect benefits, Caribbean fisheries management organisations have limited operational capacity. In 1984, seafood products worth an estimated US\$2.2 million were harvested by Anguillan fishermen. This included some US\$1.3 million worth of exports, making the fishing industry the most valuable foreign currency earner after tourism (Jones 1985). A census in the same year indicated that 7% of the working population were full-time fishermen. However despite the evident socio-economic importance of Anguilla's small-scale fisheries, government spending for the effective management of fisheries is severely lacking in Anguilla. Several limitations in the department of marine and fisheries resources have been reported and include inadequate staffing and additional workloads (Gumbs 2003). A report by the Development Planning Unit of the Ministry of Finance stated that fishing contributed 2.5 percent to the GDP of the British Virgin Islands in 1988. Despite the economic and cultural significance of marine fisheries to these islands, fisheries administration is lagging; with less than 25 years of formal fisheries management in the BVI (Mills et al. 2005). There is a wide gap between the value of fisheries resources and the importance placed on fisheries management in the Caribbean. Most fisheries managers in the Caribbean are required to manage marine resources on meager budgets, with little scientific information and a limited capacity for monitoring and enforcement.

Whilst assumptions may be necessary to achieve our reconstructions, we maintain a conservative approach. For example our estimates of subsistence catches for Guadeloupe may be underestimated given the lack of data on IUU catches in this region. Further, for a number of the countries covered in this study, no reconstruction of the recreational sector or discards was possible due to limited data accessibility e.g. Montserrat, Dominica. Therefore, total marine extractions are likely higher than the total reconstructed estimates suggested in this study. The reconstructions can be viewed as an improvement on the data submitted to the FAO catch database and are available online at [www.searoundus.org](http://www.searoundus.org).

### ACKNOWLEDGEMENTS

Thank you Jeanel Georges, Kyrstn Zylich, Dyhia Belhabib, Danielle Knip, Andres Cisneros, Frederic Le Manach, Dawit Teflesmichael and Robin Mahon.

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