Reconstruction of total marine fisheries catches for Cuba (1950 – 2010)[1]

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Abstract

The reconstructed total catch for Cuba (within Cuba's EEZ) was estimated to be over 2.75 million t for the period 1950 to 2010. This is around 18 percent higher than the 2.33 million t reported by FAO on behalf of Cuba (although FAO data were adjusted to represent Cuban catches within the Cuban EEZ only). Reconstructed total catch including catch allocated to Caribbean waters outside the Cuban EEZ was estimated to be just over 3.15 million t, or 16% higher than the total landings reported for FAO area 31 on behalf of Cuba. These data include all reported commercial landings, as well as estimates of unreported catches generated from the artisanal, industrial, subsistence, and recreational sectors. Overall, catches within the EEZ peaked at over 76,700 t·year^{-1} in 1985 and have been declining ever since, with just under 28,500 t·year^{-1} in 2010. Present declines in marine catches are symptomatic of overexploitation and are of particular concern, as the fishing industry is a primary source of revenue and protein for thousands of Cubans.

Introduction

Cuba has increasingly been playing a larger role in the global seafood market as a producer of high-valued seafood (Adams *et al.* 2001; Baisre *et al.* 2003). While several policies have been introduced in recent years to address over-fishing, most of the Cuban fishery resources are considered fully- or over-exploited (Claro *et al.* 2001). The Caribbean spiny lobster (*Panulirus argus*) is the most valuable target species, accounting for about 15% of total near-shore catches and 60-65% of the national income from fisheries products (Claro *et al.* 2001; Muñoz-Nuñez 2009). The shrimp fishery is the second most valuable fishery and accounts for over 85% of the total commercial catches (Baisre *et al.* 2003). The shrimp fishery targets mainly two species, the pink shrimp (*Penaeus notialis*) and white shrimp (*P. schmitti*). Until the 1990s, the majority of Cuban fisheries were government owned and managed. The Ministry of Fishing Industries (Ministerio de la Industria Pesquera, MIP) was the authority in charge of managing marine resource use and the only authorized purchaser of commercial catches from fishers (Claro *et al.* 2001; Claro *et al.* 2009). As a result, commercial landings and fishing effort have been fairly detailed and reliably recorded (Claro *et al.* 2009).

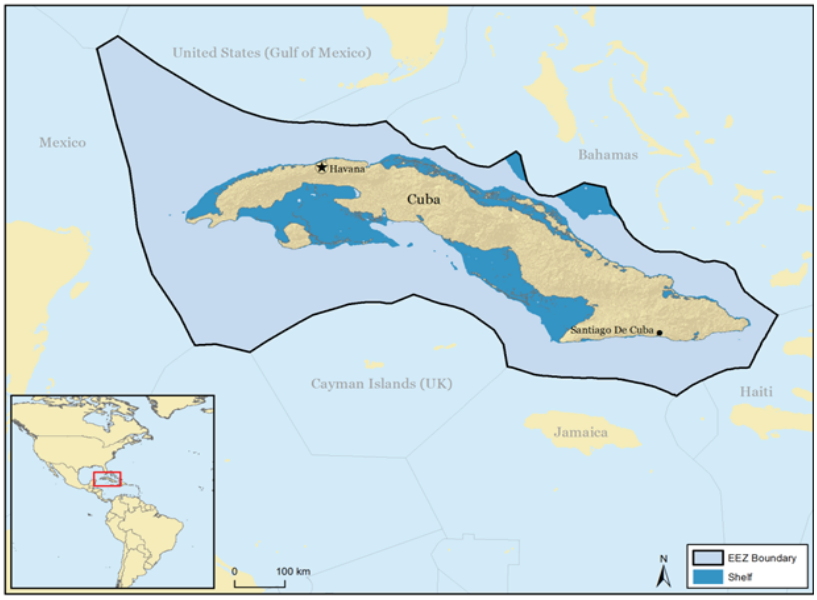

Figure 1. Cuban Exclusive Economic Zone (EEZ) and shelf area (to 200 m depth).

The Cuban Archipelago is located in the northern Caribbean Sea, adjacent to the Gulf of Mexico to the west and the Atlantic Ocean to the east (Figure 1). The mainland of Cuba is surrounded by four major groups of islands: Los Colorados, north-east of the Pinar del Rio Province; Sabana-Camagüey Archipelago, north of Matanzas, Villa Clara, Sancti Spirtus, Ciego de Avila and Camguey; Jardines de la Reina, south of Ciego de Avila and Camaguey; and Los Canarreos, south of Matanzas, Habana, and Pinar del Rio. The total land area is approximately 110,900 km^2 and the Exclusive Economic Zone (EEZ) covers an area of about 365,500 km^2 (www.seaaroundus.org, Figure 1). The coastline is marked by reefs, bays, keys and islets, while the southern coastline is dominated by swamps and lowlands. The country is divided into 14 provinces, 169 municipalities, and the Special Municipality of the Isle of Youth (www.cubadiplomatica.cu). As of 2010, the population of Cuba was over 11.2 million (WorldBank), with approximately a third of the population located along the coast. Major economic activities include the sugar agro-industry, tobacco harvest and manufacturing, nickel mining, tourism, and fishing.

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Prior to the 1960s, Cuban fisheries consisted mostly of small boats targeting near-shore, high-value species (Adams *et al.* 2001; Baisre *et al.* 2003). Support from the Soviet Union in the 1960-70s promoted the development of large, distant-water fleets that targeted low-valued stocks (Adams *et al.* 2001; Baisre *et al.* 2003). Cuban fisheries underwent a rapid growth phase which lasted until the end of the 1970s (Valle *et al.* 2011). The end of this period was marked by declines in several important commercial species in the finfish fishery (Claro *et al.* 2009). By the early 1990s, Cuban fishing efforts were curtailed as a result of the breakup of the Soviet Union (leading to an end of subsidies and cheap fuel supply) and stricter US embargo regulations (Adams *et al.* 2001; Baisre *et al.* 2003). This resulted in a reduction in distant-water landings and a return to focusing on near-shore, high-value finfish and shellfish (Adams *et al.* 2001; Baisre *et al.* 2003). In response to the economic crisis of the 1990s, the Cuban government initiated a series of reforms intended to improve efficiency and productivity of the fishing industry (Adams *et al.* 2001). This included an overall decentralization of the MIP and delegation of production activities to newly created Provincial Fishing Associations.

An earlier reconstruction of Cuba's commercial fisheries catches from 1950 to 1999 was undertaken by Baisre *et al.* (2003). Using national records obtained from the Cuban Ministry of Fishing Industries, and reported landings from FAO FISHSTAT (FAO area 31), the authors separated catches into 'inshore' (EEZ/shelf) and 'offshore' (area 31 outside of Cuban EEZ/shelf) components. In addition to this, national data on shrimp fisheries and studies on shrimp by-catch composition (Claro *et al.* 2001), were used to reassign a large portion of the 'miscellaneous' category 'marine fishes nei' to specific taxa. Overall, the reconstruction showed a rapid increase in commercial landings after 1959, peaking at 76,000 $t \cdot year^{-1}$ in 1987. Since then, landings have declined, evidence of over-exploitation of marine resources (Claro *et al.* 2004). Using the database constructed by Baisre *et al.* (2003), FAO reported landings data, and additional information obtained from published reports, here we estimated total marine catches for Cuba from 1950 to 2010. Although tuna and other large pelagic species are targeted by large scale Cuban fisheries, the catch of these species was not considered in the original reconstruction and will not be considered here either. These large-pelagic catches will be addressed in a separate global report focusing specifically on large pelagic catches by ocean basin. Therefore, in this reconstruction the following 12 species were not considered: albacore tuna (*Thunnus alalunga*), Atlantic bluefin tuna (*Thunnus thynnus*), Atlantic sailfish (*Istiophorus albicans*), Atlantic white marlin (*Kajikia albida*), bigeye tuna (*Thunnus obesus*), blackfin tuna (*Thunnus atlanticus*), blue marlin (*Makaira nigricans*), common dolphinfish (*Coryphaena hippurus*), little tunny (Atlantic black skipjack; *Euthynnus alletteratus*), skipjack tuna (*Katsuwonus pelamis*), swordfish (*Xiphias gladius*), and yellowfin tuna (*Thunnus albacares*).

Methods

Total marine catches in Cuba were estimated for the period 1950 to 2010. The original reconstruction by Baisre *et al.* (2003) was accepted as our starting point for the industrial and artisanal sectors with only minor adjustments made in order to meet the data definition requirements of *Sea Around Us*. We used FAO landings data (excluding the 12 large pelagic taxa) as our baseline for comparison and compared the database constructed by Baisre *et al.* (2003) (with our adjustments) to FAO data from 1950 to 1999. In order to extend the reconstruction to 2010, the average ratio of total reconstructed catch to reported FAO landings from 1997 to 1999 was applied to FAO landings from 2000 to 2010. Comparison of FAO landings data and information presented by Baisre *et al.* (2003) allowed us to calculate reported and unreported catches from industrial and artisanal fisheries. National records and FAO landings data do not account for catches generated by subsistence and recreational fisheries. Therefore, we used information from published reports, and assumption-based estimates to determine unreported catches generated by these sectors. Total marine catches in Cuba are equal to the sum of all reported and unreported catches from commercial, subsistence, and recreational fisheries.

Inshore and offshore catches

Baisre *et al.* (2003) separated catches from 1950-1999 into inshore (EEZ) and offshore (area 31 outside of the Cuban EEZ) components using FAO data and national records. In order to extend this to the 2000-2010 period, we determined the ratio of catches inside/outside the EEZ for species with offshore catch components in 1999, and then applied this ratio to the total catches of these species for each year between 2000 and 2010.

Industrial sector

The Cuban industrial sector includes the shrimp fisheries and associated by-catch species. Catches which had been allocated outside of the EEZ by Baisre *et al.* (2003) were also considered to be part of the industrial catch, as artisanal vessels (by definition) do not fish beyond the EEZ boundaries. However, the vessels making these catches may be considered semi-industrial by Cuban standards. Baisre *et al.* (2003) suggested that the majority of shrimp by-catch is included in the FAO data as 'marine fishes nei', as such by-catch is used for fishmeal production. The previous reconstruction provides tonnages of by-catch for the period 1969-1999. The species composition of the shrimp by-catch is summarized in Claro *et al.* (2001) and was used to derive the taxonomic breakdown for the shrimp by-catch from 1969-1999.

By-catch from 2000 to 2010

To determine the by-catch for the 2000-2010 period, the ratio of by-catch to FAO shrimp landings in 1999 was applied to the FAO shrimp landings in the following years. The resulting by-catch values were subtracted from the FAO category 'marine fishes nei', and the remaining FAO 'marine fishes nei' catches were considered artisanal. The taxonomic breakdown of the by-catch was derived using the same species proportions applied to the 1969-1999 shrimp by-catch by Baisre *et al.* (2003).

Discards

While Baisre *et al.* (2003) assumed that all shrimp by-catch was retained, landed and used for fishmeal production, here we assumed that a small portion of by-catch was likely not retained but rather discarded. These likely consisted of small hard-shelled organisms (e.g., small crabs) and other invertebrates or damaged fishes not suitable for retention and fishmeal production. Hence, we applied a conservative 2% discard rate to shrimp landings for the entire time period, which was assigned to 'Brachyura', 'marine invertebrates nei' and 'marine fishes nei' in equal proportions.

Taxonomic breakdown of the artisanal catch from 1950 to 2010

A large portion of the reconstructed catch from 1950 to 1999 was attributed to the 'marine fishes nei' category. Therefore, we used the species composition of the total catch (excluding the shrimp and associated by-catch that was deemed to be reported) each year to reassign a significant portion of the 'marine fishes nei' catch to better taxonomic resolution (i.e., family, genus or species). For the 2000 to 2010 period, we reassigned a significant portion of the FAO 'marine fishes nei' category to specific taxonomic groups using the FAO species proportions excluding the shrimp and already disaggregated by-catch. The new artisanal species proportions were then used to derive the species composition of the unreported artisanal catch for the same period.

Subsistence from 1950 to 2010

Cuban population data were obtained from Populstat (www.populstat.info) for 1950 to 1959, and from the WorldBank (data.worldbank.org/country/cuba) for 1960 to 2010 (Figure 2). Total annual coastal population was determined by applying the percent coastal population to the total population for each year. Coastal population data were known for 1990, 2000, and 2010 (CIESIN 2012). The percentages of population living on the coast were interpolated between 1990, 2000 and 2010, and the 1990 anchor point was carried back, fixed, to 1950. From 1950 to 2010, we assumed a decrease in *per capita* subsistence seafood consumption, and linearly interpolated from an assumed 2 kg·person^{-1}·yr^{-1} in 1950 to 1 kg·person^{-1}·yr^{-1} in 2010. These rates were applied to the total coastal population to determine the total subsistence catch per year. The total subsistence catch was disaggregated at the family level using the artisanal family composition for the same period, excluding catch associated with the 'Caribbean spiny lobster' and 'Stromboid conchs nei'.

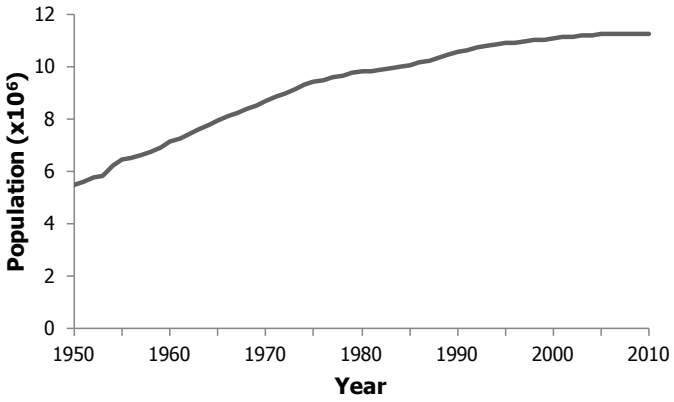

Figure 2. Population estimates for Cuba, 1950-2010.

Cuban tourism and recreational fishing from 1950-2010

There has been a rapid increase in tourist arrivals to Cuba since the late 1980s (Espino 2008). Recreational fishing is a popular attraction for tourists; however few attempts have been made to quantify the extent of recreational fishing in Cuba (Figueredo Martin *et al.* 2010). We estimated recreational catches based on the assumption that recreational fishers make up 20% of tourists arriving to Cuba. We then estimated the number of recreational fishers using available data on tourist arrivals from 1950 to 2010. Tourism data from 1950 to 1961 and 1990 to 2000 were based on estimates made by Jayawardena (2003). We assumed minimal tourist arrivals after the Cuban revolution in 1959, until around 1975 when efforts to promote the tourism industry renewed (Elliott and Neirotti 2008; Taylor and McGlynn 2009). Therefore, we set the number of recreational fishers to a very conservative zero from 1961 to 1975 and interpolated between 1975 and 1982. From 1982 to 1989 and 2001 to 2007, tourist arrivals were based on estimates made by Espino (2008). Tourist arrivals from 2008 to 2010 were obtained from the Cuban National Statistics Office (Anon. 2012). Finally, we assumed a recreational catch rate of 5 kg·recreational fisher^{-1}·year^{-1} and assigned the estimated recreational catch to four fish families commonly associated with recreational catch: Serranidae (20%), Lutjanidae (30%), Haemulidae (20%), and Scombridae (30%).

Catch-and-release has become an increasingly popular option for recreational fishers, especially if they fish in marine protected areas (Figueredo Martin *et al.* 2010). This method reduces the impact of recreational fishing on marine ecosystems and has been considered more economically and ecologically favorable compared to recreational fishing for consumption purposes. Catch-and-release is the only permitted form of fishing practiced in the Jardines de la Reina reserve. This is the largest marine reserve in the Caribbean and a popular destination for recreational fishers around the world (Figueredo Martin *et al.* 2010).

Results

Reconstructed total catch 1950-2010

The reconstructed total marine catch for Cuba within Cuba's EEZ waters is estimated to be over 2.75 million t over the 1950 to 2010 period. This is 18% higher than the amount reported by FAO (after adjustment for catches within the EEZ only; Figure 3a). Total reconstructed catch including catches allocated to outside the EEZ was estimated to be over 3.15 million t (i.e., 16% higher than the landings reported by FAO for area 31, but excluding the large pelagics).

Reconstructed total catches within Cuba's EEZ waters increased from over 10,000 t·year^{-1} in 1950 to a peak of 76,700 t·year^{-1} in 1985, and then declined to approximately 28,500 t·year^{-1} in 2010. Of the reconstructed catch, the artisanal sector constitutes 66% (1.8 million t), industrial 23% (644,500 t), subsistence 10% (268,400 t), and recreational 1% (almost 36,000 t; Figure 3a). The Caribbean spiny lobster (*Panulirus* argus) was the largest contributor, accounting for nearly 21% (571,000 t) of the total catch. This was followed by *Lutjanus synagris* (5.6%), Elasmobranchii (5.0%), Haemulidae (4.9%), *Penaeus duorarum* (4.8%), and *Crassostrea rhizophorae* (4.1%; Figure 3b).

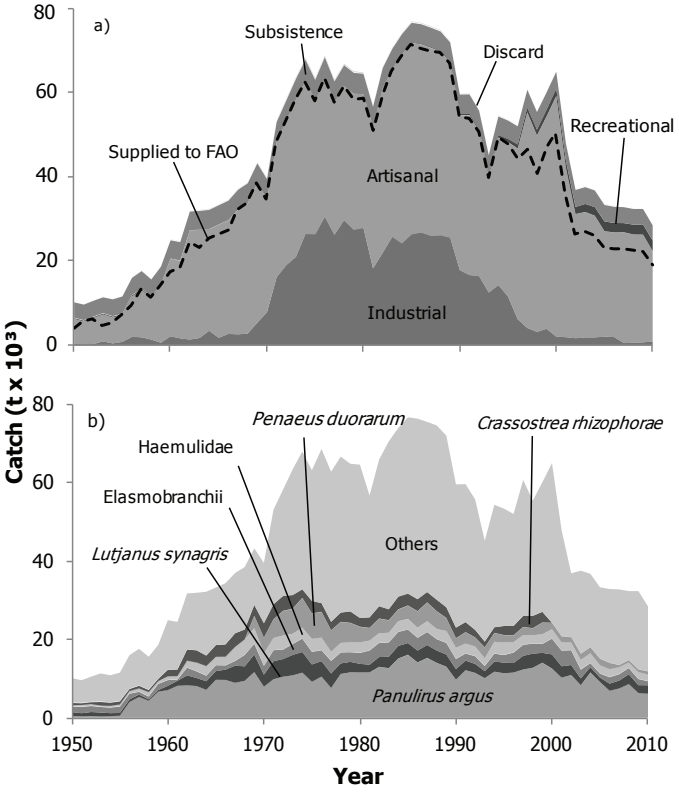

Figure 3. Reconstructed total catch by a) fisheries sector plus discards for Cuba (inside the Cuban EEZ) for 1950-2010. Note that data reported by FAO on behalf of Cuba are overlaid as line graph; and b) by major taxa with 'others' representing an additional 60 taxa.

Industrial shrimp fisheries and by-catch

Beginning in the late 1960s, estimated industrial catch, including by-catch associated with the shrimp fisheries, increased rapidly to an average of nearly 28,000 t·year^{-1} in the late 1970s. Between 1969 and 1989, industrial catch totaled 488,000 t. By the early 1990s, industrial catch began to decline, reaching 1,000 t·year^{-1} in 2010. The total by-catch generated by the Cuban shrimp fisheries from 1969-2010 was about 442,300 t. Following 1969, recorded by-catch increased considerably to an average of almost 20,300 t·year^{-1} in the late 1970s. This was followed by a sharp drop to 13,750 t·year^{-1} in 1981 which then rose again to an average of 21,450 t·year^{-1} between 1983 and 1989. By-catch has significantly declined since the early 1990s, dropping to 265 t·year^{-1} in 2010. By-catch was largely composed of mojarras (Gerridae) including *Eucinostomus* spp. and *Diapterus rhombeus*, accounting for approximately 8% and 7%, respectively. In addition to this retained by-catch, we conservatively estimated a general discard of 3,345 t over the 1969 to 2010 time period (Figure 3a).

Artisanal fisheries

Reconstructed artisanal catch from 1950 to 2010 was just under 1.81 million t. Artisanal catch increased from less than 6,000 t·year^{-1} in 1950 to a peak of nearly 57,000 t·year^{-1} in 2000. Since the early 2000s, artisanal catches have rapidly declined to less than 21,400 t·year^{-1} in 2010. The Caribbean spiny lobster (*Panulirus argus*) contributed to the majority of the total artisanal catch, accounting for over 571,300 t (31.7%) of the catch from 1950-2010. This was followed by *Lutjanus synagris* (7.6%), Elasmobranchii (6.4%), *Crassostrea rhizophorae* (6.3%), and Haemulidae (5.5%).

Subsistence fisheries

Subsistence catches increased gradually from around 3,640 t·year^{-1} in 1950 to a peak of nearly 5,000 t·year^{-1} in 1976. It has been on a gradual decline ever since, dropping back down to 3,600 t·year^{-1} in 2010. Subsistence catches were dominated by Lutjanidae (23%), followed by Serranidae (15%), Haemulidae (10.5%), and Clupeidae (9%). Over the entire time period, catches of Serranidae exhibited a significant decrease, falling from an average of around 1,200 t·year^{-1} in the 1950s to an average of 27 t·year^{-1} in the 2000s.

Recreational fisheries

Recreational fishing averaged just over 200 t·year^{-1} from 1950-1959, dropping to a mere 4 t after the Cuban revolution. Recreational fishing was non-existent until the late 1970s, after which it increased gradually up until the 1990s. Following 1990, estimated catches increased rapidly to a maximum of 2,500 t·year^{-1} in 2010.

Discussion

The reconstructed total marine catches from 1950 – 2010 within the Cuban EEZ were estimated to be 18% higher than the amount reported by the FAO for the same time period. Our reconstruction demonstrates that, in general, commercial catches have been well reported to the FAO during this period (Figure 3a). Cuban marine catches follow a typical trend seen in many other fisheries, demonstrating a rapid growth phase followed by an over-exploited phase (Baisre *et al.* 2003). Trends in Cuba's fisheries are largely tied to the changes to its socio-economic context and its evolving management strategies.

Until the mid 1960s, there was relatively low demand for seafood products and Cuban marine resources were considered under-exploited (Claro *et al.* 2009). The period of rapid growth observed after the mid 1960s was largely fueled by economic support from the Soviet Union which promoted an increase in fishing effort and expansion of large-scale fisheries (Claro *et al.* 2009). Improvements to the organization and efficiency of the commercial fishery lead to a peak in total landings of over 76,700 t·year^{-1} in 1985 (Figure 3).

Associated with the rapid expansion of the fishing industry was a decline in several key commercial species, including Caribbean spiny lobsters, Nassau groupers, lane snappers, grey snappers, and mullets (Claro *et al.* 2009; Valle *et al.* 2011). The Caribbean spiny lobster is the most valuable commercial fishery in Cuba and is currently considered fully-exploited (Valle *et al.* 2011). Several management measures were introduced in the 1980s to address over-fishing, including a reduction in commercial fishing effort and increasing the length of the closed season. Despite these measures, we estimated a decline of 39% in spiny lobster landings from its peak in 1985 to 2010.

The decline in overall landings since the mid 1980s may be attributed to the combined effect of overfishing and habitat damage leading to a reduction in recruitment and population abundance since 1989 (Baisre *et al.* 2003; Puga *et al.* 2005). In addition to this, the end of economic support due to the collapse of the Soviet Union and tightening of US trade embargos largely impaired fishing effort after 1990. This led to reductions in commercial landings, especially also associated with distant-water fleets (Adams *et al.* 2001).

Presently, there is a lack of information available regarding fishery removals by subsistence and recreational fishing in Cuba. Catches from subsistence and recreational fisheries as estimated here accounted for only 9.8% and 1.3%, respectively, of the reconstructed catch from 1950-2010. The majority of subsistence catch is sold on the black market or used for domestic consumption, therefore these catches are not typically reflected in government landings data (Claro *et al.* 2009). Recreational fishing quotas, gear restrictions, and licenses were not introduced by the MIP until 1997, along with the establishment of the National Office of Fish Inspection (ONIP) which manages license distribution and compliance. Using anecdotal information and fishing license data obtained from the ONIP, Claro *et al.* (2004) estimated recreational catches in the Archipelago Saban-Camagüey alone to be around 1,800 t for the year 2000, which is already slightly higher than our country-wide estimate of 1,770 t.

Conclusion

The Cuban fishing industry has undergone considerable change over the past 50 years as a result of changing political environments and management strategies. By taking into account unreported catches from both commercial and non-commercial small-scale fisheries, our reconstruction provides a more comprehensive account of total marine resource use in Cuba. Several of Cuba's key commercial species are currently exploited at their maximum sustainable yield, and many are exhibiting signs of overfishing (Valle *et al.* 2011). Continued over-exploitation of marine resources will negatively impact the role of Cuban fisheries as a primary supplier of seafood to the global market and as a valuable source of domestic revenue and animal protein.

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

Year	FAO landings	Reconstructed total catch	Industrial	Artisanal	Subsistence	Recreational	Discard
1950	4,159	10,200	472	5,900	3,640	168	9
1951	5,758	9,600	351	5,410	3,690	189	7
1952	6,172	10,600	400	6,220	3,740	189	8
1953	4,591	11,400	1,020	6,400	3,750	192	20
1954	5,439	10,900	550	6,150	3,990	199	11
1955	7,266	11,600	900	6,370	4,080	214	18
1956	9,593	16,000	2,110	9,580	4,080	223	42
1957	13,204	17,600	1,990	11,210	4,130	272	40
1958	11,231	15,600	1,450	9,780	4,170	212	29
1959	14,258	18,700	718	13,540	4,210	180	14
1960	17,336	25,000	2,239	18,280	4,320	87	45
1961	18,244	24,500	1,744	18,370	4,370	4	35
1962	24,591	31,800	1,461	25,860	4,420	22	29
1963	23,157	32,000	1,830	25,610	4,480	-	37
1964	25,319	32,200	3,541	24,080	4,530	-	71
1965	26,234	33,300	1,874	26,810	4,590	-	37
1966	27,492	34,400	2,807	26,900	4,630	-	56
1967	32,271	37,000	2,690	29,580	4,670	-	54
1968	33,748	38,500	2,883	30,870	4,710	-	58
1969	38,466	43,300	5,461	33,010	4,750	-	88
1970	34,682	39,600	7,907	26,770	4,790	-	110
1971	48,207	53,200	16,177	32,030	4,820	-	132
1972	53,287	58,300	19,049	34,240	4,860	-	178
1973	58,343	63,500	20,974	37,430	4,890	-	180
1974	62,527	68,000	26,453	36,460	4,910	-	214
1975	58,144	63,200	26,368	31,780	4,920	-	182
1976	63,539	68,600	30,467	33,070	4,920	-	186
1977	57,742	62,900	26,221	31,520	4,920	43	154
1978	61,580	66,700	29,664	31,920	4,900	65	152
1979	58,189	64,900	27,430	32,340	4,880	86	140
1980	58,529	64,600	27,862	31,700	4,860	108	113
1981	50,850	56,800	18,278	33,450	4,830	129	91
1982	59,487	66,000	21,943	38,960	4,790	151	105
1983	65,107	70,600	25,749	39,790	4,760	174	90
1984	68,598	74,000	24,212	44,790	4,730	218	85
1985	71,381	76,700	26,361	45,330	4,710	243	96
1986	70,468	76,400	26,776	44,550	4,690	282	92
1987	69,920	75,600	25,988	44,510	4,680	294	95
1988	69,596	74,700	26,110	43,490	4,680	309	89
1989	66,980	72,000	25,573	41,410	4,670	326	66
1990	54,098	59,600	17,846	36,750	4,650	327	48
1991	53,756	59,700	16,705	37,880	4,620	415	57
1992	50,710	55,800	16,445	34,270	4,570	455	45
1993	39,821	45,200	12,568	27,530	4,530	544	55
1994	49,270	54,400	14,311	34,960	4,480	617	45
1995	47,912	53,400	11,635	36,570	4,430	763	37
1996	44,201	52,100	6,257	40,390	4,380	1,004	34
1997	46,632	60,700	4,190	51,020	4,320	1,170	40
1998	40,772	55,500	3,267	46,480	4,260	1,416	35
1999	47,090	60,200	4,002	50,290	4,200	1,603	59
2000	50,278	65,000	2,159	56,930	4,150	1,772	32
2001	35,816	48,000	2,017	40,060	4,100	1,775	30
2002	26,533	36,900	1,778	29,380	4,050	1,686	26
2003	26,959	37,600	1,967	29,690	4,010	1,900	29
2004	26,196	36,800	1,972	28,800	3,950	2,049	29
2005	23,085	33,400	2,150	24,950	3,900	2,319	32
2006	22,846	32,900	2,063	24,760	3,850	2,221	30
2007	22,866	32,800	631	26,240	3,790	2,152	9
2008	22,412	32,400	720	25,610	3,730	2,316	11
2009	22,387	32,400	809	25,490	3,660	2,405	12
2010	19,049	28,500	1,003	21,370	3,600	2,507	15

Appendix Table A1. Reconstructed total catches (in tonnes) by major taxonomic groups for Cuba, 1950-2010. 'Others' contain 55 additional taxonomic categories.

Year	*Panulirus argus*	Miscellaneous marine fishes	*Lutjanus synagris*	Elasmobranchii	Haemulidae	*Penaeus duorarum*	*Crassostrea rhizophorae*	Others
1950	588	14	1,001	1,390	423	-	571	6,210
1951	539	99	758	1,572	610	-	401	5,760
1952	583	91	1,014	1,534	571	-	449	6,400
1953	518	37	963	1,407	446	-	877	7,170
1954	559	25	747	1,416	539	-	763	6,880
1955	671	20	692	1,625	616	-	748	7,220
1956	4,158	47	662	1,458	732	-	471	8,560
1957	5,456	162	589	715	913	-	636	9,330
1958	4,488	102	367	692	1,194	-	505	8,390
1959	6,789	64	413	1,583	751	-	533	8,600
1960	7,190	14	1,112	1,451	993	-	1,630	12,590
1961	8,291	3	1,292	306	901	-	1,632	12,100
1962	8,409	438	2,545	1,971	1,765	-	2,806	14,290
1963	8,225	530	2,052	1,689	2,249	-	3,078	14,660
1964	7,257	412	2,199	1,424	2,454	-	2,639	16,250
1965	9,816	304	2,232	1,500	2,118	-	2,973	14,670
1966	9,788	363	2,620	1,094	2,186	-	3,107	15,600
1967	9,046	411	4,393	1,195	3,540	-	3,455	15,370
1968	9,551	312	3,699	2,929	3,890	-	2,507	15,940
1969	11,780	454	4,523	2,735	3,937	3,100	2,763	14,470
1970	8,053	549	3,097	2,261	3,186	3,900	3,684	15,400
1971	9,958	2,496	4,617	2,804	3,097	4,700	3,828	24,160
1972	10,605	3,335	4,522	2,433	3,558	6,200	3,797	27,210
1973	10,942	5,318	5,240	2,783	2,599	6,300	3,475	32,130
1974	11,633	4,736	5,282	3,432	2,744	7,500	2,202	35,240
1975	9,304	3,856	4,438	3,220	3,295	6,400	3,184	33,410
1976	10,623	4,725	3,962	2,785	3,203	6,500	2,219	39,360
1977	7,738	4,197	3,715	3,192	2,351	5,400	2,145	38,320
1978	11,309	5,243	2,694	2,811	2,411	5,300	2,355	39,820
1979	11,717	4,775	2,680	2,469	2,520	4,900	2,890	37,710
1980	11,681	5,459	2,220	2,800	2,654	3,940	2,224	39,120
1981	11,697	3,504	1,973	3,629	2,534	3,170	2,661	31,110
1982	13,133	4,519	2,507	3,606	2,455	3,670	3,124	37,460
1983	12,787	6,204	2,921	3,662	2,429	3,150	2,773	42,840
1984	15,247	6,819	3,232	3,570	2,686	2,960	3,256	43,090
1985	16,213	6,922	2,988	3,472	2,636	3,370	3,025	45,030
1986	14,248	7,319	3,040	3,252	2,550	4,140	3,062	46,100
1987	15,401	7,112	3,294	3,331	2,700	4,740	2,642	43,460
1988	14,128	7,141	3,160	2,909	2,570	4,450	2,934	44,520
1989	13,163	6,704	3,111	2,973	2,992	3,280	2,730	43,790
1990	9,861	6,116	2,705	2,571	2,876	2,380	2,667	36,560
1991	12,259	5,839	2,460	1,813	2,535	2,860	2,545	35,210
1992	11,581	5,649	2,283	1,978	2,485	2,260	1,896	33,300
1993	10,240	3,696	1,786	1,325	1,984	2,740	1,438	25,720
1994	11,888	4,914	2,609	2,007	3,013	2,230	1,407	31,260
1995	11,484	4,365	2,709	1,946	3,187	1,850	2,301	29,960
1996	11,662	3,949	2,456	2,659	2,655	1,710	2,350	28,570
1997	12,448	9,379	3,495	2,826	2,458	2,000	2,814	34,700
1998	12,878	7,882	3,621	2,563	2,129	1,730	3,121	29,420
1999	14,171	12,299	2,523	2,299	2,426	2,940	2,709	33,090
2000	12,696	12,546	3,609	4,042	2,354	1,590	-	40,750
2001	10,362	4,218	2,910	4,006	2,063	1,480	-	27,160
2002	11,035	1,184	2,569	3,770	1,952	1,310	-	16,290
2003	8,453	4,897	1,744	2,215	2,536	1,450	-	21,190
2004	11,696	3,390	1,358	1,032	2,529	1,450	-	18,740
2005	9,270	3,862	1,122	1,038	2,135	1,580	-	18,210
2006	7,024	3,872	1,821	1,638	2,089	1,520	-	18,830
2007	7,614	4,276	2,010	1,631	1,820	460	-	19,280
2008	8,717	2,894	2,514	1,584	1,451	530	-	17,590
2009	6,459	3,614	1,993	1,564	1,822	600	-	19,950
2010	6,265	1,065	2,165	1,022	1,747	740	-	16,560