

Historical Development of Cuban fisheries: Why we need an Integrated Approach to Fisheries Management?

JULIO A. BAISRE

Ministerio de la Industria Pesquera, Barlovento, Santa Fé 19 100, Playa, La Habana, Cuba
Phone (537) 2097981, Fax: (537) 2097253

ABSTRACT

An analysis of archeological and historical data about fisheries in Cuba shows that the impact of aboriginal population on fisheries resources was not significant due to their low number and fishing technology. The interest for gold, the size of the population, the technological constraints for fishing and preserving fish catches and the food preferences of Spaniards all indicated that fishing was neither an important economic activity during the three next centuries after the arrival of Columbus. The dietary preferences for meat and salted cod and the slow population growth during the colonial period determined that most of the fisheries resources, with the exception of manatee and marine turtles, remained almost unfished for some centuries after the Conquest. Statistical and historical data revealed that fishing experienced a rapid growth since 1950 and this pattern seems to be a common feature in the Caribbean as well as in other part of the world.

The pressures on marine life were more evident in the second half of the xx century when population growth, technological improvements and markets demands accelerated the fisheries sector as well as the urbanization in most of the Caribbean countries.

KEY WORDS: Historical overfishing, anthropogenic impacts, seagrasses, coral reefs.

Desarrollo Histórico de las Pesquerías Cubanas: Por que necesitamos un enfoque Integrado para el Manejo de Pesquerías?

Un análisis de los datos arqueológicos e históricos sobre la pesca en Cuba muestra que el impacto de la población aborigen sobre los recursos pesqueros no fue significativo debido a su baja densidad poblacional y a las tecnologías de pesca. El interés por el oro, el tamaño de la población, las limitaciones tecnológicas para la pesca y preservación de las capturas así como las preferencias dietéticas de los españoles todas indican que la pesca tampoco fue una actividad económica importante durante los tres siglos que siguieron a la llegada de Colón. Las preferencias por la carne de res y el bacalao salado y la baja tasa de crecimiento poblacional durante el período colonial determinaron que la mayor parte de los recursos pesqueros, con la excepción del manatí y las tortugas marinas, permanecieran prácticamente inexplorados durante varios siglos después de la Conquista. Los datos estadísticos e históricos revelan que la pesca experimentó un rápido crecimiento desde 1950 y este patrón parece ser una característica común en el Caribe así como en otras partes del mundo. Las presiones sobre la vida marina fueron más evidentes en la segunda mitad del siglo xx cuando el crecimiento poblacional, las mejoras tecnológicas y las demandas del mercado aceleraron el sector pesquero así como la urbanización en la mayoría de los países del caribe.

PALABRAS CLAVES: Sobrepesca histórica, impactos antropogénicos, hierbas marinas, arrecifes de coral

INTRODUCTION

Archaeological and historical evidences are useful tools to assess the human impact on natural resources and to avoid the shifting baseline syndrome (Pauly, 1995; Sheppard, 1995). As human footprint on renewable resources is unambiguously related to population density, technological development and patterns of consumption and market demands (Vitousek *et al.*, 1997; Wackernakel *et al.*, 2002; Lotze *et al.*, 2006), the impact of aboriginal (before 1492), colonial (from 1492 to about 1900) and recent population (from 1900 to present), upon marine fisheries resources must be assessed by a careful analysis of population growth, technological development of the fisheries as well as consumer's demands of fish and fish products. While there are evidences that in regions with low population density indigenous people had no or little impact on common target species, in regions with high human population density there are indications of a high exploita-

tion pressure (Lotze, 2004).

In this paper I examined the human impact upon fisheries resources of the Caribbean Sea through a detailed analysis of the archaeological and historical data on Cuban fisheries since pre-Columbian time.

Fisheries before Columbus

In order to assess the human impact on fisheries resources of the Caribbean Sea before 1492 we must know how large the aboriginal population at the moment of Columbus arrival was. Unfortunately this figure is badly known and assessments of the number of Indians throughout the Caribbean in 1492 are very variable ranging from 225 000 to 6 millions, half of them living at Hispaniola (Rogozinski, 1994). Probably this controversial information comes from the written of the Spanish priest and historiographer Bartolomé de las Casas when he arrived to Hispaniola: "*There were 60,000 people living on this island*

[when I arrived in 1508], including the Indians; so that from 1494 to 1508, over three million people had perished from war, slavery and the mines. Who in future generations will believe this?" (Wikipedia, 2006). In spite of the disagreements related to the main causes on the rapidity of the extinction (Sauer, 1966; Thomas, 1971), there is no doubt about the practical disappearance of the Cuban aboriginal population by 1550 (Marrero, 1956) and this have also occurred in other Caribbean islands (Sauer, 1966). This rapid extinction process is an indication that perhaps the population was lower than have been supposed by some of the first historians. First travelers were easily deceived in appraising the magnitude of the aboriginal population because the multitude of persons brought to the coast by the proximity of the vessels (Humboldt, 1895).

Populations of a certain density always left a footprint depending on the technological level reached by this civilization. Aboriginal people in the Caribbean were at a Neolithic stage and in the archaeological sites has been reported only a few and rudimentary tools, discarded bones or shells of wild animals, simplistic paintings and pieces indicating a primitive pottery and wood carving (Tabío and Rey, 1979). Based on this information it seems to be that the aboriginal people in Cuba lacked the technology that other societies needed to maintain a high population density. In fact, the overall scarcity of artifacts across so much of the Caribbean is a strong indication that the native population density was far less than ancient farming communities in comparable climatic zones of the Old World. This is also supported in a report from

Meditz and Hanratty (1987), which considered that an indigenous population of less than a million for all of the Caribbean would still be a relatively dense population, given the technology and resources of the region in the late fifteenth century. Probably one-half of these inhabitants would have been on the large island of Hispaniola, about 50,000 in Cuba, and far fewer than that in Jamaica, Puerto Rico, Dominica, St. Lucia, St. Vincent, and Trinidad all had fairly concentrated, if not large, populations. The explanation for this small population in Cuba may lie in the relatively recent arrival of agriculturalists in the archipelago (Sauer, 1966). Archaeological evidence also shows that the Taíno in Cuba occupied only the eastern part of the country and human settlements were relatively spread meaning that colonization process of the island by the aboriginal people was not fully accomplished (Tabío and Rey, 1979); giving additional support to the hypothesis tan population was not as large as previously supposed.

Archaeological research in aboriginal settlements showed that bones of small rodents (*Capromys*), manatee, turtles and other reptiles as well as shells of several mollusk species and fish bones were frequently found in different sites in Cuba (Dacal Moure and Rivero de la Calle, 1986). These archeological findings also indicated that the exploitation of marine resources focused strongly in mollusks: mangrove oyster (*Crassostrea rhizophorae*), Queen Conch (*Strombus gigas*), brown crown conch (*Melongena melongena*), king helmet (*Cassis tuberosa*) and West Indies top shell (*Cittarium pica*) (Tabío and Rey, 1979; Dacal Moure and Rivero de

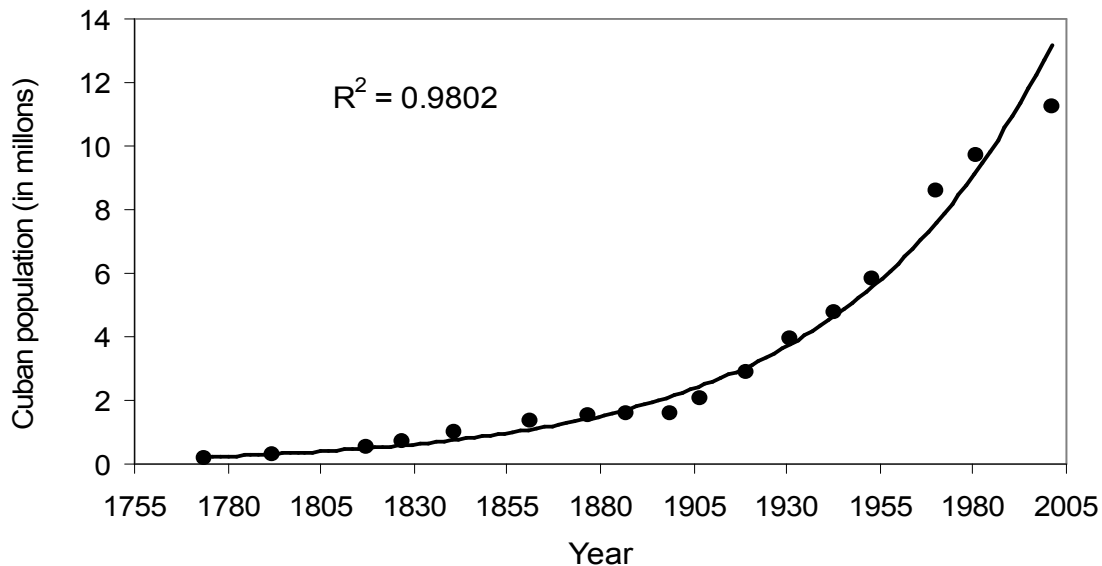


Figure1. Population in Cuba since the first Census in 1774, to the last in 2002. An exponential curve was fitted to the data and it is noted the accelerated growth of the population after 1950.

la Calle, 1986). Some sites also showed an extraordinary consumption of land crab (*Cardisoma guanhumi*) and blue crab (*Callinectes sapidus*) (Dacal Moure and Rivero de la Calle, 1986). All of these species were easily collected in nearshore areas and their abundance in the archaeological sites is a direct evidence of their importance for the aboriginal people. The primitive fishing gears and boats, the size and the spread of the population living in coastal areas and the facilities to collect nearshore species all pointed out that fishing impact on marine resources before Columbus arrival to Cuba was practically negligible.

The fisheries during the Spanish rule

As fishing pressure depends on both fishing effort and fishing technology and it is strongly related with the demand of fish and fish products, the size of the population might be considered as a proxy for estimating the fishing intensity upon fisheries resources. In 1537, 25 years after the arrival of Diego Velázquez, the Cuban population was estimated in 5 800 inhabitants. The population grew slowly from 6 300 in 1535 to 20 000 in 1602 (Thomas, 1971) and the first census of 1774 gave an overall population of 171 620 persons. The growth of Cuban population continued being slow throughout the *xvi*, *xvii*, and most of the *xviii* centuries (Fig.1), and not only was the population small, but it was mostly urban (Butzer, 1992).

A careful analysis of fisheries activities in Cuba shows that there are strong evidences supporting the hypothesis (Baisre, 1987a) that during the first centuries of the Spanish rule fishing was not an important economic activity: 1) The growth of the Cuban population remains slow through-

out the *xvi*, *xvii*, and most of the *xviii* centuries. 2) There are very few references to fishing activities in the comprehensive and rigorous report of Alexander von Humboldt about Cuban geography and economy (Humboldt, 1895) after a 3 month exploration of a considerable part of the territory. 3) All the historical accounts pointed out that local fishes were not a regular component of Cuban meals but they were replaced by imported salted and dried cod which was sold to a lower price (García de Arboleya, 1859; Marrero, 1950; Sánchez Roig and Gómez de la Maza, 1952) and 4) Due to logistic, economic and technological constraints, the largest market for fresh fishes in the city of Havana was supplied by vessels operating in the waters of Florida (Dry Tortugas), Campeche (Mexico) and Salt Bank (Sánchez Roig and Gómez de la Maza, 1952; Rivero Muñoz, 1957 and 1958, Covington, 1959). The lack of ice and the bad conditions of the roads in Cuba both limited the transportation of fish and fish products over long distances. Until the end of *xix* century, ice was brought to Havana directly from Florida and the first ice plant in Cuba was established in 1890 (Sánchez Sánchez Roig and Gómez de la Maza, 1952). Under these circumstances, a direct transportation from relatively non distant fishing grounds through fishing vessels provided with live-wells to keep the catch alive was a successful way to supply fish to the growing population of Havana, the largest city of Cuba (Fig.2) and by this time the capital of the country (Baisre, 1987a). Cuban landings in 1849 reached only 1548 tons but half of this catches were landed in Havana (Segarra, 1853). In 1856, total landings, excluding marine turtles and sponges, were 1304 tons (García de Arboleya, 1859). The



Figure 2. Map of Cuba showing the origin of the fresh fish sold in the Havana market. The broken line shows the distance in case of bringing live fishes from Batabanó the nearest and important fishing port located in the south of Havana.

imports of salted cod in 1846, however, reached 6413 tons (Suárez-Caabro, 1988).

According to Humboldt (1895), the Cuban slaves were frequently fed with *tasajo* (dry and salted meat) and *bacalao* (dry and salted cod). Cod was caught in large quantities by Spanish fisherman in waters of the Grand Banks and García de Arboleya (1859) reported that some 7 000 tons of this product were imported annually, after the establishment of the regular steamship service between Spain and Cuba since 1827 (Sánchez Roig and Gómez de la Maza, 1952). The importance of imported fish and fish products in the Cuban consumption remains the same even until the middle of the *xx* century.

Even the increase of the population occurring in the *xix* century does not result in a corresponding increase in the demand for local marine species. "Among us, fish has not achieved the cheapness of meat and its scarcity has made it almost a luxury object" (García de Arboleya, 1859). During the end of the colonial period, two local consumption patterns co-existed in Cuba (Joyce, 1996). One was rural and based on imports of large quantities of cheap salted and dried cod and canned and salted sardines, and the other was urban, upper class, and based on fresh fish and shellfish (García de Arboleya, 1859; Sánchez Roig and Gómez de la Maza, 1952).

Joyce (1996) has also examined five different causes that might explain the decline of fishing during the first centuries of the Spanish rule: 1) Their interest on obtain as much gold as possible, 2) Because the exhaustion of gold the Spanish immigration was reduced and population grew

slowly from 1553 until the late *xviii* century, 3) The Spaniards who came to Cuba did not like fish (Thomas, 1971), 4) They were culturally predisposed to ranching (Bishko, 1952) and livestock ranching of hogs, cattle and horses becomes a very important alternative as a new food source, and 5) The danger of being subject to ciguatera poisoning (Baisre, 1987a). If we consider the destruction of much of the aboriginal culture and the conquistador's attitude toward fish and proclivities toward ranching and meat eating, the disappearance of fishing from historical records from the early colonial period is not surprising (Joyce, 1996).

The fisheries during the *xx* century

Systematic catch statistics on Cuban fisheries are available since 1935 (Baisre, 2000), although there are some scattered data points for a few years of the Spanish rule (Fig.3). This trend of the catches reaffirms the slow growing process of the fisheries which were not very important until the second half of the *xx* century. As shown in the figure, it was not until the mid 1950's that the growth process of the Cuban fishing industry begun (Baisre, 1987b). Some technological and economical breakthroughs have been associated to this growth: 1) Shrimp trawling was first introduced in 1953 in Ensenada de la Broa (Pérez Farfante, 1953) and further extended to the rest of the country since 1954 (Baisre and Zamora, 1983); 2) Spiny lobster catches increased rapidly due the expanding demands for frozen products to the markets of United States and France (Naranjo, 1956); 3) There was an increase in the tuna fishery associated to the establishment of several

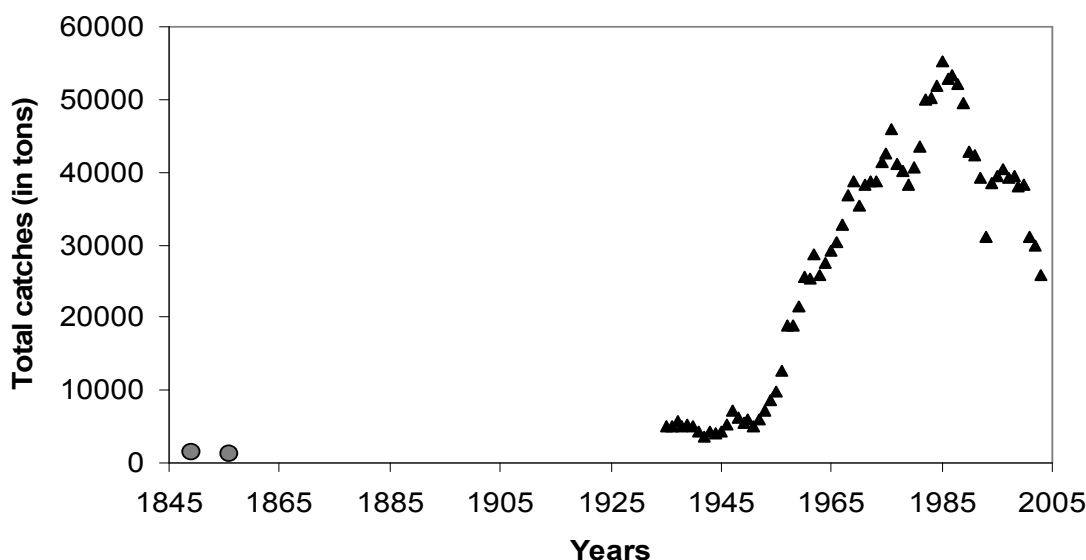


Figure 3. Evolution of Cuban marine fishery landings since 1935 to 2003(solid triangles).Two additional data point of catches in 1849 and 1856 (grey circles) were included as reference points indicating the importance of fisheries during the Colonial period. The figure clearly illustrates that during the first hundred year of available data, fisheries was not very important.

canneries by 1953 (Howell-Rivero, 1953, Palomera, 1958); 4) The use of longlines for billfishes (and sharks) began at the end of 1950's (Guitart, 1964); and 5) A sudden rise in the price of fisheries products, paid to the fishers, was established in 1959 (Baisre, 1987b). In spite of this developments, the import of fish remains as an important alternative for the domestic consumption. Between 1925 and 1928 annual consumption of imported salted cod was more than 12 000 tons (Marrero, 1950) descending to some 4 500 during 1939 to 1948 because the Second World War.

The extended data set of fisheries catches from 1935 to 1995 provides a coherent picture of Cuban fisheries over the last 60 years. The landing statistics show sustained growth from the mid-1950s until the end of the 1970s, a diminution of the rate of increase during the 1980s and a decrease, coinciding with the decline of some important fisheries, from the beginning of the 1990s. From the mid-1970s, most of the species or species groups were in the mature phase and the first cases of overfishing in the Cuban fishery sector were beginning to appear. In 1995, about 38.9 percent of the fisheries were in the senescent phase, 48.7 percent were in the mature phase with a high level of exploitation, and only 12.4 percent were in the developing phase with some possibility for growth (Baisre, 2000).

Anthropogenic effects from land-based sources

The main reasons for deteriorating the habitat and the water quality in coastal systems are vegetation removal, soil erosion, and fertilizer loss from expanding agriculture, expanding urbanization, regulation of freshwater flows and associated discharges of sewage and industrial wastes (ISRS, 2004, Vorosmarty and Sahagian, 2000). The size of the population, particularly from the urban centers in coastal areas, might therefore be considered as a proxy to assess the land-based effects upon coastal ecosystems (Caraco and Cole, 1999; Smith *et al.*, 2005). From 1778 to 1861, Cuban population experienced a rapid growth and this period was marked by great economic changes. At the beginning of the 1800's the sugar cane industry grew extensively modifying drastically, by the first time, the landscape of the central and western plains. In a movement to the eastern part of the country, the sugar cane producers cleared the forest to use the virgin soils and to feed de steam engines with the woods (Marrero, 1950, Smith, 1954). Railroad development also helped to clear the forest in that part of the country. Available data suggest that approximately 60% of Cuba was covered with forest in pre-Columbian times (Smith 1954). This forest was largely deciduous broad-leaf while pine forests probably occupy the same 4% they do today and the tropical rain forest was limited to a small area in the northeastern mountains (Marrero 1950). A rapid development of the population took place since that time and by 1899 the Census reported that about 50 % of the country was still forested even when the population reached 1.6 millions inhabitants. Then, although deforestation obviously took place since first Span-

ish settlement, do not reach disastrous proportions until the first half of the *xx* century. According to Smith (1954), the trend in the destruction and removal of Cuba's forest date from the treaty of 1903 between Cuba and the United States. This treaty gave sugar a place on the preferred list of imports into the U.S.A. For that reason, land was rapidly cleared for cane planting, and the forests were extensively cut and burned. In 1950, the forests covered only 18 % of the landscape (Marrero, 1950; Smith, 1954).

The previous information strongly suggests that landscape transformation after the first human settlement at the island and before the Columbus arrival to America was practically negligible. The modification of the landscape was intensified progressively during the colonial period when the forest cover decreased about 10 % of the country area and population increased from some 170 000 to 1.6 million inhabitants from 1774 to 1899. However, the first half of the *xx* century witnessed a much more drastic alteration of the landscape when more than 30 % of the country area was cleared and the population grew from 1.6 to more than 5.5 millions inhabitants. This dramatic land-use change must have resulted in increased sediments and nutrients loads entering to shelf waters, and affecting particularly to those marine communities, including coral reefs, closer to the shoreline. When trying to set the baseline on marine ecosystems, unfortunately these changes are usually neglected or are poorly documented.

DISCUSSION

The assumption that the import of large quantities of cod was related to the severe overfishing of local resources in Jamaica and other Caribbean countries (Jackson, 1997; 2001) does not seem to have occurred in Cuba. Nor the population growth, neither the technological development of the fisheries or the demand for local fishery products was supportive of an intense fishing activity. The import of salt and dried cod and canned sardines was a logical consequence of the dietary preferences of the Spaniards combined with the higher prices of fresh fish due to their low abundance, the lack of ice, the bad conditions of the roads and the long distances from fishing ports to the main urban centre. Salted and dried cod was a cheaper and easy to manipulate fish product widely used to feed the slaves in the Caribbean. This pattern of fish consumption has been reported for the former British colonies in the Caribbean (Kenny, 1978) and also Thomas (1971) refers that in the 1880's the tradition in Cuba, like the rest of the West Indies, was to buy food in bulk from the north or from Europe, to feed the slaves. In French and English Caribbean Islands slaves were used to fish for the master's table and only rarely to produce cheap food for the labor force (Price, 1966). More recent sources (Belloc, 1950; Idyll and Whiteleather, 1950, Sánchez Sánchez Roig and Gómez de la Maza, 1952), also mentioned the preference for imported fish until the mid of the *xx* century. Under these circum-

stances, the low-priced salted cod becomes a popular and a traditional meal for the low-income rural population in most of the Caribbean. The use of artisanal fishing gears, the lack of engines to fish more efficiently and to cover large areas, the lack of ice to preserve the catches and the bad conditions of the roads; together with a relatively small population with many slaves depending on cheaper and easy to handle dry and salted fish, all support the previous hypothesis.

The actual fisheries scenario is well different. According to Baisre (1993), most of the Cuban commercial species are at high risk of overexploitation, as they are in other tropical countries. This is the result of one or several of the following factors: 1) the high market value of the target species; 2) the fishing of the spawning aggregations (reproductive runs) which are well known by the fishers; 3) the use of non-selective fishing gears; 4) the low reproductive potential (e.g. sharks) and/or low growth rate (e.g. many species of reef fishes) of many exploited species; and 5) many species have their essential (critical) habitat close to the shore and they are easily accessible and vulnerable to human impacts.

There is no doubt that overfishing exists in many of the world's fisheries (Hilborn *et al.*, 2003) including the Caribbean

(FAO, 2005) and Cuba (Baisre, 2000), but do not seem reasonable to ignore that like others human impacts on natural resources this phenomena might also be also accelerated or even surpassed by the effects of the huge growth of human population and the technological improvements occurring after the industrial revolution in the whole planet (Vitousek *et al.*, 1997; Wackernakel *et al.*, 2002). This is particularly true during the last fifty years. In past centuries, exploitation of marine resources have been constrained either by the inaccessibility of remote locations or by relatively inefficient harvest technology. Although we must to acknowledge that some coastal systems have been exploited for centuries, and some particular species become endangered (manatee and marine turtles) or even extinct (monk seal) it is only after 1950 that fishing in Cuba and probably in the Caribbean, becomes a real threat to the marine ecosystems of the region. Therefore, there are more possibilities that overfishing of large fishes in the Caribbean is more recent than Jackson (1997) concluded and this pattern do not seems very different to that occurring in many parts of the world. The cod stocks in the Grand Banks in Newfoundland, exploited by the Basque fishermen before Columbus came to America, were sustainable harvested by 500 years but in a few decades beginning in the 1960's were completely overfished (Hilborn, 2004). In a recent assessment of the degradation of coastal seas and estuarine areas (Lotze *et al.* 2006), was concluded that human impacts escalated into rapid resource depletion during the market-colonial development period and continued in the two global market periods, 1900-1950 and 1950-2000. According to the authors these were periods of (i)

rapid human population growth and increasing demand, (ii) commercialization of resource use and development of luxury markets, and (iii) industrialization and technological progress toward more efficient but also unselective and destructive gears.

Regardless of the historical sequence of human stresses in the coastal ecosystems or the primacy of overfishing or land-based effects, we will need of an integrated and multidisciplinary approach if we really want to solve or to mitigate these impacts. Any attempts to restore coastal ecosystem will need the use of different alternatives. Top-down effects caused by fishing need to be regulated by controlling fishing effort and destructive fishing gears must be replaced by more selective devices, while protection of nursery areas or essential fish habitats must be also part of the management plans. Bottom-up approaches to reduce pollution, sedimentation and excessive nutrient discharges are the other side of the coin. The impacts of water use, water regulation and reservoir buildings on estuarine areas and wetlands can neither be overlooked (Baisre and Arboleya, 2006). The reduction of the emissions of greenhouse gases will also be a high priority if we like to stop or at least to slow the global warming trend and the coral reef crisis (Hoegh-Guldberg, 1999). Therefore, it is needed a more integrated multiple human-impact management approach (Lotze, 2004), which must not rely exclusively on the ecological or biological aspects, neither the fishery aspects along. Recognizing that fishing is largely an economic activity, it is surprising how little attention is paid to the economics of fisheries sustainability and practically all the intellectual and political energy has gone into the biological aspects of sustainability (Hilborn *et al.* 2003). Because humans have multiple impacts on aquatic ecosystems, which interact with one another, they must be managed together. There is a unique chance and challenge to break our historical patterns and because of our global impacts, it might be our only one (Lotze, 2004).

LITERATURE CITED

- Baisre, J. A. y A. Zamora 1983. Las pesquerías de camarón: Antecedentes, Situación actual y perspectivas. *Centro de Investigaciones Pesqueras*, 64 p.
- Baisre, J.A. 1987a. La Pesca en Cuba. Apuntes para su Historia. La pesca desde 1492 hasta 1902. Etapa colonial. *Mar y Pesca*, **263**:38-41.
- Baisre, J.A. 1987b. La Pesca en Cuba. Apuntes para su Historia. La pesca después de 1959. Etapa Revolucionaria. *Mar y Pesca*, **265**: 37-41.
- Baisre, J.A. 1993. Marine Fishery Resources of the Antilles. Pt IV. Cuba. *FAO Fisheries Technical Paper* **326**:182-235.
- Baisre, J.A. 2000. Chronicle of Cuban marine fisheries (1935-1995). Trend analysis and fisheries potential. *FAO Fisheries Technical Paper* 394:26 p.
- Baisre, J.A. and Z. Arboleya, 2006. Going against the flow: Effects of River damming in Cuban Fisheries. *Fisher-*

- ies Research* **81**: 283-292.
- Belloc, M.1950.The Fisheries of the Antilles. *Proceedings Gulf and Caribbean Fisheries Institute* **2**: 110-111.
- Bishko, C.J. 1952.The Peninsular Background of Latin American Cattle Ranching. *Hispanic American Historical Review* **32**: 491-515. Boyd-Bowman, P. 1964.
- Butzer, K.W. 1992.The Americas before and after 1492: An introduction to current geographical research. *Assoc. Amer. Geographers Annals* **82(3)**: 345-368.
- Caraco, N.F. and Cole, J.J. 1999. Human impact on nitrate export: an analysis using major world rivers. *Ambio* **28a**: 167-170.
- Covington, J.W.1959. Trade relations between southwestern Florida and Cuba 1600-1840.*Florida Historical Quarterly* **38(2)**: 114-128.
- Dacal Moure, R. and Rivero de la Calle, M. 1986. *Arqueología Aborigen de Cuba*. Habana, Editorial Gente Nueva.
- FAO, 2005. Examen de la situación mundial de los recursos pesqueros marinos mundiales. *FAO Documento Técnico de Pesca* No. **457**: 260 p.
- García de Arboleya, J. 1876. *Manual de la Isla de Cuba*. Habana, Imprenta del Tiempo.175 p.
- Guitart, D.J. 1964. Biología pesquera del emperador o pez espada, *Xiphias gladius* Linnaeus (Teleostomi: Xiphidae) en las aguas de Cuba. *Poeyana, Ser. B.*, 1:1-37.
- Hilborn, R. 2004. Ecosystem-based fisheries management: the carrot or the stick? In: Browman, H.I. Stergiou, K.I. (eds) Perspectives on ecosystem-based approaches to the management of fisheries resources. *Mar.Ecol.Prog. Ser.* **274**: 275-278.
- Hilborn, R., Branch, T.A., Ernst, B., Magnusson, A., Minte-Vera, C.V., Scheuerell, M.D. and Valero, J. 2003. State of the World Fisheries. *Annual Review Environmental Resources* **28**: 359-399.
- Hoegh-Guldberg, O. 1999. Climate change, coral bleaching and the future of world's coral reefs. *Marine and Freshwater Research* **50**: 839-866.
- Howell-Rivero, L.1953. Los escómbridos de Cuba. Su biología e industrialización. *Centro Investigaciones Pesqueras Contribución* **2**: 105 p.
- Humboldt, A.von, 1895.*Personal narrative of travels to equinoctial regions of America during the years1799-1804.Vol III*. Translated and edited by Thomasina Russ. London. George Routledge & Sons.
- Idyll, C.P. and Whiteleather, R.T.1950. Potentialities of the Caribbean Fisheries and Recommendations for their Realization. *Proceedings Gulf and Caribbean Fisheries Institute* **2**: 116-118.
- ISRS, 2004.The effects of terrestrial runoff of sediments, nutrients and other pollutants on coral reef. *Briefing Paper* 3, International Society for Reef Studies, pp: 18.
- Jackson, J.1997.Reefs since Columbus, vol 1. In: *Proceeding of 8th International Coral Reef Symposium*, pp 97-106
- Jackson, J.B.C.2001.What was natural in the coastal oceans? *Proceedings National Academy of Science* **98**: 5411-5418
- Joyce, I.T. 1996. *The Fisheries of the Cuban insular shelf: Culture, History and Revolutionary Performance*. Thesis submitted in partial fulfillment for the degree of Doctor of Philosophy. Simon Fraser University, 624 p.
- Kenny, J.S., 1978.Historical, nutritional, sociological and economic importance of fisheries to the countries of the Caribbean an overview. *Proceedings Gulf and Caribbean Fisheries Institute* **30**:122-8.
- Lotze, H.K. 2004.Repetitive history of resource depletion and mismanagement: The need for a shift in perspective. In: Browman, H.I. Stergiou, K.I. (eds) Perspectives on ecosystem-based approaches to the management of fisheries resources. *Marine Ecology Progress Series* **274**: 282-285.
- Lotze, H.K., Lenihan, H.S., Bourque, B.J., Bradbury, R.H., Cooke, R.G., Kay, M.C. Kidwell, S.M., Kirby, M.X., Peterson, C.H. and Jackson, J.B. C.2006. Depletion, Degradation, and Recovery Potential of Estuaries and Coastal Seas. *Science* **312 (5781)** : 1806 – 1809.
- Marrero, L. 1950. *Geografía de Cuba*. Talleres Alfa, 736 p.
- Marrero, L. 1956. *Historia Económica de Cuba*. Universidad de la Habana.
- Meditz, S.W. and Hanratty, D.M.1987. *Islands of the Commonwealth Caribbean: a regional study*. Federal Research Division, Library of Congress, 771 p. <http://hdl.loc.gov/loc.gdc/cntrystd.cx>
- Naranjo, A. 1956. *Cordel y Anzuelo*. Editorial Cenit, La Habana, 251 p.
- Pauly, D.(1995) Anecdotes and the shifting baseline syndrome of fisheries. *Trends in Ecology and Evolution* **10(10)**:430.
- Palomera, I. 1958. Datos sobre el desarrollo de la pesca del bonito en Cuba y su industrialización. *Mar y Pesca*, **2 (2)**: 34-35.
- Pérez-Farfante, I.1953. The discovery of a new shrimp bank at gulf of Batabanó, Cuba. *Proceedings Gulf and Caribbean Fisheries Institute* **6**: 1-2.
- Price, R. 1966. Caribbean fishing and fishermen. *American Anthropologist* **68(6)**:1363-1381.
- Rivero Muñoz, J. 1957. El suministro de pescado a la Habana en la época colonial. *Mar y Pesca* **1 (4)**: 42-43.
- Rivero Muñoz, J. 1958. Las fuentes pesqueras de Cuba. Las Islas Tortugas. *Mar y Pesca* **2 (2)**: 34-35.
- Rogozinski, J. 1994. *A Brief History of the Caribbean: From Arawak to the Present*. New York: Meridian Books
- Sánchez Roig, M. y F. Gómez de la Maza, 1952. *La Pesca en Cuba*. Ministerio de la Agricultura, República de Cuba, Seoane, Fernández y Cía. 272 p.
- Sauer, C.O. 1966. *The Early Spanish Man*. Berkeley, University of California Press.175 p.
- Segarra, J.B. 1853. *Geografía*. Santiago de Cuba.

-
- Sheppard, C. 1995. The shifting baseline syndrome. *Marine Pollution Bulletin* 30: 766-767.
- Smith, E.E. 1954. The Forest of Cuba. *Maria Moors Cabot Foundation Publication 2*: 98 pp.
- Smith, S.V., Swaney, D.P., Buddemeier, R.W., Scarsbrook, M.R., Weatherhead, M.A., Humborg, C., Eriksson, H. and Hannerz, F. 2005. River nutrient loads and catchment size. *Biogeochemistry* 75: 83-107.
- Suárez-Caabro, J.A. 1988. *Cuba y su Pesca*, Miami, Florida. 90 p.
- Tabío, E. and E. Rey. 1979. *Prehistoria de Cuba*. Habana. Editorial Ciencias Sociales.
- Thomas, H. 1971. *Cuba. The pursuit of freedom*. New York, Harper & Row.
- Vitousek, P.M., Mooney, H.A., Lubchenco, J. and Melillo, J.M., 1997. Human Domination of Earth's Ecosystems. *Science* 277: 494-499.
- Vorosmarty, C.J. and Sahagian, D. 2000. Anthropogenic disturbance of the Terrestrial Water Cycle. *Bioscience* 50(9): 765.
- Wackernagel, M., Schulz, N.B., Deumling, D., Callejas Linares, A., Jenkins, M., Kapos, V., Monfreda, C., Loh, J., Myers, N., Norgaard, R., and Randers, 2002. Tracking the ecological overshoot of the human economy. *Proceedings National Academy of Science* 99 (14): 9266-9271.
- Wikipedia, 2006. Taíno (2006, September 14). In *Wikipedia, The Free Encyclopedia*. Retrieved 16:38, September 21, 2006, from <http://en.wikipedia.org/w/index.php?title=Ta%C3%ADno&oldid=75730655>