

Status of the Hawksbill Turtle (*Eretmochelys imbricata*) in the Caribbean Region

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ABSTRACT. – The status and trends of hawksbill populations are reviewed for 35 countries and territories in the Caribbean region. Annual nesting data for many years are presented for four regularly monitored beaches. Hawksbill populations are reported to be declining or depleted in 22 of the 26 geopolitical units for which some status and trend information is available. An order-of-magnitude estimate for the number of females nesting annually in the region is 5000. The only populations considered to be increasing in size are those of Mexico and Mona Island, Puerto Rico. Historical population declines are described for the region.

KEY WORDS. – Reptilia; Testudines; Cheloniidae; *Eretmochelys imbricata*; sea turtle; Critically Endangered; Endangered; status; tortoiseshell; conservation; Caribbean

For centuries, the hawksbill turtle (*Eretmochelys imbricata*) has been sought after for the richly patterned scutes (tortoiseshell or bekko) that cover its shell. It has been pursued by, in turn, the ancient Egyptians, the Romans, the Chinese, the Japanese, and the modern Europeans (Parsons, 1972). In the 20th century, prices for raw tortoiseshell have at times rivaled those of ivory (Mack et al., 1979). The intensity and antiquity of the demand for tortoiseshell around the world have had a profound influence on the survival status of the species (Carr, 1972; Parsons, 1972; Nietschmann, 1981; Mortimer, 1984; Cruz and Espinal, 1987; Groombridge and Luxmoore, 1989; Meylan, 1989; Eckert, 1995; Limpus, 1997). More than 25 years ago, Carr (1972) debated — without being able to decide — whether the hawksbill or Kemp's ridley (*Lepidochelys kempii*) merited the dubious distinction of being the world's most endangered sea turtle. Shortly thereafter, in 1975, both species were listed on Appendix I of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES). In a global assessment of the status of the hawksbill in 1989, Groombridge and Luxmoore (1989) reported that hawksbill populations were depleted or declining in 56 of 65 geopolitical units for which some information on nesting density was available, with declines well substantiated in 18 areas and suspected in the other 38. With the future of both the hawksbill and Kemp's ridley still in jeopardy in 1996, these species were listed as Critically Endangered on the *IUCN Red List of Threatened Animals* (Baillie and Groombridge, 1996).

The global status of the hawksbill turtle recently has been reviewed by Meylan and Donnelly (1999). The purpose of this paper is to review the status of hawksbill populations within the Caribbean region.

STATUS IN THE CARIBBEAN

Although considerable gaps in information remain, the status of the hawksbill in the Caribbean region has received much attention. The Caribbean is used here in a broad sense

and includes the Caribbean Sea, the Gulf of Mexico, and other waters of the western tropical Atlantic Ocean from Bermuda south through Venezuela. The Western Atlantic Turtle Symposia (WATS) I and II, held in Costa Rica and Puerto Rico in 1983 and 1987, respectively, prompted field surveys of marine turtle populations throughout the Caribbean and resulted in national reports concerning 36 geopolitical units. Meylan (1989) reviewed these and other data in a status review of the hawksbill in the Caribbean. Groombridge and Luxmoore (1989) conducted an exhaustive review of Caribbean hawksbill populations as part of a global survey of the species. The most recent data concerning the status of hawksbills in the Caribbean were provided by Eckert (1995) for populations nesting within U.S. jurisdiction (Puerto Rico, U.S. Virgin Islands) and by WIDECAS (Wider Caribbean Sea Turtle Conservation Network) Sea Turtle Recovery Action Plans for populations in many Caribbean countries.

Table 1 summarizes the most current data available on the status of hawksbill populations in 35 geopolitical units in the Caribbean region. Hawksbill nesting has been reported in all but 3 geopolitical units — Aruba, Bermuda, and the Cayman Islands. For areas for which data are available, the number of hawksbill nests per year or number of nesting females per year is given in Table 1 as an index of the size of the nesting population. The most common remigration intervals for hawksbills are two and three years (Corliss et al., 1990; Hillis, 1994a, 1994b). The remigration interval is defined as the period between reproductive seasons. The number of nests laid by individual female hawksbills during one reproductive season varies geographically; the averages range from approximately three in Mexico to five in the eastern Caribbean (Richardson et al., 1989; Guzmán et al., 1995; Hillis, 1995).

The estimates of numbers of nests or nesting females in Table 1 are, in a few cases, the product of systematic, long-term monitoring; but most are derived by extrapolations from limited sampling or interviews. A long nesting season

Table 1. Status of hawksbill turtles (*Eretmochelys imbricata*) in 35 geopolitical units of the Caribbean region. The number of nests per female per nesting season usually averages 3 to 5, depending on location (Richardson et al., 1989; Guzmán, 1995; Hillis, 1995). The most common remigration intervals for female hawksbills in the Caribbean are two and three years (Corliss et al., 1990; Hillis, 1994a, 1994b).

Geopolitical Unit	Population Estimates		Status/ Trends (Source)
	Number of Nests or Nesting Females Per Year	Comments (Source)	
Anguilla	No estimate available	Nesting density low, based on interviews (Meylan, 1983)	Population depleted (Meylan, 1983)
Antigua/Barbuda	400–500 nests	Most significant nesting site is Jumby Bay, Antigua (see Table 2) (Fuller et al., 1992)	Hawksbill populations in Antigua and Barbuda are considered “remnants” (Fuller et al., 1992); number of nesting females at Jumby Bay appears stationary (J. Richardson, <i>pers. comm.</i>)
Aruba	No nesting known	Appropriate nesting habitat available but no confirmed nesting (Barnes et al., 1993)	Trends unknown
Bahamas	No estimate available	Surveys limited but no concentrated nesting known (K. Bjorndal, <i>pers. comm.</i>)	Stable (Higgs, 1984); considerable decline in last 50 years (Carr et al., 1982)
Barbados	50–60 females	Estimate based on public reports, beach surveys, tagging program (Horrocks, 1992; J. Horrocks, <i>pers. comm.</i>)	Decline in landings of marine turtles (1963–74), average catch, average size (Hunte, 1984; Horrocks, 1992)
Belize	40–50 females	Most significant nesting site is Manatee Bar with 25 females per year (Smith et al., 1992); 30–40 nests/yr at Sapodilla Cays (K. Holterman, <i>pers. comm.</i>)	Noticeable decline in the Belize hawksbill population (C. Miller, cited in Moll, 1985)
Bermuda	No nesting known	Burnett-Herkes, 1987	Trends unknown
British Virgin Islands	No estimate available	3 nests in 1990 (6 islands surveyed); 10 nests in 1991 (10 islands surveyed); 61 nests in 1992 (12 islands surveyed); surveys intermittent (Eckert et al., 1992)	Stable (Clarke, cited in Groombridge & Luxmoore, 1989); “decline in stocks over recent decades” (Eckert et al., 1992)
Cayman Islands	No nesting known	Groombridge & Luxmoore, 1989	“breeding populations essentially extinct since 1900” (Groombridge & Luxmoore, 1989)
Colombia	No estimate available	Nesting sparse on mainland (Groombridge and Luxmoore, 1989); total of 21 nests recorded in San Andrés Archipelago in 1996 (Cordoba et al., in press)	Nesting markedly decreased at Buritaca (mainland), now rare (Kaufmann, 1975); marked decline on offshore cays (Carr et al., 1982)
Costa Rica	< 25 nests/yr at Tortuguero 1955–98	Surveys on 8 km of 35 km Tortuguero Beach (see Table 2) (Caribbean Conservation Corporation, unpubl. data).	Continuous decline at Tortuguero from 1956 to 1991 (Bjorndal et al., 1993)
Cuba	1700–3400 nests	Full extent of nesting unknown; maximum estimate of 409 nests annually on 47 beaches in 1994–98 (Moncada et al., 1999)	Trends of nesting population unknown, but suspected to be declining in some areas (Carrillo et al., 1999; Moncada et al., 1999).
Dominica	No estimate available	6 confirmed nests in 1984 (Edwards, 1984); nesting density low (Gregoire, cited in Groombridge & Luxmoore, 1989)	Nesting population decreasing (Gregoire, cited in Groombridge & Luxmoore, 1989)
Dominican Republic	310 females	Estimate based on aerial surveys and interviews conducted in 1980–81 (Ottenwalder, 1981, 1987)	Population decreasing (Ottenwalder, 1981, 1987)
Grenada (and Grenadines)	No estimate available	Previous estimate (> 500 females; Finley, 1984) not based on surveys, considered too high (C. Isaac, <i>pers. comm.</i> to M. Donnelly)	Trends unknown
Guadeloupe (and St. Barthelemy, St. Martin)	No estimate available	Nesting levels low, based on interviews (Meylan, 1983)	Definite decline in marine turtle population levels; 14 of 15 persons interviewed on Guadeloupe who had knowledge of turtles reported decline (Meylan, 1983)
Guatemala	380–760 nests	Estimate based on 53 observed nests (Rosales-Loessner, 1984); needs verification	Trends unknown
Haiti	No estimate available	Aerial surveys in 1982 and 1983 revealed total of 3 nests (Ottenwalder, 1996)	“second most abundant species in late 1700s. Today, populations seem severely reduced and, although nesting numbers are unknown, these are probably low” (Ottenwalder, 1996)

Table 1. (continued).

Honduras	No estimate available	Aerial and ground surveys on mainland and offshore islands between 1982 and 1987 revealed only sparse nesting (Cruz & Espinal, 1987)	Numbers greatly diminished on mainland, badly depleted in Bay Islands (Carr et al., 1982); hawksbill population has declined around Utila in last 10–15 yrs and throughout Honduras in last 10–20 years (Cruz & Espinal, 1987)
Jamaica	200–275 females	Beach surveys conducted 1991–96 (R. Kerr, <i>pers. comm.</i>)	Nesting population decreasing (Haynes, cited in Groombridge & Luxmoore, 1989)
Martinique	245–375 nests	Estimate based on limited beach surveys, interviews (Dropsy, 1987)	Marine turtle populations of Martinique “gravely threatened” (Lescure, 1987)
Mexico	Average of 2828 nests/yr 1992–96	Data from beach surveys conducted in Campeche, Yucatán, and Quintana Roo (Garduño-Andrade et al., 1999)	Population increasing over period 1977–96 (Garduño-Andrade et al., 1999)
Montserrat	No estimate available	Nesting incidental, based on reconnaissance of beaches and interviews (Meylan, 1983)	Trends unknown
Netherlands Antilles (Bonaire, Curacao, Saba, St. Eustatius, St. Maarten)	No estimate available	Nesting rare (Meylan, 1983; Van Buurt, 1984; Sybesma, 1992)	“Hawksbills appear to be much depleted from their former numbers” (Sybesma, 1992)
Nicaragua	25 females	Basis of estimate unknown (Incer, 1984); Nietschmann (cited in Groombridge & Luxmoore, 1989) described numerous nesting sites on offshore cays	Population under extreme pressure from exploitation (Nietschmann, 1981); 92% decline in harvest rate in 28 yrs (Lagueux, 1998)
Panama	No estimate available	Nesting occurs at low density throughout Bocas del Toro Province and the Comarca de San Blas (Carr et al., 1982; Meylan & Meylan, unpubl. data; A. Ruiz, <i>pers. comm.</i>)	Chiriquí Beach, once considered best nesting beach in Caribbean (Carr, 1956), now hosts only occasional nesting (Carr et al., 1982; Meylan & Meylan, unpubl. data)
Puerto Rico (Mona, Culebra, Vieques, mainland)	650 nests	Calculated from Eckert, 1995; Diez et al., 1998; and K. Hall, <i>in litt.</i> ; see Table 2 for Mona Island	“depleted U.S. populations are not currently declining, but neither are there indications of recovery” (Eckert, 1995); nesting population at Mona Island increasing (Diez et al., 1998, C. Diez, <i>pers. comm.</i>)
St. Kitts/Nevis	No estimate available	Low density nesting occurs on both islands (Meylan, 1983; Wilkins & Meylan, 1984; Eckert & Honebrink, 1992)	“serious decline in numbers (of hawksbills) over the course of recent decades” (Eckert & Honebrink, 1992)
St. Lucia	11 females	Basis of estimate unknown (Murray, 1984); nesting occurs widely but at low density (Carr et al., 1982); nesting hawksbills of “medium abundance” (Butler, cited in Groombridge & Luxmoore, 1989); nesting in very low density (d’Auvergne & Eckert, 1993)	Hawksbill nesting population decreasing (Butler, cited in Groombridge & Luxmoore, 1989); “populations of all species are declining” (d’Auvergne & Eckert, 1993)
St. Vincent (and Grenadines)	< 20 females	Bullis, 1984 (estimate based on limited data from Morris, 1984); hawksbills nest widely but everywhere in reduced numbers (Carr et al., 1982)	“The consequence of hundreds of years of exploitation is a widely acknowledged decline in the abundance of sea turtles” (Scott & Horrocks, 1993)
Trinidad and Tobago	No estimate available	Nesting levels described variously as rare, minimal, and regular (see Groombridge & Luxmoore, 1989)	Trends unknown
Turks and Caicos Islands	200–275 females	Estimated from 37 observed nests (Groombridge & Luxmoore, 1989); needs verification	Nesting population decreasing (Garland, cited in Groombridge & Luxmoore, 1989)
United States (mainland)	1–2 nests	Surveys cover > 1000 km of beaches in Florida; there may be additional, low-level nesting in Florida Keys (Meylan et al., 1995)	Trends unknown
U.S. Virgin Islands (St. John, St. Croix, St. Thomas, Buck Island Reef National Monument)	ca. 400 nests	Estimate calculated from Eckert (1995); for Buck Island Reef National Monument, St. Croix, see Table 2	Local stocks depleted by intense commercial harvest of shell for export (1920–40s); “depleted U.S. populations are not currently declining, but neither are there indications of recovery” (Eckert, 1995)
Venezuela	50–500 females	Rodriguez & Rojas-Suarez, 1995; nesting occurs widely on offshore islands and is reported for three states on the mainland (Groombridge & Luxmoore, 1989)	Trends unknown

(typically 6 months) and low nesting densities in most areas in recent decades have hindered monitoring efforts. Despite the significant variation in data quality, surveillance of Caribbean nesting beaches has been extensive. Some attempt at evaluating nesting density has been made for nearly all Caribbean beaches, largely as a result of WATS I and II, national initiatives such as the one in Mexico, and follow-up conservation efforts by WIDECAS. Where multiple sources are available for a particular country, the data are generally concordant.

In an earlier status review, Meylan (1989) concluded that most countries in the Caribbean hosted fewer than 100 nesting females per year (300–500 nests/yr). This evaluation still holds true, despite the addition of new survey data. Only 21 hawksbill nests were recorded by new surveys in the San Andrés Archipelago, Colombia, during the entire 1996 nesting season (Cordoba, 1997; Cordoba et al., in press). Cuba, which was unsurveyed at the time of WATS I and II, was suspected to host large populations; however, sampling conducted from 1987 to 1995 revealed only a few hundred nests annually (Republic of Cuba, 1997). Extrapolating from these and subsequent surveys in Cuba, Moncada et al. (1999) estimated between 1700 and 3400 nests were constructed annually. These authors and Carrillo et al. (1999) suggested some population declines, but further data are needed. None of the countries for which estimates are lacking are thought to harbor large nesting aggregations because all have been surveyed for turtles to some extent, either on foot, by air, or both.

The largest hawksbill nesting populations in the Caribbean are those of Mexico, where a combined total of several thousand nests are recorded annually in the states of Campeche, Yucatán, and Quintana Roo (Garduño-Andrade et al., 1999). Some of the other higher population estimates (e.g., estimates of populations in Grenada, Guatemala, and the Turks and Caicos Islands) were provided for WATS I or II after limited or no field sampling, and these values need verification (Meylan, 1989). According to C. Isaac (*pers. comm.* to M. Donnelly), the previous estimate by Finley (1984) of more than 500 females nesting annually in Grenada is too high, but no new estimate is available because recent surveys are lacking.

Estimating the total number of hawksbills nesting annually in the Caribbean region is difficult given the extremely variable quality and age of nesting data from the various countries. However, an order-of-magnitude estimate can be attempted from both the data presented above and the various documents reviewed during the preparation of this paper. Assuming females nest four times per nesting season in the Caribbean region, a total of 2526–3336 nests are represented in Table 1. Allowing for those countries which are known to have some hawksbill nesting but which lack numerical estimates (e.g., Bahamas, Colombia, Grenada, Honduras), and for those with estimates that do not reflect surveys of the entire coast (e.g., Costa Rica, Panama, Venezuela), or for which information is dated (e.g., Dominican Republic, Guatemala, Nicaragua), a more accurate estimate

of the total number of hawksbills nesting annually in the 35 geopolitical units is probably on the order of 5000 adult females. Again, this must only be considered an order-of-magnitude estimate given the poor quality and incompleteness of some of the data associated with it.

A maximum of 600 hawksbills are estimated to nest east of Venezuela along the Atlantic coast of South America, based on the following estimates: 1–5 nests/yr in French Guiana (J. Fretey, 1987, *pers. comm.*), 30 nests/yr in Suriname (Reichart and Fretey, 1993), and 1200–1500 nests/yr in Brazil (M. Marcovaldi, *pers. comm.*). Nesting by hawksbills occurs at low densities in Guyana; a countrywide estimate is not available.

POPULATION TRENDS IN THE CARIBBEAN

Hawksbill populations are reported to be declining or depleted in 22 of the 26 geopolitical units in the Caribbean for which status and trend information are available (no nesting occurs in 3 additional units) (Table 1). In all cases where status and trend information are presented collectively for all species of sea turtles, the hawksbill was identified as being an important, if not predominant, element of the sea turtle fauna. No information on population trends is available for Cuba (but see Carrillo et al., 1999), Grenada, Guatemala, Montserrat, Trinidad and Tobago, and Venezuela. No trend can be described for hawksbills in Florida, the only locality on the mainland of the United States where nesting predictably occurs, because only 1–2 nests/yr have been recorded since monitoring began in 1979 (Meylan et al., 1995). The status of hawksbills in the Bahamas and the British Virgin Islands is debated. Carr et al. (1982) reported a considerable decline in numbers of hawksbills in the Bahamas, whereas Higgs (1984) described populations there as stable. Similarly, Clark (cited in Groombridge and Luxmoore, 1989) reported populations in the British Virgin Islands to be stable, whereas Eckert et al. (1992) described a decline in recent decades. In Puerto Rico and the U.S. Virgin Islands, populations are described as depleted, but not currently declining (Eckert, 1995).

Annual nesting data are presented in Table 2 for four relatively regularly monitored nesting beaches in the Caribbean. Variations in survey effort from year to year make it difficult to determine the long-term trend at Mona Island, Puerto Rico, but the number of nests observed in 1997 and 1998 were the highest ever recorded (Diez et al., 1998; C. Diez, *pers. comm.*) and researchers there believe the nesting population is increasing (C. Diez and R. van Dam, *pers. comm.*). At Buck Island Reef National Monument, St. Croix, and Jumby Bay, Antigua, coverage is thorough and consistent, and nesting populations appear to be stationary, although quite small. At all three localities (Mona Island, Buck Island, and Jumby Bay), there is a history of protection for marine turtles. Hawksbills nesting on Mona Island are fairly well protected from exploitation by the deep water separating the island from mainland Puerto Rico and the Dominican Republic, by the difficulty in accessing the many

Table 2. Number of nests of hawksbill turtles (*Eretmochelys imbricata*) recorded annually at four regularly monitored beaches in the Caribbean. Number of nests per female averages 3 to 5, depending on location (Richardson et al., 1989; Guzmán et al., 1995; Hillis, 1995). Sources: Mona Island, Puerto Rico: Diez et al., 1998; C. Diez and R. van Dam, *pers. comm.*; Buck Island Reef National Monument, St. Croix, U.S. Virgin Islands: Z. Hillis and B. Phillips, *pers. comm.*; Jumby Bay, Antigua: Hoyle and Richardson, 1993; J. Richardson, *pers. comm.*; R. Kerr, *pers. comm.*; Tortuguero, Costa Rica: Caribbean Conservation Corporation, unpubl. data; only the northern 8 km of the 35 km beach at Tortuguero are monitored.

Survey Year	Mona Island, Puerto Rico	Buck Island, USVI	Jumby Bay, Antigua	Tortuguero, Costa Rica
1972				16
1973				5
1974	177			10
1975				6
1976				21
1977				11
1978				14
1979				13
1980				2
1981				6
1982				9
1983				9
1984				3
1985				4
1986	68			3
1987	66	73	103	10
1988	59	126	154	12
1989	126	116	129	6
1990	196	79	77	3
1991		119	139	1
1992		88	114	4
1993		101	107	0
1994	308	118	109	4
1995	157	135	126	2
1996	354	114	82	12
1997	475	85	94	10
1998	537	121	117	9

small beaches, and by the added surveillance conferred by the 1982 Critical Habitat designation of the U.S. Fish and Wildlife Service (Eckert, 1995). Buck Island Reef National Monument is regularly patrolled by the U.S. National Park Service. Jumby Bay is a privately owned resort.

Other than Mona Island, the only other hawksbill populations in the Caribbean that are considered to be increasing are those in Mexico. A total of 4522 nests were recorded in the states of Campeche, Yucatán, and Quintana Roo in 1996, compared to only a few hundred in the early 1980s (Garduño-Andrade et al., 1999). A combination of several factors is suggested to have effected this change. These include increased recruitment into the reproductive population from hatchlings born on local, protected beaches, and increased survival of juveniles and adults due to conservation measures adopted in Mexico and the region (Garduño-Andrade et al., 1999). Although survey effort for hawksbill nesting beaches in Mexico has unquestionably increased during the period of monitoring, researchers there believe that the increased nesting totals are likely to be a reflection of true population increase (Garduño-Andrade et al., 1999). J. Frazier (*pers. comm.*) noted that the increase in records of hawksbill nesting coincided with a dramatic reduction in harvest of these turtles in neighboring Cuba, but Carrillo et al. (1999)

concluded that improved management in Mexico, rather than the phasedown of Cuba's harvest, appeared to be the prime factor driving the recovery reported from Mexico. Despite cautious optimism that the Mexican populations are increasing, there is concern about threats posed by habitat destruction due to coastal development, by coastal highways in Campeche that border the nesting beaches, by illegal poaching, and by the incidental capture of turtles in active and discarded non-trawler fishing gear (R. Briseño, *pers. comm.*).

HISTORICAL CHANGES IN HAWKSBILL POPULATIONS

There are abundant data documenting the long-term exploitation of hawksbills (see Meylan and Donnelly, 1999). "Among the several species of giant marine turtles that inhabit tropical seas, it is the hawksbill..., source of the tortoise shell of commerce, that has probably experienced the longest and most sustained history of commercial exploitation" (Parsons, 1972). In 1494, during his second voyage to the New World, Columbus visited Doce Leguas Cays (formerly the Gardens of the Queen) in Cuba and found the Indians fishing for hawksbills and green turtles (De Sola, 1932). Roberts (1827) described expeditions to the Mosquito coast in the early 1800s to secure tortoiseshell. Export figures for tortoiseshell from the Danish West Indies (now the U.S. Virgin Islands) date back to 1898, in which year they were valued at 16,060 German marks (Schmidt, 1916). Cruz and Espinal (1987) reported that an active market in tortoiseshell has existed in the Bay Islands of Honduras for the last 90 years.

Table 1 presents information about population trends of hawksbills in 35 geopolitical units within the Caribbean. Quantitative data on population changes of hawksbills are scarce, in part because hawksbills were already greatly reduced in number when scientific studies of sea turtles began in the late 1950s. At Chiriquí Beach, Panama, there is evidence of the collapse of a major rookery. Roberts (1827) mentioned the importance of this beach and nearby Escudo de Veraguas in his account of bartering for tortoiseshell in the area in 1815. Carr (1956) described Chiriquí Beach as the most important nesting aggregation in the Caribbean, after he visited Bocas del Toro Province in the mid-1950s. In those days, individual miles of the 29 km beach were leased out to *veladores*, literally "stayers awake" who watched the beach at night and captured all the nesting females on their section of beach. Former *veladores* who were interviewed in the early 1980s independently reported catching as many as 35 to 50 nesting females on their mile in a single night during the peak of the season in the early 1950s (A. Meylan and P. Meylan, unpubl. data). Ground surveys conducted during the nesting season in 1980 and 1981 revealed only 17 and 13 hawksbill tracks, respectively, on the entire nesting beach; these tracks represented at least several days to a week of nesting activity (Carr et al., 1982). Aerial surveys of the beach in 1979–81 also failed to document any significant nesting activity. During a survey of Chiriquí Beach in 1990,

one fresh track and two non-nesting emergences were recorded. Six groups of Ngobe Indians who were looking for hawksbills were encountered on the beach; one hawksbill had been taken (A. Meylan and P. Meylan, unpubl. data). It would appear that this once great nesting aggregation is now severely depleted.

A significant decline in catch rates has been reported for the Colombian islands that lie off the coast of Nicaragua (San Andrés, Providencia, Roncador, Quitasueño Bank, and Serrana Bank). During a research cruise to the area in 1969, Ben-Tuvia and Rios (1970) interviewed fishermen who reported that in former times up to 100 turtles, mostly hawksbills, could be taken in a day. During the research expedition, four hired divers working for seven hours captured one hawksbill on Quitasueño Bank. Three divers worked eight hours to catch six hawksbills on Serrana Bank. Interviews and ground surveys by A. Carr in the San Andrés Archipelago in 1980 confirmed the depletion of hawksbill populations there. Combined takes of loggerheads and hawksbills had reportedly declined from 100 turtles per boat per season to about 25 (Carr et al., 1982). Carr identified a crucial problem for the hawksbill during this visit — that divers spearfishing for snappers and groupers and snaring lobsters were also capturing hawksbills incidentally and would continue to do so even when hawksbills became very scarce (Carr et al., 1982). The overlapping of habitats of these valuable reef-dwelling species and the relative ease of capturing hawksbills are a problem throughout the tropics (Carr and Meylan, 1980). On the basis of surveys conducted in San Andrés in 1996, Cordoba (1997) concluded that hawksbill populations there were still under extreme pressure from exploitation.

An analysis of the hawksbill nesting data at Tortuguero, Costa Rica, from 1972 to 1991 (encompassing years with standardized patrol effort) revealed a significant downward trend ($p = 0.014$), and led Bjorndal et al. (1993) to conclude that the Tortuguero nesting population had been declining continuously since monitoring began in 1956. Fewer than a dozen hawksbills have been recorded on the 8 km of patrolled beach each year during the last 19 years (see Table 2) (Caribbean Conservation Corporation, unpubl. data) in an area that up to the mid-1960s supported a hawksbill fishery (Carr et al., 1966; Carr and Stancyk, 1975).

Changes in capture rates are, in many cases, all that is left to evaluate population trends. In Nicaragua, the estimated annual harvest of hawksbills along the east coast has declined 92% between the late 1960s to early 1970s and the mid-1990s (Lagueux, 1998). A fisherman assisting the PESCA fisheries inspector at Sabancuy, Mexico, reported that in his father's day (ca. 1960s) it was not difficult to obtain 13 hawksbill nests each night during the nesting season but that today (mid-1980s), finding three was not easy (D. Bowman, *in litt.* to J. Woody, 1984). Thurston and Wiewandt (1976) described declining catches of hawksbills for fishermen from Cabo Rojo, Puerto Rico, who fished with nets in the vicinity of Mona Island.

CONCLUSIONS

Examples of the decline of hawksbill populations exist all around the Caribbean. Certainly, Panamanian fishermen believe that Chiriquí Beach was once the major regional rookery for the hawksbill, in the same way that Tortuguero, Costa Rica, is the major regional rookery for green turtles (*Chelonia mydas*). Some authors (Groombridge and Luxmoore, 1989) have inferred from the current scarcity of hawksbills that they are naturally rare. On the basis of information reviewed for this and other papers (Meylan and Donnelly, 1999), it seems more likely that the "shifting baseline" phenomenon is responsible for this perception (Pauly, 1995; Sheppard, 1995). Shifting baselines refer to the tendency of each new human generation to assume that the situation that they personally first viewed is the primordial condition. Baselines are thus constantly re-set, and our ability to see things with historical perspective is lost. In the case of hawksbills, our incorrect perception of them as being naturally rare appears to be the consequence of their having already been reduced to very low levels before we took stock of them.

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