The status of marine turtles in Montserrat (Eastern Caribbean)

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Abstract

The status of marine turtles in Montserrat (Eastern Caribbean).— The status of marine turtles in Montserrat (Eastern Caribbean*)* is reviewed following five years of monitoring (1999–2003). The mean number of nests recorded during the annual nesting season (June–October) was 53 (± 24.9 SD; range: 13–43). In accordance with earlier reports, the nesting of hawksbill (*Eretmochelys imbricata*) and green (*Chelonia mydas*) turtles was confirmed on several beaches around the island. Only non–nesting emergences were documented for loggerhead turtles (*Caretta caretta*) and there was no evidence of nesting by leatherback turtles (*Dermochelys coriacea*); however, it is possible that additional survey effort would reveal low density nesting by these species. Officially reported turtle capture data for 1993–2003 suggest that a mean of 0.9 turtle per year (± 1.2 SD; range: 0–4) were landed island–wide, with all harvest having occurred during the annual open season (1 October to 31 May). Informed observers believe that the harvest is significantly under–reported and that fishermen avoid declaring their catch by butchering turtles at sea (both during and outside the open season). Of concern is the fact that breeding adults are potentially included in the harvest, and that the open season partially coincides with the breeding season. The present study has shown that although Montserrat is not a major nesting site for sea turtles, it remains important on a regional basis for the Eastern Caribbean.

Key words: Caribbean, *Eretmochelys imbricata*, Hawksbill sea turtle, *Chelonia mydas*, Green sea turtle, Conservation.

Resumen

Estatus de las tortugas marinas en Montserrat (Caribe oriental).— Se ha estudiado la situación de las tortugas marinas en Montserrat (Caribe oriental) mediante un seguimiento de cinco años (1999–2003). El número medio de nidos registrados durante la estación anual de nidificación (junio–octubre) fue de 53 (± 24.9 SD; rango: 13–143). En concordancia con informes anteriores, se confirmó la nidificacón de las tortugas carey (*Eretmochelys imbricata*) y verde (*Chelonia mydas*) en varias playas alrededor de la isla. En la tortuga boba (*Caretta caretta*) sólo se registraron salidas sin nidificación, y no se encontraron pruebas de que la tortuga laúd (*Dermochelys coriacea*) nidificase; sin embargo, es posible que ulteriores estudios pongan de manifiesto una baja densidad de nidificación de esta especie. Los datos oficiales de capturas de tortugas (1993–2003) sugieren que en toda la isla llegaban a tierra una media de 0.9 tortugas anuales (± 1.2 SD; rango: 0–4), produciéndose todas las capturas cuando se había levantado la veda. Observadores bien documentados creen que las cifras de recolección están significativamente falseadas a la baja, y que los pescadores evitan declarar sus capturas sacrificando las tortugas en el mar (con la veda abierta o cerrada). Es preocupante que en esta caza puedan incluirse tortugas que crían, y que el período de captura permitida coincide en parte con la estación reproductora. Este estudio demuestra que aunque Montserrat no es un lugar principal de nidificación de las tortugas marinas, sigue siendo importante a escala regional en el Caribe oriental.

Palabras clave: Caribe, *Eretmochelys imbricata,* Tortuga carey, *Chelonia mydas,* Tortuga verde, Conservación.

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Introduction

Four species of sea turtles have been reported as nesting in Montserrat (Eastern Caribbean). Early studies suggested that the green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*) turtles nested in small numbers, whilst loggerhead (*Caretta caretta*) and leatherback *(Dermochelys coriacea)* turtle nests were only occasionally encountered (Meylan, 1983; John, 1984; Groombridge & Luxmore, 1989). A recent review of hawksbill turtle nesting in the Caribbean region (Meylan, 1999) reported that nesting in Montserrat is "incidental" although this result was based on reconnaissance of beaches and interviews cited in Meylan (1983). Meylan (1983) concluded that nesting levels were low, presumably because of constant human activity on the island's beaches (which were widely used for boat storage and recreational purposes).

Both adult and juvenile hawksbill and green turtles are found in Montserrat's inshore waters (Meylan, 1983; John, 1984). Montserrat's Turtle Ordinance (1951) states that turtles can be captured, sold and bought during an annual open season (1 October to 31 May). Although there are no quota or species restrictions, harvested turtles must weigh at least 20 lbs (*ca* 9.1 kg), and there are no restriction on the maximum size of harvested turtles. For several years now, the island's fisheries authorities have been attempting to raise awareness about biodiversity conservation and turtle stock management issues among the island's local fishermen. During these conversations, local fishermen are often verbally encouraged by the fisheries authorities to report any sea turtle catch to them (along their fish catches). It is not known, however, what proportion of fishermen actually report their turtle catches to the authorities.

We present a five–year marine turtle monitoring dataset gathered with limited resources to elucidate spatial and temporal patterns of marine turtle nesting in Montserrat. The first estimates of sea turtle nest numbers for Montserrat are provided. In addition, available turtle capture data are presented, offering preliminary insights into the local marine turtle fishery.

Material and methods

Study site

The Caribbean Island of Montserrat (62° 12' W, 16° 45' N) is part of the Leeward Islands of the Lesser Antilles. It is 104 km² in area and situated approximately 35 km southwest of Antigua and 60 km northwest of Guadeloupe (fig. 1; Blankenship, 1990). Apart from Trant's and Farm beaches (east coast), all of Montserrat's sandy beaches are located on the western side of the island (fig. 1). The island is of volcanic origin and all but one of its sandy beaches consist of black volcanic sand; white calcareous sand dominates at Rendez–vous beach, the northern most beach on the island's western side (Anonymous, 1993). The volcanic origin of the island was dramatically exposed in 1995 when the Soufrière Hills' volcano located in the southern part of the island began exhibiting signs of volcanic activity. Since then, there has been an ongoing volcanic crisis, with an evacuation of the southern part of the island (including the Capital, Plymouth), a safety "exclusion zone" that covers almost two thirds of the island (fig. 1; Gell & Watson, 2000) and widespread human emigration and economic disruption.

Nesting populations

Day–time monitoring of marine turtle nesting

The Fisheries Department of Montserrat's Ministry of Agriculture has been coordinating the monitoring of beaches for turtle activities (including nesting, hatchling emergences, and nest excavations) since 1999. Although ad–hoc day–time beach monitoring has been carried out by dedicated island residents who regularly check local beaches for turtle emergences and nests, the bulk of the monitoring effort has been carried out by the Fisheries Department (J. J.). Monitoring frequency of nesting beaches has been uneven, being especially patchy (i.e. a few times a year) on the beaches located in the exclusion zone (fig. 1). Safe, accessible beaches were walked and checked for turtle tracks and nests on a fairly regular basis (i.e. up to twice a week at the peak of the nesting season).

Beach monitoring datasheets were completed (by J. J.) each time a beach was visited, even if no nesting activity had taken place; other island residents did so only when they detected nesting activity. As a result, the number of beach monitoring sheets filled during a given period of time was only loosely indicative of the monitoring effort. Nests (N), i.e. adult emergences thought to have resulted in the deposition of a clutch of eggs, were individually counted. Non–nesting emergences (NNE) were not counted individually but, instead, their presence or absence on any given survey day was recorded. No distinction was made among species based on track morphology, as in many cases the nature of the beach, the type of substratum, the age of the tracks, and the relative inexperience of some the recorders precluded reliable species identification.

All island beaches were monitored a minimum of once a week for one month (mid–August / mid–September) in 2003. Although one month of comprehensive survey was insufficient to accurately assess, on an annual basis, the extent of the spatial bias caused by uneven monitoring effort, it was thought sufficient for detecting any major underestimation of nesting activity for beaches relatively less monitored during the five year dataset (1999–2003). Due to the relatively low nesting activity, monitoring beaches a minimum of once a week was sufficient to detect all activities occurring during the preceding week. More frequent monitoring

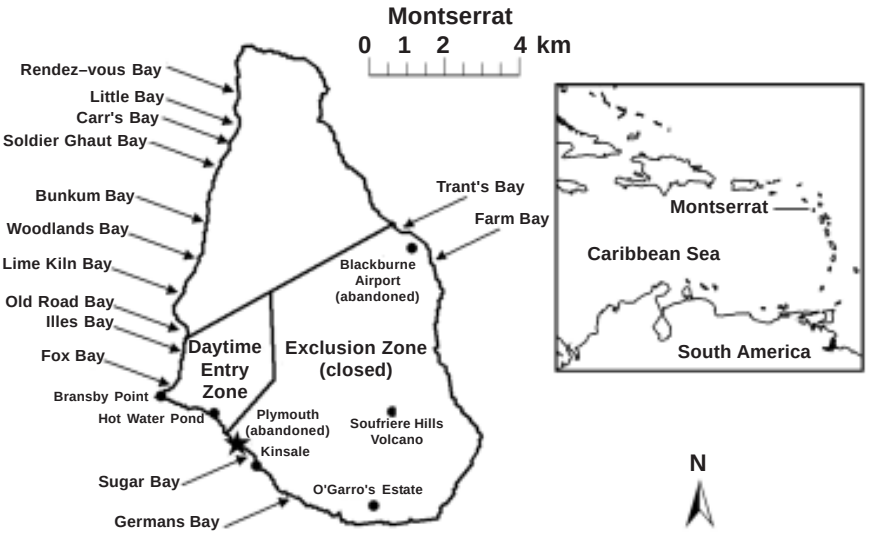

Fig. 1. The island of Montserrat in the Eastern Caribbean, showing nesting sites and the Exclusion Zone.

Fig. 1. Isla de Montserrat en el Caribe oriental, mostrando los lugares de nidificación y la Zona de Exclusión.

(i.e. more than once a week) facilitated species identification based on track morphology (following Pritchard & Mortimer, 1999). Beaches were either walked or checked from a distance with binoculars (e.g. from a helicopter/boat). Special permission was granted from the authorities to access and walk some of the beaches of the exclusion zone (at the time Trant's, Farm, Fox's, Bransby Point, Hot Water Pond). In these surveys, individual non–nesting emergences and nests were counted.

Night–time monitoring of marine turtle nesting

In 2002 and 2003, logistics permitting, beaches were monitored at night for the presence of nesting turtles. When possible, nesting turtles were measured (Curved Carapace Length, CCL) and tagged subcutaneously with Passive Integrated Transponder (PIT) tags.

Fishery harvest data

Records of turtle harvests were obtained from Montserrat's Fisheries Department in the form of a list detailing the month and year (1993–2003) of capture, the turtle species (if known), and the weight of the animal (in lb, if measured). The list had been compiled, over the years, by officers working at the island's main harbours (Plymouth then Carr's Bay). No other information is available, hence it is not known what percentage of the turtle catch these represent or if certain forms of fishing are over or under represented.

Results

Nesting populations

Day–time monitoring of marine turtle nesting

For the five year dataset (1999–2003), data originating from a total of 453 beach monitoring forms were analysed. The mean annual number of nests was 53 (± 24.9 SD, range: 13–143). Records of non–nesting emergences (NNE) and numbers of nests (N) followed patterns similar to the monitoring effort (as defined by the number of completed beach monitoring datasheets) (fig. 2A). As could be predicted, the seasonality of nesting closely follows the seasonality of the monitoring effort (fig. 2B). The inventory of completed beach monitoring datasheets reveals that relatively little survey effort was expended annually during the five months between January and May, inclusive, and, given the seasonal pattern of nesting of the leatherback and loggerhead in the region, may in part explain the absence of documentation of theses species. Nevertheless, the collected information revealed that nesting activities followed a strong seasonal pattern, with 97% of activities (non–nesting emergences and nests) recorded between the months of June and October, clearly peaking in September (fig. 2B).

During the monitoring period (1999–2003), Woodlands beach demonstrated the greatest nesting intensity of all beaches, but was also the most monitored beach on the island (fig. 3A). The three other

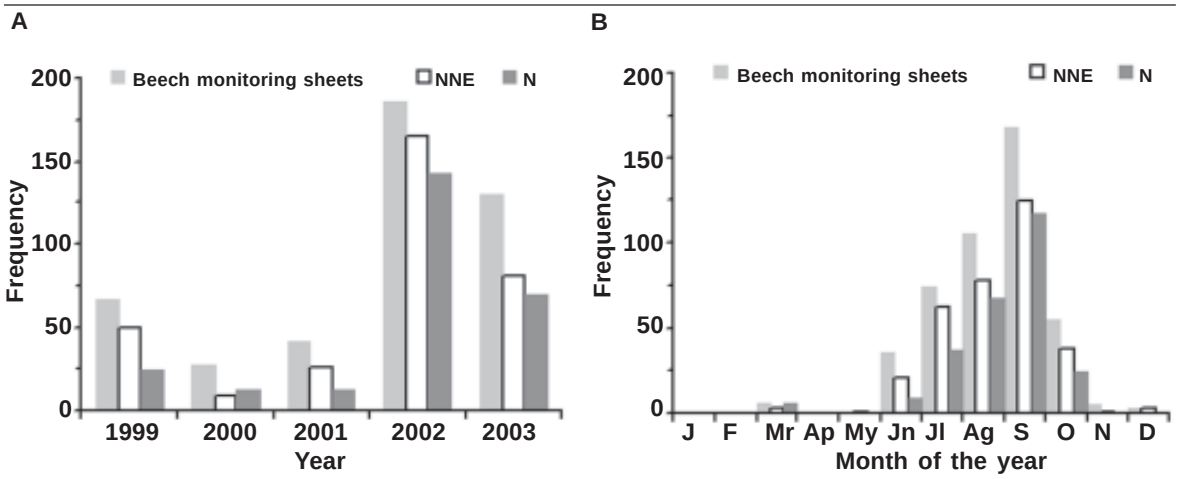

Fig. 2. The total numbers of completed beech monitoring sheets, records of non–nesting emergences (NNE), and records of nesting emergences (N) by year and cumulatively (A) and by month (B) for the period 1999 to 2003: J. January; F. February; Mr. March; Ap. April; My. May; J. June; Jl. July; Ag. August; S. September; O. October; N. November; D. December.

Fig. 2. Cifras totales de las hojas de control de las playas, registros de salidas sin nidificación (NNE) y registros de las salidas con nidificación (N) por: A. Año y acumulativamente; B. Mes para el período 1999–2003. (For abbreviations of fig. 2B see above.)

key nesting beaches appeared to be Rendez–vous, Fox's Beach/Bransby Point and Old Road/Iles Bay beaches (fig. 3A). Preliminary results for the 2004 season indicated that Fox's Bay was no longer a prime nesting site, while beaches near Plymouth (Hot Water Pond, Sugar Bay, Kinsale) showed increased nesting activities.

During the study period (1999–2003), 594 nesting attempts (including 263 successful nests) were documented (table 1). During the more intensive monitoring period between mid–August and mid–September 2003, a total of 79 nesting attempts, including 19 successful nests were recorded (table 2). There were 21 non–nesting emergences and six nests from green turtles, and 17 non–nesting emergences and three nests from hawksbill turtles. Because of their relatively large widths, four asymmetrical tracks observed on Trant's beach were attributed to loggerhead turtle(s), despite no nest being observed. The spatial distributions of non–nesting emergences and nests for mid–August/mid–September 2003 (fig. 3B) showed patterns similar to those shown when all data are pooled for 1999–2003 (fig. 3A). The numbers of non–nesting emergences for mid–August/mid–September 2003 were highly correlated with the total numbers of recorded non–nesting emergences for the period 1999 to 2002 (Spearmans rank correlation $Rs = 0.84$; $P < 0.01$). This relationship in spatial pattern was also detected between the numbers of nest for mid–August/mid–September 2003 and the total number of nests for the period 1999 to 2002 ($Rs = 0.57$; $P < 0.05$).

Night–time monitoring of marine turtle nesting

In 2002 and 2003, a total of 28 individual nesting turtles were measured: 16 green turtles (12 in 2002, four in 2003; mean CCL (cm) = 106.9 ± 6.3 SD, range: 103–118) and 11 hawksbill turtles (nine in 2002, two in 2003; mean CCL (cm) = 87.8 ± 6.8 SD; range: 79–103). A total of nine hawksbill (eight in 2002, one in 2003) and 13 green turtles (11 in 2002, two in 2003) were PIT tagged. All were tagged on Woodlands beach, with the exception of three hawksbill turtles tagged on Carr's Bay (two in 2002, one in 2003). In 2002, two green turtles were re–sighted on Woodlands beach, 11 and 12 days respectively, after having been PIT tagged on that beach. These data were supplemented by one sighting (by a member of the public) of a loggerhead turtle nesting on Woodlands beach in August 2002 and hatchling leatherback turtles being discovered and filmed on the same beach in the mid 1990's (J. J., unpublished data).

Fishery harvest data

For the period 1993 to 2003, the harvest of 10 turtles was declared to the Fisheries Department (fig. 4), hence a mean of 0.9 harvest per year (± 1.2 SD; range: 0–4). All captures took place during the open season (October to May). One green turtle (9.1 kg) and seven hawksbill turtles (13.6 kg, 18.1 kg, 29.5 kg, 45.4 kg, 45.4 kg, 63.1 kg, 90.9 kg; mean mass (kg) = 43.7 ± 26.9 SD) were declared to the authorities. There were two

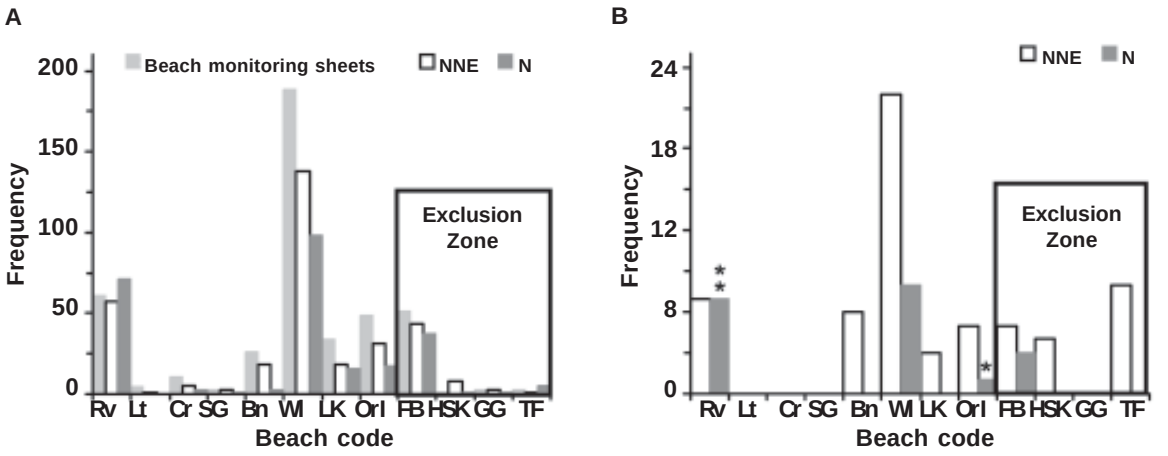

Fig. 3. The total numbers of completed beach monitoring sheets, records of non–nesting emergences (NNE) and numbers of nests (N), per beach (A) during the years 1999–2003 and (B) for the period mid–August to mid–September 2003. Beach codes: Rv. Rendez–vous; Lt. Little Bay; Cr. Carr's Bay; SG. Soldier Ghaut; Bn. Bunkum Bay; Wl. Woodslands Beach; LK. Lime Kiln Bay; OrI. Old Road/Iles Bay; FB. Fox's Bay/Bransby Point; HSK. Hot Water Pond/Sugar/Kinsale; GG. German's/O'Garro's; TF. Trant's/Farm Bay); * One hawskbill turtle nest; ** Two hawksbill turtle nests. (For other abbreviations see figure 2.)

*Fig. 3. Cifras totales de las hojas de control de las playas, registros de las salidas sin nidificación (NNE) y números de nidos (N) por playa (A) durante los años1999–2003 y (B) para el período de mediados de agosto–mediados de septiembre del 2003. Códigos de las playas: Rv. Rendez–vous; Lt. Little Bay; Cr. Carr's Bay; SG. Soldier Ghaut; Bn. Bunkum Bay; Wl. Woodlands Beach; LK. Lime Kiln Bay; OrI. Old Road/Iles Bay; FB. Fox's Bay/Bransby Point; HSK: Hot Water Pond/Sugar/Kinsale; GG. German's/ O'Garro's; TF. Trant's/Farm Bay; * Un nido de tortuga carey; ** Dos nidos de tortuga carey. (Para las otras abreviaturas ver la figura 2.)*

declared captures for which the species was not recorded. All reported landings were of turtles that met the legal minimum size criteria (> 20 lbs, or 9.1 kg).

Using a published regression equation between mass and CCL for hawksbill turtles (Log_{10} (mass) = 2.8966 * Log_{10} (CCL) – 3.8534, with mass in kg and CCL in cm, Limpus et al., 1983), the masses of nesting hawksbill turtles that were measured in Montserrat were estimated to range from 43.9 to 94.8 kg. When compared to the masses of harvested turtles, it appeared that four out of the seven harvested hawksbill turtles declared to authorities could have been adults. These four potentially adult turtles were captured during the months of February (*N* = 1 turtle), October (*N* = 1 turtle) and November (*N* = 2 turtles).

Discussion

Although marine turtle monitoring had been ongoing since preliminary studies in the early 1980's (Meylan, 1983; John, 1984), almost all relevant data were lost, along with many government records, in the volcanic flows that engulfed Plymouth in 1997. Monitoring efforts documented by this study (1999–2003) were intermittent and uneven, meaning that caution is warranted in making any recommendation regarding population status. There are, however, a few key points that can be extracted from the existing data. Green and hawksbill turtles nest in modest yet regionally important numbers for the Eastern Caribbean, probably every year. Leatherback and loggerhead turtles may also nest, but at lower densities. The lack of documented leatherback nesting may be attributed to a comparatively low level of monitoring during peak nesting months (April–June), however it is unlikely that nesting of this species is more frequent than occasional. The data are in concord with the wider literature which suggests that green, hawksbill and leatherback turtles (and loggerheads to a much lesser extent) are the most common species of nesting sea turtles in the Lesser Antilles (e.g. Carr et al., 1982; Meylan, 1983, 1999; Eckert et al., 1992; Eckert & Honebrink, 1992; Fuller et al., 1992; Sybesma, 1992; D'Auvergne & Eckert, 1993; Scott & Horrocks, 1993; Richardson et al., 1999; Chevalier & Lartiges, 2001).

The magnitude of nesting data recorded was closely correlated with survey frequency in time

Table 1. Breakdown of the records of non–nesting emergences (NNE), and the numbers of nests (N), per beach and year, for the period 1999–2003.

Tabla 1. Detalle de los registros de salidas del mar sin nidificación (NNE), y número de nidos (N), por playa y por año, para el período 1999–2003.

	1999		2000		2001		2002		2003	
	NNE	N	NNE	N	NNE	N	NNE	N	NNE	N
Rendez–vous	7	6	1	3	4	3	23	25	22	34
Little	0	0	0	0	0	0	0	0	1	0
Carr's	1	0	0	0	0	0	2	3	2	0
Soldier Ghaut	1	1	0	0	1	0	1	0	0	0
Bunkum	2	0	0	0	0	0	11	2	5	0
Woodlands	4	4	1	0	4	4	93	70	36	21
Lime Kiln	0	0	0	0	1	0	10	16	7	0
Old Road/Iles	9	4	1	4	9	3	11	7	2	0
Fox's/Bransby Point	20	5	4	5	7	3	10	15	5	10
Hot Water Pond/Sugar/Kinsale	3	4	2	1	0	0	4	5	0	0
German's/O'Garro's	3	0	0	0	0	0	0	0	0	0
Trant's/Farm	0	0	0	0	0	0	0	0	1	5
Total	50	24	9	13	26	13	165	143	81	70

Table 2. Breakdown of the numbers of non–nesting emergences (NNE), and the numbers of nests (N), per beach and by species, for the period mid–August to mid–September (2003).

Tabla 2. Detalle de los registros de salidas del mar sin nidificación (NNE), y número de nidos (N), por playa y por especie, para el período mediados de agosto–mediados de septiembre (2003).

	Green		Hawksbill		Loggerhead		Undetermined	
	NNE	N	NNE	N	NNE	N	NNE	N
Rendez–vous	0	1	0	2	0	0	7	4
Little	0	0	0	0	0	0	0	0
Carr's	0	0	0	0	0	0	0	0
Soldier Ghaut	0	0	0	0	0	0	0	0
Bunkum	1	0	3	0	0	0	2	0
Woodlands	14	4	5	0	0	0	3	4
Lime Kiln	0	0	3	0	0	0	0	0
Old Road/Iles	0	0	4	1	0	0	1	0
Fox's/Bransby Point	2	1	0	0	0	0	3	2
Hot Water Pond/Sugar/Kinsale	2	0	2	0	0	0	0	0
German's/O'Garro's	0	0	0	0	0	0	0	0
Trant's/Farm	2	0	0	0	4	0	2	0
Total	21	6	17	3	4	0	18	10

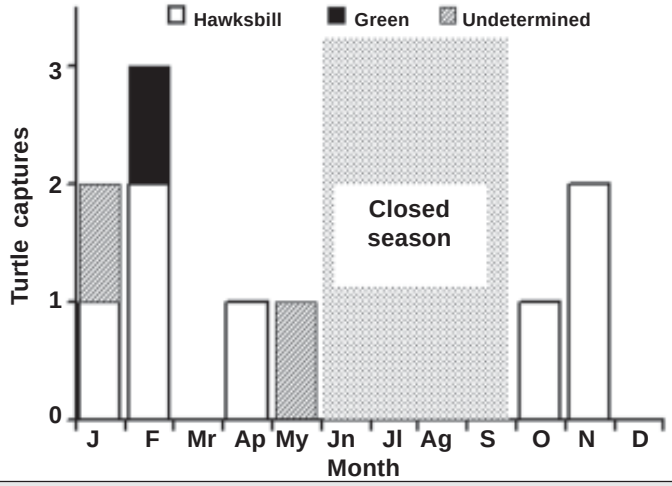

Fig. 4. The temporal distribution of reports of turtle captures (1993–2003; *N* = 10 turtles). The closed season is highlighted. (For abbreviations see figure 2.)

Fig. 4. Distribución temporal de los registros de capturas de tortugas (1993–2003; N = *10 tortugas). Se ha destacado la estación de veda. (Para las abreviaturas ver la figura 2.)*

and space. It is likely that recorders more frequently carried out surveys at times and locations when the probability of recording turtle nesting activity was more likely. Although this may have resulted in spatial and temporal biases in the dataset, the seasonality of the Montserrat nesting season as described by the data set is plausible, peaking from June to October, if we assume that hawksbill and green turtles are the dominant nesting species. Although because of the nature of the data, it was not possible to discriminate between the seasonality of the different species, the temporal distribution of the data are consistent with seasonality of nesting reported for hawksbill and green turtles (Fuller et al., 1992; Hirth, 1997) and hawksbill turtles (Eckert & Honebrink, 1992; Corliss et al., 1989; Scott & Horrocks, 1993) in the Eastern Caribbean region. Additionally, data collected during the period of intensive monitoring in 2003 generated a spatial distribution of nesting broadly similar with that of the data gathered in previous years. Notwithstanding, it is likely that comprehensive (e.g. once weekly, year–around) island–wide surveys would reveal more complex patterns of habitat use by gravid females.

The key nesting beaches for green and hawksbill turtles in Montserrat appeared to be Woodlands (so far unreported in the literature), Rendez–vous, Fox's/Bransby Point and Old Road/Iles Beaches. Even though green turtles left tracks on many of the island's beaches, actual nesting by this species was only confirmed for Rendez–vous, Woodlands and Fox's/Bransby Point beaches. Based on interviews with island residents and beach reconnaissance, Meylan (1983) reported that green turtles might also be nesting at Little and Iles beaches. Actual nesting by hawksbill turtles was solely confirmed in the present study for Rendez–vous and Old Road/Iles Beaches, although Meylan (1983) also quotes Carr's, Little and Soldier Ghaut beaches as nesting sites for this species. On Trant's beach, tracks possibly left by loggerhead turtles were reported, in agreement with the belief that loggerhead turtles occasionally nest on the island (John, 1984).

It is thought that the turtle fishery has declined significantly in magnitude since the extensive emigration from the island in recent years. Only ten turtles were declared to the fishing authorities for the period 1993 to 2003. Popular accounts suggest that it is likely that this low total is the result of significant under–reporting. Fishermen are said to avoid declaring their catch to the authorities by butchering turtle carcasses at sea both in and outside the open season. Of great concern, as evidenced by the temporal distribution of declared turtle capture records and the fact that potential breeding adults are being captured, is that the open season for the turtle fishery overlaps partially with the nesting season. Consequently, in planned regulations, it has been suggested that the closed season be defined as 1 March (the beginning of leatherback nesting season in the central Eastern Caribbean) to 1 December. Other suggested changes in the regulation include the prohibition of catching turtles on land and an increase of the minimum weight of harvested turtles from 20 pounds (9.07 kg) to 50 pounds (22.68 kg). However, a recent report to the UK Government (Godley et al., 2004) recommended that legislation be further revised to "ensure a permanent and complete prohibition of harvest of any large,

reproductively valuable turtles by instigating a maximum size limit". It was suggested that this threshold should be based upon further research into the fishery and turtle stocks and that a curved carapace length threshold was developed. A shift from weight–based to size–based limits enables a fisherman to more easily determine the legality of the catch while still at sea.

The harvest information suggests that a wide size range of green and hawksbill turtles could be present year round in Montserrat's waters. Relatively little is known of the current state of Montserrat's marine and coastal habitats with regards to suitability as marine turtle foraging areas. The area of the coastal shelf is relatively small (140 km^2) and only generalized distributions of primary substrata types are available (Meylan, 1983; Anonymous, 1993). Before 1995, coral communities (foraging habitats for hawksbill turtles) were found in small patches interspersed with sand and sediment on the north, south and west coasts (Gell & Watson, 2000). The harmful consequences of sediments on coral reef communities and associated organisms are well documented (e.g. Rogers, 1990). In Montserrat, volcanic sediments are thought to have had a severe impact on reef growth, particularly those in the east and southwest of the island (Gell & Watson, 2000). Direct deposits of ash and waterborne sediments have led to some coral bleaching and disintegration of large sponges. Some reef areas, however, are thought to be recovering (Wolfe Krebs, pers. comm. 2003). In recent times, three main seagrass beds (foraging habitats for green turtles) were known: the largest, 750 ha, being located at the northern tip of the island and the other two on the east and west coasts (Gell & Watson, 2000). It is thought that seagrass beds suffered considerable damage during Hurricane Hugo in 1989, although the effect on the spatial distribution of foraging habitat for green turtles is not known.

Montserrat presents a relatively narrow coastal shelf, dropping off rapidly to nearly 200 m only 650 m from the shoreline along the southern half of the island, whilst in the north, northeast and west, the shelf slopes more gently (the 200 m contour is approximately 5 km offshore, Gell & Watson, 2000). The result is a high energy, erosion prone coastline, with generally intermittent beaches (Anonymous, 1993). For this reason, the quality of Montserrat's beaches with regards to sea turtle nesting appears to be naturally poor. Although only assessed qualitatively to date, beach erosion destroys incubating eggs and periodically prevents gravid turtles from nesting. Additional factors of concern are linked to the volcanic eruptions and include ash deposits and beach mining. Occasional ash deposits cover nesting beaches, rendering them less suitable or wholly unsuitable for nesting until they are cleared by heavy storms. For Montserrat's rebuilding after the catastrophic eruptions of 1997, extraction of beach sediments, largely of volcanic origin, are commonplace. Such extraction has ceased at Isle's Bays (in 2003) but is ongoing at Trant's Bay. It is important that the integrity of Trant's Bay be maintained and that ongoing sea turtle monitoring, preferably on a more frequent basis, include the relocation of clutches from high risk to lower risk beach areas. Nest predation by feral pigs and feral/domestic dogs has also been recorded (J. J. and B. J. G. pers. obs.), but the actual levels are yet to be quantified.

The present study has drawn a more accurate picture of the status of marine turtles in Montserrat. Further studies involving species identification with increased survey effort will more fully elucidate the status of nesting populations. Of high priority for marine turtle conservation are a revision of the regulatory framework to feature a more restricted harvest season (and one that does not coincide with the turtle breeding season), maximum rather than minimum size limits, new measures to encourage fishermen to report their turtle catches, the full protection of nesting adults, their eggs and young, the careful management of beach sediment extraction, and the control of feral pigs and feral/domestic dogs.

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