

Records of the leatherback sea turtle (*Dermochelys coriacea*) on the Brazilian coast, 1969–2001

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Data from several sources and original data are presented regarding sightings, strandings and incidental captures of leatherback sea turtles (*Dermochelys coriacea*) on the Brazilian coast in a 33 year period, from 1969 to 2001. Two of the turtles were small juveniles (curved carapace length=40 cm and approximately 85 cm) and the remaining animals with known carapace size were large juveniles or adults. The origin of leatherbacks observed in Brazil is unknown. Several colonies in South America, including a Brazilian one, in the Caribbean, in western Africa and even in eastern South Africa could be the source of these turtles. The data presented here suggest that more effort should be directed to the assessment of the impact of fishing gear and marine pollution on leatherbacks and that systematic surveys on beaches should be maintained in order to monitor long term fluctuations in stranding levels and spatial stranding patterns. Genetic studies and satellite telemetry would be helpful in clarifying the origin of leatherbacks stranded or incidentally captured on the Brazilian coast.

INTRODUCTION

The leatherback sea turtle *Dermochelys coriacea* (Vandelli, 1761) (in Portuguese: ‘tartaruga-de-couro’, ‘tartaruga-gigante’, ‘tartaruga-de-casco-mole’ or ‘careba-mole’) is essentially a pelagic species, highly adapted for life in the open seas, feeding on jellyfish, salps and other gelatinous organisms distributed in the water column. It has a wide distribution in all oceans, from the tropics to relatively high latitudes, but nesting is restricted to tropical (rarely subtropical) regions (Pritchard & Trebbau, 1984).

The leatherback turtle is currently classified as critically endangered by the International Union for the Conservation of Nature (IUCN—The World Conservation Union). Drastic declines in nesting populations have recently been observed in several places around the world, mainly in the Pacific Ocean (Spotila et al., 1996). Egg harvesting, pollution of the seas (mainly by plastics and other marine debris) and incidental capture in drift nets, longlines and other fishing gear are some of the main threats faced by leatherbacks worldwide. Reviews of leatherback biology and current conservation issues can be found in Eckert (1991) and Frazier (2000). Great importance should be placed nowadays on the monitoring of leatherback distribution, population levels and threats, as a way to continually assess the status of that species (IUCN/SSC, 1995).

In Brazil, the leatherback turtle is currently classified as critically endangered by the Brazilian Ministry of the Environment (<http://www.mma.gov.br>). The only place

in Brazil where regular leatherback nesting is known to occur is located on the northern coast of the State of Espírito Santo (Marcovaldi & Marcovaldi, 1999). Occasional nesting has been observed in a few other places (Barata & Fabiano, 2002). Leatherback sightings and records of strandings and incidental captures of juveniles and adults, however, have been made not only around the nesting beaches in the State of Espírito Santo, but along most of the Brazilian coast. Much of this information is scattered in the scientific literature, daily newspapers and museum records.

In this article, we collate data from several sources and present original data regarding leatherback occurrence on the Brazilian coast in a 33 year period, from 1969 to 2001. Observations of females in reproductive activities on nesting beaches are not considered here, although animals stranded on nesting beaches or observed or captured at sea around nesting beaches are included. Incidental captures in pelagic fisheries are also not considered, except in two cases (at places relatively close to the coast, in northern Brazil) taken from the literature; Kotas et al. (2004) present some information on the incidental capture of leatherbacks in pelagic longlines in Brazil. Our objective is to draw the reader’s attention to the magnitude and geographical extent, possibly unsuspected heretofore, of leatherback coastal occurrences in Brazil, and to establish some links between the Brazilian records and international efforts regarding the conservation of this endangered species.

MATERIALS AND METHODS

Data from the following sources were gathered here: (1) Projeto TAMAR (Projeto Tartaruga Marinha), the Brazilian sea turtle conservation programme; (2) GEMARS (Grupo de Estudos de Mamíferos Aquáticos do Rio Grande do Sul/Rio Grande do Sul Aquatic Mammal Study Group), a nongovernmental organization dedicated to marine conservation; (3) personal communications by Brazilian researchers working on marine conservation (Carolina P. Bertozzi, São Paulo; Shirley P. de Souza, São Paulo); (4) museum records (Museu Nacional, Rio de Janeiro); (5) data obtained from the scientific literature (Müller, 1971; Menezes, 1972; Cunha, 1975; Lema & Fabián-Beurmann, 1977; Frazier, 1984; Lema & Ferreira, 1990; D'Amato, 1991; Lima & Evangelista, 1997; Pinedo et al., 1998; Sampaio, 1999; Sanches et al., 1999; Bugoni et al., 2001); (6) information published in daily newspapers; in this case, a record was only included in this article when a photograph had been published, to confirm the species identification (Anon., 1997, 2000, 2001a,b; Dutra, 2001); and (7) personal observations by the authors. A table with detailed information about the records included in this article and their sources is available on request from the first author.

Whenever available, date, locality, turtle size (curved carapace length, CCL, or straight carapace length, SCL), the turtle's condition at the moment of observation (dead or alive), information concerning the mode of observation (stranding, incidental capture in fishing gear, etc.) and any related information are presented. Only records from 1969 to 2001 are presented here. We are aware of some other records in south-eastern Brazil during that period, which could not be included in this article due to rights over the data.

Data are presented regarding two time periods, 1969–1991 and 1992–2001. Up to 1991, Projeto TAMAR's activities focused mainly on nesting beaches. In 1991–1992, due to an increasing concern with the incidental capture of sea turtles in coastal fisheries, two TAMAR stations were created in selected feeding areas for sea turtles, one in the State of São Paulo and the other in the State of Ceará; these stations were fully operational in 1992 (Marcovaldi & Marcovaldi, 1999). Since the creation of these two stations, a significant amount of data related to strandings and incidental captures of sea turtles in fisheries has been gathered by Projeto TAMAR, not only in São Paulo and Ceará but in other states as well. Moreover, TAMAR's activities with fisheries since 1992 played an important role in the development of an informal network of sea turtle observers along the Brazilian coast, mostly university researchers working on marine affairs mainly in south-eastern Brazil, and public officials working on environmental matters; much of the data presented in this article were obtained from these observers. The division of the data in two time periods was intended to reflect what we believe to be a significant change, as from 1992, in the information system regarding the occurrence of sea turtles on the Brazilian coast.

With regard to carapace size, leatherbacks were broadly classified as 'small juveniles' (turtles with CCL smaller than 85 cm) or 'large juveniles or adults', on the basis of information available in the literature concerning the size

of nesting females in different colonies (Márquez, 1990). Only turtles for which a measurement was available were included in the statistical analyses.

Pinedo et al. (1998) provided data on 58 leatherbacks stranded dead on the State of Rio Grande do Sul coast between January 1992 and November 1995. These authors presented only aggregated data on SCL and time period of occurrence (with varying sample sizes), without any information on the locations of individual records, their carapace size and date of occurrence. Accordingly, we could not always include their data directly in our statistical analyses.

In Figure 3, to avoid overlapping of data points, the region coordinates of the data points were jittered, that is, data points were displaced from their true position in the graph by adding a small amount of uniform random noise to the region coordinates. Statistical tests were carried out with the software R 1.9.1 (R Development Core Team, 2004); $\alpha=0.05$ (probability of a type I error).

RESULTS

Geographical distribution

Data are presented regarding two time periods, 1969–1991 (N=15) and 1992–2001 (N=119) (Figure 1). The geographical distribution of turtles in 1969–1991, relative to 1992–2001, reveals a paucity of observations mainly in the northern region, but also in the eastern region (Figure 1). In this article, we will analyse mainly records from 1992–2001, which are essentially concentrated in three regions (circled on the right map of Figure 1): northern Brazil (Maranhão to Rio Grande do Norte, and around the oceanic islands Penedos de São Pedro e São Paulo (Saint Paul's Rocks) and Fernando de Noronha; N=13, or 11% of total records); eastern Brazil (Espírito Santo to São Paulo, N=21, or 18%); and southern Brazil (Rio Grande do Sul; N=84, or 71%). In 1992–2001, the available data includes also one record on the north-eastern coast, near Salvador, State of Bahia.

Temporal distribution

In 1992–2001, the average annual number of leatherbacks observed in Brazil was 11.9 turtles, although the annual numbers were quite variable, in the range of 0–66 turtles. Statistical analysis indicates that the distribution by month was not significantly different among the three main regions (Kruskal–Wallis test, N=58, $P=0.064$; Figure 2). However, it should be noted that, in the East region, where the regular nesting area in Brazil is located (Figure 1), 57% of the records (12 out of 21) occurred in July–August, and 33% of the records (7 out of 21) occurred in October–January (Figure 2). In the South region, 46% of the records (11 out of 24) occurred in December, in summer. Pinedo et al. (1998) showed that most (about 81%) of their leatherback records in Rio Grande do Sul (South region, N=58) occurred in spring and summer months (September–February). The only record from the State of Bahia occurred in February 1999.

Size and sex distribution

In the North region, two of the turtles were small juveniles (one with CCL=40 cm, the other with

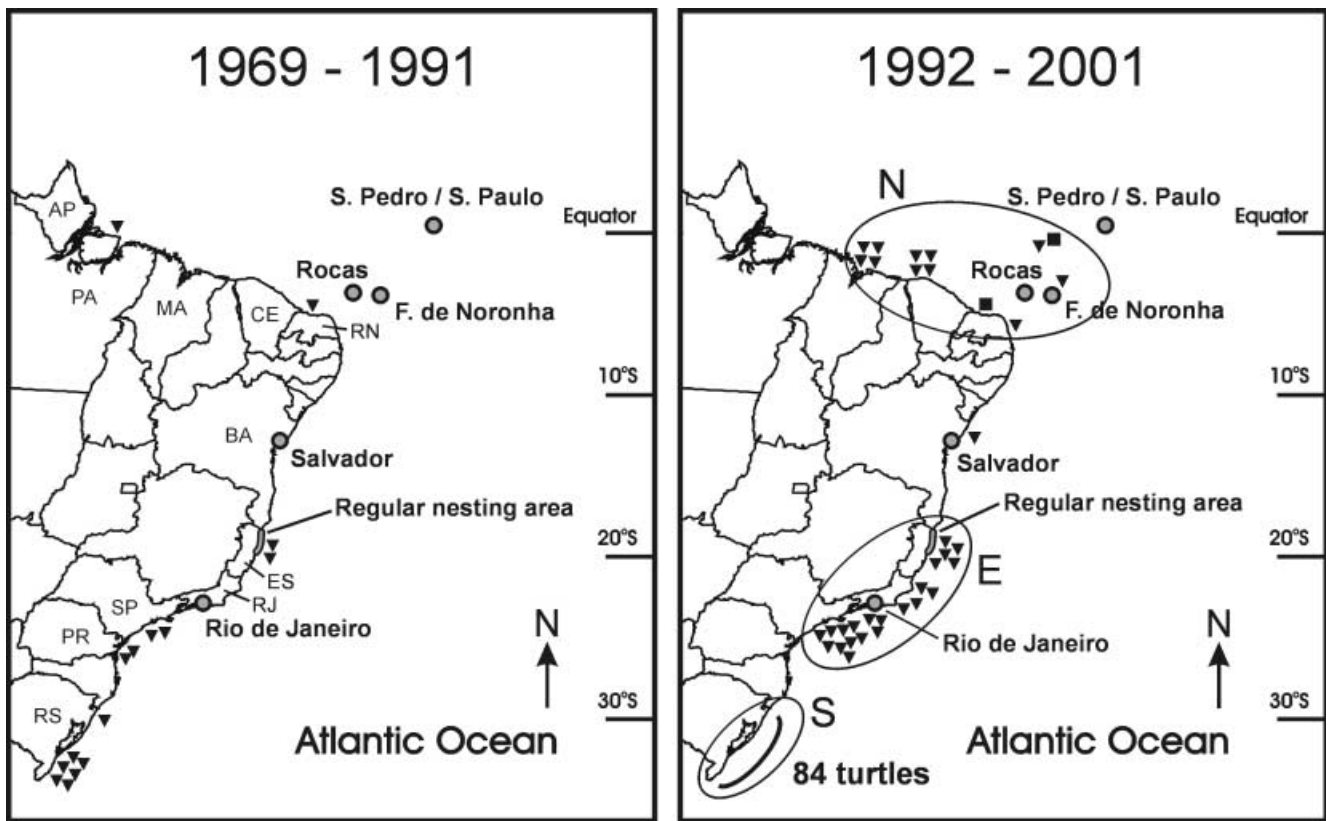


Figure 1. Maps of Brazil, showing leatherback records in two time periods. Each black triangle indicates one leatherback record; the two black squares on the right map indicate animals with curved carapace length smaller than 85 cm. Sample sizes are $N=15$ (1969–1991) and $N=119$ (1992–2001). The regular nesting area in Brazil (1992–2001), on the northern coast of the State of Espírito Santo, is shown in grey. On the right map, the three regions with the highest concentration of records are indicated: N (north), E (east) and S (south). Some selected Brazilian states are indicated on the left map: AP, Amapá; PA, Pará; MA, Maranhão; CE, Ceará; RN, Rio Grande do Norte; BA, Bahia; ES, Espírito Santo; RJ, Rio de Janeiro; SP, São Paulo; PR, Paraná; RS, Rio Grande do Sul.

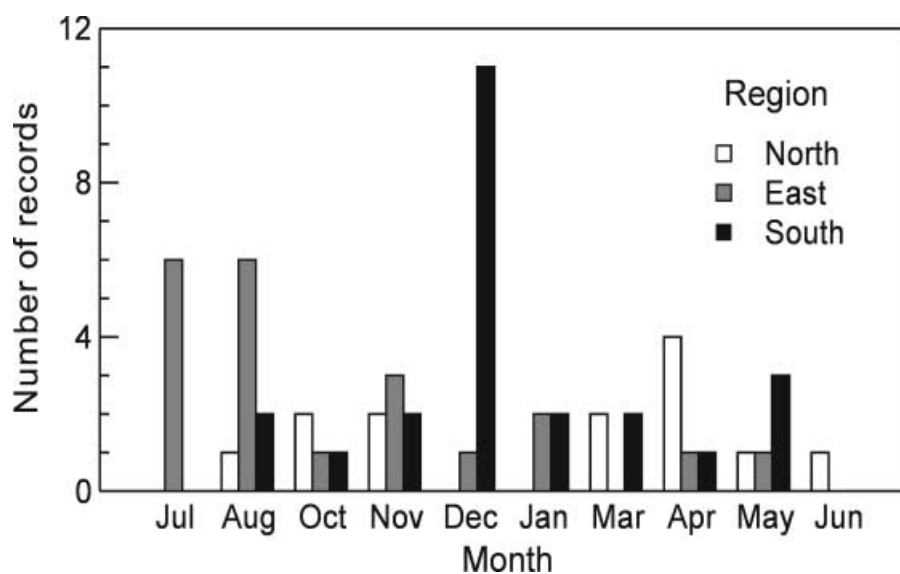


Figure 2. Distribution of records by month, by region, 1992–2001. Regions North, East and South are those circled on the right map of Figure 1. Sample sizes are $N=13$ (North), $N=21$ (East) and $N=24$ (South). The records from Pinedo et al. (1998) in southern Brazil ($N=58$) are not included in this figure (see Materials and Methods).

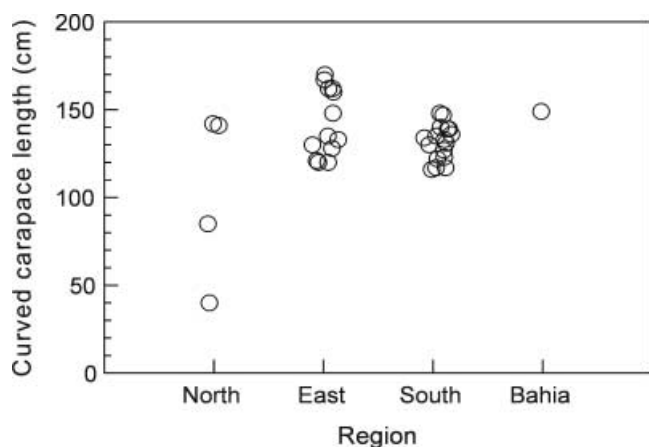


Figure 3. Curved carapace length by region, 1992–2001. Regions North, East and South are those circled on the right map of Figure 1. Sample sizes are $N=4$ (North), $N=13$ (East) and $N=17$ (South). The only record in the State of Bahia is also shown. The records from Pinedo et al. (1998) in southern Brazil ($N=58$) are not included in this figure (see Materials and Methods).

carapace size approximately 85 cm (not stated if CCL or SCL)); the two remaining animals were large juveniles or adults (CCL=141 cm and 142 cm; Figure 3). In regions East and South, all animals were large juveniles or adults (Figure 3). There is no significant difference in CCL between regions East and South (Wilcoxon–Mann–Whitney test, $N=30$, $P=0.194$); pooling the data from these two regions, average CCL=136.3 cm, median=133.5 cm, $SD=15.5$ cm, minimum=116 cm,

maximum=170 cm ($N=30$). The only record from the State of Bahia had CCL=149 cm; this turtle is a large juvenile or adult (Figure 3). Pinedo et al. (1998) presented data (not included in Figure 3) for 24 turtles in the South area, observed in 1992–1995, with SCL in the approximate range of 100–179 cm, that is, these turtles were large juveniles or adults.

The sex of the observed turtles is generally unknown. Only six turtles had their sex recorded: in each of the two periods (1969–1991 and 1992–2001) there were two females and one male.

Condition at the moment of observation

Leatherbacks were found, alive or dead, either stranded or incidentally captured in fishing gear, or were sighted at sea. Table 1 presents data regarding the mode of observation and condition of the turtles at capture (alive or dead) in 1992–2001. Two of the leatherbacks stranded dead in Rio Grande do Sul in that period had plastic debris in the digestive tract (Bugoni et al., 2001).

DISCUSSION

Geographical, temporal and size distribution

Although a real increase in leatherback captures, sightings and strandings from 1992 on (Figure 1) cannot be ruled out, a strong component of an explanation for the large number of records in that period, when compared to the period before 1992, is a more efficient information gathering system in operation since 1992 (see Materials and Methods). Moreover, many records (usually the ones published in daily newspapers and many that came

Table 1. Mode of observation and turtle condition at capture (alive or dead) by region, 1992–2001. Regions North, East and South are those defined on the right map of Figure 1; a single record in the State of Bahia is also presented. State abbreviations as in Figure 1; PP, Penedos de São Pedro e São Paulo (Saint Paul's Rocks); FN, Fernando de Noronha. Observations marked with an asterisk (*) were made on or around nesting beaches in the State of Espírito Santo.

Condition	Mode of observation				Total
	Region				
	North	East	South	Bahia	
Alive	1 captured in longline in PP 1 entangled in longline in FN 2 stranded in MA 3 captured in fish weirs in CE 1 stranded in CE	2 captured in fishing nets in ES* 2 sighted at sea in RJ 2 captured in fishing nets in SP 1 stranded in SP	—	1 stranded in BA	16
Subtotal	8	7	—	1	16
Dead	1 captured in longline in PP 2 stranded in MA 2 stranded in RN	2 captured in fishing nets in ES* 1 stranded in ES* 1 captured in fishing net in RJ 3 stranded in RJ 1 record in RJ, no information on the mode of observation 6 stranded in SP	84 stranded	—	103
Subtotal	5	14	84	—	103
Total	13	21	84	1	119

to the attention of researchers) have been initially informed by the general public, which may reflect an increasing public awareness about the conservation of marine animals.

The large relative proportion of records in the State of Rio Grande do Sul (Figure 1) is in part due to systematic surveys of beaches, carried out year round since the early 1990s by researchers from universities and nongovernmental marine conservation organizations. It should be noted that the number of turtles stranded dead should be regarded as a minimum estimate of mortality at sea, since not all turtles that die at sea wash ashore (Epperly et al., 1996). Thus the relatively large number of strandings in Rio Grande do Sul may indicate a higher level of mortality at sea, although the ratio of strandings to deaths is not known. Furthermore, it is not known if leatherbacks stranded on the Rio Grande do Sul coast died at places at sea of about the same latitude as Rio Grande do Sul, since currents could bring carcasses to the coast from faraway locations (Epperly et al., 1996). In fact, this last comment applies to all strandings in Brazil: the stranding location provides no information about the actual place of death of the turtle at sea. Besides the beach surveys in Rio Grande do Sul, to our knowledge, systematic beach monitoring is only performed in a small area in eastern Rio de Janeiro (Arraial do Cabo) and in the areas under TAMAR's protection in sea turtle nesting and/or feeding areas in western Ceará, Fernando de Noronha, Atol das Rocas, Sergipe, northern Bahia, the southernmost part of Bahia, northern Espírito Santo, northern Rio de Janeiro and northern São Paulo.

In Brazil, the nesting season in the State of Espírito Santo is generally from September to March, but about 90% of the clutches are deposited between October and January (Projeto TAMAR, unpublished data, 1988/1989 to 2003/2004). So, most (19 out of 21, or 90%) of the records in the East region (States of Espírito Santo, Rio de Janeiro and São Paulo) in 1992–2001 occurred just before or during the nesting season (Figure 2). The records in the State of Espírito Santo (five records in 1992–2001) occurred during the nesting season, right on or in front of nesting beaches; the turtles were observed dead at sea, stranded or were incidentally captured in fishing nets (Table 1).

We believe that the great number of records in Rio Grande do Sul in December, as shown in Figure 2, is not the result of sampling bias, since beach monitoring by GEMARS, the organization which produced the data from the South region presented in that figure, has been carried out at approximately the same rate for each month during 1994–2001. Furthermore, the results presented in Figure 2 roughly agree with Pinedo et al. (1998) data, where most of the records occurred in September–February.

The North region is poorly known, with regard to the occurrence of sea turtles. No monitoring is carried out in the State of Amapá (Figure 1), which is contiguous to French Guiana, where a large leatherback colony exists (Girondot & Fretey, 1996), and also in the State of Pará (Figure 1), which includes the large Island of Marajó. The four leatherbacks captured in fishing weirs in Ceará and three out of four leatherbacks stranded in Maranhão in

1992–2001 (Figure 1, right map) were recorded between March and June, that is, at the start or during the nesting season in French Guiana, generally between April and August (Girondot & Fretey, 1996).

Except for two small juveniles, leatherbacks recorded in Brazil were large juveniles or adults (Figure 3), that is, they were individuals with a high reproductive value for the population. The two small juveniles were found in the North area, near to the Equator (Figure 1), which is compatible with Eckert's (2002) finding that sightings or strandings of small leatherbacks are restricted to warmer waters, generally in latitudes smaller than 20°.

Origin of leatherbacks found in Brazil

The origin of the turtles observed on the Brazilian coast is unknown. Genetic analysis would help to clarify their natal origin, but no genetic information is available regarding the records presented here. Leatherbacks are known to travel long distances from their nesting beaches into pelagic waters (Eckert & Sarti, 1997; Eckert, 1998; Hughes et al., 1998), so the South Atlantic may be a suitable habitat for leatherbacks from many different nesting colonies, not only from Brazil. In the Atlantic, there are nesting colonies in French Guiana and Suriname in South America, Trinidad in the southern Caribbean, and Gabon and Congo in Africa, which are currently the largest leatherback nesting colonies in the world, with estimated number of females numbering in the thousands (Girondot & Fretey, 1996; Spotila et al., 1996; Fretey, 2001; S.A. Eckert, personal communication, 2004). Smaller nesting colonies exist in the Caribbean (Spotila et al., 1996). The Brazilian nesting colony, with about 10–90 nests per year (Projeto TAMAR, unpublished data, State of Espírito Santo, 1988/1989 to 2003/2004), is quite small, when compared to other colonies in the Atlantic and Caribbean. Satellite telemetry data indicate that even leatherbacks nesting in eastern South Africa can enter the South Atlantic (Hughes et al., 1998; G.R. Hughes, personal communication, 2002). In French Guiana, as stated before, nesting generally occurs between April and August, although there is a second nesting season, peaking around December, with a number of nestings much smaller than that in the main season (Girondot & Fretey, 1996). In Gabon and Congo, nesting occurs mainly from November to April (Fretey, 2001). The colonies in French Guiana and Gabon/Congo have nearly complementary nesting seasons, so large numbers of turtles could be foraging throughout the Atlantic at any time of the year. Movements of leatherbacks throughout the Atlantic have been confirmed by satellite telemetry (Eckert, 1998; S.A. Eckert, personal communication, 2004).

A relation can be established between the number of nests in the Brazilian colony in the State of Espírito Santo and the number of leatherback records on the Brazilian coast. The minimum CCL of nesting females in the Brazilian colony is 139 cm (Projeto TAMAR, unpublished data, 1982/1983 to 2003/2004). Pinedo et al. (1998) recorded 58 leatherbacks stranded dead in the State of Rio Grande do Sul between January 1992 and November 1995. Those authors present data regarding SCL of 24 turtles, of which nine turtles (38%) have SCL equal to or greater than 140 cm (approximately the minimum CCL of

nesting females in Brazil), that is, they are potentially adults. So, among the 58 stranded leatherbacks, 22 are estimated to be adults, which amounts to 5.5 adult turtles stranded in Rio Grande do Sul per year, on average. In the nesting seasons from 1992/1993 to 1995/1996, 16.5 clutches were laid by leatherbacks each year in Brazil, on average (Projeto TAMAR, unpublished data), which amounts to 3.3 turtles nesting per year on average, if one uses five clutches as an estimate for the mean annual number of clutches per female (Spotila et al., 1996). The average leatherback re-nesting interval is about 2.5 years (Spotila et al., 1996), so 3.3 turtles/year amount to about eight reproductive females in the colony nesting in Brazil, on average. The sex ratio among adult turtles is not known, so the total number of adults cannot be estimated. The estimated average annual number of stranded adults obtained from data by Pinedo et al. (5.5 turtles/year) is greater than the estimated average annual number of females nesting in Brazil (3.3 turtles/year), and amounts to about 69% of the average number of reproductive females in the Brazilian colony (8 turtles). Although a more detailed demographic analysis has yet to be carried out, at first glance it appears unlikely that the Brazilian colony alone could be the source of the stranded turtles observed in Rio Grande do Sul. More likely, leatherbacks from nesting colonies other than the Brazilian one are among those stranded in that state. Leatherbacks have also been observed or captured in Uruguay and Argentina, contiguous to the State of Rio Grande do Sul (Frazier, 1984; Achaval et al., 2000).

Causes of leatherback strandings and captures on the Brazilian coast

Many of the leatherbacks recorded in Brazil were incidentally captured by or showed signs of interaction with fishing gear (Table 1). Worldwide, incidental capture in fishing gear is one of the main sources of injury and mortality of juvenile and adult sea turtles, and there is a growing concern regarding the impacts of fishing activities on leatherback turtles (Eckert & Sarti, 1997; Lewison et al., 2004). In Brazil, artisanal and industrial fishing activities are widespread, and many fishing techniques (e.g. set nets, drift nets, trawl nets, fishing weirs, longlines) are used that could incidentally capture sea turtles (Thomé et al., 2003). There are records of leatherbacks incidentally captured in coastal fishing nets at several points off the Brazilian coast. In northern Brazil, leatherbacks have been captured in fishing weirs, which are widely used in the State of Ceará, located relatively close to the nesting beaches in the Guianas. The three turtles recorded around Penedos de São Pedro e São Paulo (Saint Paul's Rocks) and Fernando de Noronha were captured by or found entangled in longlines. The possibility exists that some of the leatherbacks stranded dead in southern Brazil had interactions with pelagic longlines, since incidental capture of leatherbacks in longlines has been recorded by vessels from Brazil and Uruguay operating in the South Atlantic below latitude 25°S (Achaval et al., 2000; Kotas et al., 2004). The South Atlantic is also fished by longliners from Chile, Japan, Taiwan and Spain (Kotas et al., 2004). Worldwide, longlines have been implicated in a large number of incidental captures of leatherback turtles, with

deaths in the Pacific Ocean alone estimated to number in the thousands in 2000 (Lewison et al., 2004).

Two leatherbacks stranded dead in the State of Rio Grande do Sul had plastic debris in the digestive tract. Plastic and other anthropogenic marine debris, including fishery-related debris (discarded or lost gear), are known to represent, through ingestion, entrapment or entanglement, a significant mortality risk for sea turtles (Lutcavage et al., 1997). Other kinds of marine pollution, such as chemical contamination (e.g. heavy metal residues, chlorinated compounds), sonic pollution (e.g. from offshore marine seismic surveys for the oil industry) and oil spills, represent potential hazards to sea turtles (Lutcavage et al., 1997), although no leatherback records are available in Brazil that can be associated with these kinds of pollution.

Conclusions

The data presented here suggest that more effort should be directed to the assessment of the impact of fishing gear and marine pollution on leatherbacks, and that systematic surveys on beaches should be maintained (Epperly et al., 1996) in order to monitor long term fluctuations in stranding levels and spatial stranding patterns. This is no small task, considering that Brazil has over 8000 km of coastline. Systematic surveys should be carried out in areas that are not currently covered, as is the case for the northernmost region (States of Amapá and Pará). Whenever possible, detailed external examinations of observed turtles, laboratory examination of tissues and necropsies should be performed, which could provide information on causes of strandings and deaths (Herbst & Jacobson, 2003). We suggest that a leatherback blood and tissue data bank should be maintained in Brazil, which would allow comparative (geographic, temporal) chemical and genetic analyses. Together with genetic studies, satellite telemetry would be helpful in clarifying the origin of leatherbacks incidentally captured on the Brazilian coast.

In Brazil, all species of sea turtles are fully protected by federal legislation that was enacted in 1986, thereby ending their intentional capture, a common fact in the past. Nesting beaches (including the leatherback nesting beaches in the State of Espírito Santo) have been protected by Projeto TAMAR since 1982, and as a result egg poaching and the killing of females have been drastically reduced (Marcovaldi & Marcovaldi, 1999). Nevertheless, despite continued conservation efforts some sea turtle deaths around nesting beaches continue to happen due to incidental capture in fishing nets (Table 1). Since 1992, TAMAR has been working in some feeding areas that have high levels of sea turtle incidental capture in coastal artisanal fishing (Marcovaldi & Marcovaldi, 1999), and since 2001 TAMAR has been developing and implementing (through partnerships with other institutions) a national action plan whose main objective is the assessment of fishery-related sea turtle mortality and the reduction of incidental capture in artisanal and industrial fishing, including captures by longlines and other fishing operations in the open sea (Thomé et al., 2003). Furthermore, state and municipal governmental agencies, nongovernmental organizations and universities are

increasingly working on marine conservation throughout Brazil. However, the existence of leatherback nesting beaches in several countries and the highly migratory behaviour of leatherbacks, crossing national and international waters, call for international cooperation in the conservation of this species (Eckert & Sarti, 1997; Frazier, 2000; Lewison et al., 2004). Leatherback populations have recently faced dramatic declines in the Pacific Ocean. We hope that conservation measures can ensure that Atlantic populations face a better future.

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