

# SATELLITE TELEMETRY STUDIES HIGHLIGHT AN IMPORTANT FEEDING GROUND FOR LOGGERHEADS AND HAWKSILLS IN NORTHERN BRAZIL



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## Introduction

Brazil has 8000 km of coastline and is known as an important habitat for sea turtle populations. The main sea turtle nesting sites and foraging grounds in Brazil have been protected since 1980 by TAMAR (Brazilian Sea Turtle Conservation Program), a federal government initiative (ICMBio - Chico Mendes Institute of Biodiversity), co-managed by Fundação Pró-TAMAR, a national NGO.

The most significant nesting grounds for hawksbills (*Eretmochelys imbricata*) within Brazil are located in the states of Bahia and Rio Grande do Norte (Marcovaldi et al. 2007). While for loggerheads (*Caretta caretta*) main nesting aggregations are located along the mainland coast, from the states of Rio de Janeiro to Sergipe, with the peak nesting concentration along the northern coast of the state of Bahia (Marcovaldi & Chaloupka 2007).

Understanding the movement of endangered species throughout their range is an important criterion for species conservation. Satellite tracking facilitates rapid identification of sea turtle critical habitats (e.g. nesting and inter-nesting areas, migratory routes and feeding grounds) thus representing a valuable tool for elucidating management requirements of areas for protection and conservation (Blumenthal et al. 2006).

Here we aim to elucidate the movements and behavior of post-nesting loggerhead and hawksbill turtles satellite tracked from the northern coast of Bahia, Brazil.

## Materials and Methods

Satellite transmitters (platform terminal transmitters, PTTs) were attached to female loggerheads (n = 10) and hawksbills (n = 15) nesting in the northern coast of the State of Bahia, northeastern Brazil. PTTs manufactured by Sirtrack, New Zealand (Model: Kiwisat 101) were attached to the crown of the carapace using epoxy glue and covered with a layer of antifouling paint. We located turtles through the Argos system (<http://www.argosinc.com>). Routes were reconstructed using LC 1-3 positions and filtered Argos positions (location classes O, A, B) based on a maximum rate of travel of 5 km/h.

Post-nesting migrations were deemed to have begun once movement away from the nesting beach was directional and protracted. Feeding/resting was considered as restricted movements following post-nesting migrations that continued until the transmitters stopped sending information or until new return migrations.

## Results and Discussion

### Loggerheads

Loggerheads were tracked for 426 to 1094 days (Table 1), during which they migrated to the northern coast of Brazil, moving over the continental shelf (along the 100m isobath). Movements ceased when the turtles arrived at foraging areas located off the States of Ceará (n = 8), Maranhão (n = 1) and Pará (n = 1). The individual foraging areas were clearly delineated, mean size of individual foraging areas was 8.3 ffl 10.9 km<sup>2</sup> (range 1.9 - 37.9 km<sup>2</sup>), located at a distance (central point) from the coast that ranged from 40 to 125 km (Fig. 1).

Five loggerheads migrated back to their former nesting areas for another reproductive season; time intervals between the end and start of these consecutive nesting seasons were 610, 637, 656, 965 and 1005 days. Three loggerheads returned later to the same foraging areas, moving along the same coastal migratory corridor used previously in both pre- and post-nesting movements. Satellite transmitters from three turtles are still transmitting after almost three years (Table 1).

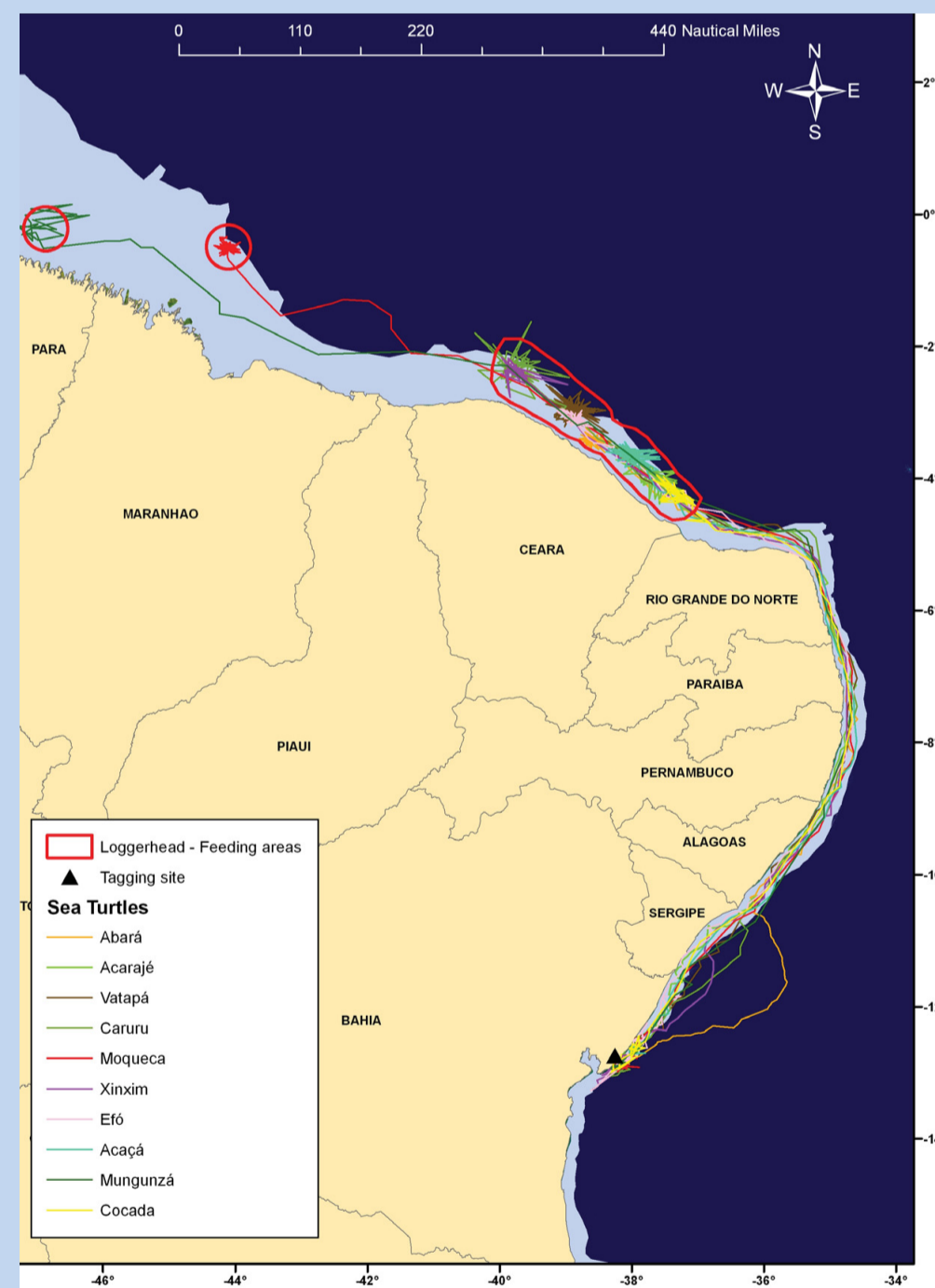


Figure 1. Post-nesting migration routes of loggerheads (n = 10) satellite tagged along the northern coast of Bahia, Brazil.

Table 1. Summary information for loggerhead turtles *Caretta caretta* (n = 10) equipped with PTTs along the northern coast of the state of Bahia, Brazil, from January to March, 2006 CCL, Curve carapace length (cm); CE, Ceará; MA, Maranhão; PA, Pará

Turtle ID	Length CCL (cm)	Date deployed	Inter-nesting (days)	Post-nesting migration (days)	Feeding/resting (days)	Foraging habitat		Last location	Total time tracked (days)	Number of trans-missions	Distance traveled (km)
						Name	Location				
Abará	110.7	25/01/06	15	28	550	CE	3.4°S, 38.5W	10/09/07	593	942	3.353
Acarajé	99	27/01/06	0	37	860	CE	3.9°S, 37.3 W	12/07/08	897	1565	6.467
Vatapá	102	31/01/06	15	30	938 <sup>a</sup>	CE	3.1°S, 38.9W	30/01/09*	1095	1732	10.760
Caruru	100	03/02/06	44	42	914 <sup>a</sup>	CE	3.9°S, 37.5 W	30/01/09*	1092	1684	11.440
Moqueca	101.3	14/02/06	66	47	313	MA	0.5°S, 44.1 W	16/04/07	426	1156	4.748
Xinxim	100	15/02/06	29	36	500	CE	2.8°S, 39.8W	07/09/07	569	886	3.194
Efó	103	18/02/06	28	42	534 <sup>b</sup>	CE	10.6°S, 36.6 W	29/01/09*	1076	2513	9.450
Acaçá	101	21/02/06	15	36	554 <sup>b</sup>	CE	7.4°S, 34.6 W	13/04/08	782	958	5.700
Munzunzá	101.5	22/02/06	63	42	399	PA	0.3°S, 46.9 W	11/07/07	504	800	4.107
Cocada	101	05/03/06	0	34	570 <sup>b</sup>	CE	4.6°S, 37.2 W	08/06/08	826	1417	8.358

\*Still transmitting

<sup>a</sup> Returned to the nesting beaches in Bahia after 3yr

<sup>b</sup> Returned to the nesting beaches in Bahia after 2yr and then back to the same foraging area (Ceará)

### Hawksbills

For the 15 hawksbills, three stopped transmitting in the first 30 days (two during the interesting period), the remaining 12 were tracked for 486 ± 279 days (range 238 - 804 days) (Table 2). Five hawksbills moved southward and eight northward. Hawksbills that moved northward stopped at different points, including the States of Bahia (n = 1), Alagoas (n = 2), Pernambuco (n = 1), Rio Grande do Norte (n = 1), Ceará (n = 1) and Pará (n = 2). Hawksbills that moved southward stopped in different points off southern Bahia (n=4); one moved away from the coast, along the Vitória-Trindade seamount chain before transmissions ceased (Fig. 2). Tracked hawksbills were sampled for genetic analysis, and results showed that six were hawksbill-loggerhead hybrids. Five of these hybrids migrated northward, similarly to loggerheads, one stopped its transmissions during migration while the other four remained at foraging areas along the northern coast of Brazil. Only one hybrid moved to southern Bahia. Amongst the nine 'true' hawksbills, two stopped transmitting before leaving the nesting areas, four moved southward and three moved northward to areas different from loggerheads (e.g. northeastern coast).

Post-nesting destinations of 'true' hawksbills were characterized by reef ecosystems and differed from those foraging areas frequented by loggerhead and hybrids, which centered their foraging activities on rocky, muddy and sandy marine habitats of the northern coast of Brazil (Fig. 2).

Despite the potential effects of hybridization in the post-nesting movements of hawksbills, the key role of the northern Brazilian coast, especially Ceará, and the presence of a coastal migratory corridor for both loggerheads and hawksbills that nest in northeastern Brazil are highlighted by these results which therefore have important conservation implications.

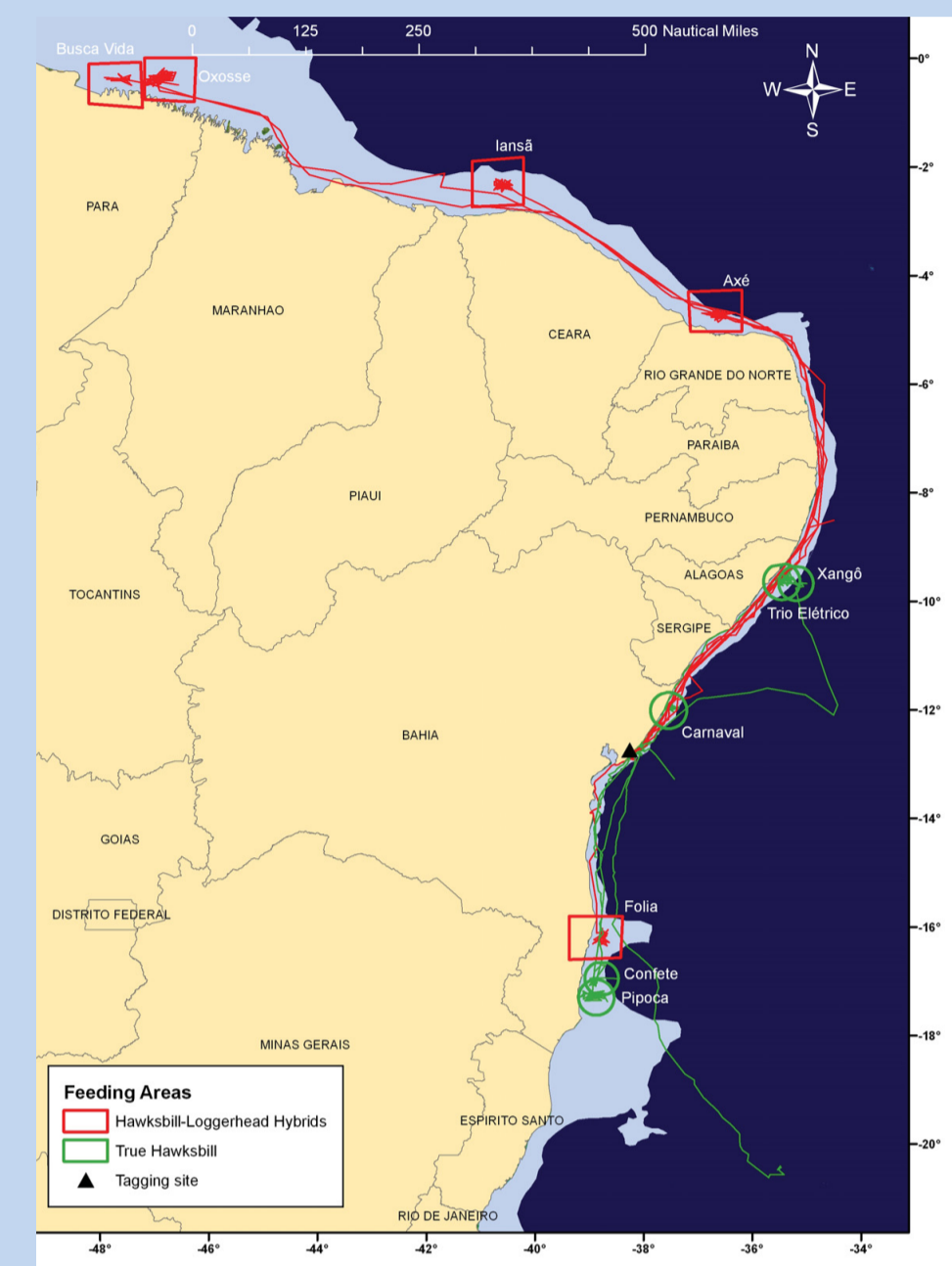


Figure 2. Post-nesting migration routes of hawksbills (n = 15) satellite tagged along the northern coast of Bahia, Brazil.

Table 2. Summary information for hawksbill turtles *Eretmochelys imbricata* (n = 15) equipped with PTTs along the northern coast of the state of Bahia, Brazil, from February to March, 2005. CCL, Curve carapace length (cm); BA, Bahia; PA, Pará; AL, Alagoas; RN, Rio Grande do Norte; CE, Ceará.

Turtle ID	Length CCL (cm)	Date deployed	Inter-nesting (days)	Post-nesting migration (days)	Feeding/resting (days)	Foraging habitat		Last location	Total time tracked (days)	Number of trans-missions	Distance traveled (km)
						Name	Location				
Carnaval	99	05/02/05	51	3	308	BA	11.9°S, 37.5W	02/02/06	362	436	1479
Ressaca	91.5	05/02/05	22	-	-	-	-	27/02/05	22	55	65
Busca Vida <sup>h</sup>	106.5	06/02/05	60	49	147	PA	0.4°S, 47.9°W	20/10/05	256	427	3338
Folia <sup>h</sup>	100	07/02/05	44	10	184	BA	16.1°S, 38.7 W	03/10/05	238	371	1749
Confete	92.5	09/02/05	20	12	66	BA	16.9°S, 38.5 W	13/12/05	307	298	2028
Serpentina <sup>h</sup>	100	09/02/05	-	19	-	-	-	28/02/05	19	83	760
Colombina	91.5	11/02/05	37	-	-	-	-	20/03/05	37	88	70
Trio Elétrico	86	11/02/05	19	11	723	AL	9.6°S, 35.4 W	06/03/07	753	533	2977
Pipoca	92	11/02/05	48	17	640	BA	17.4°S, 38.7 W	17/01/07	705	448	1811
Axe <sup>h</sup>	99	12/02/05	-	27	500	RN	4.6°S, 36.6 W	24/07/06	527	727	4936
Yemanjá	93	21/02/05	34	23	-	-	-	19/04/05	57	223	1353
Oxala	94.5	25/02/05	12	3	-	-	-	12/03/05	15	59	278
Inasã <sup>h</sup>	105	26/02/05	29	25	442	CE	2.4°S, 40.4 W	07/07/06	516	553	3893
Oxossê <sup>h</sup>	101.5	27/02/05	38	58	537*	PA	0.4°S, 47.1°W	12/05/07	804	638	6903
Xangô	90.5	28/03/05	22	21	162	AL	9.6°S, 35.4 W	19/04/05	387	186	1338

<sup>h</sup>Hybrids

\*Returned to the nesting beaches in Bahia after 2yr

### Next steps

- Increase monitoring efforts in the feeding areas indicated off the coast of Ceará.
- Further the participation of TAMAR on existing "Reef Monitoring Networks" in areas indicated as relevant to sea turtles by this study.
- Explore possible management actions and conservation measures of oil and gas exploration activities and regional fisheries operating along the migratory corridor.

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### References

Available from the author upon request.