Short Communication

Post-nesting migrations of loggerhead turtles *Caretta caretta* from Georgia, USA: conservation implications for a genetically distinct subpopulation

Pamela T. Plotkin and James R. Spotila

Abstract The loggerhead sea turtle *Caretta caretta* is listed as threatened with extinction on the US Endangered Species Act. Those loggerhead turtles that nest on US beaches from North Carolina to north-east Florida are a genetically distinct subpopulation. This subpopulation is small, and may be declining. To obtain information about the migratory pathways of these turtles we tracked post-nesting movements of five females by satellite from their nesting beach at Wassaw Island, Georgia. Four turtles migrated north of the nesting beach, of which three moved to coastal waters of mid Atlantic states (total distances of 157–1,458 km). Efforts to reduce mortality of northern subpopulations of loggerhead turtles need to focus on identifying and reducing threats in north-east US waters.

Keywords *Caretta caretta*, Georgia, loggerhead turtle, migration, telemetry, USA.

The loggerhead sea turtle *Caretta caretta* is categorized as Endangered on the 2000 IUCN Red List (Hilton-Taylor, 2000), and listed as threatened on the US Endangered Species Act. The assemblage of loggerhead turtles that nests on beaches along the eastern seaboard of the USA is the largest in the western Atlantic and second largest in the world (Dodd, 1988). Nesting occurs in the south-east, mostly from North Carolina to Florida, with the densest concentration in Florida. Tagging studies indicate that most loggerhead turtles return to the same (Bjorndal *et al.*, 1983) or adjacent beaches (Bell & Richardson, 1978) to nest in successive breeding seasons. These studies also indicate that loggerhead turtles nesting on Georgia and South Carolina beaches migrate north along the east coast at the end of the nesting season (Bell & Richardson, 1978), while most loggerhead turtles nesting on Florida beaches migrate south to the Gulf of Mexico and Caribbean Sea (Caldwell *et al.*, 1959; Meylan, 1982; Meylan *et al.*, 1983).

This assemblage of loggerhead turtles is genetically structured into three distinct subpopulations (Encalada *et al.*, 1998). Loggerhead turtles nesting in North Carolina, South Carolina, Georgia, and north-east Florida are genetically similar to one another (northern subpopulation), but genetically distinct from loggerhead turtles nesting in south Florida (south Florida subpopulation), and north-west Florida (north-west Florida subpopulation). The implications of the findings of Encalada *et al.* (1998) are important for the management of these turtles. The northern subpopulation of loggerhead turtles is small and may be declining (Turtle Expert Working Group, 2000), and so measures to reduce mortality are urgently needed. Although numerous human activities threaten loggerhead turtles (Lutcavage *et al.*, 1996), determining the relative impacts of these threats on the various subpopulations is difficult because we know little about the migratory pathways of the turtles and thus the particular threats to which they may be exposed.

We studied the post-nesting movements of loggerhead turtles of the northern subpopulation to document their migratory pathways. We attached Telonics, Inc. model ST-6 back-pack style transmitters (duty cycle 8 h on, 52 h off) to five post-nesting loggerhead turtles in mid to late July 1997 (Table 1) using attachment procedures detailed in Plotkin (1998). When transmitters were 'on' and a turtle was at or near the surface, the transmitter sent a signal to a satellite. Argos, Inc. Data and Collection Service (Landover, Maryland, USA) provided calculated transmitter locations and an estimate of the quality of each location.

We received transmissions from all turtles for 4–5 months after their release (Table 1), but the transmitters then failed for unknown reasons. Argos was unable

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Received 14 November 2001. Revision requested 9 May 2002. Accepted 14 June 2002.

© 2002 FFI, *Oryx*, **36**(4), 396–399 DOI: 10.1017/S0030605302000753 Printed in the United Kingdom

Table 1 Transmitter longevity and estimated distances travelled from Wassaw Island, Georgia, USA, by post-nesting loggerhead turtles tracked by satellite.

Turtle	Date deployed	Date of last transmission	Distance travelled (km)
1	17 July 1997	18 December 1997	1,182
2	18 July 1997	17 December 1997	1,458
3	18 July 1997	12 November 1997	157
4	19 July 1997	29 December 1997	1,010
5	26 July 1997	4 November 1997	1,409

to calculate locations for the majority of transmissions received, presumably because the turtles did not remain at the surface long enough during satellite overpasses. From those location estimates that were received we calculated distances travelled from Wassaw Island, and these represent minimum estimates of the furthest distance travelled during the tracking period (Table 1). The shortest and longest distances recorded were 157 km and 1,458 km, respectively. Four of the five turtles migrated north after the nesting season and one migrated south (Fig. 1).

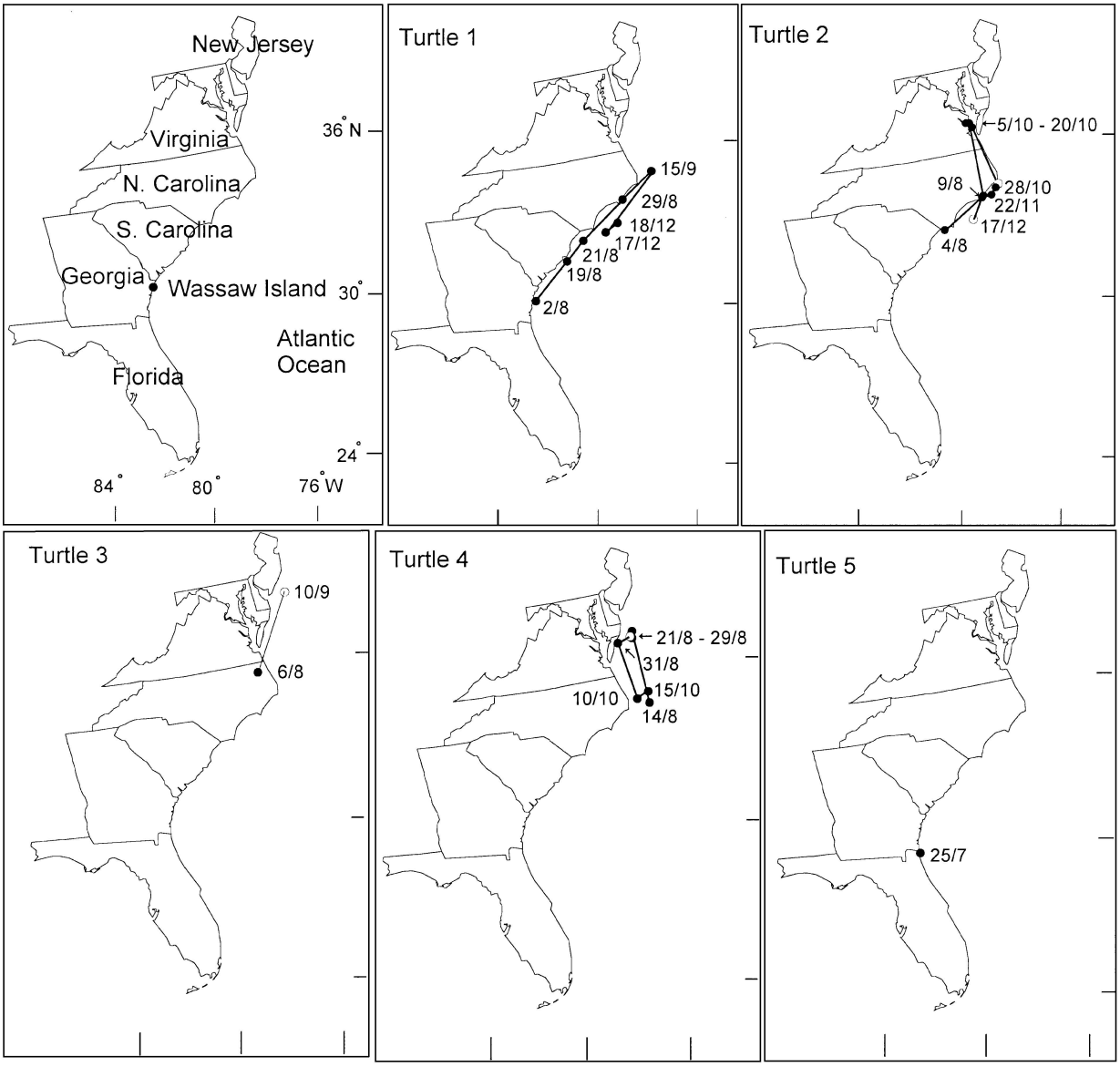

Fig. 1 The eastern coast of the USA with the location of Wassaw Island, Georgia, and the post-nesting movements of the five loggerhead turtles tracked from Wassaw Island, Georgia, USA, by satellite. Solid circles indicate low quality location estimates; open circles indicate high quality location estimates. Numbers next to each circle indicate the day and month that the location was transmitted. Lines are used only to connect consecutive locations, and do not represent the actual path of the turtle.

https://doi.org/10.1017/S0030605302000753 Published online by Cambridge University Press

The post-nesting movements of the loggerhead turtles tracked from Georgia indicated that important migratory pathways exist north of the nesting beach. Our findings support data from mark-recapture studies (Bell & Richardson, 1978; Meylan *et al.*, 1983), as well as two recent studies that tracked post-nesting movements of northern subpopulation loggerhead turtles: two of five turtles tracked by satellite from beaches in South Carolina migrated north to Virginia and New Jersey coastal waters (S. Murphy, pers. comm.), and one turtle tracked from Back Bay Wildlife Refuge, Virginia, migrated north to Delaware Bay for 2 months (J.A. Musick, pers. comm.).

Analysis of the post-nesting movements of loggerhead turtles supports results from previous mark-recapture studies and suggestions from genetic studies that northern subpopulation loggerhead turtles may be behaviourally as well as ecologically distinct. Nevertheless, it is important to note that the northern subpopulation and the adjacent south Florida subpopulation are not completely segregated. Tagging studies indicate there is overlap in their post-nesting movements (Caldwell *et al.*, 1959; Meylan, 1982; Meylan *et al.*, 1983), and this overlap is consistent with genetic studies that indicate that common haplotypes are shared between the two subpopulations (Encalada *et al.*, 1998). In other words, whilst they are genetically distinct and tend to have different migratory pathways, there exists some genetic, behavioural and ecological overlap between the two subpopulations.

Our findings have important conservation and management implications. The importance of north-east US waters for reproductively active adult loggerhead turtles is now evident, yet despite the demonstrated high abundance of sea turtles in these waters (Shoop & Kenney, 1992) these areas have not been deemed important sea turtle habitat. In the US government's recovery plan for this species (NMFS & USFWS, 1991) none of the recovery objectives or tasks identified are for waters off the north-east USA. We strongly recommend re-evaluation of the recovery tasks to include identification and mitigation of threats to loggerhead turtles in these waters. One such threat that has recently been identified is the Atlantic pelagic longline fishery. The National Marine Fisheries Service (NMFS) concluded that the operation of this fishery jeopardized the continued existence of the northern subpopulation of loggerhead turtles (NMFS, 2001), and subsequently closed a vast area of the western North Atlantic Ocean to USA pelagic longline fishermen for 6 months (Federal Register, 2001).

We recommend that the NMFS consider regulatory actions specifically for subpopulations of loggerhead turtles. For example, if the northern subpopulation of loggerhead turtles were listed under the US Endangered Species Act as endangered rather than threatened, it would be easier to restrict fisheries that affect this subpopulation. However, we urge the NMFS to continue treating loggerhead turtle subpopulations as a single conservation unit in the next Recovery Plan, with the goal of conserving natural evolutionary processes among the subpopulations (Crandall *et al.*, 2000; Templeton *et al.*, 2000), specifically to sustain gene flow (Encalada *et al.*, 1998).

Acknowledgements

We thank the National Geographic Society (grant #5583–95), the National Marine Fisheries Service Office of Protected Resources, and the Betz Chair endowment of Drexel University for funding this study; Randy Isbister, Earl Possardt, Barbara Schroeder, Kris Williams, Caretta Research Project volunteers, US Fish and Wildlife Service and the Georgia Department of Natural Resources for logistical support; and J. Bernardo, S. Hopkins-Murphy, and an anonymous reviewer for helpful discussion and comments that greatly improved this manuscript.

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Biographical sketches

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https://doi.org/10.1017/S0030605302000753 Published online by Cambridge University Press