Tag-recapture results of bonnethead (*Sphyrna tiburo*) and Atlantic sharpnose (*Rhizoprionodon terraenovae*) sharks in the Gulf of Mexico and Florida Coastal Waters

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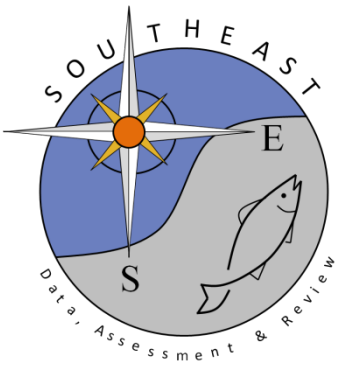

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Tag-recapture results of bonnethead (*Sphyrna tiburo*) and Atlantic sharpnose (*Rhizoprionodon terraenovae*) sharks in the Gulf of Mexico and Florida Coastal Waters

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SEDAR 34 Data Workshop

Summary

Tag-recapture data from Mote Marine Laboratory's Center for Shark Research are summarized for the bonnethead, *Sphyrna tiburo* and Atlantic sharpnose, *Rhizoprionodon terraenovae*, sharks. Of the 7,781 sharks tagged from these two species, there were 246 reported recaptures (3.2 %). The movement patterns were variable but there is evidence of significant inshore-offshore and north-south movements that is likely related to temperature-mediated seasonal migrations. There was no evidence of either species moving from the Gulf of Mexico into the Atlantic or migrations across the Gulf of Mexico

Introduction

Mote Marine Laboratory's Center for Shark Research (CSR) has conducted tag-recapture studies of sharks since 1991. During this time, significant effort has been devoted to the tagging of small coastal sharks along the Gulf coast of Florida (Hueter and Tyminski, 2007). In addition, CSR tagging efforts have been extended throughout the Gulf of Mexico via collaborative projects. The purpose of this report is to use the CSR database to provide information relevant to the 2013 stock assessment workshop for two species of small coastal shark, the bonnethead and Atlantic sharpnose. We present summaries of the numbers of sharks tagged, size-frequency information, the number of sharks recaptured, and figures demonstrating tagging locations and shark movements.

Materials and Methods

Field methods and data collection

This report contains data from sharks captured using a number of gear types including gill net, longline, drumline, and rod & reel. Collected sharks were identified, sexed, measured (precaudal length, PCL; fork length, FL; total length, TL; and stretch total length, STL) to the nearest cm, weighed to the nearest 0.1 kg (when feasible), and either tagged and released or retained for study. The stage of maturity of males was confirmed through examination of the claspers which become elongate, calcified, and capable of distal-end flaring upon maturation. The reproductive stage of female sharks was determined by comparing lengths to published sizes at maturity for the two species (Parsons 1983; Parsons 1993; Carlson and Parsons 1997, Carlson and Baremore 2003; Loefer and Sedberry 2003; Lombardi-Carlson et al. 2003).

In most cases, the sharks caught and released were tagged with a nylon-head, plastic barb tag (Hallprint Pty, Ltd, South Australia) inserted just below the first dorsal fin across the body midline, such that the tag head was firmly anchored in the cartilage and connective tissue below the fin. Other types of conventional tags used to tag small coastal species included Rototags (Dalton, England) and CSR M-type tags (Type SSD; Hallprint Pty).

Movement analysis

Tag-recapture data for the bonnethead and Atlantic sharpnose sharks for which there were valid tagging and recapture locations were plotted using GIS software (ArcView 3.2).

Results and Discussion

Atlantic Sharpnose Shark

A total of 1,533 Atlantic sharpnose sharks were tagged and released by the CSR during the period of 1991-2013. In addition to Florida's Gulf coastal waters, significant numbers of Atlantic sharpnose sharks were tagged with Mote tags during NMFS offshore surveys in the northern Gulf. Additionally, a few specimens were tagged and released off Florida's Atlantic coast and in Mexican coastal waters (Hueter et al. 2007) (Fig. 1).

Of the tagged sharks of known sex, 1,024 were males (67.4%) and 496 were females (32.6%). For tagged males with an identified reproductive stage, 65 were YOY (6.8 %), 256 were juveniles (26.6 %) and 641 (66.6 %) were mature sharks. Of the tagged females, 49 were YOY (14.0 %), 95 were juveniles (27.1 %) and 206 (58.9%) were mature (Table 1). The mean total length of tagged Atlantic sharpnose sharks was 82.3 cm (Table 1); a bimodal distribution was present in the length-frequency data with peaks in the 60-65 cm and 90-95 cm TL ranges (Fig. 2).

To date, a total of 43 *R. terraenovae* have been recaptured and reported (2.8 %). The longest time at liberty for a tagged Atlantic sharpnose shark was 3,925 days (10.7 yrs) for a male and 2,168 days (5.9 yrs) for a female (Table 1). The longest straight-line distance traveled for *R. terraenovae* was from a male specimen tagged off Longboat Key (near Sarasota, FL) and recaptured 298 km to the north-northwest near Yankeetown, FL (Table 1; Fig. 3a). A few of the longer distance recaptures (>25 km) along the Florida coast demonstrate an inshore-offshore movement pattern. However, there was no evidence of movement from the Gulf of Mexico to the Atlantic coast. Shorter distance recaptures (<25 km) were primarily within a given bay or estuarine system (Fig. 3b).

Bonnethead Shark

A total of 6,248 bonnetheads were tagged by the CSR and its collaborators during the period of this report. The sharks were primarily tagged in the bays and estuaries and along the beaches of Florida's southwest coast and in the Florida Keys. Additionally, a few specimens were tagged along the lower Texas coast, the Atlantic coast of Florida, and the Yucatan Peninsula's inshore waters (Hueter et al. 2007)(Fig. 4).

Of the tagged sharks of known sex, 2,374 were males (38.3%) and 3,826 were females (61.7%). For tagged males with an identified reproductive stage, 22 were YOY (0.9 %), 553 were juveniles (23.6 %), and 1,766 (75.5 %) were adult sharks. Of the tagged females, 34 were YOY (0.9 %), 1,531 were juveniles (40.7 %), and 2,194 (58.4%) were mature sharks (Table 2). The overall mean total length of tagged bonnetheads was 78.4 cm (Table 2) while a unimodal distribution was present in the length-frequency profile with a peak at the 70-75 cm TL range (Fig. 5).

A total of 203 recaptures of tagged bonnetheads have been reported to date (3.2 %). The longest time at liberty for a CSR-tagged *S. tiburo* was 1,638 days (4.5 yrs) for a male and 2,247 (6.2 yrs) for a female. The longest minimum at-sea distance traveled for a bonnethead came from a female tagged off New Pass, FL (near Sarasota, FL) in December, 1995 and recaptured 315 km to the south-southeast in the Florida Keys after being at large for 97 days (Table 3; Fig. 6). The longer distance movements occurred primarily in a north-south direction, most likely corresponding to temperature-mediated seasonal migrations. None of the bonnetheads tagged outside of Florida have been recaptured to date and we have no evidence of this species moving from Gulf waters into the Atlantic.

Acknowledgments

The authors are deeply indebted to the staff and interns of Mote Marine Laboratory's Center for Shark Research for their countless hours in the field for this research. We also recognize collaborators both within and outside the state of Florida who have enabled us to extend the geographic scope of our tagging work. This work was supported by funding from the NOAA/NMFS MARFIN Program, the NOAA/NMFS Highly Migratory Species Division, NOAA/NMFS through the National Shark Research Consortium, the Florida Fish and Wildlife Conservation Commission (formerly the FDEP), and Mote Marine Laboratory.

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Table 1. Summary of Atlantic sharpnose shark tagging results by the Mote Center for Shark Research, 1991-2013.

Sex	Reprod. Stage	No. Tagged	Mean TL (cm)	No. of Recaps	Recap Rate (%)	Days at Large	Distance (km)
Male	YOY	65	58.2				
	Juv.	256	67.4				
	Mat.	641	87.7				
	Uk.	62	-				
	Total	1,024		38	3.7	7 - 3,925	0 - 298
Female	YOY	49	57.7				
	Juv.	95	66.7				
	Mat.	206	98.2				
	Uk.	146	-				
	Total	496		4	0.8	45 - 2,168	93 - 250
Unknown		13	-	1	7.7	23	74
	Overall	1,533	82.3	43	2.8	7 - 3,925	0 - 298

Table 2. Summary of bonnetheads tagged by the Mote Center for Shark Research, 1991-2013.

Sex	Reprod. Stage	No. Tagged	Mean TL (cm)	No. of Recaps	Recap Rate (%)	Days at Large	Distance (km)
Male	YOY	22	47.3				
	Juv.	553	64.8				
	Mat.	1,766	74.2				
	Uk.	33	-				
	Total	2,374		55	2.3	1 -1,638	0 - 189
Female	YOY	34	48.5				
	Juv.	1,531	71.1				
	Mat.	2,194	91.1				
	Uk.	67	-				
	Total	3,826		148	3.9	1 - 2,247	0 - 315
Unknown		48	-	0	-	-	-
	Overall	6,248	78.4	203	3.2	1 - 2,247	0 - 315

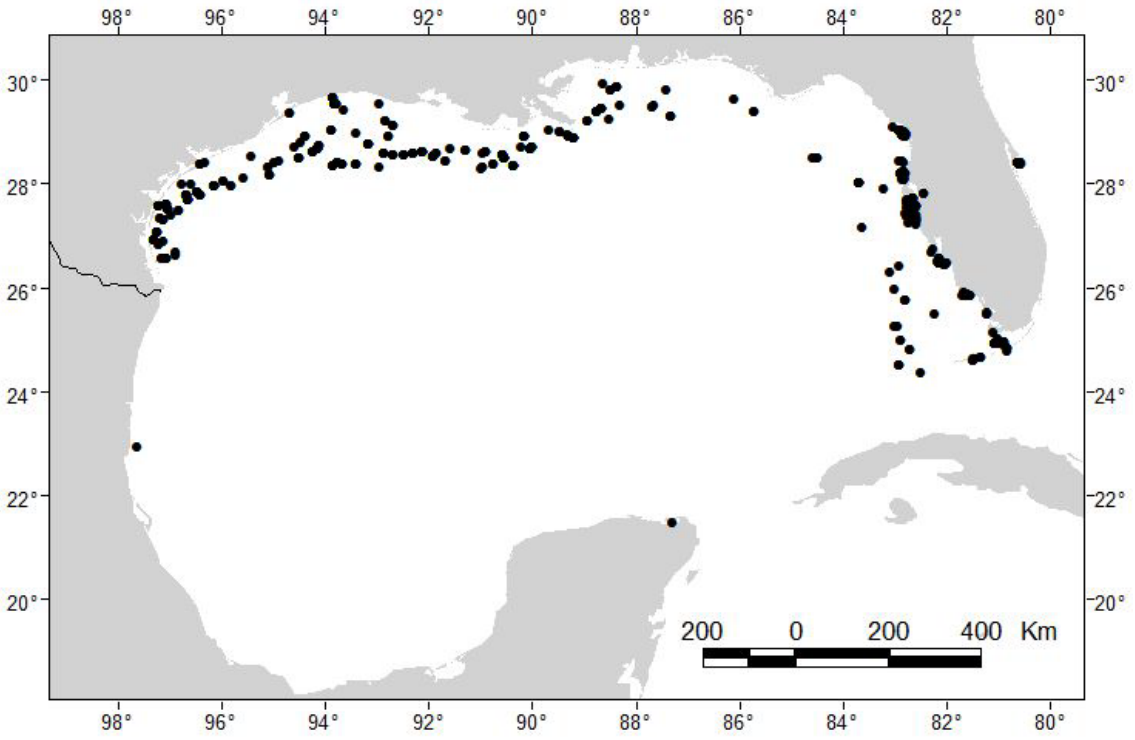

Figure 1. Locations of Atlantic sharpnose sharks *Rhizoprionodon terraenovae* tagged by the Mote Center for Shark Research, 1991-2013.

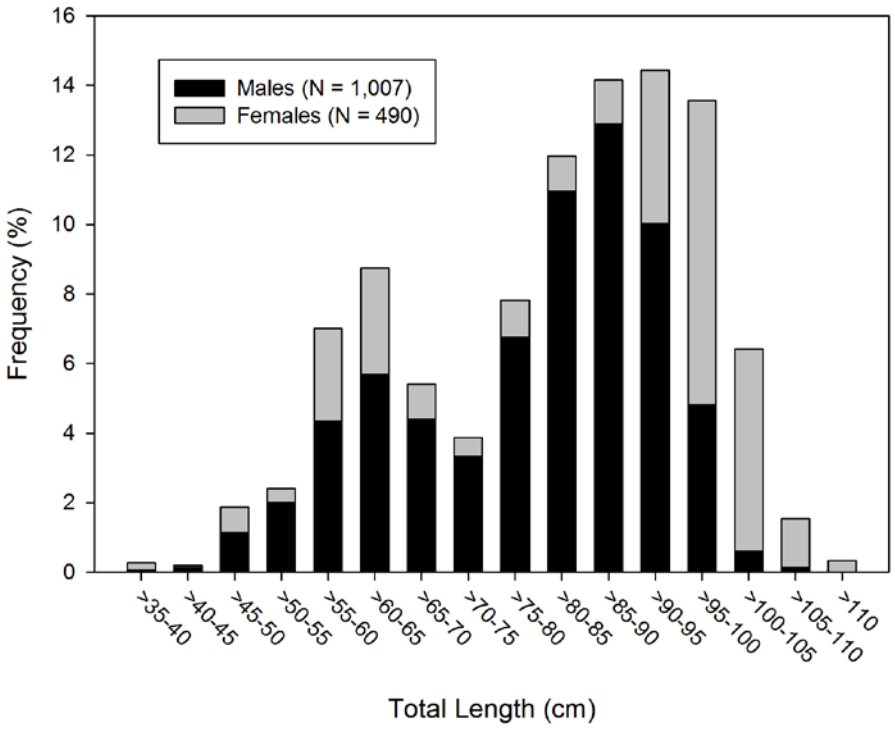

Figure 2. Length-frequency distribution of CSR-tagged Atlantic sharpnose sharks (N = 1,497).

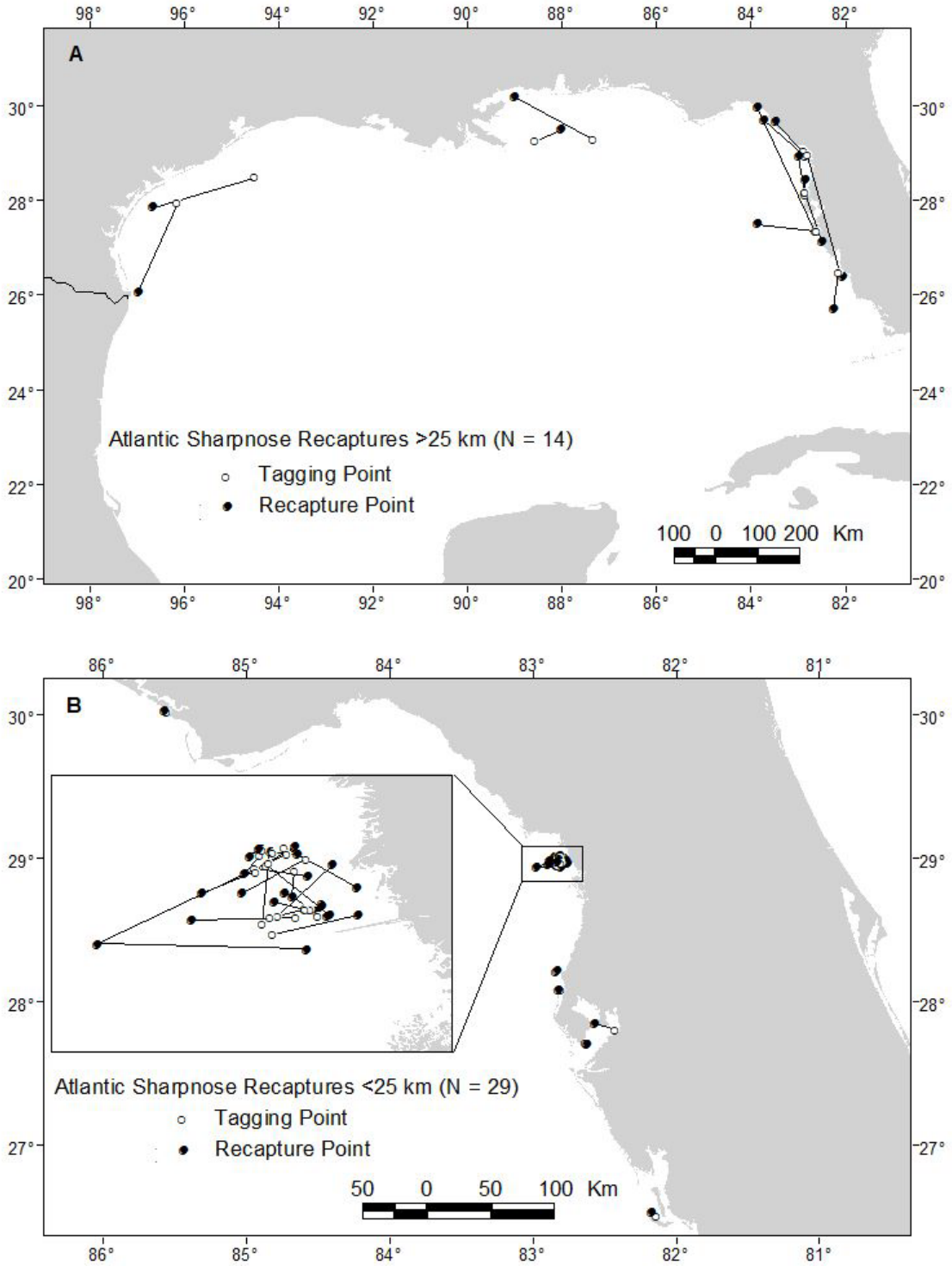

Figure 3. Movements of the Atlantic sharpnose shark *Rhizoprionodon terraenovae* in the Gulf of Mexico through conventional tagging. (A) Recaptures demonstrating movement >25 km from the tagging site. (B) Recaptures demonstrating movement <25 km from the tagging site. Open circles represent the tagging location and closed circles indicate the point of recapture.

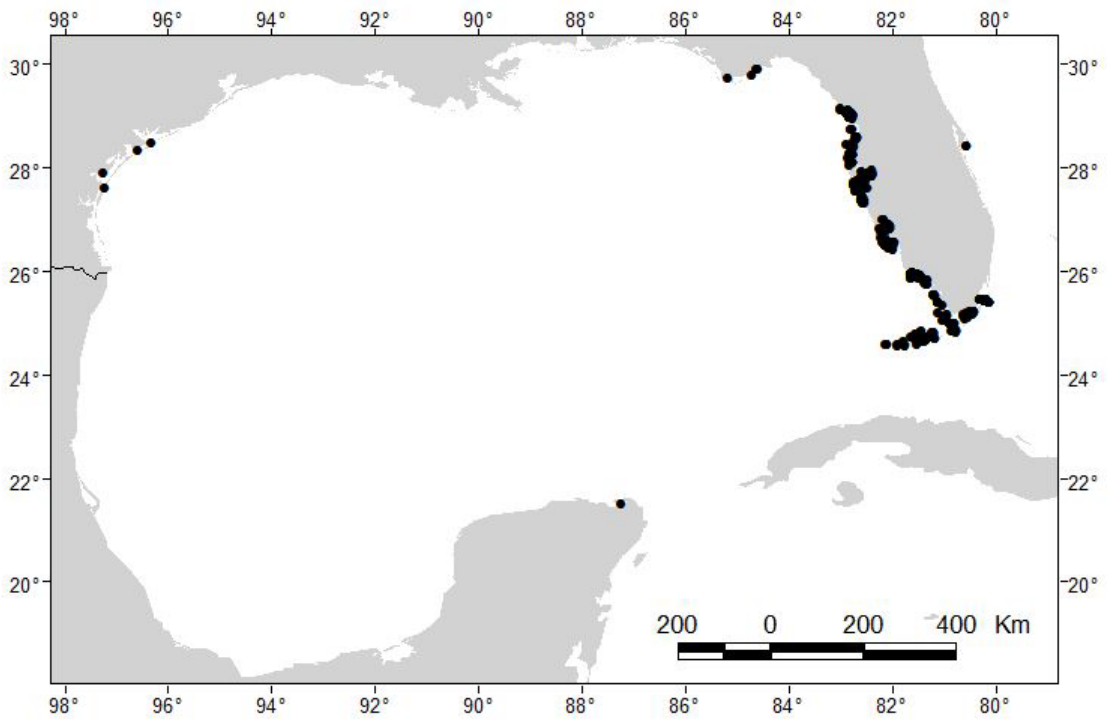

Figure 4. Locations of bonnethead sharks *Sphyrna tiburo* tagged by the Mote Center for Shark Research, 1991-2013.

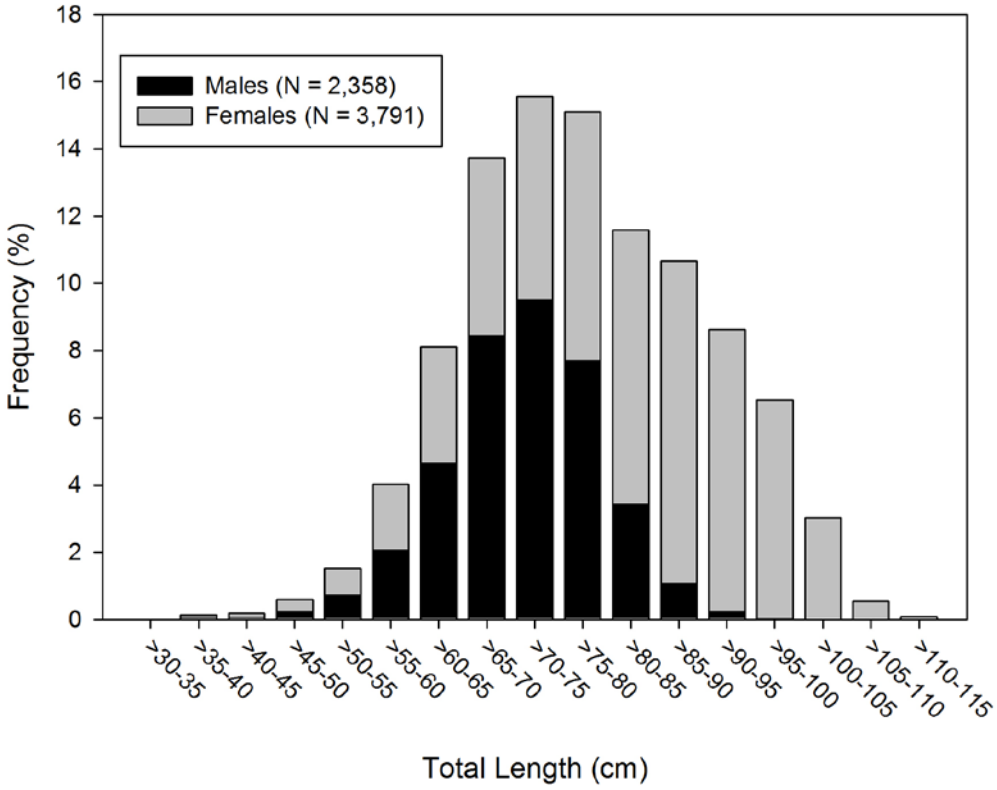

Fig. 5. Length-frequency distribution for CSR-tagged bonnetheads (N = 6,149).

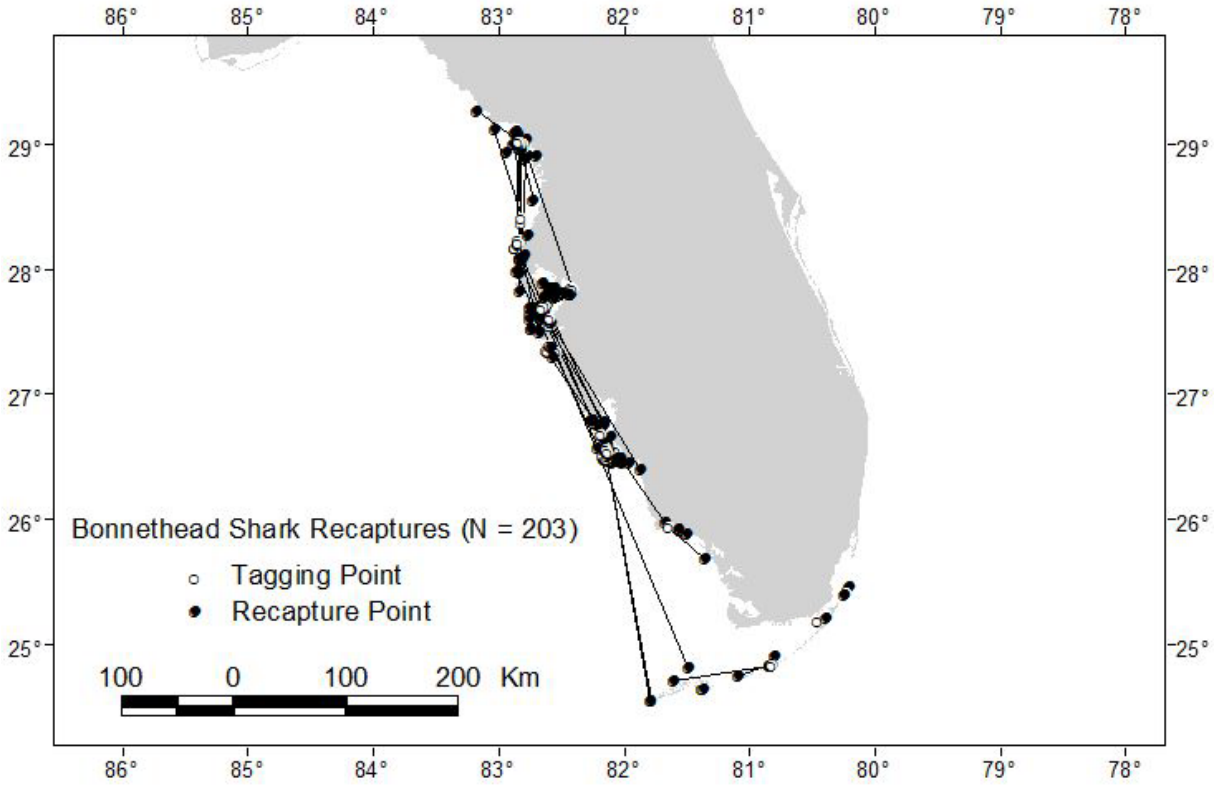

Figure 6. Movement of bonnetheads from the Gulf coast of peninsular Florida through conventional tagging (N = 203). Open circles denote the tagging location and solid circles represent the point of recapture.