Tag-recapture results of small coastal sharks (*Carcharhinus acronotus, C. isodon, Rhizoprionodon terraenovae,* and *Sphyrna tiburo*) in the Gulf of Mexico.

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Summary

Tag-recapture data from Mote Marine Laboratory's Center for Shark Research were summarized for the Atlantic sharpnose, *Rhizoprionodon terraenovae*, blacknose, *Carcharhinus acronotus*, bonnethead, *Sphyrna tiburo*, and finetooth, *Carcharhinus isodon*, sharks. Of the 7,871 sharks tagged from these species, there were 267 reported recaptures (3.4 %). 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 sharks moving from the Gulf of Mexico into the Atlantic or cross Gulf movements.

Introduction

Mote Marine Laboratory's Center for Shark Research (CSR) has been conducting 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, in press). While focused on the Florida coastal areas, tagging has been carried out throughout the Gulf of Mexico via collaborative projects. The purpose of this report was to use the data from the Mote Marine Laboratory shark tagging database to provide information relevant to the 2007 stock assessment workshop for small coastal sharks. The data includes summaries of the numbers of sharks tagged, size frequency information, the number of sharks recaptured, and figures demonstrating 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, rod & reel, and seine net. 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 after maturation. The reproductive stage of female sharks was determined by comparing to published sizes at maturity (Branstetter 1981; Parsons 1983; Carlson and Parsons 1997, Carlson et al. 2003). In most cases, the sharks caught and released were tagged with a nylon-head, plastic barb tag 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 include Rototags and CSR M-type tags.

Movement analysis

Tag-recapture data for the Atlantic sharpnose, blacknose, bonnethead, and finethooth sharks for which there were valid tag and recapture locations were plotted using a GIS (ArcView 3.3).

Results and Discussion

Atlantic Sharpnose Shark

A total of 1,244 Atlantic sharpnose sharks were tagged and released by the CSR during the period of 1991-2006. In addition to Florida's Gulf coastal waters, significant numbers of sharpnose 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 Mexican coastal waters (Hueter et al., in press) (Fig. 1).

Of those tagged sharks, 891 were males (72.1%) and 345 were females (27.9%). For tagged males, 67 were YOY (7.5 %), 232 were juveniles (26.0 %), and 592 (66.5 %) were mature sharks. Of the tagged females, 53 were YOY (15.4 %), 86 were juveniles (24.9 %), and 206 (59.7%) were mature fish (Table 1).

To date, a total of 41 *R. terraenovae* have been recaptured (3.3 %). The longest time at liberty for a tagged sharpnose was 2,461 days for a male and 2,168 for a female. The longest straight line distance traveled for *R. terraenovae* was from a male shark tagged off Longboat Key (near Sarasota, FL) and recaptured 298 km to the north-northwest near Yankeetown, FL (Table 1; Fig. 2a). 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. 2b).

Blacknose Shark

From 1991-2006, there were total of 880 blacknose sharks tagged and released by the CSR. More than half of these tagged sharks (N=512) were captured by rod and reel during a CSR-sponsored catch and release shark fishing tournament that was centered in the Tampa Bay area. Additionally, blacknose sharks were commonly tagged and released during routine CSR field work targeting other shark species. This species was also tagged with Mote tags during NMFS shark surveys aboard the Oregon II (1995-1997) in the northern Gulf (Fig. 3).

Of the CSR tagged blacknose sharks, 413 were males (47.7 %) and 453 were females (52.3%). For tagged males, 50 were YOY (12.1 %), 178 were juveniles (43.1 %), and 185 (44.8 %) were adult sharks. Of the tagged females, 66 were YOY (14.6 %), 227 were juveniles (50.1 %), and 160 (35.3%) were adult sharks (Table 2).

A total of 27 *C. acronotus* have been recaptured (3.1 %). The longest time at liberty was 1,452 days for a male and 1,820 for a female blacknose shark. The longest distance traveled was from a male blacknose shark tagged offshore of Tampa Bay and recaptured from a fishing pier in Venice, FL, about 111 km southeast of the tagging location (Table 2; Fig. 4). There is no evidence of significant north-south movement pattern for the blacknose. However, the longer distance recaptures suggest significant inshore-offshore movements.

Bonnethead

A total of 5,670 bonnetheads were tagged by the CSR 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. Additionally, a few specimens were tagged along the lower Texas coast, the Atlantic coast of Florida, and the Yucatan Peninsula's inshore waters (Fig. 5).

Of the tagged sharks of known sex, 2,191 were males (38.8%) and 3,452 were females (61.2%). For tagged males, 22 were YOY (1.0 %), 532 were juveniles (24.3 %), and 1,637 (74.7 %) were adult sharks. Of the tagged females, 38 were YOY (1.1 %), 1,455 were juveniles (42.1 %), and 1,959 (56.8%) were mature sharks (Table 3.).

A total of 196 recaptures of tagged bonnetheads have been reported (3.5 %).
The longest time at liberty for a Mote-tagged *S. tiburo* was 1,638 days for a male and 2,247 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 four bonnetheads tagged outside of Florida have been recaptured to date.

Finethooth Shark

A total 77 finetooth sharks have been tagged by the CSR during the period of this report. Very few have been tagged in Florida waters (N = 5). However, CSR collaborations with recreational

anglers in the western Gulf of Mexico have facilitated the tagging of 72 finetooth in the coastal waters of Texas and Louisiana (Fig. 7).

The tagged finetooth sharks comprised 29 males (37.7 %) and 48 females (62.3 %). Of the tagged males, one was a YOY (3.4 %), 24 were immature (82.8 %), and 4 were mature males (13.8 %). For tagged females, 44 were immature (91.7 %) while 4 were adult females (8.3 %). (Table 4).

A total of three tagged *C. isodon* have been reported as recaptured (3.9 %) to date. All three of these sharks were tagged during the fall of 2000 (late September through late October) off Corpus Christi, TX. The longest time at liberty for a finetooth shark was 118 days. The longest distance traveled was from a female shark tagged on October 28th and recaptured 118 days later by a commercial fishing vessel off Veracruz, Mexico (Table 4; Fig. 8.). Another finetooth shark tagged on September 28th was recaptured after being at large only one day and moved a straight line distance of 55.6 km. These recaptures suggest finetooth sharks in Texas undergo a fall nearshore migration (most likely temperature-mediated) south to Mexican over-wintering areas.

Acknowledgments

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Table 1. Summary of Atlantic sharpnose sharks tagged by the MML – Center for Shark Research, 1991-2006.

Sex	Reproductive Stage	No. Tagged	Ave. Length FL (cm)	No. of Recaptures	Recapture Rate (%)	Days at Large	Distance (km)
Male	YOY	67	49				
	JUV	232	57				
	MAT	592	75				
	Total	891		37	4.2	7 - 2,461	0 - 298
Female	YOY	53	48				
	JUV	86	57				
	MAT	206	82				
	Total	345		4	1.2	45 - 2,168	93 - 250
Unknown		8		0	0.0		
	Overall Total	**1,244**		**41**	**3.3**		

Table 2. Summary of blacknose sharks tagged by the MML – Center for Shark Research, 1991-2006.

Sex	Reproductive Stage	No. Tagged	Ave. Length FL (cm)	No. of Recaptures	Recapture Rate (%)	Days at Large	Distance (km)
Male	YOY	50	40				
	JUV	178	71				
	MAT	185	89				
	Total	413		10	2.4	4 - 1,452	0 - 111
Female	YOY	66	41				
	JUV	227	70				
	MAT	160	93				
	Total	453		17	3.8	1 - 1,820	0 - 83
Unknown		14					
	Overall Total	**880**		**27**	**3.1**		

Table 3. Summary of bonnethead sharks tagged by the MML – Center for Shark Research, 1991-2006.

Sex	Reproductive Stage	No. Tagged	Ave. Length FL (cm)	No. of Recaptures	Recapture Rate (%)	Days at Large	Distance (km)
Male	YOY	22	38				
	JUV	532	53				
	MAT	1,637	62				
	Total	2,191		54	2.5	1 - 1,638	0 - 189
Female	YOY	38	39				
	JUV	1,455	58				
	MAT	1,959	77				
	Total	3,452		142	4.1	1 - 2,247	0 - 315
Unknown		27		0	0.0		
	Overall Total	**5,670**		**196**	**3.5**		

Table 4. Summary of finetooth sharks tagged by the MML – Center for Shark Research, 1991-2006.

Sex	Reproductive Stage	No. Tagged	Ave. Length FL (cm)	No. of Recaptures	Recapture Rate (%)	Days at Large	Distance (km)
Male	YOY	1	58				
	JUV	24	65				
	MAT	4	101				
	Total	29		0	0.0		
Female	YOY	0	-				
	JUV	44	65				
	MAT	4	102				
	Total	48		3	6.3	1 - 118	56 - 611
Unknown		0		0			
	Overall Total	**77**		**3**	**3.9**		

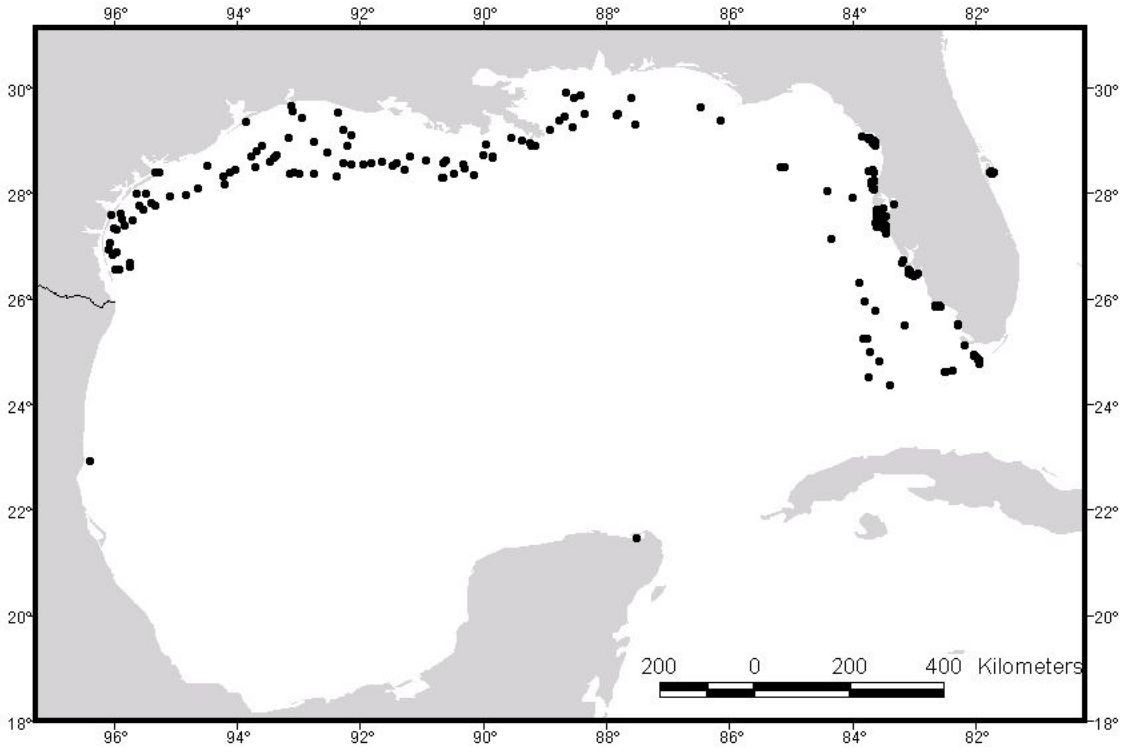

Figure 1. Tagging locations of the Atlantic sharpnose shark.

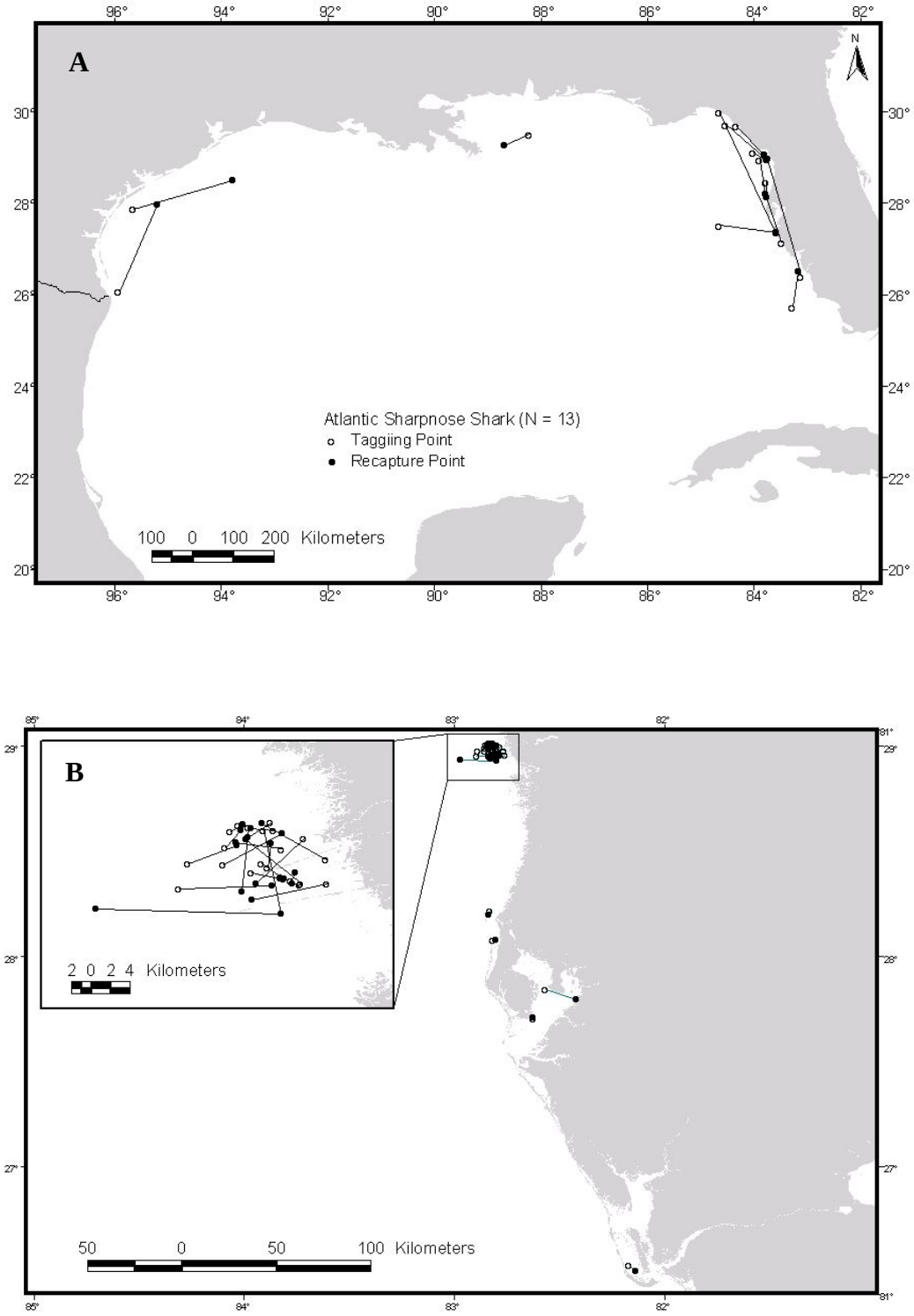

Figure 2. Movements of Atlantic sharpnose sharks in the Gulf of Mexico. Open circles represent the tagging location. Closed circles indicate the point of recapture. (A>25 km; B<25 km).

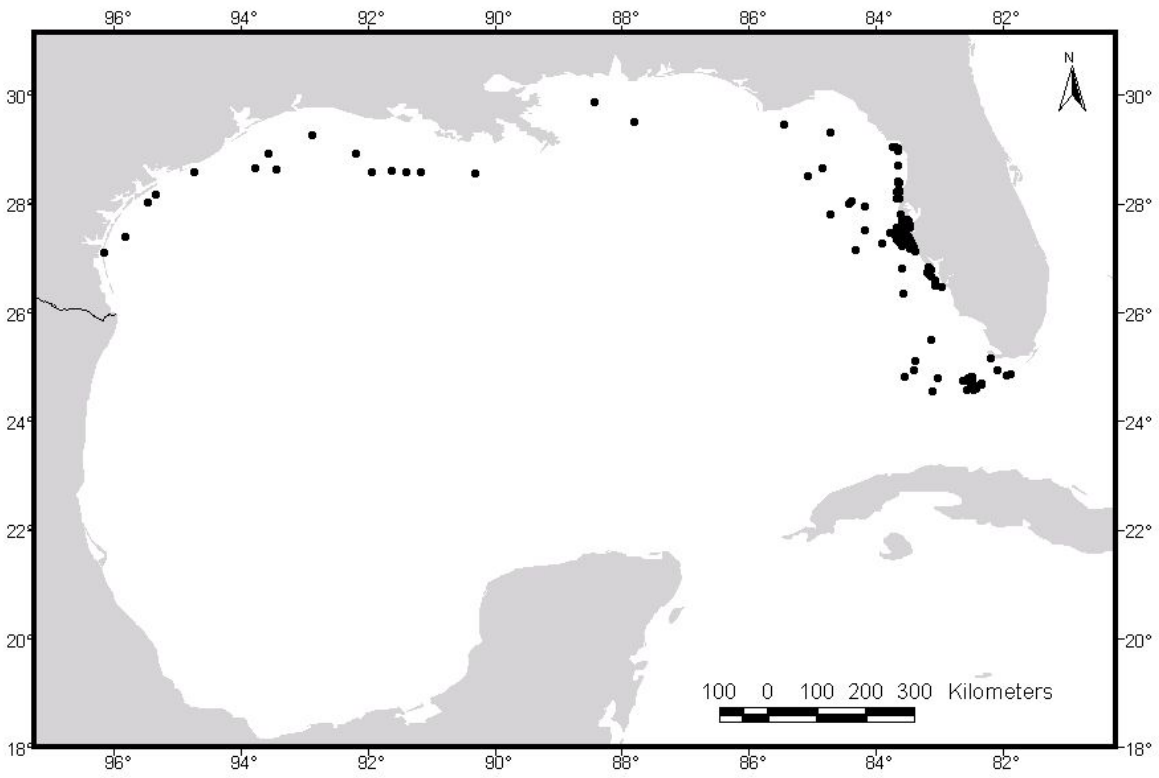

Figure 3. Tagging locations of the blacknose shark.

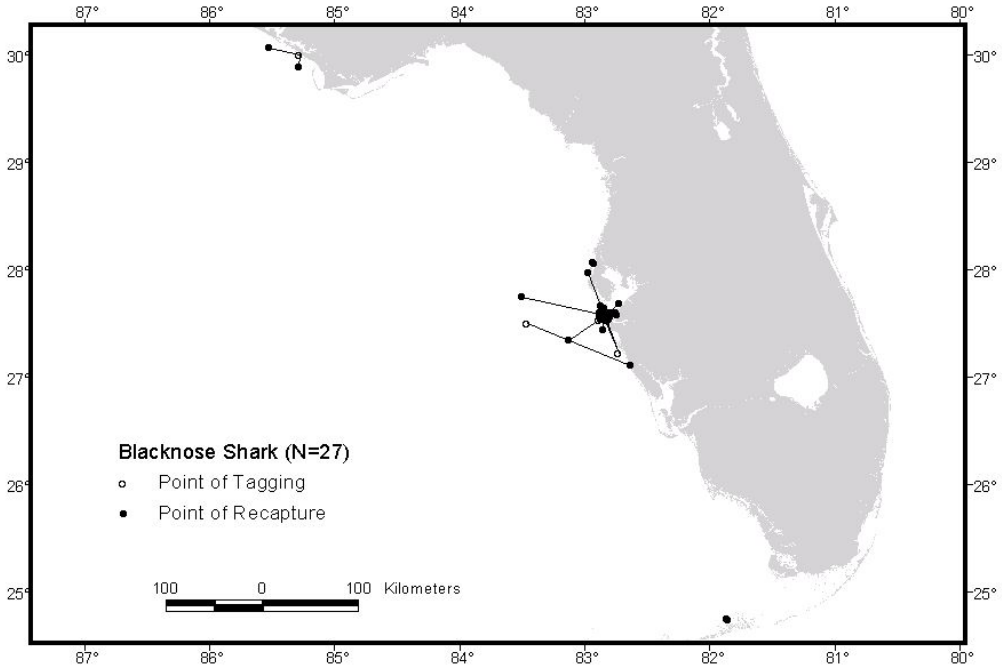

Figure 4. Movements of the blacknose shark along the west coast of Florida from tag-recapture data. Open circles indicate the point of tagging. Solid circles represent the point of recapture.

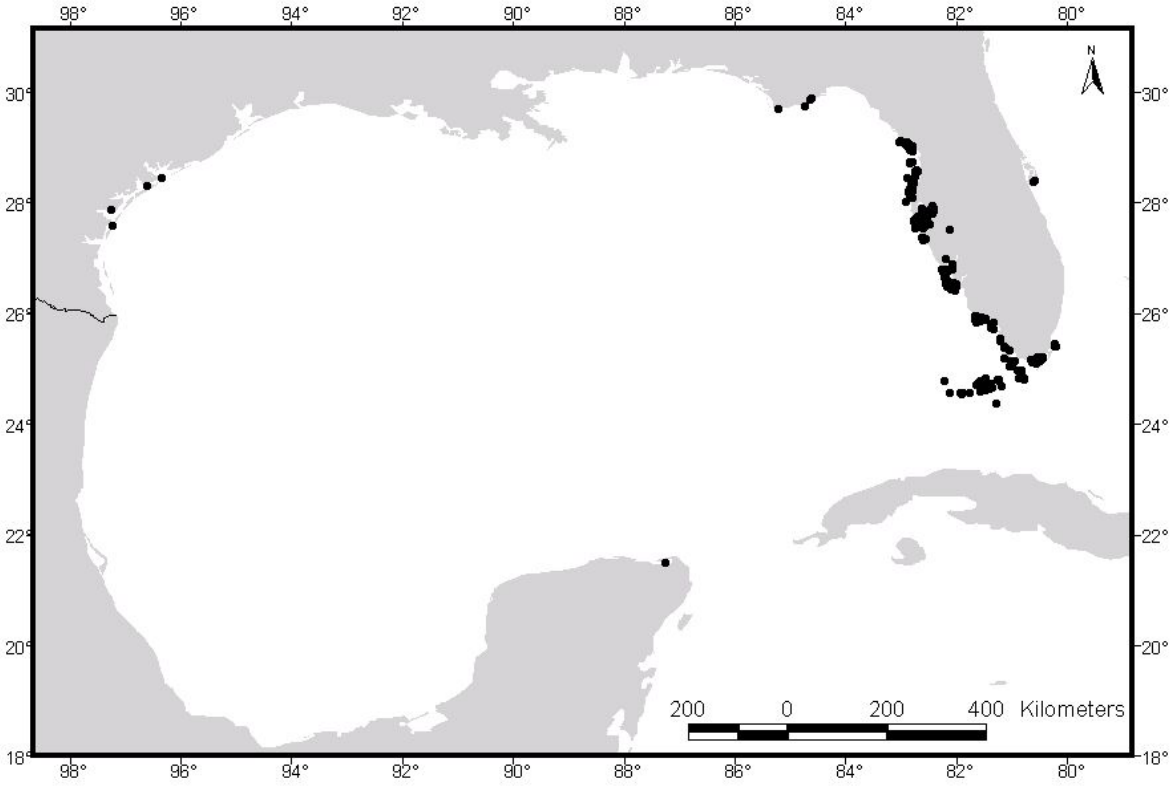

Figure 5. Tagging sites of the bonnethead shark.

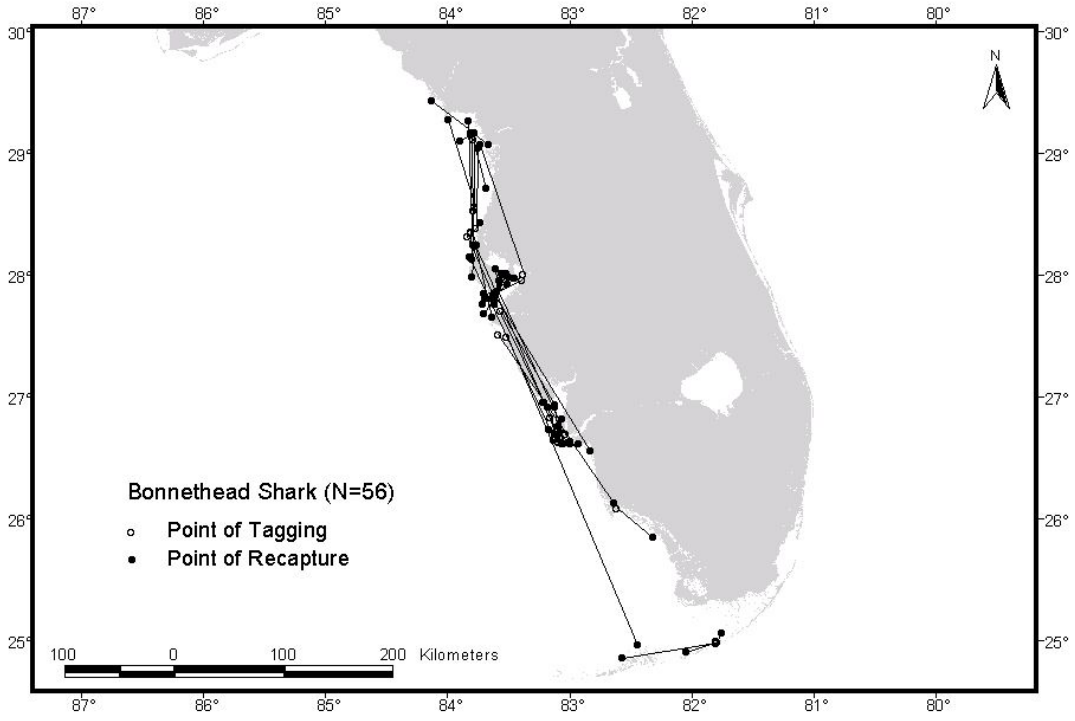

Figure 6. Movement of bonnethead sharks from the west coast of Florida (>10 km). Open circles indicate the tagging location. Solid circles represent the point of recapture.

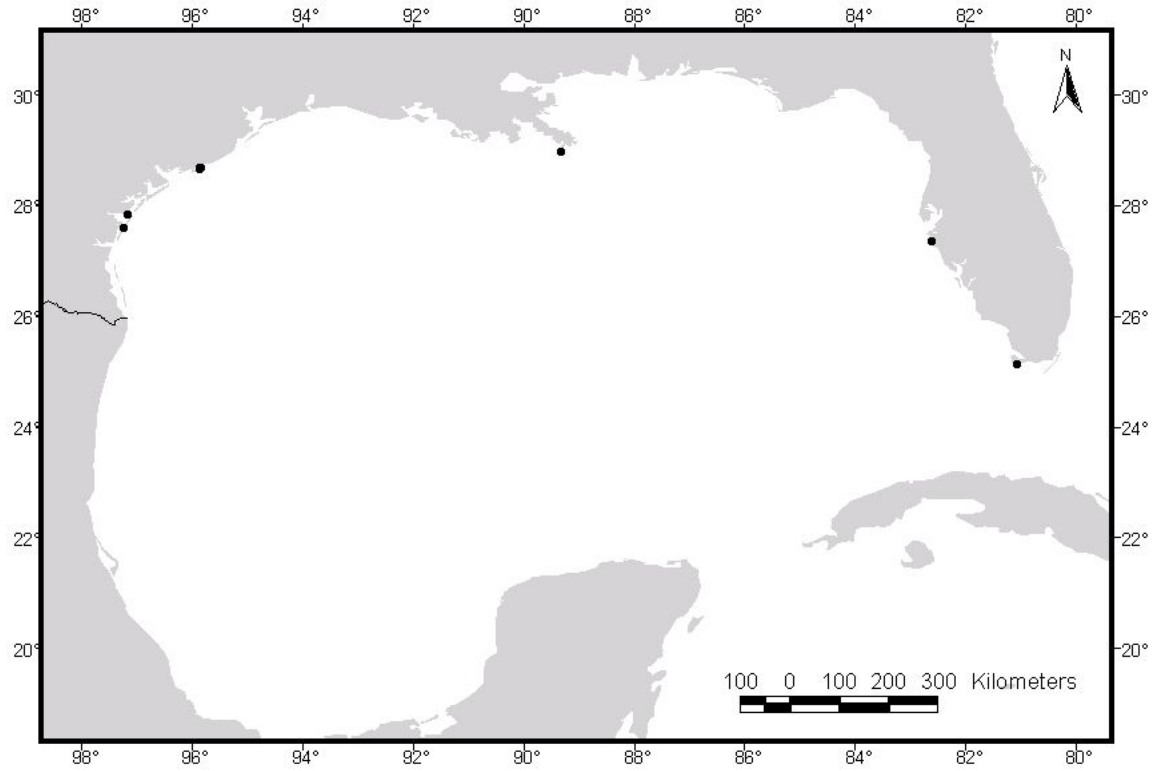

Figure 7. Tagging locations of the finetooth shark.

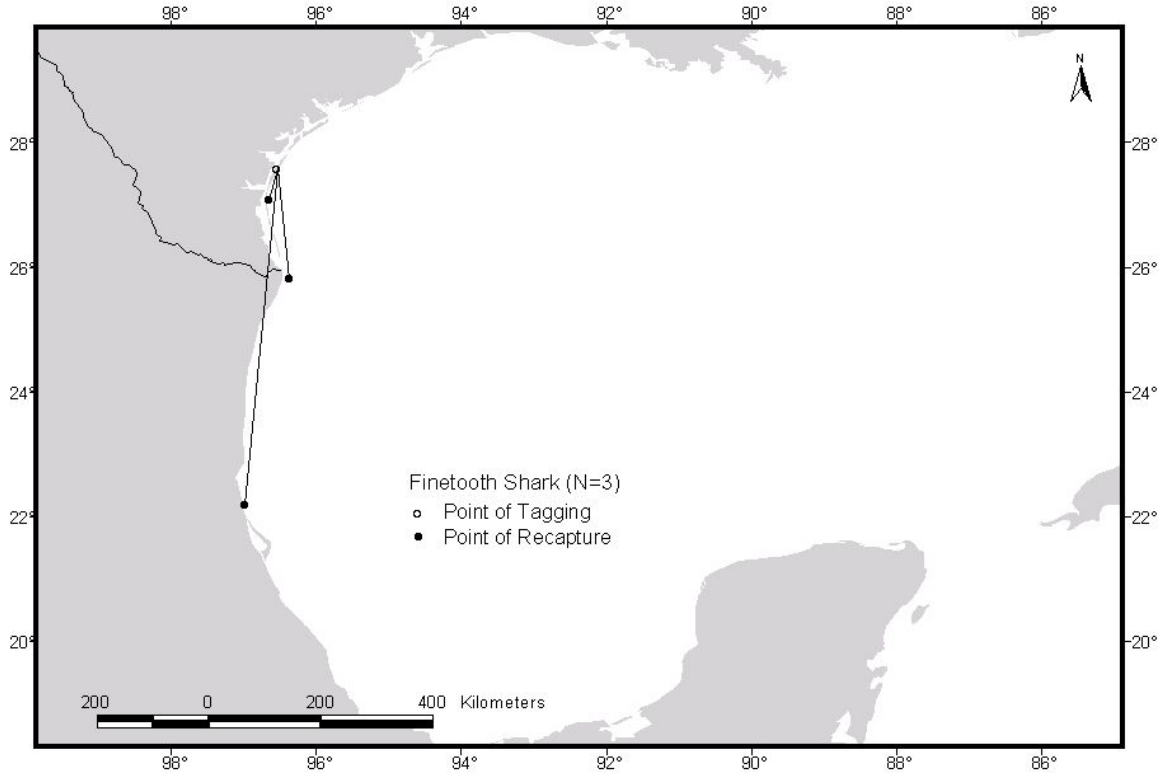

Figure 8. Movements of the finetooth shark in the western Gulf of Mexico. Open circles represent the point of tagging. Solid circles indicate the point of recapture.