

NMFS Cooperative Shark Tagging Program, 1962–93: An Atlas of Shark Tag and Recapture Data

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Introduction

The National Marine Fisheries Service (NMFS) Cooperative Shark Tagging Program (CSTP) is part of continuing research directed to the study of the biology of large Atlantic sharks. The CSTP was initiated in 1962 at the Sandy Hook Laboratory in New Jersey under the Department of Interior's U.S. Fish and Wildlife Service (USFWS). During the late 1950's and early 1960's, sharks were considered a liability to the economy of resort communities, of little or no commercial value, and a detriment to fishermen in areas where sharks might damage expensive fishing gear or reduce catches of more commercially valuable species.

Several shark attacks along the New Jersey coast at that time gave rise to public concern about a perceived shark menace. In response to that concern, a shark longline survey was conducted in 1961 from Jones Inlet, N.Y., to Cape Henlopen, Del., by laboratory staff. The objectives of that study were to determine the species composition, distribution, abundance, food habits, seasonal

occurrence, and other aspects of the biology of large sharks off the middle Atlantic states. The survey resulted in the capture of over 300 sharks, including white sharks, *Carcharodon carcharias*; and tiger sharks, *Galeocerdo cuvier*, considered to be among the most dangerous species.

When the details of the survey were made public, hundreds of recreational fishermen interested in fishing for sharks as "big game" in the rapidly expanding offshore recreational fisheries offered to assist USFWS biologists in their research on sharks. This was the genesis of the CSTP. Volunteer participation began with an initial group of less than 100 fishermen involved in tagging feasibility studies in 1963. The program expanded in subsequent years, coming under the auspices of the U.S. Department of Commerce's National Marine Fisheries Service, NOAA, in 1970. It currently includes over 6,500 volunteers distributed along the Atlantic and Gulf coasts of North America and Europe. An overview of the early history of the CSTP is included in Casey (1985).

This paper broadly summarizes the tagging and recapture (T/R) information from the CSTP for 1962 through 1993. T/R data are presented in an atlas format to provide an overview of the 32-year database and show the extent of the tagging effort, areas of release and recapture, sources of recaptures, and movements of tagged sharks with respect to state boundaries, the 200-mile U.S. Exclusive Economic Zone (EEZ),

and international and territorial waters of other countries.

Materials and Methods

The tagging methods used in the CSTP have been essentially unchanged during the past 30 years. The two principal tags in use are a fin tag (Jumbo Rototag) and a dart tag ("M" tag) (Fig. 1). The Rototag is a two-piece, plastic cattle ear tag that is inserted through the first dorsal fin. These tags were primarily used by USFWS biologists on small sharks during the first few years of the CSTP. As the program expanded to include thousands of volunteer fishermen, the dart tag was developed to be easily and safely applied to sharks in the water. The "M" tag is composed of a stainless steel dart head, monofilament line, and a Plexiglas capsule containing a vinyl plastic legend with return instructions printed in English, Spanish, French, Japanese, and Norwegian. These dart tags, in use since 1965, are implanted in the musculature near the base of the first dorsal fin. Numbered dart tags are sent to volunteer participants on self-addressed return post cards for recording tagging information (species, size, and sex of shark, and date, location, and gear).

In addition, first time taggers are sent a tagging needle, tagging instructions, a copy of the "Anglers Guide to Sharks of the Northeastern United States" (Casey, 1964), and a current *Shark Tagger* newsletter. This newsletter is an annual summary of the previous year's T/R data and biological studies on

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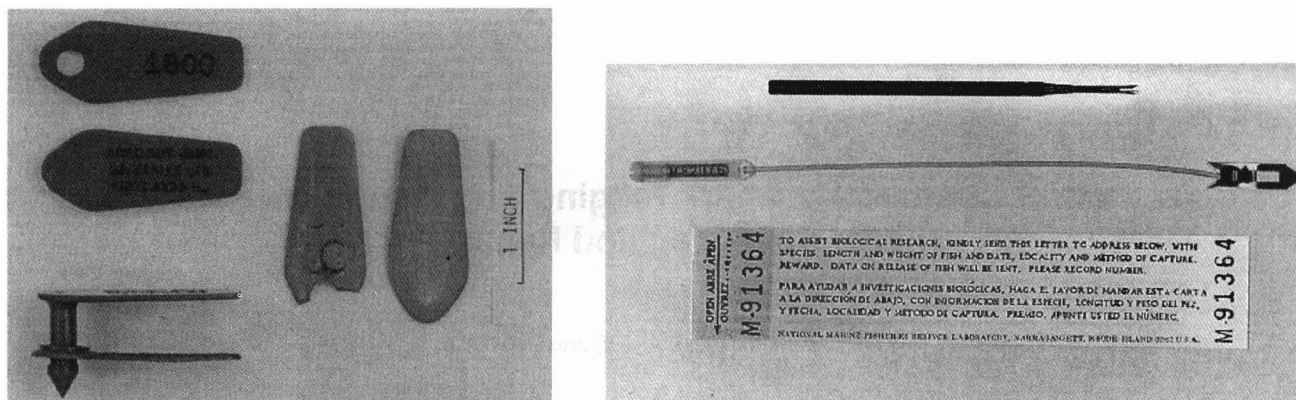


Figure 1.—The two principal tags, Jumbo Rototag (left) and “M” dart tag (right), used in the NMFS Cooperative Shark Tagging Program from 1962 to 1993.

sharks that is sent to all participants in the CSTP. Tagging studies have been mostly single-release events in which recoveries are made opportunistically by recreational and commercial fishermen. When a tagged shark is recaptured, information similar to that obtained at tagging is requested from the recapturer. Initially, a \$1.00 reward was sent as an incentive for returning tags; after a few years, the reward was increased to \$5.00. Since 1988, a hat with an embroidered logo has been used.

Throughout the program, special care has been taken with respect to identification of species. It was apparent in the first few years that fishermen were having difficulty identifying sharks. Sharks in the genus *Carcharhinus* were (and remain) the most difficult to identify. Difficulties were also apparent in separating the mackerel sharks (i.e. shortfin mako, *Isurus oxyrinchus*; porbeagle, *Lamna nasus*; and white shark) and smooth, *Sphyrna zygaena*; and scalloped, *S. lewini*, hammerheads. In addition, taggers sometimes simply reported “shark,” “sand shark,” “dogfish,” or “gray shark,” names that can refer to any of several species. Over the course of the CSTP, there has been a continuing effort to provide shark identification materials to participants, many of whom have become experts in identifying sharks in their areas. The cadre

of sport and commercial fishermen, scientists, fish dealers, and foreign fisheries observers send measurements, photographs, teeth, skin, and other materials to verify species identification.

For this paper, the combined 32-year database was further refined by plotting T/R locations by species and verifying observations that fell outside expected distributions. Tag and recapture data were evaluated to provide an overview of the range of some of the more important species of sharks and to show the extent of their migrations. Any data judged to be important with respect to long-distance movements, extended times at liberty, or unusual locations were considered valid only if they were tagged by NMFS biologists, other scientists, experienced foreign fisheries observers, or knowledgeable/experienced shark fishermen. Additionally, fishermen were contacted by telephone or letter to confirm details when the information was judged to be particularly relevant. If the data could not be verified, it was deleted or assigned to a non-specific category such as “unidentified *Carcharhinus*.”

During the course of the program, fishermen have become more experienced in identifying sharks, navigational systems and the accuracy of tagging data have improved, and questionable information from early years have

become more obvious. Moreover, the additive effect of recaptures from sharks tagged by NMFS and other biologists have helped to confirm overall movement patterns of many species. Concerted attempts have also been made to critically and conservatively evaluate T/R information with respect to times at liberty, distances traveled, rates of travel and movements of sharks in relation to national and international boundaries.

This paper summarizes tagging and recapture data for 33 species of sharks taken in the CSTP, together with ancillary information, e.g. type of gear used and occupation of participants. Standard sets of figures (maps and graphs) are included for each species. Maps are displayed in a longitude/latitude projection with the U.S. EEZ boundary represented by a dotted-dashed line. Species sections appear in taxonomic order. Figures for each species include the following:

1) Atlantic distribution—Tagging and recapture locations are plotted on a standard Atlantic Ocean map. Summary information includes number of males and females tagged and recaptured, overall recapture rate, and maximum observed speed, distance traveled, and time at liberty. Note that maps show a general distribution of tagging and recapture locations, but because of scale, do not readily reflect tagging density.

2) Tagging distribution—The initial map represents an overview of the total tagging data with distinct symbols for males, females, and unknowns. These data are further broken down by area on subsequent maps where appropriate. Numbers of each sex and the 200 m depth contour are marked on each figure.

3) Recapture distribution—All of the recapture information for each species is displayed on a single map with arrows depicting the point of tagging (origin of arrow), and point of recapture (arrowhead). In some instances, an enlargement of a particular area is included on the same page (denoted as A and B) to improve clarity. An additional map denoting long-distance movements is included for some species.

4) Yearly summaries—Number of sharks tagged and recaptured by year are plotted on two distinct line graphs with the same year scale for comparison.

The blue shark, *Prionace glauca*, presented us with unique problems in portraying the tagging data. The substantial tagging effort off the northeastern coast of the United States made it difficult to definitively display sex ratios and tagging effort. For example, 22,500 blue sharks were tagged within a 60-mile radius of Montauk Point, Long Island, N.Y., during the study period. The blue shark data were therefore divided into eight regions, and sex ratios (males to females) were determined for each region. These regions were based on general distribution of the data and geographic areas (e.g. Grand Banks). The three regions off the U.S. coast have the EEZ as their eastern boundary.

Results and Discussion

The CSTP, between 1962 and 1993, has resulted in 106,449 tagged sharks of 33 species and 4,598 recaptures of 29 species. Ninety-one percent of the tags are accounted for by eight species: blue shark (57%); sandbar shark, *Carcharhinus plumbeus* (15%); dusky shark, *C. obscurus* (6%); tiger shark (4%); shortfin mako (3%); blacktip shark, *C. limbatus* (2%); scalloped hammerhead (2%); and Atlantic sharpnose shark, *Rhizoprionodon terraenovae* (2%) (Table 1). The number of sharks

tagged varies from 22 for the Greenland shark, *Somniosus microcephalus*, to 60,856 for the blue shark. Most species (27) have more than 100 sharks tagged.

Numbers of recaptures by species range from 0 to 2,339. Ninety-two percent of the recaptures are accounted for by seven species: blue shark (51%); sandbar shark (16%); tiger shark (10%); shortfin mako (7%); lemon shark, *Negaprion brevirostris* (3%); dusky shark (3%); and nurse shark, *Ginglymostoma cirratum* (2%). For most species (26), less than 100 fish were recaptured. No returns to date have been reported for the basking shark, *Cetorhinus maximus*; finetooth shark, *Carcharhinus isodon*; smalltail shark, *C. porosus*; and Atlantic angel shark, *Squatina dumeril*. The rate of recapture ranges from 0.0 to 10.9% (for the nurse shark).

The number of fish tagged and recaptured is influenced by a variety of factors, and the apparent abundance of a species, as reflected in the T/R data, can be misleading. The blue shark, for example, is an abundant species, and because of its low economic value, many are released. On the other hand, the shortfin mako is prized by both recreational and commercial fishermen, and this is reflected in the relatively low numbers of makos tagged and released and high recapture rate (third highest). The tiger shark is an example of a species where an intensive age and growth study, in recent years, has increased the numbers tagged and recaptured. Life history characteristics may also influence tagging and recapture success (e.g. a species that stays in an area for extensive periods of time, like the nurse shark, is more subject to capture and

Table 1.—Summary of tag and recapture data for 33 species of sharks from the NMFS Cooperative Shark Tagging Program during 1962–93.

Species	No. of sharks tagged	No. of sharks recaptured	Recapture rate (%)	Max. speed (n.mi./day)	Max. distance traveled (n.mi.)	Max. time at liberty (years)
Nurse shark, <i>Ginglymostoma cirratum</i>	923	101	10.9	1.3	292	7.8
Sand tiger, <i>Odontaspis taurus</i>	562	31	5.5	2.9	641	3.2
Bigeye thresher, <i>Alopias superciliosus</i>	329	7	2.1	9.4	1,494	6.5
Thresher shark, <i>A. vulpinus</i>	48	2	4.2	0.1	86	8
Basking shark, <i>Cetorhinus maximus</i>	156	0	0			
White shark, <i>Carcharodon carcharias</i>	36	2	5.6	0.9	546	2.5
Shortfin mako, <i>Isurus oxyrinchus</i>	3,457	320	9.3	35.7	2,453	9.5
Longfin mako, <i>I. paucus</i>	73	4	5.5	5.2	859	1.2
Porbeagle, <i>Lamna nasus</i>	457	31	6.8	22	1,005	8.6
Blacknose shark, <i>Carcharhinus acronotus</i>	387	6	1.6	0.8	170	9.2
Bignose shark, <i>C. altimus</i>	169	9	5.3	2.4	1,805	8.8
Spinner shark, <i>C. brevipinna</i>	341	9	2.6	3.3	899	0.8
Silky shark, <i>C. falciformis</i>	819	54	6.6	32.2	723	7.1
Galapagos shark, <i>C. galapagensis</i>	339	14	4.1	1	1,544	4.4
Finetooth shark, <i>C. isodon</i>	114	0	0			
Bull shark, <i>C. leucas</i>	520	10	1.9	1.6	235	7
Blacktip shark, <i>C. limbatus</i>	2,398	98	4.1	16.4	1,159	7.3
Oceanic whitetip shark, <i>C. longimanus</i>	542	6	1.1	17.5	1,226	3.3
Dusky shark, <i>C. obscurus</i>	5,983	124	2.1	22.3	2,052	15.8
Reef shark, <i>C. perezi</i>	546	10	1.8	< 0.1	16	4.4
Sandbar shark, <i>C. plumbeus</i>	15,617	727	4.7	11.7	2,039	27.8
Smalltail shark, <i>C. porosus</i>	29	0	0			
Night shark, <i>C. signatus</i>	191	12	6.3	6	1,441	12.9
Tiger shark, <i>Galeocerdo cuvier</i>	4,850	446	9.2	33.2	1,871	10.9
Lemon shark, <i>Negaprion brevirostris</i>	1,602	163	10.2	4	230	4.1
Blue shark, <i>Prionace glauca</i>	60,856	2,339	3.8	49.9	3,740	8.5
Atlantic sharpnose shark, <i>Rhizoprionodon terraenovae</i>	2,015	21	1	2.3	344	7.3
Scalloped hammerhead, <i>Sphyrna lewini</i>	2,131	34	1.6	6	902	9.6
Great hammerhead, <i>S. mokarran</i>	103	2	1.9	0.4	102	0.7
Bonnethead, <i>S. tiburo</i>	583	9	1.5	1.2	141	0.4
Smooth hammerhead, <i>S. zygaena</i>	166	6	3.6	2.6	496	2.1
Greenland shark, <i>Somniosus microcephalus</i>	22	1	4.5	0	0	1
Atlantic angel shark, <i>Squatina dumeril</i>	85	0	0			

recapture than a species that is highly migratory). Conversely, lower tagging and recapture success does not necessarily reflect low abundance but may mean that a species may be undesirable or inaccessible to the main body of fishing and tagging effort. Some species occur farther offshore, in deeper waters, are not present in areas during the primary fishing season, or are not readily caught. For instance, 156 basking sharks were tagged by members of the CSTP, but none have been recaptured. This is because basking sharks are relatively easy to tag free swimming but are not taken incidentally on most types of fishing gear and are not subject to commercial fisheries.

The annual number of fish tagged per year varied from 38 in 1962 to 8,113 in 1992 and averaged 5,700 during 1984–93. The number of fish recaptured by year ranged from 2 in 1963 to 444 in 1993 and averaged 300 for 1984–93 (Fig. 2). The fairly steady rise in number of recaptures is partially due to the fact that as the number of tagged fish

increased (each year an additional 5,000 to 8,000 were added), the number of recaptures per year increased. Trends in number of fish tagged and recaptured must be interpreted with caution, because tagging effort can vary due to annual changes in fishing effort, weather conditions, water temperature, number of participants in the CSTP, occurrence of research cruises, opening or closure of a commercial fishery, and number of tags available. All these variables are difficult to measure and may mask any direct correlation of number of tags used per year and population size fluctuations.

Peaks in numbers of tags and recaptures per year can be further clarified by comparing the total with the data for the blue and sandbar sharks. Since blue sharks represent the largest percentage of the total numbers tagged and recaptured, the pattern in numbers per year for this species mirrors the total and dominates the trends. Species with fewer tags and recaptures are particularly affected by the variables discussed above, since single events can signifi-

cantly increase or decrease their numbers. For example, there were large numbers of sandbar sharks tagged between 1964 and 1968 by NMFS biologists in conjunction with commercial fishermen off coastal Virginia. Likewise, since 1986, there was an increase in the number of sandbar sharks tagged (on NMFS research cruises in 1986, 1989, and 1991) and recaptured (due to the developed commercial fishery for coastal sharks).

Anglers using rod and reel accomplished the majority of the tagging (Fig. 3). Biologists, NMFS fisheries observers, and commercial fishermen using primarily longlines, handlines, and nets (gill, trawl) accounted for the remainder. Conversely, commercial fishermen (50%) using longlines and net gear, and rod and reel anglers (40%) were responsible for the majority of the tag returns (Fig. 4).

Distances traveled for the 33 species ranged from no movement to 3,740 n.mi. (Table 1). This maximum distance was for a blue shark that was tagged by

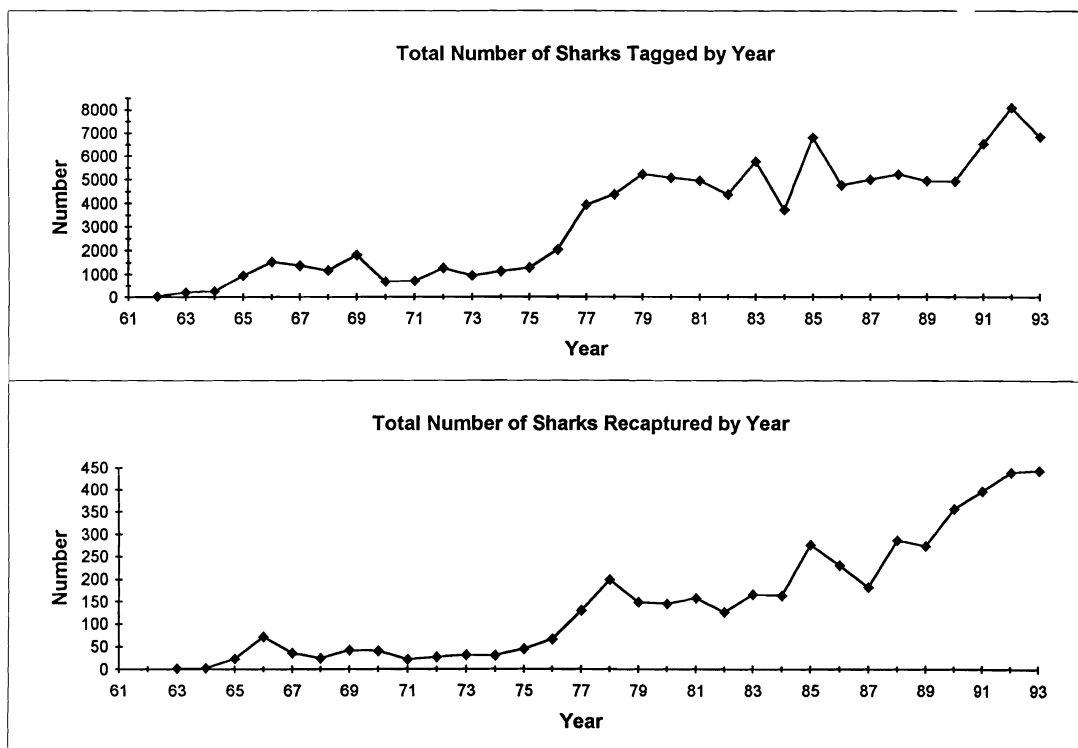


Figure 2.—Total number of sharks tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program from 1962 to 1993.

a sport fisherman southeast of Shinnecock Inlet, N.Y., and recaptured approximately 560 miles east of Natal, Brazil 1.4 years later. In total, one species, the blue shark, traveled distances over 3,000 miles, 3 species traveled distances between 2,000 and 3,000 miles (shortfin mako, dusky, and sandbar shark), and 8 species between 1,000 and 2,000 miles (tiger; bignose, *Carcharhinus altimus*; Galapagos, *C. galapagensis*; bigeye thresher, *Alopias superciliosus*; night, *C. signatus*; oceanic whitetip, *C. longimanus*; blacktip, and porbeagle shark). Six species traveled distances of 500–1,000 miles (scalloped hammerhead; spinner, *C. brevipinna*; longfin mako, *Isurus paucus*; silky, *Carcharhinus falciformis*; sand tiger, *Odontaspis taurus*; and white shark).

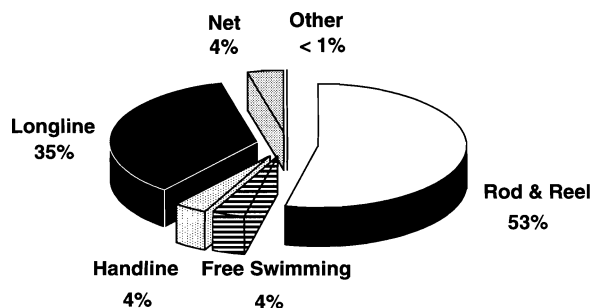
The longest time at liberty for any shark in the CSTP is 27.8 years (Table 1). This record is for a sandbar shark that was tagged by NMFS Narragansett Laboratory biologist Charles Stillwell,

fishing with a gill net in Great Machipongo Sound, Va., in June of 1965 and recaptured by a commercial shark longline fisherman east of Daytona Beach, Fla. Overall, 4 species of shark have been at liberty for over 10 years (sandbar, dusky, night, and tiger shark), and 13 have been at liberty between 5 and 10 years (scalloped hammerhead; shortfin mako; blacknose, *Carcharhinus acronotus*; bignose; porbeagle; blue; thresher, *Alopias vulpinus*; nurse; Atlantic sharpnose; blacktip; silky; bull; and bigeye thresher shark).

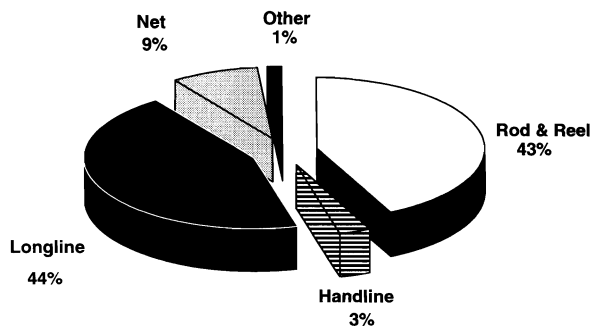
One of the major challenges to fisheries managers is the management and allocation of transboundary or migratory stocks (Hilborn et al., 1990). Data from tagging programs, such as the NMFS CSTP, play a major role in this process by providing direct evidence of the extent of fish movements with respect to national and international boundaries and for defining the stocks of Atlantic sharks (Fig. 5–161). Recap-

ture data from the CSTP provide evidence of transboundary movements for the 29 shark species with recaptures (Table 2). Twenty species showed movement across the U.S. EEZ boundary. Of these, 6 belong to the pelagic sharks, 12 to the large coastal, and 2 to the small coastal shark species group as per the Fishery Management Plan for Sharks of the Atlantic Ocean (Anonymous, 1993). T/R data provide evidence that 25 of the species occur in the Gulf of Mexico. Of these, 12 show movement into the Gulf and 11 show movement out of the Gulf. Sixteen species occur in the Caribbean Sea, of which 8 show movement in and none show movement out. Eight species occur in the South Atlantic, and one species, the blue shark, shows evidence of crossing the equator. Overall, fishermen representing 32 countries have tagged sharks and 47 countries are represented in the tag returns. Thus, the need for international cooperation and management for some

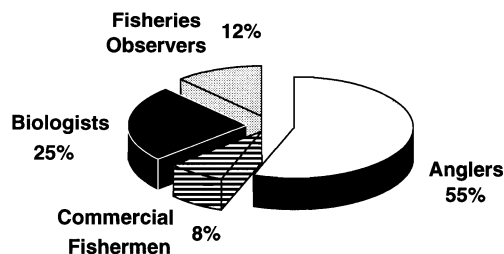
Tag Releases by Gear



Tag Returns by Gear



Tag Releases by Occupation



Tag Returns by Occupation

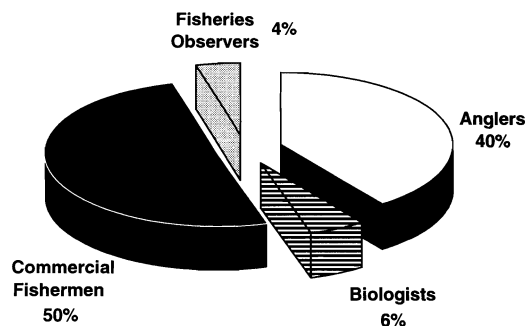


Figure 3.—Summary of tag releases by gear and occupation of participants in the NMFS Cooperative Shark Tagging Program from 1962 to 1993.

Figure 4.—Summary of tag returns by gear and occupation of participants in the NMFS Cooperative Shark Tagging Program from 1962 to 1993.

Table 2.—Summary of occurrence and transboundary movement for 33 species of sharks from the NMFS Cooperative Shark Tagging Program during 1962–93.

Species	Shark species tagged and/or recaptured in:						Moved across U.S. EEZ	Moved into:			Moved out of Gulf of Mexico
	N. of Cape Hatteras	S. of Cape Hatteras	Gulf of Mexico	Caribbean Sea	E. N. Atl. Ocean	S. Atl. Ocean		Caribbean Sea	Gulf of Mexico	S. Atl. Ocean	
<i>Ginglymostoma cirratum</i>		X	X	X							X
<i>Odontaspis taurus</i>	X	X									
<i>Alopias superciliosus</i>	X	X	X	X	X		X		X		
<i>A. vulpinus</i>	X	X			X						
<i>Cetorhinus maximus</i>	X						NA ¹	NA	NA	NA	NA
<i>Carcharodon carcharias</i>	X	X				X					
<i>Isurus oxyrinchus</i>	X	X	X	X	X	X	X	X	X		X
<i>I. paucus</i>	X	X	X	X			X				X
<i>Lamna nasus</i>	X				X	X	X				
<i>Carcharhinus acronotus</i>		X	X								
<i>C. altimus</i>	X	X	X	X			X	X	X		X
<i>C. brevipinna</i>	X	X	X	X			X	X	X		
<i>C. falciformis</i>	X	X	X	X	X	X	X	X	X		X
<i>C. galapagensis</i>		X					X				
<i>C. isodon</i>	X	X	X				NA	NA	NA	NA	NA
<i>C. leucas</i>	X	X	X				X				
<i>C. limbatus</i>	X	X	X	X			X		X		X
<i>C. longimanus</i>	X	X	X	X	X	X	X	X			X
<i>C. obscurus</i>	X	X	X	X	X		X	X	X		X
<i>C. perezi</i>		X	X	X							
<i>C. plumbeus</i>	X	X	X				X		X		X
<i>C. porosus</i>				X			NA	NA	NA	NA	NA
<i>C. signatus</i>	X	X	X				X		X		
<i>Galeocerdo cuvier</i>	X	X	X	X			X	X	X		X
<i>Negaprion brevirostris</i>	X	X	X	X			X		X		X
<i>Prionace glauca</i>	X	X	X	X	X	X	X	X	X	X	
<i>Rhizoprionodon terraenovae</i>	X	X	X				X				
<i>Sphyrna lewini</i>	X	X	X				X				
<i>S. mokarran</i>	X	X	X								
<i>S. tiburo</i>		X	X				X				
<i>S. zygaena</i>	X	X	X	X	X	X					
<i>Somniosus microcephalus</i>	X				X						
<i>Squatina dumeril</i>	X	X	X				NA	NA	NA	NA	NA

¹ NA = Not applicable.

shark species is underscored by the fact that many have wide ranging distributions, frequently traverse national boundaries, and are exploited by multinational fisheries.

The CSTP is an ongoing means to increase our biological understanding of sharks and to obtain information required for their successful management. The tagging of sharks (and other aquatic animals) provides information on stock identity, movements and migration (including rates and routes), abundance, age and growth (including verification/validation of age-determination methods), mortality, behavior, and stocking success (McFarlane et al., 1990). This atlas is the foundation upon which to begin to fill in the gaps in our knowledge on the migrations and other elements of the biology of Atlantic sharks.

Future reports will provide more detailed analysis of the T/R data in relation to stock identification, size distribution, reproductive biology, food habits, and environmental parameters that define the geographic ranges and help to explain movements of individual species.

Acknowledgments

We would like to acknowledge the thousands of sport and commercial fishermen, fisheries observers, research vessel captains and crew, tournament officials, and cooperating scientists who have helped make this one of the largest shark tagging programs in the world. It owes its success to their unselfish cooperation, spending many hours at sea tagging and recapturing sharks and providing valuable data from logbooks,

tournament records, and field observations. Many sport, commercial, and research boats have allowed us sea time on their vessels at no cost. There are so many people involved in a program of this kind, including the people who make the tags, that it is difficult to single out any individuals or individual groups. Many thanks to all of you for your dedication and support of our program. Special thanks also to past and present API staff, including Ruth Briggs, Lisa Natanson, Gregg Skomal, H. Wes Pratt, Mike Couturier, Fred Lerch, Larry Lindgren, Nancy Kelley, and Patricia Hadfield for their assistance and support with data collection and processing. We also are very grateful to Steve Clark, Teri Frady, Daniel Sheehan, and Jon Gibson for providing valuable technical assistance.

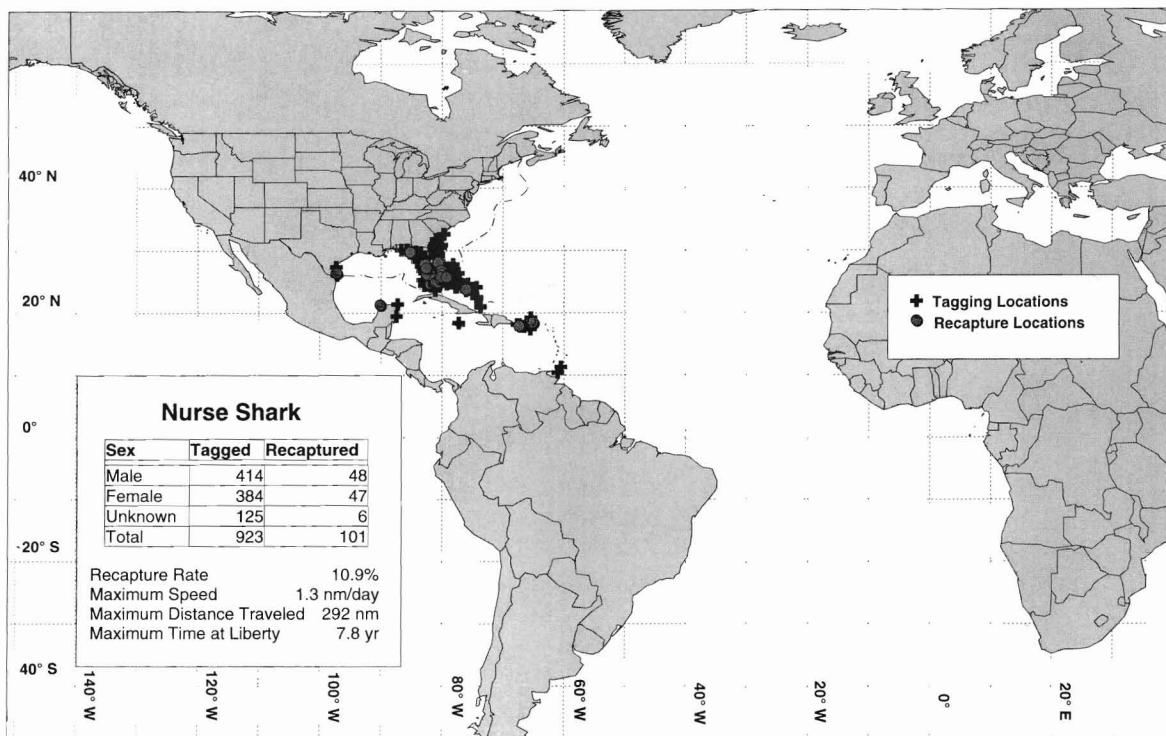


Figure 5.—Atlantic distribution of tag and recapture locations for the nurse shark, *Ginglymostoma cirratum*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

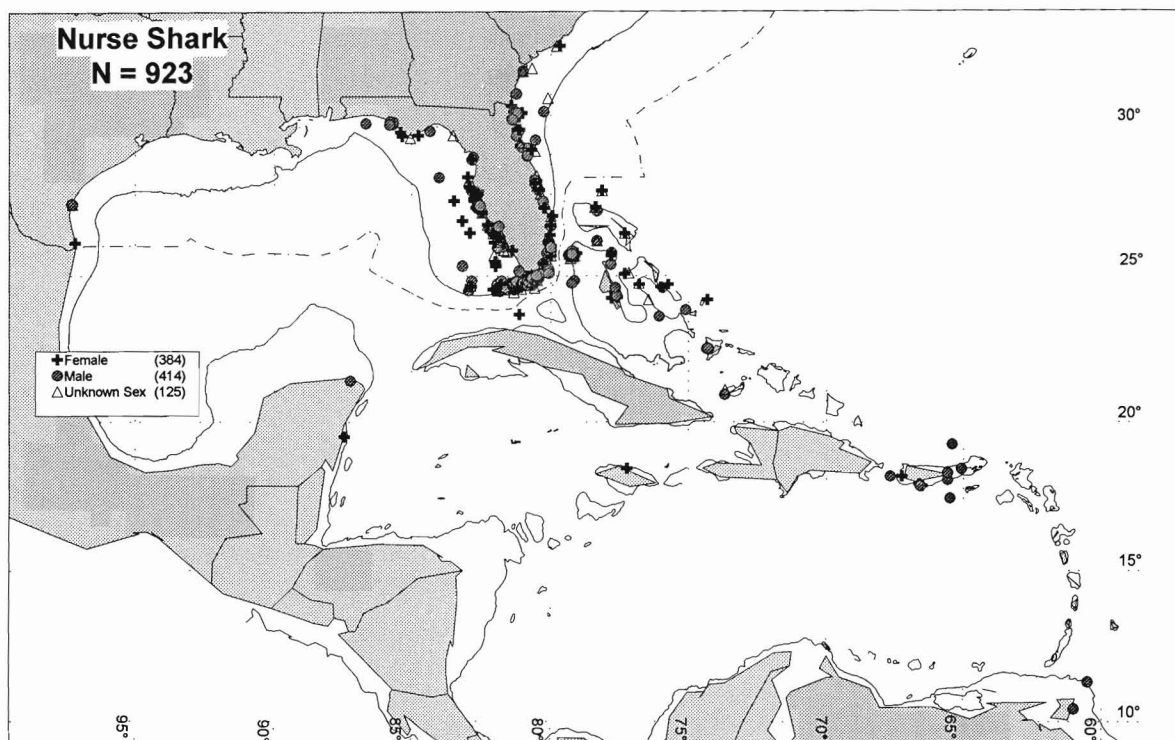


Figure 6.—Total tagging distribution for the nurse shark, *Ginglymostoma cirratum*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

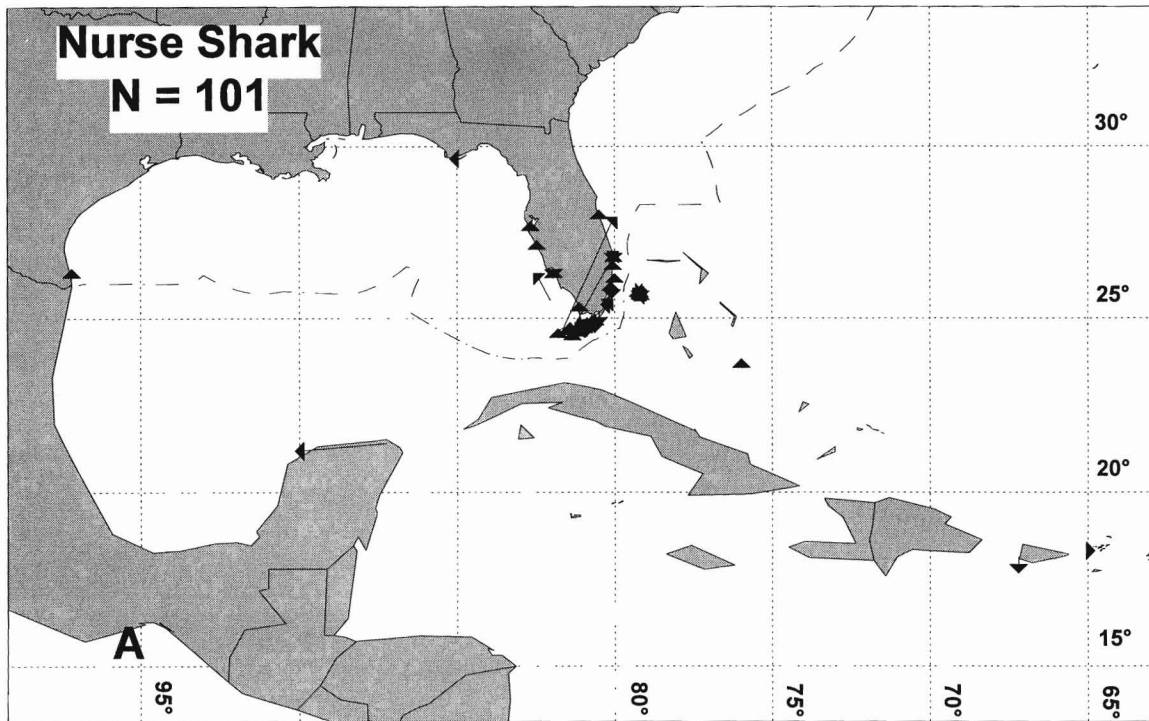


Figure 7a.—Recapture distribution for the nurse shark, *Ginglymostoma cirratum*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

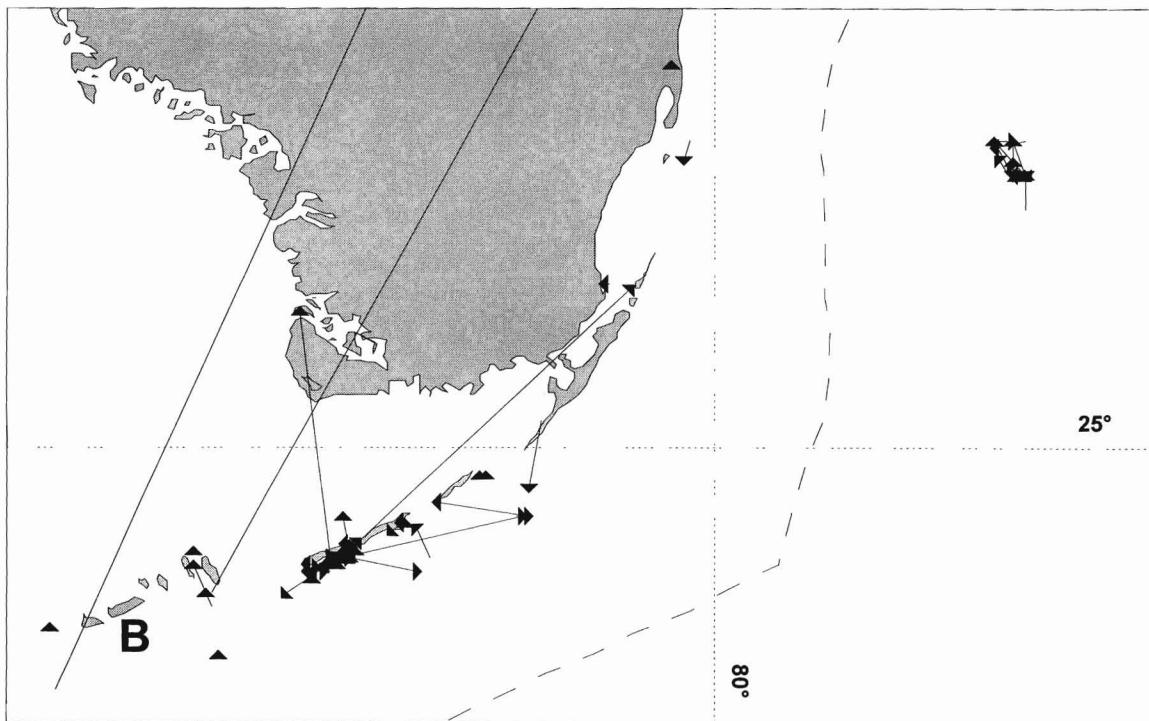


Figure 7b.—Detailed map of southern Florida recapture distribution for the nurse shark, *Ginglymostoma cirratum*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

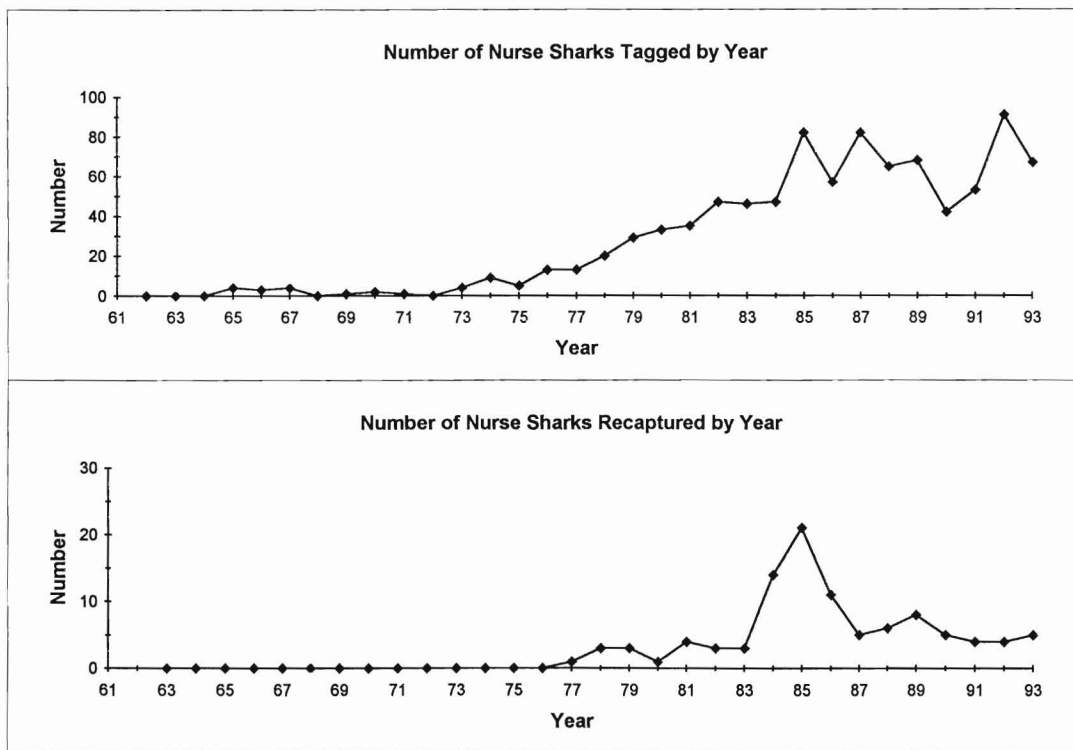


Figure 8.—Total number of nurse shark, *Ginglymostoma cirratum*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

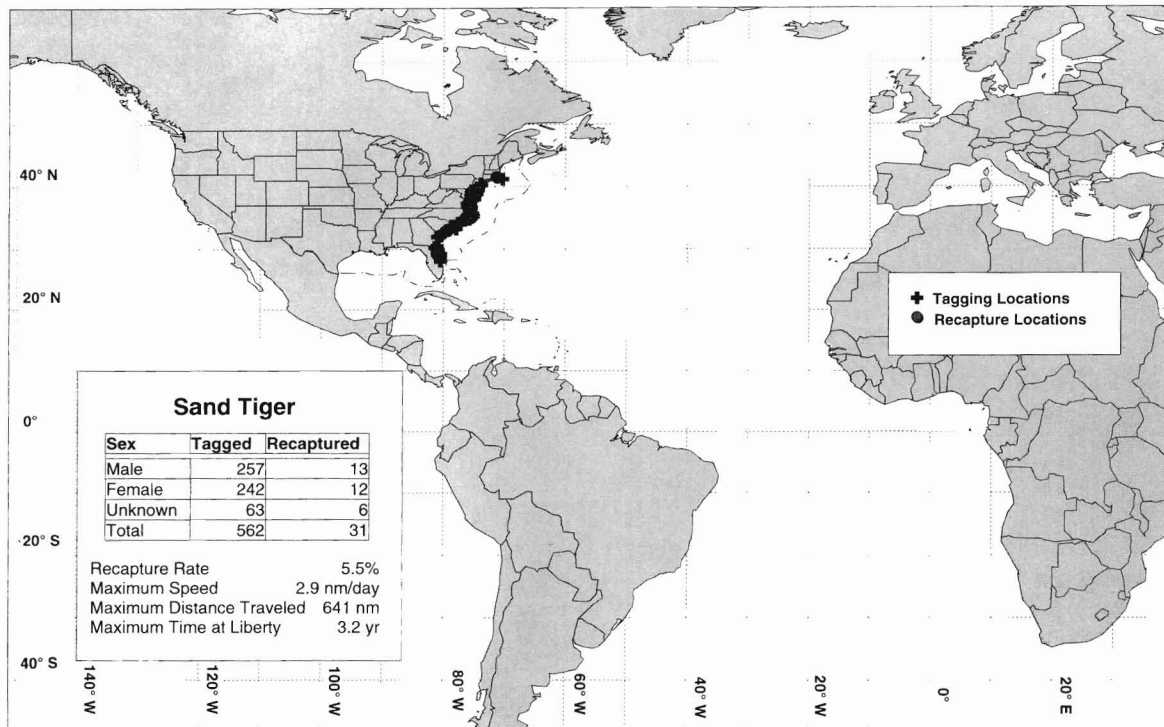


Figure 9.—Atlantic distribution of tag and recapture locations for the sand tiger, *Odontaspis taurus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

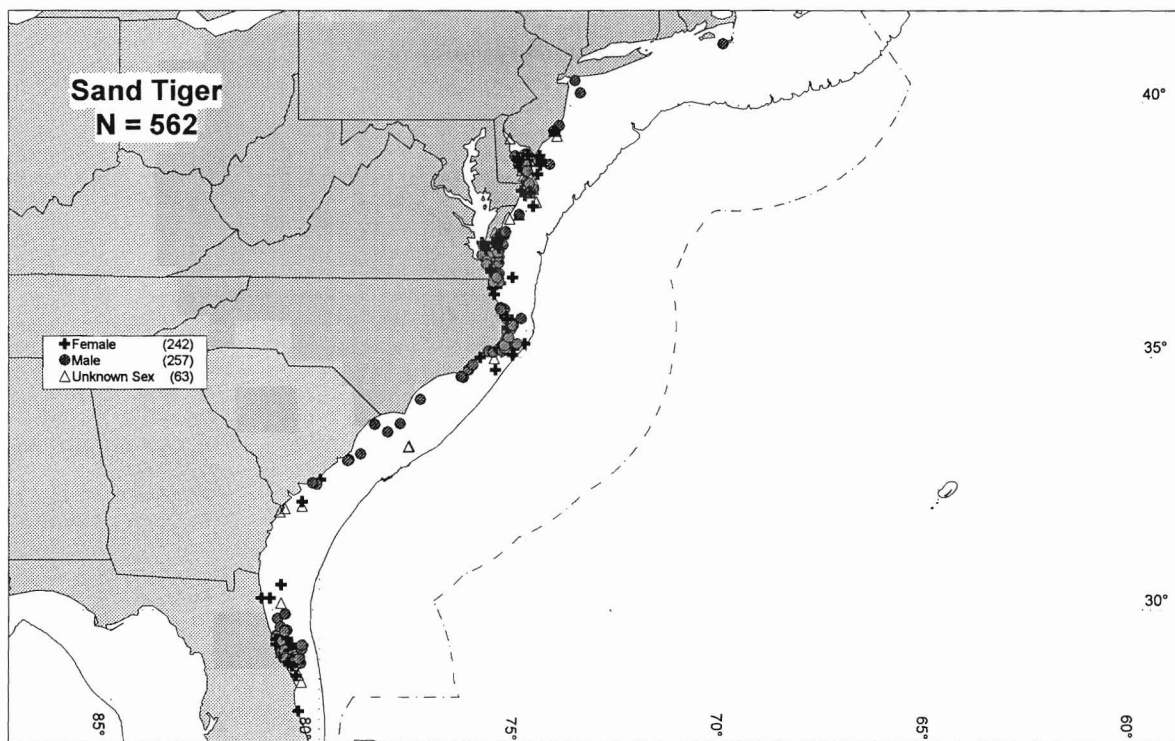


Figure 10.—Total tagging distribution for the sand tiger, *Odontaspis taurus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

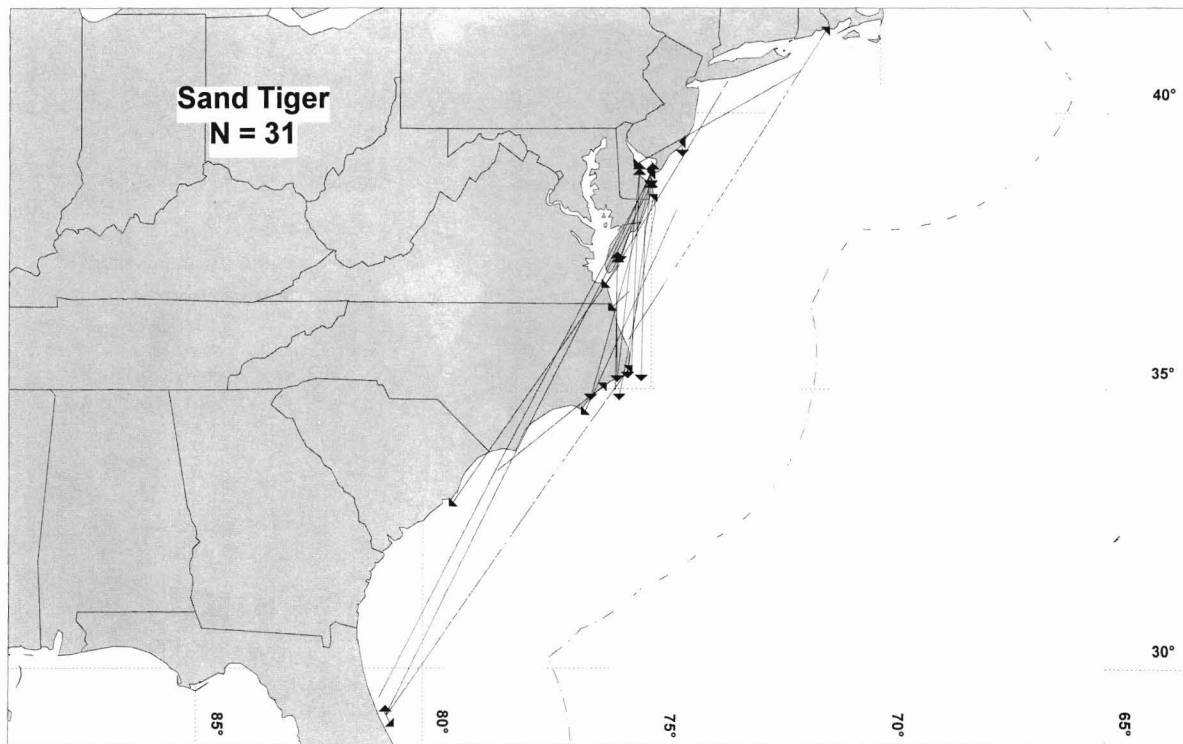


Figure 11.—Recapture distribution for the sand tiger, *Odontaspis taurus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

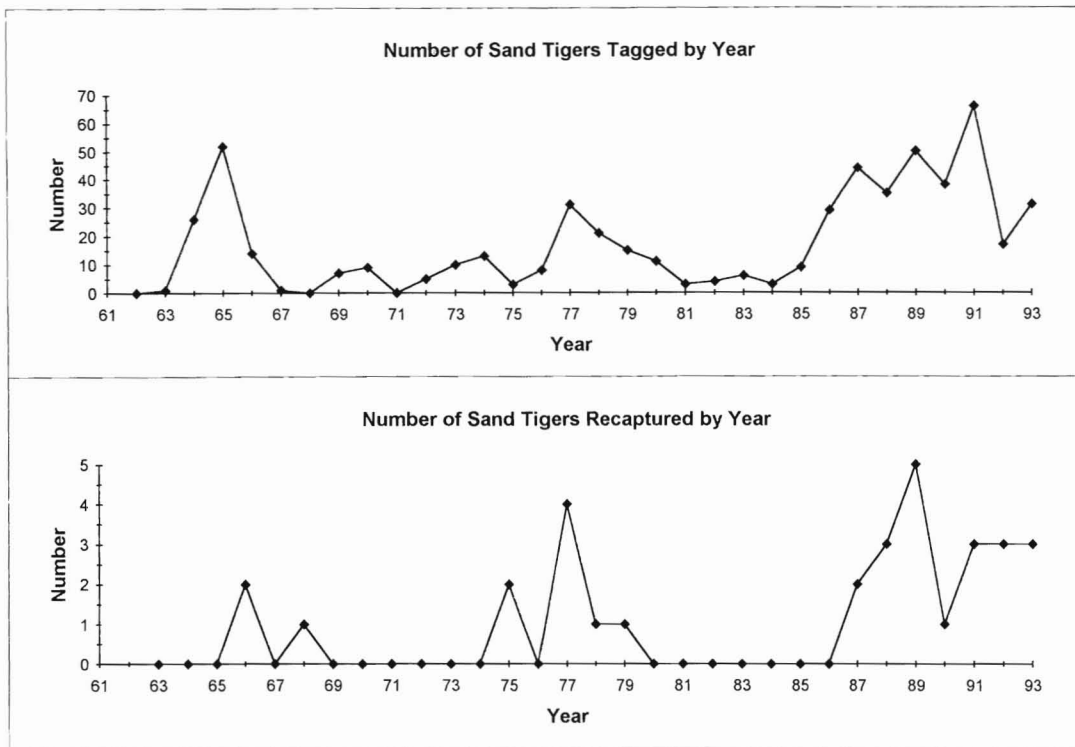


Figure 12.—Total number of sand tiger, *Odontaspis taurus*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

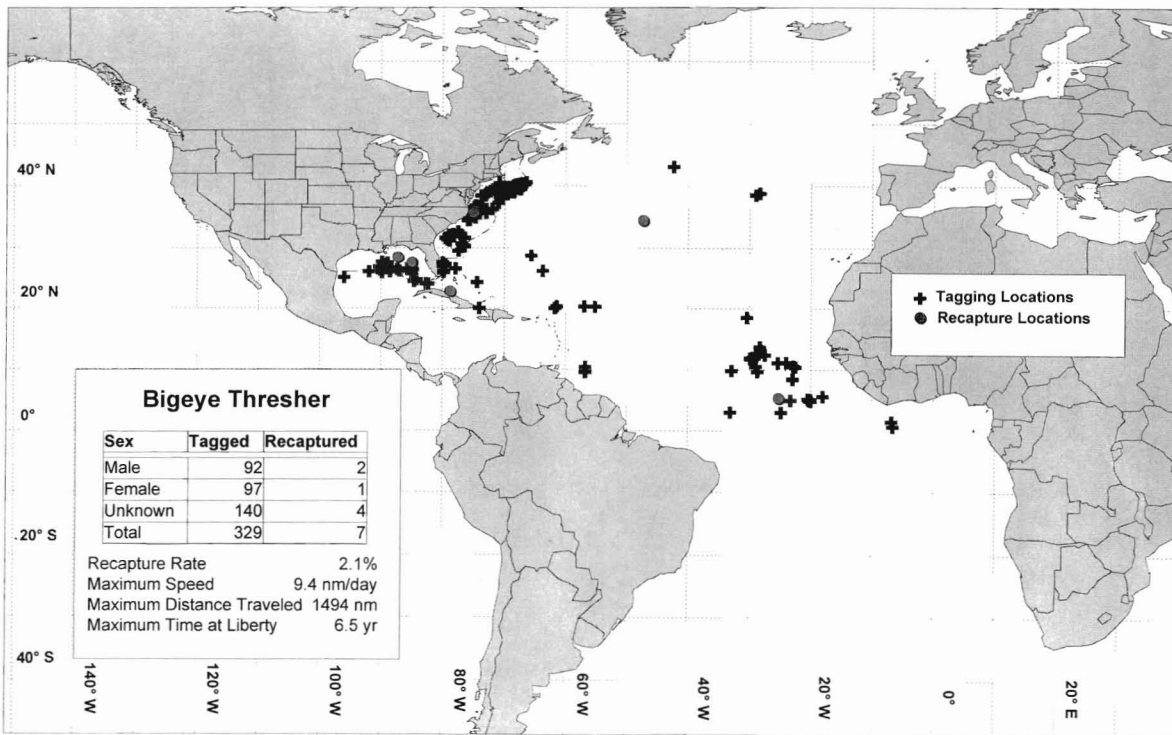


Figure 13.—Atlantic distribution of tag and recapture locations for the bigeye thresher, *Alopias superciliosus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

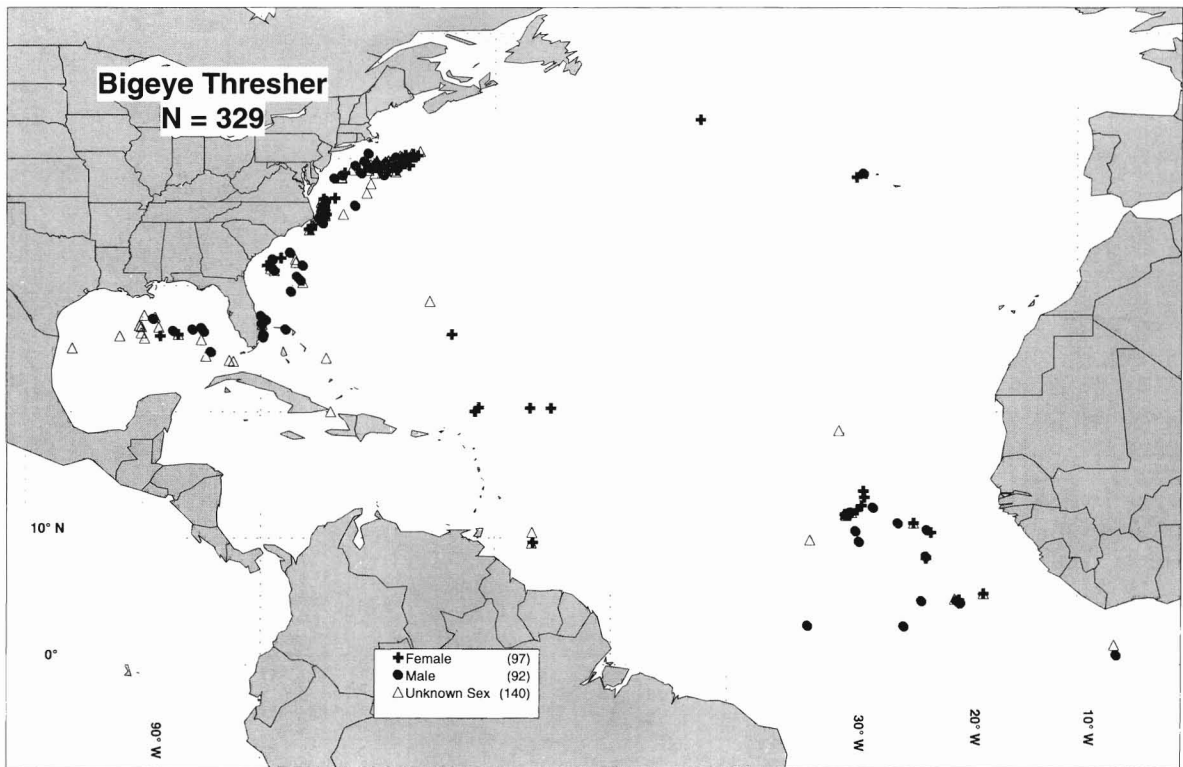


Figure 14.—Total tagging distribution for the bigeye thresher, *Alopias superciliosus*, from the NMFS Cooperative Shark Tagging Program during 1962–93.

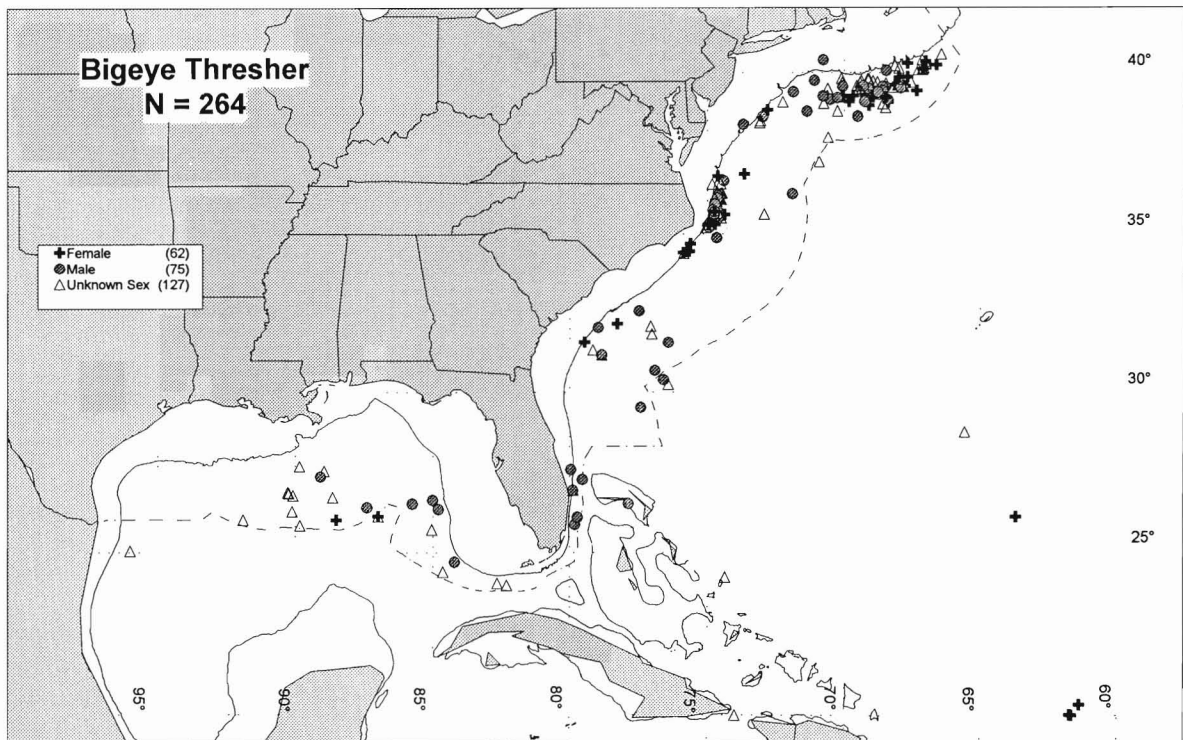


Figure 15.—U.S. tagging distribution of the bigeye thresher, *Alopias superciliosus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

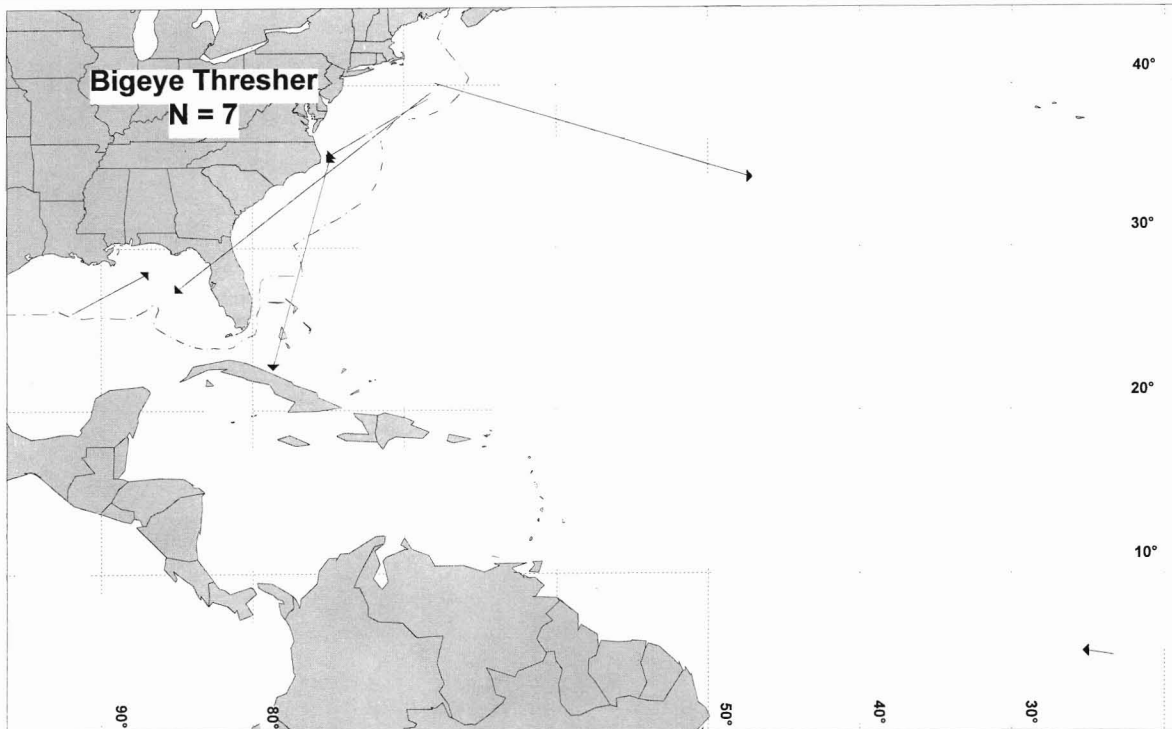


Figure 16.—Recapture distribution for the bigeye thresher, *Alopias superciliosus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

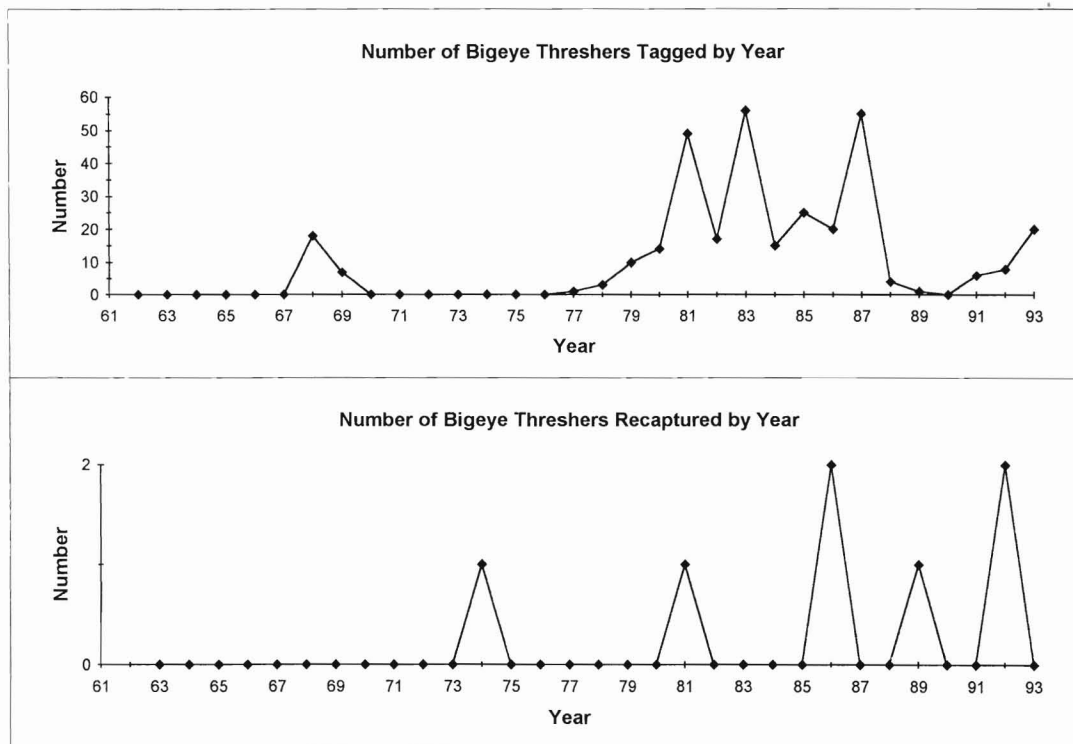


Figure 17.—Total number of bigeye thresher, *Alopias superciliosus*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

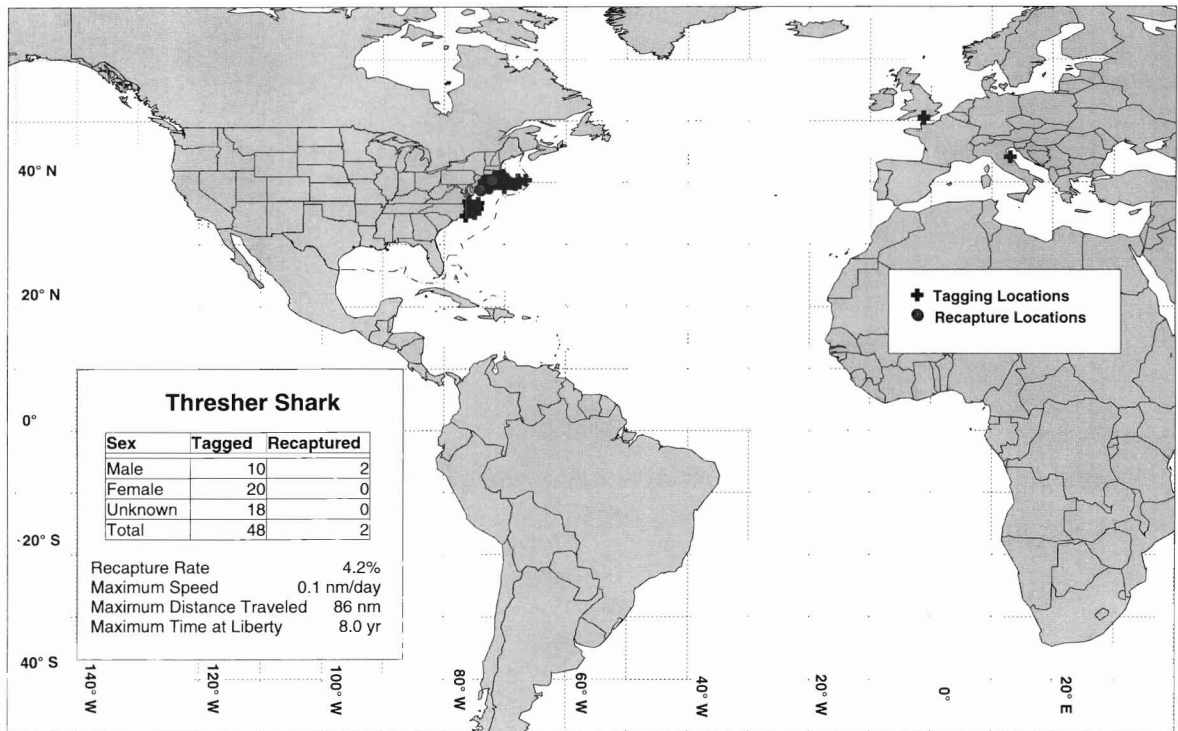


Figure 18.—Atlantic distribution of tag and recapture locations for the thresher shark, *Alopias vulpinus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

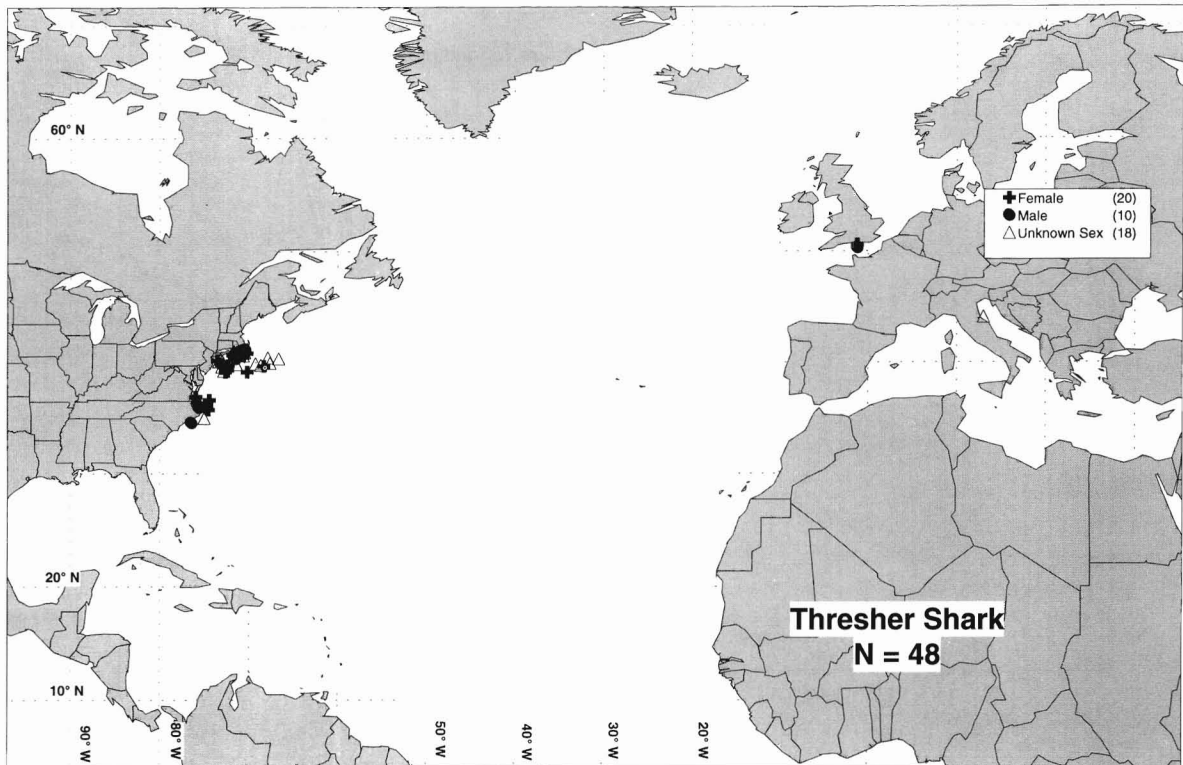


Figure 19.—Total tagging distribution for the thresher shark, *Alopias vulpinus*, from the NMFS Cooperative Shark Tagging Program during 1962–93.

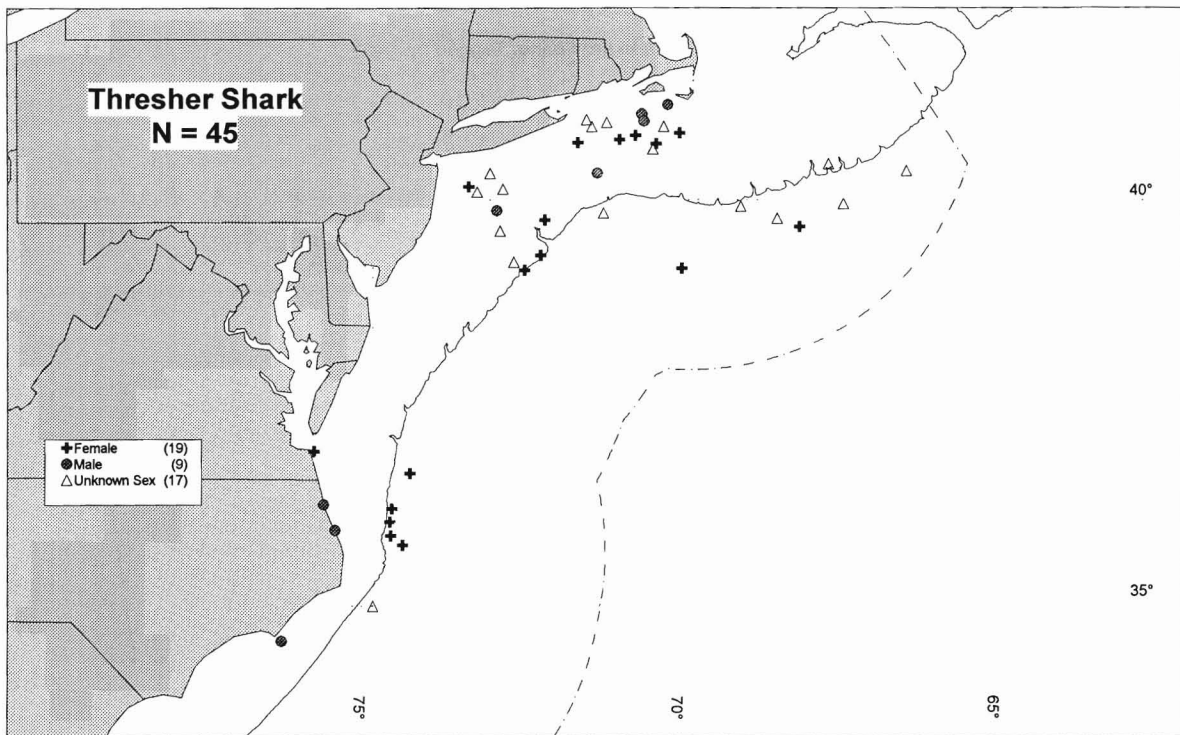


Figure 20.—U.S. tagging distribution of the bigeye thresher, *Alopias vulpinus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

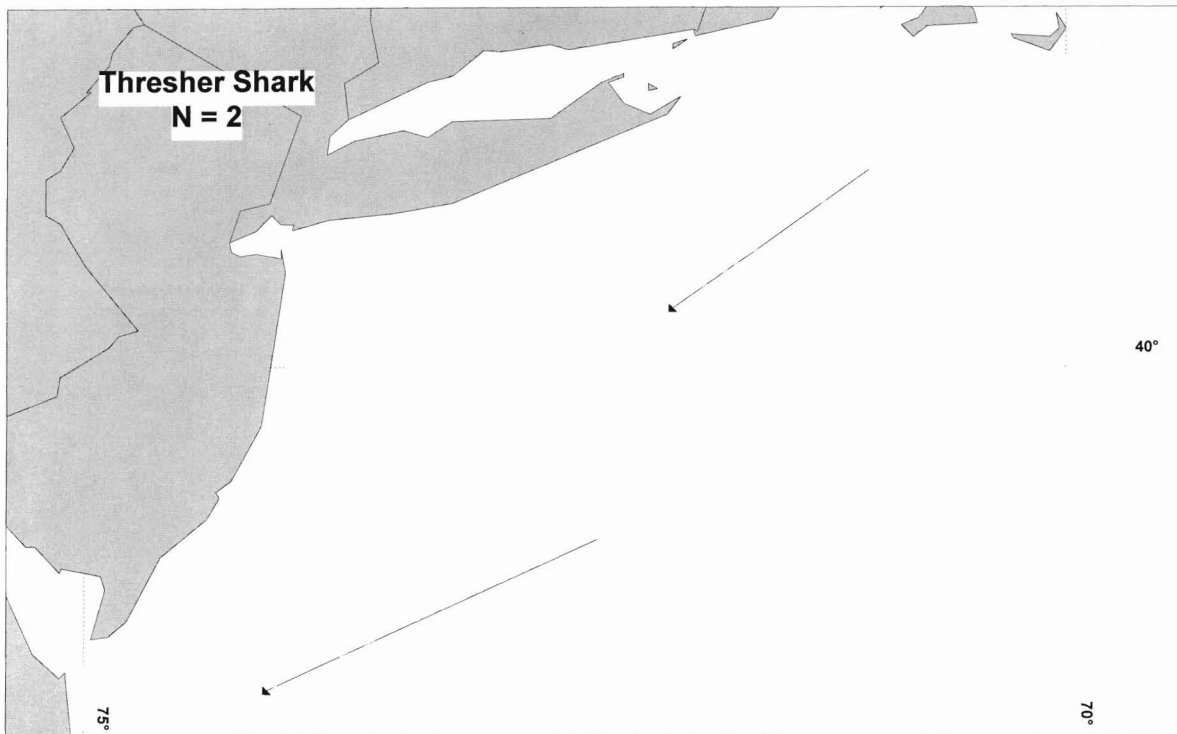


Figure 21.—Recapture distribution for the thresher shark, *Alopias vulpinus*, from the NMFS Cooperative Shark Tagging Program during 1962–93.

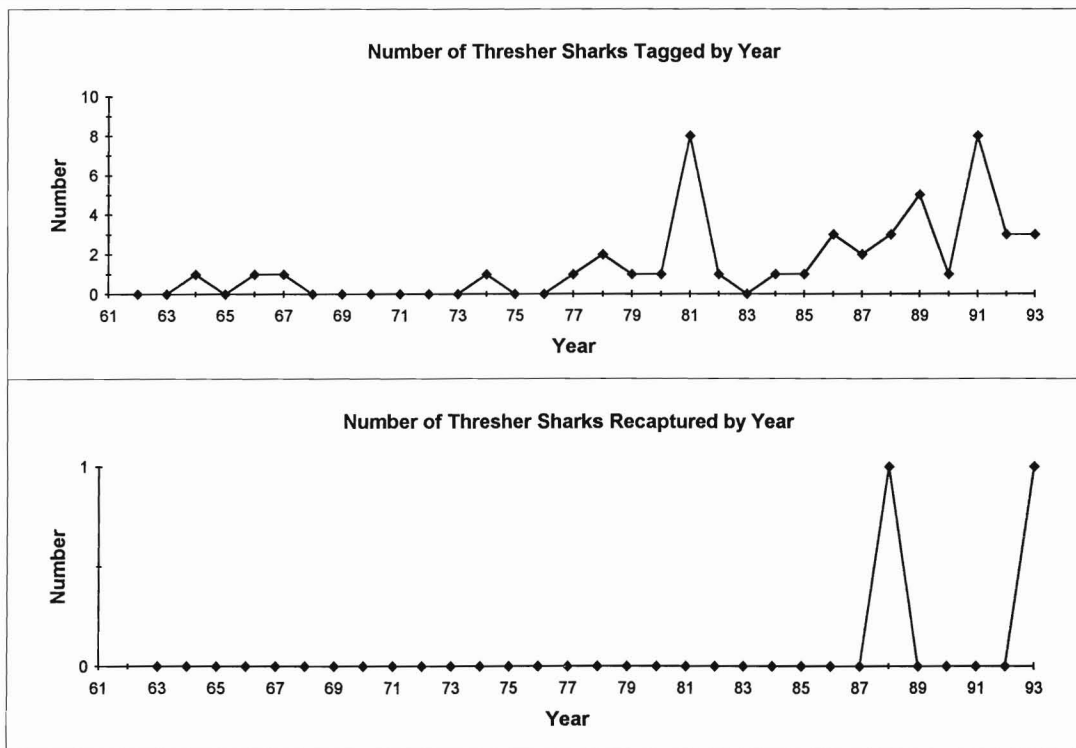


Figure 22.—Total number of thresher shark, *Alopias vulpinus*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

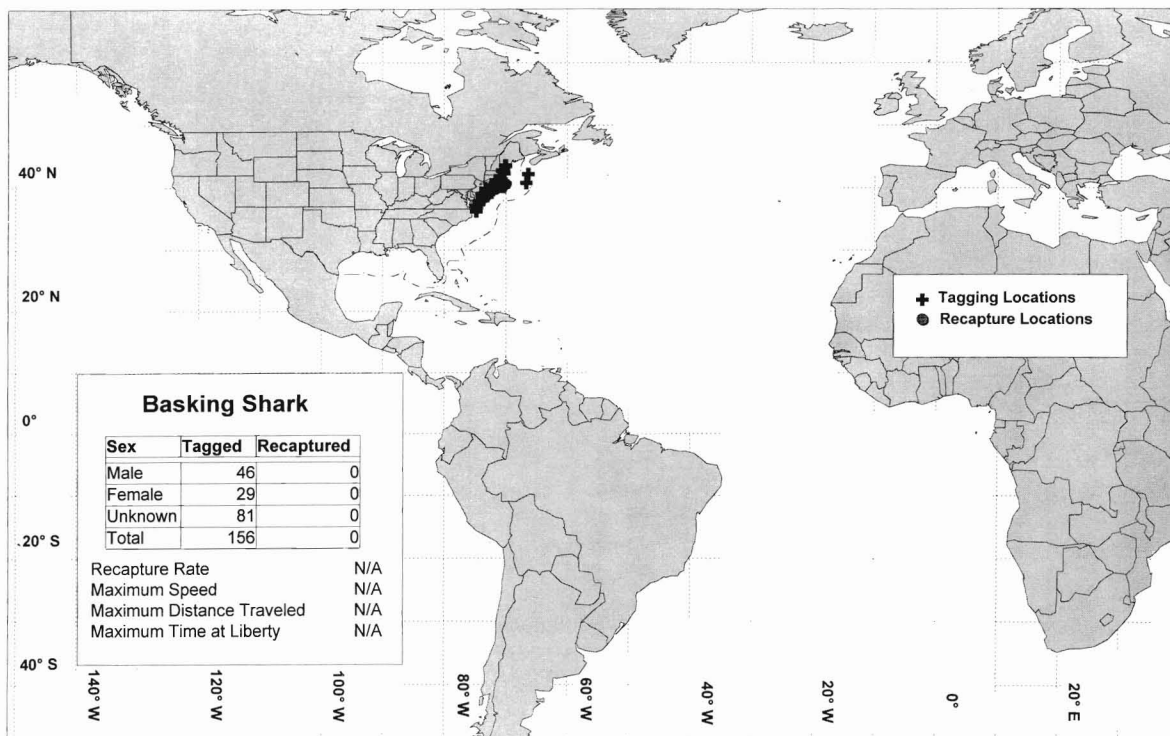


Figure 23.—Atlantic distribution of tag and recapture locations for the basking shark, *Cetorhinus maximus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

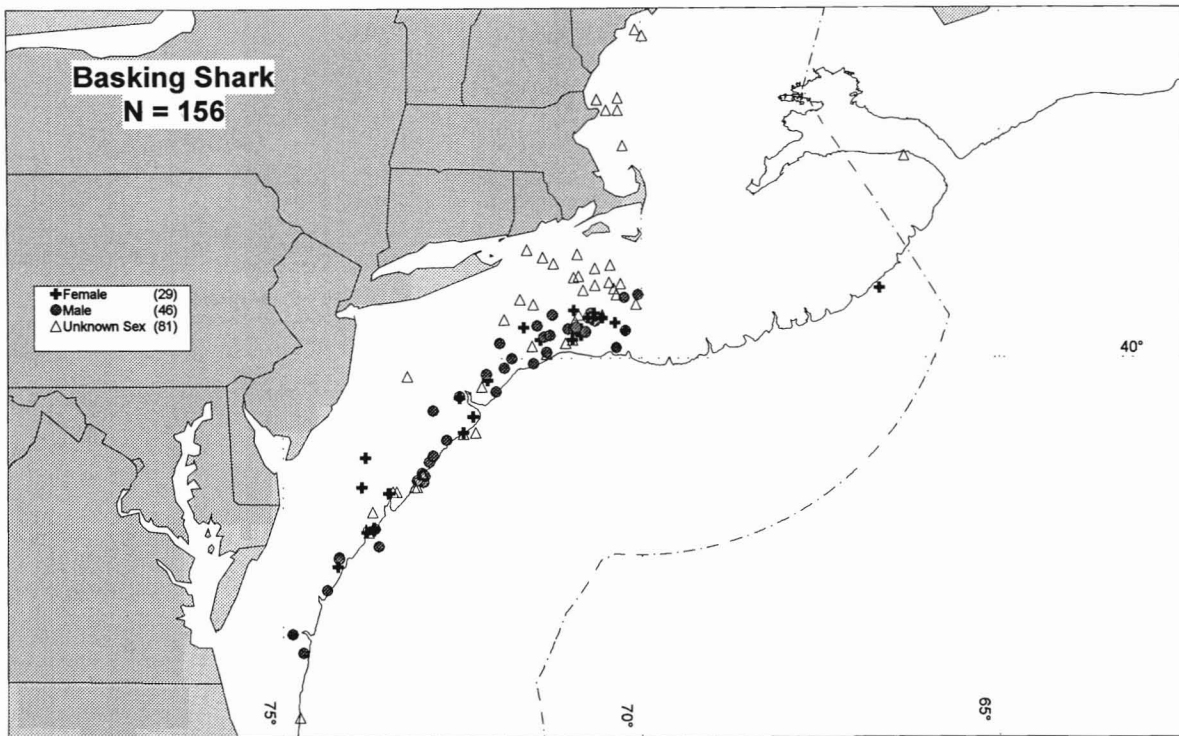


Figure 24.—Total tagging distribution for the basking shark, *Cetorhinus maximus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

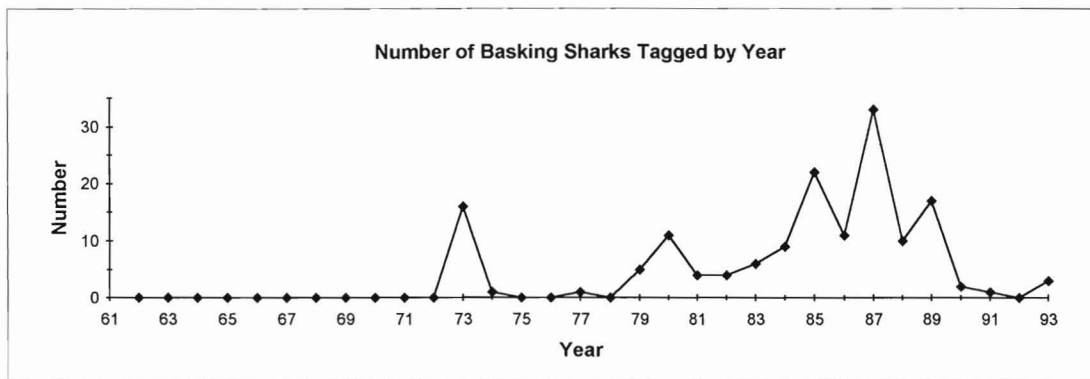


Figure 25.—Total number of basking shark, *Cetorhinus maximus*, tagged by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

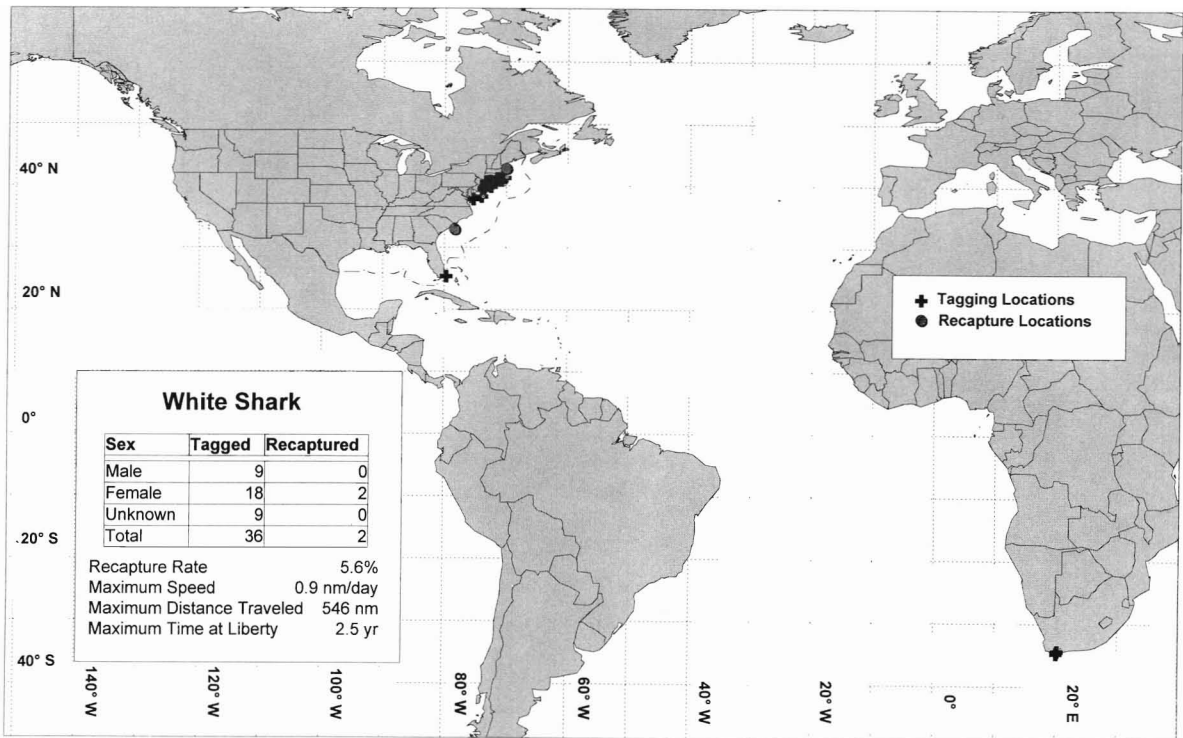


Figure 26.—Atlantic distribution of tag and recapture locations for the white shark, *Carcharodon carcharias*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

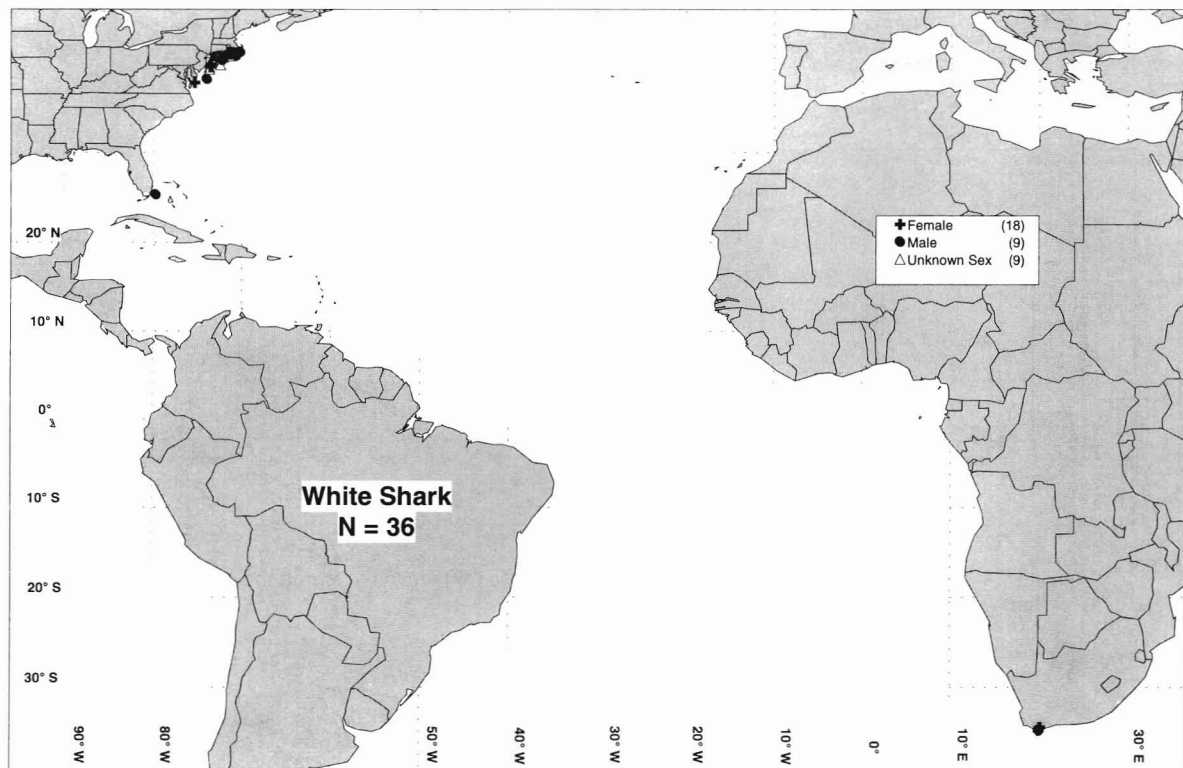


Figure 27.—Total tagging distribution for the white shark, *Carcharodon carcharias*, from the NMFS Cooperative Shark Tagging Program during 1962–93.

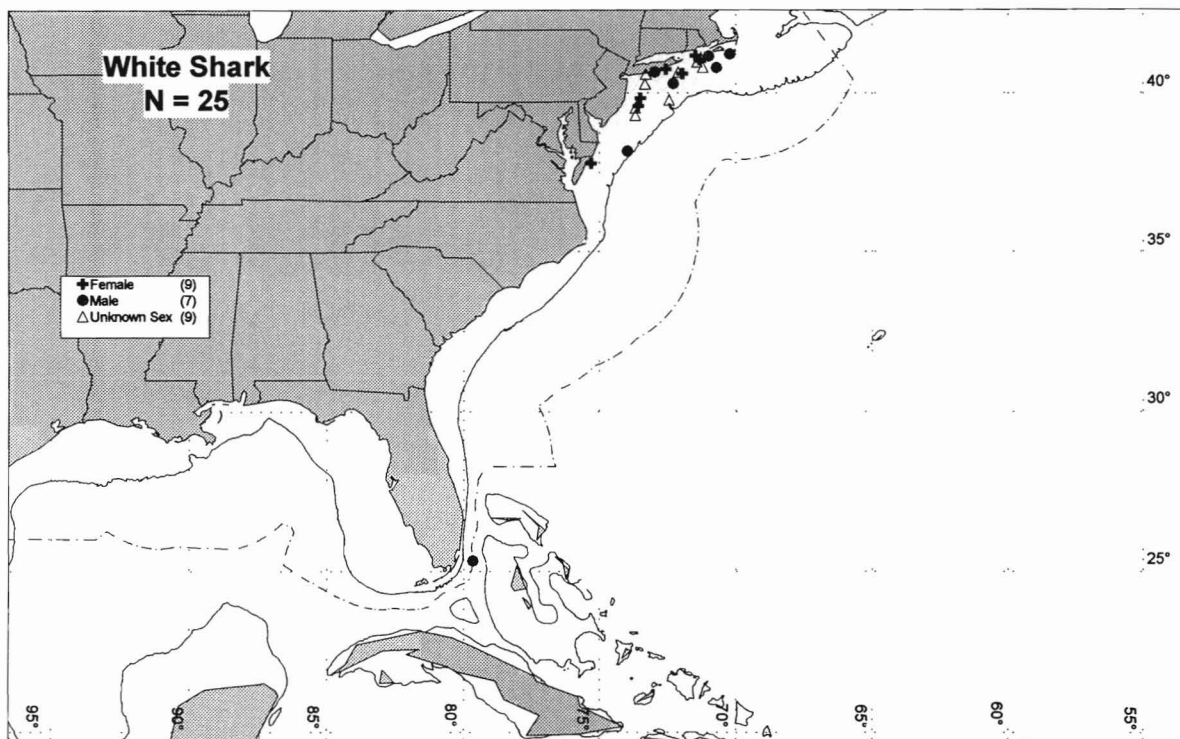


Figure 28.—U.S. tagging distribution of the white shark, *Carcharodon carcharias*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

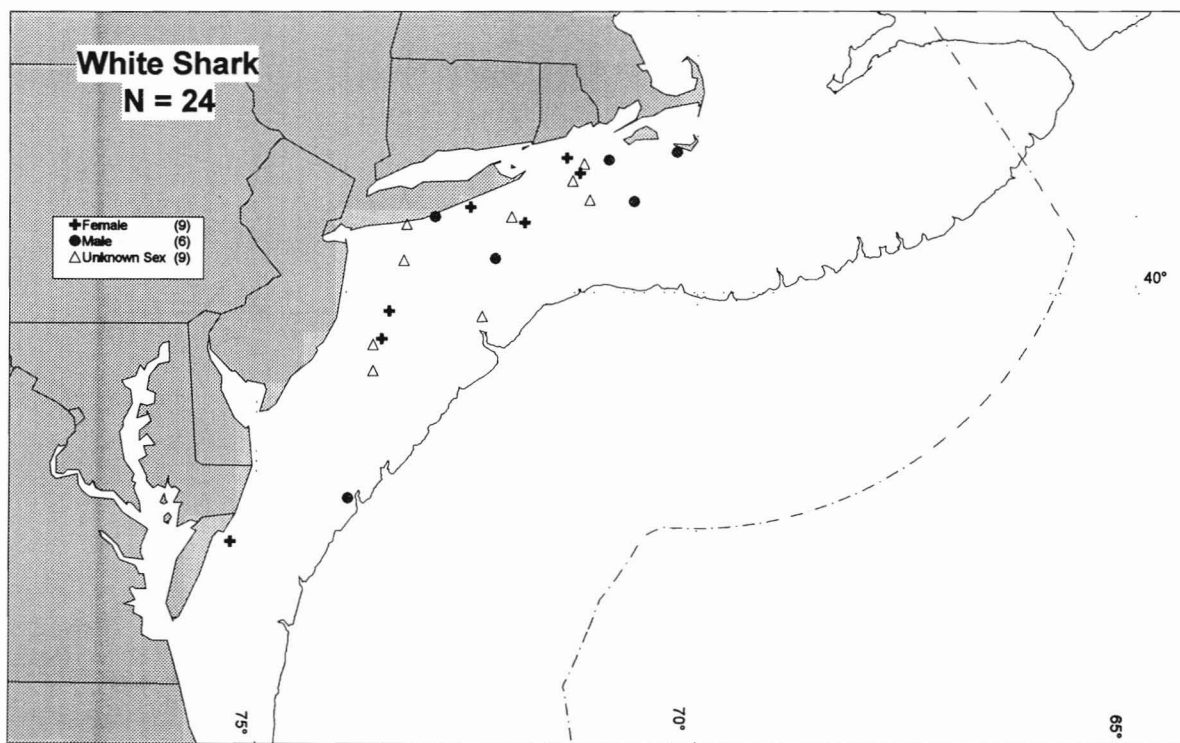


Figure 29.—Northeastern U.S. tagging distribution of the white shark, *Carcharodon carcharias*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

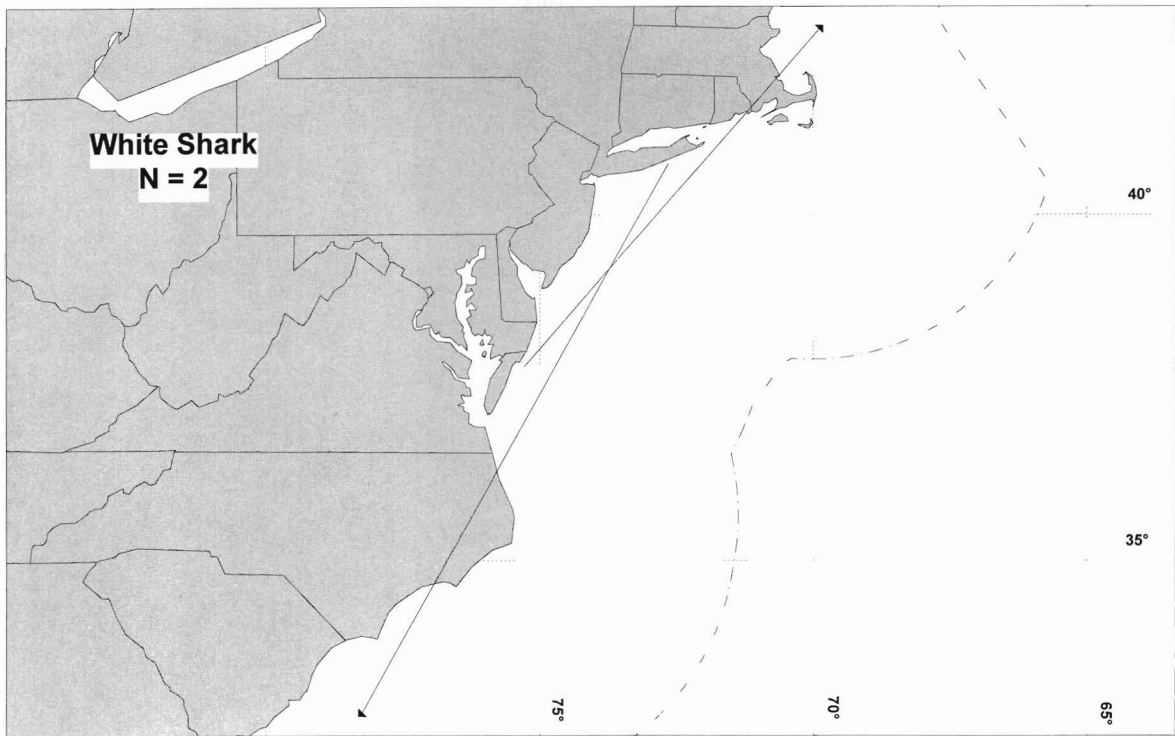


Figure 30.—Recapture distribution for the white shark, *Carcharodon carcharias*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

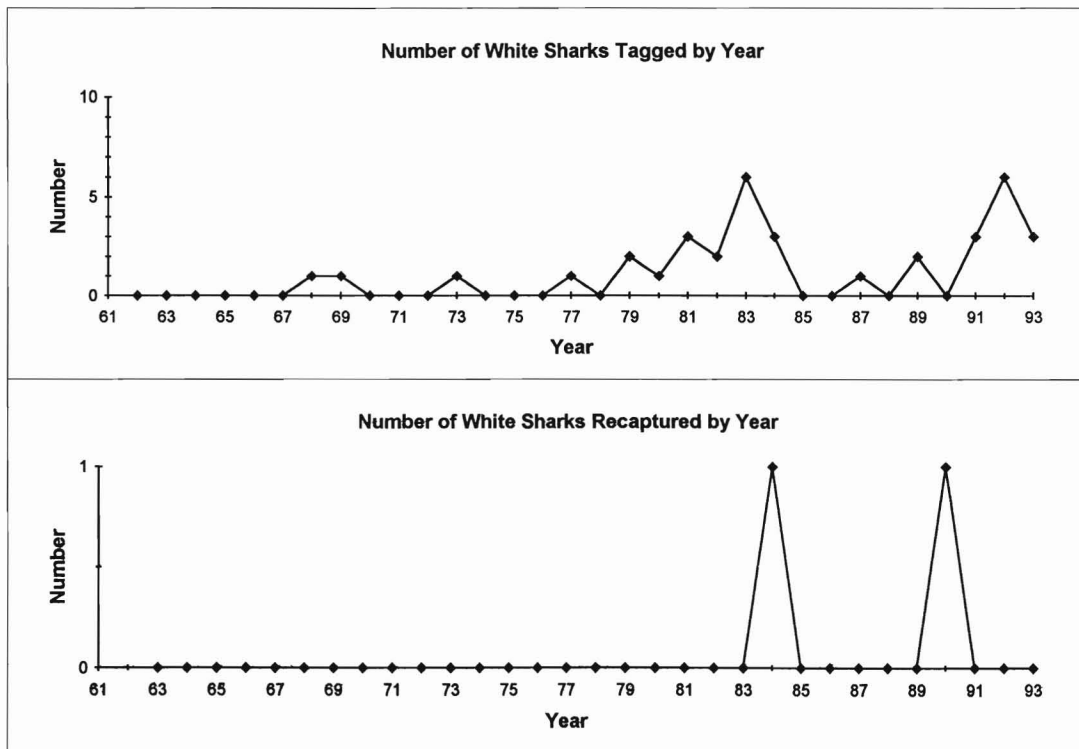


Figure 31.—Total number of white shark, *Carcharodon carcharias*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

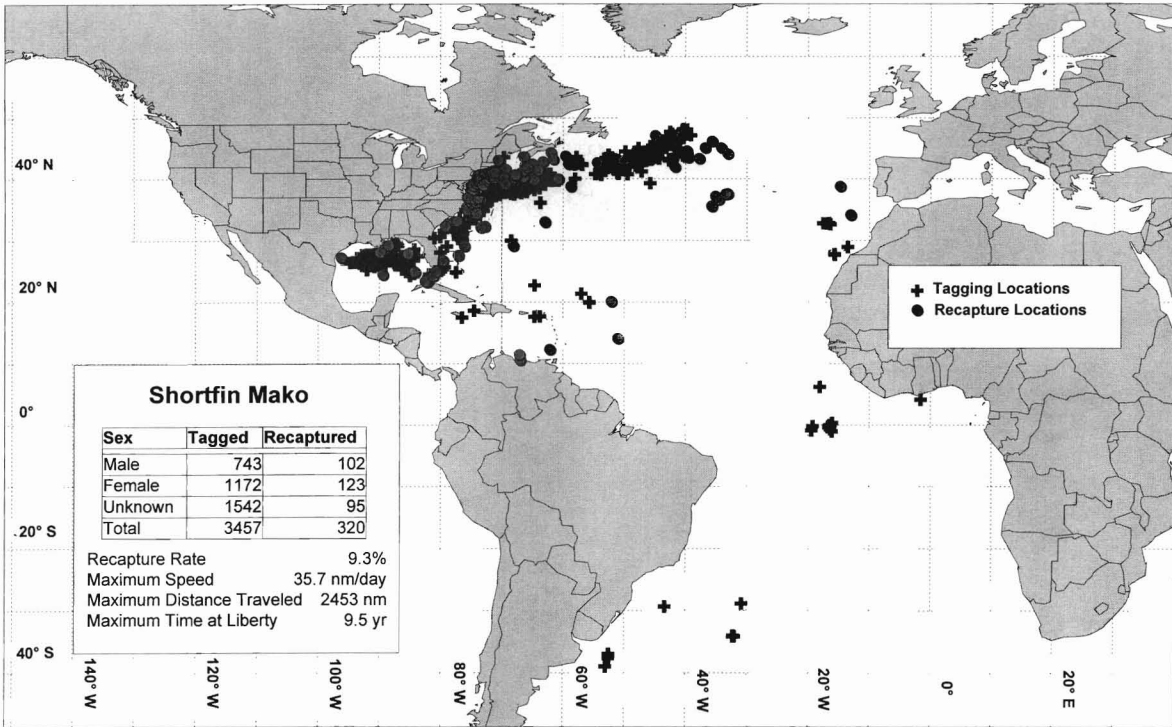


Figure 32.—Atlantic distribution of tag and recapture locations for the shortfin mako, *Isurus oxyrinchus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

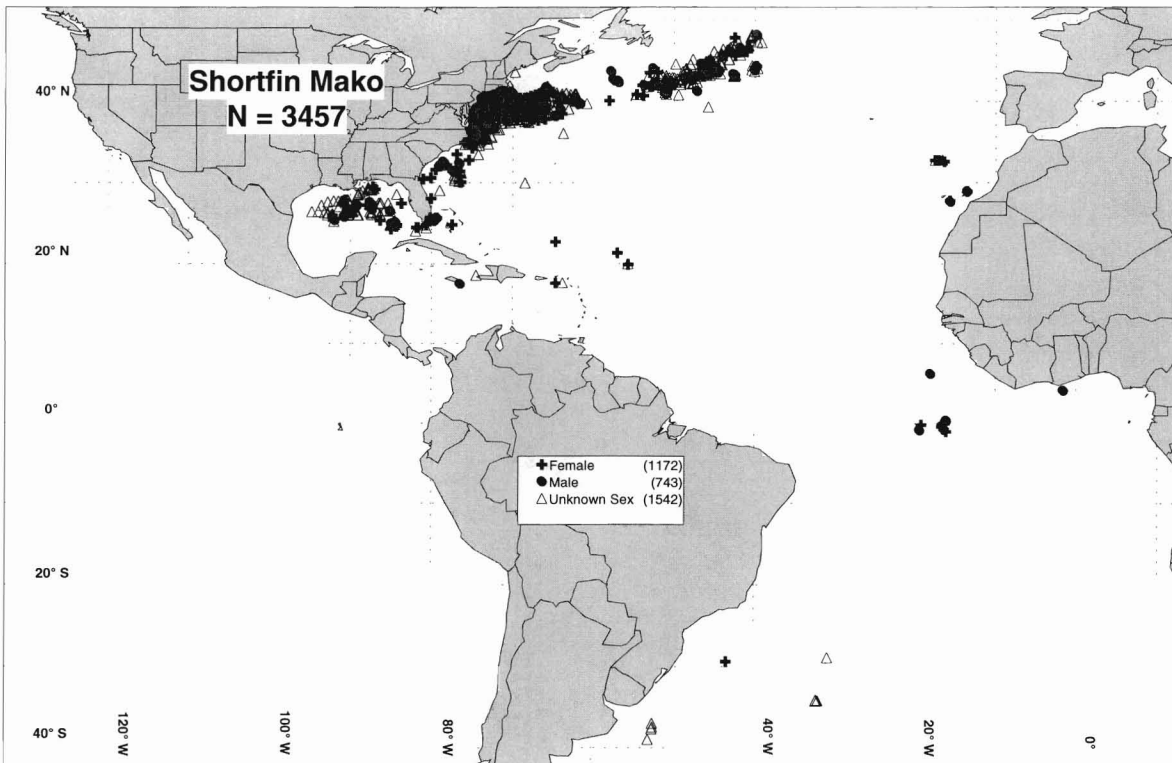


Figure 33.—Total tagging distribution for the shortfin mako, *Isurus oxyrinchus*, from the NMFS Cooperative Shark Tagging Program during 1962–93.

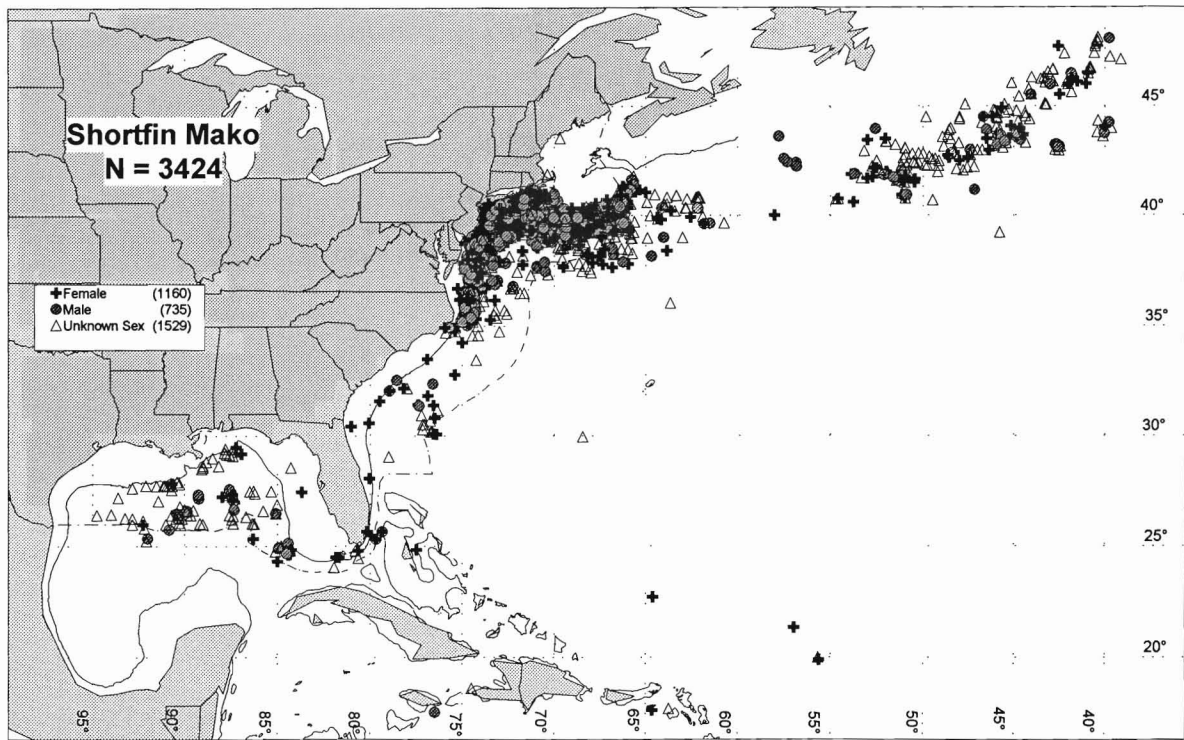


Figure 34.—U.S. tagging distribution of the shortfin mako, *Isurus oxyrinchus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

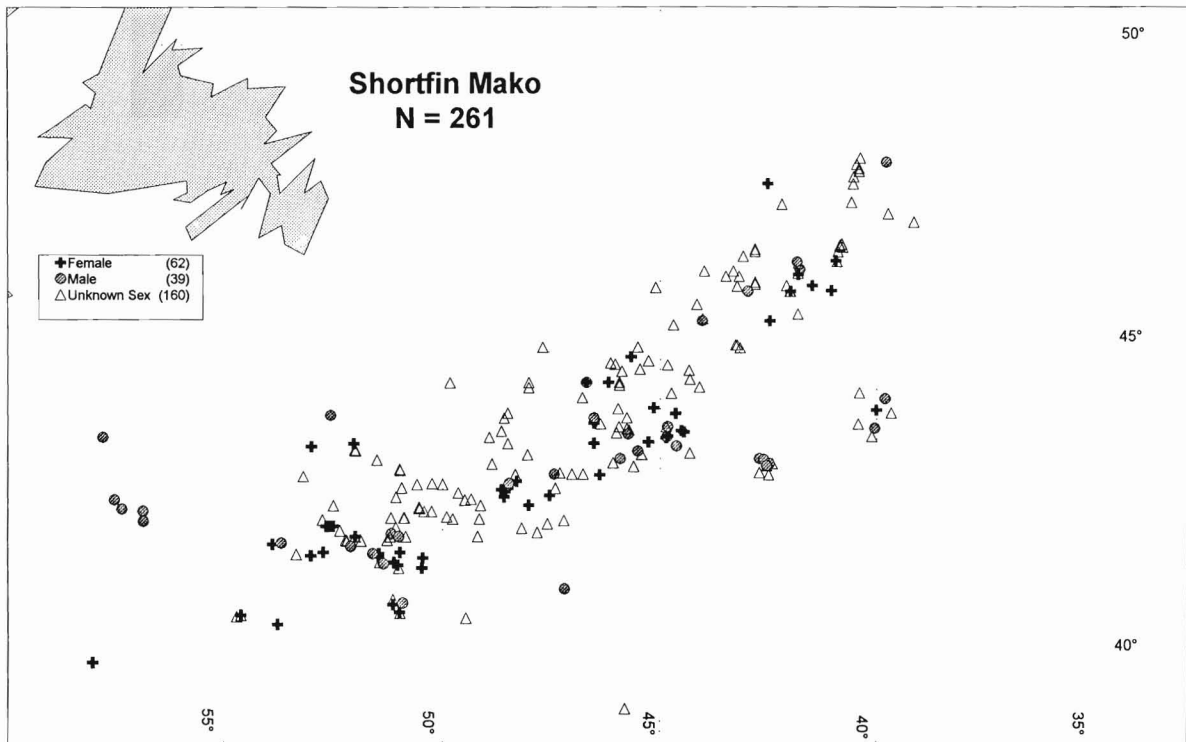


Figure 35.—Grand Banks tagging distribution of the shortfin mako, *Isurus oxyrinchus*, from the NMFS Cooperative Shark Tagging Program during 1962–93.

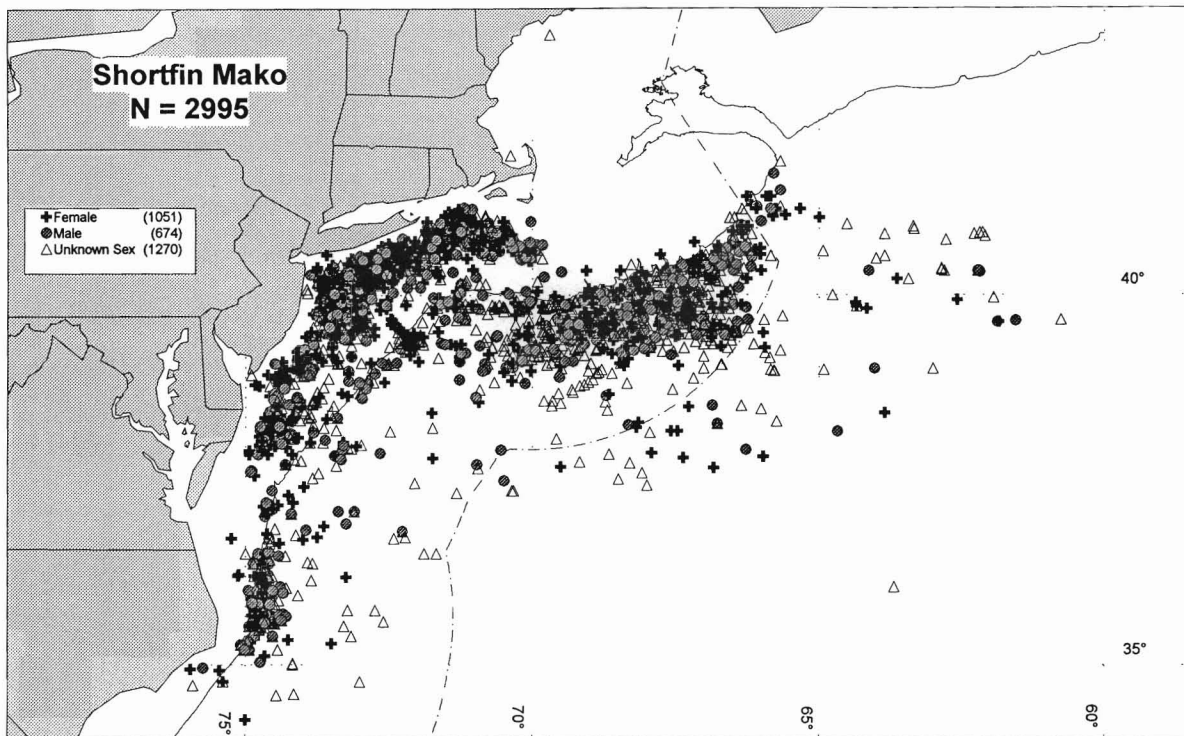


Figure 36.—Northeastern U.S. tagging distribution of the shortfin mako, *Isurus oxyrinchus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

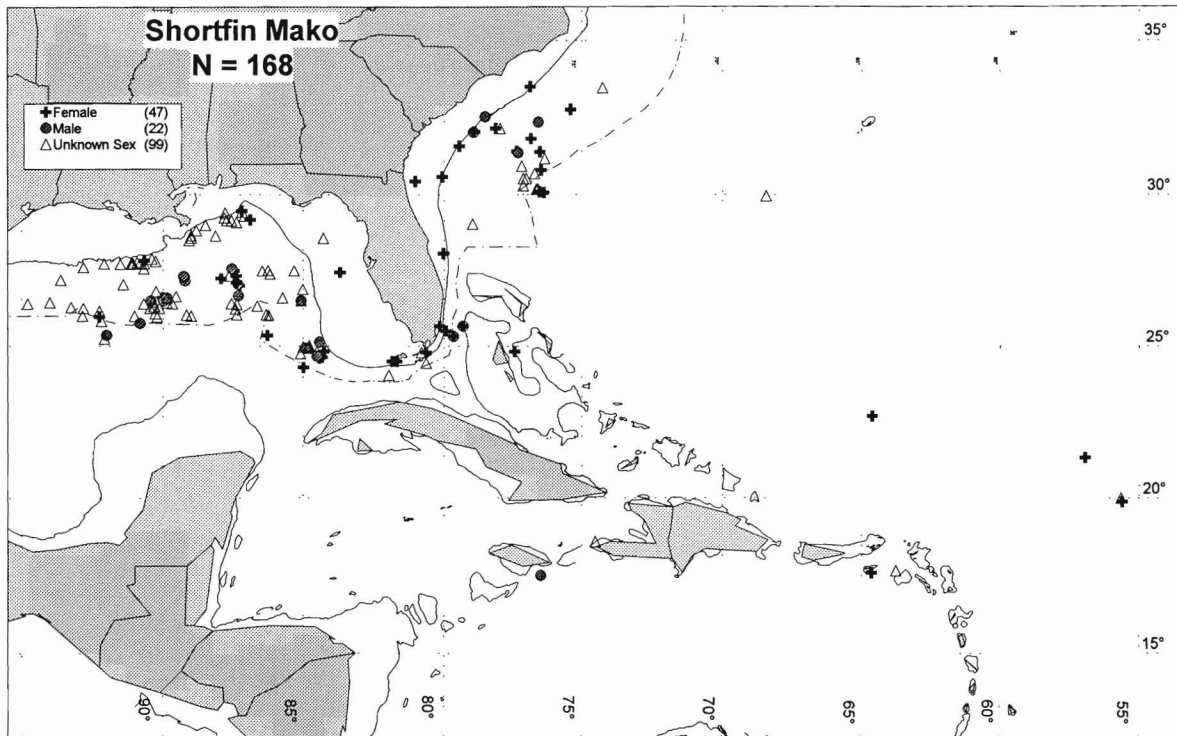


Figure 37.—Southeastern U.S. tagging distribution of the shortfin mako, *Isurus oxyrinchus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

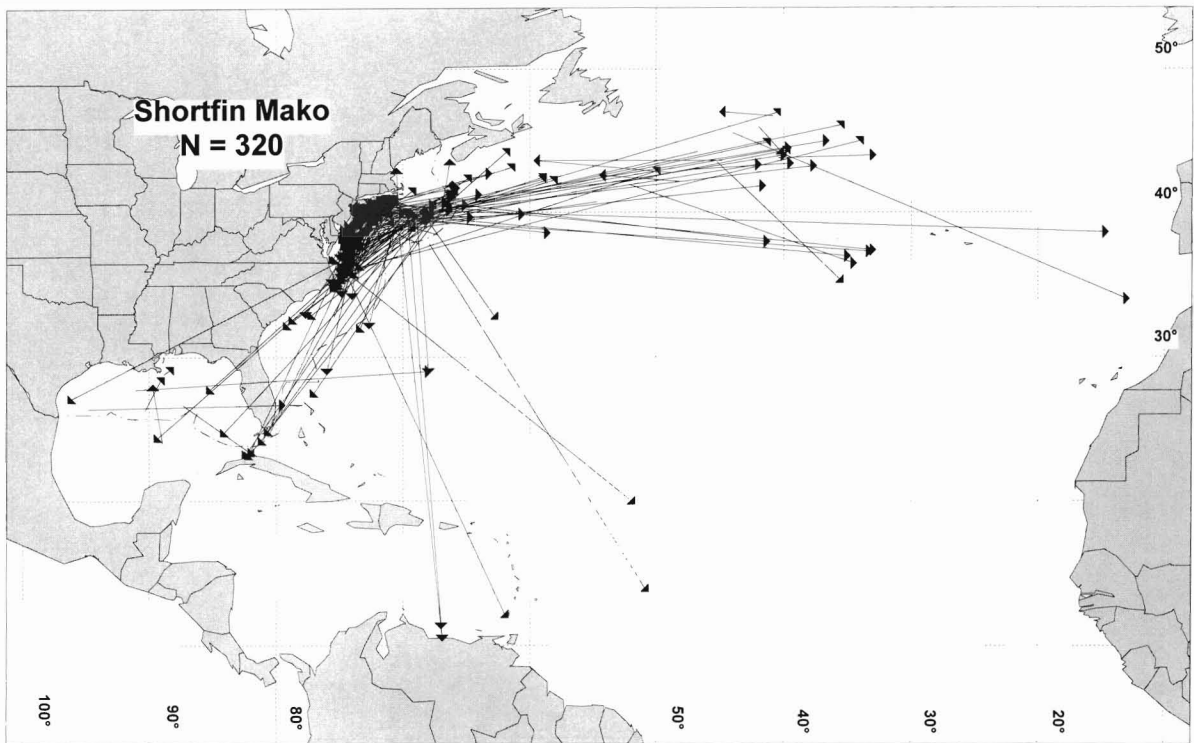


Figure 38.—Recapture distribution for the shortfin mako, *Isurus oxyrinchus*, from the NMFS Cooperative Shark Tagging Program during 1962–93.

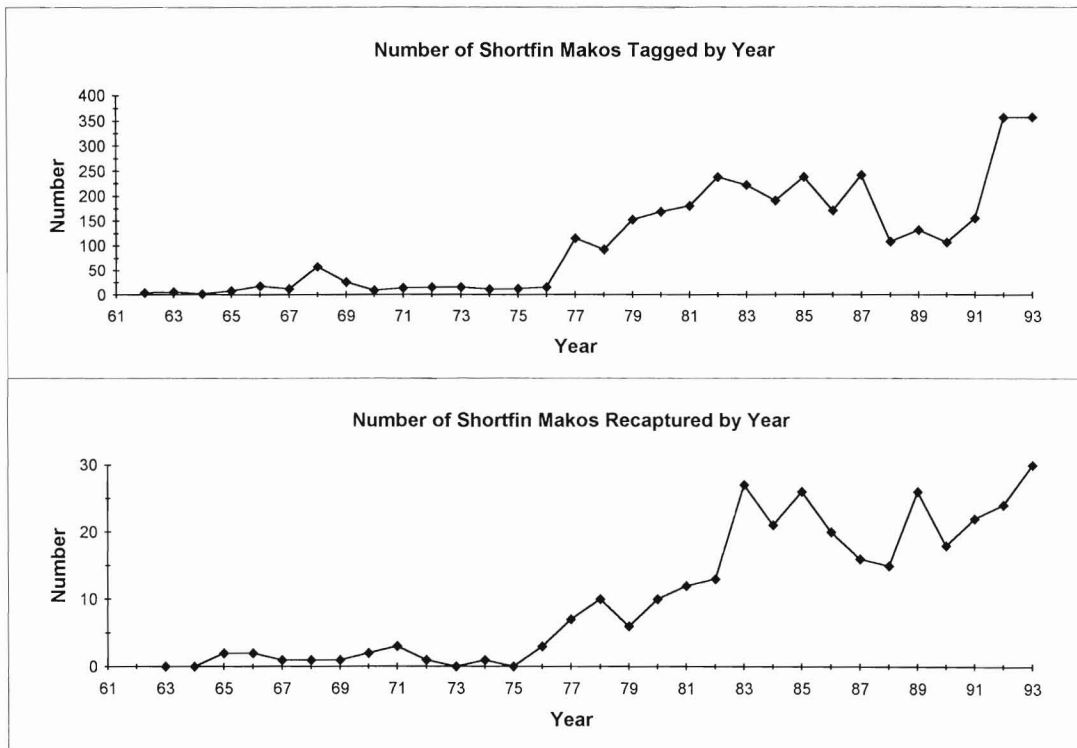


Figure 39.—Total number of shortfin mako, *Isurus oxyrinchus*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

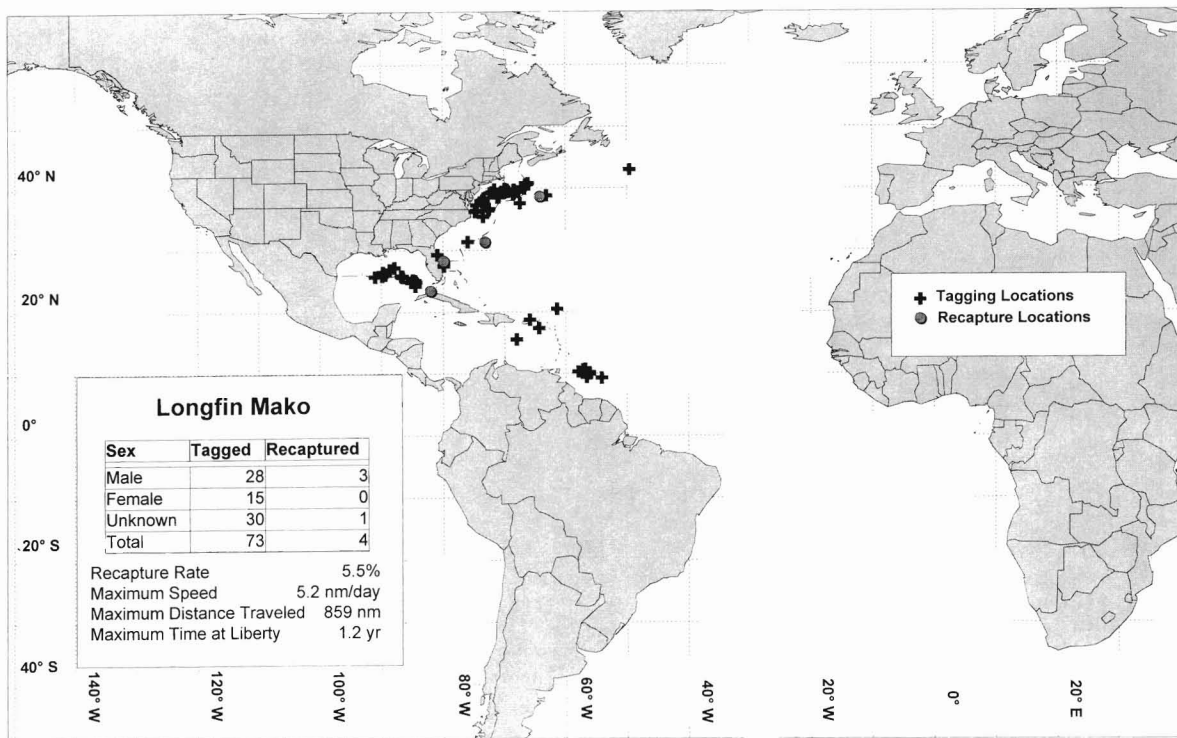


Figure 40.—Atlantic distribution of tag and recapture locations for the longfin mako, *Isurus paucus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

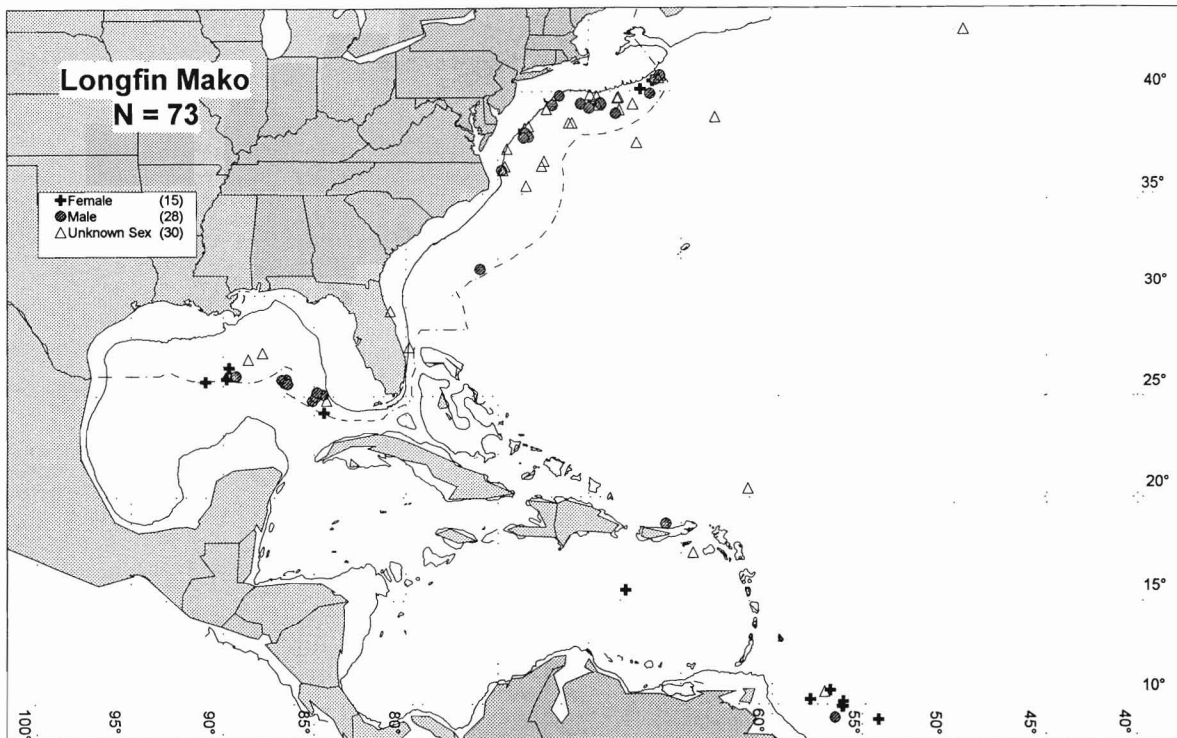


Figure 41.—Total tagging distribution for the longfin mako, *Isurus paucus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

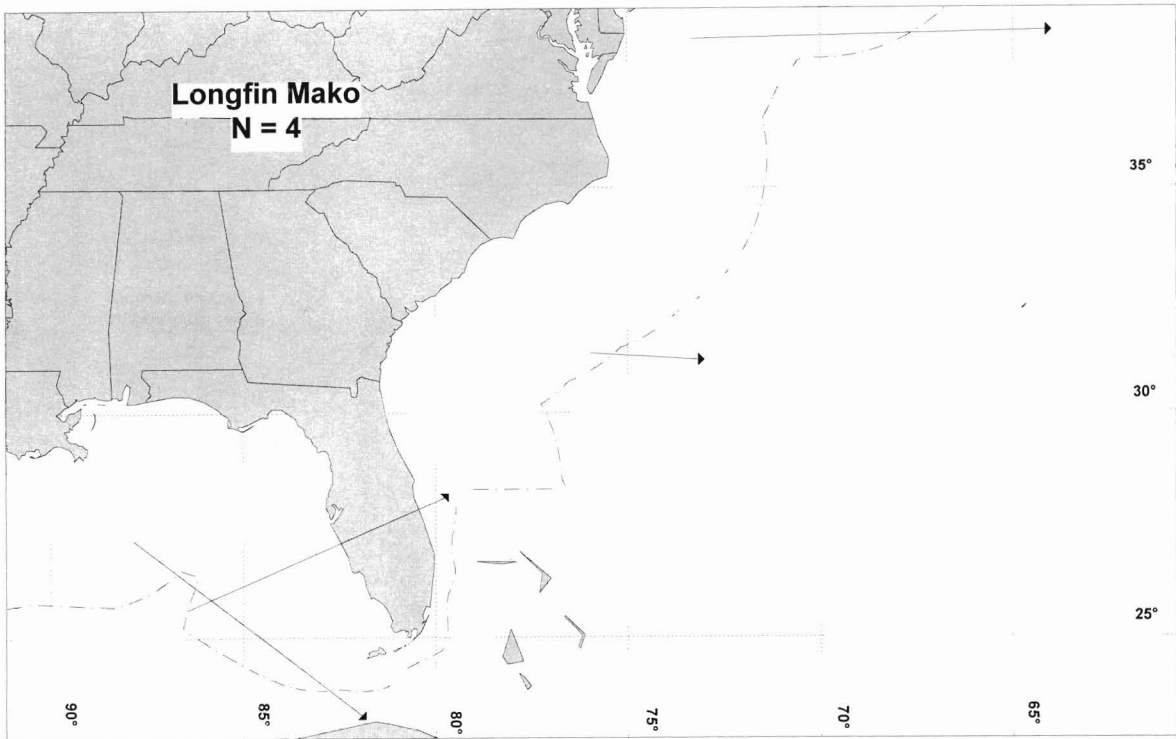


Figure 42.—Recapture distribution for the longfin mako, *Isurus paucus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

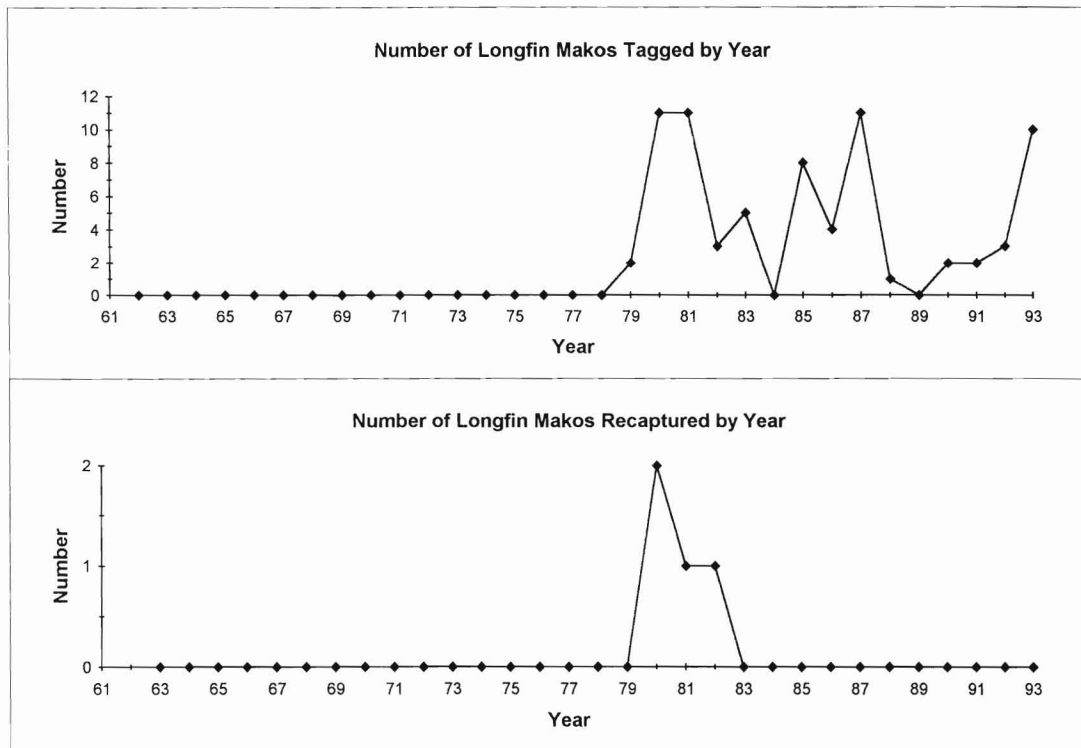


Figure 43.—Total number of longfin mako, *Isurus paucus*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

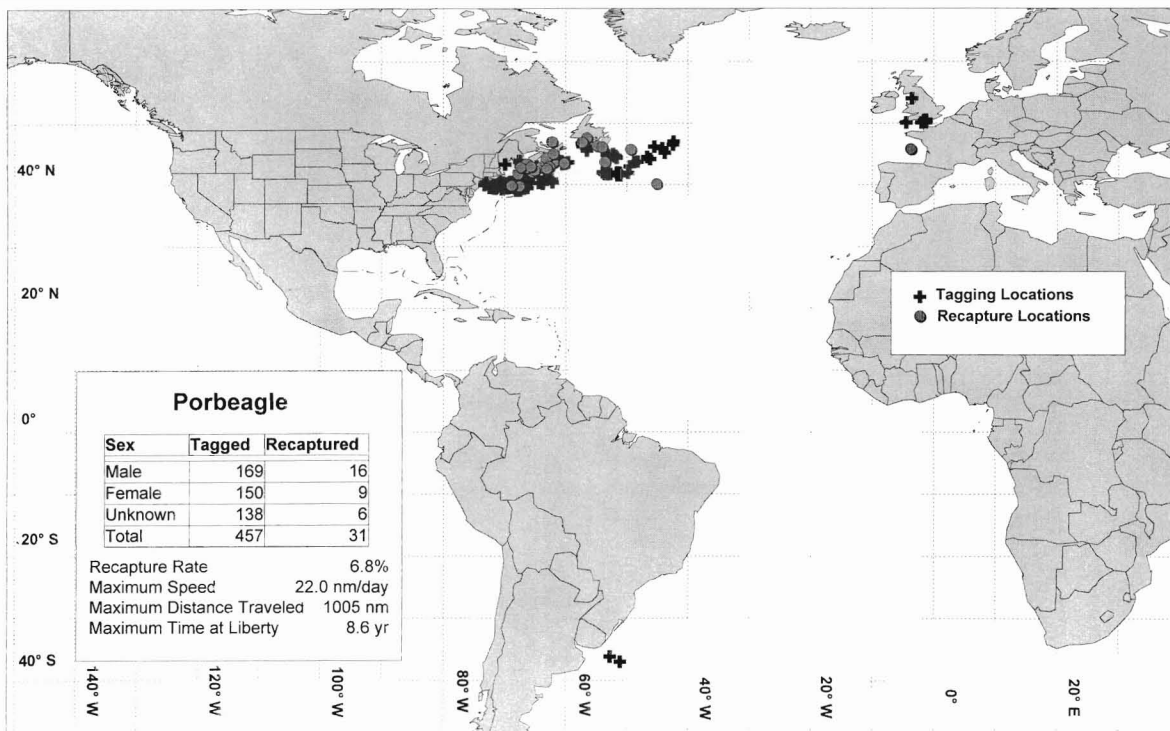


Figure 44.—Atlantic distribution of tag and recapture locations for the porbeagle, *Lamna nasus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

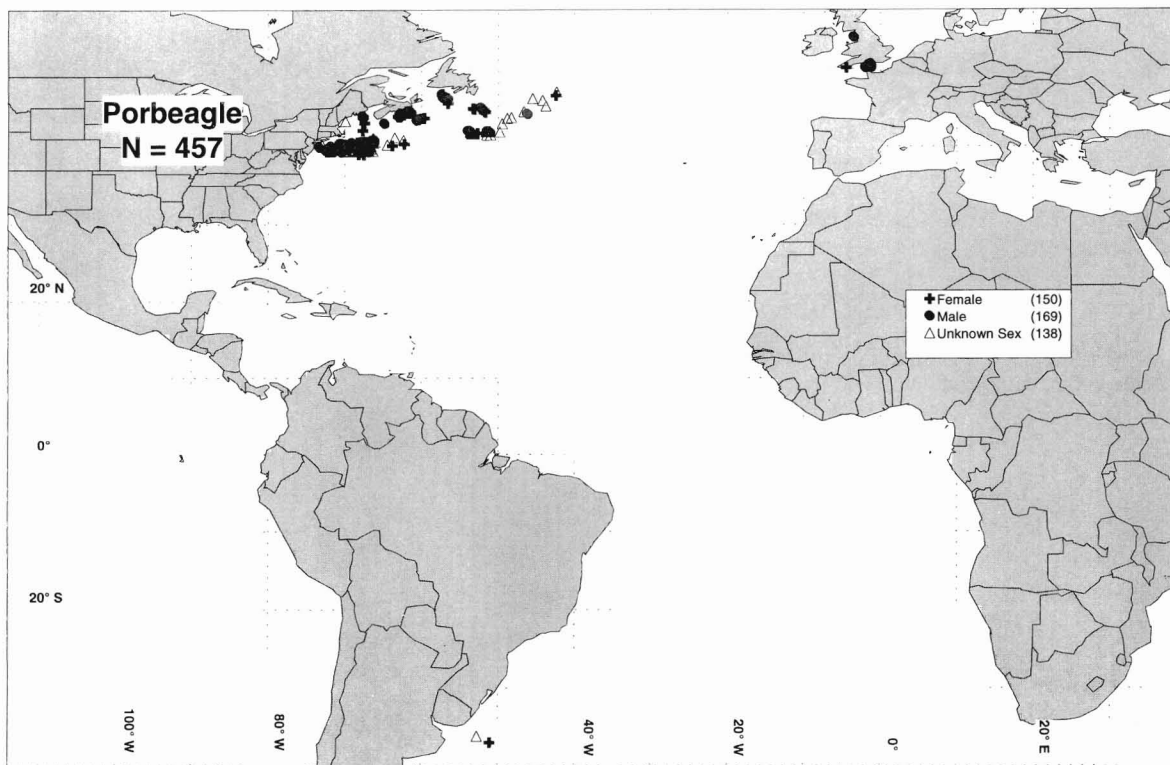


Figure 45.—Total tagging distribution for the porbeagle, *Lamna nasus*, from the NMFS Cooperative Shark Tagging Program during 1962–93.

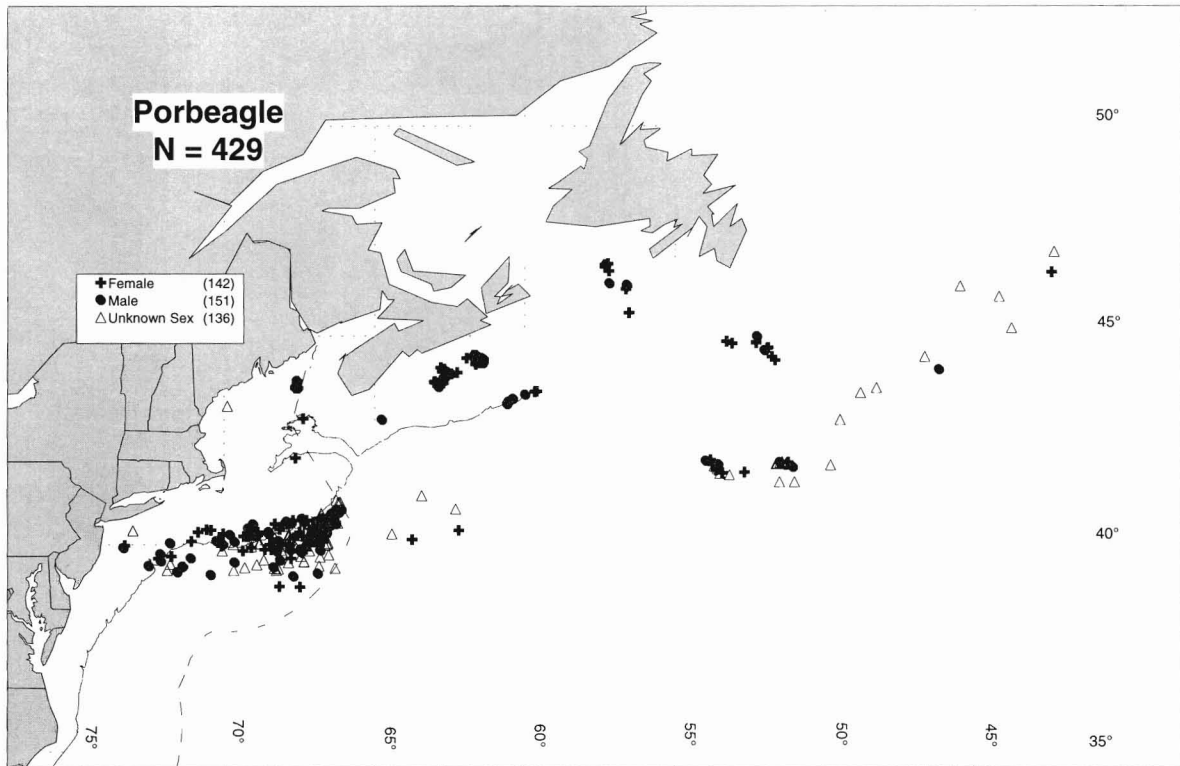


Figure 46.—Northeastern U.S. tagging distribution of the porbeagle, *Lamna nasus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

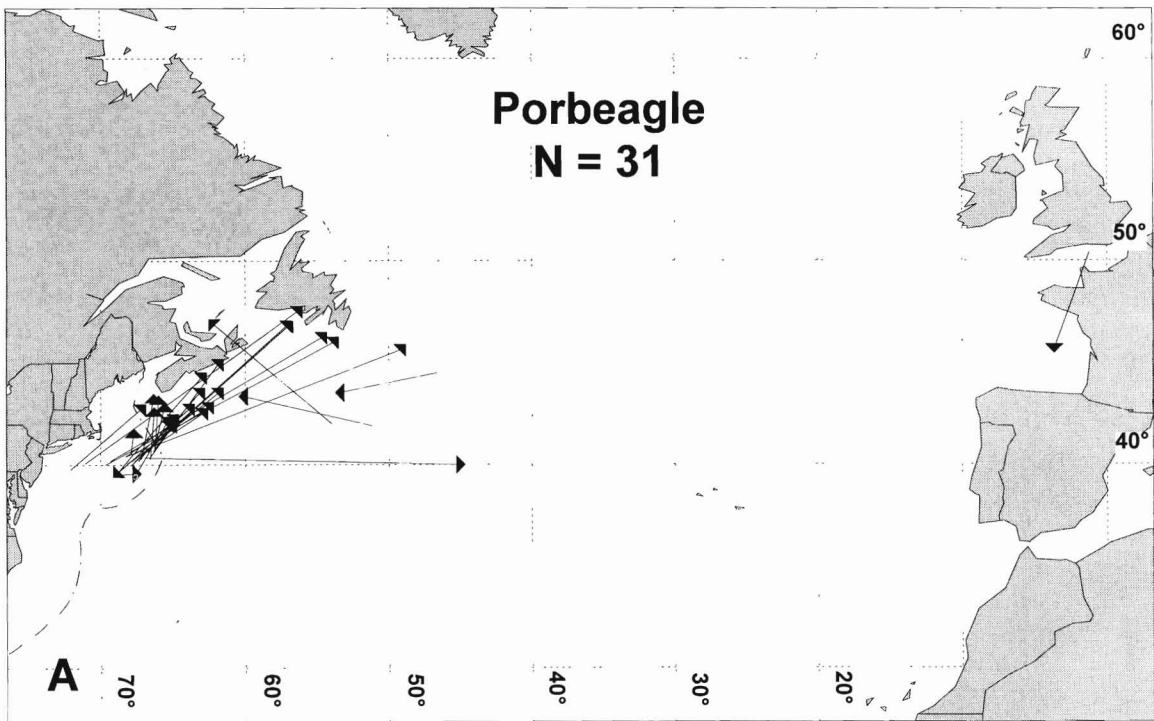


Figure 47a.—Recapture distribution for the porbeagle, *Lamna nasus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

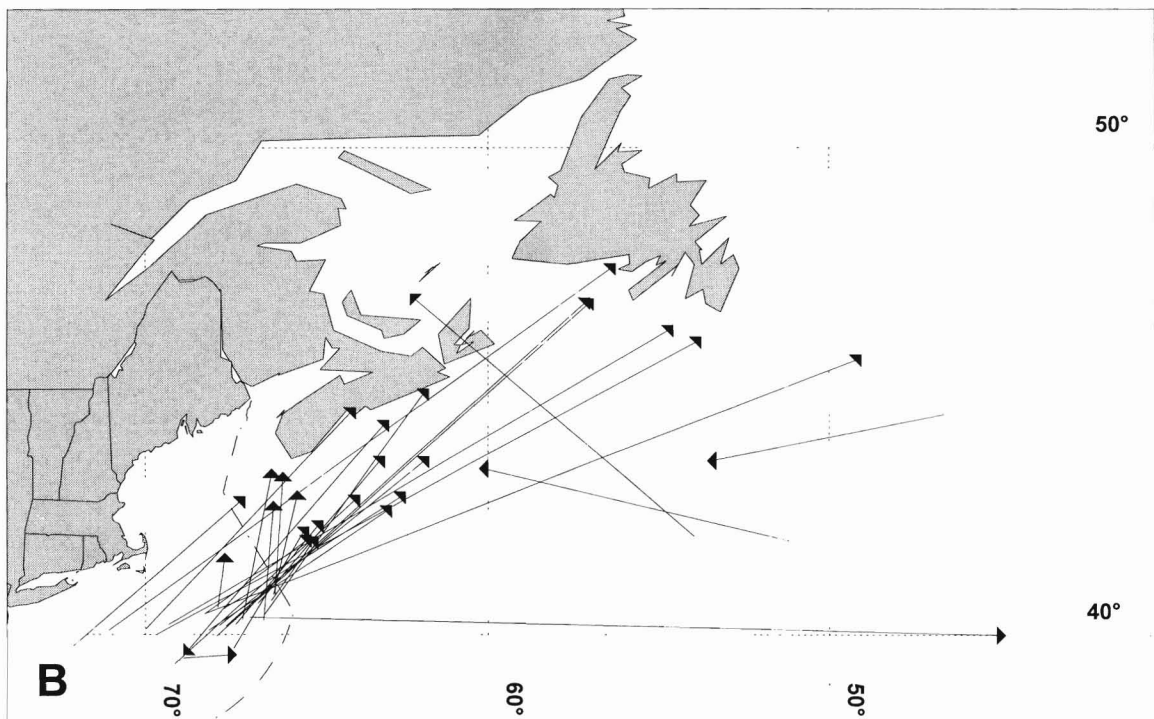


Figure 47b.—Detailed map of northeastern U.S. recapture distribution for the porbeagle, *Lamna nasus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

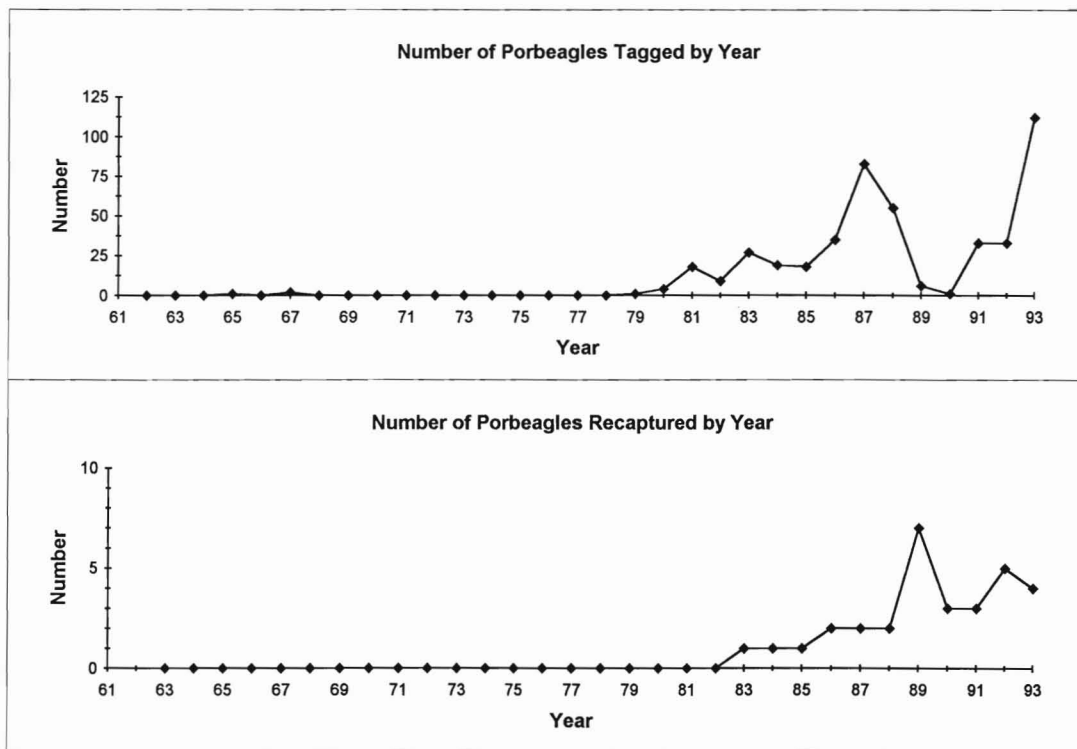


Figure 48.—Total number of porbeagle, *Lamna nasus*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

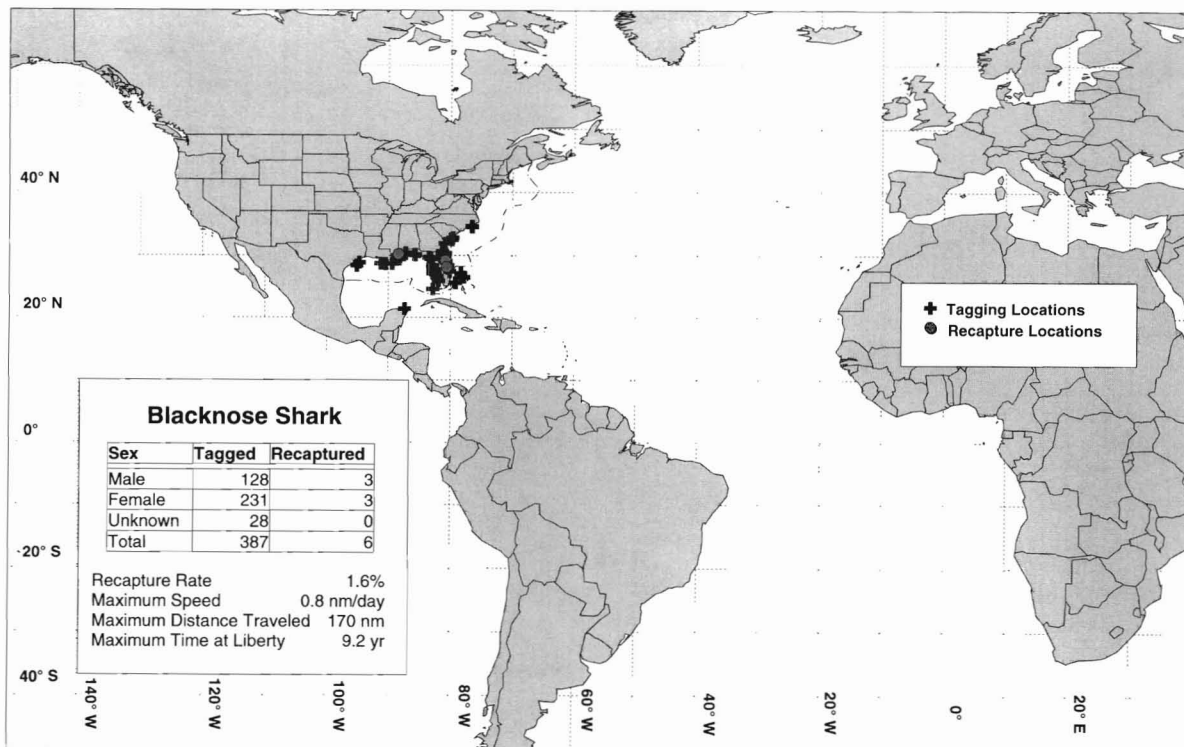


Figure 49.—Atlantic distribution of tag and recapture locations for the blacknose shark, *Carcharhinus acronotus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

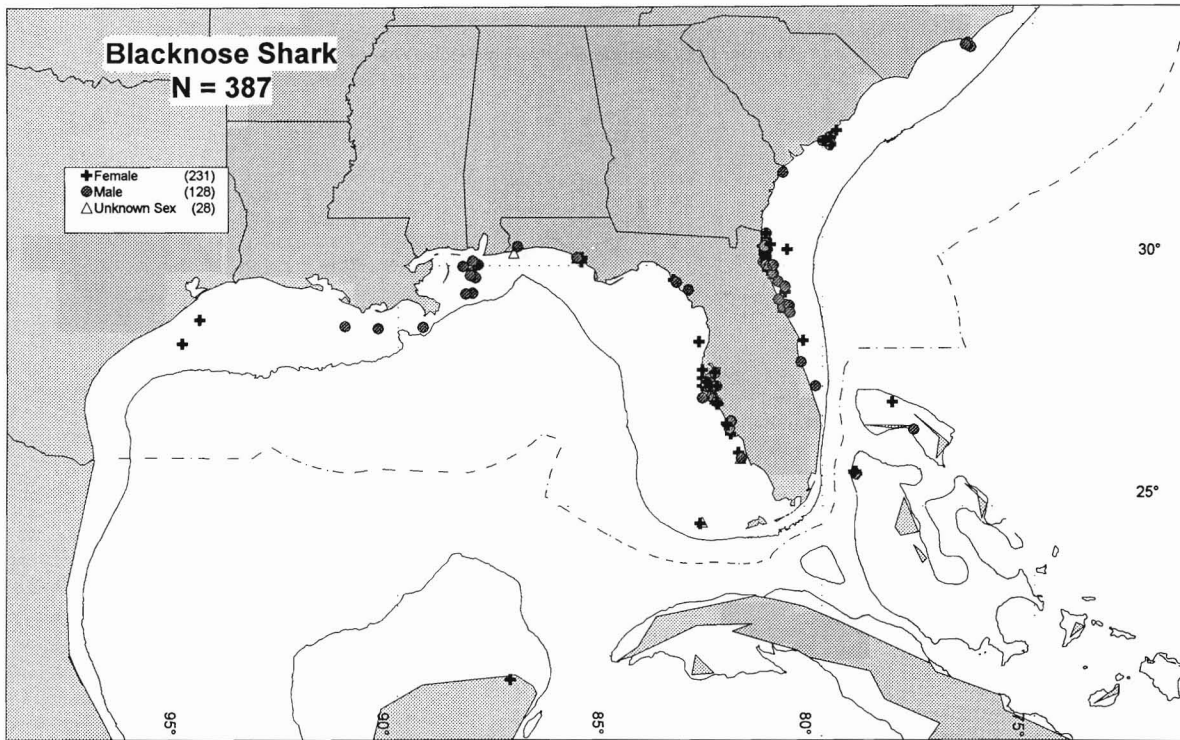


Figure 50.—Total tagging distribution for the blacknose shark, *Carcharhinus acronotus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

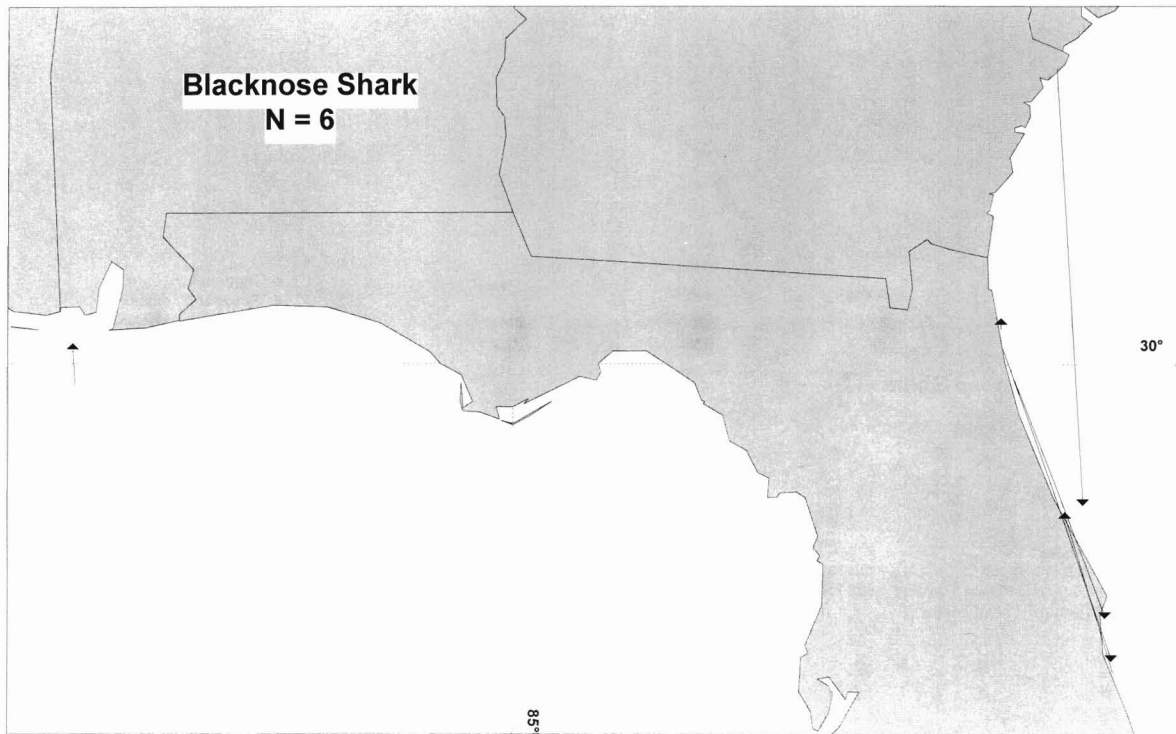


Figure 51.—Recapture distribution for the blacknose shark, *Carcharhinus acronotus*, from the NMFS Cooperative Shark Tagging Program during 1962–93.

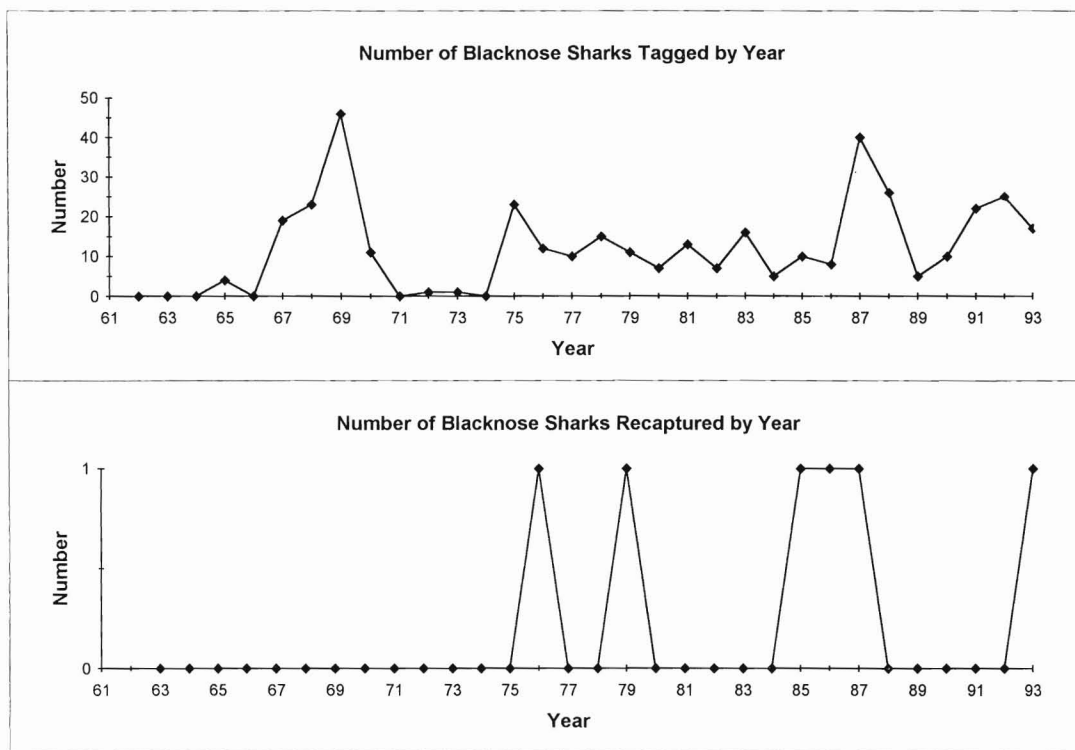


Figure 52.—Total number of blacknose shark, *Carcharhinus acronotus*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

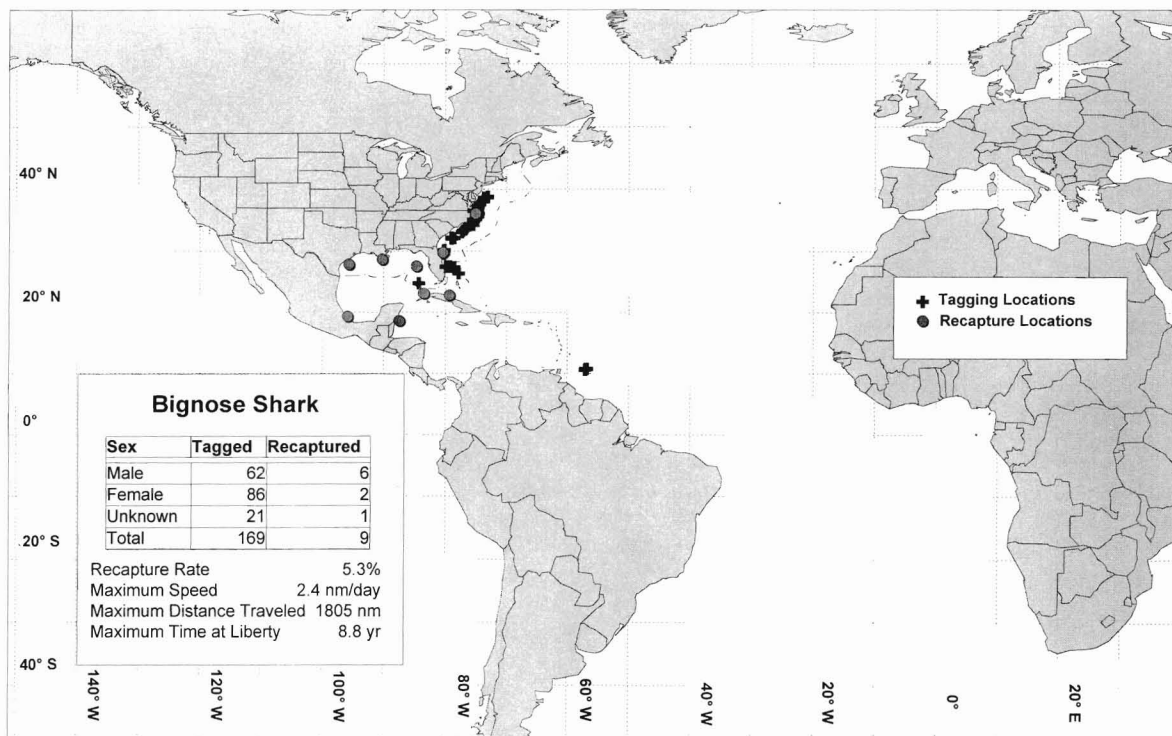


Figure 53.—Atlantic distribution of tag and recapture locations for the bignose shark, *Carcharhinus altimus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

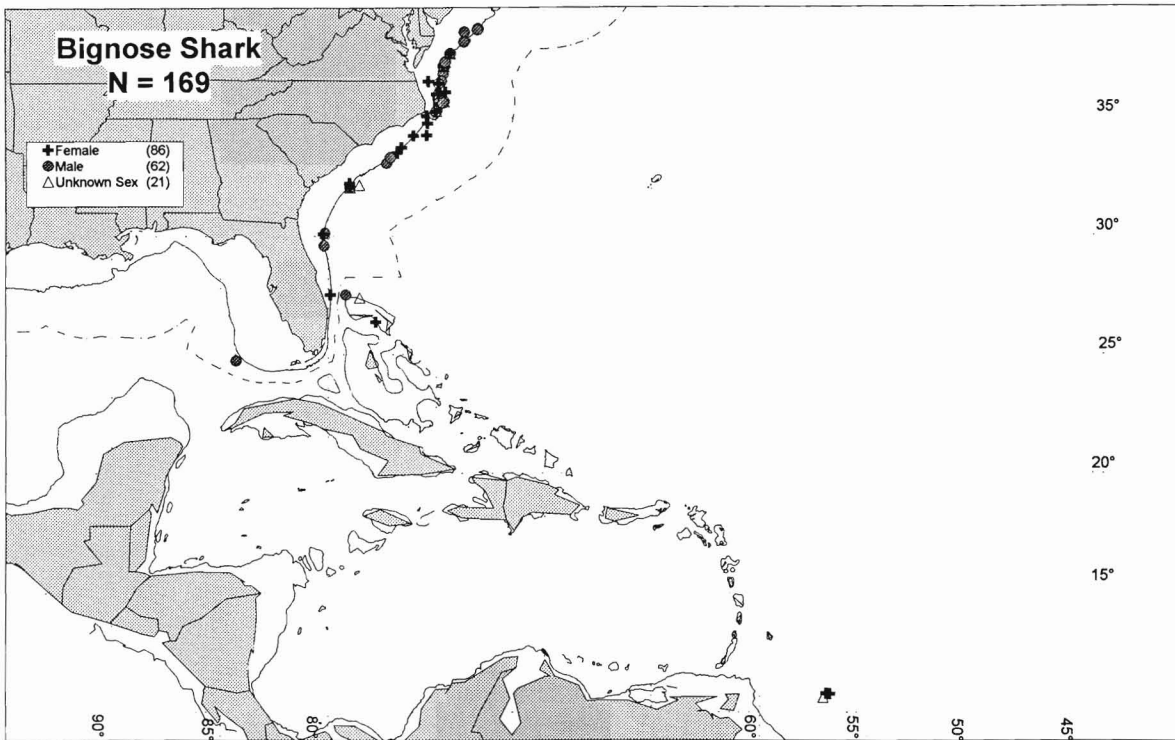


Figure 54.—Total tagging distribution for the bignose shark, *Carcharhinus altimus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

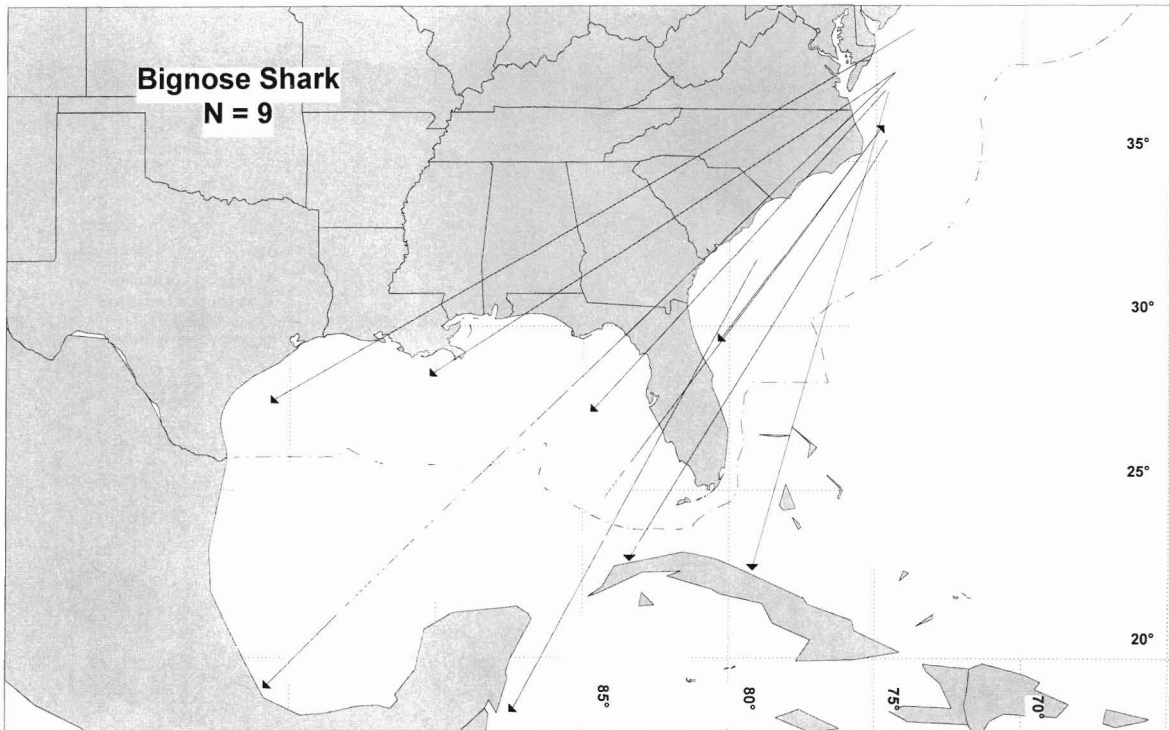


Figure 55.—Recapture distribution for the bignose shark, *Carcharhinus altimus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

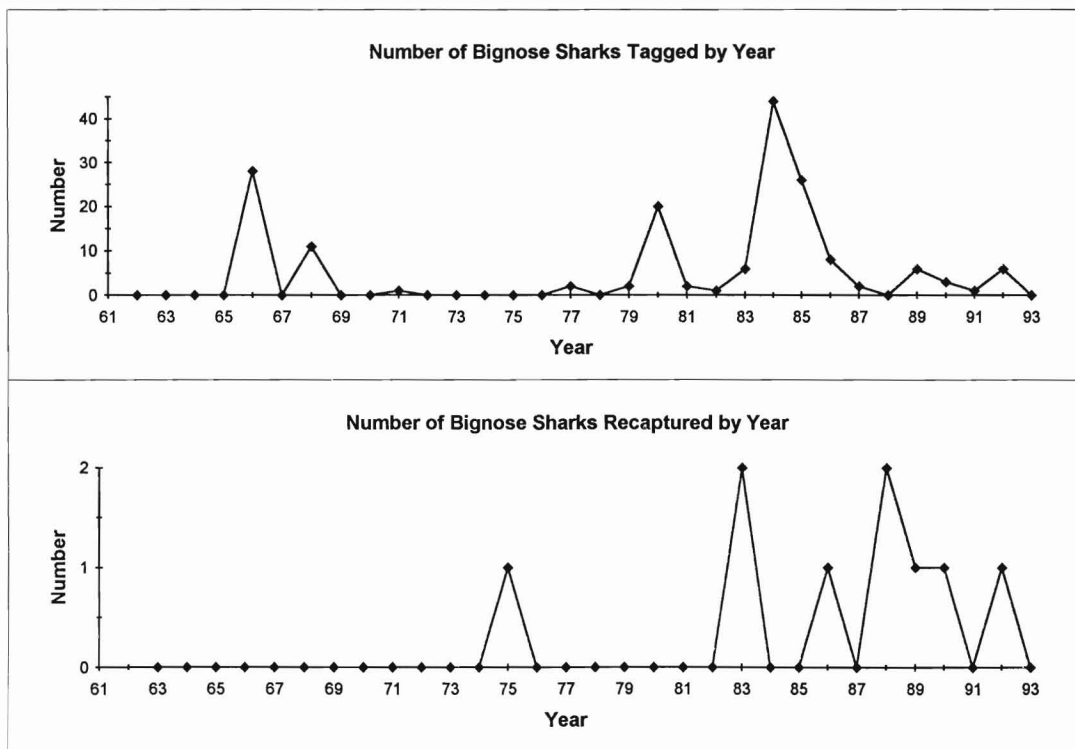


Figure 56.—Total number of bignose shark, *Carcharhinus altimus*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

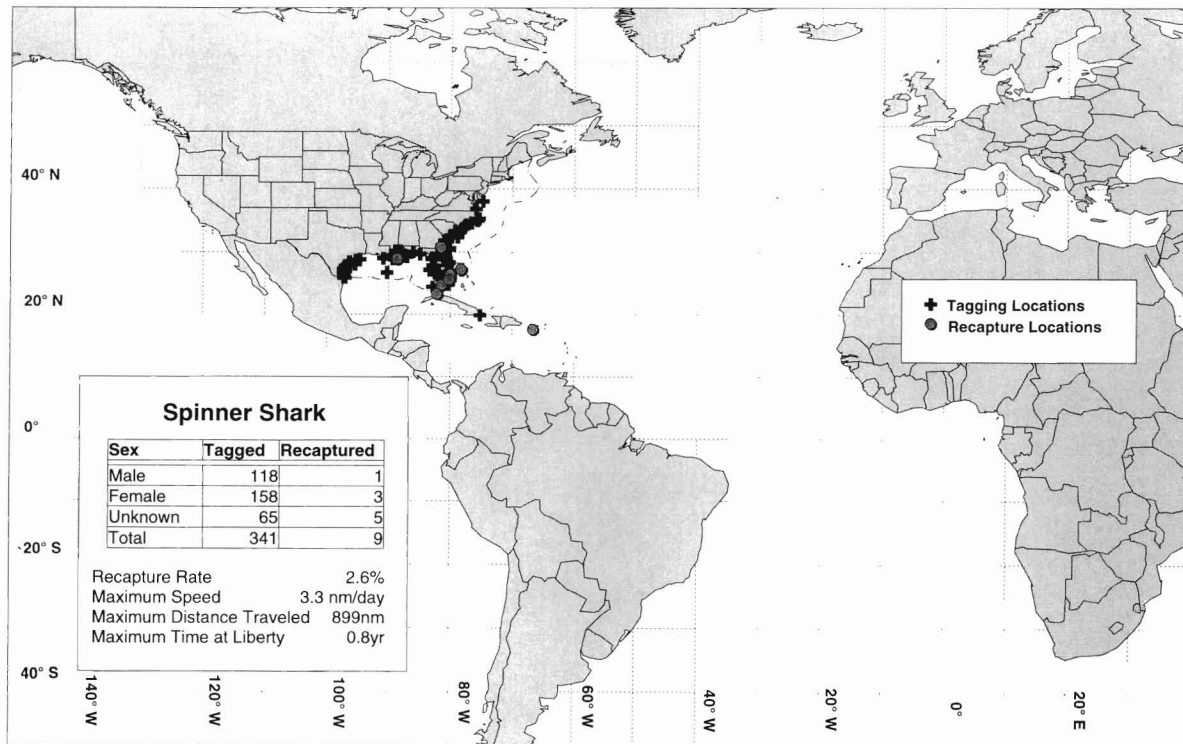


Figure 57.—Atlantic distribution of tag and recapture locations for the spinner shark, *Carcharhinus brevipinna*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

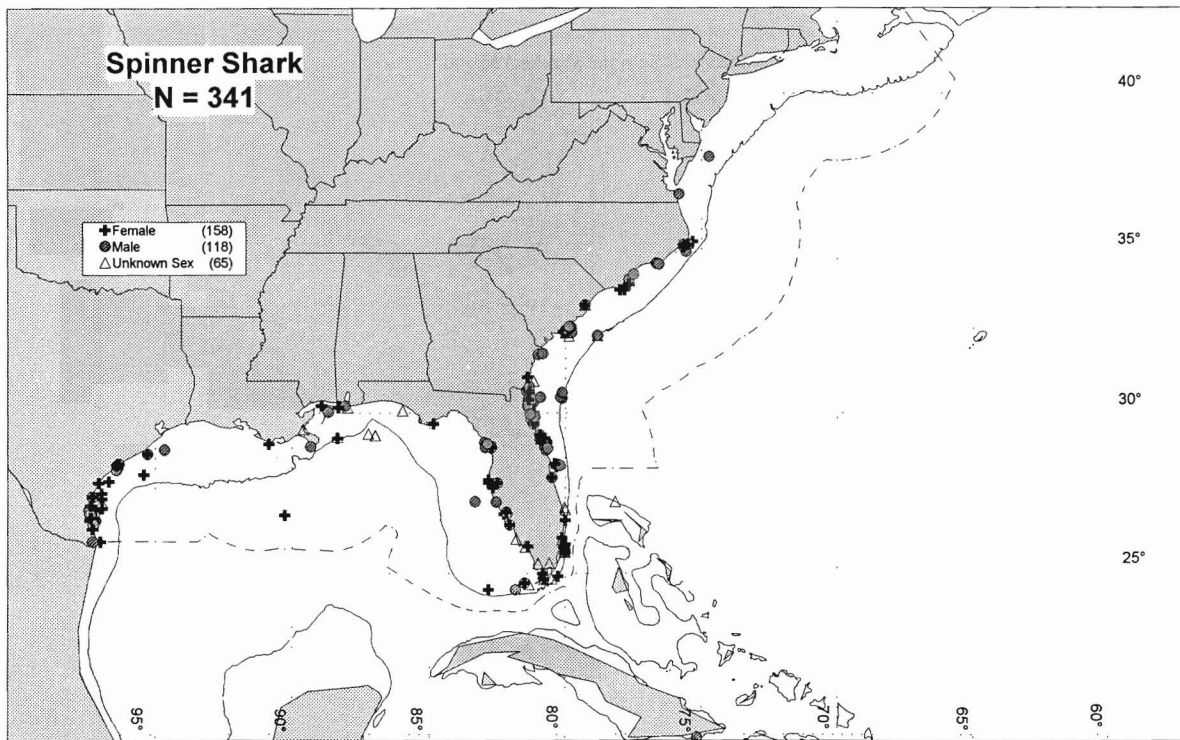


Figure 58.—Total tagging distribution for the spinner shark, *Carcharhinus brevipinna*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

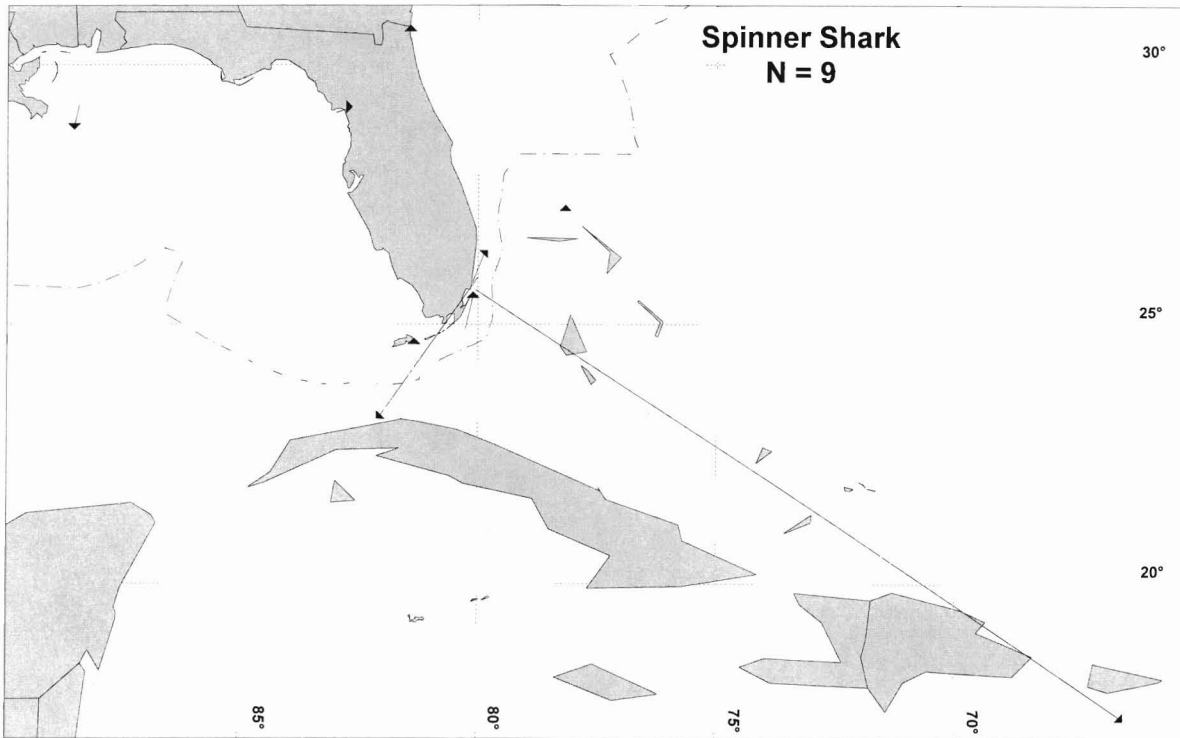


Figure 59.—Recapture distribution for the spinner shark, *Carcharhinus brevipinna*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

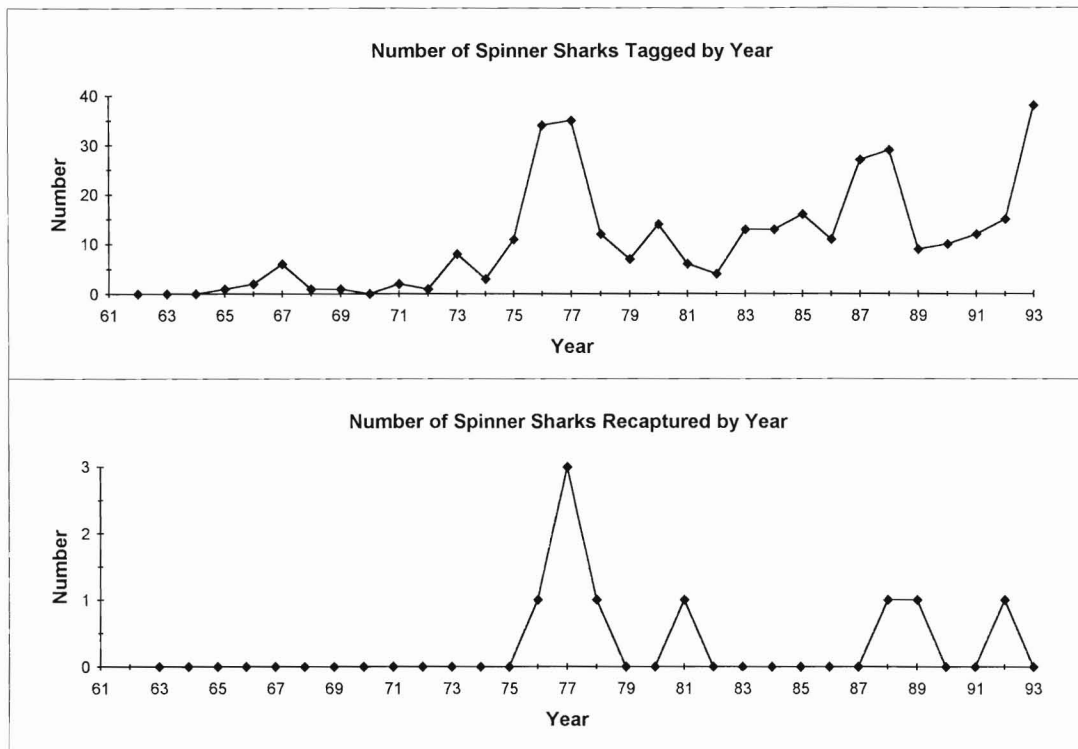


Figure 60.—Total number of spinner shark, *Carcharhinus brevipinna*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

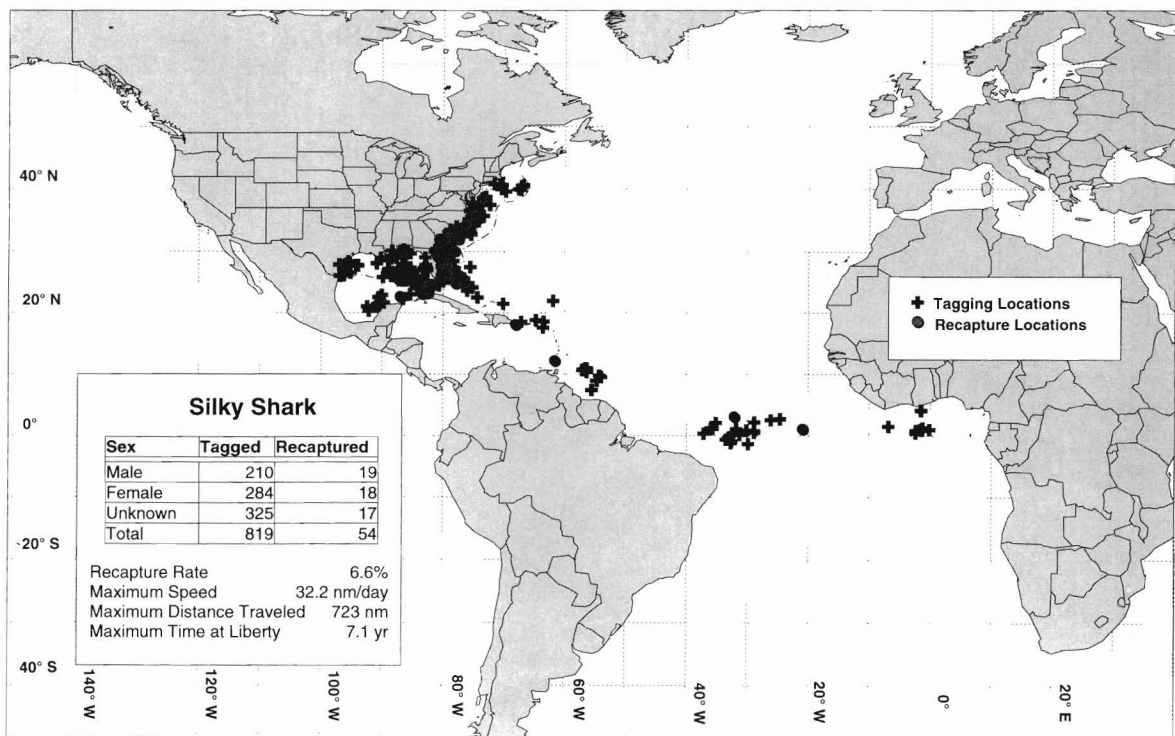


Figure 61.—Atlantic distribution of tag and recapture locations for the silky shark, *Carcharhinus falciformis*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

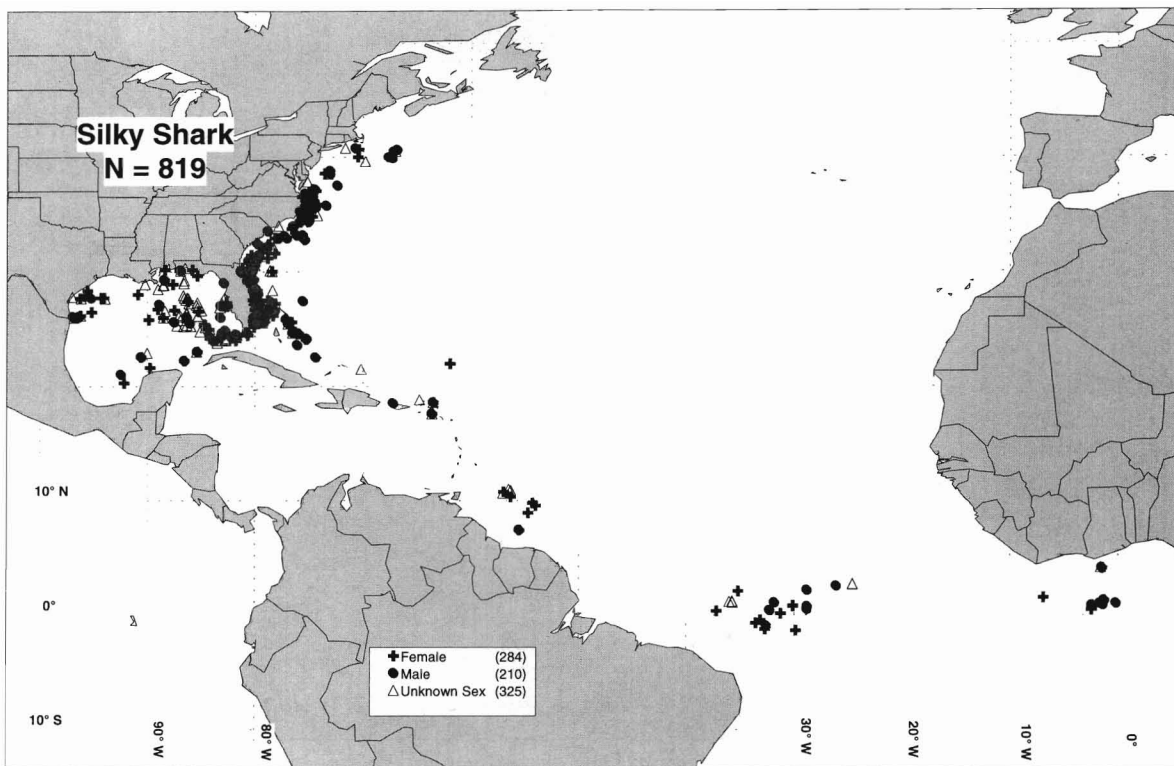


Figure 62.—Total tagging distribution for the silky shark, *Carcharhinus falciformis*, from the NMFS Cooperative Shark Tagging Program during 1962–93.

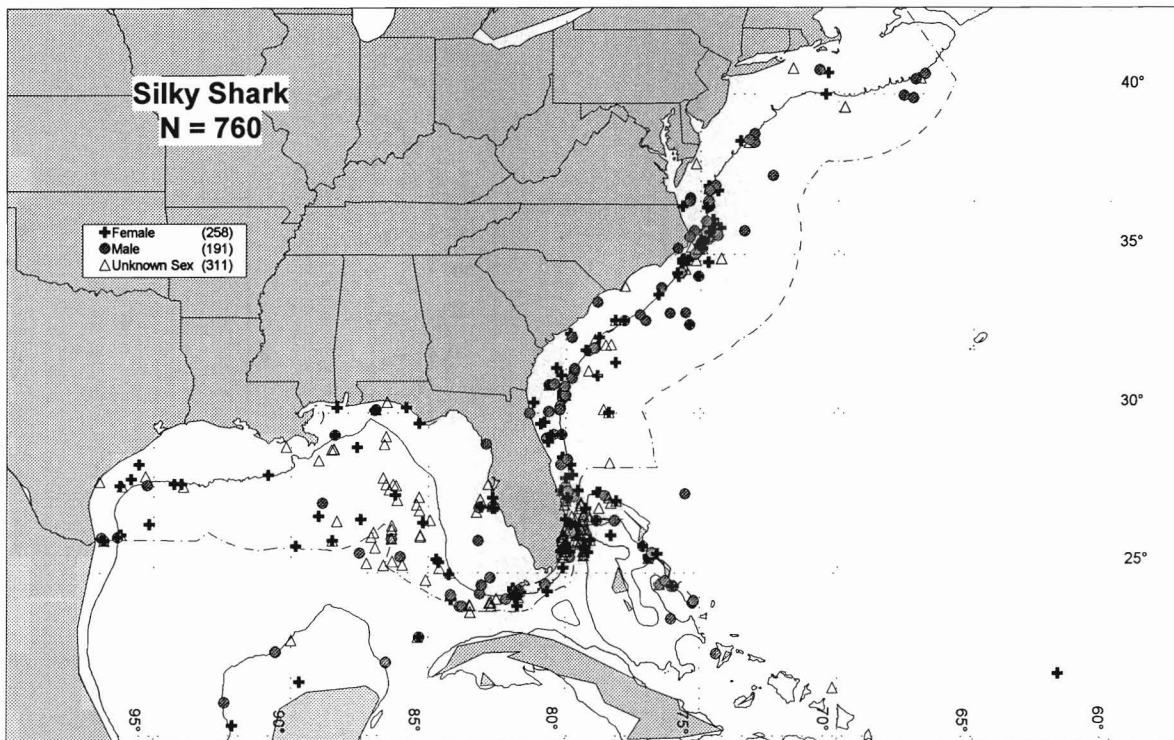


Figure 63.—U.S. tagging distribution of the silky shark, *Carcharhinus falciformis*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

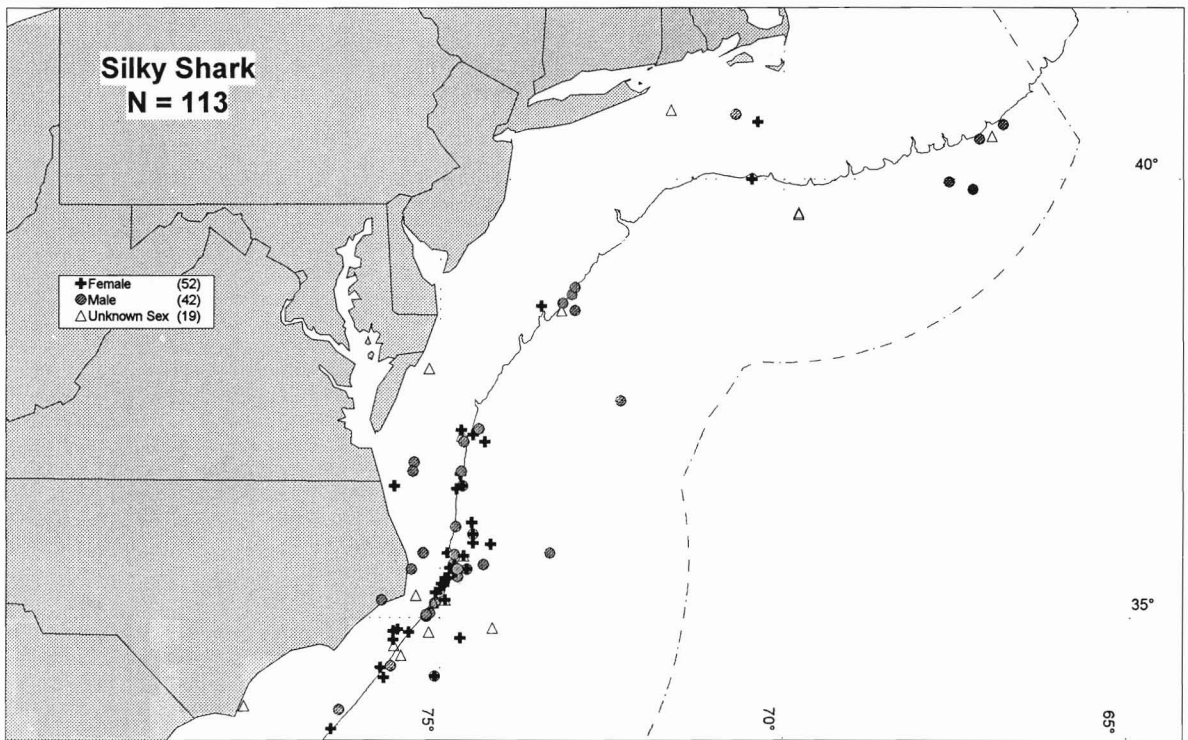


Figure 64.—Northeastern U.S. tagging distribution of the silky shark, *Carcharhinus falciformis*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

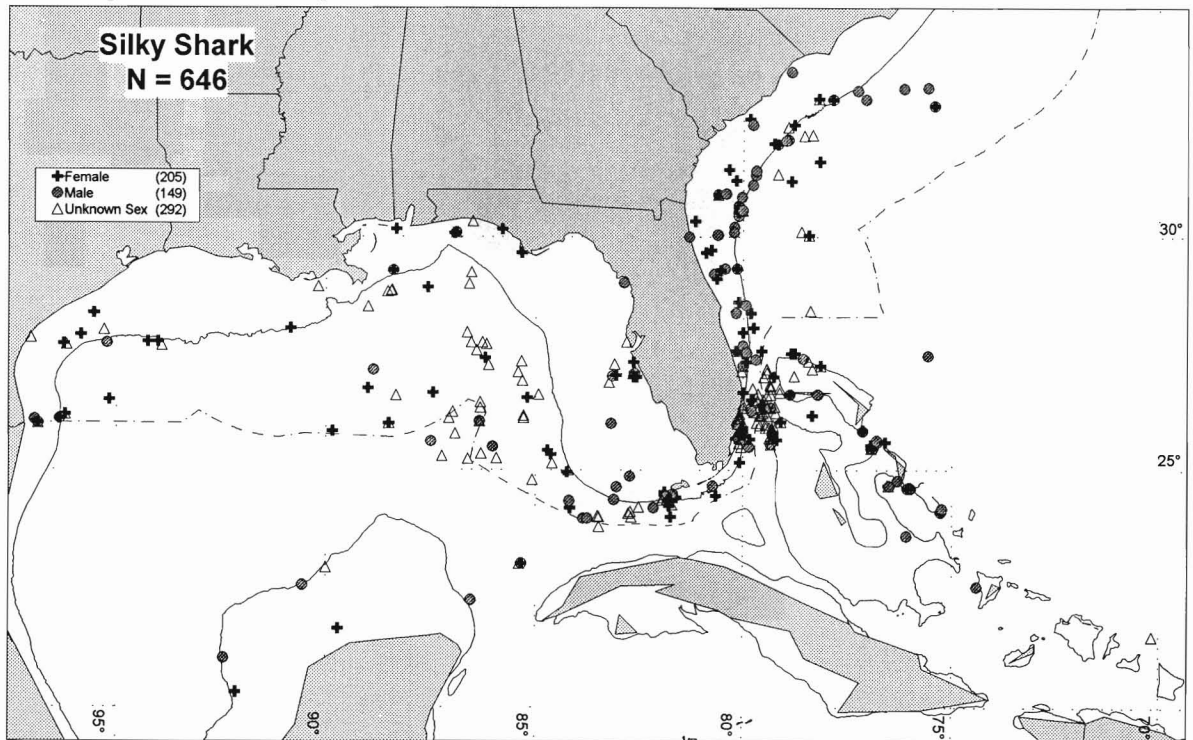


Figure 65.—Southeastern U.S. tagging distribution of the silky shark, *Carcharhinus falciformis*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

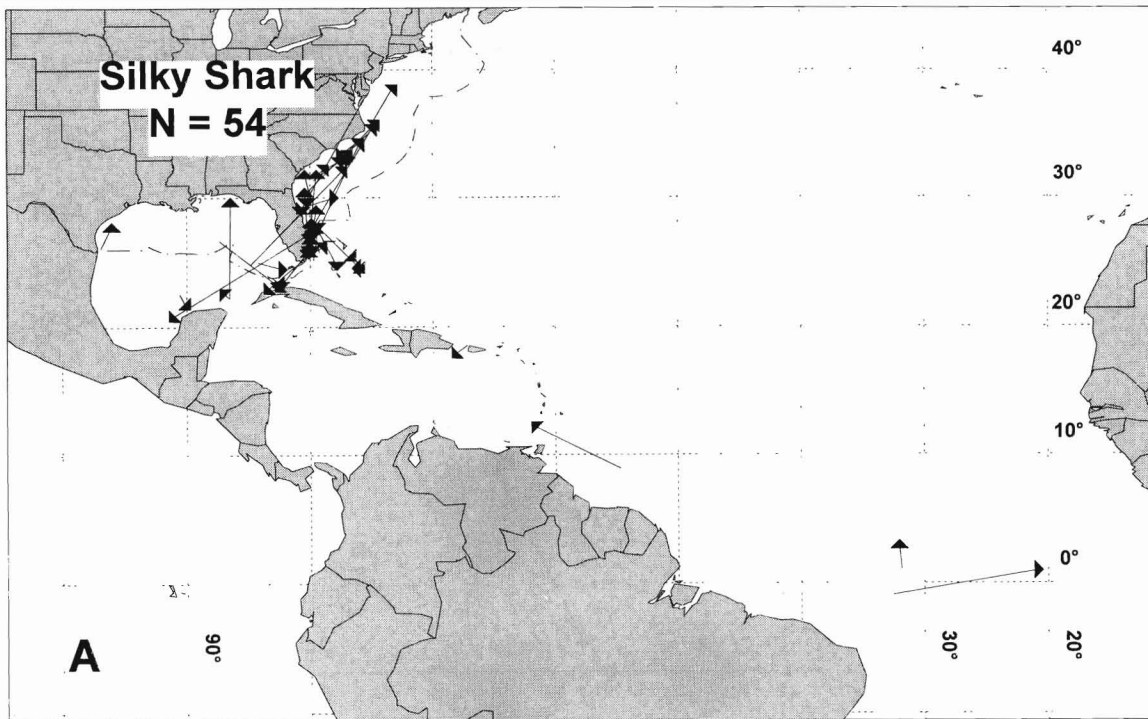


Figure 66a.—Recapture distribution for the silky shark, *Carcharhinus falciformis*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

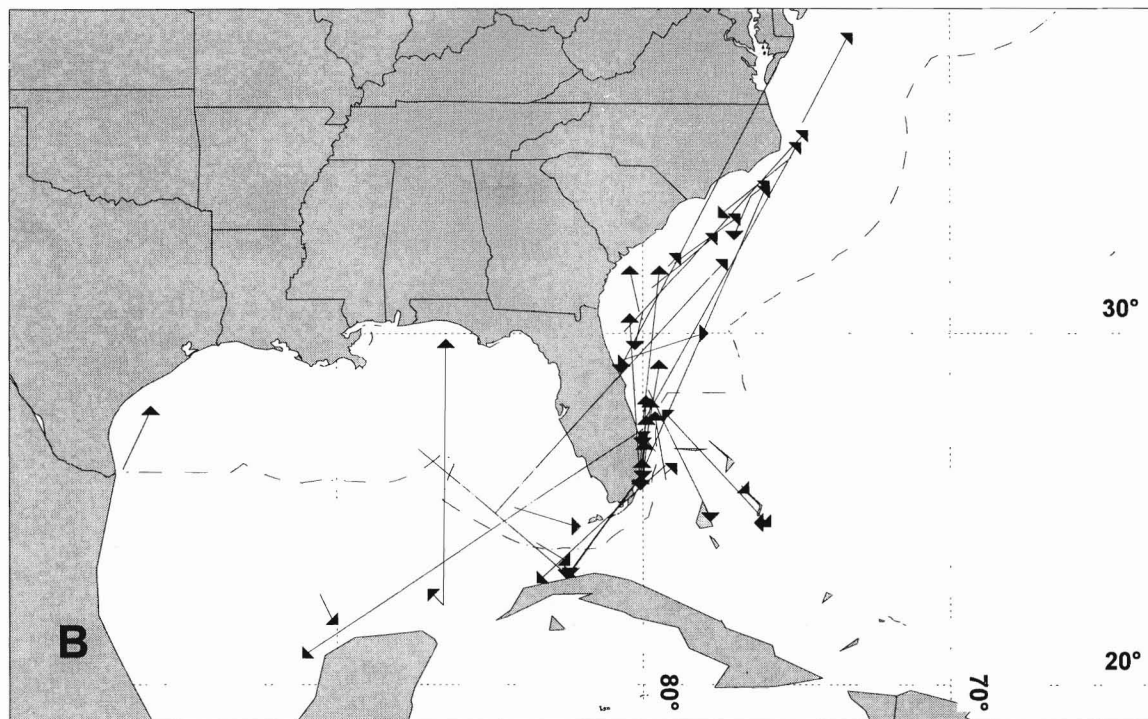


Figure 66b.—Detailed map of southeastern U.S. recapture distribution for the silky shark, *Carcharhinus falciformis*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

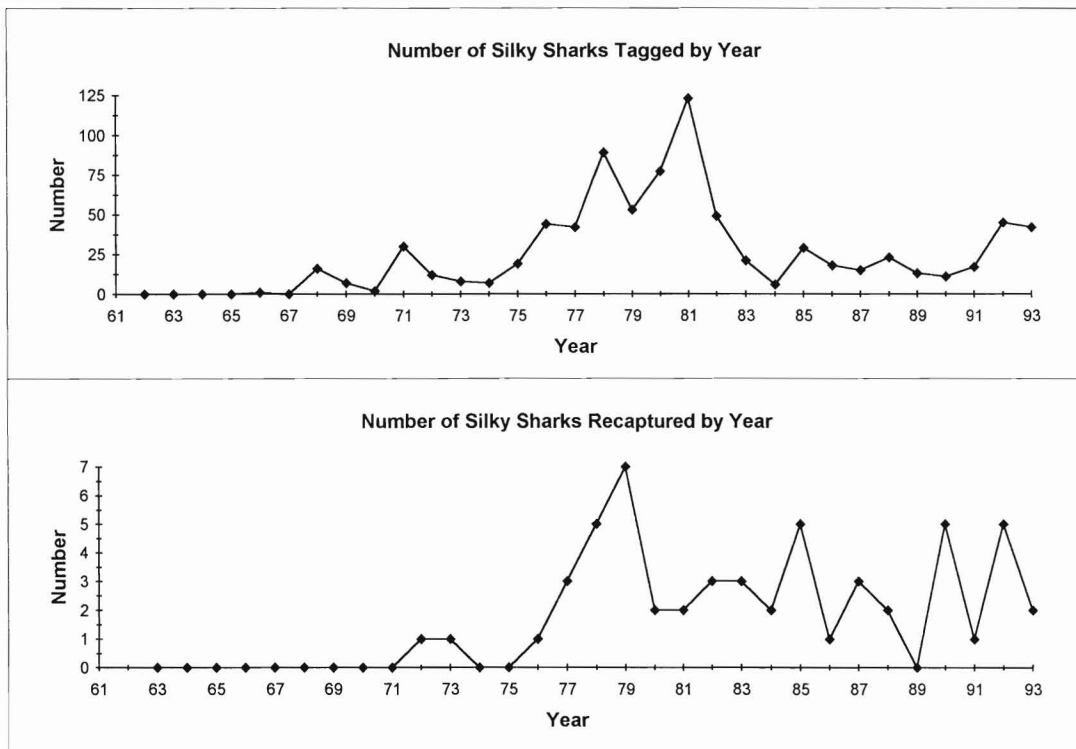


Figure 67.—Total number of silky shark, *Carcharhinus falciformis*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

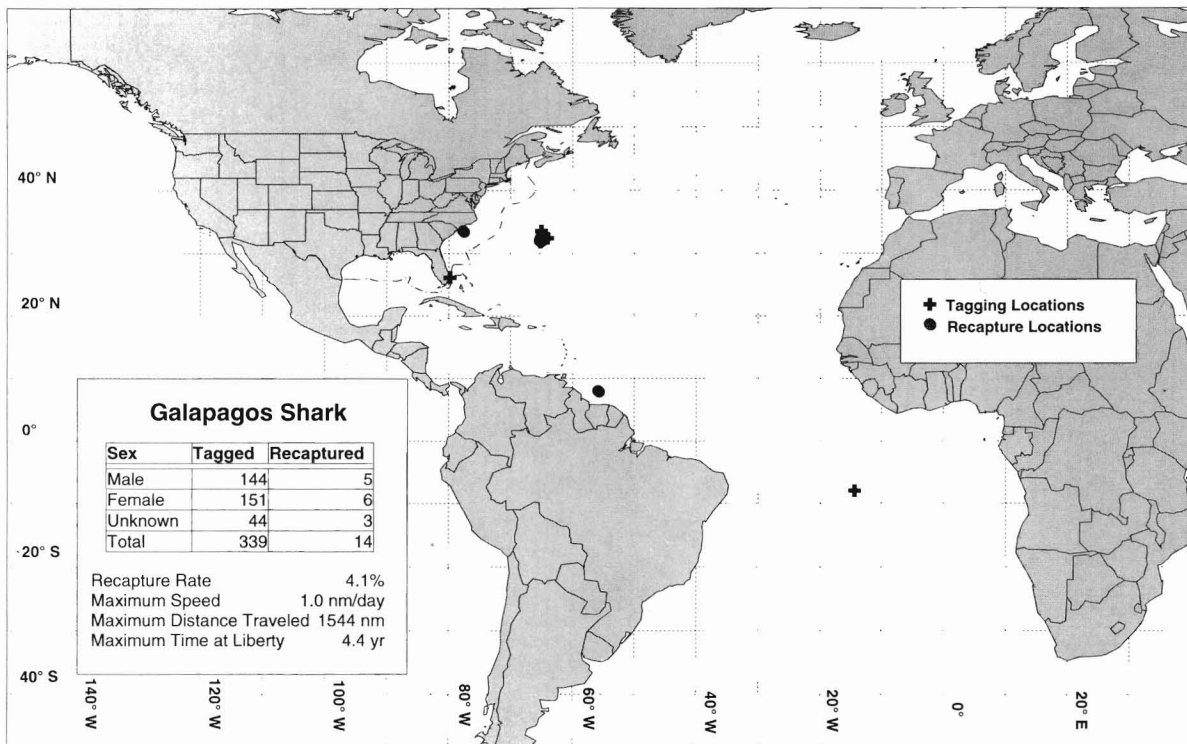


Figure 68.—Atlantic distribution of tag and recapture locations for the Galapagos shark, *Carcharhinus galapagensis*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

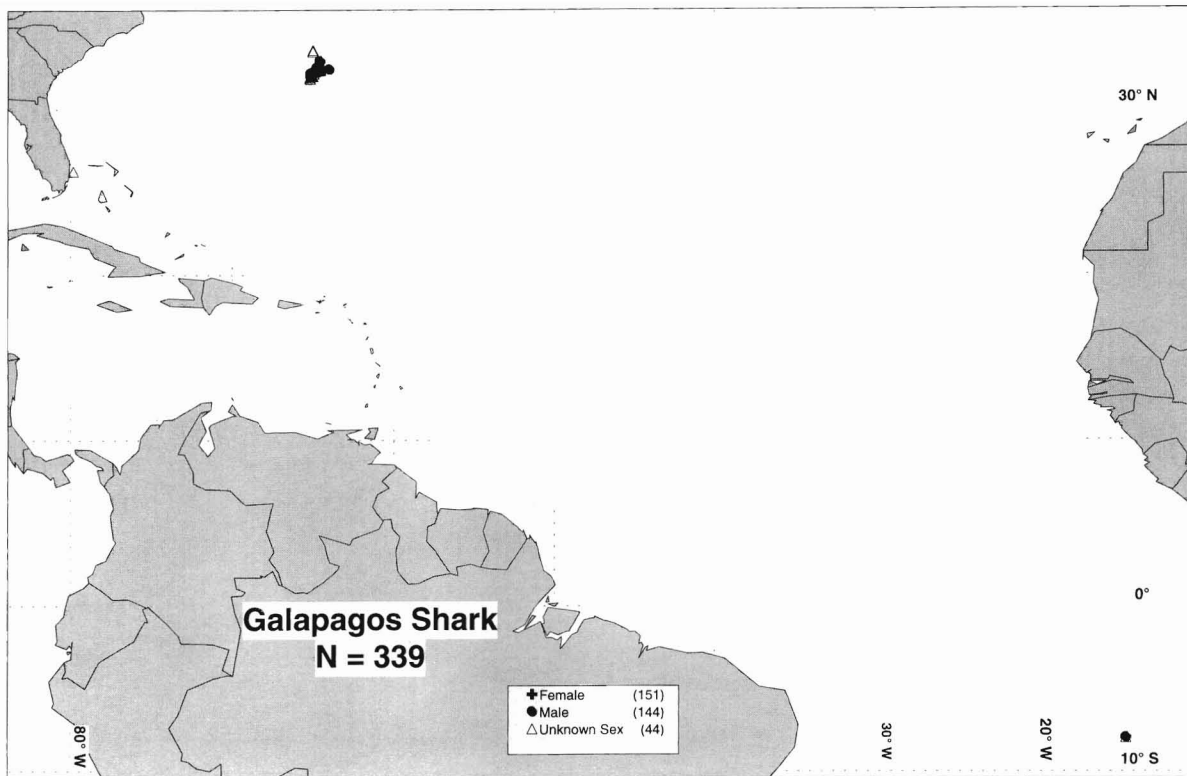


Figure 69.—Total tagging distribution for the Galapagos shark, *Carcharhinus galapagensis*, from the NMFS Cooperative Shark Tagging Program during 1962–93.

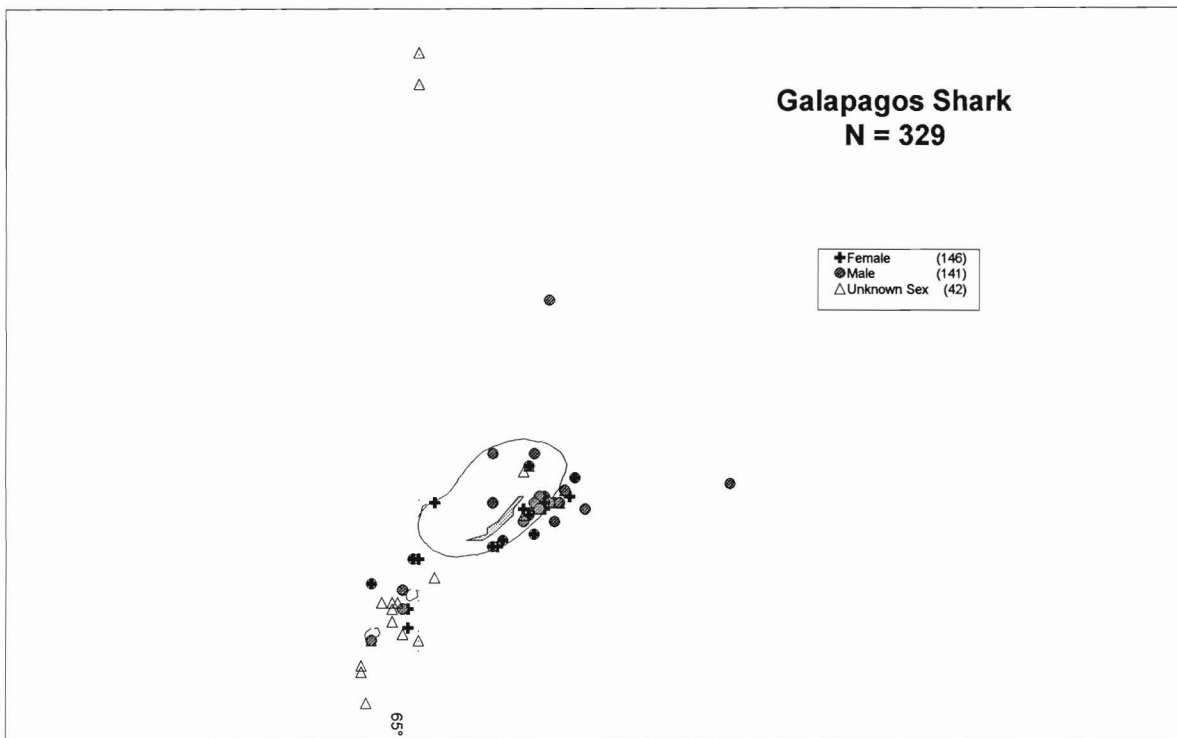


Figure 70.—Detailed map of Bermuda tagging distribution for the Galapagos shark, *Carcharhinus galapagensis*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The solid line represents the 200 m depth contour.

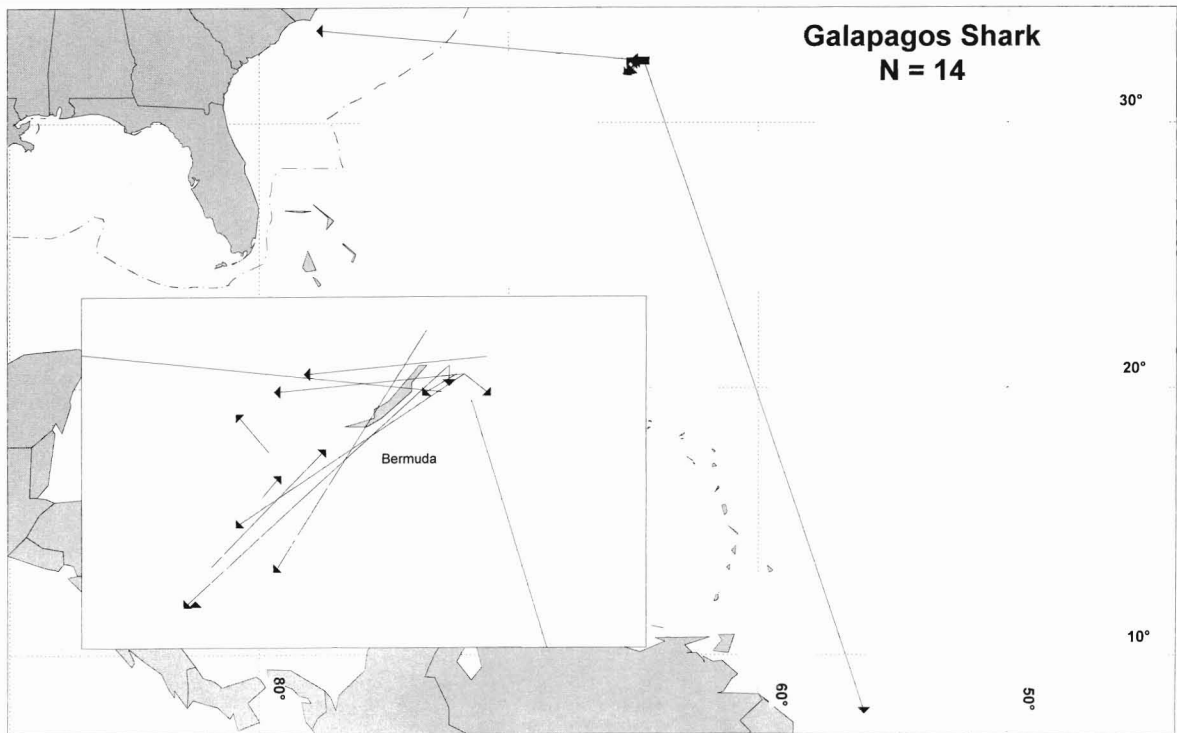


Figure 71.—Recapture distribution for the Galapagos shark, *Carcharhinus galapagensis*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

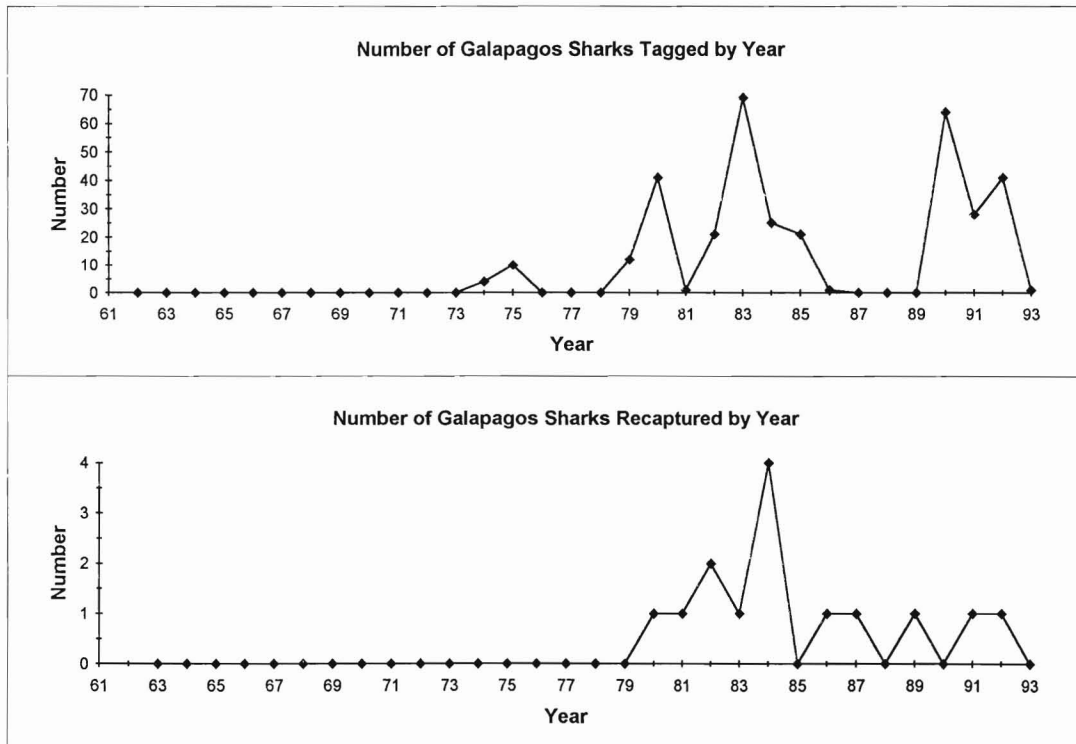


Figure 72.—Total number of Galapagos shark, *Carcharhinus galapagensis*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

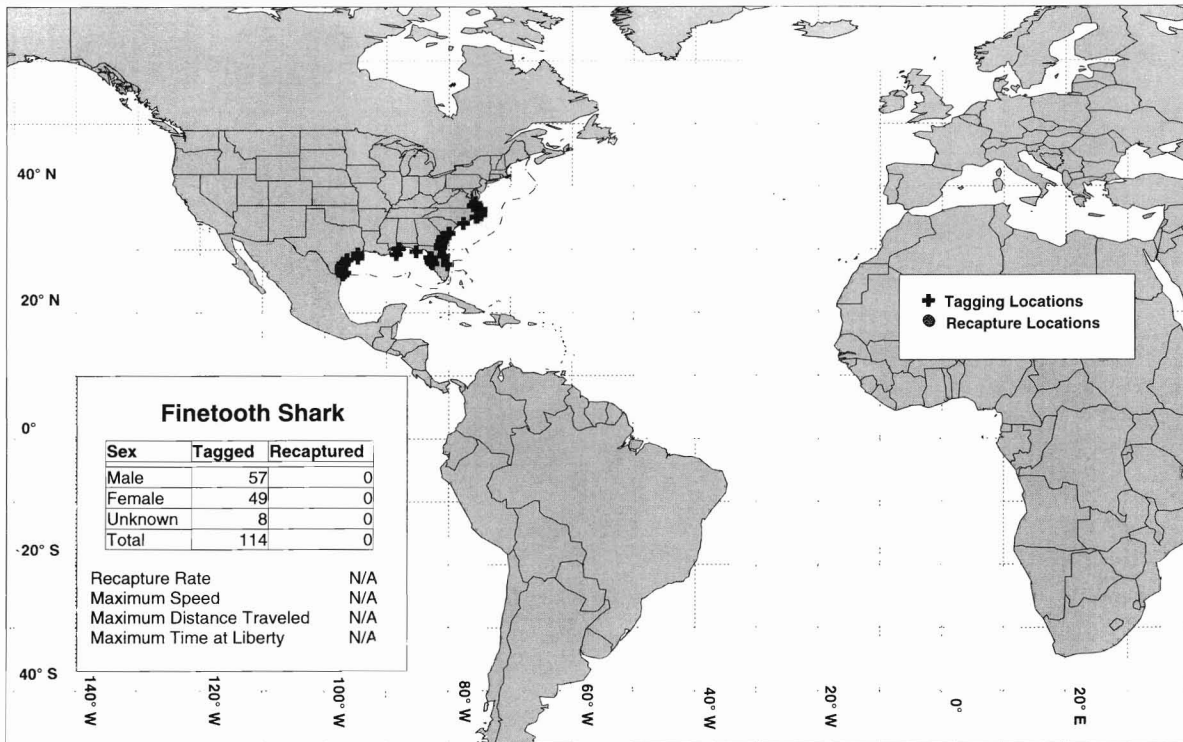


Figure 73.—Atlantic distribution of tag and recapture locations for the finetooth shark, *Carcharhinus isodon*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

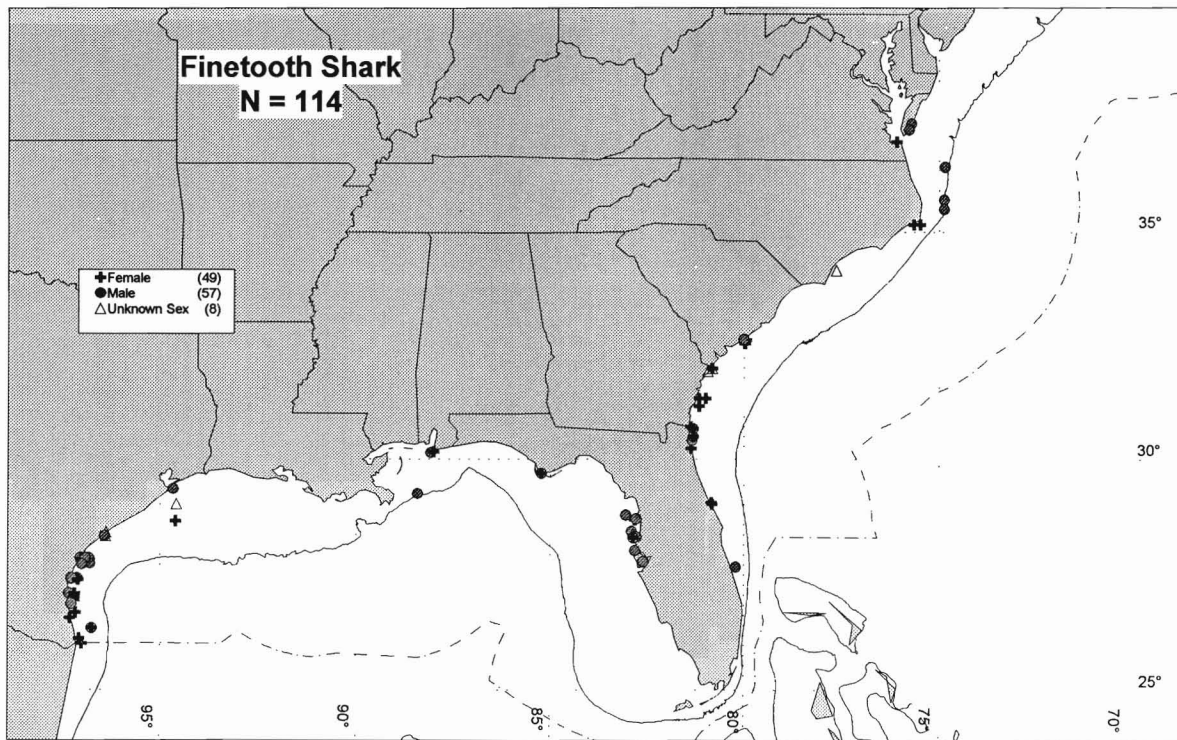


Figure 74.—Total tagging distribution for the finetooth shark, *Carcharhinus isodon*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

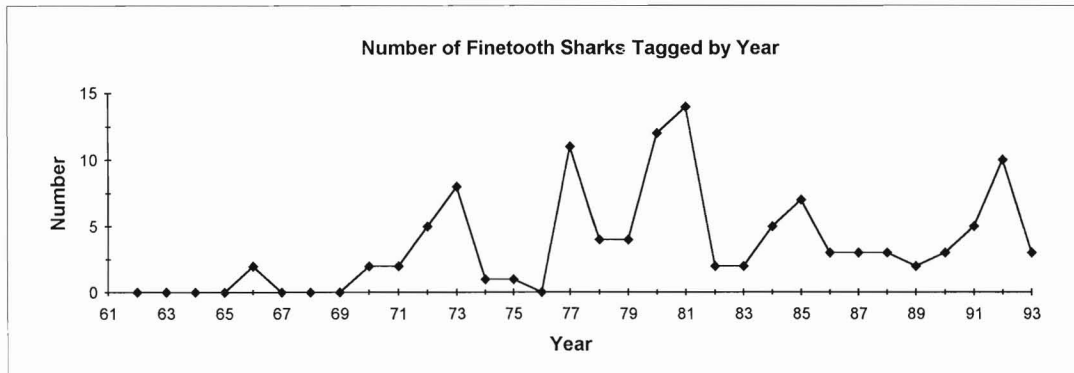


Figure 75.—Total number of finetooth shark, *Carcharhinus isodon*, tagged by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

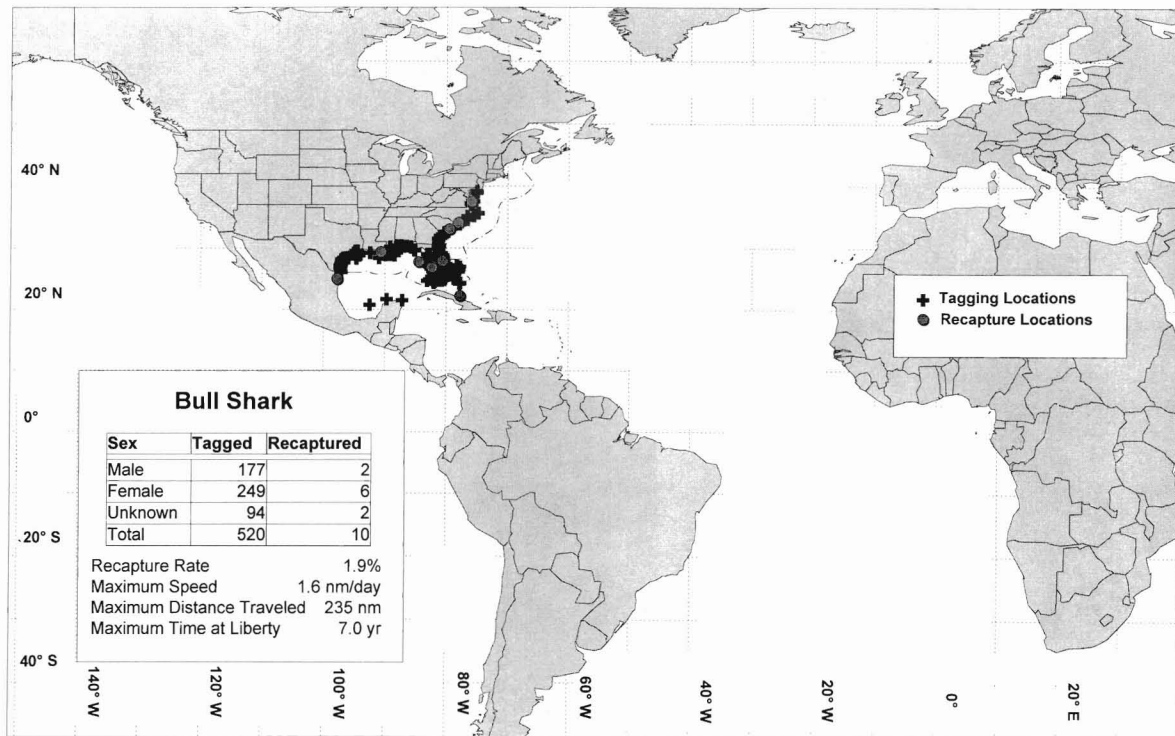


Figure 76.—Atlantic distribution of tag and recapture locations for the bull shark, *Carcharhinus leucas*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

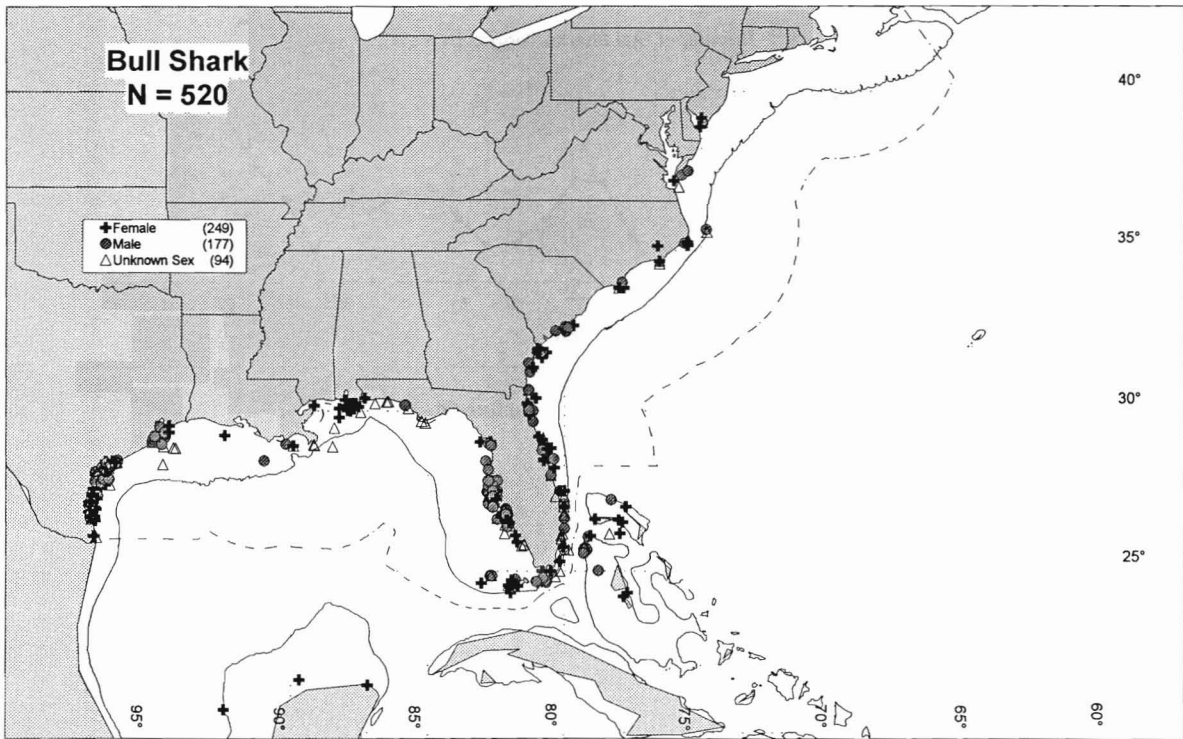


Figure 77.—Total tagging distribution for the bull shark, *Carcharhinus leucas*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

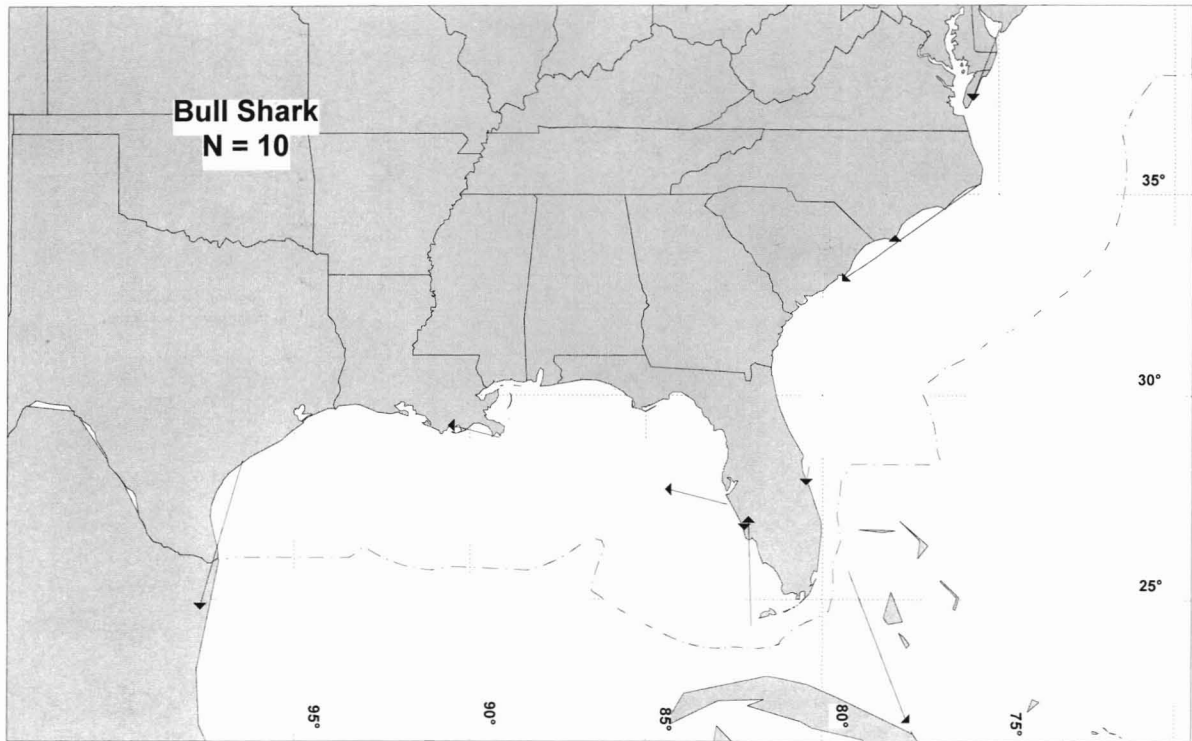


Figure 78.—Recapture distribution for the bull shark, *Carcharhinus leucas*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

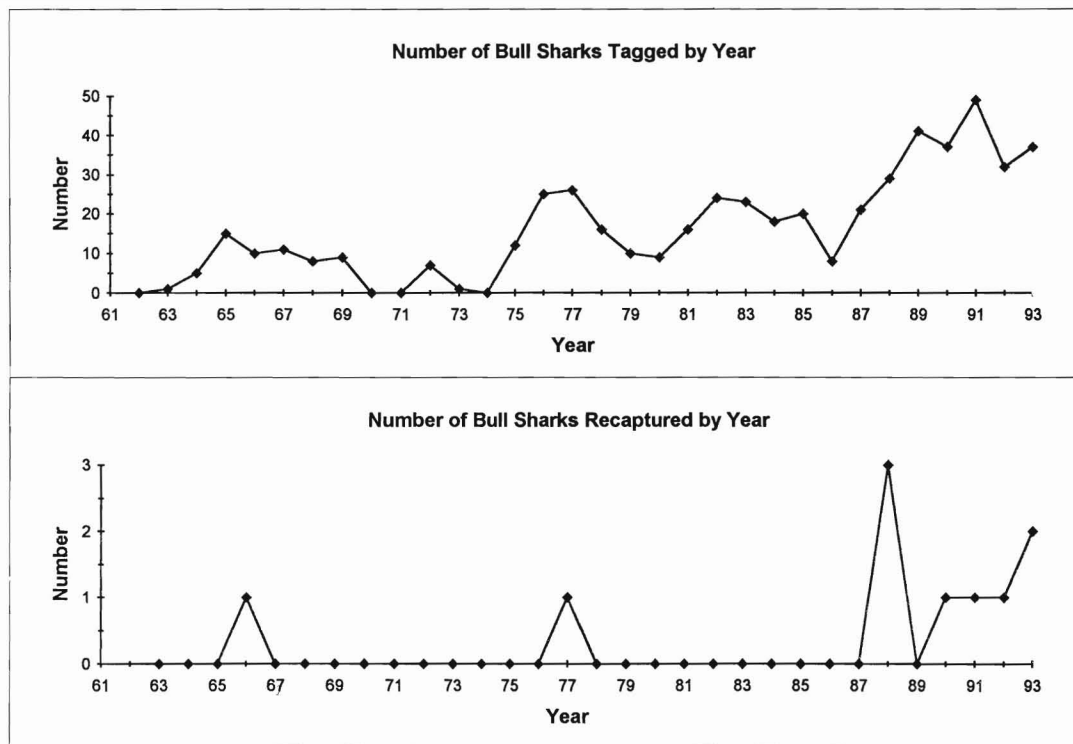


Figure 79.—Total number of bull shark, *Carcharhinus leucas*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

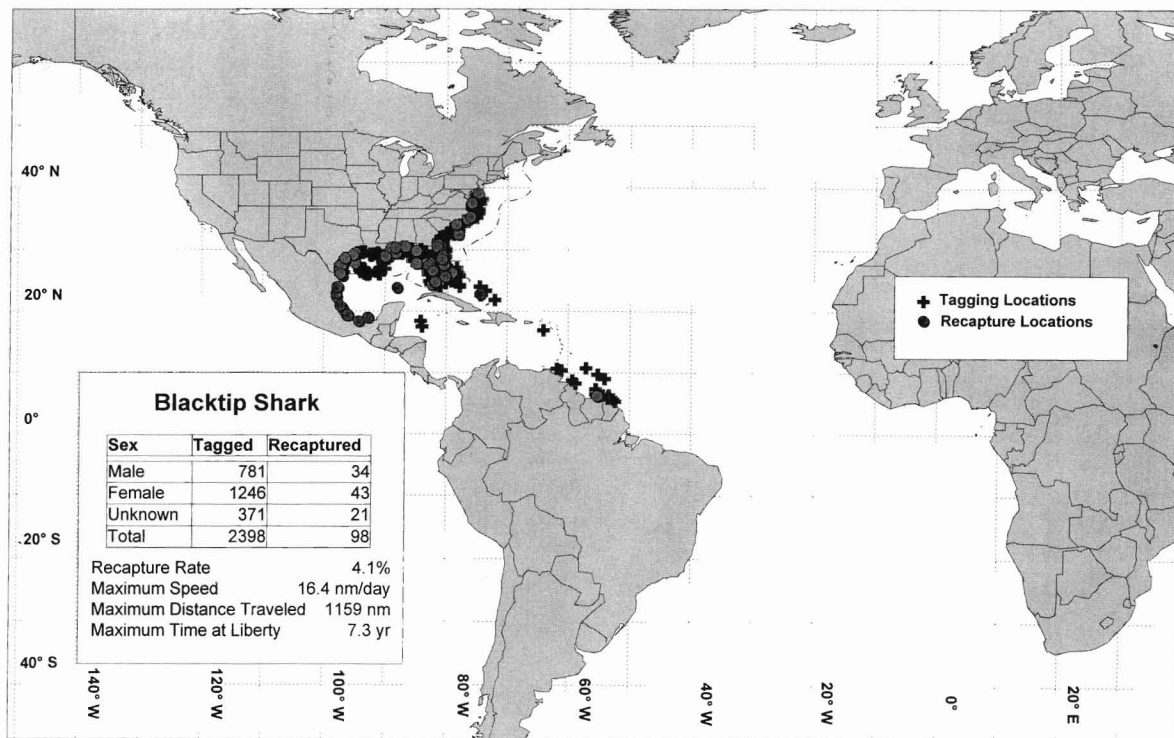


Figure 80.—Atlantic distribution of tag and recapture locations for the blacktip shark, *Carcharhinus limbatus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

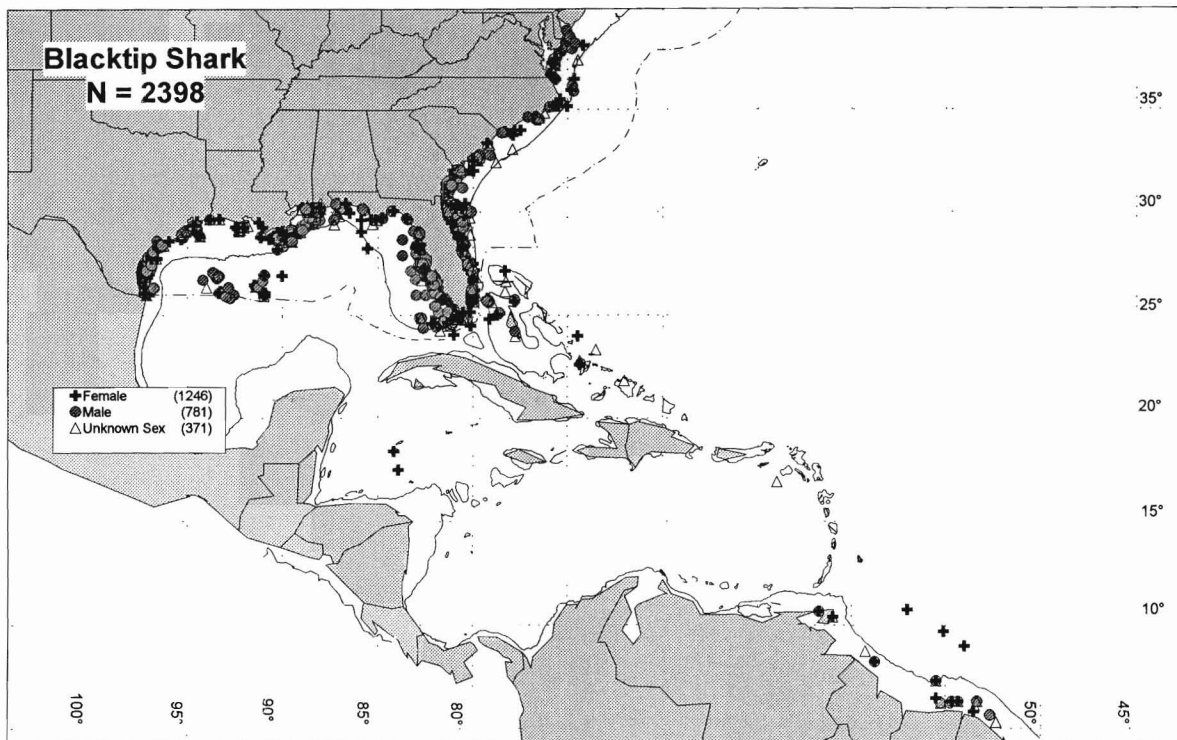


Figure 81.—Total tagging distribution for the blacktip shark, *Carcharhinus limbatus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

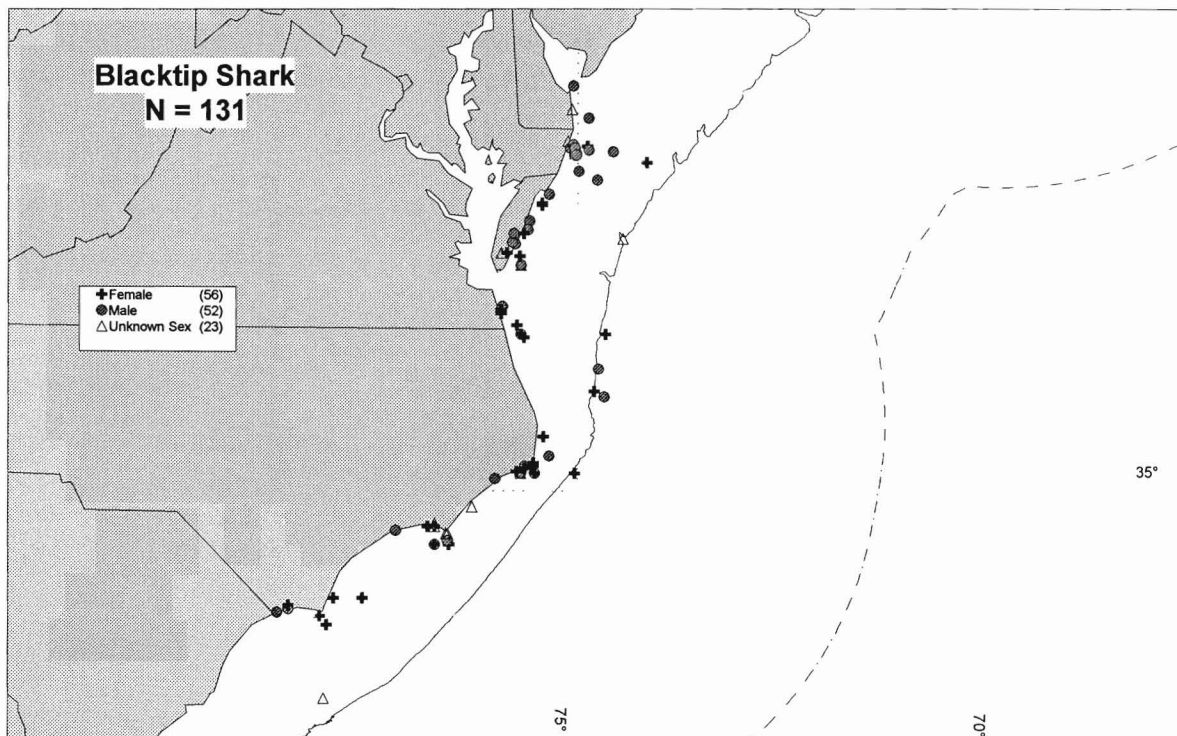


Figure 82.—Northeastern U.S. tagging distribution of the blacktip shark, *Carcharhinus limbatus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

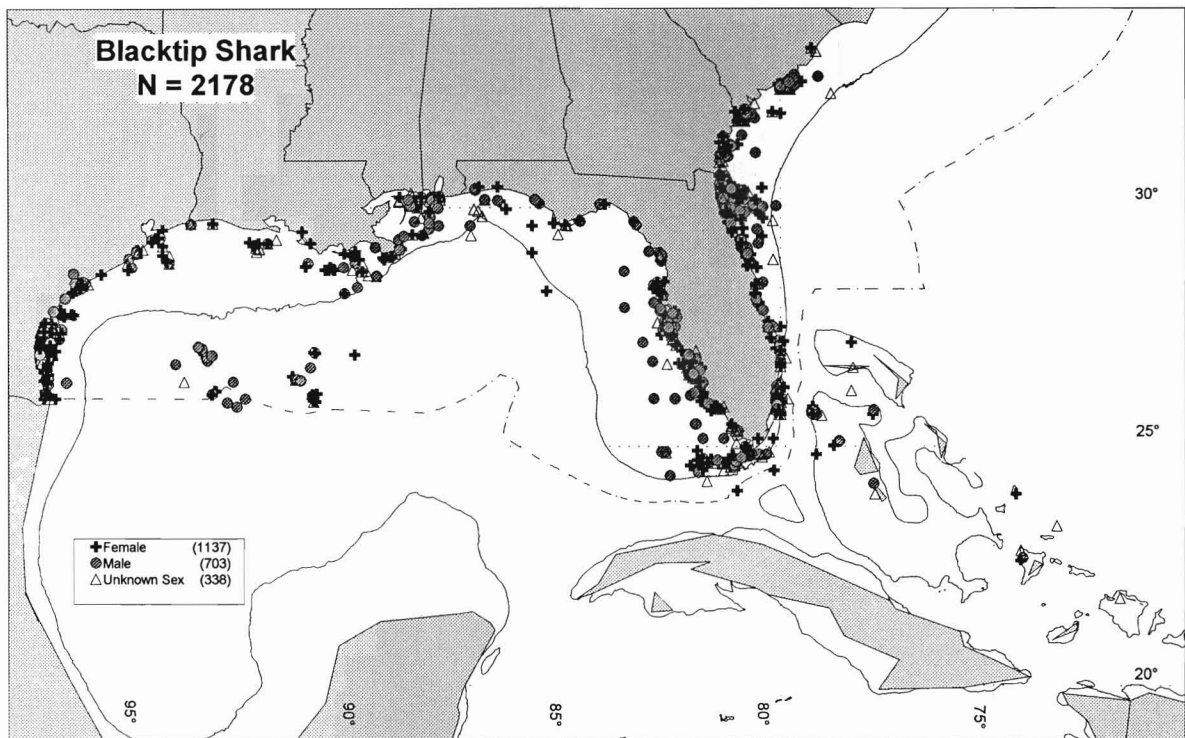


Figure 83.—Southeastern U.S. tagging distribution of the blacktip shark, *Carcharhinus limbatus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

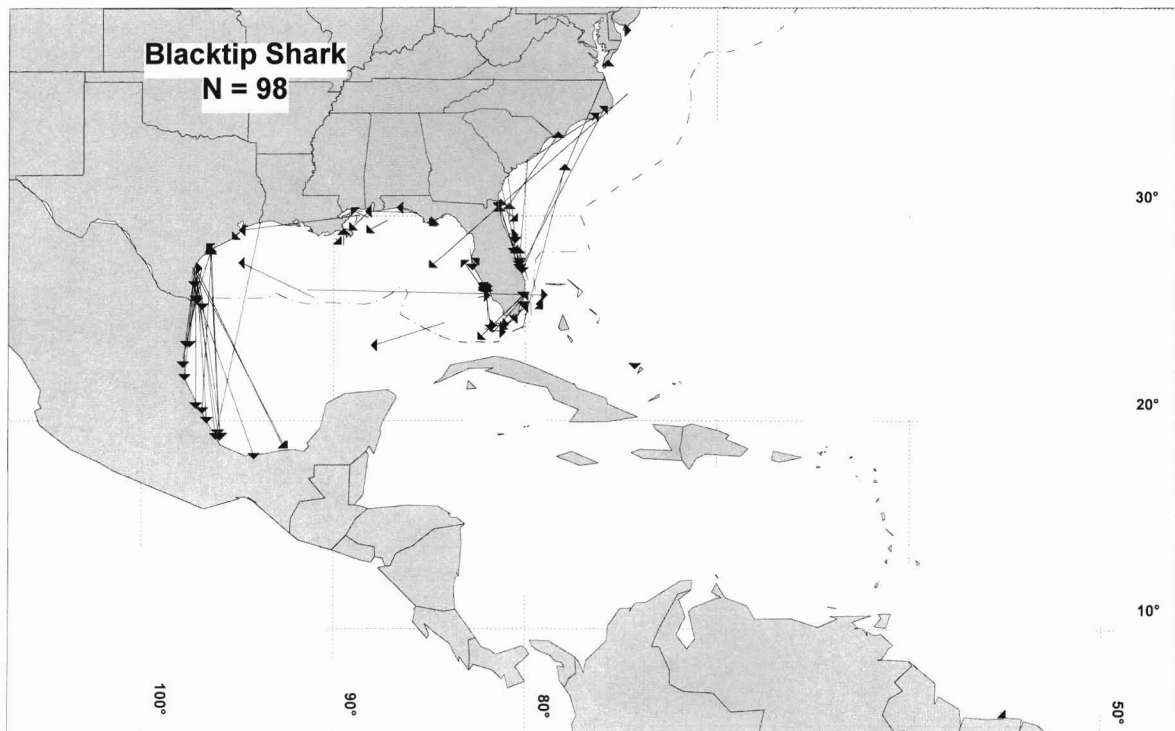


Figure 84.—Recapture distribution for the blacktip shark, *Carcharhinus limbatus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

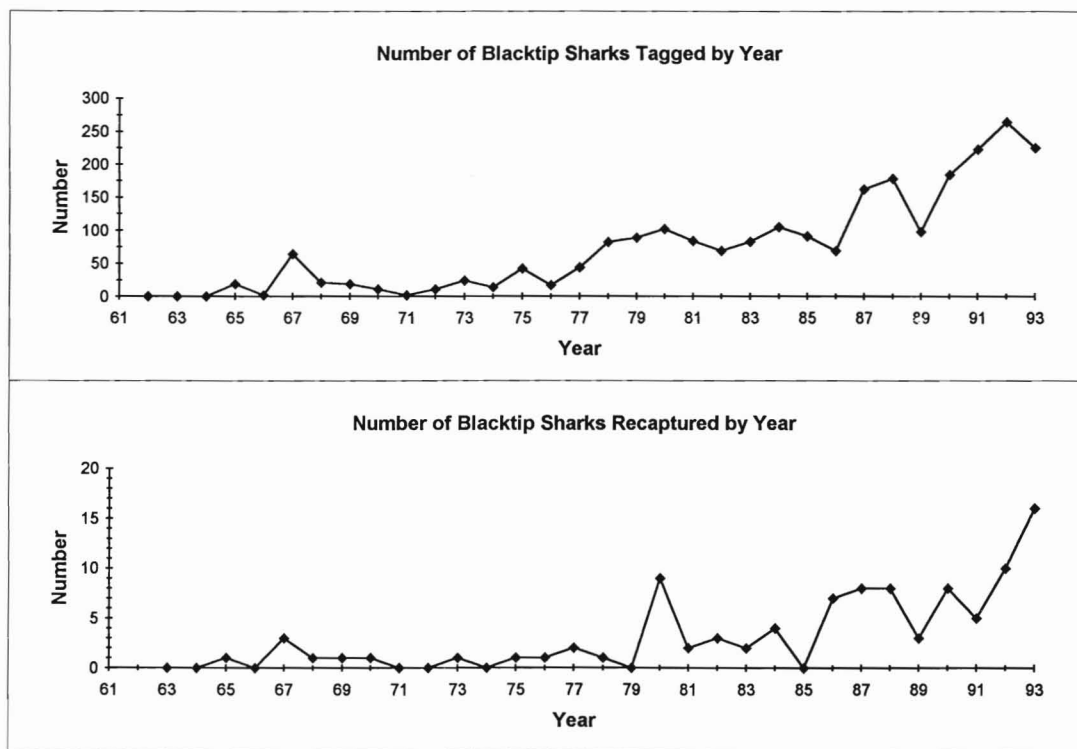


Figure 85.—Total number of blacktip shark, *Carcharhinus limbatus*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

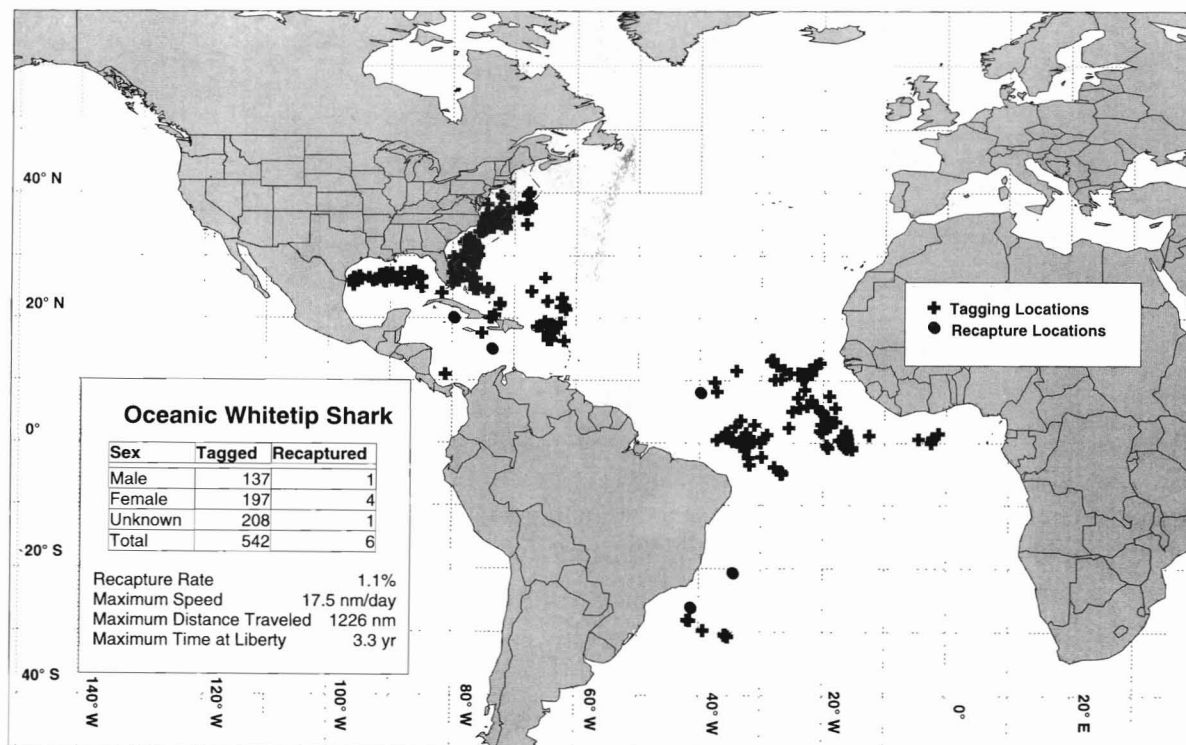


Figure 86.—Atlantic distribution of tag and recapture locations for the oceanic whitetip shark, *Carcharhinus longimanus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

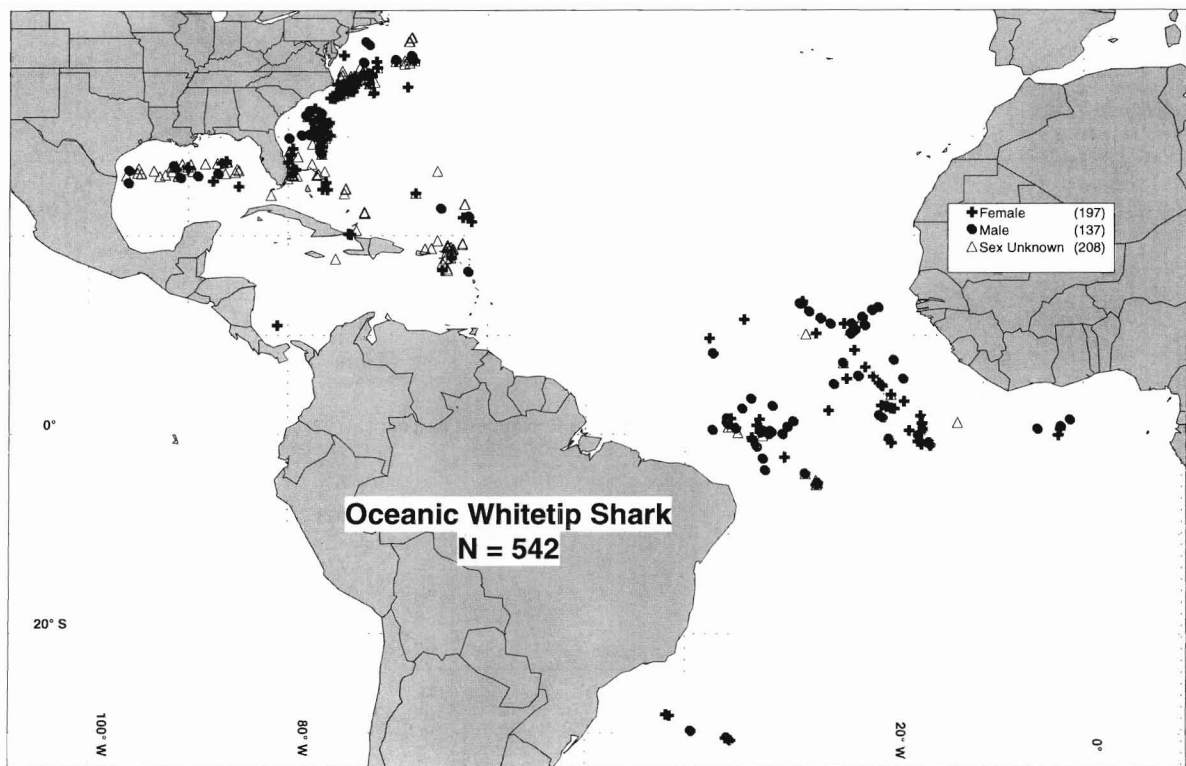


Figure 87.—Total tagging distribution for the oceanic whitetip shark, *Carcharhinus longimanus*, from the NMFS Cooperative Shark Tagging Program during 1962–93.

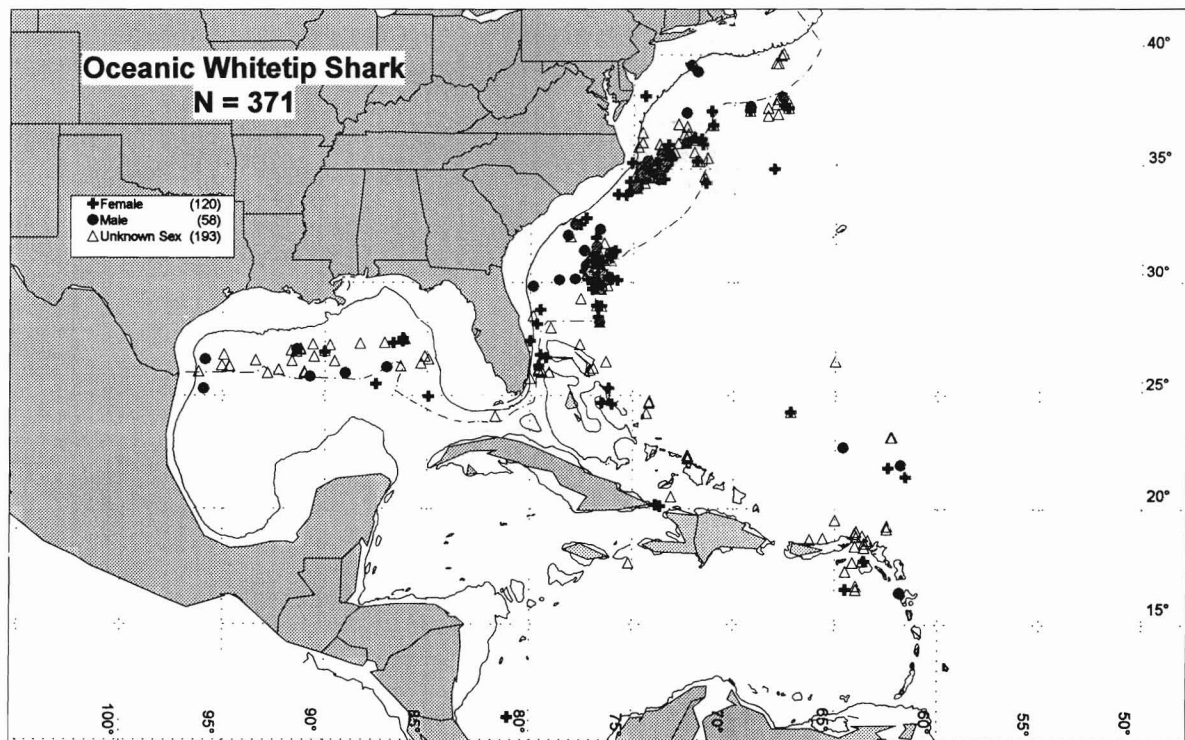


Figure 88.—U.S. tagging distribution of the oceanic whitetip shark, *Carcharhinus longimanus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

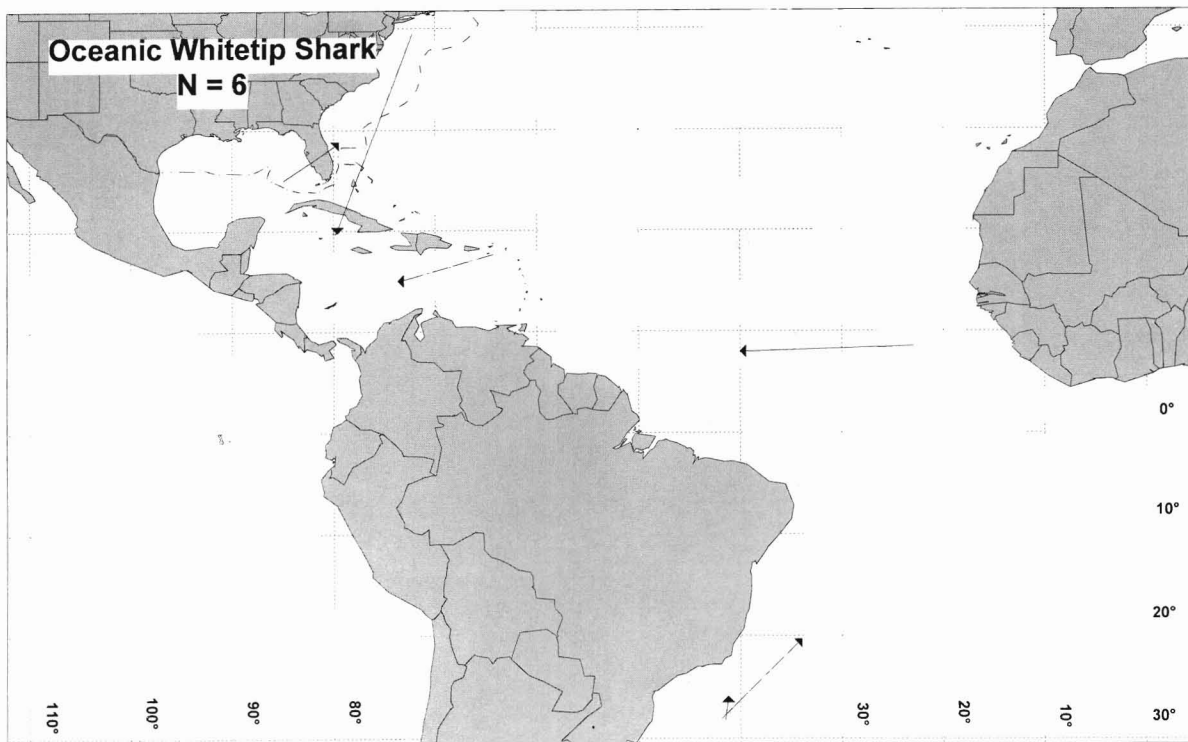


Figure 89.—Recapture distribution for the oceanic whitetip shark, *Carcharhinus longimanus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

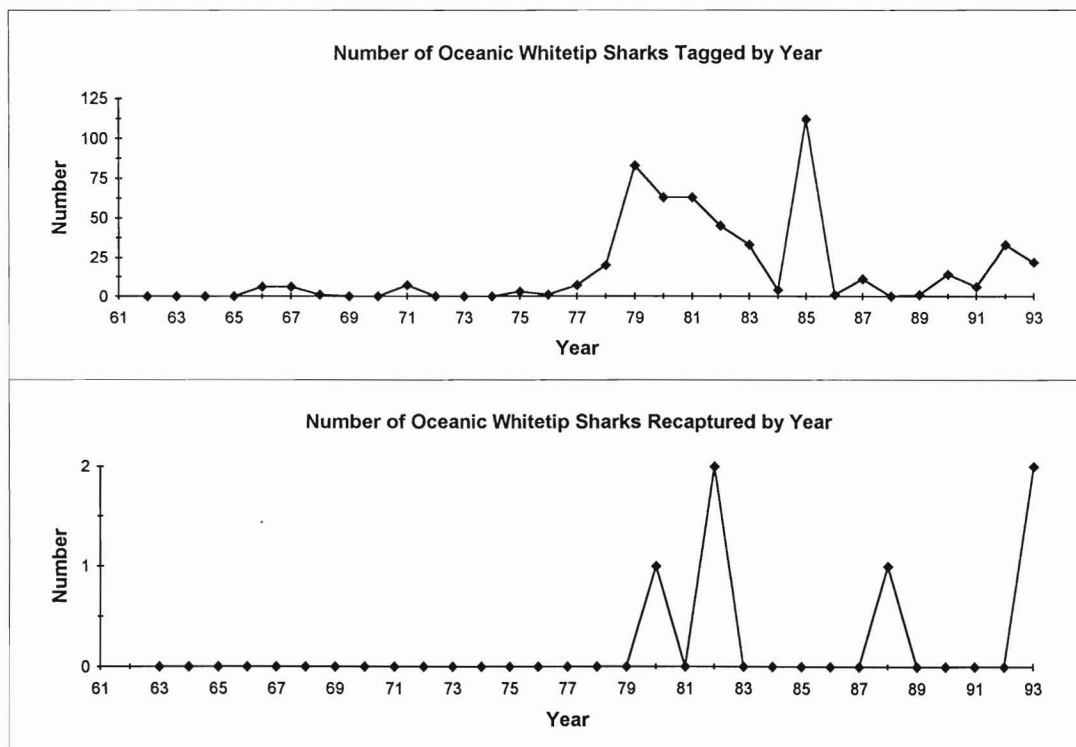


Figure 90.—Total number of oceanic whitetip shark, *Carcharhinus longimanus*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

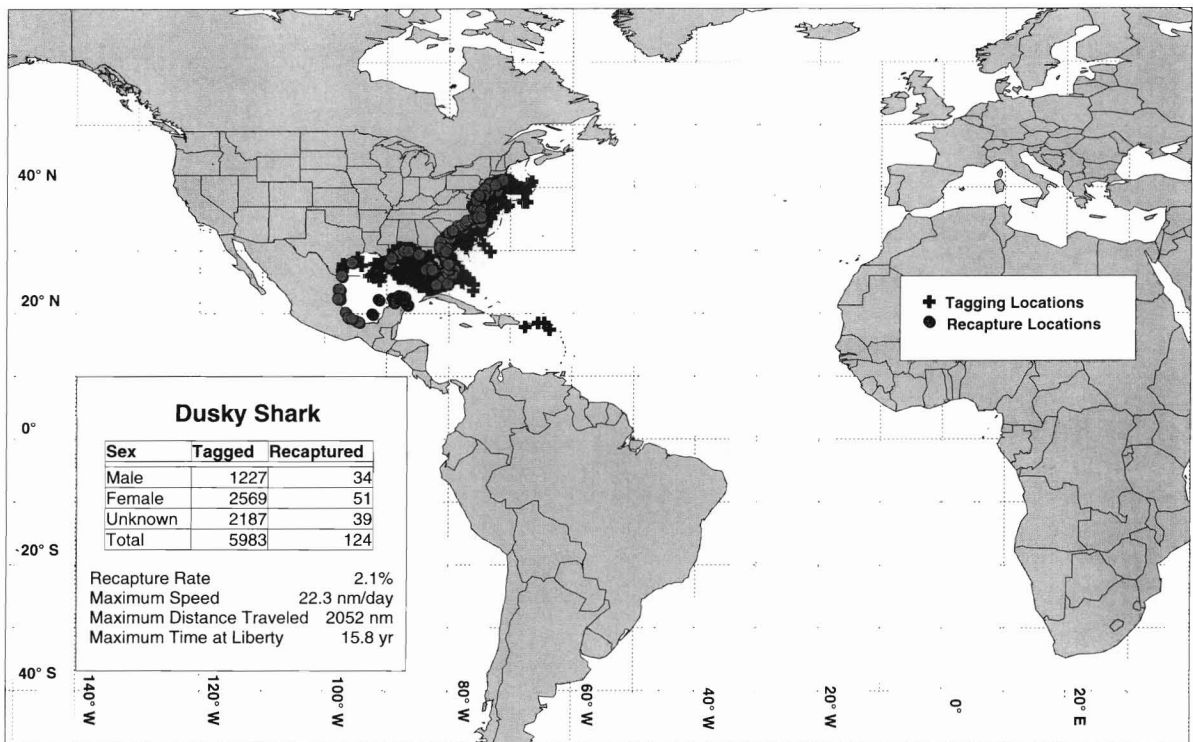


Figure 91.—Atlantic distribution of tag and recapture locations for the dusky shark, *Carcharhinus obscurus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

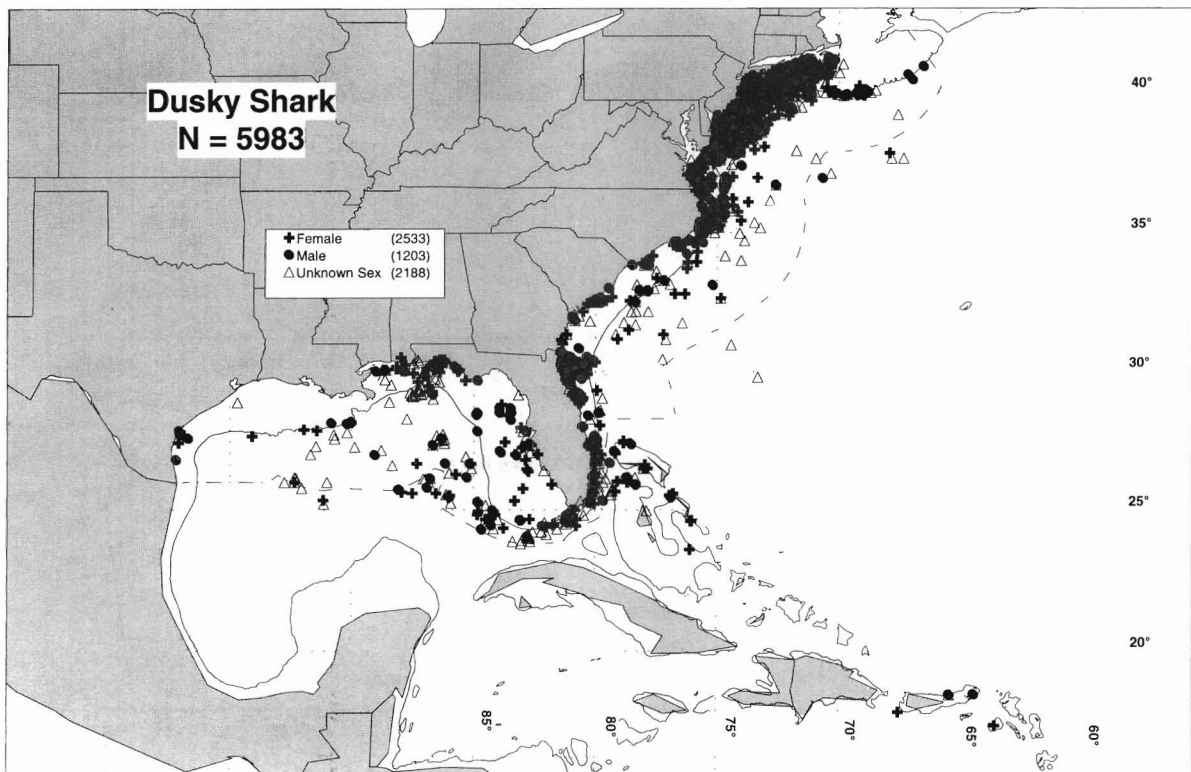


Figure 92.—Total tagging distribution for the dusky shark, *Carcharhinus obscurus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

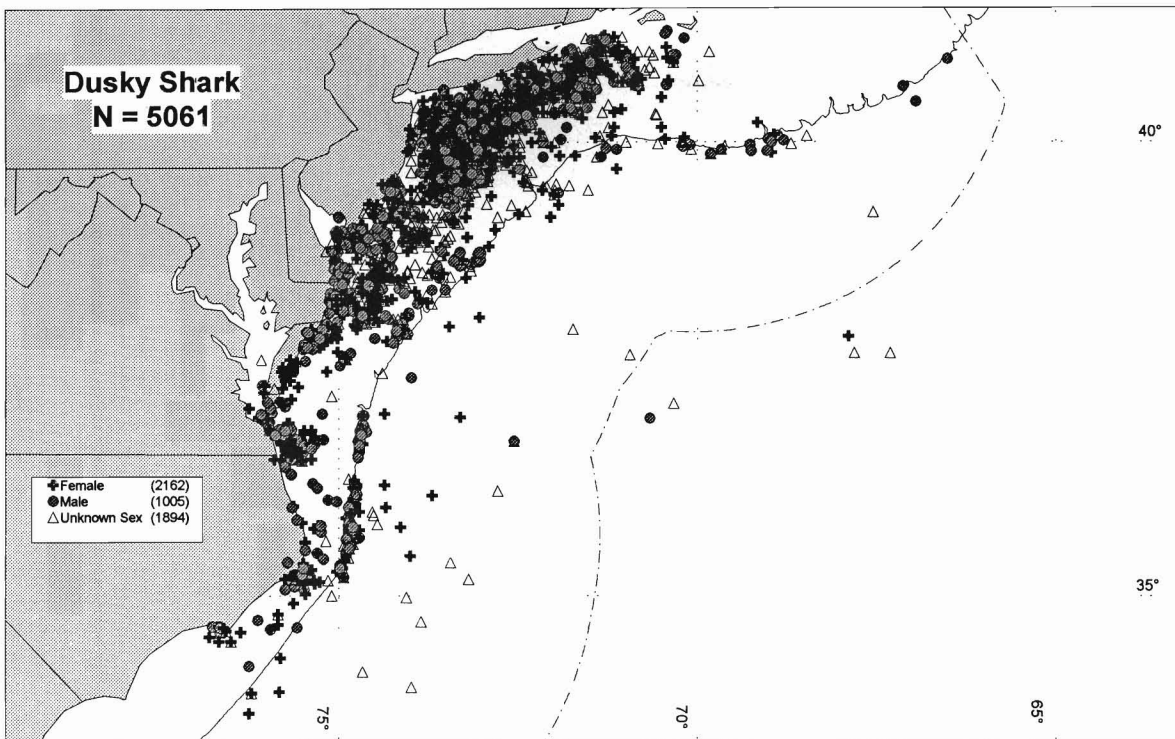


Figure 93.—Northeastern U.S. tagging distribution of the dusky shark, *Carcharhinus obscurus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

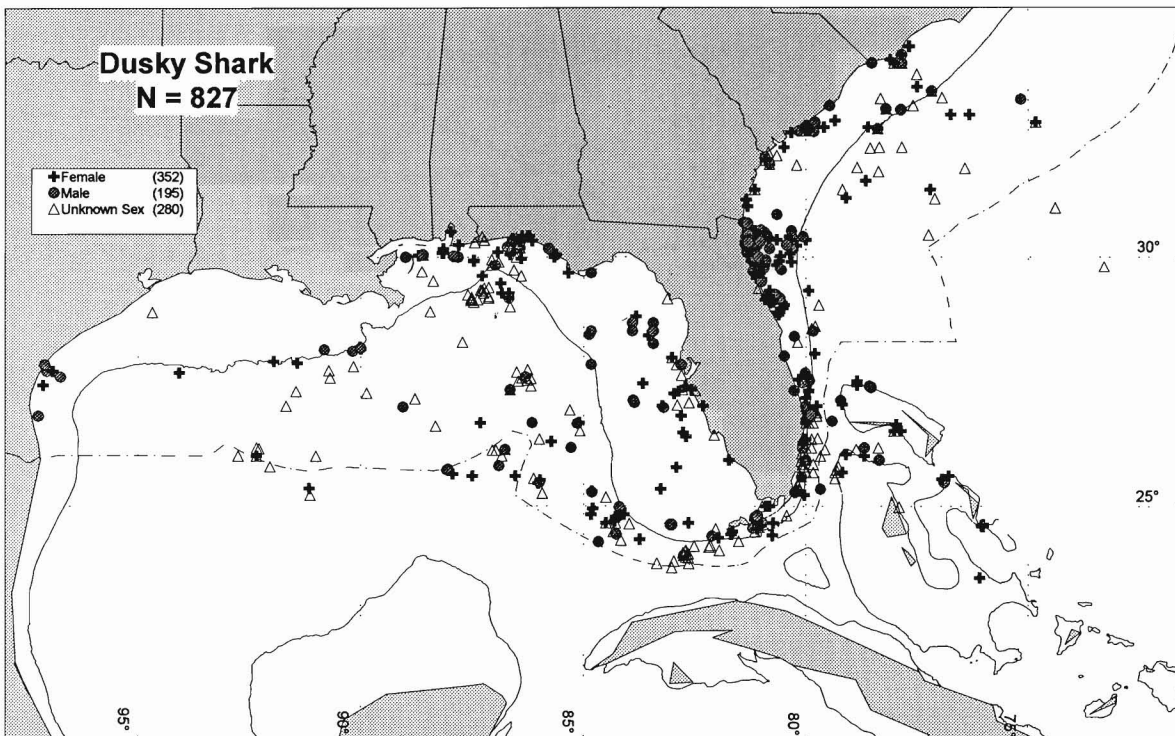


Figure 94.—Southeastern U.S. tagging distribution of the dusky shark, *Carcharhinus obscurus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

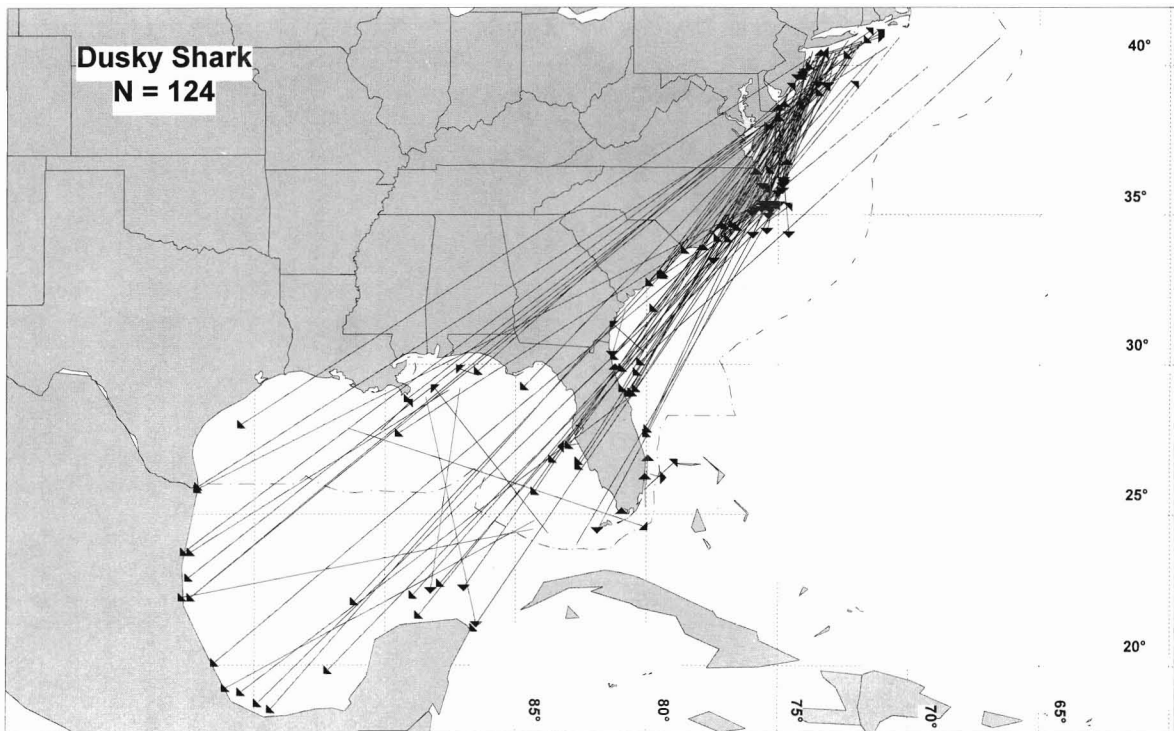


Figure 95.—Recapture distribution for the dusky shark, *Carcharhinus obscurus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

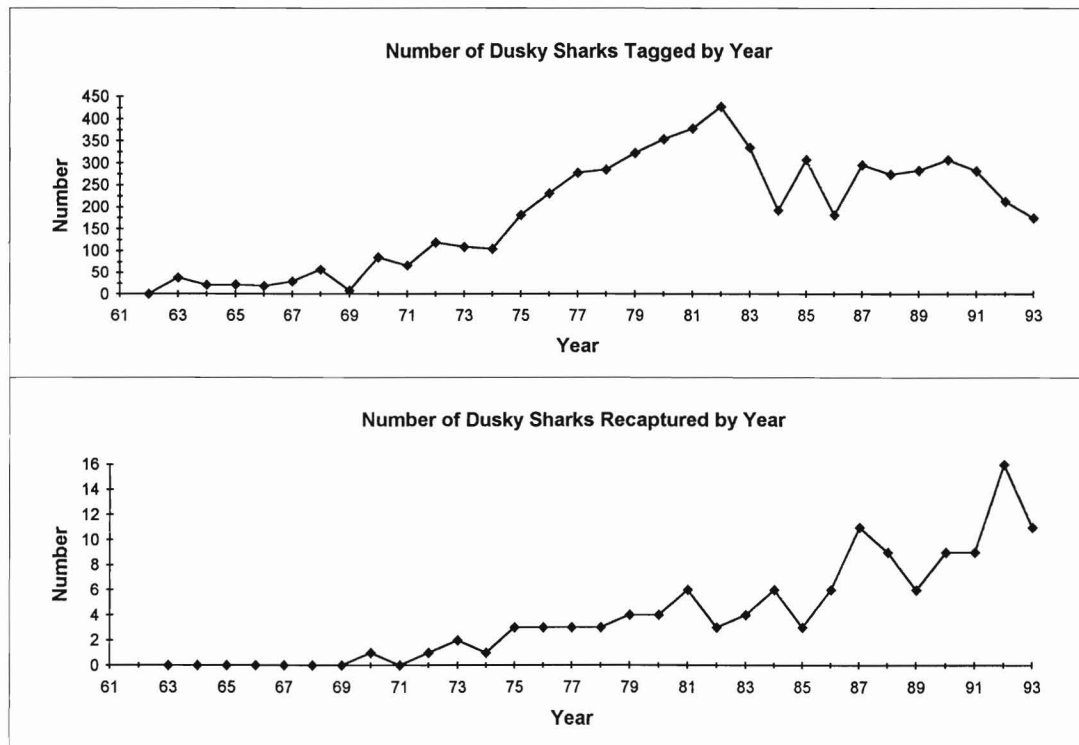


Figure 96.—Total number of dusky shark, *Carcharhinus obscurus*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

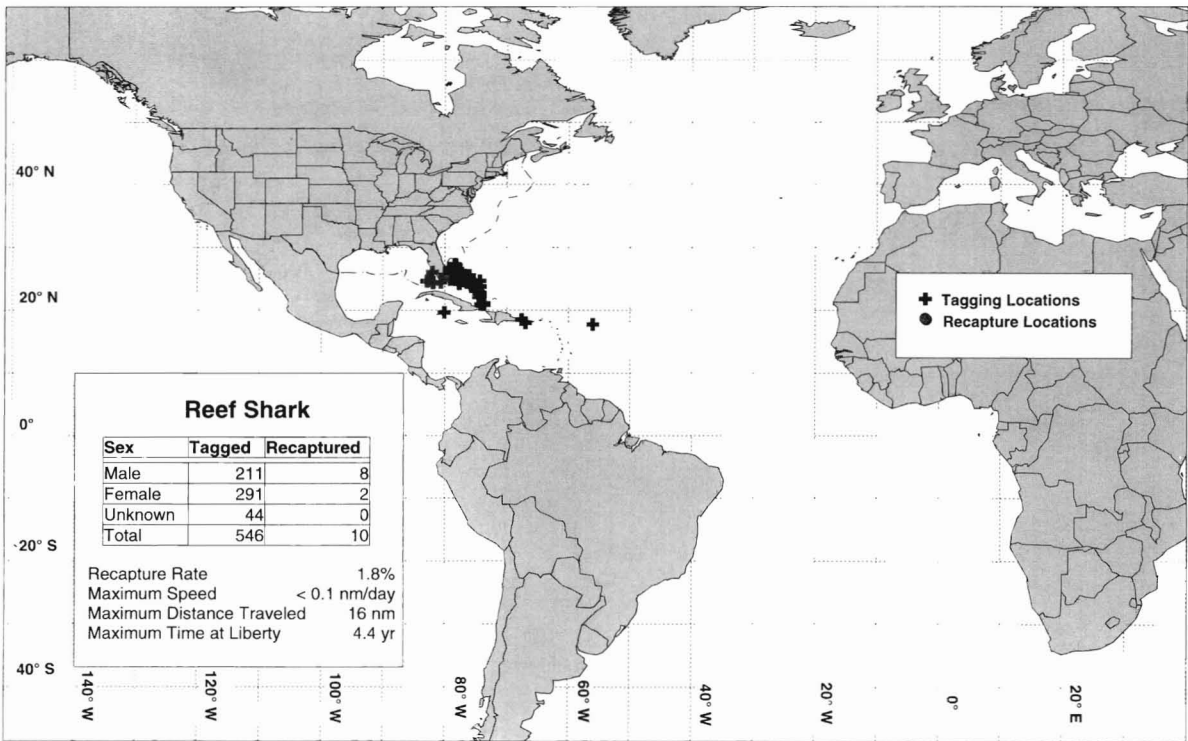


Figure 97.—Atlantic distribution of tag and recapture locations for the reef shark, *Carcharhinus perezii*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

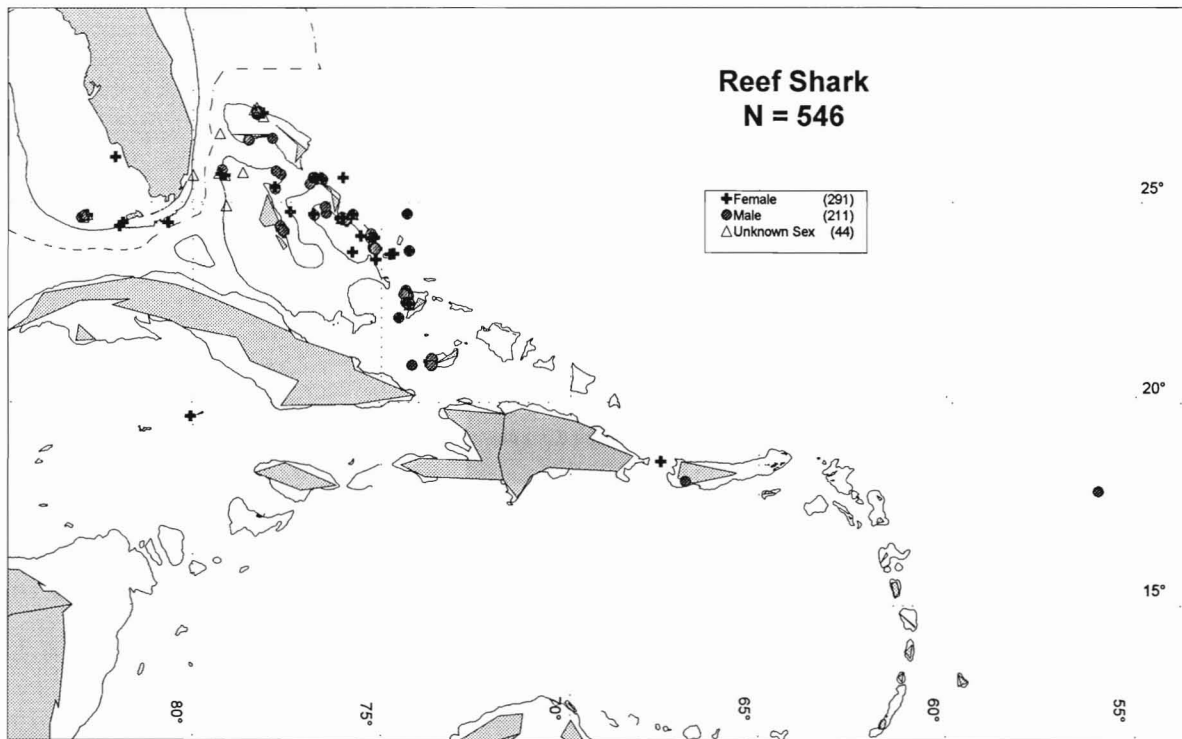


Figure 98.—Total tagging distribution for the reef shark, *Carcharhinus perezii*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

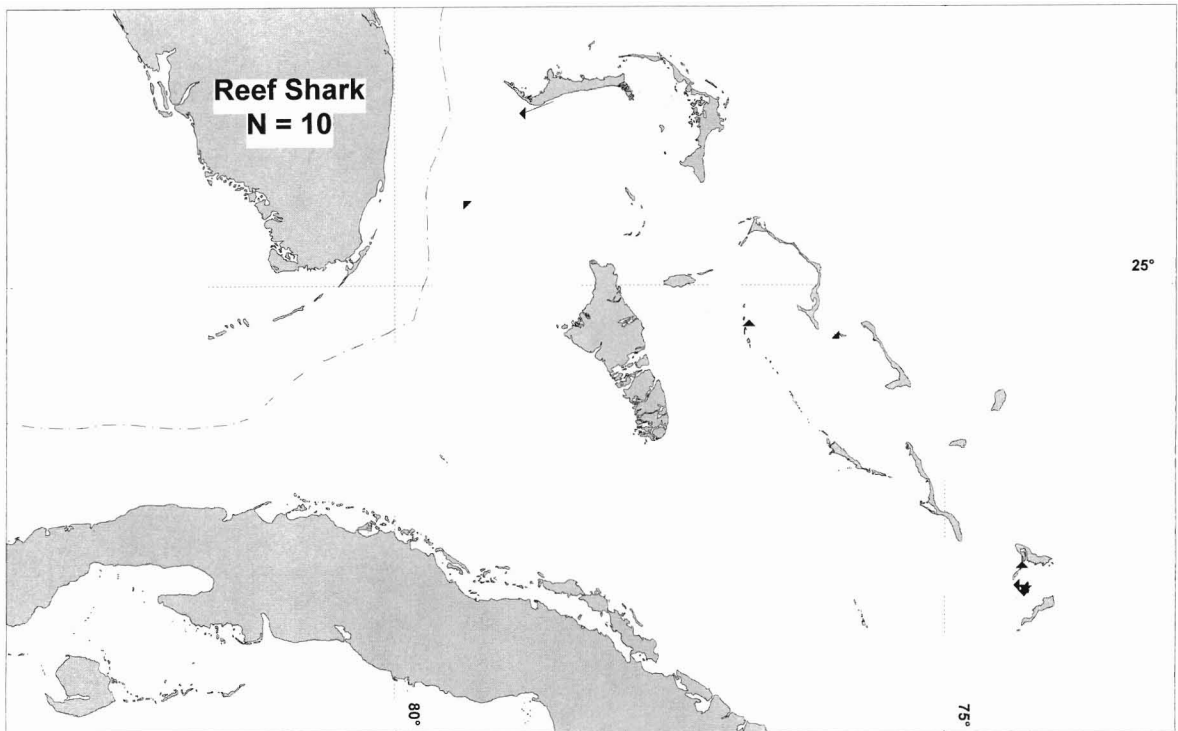


Figure 99.—Recapture distribution for the reef shark, *Carcharhinus perezii*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

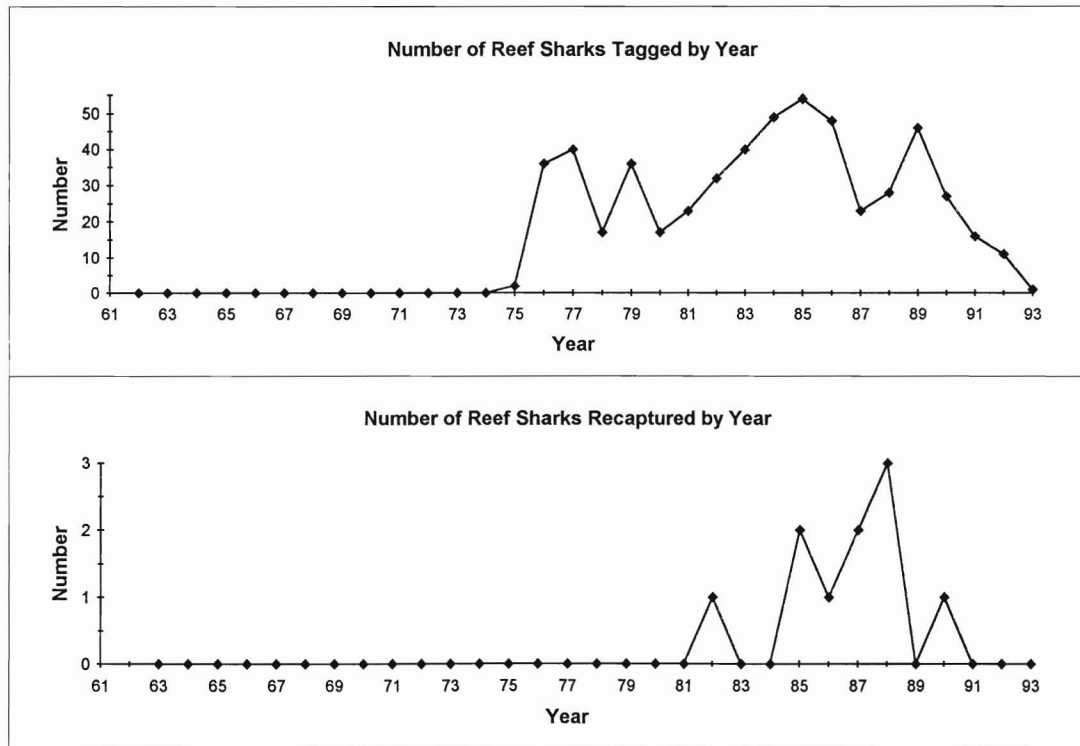


Figure 100.—Total number of reef shark, *Carcharhinus perezii*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

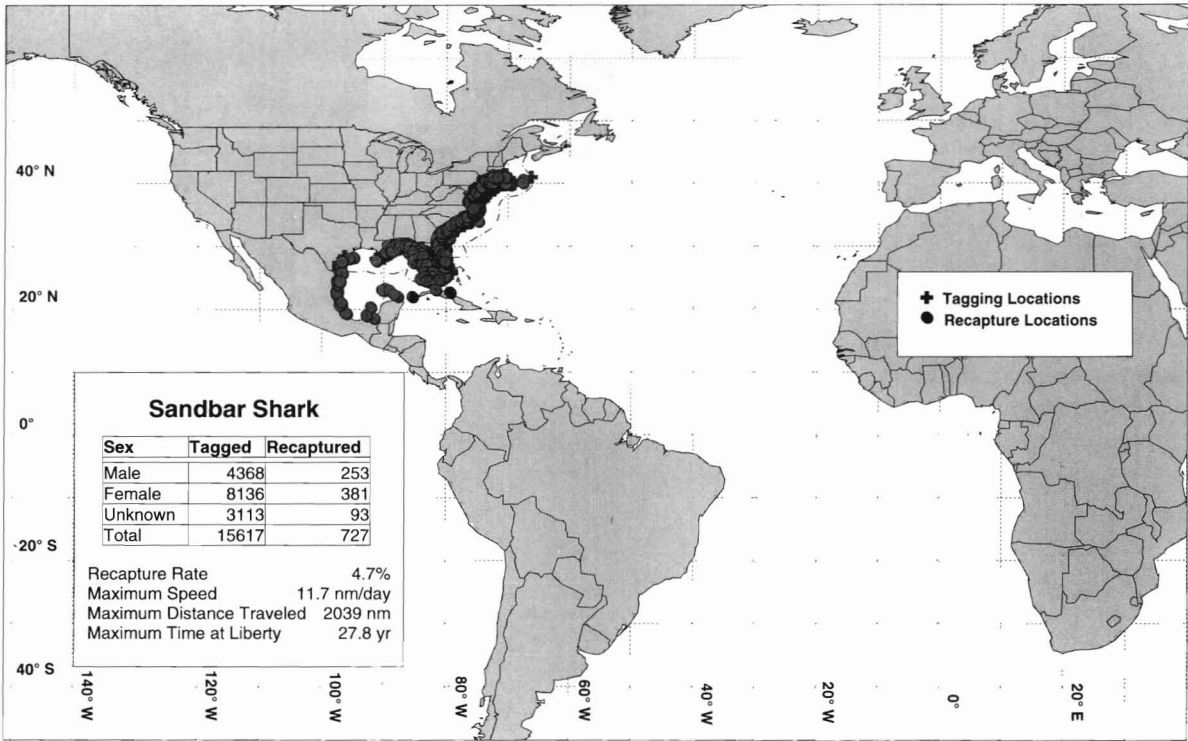


Figure 101.—Atlantic distribution of tag and recapture locations for the sandbar shark, *Carcharhinus plumbeus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

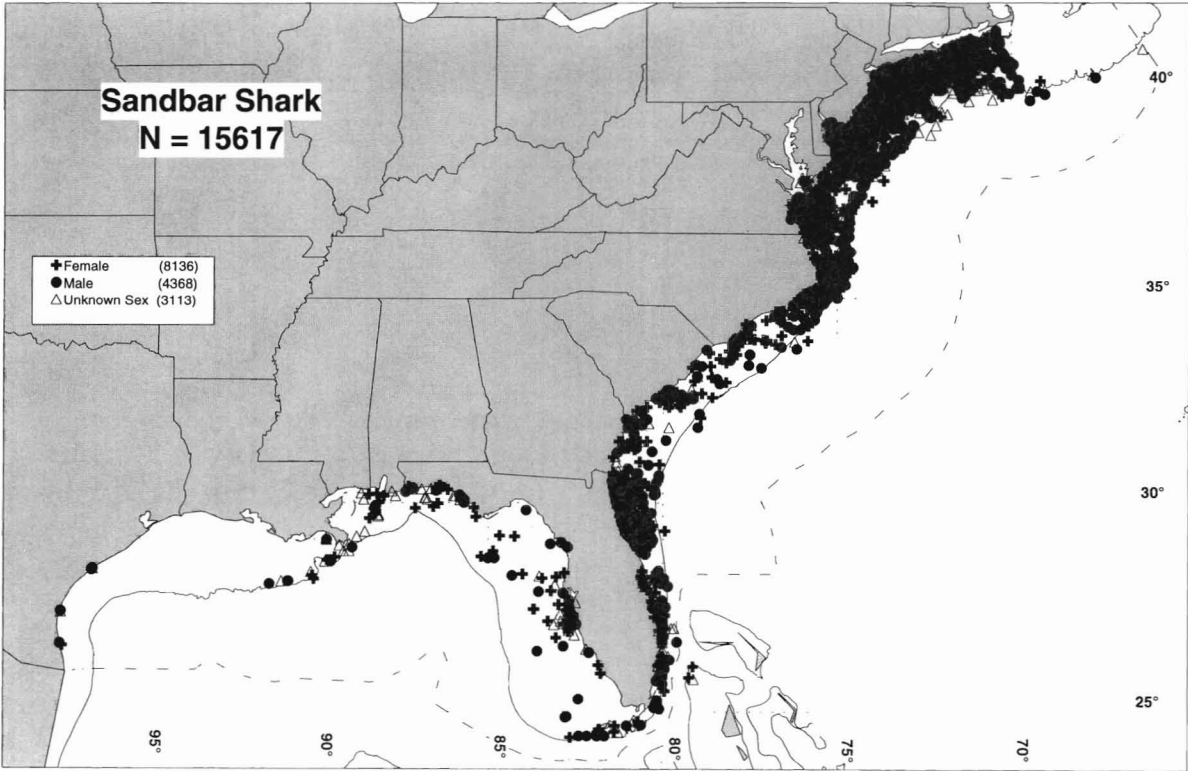


Figure 102.—Total tagging distribution for the sandbar shark, *Carcharhinus plumbeus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

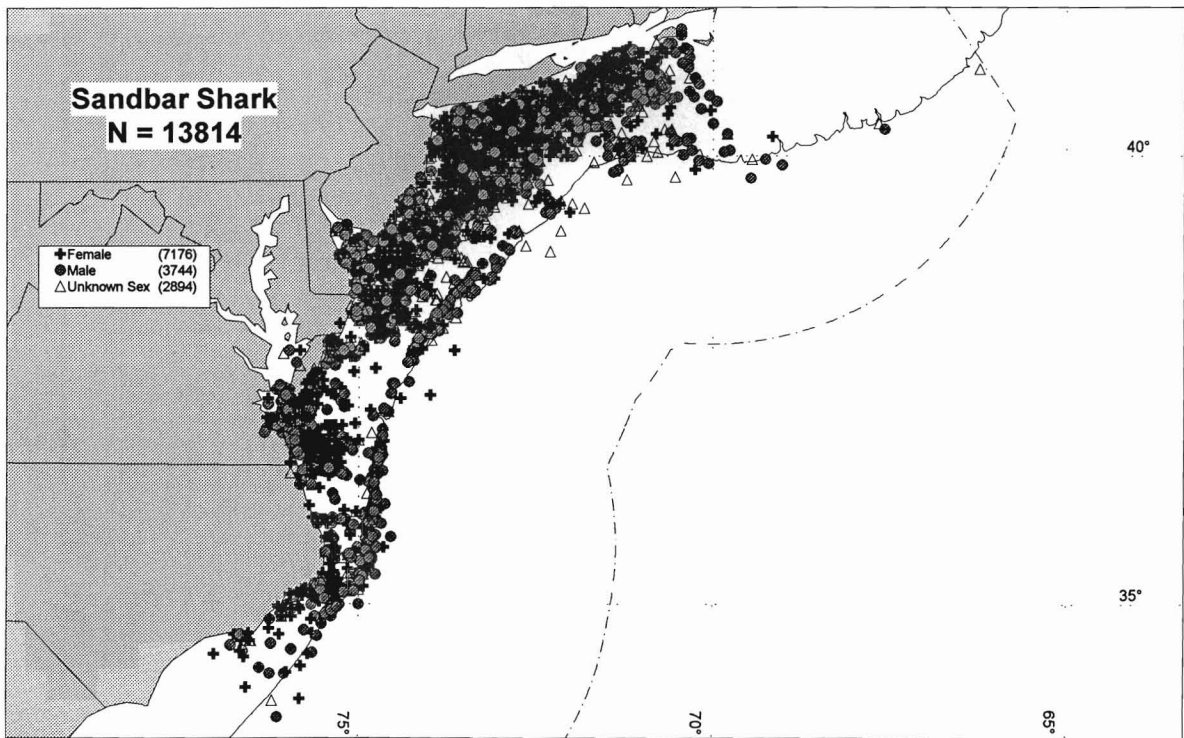


Figure 103.—Northeastern U.S. tagging distribution of the sandbar shark, *Carcharhinus plumbeus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

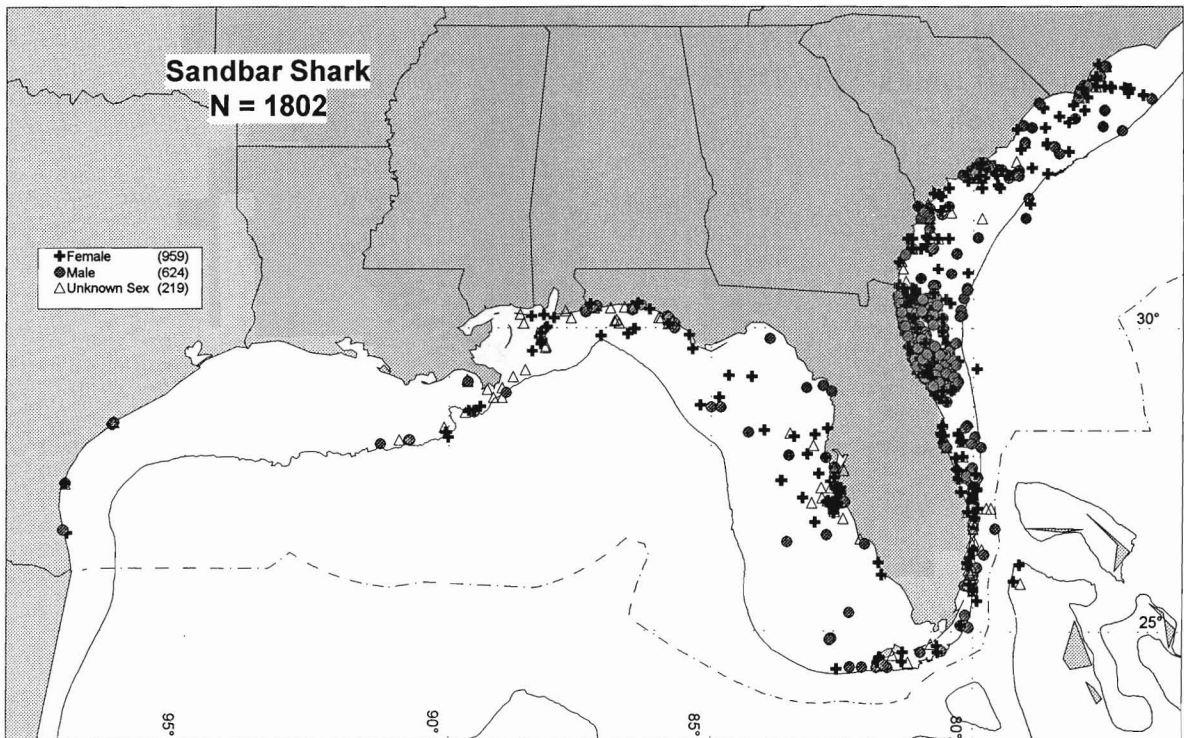


Figure 104.—Southeastern U.S. tagging distribution of the sandbar shark, *Carcharhinus plumbeus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

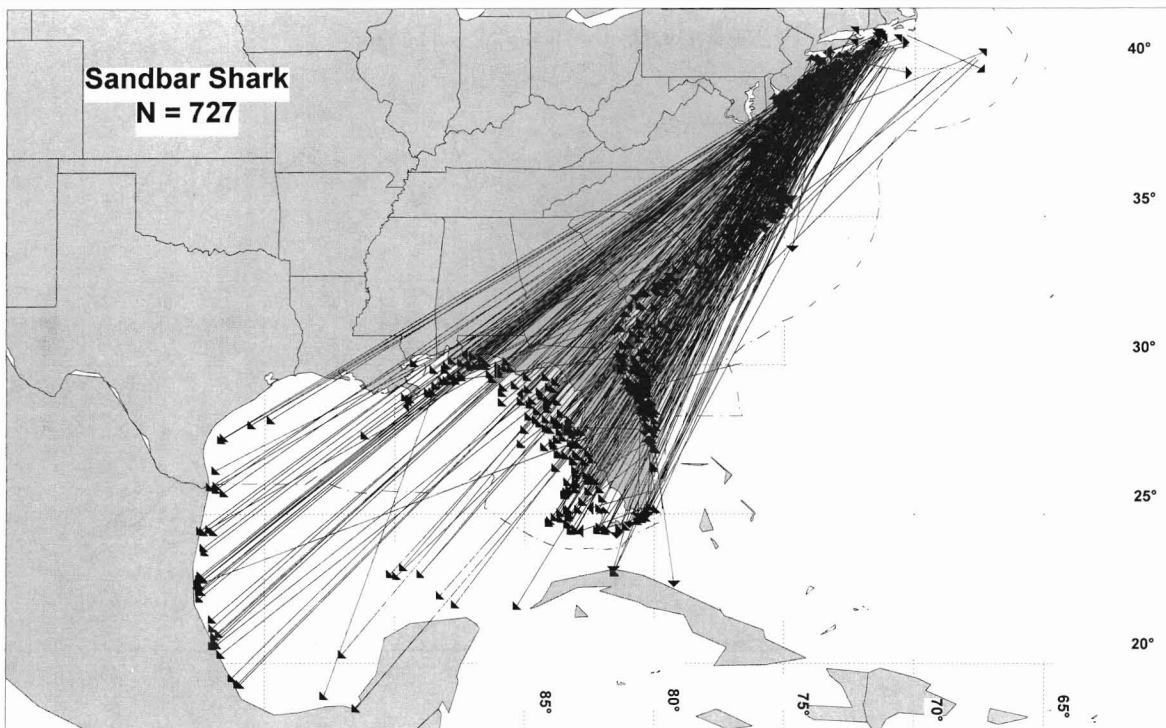


Figure 105.—Recapture distribution for the sandbar shark, *Carcharhinus plumbeus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

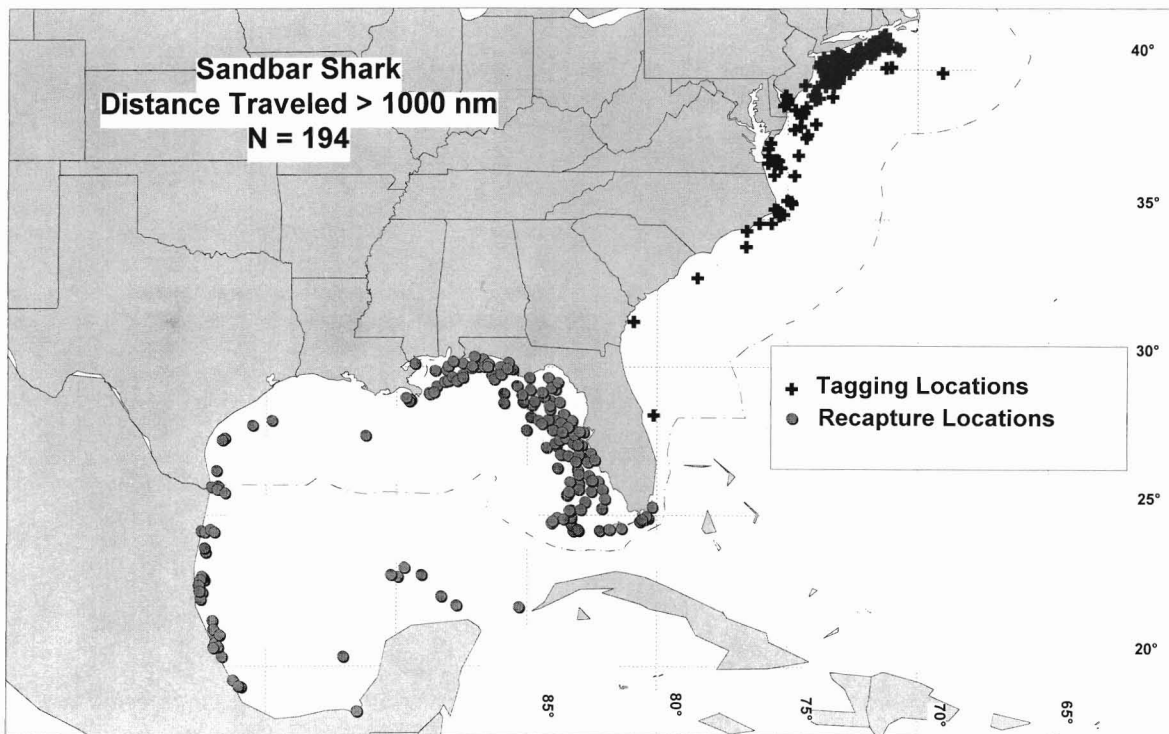


Figure 106.—Long distance recoveries (> 1000 n. mi.) for the sandbar shark, *Carcharhinus plumbeus*, showing tagging and recapture locations, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

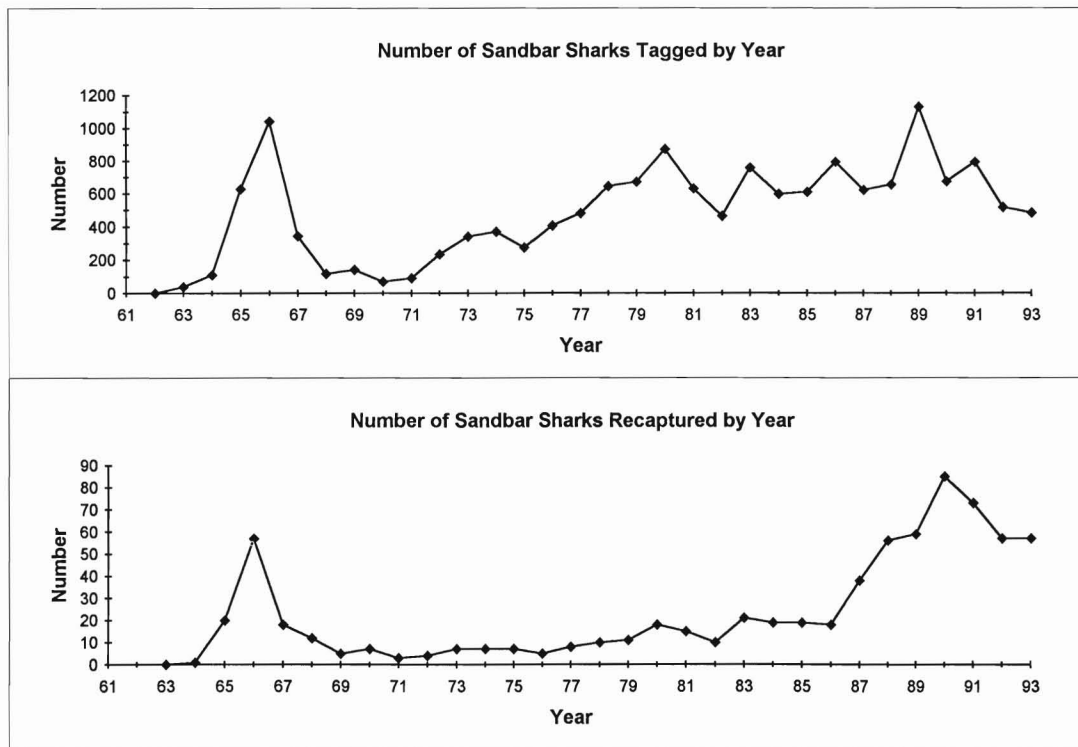


Figure 107.—Total number of sandbar shark, *Carcharhinus plumbeus*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

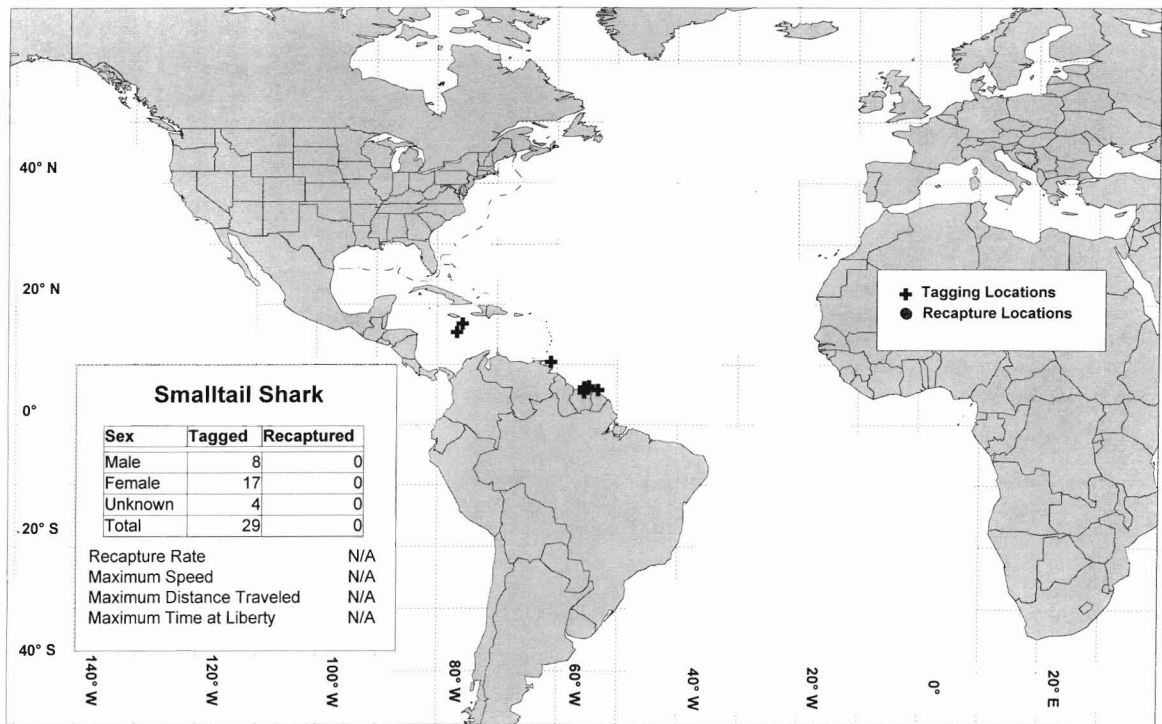


Figure 108.—Atlantic distribution of tag and recapture locations for the smalltail shark, *Carcharhinus porosus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

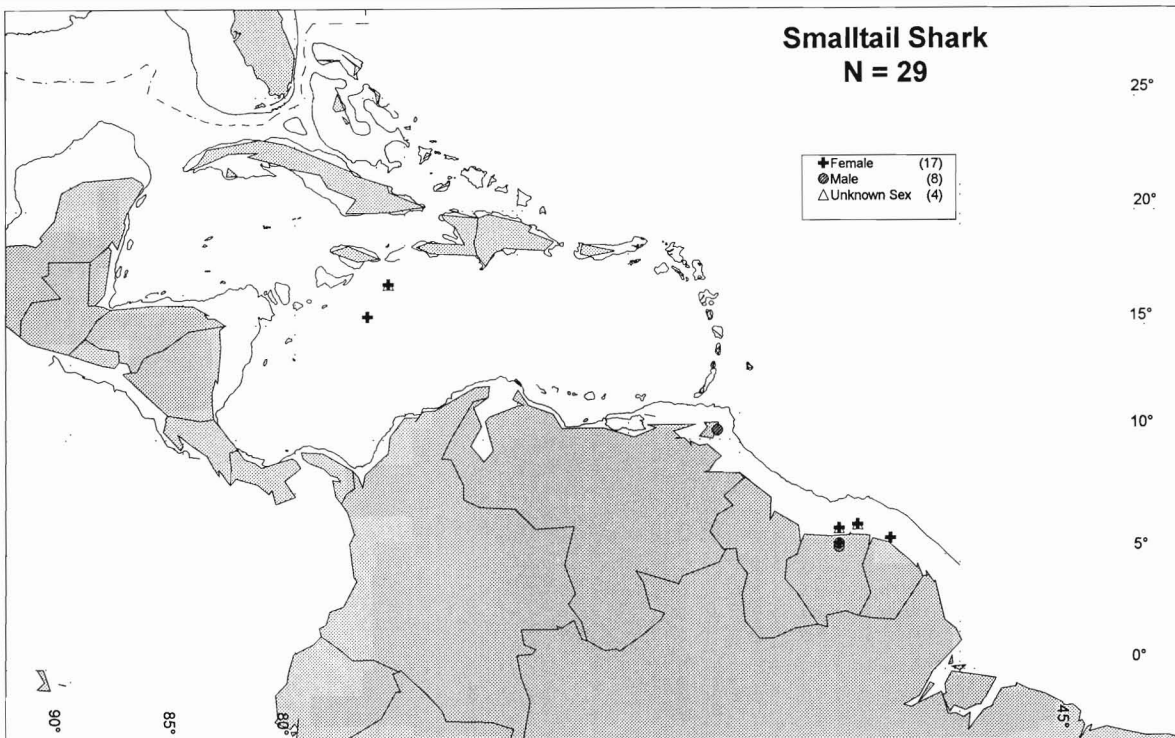


Figure 109.—Total tagging distribution for the smalltail shark, *Carcharhinus porosus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

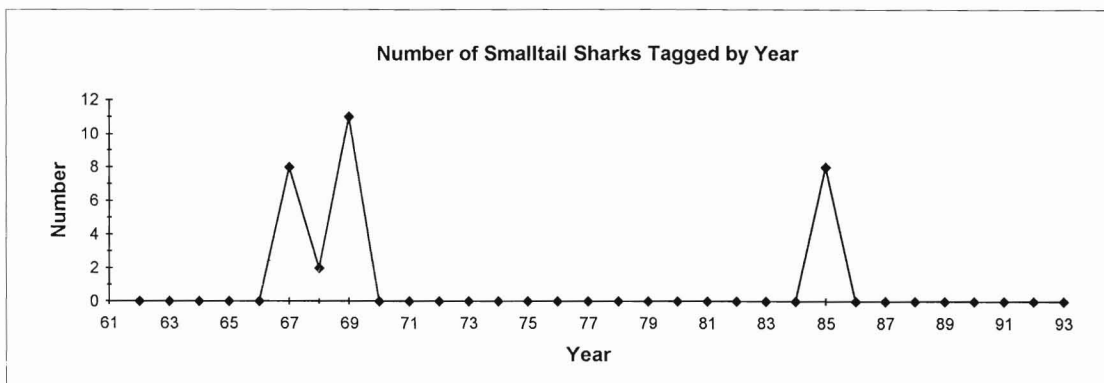


Figure 110.—Total number of smalltail shark, *Carcharhinus porosus*, tagged by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

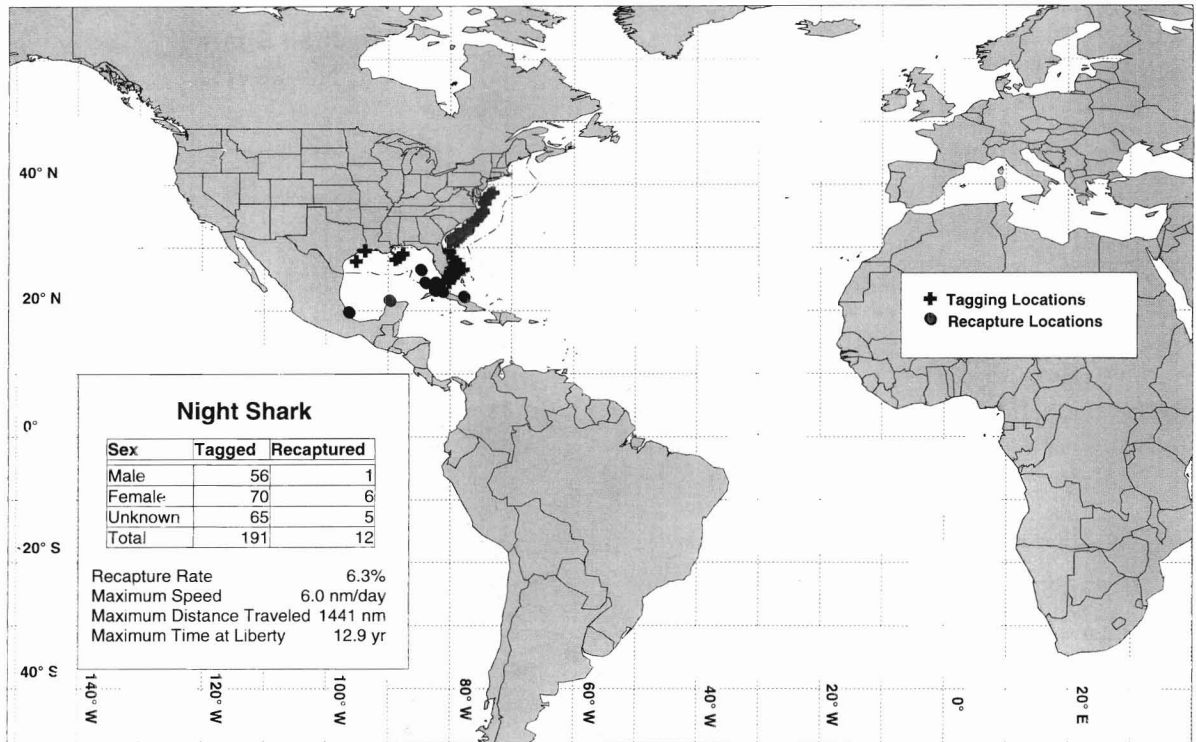


Figure 111.—Atlantic distribution of tag and recapture locations for the night shark, *Carcharhinus signatus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

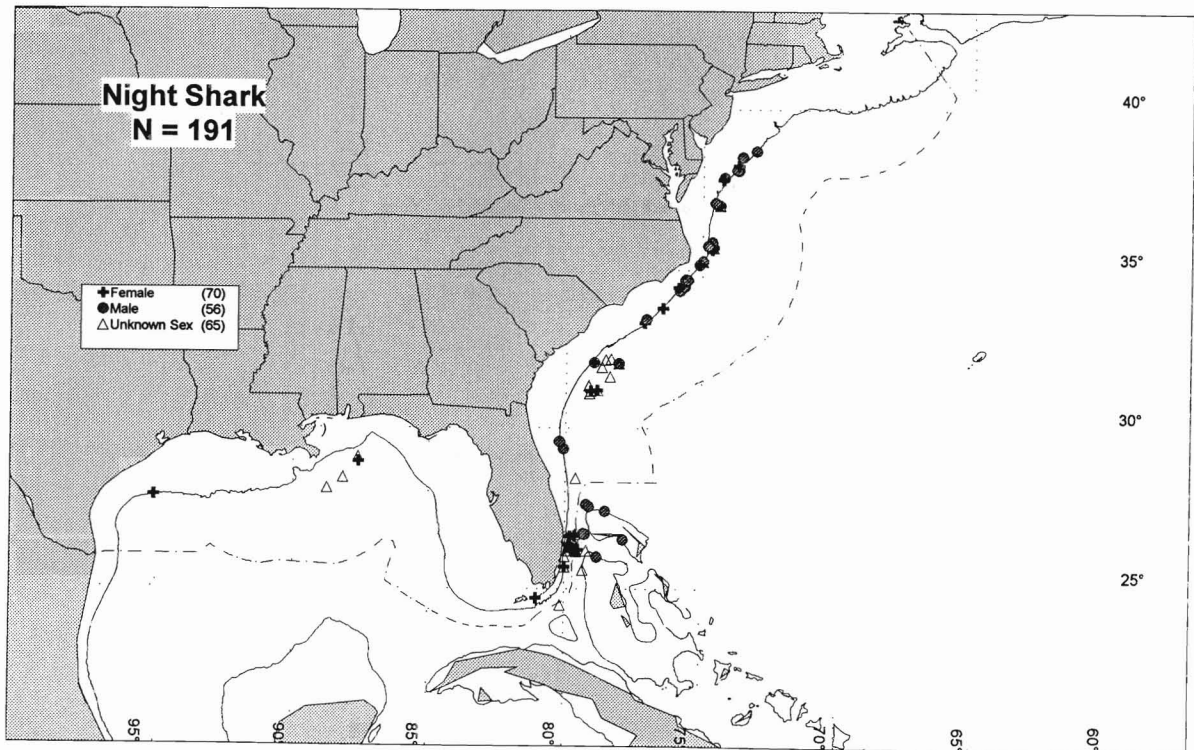


Figure 112.—Total tagging distribution for the night shark, *Carcharhinus signatus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

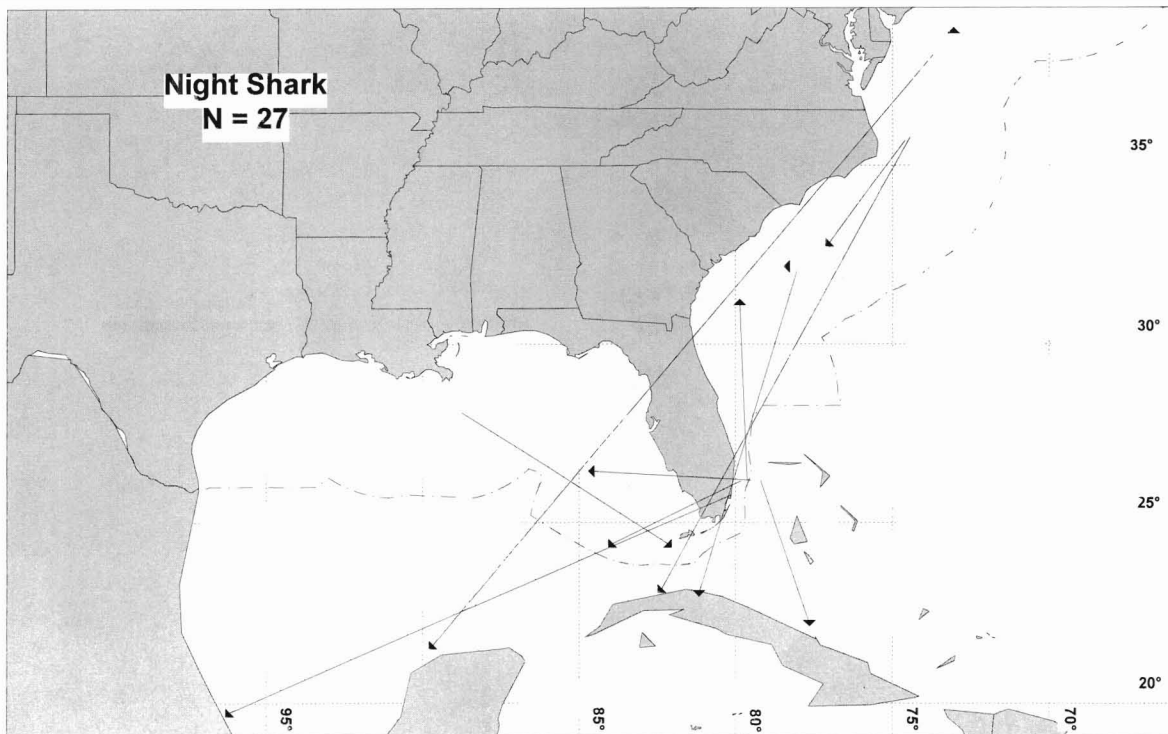


Figure 113.—Recapture distribution for the night shark, *Carcharhinus signatus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

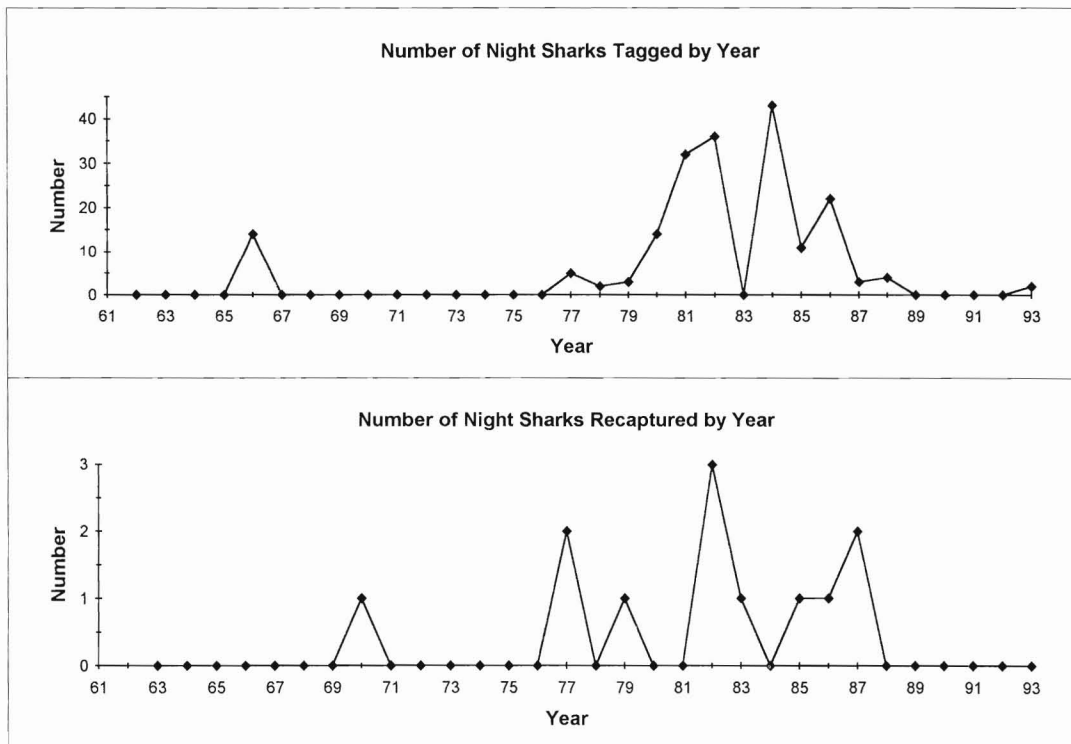


Figure 114.—Total number of night shark, *Carcharhinus signatus*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

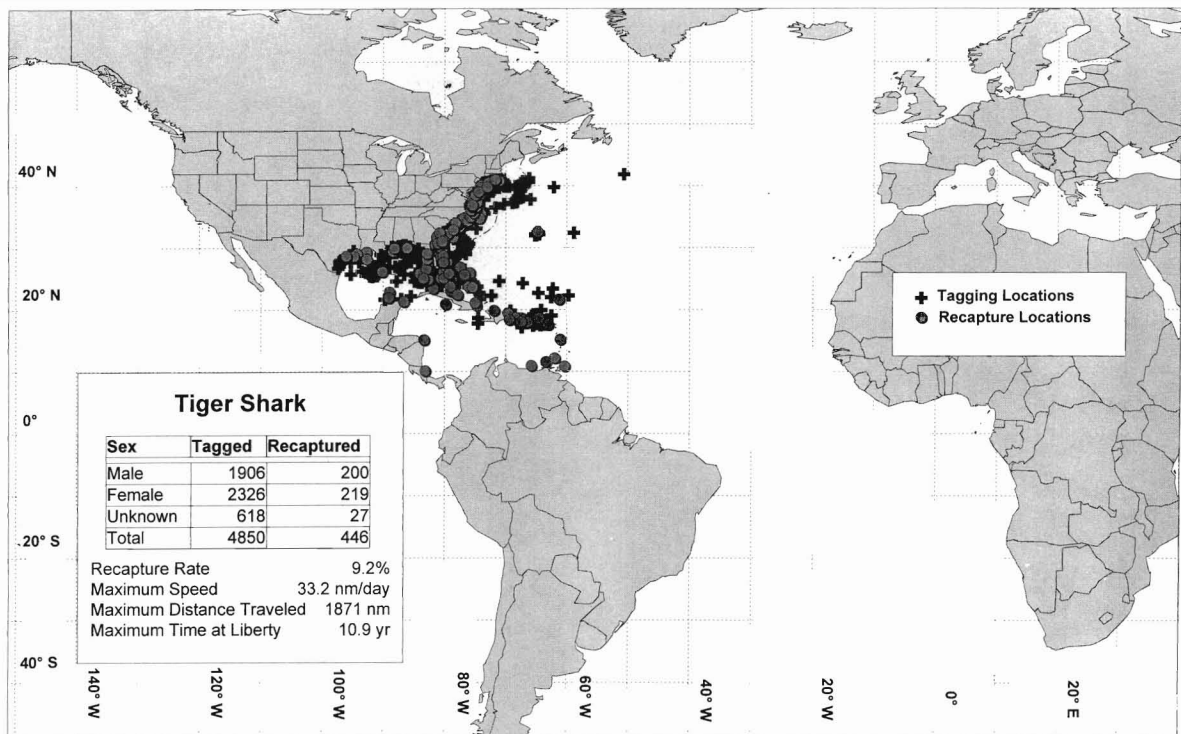


Figure 115.—Atlantic distribution of tag and recapture locations for the tiger shark, *Galeocerdo cuvier*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

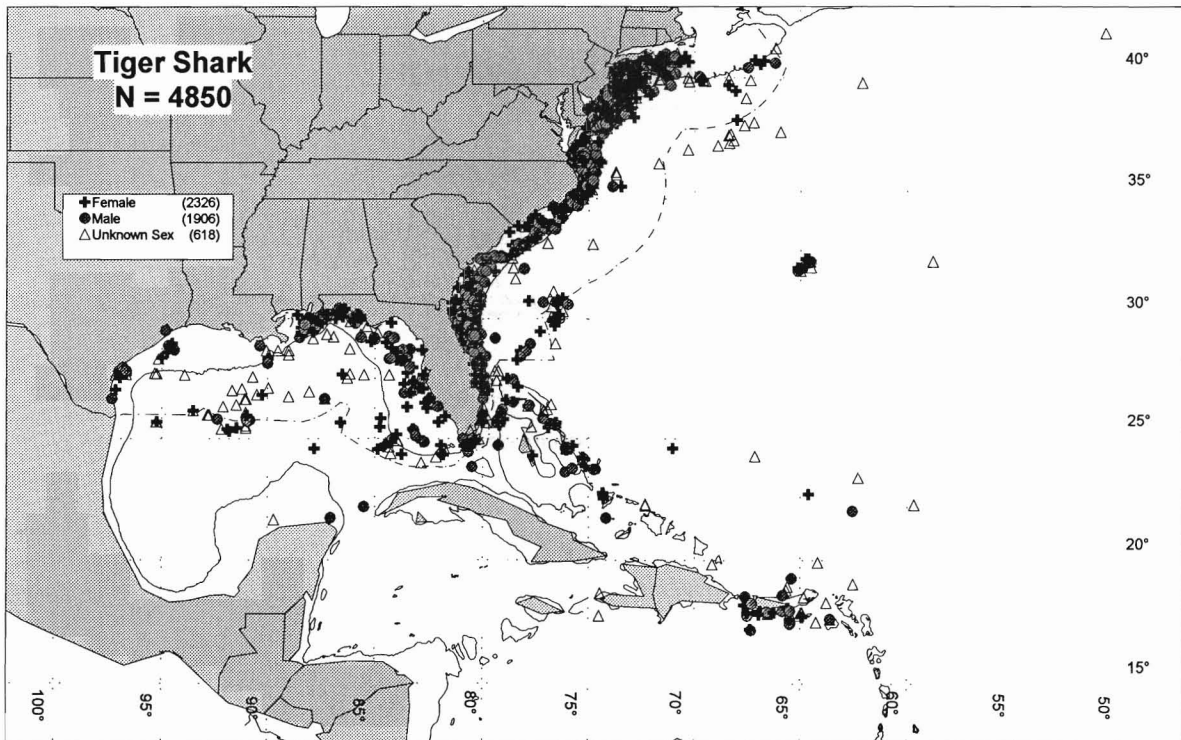


Figure 116.—Total tagging distribution for the tiger shark, *Galeocerdo cuvier*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

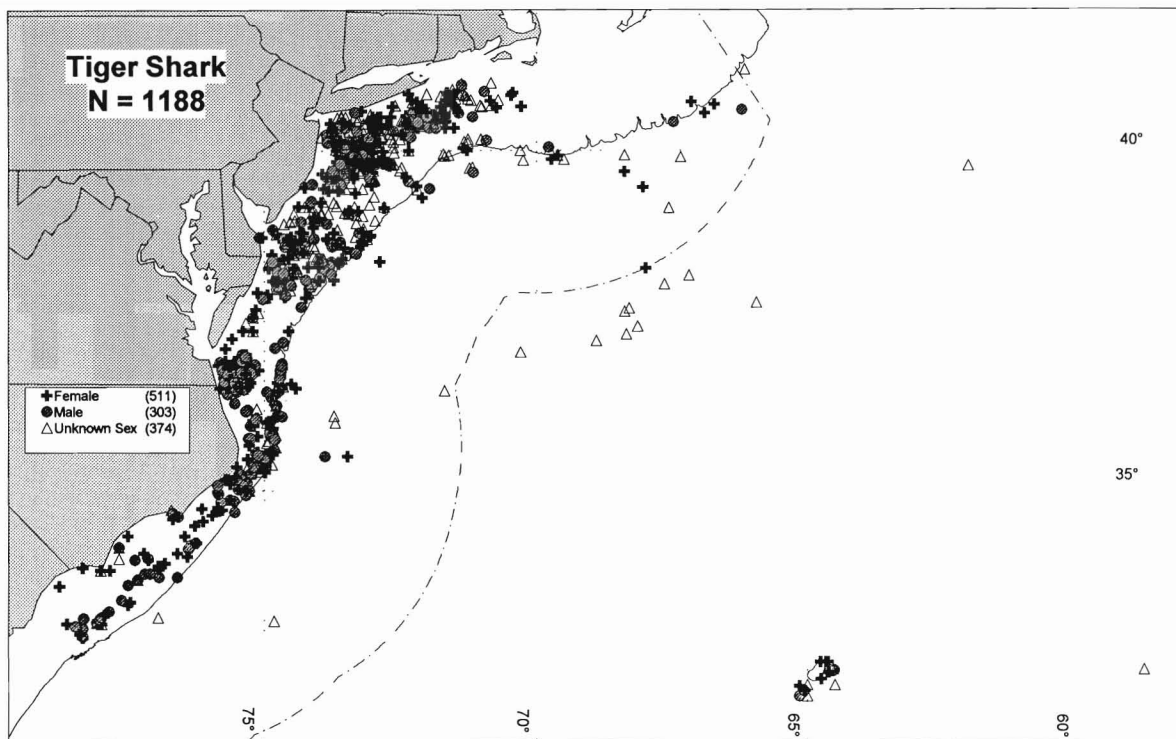


Figure 117.—Northeastern U.S. tagging distribution of the tiger shark, *Galeocerdo cuvier*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

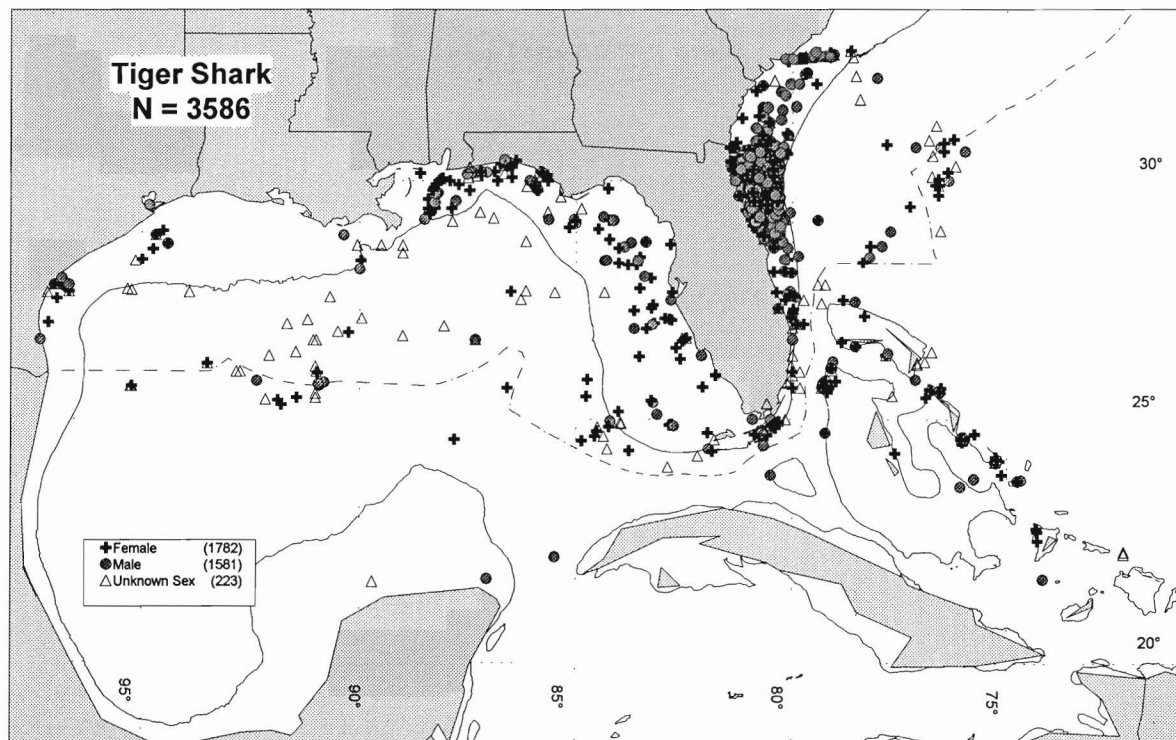


Figure 118.—Southeastern U.S. tagging distribution of the tiger shark, *Galeocerdo cuvier*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

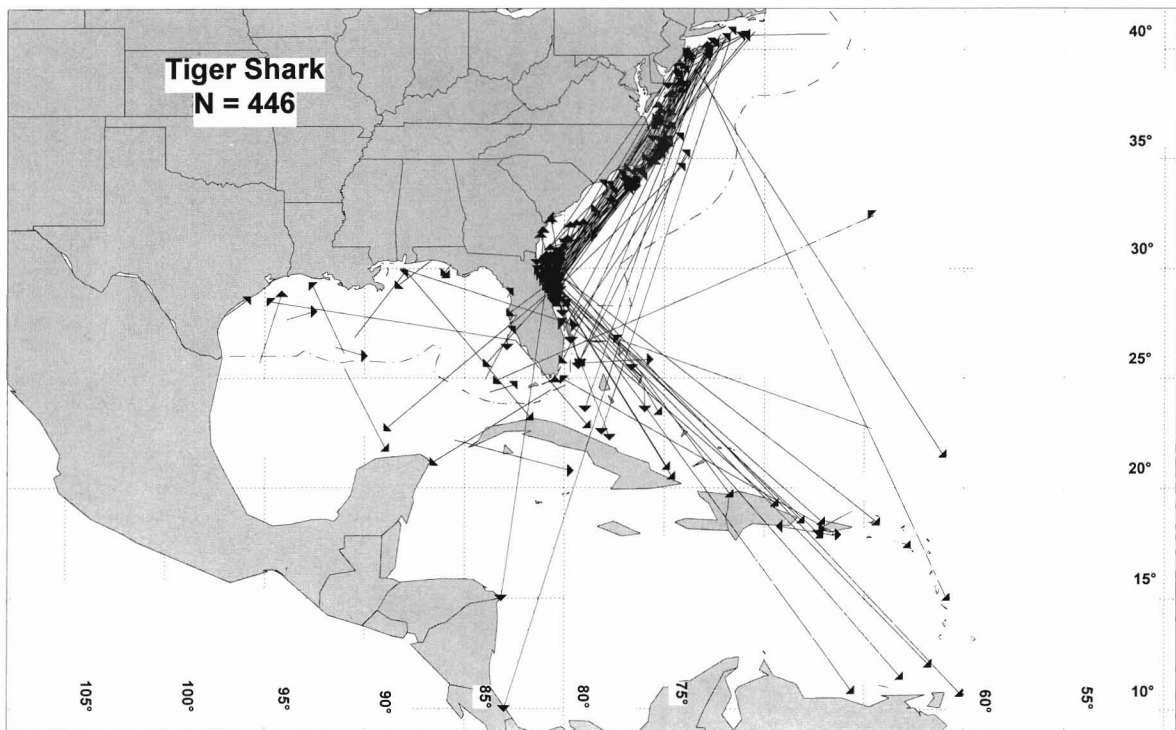


Figure 119.—Recapture distribution for the tiger shark, *Galeocerdo cuvier*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

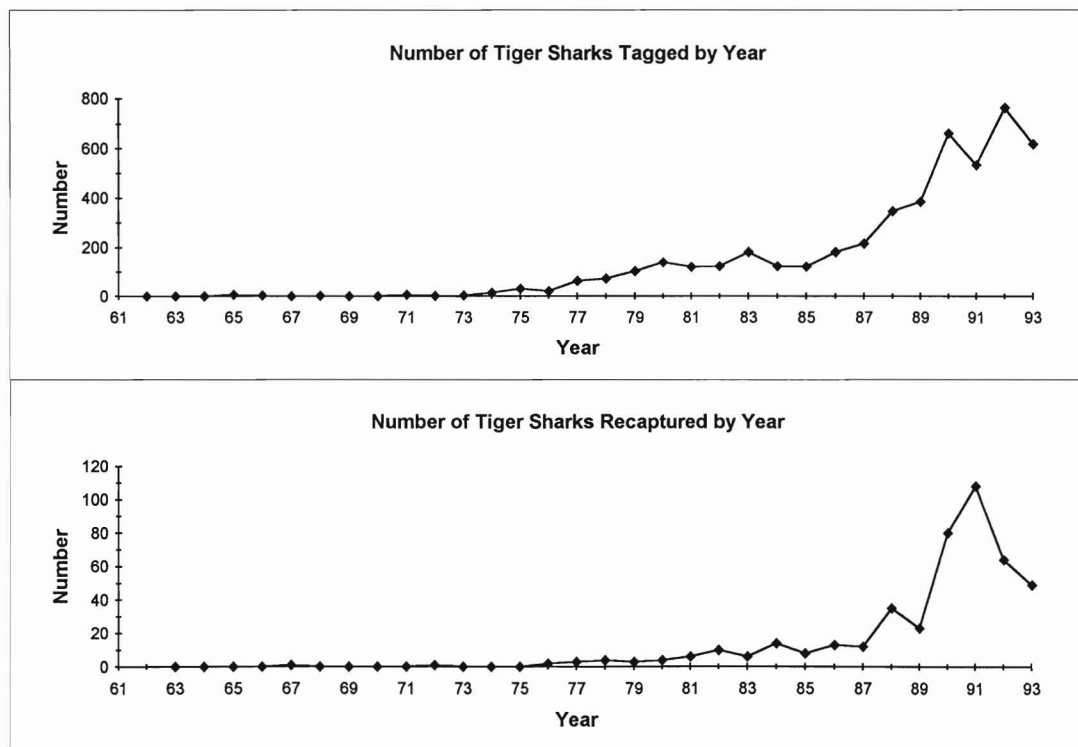


Figure 120.—Total number of tiger shark, *Galeocerdo cuvier*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

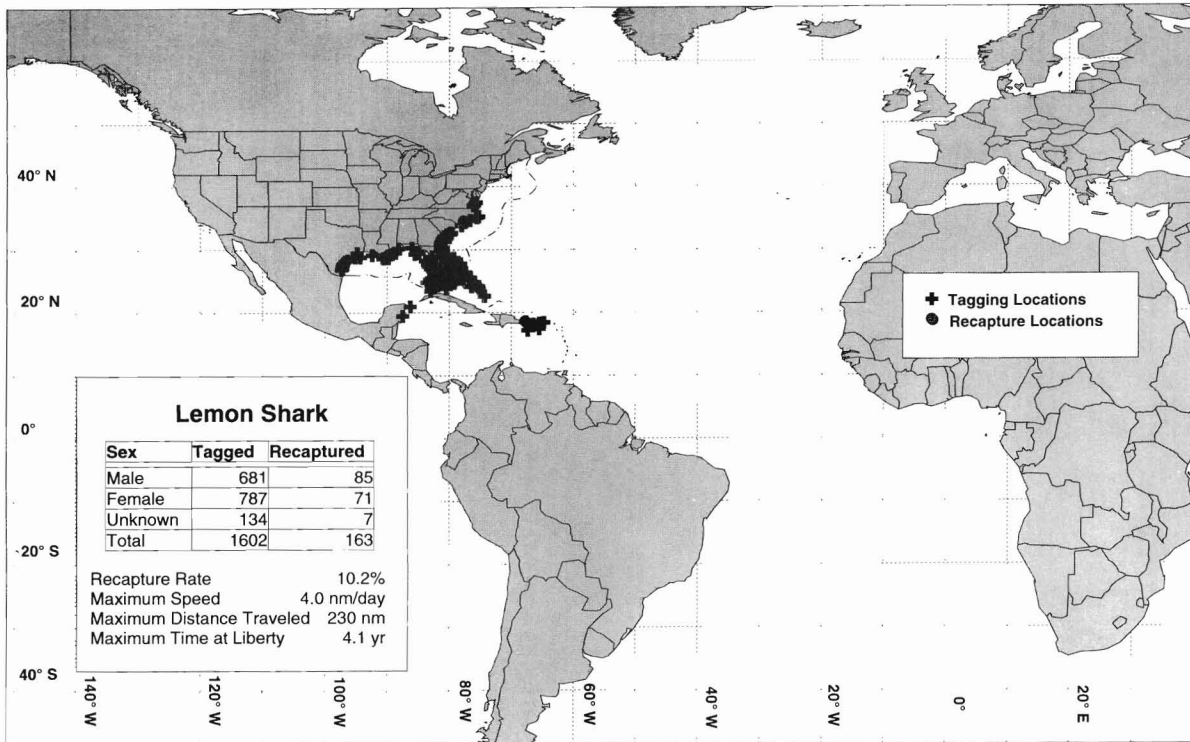


Figure 121.—Atlantic distribution of tag and recapture locations for the lemon shark, *Negaprion brevirostris*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

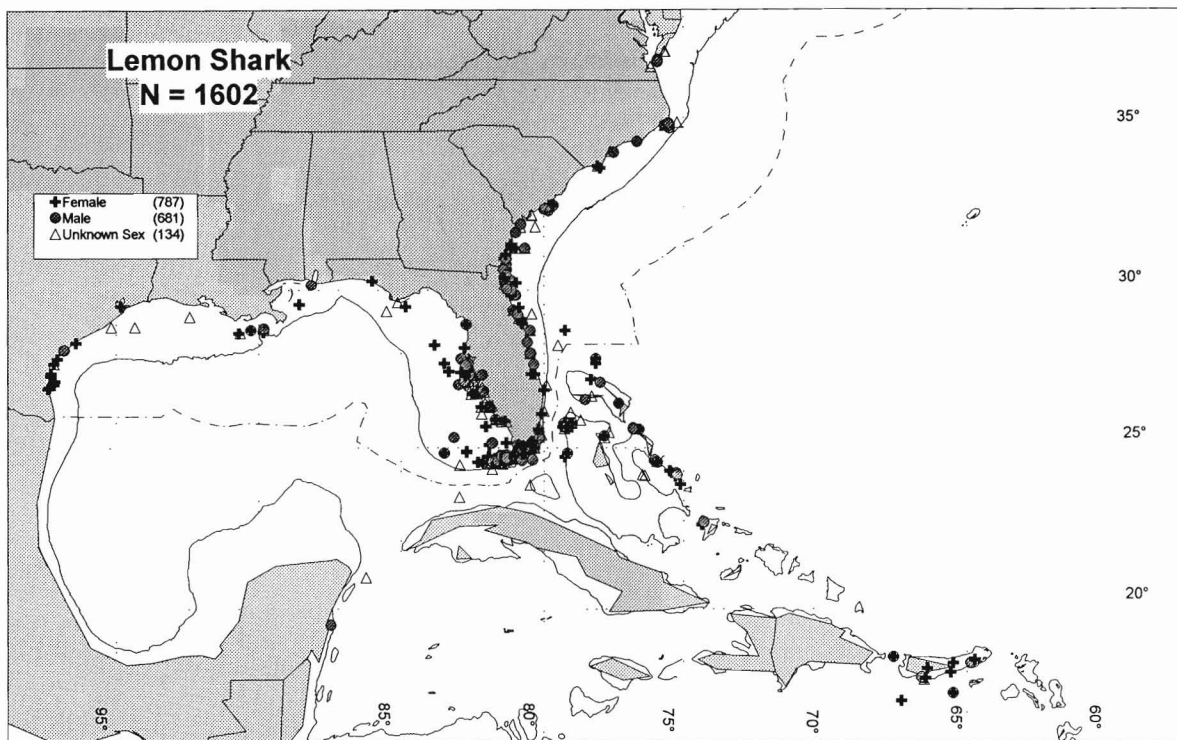


Figure 122.—Total tagging distribution for the lemon shark, *Negaprion brevirostris*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

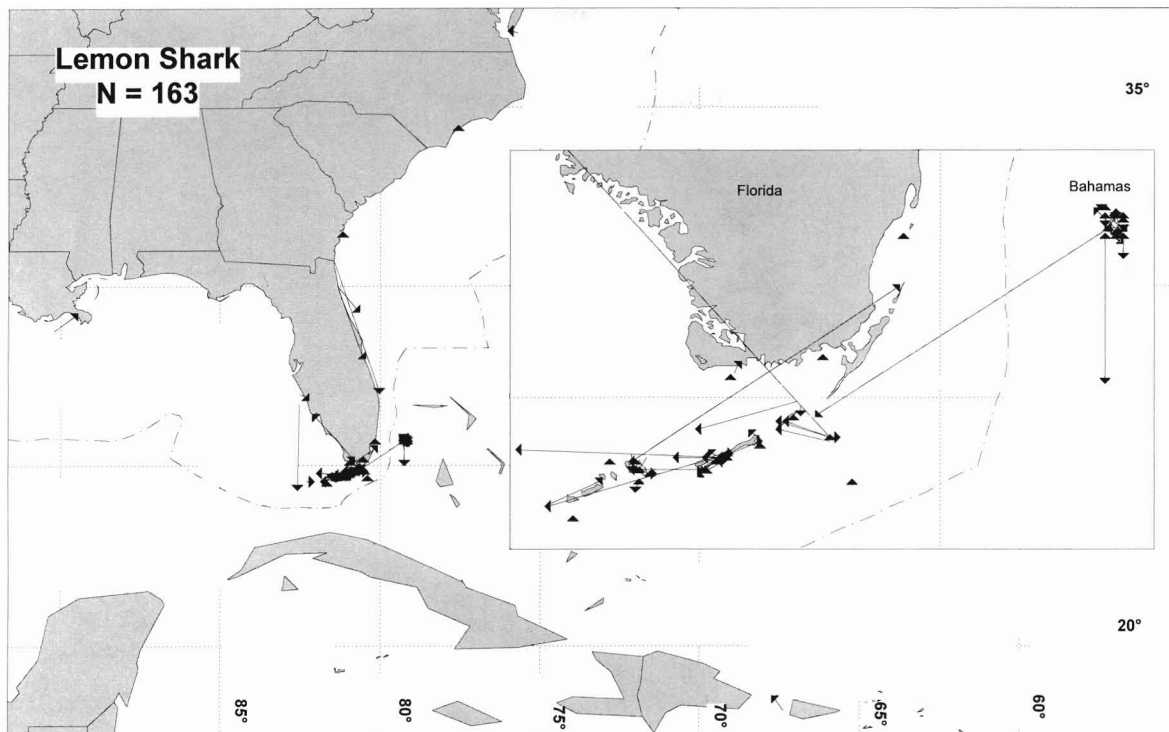


Figure 123.—Recapture distribution for the lemon shark, *Negaprion brevirostris*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

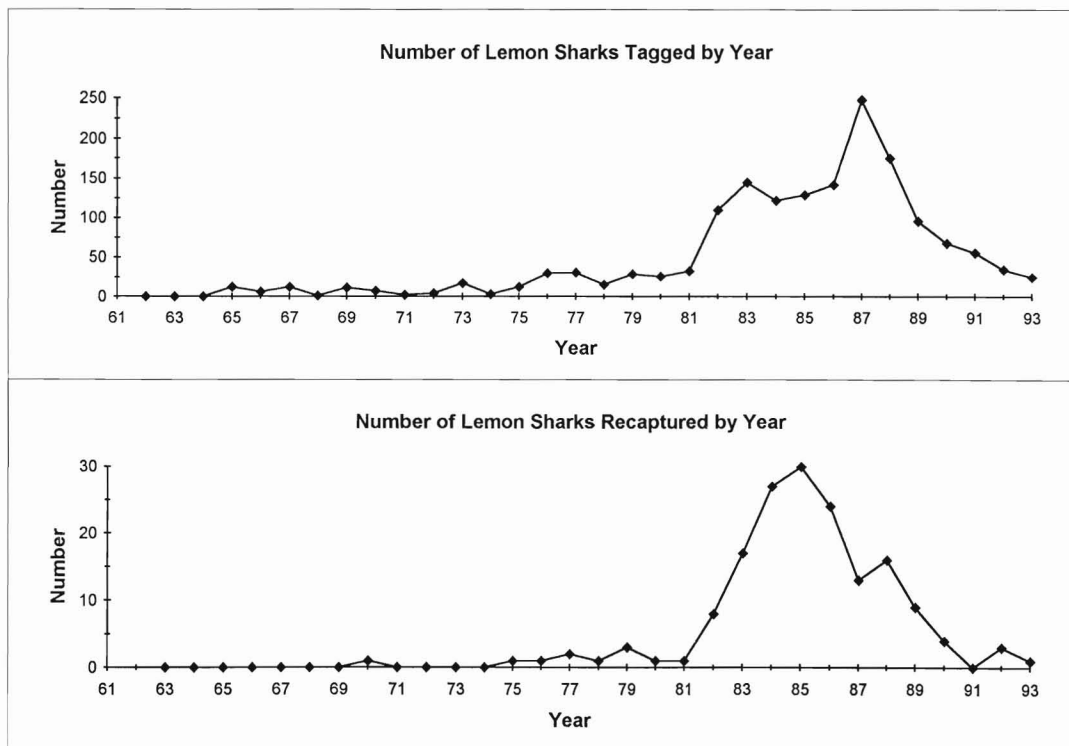


Figure 124.—Total number of lemon shark, *Negaprion brevirostris*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

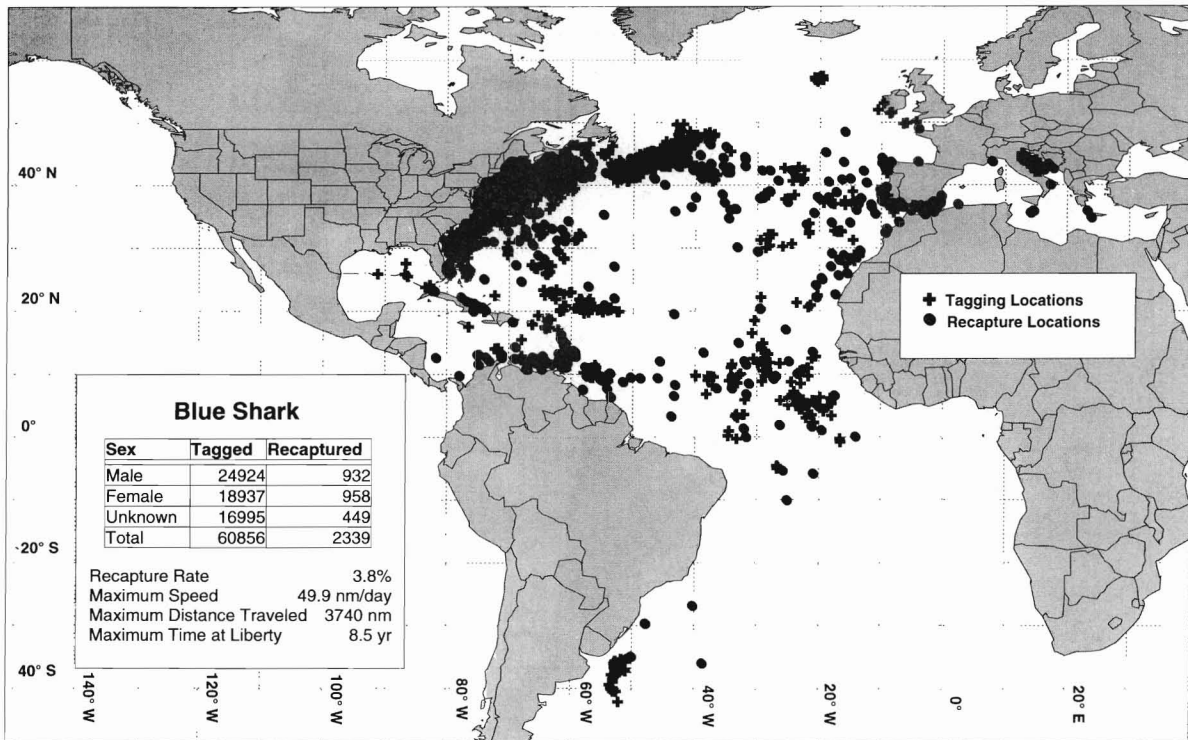


Figure 125.—Atlantic distribution of tag and recapture locations for the blue shark, *Prionace glauca*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

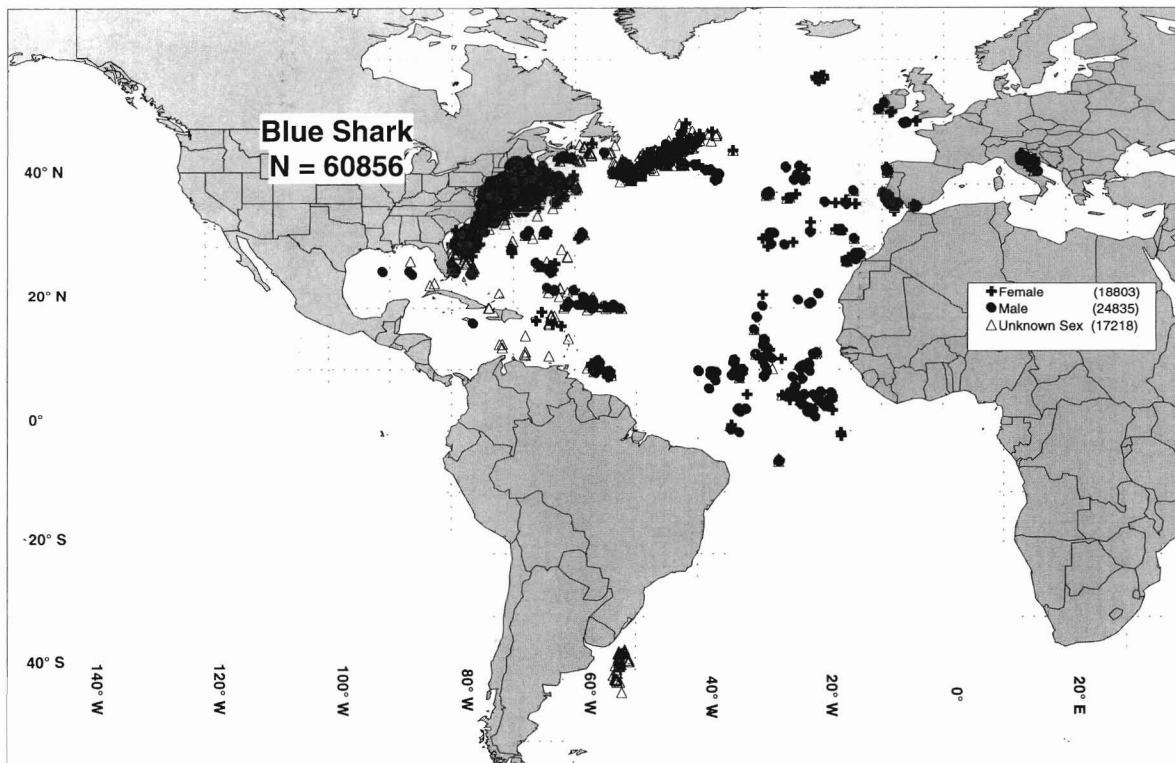


Figure 126.—Total tagging distribution for the blue shark, *Prionace glauca*, from the NMFS Cooperative Shark Tagging Program during 1962–93.

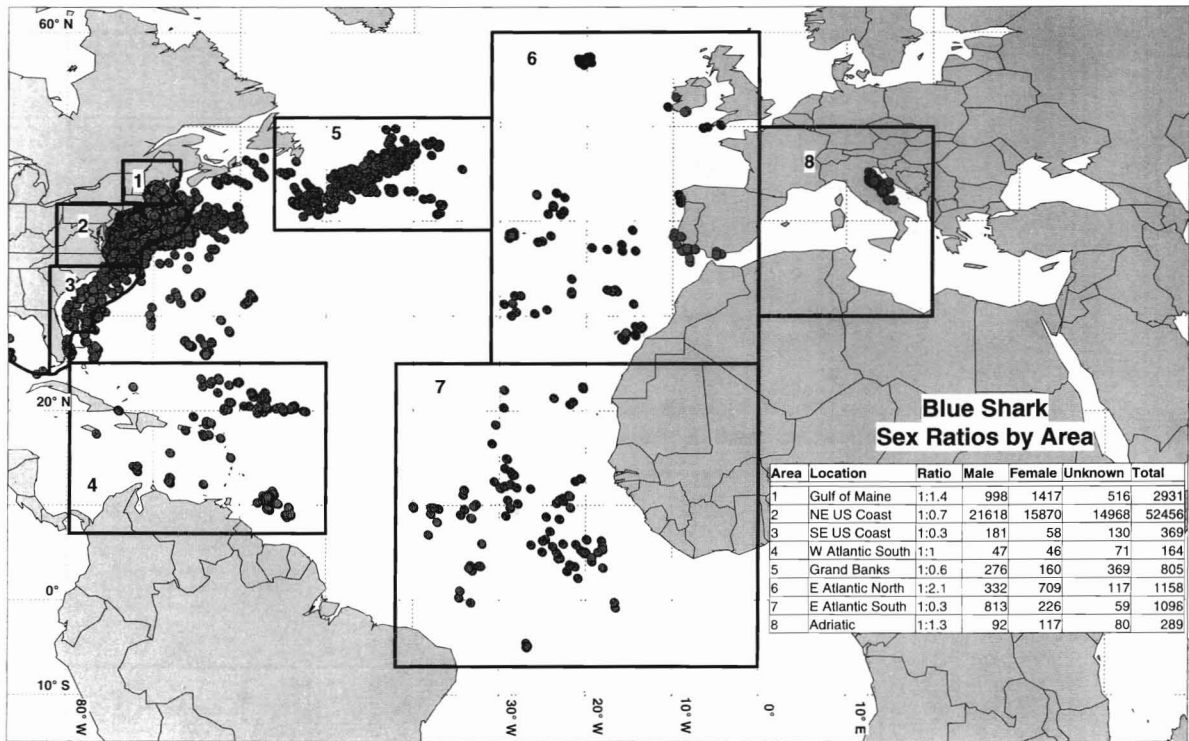


Figure 127.—Sex ratios of the blue shark, *Prionace glauca*, by area, from the NMFS Cooperative Shark Tagging Program during 1962–93.

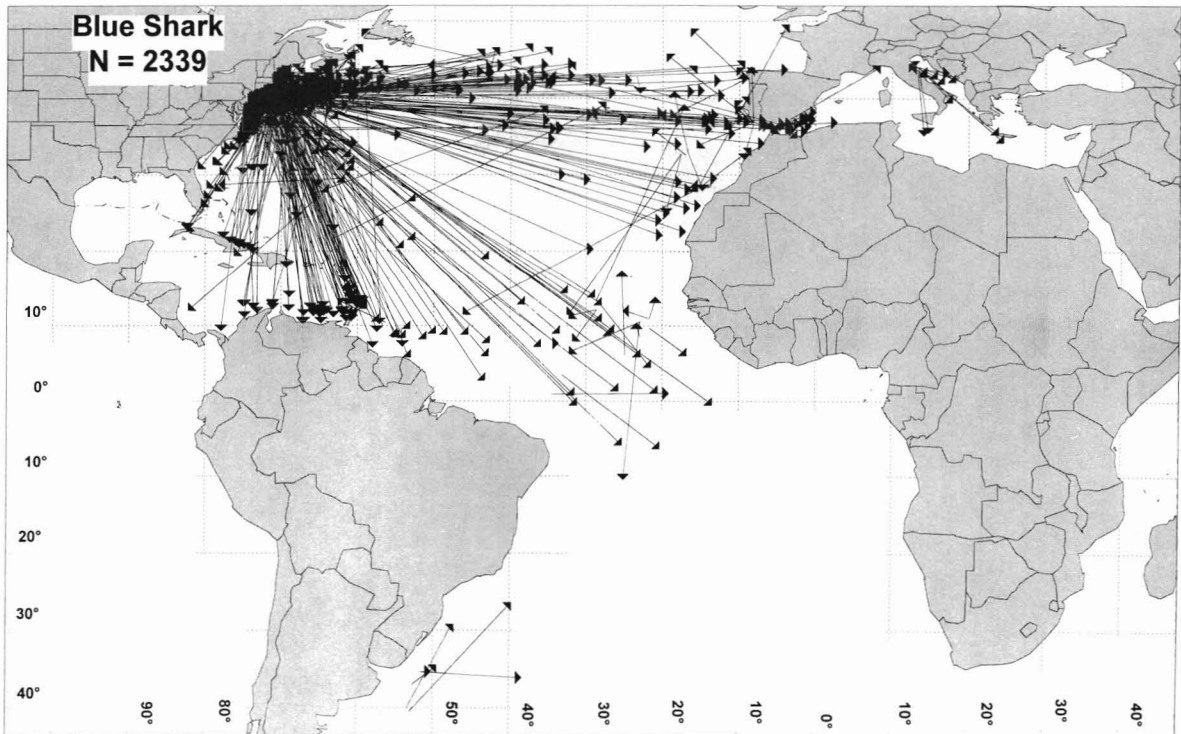


Figure 128.—Recapture distribution for the blue shark, *Prionace glauca*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

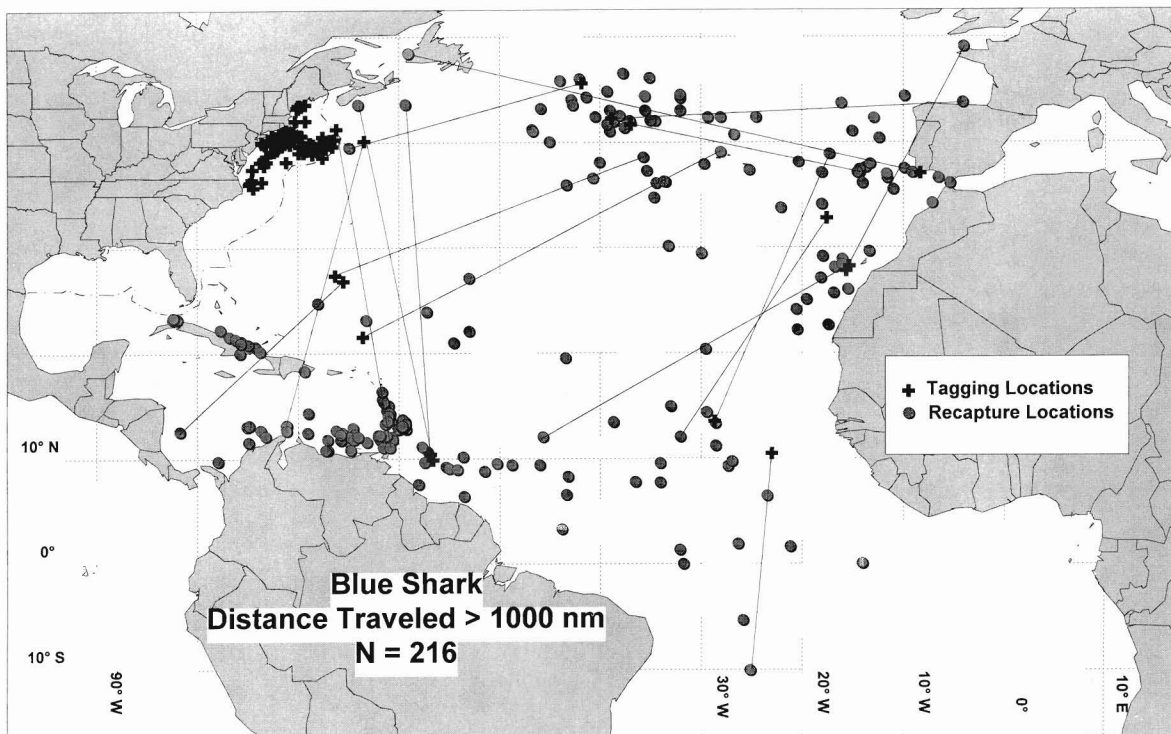


Figure 129.—Long distance recoveries (> 1000 n. mi.) for the blue shark, *Prionace glauca*, showing tag and recapture locations, from the NMFS Cooperative Shark Tagging Program during 1962–93. Lines are shown for those returns that were originally tagged outside the U.S. EEZ. The dotted-dashed line represents the U.S. EEZ.

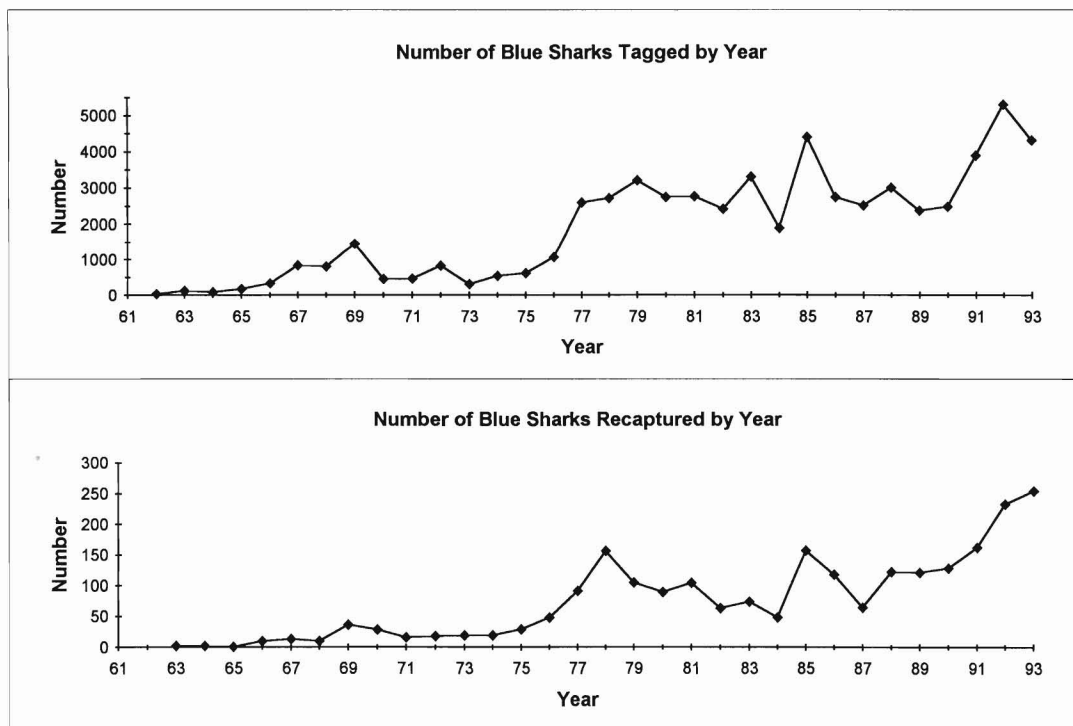


Figure 130.—Total number of blue shark, *Prionace glauca*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

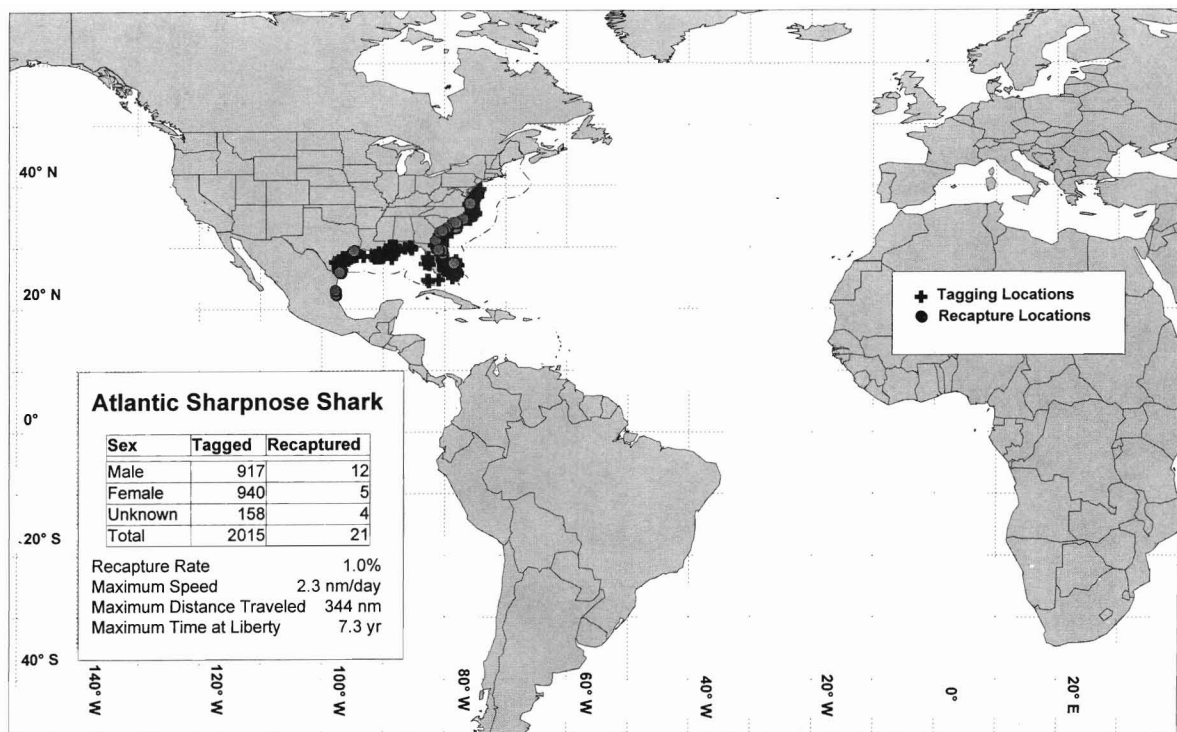


Figure 131.—Atlantic distribution of tag and recapture locations for the Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

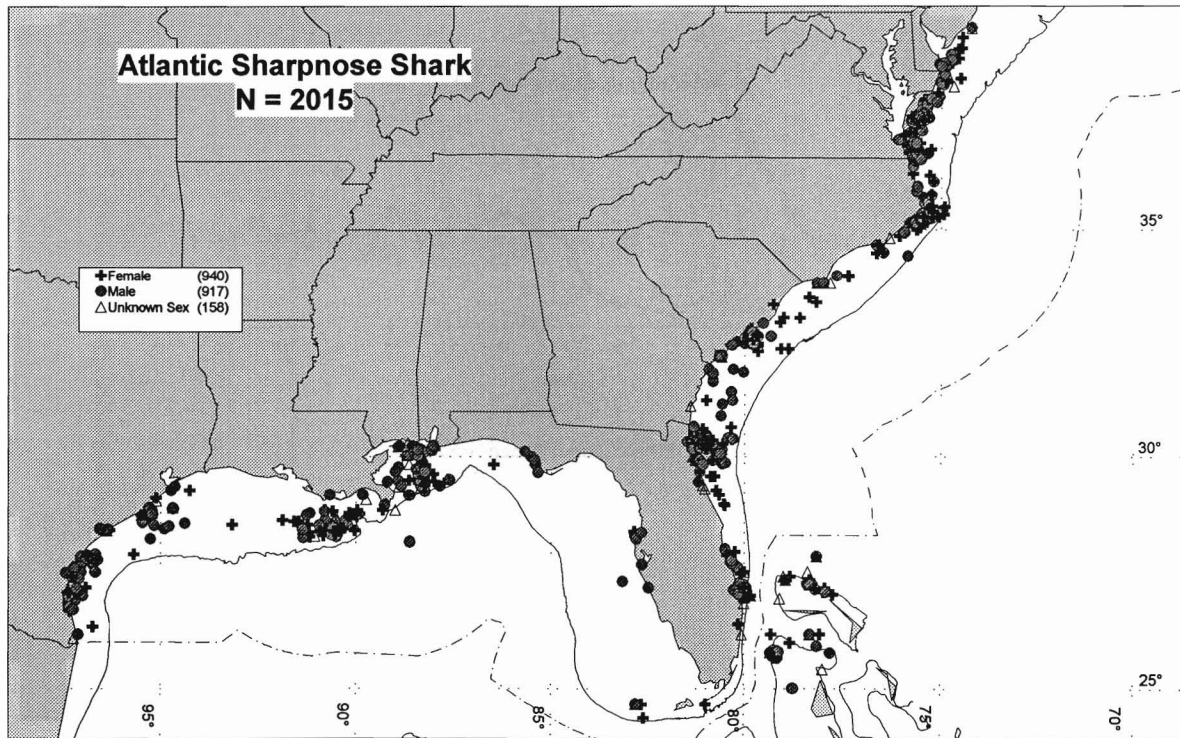


Figure 132.—Total tagging distribution for the Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

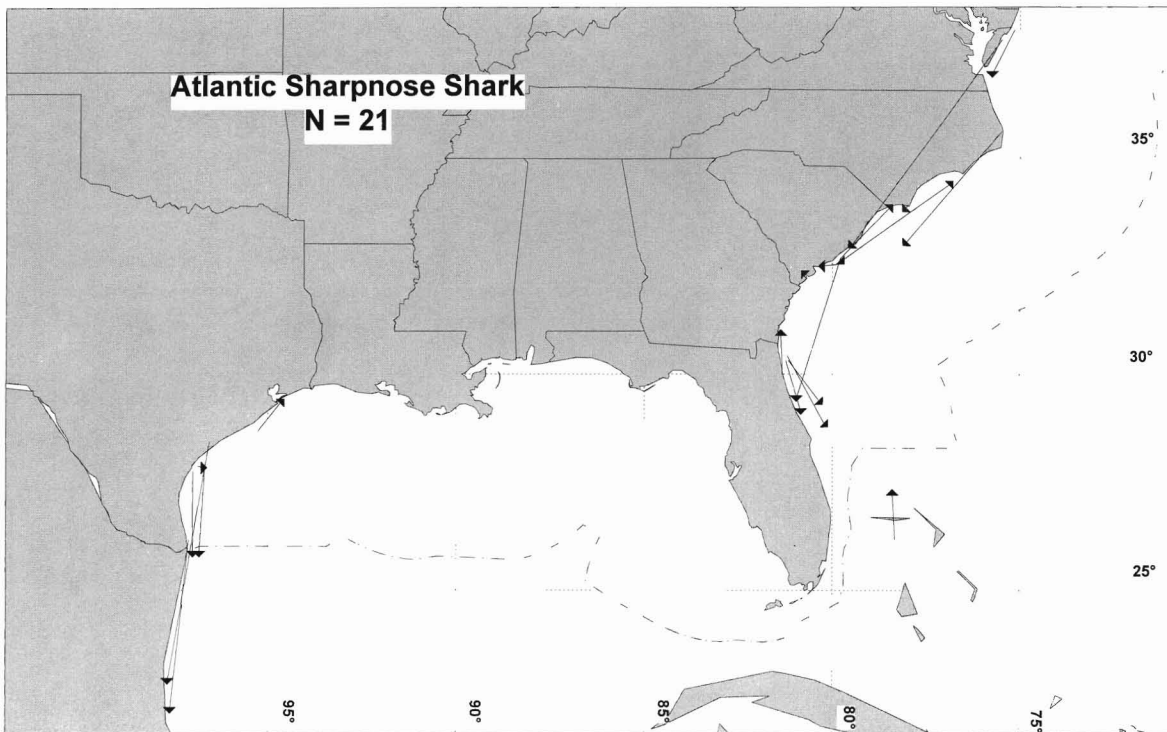


Figure 133.—Recapture distribution for the Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

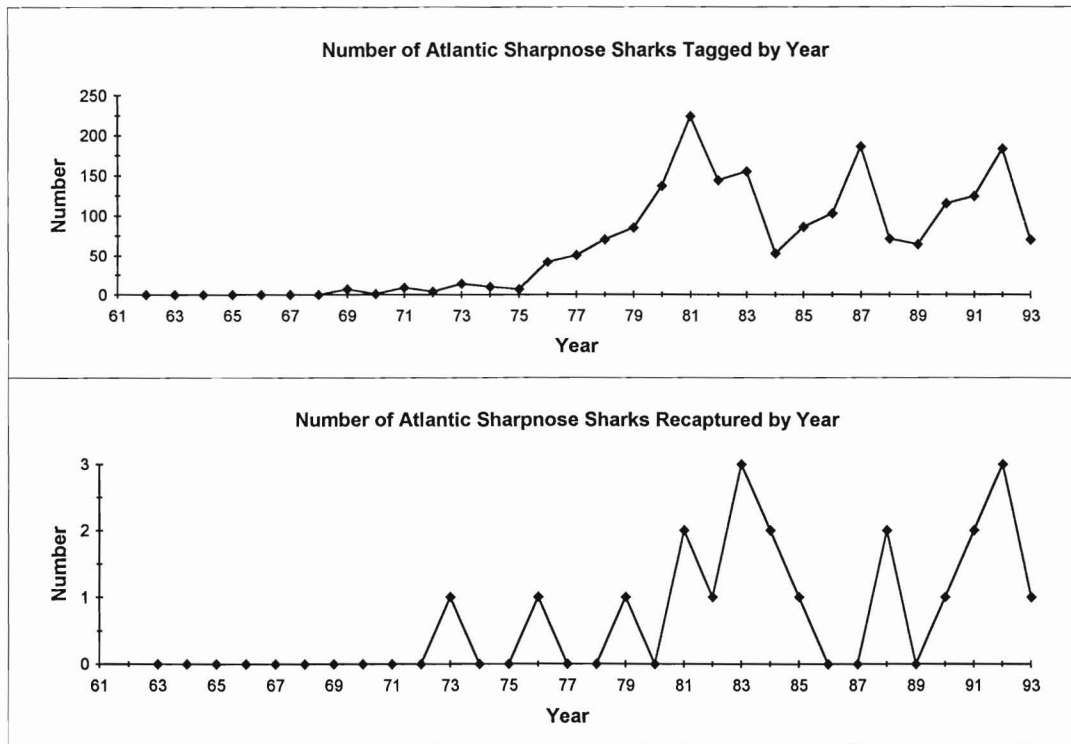


Figure 134.—Total number of Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

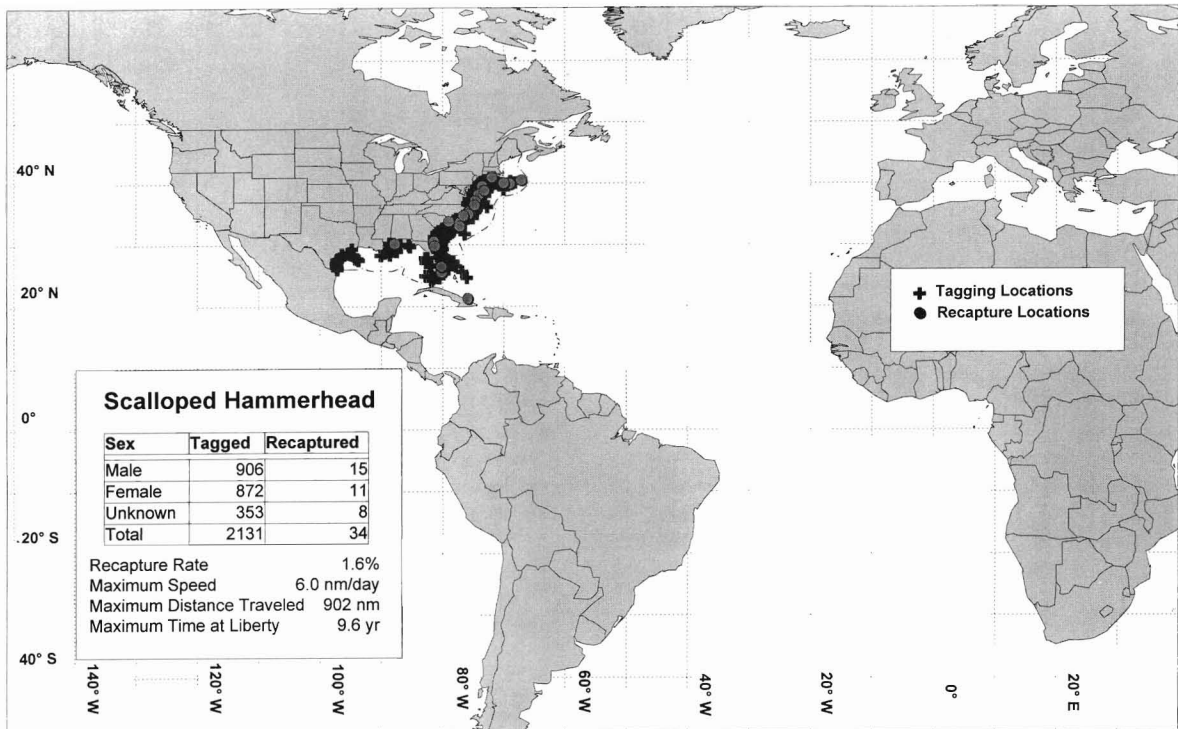


Figure 135.—Atlantic distribution of tag and recapture locations for the scalloped hammerhead, *Sphyrna lewini*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

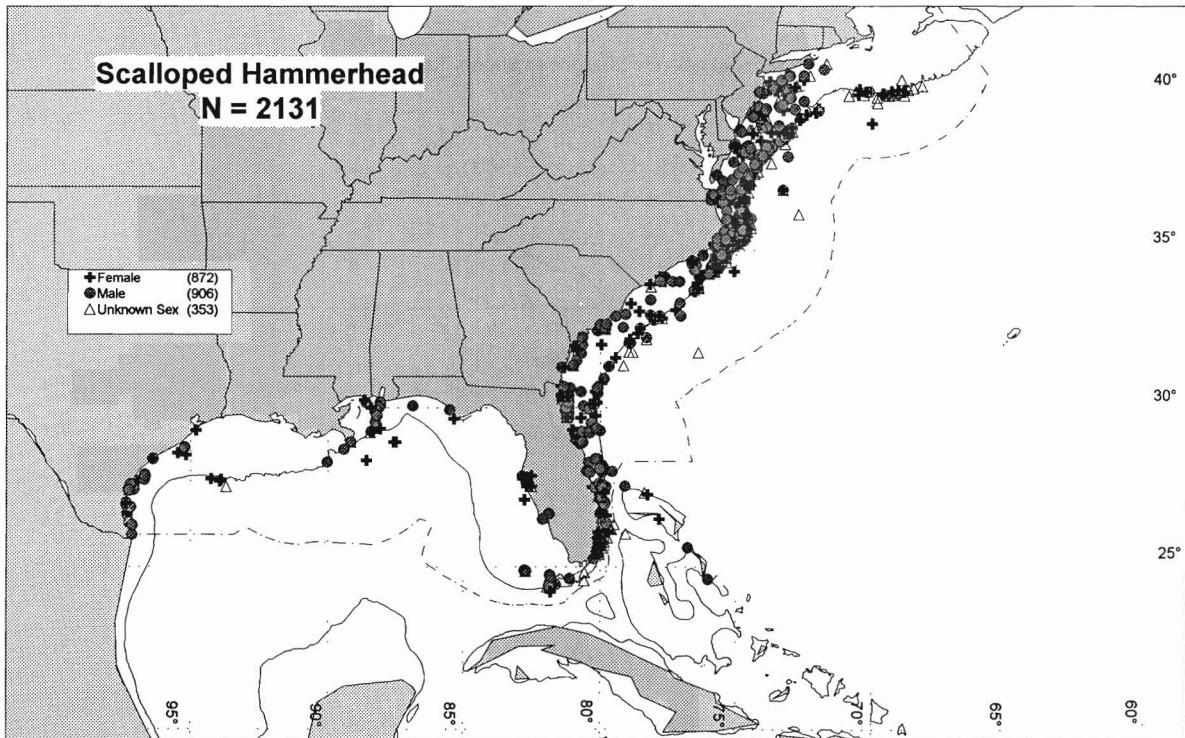


Figure 136.—Total tagging distribution for the scalloped hammerhead, *Sphyrna lewini*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

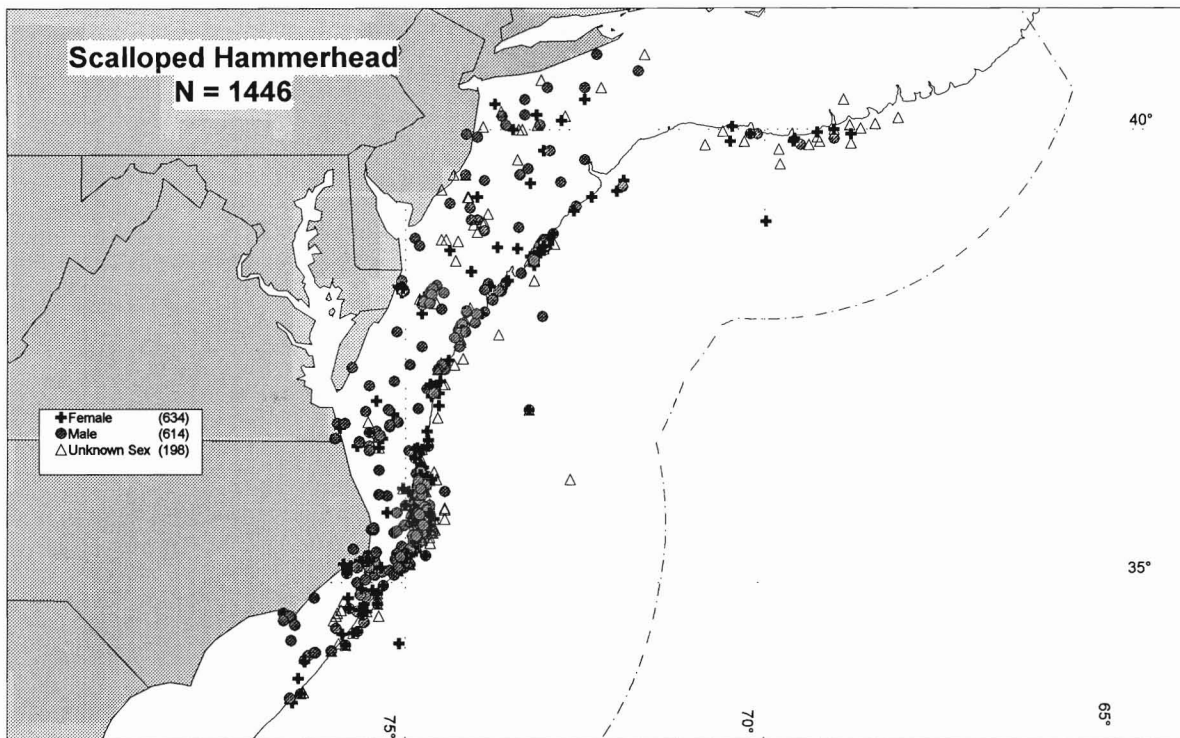


Figure 137.—Northeastern U.S. tagging distribution of the scalloped hammerhead, *Sphyrna lewini*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

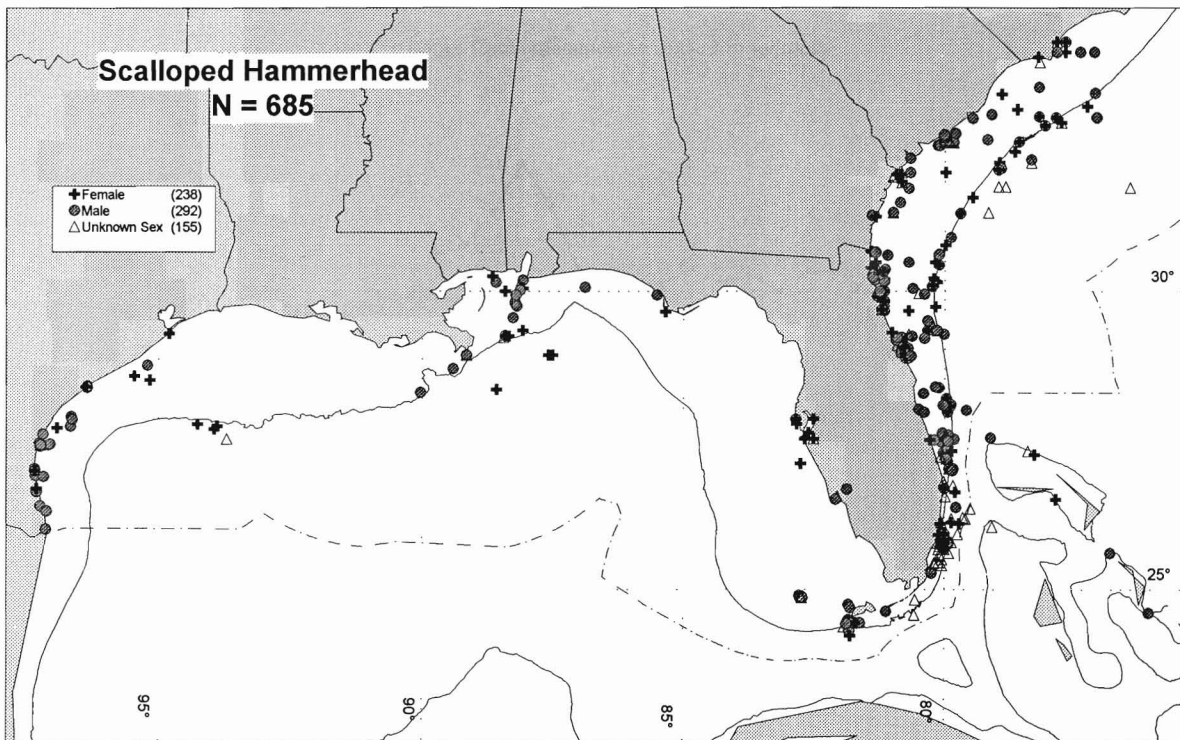


Figure 138.—Southeastern U.S. tagging distribution of the scalloped hammerhead, *Sphyrna lewini*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

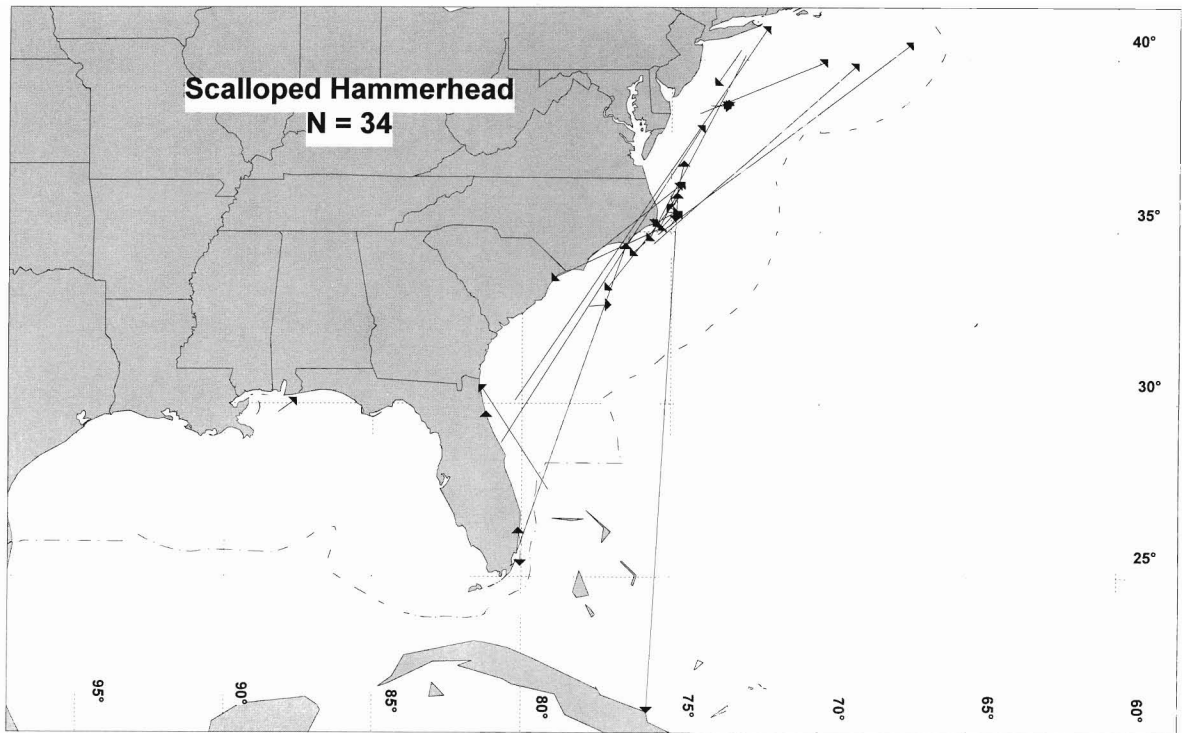


Figure 139.—Recapture distribution for the scalloped hammerhead, *Sphyrna lewini*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

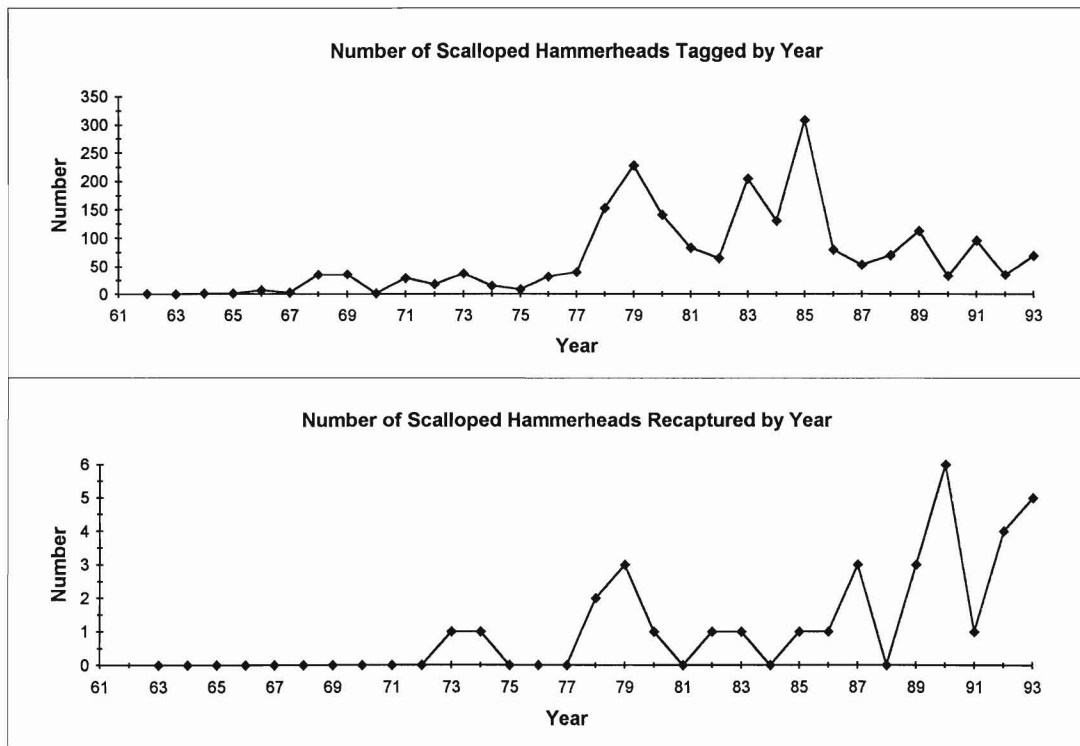


Figure 140.—Total number of scalloped hammerhead, *Sphyrna lewini*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

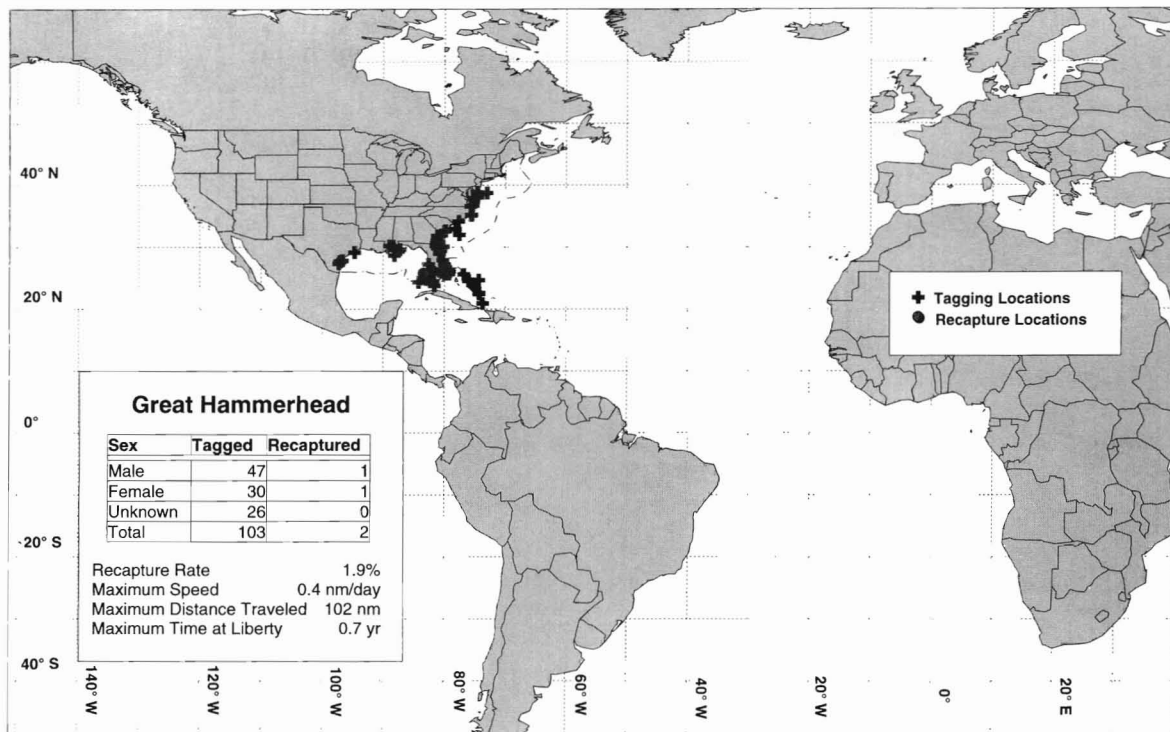


Figure 141.—Atlantic distribution of tag and recapture locations for the great hammerhead, *Sphyrna mokarran*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

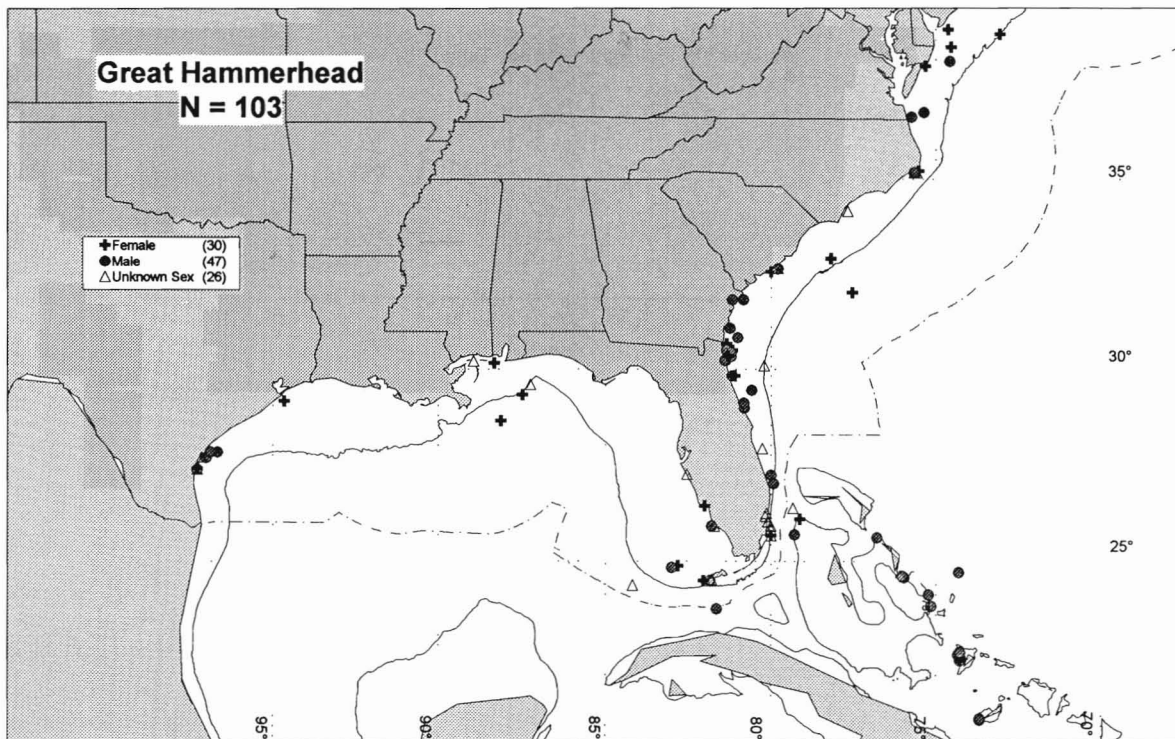


Figure 142.—Total tagging distribution for the great hammerhead, *Sphyrna mokarran*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

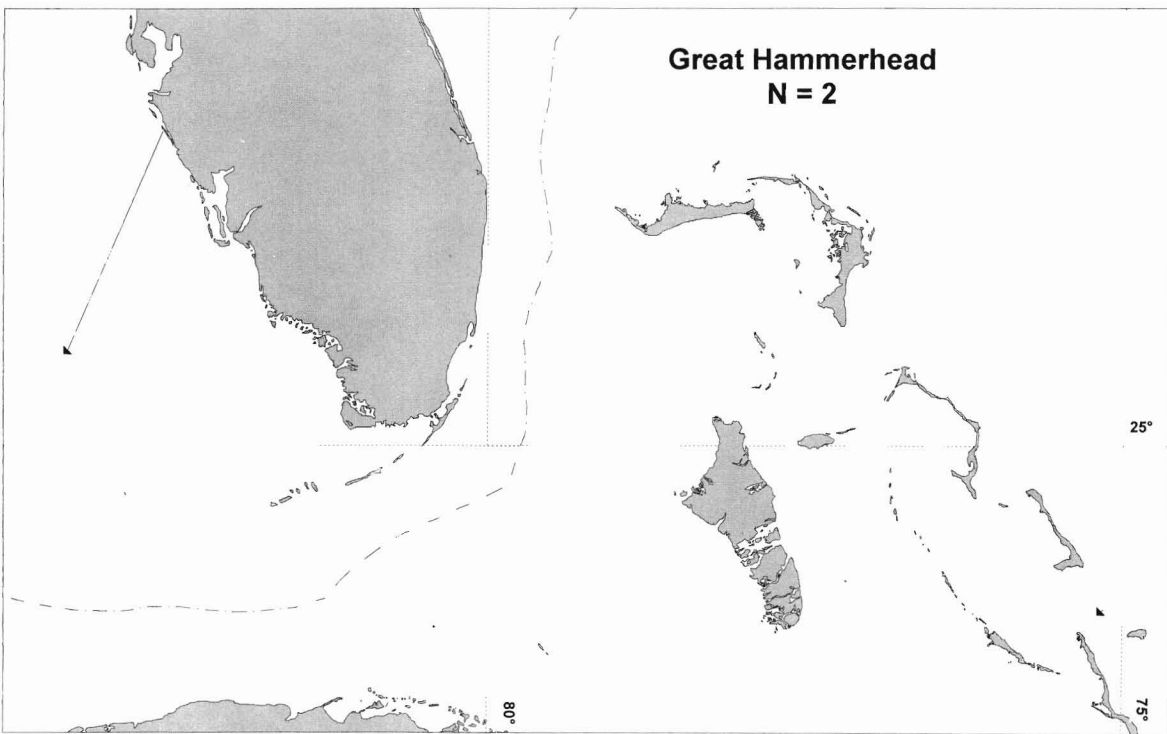


Figure 143.—Recapture distribution for the great hammethead, *Sphyrna mokarran*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

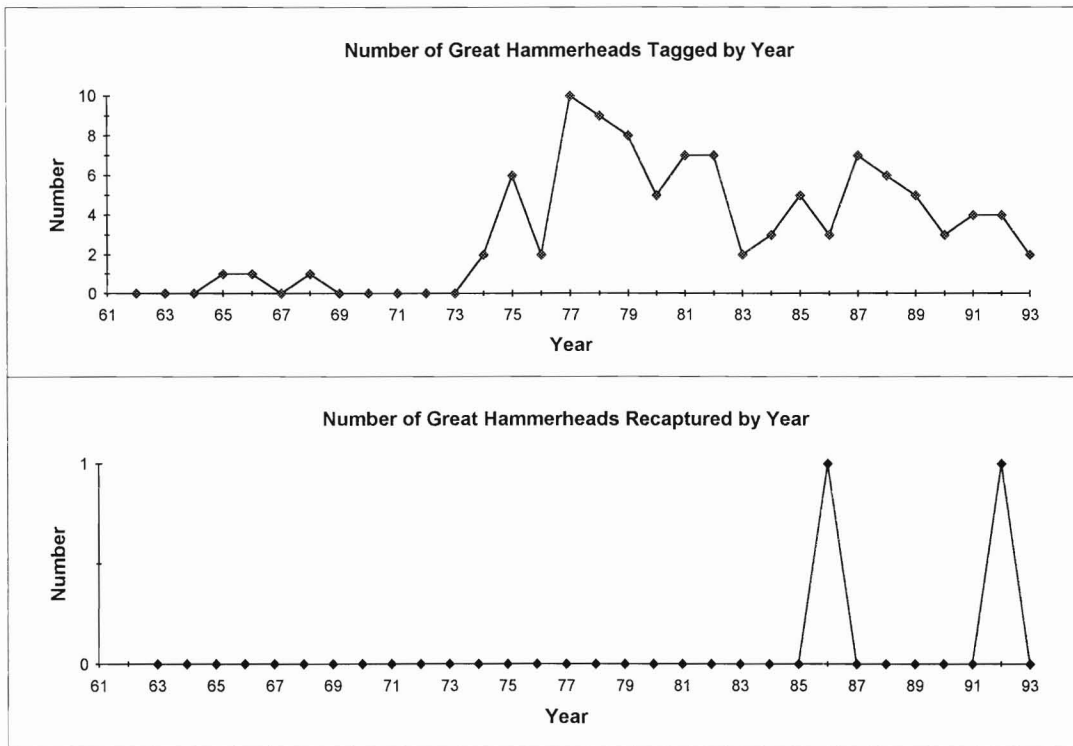


Figure 144.—Total number of great hammethead, *Sphyrna mokarran*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

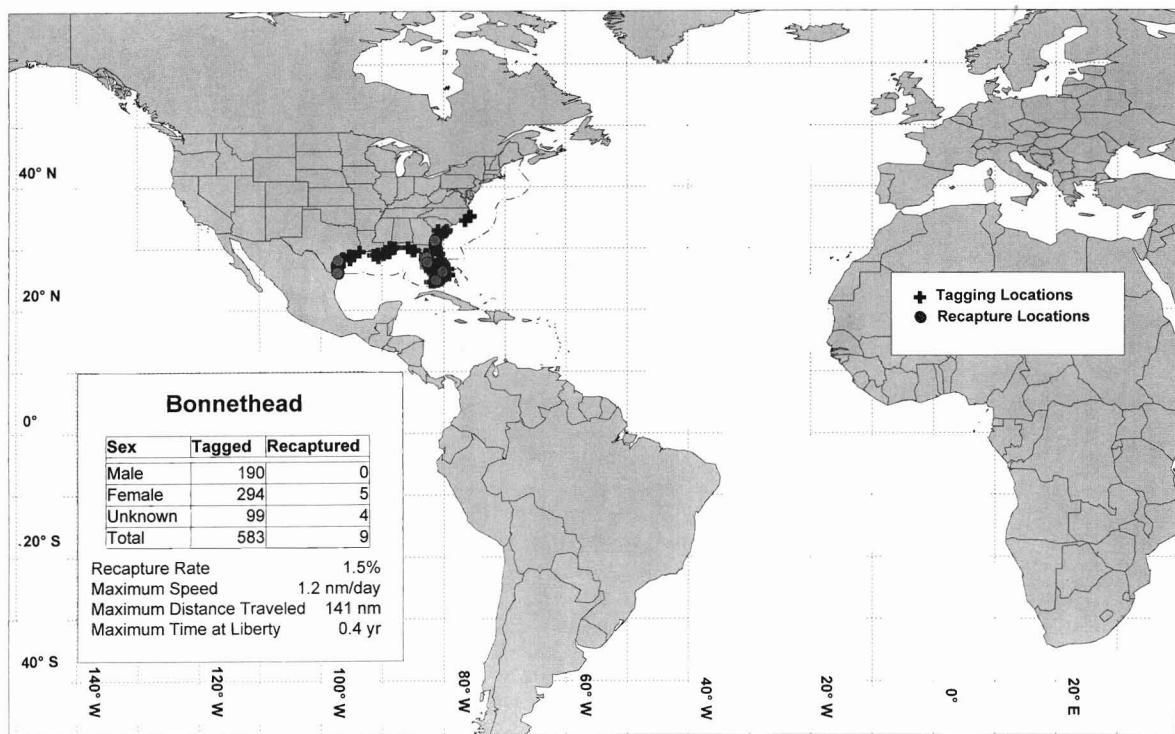


Figure 145.—Atlantic distribution of tag and recapture locations for the bonnethead, *Sphyrna tiburo*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

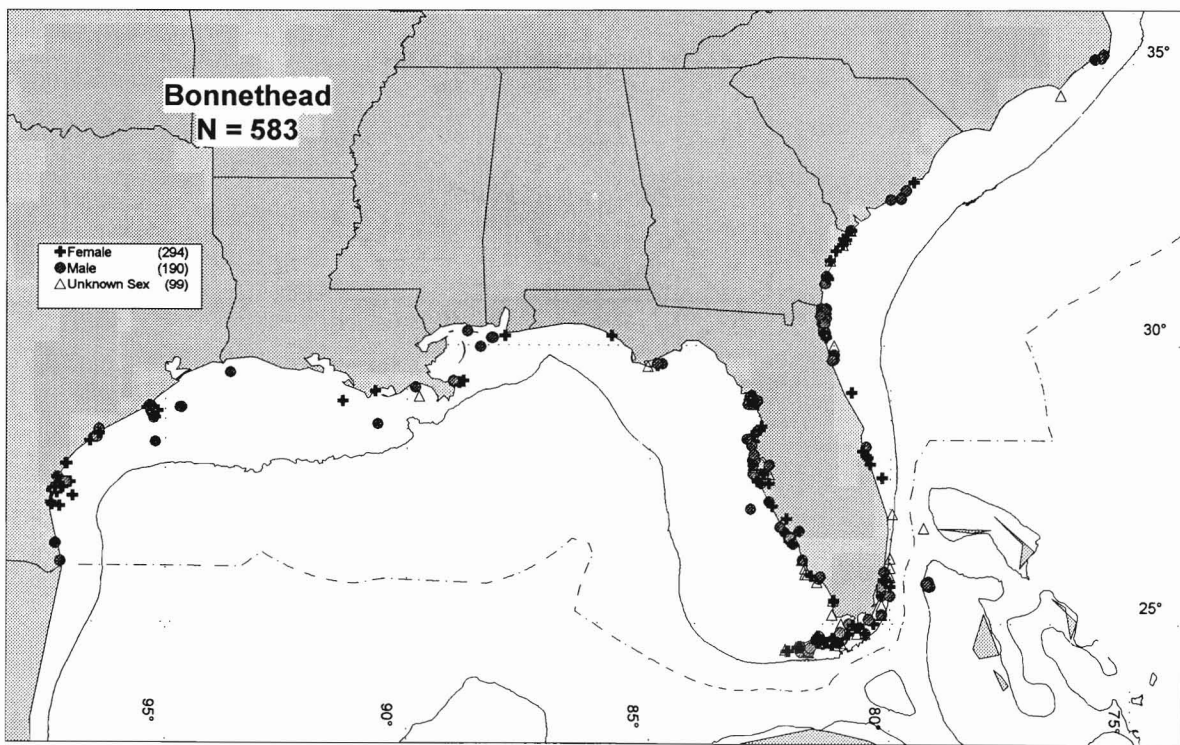


Figure 146.—Total tagging distribution for the bonnethead, *Sphyrna tiburo*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

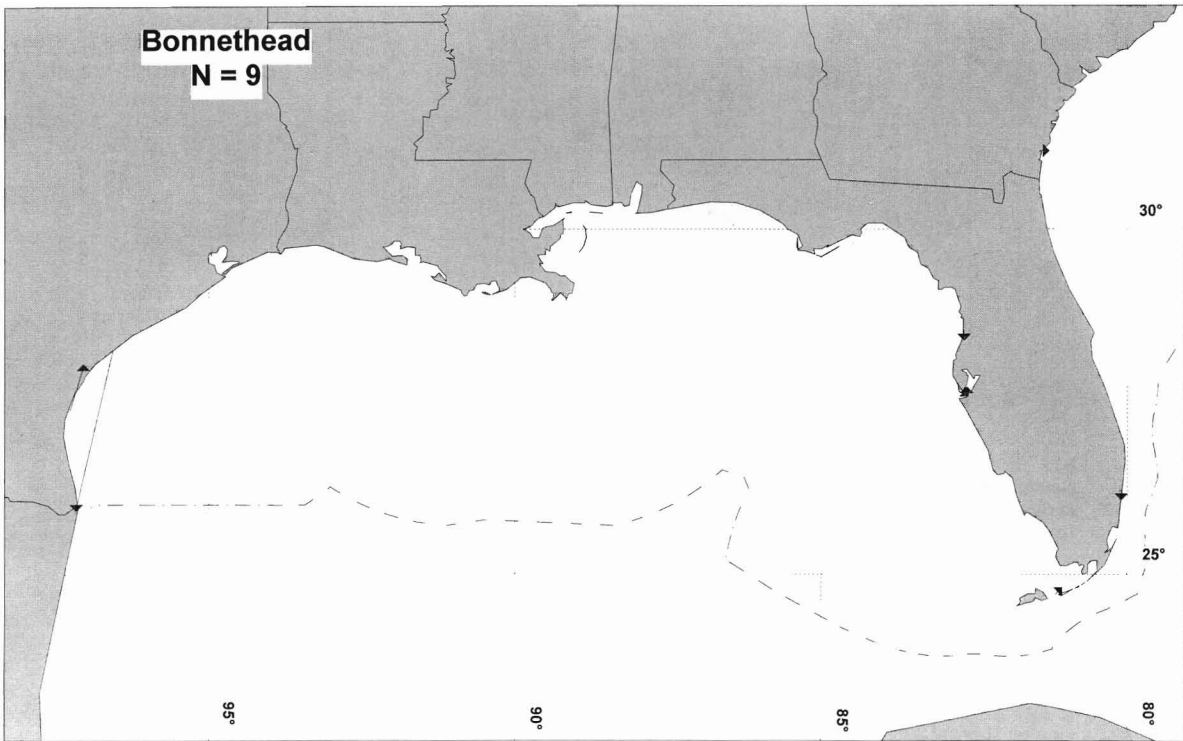


Figure 147.—Recapture distribution for the bonnethead, *Sphyrna tiburo*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

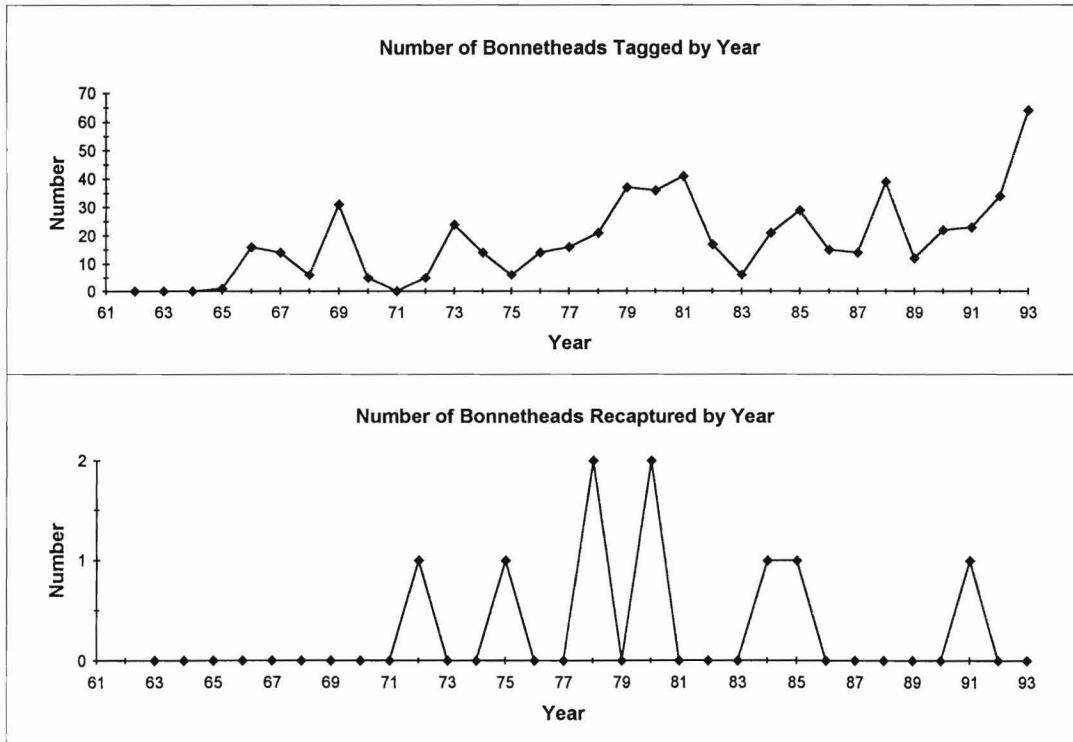


Figure 148.—Total number of bonnethead, *Sphyrna tiburo*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

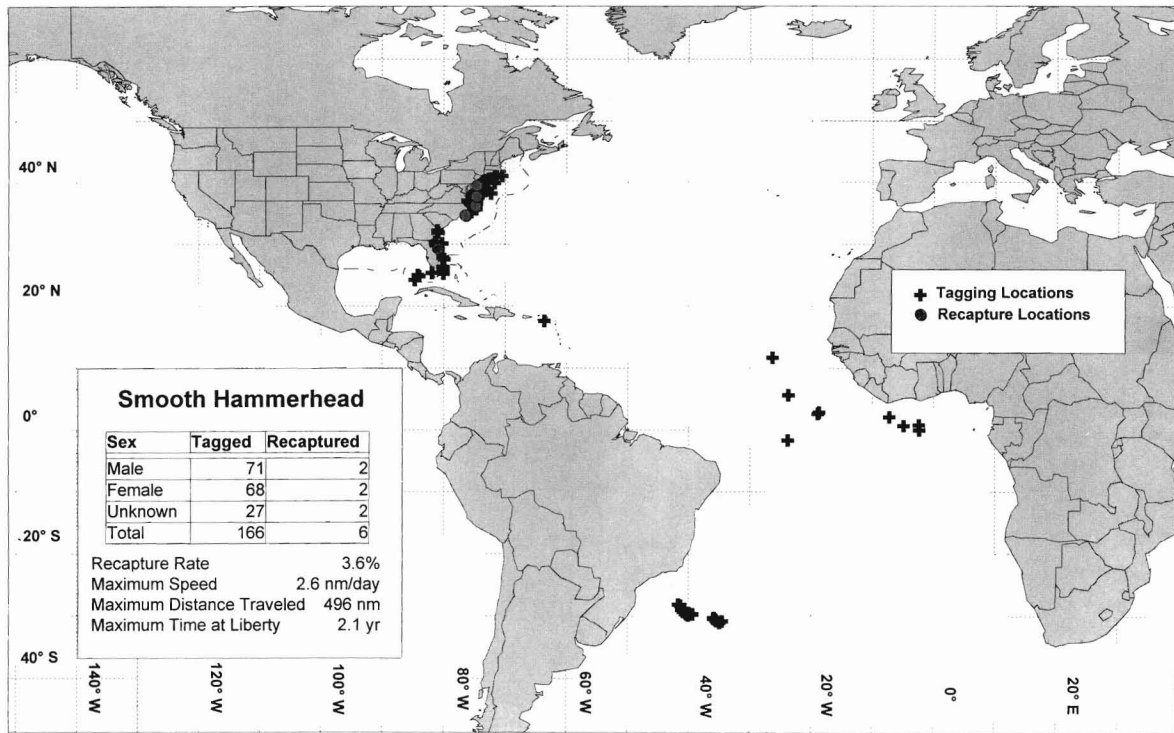


Figure 149.—Atlantic distribution of tag and recapture locations for the smooth hammerhead, *Sphyrna zygaena*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

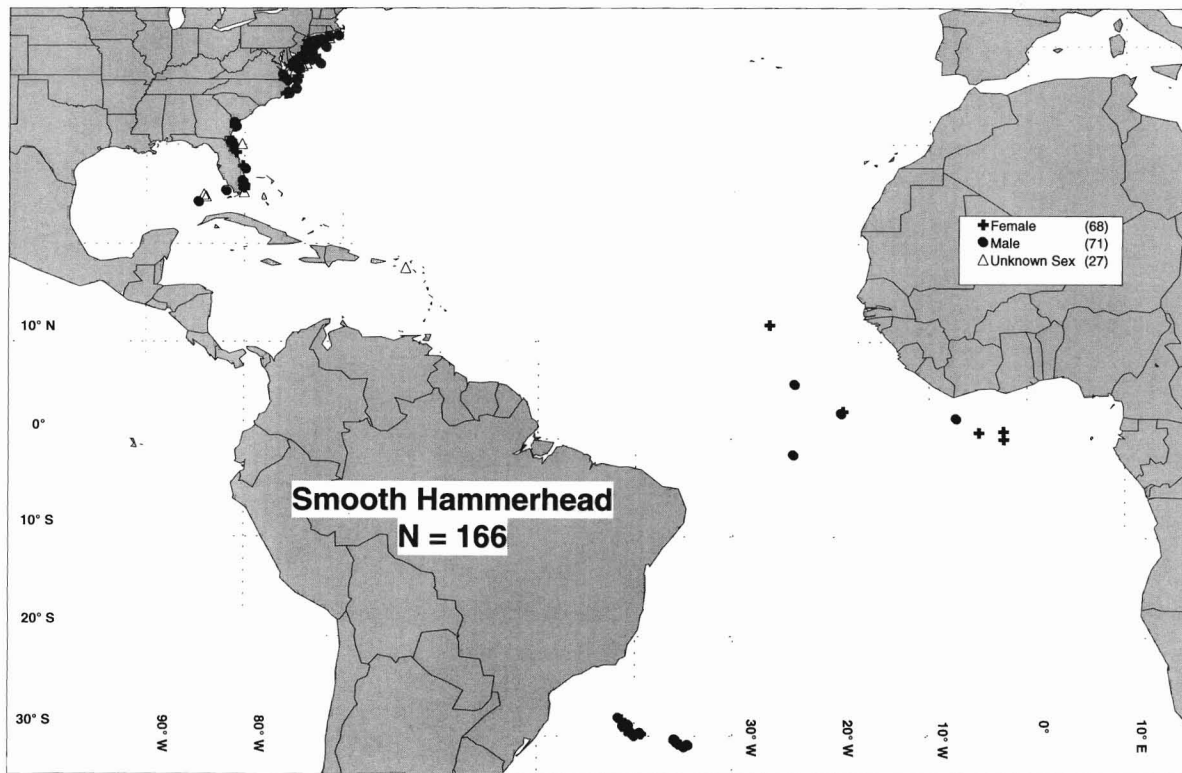


Figure 150.—Total tagging distribution for the smooth hammerhead, *Sphyrna zygaena*, from the NMFS Cooperative Shark Tagging Program during 1962–93.

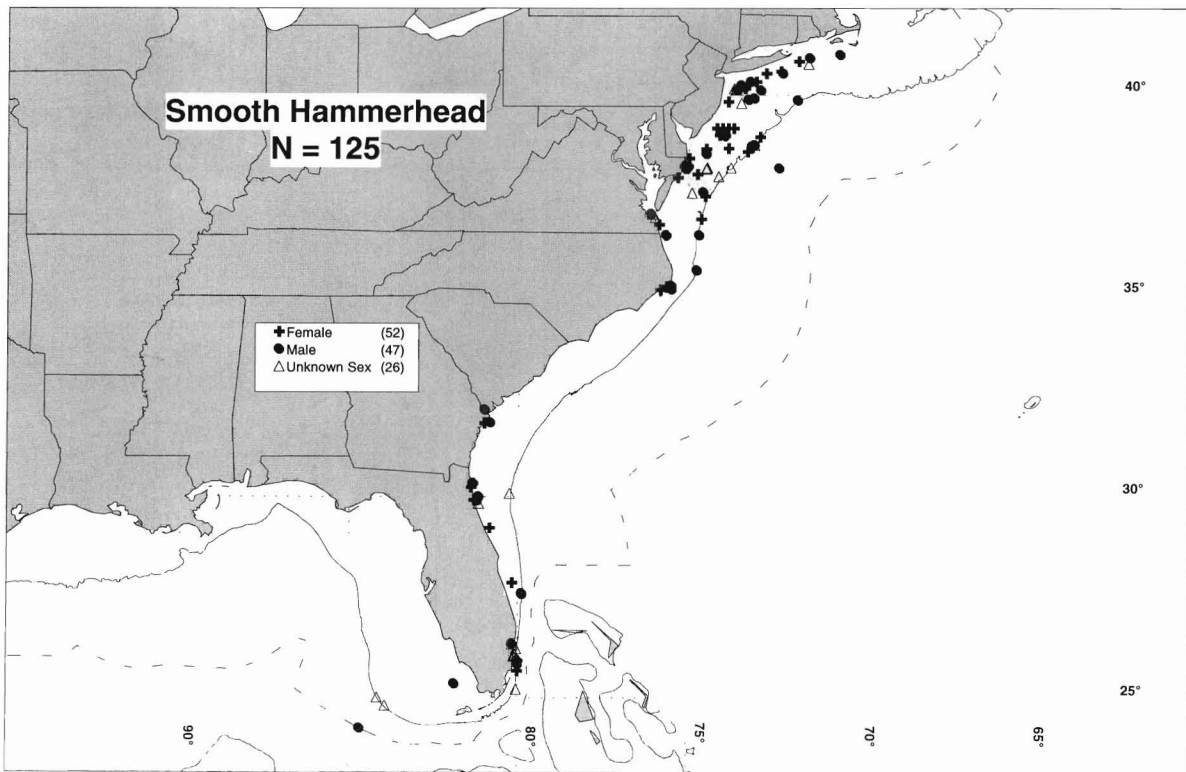


Figure 151.—U.S. tagging distribution of the smooth hammerhead, *Sphyrna zygaena*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

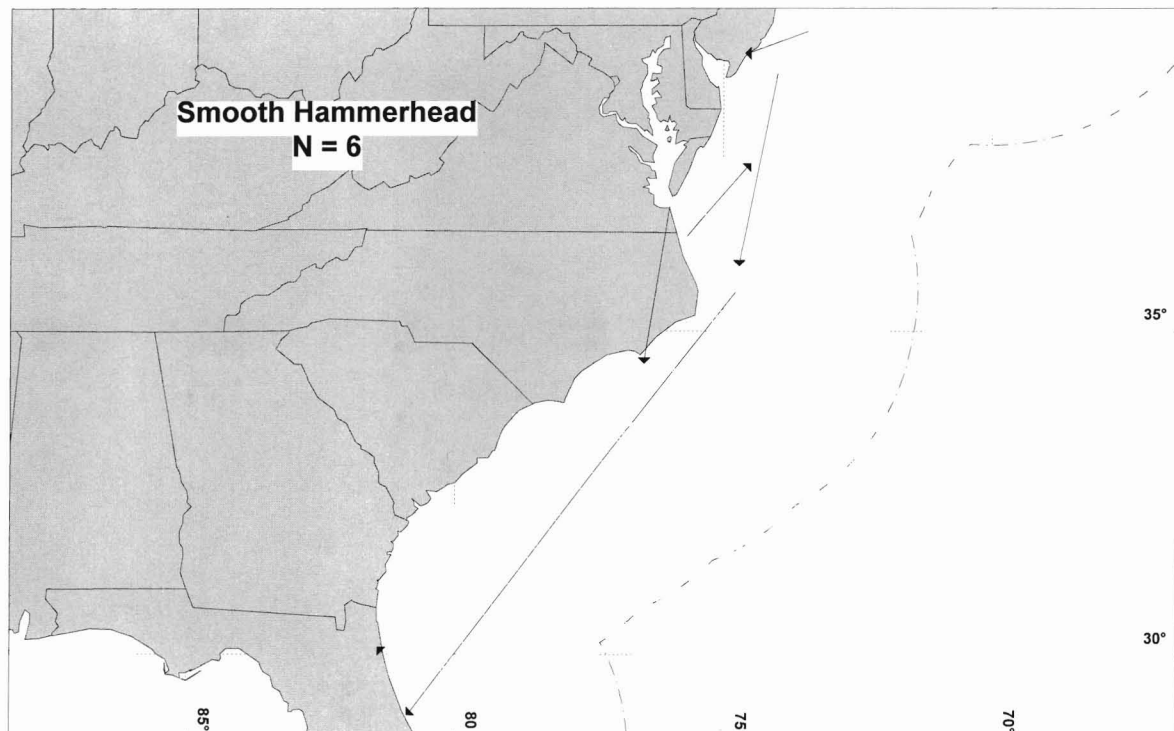


Figure 152.—Recapture distribution for the smooth hammerhead, *Sphyrna zygaena*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

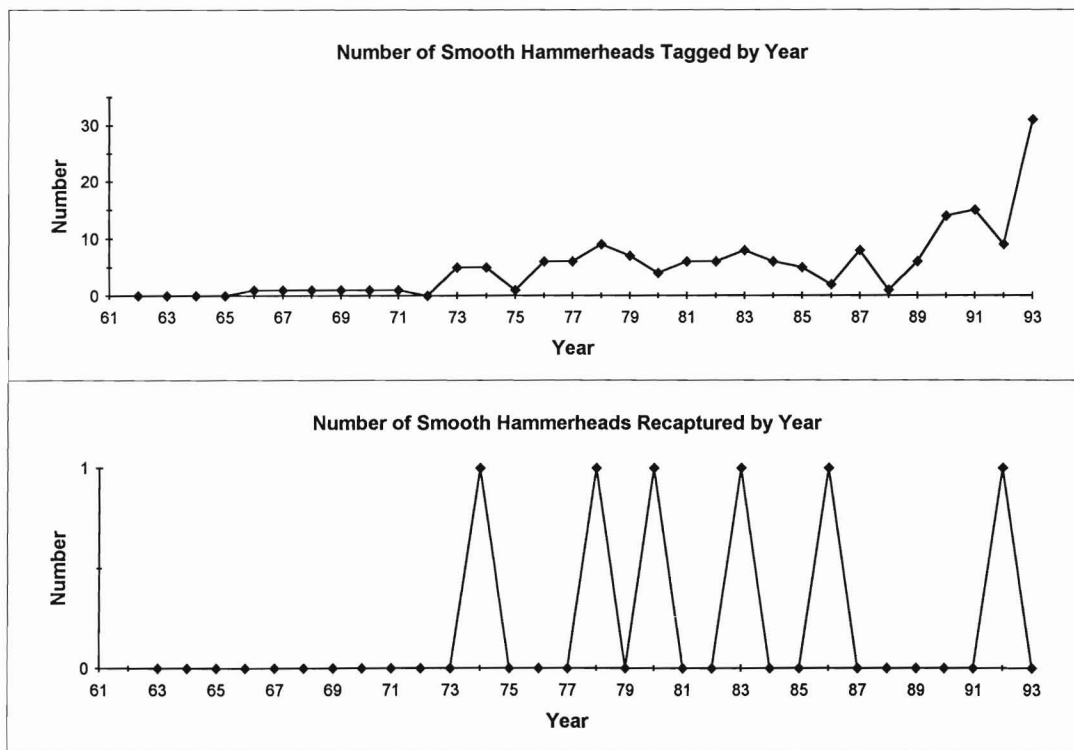


Figure 153.—Total number of smooth hammerhead, *Sphyrna zygaena*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

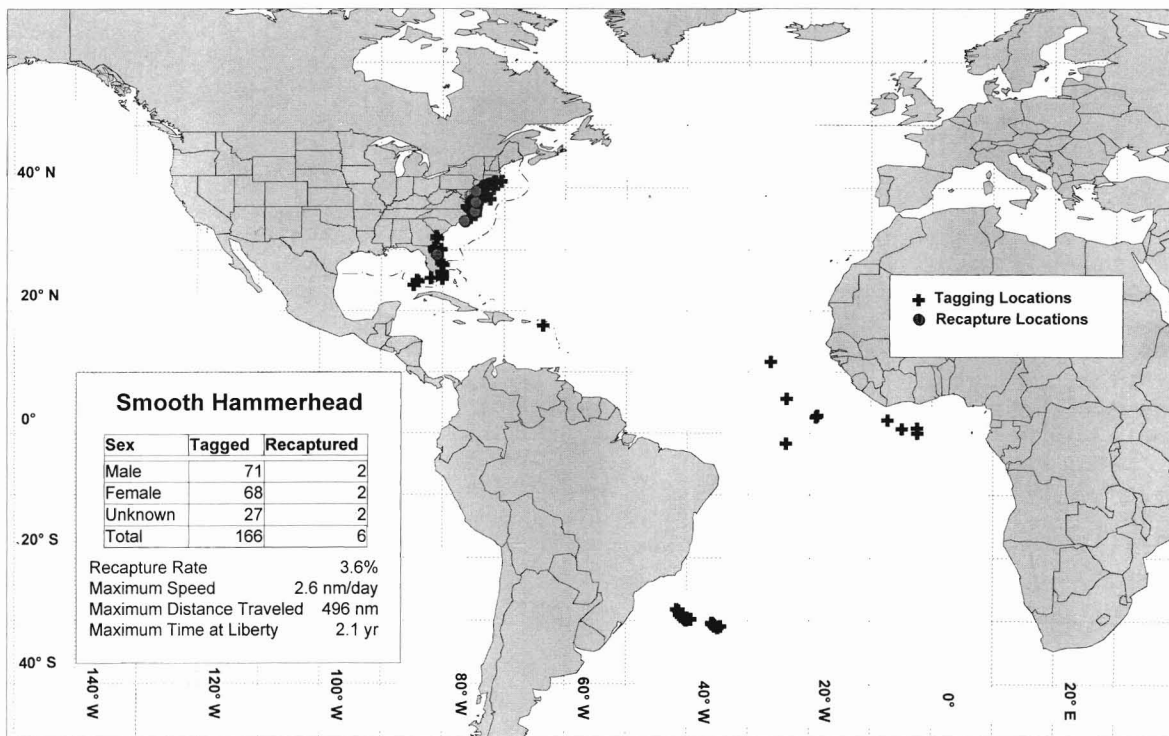


Figure 154.—Atlantic distribution of tag and recapture locations for the Greenland shark, *Somniosus microcephalus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

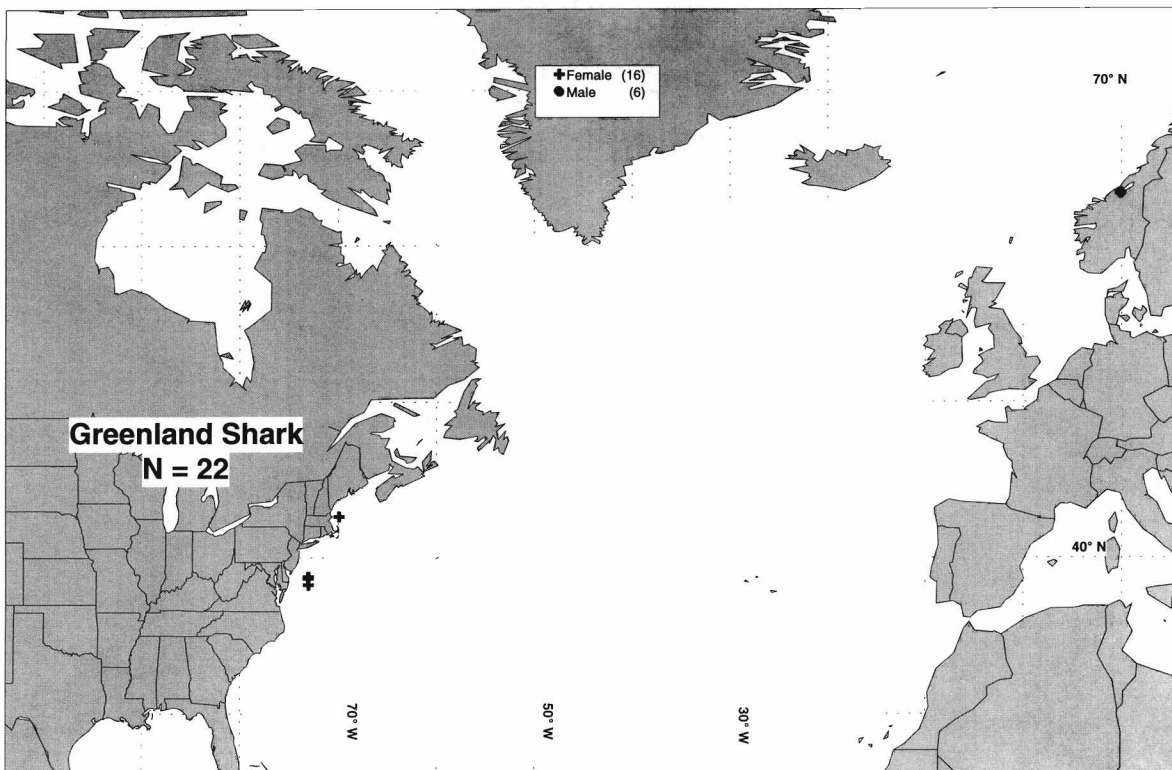


Figure 155.—Total tagging distribution for the Greenland shark, *Somniosus microcephalus*, from the NMFS Cooperative Shark Tagging Program during 1962–93.

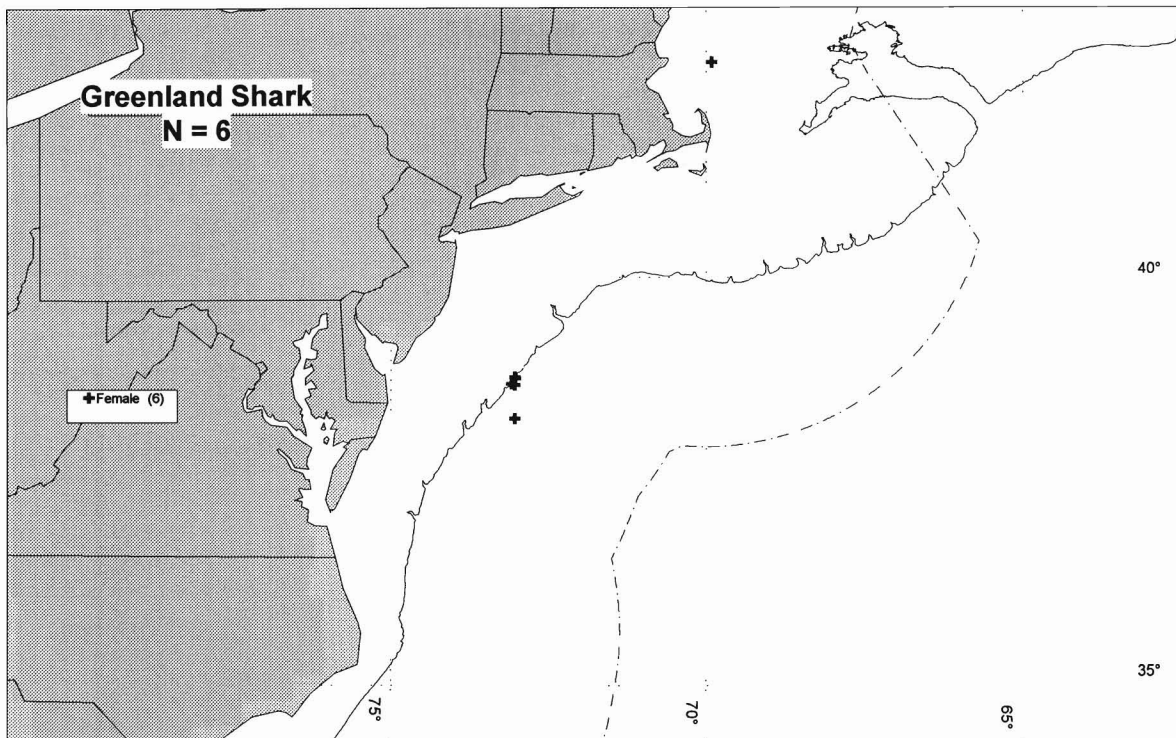


Figure 156.—Northeastern U.S. tagging distribution of the Greenland shark, *Somniosus microcephalus*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

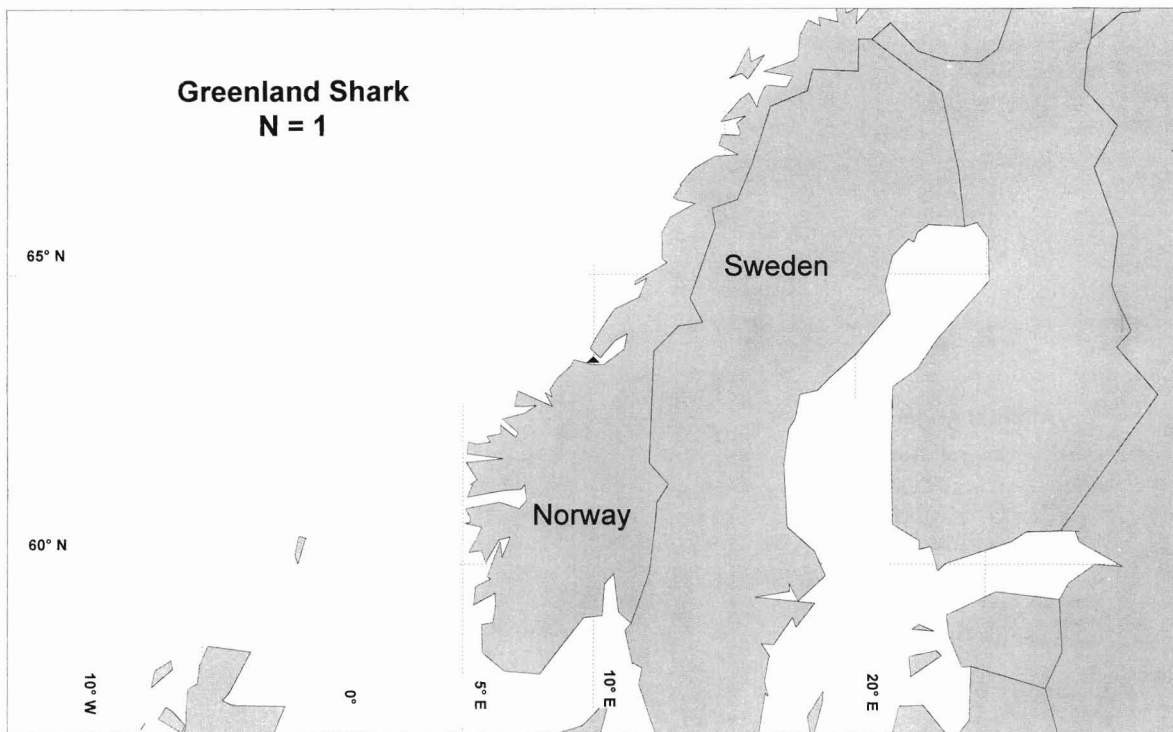


Figure 157.—Recapture distribution for the Greenland shark, *Somniosus microcephalus*, from the NMFS Cooperative Shark Tagging Program during 1962–93.

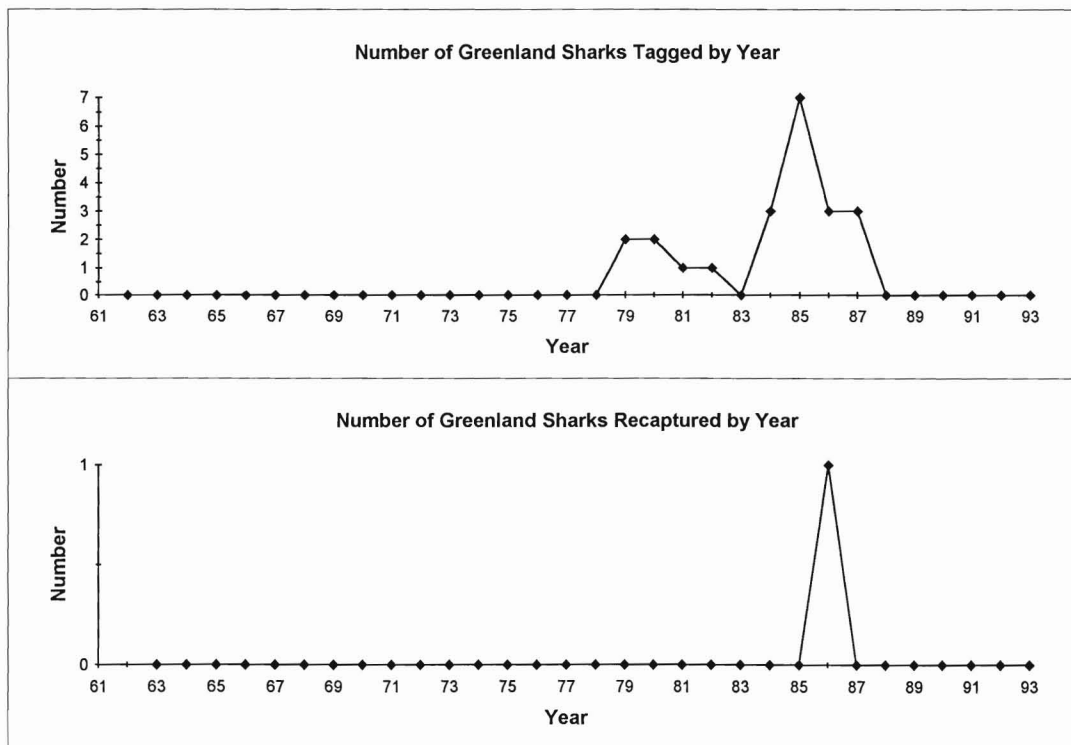


Figure 158.—Total number of Greenland shark, *Somniosus microcephalus*, tagged and recaptured by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

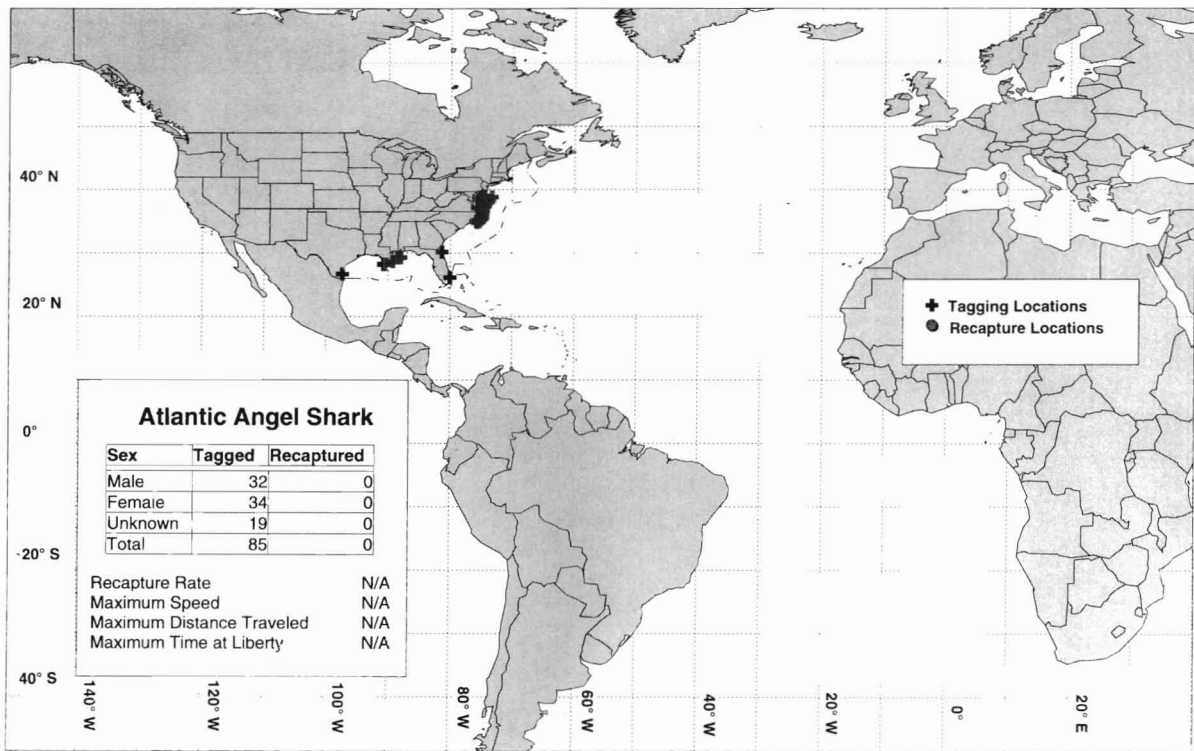


Figure 159.—Atlantic distribution of tag and recapture locations for the Atlantic angel shark, *Squatina dumeril*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ.

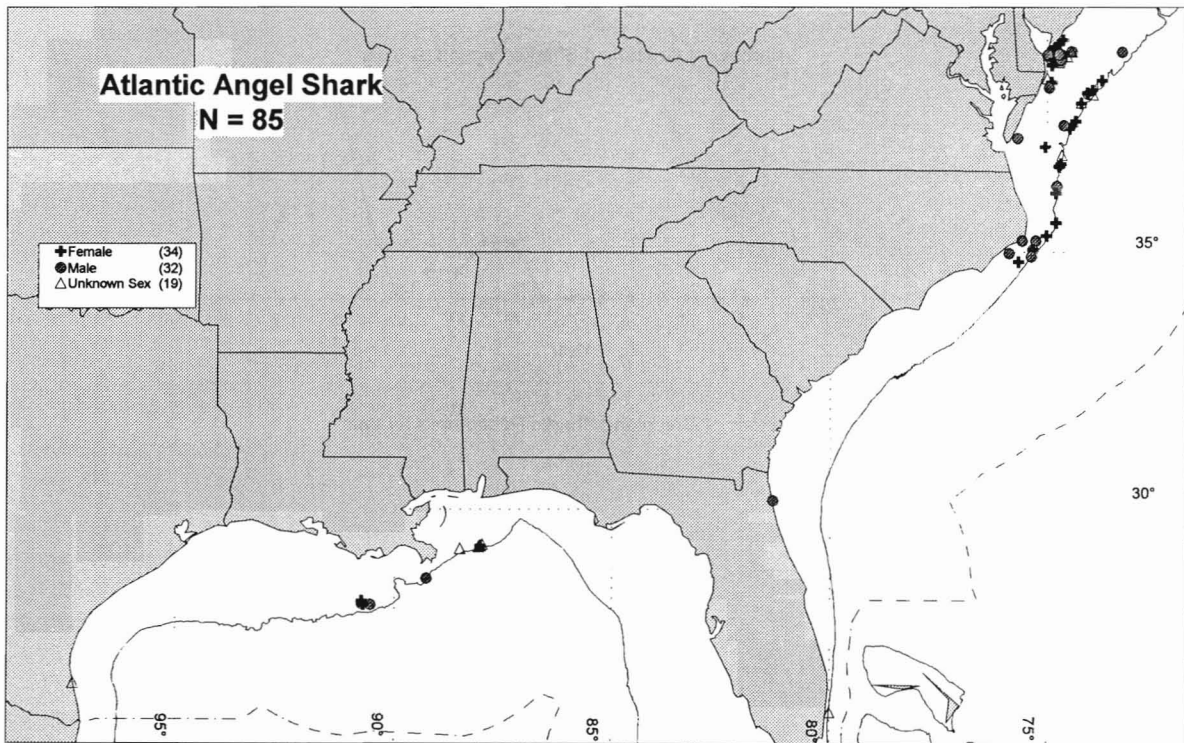


Figure 160.—Total tagging distribution for the Atlantic angel shark, *Squatina dumeril*, from the NMFS Cooperative Shark Tagging Program during 1962–93. The dotted-dashed line represents the U.S. EEZ. The solid line represents the 200 m depth contour.

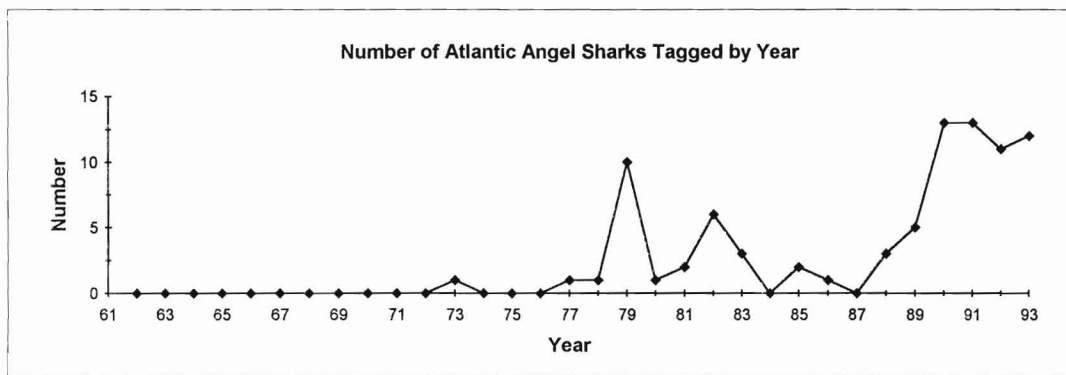


Figure 161.—Total number of Atlantic angel shark, *Squatina dumeril*, tagged by year in the NMFS Cooperative Shark Tagging Program, from 1962 to 1993.

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