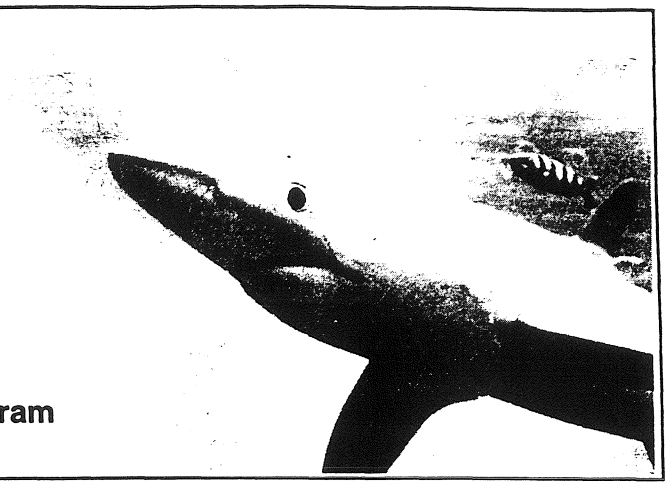
THE SHARK TAGGER 1996 SUMMARY



Newsletter of the Cooperative Shark Tagging Program

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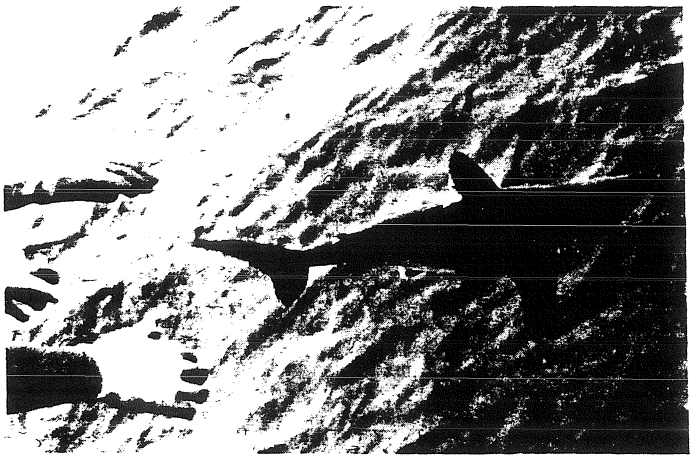

1996 OVERVIEW

Thanks to the outstanding effort by members of the Cooperative Shark Tagging Program (CSTP), 1996 was a banner year for numbers of fish tagged (9,376) and recaptured (602). This increase was due largely to the record number of blue sharks both tagged and recaptured. In 1996, surface and bottom temperatures in the Mid-Atlantic Bight were the lowest since hydrographic data records began in 1978 (Ship of Opportunity Program). These unseasonably cool water temperatures resulted in an abundance of blue sharks accessible to fishermen who might normally have turned to other more traditional species (e.g. tuna) that were not readily available.

The addition of the 1996 data brings the total number of fish tagged to 138,315 and recaptures to 6,812. The combined efforts of the sportsmen, commercial fishermen, biologists and fisheries observers this year and every year for the previous three decades has made the CSTP a most successful tagging program. Our sincere thanks to all of you.

Tags

Members of the CSTP tagged and released 9,376 fish, including 36 species of sharks and 15 species of teleosts (Table 1). The principal shark species tagged were blue (65%), sandbar (15%), tiger (5%), blacktip (3%), and dusky (2%). Anglers accounted for 67% of the tagging effort, followed by NMFS and other cooperating biologists (16%), U.S. and Canadian Fisheries Observers aboard commercial vessels (14%), and commercial fishermen (3%). We saw an increase in tags by biologists over previous years due in part to our rigorous field schedule (see articles pages 14 and 15). Methods used to capture sharks for tagging included rod and reel (64%), longline (18%), gill net (10%), and hand line (4%). The majority of fish were released by U.S. taggers (98%), with tags also placed on fish by taggers from Portugal, Bahamas, Canada, France, Italy, and Great Britain.

This year, we had a record number of blue sharks (6,078) and sandbar sharks (1,407) tagged. It is interesting to note that over half of the sandbar sharks were tagged by fisheries observers on commercial vessels. We are grateful for this cooperative effort between the biologists and commercial fishermen, which is critical for furthering our research efforts on all species.

Recaptures

In 1996, information was received on 602 recaptured fish representing 16 species of sharks and 3 species of teleosts. Blue (420), sandbar (52), shortfin mako (35), tiger (18) and porbeagle (13) sharks represented the predominant species recaptured (Table 2).

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Distribution of this newsletter is limited to active participants in the NMFS Cooperative Shark Tagging Program. This information is preliminary, and subject to revision.

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Narragansett, RI 02882-1199

Table 1.

Species	Number Tagged by Cooperative Taggers
Sharks	
Blue shark	6078
Sandbar shark	1407
Tiger shark	459
Blacktip shark	244
Dusky shark	204
Shortfin mako	122
Atlantic sharpnose shark	85
Nurse shark	64
Porbeagle	63
Spinner shark	52
Blacknose shark	49
Bonnethead	39
Reef Shark	36
Lemon shark	28
Night shark	28
Sand tiger	27
Galapagos shark	21
Bull shark	19
Silky shark	17
Scalloped hammerhead	16
Thresher shark	8
Smooth hammerhead	6
Longfin mako	6
Finetooth shark	5
Bigeye thresher	5
Oceanic whitetip shark	3
Great hammerhead	3
Bignose shark	1
Atlantic angel shark	1
Dogfish	42
Hammerhead, unspecified	11
Brown/Dusky, unspecified	8
Miscellaneous sharks	26
Miscellaneous rays	20
Total Sharks	9203
Teleosts	
Swordfish	105
White Marlin	15
Blue Marlin	14
Sailfish	9
Bluefin tuna	8
Striped bass	6
Yellowfin tuna	5
Bigeye tuna	3
Miscellaneous teleosts	8
Total teleosts	173
Grand Total	9376

On the cover: Tagged and injected porbeagle shark being released from the F/V *Isabel S* (see Page 14). Photo Credit Lisa J. Natanson.

The recaptured sharks were tagged primarily by recreational anglers (81%) using rod and reel and also tagging free swimming sharks. Commercial fishermen, biologists and U.S. and Canadian fisheries observers contributed to the remainder of the tagging effort. The fish were re-caught by anglers (58%) using rod and reel and by commercial fishermen (39%) using longline gear (Table 3). Traditionally, sport fishermen are responsible for the principal tagging effort and commercial fishermen represent the primary recapture effort. The shift in recapture effort (by percentage) this year is due to the large number of blue shark returns, a species not commonly commercially fished in U.S. waters. Overall this year, blue (292), sandbar (19), shortfin mako (10), blacktip (6), tiger (4), and nurse (4) sharks were the primary species returned by anglers (11 species in total) whereas commercial fishermen returned data on mostly blue (119), sandbar (29), shortfin mako (25), porbeagle (25), and tiger (11) sharks, and swordfish (7).

Recapture information was obtained from fishermen representing 18 countries, mainly the United States (458), Spain (85), and Canada (26) (Table 3). The majority of the Spanish recaptures were blue sharks returned by a cooperating biologist; the Canadian recaptures consisted of blue and porbeagle sharks which were returned by individual commercial fishermen. Taggers on vessels from the following 8 countries originally released the fish recaptured this year: United States (560), England (17), Portugal (10), Canada (9), Italy (2), Japan (2), Spain (1), and the Bahamas (1).

Blue Sharks (420 Returns)

The record number of blue sharks recaptured in 1996 produced some notable results. Four sharks were at liberty for over seven years; there is only one blue shark out for a longer period of time (8.5 years). In addition to the longevity data derived from these returns, it is interesting to note that three out of four of these sharks were tagged within 24 hours and 5 nautical miles (nm) of each other in July of 1989 off New England. After seven years, they were recaptured less than 90 nm from their tagging location (10, 42, and 86 nm). Two of these fish were released again without a tag and one was re-tagged and released. When tagged, all three were larger than 5' fork length (FL) and one was estimated at nearly 9' FL. At this size, the shark would have been approximately 15 years old at tagging. The fourth fish, at liberty for 7.2 years, was tagged in the Gulf of Maine and recaptured off Colombia, SA (a distance of 1,919 nm).

Numerous other examples exist where blue sharks consistently return to the same area after various time periods. Information was obtained in 1996 on 31 recaptured blue sharks at liberty for over one year that were recaptured less than 50 nm from their tagging sites. Multiple recaptures of the same fish give additional information on migrations and residence times. One blue shark was first tagged off the New Jersey coast, recaptured and re-released three years later off New York then recaptured again one year later only 26 nm away. Another fish was re-caught after one year at liberty and 5 nm to the south. This shark was recaptured again 12 days later 20 nm to the northwest. Other examples include: a shark tagged, re-caught after 2.1 years only 19 nm away, released and re-caught 11 months later, 14 nm to the west (16 nm from first tagging location); and finally, another shark that was tagged, re-caught 30 days and 9 nm away, released and caught again 28 days later only 9 nm away. This fish was only 1.8 nm from its' original tag site and was subsequently re-tagged and released again. In all, 48% of the blue sharks recaptured in 1996 were re-released with a tag or re-released untagged.

Overall, 245 blue sharks traveled distances less than 100 nm; 329 less than 500 nm; and 55 greater than 1,000 nm. Prior to this year, a total of 649 blue sharks had shown movements of over 1,000 nm. The 55 recoveries this year

Table 3.
Total Number Tagged: 9,376
Total Number Recaptured: 602

	Percent of Total	
	Tag	Recapture
Occupation:		
Angler	67	58
Biologist	16	2
Observer	14	1
Commercial	3	39
Method:		
Rod and Reel	64	56
Longline	18	38
Gillnet	10	2
Free swimming	4	1
Misc.	4	3
Country:		
USA	98	76
Portugal	1	1
Canada	< 1	4
England	< 1	0
Spain	0	14
Venezuela	0	1
Misc.	< 1*	3**

* Bahamas, Italy
** Bahamas, Barbados, Brazil, Colombia, Cuba, Croatia, France, Indonesia, Italy, Mexico, St. Johns (WI), Tobago (WI), Uruguay

have greatly enhanced our knowledge of the patterns of movements established by previous long distance returns. These fish were primarily tagged in the waters off NY, RI, and MA and many traveled approximately 1,500 nm due east to be recovered in a broad area south of the Flemish Cap. Others from this tagging area were recaptured off the northern coast of South America in both the Caribbean Sea and Atlantic Ocean; in the Lesser Antilles; near the Cape Verde Islands; and off Cuba. Increased tagging efforts in the Gulf of Maine in recent years by sport fishermen have produced numerous long distance Atlantic returns as well as the maximum distance traveled this year of 2,323 nm.

Eight fish that were tagged south of Portugal showed movements up to 1,232 nm and times at liberty ranging from 18 days to 2.5 years. These fish ranged in size from 2.3' to 4.2' FL at tagging and radiated out in all directions. Another fish tagged further south (west of Madeira Island) traveled 1,116 nm to the Cape Verde Islands. Another shark was recaptured in the Eastern Atlantic after being tagged by a fisheries observer on board a longline vessel 1,657 nm to the west. These international recaptures highlight the importance of our foreign cooperators and the valuable information that results from their efforts.

Sandbar Sharks (52 Returns)

Sandbar sharks tagged by the CSTP and recaptured in 1996 have been at liberty for 2 days to 15.5 years; most (27) were returned more than one year after tagging. Distances traveled ranged from less than 1 to 1,677 nm. This long distance recapture was originally tagged off Long Island, NY by a sport fisherman and recaptured west of Progreso, Mexico by a gill net fisherman after 5.8 years at liberty. It was the forty-fifth sandbar shark tagged in U.S. waters by members of the CSTP that was recaptured off Mexico. Of these, 44 have moved from the Atlantic Ocean into the Gulf. Times at liberty and distances traveled for these U.S./Mexican fish range from 0.9 to 17.1 years and 696 to 2,039 nm. Additionally, in 1996 a sandbar shark was recaptured off Cuba after traveling 799 nm from an area southeast of Oregon Inlet, NC. Originally tagged by NMFS biologists, this is only the seventh sandbar shark recaptured off Cuba. All of the U.S./Cuban sandbar sharks were at liberty from 2.7 to 12.1 years and traveled distances of 302 to 1,159 nm. Overall this year, 14 sandbar sharks were recaptured in the Gulf of Mexico; 12 off the west coast of Florida, and one off Progreso, Mexico.

The predominant direction traveled for those fish at liberty over 6 months (and greater than 100 nm from the tagging location) was south/southwest with the exception of two fish. One of these was tagged off North Carolina in November and was recaptured further north off Virginia when the water temperatures warmed (158 nm North; 0.5 years); the other was tagged off Florida and was recaptured off South Carolina (156 nm North; 3.7 years). In summary, most (28) of the sandbar sharks recaptured in 1996 traveled more the 100 nm from the original tag site, with 17 traveling distances greater than 500 nm.

Other interesting returns include: two sandbar sharks tagged in June off Long Island, NY within a day of each other that were recaptured off Southport, NC within one day and five nm of each other; and two sharks that were tagged within a month of each other that were recaptured in the same location after being at liberty for six years. Furthermore, 11 fish were re-released with their tags in place or re-released untagged.

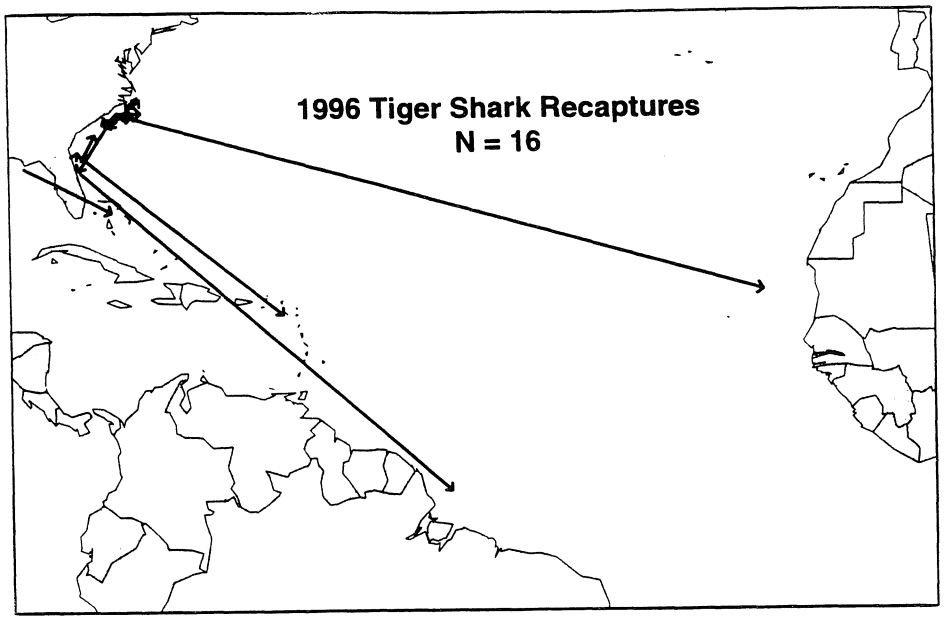
Sixteen neonate (pup) sandbar sharks were tagged and recaptured by NMFS biologists as part of a nursery ground study in 1996 (see article Page 16). These sharks showed only local movements. Two other neonates were tagged by cooperative taggers and were recaptured after 9 and 45 days at liberty. The first was tagged and recaptured in Delaware Bay and the other was tagged off Hatteras Inlet, NC and recaptured 34 miles away, inside Drum Inlet, NC. Two larger juveniles (approximately 3' FL) that were tagged in July in Delaware Bay by biologists from the National Aquarium in Baltimore exhibited more extensive movements outside the Bay. One was caught and re-released 51 miles to the northeast after one month and the other was recaptured east of Cape Lookout, NC after 8 months at liberty (257 nm South).

Shortfin Makos (35 Returns)

Distances traveled by mako sharks ranged from 5 to 2,113 nm with seven traveling distances greater than 1,000 nm. The two longest distance recaptures reported this year (1,943 and 2,113 nm) are the second and fourth longest distances traveled for any mako previously recaptured in the CSTP. They were both tagged off the northeast coast of the U.S. in the summer and were recaptured within a few miles of each other in early October near the Azores (after 2.8 and 4.1 months at liberty). Although their actual migratory routes are unknown, the overall direction was easterly and overall rate of speed for both fish was fairly rapid (22.6 and 17.0 nm/day - sixth and ninth fastest speeds recorded for makos in the CSTP).

Two other long distance returns (1,360 and 1,554 nm) were tagged off New England and were recaptured south of the Flemish Cap. Ten mako sharks were tagged and recaptured in this general area, having been at liberty from 13 days to 3.1 years and traveling distances from 90 to 398 nm. Two other makos that were tagged in this area were recaptured over 1,000 nm away; one off Oregon Inlet, NC and the other approximately 400 nm west of Spain. This latter fish is only the third mako shark in the CSTP to be returned east of the Azores. All fish were small (mostly 40 lbs. or less), both males and females, and were originally tagged and released by commercial fishermen or by fisheries observers on commercial vessels.

All of the recaptured makos were tagged and recaptured at a latitude of 35° 00' or greater with the exception of three fish; two were tagged off Long Island, NY and one was re-.



caught off Charleston, SC and the other off Cuba. This Cuban recapture is only the sixth to have been returned from that area. The third fish was recaptured north of the Canary Islands with an unknown tagging location (presumably an Eastern Atlantic tag).

Evidence that mako sharks remain in a localized area for a period of time or return to that area successively is shown by five returns. Four were recaptured less than 55 miles from their original tagging location; all were at liberty from one to two years. A fifth shark was recaptured only eight miles away after 24 days at liberty.

Another group of four recaptures were tagged by a sport fisherman south of Portugal; all were less than 3' FL at tagging and were recaptured after two to five months at liberty and up to 214 miles away. Overall, makos were at liberty from 13 days to over 4 years.

Tiger Sharks (18 Returns)

Although the number of tiger shark recaptures was not as numerous as in previous years, long distance returns from 1996 were significant and critical to our understanding of the migrations of this coastal-pelagic species. Four tagged fish were re-caught after traveling distances greater than 400 nm. One fish was tagged off the west coast of Florida and was recaptured in the Bahamas (461 nm). This is only the second tiger shark to show movement out of the Gulf of Mexico into the Atlantic Ocean. Two fish were tagged off northern Florida in May and June of 1994; one was recaptured off Antigua, West Indies (1,250 nm), and the other off Brazil (2,421 nm). The Brazilian recapture is the first tiger shark return from this area and is the third longest distance traveled to date. The other long distance return was originally tagged off North Carolina and was re-caught off the Cape Verde Islands after migrating 3,089 nm in 8.5 months. This is only the second trans-Atlantic recapture and is the second longest distance return.

Overall, tiger sharks were at liberty from 3.7 months to 2.6 years and traveled distances of 1 to 3,089 nm. Sixteen were originally tagged and released by commercial fishermen or by fisheries observers on commercial vessels and two were tagged by biologists. Five were measured at both tagging and recapture; one of these was injected with OTC at tagging. Unfortunately, a portion of the backbone was not saved from the fish for ongoing age studies (see article below).

Other Species (77 Returns)

Recaptures of other species included some long distance and maximum time at liberty records. A **great hammerhead** recaptured off Florida within 2 nm of its tagging site was recaptured after 1.2 years at liberty and re-released with the same tag. This is only the third great hammerhead recaptured to date and is a record time at liberty for this species. A **porbeagle** tagged west of Newfoundland was recaptured southeast of Nova Scotia, Canada (306 nm). This is the first porbeagle recovered from that tagging area. Three porbeagle sharks tagged south of the Isle of Wight, England were recaptured within 40 nm of the original tagging sites after up to two years at liberty (see map Page 13). Other interesting recoveries include: two **bignose sharks** at liberty for 10.9 and 11.2 years (the longest times at liberty for this species); a **night shark** at liberty for 13.8 years that traveled from South Carolina to Florida (record time at liberty for this species); a **Caribbean reef shark** that was tagged by NMFS biologists off Florida and traveled 26 nm (a maximum distance record); an **Atlantic sharpnose** that was released from a trawl net and traveled 16 nm from its tagging location after 5.0 years at liberty (fourth longest time at liberty); and a **bonnethead** at liberty for a record 2.0 years.

Age Validation Using Oxytetracycline

Since the early 1960's, members of the API have been collecting backbones from Atlantic sharks for the purpose of using them for age and growth studies. Shark vertebrae have band pairs (consisting of one opaque and one translucent band) analogous to growth rings on trees. At present, we have more than 3,000 vertebral samples from 40 species. Numbers per species range from one, for the crocodile shark, to 870 for the sandbar shark. If, as in theory, the pairs are annual, they can be counted and an age assigned to an individual shark. Subsequent age data from sharks throughout the size range of a species can then be used to then generate a growth curve. However, it is now known that not all species have annual band pairs and that in some species the periodicity of band pair deposition may vary depending on the size of the individual. In order to determine the actual periodicity of band pair deposition for the entire size range of a species, the staff of the API began injecting measured, tagged sharks with the biomarker oxytetracycline (OTC) in 1985. OTC injection is a commonly used technique for validating band periodicity. Injected OTC, circulating in the bloodstream, is absorbed and deposited at sites undergoing calcification, such as the vertebral column. The OTC mark is visible under fluorescent light, while growth before and after the injection does not fluoresce. All growth past the mark can be attributed to deposition over the time period subsequent to the injection, and growth and deposition rates can be derived.

In 1996 alone, over 880 individual sharks of 13 species were injected by NMFS and other biologists. The majority of these were sandbar (734) followed by tiger (32), Atlantic sharpnose (27), blue (23), blacknose (22), and porbeagle (15) sharks (see article Page 13). To date, more than 3,100 sharks have been tagged and injected. The majority of these fish are still at liberty with some having been at large since 1985. Since there is no indication on the tag as to whether or not the individuals have been injected, the return of all backbones from recaptured, landed sharks with an accurate fork length is requested. These backbones are vital to the age and growth research conducted by the API as the number of bands past the OTC mark will be compared to the time the fish was at liberty to determine the periodicity of band formation and accurately assess the ages of these species.

Table 2. Tag recoveries: January-December 1996.

	GENERAL LOCATIONS		MONTHS AT LIBERTY	DIST. (MI.) AND DIR.	CAPTURE METHOD		TAGGED BY	
	TAGGED	RECAPTURED			TAG.	REC.	TAGGER	RESIDENCE
Blue shark	E Avalon, NJ	SE Montauk Pt., NY	<1	0	NR	NR	Thomas A. Carrano	NY
" "	NR	NE Ancona, Italy	<1	0	RR	RR	Egidio Rossi	Italy
" "	E Absecon Inlet, NJ	S Montauk Pt., NY	2	113 NE	RR	RR	Gary Wimmer	PA
" "	NR	SE Montauk Pt., NY	<1	0	RR	RR	Edward Keneske	NY
" "	N Truro, MA	SE Flemish Cap	24	1327 E	RR	LL	Eric Stewart	MA
" "	SE New London, CT	SE Block Isl., RI	1	15 E	RR	RR	Lee Pepin	CT
" "	S Jones Inlet, NY	SE Moriches Inl., NY	<1	64 E	RR	RR	Daniel O'Neill	NY
" "	S Jones Inlet, NY	SE Moriches Inl., NY	<1	64 E	RR	RR	Daniel O'Neill	NY
" "	SE Pt. Judith, RI	SE Indian River Inlet, DE	1	231 SW	RR	RR	Jim Levy	RI
" "	E Manasquan Inlet, NJ	W Faial Isl., Azores	<1	1592 E	RR	NR	John Mautner	NJ
" "	SE Cape Sable, NS, Canada	S Cape Sable, NS, Canada	26	43 W	RR	LL	Arthur Luke	MA
" "	SE Montauk Pt., NY	S Pt. Judith, RI	49	16 NE	RR	RR	Mike Finazzo	NY
" "	E Beach Haven, NJ	E Ocean City, MD	<1	103 SW	RR	RR	Bud McArthur	NJ
" "	SE Moriches Inlet, NY	N of La Blanquilla, Venezuela	69	1440 S	RR	LL	Paul Trovitch	NY
" "	E Beach Haven, NJ	W Mauritania	20	2890 E	RR	LL	John Hand	NJ
" "	SW Martha's Vineyard, MA	NE Truro, NS, Canada	85	86 NE	RR	RR	Tony Tolentino	MA
" "	SE Pt. Judith, RI	SW Martha's Vineyard, MA	85	10 N	RR	RR	Jack Chagnon	RI
" "	E Rehoboth Beach, DE	S Montauk Pt., NY	1	166 NE	RR	RR	Jim Groover	PA
" "	S Martha's Vineyard, MA	S Montauk Pt., NY	86	42 SW	LL	RR	Stephen Connett	RI
" "	S Montauk Pt., NY	SE Flemish Cap	<1	1374 E	RR	LL	Gene Blau	NY
Blue shark	SE Moriches Inlet, NY	SE Montauk Pt., NY	13	55 NE	RR	RR	Charlie Johnson	NY
" "	SE Shinnecock Inlet, NY	S Pt. Judith, RI	15	39 NE	RR	RR	Richard Torre	NY
" "	SE Montauk Pt., NY	N Cape Verde Isl.	58	2732 E	RR	LL	James Little	CT
" "	SE Portland Headlights, ME	NW Santa Marta, Colombia	87	1919 S	RR	LL	Bob Puddister	ME
" "	E Ocean City, MD	Georges Bank	4	0	RR	LL	Joseph Maffei	PA
" "	S Shinnecock Inlet, NY	SE Fire Isl. Inlet, NY	2	15 SW	RR	RR	John Kurdick	NY
" "	S Shinnecock Inlet, NY	S Block Isl., RI	48	47 NE	RR	RR	Floyd Carrington	NY
" "	E Barnegat Inlet, NJ	E Toms River, NJ	<1	28 NW	RR	RR	Bruce Miller	NJ
" "	SE Pt. Judith, RI	S Pt. Judith, RI	51	42 W	RR	RR	Denny Dillon	RI
" "	SE Shinnecock Inlet, NY	Georgetown, Guyana	28	2057 SE	RR	LL	Ed Carpenter	NY
" "	NR	S Montauk Pt., NY	<1	0	RR	RR	Barry Springer	NY
" "	SE Jones Beach, NY	SE Montauk Pt., NY	10	73 NE	RR	RR	John Fields	NY
" "	E Beach Haven, NJ	SE Fire Isl. Inlet, NY	<1	64 N	RR	RR	Ray Mombelardi	NJ
" "	S Martha's Vineyard, MA	E Cape May, NJ	51	182 SW	HL	RR	Stephen Connett	RI
" "	S Montauk Pt., NY	S Flemish Cap	<1	1278 E	RR	LL	Mike Plaia	CT
" "	S Fire Isl. Inlet, NY	SE Montauk Pt., NY	2	96 E	RR	LL	Robert Howard	NY
" "	SW Nantucket Isl., MA	N La Asuncion, Venezuela	43	1742 S	RR	LL	Tom Birch	MA
" "	E Barnegat Inlet, NJ	S Montauk Pt., NY	<1	88 NE	RR	RR	Jody Distasio	NJ
" "	SE Pt. Pleasant, NJ	S Shinnecock Inlet, NY	1	69 N	RR	RR	Kevin Gerrity	NJ
" "	SE Montauk, NY	E Little Egg Inlet, NJ	1	132 SW	RR	RR	Van A. Starkweather	CT
Blue shark	E Barnegat Inlet, NJ	SE Pt. Judith, RI	1	114 NE	RR	RR	Jim Lynch	NJ
" "	E Barnegat Inlet, NJ	SE Jones Inlet, NY	<1	25 NE	RR	RR	Jim Lynch	NJ
" "	SE Montauk Pt., NY	S Martha's Vineyard, MA	49	25 E	RR	RR	Joe McBride	NY
" "	SE Portland Headlights, ME	NW Faial, Azores	42	1803 E	RR	LL	Mark Chase	ME
" "	E Provincetown, MA	SE St. Croix, USVI	21	1569 S	RR	LL	Thomas Fiala	MA
" "	W Madeira Isl., Portugal	SE Madeira Isl., Portugal	49	181 SE	RR	LL	Roddy Hays	Portugal
" "	SE Flemish Cap	SE Flemish Cap	46	163 S	LL	LL	Alex Sutton	NY
" "	W Funchal Madeira Isl., Portuc	Cape Verde Isl.	39	1116 SW	RR	HL	Roddy Hays	Portugal
" "	S Fire Isl. Inlet, NJ	E Manasquan Inlet, NJ	2	12 SW	RR	RR	Frank Christy	NY
" "	NR	NW Netherland, Antilles	<1	0	RR	LL	Jerome Robertson	MA
" "	E Cape May, NJ	SW Fire Isl. Inlet, NY	1	121 N	RR	RR	Richard Obszarski	NJ
" "	E Ocean City, MD	E Ocean City, MD	<1	9 NE	RR	RR	Richard Obszarski	NJ
" "	S Montauk Pt., NY	SW Faial, Azores	33	1592 E	RR	LL	Jack Salisbury	CT
" "	NR	SE Montauk Pt., NY	<1	0	RR	RR	Normand Poulin	CT
" "	SW Martha's Vineyard, MA	S Pt. Judith, RI	36	31 W	RR	RR	Bill Tucker	MA
" "	S Montauk Pt., NY	S St. Croix, USVI	21	1485 S	RR	LL	Hal Weissman	NY
" "	E Barnegat Inlet, NJ	S Flemish Cap	13	1368 E	RR	LL	Robert Dworzak	NJ
" "	SE Cape Elizabeth, ME	E Vineyard Haven, MA	25	110 SE	RR	LL	Marc St. Pierre	ME
" "	S Montauk Pt., NY	SW Montauk Pt., NY	13	14 NW	RR	RR	Peter Fraker	NY
" "	S Montauk Pt., NY	N Punto Fijo, Venezuela	22	1641 S	RR	LL	Fred Wedley	NY
Blue shark	SSE Block Isl., RI	E Montauk Pt., NY	<1	16 NW	RR	RR	Michael P. Amodeo	CT
" "	SW Pt. Judith, RI	W Spanish Sahara, Africa	32	2731 E	RR	LL	Charlie Donilon	RI
" "	S Newport, RI	W Faial Isl., Azores	21	1482 E	RR	LL	Jim Quinn	RI
" "	SE Gloucester, MA	E Absecon Inlet, NJ	38	199 SW	RR	RR	John Shea	NH
" "	S Portland Headlights, ME	W Spanish Sahara, Africa	28	2702 E	RR	LL	Mark Chase	ME
" "	SE Martha's Vineyard, MA	E Block Isl., RI	36	208 NW	LL	RR	J. Harrington, NMFS Obs.	MA
" "	SE Pt. Judith, RI	Grand Banks, NF	23	0	RR	LL	Kenneth Turrisi	NY
" "	W Madeira, Portugal	N Sao Miguel Isl., Azores	<1	0	RR	LL	Roddy Hays	England
" "	SE Montauk Pt., NY	SW Montauk Pt., NY	12	26 W	RR	RR	Harry McAllister	NY
" "	SE Montauk Pt., NY	SE Montauk Pt., NY	<1	2 S	RR	RR	Matt Poitras	CT
" "	SE Montauk Pt., NY	SE Montauk Pt., NY	16	147 SE	RR	LL	Alan Weiss	NY
" "	E Townsends Inlet, NJ	SE Ocean City, MD	<1	69 SW	RR	RR	Peter Roscoe	PA
" "	SSW Pt. Judith, RI	W Faial, Azores	33	1499 E	RR	LL	Charlie Donilon	RI
" "	S Fire Isl. Inlet, NY	SE Fire Isl. Inlet, NY	1	31 W	RR	RR	Albert Katz	NY
" "	SE Montauk Pt., NY	W Sao Miguel, Azores	34	1737 E	RR	LL	Tim Favia	NY
" "	E Barnegat Inlet, NJ	S Shinnecock Inlet, NJ	1	54 NE	RR	RR	Harry Thorne	NJ
" "	SE Manasquan Inlet, NJ	E Manasquan Inlet, NJ	<1	31 N	RR	RR	Harry Thorne	NJ
" "	SE Barnegat Inlet, NJ	SW Martha's Vineyard, MA	2	146 NE	RR	RR	Jeff Merrill	NJ
" "	SE Pt. Judith, RI	SE Pt. Judith, RI	24	25 NW	RR	RR	Tom Birch	MA
" "	E Ocean City, MD	NR	<1	0	RR	LL	Hall Jump	MD
Blue shark	SE Portland Headlights, ME	NE Faial, Azores	19	2173 E	RR	LL	Ian Bexon	ME
" "	SE Portland Headlights, ME	N Cayenne, French Guiana	13	2323 SE	RR	LL	Ben Garfield	ME
" "	SE Gloucester, MA	SE Martha's Vineyard, MA	23	57 S	RR	RR	Gary Davis	MA
" "	SE Seguin Isl., ME	SE Montauk Pt., NY	14	193 SW	RR	RR	Robert Howe	ME
" "	E Gloucester, MA	SW Ponce, Puerto Rico	4	1544 S	RR	LL	Albert Trudeau	NH
" "	SE Saco River, ME	SE Montauk Pt., NY	11	166 SW	RR	RR	David Harrold	MA
" "	SE Montauk Pt., NY	S Flemish Cap	<1	1235 E	LL	LL	G. Hinteregger, NMFS Obs.	RI
" "	SE Montauk Pt., NY	E Cape Sable, NS, Canada	14	339 NE	RR	LL	Carl Safina	NY
" "	SE Montauk Pt., NY	S Moriches Inlet, NY	12	52 W	RR	RR	Carl Safina	NY

Table 2. Tag recoveries: January-December 1996.

	GENERAL LOCATIONS		MONTHS AT	DIST. (MI.) AND DIR.	CAPTURE METHOD		TAGGED BY	
	TAGGED	RECAPTURED	LIBERTY		TAG.	REC.	TAGGER	RESIDENCE
Blue shark	SE Shinnecock Inlet, NY	S Vineyard Haven, MA	11	70 E	RR	RR	Donald Van de Water	NY
" "	E Cape Race, NF, Canada	SE Flemish Cap	8	298 SE	LL	LL	P. O'Donnell, NMFS Obs.	MA
" "	SE Montauk Pt., NY	SSW Pt. Judith, RI	<1	7 SE	RR	RR	Gary Thompson	CT
" "	SE Pt. Judith, RI	N Boca del Pozo, Venezuela	17	1702 S	FS	LL	Charlie Donilon	RI
" "	SE Manasquan Inlet, NJ	SE Montauk Pt., NY	<1	111 NE	RR	RR	Joseph Dymarczyk	NJ
" "	SE Portland Headlights, ME	NW Boca del Pozo, Venezuela	14	1890 S	RR	LL	Ronald P. Pimpare	ME
" "	SE Montauk Pt., NY	E Block Isl., RI	11	39 NW	RR	HL	A.C. Miller	CT
" "	SE Montauk Pt., NY	W Faial, Azores	6	1485 E	RR	LL	Chuck Miller	CT
" "	E Newburyport, MA	SE Montauk Pt., NY	22	134 SW	RR	RR	John Pirie	MA
" "	S Shinnecock Inlet, NY	SE Montauk Pt., NY	<1	39 NE	RR	RR	Walter Dreyer	NY
" "	SW Shinnecock Inlet, NY	SW Faial, Azores	10	1802 E	RR	LL	Tom Cashman	NY
" "	SW Montauk Pt., NY	SSE Montauk Pt., NY	13	50 E	RR	RR	Tom Cashman	NY
" "	SE Fire Isl. Inlet, NY	SE Ocean City, MD	14	166 S	FS	RR	Carl Stetz	NY
" "	SE Shinnecock Inlet, NY	E Manasquan Inlet, NJ	2	152 E	RR	LL	Laird Summerlin	MA
" "	SE Fire Isl. Inlet, NY	SW Faial Isl., Azores	13	1744 E	RR	LL	Ray Wittmann	NY
" "	NR	E Hampton, NH	<1	0	RR	RR	Ric Fuller	Portugal
" "	NR	SW Spanish Sahara, Africa	<1	0	RR	LL	Ric Fuller	Portugal
" "	E Barnegat Inlet, NJ	SE Barnegat Inlet, NJ	1	49 SW	RR	LL	NMFS Observer	MA
" "	S Flemish Cap	W Faial Isl., Azores	11	338 SE	LL	LL	P. O'Donnell, NMFS Obs.	MA
" "	S Flemish Cap	W Cape Verde Isl.	16	1813 SE	LL	LL	P. O'Donnell, NMFS Obs.	MA
Blue shark	SW Flemish Cap	W Faial, Azores	20	629 SE	LL	LL	J. Symonds, NMFS Obs.	MA
" "	SE Cape May, NJ	SE Montauk Pt., NY	1	206 NE	RR	RR	Brion Babbitt	NJ
" "	E Barnegat Inlet, NJ	S Montauk Pt., NY	1	84 NE	RR	RR	Pete Barrett	NJ
" "	SE Barnegat Inlet, NJ	SW Shinnecock Inlet, NY	1	70 NE	RR	RR	Pete Barrett	NJ
" "	S Jones Inlet, NY	S Pt. Judith, RI	14	89 E	RR	RR	Sy Kaufman	NY
" "	SSW Pt. Judith, RI	W Faial, Azores	19	1620 E	RR	LL	Charlie Donilon	RI
" "	E Wachapreague Inlet, VA	SE Block Isl., RI	2	241 NE	RR	LL	James Houser	MD
" "	SE Ocean City, MD	SE Shinnecock Inlet, NY	1	178 NE	RR	RR	Richard Brown	PA
" "	SE Cape May, NJ	SE Ocean City, MD	12	42 S	RR	RR	Ed Pickul	MD
" "	SE Montauk Pt., NY	SSE Fire Isl. Inlet, NY	24	71 SW	RR	RR	Bill Ricca	NY
" "	SE Shinnecock Inlet, NY	W Spanish Sahara, Africa	16	2736 E	RR	LL	Fred Wedley	NY
" "	SE Shinnecock Inlet, NY	S Martha's Vineyard, MA	23	55 E	RR	RR	Fred Wedley	NY
" "	SE Martha's Vineyard, MA	S Pt. Judith, RI	26	54 W	RR	RR	Bob Greene	MA
" "	E Cape May, NJ	E Wachapreague Inlet, VA	13	70 S	RR	RR	Craig Otton	NJ
" "	E Martinique, W.I.	N Cape Verde Isl.	19	1657 E	LL	LL	G. Hinteregger, NMFS Obs.	RI
" "	SE Fire Isl. Inlet, NY	SE Shinnecock Inlet, NY	2	48 NE	RR	RR	Chris Hoppner	NY
" "	SE Fire Isl. Inlet, NY	SE Pt. Judith, RI	<1	92 NE	RR	RR	Pete Scelfo	NY
" "	E Barnegat Inlet, NJ	S Martha's Vineyard, MA	13	115 E	RR	RR	Ken Kelmenson	NY
" "	S Pt. Judith, RI	SE Montauk Pt., NY	2	8 SW	RR	RR	Ralph Carlson, Jr.	RI
" "	SE Montauk Pt., NY	SE Cape May, NJ	2	171 SW	RR	RR	Steve Szoke	NY
Blue shark	SE Pt. Judith, RI	S Martha's Vineyard, MA	25	16 NE	RR	RR	Tom Birch	MA
" "	S Vineyard Haven, MA	S Flemish Cap	<1	1301 E	RR	LL	Joe Gouveia	MA
" "	S Montauk Pt., NY	SE Montauk Pt., NY	15	15 NE	RR	RR	Frank Braddick	NY
" "	S Montauk Pt., NY	E Cape Sable, NS, Canada	14	441 NE	RR	LL	Frank Braddick	NY
" "	SE Pt. Judith, RI	SE Portland Headlights, ME	25	155 N	RR	RR	Dana Zewinski	RI
" "	S Pt. Judith, RI	NE Rockport, MA	12	116 N	RR	RR	Damon Hamilton	RI
" "	SE Shinnecock Inlet, NY	S Montauk Pt., NY	1	14 NE	RR	RR	Bill Mercado	NE
" "	SE Pt. Judith, RI	SW Sable Isl., NS, Canada	12	506 E	RR	LL	Jim Walsh	CT
" "	S Pt. Judith, RI	W Faial, Azores	21	1462 E	RR	LL	Steven West	RI
" "	SE Pt. Judith, RI	SW Montauk Pt., NY	21	54 SW	RR	RR	Gary Eaton	RI
" "	SE Portland Headlights, ME	S Monhegan Isl., ME	<1	38 E	RR	GN	Richard Provencher	ME
" "	S Moriches Inlet, NY	SE Montauk Pt., NY	3	76 NE	RR	RR	George Saer	NY
" "	NR	S Moriches Inlet, NY	<1	0	RR	RR	John Ferrera	NY
" "	S Block Isl., RI	SE Moriches Inlet, NY	<1	33 W	RR	RR	Robert Sangster	RI
" "	E Faro, Portugal	El Rompido, Huelva, Spain	<1	0	RR	LL	Helder Ferreira	Azores
" "	SE Camp Ellis Beach, ME	W Faial, Azores	56	1464 E	RR	LL	David Lambert	ME
" "	SE Fire Isl. Inlet, NY	E Beach Haven, NJ	1	60 SW	RR	RR	John Raguso	NY
" "	SW Montauk Pt., NY	NW Barbados	10	1738 SE	RR	HL	Frank Braddick	NY
" "	S Pt. Judith, RI	SE Cape May, NJ	11	198 SW	RR	RR	Fran Ramella	RI
" "	SE Montauk Pt., NY	E Little Egg Inlet, NJ	11	116 SW	RR	RR	Lee Pepin	CT
Blue shark	S Montauk Pt., NY	SSE Montauk Pt., NY	15	9 E	RR	RR	Mike Brumm	NY
" "	SE Ocean City, MD	E Cape May, NJ	<1	61 NE	RR	FS	Gary Stamm	MD
" "	S Pt. Judith, RI	S Montauk Pt., NY	2	27 SW	RR	RR	Ed Abbenante	RI
" "	S Pt. Judith, RI	W Faial, Azores	19	1487 E	RR	LL	Ken Benson	RI
" "	S Pt. Judith, RI	SE Portland Headlights, ME	13	165 NE	RR	RR	Bob Messinger	RI
" "	SE Cape Elizabeth, ME	S Sao Miguel Isl., Azores	<1	2120 E	RR	LL	Ian Bexon	ME
" "	E Faro, Portugal	40 mi. W Aveiro, Portugal	13	235 NW	RR	LL	Helder Ferreira	Azores
" "	E Montauk Pt., NY	SE Montauk Pt., NY	11	29 S	RR	RR	Tom O'Brien	NY
" "	SE Portland Headlights, ME	S Flemish Cap	22	1164 E	RR	LL	Ian Bexon	ME
" "	S Flemish Cap	SE Flemish Cap	<1	296 E	LL	LL	Barry Marx	FL
" "	E York Harbor, ME	S Cape Sable, NS, Canada	13	211 E	RR	LL	Robert Fuehrer	VT
" "	E Ocean City, MD	S Montauk Pt., NY	16	202 NE	RR	RR	Mark Sampson	MD
" "	SSW Pt. Judith, RI	S Block Isl., RI	14	76 SE	FS	RR	Charlie Donilon	RI
" "	SE Shinnecock Inlet, NY	SE Shinnecock Inlet, NY	15	8 N	RR	RR	Bill Williams	NY
" "	SE Montauk Pt., NY	SE Rockport, MA	13	116 NE	RR	RR	Frank Braddick	NY
" "	S Portland Headlights, ME	S Montauk Pt., NY	<1	157 SW	RR	RR	Mike Boucher	ME
" "	SE Montauk Pt., NY	SE Shinnecock Inlet, NY	2	25 SW	RR	RR	Laird Summerlin	MA
" "	SE Wachapreague Inlet, VA	S Pt. Judith, RI	3	281 NE	RR	RR	James Houser	MD
" "	E Wachapreague Inlet, VA	SE Moriches Inlet, NY	<1	198 NE	RR	RR	James Houser	MD
" "	SE Pt. Judith, RI	E Manasquan, NJ	9	115 SW	RR	RR	Stephen Barr	RI
Blue shark	SW Provincetown, MA	SE Shinnecock, NY	11	0	RR	RR	Tim Armstrong	MA
" "	S Shinnecock Inlet, NY	SW Spanish Sahara, Africa	17	2831 E	RR	LL	Fred Wedley	NY
" "	SE Barnegat Inlet, NJ	S Montauk Pt., NY	12	107 NE	RR	RR	Keith Burnet	NJ
" "	S Lagos, Portugal	W Vigo, Spain	9	317 N	RR	LL	George Burgum	England
" "	S Lagos, Portugal	SW Lagos, Portugal	11	21 SW	RR	LL	George Burgum	England
" "	S Lagos, Portugal	SW Faial, Azores	<1	989 W	RR	LL	Graeme Pullen	England
" "	SW Algarve, Portugal	W Cabo Sao Vincente, Portugal	7	402 W	RR	LL	Graeme Pullen	England
" "	NR	SE Montauk Pt., NY	<1	0	RR	RR	Joseph Hahn	CT
" "	SE Shinnecock, NY	SE Flemish Cap	<1	1358 E	RR	LL	Charles Tulevech	NY

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	GENERAL LOCATIONS		MONTHS AT LIBERTY	DIST. (MI.) AND DIR.	CAPTURE METHOD		TAGGED BY	
	TAGGED	RECAPTURED			TAG.	REC.	TAGGER	RESIDENCE
Blue shark	S Montauk Pt., NY	S Block Isl., RI	12	24 E	FS	RR	Charles Tulevech	NY
" "	S Shinnecock Inlet, NY	SE Fire Isl. Inlet, NY	<1	24 S	RR	RR	Dan Miller	NY
" "	E Shark River Inlet, NJ	S Fire Isl. Inlet, NY	1	17 E	RR	RR	Christopher DeFoe	NJ
" "	S Fire Isl. Inlet, NY	SE Indian River Inlet, DE	4	119 S	RR	RR	Raymond DeAngelis	NY
" "	SE Absecon Inl., NJ	SE Manasquan Inlet, NJ	<1	55 NE	RR	RR	Ray Bergman	NJ
" "	SE Montauk Pt., NY	E Beach Haven, NJ	15	87 SW	RR	RR	Frank Braddick	NY
" "	NR	NW Tobago, West Indies	<1	0	RR	LL	Terrence Stoner	NY
" "	SE Fire Isl. Inlet, NY	SE Fire Isl. Inlet, NY	<1	20 S	RR	RR	Tom Kieman	NY
" "	S Pt. Judith, RI	E Oregon Inlet, NC	11	359 SW	FS	LL	Charlie Donilon	RI
" "	S Pt. Judith, RI	S Pt. Judith, RI	12	5 S	FS	FS	Charlie Donilon	RI
" "	S Pt. Judith, RI	SW Montauk Pt., NY	12	40 SW	FS	RR	Charlie Donilon	RI
" "	SSE Pt. Judith, RI	SE Montauk Pt., NY	14	23 W	FS	RR	Charlie Donilon	RI
" "	S Pt. Judith, RI	W Faial, Azores	7	1488 E	RR	LL	Charlie Donilon	RI
" "	SE Moriches Inlet, NY	SE Flemish Cap	<1	1489 E	RR	LL	Wainwright Carlough	NY
" "	S Fire Isl. Inlet, NY	E Oregon Inlet, NC	10	254 S	RR	LL	Sy Kaufman	NY
" "	NR	SW Shinnecock Inlet, NY	<1	0	RR	RR	Richard Neckles	NY
" "	NR	E Barnegat Inlet, NJ	<1	0	RR	LL	David Lee	NY
" "	SW Jones Inlet, NY	E Manasquan Inlet, NJ	12	17 SE	RR	RR	Dennis O'Reilly	NY
" "	S Montauk Pt., NY	SE Moriches Inlet, NY	13	20 SW	RR	RR	Allan Kapuse	CT
" "	SE Montauk Pt., NY	S Cape Sable, NS, Canada	13	366 E	RR	LL	Dana Zewinski	RI
Blue shark	SE Montauk Pt., NY	S Cape Sable, NS, Canada	15	281 E	RR	LL	Dana Zewinski	RI
" "	S Montauk Pt., NY	SE Ocean City, MD	11	210 SW	RR	RR	Nick Millilo	CT
" "	NR	SE Moriches Inlet, NY	<1	0	RR	RR	Gary Rubio	NY
" "	S Pt. Judith, RI	N Grenada	11	1775 S	RR	HL	Richard Scolavino	RI
" "	NR	SE Absecon Inlet, NJ	<1	0	RR	RR	Anthony Cassano	NY
" "	S Montauk Pt., NY	SE Shinnecock Inlet, NY	15	30 W	RR	RR	John Farris	NY
" "	SE Jones Inlet, NY	SE Flemish Cap	13	1432 E	RR	LL	Lawrence Festa	NY
" "	SE Jones Inlet, NY	SW Montauk Pt., NY	12	36 NE	RR	RR	Lawrence J. Festa	NY
" "	S Fire Isl. Inlet, NY	S Nantucket Isl., MA	13	149 E	RR	RR	Leo Sattle	NY
" "	SE Fire Isl. Inlet, NY	SE Pt. Judith, RI	13	95 NE	RR	RR	Tom Boniberger	NY
" "	SE Montauk Pt., NY	SW Montauk Pt., NY	<1	32 W	RR	RR	Perry Pratt	CT
" "	SE Cape May, NJ	SE Moriches Inlet, NY	1	150 NE	RR	RR	Tom Basiura	PA
" "	SE Fire Isl. Inlet, NY	S Pt. Judith, RI	12	80 NE	RR	RR	Al Hill	NY
" "	S Moriches Inlet, NY	E Cape May, NJ	<1	95 SW	RR	LL	Joe Salinitro	NY
" "	E Ocean City, MD	E Ocean City, MD	1	10 E	RR	RR	Joseph Maffei	PA
" "	SE Fire Isl. Inlet, NY	SE Debs Inlet, NY	3	26 W	RR	RR	Carl Stetz	NY
" "	SE Montauk Pt., NY	S Montauk Pt., NY	12	12 NW	RR	RR	John Salisbury	CT
" "	S Montauk Pt. NY	W Faial Isl., Azores	12	1543 E	RR	LL	Gary Savard	MA
" "	S Pt. Judith, RI	SW Cape Sable, NS, Canada	14	235 E	RR	LL	Robert Malerba	CT
" "	S Montauk Pt., NY	S Montauk Pt., NY	12	10 N	FS	RR	tom Federico	NY
Blue shark	SE Shinnecock Inlet, NY	E Manasquan Inlet, NJ	1	70 SW	RR	RR	Laird Summerlin	MA
" "	SE Montauk Pt., NY	N Santa Cruz, Cuba	11	1186 SW	RR	LL	Charles Betz	NY
" "	E Barnegat Inlet, NJ	S Fire Isl. Inlet, NY	1	35 N	RR	RR	Art Schuessler III	PA
" "	E Pt. Pleasant, NJ	SE Barnegat Inlet, NJ	1	66 S	RR	LL	Art Schuessler	PA
" "	SE Fire Isl. Inlet, NY	S Barnegat Inlet, NJ	1	92 SW	RR	LL	Anthony Innamorato	NY
" "	SE Fire Isl. Inlet, NY	SE Shinnecock Inlet, NY	1	44 NE	RR	RR	Anthony Innamorato	NY
" "	SE Moriches Inlet, NY	S Fire Isl. Inlet, NY	2	48 W	RR	RR	Augustino Palladino	NY
" "	S Fire Isl. Inlet, NY	SE Moriches Inlet, NY	13	44 NE	RR	RR	Scott Shapiro	NY
" "	SE Fire Isl. Inlet, NY	SE Cape Elizabeth, ME	3	232 NE	RR	RR	Scott Shapiro	NY
" "	SE Fire Isl. Inlet, NY	SE Jones Inlet, NY	1	18 S	RR	RR	Ben Denson	NY
" "	SW Fire Isl. Inlet, NY	SW Fire Isl. Inlet, NY	<1	43 E	RR	RR	Lewis Liebetroth	NY
" "	SE Montauk Pt., NY	SE Fire Isl. Inlet, NY	<1	64 W	RR	RR	Stret Whitting	NY
" "	E Shark River Inlet, NJ	SE Moriches Inlet, NY	<1	56 NE	RR	RR	Chris Defoe	NJ
" "	SE Moriches Inlet, NY	SE Montauk Pt., NY	1	35 NE	RR	RR	Richard Dinka	NY
" "	SE Moriches Inlet, NY	S Montauk Pt., NY	<1	26 E	RR	RR	Richard Dinka	NY
" "	SE Fire Isl. Inlet, NY	SE Barnegat Inlet, NJ	<1	52 SW	RR	RR	Kenneth Schmieder	NY
" "	SE Moriches Inlet, NY	SE Pt. Judith, RI	2	66 NE	RR	RR	Wain Carlough	NY
" "	SE Moriches Inlet, NY	SW Moriches Inlet, NY	<1	21 W	RR	RR	Wain Carlough	NY
" "	S Fire Isl. Inlet, NY	E Cape May, NJ	1	66 S	RR	LL	John Young	NY
" "	S Pt. Judith, RI	E Nantucket Isl., MA	6	258 E	RR	LL	Jon Dodd	RI
Blue shark	S Pt. Judith, RI	SE Montauk Pt., NY	1	15 SW	RR	RR	Dave Blackburn	RI
" "	SE Montauk Pt., NY	S Pt. Judith, RI	<1	19 S	RR	RR	Barry Steinberg	NY
" "	S Pt. Judith, RI	SW Martha's Vineyard, MA	10	29 E	RR	RR	Jim Bohara	CT
" "	S Pt. Judith, RI	SW Pemaquid Pt., ME	1	184 NE	RR	RR	James G. Walsh	CT
" "	NR	SE Montauk Pt., NY	<1	0	RR	LL	Bruce Moniz	RI
" "	SE Pt. Judith, RI	SW Martha's Vineyard, MA	14	8 NE	RR	RR	Barry Bordner	MA
" "	S Pt. Judith, RI	SW Martha's Vineyard, MA	1	22 E	RR	RR	Robert Reichenberger	NY
" "	S Shinnecock Inlet, NY	S Block Isl., RI	<1	55 NE	RR	RR	David Mann	NY
" "	S Pt. Judith, RI	SE Pt. Judith, RI	2	6 E	RR	RR	Everett Petronio	RI
" "	SE Pt. Judith, RI	S Fire Isl. Inlet, NY	1	102 W	RR	RR	Ernest Dunphy	RI
" "	SE Pt. Judith, RI	S Fire Isl. Inlet, NY	2	97 W	RR	RR	Ernest Dunphy	RI
" "	SE Shinnecock Inlet, NY	SW Montauk Pt., NY	11	12 N	RR	RR	Bill Williams	NY
" "	SE Shinnecock Inlet, NY	SE Pt. Judith, RI	14	52 NE	RR	RR	Bill Williams	NY
" "	SE Fire Isl. Inlet, NY	SE Montauk Pt., NY	1	83 E	RR	RR	George Maisch	NY
" "	S Montauk Pt., NY	S Shinnecock Inlet, NY	1	51 NW	RR	RR	Carl Safina	NY
" "	S Montauk Pt., NY	S Fire Isl. Inlet, NY	12	68 SW	RR	RR	Al Phillips	NY
" "	SE Montauk Pt., NY	S Pt. Judith, RI	12	12 N	RR	RR	Stephen Roland	NY
" "	E Montauk Pt., NY	SE Montauk Pt., NY	<1	9 S	RR	RR	Jim Noon	RI
" "	E Montauk Pt., NY	S Montauk Pt., NY	<1	18 SW	RR	RR	Lee Pepin	CT
" "	S Pt. Judith, RI	SE Pt. Judith, RI	<1	17 E	RR	RR	Lee Pepin	CT
Blue shark	S Montauk Pt., NY	S Fire Isl. Inlet, NY	2	80 SW	RR	RR	Tom Mort	RI
" "	S Montauk Pt., NY	SE Fire Isl. Inlet, NY	<1	166 SE	RR	RR	Tom Mort	RI
" "	SE Pt. Judith, RI	S Pt. Judith, RI	1	9 SW	RR	RR	Ray Chappuis	CT
" "	NR	E Cape May, NJ	<1	0	RR	LL	Andy Becker	NY
" "	E Martha's Vineyard, MA	S Montauk Pt., NY	2	50 SW	RR	RR	Gregg Skomal	MA
" "	SE Pt. Judith, RI	SW Pt. Judith, RI	1	19 W	RR	RR	Albert Woynar	CT
" "	SE Montauk Pt., NY	E Cape May, NJ	1	86 SW	RR	LL	Albert Woynar	CT
" "	S Portland Headlights, ME	W Faial, Azores	8	1572 E	RR	LL	Brad MacDonald	ME
" "	SE Montauk Pt., NY	SE Pt. Judith, RI	1	34 N	RR	RR	Bob Weaver	NY

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	GENERAL LOCATIONS		MONTHS AT LIBERTY	DIST. (MI.) AND DIR.	CAPTURE METHOD		TAGGED BY	
	TAGGED	RECAPTURED			TAG.	REC.	TAGGER	RESIDENCE
lue shark	SE Portland Headlights, ME	W Faial, Azores	8	1314 E	RR	LL	Arnold Beleckis	ME
" "	SE Pt. Judith, RI	S Pt. Judith, RI	<1	6 SW	RR	RR	Rick Bellavance	RI
" "	SE Wood Isl. Light, ME	SE Pt. Judith, RI	10	153 S	RR	RR	Dana Sevigny	ME
" "	SE Pt. Judith, RI	S Pt. Judith, RI	2	39 W	RR	RR	Chuck Walker	MA
" "	S Portland Headlights, ME	SE Nantucket Isl., MA	1	205 S	RR	LL	Brad MacDonald	ME
" "	S Pt. Judith, RI	SE Fire Isl. Inlet, NY	1	75 SW	RR	RR	Mitch Chagnon	RI
" "	S Portland Headlights, ME	S Portland Headlights, ME	<1	19 S	RR	GN	Ben Garfield	ME
" "	SW Montauk Pt., NY	S Fire Isl. Inlet, NY	2	50 SW	RR	RR	Frank Braddick	NY
" "	S Portland Headlights, ME	SE Portland, ME	1	8 NE	RR	RR	Merrill Robbins	ME
" "	S Pt. Judith, RI	SSE Pt. Judith, RI	1	8 NE	RR	FS	Jim Walsh	CT
" "	SE Montauk Pt., NY	S Montauk Pt., NY	13	31 W	FS	RR	Jim Walsh	CT
" "	S Montauk Pt., NY	SW Martha's Vineyard, MA	1	64 NE	RR	RR	Robert L. Crawford Jr.	NY
" "	SSE Pt. Judith, RI	SE Montauk Pt., NY	11	14 W	FS	LL	Charlie Donilon	RI
" "	SSE Pt. Judith, RI	S Montauk Pt., NY	9	39 W	RR	RR	Charlie Donilon	RI
" "	S Pt. Judith, RI	SE Pt. Judith, RI	11	21 NE	FS	RR	Charlie Donilon	RI
" "	S Pt. Judith, RI	S Montauk Pt., NY	9	26 SW	RR	RR	Charlie Donilon	RI
" "	S Lagos, Portugal	SW Cadiz, Spain	1	105 E	RR	LL	George Burgum	England
" "	SW Algarve, Portugal	Sines, Portugal	4	64 NW	RR	LL	George Burgum	England
" "	S Lagos, Portugal	S Cabo Sao Vicente, Portugal	2	40 W	RR	LL	George Burgum	England
" "	NR	E Manasquan Inlet, NY	<1	0	RR	RR	Ray Nettune	NY
Blue shark	ESE Saco River, ME	S Montauk Pt., NY	13	178 SW	RR	RR	Jim Hinkley	ME
" "	SE Portland Headlights, ME	E Montauk Pt., NY	10	158 S	RR	RR	Merrill Robbins	ME
" "	S Montauk Pt., NY	SE Pt. Judith, RI	11	47 NE	RR	RR	Steve Roland	NY
" "	S Pt. Judith, RI	SSE Fire Isl. Inlet, NY	1	84 SW	RR	RR	Bill Voloshen	MA
" "	NR	SE Pt. Judith, RI	<1	0	RR	FS	Keith Micallef	NY
" "	SE Moriches Inlet, NY	SW Shinnecock Inlet, NY	<1	19 W	RR	RR	Paul Lesiewicz	NY
" "	E Portland Headlights, ME	SE Portland Headlights, ME	1	17 W	RR	RR	Alan Fortier	ME
" "	SE Cape May, NJ	SE Manasquan Inlet, NJ	1	81 NE	RR	RR	William Weisberg	NJ
" "	SE Fire Isl. Inlet, NY	SW Shinnecock Inlet, NY	2	15 N	RR	RR	Tom Cashman	NY
" "	SE Absecon Inlet, NJ	SSE Montauk Pt., NY	1	153 NE	RR	RR	Ray Bergman	NJ
" "	SE Moriches Inlet, NY	SW Shinnecock Inlet, NY	1	28 W	RR	RR	Gary Blackler	NY
" "	S Pt. Judith, RI	S Block Isl., RI	<1	2 NW	RR	RR	Steve West	RI
" "	E Toms River, NJ	S Shinnecock Inlet, NY	<1	45 E	RR	RR	Fred Langbein	NJ
" "	E Manasquan Inlet, NJ	S Fire Isl. Inlet, NY	2	35 NE	RR	RR	Fred Langbein	NJ
" "	N Race Pt. Light, MA	E Race Pt. Light, MA	<1	5 SE	RR	RR	Eric Stewart	MA
" "	SE Shinnecock Inlet, NY	S Montauk Pt., NY	1	46 SE	RR	LL	Bill Williams	NY
" "	SE Shinnecock Inlet, NY	SE Fire Isl. Inlet, NY	3	45 W	RR	RR	Bill Williams	NY
" "	E Ocean City, MD	SE Fire Isl. Inlet, NY	1	146 NE	RR	RR	Mark Sampson	MD
" "	SE Shinnecock Inlet, NY	SE Montauk Pt., NY	1	35 NE	RR	RR	Fred Wedley	NY
" "	S Montauk Pt., NY	SE Fire Isl. Inlet, NY	1	61 W	RR	RR	Mike Brumm	NY
Blue snark	SE Barnegat Inlet, NJ	E Manasquan Inlet, NY	1	38 N	RR	RR	Joe Cleveland	NJ
" "	E Montauk Pt., NY	SE Moriches Inlet, NY	<1	49 SW	RR	RR	Uldis Ozolins	MA
" "	SE Montauk Pt., NY	NE Cape Hatteras, NC	3	321 SW	RR	LL	Frank Braddick	NY
" "	SW Montauk Pt., NY	S Pt. Judith, RI	2	29 NE	RR	RR	Frank Braddick	NY
" "	SW Montauk Pt., NY	SE Shinnecock Inlet, NY	1	8 SE	RR	RR	Frank Braddick	NY
" "	S Montauk Pt., NY	S Pt. Judith, RI	1	34 NE	RR	RR	Tom White	CT
" "	SE Montauk Pt., NY	E Cape Sable, NS, Canada	3	455 E	RR	LL	Ed Rakowski	CT
" "	S Montauk Pt., NY	E Barnegat Inlet, NJ	1	89 SW	RR	RR	Richard Scolavino	RI
" "	S Montauk Pt., NY	S Fire Isl. Inlet, NY	1	69 W	RR	RR	Steven Lovegreen	RI
" "	S Montauk Pt., NY	SE Manasquan Inlet, NJ	1	83 SW	RR	RR	Bill Ozolins	MA
" "	SSW Pt. Judith, RI	SE Montauk Pt., NY	<1	11 N	FS	RR	Charlie Donilon	RI
" "	SSW Pt. Judith, RI	SE Pt. Judith, RI	1	22 NE	FS	FS	Charlie Donilon	RI
" "	SSW Pt. Judith, RI	S Pt. Judith, RI	2	9 NW	FS	RR	Charlie Donilon	RI
" "	E Wachapreague Inlet, VA	SW Jones Inlet, NY	1	171 N	RR	RR	James Houser	MD
" "	E Indian River Inlet, DE	S Pt. Judith, RI	1	211 NE	RR	RR	James D Houser	MD
" "	SE Montauk Pt., NY	S Fire Isl. Inlet, NY	<1	84 SW	RR	RR	Joe McBride	NY
" "	E Barnegat Inlet, NJ	E Barnegat Inlet, NJ	2	22 W	RR	LL	Jody Distasio	NJ
" "	SE Martha's Vineyard, MA	SE Martha's Vineyard, MA	<1	2 N	GN	GN	P. O'Donnell, NMFS Obs.	MA
" "	SE Montauk Pt., NY	SE Fire Isl. Inlet, NY	2	71 W	RR	RR	Wayne King	NY
" "	S Montauk Pt., NY	S Montauk Pt., NY	1	10 E	RR	RR	Steve DeMarco	CT
Blue shark	S Shinnecock Inlet, NY	E Pt. Pleasant, NJ	1	62 W	RR	RR	Jeff Malerba	CT
" "	S Montauk Pt., NY	SW Montauk Pt., NY	1	42 W	RR	RR	Mike Brumm	NY
" "	S Shinnecock Inlet, NY	SE Cape Sable, NS, Canada	3	404 E	RR	LL	Robert Tyree	NY
" "	NR	SW Shinnecock Inlet, NY	<1	0	RR	RR	Andy Becker	NY
" "	SE Moriches Inlet, NY	SSE Fire Isl. Inlet, NY	3	33 SW	RR	RR	Richard Dinka	NY
" "	S Montauk Pt., NY	SE Pt. Judith, RI	1	53 NE	RR	RR	Mike Brumm	NY
" "	S Montauk Pt., NY	SE Pt. Judith, RI	1	33 NE	RR	RR	Michael Brumm	NY
" "	S Pt. Judith, RI	S Fire Isl. Inlet, NY	13	93 SW	RR	RR	Charlie Donilon	RI
" "	S Fire Isl. Inlet, NY	SE Shinnecock Inlet, NY	1	44 NE	RR	RR	Larry Festa	NY
" "	SE Moriches Inlet, NY	SE Moriches Inlet, NY	<1	5 E	FS	RR	David A. Mann	NY
" "	S Shinnecock Inlet, NY	SW Shinnecock Inlet, NY	<1	21 NW	RR	RR	Steven Soltes	NY
" "	E Cape May, NJ	E Cape May, NJ	<1	2 S	RR	RR	Kevin Gerrity	NJ
" "	S Pt. Judith, RI	S Pt. Judith, RI	<1	10 SW	RR	RR	Andy Dangelo	RI
" "	SE Shinnecock Inlet, NY	E Cape May, NJ	1	112 S	RR	LL	Bill Williams	NY
" "	SE Pt. Judith, RI	E Cape May, NJ	2	170 SW	RR	LL	Ernest Dunphy	RI
" "	SE Pt. Judith, RI	S Montauk Pt., NY	3	28 SW	RR	RR	Ernest Dunphy	RI
" "	SE Pt. Judith, RI	S Martha's Vineyard, MA	<1	34 E	RR	HL	Ernest Dunphy	RI
" "	S Pt. Judith, RI	S Pt. Judith, RI	<1	10 NW	RR	RR	Jim Walsh	CT
" "	S Pt. Judith, RI	SW Montauk Pt., NY	<1	20 NW	FS	RR	Charlie Donilon	RI
" "	SE Pt. Judith, RI	SE Pt. Judith, RI	1	9 SE	RR	RR	Andy Dangelo	RI
Blue shark	S Pt. Judith, RI	S Shinnecock Inlet, NY	3	50 W	RR	RR	Andy Dangelo	RI
" "	SE Pt. Judith, RI	SE Pt. Judith, RI	<1	0	RR	RR	Don Mattera	RI
" "	SE Montauk Pt., NY	S Montauk Pt., NY	<1	16 W	RR	RR	Charles Betz	NY
" "	S Pt. Judith, RI	SE Vineyard Haven, MA	<1	53 E	RR	RR	Gary Savard	MA
" "	SE Fire Isl. Inlet, NY	SE Moriches Inlet, NY	<1	35 NE	RR	RR	Doug Barry	NY
" "	S Moriches Inlet, NY	SE Pt. Judith, RI	<1	79 NE	RR	RR	Steve Morotta	NY
" "	S Pt. Judith, RI	SE Cape May, NJ	2	182 SW	RR	RR	Philip Randolph	RI
" "	S Pt. Judith, RI	SE Pt. Judith, RI	1	4 NE	RR	RR	David Blackburn	RI
" "	SE Moriches Inlet, NY	SW Moriches Inlet, NY	1	14 W	RR	RR	Bob Best	NY

Table 2. Tag recoveries: January-December 1996.

	GENERAL LOCATIONS		MONTHS AT LIBERTY	DIST. (MI.) AND DIR.	CAPTURE METHOD		TAGGED BY	
	TAGGED	RECAPTURED			TAG.	REC.	TAGGER	RESIDENCE
Blue shark	SE Moriches Inlet, NY	NR	<1	0	RR	LL	Bob Best	NY
" "	SE Shinnecock Inlet, NY	S Cape Race, NF, Canada	3	907 E	RR	LL	Anthony Visentin	NY
" "	SSE Pt. Judith, RI	S Pt. Judith, RI	<1	10 SW	FS	RR	Charlie Donilon	RI
" "	SSE Pt. Judith, RI	SW Martha's Vineyard, MA	1	13 E	FS	RR	Charlie Donilon	RI
" "	S Pt. Judith, RI	SE Pt. Judith, RI	1	9 N	RR	RR	John Rainone	RI
" "	SE Pt. Judith, RI	SE Block Isl., RI	1	32 SE	RR	RR	Ryan Hogan	RI
" "	SE Pt. Judith, RI	SW Martha's Vineyard, MA	1	11 NE	RR	RR	Al Anderson	RI
" "	SE Pt. Judith, RI	SE Shinnecock, NY	<1	0	RR	RR	Al Anderson	RI
" "	SE Pt. Judith, RI	SW Martha's Vineyard, MA	<1	2 S	RR	RR	Denny Dillon	RI
" "	SE Pt. Judith, RI	SSE Pt. Judith, RI	<1	10 SE	RR	FS	Denny Dillon	RI
" "	S Martha's Vineyard, MA	SE Pt. Judith, RI	<1	4 NW	RR	RR	Tom Birch	MA
" "	SE Pt. Judith, RI	SE Block Isl., RI	1	20 NW	RR	RR	Ken Benson	RI
" "	SSW Pt. Judith, RI	S Pt. Judith, RI	<1	10 E	FS	RR	Charlie Donilon	RI
" "	SSW Pt. Judith, RI	S Pt. Judith, RI	<1	8 NE	FS	RR	Charlie Donilon	RI
" "	SSW Pt. Judith, RI	S Montauk Pt., NY	<1	19 SW	FS	RR	Charlie Donilon	RI
Blue Shark	SSE Pt. Judith, RI	SE Pt. Judith, RI	<1	4 W	FS	RR	Charlie Donilon	RI
" "	SSE Pt. Judith, RI	SSW Pt. Judith, RI	1	28 W	RR	RR	Charlie Donilon	RI
" "	S Pt. Judith, RI	E Oregon Inlet, NC	1	346 SW	RR	LL	Al Anderson	RI
" "	SW Montauk Pt., NY	S Montauk Pt., NY	<1	24 E	RR	RR	Anthony Visentin	NY
" "	SSW Pt. Judith, RI	E Block Isl., RI	<1	32 NE	FS	RR	Charlie Donilon	RI
" "	SSW Pt. Judith, RI	W Cape Verde Isl.	3	2536 SE	RR	LL	Charlie Donilon	RI
" "	S Pt. Judith, RI	S Pt. Judith, RI	<1	1 SE	RR	RR	Jim Noon	RI
" "	SE Pt. Judith, RI	E Georgetown, SC	4	574 SW	RR	LL	Jim Walsh	CT
" "	S Montauk Pt., NY	SE Montauk Pt., NY	<1	31 NE	RR	RR	Anthony Visentin	NY
" "	SE Stonington, CT	SE Pt. Judith, RI	<1	2 NE	RR	RR	James Walsh	CT
" "	SE Pt. Judith, RI	SE Pt. Judith, RI	<1	2 W	RR	RR	Jim Walsh	CT
" "	SSW Pt. Judith, RI	SE Montauk Pt., NY	<1	3 E	FS	RR	Charlie Donilon	RI
" "	SE Martha's Vineyard, MA	E Indian River Inlet, DE	2	201 SW	RR	LL	Deborah Valentine	MA
" "	E Portland Headlights, ME	NE Provincetown, MA	1	76 S	RR	RR	Jerry Sullivan	ME
" "	SE Pt. Judith, RI	SSW Pt. Judith, RI	1	25 W	RR	RR	Andy Dangelo	RI
" "	S Pt. Judith, RI	S Fire Isl. Inlet, NY	1	84 SW	RR	RR	Andy Dangelo	RI
" "	S Pt. Judith, RI	S Pt. Judith, RI	<1	2 SW	RR	RR	Andy Dangelo	RI
" "	S Pt. Judith, RI	SE Montauk Pt., NY	<1	5 SE	RR	RR	Andy Dangelo	RI
" "	SW Martha's Vineyard, MA	SW Martha's Vineyard, MA	<1	2 N	HL	HL	Stephen Connett	RI
" "	S Martha's Vineyard, MA	S Moriches Inlet, NY	1	81 W	HL	RR	Stephen Connett	RI
Blue Shark	SW Martha's Vineyard, MA	S Martha's Vineyard, MA	<1	5 S	HL	HL	Stephen Connett	RI
" "	SW Martha's Vineyard, MA	S Martha's Vineyard, MA	2	22 E	HL	RR	Stephen Connett	RI
" "	SW Martha's Vineyard, MA	E Cape Sable, NS, Canada	6	366 E	HL	LL	Stephen Connett	RI
" "	S Martha's Vineyard, MA	S Martha's Vineyard, MA	1	21 N	FS	RR	Stephen Connett	RI
" "	S Martha's Vineyard, MA	E Barnagat Inlet, NJ	2	108 SW	HL	LL	Stephen Connett	RI
" "	S Martha's Vineyard, MA	E Montauk Pt., NY	2	26 W	FS	RR	Stephen Connett	RI
" "	S Martha's Vineyard, MA	E Wachapreague Inlet, VA	3	263 SW	FS	LL	Stephen Connett	RI
" "	S Martha's Vineyard, MA	S Martha's Vineyard, MA	1	19 NW	FS	RR	Stephen Connett	RI
" "	S Fire Isl. Inlet, NY	E Cape May, NJ	13	68 S	RR	RR	Raymond Beck	NY
" "	S Fire Isl. Inlet, NY	SE Shinnecock Inlet, NY	13	60 NE	RR	RR	Raymond Beck	NY
" "	SE Montauk Pt., NY	S Montauk Pt., NY	13	10 SW	RR	RR	Steve Szoke	NY
" "	SE Cape May, NJ	SE Ocean City, MD	2	36 S	RR	RR	Ray Szulczewski	NJ
" "	S Montauk Pt., NY	S Moriches Inlet, NY	<1	36 W	RR	RR	Roger Olsen	NY
" "	SE Pt. Judith, RI	E Cape Sable, NS, Canada	12	533 E	RR	LL	John Migdelany	MA
" "	SE Pt. Judith, RI	SSE Pt. Judith, RI	25	19 SE	RR	RR	Charlie Donilon	RI
" "	S Pt. Judith, RI	S Flemish Cap	12	1314 E	RR	LL	Bob Reichenberger	NY
" "	SE Montauk Pt., NY	S Flemish Cap	<1	1371 E	RR	LL	Dave Preble	RI
" "	SE Jones Inlet, NY	SE Jones Inlet, NY	12	12 SE	RR	RR	Timothy Sullivan	NY
" "	SE Montauk Pt., NY	E Cape Henlopen, DE	<1	144 SW	RR	LL	Frank Braddick	NY
" "	SW Faro, Portugal	NE Cape Verde Isl.	30	1232 SW	RR	LL	Ric Fuller	Portugal
Blue shark	S Pt. Judith, RI	S Pt. Judith, RI	11	9 SW	RR	RR	R. Ben David	MA
" "	NR	S Fire Isl. Inlet, NY	<1	0	RR	RR	Robert LaValley	RI
" "	SE Fire Isl. Inlet, NY	SE Moriches Inlet, NY	13	36 NE	FS	RR	Thomas Kiernan	NY
" "	S Montauk Pt., NY	SE Montauk Pt., NY	24	16 NE	RR	RR	John Schoen	NY
" "	S Shinnecock Inlet, NY	SE Montauk Pt., NY	<1	52 NE	RR	RR	Bill Martin	NY
" "	SE Moriches Inlet, NY	SW Montauk Pt., NY	22	21 NE	RR	RR	Wain Carlough	NY
" "	SE Portland Headlights, ME	E Cape May, NJ	22	321 SW	RR	RR	Mark Chase	ME
" "	S Martha's Vineyard, MA	SE Fire Isl. Inlet, NY	1	88 SW	HL	RR	Stephen Connett	RI
" "	S Vineyard Haven, MA	SE Montauk Pt., NY	1	20 W	HL	RR	Stephen Connett	RI
Sandbar shark	NR	Charleston, SC	<1	0	NR	LL	NR	NR
" "	S Montauk Pt., NY	NW Tarpon Springs, FL	<1	1527 SW	RR	LL	Bailey Smith	Italy
" "	Broadkill, DE	Broadkill, DE	10	1 S	GN	LL	Biologist (NMFS)	RI
" "	Primehook Bch., DE	Brigantine, NJ	1	51 NE		RR	Bruce Hecker	MD
" "	Broadkill Bch, DE	Delaware Bay, DE	1	16 NE	GN	RR	Biologist (NMFS)	RI
" "	NW Broadkill Bch, DE	Broadkill Bch., DE	1	2 SE	GN	RR	Biologist (NMFS)	RI
" "	NW Broadkill Bch, DE	WSW Miah Maul Shoal, DE	<1	16 N	GN	RR	Biologist (NMFS)	RI
" "	NW Broadkill Bch, DE	Broadkill Bch., DE	1	2 SE	GN	RR	Biologist (NMFS)	RI
" "	Primehook Bch., DE	NE Sandy Pt., DE	2	15 N	GN	TN	Biologist (NMFS)	RI
" "	Primehook Bch., DE	Broadkill Bch., DE	1	2 SE	GN	RR	Biologist (NMFS)	RI
" "	Broadkill Bch, DE	Big Stone Bch., DE	1	14 NW	GN	RR	Biologist (NMFS)	RI
" "	N Roosevelt Inlet, DE	Bigstone Bch., DE	<1	14 NW	GN	RR	Biologist (NMFS)	RI
" "	Broadkill Bch, DE	Broadkill Bch., DE	1	2 N	GN	RR	Biologist (NMFS)	RI
" "	NW Lewes, DE	Lewes, DE	<1	2 NE	GN	RR	Biologist (NMFS)	RI
" "	NW Broadkill Bch, DE	SE Broadkill Bch., DE	<1	5 SE	GN	RR	Biologist (NMFS)	RI
" "	Great Bay, NJ	Great Bay, NJ	1	2 N	GN	RR	Biologist (NMFS)	RI
" "	Broadkill Bch., DE	Broadkill Bch., DE	<1	0	GN	RR	Biologist (NMFS)	RI
" "	NW Broadkill Bch., DE	Broadkill Bch., DE	<1	8 SE	GN	RR	Biologist (NMFS)	RI
" "	S Primehook, DE	Cape Henlopen Pt., DE	1	7 E	GN	RR	Biologist (NMFS)	RI
" "	SW Hatteras Inlet, NC	Core Sound, NC	<1	34 SW	GN	RR	Chris Jensen	NC
Sandbar shark	E Montauk Pt., NY	SE St. Augustine, FL	186	830 SW	RR	LL	Stephen Babbitz	CT
" "	S Atlantic City, NJ	W Naples, FL	175	1216 SW	RR	LL	David Moss	NJ
" "	S Jones Inlet, NY	NW Tarpon Springs, FL	<1	1477 SW	RR	LL	Ray Schmidt	NY
" "	SE Pt. Judith, RI	SW Naples, FL	92	1060 SW	RR	LL	George Hehner	RI
" "	SE Oregon Inlet, NC	Cayo Frances, Cuba	123	799 S	LL	LL	Biologist (NMFS)	RI

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	GENERAL LOCATIONS		MONTHS AT	DIST. (MI.) AND DIR.	CAPTURE METHOD		TAGGED BY	
	TAGGED	RECAPTURED	LIBERTY		TAG.	REC.	TAGGER	RESIDENCE
Sandbar shark	SE Martha's Vineyard, MA	E Cape Henlopen, DE	108	219 SW	TN	LL	R. Tegge, NMFS Obs.	
" "	SE Fire Isl. Inlet, NY	W Dry Tortugas, FL	106	1151 SW	RR	LL	Bill Martin	NY
" "	SE Rudee Inlet, VA	W Cape Sable, FL	91	876 SW	RR	LL	John Thurston	VA
" "	SW Fire Isl. Inlet, NY	E Ponce inlet, FL	77	752 SW	RR	LL	Norbert Freitag	NY
" "	SE Moriches Inlet, NY	E Southport, NC	78	447 SW	RR	LL	Kenneth Schmeider	NY
" "	SE Fire Isl. Inlet, NY	E Southport, NC	78	442 SW	RR	LL	Pete Scelfo	NY
" "	SE Ocean City, MD	E Ponce Inlet, FL	78	617 SW	RR	LL	Al Knepper	PA
" "	E Montauk Pt., NY	SE Cape Hatteras, NC	84	407 SW	RR	LL	Bob McReynolds	NY
" "	E Ocean City, MD	SW Pine Isl., FL	84	1200 SW	RR	LL	Richard Janiszewski	NJ
" "	NR	N Ponce Inlet, FL	<1	0	RR	LL	Tom Federico	NY
" "	E Barnegat Inlet, NJ	SE Southport, NC	79	438 SW	RR	LL	Donna Mycewicz	NJ
" "	E Hatteras Inlet, NC	W Cedar Key, FL	84	563 SW	LL	LL	Biologist (NMFS)	RI
" "	SE Fire Isl. Inlet, NY	W Progreso, Mexico	70	1677 SW	RR	GN	Douglas Wells	NY
" "	S Montauk Point, NY	W Tarpon Springs, FL	61	1522 SW	RR	LL	Bob Genereau	CT
" "	NR	W St. Petersburg, FL	<1	0	RR	LL	Bob Baliatico	NJ
" "	Cape Lookout, NC	W Pine Isl., FL	60	822 SW	RR	RR	Bruce G. Williams	VA
" "	S Shinnecock Inlet, NY	S Cape Hatteras, NC	22	346 SW	RR	LL	John Hagon	NY
" "	E Morehead City, NC	W Dry Tortugas, FL	<1	747 SW	LL	LL	Biologist (NMFS)	RI
" "	S Montauk Pt., NY	E Ocracoke Inlet, NC	43	383 SW	RR	LL	Carl Safina	NY
" "	NE Ponce Inlet, FL	NE Hilton Head, SC	45	156 N	LL	RR	Tris Colket	FL
Sandbar shark	Great Bay, NJ	E Hatteras Inlet, NC	17	271 S	RR	LL	John Golebiewski	NJ
" "	E Ocean City, MD	S Appalachicola, FL	12	1372 SW	RR	LL	Joe Nibali	CA
" "	S Shinnecock Inlet, NY	E Barnegat Inlet, NJ	25	57 SW	RR	LL	Tom Cashman	NY
" "	SW Cape May Canal, NJ	S Cape May Canal, NJ	2	4 NE	RR	RR	Bill Garrison	NJ
" "	SW Buxton, NC	NE Wachapreague Inlet, VA	7	158 N	GN	GN	Glen Hopkins	NC
" "	NE Lewes, DE	E Cape Lookout, NC	8	257 S	LL	LL	Bruce Hecker	MD
" "	SW Cape Hatteras, NC	E Cape May, NJ	3	0	LL	LL	S. Branstetter	FL
Shortfin mako	SE Shinnecock Inlet, NY	SE Moriches Inlet, NY	24	5 NW	RR	RR	Ron Scott	NY
" "	E Beach Haven, NJ	SE Flemish Cap	50	1554 E	RR	LL	Tom Canto	NJ
" "	SE Manasquan Inlet, NY	E Charleston, SC	<1	499 SW	RR	LL	Jim Lynch	NJ
" "	SE Manasquan Inlet, NJ	W Habana, Cuba	37	1108 SW	RR	LL	Al Ristori	NJ
" "	NR	SE Flemish Cap	<1	0	RR	LL	Stuart Hummel	RI
" "	SE Cape May, NJ	ENE Barnegat Inlet, NJ	2	94 N	RR	RR	Frank Hineline	NJ
" "	E Avalon, NJ	E Ocean City, MD	11	54 S	RR	RR	John Quinn	PA
" "	S Flemish Cap	SE Flemish Cap	<1	316 SE	LL	LL	G. Hinteregger, NMFS Obs.	RI
" "	SE Flemish Cap	S Flemish Cap	36	398 S	LL	LL	G. Hinteregger, NMFS Obs.	RI
" "	ESE Indian River Inlet, DE	SW Faial, Azores	4	2113 E	RR	LL	Louis Hirst	NJ
" "	NR	SE Fire Isl. Inlet, NY	<1	0	RR	RR	John Sollan	NY
" "	S Fire Isl. Inlet, NY	E Wachapreague Inlet, VA	23	184 S	RR	RR	Warren Heller	NY
" "	NE Toms River, NJ	E Rudee Inl., VA	10	217 S	RR	RR	Joseph Peldunas	NJ
" "	SW Flemish Cap	S Flemish Cap	37	141 SE	LL	LL	Alex Sutton	NY
" "	SE Flemish Cap	W Faial Isl., Azores	22	276 S	LL	LL	Tim Johnston	FL
" "	NR	N Lanzorte, Canary Isl.	<1	0	RR	LL	Roddy Hays	Portugal
" "	SE Grand Banks	SE Flemish Cap	12	394 E	LL	LL	D. Bidwell, NMFS Obs.	MA
" "	S Montauk Pt., NY	SE Montauk Pt., NY	14	20 NE	RR	RR	Steve Szoke	NY
Shortfin mako	NE Wachapreque Inlet, VA	SE Ocean City, MD	1	8 E	RR	RR	Keith Patton	MD
" "	S Flemish Cap	SE Flemish Cap	20	278 SE	LL	LL	Barry Marx	FL
" "	E Ocean City, MD	E Cape May, NJ	13	49 NE	RR	LL	Richard Jacobs	MD
" "	S Fire Isl. Inlet, NY	S Martha's Vineyard, MA	11	118 E	RR	RR	Robert Tyree	NY
" "	SE Flemish Cap	S Flemish Cap	9	298 S	LL	LL	P. O'Donnell, NMFS Obs.	MA
" "	SE Flemish Cap	SE Flemish Cap	10	155 E	LL	LL	Barry Marx	FL
" "	SE Flemish Cap	S Flemish Cap	<1	90 SW	LL	LL	Barry Marx	FL
" "	SE Fire Isl. Inlet, NY	SE Ocean City, MD	9	170 SW	RR	RR	George Maisch	NY
" "	SE Montauk Pt., NY	SW Faial, Azores	3	1943 E	RR	LL	C. Mike Brumm	NY
" "	S Lagos, Portugal	Cabo Sta. Maria, Portugal	2	47 SE	RR	GN	George Burgum	England
" "	SE Lagos, Portugal	W Cabo Sao Vicente, Portugal	5	214 W	RR	LL	George Burgum	England
" "	S Lagos, Portugal	S Cabo Sao Vincente, Portugal	2	23 SW	RR	LL	George Burgum	England
" "	E Cabo Sao Vincente, Portuga	SE Faro, Portugal	2	58 E	RR	LL	George Burgum	England
" "	S Fire Isl. Inlet, NY	SE Flemish Cap	17	1360 E	RR	LL	Richard Hunter	NY
" "	E Flemish Cap	W La Coruna, Spain	23	1013 E	LL	LL	M. Terwilleger, NMFS Obs.	MA
" "	S Flemish Cap	S Flemish Cap	23	102 S	LL	LL	Scott Drabinowicz	MA
" "	S Flemish Cap	E Oregon Inlet, NC	18	1396 W	LL	LL	L. Horne, NMFS Obs.	MA
Tiger shark	SE Southport, NC	E Southport, NC	10	18 N	LL	RR	Steve Branstetter	FL
" "	E Southport, NC	E NC Coast	<1	0	LL	LL	Steve Branstetter	FL
" "	SW Apalachicola, FL	Berry Isl., Bahamas	13	461 SE	LL	RR	Steve Branstetter	FL
" "	E Jacksonville Beach, FL	Sandy Isl., Antigua, WI	31	1250 SE	LL	HL	Tris Colket	FL
" "	E Charleston, SC	E Charleston, SC	5	40 SW	LL	LL	Steve Branstetter	FL
" "	SE Ponce Inlet, FL	N Belem, Brasil	<1	2421 SE	LL	LL	Tris Colket	FL
" "	NR	SE Flemish Cap	<1	0	LL	LL	Glen Hopkins	NC
" "	E Southport, NC	E Southport, NC	8	98 E	LL	LL	Steve Branstetter	FL
" "	E Southport, NC	E Southport, NC	7	70 E	LL	LL	Steve Branstetter	FL
" "	E Hatteras Inlet, NC	SW Hatteras Inlet, NC	10	66 SW	LL	LL	Glen Hopkins	NC
" "	E Southport, NC	NE Cape Verde Isl.	9	3089 E	LL	LL	Steve Branstetter	FL
" "	E St. Augustine, FL	SE Charleston, SC	6	142 NE	LL	LL	Steve Branstetter	FL
" "	E Charleston, SC	E Ponce Inlet, FL	11	266 SW	LL	LL	Biologist (NMFS)	RI
" "	SE Southport, NC	E Charleston, SC	4	69 SW	LL	RR	Steve Branstetter	FL
" "	E Southport, NC	SW Southport, NC	4	84 SW	LL	LL	Steve Branstetter	FL
" "	NE St. Augustine, FL	E Fernandina Beach, FL	6	34 N	LL	LL	Steve Branstetter	FL
" "	S South Bimini, Bahamas	Bimini, Bahamas	6	1 W	LL	LL	Sonny Gruber	FL
" "	E Southport, NC	SE Cape Hatteras, NC	<1	98 NE	LL	RR	Steve Branstetter	FL
Porbeagle shark	S Isle of Wight, England	N Pte.de BarFleur, France	12	23 SW	RR	LL	Daniel Vokins	England
" "	S Isle of Wight, England	NE Pte.de BarFleur, France	13	0	RR	LL	Daniel Vokins	England
" "	SW Isle of Wight, England	N Pte. de BarFleur, France	25	11 SE	RR	LL	Trevor Phillips	England
" "	W Stephenville, NF, Canada	SE Halifax, NS, Canada	18	306 S	LL	LL	Kevin Antle, Canadian Obs.	Canada
" "	S Cape Sable, NS, Canada	S Cape Sable, NS, Canada	24	64 E	LL	LL	Steve Athanosios	ME
" "	E Cape Sable, NS, Canada	SE Cape Sable, NS, Canada	23	74 SW	LL	LL	Albert Lawrence	Canada
" "	SW Cape Race, NF, Canada	E Cape Sable, NS, Canada	19	410 W	LL	LL	Albert Lawrence	Canada
" "	E Louisburg, NS, Canada	S Louisburg, NS, Canada	29	397 W	LL	LL	Albert Lawrence	Canada
" "	SE Halifax, NS, Canada	S Cape Race, NF, Canada	<1	418 E	LL	LL	Albert Lawrence	Canada

Table 2. Tag recoveries: January-December 1996.

	GENERAL LOCATIONS		MONTHS AT LIBERTY	DIST. (MI.) AND DIR.	CAPTURE METHOD		TAGGED BY	
	TAGGED	RECAPTURED			TAG.	REC.	TAGGER	RESIDENCE
Porbeagle shark	SE Cape Sable, NS, Canada	NE Cape Breton Isl., Canada	15	292 NE	LL	LL	Andy Kingman	PA
" "	E Cape Sable, NS, Canada	SE Cape Sable, NS, Canada	5	110 S	LL	LL	K. Antle, Canadian Obs.	Canada
" "	E Cape Breton Isl., Canada	SE Cape Sable, NS, Canada	4	300 SW	LL	LL	K. Antle, Canadian Obs.	Canada
" "	Cape Sable, NS, Canada	SE Cape Sable, NS, Canada	22	71 E	LL	LL	Albert Lawrence	Canada
Blacktip shark	St. Martins Reef, Hudson, FL	W Sanibel Isl., FL	<1	127 S	RR	LL	Roy Allen	FL
" "	S Egmont Key, FL	SW Sanibel Isl., FL	<1	120 SW	RR	LL	Mike Pesaturo	FL
" "	Pine Isl. Sound Sanibel, FL	Pine Isl. Sound, FL	1	0	RR	RR	Don Case	FL
" "	Machapongo Channel, VA	S Ocean City Inlet	25	57 NE	GN	RR	Carter Bundick	VA
" "	Pine Isl. Sound, FL	Pine Isl. Sound, FL	1	1 SW	RR	RR	Leo Dunn	FL
" "	Pine Isl. Sound, FL	Pine Isl. Sound, FL	1	0	RR	RR	Leo Dunn	FL
" "	Pine Isl. Sound, FL	S Pine Isl. Sound, FL	3	6 SE	RR	GN	Skip Dunn	FL
" "	Crystal River, FL	Crystal River, FL	7	8 E	RR	RR	Brian Gruber	FL
" "	San Antonio Bay, TX	San Antonio Bay, TX	1	5 SW	GN	GN	Mark Kelley	TX
" "	Pine Isl. Sound, FL	S St. James City, FL	1	3 SE	RR	RR	Leo Dunn	FL
Nurse shark	Big Pine Key, FL	Big Pine Key, FL	14	2 W	RR	RR	Jeff Carrier	MI
" "	Pine Isl. Sound, FL	Sanibel Causeway, FL	10	14 SE	RR	RR	Leo Dunn	FL
" "	N Naples, FL	N Naples, FL	12	1 S	RR	RR	John Brossard	FL
" "	W Naples, FL	Naples, FL	2	1 S	RR	RR	John Brossard	FL
Atl. sharpnose	N Ponce Inlet, FL	NE Daytona Beach, FL	1	6 N	LL	LL	S. Branstetter	FL
" "	E St. Lucie Inlet, FL	E Vero Beach, FL	<1	29 NW	RR	GN	Robert Pelosi	FL
" "	E Wachapreague Inlet, VA	SE Chincoteague Inlet, VA	58	16 NE	TN	LL	Biologist (NMFS)	MA
Car. reef shark	Walkers Cay, Bahamas	Walkers Cay, Bahamas	6	0	FS	FS	Gary Adkison	FL
" "	Bimini, Bahamas	Bimini, Bahamas	2	0	RR	RR	Larry Laffler	FL
" "	SE Delray Beach, FL	E Juno Beach, FL	1	26 N	LL	RR	Biologist (NMFS)	RI
Bignose shark	E Oregon Inlet, NC	E Gould Inlet, GA	131	351 SW	LL	LL	Biologist (NMFS)	RI
" "	E Oregon Inlet, NC	E Key West, FL	134	806 SW	LL	LL	Biologist (NMFS)	RI
Dusky shark	E Cape May, NJ	SE Cape Hatteras, NC	53	235 S	RR	LL	John Bass	NJ
" "	SE Montauk Pt., NY	E Barnegat Inlet, NJ	37	80 SW	RR	LL	Frank Braddick	NY
Bonnethead	Islamorada, FL	Islamorada, FL	24	0	RR	RR	Graeme Pullen	England
" "	Peterson Key, Islamorada, FL	Upper Arseniker Keys, FL	3	4 W	RR	RR	Graeme Pullen	England
Bull shark	Pine Isl. Sound, FL	Captiva Pass LeeCo, FL	12	10 NW	RR	RR	Leo Dunn	FL
Night shark	SE Charleston, SC	E Cocoa Beach, FL	166	225 S	LL	LL	Ron Schatman	FL
Great hammerhead	SW Port Inglis, FL	SW Port Inglis, FL	14	2 E	RR	GN	Brian Gruber	FL
Spinner shark	Padre Isl., TX	S Padre Isl., TX	<1	0	RR	TO	Chris Ruiz	TX
Hammerhead shark	Miami Beach, FL	Miami Beach, FL	11	2 SW	RR	RR	Sanford Blum	FL
Brown/Dusky shark	E Manasquan Inlet, NY	E Cape May, NJ	85	74 S	RR	LL	Burton Greene	NJ
" "	E Manasquan Inlet, NJ	SW St. Petersburg, FL	<1	1371 SW	RR	LL	John Williams	NJ
" "	SE Shinnecock Inlet, NY	SE Cape Hatteras, NC	104	368 SW	RR	LL	Bill Williams	NY
" "	S Shinnecock Inlet, NY	E Folley Bch., SC	28	566 SW	RR	LL	John Manarte	NY
Carcharhinus	SE Charleston, SC	SSE Southport, NC	170	53 NE	LL	LL	Ron Schatman	FL
" "	E Southport, NC	NW Faial Isl., Azores	<1	1901 NE	LL	LL	NMFS Obs.	MA
" "	E Brunswick, GA	NE Ft. Lauderdale, FL	8	302 S	LL	LL	Randall Dyal	FL
Carcharhinidae	SE Fire Isl. Inlet, NY	S Shinnecock Inlet, NY	1	19 NE	RR	RR	Bruce Dean	NY
" "	E Charleston, SC	S St. Croix, USVI	9	1168 SE	LL	LL	K. Cute, NMFS Obs.	MA
" "	S Shinnecock Inl., NY	S Shinnecock Inl., NY	24	15 SE	RR	RR	Wain Carlough	NY
Shark	NR	NR	<1	0	RR	RR	Egidio Rossi	Italy
" "	SW Grand Banks	SE Portland Headlights, ME	62	770 W	LL	LL	Barry Marx	FL
" "	SE Townsends Inlet, NJ	NE Plymouth, MA	<1	255 NE	RR	GN	Greg Ball	PA
" "	E Nantucket Isl., MA	S Flemish Cap	46	1146 E	LL	LL	Nelson Beideman	NJ
" "	SE Jones Inlet, NY	NR	<1	0	FS	LL	Larry Festa	NY
" "	NR	S Olhao, Portugal	<1	0	RR	GN	Ric Fuller	Portugal
" "	NR	S Olhao, Portugal	<1	0	RR	GN	Ric Fuller	Portugal
" "	SW Flemish Cap	W Lisboa, Portugal	22	1332 E	LL	LL	Barry Marx	FL
" "	S Pt. Judith, RI	SE Shinnecock Inlet, NY	<1	55 N	RR	RR	Laird Summerlin	MA
" "	NR	SE Wildwood, NJ	<1	0	RR	LL	Paul Smith	NY
Unknown	S Nantucket, MA	S St. Croix, USVI	88	1426 S	RR	LL	Larry Nickel	NY
" "	S Flemish Cap	SE Cape Sable, NS, Canada	11	875 W	LL	LL	P. O'Donnell, NMFS Obs.	MA
" "	S Shinnecock Inlet, NY	SE Flemish Cap	7	1382 E	RR	LL	John Manarte	NY
Swordfish	SE Martha's Vineyard, MA	SE Martha's Vineyard, MA	115	64 S	LL	LL	A. Poshkus, NMFS Obs.	MA
" "	SE Provincetown, MA	E Guantanamo, Cuba	112	1210 S	LL	LL	J. Cygler, NMFS Obs.	MA
" "	SW Rocha, Uruguay	E Rocha, Uruguay	9	35 N	LL	LL	Butch Winter	NJ
" "	SE Rocha, Uruguay	E Santa Vitoria, Brazil	29	261 N	LL	LL	Butch Winter	NJ
" "	NE Rocha, Uruguay	W Spanish Sahara, Africa	16	1911 E	LL	LL	Butch Winter	NJ
" "	SE Maldonado, Uruguay	S Rio De Janeiro, Brazil	25	753 NE	LL	LL	Butch Winter	NJ
" "	NR	W Faial Isl., Azores	<1	0	LL	LL	Barry Marx	FL
Atl. Sailfish	E Port Everglades, FL	E St. Lucie Inlet, FL	12	65 N	RR	RR	Bob Fish	RI
Yellowfin Tuna	E Southport, NC	E Cape Hatteras, NC	1	132 NE	LL	RR	Steve Branstetter	FL
Tuna sp.	E Ocean City, MD	E Wachapreague Inlet, VA	12	36 S	RR	PS	Donald Lorden	MD

NOTE: FS=Free Swimming; GN=Gillnet; HL=Handline; LL=Longline; RR=Rod&Reel; TN=Trawl Net; PS=Purse seine; TO=Tag Only Found;Obs=Foreign Fisheries Observer; NR=Not Reported

Coming soon our new web page at http://mola.gso.uri.edu/sharks.html

We have been working hard at getting our web page on line, and it should be ready for its debut later in 1997. Find out more about our current research projects, get more information about your favorite species of shark, and check out some photos taken by our staff. As this is a 'work in progress', let us know what you think, and what else you would like to see included on our site. Send your comments to:

webmaster@mola.gso.uri.edu

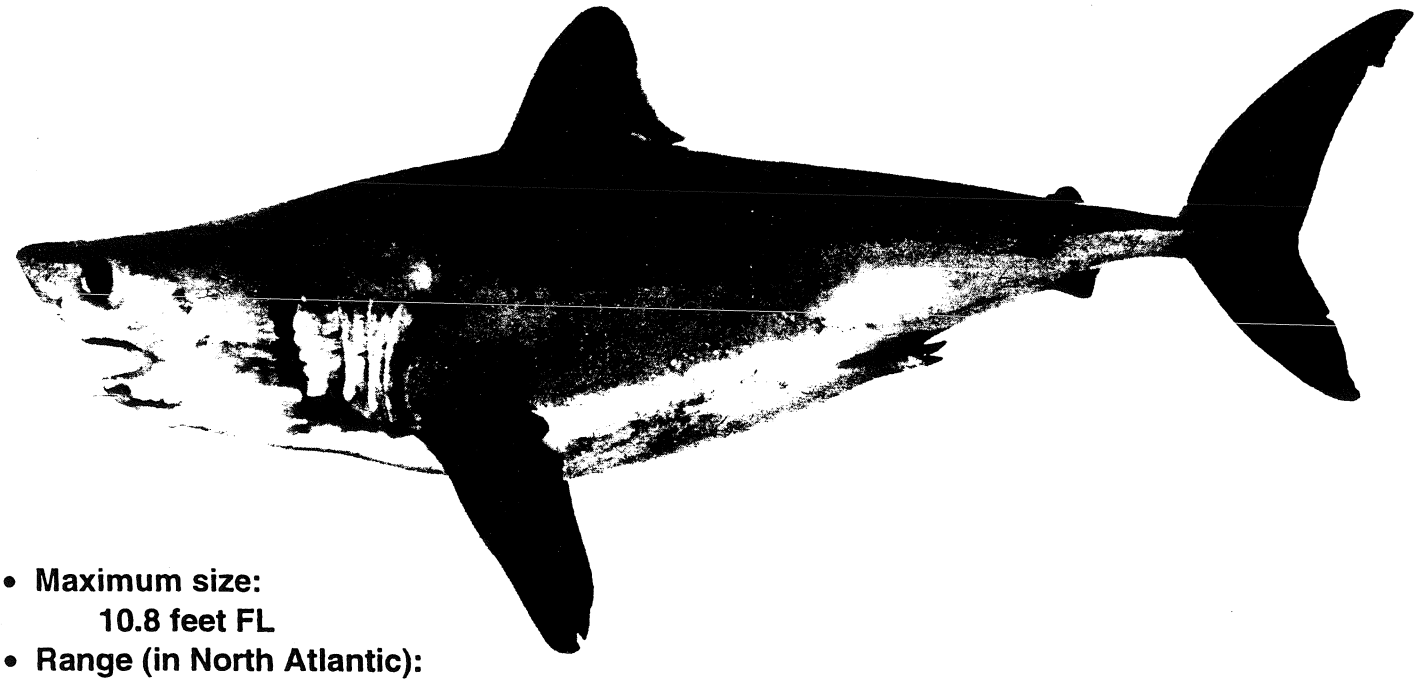
Feature Shark - Porbeagle (*Lamna nasus*)

The porbeagle shark, as well as the four other species in the family Lamnidae, is "warm-blooded". They are not able to keep a constant body temperature irrespective of their environment like birds or mammals, but they are often much warmer than the surrounding water. The white shark and the two makos (shortfin and longfin) also use this evolutionary asset to maintain their high metabolic rates when venturing into the cooler end of their temperature ranges. The two sharks of the genus *Lamna* (porbeagle and salmon shark) have employed the same "warm-bloodedness" to access a habitat that is simply not open to the majority of shark species.

The distribution of the porbeagle shark includes the South Pacific, Southern Indian Ocean, South Atlantic, Antarctic Ocean, North Atlantic and Mediterranean. In the North Atlantic, their range extends from New Jersey (U.S.) to North Africa and north to Iceland, but they are encountered in number only from Massachusetts (U.S.) to Newfoundland (Canada) and France to Norway. Within this range, they take advantage of their warm-bloodedness to follow and feed on schools of cold water prey, including squid, cod, hake, haddock, herring and dogfish.

They will follow prey into the shore and out to the deep ocean, but prefer the intermediate depths of continental shelf waters. For a short time during the winter months, they migrate south and perhaps offshore but tagging studies have yet to produce evidence of any long distance migrations like those of the blue and mako shark (see map). In northern shelf waters, porbeagle concentrate densely in groups segregated by size and sex. Little is known of their social interaction, but small groups of porbeagle have been seen herding prey into tight schools while they take turns charging, mouth agape, through the school.

Porbeagle, *Lamna nasus* **3 foot TL specimen**



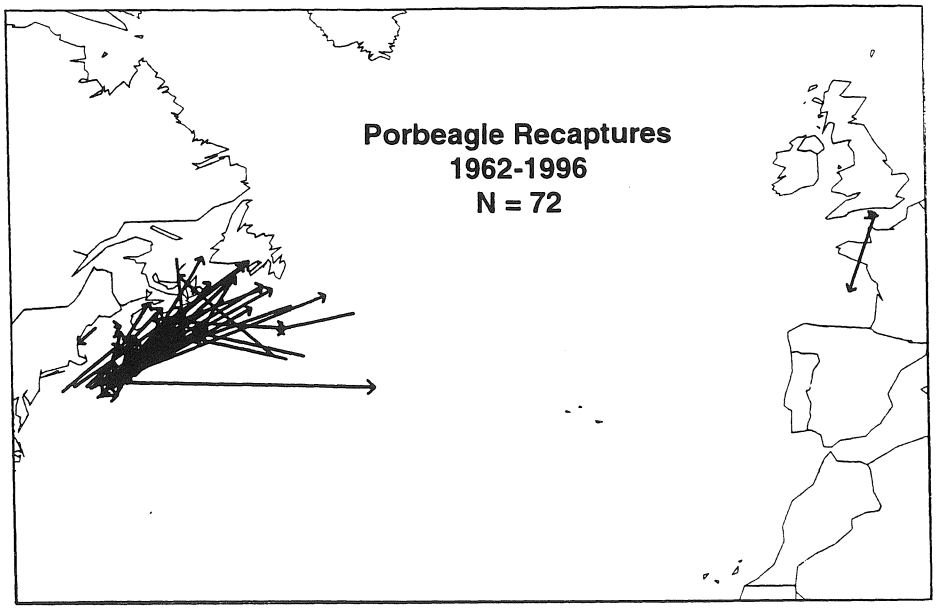
- **Maximum size:**
  10.8 feet FL
- **Range (in North Atlantic):**
  Arctic south to New Jersey
- **Distinguishing Characteristics:**
  Teeth with two small lateral cusps
  Small second keel on caudal fin
  Dark bluish-gray to brown above - white below often with a white spot at the posterior base of the first dorsal fin

Review of the Porbeagle Shark Fishery in Atlantic Canada

Contributed by: Peter Hurley, Department of Fisheries and Oceans, Dartmouth, Nova Scotia, Canada

A longline fishery for porbeagle sharks in the northwest Atlantic was initiated by Norwegian vessels in 1961. Landings increased from 1,824t in 1961 to 8,060t in 1964, but then declined to 1,373t in 1966. As many as twenty-eight freezer longline vessels participated in this fishery. This fleet then changed to fishing other areas and targeting other species as catch rates had declined to unprofitable levels. Catch rates are reported to have declined from 9.1 sharks/100 hooks when the fishery began in 1961 to 2.9 in 1964. Vessels from the Faroe Islands entered the fishery in 1964 and have maintained some level of effort since that time. Faroese landings were 1,088t in 1965 but declined and remained less than 500t until 1990. Faroese effort increased in 1991 and landings increased to 1,102t.

A Canadian freezer longline vessel entered the fishery in 1991 and total porbeagle landings were 1,402t (346t Canadian, 768t Faroese). A second Canadian freezer longline vessel



entered the fishery in 1992 and total landings increased to 1,777t (741t Canadian, 993t Faroese). Foreign vessels were limited to 400t of porbeagle in Canadian Atlantic waters in 1993 and were excluded from the fishery entirely in 1994. A third Canadian freezer longline vessel and several inshore vessels entered the fishery in 1993 and landings in 1993 and 1994 were 1,221 and 1,549t respectively. Effort by the freezer longline vessels has decreased in the past two years, with one vessel leaving the fishery completely. Total landings decreased to 1,305 and 1,015t in 1995 and 1996 respectively. However downturns in the groundfish and swordfish fisheries have resulted in a significant increase in effort directed at porbeagle sharks by inshore vessels. Landings by inshore vessels increased from 92t in 1994 to 290t in 1996.

The porbeagle fishery is seasonal, with most of the activity occurring between March and November. Fishing begins on the edge of the Scotian Shelf in early spring and progresses onto the Shelf itself, then into the Gulf of St. Lawrence and onto the Grand Banks in July, and then follows the fish back into deeper water in the late fall. The by-catch of other species is very low, typically less than 1% on average, and comprised primarily of blue shark and spiny dogfish. Preliminary analysis of Fishery Observer data from the Faroese and Canadian vessels shows substantial spatial and temporal variability in catch rate and in size and sex composition of the catches.

A Fisheries Management Plan for pelagic sharks in Atlantic Canada was announced in 1994, but was not fully implemented until 1996. This plan established precautionary catch levels for porbeagle (1,500t), shortfin mako (250t) and blue (250t) sharks in the directed shark fishery; limited the number of licenses by defining eligibility criteria; specified that licenses will be exploratory; prohibited "finning"; restricted fishing gears; established fishing seasons; restricted fishing areas; limited by-catch of other species in the directed fishery; restricted the recreational fishery to hook and release only; and established a scientific data collection program.

During the review of porbeagle stock status in 1996, it was recommended that the 1995 level of effort not be exceeded and that the 1995 catch be used as a harvest ceiling, given the lack of knowledge of this resource. Research efforts are focused on analysis of catch rate and sampling data collected by Canadian Fisheries Observers. Canadian researchers at Bedford Institute of Oceanography are collaborating with the Apex Predators Investigation in studies of age and growth, reproductive biology, and stock structure. The next review of stock status for this resource is scheduled for fall 1998 and it is hoped that the results of this joint research will result in estimates of sustainable harvest levels derived from a population model.

Age and Growth of the Porbeagle

Contributed by: Joseph Mello
University of Rhode Island

In an effort to help prevent the porbeagle shark from being overfished, life history data must be attained. There are several major areas of study in this process, one of which is to look at the age and growth of the porbeagle shark.

Age estimates are being determined using a set of over 140 vertebral samples from measured porbeagle sharks, length-frequency data, and tagging data. The number of bands present in the vertebrae can provide age estimates for each shark assuming the periodicity of band formation is known.

In past studies, it has been shown that two bands per year form in some lamnid sharks (mako sharks, sand tiger sharks, and basking sharks), the group to which the porbeagle belongs. Additionally, in some species, such as the Pacific angel shark, *Squatina californica*, band formation is not related to time. Thus, it is imperative to validate the number of bands deposited per year in the porbeagle shark. Validation can be directly evaluated through the use of oxytetracycline.

The API staff is in the process of injecting as many porbeagle sharks as possible in hope of increasing the possibility of the recapture of one of these sharks. On a longline cruise in September of 1996, 15 porbeagle sharks were injected with oxytetracycline (see Page 4). The return of the vertebrae from these injected sharks is vital to providing validation of band deposition. There are plans to continue injecting more porbeagle sharks in 1997.

The next step in this age and growth study will be to generate a preliminary growth curve and begin analyzing length-frequency data. This project will be updated in future issues of the Shark Tagger.

Reproduction of the Porbeagle

Contributed by: Abner Kingman,
University of California at Berkeley

Porbeagles share the reproductive strategies of other lamnid sharks, the white shark, and the two species of mako sharks, the shortfin and longfin. Groups of mature male (greater than 5.2' FL) and female porbeagle sharks (greater than 6.7' FL), mate in Western North Atlantic waters during September and October. Details of mating are unknown but like other sharks, internal fertilization is accomplished probably through the use of one clasper after a brief courtship interval.

Shortly after mating, a small number of eggs (1-5) are fertilized in the female's reproductive tract, in the vicinity

Continued Page 17

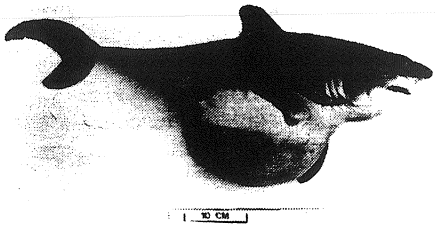


Photo Credit Wes Pratt

FIELD STUDIES

1996 was a tremendous year for field research for the API. The sampling season began in April with a 41 day survey of large coastal sharks along the western North Atlantic coast. The summer was filled with shark tournaments conducted between New Jersey and Maine, nursery ground surveys of the bays and estuaries along the northeastern U.S. coast, in situ nurse shark mating observations in the Dry Tortugas and participation in the Southeast Fisheries Science Center's (SEFSC) summer shark survey of the Gulf of Mexico and Atlantic coasts. The season ended with a fall cruise in the Gulf of Maine designed to catch and tag porbeagle sharks.

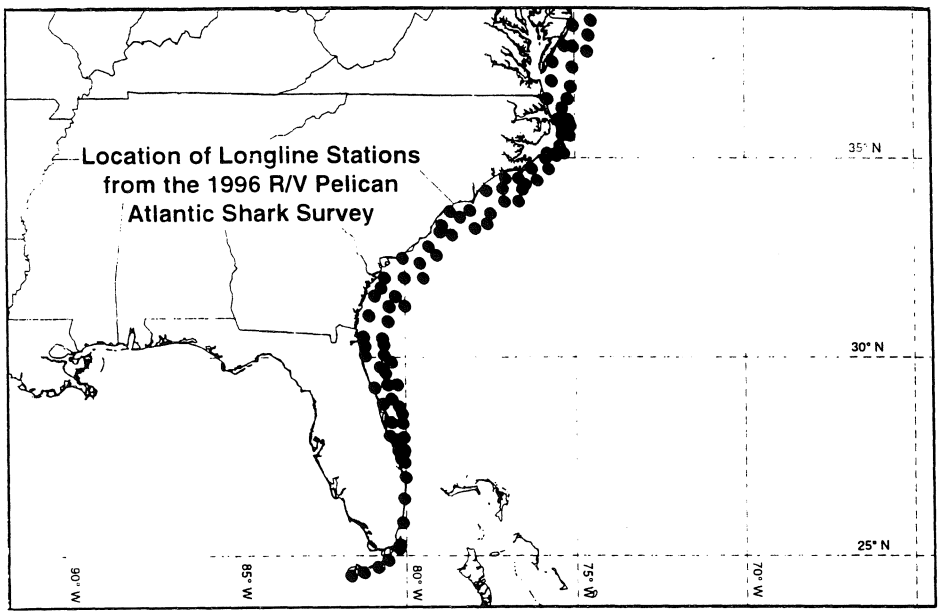
Research Cruises

Spring Shark Survey* - R/V *Pelican*

In the spring of 1989 and 1991, members of the API, onboard the NOAA Ship R/V *Delaware II*, conducted two longline surveys of large coastal sharks along the Atlantic coast. The 1989 survey was conducted between Tampa Bay, FL and southern New England. The 1991 survey repeated much of the 1989 trip between Miami and southern New England during the same season and using the same fishing methods. A third survey, conducted in 1996 and summarized below, was an attempt to repeat stations from the first two surveys in the region from Key West, FL to Delaware Bay during the same seasonal period. The cruises were similar with respect to biological studies of sharks. However, the gear and soak times were altered to more accurately represent that of the large coastal commercial shark fishery. Additionally, the survey was conducted from five to 40 fathoms, eliminating all stations outside this depth range.

The objectives of the 1996 survey were to: 1) investigate the distribution, abundance and species composition of sharks; 2) collect baseline catch per effort data (C/E); 3) tag sharks for migration studies; 4) inject tagged sharks with tetracycline for age validation studies; 5) collect biological samples for age and growth, food habits and reproductive studies; and 6) collect morphometric data. These data will be used in conjunction with the data from the 1989 and 1991 spring surveys and the SEFSC summer surveys (described Page 15) to assess the populations of coastal sharks in the Atlantic Ocean.

The spring survey was conducted from 16 April through 26 May 1996 on board the R/V *Pelican*. Ninety-five sets were completed between Key West, FL and Delaware Bay (see map) with the majority of the stations (49) in the 10-19 fm depth zone. Of the 193 sharks caught, 167 were tagged and released, 20 were brought onboard and dissected for biological studies and 6 were lost at the rail. The majority of sharks caught were sandbar sharks (*Carcharhinus plumbeus*) (58%), and tiger sharks (*Galeocerdo cuvier*) (21%). No other single represented more than 5% of the total shark catch.



Comparison to previous surveys

Forty-nine of the stations were conducted at locations sampled on surveys in both 1989 and 1991. Overall, 15 species of shark were caught at these stations. At the 49 repeat stations, a total of 304 sharks of 13 species were caught in 1989; 157 sharks of 10 species were caught in 1991; and 103 sharks of 8 species were caught in 1996. In each year, sandbar sharks were the most commonly caught large coastal species. Mean surface temperature at all stations was 0.9° C and 1.9° C lower in 1996 than in 1989 or 1991, respectively.

The success of these cruises is largely the result of cooperation between scientists of all the participating institutions and the assistance of the ship's crew. As always, we are grateful for the assistance of all who participated in the survey.

*(see related articles in the 1989 and 1991 Shark Tagger Newsletters)

International Porbeagle Tagging Cruise - F/V *Isabel S*

Apex Predators Investigation personnel are conducting research to evaluate the age and growth of the porbeagle shark, (see article Page 13). This project is being conducted in conjunction with NMFS, NEFSC, Narragansett Lab. and the Department of Fisheries and Oceans in Bedford, NS, Canada. Both U.S. and Canadian fishermen participate in a porbeagle longline fishery which includes fish that migrate between the U.S. and Canada, testifying to the need for cooperation between our two countries in studying this species. This cruise was designed to target porbeagles off the coast of Maine and possibly Canada for the primary purpose of injecting with oxytetracycline (OTC) and tagging as many individuals as possible. OTC injection and the subsequent validation of vertebral band periodicity using the backbones of recaptured injected sharks is vital to any age and growth study (see related article Page 4).

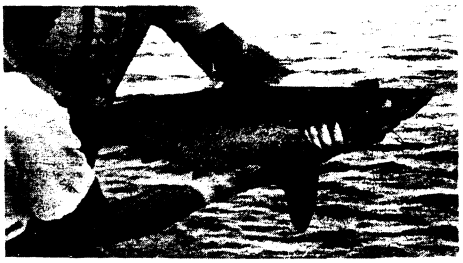


Photo Credit Lisa J. Natanson

A total of 246 sharks, representing 3 species, were caught on 18 pelagic longline sets during the cruise; 223 were tagged and released, 9 were brought aboard, and 14 were released untagged or lost. Sharks represented 100% of the total catch of which blue sharks (224) were the most common, followed by porbeagle (21) and spiny dogfish (1). Of the 207 blue and 16 porbeagle sharks tagged, 22 blue and 15 porbeagle sharks were injected with OTC prior to release. Morphometric data were collected for the sharks brought on board, and samples were taken for ongoing biological studies.

In the 1995 Shark Tagger Summary, we reported on the NMFS/SEFSC Pascagoula Lab shark longline survey cruises. In 1996, the surveys, conducted along the coasts of the Gulf of Mexico and Western North Atlantic, were repeated and enhanced. The results of these surveys are reported below.

Coastal Shark Assessment Bottom and Surface Longlining

Contributed by: Mark Grace, NMFS, Pascagoula, MS

The 1996 Gulf and Atlantic Coastal Shark Assessment Cruise was conducted onboard the NOAA Ship R/V *Oregon II*. The survey gear consisted of commercial style bottom longline (see 1995 Shark Tagger Summary for details) with the addition of opportunistic sets using surface longline. The survey area extended from Brownsville, TX to Cape Ann, MA and was conducted during 31 July - September 9 (see map). The depth range for bottom longline effort was from 10 - 40 fathoms (fm); for surface longline effort, the gear depth was from 8 - 30 fm.

The objectives were to: 1) conduct a pilot study to assess the feasibility of using bottom and surface longline gear to determine the distribution and abundance of coastal sharks; 2) collect biological and environmental data; 3) tag and release shark species; 4) conduct a calibration of a fisheries acoustic system (FAS) and collect FAS data at selected survey sites.

During the survey, 151 sites were sampled. Of these sites, 141 were bottom longline effort (14,100 hook hours (hk hrs)) and 10 were surface longline effort (2,150 hk hrs). Leg I was conducted in the western Gulf of Mexico from offshore the Mexico-Texas border to south of Mississippi (47 stations); Leg II in the eastern Gulf of Mexico from south of Alabama through the Florida Straits to Miami, FL (50 stations); Leg III from Miami, FL along the U.S. Atlantic coast north to Cape Ann, MA (54 stations).

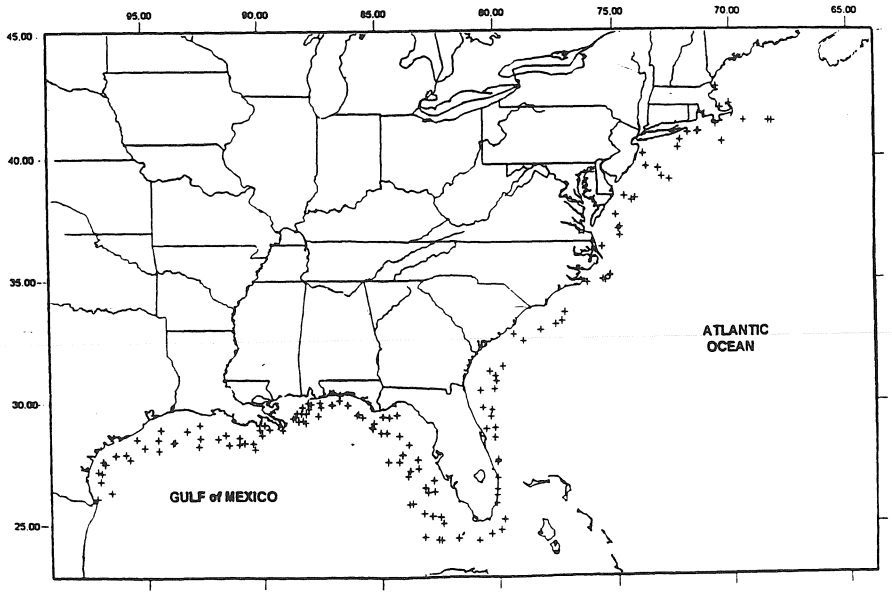
Shark captures comprised 81% (424) of the total catch with the remaining 19% classified as others. Of the 16 shark species caught, 12 were large coastal species (18%) and 4 were small coastal species (82%). The dominant large coastal shark for Legs I and II was the blacktip, and the sandbar for Leg III. Atlantic sharpnose was the dominant small coastal for Legs I and III; the blacknose was the dominant small coastal for Leg II. The catch per unit effort (C/E) of sharks for Leg I was 6.95/100 hk hrs; Leg II was 0.95/100 hk hrs and Leg III was 1.3/100 hk hrs.

Fifty-eight percent of sharks caught were tagged and released. Most of the tagged sharks were injected with OTC to facilitate age and growth studies. Samples collected from sharks landed included tissue for DNA analysis, spinal column sections for ageing studies, teeth, and external and internal parasites.

With the exception of a swordfish (*Xiphias gladius*) captured from surface longline, surface longline effort did not produce captures. However, configuring the gear for surface longlining was not difficult and was accomplished by the addition of bullet floats every 10 hooks attached to the mainline by float droplines of 8 fm, 15 fm or 30 fm. Prior to surface longline sets, the CTD temperature data were plotted to discern the presence of thermoclines for determining gear set depths. Even though surface longline effort did not produce shark captures, set and haulback operations were successful.

Collection of acoustic data was opportunistic during 30 longline sets. Data were partitioned into a near bottom stratum (0.5 m - 10.5 m above bottom) and an additional stratum that included the remainder of the water column. Due to the reverberation of sound off bottom, an acoustic "dead zone" prevents collection of FAS data within at least 0.5 m of the bottom. Initial results from processed FAS data showed variations in fish densities along individual sets and also between sets. FAS density estimates were compared to shark catches (small coastal, large coastal and combined) but there were no significant correlations. FAS fish density estimates varied by region and time of day and partitioning data by those variables created small data sets collected from a broad geographic area (Texas-Mexico boundary to the central Gulf of Mexico). The small sample size for FAS data limits the usefulness of the present information, however, FAS operations will be included during future surveys.

The 1997 survey is going to focus on the Gulf of Mexico. Researchers from the U.S. and Mexico will conduct a joint project under the auspices of MEXUS-GULF aboard the NOAA Ship R/V *Oregon II* to assess the abundance and distribution of coastal sharks from 5 to 30 fm along the entire Gulf of Mexico coastline.

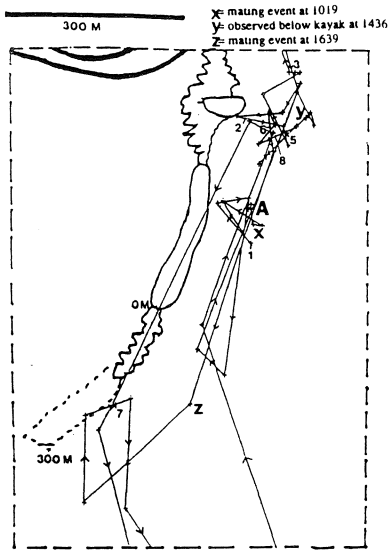


ONGOING RESEARCH

These articles update studies that we have reported in previous Shark Tagger newsletters.

Nurse Sharks

API staff in conjunction with Dr. Jeff Carrier and Jim Beck of Albion College continued studies of the reproductive dynamics of a population of seasonally mating nurse sharks (*Ginglymostoma cirratum*) in the Dry Tortugas, FL. Results thus far have shown that during the mating season, reproductively active females reside in the shallow mating area for periods of a few hours to more than a week. Males, singly or in groups, make brief sorties into the mating area from surrounding deeper waters, mate or attempt to mate with females, then usually return quickly to



deeper water. This year, to investigate male site fidelity, mating interactions and activities between mating events, movements of two reproductively active male nurse sharks were studied using ultrasonic transmitters with unique frequency pulses. Transmitters were attached externally with modified NMFS dart tags and tracked. Five tracks were made, four using a hand held Global Positioning System (GPS). Sharks were tracked for a total of 4.92 and 17.9 hours.

Sharks followed irregular to cyclic tracks within a 50 square kilometer area, traveling approximately one kilometer per hour. Sixty minute "rest periods" in and around reef structure were common. There were definite repetitive north-south movements along the fringing reef area in 5 to 60 feet of water. Longer tracks were interspersed with short, frequent course reversals within a few hundred kilometers. This behavior was, at times, identified with specific mating events (see map). Both sharks traveled within a discrete area and could be located repeatedly using the telemetry equipment. Therefore, these two males are probably residents of this area, at least during mating season. Future plans are to expand tracking to include more males and females to learn the home range and social structure of these sexually active sharks.

Sandbar Shark Nursery Study

Contributed by Rebeka Merson
University of Rhode Island

Several live-bearing shark species migrate into coastal bays to give birth to their young. Here, the young are relatively safe from predators (larger sharks) and find an abundance of food. In 1996, API biologists conducted exploratory gillnet and hook/line surveys in known and suspected sandbar shark, *Carcharhinus plumbeus*, nursery grounds along the US east coast (see map). Additionally, monthly gillnet sampling was conducted from June to October in Delaware Bay, DE, an important nursery ground for the sandbar shark. Objectives were to tag and release young-of-the-year sharks, identify nursery grounds along the east coast north of Chesapeake Bay, VA, and determine their seasonal distribution in Delaware Bay.

In Delaware Bay, 314 young-of-the-year (age 0) and juvenile (age 1+) sandbar sharks were captured from June to October, 1996, with a peak from July to September (303 sandbars). Two-hundred and forty-seven of these young sharks were tagged and 15 were recaptured by recreational fishermen and researchers in Delaware Bay during the 1996 nursery season. To date, 23 sandbar sharks tagged during the API nursery ground project have been recaptured in Delaware Bay (8 in 1995). Sharks were at liberty between 2 and 310 days, and all were recaptured within 16 nm of the original tagging sites. More than half of these sharks were recaptured less than 2.5 nm from where they were released. These data suggest a very localized nursery ground population during the nursery season.

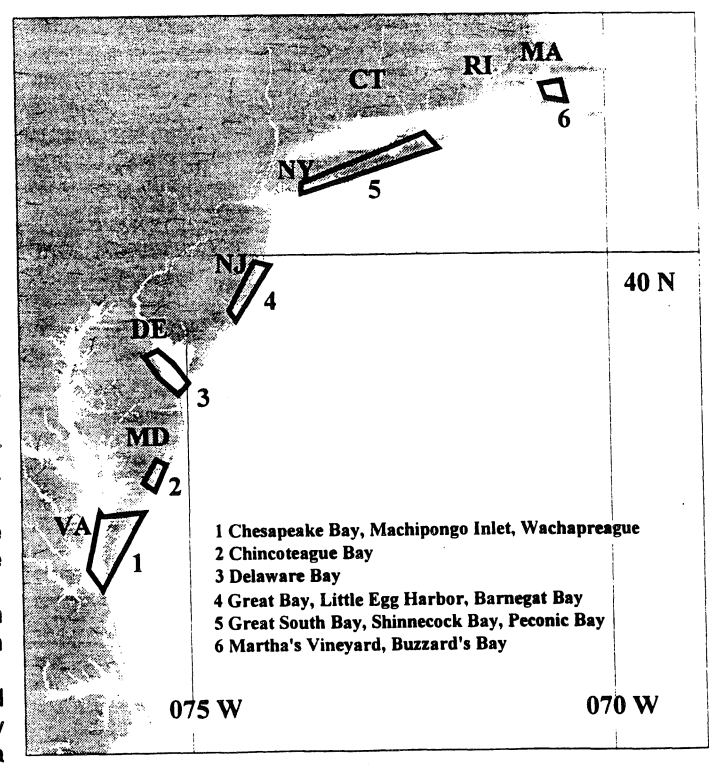
Young-of-the-year and juvenile sandbar sharks migrate south in the fall to their overwintering nursery grounds. In the spring these sharks migrate back into the coastal bays. In 1996, a shark was recaptured in Delaware Bay less than 1 nm from where it was tagged in 1995. This suggests that juveniles may either be homing to their natal nursery ground or migrating back to a limited number of summer nursery grounds along the US east coast.

API biologists sampled a total of fourteen stations (gillnet and hook/line) in Chesapeake Bay, Machipongo Inlet, Wachapreague Inlet, and Chincoteague Bay, VA (see map). Sixteen sandbar sharks (5 young-of-the-year and 11 juveniles) were captured and 12 were tagged and released. A gear comparison study was attempted in Chesapeake Bay. Stations were sampled with API's survey gillnet and the Virginia Institute of Marine Science longline, but too few sharks were captured to draw any conclusions from this initial experiment.

Historically, pupping grounds have extended to Great South Bay, Long Island, NY. API biologists conducted gillnet and hook/line sampling in Great South, Shinnecock and Peconic Bays, NY (see map), from August 15-22, coinciding with the timing of historical captures of sandbar sharks. None were captured in NY during this survey. It appears that Great South Bay is not a current pupping ground, but reports of sandbar shark captures outside the Bay, along Fire Island, indicate that the south coast of Long Island may still be an important summer nursery ground for juveniles.

In New Jersey, API biologists deployed gillnets in Great Bay, Little Egg Harbor, Barnegat Bay, and adjoining areas during early July (see map). Seventeen sandbar sharks, all with fresh umbilical scars or umbilical cord remains, were captured by gillnet in Great Bay on July 8. No sandbars were captured in Little Egg Harbor or Barnegat Bay during this study. It appears that Great Bay, NJ, is the current northern limit of sandbar pupping grounds. One young-of-the-year shark was recaptured 2 nm from its release location after being at liberty for 25 days in Great Bay, suggesting that like Delaware Bay, Great Bay has a localized sandbar shark population which remains in the nursery throughout the summer months.

In late August, API biologists partcipated in cooperative research with Gregg Skomal, of the Massachusetts



Division of Marine Fisheries, in Cape Cod, MA (see map), the northern limit of juvenile sandbar shark summer nursery grounds. Our sampling demonstrated that young-of-the-year sandbars were absent from areas with similar characteristics to known nursery grounds.

Porbeagle Reproduction
Continued from Page 13

of the paired shell glands. These eggs are then packaged individually in soft cases and sent down to the uteri. There, the tiny embryos are nourished by their attached yolks until they are more than an inch long and the yolk has been absorbed. At this stage, the little embryos, that now look like a cross between a worm and a fish, but nothing like a fully developed porbeagle, break free from their transparent shell.

While they were still attached to the egg, other (unfertilized) eggs were being packaged in groups of several dozen and sent down to the uteri. These eggs serve as food for the embryos, now hungrily swimming in the uteri, scavenging for things to eat. Over the next several months, each embryo will consume thousands of eggs. So many eggs are eaten that at certain stages the weight of eggs in the embryo's stomach will approach the weight of the embryo itself. Eventually, ovarian production of eggs stops and the distended stomachs shrink as the embryos absorb the ingested yolk and approach pupping size. In late spring, after about 8 months gestation, an average of four 28 inch pups are born looking like small versions of the adults.

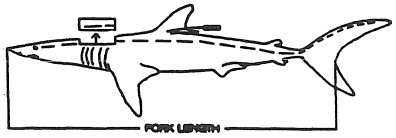
Reminder

Please write down the tag number when returning recapture information. Tags and tag capsules often get torn from the envelopes when they go through the machines at the post office and important information is lost.

REQUEST FOR BACKBONES OF RECAPTURED SHARKS

The large number of sharks currently being recaptured offers a unique opportunity for fishermen to assist biologists in age and growth studies.

IF YOU CATCH A TAGGED SHARK



Measure fork length.

Record tag number and recapture details (date, location, latitude and longitude or loran, sex, method of capture, etc.)

Remove a 6 to 10 inch piece of backbone from over the gills.

Freeze backbone.

Telephone collect for postage-paid mailers (401-782-3320).

Atlantic Shark Fisheries Management Plan Update

On April 2, 1997, the National Marine Fisheries Service filed a final rule, effective immediately, that:

1. reduces the annual commercial quota for large coastal sharks by 50% from 2,570 metric tons dressed weight (mt dw) to 1,285 mt dw. This action is effective immediately and is meant to reduce effective fishing mortality on large coastal sharks as recommended by the latest stock assessment (NMFS, June 1996);

2. establishes a commercial quota of 1,760 mt dw for small coastal sharks. The commercial quota for pelagic sharks remains at the current level of 580 mt dw;

3. reduces the recreational bag limits for all Atlantic sharks. NMFS has combined all sharks into a single bag limit of 2 sharks per vessel per trip, with an additional allowance of 2 Atlantic sharpnose sharks per person per trip;

4. prohibits ALL directed (commercial and recreational) fishing for five species (whale, basking, white, sand tiger, and bigeye sand tiger);

5. establishes a catch-and-release-only recreational fishing for white sharks;

6. prohibits filleting of sharks at sea; and

7. refers to the requirement for species-specific identification by all owners or operators, dealers, and tournament operators of all sharks landed.

Additionally, on December 27, 1996, the National Marine Fisheries Service proposed Amendment 1 to the Fishery Management Plan for Atlantic Sharks. If approved, Amendment 1 would establish a two-tiered permit system for the Atlantic commercial shark fishery in which permits would be classified as "directed" or "incidental". Amendment 1 would also set forth eligibility criteria for these permits based on historical participation, and limit the transferability of such permits. On May 20, 1997, NMFS published a Notice of Intent to Prepare a Supplemental Environmental Impact Statement.

Comments are welcomed concerning any management issues. Please contact C. Michael Bailey or Margo Schultze, NMFS-SSMC3-F/CM4, 1315 East West Highway, Silver Spring, MD 20910.
Telephone (301) 713-2347, FAX (301) 713-0596.

NMFS Cooperative Shark Tagging Program, 1962-1993: An Atlas of Shark Tag and Recapture Data

To be published as a NOAA Technical Memorandum in 1997.

This report summarizes the tagging and recapture information from the Cooperative Shark Tagging Program covering the period from 1962 through 1993. Over 100,000 tagged fish of 33 species and 4,500 recaptured fish of 29 species are presented in an atlas format to provide an overview of the 32 year database. The intent is to show the extent of 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, and international and territorial waters of other countries. This report is currently in press and should be available by the end of the year.

A preliminary estimate of age and growth of the dusky shark *Carcharhinus obscurus* from the south-west Indian Ocean, with comparisons to the western North Atlantic population.

To be published in South African Journal of Marine Science Volume 17, 1997.

Age and growth of the dusky shark, *Carcharhinus obscurus*, from the South Western Indian Ocean was determined from rings in the vertebrae of 42 individuals. Age to maturity was estimated at 20.5 years for males and between 17 and 24 years in females. The oldest fish aged was a 34-year old female. von Bertalanffy growth parameters calculated for the sexes combined were L_∞ = 334 cm FL, k = 0.047, and t_0 = -5.18 (see figure). Comparisons of growth between dusky shark populations from the South Western Indian Ocean and the Western North Atlantic Ocean indicated that they grow at a similar rate.

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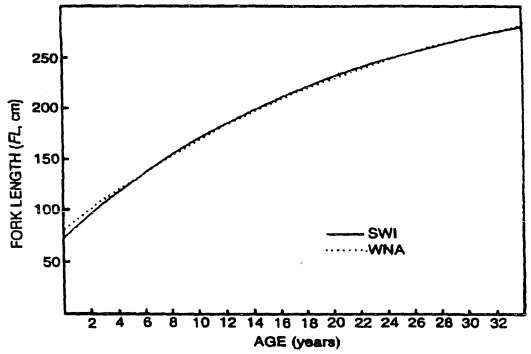

DEDICATION

Charles Edward "Chuck" Stillwell was a fellow biologist with the Apex Predators Investigation. He was the first researcher to join the now retired Jack Casey at the Sandy Hook Lab, in New Jersey in 1965. At sea or in the office, Chuck always had a warm smile, a kind word and a helping hand for everyone he met. He began his shark research with tagging and age and growth studies, but Chuck's expertise eventually led to pioneering work on the food habits of sharks.

Chuck passed away last summer after a tough battle with cancer. We all have lost a fine friend, a shipmate and a colleague. We dedicate this newsletter to his memory.