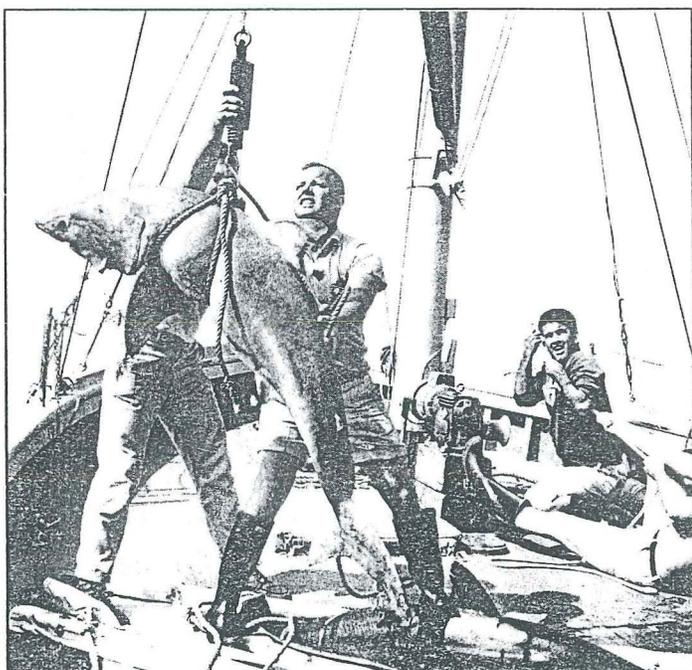
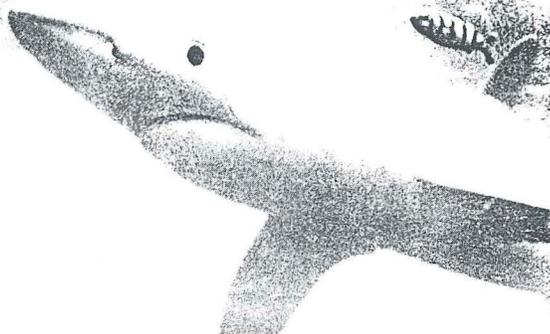


THE SHARK TAGGER 1993 SUMMARY

Newsletter of the Cooperative Shark Tagging Program

Photo by H. W. Pratt



1993 Overview

In 1993, just over seven thousand (7,373) fish were tagged despite our inauspicious beginning due to a delayed tag order. This is the second highest number tagged in any single year and brings the total to 113,000 fish tagged since the inception of the Program in 1962. Additionally, this was a record year for number of fish recaptured (546). A total of 5,086 fish have been recaptured with an overall return rate of 4.5% for all species. We wish to acknowledge the thousands of cooperating recreational and commercial fishermen, scientists and fisheries observers whose combined efforts have made this the most extensive shark tagging program in the world.

The annual number of fish tagged over the past ten years has varied from 4,000 to 8,000. Trends in numbers of fish tagged and recaptured, however, must be interpreted with caution because tagging effort can vary from year to year due to weather conditions, addition of new participants in the Program, opening or closure of a

In this issue:

- 7373 Fish Tagged and 546 Recaptured
- Sandbar Shark Recaptured after 23 Years
- Time at Liberty Records for Swordfish (9 Years), Mako Shark (9 Years), Tiger Shark (11 Years) and Dusky Shark (16 Years)
- Recaptured Blue (29%) and Mako (20%) Sharks Retagged
- Tiger Shark Age and Growth
- Nurse Shark Mating Behavior
- High Seas Longlining
- Satellite Transmitters on Blue Sharks
- Sandbar Sharks Studied off Chappaquiddick
- 1994 Spring *Shark Tagger* Update
- A Look Back at the NMFS Tagging Program (1962-1993)

commercial fishery, or number of tags available. For example, a decrease in the number of blue sharks tagged in June is not necessarily due to a decline in the blue shark population, but may be a result of inclement weather on the weekends. Alternately, the number of mako sharks tagged this year (360) is similar to last year's total, but is nearly double the average for the previous ten years. This is believed to reflect an increased tagging effort on mako sharks by both recreational and commercial fishermen rather than a population increase. In the last few years, many individuals have been more willing to release mako sharks of all sizes. Environmental factors such as water temperature or salinity can also influence relative species abundance in a particular area. All these variables are difficult to measure and may mask any direct correlation of number of tags used per year and population size. Even so, many

Continued on Page 2

Printed compliments of Carl Darenberg, Jr., Montauk Marine Basin, Montauk, NY

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

Table 1. Summary of sharks and teleosts tagged, January to December, 1993

Species	Tagged by		Total
	Cooperative Taggers	Narragansett Biologists	
Blue shark	4514	0	4514
Tiger shark	501	117	618
Sandbar shark	460	37	497
Shortfin mako	360	0	360
Blacktip shark	232	3	235
Dusky shark	178	0	178
Porbeagle	112	0	112
Nurse shark	72	4	76
Scalloped hammerhead	71	0	71
Atlantic sharpnose shark	70	1	71
Bonnethead	66	0	66
Silky shark	43	0	43
Spinner shark	39	0	39
Bull shark	38	0	38
Sand tiger	33	0	33
Smooth hammerhead	31	0	31
Lemon shark	27	0	27
Oceanic whitetip shark	22	0	22
Bigeye thresher shark	20	0	20
Blacknose shark	18	1	19
Atlantic angel shark	16	0	16
Longfin mako	10	0	10
Smooth dogfish	8	0	8
Sixgill shark	6	0	6
Tope shark	6	0	6
Finetooth shark	5	0	5
Crocodile shark	5	0	5
White shark	3	0	3
Spiny dogfish	3	0	3
Great hammerhead	3	0	3
Common thresher shark	3	0	3
Basking shark	3	0	3
Night shark	2	0	2
Reef shark	1	0	1
Whale shark	1	0	1
Hammerhead, unspecified	29	0	29
Sand, unspecified	19	0	19
Brown/dusky, unspecified	12	0	12
Miscellaneous sharks and rays	34	0	34
Total sharks	7076	163	7239
Yellowfin tuna	21	0	21
Blue marlin	20	0	20
Bluefin tuna	19	0	19
White marlin	19	0	19
Swordfish	18	0	18
Atlantic sailfish	13	0	13
Bigeye tuna	4	0	4
Miscellaneous teleosts	20	0	20
Total teleosts	134	0	134
Total	7210	163	7373

On the cover: 1964- Jack Casey weighs a white shark on *R/V Challenger*. Photo by S. Faulk (See: "A Look Back" p.16)

experienced fishermen are convinced that some species (e.g. sandbar sharks) have declined in recent years.

The number of fish tagged in a single year is also related directly to the number of tags we are able to put in the hands of fishermen. In the last two years, we distributed more tags than in previous years (13,000 to 14,000 instead of 10,000 to 12,000) and this fact alone probably accounts for the record numbers of fish tagged in 1992 and 1993. Likewise, as the number of tagged fish in the population increases (each year an additional 5,000 to 8,000 fish are added), the number of recaptures per year will increase. We continuously get many more requests for tags than the number of tags we have on hand for the entire year. We can understand your frustration when you are willing to undertake the time and expense of catching a shark and must release the fish without a tag. We appreciate your patience in this matter and hope that you will continue to request tags and tag as many fish as possible.

Tags

Volunteers and NMFS biologists tagged and released 7,373 fish of 37 species of sharks and rays and 15 species of teleosts (Table 1). The principal species tagged were blue sharks, tiger sharks, sandbar sharks, mako sharks, blacktip sharks, and dusky sharks. Anglers accounted for 67% of the tagging effort followed by commercial fishermen (14%); collaborators on the *R/V Geronimo*, NMFS, and other biologists (13%); and fisheries observers aboard commercial vessels (6%). Methods used to capture the sharks for tagging consisted of rod and reel (66%), longline (27%), handline (4%), and gill net, trawl net and free swimming (3%). Fish were released by taggers representing nine countries and island territories: United States, Spain, Canada, Portugal, Italy, England, Azores, Bahamas, and South Africa.

Anglers tagged the largest variety of species (30 in all), primarily blue sharks (72%), sandbar sharks (6%), and mako sharks (5%). Commercial fishermen tagged a fewer number of species (18) mainly tiger sharks (42%), blue sharks (25%), sandbar sharks (9%), and mako sharks (6%). Fisheries observers onboard commercial vessels tagged 12 species, primarily blue sharks (56%), mako sharks (14%), dusky sharks (8%) and scalloped hammerhead sharks (8%). The combined efforts of these groups add to the wide diversity of the Program in terms of numbers of fish and species tagged (Table 1).

Recaptures

In 1993, information was returned from 546 tagged fish representing 19 species of sharks and 5 species of teleosts (Table 2). The majority were blue sharks (300), sandbar sharks (65), tiger sharks (56), and mako sharks (35). The occupations of people who returned tags were primarily commercial fishermen (52%) and anglers (45%). Others included U.S. and Canadian observers aboard commercial vessels and other biologists (3%). Tags were returned from fishermen representing the following 17 countries: United States, Spain, Brazil, Canada, Colombia, Cuba, France, Japan, Mexico, Portugal, Italy, Venezuela, Trinidad, England, Philippines, Uruguay, and Croatia. The fish that were recaptured were originally caught on rod and reel (69%), longline (25%), handline (2%), and gill net, trawl net and free swimming (4%). These percentages by gear type are similar to those recorded for initial capture methods and suggest that sharks can survive capture by all gear types.

Blue Sharks (300 Returns)

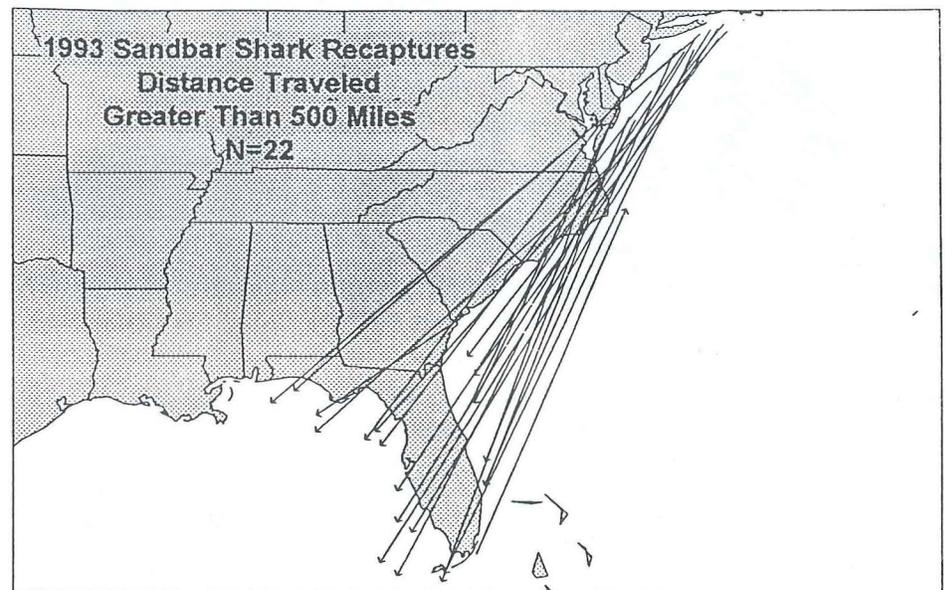
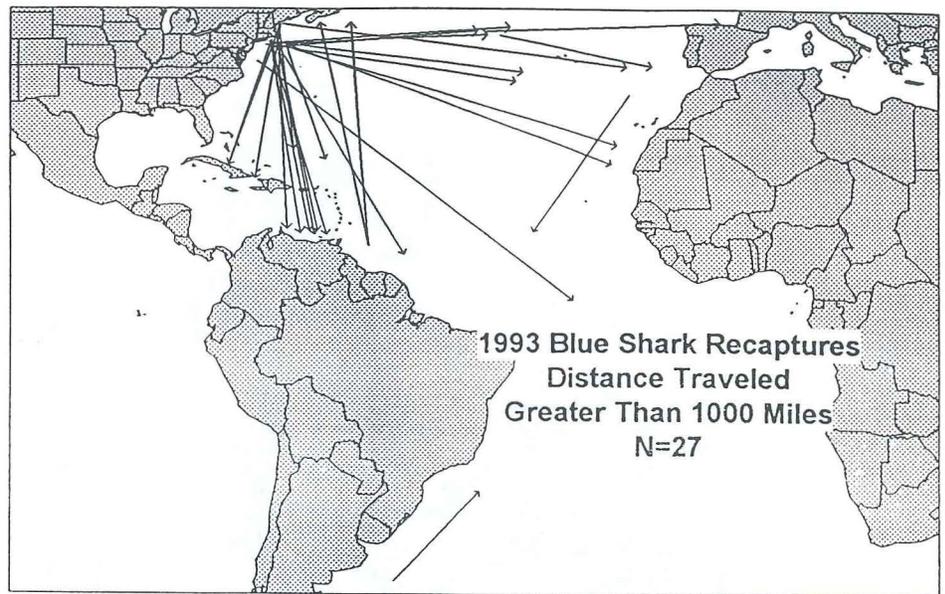
Blue sharks were at liberty from 1 day to 6.7 years, with most (80%) recaptured within one year. The 6.7 year return is the second longest time at liberty for any blue shark in the Program. The record is 8.5 years. The next 8 fish in terms of maximum time at liberty are all within 125 days of each other (5.8 to 6.1 years). Ver-

tebral age data suggests that blue sharks live approximately 20 years. Fortunately, the 6.7 year recaptured fish was retagged and if recaptured again, will provide valuable information on longevity in this species.

Blue sharks traveled distances ranging up to 3,366 miles. This latter recapture is the third longest distance traveled for any fish in the Program and was tagged approximately 100 miles east of Wachapreague Inlet, Virginia and recaptured just north of the equator, midway between the South America and Africa after 9.4 months at liberty. Overall, 27 blue sharks (10%) were recaptured over 1,000 miles from their tagging location. These long distance recaptures included returns from Canada, the Azores, Spain, Portugal, Senegal, Brazil, Venezuela, Tobago and Cuba.

Two of the long distance recaptures were tagged in early March of 1993 by a commercial fisherman northeast of Guyana and were recaptured in August and September approximately 2,000 miles away off Nova Scotia, Canada. Two other blue sharks tagged near the Azores in the same time of year (April) both traveled east to France and Portugal. Four out of six fish caught off Venezuela were originally tagged in the summer of 1992 off New England. They were all recovered throughout 1993, with times at liberty ranging from 3.4 to 11.8 months. The high number of these tags may be due to an increased reporting rate of the recaptures by Venezuelan fishermen as well as increased fishing effort in that area. Two blue sharks recaptured off Senegal, Africa were tagged in the summer of 1988 and 1989 off New England. They were both recaptured within two months of each other by Spanish longline fishermen. Shorter distance recaptures reflect patterns of "local" movements. For example, of four fish tagged off Pt. Judith, Rhode Island on the same day in August of 1992: one was recaptured after 2 months approximately 300 miles east of its tagging location; another was returned in that same area after 10 months of liberty; and the two other fish, also recaptured after 10 months, were both caught approximately 75 miles west of the original tag site. These recaptures suggest that some parts of the population may overwinter a few hundred miles offshore and return to the same general area the following spring, while other segments of the population make long-range movements.

There are also examples of blue sharks that are tagged at the same time and place and are recaptured thousands of miles apart. For example, two sharks tagged on the same day in July of 1988 off Rhode Island were recaptured in 1993; one off Senegal and the other off Canada. In all, 11 of the 21 blue sharks (52%) that had traveled more than 1,000 miles were tagged off the northeastern coast of the United States



in 1992. These blue sharks were immature and mature males and females. We have yet to understand the biological or environmental factors that could explain why these fish migrate long distances in some years and not in others, or that cause certain groups of fish to stay together.

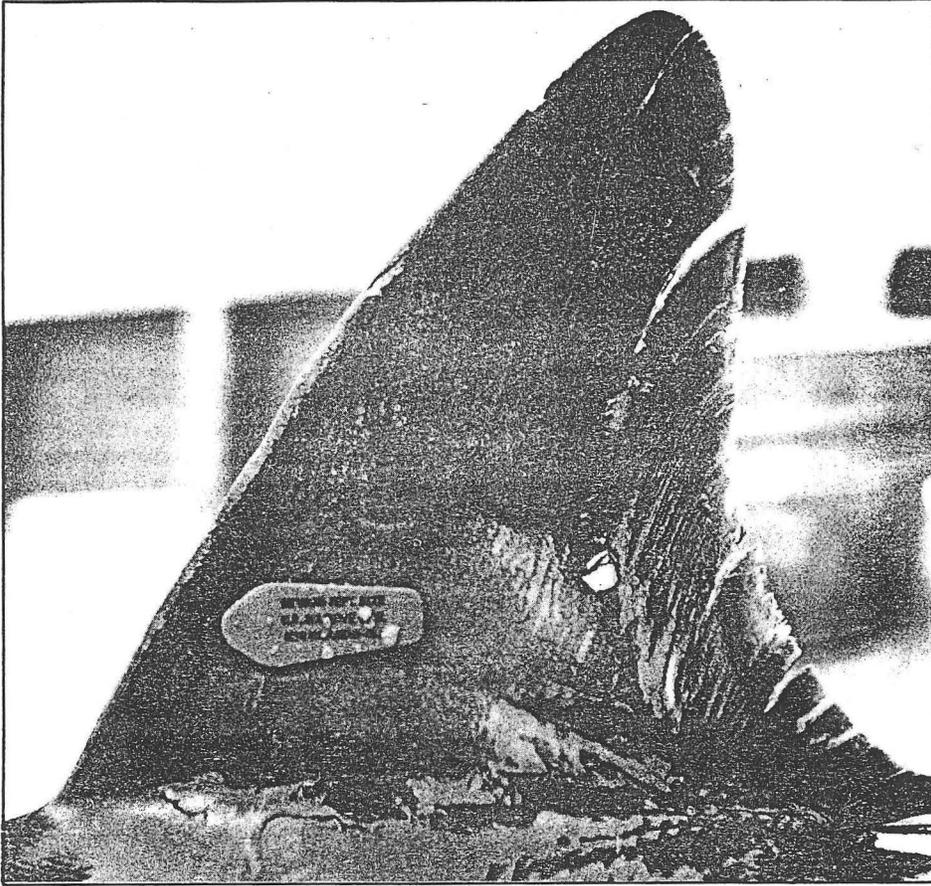
An exciting recapture received this year establishes the northernmost location of any tagged blue shark in our Program. This fish was tagged south of Newfoundland, Canada by a commercial longline fisherman and was recaptured almost 14 months later approximately 160 miles southwest of Greenland by a Canadian fisherman. The shark was released, unfortunately without a tag.

Overall, 47% of the blue shark recaptures were retagged, released with the same tag, or released without a tag. Multiple recaptures of the same fish provide information on how well some sharks survive tagging. One blue shark was tagged, recaptured by the same fisherman after 30 minutes and

re-released with the same tag. The shark was then recaptured a year later only 13 miles from its original tagging location at which time it was retagged and released again.

Sandbar Sharks (65 Returns)

A new time at liberty record for the sandbar shark (and for any fish in the Program) was set this year. Two red roto tags (plastic fin tags) were recovered from sharks at liberty for 26.9 and 27.8 years. These fish were originally tagged in Great Machipongo Sound, Virginia in 1965 and 1966 by Chuck Stillwell (NMFS biologist who retired last year) and were both recovered off Florida (Key West and Daytona Beach). The length of the 26.9 year shark was measured at tagging and estimated at recapture. Growth was calculated at 1.2 inches per year. These data agree well with the very slow growth and long life expectancy (40 to 50 years) we have determined for this



WATCH FOR ROTO TAGS ! Some may be on sharks at liberty for 30+ years.

species. Growth information could not be calculated for the 27.8 year recapture since the last digit on the tag number was not clear. It was fortunate that the fisherman was familiar with the Program and recognized the tag. If a shark is recaptured with a red or yellow tag attached through the dorsal fin, measure the fork length and return the tag and information to us. If it is possible to take a piece of the backbone from this measured fish, this vertebral sample would be invaluable. In most cases, these tags were put on the sharks in the early 1960s and the return address may be worn off by now. Tag and recapture information is important for determining a species' life span. If you find a tag that cannot be identified, please send the tag and information to us with your address and phone number and we will try to locate the proper agency.

Another significant return in 1993 came from a sandbar shark tagged, measured and injected with OTC (the antibiotic oxytetracycline) by NMFS biologists on a research cruise in 1989. The shark was recaptured by a commercial fisherman 3.8 years later and the entire fish was brought to the laboratory for examination. We were thus able to measure the shark and remove a piece of the backbone for age and growth analysis. The tetracycline mark in the ver-

tebrae was clearly visible, permitting an exact determination of growth since the fish was tagged.

Results of sandbar shark returns in previous years show an inshore pattern of distribution from Cape Cod and southern George's Bank to Mexico with a north to south overall direction of movement. This year's recaptures were all returned along the Atlantic coast of the United States and off the west coast of Florida with none recovered further west into the Gulf or off the Mexican Coast. Consistent with earlier results, the long distance returns (> 300 miles) showed a southwest direction of movement (14 traveled from the Atlantic into the Gulf of Mexico) with the exception of three fish that were tagged off Florida and traveled north to North Carolina and New Jersey. Of all the sandbar sharks recovered, only two that were tagged in the Gulf of Mexico have been recaptured outside of the Gulf. These two fish were initially tagged off Key West, Florida and the Dry Tortugas. Alternately, 215 of the fish tagged in the Atlantic have been recovered in the Gulf. The lack of Atlantic returns from Gulf of Mexico tagging is very probably due to the low numbers of fish tagged in that area. Additional tagging along the U.S. and Mexican coasts in the Gulf of Mexico is necessary for determining sandbar shark move-

ments from the Gulf of Mexico to the East Coast of the United States. Cooperative research with Mexico has been proposed to address this issue.

Twelve of the sandbar sharks traveled distances greater than 1,000 miles. The longest distance traveled was 1,637 miles by a shark tagged off Shinnecock, New York and recaptured off Pensacola, Florida after 5.6 years at liberty. Although no long distance records were set this year, recaptures over short distances provided valuable information. An interesting return that traveled a relatively short distance was a sandbar shark tagged southeast of Fire Island Inlet, New York that was recaptured off Griswold Point, Connecticut at the mouth of the Connecticut River. This was one of at least 15 sandbar sharks caught in that area last summer and the only one tagged. We are very interested in learning about any unusual local increases or decreases in abundance of sharks.

Tiger Sharks (56 Returns)

Tiger sharks were at liberty from 5 days to 10.9 years. The 10.9 year recapture is the longest time at liberty for any tiger shark tagged in the Program. This fish was tagged off New Jersey in August of 1982 and was recaptured south of Pt. Judith in July of 1993. The previous record was 8.0 years.

The majority of the tiger sharks were small (less than 4 ft), and were tagged and recaptured by participating commercial fishermen in a nursery area off northeastern Florida (see "Field Studies," page 12). Although at liberty for many months, the young tigers apparently traveled only short distances from the tagging location; most were caught within 100 miles.

Overall, 37 (66%) of the recaptured tiger sharks were measured at both the time of tagging and recapture (often by the same fisherman). Of these, 27 were released with the same or new tag in place and 10 were sampled for a piece of the backbone. Two of the backbones were from tiger sharks that had been previously injected with OTC and were at liberty for three months. One was first recaptured after 34 days, remeasured and released, then recaptured after another 47 days at liberty, at which time the valuable vertebral sample was collected. In all, six fish that were injected with OTC were recaptured this year. All vertebrae examined showed distinct yellow OTC bands under ultraviolet light with growth past these marks. We are grateful to the fishermen who take the time and effort to measure these fish and remove the small sample of backbone from over the gills.

Table 2. Tag recoveries: January-December 1993.

TAGGED	GENERAL LOCATIONS		MONTHS AT LIBERTY	DIST. (MI.) AND DIR.	CAPTURE METHOD		TAGGED BY	RESIDENCE
	TAGGED	RECAPTURED			TAG. REC.	TAGGER		
Blue shark	SE Fire Is. Inlet, NY	S Montauk Pt., NY	<1	29 NE	RR	RR	Charles L. Guttilla	NY
"	SE Pt. Judith, RI	NW Cumana, Venezuela	30	1790 S	RR	LL	Bob Rowan	RI
"	ESE Manasquan Inlet, NJ	E Manasquan Inlet, NJ	<1	21 N	RR	RR	Barry Boyce	NJ
"	SE Shinnecock Inlet, NY	SW Montauk Pt., NY	<1	6 NW	FS	RR	Ed Anker	NY
"	SE Montauk Pt., NY	S Pt. Judith, RI	<1	2 N	RR	RR	John Kudrick	NY
"	SE Montauk Pt., NY	E Tom's River, NJ	11	93 SW	RR	RR	John Mangano	NY
"	S Martha's Vineyard, MA	SW Sable Is., Canada	70	457 NE	LL	LL	D. Kotula, NMFS Obs.	MA
"	SE Pt. Judith, RI	E Tobago	55	2168 S	LL	LL	Stephen Connett	RI
"	S Fire Is. Inlet, NY	SE Montauk Pt., NY	<1	90 NE	RR	RR	Rick Buckley	NY
"	E Barnegat Inlet, NJ	NE San Juan, Puerto Rico	80	1040 S	LL	LL	G. Hinteregger, NMFS Obs.	MA
"	E Pt. Pleasant, NJ	SE Bay Shore, NY	3	95 E	RR	LL	Arthur Schuessler	PA
"	SE Nantucket Is., MA	NW Dakar, Senegal	54	2712 E	HL	LL	Stephen Connett	RI
"	SE Pt. Judith, RI	SE Cape Sable, NS, Canada	58	280 E	HL	LL	Stephen Connett	RI
"	E Manasquan Inlet, NJ	NE Fernandina Beach, FL	8	639 SW	RR	LL	Ed Zinke	NJ
"	E Pt. Pleasant, NJ	E Block Is., RI	1	95 NE	RR	RR	Robert Bangston	NY
"	SE Pt. Judith, RI	S Nantucket, MA	65	35 E	RR	TN	Frank Mundus	HI
"	E Montauk Pt., NY	SE Pt. Judith, RI	12	32 SE	RR	RR	Frank Foli	NY
"	S Montauk Pt., NY	S Montauk Pt., NY	<1	1 NE	RR	RR	Bud Brandt	NY
"	SW Montauk Pt., NY	SSE Moriches Inlet, NY	<1	23 SE	RR	RR	Daniel A. Dantuono	NY
"	SE Moriches Inlet, NY	SW Cape Race, NF, Canada	36	700 E	RR	LL	Charles A. Witek, III	NY
Blue shark	SE Montauk Pt., NY	Hudson Canyon	10	90 SW	RR	RR	Ron Chambers	CT
"	S Pt. Judith, RI	S Montauk Pt., NY	<1	14 SW	FS	RR	Robert Flanagan	CT
"	S Montauk Pt., NY	S Pt. Judith, RI	<1	27 NE	RR	RR	Jim Ferrone	CT
"	SW Jones Inlet, NY	SE Montauk Pt., NY	25	86 NE	RR	RR	Bruce Weisinger	NY
"	S Block Is., RI	N Dakar, Senegal	38	2735 E	RR	LL	Charles Lee	RI
"	E W. Hampton Beach, NY	SW Faial, Azores	19	1799 E	RR	LL	Dori Messier	CT
"	E Montauk Pt., NY	S Montauk Pt., NY	11	62 S	RR	RR	Bob Morel	RI
"	E Little Egg Inlet, NJ	SE Cape May, NJ	36	81 S	RR	RR	John Canavari	NJ
"	SE Pt. Judith, RI	SW Martha's Vineyard, MA	47	70 NW	HL	RR	Stephen Connett	RI
"	S Montauk Pt., NY	NW Flores, Azores	12	1396 E	RR	LL	Tom Dorfmeier	CT
"	SE Shinnecock Inlet, NY	SE Fire Is. Inlet, NY	<1	26 SW	RR	RR	Danny Azzato	NY
"	SE Moriches Inlet, NY	ESE Cape May, NJ	11	135 SW	RR	RR	Wain Carlough	NY
"	SE Moriches Inlet, NY	SE Indian River, DE	11	167 SW	RR	RR	Wain Carlough	NY
"	SW Shinnecock Inlet, NY	E Oregon Inlet, NC	31	NR	RR	LL	Frank Basil	NY
"	SE Montauk Pt., NY	N Port La Guaira Venezuela	8	1760 S	RR	LL	Bill Ducci	CT
"	SE Portland, ME	Not Reported	32	NR	RR	GN	Mark Chase	ME
"	E Sequin Is., ME	S Sequin Is., ME	1	16 SW	RR	RR	David Sinclair	ME
"	Not Reported	SSE Pt. Judith, RI	NR	NR	RR	RR	Steven West	MA
"	E York Harbor, ME	E York Harbor, ME	13	1 NE	RR	RR	Paul Karambay	CT
"	E Pto. S. Giorgio, Italy	Palagruza Is., Croatia	14	116 SE	RR	LL	Big Game Italia	Italy
Blue shark	NE Rimini, Italy	W Dubrovnik, Yugoslavia	14	227 SE	RR	LL	Mario Urbinati, BGI	Italy
"	E Ocean City, MD	SE Ocean City, MD	<1	31 SW	RR	RR	Brian Babbitt	NJ
"	E Beach Haven, NJ	SE Fire Is. Inlet, NY	<1	47 N	RR	RR	Mike Szegeski	NJ
"	SE Pt. Judith, RI	NE Cayo Verde, Cuba	11	1183 S	RR	LL	Andy Dangelo	RI
"	SW Montauk Pt., NY	E Forked River, NJ	1	233 E	RR	LL	Jeff Picken	NJ
"	S Montauk Pt., NY	SE Cape Sable, NS, Canada	40	349 E	RR	LL	Frank Braddick	NY
"	SE Montauk Pt., NY	S Pt. Judith, RI	25	21 N	RR	RR	Bill Ricca	NY
"	S Pt. Judith, RI	SE Pt. Judith, RI	<1	5 NE	RR	RR	Steve Grennan	RI
"	S Pt. Judith, RI	NW Cumana, Venezuela	3	1745 S	RR	LL	George Brouillette	RI
"	SE Pt. Judith, RI	SE Cape Sable, NS, Canada	9	331 E	RR	LL	George Brouillette	RI
"	S Shinnecock Inlet, NY	SW Fire Is. Inlet, NY	<1	55 W	RR	RR	Charles A. Witek, III	NY
"	S Montauk Pt., NY	SE Shinnecock Inlet, NY	NR	NR	RR	RR	Howard Svendsen	NY
"	SE Pt. Judith, RI	S Shinnecock Inlet, NY	<1	66 SW	RR	RR	Fred Gallagher	RI
"	SSW Pt. Judith, RI	S Nantucket Is., MA	24	31 E	RR	RR	Charlie Donilon	RI
"	SE Montauk Pt., NY	E Beach Haven, NJ	1	79 SW	RR	LL	Fred Deutch	NY
"	S Montauk Pt., NY	E Cape May, NJ	9	146 SW	RR	RR	Bob Carman	NY
"	SE Fire Is. Inlet, NY	S Shinnecock Inlet, NY	11	18 SE	RR	RR	Steve Carmadese	NY
"	E Shark River Inlet, NJ	S Fire Is. Inlet, NY	2	35 W	RR	RR	Ed Unkel	NY
"	E Beach Haven, NJ	E Cape Hatteras, NC	10	285 SW	RR	LL	Jerry Angelini	NJ
"	S Block Is., RI	SE Montauk Pt., NY	21	38 N	RR	RR	Donald Blank	RI
Blue shark	NE Oregon Inlet, NC	E Shark River Inlet, NJ	25	271 NE	HL	RR	Stephen Connett	RI
"	E Shark River Inlet, NJ	SW Faial, Azores	23	1805 E	RR	LL	Jim Jolly	NY
"	SE Shinnecock Inlet, NY	E Wachapreague Inlet, VA	2	219 SW	RR	LL	Robert Bangston	NY
"	SE Montauk Pt., NY	E Ocean City, MD	23	197 SW	RR	RR	Eugene B. Artusa	NY
"	E York Harbor, ME	NW Nuevitas, Cuba	26	1323 S	RR	LL	Mark Chase	ME
"	SE Pt. Judith, RI	SE Pt. Judith, RI	<1	0	RR	RR	Stu Hummel	RI
"	E Bay Shore, NY	NW Faial, Azores	22	1558 E	LL	LL	Stephen Connett	RI
"	SE Pt. Judith, RI	SE Pt. Judith, RI	22	31 NW	HL	RR	Stephen Connett	RI
"	S Nantucket Is., MA	E Montauk Pt., NY	24	45 W	HL	RR	Stephen Connett	RI
"	SE Pt. Judith, RI	Not Reported	NR	NR	LL	LL	Stephen Connett	RI
"	E Rudee Inlet, VA	S Nantucket Is., MA	13	315 NE	HL	HL	Stephen Connett	RI
"	E Rudee Inlet, VA	S Montauk Pt., NY	13	NR	HL	LL	Stephen Connett	RI
"	E Montauk Pt., NY	SE Montauk Pt., NY	12	22 S	RR	RR	Stephan A. Roy	RI
"	S Pt. Judith, RI	SE Pt. Judith, RI	1	16 NE	RR	RR	Dana Zewinsky	RI
"	Not Reported	S Montauk Pt., NY	NR	NR	RR	RR	Perry K. Pratt	CT
"	SSE Montauk Pt., NY	S Pt. Judith, RI	25	18 E	RR	RR	Mike Brumm	NY
"	E Manasquan Inlet, NJ	S Montauk Pt., NY	12	56 NE	RR	RR	Ken Schmieder	NY
"	SE Shinnecock Inlet, NY	SE Moriches Inlet, NY	<1	10 SW	RR	RR	Gene Blau	NY
"	S Montauk Pt., NY	S Shinnecock Inlet, NY	1	33 SW	RR	RR	Doug Fogg, Sr.	CT
"	SE Pt. Judith, RI	E Cape May, NJ	3	165 SW	RR	LL	Mike Plaia	CT
Blue shark	E Rockaway Pt., NY	E Tom's River, NJ	1	68 SE	RR	LL	Anthony Squeglia	NY
"	SE Montauk Pt., NY	SE Montauk Pt., NY	10	8 SE	RR	RR	Peter Jakits	NY
"	SE Montauk Pt., NY	ESE Montauk Pt., NY	11	13 NE	RR	RR	Al Phillips, Jr.	NY
"	S Montauk Pt., NY	NE Brazil	10	3528 SE	RR	LL	Howard Kiedaisch	NY
"	S Pt. Judith, RI	SE Pt. Judith, RI	<1	46 NE	RR	RR	Durien Way	CT
"	S Montauk Pt., NY	S Montauk Pt., NY	12	1 N	RR	RR	Bill Ricca	NY
"	S Montauk Pt., NY	E Ocean City, MD	15	144 SW	RR	RR	Ben Franford	CT
"	SE Montauk Pt., NY	SE Montauk Pt., NY	11	7 SW	RR	RR	Wayne P. King	NY
"	SE Pt. Judith, RI	E Montauk Pt., NY	14	34 NW	RR	LL	Don Tortora	MA

Table 2. Tag recoveries: January-December 1993.

TAGGED	GENERAL LOCATIONS RECAPTURED	MONTHS AT LIBERTY	DIST. (MI.) AND DIR.	CAPTURE METHOD		TAGGED BY		RESIDENCE
				TAG.	REC.	TAGGER		
Blue shark	S Shinnecock Inlet, NY	SE Montauk Pt., NY	9	53 NE	RR	RR	Tom Cashman	NY
"	E Sandy Hook, NJ	E Sandy Hook, NJ	<1	8 NW	RR	RR	Tom Cashman	NY
"	Not Reported	S Montauk Pt., NY	NR	NR	RR	RR	Frank Egitto	NY
"	E Montauk Pt., NY	E Oregon Inlet, NC	5	499 SW	FS	LL	James Nelson	RI
"	E Boston, MA	SE Montauk Pt., NY	8	135 SW	RR	RR	Mark Chase	ME
"	SE Cape Elizabeth, ME	SE Cape Elizabeth, ME	13	4 W	RR	RR	Rich Provencher	ME
"	S Pt. Judith, RI	SE Pt. Judith, RI	1	18 E	RR	RR	Jim Noon	RI
"	SE Pt. Judith, RI	SE Pt. Judith, RI	<1	3 NE	RR	RR	Andy Dangelo	RI
"	SE Ocean City, MD	E Babylon, NY	<1	211 NE	RR	RR	Mark Sampson	MD
"	S Montauk Pt., NY	SE Pt. Judith, RI	<1	39 NE	RR	RR	Frank Braddick	NY
"	S Montauk, NY	S Montauk Pt., NY	<1	7 S	RR	RR	Frank Braddick	NY
"	S Algarve, Portugal	W Sao Vicente, Portugal	15	266 W	RR	LL	Ric Fuller	Portugal
"	S Algarve, Portugal	WSW Peniche, Portugal	15	123 NW	RR	LL	Ric Fuller	Portugal
"	NE York Harbour, ME	N San Juan, Puerto Rico	9	1124 S	RR	LL	Richard Provencher	ME
"	SE Saco, ME	SE Fire Is. Inlet, NY	11	218 SW	RR	RR	Ian Bexon	ME
"	S Montauk Pt., NY	S Cape Sable, NS, Canada	16	248 E	RR	LL	Frank Braddick	NY
"	S Pt. Judith, RI	Not Reported	NR	NR	RR	RR	Jim Bohara	CT
"	SE Block Is., RI	E Shark River Inlet, NJ	9	81 SW	RR	RR	Alex Maggiori	MA
"	SE Block Is., RI	E Tom's River, NJ	1	65 S	RR	LL	Rich Templeton	RI
"	Not Reported	SE Pt. Judith, RI	NR	NR	RR	RR	Rocco D'Angelo	RI
Blue shark	W Madeira Is. Portugal	W Dakar, Senegal	4	1476 SW	FS	LL	Roddy Hays	Portugal
"	NE Georgetown, Guyana	W St. Vincent, W.I.	6	374 NW	LL	LL	Alex Sutton	NY
"	SE Pt. Judith, RI	SE Pt. Judith, RI	9	24 E	RR	HL	Kenneth O. Court	RI
"	NW Provincetown, MA	NW Provincetown, MA	<1	2 W	RR	HL	Putnam Maclean	MA
"	S Shinnecock Inlet, NY	S Montauk Pt., NY	<1	68 NE	RR	RR	Bruce Weisinger	NY
"	S Cape Race, NF, Canada	E Sable Is., Canada	1	383 NW	LL	LL	John W. Caldwell	FL
"	E Wachapreague Inlet, VA	S Cape Sable, NS, Canada	16	352 NE	RR	LL	Billy Verbanas	DE
"	Not Reported	SW Montauk Pt., NY	NR	NR	RR	RR	John Simone	NJ
"	ESE Indian River Inlet, DE	SE Montauk Pt., NY	12	184 NE	RR	RR	Louis B. Hirst	NJ
"	S Algarve, Portugal	Ayamonte, Gulf of Cadiz	<1	58 SE	RR	LL	Graeme Pullen	England
"	Not Reported	NE La Guaira, Venezuela	NR	NR	RR	RR	Barton A. Forbes	ME
"	SE Montauk Pt., NY	SE Fire Is. Inlet, NY	3	70 SW	RR	RR	Steve Szoke	NY
"	E Shinnecock Inlet, NY	E Montauk Pt., NY	1	14 N	RR	RR	Steve Szoke	NY
"	S Shinnecock Inlet, NY	E Shark River Inlet, NJ	<1	24 W	RR	RR	Lou Evers	NY
"	S Montauk Pt., NY	E Montauk Pt., NY	12	62 E	RR	RR	Ted Maquire	NY
"	E Wachapreague Inlet, VA	SE Cape Sable, NS, Canada	13	512 NE	RR	LL	Billy Verbanas	DE
"	E Wachapreague Inlet, VA	E Montauk Pt., NY	13	222 NE	RR	RR	Billy Verbanas	DE
"	S Vilamoura, Portugal	NE Sao Miguel, Azores	1	700 NW	RR	GN	Ric Fuller	Portugal
"	E Wachapreague Inlet, VA	SW Dakar, Senegal	9	3366 SE	RR	LL	Billy Verbanas	DE
"	E Wachapreague, VA	SE Cape Sable, NS, Canada	12	521 NE	RR	LL	Bill Verbanas	DE
Blue shark	E Wachapreague Inlet, VA	E Cape Hatteras, NC	10	171 SW	RR	LL	Billy Verbanas	DE
"	E Pt. Pleasant, NJ	E Sandy Hook, NJ	1	25 N	RR	RR	Dan Schloman	NY
"	E Flemish Cap	S Flemish Cap	8	208 S	LL	LL	Alex Sutton	NY
"	S Cape Race, NF, Canada	S Cape Farvel, Greenland	13	997 N	LL	LL	Scott Drabinowicz	MA
"	E Pesaro, Italy	E Rimini, Italy	<1	14 E	RR	LL	M. Cardimali, BGI	Italy
"	E Cape Race, NF, Canada	W Sable Is., NS, Canada	11	785 W	LL	LL	John Caldwell	FL
"	E Cape Race, NF, Canada	E Cape Sable, NS, Canada	11	896 W	LL	LL	John Caldwell	FL
"	SE Jones Inlet, NY	SE Cape Sable, NS, Canada	11	410 E	RR	LL	Al Nawroth	NY
"	SE Jones Inlet, NY	E Jones Inlet, NY	<1	34 NE	RR	RR	Gary Blackder	NY
"	W Madeira Isl., Portugal	N Dakar, Senegal	4	465 S	RR	LL	Roddy Hays	Portugal
"	E Beach Haven, NJ	E Townsends Inlet, NJ	1	28 S	RR	RR	Dennis S. Pawlak	NJ
"	SE Shinnecock Inlet, NY	NW Faial, Azores	9	1470 E	RR	LL	Robert L. Greene	MA
"	SE Pt. Judith, RI	SE Cape Sable, NS, Canada	9	290 E	HL	LL	Stephen Connelt	RI
"	E Fire Is. Inlet, NY	S Montauk Pt., NY	9	80 W	LL	RR	Stephen Connelt	RI
"	SE Pt. Judith, RI	S Cape Sable, NS, Canada	1	278 E	HL	LL	Stephen Connelt	RI
"	SE Pt. Judith, RI	SE Montauk Pt., NY	10	72 W	LL	RR	Stephen Connelt	RI
"	S Pt. Judith, RI	E Beach Haven, NJ	<1	81 SW	LL	RR	Stephen Connelt	RI
"	E Wachapreague Inlet, VA	SE Pt. Judith, RI	13	230 NE	RR	RR	Billy Verbanas	DE
"	SE Montevideo, Uruguay	SE Rio de Janeiro, Brazil	9	1032 NE	LL	LL	Butch Winter	FL
"	E Jones Inlet, NY	E Ocean City, MD	1	143 SW	RR	RR	Don Van de Water	NY
Blue shark	SE Shinnecock Inlet, NY	ESE Cape May, NJ	11	141 SW	RR	RR	Bill Williams	NY
"	SE Fire Is. Inlet, NY	SSE Fire Is. Inlet, NY	<1	46 SW	RR	RR	Andy Becker	NY
"	SE Fire Is. Inlet, NY	SE Fire Is. Inlet, NY	<1	17 SW	RR	RR	Thomas Kiernan	NY
"	S Montauk Pt., NY	SE Pt. Judith, RI	12	35 NE	RR	RR	Dennis Vlakakis	CT
"	SW Montauk Pt., NY	SE Pt. Judith, RI	1	80 E	RR	RR	Bob Higgins	MA
"	SW Montauk, NY	E Tom's River, NJ	11	28 SW	RR	RR	Pete Scelfo	NY
"	E Beach Haven, NJ	SE Jones Inlet, NY	1	45 NE	RR	RR	Joe McDonald	NJ
"	E Beach Haven, NJ	E Ocean City, MD	2	97 SW	RR	RR	Joe McDonald	NJ
"	SE Fire Is. Inlet, NY	SSE Ocean City, MD	5	193 SW	RR	LL	Tom Boniberger	NY
"	SW Montauk Pt., NY	SW Montauk Pt., NY	10	14 NE	RR	RR	Tom Boniberger	NY
"	SE Jones Inlet, NY	SE Moriches Inlet, NY	<1	30 NE	FS	RR	Larry Fiesta	NY
"	E Barnegat Inlet, NJ	E Ocean City, MD	2	92 SW	RR	RR	Larry Fiesta	NY
"	SSE Montauk Pt., NY	SE Pt. Judith, RI	10	47 NE	RR	RR	Harry Clemenz	NY
"	SW Montauk, NY	SE Fire Is. Inlet, NY	<1	32 SW	RR	RR	Bill Ducci	CT
"	ESE Montauk Pt., NY	E Provincetown, MA	4	119 NE	RR	LL	Bill Ducci	CT
"	S Montauk Pt., NY	SW Montauk Pt., NY	<1	16 NW	RR	RR	Fred Wedley	NY
"	SSW Pt. Judith, RI	NE Cumana, Venezuela	10	1815 S	RR	LL	Charlie Donilon	RI
"	E Mays Landing, NJ	S Montauk Pt., NY	8	64 N	LL	RR	J. Harrington, NMFS Obs.	MA
"	E Cape Race, NF, Canada	SE Cape Race, NF, Canada	13	361 W	LL	LL	S. Soares, NMFS Obs.	MA
"	Not Reported	E Manasquan Inlet, NJ	NR	NR	RR	LL	Ilario Circoستا	MA
Blue shark	SE Pt. Judith, RI	S Shinnecock Inlet, NY	<1	85 SW	RR	RR	Ilario Circoستا	MA
"	S Pt. Judith, RI	SE Pt. Judith, RI	<1	36 E	RR	RR	Jack Salisbury	CT
"	SE Pt. Judith, RI	S Montauk Pt., NY	12	40 SW	RR	RR	Kelly Smith	CT
"	SE Moriches Inlet, NY	SE Moriches Inlet, NY	<1	7 NE	RR	RR	Wain Carlough	NY
"	SE Moriches Inlet, NY	S Shinnecock Inlet, NY	<1	17 N	RR	RR	Wain Carlough	NY
"	E Saco River, ME	SE Pt. Judith, RI	10	159 S	RR	RR	Ernie Johnson	ME
"	Not Reported	S Jones Inlet, NY	NR	NR	RR	RR	Jarrod Flecher	NY
"	S Pt. Judith, RI	E Cape Sable, NS, Canada	5	533 E	RR	LL	Paul Pessollano	CT
"	E Saco River, ME	SE Punta Maisi, Cuba	15	1409 S	RR	LL	Duke Lovelore	CT

Table 2. Tag recoveries: January-December 1993.

	GENERAL LOCATIONS		MONTHS AT LIBERTY	DIST. (MI.) AND DIR.	CAPTURE METHOD		TAGGED BY	
	TAGGED	RECAPTURED			TAG.	REC.	TAGGER	RESIDENCE
<i>Blue shark</i>	E Montauk Pt., NY	E Montauk Pt., NY	<1	23 E	RR	RR	Bruce Baxter	CT
" "	Not Reported	SE Fire Is. Inlet, NY	NR	NR	RR	RR	Alfred D. Dobras	CT
" "	SE Pt. Judith, RI	N Cumana, Venezuela	4	1767 S	RR	LL	Thomas Birch	MA
" "	SE Pt. Judith, RI	E Tom's River, NJ	2	60 SW	RR	RR	Henry Urbaniak	RI
" "	SE Martha's Vineyard, MA	SE Pt. Judith, RI	12	12 SW	RR	RR	Tony Tolentino	MA
" "	SE Pt. Judith, RI	S Martha's Vineyard, MA	NR	17 NE	RR	RR	Tony Tolentino	MA
" "	SE Montauk Pt., NY	SE Fire Is. Inlet, NY	<1	67 SW	RR	RR	Hal Weissman	NY
" "	SE Montauk Pt., NY	SE Montauk Pt., NY	10	14 E	RR	RR	Harry McAllister	NY
" "	SE Pt. Judith, RI	E Tom's River, NJ	1	179 E	RR	LL	Russel C. Everett	CT
" "	S Pt. Judith, RI	S Pt. Judith, RI	<1	16 N	RR	RR	Richard Jensen	NY
" "	S Montauk Pt., NY	S Montauk Pt., NY	<1	18 W	RR	RR	Barry Bordner	MA
" "	S Pt. Judith, RI	E Barnegat Inlet, NJ	NR	59 S	RR	LL	Richard Warren	RI
" "	SE Shinnecock Inlet, NY	SE Block Is., RI	2	48 NE	RR	RR	Bill Williams	NY
" "	S Pt. Judith, RI	E Tom's River, NJ	1	63 S	RR	LL	Joe Pagano	RI
" "	E Montauk, NY	E Indian River Inlet, DE	2	181 SW	RR	TN	Gregg Skomal	MA
" "	E Montauk Pt., NY	Not Reported	NR	NR	RR	RR	Gregg Skomal	MA
" "	E Montauk Pt., NY	S Pt. Judith, RI	<1	9 S	RR	RR	Gerald Leonard	MA
" "	ESE Montauk Pt., NY	W Cape Sable, NS, Canada	2	217 NE	RR	LL	Bill Ricca	NY
" "	S Montauk Pt., NY	SE Montauk Pt., NY	<1	17 NE	RR	RR	Carl Safina	NY
" "	E Montauk Pt., NY	SE Block Is., RI	<1	12 E	RR	RR	Carl Safina	NY
<i>Blue shark</i>	S Pt. Judith, RI	S Shinnecock Inlet, NY	<1	50 SW	RR	RR	Ed Abbenante	RI
" "	S Montauk Pt., NY	SE Shinnecock Inlet, NY	1	18 W	RR	RR	Tom Birch	MA
" "	SW Montauk Pt., NY	E Montauk Pt., NY	<1	79 NE	RR	RR	Tom Cashman	NY
" "	E Shinnecock Inlet, NY	E Shinnecock Inlet, NY	<1	9 W	FS	RR	Rodman Sykes	RI
" "	E Pt. Judith, RI	S Cape Sable, NS, Canada	3	99 NE	FS	LL	Rodman Sykes	RI
" "	E Wachapreague Inlet, VA	E Ocean City, MD	12	29 N	RR	RR	Billy Verbanas	DE
" "	E Wachapreague Inlet, VA	E Indian River Inlet, DE	9	49 N	FS	RR	Billy Verbanas	DE
" "	E Wachapreague Inlet, VA	S Montauk Pt., NY	1	199 NE	RR	RR	Billy Verbanas	DE
" "	SW Shinnecock Inlet, NY	SW Shinnecock Inlet, NY	<1	3 E	RR	RR	Tony Sguiglia	NY
" "	SE Montauk Pt., NY	E Townsends Inlet, NJ	1	107 S	RR	LL	Doug Colbath	NY
" "	SE Pt. Judith, RI	SE Pt. Judith, RI	<1	3 W	RR	RR	Jack Demers	RI
" "	SE Pt. Judith, RI	SE Pt. Judith, RI	1	4 N	LL	RR	Stephen Connnett	RI
" "	S Nantucket Is., MA	E Cape Sable, NS, Canada	1	328 NE	HL	LL	Stephen Connnett	RI
" "	S Nantucket Is., MA	E York Haror, ME	1	155 N	LL	RR	Stephen Connnett	RI
" "	S Montauk Pt., NY	S Montauk Pt., NY	<1	20 N	RR	RR	Fred Wadley	NY
" "	S Pt. Judith, RI	SE Portsmouth, NH	2	139 NE	RR	RR	Rod MacLeod	CT
" "	SW Shinnecock Inlet, NY	SW Shinnecock Inlet, NY	<1	1 E	RR	RR	Andy Becker	NY
" "	S Shinnecock Inlet, NY	E Ocean City, MD	<1	105 S	RR	RR	Andy Becker	NY
" "	E Tom's River, NJ	Not Reported	NR	NR	RR	RR	Andy Becker	NY
" "	S Pt. Judith, RI	SE Pt. Judith, RI	1	19 N	RR	RR	Jim Noon	RI
<i>Blue shark</i>	E York Harbor, ME	S Cape Sable, NS, Canada	3	210 SE	RR	LL	Bill Keiton	ME
" "	S Montauk Pt., NY	E Wachapreague Inlet, VA	8	194 SW	RR	RR	Bill Ricca	NY
" "	S Montauk Pt., NY	SSE Shinnecock Inlet, NY	2	49 S	RR	RR	Frank Fasanella	CT
" "	E Salem, MA	E Indian River Inlet, DE	7	281 SE	RR	LL	John Shea	NH
" "	S Pt. Judith, RI	E Montauk Pt., NY	<1	7 NE	RR	RR	Jeff Eckhart	CT
" "	SSW Pt. Judith, RI	E Cape Elizabeth, ME	2	182 NE	RR	RR	Charlie Donilon	RI
" "	SW Pt. Judith, RI	SE Pt. Judith, RI	<1	39 NE	FS	RR	Charlie Donilon	RI
" "	SW Pt. Judith, RI	S Pt. Judith, RI	<1	20 E	FS	RR	Charlie Donilon	RI
" "	SW Pt. Judith, RI	S Nantucket, MA	<1	88 E	FS	RR	Charlie Donilon	RI
" "	SE Portland, ME	W Sao Vicente, Portugal	14	2360 E	RR	LL	Michael Ellsmore	ME
" "	SE Pt. Judith, RI	SE Pt. Judith, RI	<1	5 S	RR	RR	Gerald Ruest	RI
" "	SE Pt. Judith, RI	S Pt. Judith, RI	<1	8 S	RR	RR	Gerald Ruest	RI
" "	SE Pt. Judith, RI	S Montauk Pt., NY	<1	75 SW	RR	LL	Ralph Carlson, Jr.	RI
" "	SE Pt. Judith, RI	S Block Is., RI	<1	15 SW	RR	RR	George Broullette	RI
" "	SE Pt. Judith, RI	S Block Is., RI	<1	13 SW	RR	RR	George Broullette	RI
" "	SE Pt. Judith, RI	SE Pt. Judith, RI	<1	10 SE	RR	RR	George Broullette	RI
" "	E York Harbor, ME	SSW Pt. Judith, RI	9	162 SW	RR	RR	Ian Bexon	ME
" "	E Bay Shore, NY	SE Pt. Judith, RI	2	40 NE	RR	RR	Robert Butler	ME
" "	S Montauk Pt., NY	SW Montauk Pt., NY	1	16 W	RR	RR	Robert Butler	MA
" "	SE Shinnecock Inlet, NY	SE Pt. Judith, RI	2	62 NE	RR	RR	Bill Williams	NY
<i>Blue shark</i>	SE Pt. Judith, RI	S Pt. Judith, RI	<1	29 W	RR	RR	Bill Della Valle	RI
" "	SE Pt. Judith, RI	SE Pt. Judith, RI	1	8 NW	RR	RR	Bill Della Valle	RI
" "	SE Saco, ME	E Cape Elizabeth, ME	<1	21 NE	RR	RR	Todd Stewart	ME
" "	E Portsmouth, NH	SE Cape Sable, NS, Canada	2	278 E	RR	LL	Rich Provencher	ME
" "	S Seguin Is, ME	E Seguin Is., ME	<1	37 NE	RR	RR	Mark Chase	ME
" "	E Saco River, ME	SE Cape Sable, NS, Canada	3	293 SE	RR	LL	Mark Chase	ME
" "	S Montauk Pt., NY	Not Reported	<1	NR	RR	RR	Frank Braddick	NY
" "	S Montauk Pt., NY	S Montauk Pt., NY	1	20 W	RR	RR	Frank Braddick	NY
" "	SE Fire Is. Inlet, NY	SE Montauk Pt., NY	<1	57 NE	RR	RR	Tom Boniberger	NY
" "	SE Fire Is. Inlet, NY	SE Pt. Judith, RI	1	88 NE	RR	RR	Tom Boniberger	NY
" "	E Tobago	SE Sable Is., Canada	6	1996 N	LL	LL	Alex Sutton	NY
" "	NE Georgetown, Guyana	E Cape Sable, NS, Canada	5	2059 N	LL	LL	Alex Sutton	NY
" "	SE Cape Race, NF, Canada	S Cape Sable, NS, Canada	<1	749 W	LL	LL	John Caldwell	FL
" "	Not Reported	W Cabo Finisterre, Spain	NR	NR	LL	LL	J. R. Martins Machado	Portugal
" "	NW Flores, Azores	W Sao Vicente, Portugal	8	1086 E	LL	LL	Andy Kingman	RI
" "	NW Flores, Azores	SW Rochefort, France	4	1518 E	LL	LL	Andy Kingman	RI
" "	E Ocean City, MD	SE Pt. Judith, RI	2	193 NE	RR	RR	T. V. Wood, III	PA
" "	E Beach Haven, NJ	S Moriches Inlet, NY	<1	75 NE	RR	RR	Ed Padewski	NJ
" "	S Montauk Pt., NY	S Montauk Pt., NY	<1	20 E	RR	RR	Ray Hendrickson	NY
" "	SE Shinnecock Inlet, NY	S Montauk Pt., NY	<1	13 SE	RR	RR	Barry Barth	NY
<i>Blue shark</i>	SE Pt. Judith, RI	SE Pt. Judith, RI	<1	0	HL	HL	Stephen Connnett	RI
" "	SE Pt. Judith, RI	SE Montauk Pt., NY	2	56 W	LL	RR	Stephen Connnett	RI
" "	SE Pt. Judith, RI	E Little Egg Inlet, NJ	5	110 SW	LL	LL	Stephen Connnett	RI
" "	S Martha's Vineyard, MA	SE Pt. Judith, RI	<1	15 SE	RR	RR	Daniel James Wright	MA
" "	E Barnegat Inlet, NJ	S Cape Sable, NS, Canada	3	280 NE	LL	LL	B. Bernatonis, NMFS Obs.	FL
" "	SE Pt. Judith, RI	SE Pt. Judith, RI	<1	4 S	RR	RR	Robert Hannah	RI
" "	S Montauk, NY	S Montauk Pt., NY	<1	5 SE	RR	RR	John Manarle	NY
" "	SE Shinnecock Inlet, NY	S Shinnecock Inlet, NY	1	28 SW	RR	RR	John Manarle	NY
" "	S Montauk Pt., NY	E Montauk Pt., NY	2	21 NE	RR	RR	Frank Fasanella	CT

Table 2. Tag recoveries: January-December 1993.

TAGGED	GENERAL LOCATIONS		MONTHS AT LIBERTY	DIST. (MI.) AND DIR.	CAPTURE METHOD		TAGGED BY	RESIDENCE
	TAGGED	RECAPTURED			TAG. REC.	TAGGER		
<i>Blue shark</i>	S Montauk Pt., NY	SE Pt. Judith, RI	2	55 NE	RR	RR	Mike Brumm	NY
"	S Montauk Pt., NY	SE Montauk Pt., NY	2	119 SE	RR	LL	Mike Brumm	NY
"	S Montauk Pt., NY	S Moriches Inlet, NY	2	43 W	RR	RR	Mike Brumm	NY
"	S Montauk Pt., NY	S Shinnecock Inlet, NY	<1	37 W	RR	RR	Frank Braddick	NY
"	SW Montauk Pt., NY	SE Fire Is. Inlet, NY	1	29 SW	RR	RR	Bill Ricca	NY
"	SE Montauk Pt., NY	S Pt. Judith, RI	1	11 N	RR	RR	Norm Paulin	CT
"	SW Montauk Pt., NY	SE Pt. Judith, RI	1	50 NE	RR	RR	Otto Haselman	NY
"	SE Jones Inlet, NY	SE Fire Is. Inlet, NY	<1	13 SE	RR	RR	Arthur Hoerning	NY
"	SE Montauk Pt., NY	SE Pt. Judith, RI	<1	26 E	RR	RR	Norm Poulin	CT
"	SE Montauk Pt., NY	E Jones Inlet, NY	1	33 SW	RR	RR	Joe McBride	NY
"	SW Montauk Pt., NY	SE Montauk Pt., NY	<1	43 E	RR	RR	Bill Ducci	CT
"	S Montauk Pt., NY	SE Pt. Judith, RI	1	67 NE	RR	RR	Ben Franford	CT
"	S Montauk Pt., NY	SE Pt. Judith, RI	<1	64 E	RR	HL	John Vaughan	NY
"	S Seguin Is., ME	S Cape Sable, NS, Canada	2	205 SE	RR	LL	Frank Bean	ME
"	SE Pt. Judith, RI	E Pt. Pleasant, NJ	<1	52 S	RR	LL	Phillip Randolph	RI
"	SE Montauk Pt., NY	E Pt. Judith, RI	1	32 N	RR	RR	Frank Fasanella	CT
"	E Montauk Pt., NY	SE Pt. Judith, RI	<1	8 NE	RR	RR	Carl Safina	NY
"	SE Moriches Inlet, NY	SW Montauk Pt., NY	<1	18 E	RR	RR	John Manarte	NY
"	SE Pt. Judith, RI	SE Sandy Hook, NJ	1	142 W	FS	RR	Sandy Ballou	RI
"	SE Pt. Judith, RI	SE Pt. Judith, RI	1	7 SE	RR	RR	Andy Dangelo	RI
<i>Blue shark</i>	SSE Pt. Judith, RI	SE Pt. Judith, RI	<1	24 E	FS	RR	Charlie Donilon	RI
"	SSE Pt. Judith, RI	S Cape Sable, NS, Canada	4	280 E	FS	LL	Charlie Donilon	RI
"	Not Reported	SE Pt. Judith, RI	NR	NR	RR	RR	Steven R. West	RI
"	S Pt. Judith, RI	SE Ocean City, MD	4	229 SW	RR	LL	Jim Noon	RI
"	E Sandy Hook, NJ	SE Montauk Pt., NY	1	69 E	RR	RR	Alfred Rossi	NY
"	SE Montauk Pt., NY	E Tom's River, NJ	<1	46 S	RR	LL	John Schoen	NY
"	Not Reported	SE Fire Is. Inlet, NY	NR	NR	RR	RR	Wayne King	NY
"	SE Pt. Judith, RI	E Jones Inlet, NY	3	56 SW	RR	RR	George Brouillette	RI
"	S Pt. Judith, RI	E Wachapreague Inlet, VA	4	244 SW	RR	LL	Joe Pagano	RI
"	E Montauk Pt., NY	SE Montauk Pt., NY	1	49 W	RR	RR	Peter Phillips	MA
"	NE Plymouth, MA	Curacao	3	1781 S	RR	LL	Clarence Olson	MA
"	E Wachapreague Inlet, VA	E Ocean City, MD	<1	74 NE	RR	LL	Billy Verbanas	DE
"	S Seguin Is., ME	S Pemaquid Pt., ME	<1	7 E	RR	RR	Frank Bean	ME
"	Gulf of Maine	La Guajira, Colombia	NR	NR	RR	LL	Mark Elliott	ME
<i>Tiger shark</i>	E Barnegat Inlet, NJ	S Pt. Judith, RI	131	118 NE	RR	LL	Bill Darney	NJ
"	NE Ponce Inlet, FL	Not Reported	NR	NR	LL	LL	Tris Colket	FL
"	E Beach Haven, NJ	E Morehead City, NC	5	316 SW	RR	LL	George Molnar	NY
"	E Ponce Inlet, FL	NE Ponce Inlet, FL	10	21 W	LL	LL	Eric Sander	FL
"	NE Ponce Inlet, FL	E Oregon Inlet, NC	7	NR	LL	LL	Eric Sander	FL
"	E Ponce Inlet, FL	E Cape Fear, NC	10	330 NE	LL	LL	Eric Sander	FL
"	E Ponce Inlet, FL	E Ponce Inlet, FL	11	11 NW	LL	LL	Eric Sander	FL
"	E Ponce Inlet, FL	NE Ponce Inlet, FL	11	31 N	LL	LL	Eric Sander	FL
"	NE Ponce Inlet, FL	Not Reported	NR	NR	LL	LL	Eric Sander	FL
"	NE Ponce Inlet, FL	E Ponce Inlet, FL	3	11 SE	LL	LL	Eric Sander	FL
"	NE Ponce Inlet, FL	E Ponce Inlet, FL	11	18 S	LL	LL	Eric Sander	FL
"	Not Reported	NE Ponce Inlet, FL	NR	NR	RR	LL	Ben Rose	FL
"	NE Ponce Inlet, FL	NE Ponce Inlet, FL	12	12 W	LL	LL	Tris Colket	FL
"	NE Ponce Inlet, FL	N Ponce Inlet, FL	19	32 SW	LL	LL	Tris Colket	FL
"	NE St. Augustine, FL	SE Morehead City, NC	6	296 NE	LL	LL	Tris Colket	FL
"	NE Ponce Inlet, FL	NE Ponce Inlet, FL	9	11 SW	LL	LL	Tris Colket	FL
"	E. St. Augustine, FL	SE Ponce Inlet, FL	6	64 S	LL	LL	Tris Colket	FL
"	E Jacksonville, FL	NE Ponce Inlet, FL	4	55 S	LL	LL	Tris Colket	FL
"	NE St. Augustine, FL	NE Ponce Inlet, FL	7	35 S	LL	LL	Tris Colket	FL
"	NE St. Augustine, FL	E Fernandina Beach, FL	7	34 NE	LL	LL	Tris Colket	FL
<i>Tiger shark</i>	E Jacksonville, FL	E Ponce Inlet, FL	10	90 S	LL	LL	Tris Colket	FL
"	E Jacksonville, FL	E Jacksonville, FL	6	28 E	LL	LL	Tris Colket	FL
"	NE Jacksonville, FL	E Georgetown, SC	NR	210 NE	LL	LL	Tris Colket	FL
"	NE Jacksonville, FL	E Jacksonville, FL	5	32 SE	LL	LL	Tris Colket	FL
"	E Ponce Inlet, FL	E Fernandina Beach, FL	5	88 N	LL	LL	Tris Colket	FL
"	E Ponce Inlet, FL	E Ponce Inlet, FL	<1	12 S	LL	LL	Eric Sander	FL
"	E Ponce Inlet, FL	E Ponce Inlet, FL	9	13 SW	LL	LL	Tris Colket	FL
"	E St. Augustine, FL	E Jacksonville, FL	5	14 NE	LL	LL	Tris Colket	FL
"	E St. Augustine, FL	E Jacksonville, FL	5	14 NE	LL	LL	Tris Colket	FL
"	E St. Augustine, FL	NE Ponce Inlet, FL	3	24 SE	LL	LL	Tris Colket	FL
"	E Ponce Inlet, FL	SE St. Augustine, FL	<1	42 NW	LL	LL	Eric Sander	FL
"	NE Ponce Inlet, FL	E Fernandina Beach, FL	6	72 N	LL	LL	Eric Sander	FL
"	NE Ponce Inlet, FL	NE Ponce Inlet, FL	8	11 SE	LL	LL	Eric Sander	FL
"	E Ponce Inlet, FL	E Ponce Inlet, FL	10	3 N	LL	LL	Eric Sander	FL
"	NE Jacksonville, FL	SW Cape Lookout, NC	4	259 NE	LL	LL	Tris Colket	FL
"	E Jekyll Is., GA	NE Ponce Inlet, FL	3	79 S	LL	LL	Tris Colket	FL
"	E Jekyll Is., GA	E Wassaw Sound, GA	5	111 E	LL	LL	Tris Colket	FL
"	E St. Mary's, GA	E Ponce Inlet, FL	7	99 S	LL	LL	Tris Colket	FL
"	E Jacksonville, FL	E Ponce Inlet, FL	7	83 S	LL	LL	Tris Colket	FL
"	E Jacksonville, FL	E Ponce Inlet, FL	7	83 S	LL	LL	Tris Colket	FL
<i>Tiger shark</i>	E Jacksonville, FL	E Ponce Inlet, FL	NR	NR	LL	TO	Tris Colket	FL
"	SE Rudee Inlet, VA	S Cape Lookout, NC	3	181 SW	LL	LL	Paul Puskas	NJ
"	NE Ponce Inlet, FL	E St. Augustine, FL	2	66 NE	LL	LL	Tris Colket	FL
"	NE Ponce Inlet, FL	NE Ponce Inlet, FL	<1	3 NW	LL	LL	Tris Colket	FL
"	NE Ponce Inlet, FL	S Charleston, SC	3	142 N	LL	LL	Tris Colket	FL
"	E St. Augustine, FL	E St. Augustine, FL	1	18 N	LL	LL	Tris Colket	FL
"	NE Ponce Inlet, FL	E St. Augustine, FL	1	24 SW	LL	LL	Tris Colket	FL
"	E St. Augustine, FL	E St. Augustine, FL	1	34 E	LL	LL	Tris Colket	FL
"	NE Ponce Inlet, FL	E Jacksonville, FL	1	20 NE	LL	LL	Tris Colket	FL
"	NE Ponce Inlet, FL	NE Ponce Inlet, FL	4	40 S	LL	LL	Tris Colket	FL
"	E Jacksonville, FL	NE Ponce Inlet, FL	3	43 S	LL	LL	Tris Colket	FL
"	E St. Augustine, FL	E Little River, SC	1	275 NE	LL	LL	Tris Colket	FL
"	NE Ponce Inlet, FL	E St. Simons, GA	<1	72 N	LL	LL	Tris Colket	FL
"	NE Ponce Inlet, FL	NNE Ponce Inlet, FL	1	17 W	LL	LL	Tris Colket	FL
"	SE St. Augustine, FL	E Jacksonville, FL	<1	35 NE	LL	LL	Tris Colket	FL

Table 2. Tag recoveries: January-December 1993.

	GENERAL LOCATIONS		MONTHS AT LIBERTY	DIST. (M.) AND DIR.	CAPTURE METHOD		TAGGED BY	
	TAGGED	RECAPTURED			TAG. REC.	TAGGER	RESIDENCE	
<i>Sandbar shark</i>	Gt. Machipongo Sound, VA	E Daytona Beach, FL	333	516 SW	GN	LL	Biologist (NMFS)	RI
"	E Jacksonville, FL	E Mayport, FL	1	36 NW	LL	LL	Tris Colket	FL
"	Gt. Machipongo Sound, VA	SE Key West, FL	322	838 S	GN	LL	Biologist (NMFS)	RI
"	S Shinnecock, NY	SE Hatteras Inlet, NC	NR	NR	RR	LL	John Frevola	NY
"	Not Reported	SE Galveston, TX	NR	NR	RR	LL	John Baumann	NY
"	S Fire Is. Inlet, NY	E Stuart, FL	117	849 SW	RR	LL	Lewis Liebetroth	NY
"	SSE Barnegat Inlet, NJ	S Cape Lookout, NC	90	360 SW	RR	LL	Roy A. Rapp	NJ
"	SE Oregon Inlet, NC	NE Cape Canaveral, FL	107	494 SW	LL	LL	Stephen Connell	RI
"	Not Reported	SE Cape Hatteras, NC	NR	NR	RR	LL	Bruce R. Haase	FL
"	E Jones Inlet, NY	E Jacksonville, FL	154	738 SW	RR	LL	R. C. Flanagan	CT
"	SE Montauk Pt., NY	NW Cape Sable, FL	127	1377 S	RR	LL	Jim Hunt	NY
"	S Pt. Judith, RI	E Morehead City, NC	57	388 SW	RR	LL	Bruce Reynolds	ME
"	SE Fire Is. Inlet, NY	S Big Pine Key, FL	102	1043 S	RR	LL	John T. Voltz	NY
"	E Shark River Inlet, NJ	W Panama City Bch, FL	132	1600 S	RR	LL	James Biehl	NY
"	SW Shinnecock Inlet, NY	E Cape Fear, NC	128	460 SW	RR	LL	William Velys	NY
"	E Manasquan Inlet, NJ	SE Cape Hatteras, NC	115	315 S	RR	LL	Martin Schmidt	NJ
"	Not Reported	E Beaufort Inlet, NC	NR	NR	RR	LL	John Cronley	NJ
"	SE Jones Inlet, NY	SE Cape Hatteras, NC	92	325 S	RR	LL	Richard Carpenter	NY
"	E Wachapreague Inlet, VA	SW Cape Lookout, NC	104	250 SW	LL	LL	Biologist (NMFS)	RI
"	E Ponte Vedra Beach, FL	E Daytona Beach, FL	95	196 W	LL	LL	R. Matus, NMFS Obs.	MA
<i>Sandbar shark</i>	SE Moriches, NY	S St. Petersburg, FL	92	1354 S	RR	LL	Dan Azzalo	NY
"	E Sandy Hook, NJ	SE Hatteras Inlet, NC	68	337 S	RR	LL	Robert Burgess	NY
"	E Oregon Inlet, NC	E Charleston, SC	83	NR	LL	LL	Biologist (NMFS)	RI
"	SE Shinnecock Inlet, NY	S Pensacola, FL	67	1637 S	RR	LL	Bill Williams	NY
"	E Sandy Hook, NJ	NW St. Petersburg, FL	83	1470 S	LL	LL	Biologist (NMFS)	RI
"	E Ponce Inlet, FL	E Avon, NC	75	481 NE	LL	LL	Tris Colket	FL
"	E Shinnecock Inlet, NY	W Cape Sable, FL	65	1303 S	RR	LL	Carl Safina	NY
"	ESE Manasquan Inlet, NJ	E Southport, NC	11	371 S	RR	LL	Kevin Delaney	NJ
"	E Rudee Inlet, VA	S Panama City, FL	56	1276 SW	RR	LL	John W. Thurston, Jr.	VA
"	E Ocean City, MD	SE Cape Canaveral, FL	138	670 SW	RR	LL	Mark Sampson	MD
"	SE Fire Is. Inlet, NY	SW Cape Lookout, NC	30	427 SW	RR	LL	John N. Raguso	NY
"	E Shark River Inlet, NJ	SW Cape Lookout, NC	54	449 SW	RR	LL	Pete Mikoleski	NY
"	NE Ponce Inlet, FL	NE Cape May, NJ	17	659 NE	LL	LL	John Fraser	FL
"	E Wildwood, NJ	NW St. Petersburg, FL	25	1374 S	RR	LL	John Cooper	NJ
"	SE Montauk Pt., NY	SE Cape Hatteras, NC	44	387 SW	RR	LL	Stret Whiting	NY
"	E Jones Inlet, NY	E Cape Hatteras, NC	55	327 SW	RR	LL	Gary Nodina	NY
"	SE Montauk, NY	SW Cedar Key, FL	58	1547 SW	RR	LL	Joe Tota	NY
"	NE Oregon Inlet, NC	SE Cape Hatteras, NC	46	54 S	LL	LL	Stephen Connell	RI
"	S Cape Florida, FL	SE Oregon Inlet, NC	46	679 NE	LL	LL	Biologists (NMFS)	RI
"	SW Cape Lookout, NC	S Cape Hatteras, NC	45	56 NE	LL	LL	Biologist (NMFS)	RI
<i>Sandbar shark</i>	E Montauk Pt., NY	NE Jacksonville Beach, FL	41	742 SW	RR	LL	Brian McNulty	RI
"	E Manasquan Inlet, NJ	S Cape Hatteras, NC	43	323 S	RR	LL	Murray LaBarr	NJ
"	SE Fire Is. Inlet, NY	Griswold Pt., CT	25	64 NE	RR	RR	Dennis Messina	NY
"	E Manasquan Inlet, NJ	E Cape Hatteras, NC	32	323 S	RR	LL	Rich Schneider	NJ
"	E Shark River Inlet, NJ	E Georgetown, SC	31	468 SW	RR	LL	Rich Schneider	NJ
"	Chesapeake Bay, VA	NW Cape Henry, VA	1	8 S	RR	RR	Richard T. Falls	VA
"	Not Reported	S Pt. Judith, RI	NR	NR	RR	LL	Paul Treue	NJ
"	SE Ocean City, MD	SW Dry Tortugas, FL	31	1027 SW	RR	LL	Larry Culp	MD
"	E Manasquan Inlet, NJ	S Cape Hatteras, NC	20	329 S	RR	LL	Rich Schneider	NJ
"	E Shark River Inlet, NJ	NW Cape Hatteras, NC	19	307 S	RR	LL	Rich Schneider	NJ
"	SE Wachapreague Inlet, VA	E Stuart, FL	17	649 SW	LL	LL	Steve Branstetter	FL
"	E Manasquan Inlet, NJ	Not Reported	17	NR	RR	LL	George Molnar	NY
"	Hog Is., VA	SW Cape Lookout, NC	8	195 S	GN	LL	Carter Bundick	VA
"	NE Ponce Inlet, FL	N Ponce Inlet, FL	19	58 N	LL	LL	Eric Sander	FL
"	Beaufort, SC	S Panama City, FL	9	996 SW	RR	LL	Al Kolberg	SC
"	E Rudee Inlet, VA	E Oregon Inlet, NC	22	78 S	LL	LL	Biologist (NMFS)	RI
"	SE Ocean City, MD	E Barnegat Inlet, NJ	1	112 N	RR	LL	Mark Sampson	MD
"	SE Charleston, SC	Cape Canaveral, FL	NR	259 S	RR	LL	Ivan Schultz	SC
"	Miami Beach, FL	Cape Canaveral, FL	NR	161 N	RR	LL	Ron Schatman	FL
"	E Ocean City, MD	Beach Haven Inlet, NJ	12	85 N	RR	RR	Bill Verbanas	DE
"	W Powell Canyon	SE Cape Hatteras, NC	7	483 SW	LL	LL	Rick Ross	FL
"	NE St. Augustine, FL	St. Catherine Sound, GA	4	88 N	LL	RR	Tris Colket	FL
"	NE Ponce Inlet, FL	N Bulls Bay, SC	2	189 N	LL	GN	Tris Colket	FL
"	NE Ponce Inlet, FL	St. Simons Is., GA	3	81 NW	LL	RR	Tris Colket	FL
"	E Ocracoke, NC	Delaware Bay, NJ	4	240 N	LL	RR	Paul Puskas	NJ
"	E Shark River Inlet, NJ	SW St. Petersburg, FL	80	1380 SW	RR	LL	Bob Baltrunas	NY
<i>Shortfin mako</i>	E Barnegat Inlet, NJ	E Charleston, SC	113	696 SW	LL	RR	Jay Carner	MA
"	SE Cape Race, NF, Canada	SW Flores, Azores	4	659 SE	LL	LL	G. Hinteregger, NMFS Obs.	RI
"	SE Cape Race, NF, Canada	SE Sable Is., Canada	2	633 W	LL	LL	G. Hinteregger, NMFS Obs.	RI
"	E Cape May, NJ	SE Oregon Inlet, NC	32	205 S	RR	LL	Mark Donato	PA
"	E Tom's River, NJ	E Manasquan Inlet, NJ	23	76 W	RR	RR	Lou Pastore	NY
"	E Shark River Inlet, NJ	SW Moriches Inlet, NY	12	48 NE	RR	RR	Frank Daddio	NJ
"	E Barnegat Inlet, NJ	SE Moriches Inlet, NY	<1	45 N	RR	RR	Alan Bendersky	NY
"	Not Reported	E Cape Henry, VA	NR	NR	RR	LL	Steven R. West	MA
"	E Cape May, NJ	Not Reported	24	0	RR	LL	Rich Humphreys	NJ
"	SE Fire Is. Inlet, NY	SE Manasquan Inlet, NJ	10	47 SW	RR	RR	Vinny Pacifico	NY
"	NE Oregon Inlet, NC	E Ocean City, MD	18	126 N	LL	RR	Nelson Beldeman	NJ
"	E Ocean City, MD	E Tom's River, NJ	13	302 W	LL	RR	A. J. Surrey	NY
"	Not Reported	E Ocean City, MD	NR	NR	RR	RR	Robert Timson	NY
"	E Manasquan Inlet, NJ	E Oregon Inlet, NC	5	259 S	RR	LL	Jim Sullivan	NJ
"	E Bay Shore, NY	SE Indian River Inlet, DE	11	925 W	LL	RR	Scott Drabinowicz	MA
"	SE Oregon Inlet, NC	S Moriches Inlet, NY	2	306 N	LL	RR	Stephen Connell	RI
"	E Cape May, NJ	E Oregon Inlet, NC	2	170 S	RR	LL	Joe Lucas	PA
"	E Wachapreague Inlet, VA	E Cape Henry, VA	1	42 S	RR	RR	Robert Conrad	MD
"	E Wachapreague Inlet, VA	SE Sable Is., Canada	<1	819 NE	RR	LL	Robert Conrad	MD
"	E Tom's River, NJ	E York Harbor, ME	11	564 NE	RR	LL	Jules Eichmann	NJ
"	E Moriches Inlet, NY	SE Nantucket Is., MA	<1	253 E	RR	LL	Durien Way	CT
"	SE Montauk, NY	E Cape Sable, NS, Canada	10	374 E	RR	LL	Mike Brumm	NY
"	NE Cape Hatteras, NC	E Ocean City Inlet, MD	7	157 N	LL	RR	Jeff Jennings, NMFS Obs.	MA

Table 2. Tag recoveries: January-December 1993.

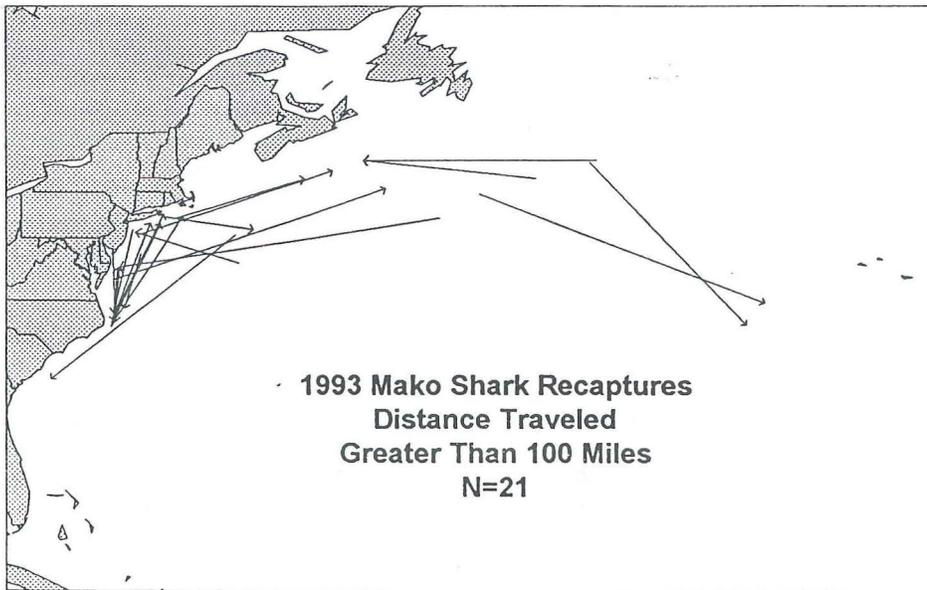
	GENERAL LOCATIONS		MONTHS AT LIBERTY	DIST. (MI.) AND DIR.	CAPTURE METHOD		TAGGED BY	
	TAGGED	RECAPTURED			TAG.	REC.	TAGGER	RESIDENCE
<i>Shortfin mako</i>	S Jones Inlet, NY	E Mays Landing, NJ	2	68 SE	RR	RR	Raymond Stanak	NY
" "	E Oregon Inlet, NC	S Montauk Pt., NY	10	346 NE	LL	RR	Paul Puskas	NJ
" "	E Cape Hatteras, NC	SE Pt. Judith, RI	5	385 NE	LL	RR	J. Harrington, NMFS Obs.	MA
" "	E Cape Hatteras, NC	SE Moriches Inlet, NY	5	342 NE	LL	RR	J. Harrington, NMFS Obs.	MA
" "	E Cape Lookout, NC	E Ocean City, MD	4	226 N	LL	RR	Ron Larson, NMFS Obs.	MA
" "	E Avon, NC	SE Cape Hatteras, NC	2	38 SW	LL	LL	Peter Scolia, NMFS Obs.	MA
" "	SE Montauk Pt., NY	S Pt. Judith, RI	<1	38 SW	RR	LL	Joe McBride	NY
" "	E Avon, NC	E Ocean City, MD	4	177 N	LL	RR	J. Harrington, NMFS Obs.	MA
" "	S Cape Race, NF, Canada	SW Flores, Azores	5	882 E	LL	LL	Alex Sutton	NY
" "	SE Cape Race, NF, Canada	SE Sable Is., Canada	2	474 W	LL	LL	Alex Sutton	NY
" "	SE Pt. Judith, RI	SW Montauk Pt., NY	<1	56 SW	RR	RR	Ted Hobert	CT
" "	SE Ocean City, MD	E Wildwood, NJ	<1	64 N	RR	RR	Mark Sampson	MD
<i>Dusky shark</i>	W Rudee Inlet, VA	SE Hatteras Inlet, NC	189	113 S	RR	LL	Bill Walker	VA
" "	NE Barnegat Inlet, NJ	E Sebastian, FL	174	817 SW	RR	LL	Jay Miller	NY
" "	SE Moriches Inlet, NY	E Ponce Inlet, FL	143	758 SW	RR	LL	Fred Wedley	NY
" "	E Rudee Inlet, VA	Holquin, Cuba	140	936 S	TN	LL	Roger Dow, NMFS Obs.	MA
" "	SW Key West, FL	E Cape Hatteras, NC	144	924 NE	LL	LL	Biologist (NMFS/SEFC)	MS
" "	SE Moriches Inlet, NY	E Daytona, FL	93	789 SW	RR	LL	James P. Becker	NY
" "	E Oregon Inlet, NC	Matamoros, Tam., Mexico	91	1672 SW	LL	LL	Biologist (NMFS)	RI
" "	E Sandy Hook, NJ	E Ponce Inlet, FL	65	771 SW	RR	LL	George J. Lucas III	NJ
" "	E Ocean City, MD	SE Rudee Inlet, VA	41	128 S	RR	TN	Henry Robbins, Jr.	NJ
" "	E Nantucket Is., MA	E Jacksonville, FL	46	931 SW	GN	LL	G. Hinteregger, NMFS Obs.	MA
" "	SE Manasquan Inlet, NJ	SE Beach Haven, NJ	50	36	RR	RR	Douglas Lombardi	NJ
" "	NE Cape May, NJ	SE Oregon Inlet, NC	30	228 S	RR	LL	Robert E. Jack	NJ
" "	Salvo, NC	E Isla Mujeres, Mexico	8	1036 SW	RR	LL	Rebecca Adams	VA
" "	SE Fire Is. Inlet, NY	E Ponce Inlet, FL	16	784 SW	RR	LL	Ed McNamara	NY
" "	S Cape May, NJ	N Bulls Bay, SC	10	401 SW	RR	GN	Bill Garrison	NJ
" "	S Ocean City, MD	SE Southport, NC	4	308 S	RR	LL	Mark Sampson	MD
<i>Blacktip shark</i>	S Savannah, GA	Fort Pierce, FL	17	234 S	RR	LL	Larry Kennedy	GA
" "	Savannah, GA	SE Ponce Inlet, FL	34	187 S	RR	LL	David DiBenedetto	GA
" "	NE Palm Beach, FL	E Cape Canaveral, FL	2	93 N	RR	RR	Gary W. Bacon	FL
" "	E Boca Raton, FL	E Ft. Lauderdale, FL	<1	15 S	RR	RR	Theodore V. Wood, III	PA
" "	SW Mobile, AL	S Texas City, TX	12	319 W	RR	RR	James Boyett, Jr.	AL
" "	Caloosahatchee River, FL	Caloosahatchee River, FL	<1	7 SW	RR	RR	Gary Bongers	FL
" "	E Cape May, NJ	E Cape May, NJ	23	6 E	RR	LL	Bill Garrison	NJ
" "	S Pine Is., FL	S Pine Is., FL	9	0	RR	GN	Leo Dunn	FL
" "	Bob Hall Pier, Padre Is., TX	Tabasco, Mexico	10	575 SE	RR	LL	Joe Hinojosa	TX
" "	SE Panama City Beach, FL	Destin, FL	1	51 W	GN	RR	Lee Trent	FL
" "	S Key West, FL	E Hollywood, FL	1	189 NE	RR	RR	A. C. Miller	FL
" "	Sabine Pass Jetties, TX	Veracruz, Mexico	2	639 S	RR	GN	Jeff Stevens	TX
" "	Matagorda Bay Jetty, TX	Port O'Conner, TX	2	7 NW	RR	RR	Mark Kelley	TX
" "	Matagorda Is., TX	NE Veracruz, Mexico	4	554 S	RR	LL	Mark Kelley	TX
" "	Matagorda Is., TX	NE Veracruz, Mexico	4	550 S	RR	LL	Mark Kelley	TX
" "	Pine Is. Sound, FL	Pine Is. Sound, FL	<1	1 N	RR	RR	Leo Dunn	FL
<i>Nurse shark</i>	Key West, FL	Key West, FL	<1	0	RR	RR	Chris Jensen	NC
" "	Key Colony Beach, FL	Key Colony Beach, FL	2	0	HL	HL	Bill Bollen	FL
" "	Fal Deer Key, FL	Marathon, FL	<1	0	HN	TO	Bill Bollen	FL
" "	Key Colony Beach, FL	Key Colony Beach, FL	3	0	RR	HL	Bill Bollen	FL
" "	Venice, FL	Venice Beach, FL	11	0	RR	RR	Bobby Spicer	FL
" "	Long Key, FL	Long Key Bridge, FL	7	2 SW	RR	RR	Matt O'Bryan	FL
" "	Long Key, FL	Bay side, Long Key, FL	7	0	RR	RR	Matt O'Bryan	FL
<i>Sc. hammerhead</i>	SSE Ponce Inlet, FL	E Ocean City, MD	63	642 NE	LL	LL	Eric Sander	FL
" "	NE Cape Hatteras, NC	SE Cape Hatteras, NC	94	35 SW	LL	LL	Biologist (NMFS)	RI
" "	NE Avon, NC	E Avon, NC	48	14 E	LL	LL	Biologist (NMFS)	RI
" "	E Oregon Inlet, NC	SE Cape Fear, NC	2	192 SW	LL	LL	J. Harrington, NMFS Obs.	MA
" "	E Beaufort, NC	SE Beaufort Inlet, NC	<1	25 SW	LL	LL	Ron Larson, NMFS Obs.	MA
<i>Porbeagle</i>	E Sandy Hook, NJ	E Halifax, NS, Canada	65	339 NE	LL	GN	G. Hinteregger, NMFS Obs.	MA
" "	SE Nantucket Is., MA	W Cape Race, NF, Canada	69	624 NE	LL	LL	Linda Craig, NMFS Obs.	MA
" "	SW Isle of Wight, England	W Rochefort, France	23	299 S	RR	LL	Denny Vokins	England
" "	S Cape Race, NF, Canada	W Cape Race, NF, Canada	15	455 NW	LL	LL	John W. Caldwell	FL
<i>Sand tiger</i>	S Wachapreague Inlet, VA	E Cape Romain, SC	21	314 SW	RR	GN	Carter Bundick	VA
" "	NE Ponce Inlet, FL	Avon, NC	18	458 NE	LL	RR	Eric Sander	FL
<i>Oc. whitetip</i>	E St. Croix, Virgin Isl.	NE Cartagena, Columbia	3	555 W	LL	LL	John Stranz	FL
" "	S Rio de Janeiro, Brazil	E Rio de Janeiro, Brazil	3	601 NE	LL	LL	Jaime Mejuto	Spain
" "	S Rio de Janeiro, Brazil	SE Rio de Janeiro, Brazil	<1	122 N	LL	LL	Jaime Mejuto	Spain
<i>Silky shark</i>	E Miami, FL	E Key Biscayne, FL	<1	8 S	RR	RR	Mark Quarliano	FL
" "	Bimini, Bahamas	E Ft. Pierce, FL	<1	112 N	RR	LL	Ron Schatman	FL
<i>Lemon shark</i>	N Bimini, Bahamas	N Bimini, Bahamas	1	1 S	RR	RR	Matt O'Bryan	FL
" "	N Bimini, Bahamas	N Bimini, Bahamas	1	0	RR	RR	Ron Schatman	FL
<i>Bull shark</i>	Buxton, NC	E Cape Romain, SC	57	235 SW	RR	GN	Arnold Farber	VA
" "	E Cocoa Beach, FL	Sebastian Creek, FL	4	23 S	LL	GN	Eric Sander	FL
<i>Atl. sharpnose</i>	NE Wachapreague Inlet, VA	N Bulls Bay, SC	33	344 SW	RR	GN	George A. Garner	VA
" "	NE Rockport, TX	S Padre Is., TX	5	129 S	RR	RR	Andrew Jenkins	TX
<i>Finetooth shark</i>	NE Palm Beach, FL	E Port Canaveral, FL	3	89 N	RR	LL	Gary W. Bacon	FL
<i>Blacknose shark</i>	Wassau Sound, GA	E Ponce Inlet, FL	42	170 S	RR	LL	David DiBenedetto	GA
<i>Thresher shark</i>	E Little Egg Inlet, NJ	ESE Cape May, NJ	50	86 SW	TN	RR	Richard Dwyer, NMFS Obs.	MA
<i>Smooth dogfish</i>	S Wachapreague Inlet, VA	E Chincoteague Is., VA	48	30 NE	LL	GN	Biologist (NMFS)	RI
<i>Hammerhead</i>	E Ocean City, MD	E Oregon Inlet, NC	16	153 S	RR	LL	Joe Viscuglia	DE
<i>Brown/Dusky shark</i>	E Avalon, NJ	E Fort Pierce Inlet, FL	52	753 SW	RR	LL	Nick Lanciano	NJ
" "	SE Indian River Inlet, DE	SE Key West, FL	22	904 SW	RR	LL	Don Evans	MD
" "	S Ocean City, MD	E Carolina Bch. Inl., NC	10	249 S	RR	LL	Mark Sampson	MD
<i>Carcharhinus</i>	SE Rudee Inlet, VA	NE Progreso, Mexico	124	1191 SW	LL	GN	Stephen Connott	RI
" "	E Little Egg Inlet, NJ	SW Havana, Cuba	51	1107 SW	RR	LL	Ronald Aareskjold	NJ
" "	Cape Point, NC	E Cape Hatteras, NC	65	20 E	RR	LL	Roland Bailey	VA
" "	SW Montauk Pt., NY	E Cape Hatteras, NC	31	338 SW	RR	LL	Jim Jolly	NY
" "	E Sandy Hook, NJ	N Vero Beach, FL	19	788 SW	RR	GN	Ed Cacioppo	NY
<i>Shark</i>	S Montauk Pt., NY	E Virginia	NR	NR	RR	LL	Tom Natoli	NY
" "	E Manasquan, NJ	Not Reported	NR	NR	RR	LL	David Mathews	NJ
" "	Looe, England	Looe, England	NR	NR	RR	TO	Ivan Chaston	England

Table 2. Tag recoveries: January-December 1993.

	GENERAL LOCATIONS		MONTHS AT LIBERTY	DIST. (MI.) AND DIR.	CAPTURE METHOD TAG. REC.	TAGGED BY		RESIDENCE
	TAGGED	RECAPTURED				TAGGER		
<i>Shark</i>	E Cape May, NJ	E Indian River Inlet, DE	69	215 W	LL	RR	Deborah Kotula	MA
"	S Montauk Pt., NY	S Cape Sable, NS, Canada	2	294 E	RR	LL	Tim Sullivan	NY
"	SE Pt. Judith, RI	E Beach Haven, NJ	<1	106 SW	RR	RR	Brian McNulty	RI
"	E Beach Haven, NJ	E Tobago	39	2069 SE	LL	LL	Ralph Tegge, NMFS Obs.	MA
"	S Pt. Judith, RI	S Montauk Pt., NY	22	44 S	RR	RR	Bob Vesch	CT
<i>Swordfish</i>	NE Oregon Inlet, NC	E Oregon Inlet, NC	106	35 S	LL	GN	M. Williamowsky, NMFS Obs.	MA
"	E Charleston, SC	SE Munson Canyon	52	676 NE	LL	GN	Charles Bergman	NJ
"	NE Flemish Cap	S Acklins Is., Bahamas	54	2287 SW	LL	LL	Charlie Johnson	ME
<i>White marlin</i>	S Mobile, AL	Not Reported	NR	NR	RR	GN	K. L. Huger	LA
<i>Atlantic Sailfish</i>	NE Miami, FL	E Ft. Lauderdale, FL	10	19 N	RR	RR	Mark Quartiano	FL
<i>Monkfish</i>	Not Reported	SE Moriches Inlet, NY	NR	NR	RR	SD	Don Clark	NY
<i>Bluefish</i>	SE New Haven Harbor, CT	S New Haven Harbor, CT	<1	9 NW	RR	RR	Tom Dornfield	CT

NOTE: FS=Free Swimming;GN=Gillnet; HL=Handline; LL=Longline; RR=Rod&Reel; SD=Scallop Dredge; TN=Trawl Net; BGI=Big Game Italia; TO=Tag Only Found; Obs=Foreign Fisheries Observer; NR=Not Reported

OVERVIEW Continued from Page 4



Mako Shark (35 Returns)

Mako sharks were at liberty for up to 9.4 years, although most (82%) were at liberty for less than 1 year. The 9.4 year recapture is the longest time at liberty recorded for a mako shark. It was tagged by an observer on a Japanese tuna vessel near Lydonia Canyon in 1983 and was recaptured off South Carolina. The previous record was 8.2 years. Nineteen of the recaptured mako sharks were originally tagged by anglers, nine by observers on commercial vessels, six by commercial fishermen, and one by a cooperating biologist. Seven (20%) of the fish were re-released with another tag or with the same tag in place.

The farthest distance traveled by a recaptured mako shark was 925 miles from an area south of the Grand Banks to Delaware in 11.3 months. Four additional makos that were tagged off the Grand Banks were also long distance returns (> 450

miles). Two were tagged on consecutive days in July of 1993 and were recaptured after 2 and 4 months at liberty. One had traveled 633 miles due west (southeast of Sable Island, Canada); the other 660 miles to the southeast of the tagging site. The other two mako sharks were tagged in June and showed a similar pattern of movement. One traveled due west and was recaptured within 1 mile of the Canadian recapture (after 2 months at liberty) and the other traveled east to within 85 miles of the second fish above (after 5 months at liberty). All of these fish were small (less than 52 in. fork length), and of both sexes. These recaptures indicate an inshore movement of mako sharks in the summer and early fall and a movement to more offshore wintering grounds in late fall and early winter (see map). This general pattern of distribution has been borne out by earlier recaptures.

The fastest rate of travel by a mako shark this year was 29.2 miles per day, which is the second fastest recorded for this species (the fastest is 35.7 miles per day).

This fish was tagged east of Wachapreague, Virginia in June of 1993 and was recaptured 28 days later off Sable Island, Canada, after traveling 819 miles.

Other Species (91 Returns)

Recaptures from other species included some long distance and maximum time at liberty records. Five **dusky sharks** were recaptured after 11.7 to 15.8 years at liberty. Of these, four were at liberty longer than any other dusky sharks previously returned in the Program. Dusky sharks traveled from North Carolina to Mexico and from Virginia to Cuba. A **common thresher shark** that was at liberty for 4.2 years was recaptured 86 miles southwest of the release site in Hudson Canyon. This is only the third recapture for this species. A **swordfish** was recovered after 8.9 years. 35 miles from the tagging location and is the record time at liberty for swordfish under our Program. Another swordfish, tagged near the Flemish Cap, was recaptured 2,287 miles away, approximately 100 miles south of the Bahamas (second longest distance). Three **oceanic whitetip sharks** were returned. Two were tagged and recaptured off Brazil and the other traveled across the Caribbean from St. Croix to Colombia. There were only four whitetips recaptured prior to this year. Other recaptures included: a **bull shark** at liberty for 4.8 years that had traveled 235 miles (longest distance and second longest time at liberty); a **scalloped hammerhead** returned after 7.9 years (second longest time at liberty); four **blacktip sharks** tagged off Texas and recaptured off Mexico (two of which were tagged and recaptured within a few days and a few miles of each other); and an **Atlantic sharpnose shark** that traveled 344 miles from Virginia to South Carolina (second longest distance).

Field Studies

Tournaments

This was a very productive year for tournament sampling. We collected information on 26 recaptured sharks at the 8 tournaments we attended. The opportunity for us to examine freshly landed sharks is not only interesting but essential to our research. We removed the backbones from twelve of these fish for age and growth studies: one was from a thresher that had been at liberty for more than four years. The Program also benefits by maintaining contact with experienced participants, registering new taggers, and handing out hundreds of tags. During tournaments we received 13 recaptures from sharks tagged at past tournaments including one from a sandbar at liberty for 13 years. The tournaments we attended in 1993 were held in New York (6), Rhode Island (1), and Maine (1). Additionally, the project was represented by cooperative biologists at tournaments in New Jersey (1), New York (1), and Massachusetts (2). The combined number of sharks landed at these tournaments was about 350, and length and weight data were obtained from 342. Blue sharks constituted the majority of the catch (50%), makos were second (42%), the rest of the catch consisted of common threshers (5%), duskys (1%), tigers (<1%), and sandbar sharks (<1%).

Work at Sea

This year Lisa Natanson made two cruises off northern Florida on board a commercial shark longline vessel with Captain Tristram Colket. The primary objective of these trips was to tag small tiger sharks after injecting them with tetracycline to mark their vertebrae for age and growth studies (more than 500 tigers have been tagged under this study). Other species, including Atlantic sharpnose, sandbar, blacktip and blacknose sharks, were also tagged and injected. Dissections were performed on specimen of several species from the commercial catch to obtain vertebrae, reproductive information, muscle tissue for DNA studies, spiral valves for parasitological studies, and skin samples for skin morphology studies.

European Contacts

International interest in sharks and shark research continues to grow among fishermen and scientists in several coun-



Lisa Natanson tagging a juvenile tiger shark.
Photo by T. Colket

tries bordering on the Atlantic and Mediterranean. People from England, Ireland, Spain, Portugal, Italy, Brazil, Mexico and other countries are participating in the NMFS tagging program. Some of this participation goes back many years. More recently other cooperative projects on shark biology have been established with scientists in some of the above countries.

For example **Big Game Italia (BGI)**, a dedicated group of fishermen, initiated a nationwide "Tag Day" to promote tagging sharks in Italy. Under the direction of President Egidio "Bibi" Rossi and marine scientist, Irene Bianchi, their program includes intensive biological studies (age and growth, reproduction, etc.) of sharks in addition to BGI-NMFS cooperative tagging studies. A new BGI project will focus on tagging young blue sharks on their nursery grounds in the Adriatic Sea. In June 1994, Jack Casey was a guest of BGI and participated in a "Tag Day" tournament conducted by the **Porto Barricata Fishing Club**. The BGI program is one of the most ambitious in Europe and is guaranteed to continue to produce new information on Mediterranean/Atlantic sharks.

Another European shark program is being developed at the Vasco da Gama Aquarium. Captain Diogo Santos (director) has a major expansion of the aquarium underway and also has plans for expanding their shark research program. Jack Casey was an invited speaker at the dedication of their new shark exhibit in October 1993. These are just two of the international programs the API was involved in last year. Ongoing cooperative research with Canada, Bermuda, Mexico, Bahamas, Brazil and other countries will be discussed in future newsletters.

The Ecology of the Sandbar Shark, *Carcharhinus plumbeus*, in the Neritic Waters of Chappaquiddick Island, Massachusetts

by Gregory Skomal

Gregory Skomal is a fisheries biologist employed by the State of Massachusetts. He earned his master's degree in zoology at the University of Rhode Island in 1990. He worked in the API from 1983-1987, where he completed his thesis on age and growth of the blue shark. The following abstract summarizes some of the results of his continuing research on sharks in waters surrounding Martha's Vineyard.

The waters off Martha's Vineyard and Nantucket Island mark the northern limit to the western Atlantic distribution of the sandbar shark, *Carcharhinus plumbeus*. During the summer months, this species is commonly taken by the recreational surf fishermen from the eastern and southern beaches of Chappaquiddick Island.

To better understand the coastal ecology of this species, 72 sandbar sharks (37 male, 27 female, and 8 unknown), 91-124 cm in fork length, were sampled from the neritic waters of Chappaquiddick Island with rod and reel and bottom longline gear from 1990-1992. Eight sandbar sharks were taken in Cape Pogue Bay, a salt pond on the island's north shore.

Age estimates ranged from 8 to 24 years and all were determined to be sexually immature. Sandbar sharks occurred in the island's nearshore waters from early July through early September of each year when water temperatures ranged from 19° to 27° C. Based on landings, peak abundance was from mid- to late July. The stomach contents of 19 sandbar sharks consisted of teleosts (66.7%), crustaceans (44.4%), elasmobranchs (22.2%) and cephalopods (11.1%); no single teleost species dominated.

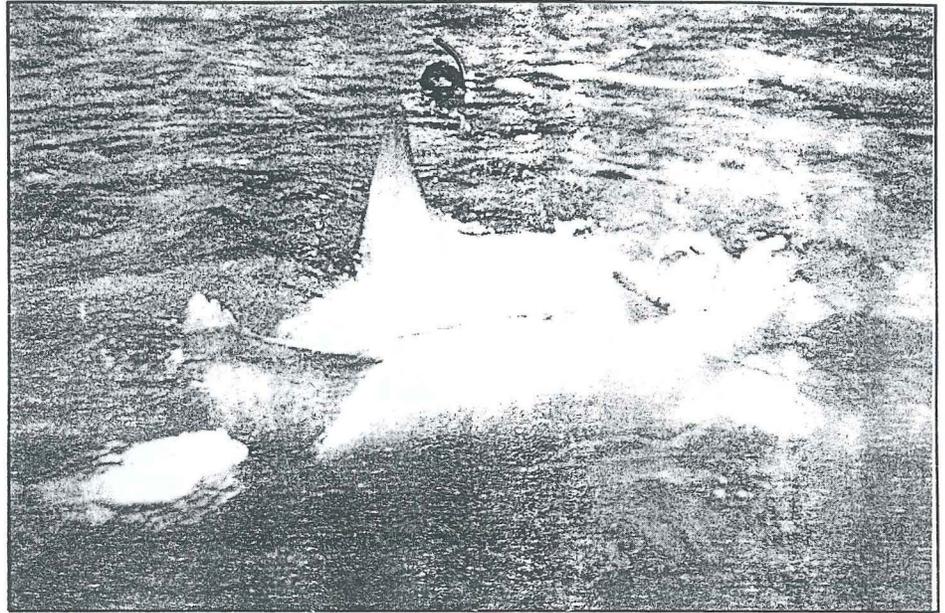
It is hypothesized that juvenile sandbar sharks travel in mixed schools, opportunistically feeding in the productive and protective neritic waters of these islands.



Mating of the Nurse Shark

Understanding the complexities of shark reproduction is essential for the successful management of sharks. Using dissection, histology, and tagging, we have looked at shark populations and shared with our readers what we have learned about shark reproduction through our fieldwork. Pressures on the coastal zone impinge on shark nursery and mating grounds and we have recently intensified our exploration of these areas. For example, this summer Kimberly Damon, one of our graduate students, will be visiting fishermen along the Atlantic coast to try to better define the range of the nursery grounds for the sandbar shark. During the summers of 1992 and 1993, Wes Pratt joined a cooperative study with researchers Jeff Carrier from Albion College, Linda Martin from the Monterey Bay Aquarium, and the National Park Service to investigate reproduction and mating activity in nurse sharks in the Florida Keys.

The nurse shark is a common species in subtropical to tropical waters. It is accessible to fishermen, though not commonly sought, except as crab bait. It is the shark a diver is most likely to see in the reefs off Florida and in the Caribbean. Fishermen and naturalists have seen nurse sharks mating in shallow water since man first came to the Florida Keys, however, little is known of nurse shark life history. During the ten-day preliminary study, one mating area for nurse sharks was defined and described and for the first time, surface and underwater videotapes were made of mating nurse sharks. Interestingly, in more than fifty re-



Nurse sharks (estimated 9 ft total length and 250 lb) mating in the shallow waters of the Florida Keys. Photo by J. Carrier

corded mating attempts, only five concluded successfully. At least ten of the mating events involved two to six males attempting to fertilize a solitary female.

In 1993, we identified some of the individuals that were mating by tagging them with NMFS tags which were modified to make them more visible to divers at a distance. Movements and numbers of mating sharks were also observed from 12 ft step-ladders placed in the shallow water of the study area. Nocturnal mating activity was

followed using a night vision scope.

Data obtained from tagged sharks may reveal local and seasonal movements, and eventually, long distance movements. We plan to continue this study by observing mating in more detail and by using radio tags to follow departing sharks in an attempt to understand their range and activities after mating. We hope that this work will lead to a better understanding of mating in other species of large sharks.



1994 Spring Update

Normally, the Shark Tagger is distributed on a semi-annual basis, i.e. a yearly summary of the previous year, and a one-page update in the spring. The two newsletters are combined in this issue because of time constraints and to reduce costs. We will return to the semi-annual schedule next year.

Tag-Recapture

From January to April, approximately 700 fish of 23 species were tagged under the Cooperative Shark Tagging Program. The major species were tiger sharks (384), blue sharks (58), sandbar sharks (39), porbeagle sharks (24), and other fish (174), released primarily by commercial longliners along the east coast of the U.S. and in the Gulf of Mexico.

During this time period, information on 110 tag returns from 16 species of

sharks including blue (29), tiger (28), sandbar (16), and other (37). One of the most interesting recaptures was a mako shark that was tagged southeast of the Flemish Cap (east of the Grand Banks) in September of 1992 by a commercial fisherman that was recaptured 169 miles east of the Azores. This long distance recapture (1022 miles) was returned by a Spanish longliner after 1.4 years at liberty. This is only the third trans-Atlantic mako shark recapture of approximately 335 mako returns.

Please Report Complete Data on Species, Size, Sex, and Location

Every year we receive tag returns for which release data is incomplete or lacking. Some of these returns represent extremely valuable information which has been lost. To ensure that your release data

is accurate, and to make computer entry easier for us, PLEASE 1) whenever possible, report latitude and longitude or complete loran numbers for location; 2) note that "fish condition" refers to the health (good or poor) of the shark when released - not the weather or fishing conditions; and 3) do not change the tag card numbers without supplying additional information. Any observations on injuries, evidence of mating activity, requests for more tags, etc., can be recorded in the remarks section of the tag card. Please review your tagging instructions and call us (401-782-3200) if you have any questions about them. We will gladly provide additional copies if you need them. Before you return data from a recaptured shark, write the tag number on the letter and also, keep a record of the number. At times, the capsule or letter has been lost in the mail, making it impossible to look up the original tagging information.



A Young Biologist Goes Fishing

by Abner Kingman

Abner "Andy" Kingman is a graduate student who assisted on our shark research cruises and has worked closely with our staff for the past four years. He was awarded a fellowship from the Thomas J. Watson Foundation to study longline fisheries in different parts of the world. The following account of his experiences is an abbreviated version of an article that he is writing for future publication.

F/V Seahawk (U.S., Sargasso Sea)

An offer to ride aboard the *F/V Seahawk* from Captain Alex Sutton had seemed like the perfect opportunity to me. I could search for pregnant makos in warm southern waters and casually observe how longline fishing really works. I wasn't sure what to expect aboard the *Seahawk*, but after having poked around shark fishing operations in four countries during other research projects, I was sure that there wouldn't be anything to catch me off guard. I was wrong. A 22-year-old kid, fresh out of college, who knows a lot less than he thinks he does is the perfect slate on which three weeks of high seas fishing can make its mark.

I had spent a few hundred days at sea before and never been sick, but then I had never been out on a bluewater fishing boat before. By the beginning of the second haul, I was feeling like I might be better off as bait, but an unfortunate injury soon stole all opportunity I had to feel sorry for myself. Fisherman Dave caught a hook in the hand and needed to be evacuated. Captain Alex informed me at this time that my shipboard duties had been modified, "You're not a biologist anymore, you just started work as a deckhand. Here's what you'll be doing..."

Three weeks aboard the *Seahawk* convinced me that there is no one who works harder than the high seas fisherman, and subsequent trips have solidified this opinion. After we spent 10-12 hours hauling gear, Alex left the deck for the wheelhouse and the four of us started setting the gear back out. On his computer, Alex had logged the coordinates of every set he made, with water temperature and information on the number, size, and precise location of all the fish he caught. He used this information along with information supplied by neighboring boats in the fleet to choose a set lo-



Abner Kingman preparing to board a Japanese longline vessel.

cation. Alex's sets always followed the course of a temperature break and he had to keep in mind which way the gear would drift and where the other boats were setting. From the *Seahawk* we set a thousand hooks (40 miles), baited with squid and light sticks; every night and every day we pulled them back. We targeted swordfish and that was mostly what we caught. The several hundred swordfish were cleaned immediately and packed on ice in the hold. There were a few dorado and sharks mixed in with the swordfish. We ran across an oceanic whitetip, a couple of carcharhinids that defied my description, a few large blue sharks and the makos I wanted to see. The first of these makos followed a hooked swordfish to the tuna door, stealing 30 lb bites along the way. She took a harpoon, then another and another, but did not come aboard until an hour and a spectacular leap after she had first approached the boat. Somewhere in the 700 lb range, she was round with well more than 100 lb of liver and 12 tiny embryos. The second, this time caught on the line, was equally large but not pregnant.

Returning to San Juan, I was appreciative of my newfound humility and the chance to rest my back. Alex and the crew had certainly done a crack job of breaking me into high seas longlining.

Spanish Longliner (central North Atlantic)

My Spanish is really not very good. I arrived in Vigo, Spain under the impression that we were on our way out for a 20-25 day trip. Spanish biologist Jaime Mejuto generously made arrangements for me to travel aboard a Spanish boat with her crew

of ten. I steamed out of Vigo blissfully enough, but two weeks into the trip my veil of ignorance was lifted and I realized those 25 days were "fishing days", which we topped off with 13 days of steaming. Luckily, Jaime had gotten me a ride on one of the best boats in the fleet. After 38 days of understanding only the BBC radio and wondering whether dinner would be pig's ears or goat tongues, I was dreaming of land. If the crew hadn't been such a good group, I may have attempted the swim.

During our 25 days of fishing we caught 24 makos, less than 200 swordfish, and about 2,000 blue sharks. (The exact numbers are privileged data.) I measured all of these fish and, to help earn my keep, ended up as one of the chief shark finners. I saw for myself what I had been told many times before; gear set for swordfish or tuna is often much better at catching blue sharks than anything else. Setting 2,500 hooks a day (50 miles) baited with mackerel, in an area between Spain and Newfoundland, we ran across a few icebergs and a good variety of blue shark sizes; everything from 3 ft juveniles to 10 ft pregnant females with embryos about a foot long during our March-April trip. The swordfish and makos were left whole, bagged in plastic, and packed with ice in the hold. The smallest blue sharks were gutted and packed in ice with the fins on. The majority of blue sharks were finned.

F/V Seifuku Maru #58 (Japanese - off Tasmania, Australia)

Dr. John Stevens, a shark biologist friend in Hobart, arranged for me to travel as an observer aboard one of the 50 Japanese tuna boats fishing in Tasmanian waters. I arrived there during a frigid June snowstorm and caught a ride out to the boats with a group of observers who told me what to expect. Japanese efficiency may be cliché but it was certainly a reality on the *Seifuku Maru #58*. Imagine eight men in blue oilskins and white helmets running to line up at the rail, with gaffs in hand, only a few seconds after a silent "fish-on" signal was given, and you can imagine the kind of team organization that marked deck operations aboard the *Seifuku*.

With two trips under my belt I was beginning to assume that I could count on all hell breaking loose at regular intervals aboard these high seas boats, but the Japanese changed my opinion. During my two weeks on the *Seifuku* there was quite a variety of fish caught, but the only ones that generated real enthusiasm among the crew (total of 19) were bluefin tuna. These fish (particularly the large ones) were treated

with great care and cleaned with remarkable precision. After half an hour of bathing in a salt water shower they were carried into the blast freezer where they spent 12 hours cooling off at -70°C. From there they made their way into the main fish hold (-40°C) where they were packed very carefully, so that a full 6-8 months worth of catch could be transported back to Japan.

The pressure to set well weighed heavily on the Fishing Master. It was his only job. He synthesized information from a dozen different instruments and plotted the sets of all the other boats nearby and their catches along the sets. Although there was no English spoken on the boat and no Japanese in my vocabulary, I picked up on the readiness with which the captains in this fleet shared information. Just as the fishermen on deck worked together as a team, so did the captains.

We set 3,500 hooks along 65 miles of mainline with a repeating bait sequence of squid, mackerel, and herring. This gear caught quite a few southern bluefin tuna along with albacore, swordfish, porbeagle shark, blue shark, soupfin shark, opah and more. The albacore were not treated with quite the same care as the bluefin because they were destined for a cannery. They were worth so little compared to the bluefin that each day a few of the small albacore were set aside as the raw component of our breakfast and dinner. The swordfish and opah were filleted and tossed into the freezer as filler and the sharks were all released. In Australian waters they were required under the licensing agreement to keep the fins from only those sharks whose

meat they kept. These sharks, judged by what I later saw being unloaded in Japan, would normally have been finned, and would have contributed to several thousand pounds of fins taken during the trip.

F/V Aquatic Pioneer (Canadian - Nova Scotia, Newfoundland)

By last October I was ready to sail with some fishermen whose conversations I could understand. Newfoundland is an English-speaking Canadian province, isn't it? All sixteen aboard the *Aquatic Pioneer* could speak English but that wasn't what they chose to speak. "Newfanese" was the language of choice and it took me 20 of my 35 days aboard to begin to understand. Luckily the crew aboard the *Pioneer* were some of the most friendly and patient people on earth. They were ready to teach Newfanese whenever I was ready to learn and the crash course was successful.

A long-standing interest in the porbeagle shark has led me to dozens of ports where I've heard they are landed. Mike Pittman at Deep Sea Trawlers in Lunenburg, Nova Scotia told me that they were indeed landing some porbeagle there. He suggested I come up to have a look and meet with Captain Albert Lawrence of the *Aquatic Pioneer*. Albert invited me out for 35 days of directed porbeagle fishing in chilly Newfoundland waters.

Each evening the crew of the *Pioneer* set 1,500 hooks baited with squid along 35 miles of mainline. The catch, while I was

aboard, consisted entirely of porbeagle, blue sharks, and cod. The blues and the cod are released alive, while the porbeagle are headed, gutted and finned. The porbeagle then spent three hours hanging out to bleed in the cool Atlantic breeze before they were carried into the blast freezer. We caught porbeagle ranging in size from 3 ft young-of-the-year to 9 ft mature females (the smallest ones were tagged and released). Unlike mako carcasses, which fetch a decent price per pound only up to a certain size, porbeagle carcasses of all sizes sell for the same price. I was hoping to find some pregnant porbeagle on this trip and found that almost all females exceeding a certain size were indeed in a similar stage of pregnancy.

The 1,300 porbeagles that I was able to measure and assess on this trip presented a great sample. Particular sets would most often produce fish of a certain size and sex, which made for some very tidy data that I will soon use in a master's thesis.

These trips aboard high seas longliners have provided me with a valuable insight and I have those who helped me along the way to thank. I deeply appreciate the help and hospitality that the captains and crews of these vessels have shown me, particularly Albert Lawrence and Alex Sutton, who have spent days and days educating me. I am also indebted to Jaime Mejuto, John Stevens, and Mike Pittman for arranging particular trips. Steve and Babby Connett aboard the *R/V Geronimo* got me started on longlining for sharks at age 16 and Jack Casey has made all my shark work since, possible. Thanks.



Shark Fisheries Management Plan Update

On April 26, 1993, the final and interim final rules implementing the Fishery Management Plan for Atlantic sharks became effective. These regulations cover the commercial and recreational shark fisheries in the exclusive economic zone of the Atlantic Ocean, Gulf of Mexico, and the Caribbean Sea. Regulations include commercial quotas, recreational bag limits and a prohibition on finning. **In addition, an interim final rule was published on December 28, 1993, establishing trip limits of 4,000 lbs of large coastal sharks in the commercial fishery. A control date was published for February 22, 1994.**

Copies of the FMP and the regulations may be obtained from either of these offices:

C. Michael Bailey
Highly Migratory Species
Management Division
F/CM4, NMFS, NOAA
U.S. Department of Commerce
1315 East-West Highway
Silver Spring, MD 20910
(301) 713-2347

Michael Justen
Southeast Regional Office
NMFS, NOAA
U.S. Department of Commerce
9721 Executive Center Drive
St. Petersburg, FL 33702
(813) 893-3721
(813) 893-3721

For permit information, contact the Regulations and Permit Branch at the Southeast Regional Office in St. Petersburg, 813-893-3722.



The NMFS Cooperative Shark Tagging Program - A Look Back

The joy of discovery is by far the greatest reward for the scientist. The second greatest reward for many of us is being able to share those discoveries with others and to feel that the world is a little bit better for our being here. All of you, past and present, are part of the NMFS shark research program and should take pride in your contributions as you reflect on the following brief summary of the knowledge you are helping to advance on shark migrations. In addition, your volunteer assistance has been vital to studies of age and growth, reproduction, food habits and other NMFS research on sharks during the past 33 years.

- 1961 •The Sandy Hook Laboratory of the then U.S. Department of the Interior, Bureau of Sport Fisheries and Wildlife conducted the first longline survey for sharks off Northeastern U.S. (300 sharks caught).
- 1962 •First shark tagged by J. Casey and M. Bartlett aboard F/V CAPT. BILL during exploratory longlining for swordfish off Southern New England.
- 1963 •Cooperative Shark Tagging Program began on experimental basis when BSFW biologists and 74 volunteer fishermen started testing tags (230 sharks tagged, 3 were recaptured).
- 1964 •Tag experiments continued, 331 sharks tagged-5 sharks recaptured (all within 100 miles).
- 1965 •Biologists began working with commercial gill net shark fishermen in Virginia. Sandbar sharks purchased for tagging at \$1.00 each.
- 1966 •First tagged sandbar shark traveled over 500 miles (NY Bight to FL).
•Tagging program transferred to Narragansett, RI.
•Total number of sharks tagged in the first 5 years - 3400, total recaptured - 114.
- 1968 •First long distance blue shark recapture (NYtoVenezuela,1682 mi.).
- 1969 •First tagged swordfish recaptured in U.S. waters (46 mi.-4 yrs).
•First tagged shark between U.S. and Mexico (blacktip shark).
•Commercial shark fishery in Virginia collapsed.
- 1970 •First tagged mako shark recaptured off South America (NY to Venezuela).
•First East to West trans-Atlantic movement by a blue shark (Canary Is. to Brazil, 1956 mi.).
•NOAA-NMFS established in the U.S. Department of Commerce.
- 1971 •Blue shark recaptured in Mid-Atlantic between Puerto Rico and Africa (tagged blue sharks have yet to demonstrate West to East trans-Atlantic movements).
•Total sharks tagged to date, 9500 representing 30 species. Total recaptures 297 of 11 species.
- 1972 •First tagged sandbar shark crosses Straits of Florida (NC to Cuba, 2.5 yrs.).
•Ten (24%) of forty-two blue sharks tagged in the Mediterranean recaptured there in the first year.
- 1973 •Nine giant tuna (375 to 650 lbs.) tagged by John Walton on Stellwagen Bank on July 27, 1973.
- 1974 •First West to East trans-Atlantic movement by a blue shark (Montauk, NY to Africa, 2885 mi.). Approximately 6000 blue sharks tagged and 156 recaptured before this trans-Atlantic return.
•First tagged bigeye thresher shark recaptured (NC to Cuba, 6 yrs).
- 1975 •Seventh giant tuna recaptured from the 9 tagged on July 27, 1973.
- 1976 •First tagged mako shark recaptured in the Gulf of Mexico.
- 1977 •First tagged sandbar shark from the Atlantic into the Gulf of Mexico (VA to Northwest FL, 12 yrs).
•First tagged swordfish from the Gulf of Mexico into the Atlantic (1900 mi. - 3.5 yrs).
•First tagged blacktip, silky and dusky sharks cross the Straits of Florida to the Bahamas.
- 1978 •First tagged sandbar shark from U.S. to Mexico (NY to Mexico, 2000 mi - 6 yrs.)
•First tagged tiger shark between U.S. and West Indies (Florida to Dominican Republic, 800 mi.-2 mo.).
•Foreign Fisheries Observers begin tagging sharks aboard Japanese and other foreign vessels in U.S. waters.
- 1979 •First tagged blue shark from U.S. into the Mediterranean Sea (N.Y. to Spain, 3145 mi.-1 yr.).
- 1980 •Five tagged blue sharks show trans-Atlantic movements.
•First tagged shortfin mako from the Atlantic into the Gulf of Mexico.
•To date tag returns from seven species of sharks show movements from the Atlantic into the Gulf of Mexico. Tag returns from five species of sharks show movements out of the Gulf into the Atlantic.
•First tagged longfin mako shark recaptured.
- 1981 •Juvenile blue shark tagged off U.S. recaptured 2 1/2 years later off Portugal with 28 embryos. First evidence that sperm could be stored in females for nearly two years.
•First recapture from a blue shark tagged in the Gulf of Maine. (171 mi. - 2 mo.).
•Three sandbar sharks tagged off NY, recaptured in Mexico
•Tiger sharks show movements from Florida to Texas, New York to Florida, and Bermuda to the Dry Tortugas (600-1100 mi. - 2 to 4 yrs.).
•Second tagged swordfish shows movement from Georges Bank to Florida (1000+ mi.-6 yrs).
- 1982 •Ten tagged blue sharks travel over 2000 mi. (U.S. to Europe, Africa, and South America).
•First tagged blue shark crosses the equator (Cape Verde Is., to 600 mi. south of the equator, 1200 mi.-2 mo.).
•Sandbar sharks recaptured after up to 17 years at liberty.
- 1983 •Tiger shark tagged off NY, recaptured off Costa Rica, Central America (1800+ mi.-6 mo.).
•Record number of sharks tagged and recaptured in a single year (5,860/186).
- 1984 •First white shark recaptured (NY to SC, 546 mi.-2 yrs).
•First mako shark makes trans-Atlantic movement (U.S. to Portugal, 2400+ mi.-9 mo.).
- 1985 •Second tagged blue shark crosses the equator (NJ to Brazil, 2400+ mi.-1 yr.).
•Nine tagged blue sharks demonstrate trans-Atlantic movements.
•Sandbar shark recaptured after 17 years, examined and found to be immature.
•Two sandbar sharks recaptured after 19 years at liberty.
•Nine (50%) of the sandbar sharks recaptured were tagged in the Atlantic and recaptured in the Gulf of Mexico, 4 (22%) from the Mexican coast.

- 1986** • Tagged mako shark sets speed record-36 mi./day (Georges Bank to Flemish Cap, 1300+ mi.-37 days).
 • Second tagged blue shark demonstrates movements from the Atlantic into the Mediterranean (Azores to Spain, 1000 mi.-3 mo.).
- 1987** • First tagged mako shark recovered in Gulf of Maine (MA to ME, 140 mi.-4 yrs.).
 • First tagged swordfish travels from Grand Banks to Virgin Islands, (Cape Race to West Indies, 1600+ mi.-2 mo.).
- 1988** • Record number of sharks tagged (5800+) and recaptured (304) in a single year.
 • Time at liberty records set for sandbar (23 yrs.), common thresher (8 yrs.), silky (7 yrs.), bull (7 yrs.), reef (5 yrs.), porbeagle (4 yrs.), and bignose sharks (4 yrs.).
 • Tagged swordfish shows fastest rate of travel (22 mi./day - Cape Sable, Can. to Haiti, 1200 mi. -57 day).
 • Japanese cease longline fishing in U.S. waters.
- 1989** • First tagged mako shark from U.S. to Mexico (NC to Yucatan, 1200+ mi. - 4 yrs.).
 • NMFS completes shark longline survey between Tampa and Cape Cod. (640 sharks of 19 species caught, 588 tagged and released).
 • Draft Fishery Management Plan (FMP) for Atlantic Sharks prepared by NMFS.
- 1990** • Record distance of 2000+ miles shown by tagged sandbar shark (Montauk, NY to Tamaulipas, Mexico, 5.7 yrs.).
 • Five blue sharks recaptured from releases by Italian cooperators in the Adriatic Sea.
 • Second tagged white shark recaptured (VA to MA, 384 mi.-1.2 yrs.).
 • Tagged swordfish travels record distance of 2357 miles between the Flemish Cap and Cuba.
 • FMP for Atlantic sharks revised and reviewed at public hearings.
- 1991** • NMFS completes shark longline cruise between Miami and Cape Cod. Catch rates of large coastal sharks in the area between Miami and Delaware Bay declined by 50% compared to the 1989 cruise.
 • 6,900 sharks tagged and 413 recaptured.
 • FMP for Atlantic sharks extensively re-written and regulations finalized.

- 1992** • Milestone year-100,000th shark tagged since the program began.
 • Second tagged mako shows trans-Atlantic movement (Flemish Cap to Madeira Is, 1600 mi.-11 mo.).
 • Second blue shark tagged off the U.S. crosses the Equator (NY to Brazil, 3200+ mi.-20 mo.).
 • FMP for Atlantic sharks completed and scheduled to go into effect in early 1993.

1962-1993 TOTALS

- No. Tagged: 113,222; No. Recaptured: 5,086 (4.5%); No. Species (T) 53; (R) 35; Longest Time at Liberty: 28 yrs (Sandbar); Longest Distance: 3,740 mi. (Blue shark); Fastest rate: 44 MPD (Blue shark); No. Countries Returning Tags: 50.
- FMP for Atlantic sharks approved Feb. 1993 quotas, bag limits, prohibition against finning, and other regulations established.



L.A. Walford (1905-1979)-From oil painting by Roberta Clark

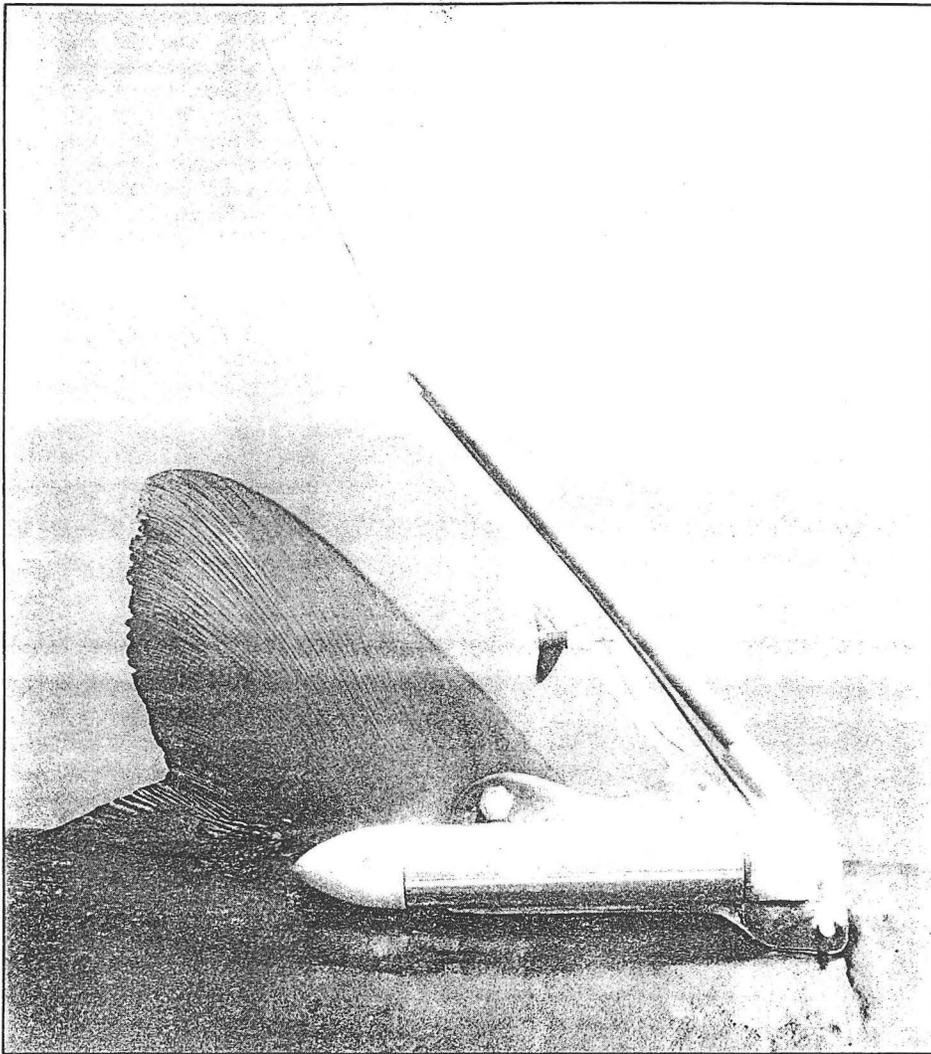
Dr. Lionel "Bert" Walford, the first director of the Sandy Hook Marine Laboratory, established the Bureau of Sport Fisheries and Wildlife's research program on sharks. He inspired everyone who knew him to appreciate and to be concerned for the living resources of the sea.

The Starting Lineup

In 1963 the Cooperative Shark Tagging Program began with a feasibility study involving the following 74 volunteers (some of whom are still tagging). They deserve special mention in this continuing program that has grown to international proportions and now includes over 6,000 cooperators. I will retire in 1994 and my most treasured memories will be of the people who shared a part of their lives with me in the pursuit of knowledge. My thanks to all of you for making this a rewarding and wonderful job. J.G.C.

Bill Anthony
 Foster Bam
 George Baque, II
 Richard E. Bartling
 William Bonatz
 Jerry Boyle
 Ogden Bradley
 Ray Bunting
 John Burgess
 Ed Callahan
 Eugenie Clark
 Zanvile Cohen
 E. Commonchoc
 Nicholas Demisay
 Leo R. Dixon
 James V. Dunleavy
 N.W. Edmund
 Charles Entenmann
 William A. Flynn, Jr.
 Jack Fontana
 Harry Frankel
 Bert Fuller
 William F. Gallagher
 Samuel Greenburg
 George Hellreigal
 Charles A. Herman
 Max Hoffman
 Edgar H. Hollis
 George H. Jantzen
 Jacob Kamovsry
 Henry J. Karsch
 Robert King
 James T. Kirkup
 Jan A. Kneib
 Richard W. Knodel
 Robert J. Kriegner
 Stanley Leeds
 Graham MacMillan
 William Maher
 Dick Manning
 Lefferts McClelland
 Tom McGannon
 Frank T. Moss
 Richard J. Muise
 John Mumaw
 Frank Mundus
 Walter Ochmanski
 Mike Peel
 Emil R. Pelcz
 Wilfred G. Pleu
 Robert W. Porter
 Joseph Ranschoff
 George H. Rasch
 John S. Rhodes
 John Riccardo
 Charles Roswell
 Frank Schwartz
 Irving P. Scott
 William Sench
 Andrew Sikora
 Richard C. Sommers
 John Steffger
 Earl Stevens
 Alfred Stuart
 Courtland Swift
 Frank Useo
 Jack Van Winkle
 John Vella
 Elton S. Vineburg
 Ross H. Walker
 John S. Walton
 Richard C. Webster
 Jim Wilbar
 Ralph Woodbine

Blue Sharks Released with Satellite Transmitters



Satellite transmitter. Photo by F. Carey

In January 1994, Wes Pratt, Andy Kingman, and Captain Paul Puskas released three large male blue sharks off Cape Hatteras with satellite transmitters attached to their dorsal fins.

Years of preparation by Dr. Frank Carey of the Woods Hole Oceanographic Institution culminated in this project. In the first few weeks, two of the three transmitters radioed the sharks' positions, water temperatures, and other information via satellite to Frank Carey.

**IF THESE SHARKS ARE
CAUGHT, BRING THEM IN
AND CALL US
IMMEDIATELY!**

Leave the transmitters in place and try to keep the delicate antenna from being damaged, even if that means killing the shark before it is brought onboard. The transmitters are very valuable and can be used again if they are undamaged. We also need to evaluate the electronics and the method of attaching the transmitter to the sharks. We will report on the details of this experiment next year.



How to Get Tuna and Billfish Tags and Permits



Tuna and Billfish Tags
Cooperative Gamefish
Tagging Program
NOAA/NMFS/SEFSC
75 Virginia Beach Drive
Miami, FL 33149
1-800-437-3936

Tuna Permits
USDOC/NOAA/NMFS
Highly Migratory Species
Management Division
1 Blackburn Drive
Gloucester, MA 01930
(508) 281-9305

THE SHARK TAGGER NEWSLETTER

Published by

**Apex Predator Investigation
Cooperative Shark
Tagging Program**

U.S. Dept. of Commerce
NOAA/NMFS/NEFSC
28 Tarzwell Drive
Narragansett, RI 02882
401-782-3200

John G. Casey, Inv. Chief
Harold Wes Pratt, Jr.
Nancy E. Kohler
Lisa J. Natanson
Patricia Turner
Ruth Briggs