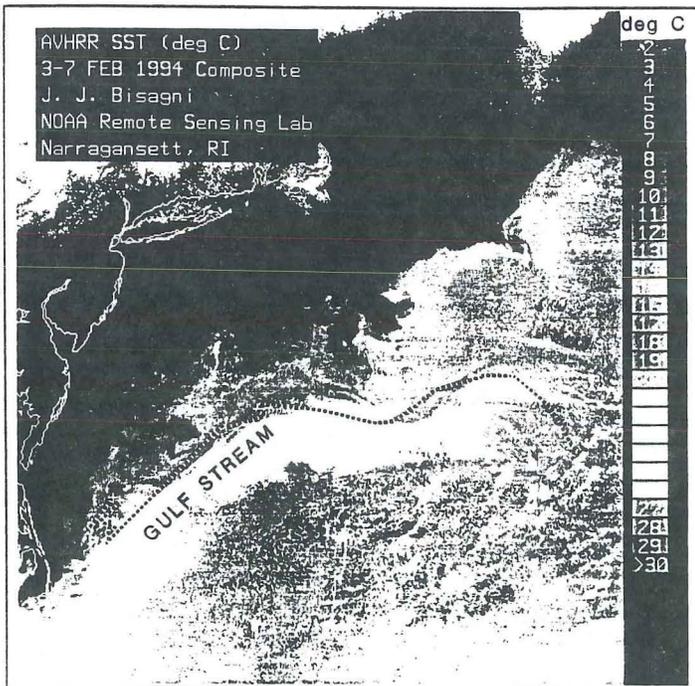


THE SHARK TAGGER 1994 SUMMARY

Newsletter of the Cooperative Shark Tagging Program



Photo by H.W. Pratt



1994 OVERVIEW

In 1994, members of the Cooperative Shark Tagging Program tagged 7,761 fish representing 39 species of sharks and 8 species of teleosts (Table 1). This is the second highest number tagged in a single year and brings the total number of tagged fish to 121,000. We would like to thank the many thousands who have participated in the Program and welcome the 320 new taggers who joined in 1994. Taggers now represent 31 countries.

The number of fish recaptured (596) sets the eighth consecutive yearly record for the number of tag returns and brings the Program total to 5,676. Recaptures represented 23 species of sharks and 7 species of teleosts (Table 2). Although commercial fishermen tagged fewer fish than anglers in 1994 (1,127 and 5,058 respectively), the species composition is more evenly distributed (see figures). Commercial fishermen (either targeting or incidentally catching sharks) generally fish in wider and more diverse areas, thus increasing the opportunity for

In this issue:

- 7,761 Fish Tagged and 596 Recaptured
- Recaptured Blue (41%) and Tiger (31%) Sharks Retagged/Rereleased
- Length and Weight Graphs
- An Update on Satellite Transmitters on Blue Sharks
- Tuna and Shark Catch and Release Survivorship Studies
- Shark Parasites
- Management Plan Update
- Nursery Grounds Study Initiated

catching a variety of species. It is also interesting to note that although anglers use the majority of tags, commercial fisherman catch the higher percentage of recaptures (Table 3). It is not surprising that method of capture reflects the above trend, with most tags being used by rod and reel anglers, and most fish recaptured on commercial gear (primarily longline) (Table 3). The complimentary nature of both sport and commercial fishing is invaluable to our research. We greatly appreciate the time and effort taken by our participants to tag a fish from a sport boat during the exciting yet chaotic moments when the shark is on the line; or to tag and log recapture information on a commercial vessel during the non-stop work of a long haul back.

The data provided through the 32 year effort of all taggers and recapturers is presently being compiled to produce an "Atlas" which will portray tagging and recapture data on 33 species of sharks. The intent is to show the extent of the tagging effort, areas of release and recapture, sources of recaptures, distances traveled, time at liberty, and maps of species distributions and movements. Reports on migrations in relation to physical and biological parameters, similar to those previously published on the mako and blue sharks, will then be written, on an individual basis. Closer examination of these data will help determine the direction of future studies.

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 02882-1199

Table 1. Summary of sharks and teleosts tagged, January to December, 1994

Species	Tagged by		Total
	Cooperative Taggers	Narragansett Biologists	
Blue shark	4438	10	4448
Tiger shark	741	228	969
Sandbar shark	456	8	464
Shortfin mako	396	4	400
Blacktip shark	215	0	215
Dusky shark	184	0	184
Porbeagle	116	0	116
Nurse shark	78	10	88
Atlantic sharpnose shark	71	0	71
Bonnethead	64	0	64
Silky shark	59	2	61
Galapagos shark	43	0	43
Oceanic whitetip shark	29	0	29
Scalloped hammerhead	29	1	30
Reef shark	24	0	24
Bull shark	20	0	20
Sand tiger	19	0	19
Blacknose shark	19	0	19
Spinner shark	13	0	13
Great hammerhead	13	0	13
Lemon shark	13	0	13
Atlantic angel shark	7	0	7
Smooth hammerhead	5	0	5
Finetooth shark	3	0	3
Common thresher shark	3	0	3
Spiny dogfish	2	0	2
Smooth dogfish	2	0	2
Longfin mako	2	0	2
Bigeye thresher shark	1	0	1
Night shark	1	0	1
Bignose shark	1	0	1
Basking shark	1	0	1
Crocodile shark	1	0	1
Shark, unspecified	38	0	38
Miscellaneous rays	20	0	20
Sand, unspecified	16	0	16
Brown/Dusky, unspecified	14	0	14
Hammerhead, unspecified	13	0	13
Carcharhinus, unspecified	10	0	10
Total sharks	7180	263	7443
Swordfish	142	0	142
Bigeye tuna	38	0	38
Bluefin tuna	36	0	36
White marlin	31	0	31
Blue marlin	20	0	20
Yellowfin tuna	19	0	19
Atlantic sailfish	5	0	5
Miscellaneous teleosts	27	0	27
Total teleosts	318	0	318
Total	7498	263	7761

On the cover: Satellite-derived sea surface temperature image with tracks of two blue sharks. See article Pg. 15.

Tags

In 1994 the principal species tagged were blue, tiger, sandbar, mako and blacktip sharks (Table 1). Sport fishermen tagged 45 species comprised primarily of blue sharks (73%). Commercial fishermen tagged 19 species mainly tiger sharks (34%) and blue sharks (21%) (see figures). The most substantial portion of the tagging effort was based in the United States; however, tags were placed on fish by taggers from 8 different countries (Table 3).

Recaptures

In 1994, information was returned from 596 tagged fish representing 23 species of shark and 7 species of teleost (Table 2) with blue sharks (335), tiger sharks (68), and sandbar sharks (49) as the top 3 species recaptured. The fish that were recaptured had been originally caught using a variety of gear including: rod and reel (398), longline (161), handline (13), gillnet (4), trawl (3), released from aquarium (3), and free swimming (14). Information was obtained from fishermen representing 18 countries (Table 3).

Blue Sharks (335 returns)

Most of the blue sharks were tagged (3,543) and recaptured (201) by sports fishermen. Traditionally, the blue shark has comprised the largest part of the sport fishing catch off the Northeast coast of the United States in summer. The number of blue sharks recaptured this year is the highest in the history of the project. Overall, 41% of blue sharks recaptured were released without a tag or with the same tag.

Blue sharks were at liberty for <1 day to 4.8 years. They traveled distances up to 2,836 mi.; 30 traveled over 1,000 mi. and 12 of these went over 2,000 mi. (see map). Though none of this year's recaptures surpassed any distance records there were some interesting trends in the data. Four blue sharks, all tagged in October of 1993 between NY and MD were recaptured in the Eastern Atlantic between February and June. The most interesting of these was the longest distance blue shark recapture of this year (2,836 mi). This male was tagged by a NMFS Observer on a longline vessel southeast of Montauk Pt., NY and recaptured 7.5 months later by Spanish longliners off Mauritania, Africa. Most of the long distance recaptures this year were caught either off the Flemish Cap, the Azores, Africa, or South America (see map). Two sharks tagged on the same day in 1993 east of Madeira Island, were recaptured in 1994 after 1 and 8 months, in an area southwest of Mauritania, Africa. The combinations of these and other recaptures tagged in the eastern Atlantic and areas outside of our typical tagging regions reinforces the hypothesis that blue sharks use the current system of the entire N. Atlantic for their migrations. The life history of the blue shark revolves around its migrations. Subadult females and mature males mate off of our coast in summer. Taggers often report that the females they catch have wounds on their dorsal surface and flanks; these are the result of mating activity. After mating, the subadult females can store sperm for over one year, subsequently the eggs are fertilized and young are produced in the pupping and nursery grounds of the eastern Atlantic. This pattern of movement between both sides of the Atlantic is corroborated by our tagging evidence which show blue sharks being captured in the current systems circling the Atlantic Ocean. Increased tagging in the eastern Atlantic will help to delineate the population characteristics of the blue shark in this area.

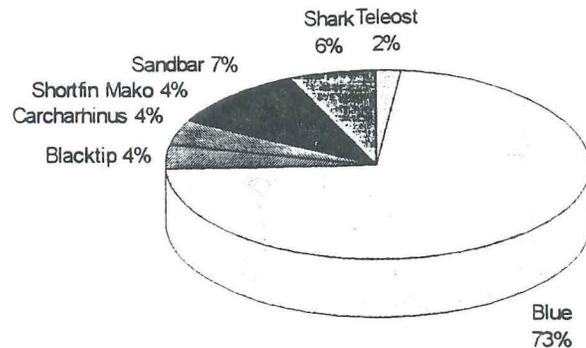
Tiger Sharks (68 returns)

Until 1990, the number of tiger shark recaptures was not high enough to place this species in the top three. The increase, in both the number tagged and recaptured, is due to the interest that we have had in studying its' growth rate. With the help of many fishermen in the directed shark fishery and biologists working on both the Florida and North Carolina coasts, we have been able to tag and inject hundreds of young tiger sharks with tetracycline (a fluorochrome marker). Many of the sharks have been tagged in localized areas where they seem to remain for two to three years, as they are commonly recaptured by fishermen frequenting that area. This year 31% of the recaptured tigers were rereleased rather than being killed. Many of these sharks were accurately measured which is very useful for continuing studies into their growth rates.

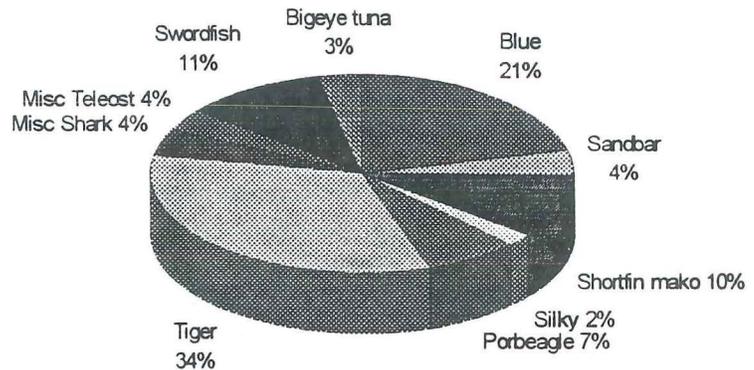
When the tigers begin to move, they disperse widely. Two tiger sharks set third place records in the recapture database this year; one for days free and one for speed. The first was at liberty for 7.5 years after being tagged in the Bahamas and traveling 732 miles north to be recaptured off Rudee Inlet, VA. The record times at liberty for this species is 11 years followed by 8 years. The other tiger traveled 515 miles in 36 days (14.3 miles per day) from SW of New Orleans, LA to Campeche, Mexico. This is only the fourth reported tiger shark recapture off Mexico.

In summary, tiger sharks were at liberty from 13 days to 7.5 years. The longest distance traveled, for a tiger this year, was 1,282 mi. This was an unusual recapture; the shark was tagged and injected with tetracycline by an observer on a shark longline vessel off North Carolina in February, and was recaptured in August, south of Cape Race, Newfoundland. The fact that the fish traveled in a northerly rather than in a southerly direction sets it apart from the other tiger shark recaptures. This recapture location is one of the furthest east for a tiger shark in our program. Though the majority of recaptures were local, four tigers tagged between Jacksonville and Ponce Inlet, FL from 1991-1993 were recaptured off Cuba (2), Puerto Rico, and the Virgin Islands. This southward movement is fairly typical for tiger sharks as many tagged off our coast have traveled to Cuba, Puerto Rico, and even to South America. The tigers also are commonly recaptured

Fish Tagged by Sport fishermen



Fish Tagged by Commercial Fishermen



along the coastal U.S. north to Long Island, NY and south into the Gulf of Mexico.

Sandbar shark (49 returns)

Sandbar sharks were at liberty from 53 days to 10.2 years; this is well under the record time at liberty of 28 years set in 1993. The 10 yr recapture is valuable, however, in substantiating our estimates of age at maturity for this species. When the shark was tagged its estimated age would have been 25 yrs, and therefore, would have been 35 yrs at recapture. At recapture, the shark was examined by a fisheries observer on a longline vessel off the coast of North Carolina and was found to be immature. Our past estimates of age at maturity for this species (approx. 30 yrs) is in agreement with this latest recapture. It is interesting to note that 11 of the 13

sandbar sharks that traveled greater than 500 miles were tagged in the Atlantic and recaptured in the Gulf of Mexico. The longest distance recapture (1,942 mi.) was tagged southeast of Manasquan Inlet, NJ in July, 1988, and recaptured 6.3 years later southeast of Tuxpan, Mexico. This shark is the first in recent years to be recaptured off Mexico. In addition, a sandbar was recaptured this year off Cayo Frances, Cuba. This shark was tagged off of Ponce Inlet, FL in 1991 and is only the fourth sandbar in our program to be recaptured off Cuba.

Mako Sharks (41 returns)

Mako sharks were at liberty for 20 days to 3.0 yrs and traveled distances of 1 to 1,576 mi. Altogether, 13 of this year's mako recaptures traveled greater than 500 mi; of these, several were notable. For the first time ever, we

Table 3

Total Number Tagged: 7,761
Total Number Recaptured: 596

	%	
	Tag	Recapture
Occupation:		
Angler	65	44
Commercial	15	52
NMFS Biologist	3	0
Biologist	5	2
Observer	12	2
Method:		
Rod and Reel	63	44
Longline	32	50
Free swimming	2	0
Gillnet	0	4
Misc.	3	2
Country:		
USA	95	74
Portugal	1	1
Canada	1	8
Italy	1	1
Spain	1	9
Great Britain	1	0
Cuba	0	1
Mexico	0	2
Venezuela	0	2
Misc.	<1*	2**

*France, Ireland

**Barbados, Brazil, Japan, Puerto Rico, St. Croix, Morocco Bermuda, Sri Lanka, Tortola, VI

obtained information on a mako that was both tagged and recaptured in the South Atlantic. This fish was tagged in November 1992 southeast of Uruguay, and recaptured southeast of Brazil after 1.9 yrs at liberty, having traveled a distance of 830 mi. NE. Also this year, we obtained information on a mako that was both tagged and recaptured in the eastern Atlantic. This fish, which was at liberty for two years, was tagged west of Madeira Island and recaptured NE of the Azores (615 mi N). Other interesting eastern Atlantic recaptures included two makos tagged off the Flemish Cap that were recaptured northeast of the Azores; previously only two makos had shown this transatlantic movement. It is interesting to note that the majority of mako shark recaptures occurred north of Cape Hatteras, NC; only two makos were recaptured south of this point. The first recapture was interesting in that it is only

the third reported recapture of a mako shark off South America. This shark was tagged off Cape Hatteras, NC in 1993 and recaptured in 1994 off Venezuela, after having traveled 1,538 mi in 8.5 months. The second was tagged off Martha's Vineyard, MA in July of 1991 and recaptured at the entrance to the Gulf of Mexico three years later (1071 mi. SW). Overall, less than 10 mako sharks that have been tagged elsewhere have been recaptured in the Gulf of Mexico.

Other species (103 returns)

A species whose trends in the data may reflect our concentrated effort and the interest of commercial fisheries is the **porbeagle**. There were 116 porbeagles tagged in 1994 and 11 recaptures. Two porbeagles, tagged by NMFS Observers in December of 1987 on Georges Bank, were recaptured within 2 months of each other in Canadian waters. These fish were at liberty more than 6.3 yrs each, placing them third and fourth in our data for time at liberty.

Other recaptures of note include **nurse sharks**. The nurse shark is a large inshore bottom dweller, occurring in water as shallow as 2 to 10 feet. It is common in the Caribbean and southern Florida with migrations to North Carolina and has occurred as far north as Rhode Island. This year two were released from an aquarium off New Jersey in early September and traveled faster than all other nurse sharks in our data base. The first traveled 66 miles south in 9 days (7.3 miles per day) and the second traveled 2.5 miles southwest in one day. Another nurse shark took second place in distance records and third in speed by traveling 284 miles south from Bob Hall Pier, TX to Tampico, Mexico. This is 1.4 miles per day for each of its' 202 days

free. Also, a nurse shark at liberty for 7.8 yrs exceeded the previous record time at liberty of 5.2 yrs. (See Shark Tagger 1993 for information on nurse shark reproductive studies by our staff and collaborators).

Recaptures from other species included speed and distance records and had some interesting movements. An **Atlantic sharpnose shark** exceeded both speed and distance records set in 1987 by traveling 522 mi. southeast from Port Mansfield, TX to Campeche, Mexico in 91 days. A backbone was returned from a tetracycline injected **blacktip shark** that was tagged by project personnel on board a commercial longline vessel and recaptured in 1994 by another commercial longline fisherman. This is the first tetracycline marked backbone returned from a blacktip shark. Another blacktip, tagged off Texas, and recaptured off Campeche, Mexico is the fourth longest distance for this species and exhibited transgulf movement from the U.S. to Mexico. The longest time at liberty record of 6.5 yrs was set by a **bigeye thresher shark** surpassing the previous record of 6.3 yrs. Both **night shark** and **scalloped hammerhead sharks** set new second place records for time at liberty for their species, at 12 yrs and 9 yrs, respectively.

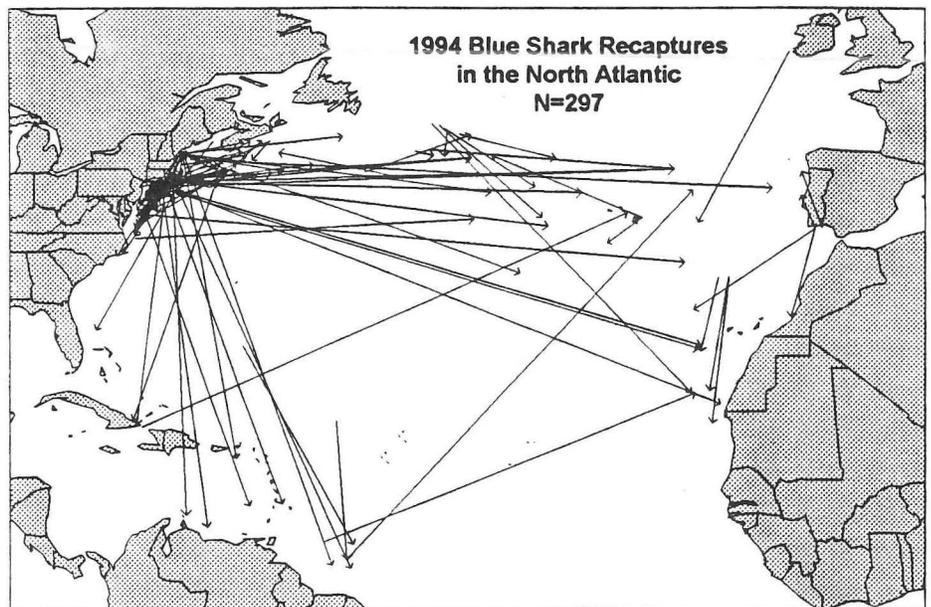


Table 2. Tag recoveries: January-December 1994.

TAGGED	GENERAL LOCATIONS		MONTHS AT LIBERTY	DIST. (MI.) AND DIR.	CAPTURE METHOD		TAGGED BY TAGGER	RESIDENCE
	TAGGED	RECAPTURED			TAG.	REC.		
Blue shark	E Rimini, Italy	NE Ancona, Italy	<1	38 SE	RR	GN	BGI	Italy
"	NE Rimini, Italy	W Grignamo, Italy	2	96 NE	RR	RR	BGI	Italy
"	Ionian Sea, Italy	SW Lecce, Italy	2	39 NE	LL	LL	Enrico Cattabiano	Italy
"	SE Jones Inlet, NY	S Martha's Vineyard, MA	1	104 NE	RR	RR	Lawrence J. Festa	NY
"	SE Pt. Judith, RI	SW Montauk Pt., NY	2	111 W	RR	RR	Ernest Dunphy	RI
"	SE Pt. Judith, RI	NE Paramaribo, Surinam	9	2165 SE	RR	LL	Dan Terceiro	RI
"	NR	SE Charleston, SC	NR	NR	RR	LL	Gary Graham	TX
"	SE Ocean City, MD	E Beach Haven, NJ	24	137 NE	RR	RR	Mark Sampson	MD
"	SE Fire Island Inlet, NY	E Cape Henry, VA	NR	NR	RR	RR	John Quigley	NY
"	SE Montauk Pt., NY	E Point Pleasant, NJ	12	78 SW	RR	RR	R.S. Hicks	CT
"	SW Montauk Pt., NY	W Las Palmas, Canary Isl	46	2720 E	RR	LL	Floyd Carrington	NY
"	E Montevideo, Uruguay	E Montevideo, Uruguay	21	249 E	LL	LL	Butch Winter	NJ
"	E Montauk Pt., NY	S Fire Island Inlet, NY	3	102 SW	RR	RR	Richard Warren	RI
"	E Montauk Pt., NY	E Sandy Hook, NJ	10	89 W	RR	RR	Ed McLaughlin	RI
"	SE Montauk Pt., NY	N Noudhibou, Mauritania, Africa	8	2836 E	LL	LL	I.M. Cute, NMFS Obs.	MA
"	E Indian River Inlet, DE	S Halifax, NS, Canada	7	433 NE	LL	LL	P. O'Donnell, NMFS Obs.	MA
"	SW Montauk Pt., NY	SW Montauk Pt., NY	<1	3 N	RR	RR	Richard Haug	NY
"	E Montauk Pt., NY	S Sequin, ME	14	169 NE	RR	RR	Bob Nyman	MA
"	E Montauk Pt., NY	NW Sao Miguel, Azores	34	1806 E	RR	LL	Al Ingulli	CT
"	SE Pt. Judith, RI	SE Pt. Judith, RI	<1	2 NW	RR	RR	Rocco D'Angelo, Jr.	RI
Blue shark	SE Pt. Judith, RI	SE Pt. Judith, RI	<1	3 N	RR	RR	Rocco D'Angelo, Jr.	RI
"	S Pt. Judith, RI	SE Flemish Cap	57	1311 E	RR	LL	Al Anderson	RI
"	NR	SW Montauk Pt., NY	NR	NR	RR	RR	Doug Adams	AL
"	E Manasquan Inlet, NJ	E Townsends Inlet, NJ	1	51 S	RR	LL	Al Riston	NJ
"	E Rimini, Italy	SW Palma di Montechiaro, Italy	25	417 S	RR	RR	G. Ricciotti	Italy
"	SE Block Island, RI	SE Pt. Judith, RI	<1	6 NE	RR	RR	George Houston	CT
"	SE Absecon Inlet, NJ	E Montauk Pt., NY	1	6 N	RR	RR	Basil Dubrosky	NJ
"	SE Ocean City, MD	S Pt. Judith, RI	5	221 NE	RR	RR	Brian Babbitt	NJ
"	S Pt. Judith, RI	SW Nantucket, MA	34	45 E	RR	RR	David Tyrrell	RI
"	SE Montauk Pt., NY	SE Montauk Pt., NY	NR	NR	RR	RR	J. Lockshier	CT
"	E Pt. Pleasant, NJ	SW Sable Island, NS, Canada	19	526 E	RR	LL	Mike Cusmano	NY
"	SW Montauk Pt., NY	S Shinnecock Inlet, NY	NR	NR	RR	RR	Ed Carpenter	NY
"	E Montauk Pt., NY	Georges Bank	25	NR	RR	LL	Tony Tolentino	MA
"	E Barnegat Inlet, NJ	E Montauk Pt., NY	1	130 NE	RR	RR	Jim Pier	NJ
"	S Corsair Canyon	SW Pt. Judith, RI	4	236 W	RR	RR	J. Symonds, NMFS Obs.	MA
"	SE Montauk Pt., NY	Great Pt., Nantucket Island, MA	1	84 NE	RR	RR	Pery K. Pratt	CT
"	SE Jones Inlet, NY	SE Manasquan Inlet, NY	3	120 SW	RR	RR	Robert Dowd	NY
"	E Montauk Pt., NY	Atlantis Canyon	1	74 S	RR	LL	Chuck Walker	MA
"	E Indian River Inlet, DE	Norfolk-Baltimore Canyons	15	47 S	RR	LL	George Jacob	NJ
"	E Jones Inlet, NY	N Nags Head, NC	30	270 SW	RR	LL	Steve Niestemski	CT
Blue shark	E Little Egg Inlet, NJ	SE Cape Henry, VA	6	NR	RR	GN	Scott Martindell	PA
"	SW Vineyard Haven, MA	SE Ocean City, MD	10	231 SW	RR	RR	Art Sansoucy	MA
"	E Montauk Pt., NY	SE Montauk Pt., NY	<1	20 S	RR	RR	Ted Maliszewski	CT
"	E Montauk Pt., NY	E Montauk Pt., NY	<1	14 SE	RR	RR	Ted Maliszewski	CT
"	S Pt. Judith, RI	SE Bonaire, Neth. Antilles	23	1740 S	RR	GN	Barry Bordner	MA
"	E Montauk Pt., NY	SE Pt. Judith, RI	25	11 E	RR	RR	Ralph Aiello	CT
"	E Montauk Pt., NY	SE Montauk Pt., NY	1	14 W	RR	RR	Dave Preble	RI
"	E Montauk Pt., NY	SE Montauk Pt., NY	<1	19 W	RR	RR	Dave Preble	RI
"	E Montauk Pt., NY	S Martha's Vineyard, MA	<1	43 E	FS	RR	Dave Preble	RI
"	SE Pt. Judith, RI	SE Montauk Pt., NY	<1	13 W	FS	RR	Dave Preble	RI
"	S Montauk, NY	SW Cape Sable, NS, Canada	26	247 NE	RR	LL	Harry Clemenz	NY
"	E Montauk Pt., NY	E Montauk Pt., NY	10	2 NE	RR	RR	Laird Summerlin	MA
"	SE Montauk Pt., NY	E Montauk Pt., NY	15	33 E	RR	RR	Fred Wedley	NY
"	S Montauk Pt., NY	NW La Guaira, Venezuela	32	1688 S	RR	LL	Daniel J. Tortora	MA
"	E Pt. Judith, RI	E Halifax Harbour, NS, Canada	25	28 NE	FS	LL	Rodman Sykes	RI
"	E Pt. Judith, RI	Cayo Moa, Holguin, Cuba	18	1283 S	FS	LL	Rodman Sykes	RI
"	S Boothbay Harbor, ME	S Sable Island, NS, Canada	5	441 E	RR	LL	Donald Chase, III	NH
"	S Block Island, RI	S Pt. Judith, RI	1	34 S	RR	RR	Bill Theis	NY
"	SE Montauk Pt., NY	E Montauk Pt., NY	20	11 NE	RR	RR	Andy Dangelo	RI
"	SE Saco River, ME	NE Cape Lookout, NC	29	597 SW	RR	LL	Bob Puddister	ME
Blue shark	S Cape Elizabeth, ME	SE Flemish Cap	22	1356 E	RR	LL	Richard Provencher	ME
"	S Newport, RI	E Montauk Pt., NY	24	16 NW	RR	RR	Ray Chappuis	CT
"	SE Montauk Pt., NY	SE Montauk Pt., NY	NR	NR	RR	RR	Chris Dadiskos	CT
"	E Ocean City, MD	SE Sao Miguel, Azores	5	2540 E	RR	LL	Wayne C. Miller	PA
"	SW Cape Sable, NS, Canada	E Montauk Pt., NY	12	209 W	GN	RR	D. Bishop, NMFS Obs.	MA
"	W Madeira Island, Portugal	SW Las Palmas, Canary Islands	19	386 S	RR	LL	Roddy Hays	England
"	S Martha's Vineyard, MA	NE Sao Miguel, Azores	24	2151 E	RR	LL	John Hunter	MA
"	NW Cayenne, French Guiana	NE Sao Miguel, Azores	30	2603 NE	LL	LL	Alex Sutton	NY
"	NE Georgetown, Guyana	NW Noudhibou, Mauritania	24	2199 NE	LL	LL	Alex Sutton	NY
"	SE Montauk Pt., NY	E Indian River Inlet, DE	14	192 SW	RR	RR	Tom Mort	RI
"	S Pt. Judith, RI	SE Ocean City, MD	13	209 SW	RR	RR	Tom Mort	RI
"	SE Cape Race, NF, Canada	NE Sao Miguel, Azores	11	1226 E	LL	LL	John W. Caldwell	FL
"	S Montauk Pt., NY	SE Pt. Judith, RI	26	33 NE	RR	RR	Frank Fasanella	CT
"	S Montauk Pt., NY	E Montauk Pt., NY	25	38 NE	RR	RR	Frank Fasanella	CT
"	Margate Pier, Margate, NJ	Brigantine, NJ	3	6 NE	RR	RR	Gene Geld	PA
"	Dingle County, Kerry, Ireland	E Sao Miguel, Azores	6	951 SW	RR	LL	Graeme Pullen	England
"	E Atlantic City, NJ	E Wachapreague Inlet, VA	2	114 SW	RR	LL	Joe Lucas	PA
"	S Vilamoura, Portugal	W Sidi Ifni, Morocco	16	468 S	RR	LL	Steve Fuller	Portugal
"	E Ocean City, MD	W Kingstown, St. Vincent	13	1571 SE	RR	LL	Bill Verbanas	DE
"	E of Sable Island, Canada	SE of Flemish Cap	24	492 NE	LL	LL	Scott Drabinowicz	MA
Blue shark	SW Flemish Cap	NW Noudhibou, Mauritania	18	1843 SE	LL	LL	Alex Sutton	NY
"	SE Venice, Italy	SW Venice, Italy	2	48 N	RR	RR	Vittadello Massimo	Italy
"	S Flemish Cap	NE Sao Miguel, Azores	21	1043 E	LL	LL	John Caldwell	FL
"	SE Flemish Cap	NW Faial Azores, Portugal	24	421 E	LL	LL	John Caldwell	FL
"	S Montauk Pt., NY	SE Jones Inlet, NY	3	51 W	RR	RR	Peter Jakits	NY
"	E Montauk Pt., NY	SE Montauk Pt., NY	<1	17 SW	RR	RR	Peter Jakits	NY
"	SE Montauk Pt., NY	NW Barbados, WI	18	1733 SE	RR	RR	Louis Lacagnine	CT
"	E Montauk Pt., NY	SE Montauk Pt., NY	<1	16 SW	RR	RR	Albert G. Wagnar	CT
"	SE Portland Headlights, ME	NW Lisbon, Portugal	24	2506 E	HL	LL	Stephen Connert	RI

Table 2. Tag recoveries: January-December 1994

TAGGED	GENERAL LOCATIONS		MONTHS AT LIBERTY	DIST. (MI.) AND DIR.	CAPTURE METHOD		TAGGED BY		RESIDENCE
	RECAPTURED				TAG.	REC.	TAGGER		
Blue shark	Marthas Vineyard, MA	SE Eastport, ME	25	259 NE	HL	LL	Stephen Connett	RI	
" "	E Shark River Inlet, NJ	E Ocean City, MD	15	118 S	RR	RR	Lawrence W. Gorman	NY	
" "	SE Montauk Pt., NY	E Montauk Pt., NY	24	17 NE	RR	RR	Howard Kiedaisch	NY	
" "	S Montauk Pt., NY	N Caracas, Venezuela	NR	NR	RR	LL	Scott Briggs	CT	
" "	SE Pt. Judith, RI	SE Fire Island Inlet, NY	2	76 SW	RR	RR	Fran Rameila	RI	
" "	S Montauk Pt., NY	SSE Block Island, RI	13	42 NE	RR	RR	Fred Wedley	NY	
" "	E Woods Hole, MA	E Woods Hole, MA	12	37 NE	GN	GN	Dianne Bishop	MA	
" "	SE Rudee Inlet, VA	W Faial, Azores	17	1580 E	LL	LL	J. Harrington, NMFS Obs.	MA	
" "	S Pt. Judith, RI	SE Jones Inlet, NY	12	86 SW	RR	RR	George Hehner	RI	
" "	S Block Island, RI	ESE Moriches Inlet, NY	2	38 SW	RR	RR	Tony Golfo	NY	
" "	E Montauk Pt., NY	SE Jones Inlet, NY	<1	73 SW	RR	RR	Kelly Smith	CT	
" "	SE Pt. Judith, RI	SE Pt. Judith, RI	<1	23 NW	FS	RR	Louis Lacagnina	CT	
" "	E Montauk Pt., NY	SE Pt. Judith, RI	0	23 NW	FS	RR	Lou Lacagnina	CT	
" "	SE Montauk Pt., NY	W Faial, Azores	19	1720 E	RR	LL	Joe McBride	NY	
" "	S Pt. Judith, RI	E Bamegat Inlet, NJ	5	104 SE	RR	LL	Charlie Donilon	RI	
" "	SSE Pt. Judith, RI	S Cape Sable, NS, Canada	13	258 E	RR	LL	Charlie Donilon	RI	
" "	SE Pt. Judith, RI	E Lewes, DE	2	157 SW	RR	LL	Laird Summerlin	MA	
" "	S Pt. Judith, RI	Norfolk Canyon	14	251 SW	RR	LL	Jeff Stonehill	CT	
" "	N San Juan, Puerto Rico	NE Georgetown, Guyana	2	1172 SE	LL	LL	Scott Drabinowicz	MA	
" "	E San Juan, Puerto Rico	NE Georgetown, Guyana	3	704 S	LL	LL	John W. Caldwell	FL	
Blue shark	S Montauk Pt., NY	E Wildwood, NJ	12	142 SW	RR	RR	Hal Weissman	NY	
" "	SE Montauk Pt., NY	SE Pt. Judith, RI	13	36 NE	RR	RR	Hal Weissman	NY	
" "	SW Montauk Pt., NY	SE Flemish Cap	8	1363 E	RR	LL	Tony Gooding	NY	
" "	SE Block Island, RI	S Block Island, RI	22	9 NW	RR	RR	Bob Morel	RI	
" "	S Pt. Judith, RI	S Pt. Judith, RI	1	26 NE	RR	RR	Barry Bordner	MA	
" "	SE Pt. Judith, RI	SE Pt. Judith, RI	3	20 W	RR	RR	William Bernstein	MA	
" "	S Pt. Judith, RI	SE Pt. Judith, RI	0	43 E	FS	RR	Gregg Skomal	MA	
" "	SE Montauk Pt., NY	S Cape Sable, NS, Canada	23	260 E	RR	LL	Bill Ricca	NY	
" "	SW Montauk Pt., NY	SE Montauk Pt., NY	<1	44 E	RR	RR	Richard Haug	NY	
" "	SW Montauk Pt., NY	S Montauk Pt., NY	1	33 E	RR	RR	Richard Haug	NY	
" "	SE Saco River, ME	E Cape May, NJ	24	291 SW	RR	LL	David Harold	MA	
" "	SE Montauk Pt., NY	E Montauk Pt., NY	22	16 E	RR	RR	Bill Ricca	NY	
" "	S Martha's Vineyard, MA	SE Pt. Judith, RI	NR	NR	RR	RR	Alex Friedman	MA	
" "	SE Saco River, ME	S St. Croix, Virgin Isl.	20	1576 S	RR	HL	Michael Gagnon	ME	
" "	SE Block Island, RI	S Nantucket Island, MA	12	59 E	RR	RR	James Killilea	RI	
" "	SE Fire Island Inlet, NY	SE Fire Island Inlet, NY	1	29 SE	RR	RR	Bill Danisi	NY	
" "	E Montauk Pt., NY	SE Fire Island Inlet, NY	3	86 SW	RR	RR	Bob Weaver	NY	
" "	E Montauk Pt., NY	E Montauk Pt., NY	12	36 NW	LL	RR	Stephen Connett	RI	
" "	SE Pt. Judith, RI	S Pt. Judith, RI	13	41 W	HL	RR	Stephen Connett	RI	
" "	S Martha's Vineyard, MA	E Saco River, ME	13	158 N	HL	RR	Stephen Connett	RI	
Blue shark	E Montauk Pt., NY	Georges Bank	1	203 E	LL	LL	Stephen Connett	RI	
" "	S Nantucket Isl., MA	S Nantucket Isl., MA	13	14 E	HL	HL	Stephen Connett	RI	
" "	SW Montauk Pt., NY	E Beach Haven, NJ	11	80 SW	RR	RR	Andy Becker	NY	
" "	SW Nantucket Island, MA	S Montauk Pt., NY	11	83 SW	RR	RR	Michael Riha	MA	
" "	SE Portland, ME	NE Cape Sable, NS, Canada	24	258 E	RR	LL	Ben Garfield	ME	
" "	S Vilamoura, Portugal	NNW Peniche, Portugal	12	179 N	RR	LL	F. Moss	Portugal	
" "	S Vilamoura, Portugal	N Sao Miguel Isl., Azores	NR	NR	RR	LL	F. Moss	Portugal	
" "	E Provincetown, MA	SW Halifax, NS, Canada	12	251 E	RR	LL	David St. John	MA	
" "	SE Montauk Pt., NY	E Bamegat Inlet, NJ	21	87 SW	RR	RR	Frank Braddick	NY	
" "	SE Portland, ME	SE Portland, ME	11	8 NW	RR	RR	Ian Bexon	ME	
" "	E Montauk Pt., NY	S Block Island, RI	NR	18 SW	RR	RR	Ed Abbenante	RI	
" "	N Provincetown, MA	E Cape Sable, NS, Canada	22	289 E	RR	LL	Thomas King	MA	
" "	E Montauk Pt., NY	E Indian River Inlet, DE	4	166 SW	RR	LL	Ralph Carlson	RI	
" "	E Montauk Pt., NY	S Montauk Pt., NY	4	77 S	RR	LL	Al Ingulli	CT	
" "	E Montauk Pt., NY	S Montauk Pt., NY	14	75 S	RR	LL	Jim Bohara	CT	
" "	SE Camp Ellis, Saco, ME	SW Cape Race, NF, Canada	12	678 E	RR	LL	Todd Stewart	ME	
" "	SE Montauk Pt., NY	E Cape May, NJ	13	140 SW	RR	RR	Mark Terceiro	RI	
" "	SW Vineyard Haven, MA	E Montauk Pt., NY	12	14 NW	RR	RR	Phillip Randolph	RI	
" "	E Saco River, ME	SW Flores, Azores	18	1643 E	RR	LL	Ben Garfield	ME	
" "	E Saco River, ME	E Rehobeth Beach, DE	9	314 SW	RR	LL	Ben Garfield	ME	
Blue shark	SE Portland Headlights, ME	N Paramaribo, Surinam	12	2229 SE	RR	LL	Mark Chase	ME	
" "	S Montauk Pt., NY	SE Montauk Pt., NY	12	22 NE	RR	RR	Frank Braddick	NY	
" "	SW Martha's Vineyard, MA	SE Montauk Pt., NY	12	21 SW	RR	RR	Alex Malgieri	MA	
" "	SE Montauk Pt., NY	NE Baracoa, Cuba	8	1226 S	RR	LL	Paul Smith	NY	
" "	N Paramaribo, Surinam	N C. Tres Puntas, Venezuela	2	460 W	LL	LL	Alex Sulton	NJ	
" "	E Madeira Isl., Portugal	SW Noudhibou, Mauntania	1	746 S	RR	LL	Roddy Hays	England	
" "	E Madeira Isl., Portugal	NW Noudhibou, Mauritania	8	583 S	RR	LL	Roddy Hays	England	
" "	E Sable Island, NS, Canada	SW Sable Island, NS, Canada	12	517 W	LL	LL	John Caldwell	FL	
" "	SE Montauk Pt., NY	S Martha's Vineyard, MA	1	50 E	RR	RR	Harry McAllister	NY	
" "	SE Portland, ME	SE Jones Inlet, NY	10	239 SW	RR	RR	Merrill T. Robbins	ME	
" "	SE Montauk Pt., NY	SE Wachapreague Inlet, VA	NR	NR	RR	RR	Bill Brown	CT	
" "	SW Martha's Vineyard, MA	Georges Bank	1	254 E	RR	LL	Rene Ben David	MA	
" "	NE Sao Miguel, Azores	SE Flemish Cap	13	737 NW	RR	LL	Adolfo Lino	MA	
" "	E Sao Miguel, Azores	SW Sao Miguel, Azores	8	206 SW	RR	LL	Adolfo Lino	MA	
" "	E Sao Miguel, Azores	SE Sao Miguel, Azores	14	50 SW	RR	LL	Adolfo Lino	MA	
" "	Montauk Pt., NY	SE Montauk Pt., NY	14	29 SW	RR	RR	Joseph Bohnenberger	MA	
" "	S Martha's Vineyard, MA	SE Block Island, RI	<1	28 NE	FS	RR	John Hunter	MA	
" "	SE Pt. Judith, RI	SW Halifax, NS, Canada	13	323 NE	HL	LL	Stephen Connett	RI	
" "	E Cape Henry, VA	SE Pt. Judith, RI	6	315 NE	LL	RR	Biologist (NMFS)	RI	
" "	SW Huelva, Spain	NW Porto, Portugal	3	300 N	RR	LL	Gaerne Pullen	England	
Blue shark	NE Venice, Italy	NE Brindisi, Italy	2	366 SE	RR	LL	Franco Murero, BGI	Italy	
" "	SE Shinnecock Inlet, NY	SW Montauk Pt., NY	<1	12 W	RR	RR	Bill Williams	NY	
" "	SE Montauk Pt., NY	E Beaufort, NC	6	422 SW	RR	LL	Joe McBride	NY	
" "	SE Pt. Judith, RI	NE Peak of Georges Bank	2	229 E	RR	LL	Al Anderson	RI	
" "	SE Pt. Judith, RI	SE Pt. Judith, RI	<1	3 N	RR	RR	Al Anderson	RI	
" "	SE Pt. Judith, RI	SE Pt. Judith, RI	1	22 W	RR	RR	Al Anderson	RI	
" "	S Pt. Judith, RI	E Montauk Pt., NY	1	10 NE	RR	RR	Al Anderson	RI	
" "	SSW Pt. Judith, RI	SE Sable Island, NS, Canada	7	644 E	RR	LL	Charlie Donilon	RI	
" "	S Montauk Pt., NY	S Shinnecock Inlet, NY	1	27 W	RR	RR	Howard Kiedaisch	NY	

Table 2. Tag recoveries: January-December 1994.

TAGGED	GENERAL LOCATIONS		MONTHS AT LIBERTY	DIST. (MI.) AND DIR.	CAPTURE METHOD		TAGGED BY		RESIDENCE
	RECAPTURED				TAG.	REC.	TAGGER		
Blue shark	SE Montauk Pt., NY	NE Peak of Georges Bank	2	242 E	RR	LL	Howard Kiedaisch		NY
" "	S Montauk Pt., NY	E Ocean City, MD	12	191 SW	RR	RR	Al Ratner		NY
" "	SE Pt. Judith, RI	S Pt. Judith, RI	<1	NR	RR	RR	Tom Birch		MA
" "	SE Montauk Pt., NY	SE Block Island, RI	12	24 NE	RR	RR	Bob Carman		NY
" "	E Manasquan Inlet, NJ	E Barnegat Inlet, NJ	1	27 S	RR	RR	Lou Green		NJ
" "	E Saco River, ME	N Venezuela	10	NR	FS	LL	Al Pillsbury		ME
" "	SE Montauk Pt., NY	SSW Montauk Pt., NY	<1	16 W	RR	RR	Harry McAllister		NY
" "	SE Montauk Pt., NY	SE Montauk Pt., NY	<1	10 NE	RR	RR	Harry McAllister		NY
" "	S Marthas Vineyard, MA	SE Montauk Pt., NY	1	45 W	RR	RR	Rick McLaughlin		MA
" "	S Marthas Vineyard, MA	SE Montauk Pt., NY	1	40 W	RR	RR	Rick McLaughlin		MA
" "	SE Pt. Judith, RI	S Marthas Vineyard, MA	<1	70 SE	RR	LL	Steve DeMarco		CT
" "	E Montauk Pt., NY	SE Pt. Judith, RI	1	28 NW	RR	RR	Steve DeMarco		CT
" "	S Montauk Pt., NY	SW Canary Islands, Spain	7	2692 E	RR	LL	Jim Bohara		CT
" "	SE Pt. Judith, RI	S Block Island, RI	<1	20 W	RR	RR	Harvey Cataldo		RI
" "	SW Montauk Pt., NY	Hudson Canyon	1	76 S	RR	LL	Skip Gula		NY
" "	E Wachapreague Inlet, VA	NE Oregon Inlet, NC	<1	94 S	RR	LL	Billy Verbanas		DE
" "	SE Ocean City, MD	S Block Island, RI	1	225 NE	RR	RR	Mark Sampson		MD
" "	SE Pt. Judith, RI	E Mays Landing, NJ	NR	NR	RR	RR	Robert LaValley		RI
" "	E Montauk Pt., NY	E Shark River Inlet, NJ	2	82 SW	RR	RR	Art Sansoucy		MA
" "	E Montauk Pt., NY	SE Block Island, RI	2	19 SW	RR	RR	Art Sansoucy		MA
Blue shark	E Montauk Pt., NY	E Montauk Pt., NY	<1	14 SE	RR	RR	Ken Benson		RI
" "	SE Portland Headlights, ME	NE Peak of Georges Bank	<1	205 SE	RR	LL	Ben Garfield		ME
" "	SE Portland Headlights, ME	NE Peak of Georges Bank	<1	205 SE	RR	LL	Ben Garfield		ME
" "	SE Punta Maisi, Cuba	S Terceira Isl., Portugal	NR	2680 NE	LL	RR	J. Grubich, NMFS Obs.		FL
" "	E Montauk Pt., NY	S Cape Sable, NS, Canada	1	237 E	RR	LL	James Walsh		CT
" "	SW Moriches Inlet, NY	SE Montauk Pt., NY	<1	59 E	RR	RR	Ron D'Angelo		NY
" "	S Moriches Inlet, NY	SE Cape May, NJ	<1	138 SW	RR	RR	Bruce Karas		NY
" "	E Jones Inlet, NY	SE Manasquan Inlet, NJ	4	45 SW	RR	RR	Tom Cashman		NY
" "	SE Montauk Pt., NY	S Montauk Pt., NY	1	41 W	RR	RR	Tom Cashman		NY
" "	SE Montauk Pt., NY	SE Montauk Pt., NY	2	44 NW	RR	RR	Tom Cashman		NY
" "	SE Montauk Pt., NY	S Montauk Pt., NY	1	51 NW	RR	RR	Tom Cashman		NY
" "	S Montauk Pt., NY	SW Montauk Pt., NY	1	5 NW	RR	RR	Bill Ricca		NY
" "	S Montauk Pt., NY	SE Montauk Pt., NY	1	30 E	RR	RR	Frank Braddick		NY
" "	E Halifax, NS, Canada	S Halifax, NS, Canada	12	110 SW	LL	LL	Andy Kingman		PA
" "	E Halifax, NS, Canada	SW Cape Sable, NS, Canada	9	238 SW	LL	LL	Mike Pittman		Canada
" "	SE Montauk Pt., NY	SE Moriches Inlet, NY	NR	NR	RR	RR	David B. Hanson		CT
" "	E Montauk Pt., NY	E Montauk Pt., NY	NR	5 S	RR	RR	Anthony Cassano		NY
" "	SW Cornwall, England	NR	3	NR	RR	LL	Graeme Pullen		England
" "	SE Pt. Judith, RI	E Montauk Pt., NY	<1	18 SW	RR	RR	Thomas A. Mort		RI
" "	E Cape Ann, MA	E Beach Haven, NJ	3	191 S	RR	LL	Paul Campbell		NH
Blue shark	SW Montauk Pt., NY	E Fire Island Inlet, NY	<1	42 W	RR	RR	Joe McBride		NY
" "	E Shark River Inlet, NJ	SE Pt. Judith, RI	2	109 NE	RR	RR	Mathew Richardson		NY
" "	S Vilamoura, Portugal	SW Madeira Isl., Portugal	6	723 SW	RR	LL	Steve Fuller		Portugal
" "	NE Ocean City, MD	E Ocean City, MD	<1	55 S	LL	LL	NMFS Obs.		MA
" "	SE Cape May, NJ	E Great Bay, NJ	NR	NR	RR	LL	Bill Garrison		NJ
" "	SE St. Johns, NF, Canada	SE St. Johns, NF, Canada	0	81 E	LL	LL	J. Symonds, NMFS Obs.		MA
" "	S Montauk Pt., NY	SE of Barnegat Inlet, NJ	2	112 SW	RR	RR	Allan Heinke		CT
" "	E Ocean City, MD	SE Wachapreague Inlet, VA	1	92 SW	RR	LL	William Verbanas		DE
" "	SE Pt. Judith, RI	S Shinnecock Inlet, NY	2	75 W	RR	LL	Charlie Donilon		RI
" "	SE Pt. Judith, RI	SE Block Island, RI	1	23 W	RR	RR	Art DiPaola		RI
" "	E Montauk Pt., NY	E Moriches Inlet, NY	3	39 SW	RR	RR	Barry Bordner		MA
" "	E Jones Inlet, NY	SE Montauk Pt., NY	1	97 SE	RR	LL	Fred Wedley		NY
" "	E Montauk Pt., NY	E Montauk Pt., NY	NR	26 S	RR	RR	William M. Ducci		CT
" "	SW Montauk Pt., NY	SE Pt. Judith, RI	1	54 NE	RR	RR	Otto Haselman		NY
" "	SW Montauk Pt., NY	SE Shinnecock Inlet, NY	NR	NR	RR	RR	Otto Haselman		NY
" "	SW Montauk Pt., NY	S Shinnecock Inlet, NY	<1	21 SW	RR	RR	Otto Haselman		NY
" "	S Montauk Pt., NY	S Montauk Pt., NY	<1	12 S	RR	RR	Michael Brumm		NY
" "	SE Montauk Pt., NY	SE Shinnecock Inlet, NY	<1	12 SW	RR	RR	Michael Brumm		NY
" "	E Montauk Pt., NY	SE Shinnecock Inlet, NY	2	49 SW	RR	RR	Jeff Eckert		CT
" "	E Montauk Pt., NY	SE Montauk Pt., NY	<1	25 SW	RR	RR	Jeff Eckert		CT
Blue shark	SE Montauk Pt., NY	SW Montauk Pt., NY	1	46 W	RR	RR	Robert Damore		NY
" "	S Moriches Inlet, NY	S Jones Inlet, NY	1	46 SW	RR	RR	Tom Cashman		NY
" "	SE Montauk Pt., NY	SE Pt. Judith, RI	<1	26 E	RR	RR	Frank Braddick		NY
" "	SE Montauk Pt., NY	NE Ocean City, MD	2	112 SW	RR	LL	Frank Braddick		NY
" "	E Montauk Pt., NY	E Montauk Pt., NY	NR	NR	RR	RR	Mike Brumm		NY
" "	S Fire Island Inlet, NY	E Montauk Pt., NY	NR	NR	RR	RR	Ken Scheben		NY
" "	S Montauk Pt., NY	S Montauk Pt., NY	<1	14 NE	RR	RR	Laird Summerlin		MA
" "	E Montauk Pt., NY	E Montauk Pt., NY	NR	NR	RR	RR	Otto Haselman		NY
" "	E Montauk Pt., NY	SE Montauk Pt., NY	NR	NR	RR	RR	Otto Haselman		NY
" "	E Montauk Pt., NY	SE Fire Island Inlet, NY	2	90 SW	RR	RR	Otto Haselman		NY
" "	SE Montauk Pt., NY	SE Pt. Judith, RI	NR	NR	RR	RR	Bruce Baxter		CT
" "	S Montauk Pt., NY	S Montauk Pt., NY	<1	8 SW	RR	RR	Mike Brumm		NY
" "	S Montauk Pt., NY	S Moriches, NY	1	10 NE	RR	RR	Steve Szoke		NY
" "	SE Montauk Pt., NY	E Montauk Pt., NY	<1	21 E	RR	RR	Bill Ricca		NY
" "	SE Montauk Pt., NY	E Barnegat Inlet, NJ	<1	90 SW	RR	LL	Frank Braddick		NY
" "	SE Montauk Pt., NY	SW Montauk Pt., NY	1	34 W	RR	RR	Frank Braddick		NY
" "	SE Montauk Pt., NY	SE Jones Inlet, NY	<1	87 W	RR	RR	Frank Braddick		NY
" "	SE Montauk Pt., NY	SE Montauk Pt., NY	<1	11 E	RR	RR	Tom Federico		NY
" "	SE Montauk Pt., NY	E Forked River, NJ	3	63 S	RR	LL	George Hettesheimer		NY
" "	SE Pt. Judith, RI	SW Montauk Pt., NY	1	104 SW	RR	RR	Arthur DiPaola		RI
Blue shark	SE Pt. Judith, RI	E Wachapreague Inlet, VA	2	273 SW	RR	LL	Joe Gouveia		MA
" "	SE Pt. Judith, RI	SE Block Island, RI	NR	NR	RR	RR	Joe Gouveia		MA
" "	S Montauk Pt., NY	SE Montauk Pt., NY	2	12 NE	RR	RR	Steve Roland		NY
" "	SE Pt. Judith, RI	E Montauk Pt., NY	<1	8 SW	RR	RR	Edward Abbenante		RI
" "	SE Montauk Pt., NY	SE Pt. Judith, RI	<1	26 E	RR	RR	Wayne King		NY
" "	E Montauk Pt., NY	SE Pt. Judith, RI	2	3 N	RR	RR	Mike Brumm		NY
" "	E Shinnecock Inlet, NY	E Absecon Inlet, NJ	2	92 SW	RR	LL	Al Phillips		NY
" "	SE Block Island, RI	S Marthas Vineyard, MA	1	42 E	RR	RR	Hal Weissman		NY
" "	SE Pt. Judith, RI	S Montauk Pt., NY	2	73 SW	RR	LL	Dana Zewinski		RI

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TAGGED	GENERAL LOCATIONS		MONTHS AT LIBERTY	DIST. (MI.) AND DIR.	CAPTURE METHOD		TAGGED BY	RESIDENCE
	RECAPTURED				TAG.	REC.		
Blue shark	E Montauk Pt., NY	SE Montauk Pt., NY	1	10 SW	RR	RR	George Brouillette	RI
" "	SE Pt. Judith, RI	SE Moriches Inlet, NY	NR	NR	RR	RR	Andy Dangelo	RI
" "	SSE Pt. Judith, RI	SE Pt. Judith, RI	1	3 NE	RR	RR	Charlie Donilon	RI
" "	S Pt. Judith, RI	SE Shinnecock Inlet, NY	2	41 S	RR	RR	Charlie Donilon	RI
" "	SE Pt. Judith, RI	S Pt. Judith, RI	3	13 SW	RR	RR	Charlie Donilon	RI
" "	SE Pt. Judith, RI	SE Vineyard Haven, MA	1	42 E	RR	RR	Charlie Donilon	RI
" "	SE Montauk Pt., NY	S Shinnecock Inlet, NY	2	57 W	RR	RR	Peter Jakits	NY
" "	S Vineyard Haven, MA	Atlantis Canyon	1	71 S	RR	LL	Gregg Skomal	MA
" "	E Montauk Pt., NY	S Cape Sable, NS, Canada	1	235 E	RR	LL	Gary Eaton	RI
" "	E Faro, Portugal	NR	NR	NR	RR	LL	Helder Ferreira	Portugal
" "	SE Montauk Pt., NY	SE Montauk Pt., NY	1	13 S	RR	RR	Fritz Hubner	NY
" "	S Flemish Cap	W. Faial, Azores	1	644 SE	LL	LL	Barry Marx	FL
" "	S Flemish Cap	NW Faial Azores	2	488 SE	LL	LL	Barry Marx	FL
" "	E Cape Race, NF, Canada	S Flemish Cap	1	126 S	RR	LL	Barry Marx	FL
" "	SE Montauk Pt., NY	E Montauk Pt., NY	NR	NR	RR	RR	William Carman	NY
" "	SE Montauk Pt., NY	S Halifax Harbour, NS, Canada	1	407 NE	RR	GN	Frank Braddick	NY
" "	SE Montauk Pt., NY	NR	NR	NR	RR	LL	Norm Poulan	CT
" "	SE Montauk Pt., NY	Georges Bank (Canadian side)	2	247 E	RR	LL	Frank Braddick	NY
" "	SE Montauk Pt., NY	S Cape Sable, NS, Canada	12	260 E	RR	LL	Mike Brumm	NY
" "	SE Montauk Pt., NY	E Montauk Pt., NY	15	14 E	RR	RR	Steve Szoke	NY
Blue shark	E Montauk Pt., NY	Great Pt. Beach, Nantucket, MA	12	41 NE	RR	RR	Sandy Ballou	RI
" "	SE Cape May, NJ	NE Peak of Georges Bank	4	456 NE	LL	LL	Paul O'Donnell	MA
" "	E Cape May, NJ	NE Peak of Georges Bank	4	364 NE	LL	LL	Paul O'Donnell	MA
" "	S Eastport, ME	S Falmouth, MA	2	262 SW	LL	RR	Paul O'Donnell	MA
" "	SE Montauk Pt., NY	SE Pt. Judith, RI	1	20 N	RR	RR	William M. Ducci	CT
" "	S Montauk Pt., NY	S Shinnecock Inlet, NY	1	33 W	RR	RR	Bill Ducci	CT
" "	SE Montauk Pt., NY	SE Absecon Inlet, NJ	13	168 SW	RR	LL	John W. Salisbury	CT
" "	E Sandy Hook, NJ	E Mays Landing, NJ	5	59 S	RR	LL	Harry Bowman	NY
" "	SE Pt. Judith, RI	E Montauk Pt., NY	<1	11 W	FS	RR	Andy Dangelo	RI
" "	S Pt. Judith, RI	S Moriches Inlet, NY	2	69 SW	FS	RR	Andy Dangelo	RI
" "	SE Pt. Judith, RI	S Pt. Judith, RI	<1	16 SW	RR	RR	Andy Dangelo	RI
" "	SE Block Island, RI	S Block Island, RI	3	12 SW	RR	TN	Andy Dangelo	RI
" "	E Montauk Pt., NY	SW Cape Sable, NS, Canada	1	214 E	RR	LL	Andy Dangelo	RI
" "	SE Pt. Judith, RI	SE Jones Inlet, NY	3	98 SW	FS	RR	Charlie Donilon	RI
" "	SE Pt. Judith, RI	SE Montauk Pt., NY	<1	25 SW	RR	RR	Al Anderson	RI
Blue shark	E Montauk Pt., NY	NE Peak of Georges Bank	NR	235 E	RR	LL	Russell Everett	CT
" "	SE Montauk Pt., NY	SSW Pt. Judith, RI	<1	18 W	RR	RR	Rich Templeton	RI
" "	S Pt. Judith, RI	S Pt. Judith, RI	1	7 W	RR	RR	Jim Noon	RI
" "	E Montauk Pt., NY	S Nantucket Island, MA	1	64 E	RR	RR	Ralph Carlson, Jr.	RI
" "	SW Montauk Pt., NY	E Rudee Inlet, VA	4	227 SW	RR	LL	Tom Cashman	NY
" "	S Pt. Judith, RI	E Montauk Pt., NY	<1	9 SE	RR	RR	Malcolm Brownell III	RI
" "	S Montauk Pt., NY	E Montauk Pt., NY	<1	36 NE	RR	RR	Mike Brumm	NY
" "	SE Montauk Pt., NY	SE Block Island, RI	1	18 NE	RR	RR	Bill Ricca	NY
" "	S Montauk Pt., NY	E Montauk Pt., NY	<1	25 NE	RR	RR	Frank J. Braddick	NY
" "	S Montauk Pt., NY	SE Pt. Judith, RI	1	56 NE	RR	RR	Frank J. Braddick	NY
" "	SE Montauk Pt., NY	SE Montauk Pt., NY	2	10 NW	RR	RR	Joe McBride	NY
" "	S Montauk Pt., NY	NE Sao Miguel, Azores	8	2199 E	RR	LL	Joe McBride	NY
" "	SE Fire Isl., NY	E Manasquan Inlet, NJ	1	49 W	RR	RR	Thomas Boniberger	NY
" "	S Fire Island Inlet, NY	SE Moriches Inlet, NY	1	46 NE	RR	RR	Ken Schmieder	NY
" "	E Shark River Inlet, NJ	SE Moriches Inlet, NY	<1	46 NE	RR	RR	Kenneth Schmieder	NY
" "	S Block Island, RI	S Montauk Pt., NY	12	36 W	RR	RR	Everett Petronio	RI
" "	E Montauk Pt., NY	S Pt. Judith, RI	12	9 NW	RR	RR	George Brouillette	RI
" "	SW Montauk Pt., NY	SW Montauk Pt., RI	1	6 NE	RR	RR	John Manarte	NY
" "	SE Montauk Pt., NY	SE Montauk Pt., NY	1	15 NW	RR	RR	Bill Ricca	NY
Blue shark	S Fire Island Inlet, NY	S Montauk Pt., NY	1	75 NE	RR	RR	Gary Blackler	NY
" "	SW Montauk Pt., NY	SE Moriches Inlet, NY	1	56 NE	RR	RR	Gary Blackler	NY
" "	SE Martha's Vineyard, MA	SW Montauk Pt., NY	NR	NR	RR	HL	Alex Friedman	MA
" "	SE Pt. Judith, RI	E Cape Canaveral, FL	8	842 SW	HL	LL	Stephen Connnett	RI
" "	SE Newport, RI	SW Cape Sable, NS, Canada	12	165 E	LL	LL	Stephen Connnett	RI
" "	E Cape May, NJ	SW Montauk Pt., NY	1	117 NE	RR	RR	James R. Gatto	NJ
" "	S Montauk Pt., NY	SE Pt. Judith, RI	1	48 NE	RR	RR	Mike Brumm	NY
" "	SE Pt. Judith, RI	S Pt. Judith, RI	1	34 W	HL	RR	Stephen Connnett	RI
" "	S Martha's Vineyard, MA	SE Montauk Pt., NY	1	27 W	HL	RR	Stephen Connnett	RI
" "	S Martha's Vineyard, MA	SE Pt. Judith, RI	<1	30 NW	HL	RR	Stephen Connnett	RI
" "	E Montauk Pt., NY	E Montauk Pt., NY	<1	10 SW	FS	RR	Stephen Connnett	RI
" "	SE Pt. Judith, RI	S Shinnecock Inlet, NY	1	78 W	HL	RR	Stephen Connnett	RI
" "	E Montauk Pt., NY	E Montauk Pt., NY	1	41 W	HL	RR	Stephen Connnett	RI
" "	SE Pt. Judith, RI	NE Peak of Georges Bank	2	217 E	HL	LL	Stephen Connnett	RI
Tiger shark	SE Eleuthra Point, Bahamas	E Rudee Inlet, VA	90	732 N	LL	RR	Steven Connnett	RI
" "	NE Daytona Beach, FL	N Punta Alegre, Cuba	39	435 S	LL	GN	Eric Sander	FL
" "	Little Finger Chincoteague, VA	SE Rudee Inlet, VA	3	90 S	RR	LL	Dwight Daniel	MD
" "	NE Ponce Inlet, FL	Punta Maisi, Cuba	25	663 SE	LL	LL	Tris Colket	FL
" "	NE St. Augustine, FL	N Oregon Inlet, NC	30	433 NE	LL	RR	Tris Colket	FL
" "	NE St. Augustine, FL	Guana Island, Virgin Islands	32	1123 SE	LL	HN	Tris Colket	FL
" "	E Jacksonville, FL	E of Hatteras Inlet, NC	19	398 NE	LL	LL	Tris Colket	FL
" "	SE Shinnecock Inlet, NY	E Little Egg Inlet, NJ	1	101 SW	RR	LL	Mike Sullivan	NY
" "	NE Jacksonville, FL	Georgetown, Guyana	18	1856 SE	LL	LL	Tris Colket	FL
" "	NE Jacksonville, FL	E Jacksonville, FL	18	31 SE	LL	LL	Tris Colket	FL
" "	E Ponce Inlet, FL	E Southport, NC	7	322 NE	LL	LL	Eric Sander	FL
" "	E Ponce Inlet, FL	E Marathon, FL	7	272 S	LL	LL	Eric Sander	FL
" "	E Ponce Inlet, FL	E Ponce Inlet, FL	13	1 SE	LL	LL	Eric Sander	FL
" "	E Ponce Inlet, FL	E Sebastian Inlet, FL	7	83 S	LL	LL	Eric Sander	FL
" "	SW New Orleans, LA	Champton, Campeche, Mexico	1	515 S	LL	LL	Robert Slaughter	FL
" "	E Ponce Inlet, FL	E Crescent City, FL	10	37 NW	LL	LL	Tris Colket	FL
" "	E St. Mary's, GA	E Jacksonville, FL	15	32 S	LL	LL	Tris Colket	FL
" "	NE Ponce Inlet, FL	E Jacksonville, FL	12	44 N	LL	LL	Tris Colket	FL
" "	E Daytona, FL	E Key Largo, FL	9	278 S	LL	LL	Tris Colket	FL
" "	Bimini, Bahamas	Bimini, Bahamas	9	0	LL	LL	Sonny Gruber	FL
" "	E Jacksonville, FL	E Sebastian Inlet, FL	8	163 S	LL	LL	Tris Colket	FL

Table 2. Tag recoveries: January-December 1994.

	GENERAL LOCATIONS		MONTHS AT LIBERTY	DIST. (MI) AND DIR.	CAPTURE METHOD		TAGGED BY		RESIDENCE
	TAGGED	RECAPTURED			TAG.	REC.	TAGGER		
Tiger shark	E Jacksonville, FL	E Canaveral Pier, FL	7	143 S	LL	LL	Tris Colket	FL	
" "	SE Southport, NC	E Wilmington, NC	10	35 N	LL	RR	Chris Jensen	NC	
" "	SE Southport, NC	E Rudee Inlet, Va	9	213 NE	LL	LL	Chris Jensen	NC	
" "	SE Southport, NC	SE Wrightsville Beach, NC	7	15 N	LL	LL	Chris Jensen	NC	
" "	E Southport, NC	S Cape Race, NF, Canada	7	1282 NE	LL	LL	Chris Jensen	NC	
" "	SE Cape Fear, NC	SE New Topsail Inlet, NC	6	33 NE	LL	RR	Chris Jensen	NC	
" "	E Jacksonville, FL	E Jacksonville, FL	4	2 N	LL	LL	Tris Colket	FL	
" "	E Jacksonville, FL	NE Ponce Inlet, FL	5	50 S	LL	LL	Tris Colket	FL	
" "	E Jacksonville, FL	E St. Catherine's Isl. GA	2	80 N	LL	LL	Tris Colket	FL	
" "	E Jacksonville, FL	E St. Augustine, FL	8	35 SW	LL	LL	Tris Colket	FL	
" "	E Jacksonville, FL	E Fernandina Beach, FL	4	16 W	LL	LL	Tris Colket	FL	
" "	E Jacksonville, FL	NE Daytona Beach, FL	4	62 S	LL	LL	Tris Colket	FL	
" "	E Jacksonville, FL	E Jacksonville, FL	4	22 SW	LL	LL	Tris Colket	FL	
" "	E Jacksonville, FL	E St. Augustine, FL	6	36 S	LL	LL	Tris Colket	FL	
" "	E Southport, NC	E Southport, NC	3	10 N	LL	LL	Chris Jensen	NC	
" "	E Southport, NC	E Ocean City, MD	6	306 N	LL	LL	Chris Jensen	NC	
" "	E Cape Fear, NC	E Cape Fear, NC	<1	18 SE	LL	LL	Chris Jensen	NC	
" "	E Cape Fear, NC	E Cape Fear, NC	1	35 E	LL	LL	Chris Jensen	NC	
" "	SE port, NC	E Cape Lookout, NC	1	118 NE	LL	LL	Chris Jensen	NC	
" "	SW Atlantic Beach, NC	E Savannah, GA	1	152 SW	LL	LL	Chris Jensen	NC	
Tiger shark	SE Southport, NC	E Cape Hatteras, NC	3	161 NE	LL	LL	Chris Jensen	NC	
" "	E Georgetown, SC	S Cape Hatteras, NC	<1	113 NE	LL	LL	Chris Jensen	NC	
" "	E St. Augustine, FL	NE St. Mary's, GA	6	82 NW	LL	RR	Tris Colket	FL	
" "	E St. Augustine, FL	E Charleston, SC	1	176 N	LL	LL	Tris Colket	FL	
" "	E St. Augustine, FL	NE Jacksonville, FL	5	28 NW	LL	LL	Tris Colket	FL	
" "	E Jacksonville, FL	SE Ponce Inlet, FL	4	76 S	LL	LL	Tris Colket	FL	
" "	E Jacksonville, FL	E Ocean City, MD	3	569 NE	LL	RR	Tris Colket	FL	
" "	E Fernandina Beach, FL	E Fernandina Beach, FL	2	5 SE	LL	LL	Tris Colket	FL	
" "	E Jacksonville Beach, FL	NE Ponce Inlet, FL	3	55 S	LL	LL	Tris Colket	FL	
" "	E Jacksonville, FL	NE Jacksonville, FL	4	12 NW	LL	LL	Tris Colket	FL	
" "	SE Ponce Inlet, FL	E Ponce Inlet, FL	2	25 W	LL	LL	Tris Colket	FL	
" "	E Fernandina Beach, FL	SE Ponce Inlet, FL	1	113 S	LL	LL	Tris Colket	FL	
" "	E Fernandina Beach, FL	E Ponce Inlet, FL	2	107 S	LL	LL	Tris Colket	FL	
" "	E St. Augustine, FL	E St. Augustine, FL	1	4 NE	LL	LL	Tris Colket	FL	
" "	E St. Augustine, FL	NE Ponce Inlet, FL	1	33 SW	LL	LL	Tris Colket	FL	
" "	E Jacksonville, FL	E St. Augustine, FL	12	26 S	LL	LL	Tris Colket	FL	
" "	E Jacksonville, FL	W Pta. Ostiones, Puerto Rico	9	1032 SE	LL	LL	Tris Colket	FL	
" "	E Jacksonville, FL	E Jacksonville, FL	7	33 SW	LL	LL	Tris Colket	FL	
" "	E Ponce Inlet, FL	E Ponce Inlet, FL	2	21 W	LL	LL	Eric Sander	FL	
" "	E Ponce Inlet, FL	NE Daytona Beach, FL	2	17 NW	LL	LL	Eric Sander	FL	
" "	E St. Augustine, FL	E Ponce Inlet, FL	12	62 S	LL	LL	Tris Colket	FL	
" "	ESE St. Augustine, FL	SE St. Augustine, FL	6	4 W	LL	LL	Tris Colket	FL	
" "	ESE St. Augustine, FL	E Cape Canaveral, FL	12	92 SE	LL	LL	Tris Colket	FL	
" "	ESE St. Augustine, FL	W Southport, NC	6	284 NE	LL	LL	Tris Colket	FL	
" "	ESE Jacksonville, FL	E Jacksonville, FL	7	39 E	LL	LL	Tris Colket	FL	
" "	E Jacksonville, FL	E Jacksonville, FL	1	15 SE	LL	LL	Tris Colket	FL	
" "	E Jacksonville, FL	E Jacksonville, FL	1	15 SE	LL	LL	Tris Colket	FL	
Sandbar shark	Yaopen Beach Pier, NC	Caswell Beach, NC	2	2 S	RR	GN	Mark Patterson	NC	
" "	SE Cape Henry, VA	SW Naples, FL	73	1025 SW	RR	LL	Fred Levitin	VA	
" "	Charleston Harbor, SC	E Charleston Hbr Inl., SC	12	8 E	RR	RR	Doug Oakley	SC	
" "	Chesapeake Bay, VA	E Cape Henry, VA	24	34 SE	LL	LL	Jack Musick	VA	
" "	SE Oregon Inlet, NC	E Cape Hatteras, NC	NR	NR	LL	LL	Stephen Connett	RI	
" "	NE Cape Hatteras, NC	SE Cape Fear, NC	118	170 SW	LL	LL	Stephen Connett	RI	
" "	SE Fire Island Inlet, NY	W Indian Key Pass, FL	102	1344 SW	RR	LL	Chris Zablocki	NY	
" "	SE Montauk Pt, NY	SW St. Petersburg, FL	NR	NR	RR	LL	Michael Herts	NY	
" "	E Barnegat Inlet, NJ	E Rudee Inlet, VA	122	199 SW	RR	LL	James Hickey	NJ	
" "	SE Moriches Inlet, NY	W Redington Beach, FL	108	1463 SW	RR	LL	Dan Azzato	NY	
" "	S Jones Inlet, NY	NE Cape Lookout, NC	NR	NR	RR	LL	Ray Carpenter	NY	
" "	S Fire Island Inlet, NY	E Southport, NC	42	437 SW	RR	LL	John Frevola	NY	
" "	SE Cape May Inlet, NJ	E Avon, NC	NR	NR	RR	LL	Steve M. Dermyan	NJ	
" "	SE Manasquan Inlet, NJ	SE of Tuxpan, Mexico	75	1942 SW	RR	LL	Al Ristori	NJ	
" "	SW Fire Island Inlet, NY	SE Pt. Judith, RI	49	121 NE	RR	GN	Mervin Bedell	NY	
" "	SE Sandy Hook, NJ	E Southport, NC	NR	NR	RR	LL	George Sincov	NJ	
" "	SE Manasquan Inlet, NJ	E Southport, NC	65	378 SW	RR	LL	David Foley	FL	
" "	E Cape May, NJ	E Ocracoke Inlet, NC	NR	NR	RR	TO	Joe Lucas III	PA	
Sandbar shark	SE Cape May, NJ	SE Barnegat Inlet, NJ	61	68 SE	RR	LL	George Jacob	NJ	
" "	SE Fire Island Inlet, NY	NE Cape Lookout, NC	55	388 SW	RR	LL	Lawrence Lund	NJ	
" "	E Montauk Pt., NY	W Everglades, FL	59	1385 SW	RR	LL	Andy Dangelo	RI	
" "	E Montauk Pt., NY	S Apalachicola, FL	58	1583 SW	RR	LL	Fred Gallagher	RI	
" "	Delaware Bay, NJ	Corolla, NC	9	174 S	RR	GN	Peter Del Rossi	PA	
" "	SE Cape Hatteras, NC	SW Montauk Pt., NY	62	308 N	LL	LL	Biologist (NMFS)	RI	
" "	NE Avon, NC	E Avon, NC	54	16 E	LL	LL	Biologist (NMFS)	RI	
" "	SE Oregon Inlet, NC	SE Ocracoke Inlet, NC	57	NR	LL	LL	Biologist (NMFS)	RI	
" "	SE Montauk Pt., NY	Marquesas Keys, FL	54	1119 SW	RR	LL	Charles Joscher	NY	
" "	E Jones Inlet, NY	NE Oregon Inlet, NC	58	271 S	RR	LL	John Frevola	NY	
" "	SE Manasquan Inlet, NJ	E Ponce Inlet, FL	31	731 SW	RR	LL	Jeff Baker	NJ	
" "	E Beach Haven, NJ	E Cape Lookout, NC	56	312 S	RR	LL	David Soleau	NJ	
" "	W Cape Hatteras, NC	SE Fire Island Inlet, NY	52	342 N	TN	RR	Jerry Prezioso	RI	
" "	E St. Augustine, FL	SW St. Petersburg, FL	49	643 SW	LL	LL	Eric Sander	FL	
" "	NE Daytona Beach, FL	S Destin, FL	54	888 W	LL	LL	Eric Sander	FL	
" "	E Pt. Pleasant, NJ	E Southport, NC	32	408 SW	RR	LL	Frank Daddio	NJ	
" "	SE Manasquan Inlet, NJ	SE Cape Canaveral, FL	32	761 SW	RR	LL	Dave Foley	FL	
" "	N Oregon Inlet, NC	E Cape May, NJ	27	160 NE	RR	LL	J T Baker	NC	
" "	E Ponce Inlet, FL	N Cayo Frances, Cuba	34	380 S	LL	LL	Eric Sander	FL	
" "	SE Folley Beach, SC	W Mule Key, Key West, FL	34	502 SW	LL	LL	Biologist (NMFS)	RI	
" "	S Beaufort Inlet, NC	Fernandina Beach, FL	36	337 SW	LL	RR	Biologist (NMFS)	RI	
" "	E Ocracoke, NC	SE Ocracoke Inlet, NC	34	NR	LL	LL	Biologist (NMFS)	RI	
" "	E Oregon Inlet, NC	NR	31	NR	LL	LL	Biologist (NMFS)	RI	
" "	S Moriches Inlet, NY	E Barnegat Inlet, NJ	2	68 SW	RR	LL	Dave Howard	NY	

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TAGED	GENERAL LOCATIONS		MONTHS AT LIBERTY	DIST. (MI.) AND DIR.	CAPTURE METHOD		TAGGED BY	
	RECAPTURED				TAG.	REC.	TAGGER	RESIDENCE
Sandbar shark	NW Folley Beach, SC	SE Apalachicola, FL	33	960 SW	RR	LL	Rick Stringer	SC
"	SW Wachapreague Inlet, VA	E Morehead City, NC	8	143 S	RR	LL	Barry Truitt	VA
"	E Cape Henlopen, DE	Cape Lookout, NC	9	276 S	RR	LL	Chris Roselli	NJ
"	E Jones Inlet, NY	E Cape Charles, VA	12	240 SW	RR	LL	Kenneth Schmieder	NJ
"	Cape Pt., Buxton, NC	E Ocean City, MD	15	196 NE	RR	LL	Paul A. Myers	NC
"	W Naples, FL	SW Panama City Beach, FL	8	266 N	LL	LL	Steve Thorsteinsson	FL
"	SE St. Augustine, FL	Savannah, GA	4	147 N	LL	RR	Tris Colket	FL
Shortfin mako	S Cape Sable, NS, Canada	ESE Hudson Canyon	18	243 W	LL	LL	Jerzy Cygler, NMFS Obs.	MA
"	SE Montevideo, Uruguay	SE Santos, Brazil	23	830 NE	LL	LL	Butch Winter	NJ
"	E Cape May, NJ	SE Manasquan Inlet, NJ	12	58 N	RR	RR	Mike Kershaw	PA
"	E Mays Landing, NJ	SE Monches Inlet, NY	12	80 NE	RR	RR	Matt Muzslay	NJ
"	SW Montauk Pt., NY	SE Eastport, ME	1	356 E	RR	LL	Ray McDevitt	NY
"	S Martha's Vineyard, MA	Key Largo, FL	36	1071 SW	RR	LL	John Migdelary	MA
"	SE Manasquan Inlet, NJ	SE Flemish Cap	11	1388 E	RR	LL	Lou Green	NJ
"	E Montauk Pt., NY	E Montauk Pt., NY	2	13 NW	RR	RR	Andy Dangelo	RI
"	SSE Ocean City, MD	SE Flemish Cap	22	1576 NE	LL	LL	John Fabryka	DE
"	S Flemish Cap	SE Flemish Cap	26	389 E	LL	LL	John Caldwell	FL
"	SE Flemish Cap	E Sao Miguel, Azores	17	1022 E	LL	LL	John Caldwell	FL
"	E Sable Island, Canada	SE Flemish Cap	24	289 E	LL	LL	John W. Caldwell	FL
"	W Madeira Island, Portugal	NE Sao Miguel, Azores	24	615 N	RR	LL	Roddy Hays	England
"	SE Rudee Inlet, VA	SE Manasquan Inlet, NJ	11	210 N	RR	RR	George M. Dulka	NJ
"	E Ocean City, MD	SE Wachapreague Inlet, VA	18	75 S	RR	LL	Robert Conrad	MD
"	E Barnegat Inlet, NJ	Norfolk Canyon	2	175 S	RR	LL	Larry Barr	NJ
"	E Cape May, NJ	S Fire Island Inlet, NY	13	109 NE	RR	RR	Lawrence Jordan	PA
"	E Montauk Pt., NY	SW Montauk Pt., NY	12	71 W	LL	RR	Stephen Connott	RI
"	S Montauk Pt., NY	SE Flemish Cap	11	1376 E	RR	LL	John Schoen	NY
"	E Montauk Pt., NY	SE of Flemish Cap	9	1281 E	RR	LL	Mark Terceiro	RI
"	E Cape Hatteras, NC	N La Guaira, Venezuela	9	1538 S	LL	GN	J. Harrington, NMFS Obs.	MA
"	E Cape Hatteras, NC	SE Oregon Inlet, NC	12	23 NE	LL	RR	J. Harrington, NMFS Obs.	MA
"	E Buxton, NC	NE Oregon Inlet, NC	15	56 N	LL	LL	J. Harrington, NMFS Obs.	MA
Shortfin mako	E Ocean City, MD	E Montauk Pt., NY	1	213 NE	RR	RR	Tom Sharp	DE
"	S Flemish Cap	N Pico Island, Azores	15	873 E	LL	LL	John Caldwell	FL
"	SW Flemish Cap	SE Flemish Cap	14	372 E	LL	LL	Alex Sutton	NY
"	SE Flemish Cap	SE Flemish Cap	14	104 NE	LL	LL	Alex Sutton	NY
"	E Oregon Inlet, NC	E Wachapreague Inlet, VA	NR	235 NE	LL	LL	Paul Puskas	NJ
"	E Barnaget Inlet, NJ	S Montauk Pt., NY	2	86 NE	RR	RR	George Melitsky Jr.	NJ
"	NW Faial, Azores, Portugal	NW Faial Azores, Portugal	1	83 NE	LL	LL	Barry Marx	FL
"	E Little Egg Inlet, NJ	E Montauk Pt., NY	2	145 NE	RR	RR	Bill Boyd	NY
"	E Ocean City, MD	E Tail of Georges Bank	2	1247 NE	RR	LL	William Verbanas	DE
"	SE Ocean City, MD	S Jones Inlet, NY	2	153 NE	RR	RR	Mark Sampson	MD
"	E Montauk Pt., NY	E Montauk Pt., NY	1	1 W	RR	RR	Otto Haselman	NY
"	SE Jones Inlet, NY	S Sambro, NS, Canada	2	445 NE	RR	LL	Larry Festa	NY
"	SW Flemish Cap	NE Faial Island, Azores	2	1183 E	LL	LL	NMFS Observer	MA
"	S Flemish Cap	NW Faial, Azores	1	533 E	LL	LL	NMFS Observer	MA
"	S Flemish Cap	SW Flemish Cap	1	88 NW	LL	LL	Scott Drabinowicz	MA
"	S Flemish Cap	SE Flemish Cap	1	152 E	LL	LL	Scott Drabinowicz	MA
"	E Manasquan Inlet, NJ	E Wachapreague Inlet, VA	4	174 SW	RR	LL	Kenneth Schmieder	NY
"	S Barnegat Inlet, NJ	SE Jones Inlet, NY	NR	99 NE	RR	RR	James R. Gatto	NJ
Bleacktip shark	SW Apalachicola, FL	SW Apalachicola, FL	35	4 W	RR	GN	Bill Arrants	FL
"	N Pine Island, FL	Charlotte Harbor, FL	<1	3 SW	RR	RR	Chuck Gause	FL
"	Folley Beach, SC	E Charleston, SC	1	22 NE	RR	RR	Rick Stringer	SC
"	Toms Harbor, Grassy Key, FL	Sprigger Bank, FL Bay, FL	16	9 N	RR	RR	Ned Stearns	FL
"	Bob Hall Pier, TX	Matamoros, Mexico	4	93 S	RR	LL	Chris Ruiz	TX
"	Pine Island Sound, FL	NR	<1	NR	RR	RR	Leo (Skip) Dunn	FL
"	Pine Island Sound, FL	Blind Pass, Pine Island, FL	1	4 N	RR	RR	Leo (Skip) Dunn	FL
"	Pine Island Sound, FL	Marco Island, FL	1	41 SE	RR	RR	Leo (Skip) Dunn	FL
"	Calosahatchee River, FL	Calosahatchee River, FL	<1	7 SW	RR	RR	Randy Hoffman	FL
"	Pine Island Sound, FL	Pine Island Sound, FL	<1	1 NE	RR	GN	Leo (Skip) Dunn	FL
"	Pass Cavallo, TX	N Campeche, Mexico	5	618 SE	RR	LL	Mark Kelley	TX
"	Pine Island Sound, FL	Pine Island Sound, FL	8	2 SE	RR	RR	Leo (Skip) Dunn	FL
"	ESE Jacksonville, FL	E Daytona Beach, FL	8	60 S	LL	LL	Tris Colket	FL
Porbeagle	E Martha's Vineyard, MA	NE Halifax Harbor, NS, Canada	78	507 NE	LL	LL	G. Hinteregger, NMFS Obs.	MA
"	E Sandy Hook, NJ	E Woods Hole, MA	66	64 N	LL	TN	J. Taylor, NMFS Obs.	MA
"	E Nantucket Island, MA	S Sable Island, NS, Canada	76	331 NE	LL	LL	D. Kotula, NMFS Obs.	MA
"	S Cape Race, NF, Canada	SW Cape Race, NF, Canada	24	357 W	LL	LL	Scott Drabinowicz	MA
"	SE Martha's Vineyard, MA	W Cape Sable, NS, Canada	3	196 N	LL	GN	Phil Ruhle	VA
"	SE Portland, ME	SE Nova Scotia, Canada	11	NR	LL	LL	Steve Athanosios	ME
"	SE Halifax, NS, Canada	SE Halifax, NS, Canada	6	105 SE	LL	LL	Mike Pittman	Canada
"	E Cape Sable, NS, Canada	SE Nantucket Island, MA	4	341 SW	LL	LL	Mike Pittman	Canada
"	E Eastport, ME	SE Eastport, ME	5	122 SW	LL	LL	Andy Kingman	PA
"	SE Halifax, NS, Canada	Hermitage Bay, Canada	3	351 NE	LL	TN	Albert Lawrence	Canada
"	E Portland Headlights, ME	N Halibut Pt., MA	1	85 SW	LL	RR	Steve Athanosios	ME
Nurse shark	S Vaca Key, FL	S Vaca Key, FL	<1	1 N	RA	FS	Frank Murru	FL
"	Key Colony Beach, FL	SW Sanibel Island, FL	94	115 NW	GN	RR	Sonny Gruber	FL
"	Little Crawl Key, FL	Vaca Key, FL	27	8 W	RR	RR	William H. Botten	FL
"	W Wiggins Pass, Naples, FL	W Wiggins Pass, Naples, FL	16	<1	RR	RR	John Brossard	FL
"	Bob Hall Pier, TX	NE Tampico, Mexico	7	284 S	RR	LL	Chris Ruiz	TX
"	E Pt. Pleasant, NJ	Little Egg Inlet, NJ	<1	66 S	RA	RR	Gail Heyer	NJ
"	E Bay Head, NJ	Bay Head, NJ	<1	2 SW	RR	RR	John and Gail Heyer	NJ
"	N Matecumbe Harbor, FL	Upper Matecumbe Key, FL	4	4 E	RR	RR	Graeme Pullen	England
"	Islamorada, FL Keys, FL	Islamorada, FL Keys, FL	1	NR	RR	RR	Graeme Pullen	England
"	E Sarasota, FL	S Ft. Meyers, FL	11	67 SE	RR	RR	John Brossard	FL
Dusky shark	SE Ocean City, MD	N of La Isabella, Cuba	111	937 S	RR	LL	Ed Haney	MD
"	E of Rudee Inlet, VA	SE Ocracoke Inlet, NC	124	116 SW	TN	LL	Paul Jones	MA
"	SW Montauk Pt., NY	E Beaufort, NC	54	349 S	RR	LL	Howie Sternberg	NY
"	SE Atlantic City, NJ	N Cabo Catoche, Mexico	44	1342 SW	RR	GN	Joe Lucas III	PA
"	E Townsend Inlet, NJ	NR	NR	NR	RR	LL	Ron Aareskjold	NJ
"	SE Pt. Pleasant, NJ	E Avon, NC	36	266 S	RR	LL	Bill (Bear) Tybor	NJ
"	Chesapeake Bay, VA	NE Cape Charles, VA	12	10 E	RR	GN	George Waldenmaier	VA

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	TAGGED	RECAPTURED			TAG.	REC.	TAGGER		
Ad. sharpnose	Bob Hall Pier, Padre Island, TX	E Altamira, Mexico	24	305 S	RR	LL	Darrell R. Mostella		TX
"	N Port Mansfield, TX	W Campeche, Mexico	3	522 SE	RR	GN	Frank Eicholz, III		TX
"	W Machipongo Inlet, VA	E Hatteras Inlet, NC	18	131 S	RR	GN	Barry Truit		VA
"	SE Charleston, SC	SSE Charleston, SC	10	6 NW	RR	RR	Rick Stringer		SC
Silky shark	E Southport, NC	E Beaufort Inlet, NC	8	56 NE	LL	LL	Paul O'Donnell		NC
"	NE Miami, FL	N Bahia Honda, Cuba	4	238 SW	RR	RR	Mark Quartiano		FL
"	Bimini, Bahamas	N Grand Bahama Isl., Bahamas	9	65 N	RR	RR	Ron Schatman		FL
"	S Sand Key, FL	Cajimar, Havana, Cuba	4	NR	RR	RR	A.C. Miller		FL
Sc. hammerhead	E Morehead City, NC	E Sebastian Inlet, FL	60	454 SW	LL	LL	Biologist (NMFS)		NC
"	E Barnegat, NJ	E Avon, NC	15	273 S	RR	LL	Tom Palchanes		NJ
"	NE Oregon Inlet, NC	E Morehead City, NC	13	88 SW	LL	LL	J. Harrington, NMFS Obs.		MA
Bonnethead	Beaufort, SC	Beaufort County, SC	<1	0	RR	RR	Al Kolberg		SC
"	Islamorada, FL	Islamorada, FL	0	0	RR	RR	Graeme Pullen		England
"	Islamorada, FL	Marathon, FL	<1	25 SW	RR	RR	Graeme Pullen		England
Blacknose shark	SE Ponte Vedra Beach, FL	Atlantic Beach, FL	0	NR	RR	TO	John Henry David		FL
"	S Pensacola Pass, FL	Pensacola Beach, FL	14	3 N	RR	GN	Joel Asmer		FL
Sand tiger	S Rodanthe, NC	E Morehead City, NC	28	41 S	RR	LL	Mike Raines		VA
"	E Oregon Inlet, NC	E Morehead City, NC	33	54 S	LL	LL	Biologist (NMFS)		RI
Galapagos shark	E Bermuda, Bahamas	E Hatteras Inlet, NC	33	505 W	LL	LL	Stephen Connott		RI
"	E St. Davids Isl., Bermuda	E St. Davids Isl., Bermuda	12	1 W	LL	RR	Stephen Connott		PA
Smooth dogfish	Townsend Inlet, NJ	E Cape Henry, NC	5	142 S	RR	GN	Bill Gallagher		PA
Spinner shark	Panama City, FL	St. Andrew Sound, FL	<1	10 SE	RR	GN	DJ Moore		FL
Oc. whitetip	E Mogadishu, Somalia	W Colombo, Sri Lanka	3	1518 E	LL	LL	Jaime Mejuto		Spain
Reef shark	E Bimini, Bahamas	E Bimini, Bahamas	1	2 SW	RR	RR	Larry Laffler		FL
Bull shark	N Port Mansfield, TX	Tamiahua, Veracruz, Mexico	1	347 S	RR	GN	Frank Eicholz		TX
Bignose shark	SE Rudee Inlet, VA	Marquesas Keys, FL	51	817 SW	LL	LL	Jack Musick		VA
Bigeye thresher	S Hydrographer Canyon	NE Oregon Inlet, NC	79	336 SW	LL	LL	K. Joyce, NMFS Obs.		MA
Night shark	SE Charleston, SC	E Wilmington River, GA	144	33 NW	LL	LL	Ron Schatman		FL
Hammerhead	NE Cape Hatteras, NC	NE Munson Canyon	110	486 NE	LL	GN	Biologist (NMFS)		RI
"	NE Little Egg Inlet, NJ	E Ocracoke Inlet, NC	67	281 S	RR	LL	Gary Wimmer		PA
"	E Charleston, SC	Norfolk Canyon	12	210 N	LL	LL	P. O'Donnell, NMFS Obs.		MA
Brown/Dusky shark	SE Montauk, NY	SW Montauk Pt., NY	68	72 SW	RR	RR	Tom Federico		NY
"	E Cape May, NJ	SE Rudee Inlet, VA	27	145 S	RR	LL	Bill Garrison		NJ
Carcharhinus	E Manasquan Inlet, NJ	N Sisal, Yucatan, Mexico	129	1559 SW	RR	LL	Charles Berwind		NY
"	E Oregon Inlet, NC	E Cape Canaveral, FL	194	513 SW	TN	LL	C. A. Dewey		MA
"	E Great Bay, NJ	W Pine Island, FL	197	948 SW	RR	LL	George L. Fisher		PA
"	E Wildwood, NJ	Tabasco, Mexico	134	NR	RR	LL	William Deal		NJ
"	W Sarasota, FL	SW Naples, FL	43	140 S	RR	LL	Marty Cohen		FL
"	NE Goulets Inlet, GA	St. Simons Sound, GA	47	9 SW	RR	LL	Larry Kennedy		GA
"	Georges Bank	N Yucatan, Mexico	93	NR	GN	GN	Michael Monteforte		RI
"	S Absecon Inlet, NJ	NE Sandwich, MA	3	241 NE	RR	RR	Fred Romanowsky		NJ
"	E Southport, NC	SE Southport, NC	3	69 SW	LL	LL	Erickson, NMFS Obs.		MA
"	E Stuart, FL	E Cape Hatteras, NC	3	553 NE	RR	LL	Robert Pelosi		FL
Shark	E Newport News, VA	E Cape Henlopen, DE	131	156 NE	RR	LL	Bill Moffett		VA
"	SE Montauk Pt., NY	SE Montauk Pt., NY	<1	10 NW	RR	RR	Stephen Roland		NY
"	NE Ocean City, MD	SE Cape Canaveral, FL	31	674 SW	RR	LL	Mark Sampson		MD
"	S Cape Race, NF, Canada	SW Canso Harbor, NS, Canada	24	323 NW	LL	LL	D. Greco, NMFS Obs.		MA
"	E Montauk Pt., NY	S Sable Island, NS, Canada	2	501 E	RR	LL	Albert Woynar		CT
"	SE Montauk Pt., NY	W Barrero, Puerto Rico	NR	NR	RR	HL	James E. Rosasco		NY
"	E Avon, NC	SE Flemish Cap	17	1562 NE	LL	LL	Paul Puskas		NJ
"	SW Montauk Pt., NY	SW Cape Sable, NS, Canada	2	307 NE	RR	LL	Barry Barth		NY
"	SE Flemish Cap	NW Faial, Azores	1	259 SE	LL	LL	Scott Drabinowicz		MA
Swordfish	E Montevideo, Uruguay	SW Rio de Janeiro, Brazil	14	482 NE	LL	LL	Butch Winter		NJ
"	E Pt D'Enfer, Martinique	SE Flemish Cap	4	1766 N	LL	LL	Daniel Shawhan		MA
Atlantic Sailfish	N Pompano Beach, FL	N C. Tres Puntas, Venezuela	26	1346 SE	RR	GN	Arnold Cooper		NY
"	Boca Raton, FL	E Jupiter Inlet, FL	24	NR	RR	RR	Rick Wehunt		FL
White marlin	W Lanzarote Island, Canary Isl.	W Mohammedia, Morocco	25	383 NE	RR	RR	BGI		Italy
Bigeye tuna	E Great Bay, NJ	E Recife, Brazil	18	4058 SE	RR	LL	Larry Thoma		NJ
Bluefin tuna	E Mays Landing, NJ	E Merrimac River, MA	26	221 N	LL	RR	Paul Puskas		NJ
Yellowfin tuna	E Cape May, NJ	SSE Pt. Judith, RI	13	153 NE	RR	RR	Robert Brooks		NJ
Amberjack	NE Folley Beach, SC	Islamorada, FL	32	463 S	RR	RR	Ivan Schultz		SC
Atlantic manta	S Sebastian Inlet, FL	S Sebastian Inlet, FL	<1	NR	FS	RR	Doug Adams		FL

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; RA=Released from Aquarium; NR=Not Reported

Tagging Reminders

Every year we strive to improve the quality of our data. The following reminders will help us complete the processing of the Tag/Release cards:

- * Tag only species that you can identify. Request species identification material in the "remarks" section of the tag card and we will do whatever we can to assist you.
- * Fish condition section of card is for recording a measure of the health of the fish (for example, good, fair, poor) when released, not weather conditions.
- * The "remarks" section can be used for requesting tags, comments on the condition of the fish, depth, surface temperature, suggestions, weather, etc.
- * Please record locations as either Lat/Longs or complete lorans.
- * Please remember to indicate whether length and weight are estimated or measured.
- * Record tagging information promptly and completely, please fill in the tag card as soon after a fish is tagged as possible.
- * Please mail tag cards promptly. Tagging serves little purpose without timely full release and recapture information.

Thank you for your assistance.

Field Studies

Tournaments

In 1994 the API staff attended, or was represented at, 10 tournaments between Texas and Maine. The majority of these were held on Long Island, NY (7) with 1 each in: Snug Harbor, RI, Saco, ME, and Freeport, TX. Overall, 230 sharks (8 species) were examined (see figure). The bull sharks (2), one sandbar and two of the tigers were obtained at the Texas tournament. One white shark was caught in July at the Snug Harbor, RI tournament. This shark was a 117 cm (46 in) fork length female; though not a tournament fish, it provided a rare opportunity to examine a white shark of this size.

Mako sharks were the most common shark landed in the 1994 tournaments. This is due to their desirability as a sport fish and their value for food. Minimum size restrictions and the desire to keep non-contending fish alive discourages tournament participants from bringing in small sharks. Blue sharks are generally tagged and released alive unless there is a chance for them to place in tournaments. Many of the fishermen we speak with turn in numerous blue shark tag cards and report that there are sometimes large numbers of blue sharks swimming in their chum slicks. Thus, despite the high percentage of makos landed they are doubtless less abundant than some of the other shark species. The percentage of makos landed changes throughout the season. At three out of the four tournaments covered in June, makos were the most common species ranging from 57 to 86% of the sharks weighed in. At the tournament on the last weekend of June held in Montauk, LI, NY, and in the

two July tournaments we attended, the percentages changed with the blue sharks ranging from 54 to 65%. Though blue sharks representing a wide range of weights were caught in both June (65 to 305 lbs) and July (145 to 325 lbs), in general, larger blues were caught in July. On the contrary, makos landed in June were heavier than those landed in either July or August (with August having the smallest sizes).

1994 was an exceptional year for obtaining recaptured sharks at tournaments. Out of 28 recaptures, 22 sharks were returned to the dock and six were retagged; all were blue sharks. Times at liberty ranged from less than one month to almost two years with distances traveled ranging from 3 to 86 miles. All of the landed sharks were measured and weighed and the backbones removed for age and growth studies.

Data on species composition, size, and sex, as well as the biological samples we obtain from tournaments are invaluable to our research. Consolidation and analysis of the 25 year data base collected at tournaments will help define the movements of sharks during the summer months off the Northeast coast of the Atlantic. We have recently finalized a paper entitled "Length-weight relationships for 13 species of sharks from the western North Atlantic". The majority of the data for this paper, which is highlighted to the right, came from tournament data. In the coming year, we will further the process of analyzing these data by relating them to both the physical environment (temperature), and to changing tournament rules and attitudes about tagging fish. Many factors contribute to varying catches throughout the years and

must be evaluated in order to explain the fluctuations in tournament catches over the last 25 years. In future Shark Tagger Newsletters we will include updates on our findings. Meanwhile, we are looking forward to seeing how the data from the summer of 1995 compares to prior years.

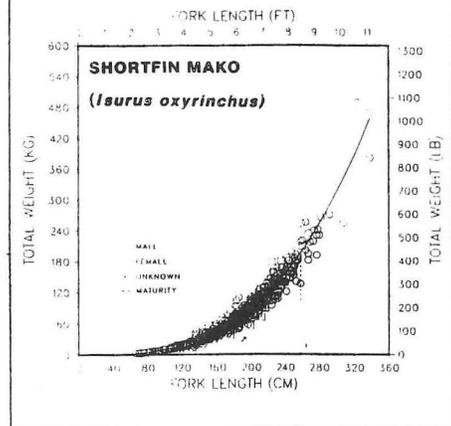
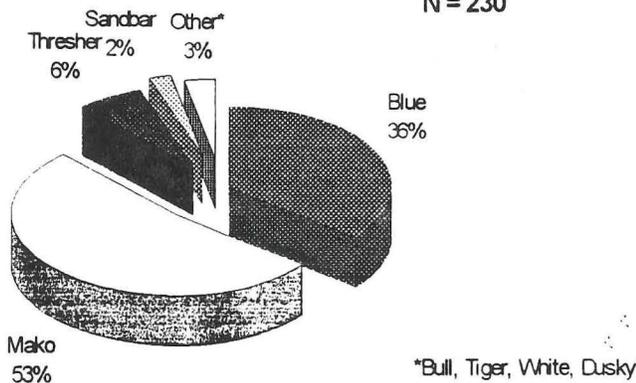


Length-Weight Relationships for 13 Species of Sharks

Conversion charts of shark sizes have a practical value for fishermen, tournament officials, and fishery managers. Many Atlantic shark tournaments have a minimum weight requirement, and since sizes must be estimated at sea, means for converting lengths to weights are essential. Basic biological information necessary for management is lacking for many of the Atlantic sharks, including minimum, maximum and average sizes, as well as length-to-weight and fork length-to-total length relationships. Thus, a single source of such information is needed for fishermen and scientists alike.

Length and weight data for 13 species of Atlantic sharks were collected by the API over a 29 year period from 1961 through 1989. Mathematical regressions of fork-to-total length were calculated for each species and for four family groups, including average sizes and size ranges for both fork and total length. Fork length-to-weight relationships were calculated and graphed for each species, as well as mean lengths, weights and size ranges. Values from published accounts for maximum fork length and maturity were also included. The graph presented below is an example of these relationships.

Species of Sharks Landed at 1994 Tournaments



Catch and release survivorship studies in Massachusetts

by: Gregory B. Skomal and Bradford C. Chase

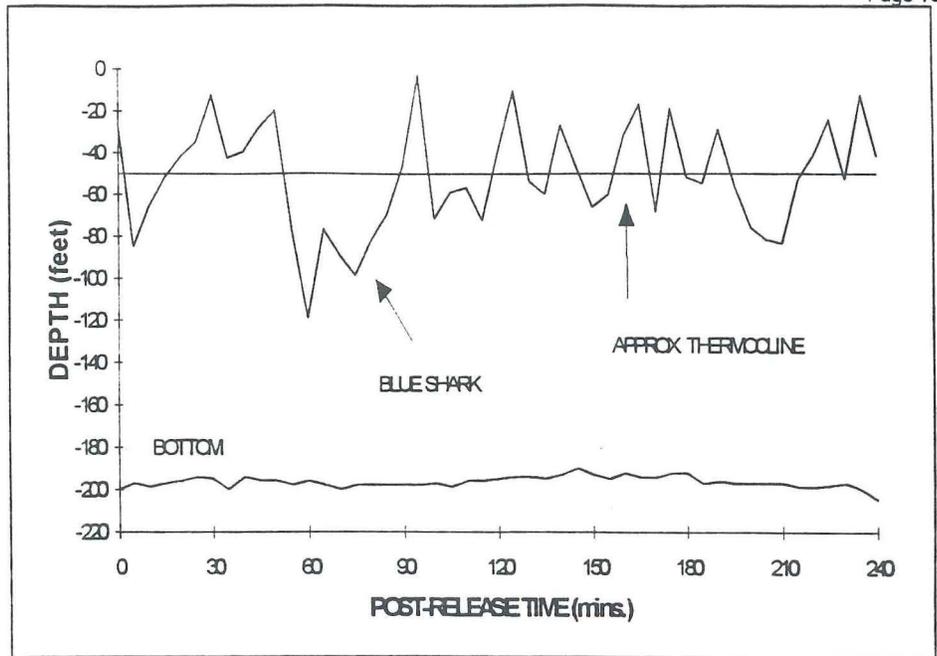
Gregg Skomal and Brad Chase are fisheries biologists employed by the Massachusetts Division of Marine Fisheries. Previously they worked at the NMFS Narragansett Laboratory. Gregg contributed an article to the 1993 Shark Tagger. The following is a summary of their ongoing research on sharks and tunas off Massachusetts.

Extensive recreational fisheries for sharks occur off the coast of Massachusetts from June through September every year. Tournament statistics compiled by the Massachusetts Division of Marine Fisheries (MDMF) show that recreational fishermen now release more sharks, both tagged and untagged, than ever before. On the average, 94% of all blue sharks and 39% of all mako sharks, caught annually during Mass. tournaments were released; of these, 41% and 26%, were tagged, respectively.

This increase has raised concern in both biologists and fishermen as to how many sharks and other pelagic species survive catch and release. Since 1993, MDMF biologists have been working on the blood chemistry of rod and reel caught sharks, tunas, and marlin in an attempt to address these concerns.

High muscular activity and stress induced by angling causes changes and disturbances in fish tissues and organs. These changes, manifested in the blood, may be severe enough to alter normal physiology and behavior, and ultimately compromise survivorship. In some cases, fish may die, either on the line or more likely after release. The chemical constituents of the blood can be used to profile the condition of the fish before it is released.

To date, 225 gamefish comprised of 12 species of sharks, tunas, and marlin have been sampled, including 52 blue and 5 mako sharks. For each fish sampled, several variables including fight time, gear type, hook location, and fish size are recorded for comparison to blood chemistry measurements. Preliminary findings show that these gamefish exhibit fluctuations in blood pH and blood levels of hormones, electrolytes, and metabolites due to the fight associated with rod and reel angling. The magnitude and nature of



these disturbances differ by species and appear to be less dramatic in the sharks when compared to the tunas.

Short and long term recovery and survivorship in the face of these disturbances can be evaluated from tag-recapture and ultrasonic tracking studies. Although very preliminary, limited evidence from tag-recaptured and telemetry tracked blue sharks suggests that the physiological stress induced by angling may not significantly inhibit survival in this species. The above figure shows the telemetry track of a blue shark subjected to an exhausting one hour fight. Although blood pH was depressed in this animal, the shark appeared to recover in about 90 minutes and exhibited somewhat normal behavior, rhythmically diving from the surface to the thermocline thereafter.

Unfortunately, not enough makos have been sampled to characterize the physiological heartiness of this species. However, these studies will continue in 1995 to increase sample sizes. In addition, emphasis will be placed on the ultrasonic tracking of blue sharks, bluefin tuna, and yellowfin tuna.

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Sharks, The Perfect Hosts

by: Janine Caira

Dr. Janine Caira is a parasitologist at the University of Connecticut. She studies gut parasites in sharks and has provided us with an overview of her research.

This is the tenth year that my students and I from the University of Connecticut have attended tournaments at Montauk, NY to examine the spiral

intestines of sharks for parasites. When studied in detail, parasites have the potential to provide information on a variety of aspects of the biology of their hosts including migrations, feeding habits, evolution and predators. Our work focuses on the tapeworms of sharks. These parasites spend their entire adult lives attached to the surface of the gut of their shark hosts. Most worms are equipped with elaborate attachment structures such as suckers and hooks to help them maintain their position in the gut of the shark. Although frightening in appearance, these tapeworms pose no threat to we humans because they are completely incapable of surviving in our bodies, which are physiologically very unlike those of sharks.

Prior to the tournament collections, little was known about the tapeworms of even the most common species of sharks in the western North Atlantic. To date, samples from sandbar, dusky, blue, thresher, mako, great white and tiger sharks suggest that each shark species is parasitized by its own complement of tapeworm species. In fact, very few tapeworm species seem able to live in more than one species of shark. Many tapeworms collected from these sharks have now been examined with light and electron microscopy so that their morphology is more clearly understood (see figure). In 1993, these collections led to the discovery of a new species of tapeworm from the mako shark which was named "*Clistobothrium montaukensis*" after the locality from which it was collected.

The tapeworms found in these sharks are becoming more completely described and we are now looking at the

ecology of this system. Of special interest is the relationship between the tapeworms and the surface of the gut at the site of attachment. Unlike the intestine of humans (and almost all other vertebrates) the intestine of sharks is not divided into a large and small intestine, but rather consists of an organ called the spiral valve or spiral intestine. This organ is the only place in a shark that adult tapeworms, which have no digestive system of their own, can live. Spiral intestines in sharks are of two basic configurations: the conicospiral type, which resembles a spiral staircase, and the scroll type, which can be unrolled to reveal a single large sheet of mucosal tissue. The former type is found in mako, thresher, and great white sharks, the latter is found in carcharhinid sharks such as sandbar, dusky, tiger and blue sharks. We are currently working on three very basic questions about the association between the tapeworms and their shark hosts. These include: Where does each tapeworm species attach within the spiral intestine? How does each tapeworm species attach to the spiral intestine? and, What sort of damage do these tapeworms cause to the shark at their site of attachment within the spiral intestine?



Scanning electron micrograph showing suckers and hooks of a tapeworm taken from a brown shark.

Answers to some of these questions are now available for a few shark species. For example, data collected from blue sharks landed at Montauk, reveal an interesting picture of site specificity. The blue shark is generally parasitized by four tapeworm species; individual blue sharks may host over 1,000 individual tapeworms. These tapeworms generally prefer to attach to the more anterior regions of the spiral intestine. Microscopic sections through tapeworms attached to the surface of the intestine indicate that these parasites make extensive use of their hooks and

muscular suckers to hold on to the mucosal surface. Interestingly, in many cases there is little evidence that they cause much damage to their hosts. In a few cases the larger parasite species are found associated with damaged areas, or lesions, at their attachment sites; but this is generally not the case. Host immune responses at the site of attachment are also minimal. It is likely that these associations, which have probably evolved over tens of millions of years, are the result of accommodation on the parts of both the worms and the sharks.

Of course many questions remain unanswered. The life cycles of these tapeworms are completely unknown. Like other tapeworms it is assumed that they depend on the food chain for passage from one host to another, making their way into the shark as a larval stage in something the shark eats. But this remains to be confirmed. Little is known about the type and quantity of food the tapeworms consume inside the gut of the sharks. As a consequence it is difficult to assess the impact these tapeworms have on the physiology of the sharks. Hopefully the answers to at least some of these questions will be forthcoming through work at future tournaments.

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Nursery grounds of the sandbar shark, *Carcharhinus plumbeus*

Many lagoons of the coastal US are the pupping and nursery grounds of sharks. These areas which provide abundant food and refuge from predators (usually larger sharks) are critical to the birth and survival of newborn and juvenile sharks. These areas are, however, vulnerable to urban and industrial development. Developmental restrictions and designation of refuges may be necessary for such areas to conserve and manage valuable shark stocks.

The sandbar shark is an important component of U. S. commercial and recreational shark fisheries in the western North Atlantic and Gulf of Mexico. Near term pregnant females migrate to coastal lagoons in early summer to give birth to their pups. Newborn sharks reside in pupping grounds for a period of time where they feed, grow and prepare for their fall migration to warmer waters. Juvenile sandbar sharks (age 1+) seasonally migrate back into these productive and protective nursery grounds. It is unknown how many seasons juveniles return to these habitats, but it could be more than ten years.

The current range and importance of the northern nursery areas of the sandbar shark is unknown. Prior to the 1960's, sandbar nurseries may have ranged from Cape Cod, MA to Cape Canaveral, FL. A survey of east coast fishermen last year by Kymm Damon, a University of RI Master's Degree candidate working with our project, suggests the present northern boundary of pupping grounds may be in New Jersey.

We will conduct a pilot study in the Summer of 1995 in cooperation with URI and the National Aquarium of Baltimore to investigate the nursery areas of Delaware Bay. Objectives are to establish minimal impact sampling techniques for capturing small sandbar sharks; tag and release them; characterize the nursery habitat; and initiate cooperative tagging studies with fishermen in known sandbar shark nurseries. We will set gill nets along tidal channels and among grass flats. Live captured sharks will be identified, measured and released with a small NMFS tag (see box on back cover) at the base of the dorsal fin to aid studies of distribution and migration. Relative abundance will be estimated to determine the importance of Delaware Bay as a nursery habitat.

Fishermen who work in these nursery areas will be asked to participate in a cooperative small shark tagging program. Volunteers will be briefed on the project and tagging procedures, then small NMFS tags will be distributed to them. Tag return data will provide important information on nursery utilization, residence time, juvenile distribution, migration and growth. To determine the range and relative importance of northern sandbar shark pupping and nursery grounds, a long-term program will be established to survey the coastal lagoons north of Chincoteague Bay, VA. The surveys will be conducted during the suspected peak pupping season (June and July) beginning in the Summer of 1996. Sampling sites will be determined by interpreting the existing NMFS tag-recapture database for these small sharks and by interviewing fishermen and biologists with knowledge of shark nursery areas. Long-term objectives include determination of the northern limit of sandbar nurseries; calculation of relative abundance of neonates and juveniles in east coast nurseries; and continuation of the small shark tagging program.



Satellite transmitter update

by: Abner Kingman

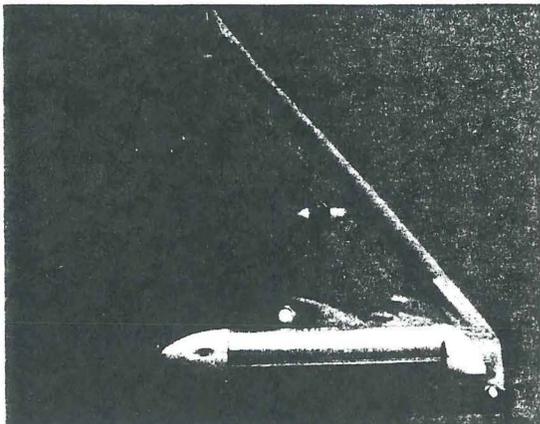
In January 1994 three large male blue sharks were tagged with satellite transmitters off Cape Hatteras, NC. These transmitters were built by Dr. Francis Carey of the Woods Hole Oceanographic Institution to study the migratory habits of the blue shark. This last experiment of Frank's has been a success and he was able to collect the results before his death in December.

Frank enjoyed a successful career in ichthyology and physiology, which included pioneering work with acoustic telemetry tracking devices. Through his work with these, Frank discovered that, in certain areas, blue sharks will spend considerable time at the surface. This behavior allows for the possibility of tracking through the ARGOS satellite system. In collaboration with Mike Fedak of the Marine Mammal Research Unit of the British Antarctic Survey, Frank built four satellite tracking devices to test the feasibility of this technique for sharks.

The transmitters are about 1 foot long and 1.5 feet tall and are powered with 2 lithium D cell batteries. They might be expected to transmit for up to 9 months. These devices record information on swimming speed, dive depth and water temperature while the shark is submerged, then send this information to the satellite when the antenna breaks the surface of the water.

Of the three sharks tagged, two provided unique and useful information on their migratory behavior (the third transmitter failed after making a single uplink) (see image on cover, supplied courtesy of Dr. James Bisagni, NOAA). These two transmitters made over 400 successful uplinks with the satellites during a one month period. Both sharks traveled hundreds of miles during this time and made regular excursions to depths of several hundred meters. Shark 1 spent more than a week in the same area at the edge of the warmer Gulf Stream then followed the edge for several hundred miles before breaking off and heading back toward Cape Hatteras, NC. Shark 2 swam directly east then south past Bermuda.

The transmitters stopped transmitting after one month of successful operation, due to a simple switch failure. This problem is now being remedied in the fourth transmitter, which will be deployed in the fall of 1995. Having proven the feasibility of this technique and having collected a remarkable quantity of useful information over the course of a month, we look forward to collecting the same high caliber data over a longer period of time.



If these sharks are caught, please bring them in and call us immediately

In Passing

The shark project depends on many people. Indeed, it is a dynamic blend of shark tagging fishermen and fellow researchers. It is difficult to acknowledge the comings and goings of all our friends, but we will greatly miss two of our stellar colleagues and one of our founding fishermen who passed away this winter.

Dr. Frank Carey, a senior scientist at Woods Hole Oceanographic Institution, was an inspiration, fellow scientist and friend to the project for thirty years. His work tracking individual sharks, tunas and swordfish using telemetry is still at the cutting edge of science.

Mr. Paul Yevich, a pathologist at the Environmental Protection Agency, Narragansett Lab, was our mentor and godfather "across the street". He taught us histological methodology and loaned us chemicals and supplies during lean times with less formality than borrowing a cup of sugar. He appeared to those who did not know him very well to be "mean, mad, and miserable" but, to those of us that knew and worked with him, he was as kind a scientist as ever looked through a microscope and will be missed by his many colleagues.

Capt. Phil Ruhle, a pioneer longline fisherman and ecologist. He was as dedicated to the conservation and understanding of the sea as he was to exploring new horizons in fisheries. His ideas, logbooks and distant water tagging were among the cornerstones of our early research. Moreover, his thoughtful questions brought out the best in us as scientists. We regret his loss, but he leaves a legacy of contributions to knowledge and widespread respect of all who knew him.

THE SHARK TAGGER NEWSLETTER

Published by

**Apex Predator Investigation
Cooperative Shark
Tagging Program**

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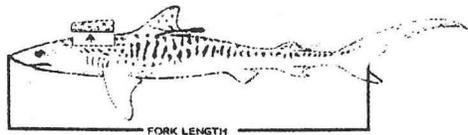
*Retired 4/29/1995

**Acting Inv. Chief

WANTED!!
RECAPTURED TIGER SHARKS

Last year we reported that we had injected small tiger sharks with tetracycline for age and growth studies. At present, we have over 600 tagged and injected tiger sharks that have been at liberty since 1993. To complete our study we need backbones from these injected sharks. If you capture a tagged tiger shark, please follow the protocol below or keep the whole shark and call Lisa Natanson at (401) 782-3322 (collect) for shipping information. Thank you for your help.

IF YOU CATCH A TAGGED SHARK

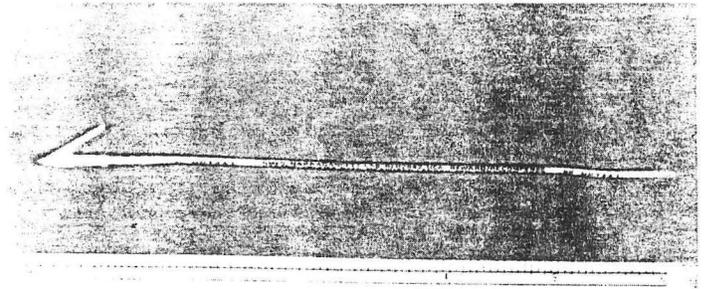


1. **Measure fork length.**
2. **Remove a 6 to 10 inch piece of backbone from over the gills.**
3. **Freeze backbone.**
4. Record tag number and recapture details (date, location, latitude and longitude or loran, sex, method of capture, etc.)
5. Telephone collect for postage-paid mailers (401-782-3322) on weekdays.

Lisa J. Natanson
 APEX PREDATOR INVESTIGATION
 USDOC/NOAA/NMFS
 28 TARZWELL DRIVE
 NARRAGANSETT, RI 02882-1199

New NMFS Tags: An Experiment on Small Sharks

In 1994, we began a limited experiment with a small tag, to be used on sharks less than 3 ft (91 cm) TL. Overall, 39 tiger sharks, 25 blue sharks and 9 dusky sharks were tagged with these plastic tipped dart tags by NMFS and other biologists. Of these, 3 blue sharks were recaptured with the longest time at liberty of 67 days and distance traveled of 97 mi.



Watch for these tags



Atlantic Shark Fishery Management Plan

On June 30, 1989, 5 Fishery Management Councils asked the Secretary of Commerce to develop a Fishery Management Plan (FMP).

Fishery Management Plan (FMP) Measures:

1. Manages 39 species in 3 groups:
 Large coastal (22 species) Overfished
 Pelagic (10 species) Fully fished
 Small coastal (7 species) Fully fished
2. Requires annual permits for commercial shark fishing vessels fishing in the U.S. exclusive economic zone (EEZ).
3. Requires data reports from owners/operators of permitted vessels.
4. Requires data reports from persons conducting shark fishing tournaments.
5. Requires permitted vessels to accommodate NMFS approved observers.
6. Establishes a fishing year of January 1 through December 31.
7. Prohibits "finning".
8. Requires sharks not retained to be released in a manner assuring maximum probability of survival.
9. Establishes recreational bag limits for sharks. 4 sharks/fishing vessel/trip for large coastal and pelagic combined and 5 sharks /person/day for small coastal.
10. Establishes semiannual quotas for landings of large coastal (1285 mt) and pelagic species (290 mt) groups.
11. Provides for commercial closures when the species group quotas are reached.
12. Limits the sale of sharks harvested from the EEZ to those caught from permitted vessels.
13. Authorizes the Assistant Administrator to implement or adjust certain management measures in accordance with a specified framework regulatory adjustment procedure.
14. Reduces the Total Allowable Level of Foreign Fishing in the EEZ for managed species to zero.

Following implementation of the FMP, a commercial trip limit of 4000 lb. for permitted vessels for large coastal sharks and a control date for the Atlantic sharks fishery was established.

For permit information contact:
Regulations and Permit Branch
(813) 893-3722

For copies of the FMP and Regulations contact:
C. Michael Bailey
(301) 713-2347