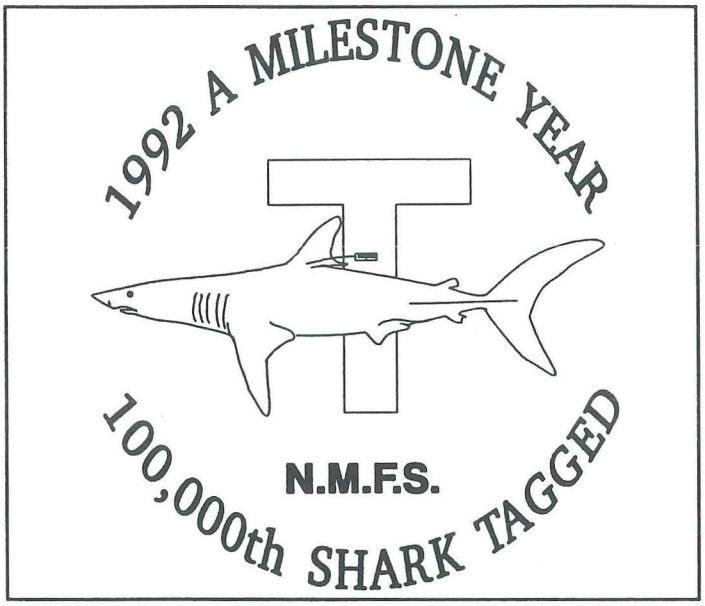
# THE SHARK TAGGER 1992 SUMMARY

**Newsletter of the Cooperative Shark Tagging Program**

*PHOTO BY H.W. PRATT*




**In this issue:**

- 1992 A Milestone Year - 100,000th Shark Tagged
- Record Number of Sharks Tagged (8451) and Recaptured (506) in 1992
- Sandbar Shark Recaptured after 24.9 Years
- Second Trans-Atlantic Recapture of a Mako Shark
- Tagged Blue Shark Crosses Equator
- Porbeagle Sharks Recaptured after 4, 6, and 8 Years
- Record Distance for Bignose Shark - 1800 Miles - New Jersey to Texas
- 38% of Recaptured Blue Sharks Released Again
- Pregnant Mako Shark with 14 Pups Examined

## 1992 Overview

The number of fish released (8451) and returned (506) in 1992 is the highest for any year in the three decade long Cooperative Shark Tagging Program. In addition, the one hundred thousandth shark was tagged in 1992 adding another milestone. Identification of that particular shark and acknowledgement of the individual tagger would be difficult as hundreds of tags are used along the U.S. East Coast on any particular day. Recognition for this outstanding accomplishment deservedly goes to every member of the Program who ever put a tag in a fish. In addition to the thousands of cooperating fishermen and scientists, we would like to acknowledge the many sport clubs, writers, conservation organizations and enthusiastic supporters who have contributed time and effort to improve our understanding of shark migrations throughout the North Atlantic and have made our joint effort a successful one over the years.

Approximately 400 new taggers joined the Tagging Program this year. We are including a brief overview of tagging studies and the results to date of our Tagging Program to familiarize new members with our research.

Tagging studies are useful to characterize the sharks in an area in terms of species, sex, and size; to help define nursery, pupping grounds, and the age structure of a fish population. Monthly, seasonal, and yearly fluctuations in relative abundance can be demonstrated if sufficient data are available over a long period of time. Recapture data add another dimension in providing a better understanding of

*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 taggedin 1992

| Species | Tagged by Cooperative Taggers |
|---|---|
| Sharks | |
| Blue shark | 5,222 |
| Tiger shark | 766 |
| Sandbar shark | 547 |
| Shortfin mako | 348 |
| Blacktip shark | 282 |
| Dusky shark | 225 |
| Atlantic sharpnose shark | 177 |
| Nurse shark | 90 |
| Galapagos shark | 41 |
| Silky shark | 42 |
| Bull shark | 39 |
| Oceanic whitetip shark | 35 |
| Porbeagle | 35 |
| Bonnethead | 32 |
| Lemon shark | 32 |
| Scalloped hammerhead | 34 |
| Blacknose shark | 27 |
| Sand tiger | 18 |
| Spinner shark | 14 |
| Bignose shark | 15 |
| Crocodile shark | 11 |
| Reef shark | 14 |
| Finetooth shark | 10 |
| Smooth hammerhead | 10 |
| Bigeye thresher shark | 8 |
| Smooth dogfish | 8 |
| Atlantic angel shark | 7 |
| White shark | 7 |
| Great hammerhead | 5 |
| Thresher shark | 5 |
| Prickly shark | 4 |
| Spiny dogfish | 4 |
| Longfin mako | 3 |
| Florida smoothhound | 2 |
| Hammerhead unspecified | 34 |
| Sand unspecified | 18 |
| Brown/Dusky unspecified | 8 |
| Blacktip unspecified | 1 |
| Miscellaneous* | 29 |
| **Total sharks** | **8,209** |
| Teleosts | |
| Swordfish | 95 |
| Bluefin tuna | 30 |
| White marlin | 28 |
| Albacore | 19 |
| Sailfish | 15 |
| Blue marlin | 14 |
| Yellowfin tuna | 10 |
| Bigeye tuna | 9 |
| Miscellaneous | 22 |
| **Total teleosts** | **242** |
| **Grand Total** | **8,451** |

*Includes species reported as "shark"

migratory patterns as well as information on rates of travel (speed), maximum times at liberty (to verify longevity estimates), growth (see article this newsletter) and stock identification. Natural mortality and survivorship can be approximated with a time series of recapture rates. In addition, differences in migratory patterns of various segments of a population due to size, sex, season or changing environmental conditions can be investigated with the data from a comprehensive tagging program.

Approximately 106,400 fish representing more than 45 species of sharks, 16 species of teleosts and 8 species of skates and rays have been tagged by cooperating recreational and commercial fishers, scientists, and fisheries observers since the Program's inception in 1962. As a direct result, considerable basic biological and life history information has been discovered over the past 32 years. For example, recaptures have established that blue sharks are a highly migratory species distributed over the entire Atlantic Ocean with mating grounds located off North America and primary pupping and nursery grounds found in the Eastern Atlantic and Mediterranean Sea. Alternatively, sandbar sharks are a coastal species exhibiting north-south movements between the Atlantic and the Gulf of Mexico. Sandbar sharks have been returned after 25 years at liberty demonstrating slow growth rates (~1 to 2 inches/year) whereas tag returns of blue, mako and tiger sharks after 8+ years at liberty show much faster rates of growth.

The majority of the tagging effort has been concentrated between North Carolina and Massachusetts. Since sharks are not confined by state, national or international boundaries, however, more pieces of the migratory puzzle are put in place as the Program expands into other geographical areas. In recent years, commercial and recreational fishers have been releasing and recovering more tagged sharks in the Gulf of Maine, Grand Banks, eastern and southern Atlantic, and the Mediterranean Sea. One location where our tagging efforts are limited is the Gulf of Mexico. Additional taggers in the Gulf would be very welcome to help answer some basic questions on exchange between the North Atlantic and the Gulf of Mexico.

## Tags

During 1992, volunteers tagged and released 8451 fish representing 33 species of sharks, 14 species of teleosts, and 5 species of rays (Table 1). The majority were blue sharks (5222), tiger sharks (766), sandbar sharks (547), mako sharks (348), blacktip sharks (282), and dusky sharks (225). Anglers accounted for 71% of the total releases followed by commercial fishermen (18%), R/V *Geronimo* and other biologists (7%) and NMFS Fisheries Observers (4%). Fish were released by taggers representing 6 countries: United States, Italy, Spain, Portugal, England, and South Africa. Gear used in the capture of the fish prior to release were rod and reel, longline, handline, trawl net, gill net, and beach seine. An additional 142 fish were tagged while free swimming near the boat.

## Recaptures

In 1992, 506 tags from 22 species of sharks and 4 species of teleosts were returned (Table 2). Commercial fishermen (55%) using longlines (264) and recreational anglers (42%) using rod and reel (216) were the primary sources of the recaptures. Tagged sharks were recaptured using gill nets, handlines, trawl nets, harpoon, and a lobster pot. Tags were returned from fishermen representing 20 countries and island territories: United States, Canada, Spain, Mexico, Venezuela, Cuba, Italy, Puerto Rico, Brazil, Japan, Portugal, Grenada, Barbados, Colombia, Trinidad, Greece, Honduras, Mauritius, Uruguay, and Morocco.

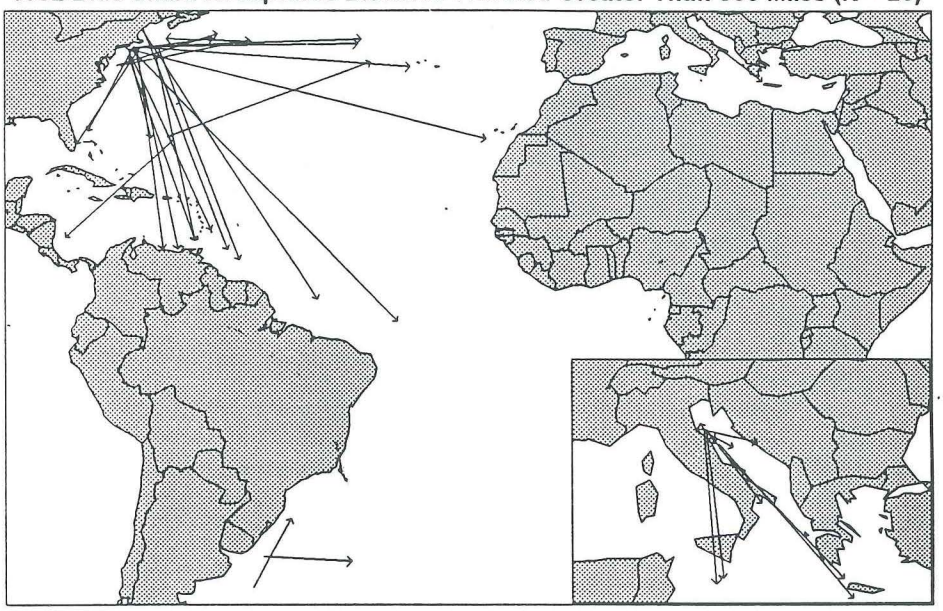
## Blue Sharks (254 Returns)

Previous recaptures have demonstrated that blue sharks commonly cross the Atlantic Ocean traveling up to 3740 miles. Results from this year provide further evidence of trans-Atlantic movements. Overall, 138 blue sharks were recovered within 100 miles of their tagging location, and 200 within 300 miles. Twenty-six blue sharks traveled more than 500 miles. The maximum distance traveled was 3263 miles by a fish tagged off Montauk Pt., NY and recaptured south of the equator. This is only the second blue shark tagged off the United States to be recaptured in southern latitudes and is the third longest distance shown by a tagged blue shark. Other long distance recoveries (500+ to 2786 miles) from fish tagged off the northern U.S. coast include blue sharks recaptured off Florida (2), the Grand Banks (3), the Azores (4), the Canary Islands, Venezuela (4), Guyana (2), also Trinidad, Barbados, and the Sargasso Sea north of Puerto Rico (see map, right). Two other blue sharks that were tagged by a U.S. commercial fisherman in the same area north of Puerto Rico were recaptured near San Andres, Colombia (1248 miles) and near the Azores (1673 miles). These two recaptures are examples of how the tagging effort is expanding into new geographical areas, allowing us to gain insight into blue shark migratory patterns. In addition, Spanish biologists are encouraging shark tagging aboard Spanish swordfish and tuna longline vessels. In 1992, more than 75 sharks were tagged from Spanish vessels and 13 tags were returned from Spanish fishermen.

Increased tagging effort has also come from recreational anglers releasing sharks in the Gulf of Maine, off Madeira Island, Italy, and Portugal. In addition, U.S. commercial swordfish fishermen are tagging sharks near the Grand Banks, off Puerto Rico, and off Uruguay, South America.

The recaptures of fish in these areas are by American, Canadian, Spanish, Cuban and Venezuelan longline fishermen. Four small blue sharks, measuring 4 to 5.5 feet in fork length (FL) at tagging, were released and recaptured off of Uruguay, South America; they were at liberty for a maximum of 1.3 years and traveled up to 672 miles from their tagging location. Two of these fish were tagged at the same time and place in June of 1992. Both moved east; one was recaptured after traveling 56 miles in 53 days and the other went 636 miles in 89 days. Presently, little is known about the blue shark movements in the southern hemisphere and we look forward to additional data from this area.

**1992 Blue Shark Recaptures Distance Traveled Greater Than 500 Miles (N = 26)**



Map inset--Recaptures from Italian tagging (1987-1992). Results from the expanding tagging effort by Big Game Italia (BGI) include 260 blue sharks tagged with 14 recaptures (maximum distance traveled: 677 miles; maximum days free: 415). This program is expected to provide valuable information on the relationship between blue sharks in the Mediterranean and those in the Atlantic.

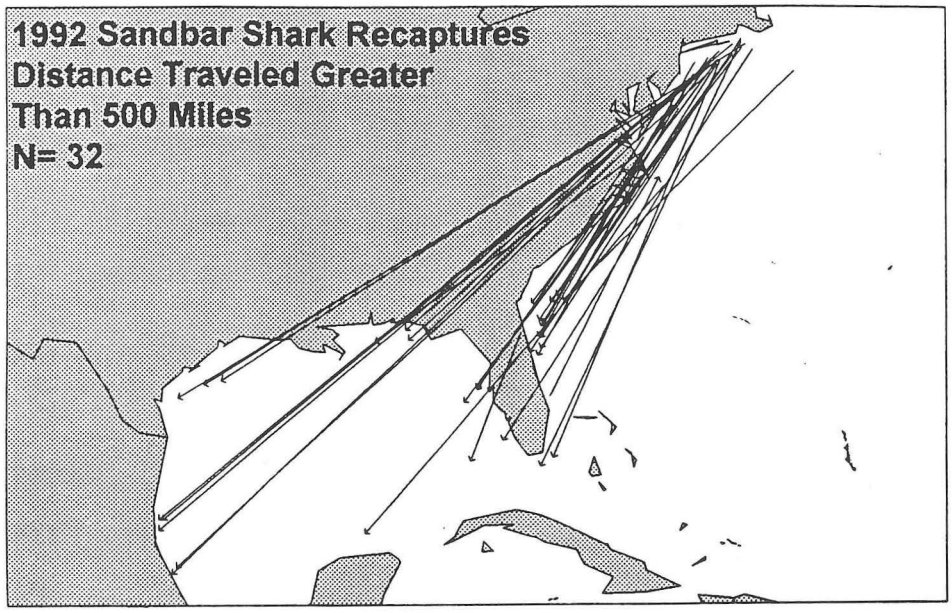
Four of the seven fish recovered from the Eastern Atlantic tagging effort had complete location information. Two of these blue sharks were tagged at the same time and place by a recreational angler near Madeira Island, Portugal. Both were recaptured by Spanish longline fishermen after moving in opposite directions; one, at liberty for 11.5 months, traveled 283 miles south and the other moved 473 miles north in 8.9 months.

Similar examples exist in the western North Atlantic where blue sharks were tagged within a short time period and were recaptured thousands of miles apart. Two fish were released off Montauk Pt., NY; one traveled 460 miles east to Nova Scotia, Canada and the other moved 1740 miles southeast to Barbados. Two other blue sharks were tagged within two days in an area north of Puerto Rico; one was recaptured in the Caribbean off Nicaragua and the other was recovered west of the Azores. Alternatively, two fish tagged together off York, ME were recaptured one year later within 16 miles of each other. Both were males, 4.5 to 5 feet in FL, that had traveled approximately 150 miles to the east. Evidently, much still needs to be learned to explain these apparent inconsistencies in the blue shark migratory patterns. Moreover, blue sharks are becoming increasingly important as a food and fin product in longline fisheries everywhere in the Atlantic. More detailed catch information than is presently being collected will be required in the near future to determine the impact of these international fisheries on blue shark populations.

In summary, blue sharks were at liberty from 0 to 2109 days (5.8 years). Many (68) were recovered within a month of tagging and most (211) within two years. Although returns this year did not exceed the 8.5 year record for blue sharks, two fish (at liberty for 5.0 and 5.8 years) are near the record time for the 2159 blue sharks recaptured in the Program. The 5.0 year fish was retagged and rereleased, and we hope will be recaptured. In all, six blue sharks were recaptured more than once. One of these was recaptured a third time after a total of 2.8 months at liberty. Ninety-five (38%) of the blue sharks for which recapture information was received are still at liberty, having been either retagged, released with the same tag, or released untagged.

## Tiger Sharks (81 Returns)

The distances traveled by tiger sharks ranged from 4 to 1466 miles. Recapture locations for long distance returns (greater than 300 miles) included North Carolina (3), New Jersey, the west coast of Florida, Cuba (2), Honduras, Dominican Republic, Puerto Rico (2), Virgin Islands, Grenada, and Venezuela (2). All of these fish were




small tigers (38 to 60 inch FL) that were tagged off the northeast coast of Florida by commercial shark fishermen. Two tagged tiger sharks were recaptured a second time (Florida to New Jersey - 699 miles; Florida to Venezuela - 1392 miles). They both originally showed local movements (less than 31 miles) off northern Florida.

Another interesting return came from a tiger shark that was tagged northeast of Munson Canyon (Georges Bank) and recaptured southeast of Pt. Judith, RI (189 miles in 1.2 years). This recovery is valuable for several reasons: the fish was large (greater than 9 feet in FL) at tagging; it was at liberty for more than one year; its fork length was measured at both tagging and recapture; and a sample of the backbone was collected.

In general, tiger shark recaptures were primarily short-term; many (25) were at liberty for less than 3 months, and most (67) were at liberty for less than 1 year. The maximum of 1.9 years is far short of the 8.0 year tiger shark record, however one-third (27) of the fish this year were rereleased with the same or a new tag. Five of these tiger sharks were captured a second time this year, giving multiple estimates of growth for individual fish. Three of these fish were released again. Four backbones were collected from measured fish for ongoing age studies (see article this newsletter).

### Sandbar Sharks (73 Returns)

The majority of the sandbar sharks were returned after protracted times at liberty; 60 were at liberty for more than 1 year; 23 for more than 5 years; and 7 for more than 10 years. The longest time at liberty this year was 24.9 years, just 35 days short of the 25.0 year record for any fish in the Program. Similar to previous long-term recoveries, this male sandbar shark was tagged with a fin tag by a Narragansett biologist (Chuck Stillwell) in Great Machipongo Sound, VA in the late 1960s. The fish traveled 1218 miles, fromoff Virginia to off St. Petersburg, FL. Although not measured at recapture, the slow growth estimate from this fish is consistent with other long-term sandbar shark returns.

Thirty-two sandbar shark recaptures traveled distances greater than 500 miles. Of these, 14 traveled more than 1000 miles and 2 traveled more than 2000 miles. The longest distance for any sandbar returned in 1992 was 2028 miles, which is within 11 miles of the record distance reported for this species. The fish was tagged off Montauk Pt., NY and recaptured off Tampico, Mexico.

Nearly all of the long distance returns were tagged north of Cape Hatteras, NC and all except one traveled in a north to south direction. The exception was a sandbar shark that was tagged off Ft. Pierce, FL by a Narragansett biologist and recaptured 3.5 years later off Oregon Inlet, NC (560 miles northeast). Nineteen sandbar sharks tagged outside of the Gulf of Mexico were recaptured in the Gulf. Seventeen of these were long distance returns exceeding 500 miles. Compared to previous years, fewer sandbar sharks were recaptured in the Gulf and more were recaptured off the northeast coast of Florida. Variations in the patterns of returns may indicate shifts in the distribution or movements of a species or may simply be the result of changes in the fishing effort and/or reporting rates of tags. We are currently analyzing the historical sandbar shark tag and recapture data.

### Mako Sharks (26 Returns)

Mako sharks were recaptured after a maximum of 4.1 years at liberty and a maximum distance traveled of 1577 miles. The long distance return was originally tagged near the Flemish Cap (east of the Grand Banks) by a commercial fisherman and recaptured almost one year later 214 miles east of Madeira Island, by a Spanish longliner. This is only the second mako shark

*See Overview, Page 14*

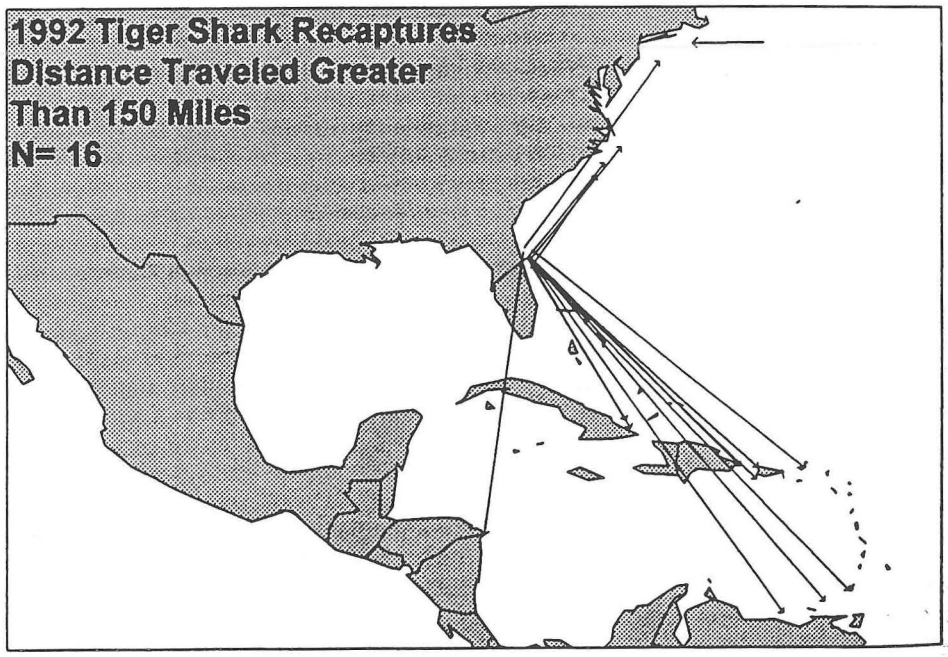


Table 2. Tag recoveries: January-December 1992.

| | GENERAL LOCATIONS | | MONTHS AT | DIST. (MI.) AND DIR. | | CAPTURE METHOD | | TAGGED BY | |
|---|---|---|---|---|---|---|---|---|---|
| | TAGGED | RECAPTURED | LIBERTY | | | TAG. | REC. | TAGGER | RESIDENCE |
| Blue shark | SE Montauk Pt, NY | E Ocean City, MD | 26 | 170 | SW | RR | LL | Gloria Hayn | NY |
| " " | S Pt. Judith, RI | E Cocoa Beach, FL | 9 | 826 | SW | RR | LL | Francis J. Powers | MA |
| " " | S St. David's I., Bermuda | W Faial, Azores | 5 | 1673 | NE | LL | LL | Alex Sutton | NY |
| " " | SE Shinnecock Inlet, NY | SE Fire Island Inlet, NY | < 1 | 41 | SW | RR | RR | Ed Anker | NY |
| " " | SE Montauk Pt., NY | SE Pt. Judith, RI | < 1 | 37 | E | RR | RR | Vincent Insinga | CT |
| " " | E Shark River Inlet, NJ | E Beach Haven, NJ | 1 | 39 | S | RR | RR | Roger Olsen | NY |
| " " | SE Oceanographer Canyon | E Pt. Judith, RI | 69 | 164 | NW | LL | RR | Ralph Tegge, NMFS Obs. | MA |
| " " | E Little Egg Inlet, NJ | W Powell Canyon | 1 | 214 | E | RR | LL | John Stack | PA |
| " " | S Montauk Pt., NY | N Recife, Brazil | 20 | 3263 | SE | RR | LL | Gene Blau | NY |
| " " | SE Montauk Pt, NY | Hudson Canyon | 3 | 89 | SW | RR | RR | Harvey Smith | NY |
| " " | SE Nantucket Island, MA | NE Cumana, Venezuela | 34 | 1661 | S | LL | LL | Linda Craig, NMFS Obs. | MA |
| " " | E Beach Haven, NJ | S Montauk Pt., NY | 60 | 186 | NW | LL | RR | K. Joyce, NMFS Obs. | MA |
| " " | E Montevideo, Uruguay | E Montevideo, Uruguay | 2 | 636 | E | LL | LL | Butch Winter | FL |
| " " | E Montevideo, Uruguay | E Montevideo, Uruguay | 1 | 56 | E | LL | LL | Butch Winter | FL |
| " " | SE Montevideo, Uruguay | E Montevideo, Uruguay | 1 | 176 | NE | LL | LL | Butch Winter | FL |
| " " | SE Montevideo, Uruguay | NE Montevideo, Uruguay | 16 | 672 | NE | LL | LL | Butch Winter | FL |
| " " | E Manasquan Inlet, NJ | SE Pt. Judith, RI | 49 | 68 | NE | HL | RR | Stephen Connett | RI |
| " " | SE Pt. Judith, RI | Cape Cod Bay, MA | 50 | 72 | N | HL | RR | Stephen Connett | RI |
| " " | SE Fire Island Inlet, NY | S Pt. Judith, RI | < 1 | 68 | NE | RR | RR | Bob Baltrunas | NY |
| " " | SE Gloucester, MA | S Montauk Pt., NY | 9 | 120 | SW | RR | RR | Thomas Lukegord | MA |
| Blue shark | E Ocean City, MD | E Cape Sable, NS, Canada | 41 | 749 | NE | RR | LL | Pete Floyd | DE |
| " " | SE of Manasquan Inlet, NJ | E Munson Canyon | 3 | 280 | E | RR | LL | Carmine Vastola | NJ |
| " " | S Pt. Judith, RI | E Scituate, MA | 11 | 127 | NE | RR | RR | Ken Benson | RI |
| " " | E Montauk Pt., NY | SE Montauk Pt., NY | 23 | 29 | S | RR | RR | Gerald Leonard | MA |
| " " | S Montauk Pt., NY | E Ocean City, MD | 3 | 157 | SW | RR | LL | Gerald Leonard | MA |
| " " | E Ocean City, MD | E Ocean City, MD | 2 | 55 | SE | RR | RR | Mike Logue | PA |
| " " | SE Munson Canyon | S Halifax, NS, Canada | 44 | 296 | NE | LL | LL | Georg Hinteregger, NMFS Obs. | MA |
| " " | SE Moriches Inlet, NY | W Las Palmas, Canary Is. | 32 | 2786 | E | RR | LL | Ron Woodward | NY |
| " " | S Pt. Judith, RI | S Pt. Judith, RI | 37 | 28 | SE | RR | RR | Bill Meyers | CT |
| " " | SE Pt. Judith, RI | S Pt. Judith, RI | 49 | 68 | W | HL | RR | Stephen Connett | RI |
| " " | SE Pt. Judith, RI | E Cape Sable, NS, Canada | 16 | 398 | E | RR | LL | Al Ingulli | CT |
| " " | SW Montauk Pt., NY | SW Jones Inlet, NY | 1 | 75 | W | RR | RR | Larry Lund | NY |
| " " | E Cape Elizabeth, ME | E Nantucket Island, MA | 34 | 212 | SE | RR | RR | Dave Sinclair | ME |
| " " | SE Pt. Judith, RI | SE Pt. Judith, RI | NR | NR | | RR | RR | Michael Collins | RI |
| " " | S Shinnecock Inlet, NY | SE Pt. Judith, RI | 2 | 75 | NE | RR | RR | Bruce Weisinger | NY |
| " " | SE Fire Island Inlet, NY | S Montauk Pt., NY | 1 | 42 | NE | RR | RR | Bruce Weisinger | NY |
| " " | Washington Canyon | SE Moriches Inlet, NY | 1 | 197 | NE | RR | RR | Bill Shaprow, Jr. | MD |
| " " | E Wachapreague Inlet, VA | E Manasquan Inlet, NJ | 1 | 188 | NE | RR | RR | Bill Shaprow, Jr. | MD |
| " " | E Indian River Inlet, DE | E Provincetown, MA | 39 | 256 | NE | LL | RR | Biologist (NMFS) | RI |
| " " | E Beach Haven, NJ | NE Cumana, Venezuela | 31 | 1742 | S | LL | LL | Biologist (NMFS) | RI |
| Blue shark | SE Montauk Pt., NY | Wilmington Canyon | 5 | 172 | SW | RR | RR | Bob Weaver | NY |
| " " | SE Pt. Judith, RI | NW Cumana, Venezuela | 27 | 1812 | S | LL | GN | Stephen Connett | RI |
| " " | SE Pt. Judith, RI | SE Pt. Judith, RI | 38 | 22 | W | HL | RR | Stephen Connett | RI |
| " " | S Montauk Pt., NY | SE Pt. Judith, RI | 12 | 65 | E | FS | HL | Carl Safina | NY |
| " " | E Rimini, Italy | E Rimini, Italy | < 1 | 23 | W | RR | RR | Big Game Italia | Italy |
| " " | SE Montauk Pt., NY | NW Sao Miguel, Azores | 33 | 1543 | E | RR | LL | William Ducci | CT |
| " " | E Shinnecock Inlet, NY | S Cape Sable, NS, Canada | 38 | 265 | E | RR | LL | Doug Fogg | CT |
| " " | SE Moriches Inlet, NY | Wilmington Canyon | 4 | 140 | SW | RR | RR | Wain Carlough | NY |
| " " | S Montauk Pt., NY | E Del Mar, NJ | 32 | 89 | W | RR | RR | Bill Ricca | NY |
| " " | E Lewes, DE | SE Martha's Vineyard, MA | 24 | 193 | NE | RR | RR | Gary W. Bacon | NJ |
| " " | SSW Montauk Pt., NY | SSW Montauk Pt., NY | < 1 | 0 | | RR | RR | Bill Ducci | CT |
| " " | SE Montauk Pt., NY | SE Montauk Pt., NY | 12 | NR | | RR | RR | Wayne King | NY |
| " " | E Beach Haven, NJ | SE Montauk Pt., NY | 1 | 103 | NE | RR | RR | Peter Bik | NJ |
| " " | SE Montauk Pt., NY | NE Gloucester, MA | 13 | 147 | N | RR | RR | Bob Weaver | NY |
| " " | SE Montauk Pt, NY | NW Cumana, Venezuela | 15 | 1829 | S | RR | LL | Frank Mundus | NY |
| " " | SW Montauk Pt., NY | SW Montauk Pt., NY | 1 | 3 | N | RR | RR | Dan Dantuono | NY |
| " " | S Pt. Judith, RI | SE Pt. Judith, RI | 1 | 17 | NE | RR | RR | Fred Gallagher | RI |
| " " | SE Shinnecock Inlet, NY | S Shinnecock Inlet, NY | < 1 | 35 | SW | RR | RR | Luis Menocal | NY |
| " " | SE Portland, ME | E Port of Spain, Trinidad | 19 | 2083 | S | RR | LL | Mark Chase | ME |
| " " | SE Montauk Pt., NY | E York Harbor, ME | 14 | 161 | NE | RR | RR | Bill Ricca | NY |
| Blue shark | SE Montauk Pt, NY | E Rudee Inlet, VA | 3 | 274 | SW | RR | RR | Chris Dadiskos | CT |
| " " | NE Rimini, Italy | E Porto Garibaldi, Italy | < 1 | NR | | RR | HN | Massimo Baccmiami, BGI | Italy |
| " " | SE Ancona, Italy | Andikithira Island, Greece | 10 | 598 | SE | RR | LL | Armando Marzi/Egidio Rossi, BGI | Italy |
| " " | SE Fire Island Inlet, NY | SSW Pt. Judith, RI | 1 | 80 | NE | RR | RR | Nicholas M. Zerille | NY |
| " " | E Nantucket Island, MA | NE Georgetown, Guyana | 24 | 1994 | SE | GN | LL | Georg Hinteregger, NMFS Obs. | MA |
| " " | E Montauk Pt, NY | NW Sao Miguel, Azores | 21 | 1499 | E | RR | LL | George Houston | CT |
| " " | SE Pt. Judith, RI | SE Pt. Judith, RI | 1 | 0 | | RR | RR | Bob Messinger | RI |
| " " | SE Pt. Judith, RI | SE Pt. Judith, RI | 1 | 0 | | RR | RR | Bob Messinger | RI |
| " " | S Pt. Judith, RI | W Sao Miguel, Azores | 24 | 1922 | E | RR | LL | Al Anderson | RI |
| " " | S Pt. Judith, RI | SE Pt. Judith, RI | 13 | 52 | E | RR | RR | Mike Plaia | CT |
| " " | SW Montauk Pt., NY | E Oregon Inlet, NC | 21 | 293 | SW | RR | GN | Pete Kazura | NY |
| " " | SE Pt. Judith, RI | E Beach Haven, NJ | 11 | 115 | SW | RR | RR | Tom Birch | MA |
| " " | S Pt Judith, RI | SE Shinnecock Inlet, NY | 3 | 31 | SW | RR | RR | Dave Tyrrell | RI |
| " " | S Montauk Pt., NY | S Cape Sable, NS, Canada | 13 | 304 | E | RR | LL | Ben Franford | CT |
| " " | SE Montauk Pt, NY | E Ocean City, MD | 10 | 182 | SW | RR | RR | Frank Braddick | NY |
| " " | S Montauk Pt., NY | SSE Montauk Pt., NY | 15 | 25 | N | RR | RR | Frank Braddick | NY |
| " " | S Shinnecock Inlet, NY | S Montauk Pt., NY | 1 | 39 | NE | RR | RR | Charles Witek | NY |
| " " | S Shinnecock Inlet, NY | SE Cape Sable, NS, Canada | 6 | 429 | NE | RR | LL | Kenneth Schmieder | NY |
| " " | SSW Pt Judith, RI | SE Montauk Pt, NY | 12 | 26 | E | RR | RR | Charlie Donilon | RI |
| " " | SW Martha's Vineyard, MA | S Fire Island Inlet, NY | < 1 | 98 | SW | RR | RR | Tony Tolentino | MA |
| " " | E Manasquan Inlet, NJ | SE Montauk Pt., NY | < 1 | NR | | RR | RR | John Williams | NJ |
| " " | SE Jones Inlet, NY | SE Jones Inlet, NY | < 1 | 22 | S | RR | RR | Larry Festa | NY |
| " " | E Pt. Pleasant, NJ | SE Pt. Judith, RI | 9 | 131 | NE | RR | RR | Frank Hirsh, Sr. | NJ |
| " " | E Beach Haven, NJ | SE Pt. Judith, RI | 2 | 127 | NE | RR | RR | Jerry Angelini | NJ |
| " " | E Beach Haven, NJ | SE Manasquan Inlet, NJ | 12 | 9 | N | FS | RR | Greg Venturo | NJ |

Table 2. Tag recoveries: January-December 1992.

| | GENERAL LOCATIONS | | MONTHS AT LIBERTY | DIST. (MI.) AND DIR. | | CAPTURE METHOD | | TAGGED BY | |
|---|---|---|---|---|---|---|---|---|---|
| | TAGGED | RECAPTURED | | | | TAG. | REC. | TAGGER | RESIDENCE |
| Blue shark | S Pt. Judith, RI | SE Ocean City, MD | 11 | 241 | SW | LL | RR | Stephen Connett | RI |
| " " | SE Pt. Judith, RI | SE Pt. Judith, RI | 12 | 18 | N | HL | RR | Stephen Connett | RI |
| " " | SE Pt. Judith, RI | E Manasquan Inlet, NJ | 12 | 85 | W | HL | RR | Stephen Connett | RI |
| " " | SE Montauk Pt., NY | SE Montauk Pt., NY | < 1 | 51 | N | RR | RR | Ilario V. Circosta | MA |
| " " | E York, ME | E Georgetown, Guyana | 21 | 2779 | SE | RR | LL | Bob Puddister | ME |
| " " | SE Moriches Inlet, NY | SSW Jones Inlet, NY | 2 | 55 | W | RR | RR | Doug Wells | NY |
| " " | SE Cape Elizabeth, ME | E Newburyport, MA | 11 | 33 | S | RR | RR | Richard Weare | ME |
| " " | E Saco River, ME | SE Fire Island Inlet, NY | 10 | 246 | SW | RR | RR | Mark Chase | ME |
| " " | S Montauk Pt., NY | Baltimore Canyon | NR | NR | | RR | LL | William Bourne | NY |
| " " | S Moriches Inlet, NY | SE Pt. Judith, RI | 2 | 79 | NE | RR | RR | John Ficarelli | NY |
| " " | S Pt. Judith, RI | S Pt. Judith, RI | NR | NR | | RR | RR | Jay Slavitz | MA |
| " " | SE Pt. Judith, RI | SE Pt. Judith, RI | 13 | 31 | NW | HL | RR | Stephen Connett | RI |
| " " | SE Montauk Pt., NY | SE Montauk Pt., RI | 11 | 84 | W | HL | RR | Stephen Connett | RI |
| " " | E York Harbor, ME | SW Nova Scotia,Canada | 12 | 154 | E | HL | LL | Stephen Connett | RI |
| " " | E York Harbor, ME | NE Munson Canyon | 1 | 186 | SE | HL | LL | Stephen Connett | RI |
| " " | E Rockport, MA | S Cape Sable, NS, Canada | 13 | 151 | E | HL | LL | Stephen Connett | RI |
| " " | SE Pt. Judith, RI | SSE Montauk Pt., NY | 10 | 70 | W | HL | RR | Stephen Connett | RI |
| " " | SE Pt. Judith, RI | SE Pt. Judith, RI | < 1 | 29 | W | HL | RR | Stephen Connett | RI |
| " " | SE Pt. Judith, RI | E Oregon Inlet, NC | 4 | 351 | SW | HL | LL | Stephen Connett | RI |
| " " | SE Pt. Judith, RI | SW Montauk Pt., NY | 2 | 93 | W | HL | RR | Stephen Connett | RI |
| Blue shark | SE Pt. Judith, RI | Wilmington Canyon | 3 | 210 | SW | HL | LL | Stephen Connett | RI |
| " " | E Manasquan Inlet, NJ | SW Cape Sable, NS, Canada | 1 | 244 | NE | RR | LL | Bob Veach | CT |
| " " | SE Pt. Judith, RI | E Montauk Pt., NY | < 1 | 14 | NE | RR | RR | Stephen A. Roy | RI |
| " " | S Vilamoura, Portugal | E Cabo Sao Vincente, Portugal | < 1 | 60 | SE | RR | LL | Ric Fuller | Portugal |
| " " | S Vilamoura, Portugal | Not Reported | 9 | NR | | RR | LL | Ric Fuller | Portugal |
| " " | S Vilamoura, Portugal | W Port of Safi, Morocco | 13 | 286 | S | RR | LL | Ric Fuller | Portugal |
| " " | SE Pt. Judith, RI | SE Pt. Judith, RI | 13 | 30 | W | RR | RR | David Kurzman | MA |
| " " | S Moriches Inlet, NY | SE Pt. Judith, RI | 1 | 102 | E | RR | RR | David Howard | NY |
| " " | SE Pt. Judith, RI | Wilmington Canyon | NR | NR | | RR | RR | Steven West | MA |
| " " | E Ocean City, MD | W Tail of the Grand Banks | 12 | 927 | E | RR | LL | Billy Verbanas | DE |
| " " | SE Pt. Judith, RI | N Ft. Lauderdale, FL | 6 | 995 | SW | RR | RR | Tony Tolentino | MA |
| " " | E Portland, ME | SE Jones Inlet, NY | NR | NR | | RR | RR | Richard Hill | ME |
| " " | S Montauk Pt., NY | E Cape Sable NS, Canada | 4 | 564 | E | RR | LL | Doug Colbath | NY |
| " " | S Shinnecock Inlet, NY | SSE Jones Inlet, NY | 1 | 40 | W | RR | RR | Floyd Carrington | NY |
| " " | E Montauk Pt., NY | Atlantis Canyon | 1 | 73 | SE | RR | LL | Carl Safina | NY |
| " " | SE Shinnecock Inlet, NY | E Oregon Inlet, NC | 10 | 291 | SW | RR | GN | Bill Williams | NY |
| " " | E Cape May, NJ | SW Montauk Pt., NY | < 1 | 130 | NE | RR | RR | Kurt Taboga | PA |
| " " | E Townsends Inlet, NJ | SSE Pt. Judith, RI | 3 | 180 | NE | RR | RR | Richard Humphreys | NJ |
| " " | S Montauk Pt., NY | SE Cape Sable NS, Canada | 4 | 460 | E | RR | LL | Ben Franford | CT |
| " " | S Montauk Pt., NY | N Barbados | 6 | 1740 | SE | RR | LL | Ben Franford | CT |
| Blue shark | S Montauk Pt., NY | S Cape Sable, NS, Canada | 1 | 288 | E | RR | HP | Frank Fasanella | CT |
| " " | S Pt. Judith, RI | SW Montauk Pt., NY | 1 | 39 | SW | RR | RR | Joe Garofano | CT |
| " " | SE Montauk Pt., NY | E Lydonia Canyon | 3 | 226 | E | RR | LL | Howard Kiedaisch | NY |
| " " | SE Montauk Pt., NY | SE Montauk Pt., NY | 12 | 14 | SW | RR | RR | Joe McBride | NY |
| " " | SE Montauk Pt., NY | SSW of Pt. Judith, RI | < 1 | 2 | S | RR | RR | Richard A. Pecheur | NY |
| " " | SW Montauk Pt., NY | SE Montauk Pt., NY | < 1 | 10 | E | FS | RR | Mike Burden | NY |
| " " | SE Moriches Inlet, NY | S Montauk Pt., NY | < 1 | 34 | E | RR | RR | Paul Schulz | NY |
| " " | E Babylon, NY | S Cape Sable, NS, Canada | 2 | 284 | NE | RR | LL | Bill Ricca | NY |
| " " | SE Moriches Inlet, NY | SE Moriches Inlet, NY | 1 | 3 | NW | RR | RR | Richard Haug | NY |
| " " | SE Pt. Judith, RI | SE Montauk Pt., NY | 12 | 18 | S | RR | RR | Al Anderson | RI |
| " " | SSE Pt. Judith, RI | E Indian River Inlet, DE | 11 | 199 | SW | FS | RR | Charlie Donilon | RI |
| " " | E Shinnecock Inlet, NY | Wilmington Canyon | 1 | 167 | SW | RR | RR | Ken Eipel | NY |
| " " | S Montauk Pt., NY | S Moriches Inlet, NY | < 1 | 48 | SW | RR | RR | Bill Schwanewede | NJ |
| " " | ESE Cape Porpoise, ME | E Munson Canyon | 2 | 221 | SE | RR | LL | J. W. Hinkley | ME |
| " " | S Pt. Judith, RI | S Pt. Judith, RI | < 1 | 0 | | FS | RR | George Hehner | RI |
| " " | SSW Pt. Judith, RI | SE Pt. Judith, RI | < 1 | 41 | E | FS | RR | Charlie Donilon | RI |
| " " | SE Shinnecock Inlet, NY | SW Cape Sable, NS, Canada | 2 | 266 | NE | RR | LL | Bill Williams | NY |
| " " | S Montauk Pt., NY | S Martha's Vineyard, MA | NR | NR | | RR | RR | Otto W. Haselman | NY |
| " " | SE Montauk Pt., NY | SE Fire Island Inlet, NY | < 1 | 52 | SW | RR | RR | John Schoen | NY |
| " " | S Pt. Judith, RI | Lydonia Canyon | NR | 222 | E | RR | LL | Steve DeMarco | CT |
| Blue shark | S Pt. Judith, RI | SE Montauk Pt., NY | < 1 | 31 | NE | RR | RR | Steve DeMarco | CT |
| " " | SE Montauk Pt., NY | S Nantucket Island, MA | 2 | 79 | SE | RR | LL | Robert Barry | PA |
| " " | SE Shinnecock Inlet, NY | N San Juan, Puerto Rico | 5 | 794 | S | RR | LL | Ben Franford | CT |
| " " | E Cape Henry, VA | E Wachapreague Inlet, VA | 13 | 54 | NE | LL | RR | Biologist (NMFS) | RI |
| " " | E Cape Henlopen, DE | SSE Montauk Pt., NY | 12 | 133 | NE | LL | RR | Biologist (NMFS) | RI |
| " " | W Block Canyon | SW Cape Sable, NS, Canada | 3 | 275 | NE | LL | LL | Biologist (NMFS) | RI |
| " " | S Montauk Pt., NY | Munson Canyon | 3 | 227 | E | LL | LL | Biologist (NMFS) | RI |
| " " | S Montauk Pt., NY | SE Pt. Judith, RI | 12 | 59 | NE | LL | RR | Biologist (NMFS) | RI |
| " " | SE Pt. Judith, RI | SE Montauk Pt., NY | NR | NR | | RR | RR | Gerald W. Gilman | CT |
| " " | SE Pt. Judith, RI | S Cape Sable, NS, Canada | 1 | 241 | NE | RR | LL | John Migdelany | MA |
| " " | SE Pt. Judith, RI | SE Pt. Judith, RI | < 1 | 3 | E | RR | RR | John Migdelany | MA |
| " " | S Montauk Pt., NY | S Jones Inlet, NY | 1 | 85 | SW | RR | RR | Barry Steinberg | NY |
| " " | S Pt. Judith, RI | SE Pt. Judith, RI | < 1 | 27 | SE | RR | RR | Eugene B. Artusa | NY |
| " " | S Pt. Judith, RI | SE Montauk Pt., NY | NR | NR | | RR | RR | Eugene B. Artusa | NY |
| " " | S Nantucket Island, MA | E Cape Sable, NS, Canada | 3 | 442 | E | RR | LL | Thomas Taylor | MA |
| " " | SE Pt. Judith, RI | SE Montauk Pt., NY | 1 | 34 | SW | RR | RR | Thomas Birch | MA |
| " " | SSW Pt. Judith, RI | SW Pt. Judith, RI | 1 | 12 | W | RR | RR | Charlie Donilon | RI |
| " " | S Moriches Inlet, NY | S Montauk Pt., NY | < 1 | 39 | NE | RR | RR | Frank Egitto | NY |
| " " | SE Pt. Judith, RI | W Wilmington Canyon | 8 | 182 | SW | RR | RR | Sandy Ballou | RI |
| " " | SE Cape May, NJ | S Pt. Judith, RI | < 1 | 209 | NE | RR | RR | Frank Hineline | NJ |
| " " | SE Pt. Judith, RI | S Montauk Pt., NY | < 1 | 33 | SW | RR | RR | James J. Noon | RI |
| " " | S Pt. Judith, RI | East Beach Haven, NJ | 3 | 82 | S | RR | LL | Andy Dangelo | RI |
| " " | SE Montauk Pt., NY | SSE Moriches Inlet, NY | < 1 | 68 | SW | RR | RR | Andy Dangelo | RI |
| " " | SE Montauk Pt., NY | E Townsends Inlet, NJ | 1 | 154 | SW | RR | LL | Bill Ricca | NY |
| " " | S Montauk Pt., NY | NE Shark River Inlet, NJ | 2 | 96 | W | RR | RR | Bill Ricca | NY |

Table 2. Tag recoveries: January-December 1992.

| | GENERAL LOCATIONS | | MONTHS AT LIBERTY | DIST. (MI.) AND DIR. | | CAPTURE METHOD | | TAGGED BY | |
|---|---|---|---|---|---|---|---|---|---|
| | TAGGED | RECAPTURED | | | | TAG. | REC. | TAGGER | RESIDENCE |
| Blue shark | E York Harbor, ME | S Montauk Pt., NY | 9 | 179 | SW | RR | RR | Bob Puddister | ME |
| " " | E York Harbor, ME | SE Portland, ME | < 1 | 11 | NE | RR | RR | Bob Puddister | ME |
| " " | SE Montauk Pt., NY | SW Cape Sable, NS, Canada | 2 | 235 | NE | RR | LL | Joe McBride | NY |
| " " | SE Montauk Pt., NY | E Pt. Judith, RI | < 1 | 57 | NE | RR | RR | Joe McBride | NY |
| " " | SE Montauk Pt., NY | SE Montauk Pt., NY | < 1 | 19 | SE | RR | RR | Joe McBride | NY |
| " " | SE Montauk Pt., NY | SE Montauk Pt., NY | < 1 | 8 | SW | RR | RR | Joe McBride | NY |
| " " | SE Cape Elizabeth, ME | SE Montauk Pt., NY | 10 | 186 | SW | RR | RR | Mark Chase | ME |
| " " | E York Harbor, ME | E York Harbor, ME | < 1 | 4 | SE | RR | RR | Mark Chase | ME |
| " " | N San Juan, Puerto Rico | Isle of San Andres, Colombia | 7 | 1248 | SW | LL | LL | Alex Sutton | NY |
| " " | Madeira Island, Portugal | NE Sao Miguel, Azores | 8 | 473 | N | RR | LL | Roddy Hays | Portugal |
| " " | S Montauk Pt., NY | E Montauk Pt., NY | 2 | 33 | NE | RR | LL | Frank Braddick | NY |
| " " | E Portsmouth, NH | E York Harbor, ME | 1 | 16 | N | RR | RR | Ben Garfield | ME |
| " " | SE Block Island, RI | SE Block Island, RI | < 1 | 2 | SE | RR | RR | Alex Malgieri | MA |
| " " | S Pt. Judith, RI | SE Pt. Judith, RI | 1 | 20 | N | RR | RR | Bill Dellavalle | RI |
| " " | E Madeira Isl., Portugal | NE Las Palmas Canary Isl. | 11 | 283 | S | RR | LL | Roddy Hays | Portugal |
| " " | SE Montauk Pt., NY | S Martha's Vineyard, MA | 1 | 20 | NE | RR | RR | Hank DiMarco | NY |
| " " | S Pt. Judith, RI | SE Pt. Judith, RI | < 1 | 27 | E | RR | RR | Hank DiMarco | NY |
| " " | S Vilamoura, Portugal | SW Cabo Sao Vincente, Portugal | NR | NR | | RR | LL | Ric Fuller | Portugal |
| " " | NE Georgetown, Guyana | E Georgetown, Guyana | 2 | 126 | S | LL | LL | Alex Sutton | NY |
| " " | S Vilamoura, Portugal | S Quarteira, Portugal | NR | NR | | RR | GN | Luis Pereira Da Silva | Portugal |
| Blue shark | E Wachapreague Inlet, VA | SE Moriches Inlet, NY | 1 | 164 | N | RR | RR | Billy Verbanas | DE |
| " " | E Wachapreague Inlet, VA | Norfolk Canyon | < 1 | 75 | SW | RR | LL | Billy Verbanas | DE |
| " " | SE Moriches Inlet, NY | S Montauk Pt., NY | < 1 | 19 | NE | HL | RR | Ray Hendrickson | NY |
| " " | E Ocean City, MD | E Ocean City, MD | < 1 | 52 | W | RR | RR | Robert F. Traa | NJ |
| " " | SE Pt. Judith, RI | SE Pt. Judith, RI | 1 | 20 | E | RR | RR | Bill Brown | CT |
| " " | SE Block Island, RI | SE Pt. Judith, RI | < 1 | 6 | N | RR | RR | Mike Amodeo | CT |
| " " | E Wachapreague Inlet, VA | S Montauk Pt., NY | 2 | 194 | NE | RR | RR | Billy Verbanas | DE |
| " " | E Wachapreague Inlet, VA | E Saco River, ME | 4 | 369 | NE | RR | RR | Billy Verbanas | DE |
| " " | E Wachapreague Inlet, VA | Baltimore Canyon | NR | 23 | NW | RR | LL | Billy Verbanas | DE |
| " " | E Ocean City, MD | SW Montauk Pt., NY | < 1 | 160 | N | RR | RR | Billy Verbanas | DE |
| " " | SW Tail of the Grand Banks | Grand Banks | < 1 | 388 | E | LL | LL | Scott Drabinowicz | MA |
| " " | S Cape Race, NFLD.,Canada | SW Cape Sable, NS, Canada | 2 | 580 | W | LL | LL | Scott Drabinowicz | MA |
| " " | E Rimini, Italy | NE Cattolica, Italy | NR | NR | | RR | RR | Big Game Italia | Italy |
| " " | S Pt. Judith, RI | SE Moriches Inlet, NY | < 1 | 30 | SW | RR | RR | Conrad Szemreio | CT |
| " " | SE Pt. Judith, RI | E Barnegat Inlet, NJ | 2 | 92 | SW | HL | LL | Stephen Connett | RI |
| " " | SE Pt. Judith, RI | S Montauk Pt., NY | 1 | 83 | W | HL | RR | Stephen Connett | RI |
| " " | E Ocean City, MD | E Ocean City, MD | < 1 | 4 | N | RR | RR | Billy Verbanas | DE |
| " " | S Pt. Judith, RI | SW Cape Sable, NS, Canada | 2 | 227 | NE | RR | LL | Bill Brown | CT |
| " " | S Montauk Pt., NY | S Cape Sable, NS, Canada | NR | NR | | RR | LL | Otto Haselman | NY |
| " " | S Shinnecock Inlet, NY | S Montauk Pt., NY | < 1 | 32 | E | RR | RR | Bill Williams | NY |
| Blue shark | SE Shinnecock Inlet, NY | SE Pt. Judith, RI | 1 | 60 | NE | FS | HL | Bill Williams | NY |
| " " | SE Shinnecock Inlet, NY | SE Fire Island Inlet, NY | < 1 | 23 | SW | RR | RR | Bill Williams | NY |
| " " | SE Fire Island Inlet, NY | SE Moriches Inlet, NY | < 1 | 14 | N | RR | RR | Andy Becker | NY |
| " " | SE Jones Inlet, NY | ESE Fire Island Inlet, NY | 1 | 17 | NE | RR | RR | Frank Christy | NY |
| " " | SE Montauk Pt., NY | SE Block Island, RI | 1 | 14 | N | RR | RR | Howard Kiedaisch | NY |
| " " | SE Pt. Judith, RI | S Pt. Judith, RI | < 1 | 48 | W | RR | RR | Robert Butler | MA |
| " " | SW Pt. Judith, RI | S Montauk Pt., NY | 1 | 15 | SE | RR | RR | Robert Butler | MA |
| " " | S Pt. Judith, RI | SE Pt. Judith, RI | 3 | 82 | E | RR | LL | Frank Noto | CT |
| " " | S Pt. Judith, RI | SW Fire Island Inlet, NY | NR | NR | | RR | RR | Scott Clemence | MA |
| " " | SW Montauk Pt., NY | SE Moriches Inlet, NY | 2 | 29 | SW | RR | RR | John Farris | NY |
| " " | SE Montauk Pt., NY | NE Hudson Canyon | < 1 | 71 | S | RR | LL | Tom Federico | NY |
| " " | SE Pt. Judith, RI | SE Montauk Pt., NY | < 1 | 6 | S | RR | RR | Robert Reichenberger | NY |
| " " | SE Pt. Judith, RI | SE Pt. Judith, RI | 1 | 5 | N | RR | RR | Robert Reichenberger | NY |
| " " | S Montauk Pt., NY | SE Block Island, RI | 1 | 46 | NE | RR | RR | Fred Wedley | NY |
| " " | S Montauk Pt., NY | SSE Pt. Judith, RI | < 1 | 49 | NE | RR | RR | Fred Wedley | NY |
| " " | E Barnegat Inlet, NJ | SE Jones Inlet, NY | 1 | 30 | NE | RR | RR | Joe McDonald | NJ |
| " " | SE Pt. Judith, RI | S Shinnecock Inlet, NY | < 1 | 81 | W | RR | RR | Ted Maguire | NY |
| " " | SE Pt. Judith, RI | SE Montauk Pt., NY | 1 | 33 | W | RR | RR | Al Anderson | RI |
| " " | SSW Pt. Judith, RI | SE Pt. Judith, RI | 1 | 21 | NE | RR | RR | Charlie Donilon | RI |
| " " | SSW Pt. Judith, RI | S Pt. Judith, RI | < 1 | 16 | NE | RR | RR | Charlie Donilon | RI |
| Blue shark | SE Moriches Inlet, NY | SE Montauk Pt., NY | 2 | 50 | E | RR | RR | Jim Matuszewski | NY |
| " " | SE Moriches Inlet, NY | SE Block Island, RI | < 1 | 52 | NE | RR | RR | Jim Matuszewski | NY |
| " " | SE Shinnecock Inlet, NY | S Pt. Judith, RI | < 1 | 49 | NE | RR | RR | Bill Williams | NY |
| " " | S Montauk Pt., NY | SE Montauk Pt., NY | 1 | 47 | E | RR | LL | Bill Williams | NY |
| " " | SE Pt. Judith, RI | SE Pt. Judith, RI | < 1 | 29 | E | RR | RR | Tom Mort | RI |
| " " | SE Pt. Judith, RI | SE Shinnecock Inlet, NY | < 1 | 48 | SW | RR | RR | Tom Mort | RI |
| " " | S Pt. Judith, RI | SE Moriches Inlet, NY | NR | 52 | W | RR | RR | Jim Bohara | CT |
| " " | SE Montauk Pt., NY | SE Pt. Judith, RI | < 1 | 10 | NE | RR | RR | Joe McBride | NY |
| " " | SE Montauk Pt., NY | S Shinnecock Inlet, NY | < 1 | 52 | W | RR | RR | Joe McBride | NY |
| " " | S Montauk Pt., NY | S Pt. Judith, RI | < 1 | 28 | NE | RR | RR | Joe McBride | NY |
| " " | SE Pt. Judith, RI | E Barnegat Inlet, NJ | 1 | 86 | S | FS | LL | Charlie Donilon | RI |
| " " | S Pt. Judith, RI | S Pt. Judith, RI | 1 | 10 | NE | RR | RR | Lee Pepin | CT |
| " " | SSE Moriches Inlet, NY | S Pt. Judith, RI | 2 | 54 | E | RR | RR | Steven Soltz | NY |
| " " | SE Pt. Judith, RI | SE Pt. Judith, RI | NR | 4 | NE | RR | RR | Henry Urbaniak | RI |
| " " | SE Montauk Pt., NY | SE Pt. Judith, RI | 1 | 49 | E | RR | RR | Stret Whitting | NY |
| " " | S Montauk Pt., NY | SSE Montauk Pt., NY | 1 | 16 | N | RR | RR | Richard J. Kossmann | NY |
| " " | E Shinnecock Inlet, NY | S Cape Sable, NS, Canada | 1 | 245 | NE | RR | LL | Barry Bordner | MA |
| " " | SE Pt. Judith, RI | SE Pt. Judith, RI | < 1 | 15 | E | RR | RR | Rick Warren | RI |
| " " | S Pt. Judith, RI | E Beach Haven, NJ | 1 | 97 | S | RR | RR | Joe Pagano | RI |
| " " | S Pt. Judith, RI | E Manasquan Inlet, NJ | NR | NR | | RR | LL | Robert B. Veach | CT |
| " " | SE Pt. Judith, RI | S Pt. Judith, RI | < 1 | 6 | W | RR | RR | James E. Killilea | RI |
| " " | S Montauk Pt., NY | SE Moriches Inlet, NY | 1 | 36 | SW | FS | RR | Doug Colbath | NY |
| " " | E Cape Elizabeth, ME | E Cape Elizabeth, ME | < 1 | 0 | | RR | RR | Rob Bidwell | ME |
| " " | S Newport, RI | E Barnegat Inlet, NJ | < 1 | 58 | SW | RR | LL | Jim Quinn | RI |

Table 2. Tag recoveries: January-December 1992.

| | GENERAL LOCATIONS | | MONTHS AT | DIST. (MI.) AND DIR. | | CAPTURE METHOD | | TAGGED BY | |
|---|---|---|---|---|---|---|---|---|---|
| | TAGGED | RECAPTURED | LIBERTY | | | TAG. | REC. | TAGGER | RESIDENCE |
| Tiger shark | Not Reported | E Oregon Inlet, NC | NR | NR | | RR | LL | Edward Tern | NY |
| " " | NE Munson Canyon | SE Pt. Judith, RI | 14 | 189 | W | GN | TN | Bernard Bernatonis, NMFS Obs. | MA |
| " " | E Daytona, FL | E Ponce Inlet, FL | 1 | 17 | E | LL | LL | Tris Colket | FL |
| " " | E Daytona, FL | N Ponce Inlet, FL | 1 | 4 | W | LL | LL | Tris Colket | FL |
| " " | NE Ponce Inlet, FL | Virgin Gorda, BVI | 22 | 1105 | SE | LL | RR | Tris Colket | FL |
| " " | SE St. Augustine, FL | Mouth of Rio Coco, Honduras | 21 | 892 | S | LL | LL | Tris Colket | FL |
| " " | NE Ponce Inlet, FL | W Grenada | 10 | 1466 | SE | LL | LL | Eric Sander | FL |
| " " | NE Ponce Inlet, FL* | Cape Hatteras, NC | 12 | 446 | NE | LL | LL | Eric Sander | FL |
| " " | E Ponce Inlet, FL | E Ponce Inlet, FL | 8 | 23 | SW | LL | LL | Tris Colket | FL |
| " " | N Ponce Inlet, FL | E Ponce Inlet, FL | 1 | 31 | SE | LL | LL | Tris Colket | FL |
| " " | NE St. Augustine, FL | Beaufort, SC | 20 | 97 | N | LL | RR | Tris Colket | FL |
| " " | NE Ponce Inlet, FL | E Ponce Inlet, FL | 2 | 15 | SE | LL | LL | Tris Colket | FL |
| " " | NE Ponce Inlet, FL | W La Tortuga, Venezuela | 6 | 1392 | SE | LL | LL | Eric Sander | FL |
| " " | NE Ponce Inlet, FL | ENE Ponce Inlet, FL | 8 | 45 | S | LL | LL | Tris Colket | FL |
| " " | NE St. Augustine, FL | E Goulds Inlet, GA | 13 | 66 | NE | LL | LL | Tris Colket | FL |
| " " | NE Ponce Inlet, FL | NE Ponce Inlet, FL | 7 | 17 | N | LL | LL | Eric Sander | FL |
| " " | NE Ponce Inlet, FL | N Cabo Engano, Dom. Rep. | 10 | 943 | SE | LL | LL | Eric Sander | FL |
| " " | NE Ponce Inlet, FL | E Jacksonville Beach, FL | 8 | 53 | N | LL | LL | Eric Sander | FL |
| " " | NE Ponce Inlet, FL | S Cape Lookout, NC | 17 | 368 | NE | LL | LL | Eric Sander | FL |
| " " | NE Ponce Inlet, FL | E Ponce Inlet, FL | < 1 | 15 | SE | LL | LL | Eric Sander | FL |
| Tiger shark | NE Ponce Inlet, FL | W Pta Borinquen, Puerto Rico | 9 | 977 | SE | LL | LL | Eric Sander | FL |
| " " | NE Ponce Inlet, FL | E Ponce Inlet, FL | 1 | 18 | SW | LL | LL | Eric Sander | FL |
| " " | E Ponce Inlet, FL | NE Bahia de Jaragua, Cuba | 3 | 592 | SE | LL | LL | Eric Sander | FL |
| " " | E Ponce Inlet, FL | E Ponce Inlet, FL | < 1 | 10 | NW | LL | LL | Eric Sander | FL |
| " " | E Ponce Inlet, FL | NW Ponce Inlet, FL | 7 | 60 | NW | LL | LL | Eric Sander | FL |
| " " | E Ponce Inlet, FL | N Ponce Inlet, FL | 2 | 35 | NW | LL | LL | Eric Sander | FL |
| " " | E Ponce Inlet, FL | E. Port Orange. FL | NR | NR | | LL | LL | Eric Sander | FL |
| " " | SE Ponce Inlet, FL | E Ponce Inlet, FL | 6 | 20 | N | LL | LL | Eric Sander | FL |
| " " | SE Ponce Inlet, FL | E Cape Fear, NC | 9 | 346 | NE | LL | LL | Eric Sander | FL |
| " " | SE Ponce Inlet, FL | E Ponce Inlet, FL | < 1 | 13 | NE | LL | LL | Eric Sander | FL |
| " " | E Ponce Inlet, FL | E Gould's Inlet, GA | 8 | 148 | N | LL | LL | Eric Sander | FL |
| " " | NE Ponce Inlet, FL | E Gould's Inlet, GA | 7 | 117 | N | LL | LL | Eric Sander | FL |
| " " | NE Ponce Inlet, FL | N St. Petersburg, FL | 9 | 731 | SW | LL | LL | Eric Sander | FL |
| " " | NE Ponce Inlet, FL | SE Atlantic City, NJ | 8 | 699 | NE | LL | LL | Tris Colket | FL |
| " " | SE St. Augustine, FL | NE Ponce Inlet, FL | 4 | 30 | N | LL | LL | Eric Sander | FL |
| " " | NE Ponce Inlet, FL | E Fernandina Beach, FL | 6 | 84 | N | LL | LL | Eric Sander | FL |
| " " | NE Ponce Inlet, FL | Margarita Island, Venezuela | 7 | 1448 | SE | LL | LL | Eric Sander | FL |
| " " | NE Ponce Inlet, FL | E Ponce Inlet, FL | 6 | 26 | S | LL | LL | Eric Sander | FL |
| " " | NE Ponce Inlet, FL | N Moa, Holquin, Cuba | 3 | 587 | SE | LL | LL | Eric Sander | FL |
| " " | SE Indian River Inlet, DE | SE Rudee Inlet, VA | 16 | 107 | S | RR | LL | Mark Sampson | MD |
| Tiger shark | SW Cape Hatteras, NC | E Rudee Inlet, VA | 6 | 108 | NE | LL | LL | Biologist (NMFS) | RI |
| " " | SE Oregon Inlet, NC | NE Oregon Inlet, NC | 18 | NR | | LL | LL | Biologist (NMFS) | RI |
| " " | NE Ponce Inlet, FL | NE Ponce Inlet, FL | 1 | 19 | W | LL | LL | Eric Sander | FL |
| " " | N Ponce Inlet, FL | Cape Canaveral, FL | 4 | 75 | S | LL | LL | Eric Sander | FL |
| " " | SE Ponce Inlet, FL | NE Ponce Inlet, FL | < 1 | 25 | N | LL | LL | Eric Sander | FL |
| " " | E Ponce Inlet, FL | NE Ponce Inlet, FL | < 1 | 26 | N | LL | LL | Eric Sander | FL |
| " " | E Ponce Inlet, FL | E Jacksonville Inlet, FL | 2 | 78 | N | LL | LL | Eric Sander | FL |
| " " | E Ponce Inlet, FL | Cape Canaveral, FL | NR | 35 | S | LL | LL | Eric Sander | FL |
| " " | NE Ponce Inlet, FL | SW Cabo Rojo, Puerto Rico | 3 | 998 | SE | LL | GN | Eric Sander | FL |
| " " | NE Ponce Inlet, FL | N Ponce Inlet, FL | 2 | 17 | W | LL | LL | Eric Sander | FL |
| " " | NE Ponce Inlet, FL | NE Ponce Inlet, FL | 2 | 5 | SE | LL | LL | Eric Sander | FL |
| " " | SE Ponce Inlet, FL | NE Ponce Inlet, FL | 8 | 20 | NW | LL | LL | Tris Colket | FL |
| " " | SE Ponce Inlet, FL | E Ponce Inlet, FL | 2 | 12 | N | LL | LL | Tris Colket | FL |
| " " | NE Ponce Inlet, FL | E Melbourne, FL | 3 | 96 | S | LL | LL | Tris Colket | FL |
| " " | NE Ponce Inlet, FL | N Ponce Inlet, FL | 7 | 13 | S | LL | LL | Tris Colket | FL |
| " " | N Ponce Inlet, FL | N Ponce Inlet, FL | 1 | 5 | S | LL | LL | Eric Sander | FL |
| " " | NE Ponce Inlet, FL | N Ponce Inlet, FL | 7 | 14 | S | LL | LL | Tris Colket | FL |
| " " | E Ponce Inlet, FL | NE Ponce Inlet, FL | 4 | 18 | W | LL | LL | Tris Colket | FL |
| " " | NE Ponce Inlet, FL | NE Ponce Inlet, FL | < 1 | 12 | NE | LL | LL | Eric Sander | FL |
| " " | NE Ponce Inlet, FL | NE Ponce Inlet, FL | 5 | 7 | E | LL | LL | Tris Colket | FL |
| Tiger shark | NE Ponce Inlet, FL | NE Ponce Inlet, FL | 8 | 7 | E | LL | LL | Tris Colket | FL |
| " " | NE Ponce Inlet, FL | N Ponce Inlet, FL | 1 | 24 | W | LL | LL | John Fraser | FL |
| " " | NE Ponce Inlet, FL | NE Ponce Inlet, FL | 6 | 13 | S | LL | LL | Tris Colket | FL |
| " " | NE Ponce Inlet, FL | NE Ponce Inlet, FL | 3 | 17 | E | LL | LL | Tris Colket | FL |
| " " | NE Ponce Inlet, FL | E Fernandina Beach, FL | 9 | 55 | N | LL | LL | Tris Colket | FL |
| " " | NE Ponce Inlet, FL | N Ponce Inlet, FL | 5 | 8 | S | LL | LL | Tris Colket | FL |
| " " | E Ponce Inlet, FL | E Jacksonville, FL | 10 | 62 | N | LL | LL | Tris Colket | FL |
| " " | NE St. Augustine, FL | NE Ponce Inlet, FL | 4 | 70 | S | LL | LL | Tris Colket | FL |
| " " | NE Ponce Inlet, FL | Cape Canaveral, FL | NR | 97 | S | LL | LL | Tris Colket | FL |
| " " | NE Ponce Inlet, FL | N Ponce Inlet, FL | 3 | 21 | SW | LL | LL | Tris Colket | FL |
| " " | NE Ponce Inlet, FL | NE Ponce Inlet, FL | 7 | 22 | SW | LL | LL | Tris Colket | FL |
| " " | NE Ponce Inlet, FL | NE Ponce Inlet, FL | 1 | 16 | SE | LL | LL | Tris Colket | FL |
| " " | E St. Augustine, FL | NE Ponce Inlet, FL | 3 | 40 | S | LL | LL | Tris Colket | FL |
| " " | E St. Augustine, FL | NE St. Augustine, FL | 2 | 13 | N | LL | LL | Tris Colket | FL |
| " " | NE St. Augustine, FL | SE St. Augustine, FL | 2 | 51 | SW | LL | LL | Tris Colket | FL |
| " " | SE St. Augustine, FL | E Jacksonville, FL | 4 | 50 | NE | LL | LL | Tris Colket | FL |
| " " | SE St. Augustine, FL | N Ponce Inlet, FL | < 1 | 10 | SE | LL | LL | Tris Colket | FL |
| " " | NE St. Augustine, FL | E Fernandina Inlet, FL | 1 | 30 | NE | LL | LL | Tris Colket | FL |
| " " | NE Ponce Inlet, FL | E St. Augustine, FL | 3 | 50 | NW | LL | LL | Eric Sander | FL |
| " " | N Ponce Inlet, FL | Cape Canaveral, FL | NR | 64 | S | LL | LL | Eric Sander | FL |
| " " | E Ponce Inlet, FL | N Ponce Inlet, FL | 1 | 36 | NW | LL | LL | Eric Sander | FL |
| Sandbar shark | Great Machipongo, VA | W St. Petersburg, FL | 299 | 1218 | SW | GN | LL | Biologist (NMFS) | RI |
| " " | E Barnegat Inlet, NJ | Pto. Ind. Altamira, Tam., Mexico | 110 | 1940 | SW | RR | LL | Frank C. Freer | NJ |
| " " | S Montauk Pt., NY | E Gould's Inlet, GA | 97 | 692 | SW | RR | LL | Bill HoJohn | NY |

Table 2. Tag recoveries: January-December 1992.

| | GENERAL LOCATIONS | | MONTHS AT | DIST. (MI.) AND DIR. | | CAPTURE METHOD | | TAGGED BY | |
|---|---|---|---|---|---|---|---|---|---|
| | TAGGED | RECAPTURED | LIBERTY | | | TAG. | REC. | TAGGER | RESIDENCE |
| Sandbar shark | SE Montauk Pt., NY | NE Tampico, Mexico | 154 | 2028 | SW | RR | LL | Steve Locke | NY |
| " " | S Montauk Pt., NY | N Ponce Inlet, FL | NR | NR | | RR | LL | Roy L. Mains | NY |
| " " | SW Montauk Pt., NY | E Barra Cazones, Ver.,Mexico | 138 | 2006 | SW | RR | LL | Robert Bangston | NY |
| " " | SW Montauk Pt., NY | NE Ponce Inlet, FL | NR | NR | | RR | LL | Bob Cicerani | NY |
| " " | S Montauk Pt., NY | SE Ponce Inlet, FL | NR | NR | | RR | LL | Ray Schmidt | NY |
| " " | S Montauk Pt., NY | E Cape Hatteras, NC | NR | NR | | NR | LL | Ed Wills | NY |
| " " | E Cape Canaveral, FL | W Dry Tortugas, FL | 131 | 414 | SE | LL | LL | Stephen Connett | RI |
| " " | E Veatch Canyon | E Gould's Inlet, GA | 140 | 726 | SW | LL | LL | Biologist (NMFS) | RI |
| " " | E Stuart Inlet, FL | E Cape Canaveral, FL | 130 | 66 | N | LL | LL | Stephen Connett | RI |
| " " | SE Manasquan Inlet, NJ | E Ponce Inlet, FL | 102 | 732 | SW | RR | LL | Charles G. Pisapia | NJ |
| " " | E Montauk Pt., NY | SW Naples, FL | 127 | 1376 | SW | RR | LL | Ken Chalson | NY |
| " " | SE Manasquan Inlet, NJ | NE Tampico, Mexico | 60 | 1938 | SW | RR | LL | Ron Frick | NJ |
| " " | SE Block Island, RI | S Galveston, TX | 107 | 1932 | SW | RR | LL | John Flanagan | RI |
| " " | SE Fire Island Inlet, NY | SW Panama City Beach,FL | 56 | 1584 | SW | RR | LL | Frank Foti | NY |
| " " | SSE Moriches Inlet, NY | W Sarasota, FL | 67 | 1414 | SW | RR | LL | Thomas Leitch | NY |
| " " | E Shark River Inlet, NJ | E Jacksonville Beach, FL | 78 | 694 | SW | RR | LL | Randall A. Bradeen | NY |
| " " | SE Fire Island Inlet, NY | W Redington Beach, FL | 105 | 914 | SW | RR | LL | Sal Cataldo | NY |
| " " | E Cape May, NJ | NE St. Augustine, FL | 12 | 602 | SW | RR | LL | Dan Guss | NJ |
| " " | SE Montauk Pt., NY | E Gould's Inlet, GA | 79 | 695 | SW | RR | LL | Warren Hader | NY |
| " " | E Kiawah, SC | E Tavernier Key, FL | 90 | 457 | S | RR | LL | Rick Stringer | SC |
| Sandbar shark | S Pt. Judith, RI | W Tampa, FL | 58 | NR | | RR | LL | Robert LaValley | RI |
| " " | Little Egg Harbor, NJ | North Brigantine Beach, NJ | 25 | 9 | S | RR | RR | Dennis Genaro | NJ |
| " " | SE Cape May, NJ | NE Ponce Inlet, FL | 69 | 608 | SW | RR | LL | Bob Vichko | NJ |
| " " | S Shinnecock Inlet, NY | E Cape Sable, FL | 70 | 984 | SW | RR | LL | Douglas Wells | NY |
| " " | N St. Augustine, FL | W Cape Sable, FL | 54 | 588 | SW | RR | LL | George Royle | FL |
| " " | S Shinnecock Inlet, NY | NE Ponce Inlet, FL | 57 | 738 | SW | RR | LL | Robert Lamontia | NY |
| " " | SE Oregon Inlet, NC | N Rio Lagantos, Yuc., Mexico | 70 | 1189 | SW | LL | LL | Biologist (NMFS) | RI |
| " " | E Shark River Inlet, NJ | E Jekyl Island, GA | 76 | 700 | SW | RR | LL | Ed Cacioppo | NY |
| " " | SW Montauk Pt., NY | SE Destin, FL | 46 | 1613 | SW | RR | LL | Ed Cacioppo | NY |
| " " | S Moriches Inlet, NY | SE Corpus Christi, TX | NR | NR | | RR | LL | Wain Carlough | NY |
| " " | SE Barnegat Inlet, NJ | SE Rockport, TX | 59 | 1889 | SW | RR | LL | Carmine Vastola | NJ |
| " " | E Charleston, SC | E St. Simons Is., GA | 66 | 123 | SW | LL | LL | Biologist (NMFS) | RI |
| " " | E Cape May, NJ | E Tom's River, NJ | 14 | 88 | NE | RR | LL | Mike Moore | PA |
| " " | SE Cape Henry, VA | E Cape Fear, NC | 45 | 190 | S | RR | LL | John Thurston | VA |
| " " | E Pt. Pleasant, NJ | SE Oregon Inlet, NC | 64 | 281 | S | RR | LL | Rich Gibbons | NY |
| " " | S Montauk Pt., NY | W Redington Beach, FL | NR | NR | | RR | LL | Joe Winter | NY |
| " " | E Manasquan Inlet, NJ | SE Barnegat Inlet, NJ | 47 | 34 | S | RR | LL | John Raguso | NY |
| Sandbar shark | E Indian River Inlet, DE | E Tom's River, NJ | 37 | 115 | NE | RR | LL | Pete Floyd | DE |
| " " | N Padre Island, TX | SE Galveston, TX | 40 | 172 | E | RR | LL | Steve Honc | TX |
| " " | Virginia Beach, VA | E Ches. Light Tower, VA | 48 | 55 | E | RR | LL | S. W. Haase | VA |
| " " | E Ormond Beach, FL | E Fernandina Beach, FL | 36 | 99 | N | LL | LL | Jack Morton | FL |
| " " | SE Manasquan Inlet, NJ | E Tuxpan, Ver., Mexico | 27 | 1926 | SW | RR | LL | Harry Thorne | NJ |
| " " | SE Fire Island Inlet, NY | E Tom's River, NJ | 23 | 31 | SW | RR | LL | Phil Bruckner | NY |
| " " | E Montauk Pt., NY | E Daytona Beach, FL | 49 | 851 | SW | RR | TN | Charlie Donilon | RI |
| " " | S Pt. Judith, RI | S Tavernier, FL | 42 | 1075 | SW | RR | LL | Fred Gallagher | RI |
| " " | E Block Island, RI | NE Ponce Inlet, FL | 44 | 834 | SW | RR | LL | Rick Templeton | RI |
| " " | SE Cape May, NJ | E Jacksonville Beach, FL | 17 | 575 | SW | RR | LL | George J. Jacob | NJ |
| " " | SE Jupiter, FL | E St. Simon, GA | 16 | 268 | N | RR | LL | Don Ewer | FL |
| " " | SSE Cape May, NJ | SE Cape Fear, NC | 31 | 332 | SW | RR | RR | Mark Wheeler | NJ |
| " " | E Cape Sable, FL | S Dry Tortugas, FL | 34 | 208 | W | LL | LL | Biologist (NMFS) | RI |
| " " | E Fort Pierce, FL. | E Oregon Inlet, NC | 42 | 560 | NE | LL | LL | Biologist (NMFS) | RI |
| " " | SE North Inlet, SC | NE Jacksonville Beach, FL | 43 | 155 | SW | LL | LL | Biologist (NMFS) | RI |
| " " | SE Cape Hatteras, NC | E Cape Fear, NC | 34 | 110 | SW | LL | LL | Biologist (NMFS) | RI |
| " " | SE Oregon Inlet, NC | E Cape Fear, NC | 34 | 137 | SW | LL | LL | Biologist (NMFS) | RI |
| " " | S Rudee Inlet, VA | E Tom's River, NJ | 38 | 243 | NE | LL | LL | Biologist (NMFS) | RI |
| " " | E Sandy Hook, NJ | E Forked River, NJ | 38 | 129 | E | RR | LL | Carl Safina | NY |
| " " | SW Shinnecock Inlet, NY | E Oregon Inlet, NC | 38 | 320 | S | RR | LL | Louis Grenja | NY |
| Sandbar shark | SE Rudee Inlet, VA | E Manasquan Inlet, NJ | 21 | 234 | NE | RR | LL | Albert Norwood | VA |
| " " | E Cape Henry, VA | SW Destin, FL | NR | 1376 | SW | LL | LL | Steve Branstetter | VA |
| " " | SE Manasquan Inlet, NJ | SE Atlantic City, NJ | 25 | 32 | SW | RR | LL | John Williams | NJ |
| " " | E Cape Hatteras, NC | SE Sandy Hook, NJ | 20 | 314 | N | LL | RR | Tom Spencer | VA |
| " " | NE Ponce Inlet, FL | NE Ponce Inlet, FL | 6 | 11 | N | LL | LL | Eric Sander | FL |
| " " | Mouth of Delaware Bay | S Freeport, TX | 15 | 1212 | SW | LL | LL | Bill Garrison | NJ |
| " " | N Ponce Inlet, FL | N Ponce Inlet, FL | 7 | 31 | NE | LL | LL | Eric Sander | FL |
| " " | E Sandy Hook, NJ | SE Atlantic City, NJ | 12 | 61 | SW | RR | LL | Douglas Wells | NY |
| " " | SE Montauk Pt., NY | E Manasquan Inlet, NJ | 1 | 104 | SW | RR | LL | Joe McBride | NY |
| " " | SE Charleston, SC | Charleston Harbor, SC | < 1 | 1 | N | RR | RR | Ivan Schultz | SC |
| " " | E Indian River Inlet, DE | ESE Oregon Inlet, NC | 4 | 176 | S | RR | LL | Billy Verbanas | DE |
| " " | S Montauk Pt., NY | SE Atlantic City, NJ | NR | NR | | RR | LL | Steve Sherwood | NY |
| " " | Chesapeake Bay, VA | NW Cape Charles ,VA | < 1 | 10 | N | LL | GN | Steve Branstetter | VA |
| Shortfin mako | SE Manasquan Inlet, NY | SE Moriches Inlet, NY | 14 | 67 | NE | RR | RR | Joe La Rosa | NJ |
| " " | SE Munson Canyon | SW Cape Sable, NS, Canada | 45 | 186 | N | LL | HL | Linda Craig, NMFS Obs. | MA |
| " " | E Tom's River, NJ | E Vineyard Haven, MA | 49 | 181 | NE | RR | RR | Bruce Miller | NJ |
| " " | E Barnegat Light, NJ | E Beach Haven, NJ | 1 | 15 | W | RR | RR | Alan G. Thomas | NJ |
| " " | E Ocean City, MD | SE Pt. Judith, RI | 13 | 222 | NE | RR | RR | Mark Shepherd | DE |
| " " | E Shark River Inlet, NJ | E Ocean City, MD | 25 | 104 | S | RR | LL | Jeffrey T. Baker | NJ |
| " " | E Tom's River, NJ | SE Moriches Inlet, NY | 35 | 53 | NE | RR | RR | Mike Szegeski | NJ |
| " " | SE Pt. Judith, RI | S Montauk Pt., NY | 23 | 70 | W | LL | RR | Stephen Connett | RI |
| " " | E Cape Race,NFLD., Canada | E Madeira Island, Portugal | 11 | 1577 | E | LL | LL | John Caldwell | FL |
| " " | SE Oregon Inlet, NC | S Pt. Judith, RI | 14 | 370 | NE | LL | RR | Glen Hopkins | NC |
| " " | Wilmington Canyon | S Pt. Judith, RI | 1 | 185 | NE | RR | RR | T. V. Wood, III | PA |
| " " | S Montauk Pt., NY | E Oregon Inlet, NC | 5 | 272 | SW | RR | LL | Lou Pastore | NY |
| " " | E Barnegat Inlet, NJ | E Cape Henlopen, DE | 4 | 64 | S | RR | LL | Ralph Leyrer | NJ |
| " " | E Beach Haven, NJ | E Beach Haven, NJ | 2 | 5 | S | RR | RR | John Williams | NJ |

Table 2. Tag recoveries: January-December 1992.

| | GENERAL LOCATIONS | | MONTHS AT LIBERTY | DIST. (MI.) AND DIR. | | CAPTURE METHOD | | TAGGED BY | |
|---|---|---|---|---|---|---|---|---|---|
| | TAGGED | RECAPTURED | | | | TAG. | REC. | TAGGER | RESIDENCE |
| Shortfin mako | S Montauk Pt., NY | E Townsends Inlet, NJ | 23 | 108 | SW | RR | LL | Howard Kiedaisch | NY |
| " " | NE Cape May, NJ | Frisco, NC | 10 | 238 | S | RR | RR | Edward W. Taylor | NJ |
| " " | SE Ocean City, MD | S Montauk Pt., NY | 12 | 196 | NE | RR | RR | Mark Sampson | MD |
| " " | SE Oregon Inlet, NC | S Jones Inlet, NY | 15 | 291 | N | LL | RR | Biologist (NMFS) | RI |
| " " | E Pt. Pleasant, NJ | SE Oregon Inlet, NC | 3 | 272 | S | RR | LL | John L. Genz | NJ |
| " " | SE Pt. Judith, RI | SE Pt. Judith, RI | < 1 | 10 | W | RR | RR | Irwin Kamen | MA |
| " " | SE Ocean City, MD | SE Pt. Judith, RI | 2 | 243 | NE | RR | LL | Mark Sampson | MD |
| " " | SE Ocean City, MD | S Shinnecock Inlet, NY | 1 | 177 | NE | RR | RR | Mark Sampson | MD |
| " " | ESE Indian River, DE | E Barnegat Inlet, NJ | 1 | 103 | NE | RR | RR | Louis Hirst | NJ |
| " " | S Fire Island Inlet, NY | SE Montauk Pt., NY | 1 | 111 | E | RR | RR | Ken Scheben | NY |
| " " | E Ocean City, MD | SE Manasquan Inlet, NJ | < 1 | 91 | NE | RR | RR | Terry Bosserman | PA |
| " " | SE Cape May, NJ | NE Shark River Inlet, NJ | 1 | 112 | N | RR | RR | Bill Walker | PA |
| Dusky shark | SE Fire Island Inlet, NY | E Cape Hatteras, NC | 89 | 327 | S | RR | LL | Phil Bruckner | NY |
| " " | E Oregon Inlet, NC | E Veracruz, Mexico | 98 | 1685 | SW | TN | LL | Rene Eppi, NMFS Obs. | MA |
| " " | E Oregon Inlet, NC | SW Mobile, AL | 114 | 1319 | SW | TN | LL | Kevin Flanagan, NMFS Obs. | MA |
| " " | NE Oregon Inlet, NC | N Dzilam Bravo, Yuc., Mexico | 80 | 1253 | SW | TN | LL | Ray Sutherland, NMFS Obs. | MA |
| " " | E Little Egg Inlet, NJ | NE Cape Hatteras, NC | 34 | 254 | S | RR | LL | David G. Wentling | PA |
| " " | SE Manasquan Inlet, NJ | E Tampico, Mexico | 2 | 1940 | SW | RR | LL | John Williams | NJ |
| " " | Hudson Canyon | Cayo Frances, Caibarien, Cuba | 56 | 1081 | SW | RR | LL | Chet Young | NJ |
| " " | S Shinnecock Inlet, NY | SE Pt. Judith, RI | 36 | 64 | NE | RR | GN | Bob Cicerani | NY |
| " " | E Chincoteague, VA | SE Atlantic City, NJ | 38 | 103 | NE | RR | LL | Mark Sampson | MD |
| " " | Chincoteague,VA | Chincoteague, VA | 1 | 1 | E | RR | RR | Joe Hays | NJ |
| " " | E Indian River Inlet, DE | S Ocracoke, NC | 3 | 221 | S | RR | RR | Billy Verbanas | DE |
| " " | E Ocean City, MD | E North Topsail Beach, NC | 1 | 241 | S | RR | GN | Christen Jorgensen | MD |
| Blacktip shark | SW Stony Inlet, SC | Core Sound, NC | 70 | 222 | NE | RR | GN | Rick Stringer | SC |
| " " | E Cape May, NJ | Cape Hatteras, NC | NR | NR | | RR | RR | Bill Garrison | NJ |
| " " | St. Georges Island, FL | St. Georges Island, FL | < 1 | 3 | W | RR | RR | Pat K. Hodges | FL |
| " " | NW Tarpon Springs, FL | SW St. Petersburg, FL | 12 | 56 | S | RR | RR | Roy Allen | FL |
| " " | Cape Coral, FL | Pine Island, FL | < 1 | 1 | SW | RR | RR | Gary Bongers | FL |
| " " | Matagorda Island, TX | S Port O'Connor, TX | < 1 | NR | | RR | RR | Mark E. Kelley | TX |
| " " | Matagorda Island, TX | Port O'Connor Jetty, TX | 1 | 7 | N | RR | RR | Mark E. Kelley | TX |
| " " | SE Port O'Connor, TX | E Tecolutla, Ver., Mexico | 4 | 476 | S | RR | GN | Drew Jenkins | TX |
| " " | N Pine Island, FL | Key West, FL | 4 | 125 | S | RR | RR | Leo (Skip) Dunn | FL |
| " " | NW Naples, FL | San Carlos Bay, FL | < 1 | 5 | W | RR | GN | James O. Keith | FL |
| " " | Padre Island, TX | Pto. el Mezquital, Mat., Mexico | < 1 | 92 | S | RR | GN | Chris Ruiz | TX |
| Silky shark | E Fernandina Beach, FL | NE Ponce Inlet, FL | 3 | 56 | S | LL | LL | Jose Castro | FL |
| " " | N Recife, Brazil | NE Recife, Brazil | 24 | 718 | E | LL | LL | Dr. Julio Moron | Spain |
| " " | E Gould's Inlet, GA | E Charleston, SC | 12 | 131 | NE | LL | LL | Biologist (NMFS) | RI |
| " " | E Miami, FL | Great Issacs, Bahamas | 5 | 13 | NE | RR | RR | Ron Schatman | FL |
| " " | NE Georgetown, Guyana | E of Grenada, West Indies | 1 | 444 | NW | LL | RR | Alex Sutton | NY |
| Porbeagle | E Shark River Inlet, NJ | W Cape Race NFLD, Canada | 102 | 604 | NE | LL | LL | Martin Williamowsky, NMFS Obs. | MA |
| " " | S Lydonia Canyon | E Cape Sable, NS, Canada | 96 | 331 | NE | LL | LL | Martin Williamowsky, NMFS Obs. | MA |
| " " | E Pt. Pleasant, NJ | W Cape Race, NFLD, Canada | 76 | 732 | NE | TN | LL | Walter Quinn, NMFS Obs. | MA |
| " " | E Pt. Pleasant, NJ | SW Cape Race NFLD, Canada | 52 | 778 | NE | TN | LL | Jerzy Cygler, NMFS Obs. | MA |
| " " | E Barnegat Inlet, NJ | SW Cape Sable, NS, Canada | NR | 278 | NE | TN | LL | Jerzy Cygler, NMFS Obs. | MA |
| Sc. hammerhead | SE Fire Island Inlet, NY | SE Barnegat Inlet, NJ | 72 | 66 | SW | RR | LL | Barry Mack | NY |
| " " | NE Oregon Inlet, NC | SE Oregon Inlet, NC | 67 | 40 | S | LL | LL | Biologist (NMFS) | RI |
| " " | E Indian River Inlet, DE | S Nantucket Island, MA | 14 | 214 | NE | RR | GN | Brion Babbitt | NJ |
| " " | NE Cape Hatteras, NC | ESE Oregon Inlet, NC | 6 | 12 | NW | LL | LL | Stephen Connett | RI |
| Nurse shark | Port of Palm Beach, FL | Palm Beach Inlet, FL | 1 | 1 | S | RA | RR | Mark Fischer | FL |
| " " | NW Naples, FL | NW Naples, FL | 13 | 1 | S | RR | RR | John Brossard | FL |
| " " | Miami, FL | E Biscayne, FL | 2 | 3 | S | RR | RR | Phillip Boucher | FL |
| " " | Long Key, FL | Long Key, FL | < 1 | 1 | W | RR | LT | Matt O'Bryen | FL |
| Sand tiger | N Oregon Inlet, NC | Sakonnet Point, RI | 7 | 389 | NE | TN | GN | Georg Hinteregger, NMFS Obs. | MA |
| " " | SW Cape Hatteras, NC | Hog Island Bay, VA | 7 | 148 | N | LL | RR | Glen Hopkins | NC |
| " " | NE Ponce Inlet, FL | Delaware Bay, NJ | 7 | 637 | NE | LL | LL | Tris Colket | FL |
| Atl. sharpnose | SE Charleston, SC | NE North Inlet, NC | 43 | 94 | NE | RR | RR | Rick Stringer | SC |
| " " | Port O'Connor, TX | Pta Jerez, Tam., Mexico | 4 | 336 | S | RR | GN | Drew Jenkins | TX |
| " " | S Charleston, SC | E Edisto Island, SC | 5 | 21 | W | RR | TN | Rick Stringer | SC |
| Bigeye thresher | SE Hydrographer Canyon | E Oregon Inlet, NC | 51 | 366 | SW | LL | LL | Steven Slota, NMFS Obs. | MA |
| " " | SE Oregon Inlet, NC | SE Oregon Inlet, NC | 57 | 3 | SW | LL | LL | Roger Dow, NMFS Obs. | MA |
| Lemon shark | Cutoe Key, FL | Big Pine Key, FL | 49 | 4 | S | RR | RR | William Botten | FL |
| " " | Fat Deer Key, FL | Key West, FL | 3 | 44 | W | RR | RR | William Botten | FL |
| Bignose shark | E Atlantic City, NJ | S Freeport, TX | 24 | 1805 | SW | RR | LL | Ray Bergman, Jr. | NJ |
| Bull shark | Port O'Connor, TX | Laguna Madre, Tam., Mexico | 6 | 222 | S | GN | GN | Mark E. Kelley | TX |
| Gt. hammerhead | Siesta Key, FL | W Cape Sable, FL | 8 | 102 | SW | RR | LL | Mike Pesaturo | FL |
| Sm. hammerhead | E Beach Haven, NJ | E Great Egg Harbor Inlet, NJ | 1 | 55 | W | RR | GN | John Williams | NJ |
| Oc. whitetip | W Mauritius | W Mauritius | 9 | 4 | W | RR | LL | Graeme Pullen | England |
| Galapagos shark | NE St. Davids Isl. Bermuda | E St. Davids Isl. Bermuda | 24 | 2 | S | LL | LL | Stephen Connett | RI |
| Spinner shark | E Matecumbe Key, FL | S Fowey Rock Light, FL | 2 | 40 | N | RR | RR | Mark Quartiano | FL |
| Sm. dogfish | E Ocean City, MD | E Ocracoke Island, NC | 26 | 189 | S | RR | GN | Dick Arnold | MD |
| Brown/Dusky | SE Jones Inlet, NY | S Jones Inlet, NY | 25 | 73 | S | RR | LL | Ed Perry | NY |
| " " | SE Fire Island Inlet, NY | NE Oregon Inlet, NC | 14 | 266 | S | RR | LL | Pete Martin | NY |
| Hammerhead | SE Cape May, NJ | S Fire Island Inlet, NY | 86 | 117 | NE | RR | RR | Bob Vichko | NJ |
| " " | Hudson Canyon | E Oregon Inlet, NC | 17 | 259 | SW | RR | GN | Jack Silverstein | NJ |
| Shark | E Jacksonville, FL | NE Ponce Inlet, FL | NR | NR | | RR | LL | Jerry Jernigan | FL |
| " " | SE Shinnecock Inlet, NY | E Jupiter, FL | 40 | 899 | SW | RR | LL | Bob Cicerani | NY |
| " " | E Beach Haven, NJ | Cape Hatteras, NC | 85 | 278 | S | RR | LL | Joe McDonald | NJ |
| " " | E Cape Henry, VA | SE Pt. Judith, RI | NR | NR | | RR | LL | Richard Dusch | VA |
| White marlin | E Wachapreague Inlet, VA | Cozumel, Mexico | 21 | 1223 | SW | RR | RR | Warren Sauers | MD |
| " " | SE Pt. Judith, RI | SE Montauk Pt., NY | 34 | 52 | NW | HL | RR | Rodman Sykes | RI |
| Swordfish | NE Oregon Inlet, NC | E Oregon Inlet, NC | 85 | 16 | SW | LL | LL | Martin Williamowsky, NMFS Obs. | MA |
| Bluefin tuna | SE Fire Island Inlet, NY | SW Munson Canyon | 31 | 223 | E | RR | LL | Anthony Angello | NY |
| Striped bass | Not Reported | Moriches Inlet, NY | NR | NR | | RR | RR | Joe Smerina | NY |

NOTE: FS=Free Swimming; GN=Gillnet; HL=Handline; HN=Hand Net; HP=Harpoon; LL=Longline; LT=Lobster Trap; RA=Released From Aquarium; RR=Rod & Reel; TN=Trawl Net; BGI=Big Game Italia; Obs=Foreign Fisheries Observer; NR=Not Reported

# Shark Age and Growth Studies

*To inform new readers of the* Shark Tagger *of ongoing research projects, we occasionally include overview articles about these studies. The following article is a synopsis of our age and growth research on sharks.*

A major problem in aging sharks is that age determination requires comprehensive sampling of different sized fish in different seasons for each species. This is particularly difficult in the study of sharks because collection requires extensive time at sea, large individuals are hard to handle, conditions are often dangerous, and much time is required to catch sufficient numbers of individuals of the various sizes necessary to conduct detailed age studies. Therefore, the collection of information is often a lengthy process for large pelagic species and we rely heavily on assistance from interested fishermen.

There are three basic methods used to age fish: (1) analysis of bands on scales, spines, ear bones, vertebrae, or other "hardparts," (2) analysis of the size groups (length frequencies) represented in the population and (3) analysis of tag/recapture data. Elasmobranchs (sharks, skates and rays) lack true bone, most do not have spines, and their scales are toothlike structures that do not have bands. Consequently, the most commonly used hardpart for aging sharks are the vertebrae. As sharks grow, the vertebrae grow proportionally and are calcified in such a way that alternating light and dark bands are deposited, much like the pattern of tree rings. By counting these bands we can estimate age, if the rate of band formation is known (*e.g.*, yearly). An understanding of band deposition rate is best obtained from vertebrae returned from sharks that have been accurately measured at both tagging and recapture. In addition, if at tagging, these sharks have been injected with tetracycline which deposits a mark at the time of injection, the bands after the mark can be realted to time and growth between tagging and recapture. Currently, we have measured and injected more than 1000 sharks of 5 species.

Length-frequency analysis utilizes accurate length measurements of many individuals to detect different size and year classes making up the population. These year classes are represented by peaks (modes) on a graph; the length between the modes is the theoretical average growth per year. This technique only requires measurement data over time, which is easier to obtain than data collected from hardparts. Unfortunately, due to the slow growth rate of sharks, individuals of the same length may vary in age by many years, making length-frequency analysis of limited use.

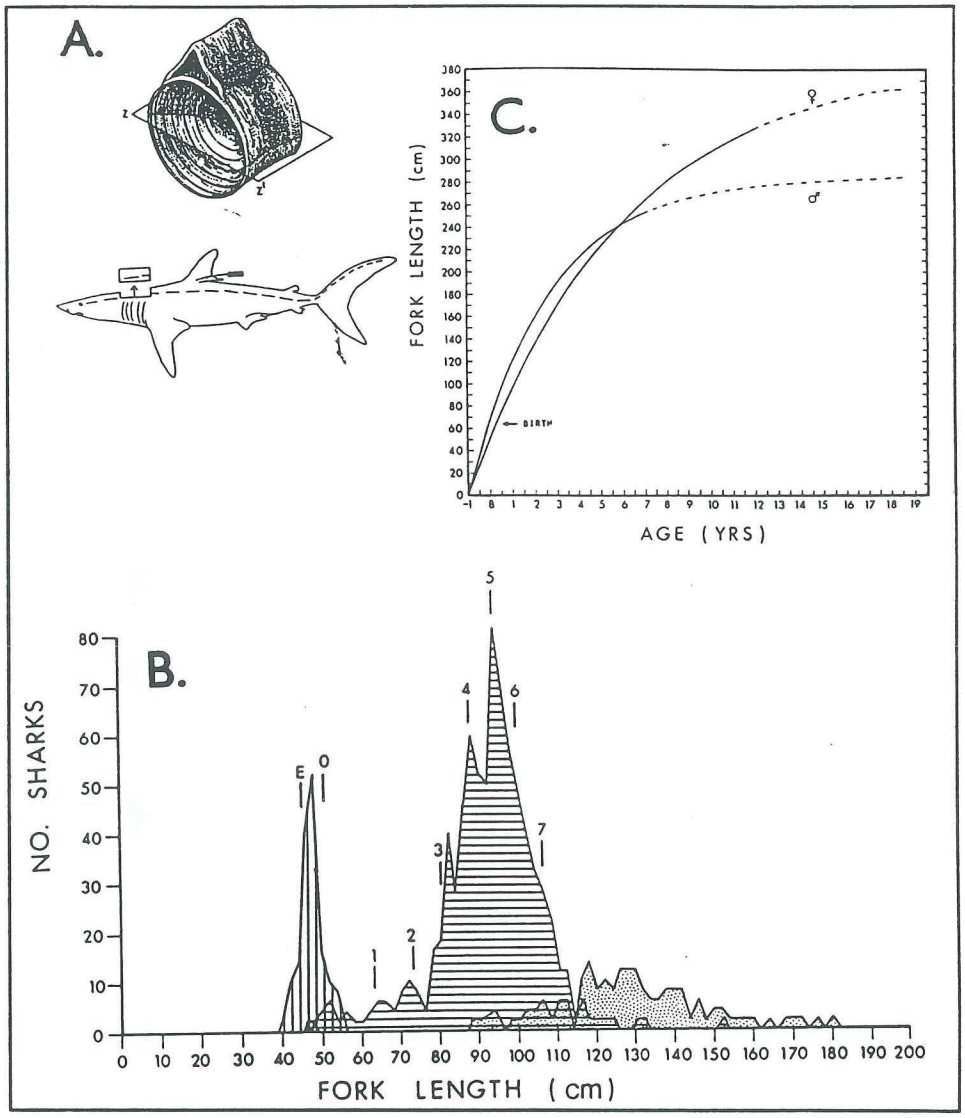


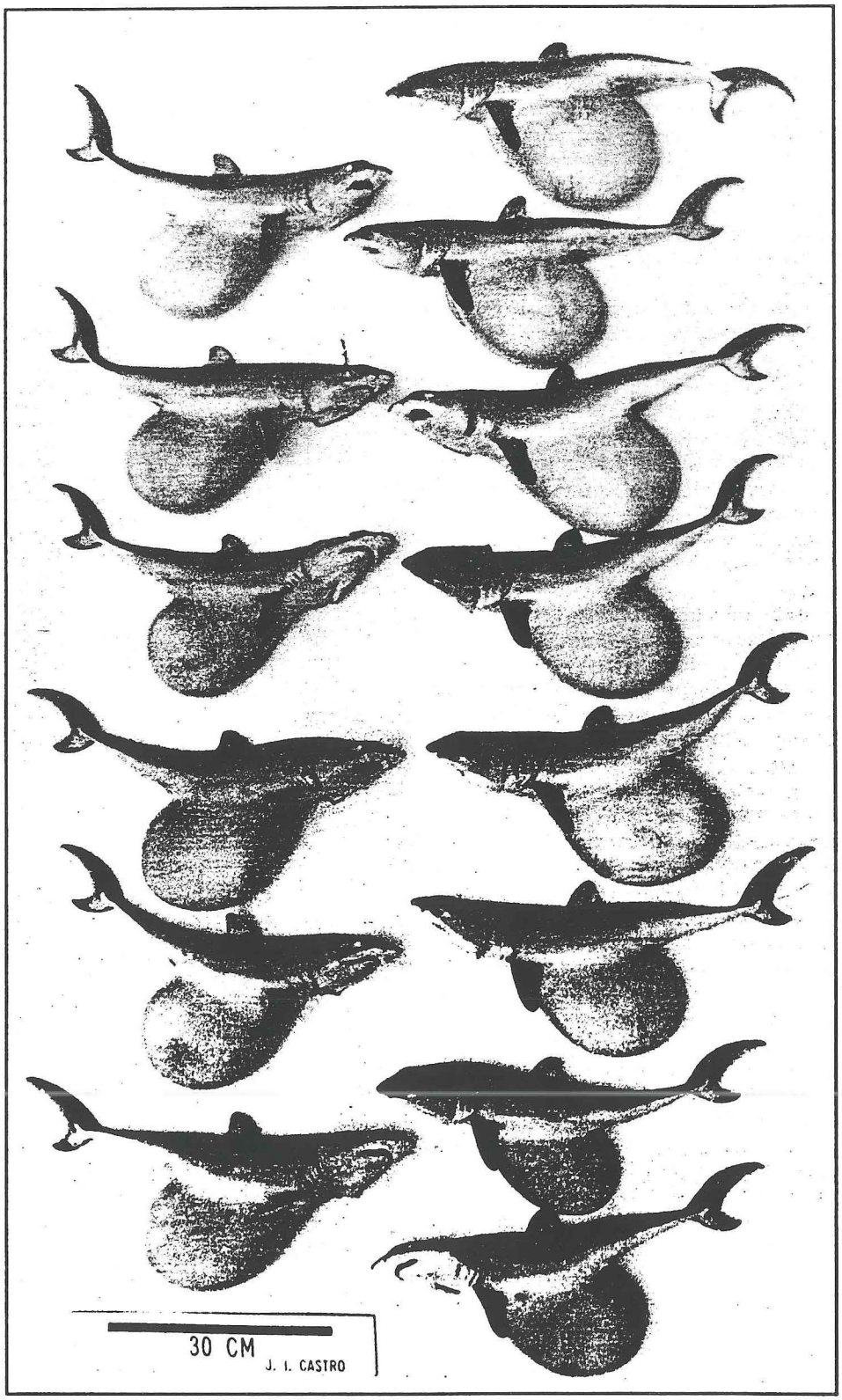

Figure 1. Example from earlier newsletters: A - growth band in a typical shark vertebra; B - length-frequency data with age estimates from embryos to age 7; and C - a typical length at age curve.

Tag/recapture data are important for estimating growth rates particularly when measurements are taken at both tagging and recapture and the time at liberty is known. This method is most useful for comparative estimates if the vertebrae are taken at recapture. Tagged sharks that have been measured then recaptured and remeasured several times and are still at liberty are especially valuable. Currently, 13 small tiger sharks have been recaptured multiple times and are still at liberty. We have completed age studies on the sandbar, dusky, blue, and shortfin mako sharks. Currently, we are concentrating on the tiger shark. Preliminary evidence suggests that this species grows faster than the sandbar and dusky and slower than the mako. The tag/recapture portion of the tiger shark study has been greatly enhanced by our ability to obtain sharks that have been repeatedly recaptured and rereleased, and because more than 180 small tigers have been tagged, injected with tetracycline, and at liberty for up to 2.5 years. This project largely depends on commercial shark fishermen who are tagging and injecting tigers as well as taking the vertebrae from recaptured individuals. We are indebted to them and to all of you who make this research possible.

# Dissection of a Pregnant Shortfin Mako, *Isurus oxyrinchus*

It is particularly difficult to study the reproductive biology of many species of large sharks. One reason is that individuals of certain sizes and reproductive states are nearly impossible to find. Pregnant mako and white sharks are a good example. Until the dissection reported here, only three pregnant shortfin mako sharks had been reported from the Western North Atlantic and none had been methodically examined. The reasons for this are many. Pregnancy may take pelagic sharks to the limits of their range, beyond traditional fishing grounds. In the case of makos and white sharks, mature adults weigh many hundreds to thousands of pounds and are difficult to land and subdue. Once boated, usually by a commercial operation, the question of how to deal with a massive shark in the hectic workday of a fishermen can be overwhelming. Pregnancy isn't usually noticed immediately, and the rare quality of a particular catch is often unknown. Fishermen routinely witness events and catch specimens that are fascinating and valuable to marine biologists.

On January 15, 1992, a commercial swordfish longliner, who is also one of our cooperative taggers, caught a rare pregnant mako off Puerto Rico that he subsequently shipped to us. The 689 pound mako was harpooned while following a longline-caught swordfish up to the boat.




Fourteen embryos from a shortfin mako shark. The extended yolk stomachs are a result of consuming the mother's ovarian eggs.

## Dissection

The mako contained 14 embryos, 6 in the left uterus and 8 in the right. They averaged 20 inches in total length and weighed about 4 pounds. Half of the weight was in their huge yolk-stomach. Unlike many shark species, mako sharks do not have a placental attachment to the mother. Embryo makos feed on thousands of their mother's eggs that are passed from the ovary to the uterus. During embryonic development, a huge yolk-stomach forms that is completely absorbed and converted to body tissue before birth. We judged these embryos to be about three months from birth. Most sharks have a gestation time of 6 to 12 months. We don't yet know gestation time for the shortfin mako, however our work suggests that the majority of shortfin makos are born in April.

So little is known about mako shark reproduction, pupping season, and location that we are interested in further observations and samples. We are particularly indebted to fishermen who take time from their work to help us by sending us reproductive samples. We described shark reproduction in an article in our 1991 *Shark Tagger*, which is available on request.

# Food Habits of the Scalloped Hammerhead Shark

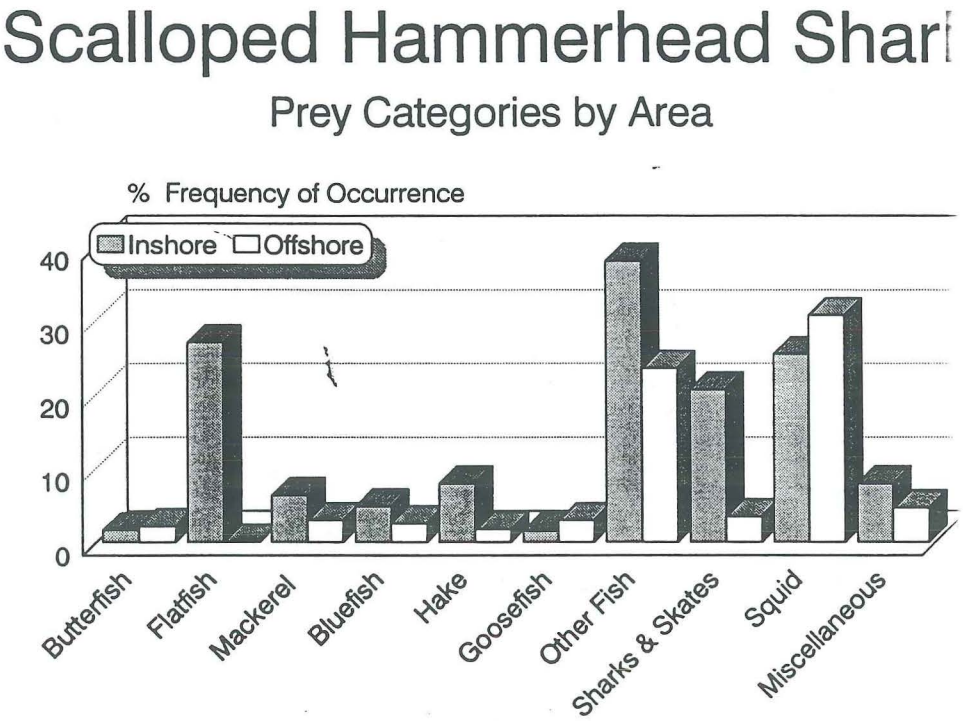
An understanding of the food and feeding habits of sharks is crucial to determining the impact that these large predators have on available fisheries resources. In evaluating the bioenergetic requirements and the predator-prey relationships of sharks, we attempt to determine the annual food requirements of the various shark species and the prey items that are most important in their diets.

Our past studies have shown that a 139 pound mako shark will consume about 4 pounds of food per day, or just over 10 times its body weight per year. In contrast, a 75 pound sandbar shark will average about two-thirds of a pound of food per day, which is three times its weight per year. The main reason for the difference between these two species is that the mako has a fast swimming, high energy life-style compared with the slower swimming, less active sandbar shark.

Our study of the food, feeding habits, and energetics of the scalloped hammerhead is incomplete, but we present here a preliminary analysis of our progress to date.

The scalloped hammerhead, *Sphyrna lewini*, is one of the more numerous species of large sharks found in the world's oceans. It is primarily a circumglobal resident of coastal, temperate, and tropical waters, and is found from the surface to depths of at least 150 fathoms. In the Western Atlantic, it is observed seasonally in the continental waters from about the area of New Jersey south to the coast of Brazil. In the northern part of its range (north of Cape Hatteras), this hammerhead is most available to U.S. fishermen from early spring through late August. In spite of the relative high abundance of the scalloped hammerhead, very little is known about its food and feeding habits. Available published information consists simply of listings of the various food items found in the stomachs. The present food habits research conducted by the National Marine Fisheries Service (NMFS), is a more comprehensive study relating to the food, feeding habits, predator-prey relationships, and differences in diet relative to area and sex.

In the northern area, samples were collected at shark fishing tournaments held annually in New York, New Jersey, Massachusetts, and Rhode Island, and during cruises aboard research and commercial fishing vessels operating in the offshore waters between Cape Hatteras, NC, and the Tail of the Grand Banks (Canada). Most sharks were captured by hook and line gear (rod and reel, longlines, handlines), and a few were taken by harpoon and drift gill net. To analyze the data for differences in diet related to depth zones, stomach samples were divided into those from sharks caught inshore of the 100 fathom contour and those from sharks caught offshore beyond 100 fathoms.




Three hundred and one scalloped hammerheads were examined. They ranged in size from 2.4 to 7.3 feet in fork length, and averaged 5.2 feet in fork length and 102 pounds in body weight. Food remains were found in 178 (59%) of the stomachs examined. The figure illustrates how frequently the major food categories occurred in both the inshore and offshore stomach samples.

Teleosts (bony fish) were the major prey species in the diet, occurring in 48% of the stomachs, and consisted primarily of flatfish (fluke and flounder), mackerels (including small tuna-like species), bluefish, hakes, cod, goosefish, and butterfish. The list of fish prey found in the stomachs included midwater and bottom-dwelling species, an indication that the scalloped hammerhead feeds selectively from the surface to the bottom.

Cephalopods (squids) constituted the second most important prey group, occurring in more than 30% of the stomachs. The long-finned, or summer squid (*Loligo pealii*) occurred in the inshore samples while the short-finned squid (*Illex illecebrosus*) was the most important food offshore. Squid beaks were often the only indication that cephalopods had been consumed because the beaks are resistant to digestion. Remains of elasmobranchs (dogfish, skates, and rays) occurred in 7% of the stomachs, and were more important inshore.

In stomachs containing prey, the average stomach content volume amounted to just over a half pound of food and was equal to 0.6% of the average body weight. The daily ration for sharks in general averages about 1% of their body weight (ranging from 0.6 to 3% depending on the species). These data for the hammerhead fall in the lower part of this range. In additional studies on the hammerhead, we will attempt to determine more precisely the daily and annual food requirements and to compare these results with data for other seasons and from other geographical areas.

# Field Studies

## Longline Cruise

From 26 January to 8 February 1992, staff biologists participated on the third leg of a cooperative research longline cruise with the NMFS Miami Laboratory on the NOAA *R/V Oregon II*. We fished outside of the 100-fathom contour from Cape Hatteras, NC, to east of Miami, FL. One to two miles of longline was set at each station. Six longline sets caught 17 fish: 4 scalloped hammerheads, 6 silkys, 3 blue sharks, 1 bignose shark, 2 swordfish, and 1 dolphin fish. One swordfish, as well as one scalloped hammerhead, one silky, and one bignose shark were tagged and released. Eleven sharks were brought onboard and dissected. A full reproductive dissection was performed on each shark. Vertebral samples were collected from all sharks to verify winter ring formation for ongoing age and growth studies. Tissue samples were collected for histological determination of sexual maturity. Information was gathered on the seasonality of scalloped hammerhead and blue sharks.

## Tournaments

In 1992, catch data was obtained from 334 sharks at 12 shark fishing tournaments held in New Jersey (3), New York (7), Rhode Island (1), and Florida (1). Staff biologists attended 9 of the tournaments and weighed, measured, and examined 264 sharks. More than half of them (60%) were blue sharks, and the remainder comprised 70 makos, 22 common threshers, 13 sandbars, 1 white shark, and 1 spinner shark. The spinner shark was an unusual catch in that this typically southern species was caught off Manasquan, N.J. Biological samples were collected from selected sharks for our ongoing studies of reproduction, age and growth, and food habits. In addition, tags recovered from several sharks landed at tournaments allowed the staff to make precise length and weight measurements and to collect vertebral samples for age and growth studies. These tournaments provide valuable opportunities for scientists to examine sharks, to maintain contacts with fishermen, and to encourage tag and release programs. Scientists from many other organizations and academic institutions also take advantage of tournaments to pursue research. We appreciate the support of tournament officials and participants who often go out of their way to make our work easier.

## Overview - *Continued*

that has been recaptured in the Eastern Atlantic (of approximately 300 returns). As we mentioned in an earlier newsletter, the paucity of mako shark recaptures east of the Mid-Atlantic ridge could be related to a preferred water temperature of 18°C (64°F) and the circulation of Sargasso Sea water in the western North Atlantic. This new Eastern Atlantic recapture is inconsistent with that hypothesis and the relationship between the mako populations in the Eastern and Western Atlantic remains unknown.

A particularly valuable recovery was a 44 inch mako shark, at liberty for 1.2 years, that was measured at the time of both tagging and recapture and showed growth of 13 inches/year. A sample of the backbone was collected by the fisherman for age studies. To date, we have only 25 vertebrae from recaptured mako sharks. Other interesting returns included: a mako at liberty for 3.0 years showing local movement of 53 miles; a mako tagged in Munson Canyon (Georges Bank) and recaptured off Nova Scotia, Canada; and another tagged and recaptured on the same day after traveling a distance of 10 miles.

### Other Species (72 Returns)

Recaptures from other species included some long distance and maximum time at liberty records. **Porbeagle sharks** were recaptured after 4.4, 6.3, 8.0 and 8.6 years at liberty. The latter three recaptures are the three longest times at liberty for any porbeagle sharks previously returned in the Program. All of the porbeagles tagged by Foreign Fisheries Observers had traveled distances between 278 and 778 miles, and were recaptured by Canadian fishermen. Two **silky sharks**, tagged off South America, were recaptured after one month and 2.1 years at liberty. One was tagged northeast of Guyana and traveled 444 miles northwest to Grenada. The other was tagged just south of the Equator off Brazil and recaptured 718 miles to the northeast. Other recaptures included: a **lemon shark** at liberty for 4 years (a record for this species) showing movements of only 4 miles; a **great hammerhead shark** at liberty for 9 months that traveled 102 miles from Siesta Key, FL to west of Cape Sable, FL (both records for this species); a **bignose shark** tagged off Atlantic City, NJ and recaptured 1805 miles away, off Freeport, TX (a long distance record); a **bull shark** tagged in Espiritu Santo Bay, TX that was recaptured in Laguna Madre, Mexico (222 miles south); and two long distance **sand tiger shark** returns - one was tagged off Florida and recaptured in Delaware Bay, NJ (637 miles northeast); the other was tagged off North Carolina and recaptured off Rhode Island (389 miles northeast).

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Maps by Michael Pirri

# The Machipongo (VA) Shark Fishery, June 1965 to June 1969

*The shark fishery at Great Machipongo, VA, lasted for the 27 years from 1943-1970. The catch was almost exclusively young sandbar sharks that were taken from inshore nursery grounds. Biologist Charles Stillwell worked with these fishermen during 1965-1969. The following article reports some of his observations from that period.*

## Sandbar Shark Estuarine Nursery Grounds

The estuarine environment inside Great Machipongo Inlet is typical of the coastal area of the Delmarva Peninsula from Chesapeake Bay to Ocean City, MD. The region inside the barrier beach that extends along much of the Delmarva Peninsula consists of tidal mud flats, channels, and large grass-covered areas that are submerged and exposed with the changing tides.

The entire estuarine area is a major nursery ground for the sandbar shark. Gravid females arrive in the area in mid- to late May with some females arriving as late as the first part of August. The females enter the protected channels and sloughs where they give birth and then depart the pupping grounds. The pups become residents of the estuary throughout the summer months, generally from June through September. At the onset of cooler temperatures in September, they move out of the estuary to offshore wintering grounds from Cape Hatteras, NC, southward. Juvenile sandbar sharks that were tagged in the Machipongo estuary have been recaptured there in later years, indicating that the young sharks may "home in" on the estuary for several consecutive years as they migrate north to the same summer nursery grounds. After they are 7 or 8 years of age, and about 4 feet in fork length, they no longer frequent the shallow estuarine nursery grounds, but instead occupy nearshore coastal waters.

## Fishing Gear

The bottom drift gill nets used in the fishery varied in length from 810 to 960 feet, and in depth from 26 to 30 feet from head to leaded footrope. Initially, the webbing material was cotton twine but in later years was changed to nylon. The mesh size of the nets was 10 to 11 inches in square measure, with a stretched measurement of about 20 inches. Wooden pine blocks, measuring 6 x 6 x 12 inches, were used as floats and were attached to the headrope with a 3 to 4 foot length of quarter-inch line approximately every 20 feet.

The nets were always set across Great Machipongo Channel on an incoming tide and were allowed to drift with the current for 2 to 2.5 hours. Sets were made during both daylight and night hours on an incoming tide after it had been rising for a minimum of 30 to 45 minutes. If a tide was "missed" by more than 1.5 to 2 hours, the nets were not set. The depths in the channel where the gear fished varied from 45 to 60 feet. The usual "drift distance" was 3.5 to 4 miles, unless the net got snagged on the bottom or on a mud flat bordering the edges of the channel.

In June 1969, two small mesh nets (3.5 and 7 inch) were used by NMFS biologists to search for pups and small juveniles that could not be caught by the commercial gear. These sinking gill nets were about 75 feet long and about 10 feet deep with a floating headrope. They were fished as fixed gear (anchored) in a marshland channel 11 miles inland from Great Machipongo Inlet. The depth of the channel was 23 to 27 feet, depending on the tide. Eighty-one sharks were captured in these nets, including newborn pups and small juveniles up to 3 feet in fork length.

Charles "Chuck" Stillwell tagging a large sand tiger shark in 1965. Chuck will retire this year after 30 years of Federal service (28 years with the Apex Predators Investigation). The API staff dedicates this newsletter to him in recognition for a job well done.

## Measuring, Tagging, Handling Catches

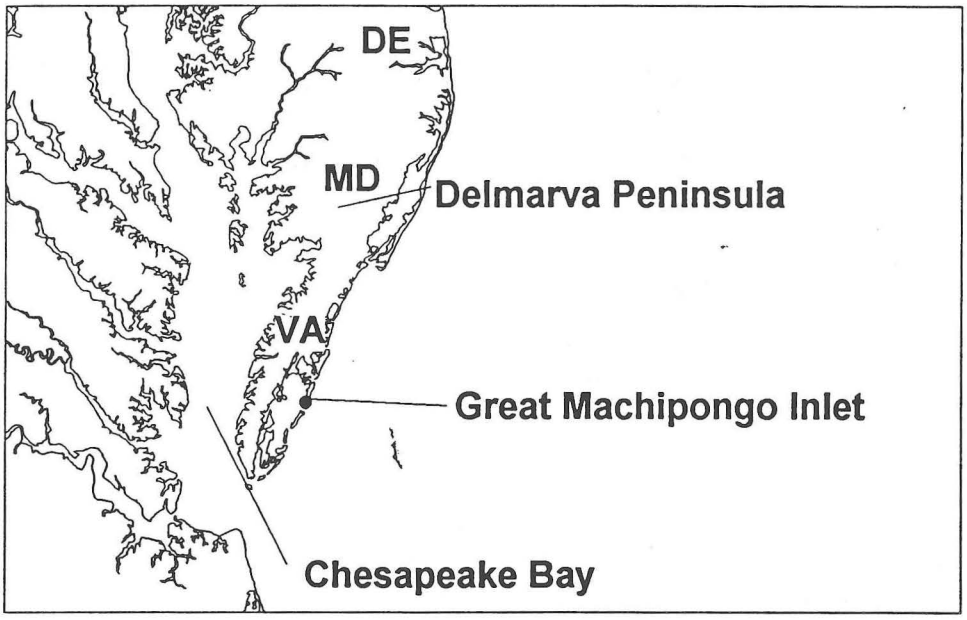
The commercial nets were always hauled by hand. As the fishermen untangled the sharks from the net, the most lively sharks were slid forward on the wet deck to an area where they were measured, tagged, and released. We arranged to purchase live sharks for $1 each, based on an average dressed weight of 10 pounds at 10 cents per pound. Dead sharks were stacked in a pile to be dressed for sale of the meat. Prior to dressing, biologists measured, weighed, and dissected the sharks to examine stomach contents and obtained backbone samples for age and growth studies.

## Cleaning and Skinning

After the net was hauled, fishermen gutted and skinned the sharks remaining on the deck. First, horizontal incisions were made midway up the abdominal wall on each side of the body, extending from the cloaca forward to the pectoral fins, and above the gill slits to the rear of the skull. The first dorsal

*See* **Machipongo-** *Page 16*

fin was then removed and discarded. Next, a shallow incision was made along the dorsal midline from the base of the tail to the rear of the skull. Two flaps of skin on each side of the back were removed by grasping the skin near the skull incision and pulling rearward to strip the skin on either side back to the base of the tail fin. The dressed carcass was then removed from the waste by severing the backbone both behind the head and at the base of the tail and cutting away the abdominal cavity. The dressed carcass was similar to dressed product on present day offshore commercial shark boats except that the skin had been removed.




## Historical Landings

The round weights of the juvenile sandbar sharks in the Great Machipongo fishery ranged from 17 to 55 pounds and averaged 30 pounds. The average dressed weight of the carcasses was about 10 to 12 pounds. According to records in a local fish house, the annual landings in the fishery fluctuated significantly during the early years and ranged from reported landings of 808 pounds in 1943, when only one boat was fishing, to 165,748 pounds in 1948 when 15 boats were operating. In these first years (to early 1946) the fishery was primarily for shark livers. Later, shark meat for human consumption became the primary product. In 1949, 12 boats participated but the reported landings were only 64,000 pounds. After 1949, the number of boats declined to five vessels in 1953 when 59,207 pounds of dressed shark were landed. Catch data for 1954 to 1960 were not available from the fish dealer. From 1961 through 1965, the annual landings declined from 160,141 pounds to 80,920 pounds and averaged 84,745 pounds. The last year for complete catch records for three boats was 1966 when 94,937 pounds of shark were landed at Oyster, VA. In subsequent years fishermen reported declining catches and by 1970, the last year of the fishery, one boat fished intermittently but the operation was no longer profitable.

During the 5-year period, we spent 14 weeks with the fishermen at Great Machipongo and tagged and/or examined more than 3500 juvenile sandbar sharks. In addition to the juveniles, 57 pregnant and 31 post-partum females were measured and examined along with almost 400 full-term pups. We tagged more than 1800 sandbar sharks and have had 116 recaptured to date. It was a golden opportunity in which fishermen and biologists shared a sense of camaraderie and understanding despite the fact that the stocks in that area were in sharp decline and, to the best of anyone's knowledge, have never recovered. It was, nevertheless, part of the "Good Old Days" that was well worth the experience.

## Shark Fisheries Management Plan Update

On February 25, 1993, the NOAA Assistant Administrator for Fisheries approved the Fishery Management Plan for Sharks of the Atlantic Ocean (FMP). The final FMP regulates commercial and recreational shark fishing in the exclusive economic zone of the Atlantic Ocean, Gulf of Mexico, and the Caribbean Sea, and addresses problems in the fishery including overfishing, current absence of management, finning (harvesting of sharks for fins alone), bycatch mortality, and inadequate fishery data. Final regulations would become effective during the late spring.

Copies of the FMP and final regulations (when published) may be obtained from either of these NMFS offices:

Office of Fisheries Conservation and Management
National Marine Fisheries Service
1335 East-West Highway
Silver Spring, MD 20910
(301)713-2347

Southeast Regional Office
National Marine Fisheries Service
9450 Koger Blvd.
St. Petersburg, FL 33702
(813)893-3161

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