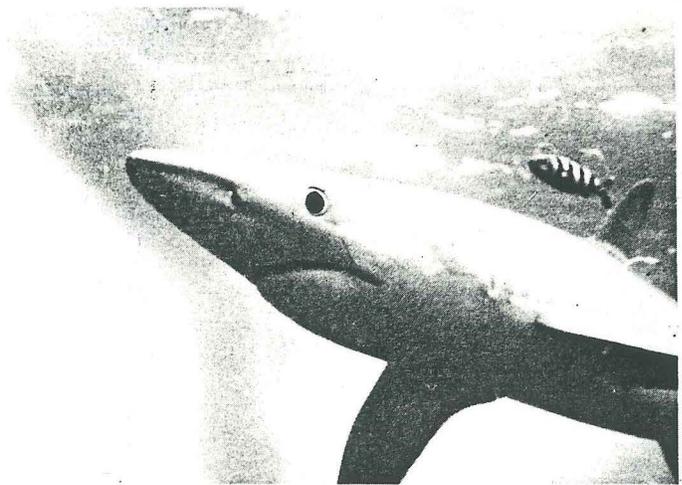


THE SHARK TAGGER 1987 SUMMARY



J. Casey, H. W. Pratt, N. Kohler and C. Stillwell

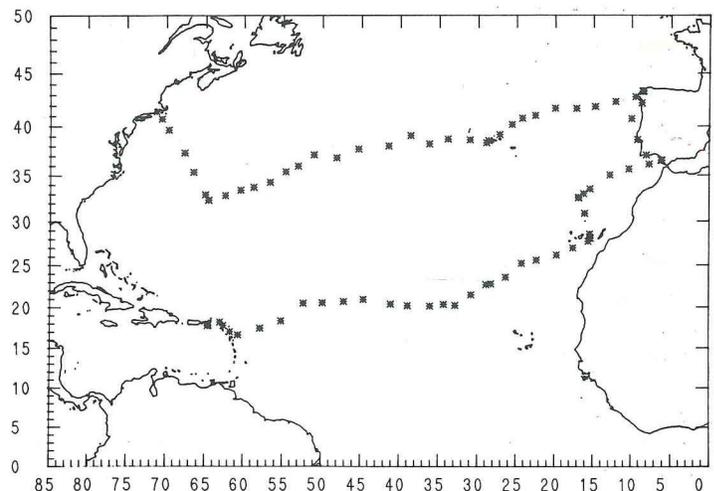
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1987 OVERVIEW

- 5760 SHARKS TAGGED IN 1987
- RECORD TIMES AT LIBERTY SET FOR SANDBAR (21.8 YRS), DUSKY (11.8 YRS), HAMMERHEAD (9.6 YRS) AND BLACKTIP SHARKS (7.3 YRS)
- SEVENTEEN TAGGED SANDBAR SHARKS TRAVEL OVER 1000 MILES
- TWELVE TAGGED BLUE SHARKS TRAVEL OVER 1000 MILES
- NIGHT SHARK SETS SPECIES DISTANCE RECORD (1400+ MI), MARYLAND TO MEXICO
- SCALLOPED HAMMERHEAD SHARK SETS SPECIES DISTANCE RECORD (765 MI), FLORIDA TO NEW YORK
- RECORD RATE OF TRAVEL SET FOR TIGER SHARK (15.1 MILES PER DAY)
- FIRST TAGGED SWORDFISH TRAVELS FROM GRAND BANKS TO VIRGIN ISLANDS
- BLUE SHARKS STUDIED IN THE EASTERN ATLANTIC

In 1987 a total of 5,760 sharks and teleosts (bony fishes) representing 41 species were tagged under the Cooperative Shark Tagging Program (Table 1). The releases were made by volunteer anglers (54%), U.S. Foreign Fisheries Observers (30%), commercial fishermen (10%) and other biologists (6%). NMFS biologists did not tag for the first time in 25 years. Even so, the number of releases last year increased to 750 more than in 1986 with the capture gear

R/V GERONIMO CRUISE TRACK TRANSATLANTIC CRUISE - 1987



about equally divided between longline and rod and reel. The annual variations in the the number of fish tagged (e.g. 3700+ in 1984, 7000+ in 1985) depends on several factors. We expect there are natural cycles of increased and decreased abundance but almost nothing is known about these cycles with respect to sharks. Actually, the total number of sharks tagged in a particular year is related more to *(Continued on Page 2)*

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



Newsletter of the
Cooperative Shark Tagging Program
U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Center
Narragansett, Rhode Island 02882

Table 1. Summary of sharks and teleosts tagged, January-December 1987.

SPECIES	TAGGED BY COOPERATIVE TAGGERS
Blue shark	2,638
Sandbar shark	632
Dusky shark	343
Tiger shark	293
Shortfin mako shark	259
Lemon shark	252
Atlantic sharpnose shark	206
Blacktip shark	189
Porbeagle shark	91
Nurse shark	91
Bigeye thresher shark	56
Scalloped hammerhead shark	51
Sand tiger shark	51
Blacknose shark	46
Basking shark	33
Spinner shark	26
Bull shark	24
Reef shark	23
Silky shark	19
Bonnethead shark	16
Smooth hammerhead shark	15
Longfin mako shark	13
Oceanic whitetip shark	12
Great hammerhead shark	7
Greenland shark	6
Night shark	4
Finetooth shark	4
Common thresher shark	3
Bignose shark	2
Smooth dogfish	2
Spiny dogfish	2
White shark	1
Caribbean sharpnose shark	1
Leopard shark	1
Whale shark	1
Hammerhead unspecified	48
Thresher unspecified	26
Brown/Dusky unspecified	14
Blacktip unspecified	8
Sand unspecified	8
Dogfish unspecified	4
Carcharhinus unspecified	4
Miscellaneous*	34
Total sharks	5,559
Teleosts	
Swordfish	122
White marlin	15
Blue marlin	15
Sailfish	3
Billfishes	3
Bluefin tuna	2
Longbill spearfish	1
Tuna unspecified	1
Miscellaneous	39
Total teleosts	201
Grand Total	5,760

*Includes species reported as "shark".

(Overview 1987 continued)

fishing activities than to changes in abundance. For example, NMFS biologists may have one or two research cruises in some years and none in others. The number of fish tagged by U.S. Fisheries Observers aboard foreign vessels depends largely on the number of foreign vessels permitted in that fishery. Last year more sharks were tagged by southern commercial shark fishermen in that expanding fishery. Considering only the number of sharks tagged by anglers in the past 10 years, the number of releases has declined slightly despite an increase in the number of participants. But even in that category annual trends must be interpreted with caution. The number of sharks tagged by anglers is influenced by a variety of factors from weekend

weather conditions, changes in the distribution of common sharks in some years, increased utilization of sharks for food, an increase in shark fishing tournaments, and a shift in fishing effort by some of our most expert taggers to other species such as tunas. As a consequence of these and other variables, the total number of sharks tagged has limitations as a measure of population abundance. On the other hand, your tagging data is vital to the understanding of shark migrations, age and growth, distribution, seasonal occurrence and other aspects of their biology.

TAG RETURNS: A total of 210 tags from 19 species were returned in 1987 (Table 2). Recaptures came from: anglers (40%), U.S. commercial fishermen (33%), foreign fishermen (21%), U.S. Foreign Fisheries Observers on foreign vessels (3%), and other biologists (3%). Tags were returned from the following 14 countries and island territories: U.S. (149), Japan (14), Mexico (12), Spain (10), Canada (7), Cuba (5), Colombia (3), Taiwan (2), Portugal (2), Bermuda (2), Bahamas (1), St. Martin (1), Barbados (1), and Canary Islands (1). Sharks recaptured in 1987 had originally been tagged by the following groups: anglers (60%), U.S. Foreign Fisheries Observers (17%), NMFS and other biologists (16%), and U.S. commercial fishermen (7%).

BLUE SHARKS (69 RETURNS): The maximum time at liberty for a blue shark was 6.0 years and the maximum distance travelled was 3251 miles. While some blues were recaptured near the release site after four years at liberty, others travelled considerable distances in a relatively short time (e.g. 546 miles in 39 days or 14 miles per day). Long distance movements by blues tagged off the U.S. coast included 6 recaptures from Canada, 3 from the Azores, 3 from Colombia, 2 from Portugal, 2 from Cuba, and 1 from the West Indies. Some returns from Spanish longliners came from areas between the Azores and the Grand Banks that are fished by American, Canadian, and Japanese vessels. In recent years, the eastward expansion of the U.S. and the westward expansion of the Spanish longline fishery is evidence that several nations have the capability to target highly pelagic species anywhere in the Atlantic. One would expect that sharks will be increasingly important to these fisheries—perhaps in the not too distant future. (We have discussed the movements of blue sharks in previous newsletters and in scientific publications. Copies are available on request.)

SANDBAR SHARKS (44 RETURNS): The maximum time at liberty for a sandbar shark was 21.8 years and the maximum distance travelled was 1945 miles. This is the longest time at liberty for any shark tagged under the program. Eight of the recaptures were tagged by NMFS biologists aboard the Polish research vessel *Wieczno* during the 1986 longline survey we conducted between New England and southern Florida. A total of 264 sandbar sharks were tagged on that cruise and the eight recaptures ranged in distance from 4 to 1100 miles over a 9.7 month period. Other sandbar recaptures demonstrated movements from the northeastern U.S. into the Gulf of Mexico (see figure). The predominantly north to south pattern shown by tagged sandbar sharks is in part explained by the larger number tagged off the northeast coast. Additional tagging off Florida and in the Gulf of Mexico including the coast of Mexico is needed to determine if sandbar sharks commonly return north from these areas. In recent years, commercial shark fishing off Florida has been expanding. Thirty-one (70%) of the 1987 returns from sandbar sharks came from longline vessels fishing off Florida or Mexico. Fortunately, some U.S. commercial shark fishermen are also avid taggers, and have provided data and vertebrae from tagged sharks for age studies. Fishermen who know about sharks also know that the stocks are highly susceptible to inten-

sive fishing. Both recreational and commercial interests are concerned that populations of some sharks will be seriously impacted by increased fishing. This concern is justified based on the past history of shark fisheries throughout the world. The sandbar shark was the most abundant species in the U.S. commercial shark fishery along the Atlantic Coast during the 1940's.

MAKO SHARKS (19 RETURNS):

The maximum time at liberty for a mako was 4.0 years and the maximum distance travelled was 1412 miles. The distance between tag and recapture exceeded 1200 miles for six (32%) of the returns. Three makos tagged in the Mid-Atlantic Bight (i.e. between Cape Hatteras and Cape Cod) were recaptured approximately 600 miles east of the Grand Banks by Spanish longliners. Two additional makos tagged in the Mid-Atlantic Bight were recaptured near Cuba. Last year we also had the first recapture of a mako shark showing movement into the Gulf of Maine. The expanding recreational shark fishery in the Gulf of Maine may reveal a higher abundance of sharks than indicated by the low numbers of tag returns from that area.

TIGER SHARKS (12 RETURNS):

The maximum time at liberty for a tiger shark was 5.5 years and the maximum distance travelled was 1126 miles. A tiger shark released off Montauk N.Y. and recaptured off Cuba is the third to show movements of this species between the U.S. and Cuba. Of the long distance returns (i.e. over 700 miles) three tigers showed southward movements from New York and New Jersey to Florida and Cuba and one travelled northward from Florida to off New York. The fastest rate of travel was 15.1 miles per day for an individual tagged off New York in late July and recaptured off Florida in September. These long distance north-south movements of tiger sharks are interesting in that it was not too long ago that tiger sharks taken north of Cape Hatteras were thought to be tropical strays. Four of the recaptures were at liberty for over three years and their vertebrae would have been valuable for age studies. Commercial shark fishermen in Florida are measuring some of the small tigers they are tagging and we ask that you make every attempt to collect vertebrae from any tagged shark you recapture.

TAG RETURNS FROM OTHER SPECIES included: **SCALLOPED HAMMERHEADS** that were at liberty for up to 9.6 years, and a maximum

distance of 765 miles (both records for this species); **BLACKTIP SHARKS** that were at liberty for up to 7 years, and a maximum distance travelled of 1159 miles between North Carolina and the Gulf of Mexico (both records for this species); **DUSKY SHARKS** that were at liberty for up to 11.8 years (a new record for this species) and a maximum distance travelled of 1385 miles (three dusky recaptures showed movements from the U.S. East Coast to Mexico); **NIGHT SHARKS** that were at liberty for up to 8.8 years and a maximum distance travelled of 1441 miles between Maryland and Mexico (a new distance record and second evidence of movement of this species between the two countries); and **REEF SHARKS** recaptured at the same location off Bermuda after 1.2 and 2.2 years that were re-tagged and are still at liberty. Returns from **LEMON, NURSE, AND OTHER SHARKS** were primarily local recaptures that provide early life history information on young sharks that were still on in-shore nursery grounds. Tags were also returned from five **SWORDFISH**

including one at liberty for 7.6 years. One swordfish recapture in 1987 is the first to demonstrate movements of swordfish from the offings of the Grand Banks to the Virgin Islands. (In March 1988 we received another swordfish return showing movement from Georges Bank to Haiti.) Recaptures from two additional swordfish tagged off Georges Bank included one from the Grand Banks and one from the Straits of Florida.

Last year was indeed successful from our standpoint, primarily because of your efforts. The tagging study and field work continue to provide new scientific information on the migrations, age structure, and food habits of sharks throughout the Atlantic. Perhaps someday sharks, like giant tuna and swordfish, will be too valuable to expect large numbers to be released by fishermen. Nevertheless, whatever future successes are realized in the conservation and management of sharks, you are already a part of them.

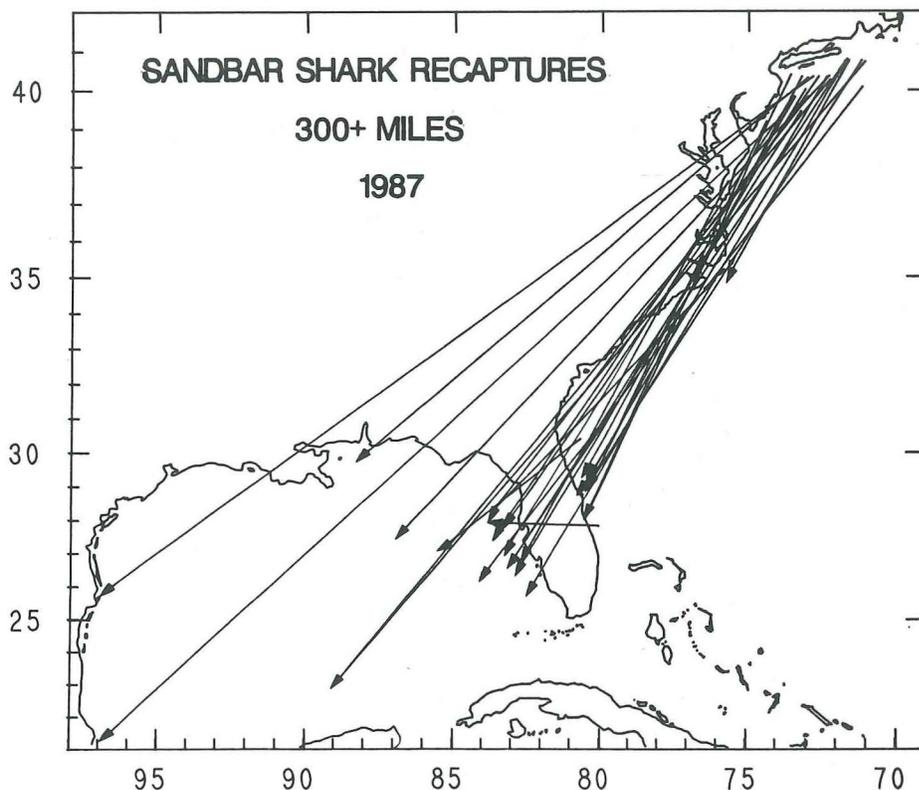


Table 2. Tag recoveries: January-December 1987

SPECIES	TAGGED	GENERAL LOCATIONS	RECAPTURED	MONTHS/ LIBERTY	DIST. & DIR. TRAVELLED	CAPTURE METHOD	TAGGING	METHOD RECAPT.	TAGGER	TAGGED BY	RESIDENCE
Blue shark	E Powell Canyon	SE Powell Canyon		<1	10 S	LL	LL	LL	Jerzy Cygler, NMFS Obs.		MA
"	S Atlantis Canyon	SW Tail of Grand Banks		25	771 E	LL	LL	LL	Paul Courtney, NMFS Obs.		MA
"	SE Pt. Judith, RI	SE Corsair Canyon		18	226 E	HL	LL	LL	Stephen Connett		RI
"	S Hydrographer Canyon	N Punta Espada, Columbia		16	1594 S	LL	LL	LL	Jerzy Cygler, NMFS Obs.		MA
"	SE Oceanographer Canyon	W Las Palmas, Canary Is.		23	1928 E	LL	LL	LL	Martin Williamowsky, NMFS Obs.		MA
"	S Hydrographer Canyon	N Punta Espada, Columbia		19	1626 S	LL	LL	LL	Jerzy Cygler, NMFS Obs.		MA
"	SE Montauk Pt., NY	E Barbados		19	1776 SE	RR	HL	HL	Dennis Steiger		CT
"	SSE Montauk Pt., NY	SSE Montauk Pt., NY		11	12 SE	RR	RR	RR	Al Phillips		NY
"	W Block Canyon	NW Cabo Sao Vicente, Portugal		19	2841 E	LL	LL	LL	Lou Puskas, Jr.		NJ
"	SE Powell Canyon	SE Lunenburg, NS, Canada		5	277 N	LL	LL	LL	Georg Hinteregger, NMFS Obs.		MA
"	N Norfolk Canyon	NE Cabo Lucrecia, Cuba		37	962 S	LL	LL	LL	Biologist (NMFS)		RI
"	S Oceanographer Canyon	SW Montauk Pt., NY		24	141 NW	LL	RR	RR	Arv Poshkus, NMFS Obs.		MA
"	SE Block Is., RI	S Montauk Pt., NY		11	36 SW	RR	RR	RR	Charlie Donilon		RI
"	SW Munson Canyon	E Ocean City, MD		4	352 W	LL	RR	RR	David R. Felch, NMFS Obs.		MA
"	Sao Miguel, Azores	W Sao Miguel, Azores		1	167 W	RR	LL	LL	J. P. Gadd		England
"	SE Shinnecock Inlet, NY	SSE Montauk Pt., NY		<1	23 NE	RR	RR	RR	Robert Cicerani		NY
"	SE Block Is., RI	S Montauk Pt., NY		<1	33 SW	RR	RR	RR	Andy Dangelo		RI
"	SW Munson Canyon	SW Cabo Sao Vicente, Portugal		6	2645 E	LL	LL	LL	Charlie Yustin, NMFS Obs.		MA
"	SE Pt. Judith, RI	N Barranguilla, Columbia		34	1776 S	RR	LL	LL	Al Anderson		RI
"	S Montauk Pt., NY	NW Sao Miguel, Azores		8	1510 E	RR	LL	LL	Skip Gula		NY
Blue shark	N Sao Miguel, Azores	NW Sao Miguel, Azores		12	518 W	LL	LL	LL	Butch Winters		FL
"	S Oceanographer Canyon	(Not reported)		17	NR NR	LL	LL	LL	Pat Michalik, NMFS Obs.		MA
"	S Veatch Canyon	NW Sao Miguel, Azores		7	1403 E	LL	LL	LL	Walter Quinn, NMFS Obs.		MA
"	E Oceanographer Canyon	SE Montauk Pt., NY		70	176 W	LL	RR	RR	J. C. Harp, NMFS Obs.		MA
"	NR	S Cabo Sao Vicente, Portugal		NR	NR	NR	LL	LL	Rudolf H. Streur		Portugal
"	SE Martha's Vineyard, MA	S Martha's Vineyard, MA		12	14 S	HL	RR	RR	Rodman Sykes		RI
"	S Montauk Pt., NY	S Martha's Vineyard, MA		13	60 E	RR	RR	RR	Jim Humphrey		CT
"	SE Pt. Judith, RI	S Pt. Judith, RI		<1	12 SW	FS	RR	RR	Joe Pagano		RI
"	SE Shinnecock Inlet, NY	S Martha's Vineyard, MA		50	53 NE	FS	RR	RR	Larry Fremgen		NY
"	E Gloucester, MA	SE Gloucester, MA		71	32 W	LL	LL	LL	Stephen Connett		RI
"	S Martha's Vineyard, MA	S Cape Verde Is.		42	3251 SE	LL	LL	LL	Stephen Connett		RI
"	SE Montauk Pt., NY	SE Block Is., RI		<1	28 NE	RR	RR	RR	Ron DiCostanzo		NY
"	SE Moriches Inlet, NY	SE Ocean City, MD		1	200 SW	RR	LL	LL	Terrence Stoner		NY
"	E Ocean City, MD	E Atlantic City, NJ		<1	68 NE	RR	RR	RR	Pete Floyd		DE
"	S Munson Canyon	Ipswich Bay, MA		6	250 NW	LL	RR	RR	Linda Craig, NMFS Obs.		MA
"	S Oceanographer Canyon	E Lunenburg, NS, Canada		6	348 NE	LL	RR	RR	Jay Loubrou, NMFS Obs.		MA
"	SE Pt. Judith, RI	S Pt. Judith, RI		1	23 W	RR	RR	RR	Charlie Donilon		RI
"	S Block Is., RI	SE Montauk Pt., NY		24	20 N	FS	RR	RR	Rodman Sykes		RI
"	S Martha's Vineyard, MA	N Boca de Jaruco, Cuba		27	1202 SW	LL	LL	LL	Stephen Connett		RI
"	SE Martha's Vineyard, MA	SE Moriches Inlet, NY		25	109 W	HL	RR	RR	Stephen Connett		RI
Blue shark	SE Moriches Inlet, NY	W Martha's Vineyard, MA		2	75 NE	RR	HP	HP	Ed Parbst		NY
"	E Manasquan Inlet, NJ	SE Pt. Judith, RI		11	119 NE	RR	RR	RR	Mike Sullivan		NY
"	NR	E Cape Lookout, NC		NR	NR	NR	RR	RR	Peter Kazura		NY
"	S Powell Canyon	SE Montauk Pt., NY		24	180 W	LL	RR	RR	Georg Hinteregger, NMFS Obs.		MA
"	SW Martha's Vineyard, MA	S Cape Sable, NS, Canada		15	260 E	RR	LL	LL	Lionel A. Lavallee		MA
"	SSE Moriches Inlet, NY	S Flemish Cap		14	1279 NE	RR	LL	LL	Lou Pastore		NY
"	NR	E Shark River Inlet, NJ		NR	NR	RR	RR	RR	Ronald Fugere		RI
"	S Oceanographer Canyon	SE Cape Sable, NS, Canada		24	272 NE	LL	LL	LL	Pat Michalik, NMFS Obs.		MA
"	E Oregon Inlet, NC	SE Cape Sable, NS, Canada		5	724 NE	LL	LL	LL	Phil Rühle, Jr.		RI
"	NR	E Corsair Canyon		NR	NR	NR	LL	LL	Wainwright Carlough		NY
"	S Corsair Canyon	SE New Harbor, NS, Canada		7	374 NE	LL	TN	TN	Georg Hinteregger, NMFS Obs.		MA
"	S Montauk Pt., NY	E Cape Hatteras Inlet, NC		41	427 SE	RR	LL	LL	Isaac Shalom		NY
"	SE Shinnecock Inlet, NY	SE Moriches Inlet, NY		<1	8 W	RR	RR	RR	Bob Romano		NY
"	NR	SE Montauk Pt., NY		NR	NR	RR	RR	RR	Haden Roosevelt		NY
"	S Montauk Pt., NY	Hudson Canyon		3	32 S	RR	LL	LL	Bob Casamento		NY
"	S Cabo Finisterre, Spain	W Cabo Finisterre, Spain		1	45 N	LL	LL	LL	Stephen Connett		RI
"	SW Montauk Pt., NY	SE Pt. Judith, RI		1	46 E	RR	RR	RR	Harry McAllister		NY
"	ESE Block Is., RI	SE Cape Sable, NS, Canada		3	349 E	RR	LL	LL	Andy Dangelo		RI
"	SE Montauk Pt., NY	E Chesapeake Bay		6	264 SW	RR	LL	LL	Don DiCostanzo		NY
"	SSE Montauk Pt., NY	SE Bermuda		6	726 SE	RR	LL	LL	Warren F. Hader		NY
Blue shark	S Shinnecock Inlet, NY	S Shinnecock Inlet, NY		0	0	RR	RR	RR	Bill Imperiale		NY
"	S Corsair Canyon	SW Cape Race, Canada		4	497 NE	LL	LL	LL	Jerzy Cygler, NMFS Obs.		MA
"	S Montauk Pt., NY	E Little Egg Inlet, NJ		3	97 S	RR	LL	LL	Jim Humphrey		CT
"	SE Fire Island Inlet, NY	S Cape Sable, NS, Canada		28	373 E	RR	LL	LL	Ted Bingham		NY
"	SW Dakar, Senegal	SW Dakar, Senegal		45	184 W	LL	LL	LL	Jan Cholyst		Poland
"	S Veatch Canyon	S Veatch Canyon		<1	10 SW	LL	LL	LL	Walter Quinn, NMFS Obs.		MA
"	S Veatch Canyon	S Veatch Canyon		<1	22 S	LL	LL	LL	Georg Hinteregger, NMFS Obs.		MA
"	SW Powell Canyon	S Veatch Canyon		1	93 W	LL	LL	LL	Linda Craig, NMFS Obs.		MA
"	S Hydrographer Canyon	SE Southport, NC		1	546 SW	LL	RR	RR	Ralph Tegge, NMFS Obs.		MA
Sandbar shark	E Ponce Inlet, FL	E Ponce Inlet, FL		4	20 W	LL	LL	LL	Biologist (NMFS)		RI
"	SW Oregon Inlet, NC	E Ponce Inlet, FL		32	456 SW	LL	LL	LL	Stephen Connett		RI
"	E Ponce Inlet, FL	NE Cape Canaveral, FL		4	37 S	LL	TN	TN	Biologist (NMFS)		RI
"	S Fire Is. Inlet, NY	S Sarasota, FL		116	1352 SW	RR	LL	LL	George McCord		NY
"	E Charleston, SC	SE Ponce Inlet, FL		33	240 S	LL	LL	LL	Douglas Oakley		SC
"	SE Montauk Pt., NY	SW Sarasota, FL		138	1377 SW	LL	LL	LL	Stephen Connett		RI
"	SSE Montauk Pt., NY	E Ponce Inlet, FL		6	784 SW	RR	LL	LL	John Gallagher		CT
"	SE Rudee Inlet, VA	S Fire Is., NY		123	216 NE	RR	RR	RR	John W. Thurston, Jr		VA
"	E Pt. Pleasant, NJ	NE Ponce Inlet, FL		68	718 SW	RR	LL	LL	Isaac Shalom		NY
"	SW Montauk Pt., NY	W St. Petersburg, FL		7	1502 SW	RR	LL	LL	Dan Azzato		NY
"	E Cape Fear, NC	E Port Canaveral, FL		4	372 SW	LL	RR	RR	Biologist (NMFS)		RI
"	Great Machipongo, VA	W Sarasota, FL		262	1192 SW	GN	LL	LL	Biologist (NMFS)		RI
"	SE Fire Is. Inlet, NY	W St. Petersburg, FL		10	1441 SW	RR	LL	LL	Barry Mack		NY
"	Atlantic Beach, NC	E McClellanville, SC		10	170 SW	RR	RR	RR	Art Stark		NC
"	SE Montauk Pt., NY	E Ponce Inlet, FL		6	836 SW	RR	LL	LL	Ken Hayn		RI
"	E Ponce Inlet, FL	E Ponce Inlet, FL		5	4 W	LL	LL	LL	Biologist (NMFS)		NY
"	S Fire Is. Inlet, NY	E Ponce Inlet, FL		7	761 SW	RR	LL	LL	Richard Gibbons		NY
"	E Beach Haven, NJ	W Englewood, FL		55	1326 SW	RR	LL	LL	Ralph Leyrer		NJ
"	S Montauk Pt., NY	W Englewood, FL		28	1425 SW	RR	LL	LL	Bob Bozek		NY
"	E Manasquan Inlet, NJ	E Cape Canaveral, FL		43	790 SW	RR	LL	LL	Bruce Miller		NJ

Table 2. Continued

SPECIES	GENERAL LOCATIONS		MONTHS/ LIBERTY	DIST. & DIR. TRAVELLED	CAPTURE TAGGING	METHOD RECAPT.	TAGGER	TAGGED BY	RESIDENCE
	TAGGED	RECAPTURED							
Sandbar shark	SE Cape Canaveral, FL	NW Sarasota, FL	9	624 W	LL	LL	Biologist (NMFS)		RI
"	NR	NW Sarasota, FL	NR		NR	LL	Mike Miller		NY
"	Delray Beach, FL	SW Marathon, FL	<1	126 SW	RR	RR	Jerry Bricker		NY
"	NE Cape Lookout, NC	NW St. Petersburg, FL	9	1106 SW	LL	LL	Biologist (NMFS)		RI
"	SE Manasquan Inlet, NJ	NW St. Petersburg, FL	47	1436 SW	RR	LL	John Meyer, Jr.		NJ
"	E Manasquan Inlet, NJ	SE Fire Is., NY	36	23 N	RR	RR	Ken Schmieder		NY
"	E Rudee Inlet, VA	E Little Egg Inlet, NJ	37	131 NE	LL	RR	Biologist (NMFS)		RI
"	SE Montauk Pt., NY	Cape Hatteras, NC	81	378 SW	RR	RR	Otto W. Haselman		NY
"	SW Moriches Inlet, NY	SE Pt. Judith, RI	24	96 E	RR	TN	Dan Azzato		NY
"	SE Ocean City, NJ	NE Tuxpan, Mexico	47	1873 SW	RR	LL	Dave Moss		FL
"	SW Shinnecock Inlet, NY	SE Port Isabel, TX	133	1945 SW	RR	HL	George Bezold		NY
"	E Jacksonville Beach, FL	W Sarasota, FL	9	765 SW	LL	LL	Biologist (NMFS)		RI
"	S Shinnecock Inlet, NY	N Progreso, Yucatan, Mexico	24	1524 SW	RR	LL	Robert Egger		NY
"	SE Montauk Pt., NY	N Progreso, Yucatan, Mexico	72	1572 SW	RR	LL	Irvin Klein		NY
"	E Rehoboth, DE	E Cape May, NJ	1	22 E	RR	RR	Martin Longenecker		PA
"	S Montauk Pt., NY	W Naples, FL	162	1393 SW	RR	LL	John R. Wolf		NY
"	N St. Augustine, FL	E St. Augustine, FL	15	48 S	LL	LL	Stephen Connett		RI
"	NE Cape May, NJ	E Ponce Inlet, FL	7	674 SW	LL	LL	Biologist (NMFS)		RI
"	SW Nantucket, MA	S Powell Canyon	11	146 SE	TN	LL	Ralph Tegge, NMFS Obs.		MA
"	N Paramore Is., VA	S Sarasota, FL	4	1193 SW	RR	LL	Jeffrey L. Pitts		VA
Sandbar shark	SE Fire Is. Inlet, NY	S Mobile Point, AL	28	1636 SW	RR	LL	James Rogers		NY
"	S Moriches Inlet, NY	S Montauk Pt., NY	88	43 E	RR	TO	William Behrens		NY
"	SE Manasquan Inlet, NY	E Madeira Beach, FL	183	1392 SW	RR	LL	Barry Boyce		NJ
"	NW Cape Lookout, NC	Hampton Roads, VA	2	140 N	LL	RR	Stephen Connett		RI
Mako shark	E Oregon Inlet, NC	SE Cape Race, Canada	18	1226 NE	LL	LL	Biologist (NMFS)		RI
"	ESE Cape May, NJ	SE Cape May, NJ	<1	12 S	RR	RR	Bob Vichko		NJ
"	S Fire Is. Inlet, NY	SE Cape May, NJ	11	117 SW	RR	RR	Ted Bingham		NY
"	E Powell Canyon	SE Flemish Cap	8	1204 E	LL	LL	Jerzy Cygler, NMFS Obs.		MA
"	S Veatch Canyon	SE Flemish Cap	43	1365 NE	LL	LL	Martin Williamowsky, NMFS Obs.		MA
"	E Ocean City, MD	E Indian River Inlet, DE	11	21 NE	RR	RR	Steve Jones		MD
"	ESE Ocean City, MD	SE Moriches Inlet, NY	36	165 NE	RR	RR	Mark Sampson		MD
"	E Manasquan Inlet, NJ	SSE Moriches Inlet, NY	13	46 NE	RR	RR	Joe LaRosa		NJ
"	SE Block Is., RI	SE Montauk Pt., NY	11	31 SW	RR	RR	Charlie Donilon		RI
"	W Oceanographer Canyon	E Flemish Cap	23	1412 E	LL	LL	Georg Hinteregger, NMFS Obs.		MA
"	E Manasquan Inlet, NJ	SW Montauk Pt., NY	<1	47 NE	RR	RR	Tom Palchanes		NJ
"	SSE Manasquan Inlet, NJ	S Manasquan Inlet, NJ	1	39 SW	RR	RR	David Foley		NY
"	E Manasquan Inlet, NJ	NE Atlantis Canyon	1	134 E	RR	LL	Rick Sabarese		NJ
"	S Veatch Canyon	N Havana, Cuba	25	1178 SW	LL	LL	Paul Courtney, NMFS Obs.		MA
"	S Munson Canyon	N Boca de Jaruco, Cuba	7	1230 SW	LL	LL	J. Cartner, NMFS Obs.		MA
"	SE Ocean City, MD	E Corsair Canyon	3	442 NE	RR	LL	Mark Sampson		MD
"	S Martha's Vineyard, MA	S Boon Is., ME	49	140 N	LL	HP	Stephen Connett		RI
"	S Hydrographer Canyon	E Rudee Inlet, VA	16	285 SW	LL	LL	Georg Hinteregger, NMFS Obs.		MA
"	E Manasquan Inlet, NJ	SE Ocean City, MD	3	147 S	RR	LL	Ralph Leyrer		NJ
Lemon shark ^a	Long Point Key, FL	Long Point Key, FL	9	1 W	RR	RR	William Botten		FL
"	Little Pine Key, FL	Big Pine Key, FL	4	3 SW	RR	RR	William Botten		FL
"	Big Pine Key, FL	Big Pine Key, FL	10	0	RR	GN	William Botten		FL
"	Big Pine Key, FL	Big Pine Key, FL	<1	0	RR	RR	William Botten		FL
"	W Key West, FL	W Key West, FL	2	11 E	RR	RR	Todd Bowen		FL
"	Key West, FL	Sugarloaf Key, FL	2	15 NE	RR	RR	Todd Bowen		FL
"	Long Point Key, FL	Marathon, FL	4	4 W	RR	GN	William Botten		FL
"	Shell Key, FL	Shell Key, FL	3	0	RR	RR	Eric Meyer		FL
"	S Sarasota, FL	W Key West, FL	18	139 S	RR	HL	Clark Balsinger		FL
"	Big Pine Key, FL	Big Pine Key, FL	<1	0	RR	GN	William Botten		FL
"	No Name Key, FL	No Name Key, FL	2	0	RR	RR	William Botten		FL
"	No Name Key, FL	No Name Key, FL	<1	0	RR	RR	William Botten		FL
"	Big Pine Key, FL	Big Pine Key, FL	<1	0	RR	GN	William Botten		FL
"	Little Crawl Key, FL	Marathon, FL	6	4 W	RR	RR	William Botten		FL
"	Islamorda Keys, FL	Lignumvitae Key, FL	41	12 W	RR	RR	Ted Avellone		FL
Dusky shark	SE Martha's Vineyard, MA	SW Sarasota, FL	8	1460 SW	TN	LL	Herb Montros, NMFS Obs.		MA
"	SE Block Is., RI	E Tampico, Mexico	76	2052 SW	RR	LL	Peter Treat		RI
"	W Key West, FL	NE Veracruz, Mexico	93	735 SW	LL	HL	Greg Spake, NMFS Obs.		MA
"	E Cape May, NJ	E Sunset Beach, NC	15	378 SW	RR	GN	Joe Harper		NJ
"	S Rudee Inlet, VA	NW Progreso, Mexico	62	1385 SW	RR	GN	Bill Moffette		VA
"	E Rudee Inlet, VA	Crova Beach, NC	2	24 SW	RR	GN	John Kerr		VA
"	E Manasquan Inlet, NJ	Cape Lookout, NC	5	360 SW	RR	NT	Tony Cuccia		NJ
"	E Brielle, NJ	E Montauk Pt., NY	141	123 E	RR	HL	Barry Boyce		NJ
"	ESE Ponce Inlet, FL	NE Alvarado, Mexico	13	1193 SW	LL	HL	Tris Colket		NJ
"	Argus Bank, Bermuda	Argus Bank, Bermuda	50	0	FS	RR	Alan J. Card		Bermuda
"	Little Egg Harbor, NJ	Little Egg Harbor, NJ	<1	1 S	RR	RR	David Kirr		PA
"	SE Montauk Pt., NY	S Shinnecock Inlet, NY	37	50 SW	RR	RR	Harry McAllister		NY
Tiger shark ^a	S Cape Lookout, NC	S Cape Lookout, NC	6	27 S	LL	LL	Biologist (NMFS)		RI
"	E Ponce Inlet, FL	SE Charleston, SC	4	197 N	LL	LL	Robert Sorenson		FL
"	ENE Ponce Inlet, FL	ENE St. Augustine, FL	<1	58 N	LL	RR	Eric Sander		FL
"	E Stuart, FL	E Shinnecock Inlet, NY	66	852 NE	RR	RR	Craig Paige		VA
"	S Montauk Pt., NY	N Faro Paredon Grande, Cuba	42	1126 S	RR	LL	Tom Peterson		CT
"	E Manasquan Inlet, NY	E Cape Henlopen, DE	10	81 S	RR	RR	Joseph LaRosa		NJ
"	ESE Rudee Inlet, VA	SE Cape May, NJ	58	120 NE	RR	RR	Gary W. Seay		VA
"	S Montauk Pt., NY	E Barnegat Inlet, NJ	10	98 SW	RR	RR	Steven Szoke		NY
"	E Barnegat Inlet, NJ	E Daytona Beach, FL	63	714 SW	RR	LL	Pete Barrett		NJ
"	SW Pascagoula, MS	S Pascagoula, MS	<1	82 E	LL	LL	Dave Millar		FL
"	S Fire Island Inlet, NY	E Ponce Inlet, FL	1	723 SW	RR	LL	R. Aareskjold		NJ
"	E Ponce Inlet, FL	E Ponce Inlet, FL	<1	4 W	LL	LL	Robert Sorenson		FL
Blacktip shark	E Oregon Inlet, NC	W Sarasota, FL	88	1159 SW	TN	LL	William Fazio, NMFS Obs.		MA
"	S Port Aransas, TX	NE Pt. Anton Lizardo, Mexico	6	496 S	RR	GN	David Hastings		TX
"	Panama City Beach, FL	Little Dauphin Is., AL	<1	133 W	RR	GN	Jonathan Wood		FL
"	Bimini, Bahamas	Bimini, Bahamas	28	7 W	LL	RR	Samuel Gruber		FL
"	SW Destin, FL	S Mobile, AL	10	53 SW	RR	HL	Cecil Cox		FL

Table 2. Continued

SPECIES	TAGGED	GENERAL LOCATIONS		MONTHS/ LIBERTY	DIST. & DIR. TRAVELLED	CAPTURE METHOD		TAGGER	TAGGED BY	RESIDENCE
		RECAPTURED				TAGGING	RECAPT.			
Blacktip shark	E Pt. Canaveral, FL	E Sebastian, FL	10	37 S	RR	GN	Ed Dwyer		FL	
"	E Key West, FL	E Charleston, SC	6	485 N	LL	LL	Mike Mercer		FL	
"	N Port Mansfield, TX	SSE Tuxpan, Mexico	1	377 S	RR	GN	Frank Eicholz		TX	
"	Ft. Lauderdale, FL	SW Key West, FL	12	349 SW	RR	LL	Alan G. Summers		FL	
Nurse shark ^a	Long Point Key, FL	Fat Deer Key, FL	9	0	RR	RR	William Botten		FL	
"	Fat Deer Key, FL	Fat Deer Key, FL	4	1 W	RR	RR	William Botten		FL	
"	Key Vaca, FL	Key Vaca, FL	11	1 E	RR	RR	William Botten		FL	
"	Arsenicker Key, FL	W Arsenicker Key, FL	11	1 W	RR	RR	Thomas Holloway		FL	
"	Staniel Cay, Exuma, Bahamas	Staniel Cay, Exuma, Bahamas	1	0	RR	RR	Chad Perlyn		FL	
Sc. Hammerhead	E Miami, FL	S Miami, FL	35	21 S	RR	RR	Mark Quartiano		FL	
"	E Jacksonville Beach, FL	S Montauk Pt., NY	88	765 NE	LL	HP	Biologist (NMFS)		RI	
"	Miami Beach, FL	Cape Lookout, NC	115	561 N	RR	GN	Gary Hall		FL	
Silky shark	NW Progreso, Mexico	NW Progreso, Mexico	4	47 SE	LL	HL	Ramon Bonfil		Mexico	
"	NE Ponce Inlet, FL	SE Daytona Beach, FL	1	16 S	RR	LL	Eric Sander		FL	
"	ESE Hatteras Inlet, NC	SE Cape Fear, NC	<1	143 SW	RR	RR	B. W. Wilson		NC	
Night shark	S Pascagoula, MS	SW Key West, FL	106	417 SE	LL	LL	Martin Bowen, NMFS Obs.		MA	
"	E Ocean City, MD	N Progreso, Mexico	70	1441 SW	LL	HL	Biologist (NMFS)		RI	
Reef shark	N Salina Pt., Bahamas	N Salina Pt., Bahamas	26	1 SW	LL	LL	Stephen Connett		RI	
"	N Salina Pt., Bahamas	N Salina Pt., Bahamas	14	1 S	LL	LL	Stephen Connett		RI	
Sand Tiger	S Montauk Pt., NY	Delaware Bay	24	190 SW	TN	RR	Linda Craig, NMFS Obs.		MA	
"	NR	ESE Hatteras Inlet, NC	NR	NR	RR	RR	Peter Cerasole		NY	
Bull shark	Port Aransas, TX	Port Aransas, TX	0	0	RR	FD	Darrell Mostella		TX	
Blacknose	SE Jacksonville Beach, FL	Jacksonville Beach, FL	<1	4 NW	RR	RR	John Henry David		FL	
Atl. Sharpnose	Padre Is., TX	Aransas Pass, TX	<1	19 N	RR	TO	Darrell Mostella		TX	
Shark	NR	E Lantana, FL	NR	NR	NR	LL	Mary Ann Janusz		NJ	
"	NR	NW Campeche, Mexico	NR	NR	NR	NT	Ernie Lane		NC	
"	NR	S Montauk Pt., NY	NR	NR	NR	NT	Michael Krokovic		NJ	
Swordfish	SE Cape Race, Canada	E Anegada, Virgin Is.	2	1625 SW	LL	LL	Phil Ruhle, Jr.		RI	
"	S Veatch Canyon	S Cape Race, Canada	10	690 E	LL	LL	Dana McIntire		ME	
"	S Pascagoula, MS	S Pascagoula, MS	91	142 SE	LL	LL	Greg Spake, NMFS Obs.		MA	
"	N Powell Canyon	S Miami, FL	5	1212 SW	LL	LL	Walter Quinn, NMFS Obs.		MA	
"	SE Oregon Inlet, NC	E Cape Canaveral, FL	87	437 SW	LL	LL	Phil Ruhle, Sr.		RI	
Bluefin tuna	S Montauk Pt., NY	E Montauk Pt., NY	27	375 E	RR	LL	Al Ristori		NJ	
Blackfin tuna	Challenger Bank, Bermuda	Challenger Bank, Bermuda	35	30 SW	RR	RR	Brian Luckhurst		Bermuda	

NOTE: FD=Found Dead; FS=Free Swimming; GN=Gill Net; HP=Harpoon; HL=Hand Line; LL=Longline; NT=Net; RR=Rod & Reel; TO=Tag Only; TN=Trawl Net; Obs.=Foreign Fisheries Observer; NR=Not Reported.

^aNot included are local returns for 6 lemon sharks, 4 nurse sharks, and 2 tiger sharks from a concentrated study off Bimini, Bahamas, by Dr. S. Gruber, Univ. of Miami.

SCIENTIFIC MEETINGS AND REPORTS

SCIENTIFIC MEETINGS AND REPORTS

In 1987 the following papers were given by our staff at two scientific meetings: The American Elasmobranch Society in Albany, N.Y. (June) and The U.S.-Japanese meeting "Sharks as Living Resources"* in Honolulu, Hawaii (Dec.). We offer these abstracts to share with you the scope and substance of some of our research on sharks. Without your assistance much of this work would not be possible. The manuscripts are now under revision and should be available in early 1989.

*Sponsored by the National Science Foundation (U.S.) and The Japan Society for the Promotion of Science.

THE REPRODUCTIVE LIMITATIONS OF SHARK FISHERIES

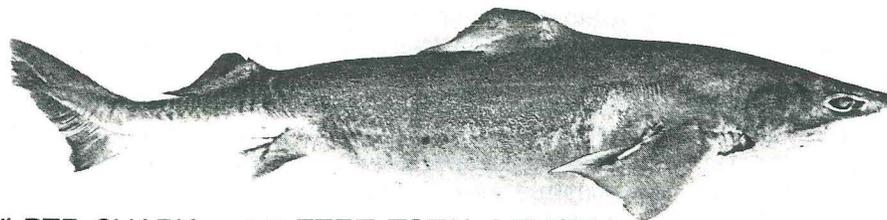
by Harold L. Pratt, Jr. and John G. Casey

An examination of historical shark fisheries characterizes them as "Boom and Bust" enterprises. The rational exploitation of shark populations can be accomplished only through careful management. The stocks of elasmobranchs require a long time to recover from the effects of directed fisheries primarily because of their reproductive strategies (i.e. a small number (2-135) of large young (100-1000 mm), born after a gestation period of 0.5 to 2.0 yr., and a late age at first maturity). An overview of shark species and reproductive parameters (through a revision of Holden's Table 1, [1974]), suggests species which are more vulnerable to directed fisheries. In order to assess the potential of elasmobranch fisheries, future research should address early life history requirements, minimum reproductive biomass and examine the adaptations (if any) of elasmobranch fecundity to fluctuations in stock abundance and food supply.

FIRST RECORD OF THE GULPER SHARK, *CENTROPHORUS GRANULOSUS*, OFF THE NORTH- EASTERN UNITED STATES

by John G. Casey, Gregory B. Skomal and Charles E. Stillwell

On March 5, 1987, three gulper sharks (*Centrophorus granulosus*) were caught by the FV *Audrey Lynn* near Norfolk Canyon (37° 06' N 74° 40' W). The vessel was bottom longlining for tilefish in depths of 300 to 600 meters (m). Two of the specimens, estimated to be 26 kg, were not retained. The third was a 145 cm (TL) immature female weighing 19 kg; its stomach was empty. Previous reports of the gulper from U.S. waters are limited to two trawl caught specimens; one taken off the coast of Louisiana in 1972 in 380 m, the other taken off the coast of Georgia in 1955 in 320 m. The gulper has also been reported from Cuba, the West Indies and Surinam. The gulper specimens taken in Norfolk Canyon represent the first record of this species in northeastern U.S. waters and a northern extension of its range in the western Atlantic of approximately 400 miles. The gulper may prove to be much more common than current records indicate. An explanation for its apparent rarity is that it occupies depth zones that lie beyond traditional fishing grounds. The morphology and distribution of the gulper is discussed and compared to other members of the genus *Centrophorus*. At our request Capt. P. Ruhle, Jr. of the *Audrey Lynn* returned and fished this area



GULPER SHARK - 4.5 FEET TOTAL LENGTH

intermittently for several weeks. On July 21st he caught three additional gulper sharks (136 to 152 cm TL). Gulper sharks are fished commercially in the eastern Atlantic both as a food fish and for the livers which are high in squalene.

REPRODUCTION IN THE MALE WHITE SHARK

by Harold L. Pratt, Jr.

There is very little known about the reproductive biology of the great white shark, *Carcharodon carcharias*. Pregnant females have so far escaped detailed scientific attention. We have examined 27 male white sharks; four of these were mature, the others were immature or just approaching maturity. Sizes ranged from 16 to 1568 kg (35 to 3454 lbs) and 117 to 493 cm fork length (17 ft. max. total length). A detailed description of the internal anatomy, information on maturity, and size at maturity was presented in graphs, line drawings and tables. Spermatozoa are formed in lobate paired testes. They are bundled in the epididymides into spermatozeugmata and stored until copulation. Claspers are robust, each bearing a retractile spur at the tip. Sexual maturity occurs between 10 and 13 ft. FL. Circumstantial evidence suggests that the Mid-Atlantic Bight may be a mating area for white sharks.

VERTEBRAL GROWTH ZONE DEPOSITION IN ANGEL SHARKS: AN ENIGMA

by Lisa J. Natanson* and Gregor M. Cailliet

One requirement of using vertebral bands to age a shark is that the bands should be deposited predictably in relation to time e.g., one band per year. Yearly banding has been found in several species such as the sandbar, leopard, and Atlantic sharpnose sharks. Bands in the Pacific angel shark, *Squatina californica*, seem to vary with the size of the shark rather than with the passing of time. Vertebrae from 247 Pacific angel sharks of various sizes were examined. Our smallest newborn (260 mm TL) had 6 to 7 bands while the largest adult (1140 mm TL) had 42. Three Pacific angel sharks, injected with tetracycline to mark the vertebrae, were kept in captivity for up to 13 months and showed as many as 7 bands past the tetracycline mark. The number of bands could not be related to season but appeared instead to be related to the growth of the shark throughout the year. The randomness of the vertebral bands was supported by information from 6 tag-recaptured specimens. This study suggests that caution must be used when ageing any species of shark from vertebral data alone.

* L. Natanson is a Ph.D. student at U.R.I. working at the NMFS Lab. Her current research deals with age and growth of the dusky shark.

GROWTH VERIFICATION FOR THE BLUE SHARK (*PRIONACE GLAUCA*) FROM THE OBJECTIVE IN- TERPRETATION OF LENGTH FREQUENCY DATA

by Gregory B. Skomal*

The determination of age and growth information for sharks is a task we have been working on for many years. Usually vertebral rings (centrum bands) are used. When vertebral data is lacking, inconclusive, erroneous, or requires cross-correlation, other methods for determining the age and growth of a species must be applied. One such method involves the analysis of length-frequency data obtained at tournaments. The total catch of a species is arranged in size groups. Well-defined modes or peaks observed in size data for the blue shark for example, probably represent distinct and separate age groups. Based on a known size at birth of 40 cm FL and recently developed computer programs, ages were assigned to these peaks and a growth curve was constructed. Since age groups 1 and 2 occur primarily in the Eastern Atlantic, they are not well represented in the Western Atlantic samples. Interpolation of the data provided size estimates of 80 cm and 115 cm FL for these age groups.

*G. Skomal is a U.R.I. graduate student who was working at the NMFS lab on age and growth of the blue shark. He is currently employed by the Massachusetts Division of Marine Fisheries.

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BLUE SHARKS STUDIED IN THE EASTERN ATLANTIC

By Captain Stephen Connett

The R/V Geronimo, a 53 ft. yawl operated by St. Georges School, a co-educational boarding school in Newport, RI, has been tagging sharks for NMFS for 14 years. In 1987 Captain Connett, his wife Babbie, their students and staff completed a six month transatlantic expedition from Newport to: Bermuda, the Azores, Spain, Portugal, Madeira, Canary Islands and the West Indies. This cruise had been 3 years in the planning stage. In October Jack Casey spent ten days on the vessel in Portugal and Spain, fishing for small blue sharks and contacting European fishermen and scientists. The following article was excerpted from the cruise report written by Captain Connett.

We left Newport on June 18 in calm weather and made two longline sets on the continental shelf before sailing to Bermuda. We tagged 31 sharks and caught our first porbeagle. The sail from Newport to Bermuda was one of the most pleasant that I can remember. The weather was excellent and gave us time to breathe after pushing hard to get under way. During our short stay in Bermuda, we were able to spend time reviewing our research objectives and get the crew in gear for the trip to the Azores.

We expected the trip from Bermuda to the Azores to be a most important part of our research cruise. We wound up, however, with what we euphemistically call "useful negative data". I could not believe how empty the ocean was between Bermuda and the Azores. We made five longline sets and did not catch a single fish. We did not see a single turtle until we were one day out of the Azores. What the trip lacked in sharks and turtles, it made up for in marine mammals. We had sightings almost every day of sperm whales, killer whales, dolphin, pilot whales and grampus.

Faial, in the Azores, is one of the loveliest islands in the Atlantic. The main port has a large fishing fleet with several new 100 foot fiberglass boats that are well equipped and efficient. The day we arrived we met with Helen Martins and Helder da Silva at the oceanographic depart-

ment of the University of the Azores. Helen has tagged well over a hundred small loggerhead turtles, and Helder is a fisheries biologist who is presently studying the kite fin shark (*Dalatias licha*). He is interested in tagging blue and mako sharks from the university's research vessel.

The cruise from the Azores to Spain began in flat calm weather which was perfect for catching turtles. We tagged 34 loggerheads north of Terceira before the breeze increased and we had to sail for seven days hard on the wind, much of the time with shortened sail. Our arrival in La Coruna, Spain on July 26 after several days in a northeasterly gale made us all happy to be in a safe harbor.

The research objective of the summer cruise along the western coasts of Spain and Portugal was to verify the existence of significant numbers of post embryonic and juvenile blue sharks in the area and to begin to describe the stock in terms of sex ratios, size distribution, and seasonal abundance. We wanted to tag as many small blue sharks as possible and to take vertebral samples for age and growth studies.

There is a strong possibility that the blue sharks of the eastern and western North Atlantic are a single or at least an interbreeding stock. Jack Casey and his staff at the National Marine Fisheries Service's Narragansett Laboratory have had over 40,000 blue sharks tagged in

the western Atlantic, but comparatively few in the eastern Atlantic. Tag returns have proven that west to east transatlantic movements are fairly common, including one shark tagged by *R/V Geronimo* off Rhode Island and recaptured off Portugal carrying 28 embryos.

We fished our shark longline gear, which is almost identical to the heavier Portugese and Spanish swordfish longline, south of Cape Finisterre, Spain and caught one blue shark. I was terrified that we had come across the Atlantic to find fish that were not there. Sergio Iglesias, the Spanish fisheries biologist who met us in La Coruna, suggested that we sail to St. Eugenia de Riveira where there was a large fishing fleet.

Through a friend of Sergio's we discovered that there is a commercial blue shark fishery at Aquino, a small harbor west of Riveira. When we visited the market in Aquino we learned that Spanish fishermen catch blue sharks but seem to keep only those that are larger than 4 kilograms (8.8 lbs.). The sharks they keep are gutted on board but not iced until they have been sold at auction, usually the same day. The fish are stacked by boat in the market (see photo). We understood that most of the sharks are shipped to Portugal and southern Spain.

One fisherman who fished for small blue sharks showed us the light longline gear that he and his friends used. The hooks were smaller



than any we had on board, and the baits were the size of silver dollars (not one pound whole mackerel as we were using). It took us two days to make up new gear, but using this gear we caught what we had come to find—small blue sharks. The smallest ones were 16 inches long and weighed less than 2 pounds. We found these small blue sharks off the northeastern coast of Spain and tagged 99 and took 19 vertebral samples for age studies at Narragansett. We injected almost all the tagged fish with tetracycline.

The fall cruise began September 17 in Puerto Sherry near Cadiz, Spain. We powered across the Gulf of Cadiz to the port of Vilamoura, where charterboat owner Rudolf Streur has been tagging blue sharks for several years. One of his tagged blues was recaptured off Newfoundland. I spoke with two captains who regularly fish for sharks. They said that the local shark fishing season was coming to an end. We set sail for Sesimbra, Portugal on Sept. 28 where we planned to load bait and learn more about the local fishery for pelagic sharks in that area. For at least the past ten years there has been a shark and swordfish fishery off the Portugese coast using various types of longlines and chum with handlines. Swordfish, blue sharks, makos, and porbeagles are sold regularly for food, but the fishermen said that the blue shark population off Sesimbra has almost disappeared. Many of the men blame the gillnetters.

On October 1 we steamed up the Tagus River to Lisbon, Portugal to meet Jack Casey at the Instituto das Pescas. We spent a productive day talking with Luiz de Matos and other scientists from the institute, several of whom were studying sharks. Luiz and his wife, Guita, drove us to the fishing port of Peniche to visit a market where they land swordfish, tuna, and sharks from coastal longline boats. We saw impressive catches of swordfish, tuna and also many blue sharks of both sexes. We could not get an accurate count of the sharks, but we met a fisheries statistician who said he would be happy to send us catch data and other information through their fisheries department.

On October 5 we steamed out of Lisbon and again found the small blue sharks when we set gear where



local captains had told us to fish (14 miles SW of Cabo da Roca). This fishing confirmed that the nursery grounds for blue sharks extends at least as far south as Lisbon.

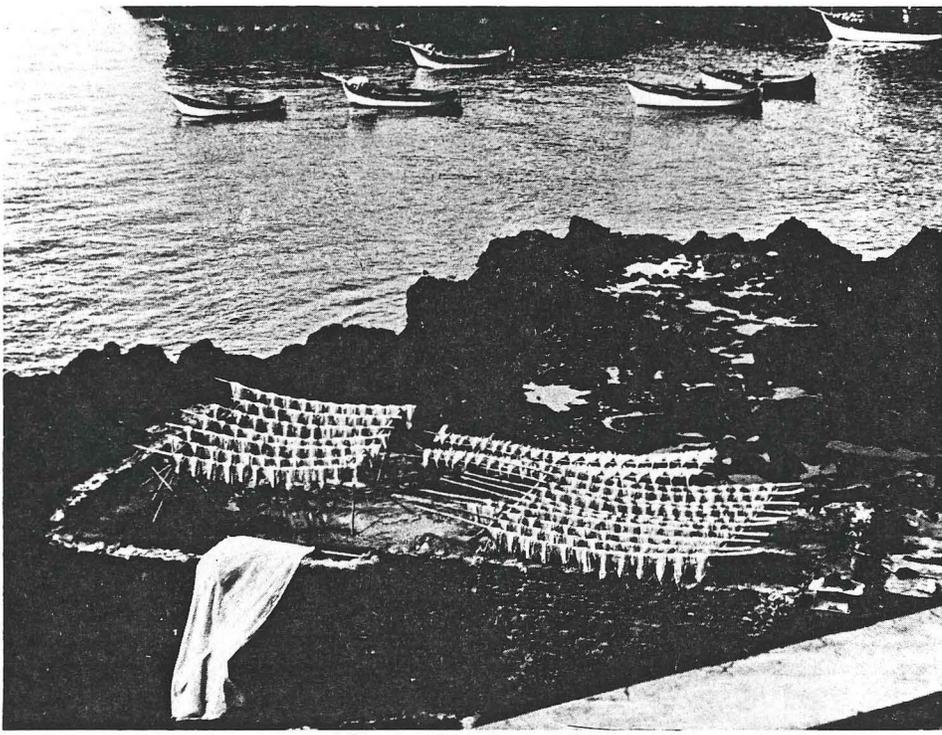
On October 7 we set gear 18 miles south of Sesimbra, Portugal and caught nothing, confirming what we had heard about the disappearance of the blue shark population in this area. Local fishermen told us they had successfully fished the area for swordfish and sharks, but that in recent years the fish had almost disappeared.

From the grounds south of Sesimbra we sailed to Vilamoura, in the Algarve region of Portugal, to meet with Captain Luis Cachao and other fishermen. They agreed that the major local shark species were blue, mako, and smooth hammerhead. Photographs of these fish were prominently displayed outside the booking offices at the marina. The captains said the best season for blue sharks begins in March and lasts through the end of September. On October 9, guided by Luis, we fished light longlines 10 miles south of Vilamoura and did not catch any sharks.

We sailed from Vilamoura to Puerto Sherry where we rented a

van and drove south along the coast past Gibraltar to Marbella. There we made contact with Captain Gordon Bland, a NMFS tagger, who has tagged a good number of blue sharks inside the Mediterranean. He said that the blue shark fishing has dropped off dramatically in recent years. It is interesting that all the recaptures of blue sharks that Gordon tagged over the years have come from further east in the Mediterranean. It is important to know whether blue sharks migrate out of the Mediterranean. Fish tagged in U.S. waters have been recaptured inside the Mediterranean, so we know there is eastward movement. If blue sharks regularly move in and out of the Mediterranean it will further complicate the migratory patterns of blue sharks in the North Atlantic.

On October 18 we set sail for the 600 mile journey to the Madeiras and Canary Islands. Unfortunately, it was too rough to fish on the way to the Madeiras. In Madeira, we met with scientist Dalila Carvalho at the Laboratorio de Investigacao das Pescas and drove to Camara de Lobos which is a major fishing town. We met with a fisherman who often
(Continued on Page 10)



(Eastern Atlantic continued)

fishes for blue sharks or catches them when he longlines for tuna. Most of the sharks are salted and dried in the sun. We saw racks of hundreds of fillets (see photos). The blue shark fins are taken for the oriental trade, and many of the skins are dried.

In late October we visited Jerry Maul and Manuel Biscoito at the Museu Municipal do Funchal (Madeira). They were aware that pregnant female blue sharks were taken in the area because the fishermen occasionally brought them samples of deformed embryos. We also met with Ms. Geny Braz, the fisherman who sent Jack Casey pictures of small blue sharks landed in Sesimbra, Portugal. These pictures and the information provided by her father several years ago had provided major impetus for our expedition.

Ms. Geny Braz is certainly one of the most knowledgeable fishermen in Madeira. She has extensive experience in the sport fishery in Spain and has also worked out of Madeira for several years. Geny told us that the small blue sharks in Madeira are unquestionably larger than those traditionally caught off the Spanish coast at Sesimbra. She said they catch pregnant females in late winter and early spring in Madeira, but she also said that blue shark fishing there has declined dramatically in the last few years.

From Madeira, we sailed to Las Palmas, Canary Islands where we met with Robert Workman and Chris Roncoroni, two long time NMFS taggers who, along with their friends, were exceptionally helpful. Chris is the International Gamefish Association representative for Gran Canaria. We again heard that blue sharks were present year round but that fewer and fewer were being caught. Chris said, however, that natural fluctuations of some fish are well known in the Canaries. We were told that several party boats operating out of Gran Canaria set shark longlines in the area. Each day these boats take the customers out to haul and reset the gear which stays out all the time, anchored to the bottom. After an enjoyable stay in the Canary Islands, we left on Nov. 15 for the Caribbean with enough provisions for a month at sea.

The Canary Islands-Caribbean passage is the best in the Atlantic for teaching celestial navigation to beginners. The sky is clear, the horizon is sharp and the seas are moderate. Experienced sailors know the aggravations of upwind sailing and variable weather, and I have never met one who whispered a complaint about this fair trade wind passage. But any ocean trip is a challenge. No matter how modern the equipment, no matter how good the weather forecasts, each vessel must reach its destination alone.

We felt a sense of accomplishment when the trip ended in St. Croix on Dec. 16.

The expedition was an educational and scientific success. We now know that a nursery grounds for blue sharks in the eastern Atlantic stretches at least from Cape Finisterre off northwestern Spain to Lisbon, Portugal. The newborn blues are present along the coast from 40 fathoms to beyond 100 fathoms from June to October. Additional study is needed to delineate the nursery grounds of newborn blues from the Bay of Biscay to North Africa, including the western Mediterranean.

The fishermen we interviewed said that blue sharks are present all year from Spain to the Canary Islands, but the populations fluctuate with season and area. Pregnant females are fairly common throughout the region in February and March. Large males are also common, but this population may not include the oldest year classes of males that are found off New England in the summer and fall.

We found conclusive evidence that there are commercial and sport fisheries for blue sharks from northern Spain to the Madeiras. These fisheries consist primarily of coastal boats, and the fisheries are seasonal. The blue sharks seem to have no commercial value until they weigh more than 4 kilograms (8.8 pounds). The coastal and distant water swordfish longliners from Spain and Portugal keep many of the blue sharks they catch.

The fishermen in Spain, Portugal, and the Canary Islands agreed that blue sharks have decreased significantly in recent years. These observations should be investigated using catch statistics and other sources of information to document if there is indeed a decline and whether the decline is the result of fishing activities or natural fluctuations.

The long expedition was successful, in part because of contacts we made before leaving the U.S. and help from people we met along the way. We are assured that this effort will serve as the basis for additional cooperative shark research between U.S. and European scientists.



A REVIEW OF SHARK TAGGING STUDIES

by John G. Casey
and Nancy E. Kohler*

Shark tagging programs throughout the world have been directed toward several objectives, including studies of migrations, age and growth, physiology, population dynamics and swimming behavior in the open sea. Tagging studies on sharks have been conducted by researchers from Australia, Canada, Great Britain, Greenland, Ireland, Norway, South Africa, South America, Japan and the United States. Results of these studies include recaptures from tagged Australian school sharks over a 30-year period, recaptures from sandbar sharks and spiny dogfish after 20 years, and recapture of a Greenland shark after 16 years. Acoustic telemetry has been used to measure average swimming speeds, diurnal movements, depth ranges and other aspects of the behavior of several species including lemon, reef, blacktip, hammerhead and blue sharks. The most extensive shark tagging program in the world has been conducted by the National Marine Fisheries Service in the North Atlantic ocean. This continuing study, covering 25 years, currently in-

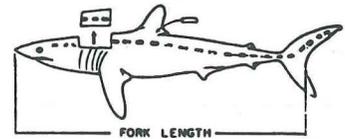
volves over 3,000 volunteer fishermen and scientists along the North American and European coasts. Under this program 67,607 sharks representing 43 species were tagged between 1962 and 1986. In the same period 2,337 sharks of 30 species were recaptured by fishermen representing 24 countries. Results of the U.S. program include: transatlantic movements of the blue sharks between North America, Europe, Africa and South America (maximum distance-3,740 mi.), recaptures from sandbar sharks showing movements between the U.S., Cuba and Mexico; recaptures of 10 shark species demonstrating movements between the Atlantic and the Gulf of Mexico, and recaptures of night, blacktip, tiger, bigeye thresher, sandbar and dusky sharks between North America and the West Indies. A review of tagging methods and summary of results of the major tagging programs on large sharks is provided. The value of tagging studies for determining man's impact on shark populations and for advancing the biological knowledge necessary for managing shark populations is discussed.

* N. Kohler of our staff, received her Ph.D. from U.R.I. in 1987. Her thesis dealt with the feeding ecology of the blue shark.

REQUEST FOR BACKBONES OF RECAPTURED SHARKS

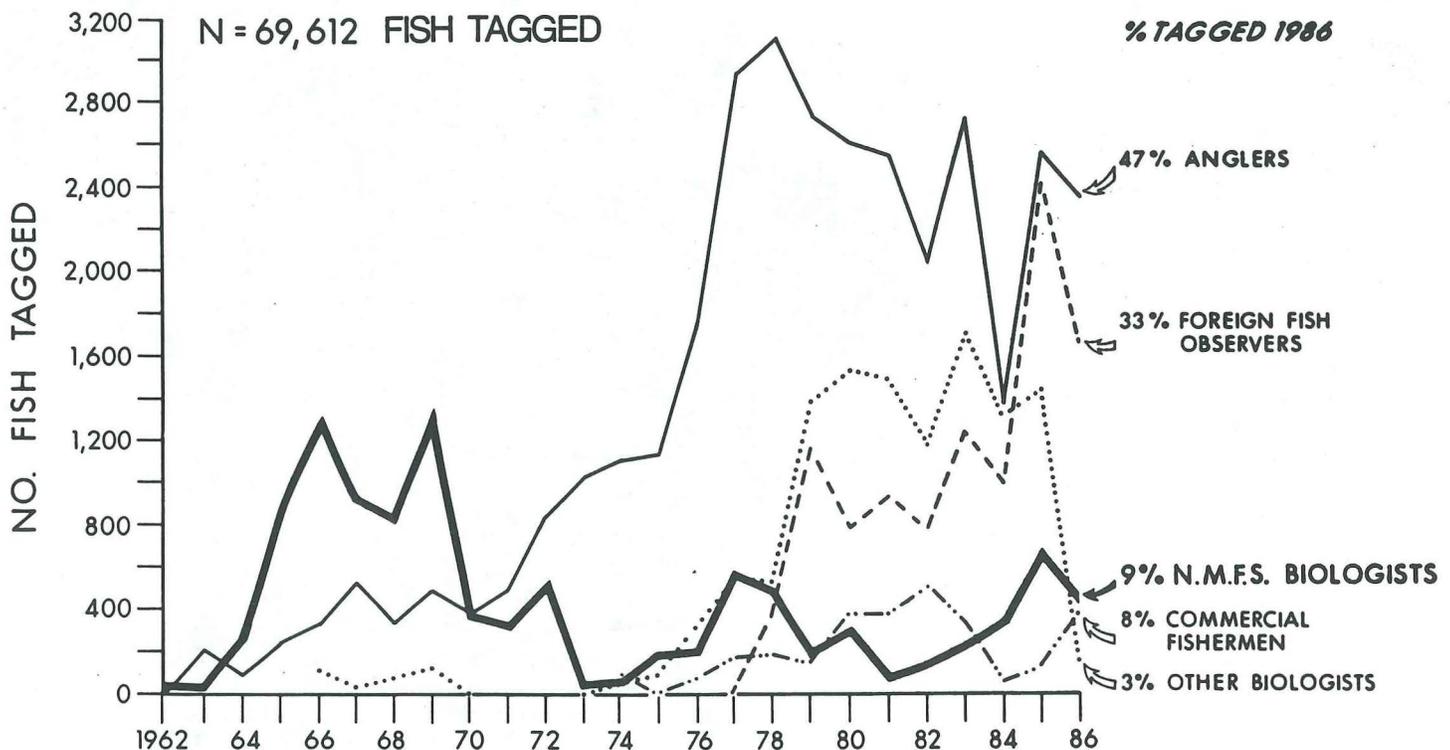
The high numbers of sharks currently being recaptured by taggers offers a unique opportunity for you to assist us with age studies.

IF YOU CATCH A TAGGED SHARK



1. Measure fork length.
2. Record tag number and recapture details (date, location, sex, etc.).
3. Remove a 6 to 10 inch piece of backbone from over gills.
4. Freeze backbone overnight or pickle in rubbing alcohol.
5. Double wrap in plastic bags and airmail.
Attention Shark Project
Open Immediately
6. Telephone if you have any questions
(401-782-3200)

N.M.F.S. COOPERATIVE TAGGING PROGRAM 1962-86



FIELD AND LABORATORY STUDIES

In 1987, we attended 12 shark fishing tournaments along the northeast coast from Massachusetts to New Jersey. Three new tournaments that were held at West Yarmouth, Nantucket, and Martha's Vineyard, MA in late August provided an opportunity to examine some very large blue sharks during the latter part of the fishing season.

Length and weight information was obtained from 221 sharks representing nine species. These included blue, mako, common thresher, tiger, dusky, white, and scalloped hammerhead sharks. Eighty-five sharks were dissected and examined in detail for food habits, reproductive, and age and growth studies. Food studies showed that the prey of most of the sharks examined was bottom dwelling fish such as goosefish, fluke and flounder. Bluefish was the principal prey of makos.

We collected vertebral samples from three tiger and six blue shark tag recaptures landed at seven different tournaments. These vertebrae accompanied by accurate length measurements are important to our studies of shark age and growth.

One blue shark caught during the Moriches tournament reportedly released her embryos while being boated. This was unusual because very few pregnant blue sharks have been reported from the Western North Atlantic. (See article on blue sharks in Eastern Atlantic.)

Two very large female makos, 622 and 782 lb., were caught off Long Island, NY last summer. The limited opportunities for biologists to examine large makos is a principal reason for the gaps in understanding the reproductive biology and other important life history parameters of this species.

At the laboratory, we dissected a number of sharks donated to us by commercial fishermen and aquariums. Specimens of two unusual deep water species, the Portuguese and gulper shark were captured on swordfish and tilefish longline gear. Both species are relatively small (approximately 5 feet), brown to black in color with very coarse skin. Two of the gulper sharks were pregnant and each of these had a new

generation of eggs maturing in their ovaries. Two other gulpers and a Portuguese shark were still juveniles. Samples of these sharks were preserved and sent to the Smithsonian Institution in Washington, DC. (See related abstract.)

Three sand tiger sharks that died at the Mystic Marinelife Aquarium in Connecticut were brought to the laboratory. These sharks had been on display for up to 11 years and had jaw infections and skin lesions. They also had enlarged livers which are typical of many sharks kept in captivity for long periods of time. The vertebrae and reproductive samples from these specimens were saved for studies of age, growth and reproduction.

Vertebrae and stomach samples from small (2-4 feet) blue sharks

caught off the coast of Spain were delivered to the lab by Captain Stephen Connett in September. The stomachs contained primarily squid beaks, anchovy and comb jelly remains. We found the percentage of stomachs with food (88%) was much higher compared to our samples of blue sharks from the U.S. coast (52%). Our field work in the coming year will include tournament sampling but the increasing numbers of tournaments makes it impossible for our staff to attend all of them. However, we want to know about new tournaments and will do what we can to be of assistance. We also request that tournament officials continue to send us catch data from your tournaments.

