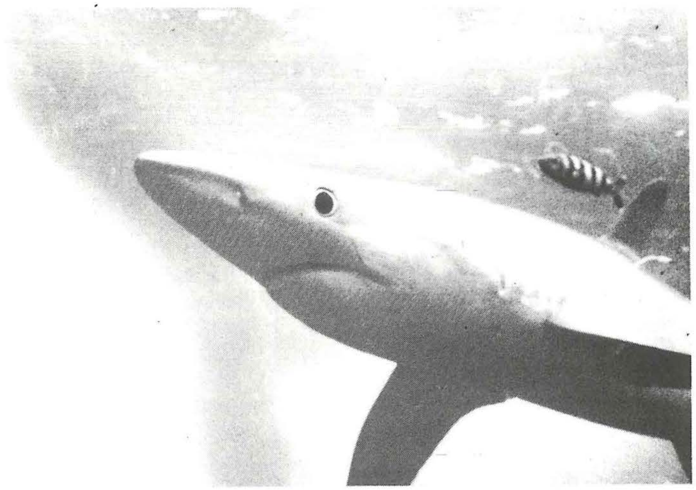
THE SHARK TAGGER 1983 SUMMARY



JOHN CASEY, HAROLD WES PRATT, CHARLES STILLWELL

PHOTO BY H. W. PRATT

WHITE SHARKS CAUGHT IN THE NEW YORK BIGHT, SEE PAGE 8.

1983 OVERVIEW

- RECORD YEAR FOR NUMBER OF SHARKS TAGGED AND RECAPTURED
- BLUE SHARKS TAGGED OFF NE COAST RECAPTURED OFF WEST INDIES AND GRAND BANKS
- SANDBAR SHARKS: RECAPTURED AFTER 17.6 YEARS AT LIBERTY
- BLUE SHARK TAGGED OFF AFRICA RECAPTURED OFF PORTUGAL (1,634 MI)
- SANDBAR SHARK TAGGED OFF NEW YORK RECAPTURED OFF MEXICO AFTER 9 YEARS
- TIGER SHARK TAGGED OFF NEW YORK RECAPTURED OFF CENTRAL AMERICA
- SWORDFISH TAGGED OFF MASS. RECAPTURED OFF FLORIDA

From January through December 1983, 5,860 fish representing 29 species of sharks and 7 species of teleosts (bony fishes) were tagged under the Cooperative Shark Tagging Program. This is a record number of releases for any year since the program began 20 years ago. The principal species tagged were blue, sandbar, dusky, and mako sharks (Table 1). U.S. rod and reel fishermen accounted for 46% of the tagging, followed by the U.S. reseach vessel *Geronimo* (20%), U.S. Fishery Observers on foreign vessels (19%), NMFS and other biologists (8%), U.S. commercial longline vessels (4%), and the Polish research vessel *Wieczno* (3%).

A total of 186 tags were returned in 1983 (Table 2). This is also a record number of recaptures in a single year. Tags were recovered from 19 species including blue (78), sandbar (27), shortfin mako (29), lemon (16), other sharks (33), swordfish (2), and marlin (1). The major categories of fishermen that accounted for the recaptures in 1983 were: U.S. sportsmen (30%); U.S. longliners (32%); foreign fishermen, primarily longliners (16%); other U.S. fishermen including NMFS and other biologists (22%). Recaptures were made by fishermen representing the following thirteen countries: U.S. (156), Japan (7), Mexico (7), Cuba (3), Canada (2), Spain (2), Bermuda (2), Puerto Rico (2), and Barbados, Poland, Italy, Algeria, and Costa Rica (1 each).

The fishermen who were responsible for tagging the 186

(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
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Northeast Fisheries Center
Narragansett, Rhode Island 02882

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Table 1. SUMMARY OF SHARKS AND TELEOSTS TAGGED, January--December 1983

SPECIES	TAGGED BY COOPERATIVE TAGGERS	NARRAGANSETT BIOLOGISTS	TOTALS
Sharks			
Blue shark	3,219	15	3,234
Sandbar shark	633	129	762
Dusky shark	399	0	399
Bull shark	23	0	23
Blacktip shark	77	0	77
Spinner shark	16	0	16
Oceanic whitetip shark	29	0	29
Silky shark	23	0	23
White shark	9	0	9
Shortfin mako shark	191	13	204
Longfin mako shark	5	0	5
Porbeagle shark	22	0	22
Sand tiger shark	6	0	6
Smooth dogfish shark	15	0	15
Bonnethead shark	6	0	6
Great hammerhead shark	4	0	4
Scalloped hammerhead shark	97	58	155
Smooth hammerhead shark	10	0	10
Atlantic sharpnose shark	149	0	149
Blacknose shark	16	0	16
Tiger shark	183	0	183
Finetooth shark	2	0	2
Lemon shark	139	2	141
Nurse shark	44	0	44
Bigeye thresher shark	41	1	42
Bignose shark	7	0	7
Angel shark	2	0	2
Basking shark	6	0	6
Reef shark	47	0	47
Hammerhead unspecified	35	0	35
Thresher unspecified	7	0	7
Sand unspecified	17	0	17
Blacktip unspecified	1	0	1
Brown/Dusky unspecified	49	0	49
Unknown*	11	0	11
Total sharks	5,540	218	5,758
Teleosts			
Swordfish	55	1	56
White marlin	14	0	14
Blue marlin	4	0	4
Bluefin tuna	2	0	2
Miscellaneous teleosts	24	2	26
Total teleosts	99	3	102
Grand Total	5,639	221	5,860

*Includes species reported as "shark".

OVERVIEW *(Continued From Page 1)*

fish recaptured in 1983 included 69 (37%) returns from U.S. sportsmen, 33 (18%) returns from the R/V *Geronimo*, 25 (13%) returns from Foreign Fishery Observers, 11 (6%) returns from U.S. longliners, 5 (3%) returns from the R/V *Wieczno*, and 43 (23%) returns from releases by NMFS and other biologists. Most of the recaptures in the biologist category were both tagged and recaptured by Dr. Samuel Gruber (U. of Miami) in conjunction with his study of the lemon shark.

The higher number of sharks tagged in 1983 compared to previous years, particularly 1982 (4,611), is largely explained by more blue sharks being tagged off New Jersey and New York by sportsmen in June 1983 (531 more than in June 1982), and an increase in releases by foreign fishery observers who tagged 355 more sharks in 1983 than in 1982. This year's tagging effort by sportsmen in the Middle Atlantic seems to support our comments in last year's newsletter that poor weather conditions and shifts in distribution might better account for lower blue shark catches in 1982 (as opposed to a decline in the overall population). The higher number of releases by U.S. fishery observers reflects an increase in their tagging efforts, rather than an increase in foreign fishing activity. Actually, a maximum of three Japanese longliners fished in the FCZ in 1983 compared to 18 in 1982. Apart from the pros and cons of allowing foreign fishing in U.S. waters, to biologists these vessels represent platforms from which to gather information and conduct studies that would not otherwise be possible. Someday, for whatever reasons, these vessels may be gone. Until then we are trying to take full advantage of the unique opportunities they offer. The U.S. observers who spend up to four weeks of sparten living on these ships have voluntarily integrated our requests for biological information and tagging into their primary regulatory duties. We recognize that their efforts are a major contribution to our studies.

Recaptures from individual species in 1983 included:

Blue sharks recaptured after 2.3 years at liberty and over a maximum distance of 1,787 miles between New York and Barbados. Another long distance recapture came from a blue tagged off the Cape Verde Islands (Africa) that was recaptured 2 years later off Lisbon, Portugal (1,634 mi). In 1983 we did not receive tags demonstrating transatlantic movements of blue sharks. The reasons for this are highly speculative because so little is known about the relationship between the stocks of blue sharks in the western Atlantic off North America and those in the eastern Atlantic off Africa and Europe. Previous tag recaptures have demonstrated some degree of mixing, but whether these represent random movements, or purposeful migrations which may change yearly, needs to be proven. We would appreciate any opportunities to increase our tagging efforts in the eastern Atlantic, and welcome suggestions from both U.S. and foreign co-operators on what we could do to encourage the return of tags. One blue shark return this year provided very precise information on its rate of movement. This shark, tagged and recaptured by an observer aboard a Japanese longliner 110 miles off Cape Cod, moved 47 miles in two days (23.5 mi/d). This is very close to the daily rate for blue sharks reported in previous newsletters from sonic tracking studies and the maximum rate computed from long-range movements.

Sandbar sharks were recaptured after a record time at liberty of 17.6 years and over a maximum distance of 1,983 miles between southern New England and Mexico. Growth information for this individual and several others are in line with our age and growth estimates provided in last year's summary. Our estimates that sandbar sharks may live to 20 or 30 years may someday be shown to be conservative. The fastest rates of travel for tagged sandbar sharks were from two individuals that traveled 633 and 871 miles and averaged 4.6 and 4.2 miles per day, respectively.

Shortfin mako sharks were recaptured after 3.4 years at liberty and over a maximum distance of 400 miles. Neither of these is a record which from previous data is 4.7 years and 1,690 miles, respectively. Most of the makos were tagged and recaptured in the Middle Atlantic Bight (MAB; Cape Cod to Cape Hatteras) which is very likely the region of highest fishing mortality for makos anywhere within their range. As a highly desirable species from both a recreational and commercial stand point, there has been concern voiced by sportsmen about overfishing the mako population. As we have pointed out previously, sharks in general are susceptible to intensive fishing, and therefore, concern about overfishing any species is justified. However, the mako population appears to be in relatively good shape based on the numbers caught and the sizes represented in the population. In 1983, small sizes (i.e., 2-3′), were quite common in the recreational catches in the MAB and in the longline fishery from Cape Hatteras to the Grand Banks. Other sizes up to 300 lb were also well represented. From out observations over the past 20 years mako fishing has never been better. There are no simple explanations as to why, but one possibility is that mako abundance is related to the high abundance of bluefish, their principal prey. If bluefish are an important controlling factor, then a sharp decline in the bluefish cycle may also affect mako abundance. In the meantime our advice is to maintain your concern, enjoy the mako fishing, and please tag the small ones as an investment in the future.

Other species.--Some of the more interesting long-term recaptures were from a **dusky shark** at liberty for 5.5 years, a **sharpnose shark** after 6 years and a swordfish after 3 years. Long distance recaptures included a new record for a **tiger shark** that traveled 1,853 miles from off New York to Costa Rica. This recapture provided new information on the rate of sustained movement by a tiger shark at 9.8 miles per day. Another long distance recapture came from a **bignose shark** tagged off S. Carolina that was recaptured off Yucatan, Mexico (1,049 miles). This is the longest distance shown by this species and is the second to show movement from the east coast into the Gulf of Mexico.

FOOD STUDIES IN JUVENILE SANDBAR SHARKS

The following article was prepared by Robert Medved, a University of Rhode Island Graduate Student working with our group on shark feeding habits. This work was supported in part by a grant from the Montauk (N.Y.) Captains' Association.

The study of food consumption in sharks can lead to a better understanding of the amount of energy they require for growth and daily activities. In addition, knowledge of the type and amount of food consumed by sharks is vital for assessing the impact of predation by sharks on important stocks of prey species. Although the prey of some sharks is known, very little has been learned about the amount of food consumed by sharks. Traditionally, food consumption in fishes has been studied in hatcheries or in laboratory aquaria under carefully controlled conditions. Unfortunately, these methods are not suitable for most sharks because they are difficult to maintain in captivity. An alternative method for studying food consumption is to measure the amount of food in stomachs at different times to determine the rate of food intake and the rate of gastric evacuation (emptying of the stomach). During the past several summers we have been collecting data of this sort for young (52 to 100 cm total length) sandbar sharks in the area of Chincoteague Bay, Virginia. The sandbar shark was selected for this study because it is an abundant, inshore shark known to eat commercially valuable species such as blue crabs.

The rate at which food is emptied from the stomach was investigated in a fenced off area (100 m x 75 m x 4 m) in the natural environment. Sharks were captured with rod and reel fishing gear and were transported to the enclosure in a large holding tank. Before being released, the stomach of each shark was pumped to remove all food. Each animal was then fed a preweighed meal of either soft blue crab or menhaden and was released in the enclosure. At various times after feeding the sharks were retrieved and the amount of food remaining in the stomach was measured. During the study 98 sharks ranging in size from 53 to 87 cm TL were fed and released. The results indicated that the passage of food from the stomach was relatively slow compared to other species of fish that have been studied. The average time required to completely evacuate a meal from the stomach was approximately 75 h. Meals of menhaden were evacuated from the stomach slightly slower than were meals of soft blue crab.

Comparative information on the types and amounts of food in the stomachs of sharks in the wild was obtained by examining the stomachs of 414 sharks captured by gill nets and rod and reel fishing gear. The primary food items were soft blue crabs and menhaden. Blue crabs were found in 67.4% and menhaden in 13.3% of the stomachs examined. Other species of crabs and fishes were found in only a small percentage of the stomachs and 17.9% of the stomachs were empty. Data collected concerning the amount, stage of digestion, and number of items of food in the stomachs indicated that feeding occurred during relatively short periods of time (12 h) separated by long periods (60 h) during which food was digested. The average quantity of food in the stomachs was 0.96% of body weight and the maximum quantity was 5.28% of body weight. The quantity of food in all stomachs was substantially less than the estimated maximum stomach capacity (13.0% of body weight). Finally, sharks caught between 0130 and 0430 h were found to contain considerably more food than those caught during other times of the day, suggesting that the early morning hours may be a period of increased feeding activity for this species.

The information concerning gastric evacuation and stomach contents is presently being used to construct a mathematical model of food consumption for the sandbar shark. This model will not only provide an estimate of the amount of food consumed by the sandbar shark, but should also give an indication of the impact by other sharks on important prey species, some of which are commercially valuable.

RESEARCH CRUISES AND FIELD STUDIES, 1983

Our field studies in 1983 included a longline cruise aboard the Polish research vessel R/V WIECZNO, gillnet fishing in Chincoteague Bay, Virginia, and attendance at several fishing tournaments held from Massachusetts to New Jersey.

The research cruise covered the area from Hudson Canyon south to Cape Hatteras, NC, primarily in the Gulf Stream and in a cold core ring (approximately 60 miles in diameter) in the Sargasso Sea about 180 miles east of Cape Hatteras. The primary purpose of the cruise was to collect biological samples for studies of age and growth, reproduction and food habits, and to tag sharks and tunas for migration studies. Dr. Frank Carey (WHOI) also tested acoustic equipment for detecting concentrations of prey species and cooperating biologist George Benz, collected shark parasites, (see article on page 6). Thirteen species of sharks and teleosts (276 fish) were taken during the cruise. Ninety-one were tagged and the rest were brought on board for study. The predominant species were scalloped hammerheads, blue sharks, mako sharks, and yellowfin tuna. Blue sharks accounted for 22 of the 26 fish caught in the cold core ring. Analysis of the stomach contents from 13 of these sharks showed they had been feeding on longnose lancetfish, a long, slender species found off the edge of the continental shelf. Although we have previously found lancetfish in stomachs of sharks captured offshore, the number found during this cruise was unusually high. From available evidence, cooler temperatures in the cold ring tended to concentrate both blue sharks and lancetfish. Eight lancetfish were also caught on the longlines set in the ring. The numbers of blue sharks diminished as we moved out of the cold ring and into the Gulf Stream off Cape Hatteras. Scalloped hammerheads predominated in the catches in this area, followed by makos, yellowfin tuna, and blue sharks. Squid was the principal prey for these predators; however, the stomachs of a few hammerheads also contained remains of goosefish and small tuna-like fish, possibly bullet or frigate mackeral. A few makos also contained these small tuna-like fish. In addition to small squid, the yellowfin tuna fed on small shrimp-like animals (amphipods, euphausids) and a variety of small fish usually associated with sargasso weed and flotsam.

The purpose of the Chincoteague Bay trip in late June was to collect data on food habits, and to compare body weights and liver weights from sandbar shark pups.

Staff biologists attended eleven tournaments this year and examined 283 sharks (8 species) and 46 bluefin tuna. Volunteers covered four tournaments held on Long Island, NY, and reported length-weight data from 79 sharks (6 species). The dominant species were mako, blue and sandbar sharks. Reports from volunteers at three tournaments held along the Gulf coast of Florida included length and weight measurement from 106 sharks representing nine species. These records provided by Steve Candileri are important in that they provide us with data on abundance and species composition of sharks in areas beyond our travel capabilities.

Table 2. Tag recoveries: January-December 1983

SPECIES	GENERAL LOCATIONS		MONTHS/ LIBERTY	DIST. & DIR. TRAVELLED N. MI.		CAPTURE METHOD		TAGGED BY	
	TAGGED	RECAPTURED				TAGGING	RECAPT.	TAGGER	RESIDENCE
Blue shark	S Marbella, Spain	N Algers, Algeria	16	481	E	RR	LL	Gordon Bland	Spain
" "	S Montauk, NY	S Montauk, NY	<1	11	N	FS	RR	Jordan Hall	NY
" "	SE Montauk, NY	SSE Montauk, NY	1	44	S	RR	RR	Joe McBride	NY
" "	SSE Montauk, NY	SSE Ocean City, MD	4	245	SW	LL	LL	Stephen Connett	RI
" "	S Montauk, NY	SSE Cape Lookout, NC	4	458	SW	RR	LL	Bob Mahoney	CT
" "	SE Marthas Vineyard, MA	SE Cape Lookout, NC	6	523	SW	LL	LL	Stephen Connett	RI
" "	SSE Bermuda	W Cape Canaveral, FL	24	823	W	LL	LL	Butch Winters	FL
" "	S Cape Verde Islands	N Cape Verde Islands	4	648	N	LL	LL	R/V WIECZNO	Poland
" "	SW Cape Verde Islands	W Lisbon, Portugal	23	1,634	N	LL	LL	R/V WIECZNO	Poland
" "	ESE Block Is., RI	ENE Oregon Inlet, NC	9	300	SW	LL	LL	Biologist	RI
" "	SE Moriches, NY	ESE Ocean City, MD	3	164	SW	RR	LL	Joe Mistina	NJ
" "	NE Cape Hatteras, NC	E Oregon Inlet, NC	4	62	S	LL	LL	Rene Eppi NMFS Obs.	MA
" "	S Nantucket, MA	SE Shinnecock, NY	10	103	W	FS	RR	Stephen Connett	RI
" "	SE Nantucket, MA	SE Oregon Inlet, NC	4	428	SW	LL	LL	Rene Eppi NMFS Obs.	MA
" "	SSE Marthas Vineyard, MA	E Ocean City, MD	22	208	SW	LL	LL	Stephen Connett	RI
" "	ESE Montauk, NY	SE Fire Is., NY	10	86	SW	FS	RR	Mario Pagano	RI
" "	S Marthas Vineyard, MA	SE Fire Is., NY	23	115	SW	LL	RR	Alan Criss NMFS Obs.	MA
" "	SE Shinnecock, NY	SE Shinnecock, NY	<1	7	NW	FS	RR	Robin Lehman	NY
" "	ESE Block Is., RI	SE Montauk, NY	<1	13	SW	RR	RR	Andy D'Angelo	RI
" "	SSE Manasquan, NJ	S Montauk, NY	<1	103	NE	FS	RR	Bob Penn	NY
" "	S Shinnecock, NY	SSE Shinnecock, NY	<1	16	E	FS	RR	Shaler Carrington	NY
" "	S Shinnecock, NY	SE Shinnecock, NY	<1	11	NE	FS	RR	Gloria Dunn	NY
" "	SE Jones Inlet, NY	SE Jones Inlet, NY	<1	15	SE	FS	RR	John McShane	NY
" "	SW Marthas Vineyard, MA	SW Marthas Vineyard, MA	24	9	NE	LL	HL	Stephen Connett	RI
" "	S Marthas Vineyard, MA	SE Montauk, NY	10	53	NW	LL	RR	John Rosapepe NMFS Obs.	MA
" "	S Shinnecock, NY	S Montauk, NY	<1	30	E	RR	RR	Robin Lehman	NY
" "	S Marthas Vineyard, MA	SE Block Is., RI	10	35	W	LL	RR	Stephen Connett	RI
" "	S Cape Verde Islands	SSE Cape Verde Islands	4	319	SE	LL	LL	R/V WIECZNO	Poland
" "	SE Fire Is., NY	SE Montauk, NY	12	58	NE	RR	RR	Al Andrus	NY
" "	E Beach Haven, NJ	SE Shinnecock, NY	1	80	NE	RR	RR	Ralph Leyner	NJ
" "	SE Fire Is., NY	SSW Moriches, NY	<1	24	NW	RR	RR	Robert McReynolds	NY
" "	S Marthas Vineyard, MA	ESE Nantucket, MA	1	172	E	LL	LL	Stephen Connett	RI
" "	SE Barnegat, NY	SW Marthas Vineyard, MA	2	149	NE	RR	RR	Mike Goione	NJ
" "	S Nantucket, MA	SW Nantucket, MA	<1	24	NW	HL	HL	Stephen Connett	RI
" "	S Moriches, NY	S Marthas Vineyard, MA	<1	75	NE	HL	RR	Stephen Connett	RI
" "	SE False Cape, VA	S Marthas Vineyard, MA	7	331	NE	LL	LL	Rene Eppi NMFS Obs.	MA
" "	S Block Is., RI	S Montauk, NY	<1	36	SW	RR	RR	Ed Nielson	RI
" "	S Nantucket, MA	ENE Oregon Inlet, NC	4	356	SW	FS	LL	Stephen Connett	RI
" "	E Nantucket, MA	SE Nantucket, MA	10	988	W	LL	LL	Phil Ruhle, Jr.	RI
" "	ENE Oregon Inlet, NC	NE Oregon Inlet, NC	5	25	N	LL	LL	C. Idelberger NMFS Obs.	MA
" "	SE Block Is., RI	SE Block Is., RI	1	65	SE	LL	LL	Stephen Connett	RI
" "	SE Montauk, NY	SE Montauk, NY	<1	14	SE	RR	RR	Bill Haga	NY
" "	E Ocean City, MD	SW Nantucket, MA	22	231	NE	TN	TN	Jim Durkin NMFS Obs.	MA
" "	SE Block Is., RI	E Pt. Judith, RI	13	63	NW	LL	RR	Stephen Connett	RI
" "	S Pt. Judith, RI	SE Nantucket, MA	2	86	E	RR	TN	Ed Neilsen	RI
" "	SE Block Is., RI	E Nantucket, MA	27	192	E	LL	TN	Stephen Connett	RI
" "	SE Shinnecock, NY	S Nantucket, MA	2	127	E	RR	LL	Robin Lehman	NY
" "	SE Montauk, NY	S Montauk, NY	<1	70	SW	LL	LL	Stephen Connett	RI
" "	SSE Block Is., RI	Grand Banks, Canada	25	1,343	NE	LL	LL	Stephen Connett	RI
" "	SE Manasquan, NJ	S Shinnecock, NY	12	50	NE	RR	RR	Steven Rubin	NJ
" "	SW Montauk, NY	S Montauk, NY	2	25	E	RR	RR	Len Gregorio	NY
" "	SE Montauk, NY	S Montauk, NY	12	11	SW	RR	RR	Joe McBride	NY
" "	E Montauk, NY	SE Ocean City, NJ	2	197	SW	LL	LL	Stephen Connett	RI
" "	SSE Montauk, NY	SE Montauk, NY	1	119	NW	LL	RR	Robert Matus NMFS Obs.	MA
" "	ESE Block Is., RI	S Montauk, NY	13	51	W	LL	RR	Stephen Connett	RI
" "	SE Montauk, NY	SSW Montauk, NY	<1	32	SW	RR	RR	Joe McBride	NY
" "	SE Nantucket, MA	SSE Nantucket, MA	1	62	SW	LL	LL	Rene Eppi NMFS Obs.	MA
" "	SE Nantucket, MA	SE Nantucket, MA	12	65	SW	LL	LL	J. Armstrong, NMFS Obs.	MA
" "	E Nantucket, MA	SE Nantucket, MA	3	77	S	LL	LL	Wade Bailey	FL
" "	S Nantucket, MA	S Nantucket, MA	15	77	SE	LL	LL	Stephen Connett	RI
" "	E Montauk, NY	SE Montauk, NY	1	61	W	LL	RR	Stephen Connett	RI
" "	SE Shinnecock, NY	SE Montauk, NY	14	103	SE	RR	LL	Gene Holland	NY
" "	SE Nantucket, MA	E Manasquan, NJ	2	287	W	LL	LL	Brad Haskell NMFS Obs.	MA
" "	SE Block Is., RI	S Nantucket, MA	NR	100	SE	RR	LL	Al Anderson	RI
" "	E Oregon Inlet, NC	SE Charleston, SC	25	314	SW	LL	LL	Steve Bouck NMFS Obs.	MA
" "	SE Block Is., RI	E Manasquan, NJ	2	102	SW	RR	LL	Charlie Donilon	RI
" "	SE Montauk, NY	E Oregon Inlet, NC	2	339	SW	LL	LL	Stephen Connett	RI
" "	S Montauk, NY	ESE Cape May, NJ	4	136	S	RR	LL	Ted Monell	NY
" "	SE Nantucket, MA	S Nantucket, MA	<1	47	W	LL	LL	G. Hinteregger NMFS Obs.	MA
" "	S Montauk, NY	NE Oregon Inlet, NC	5	293	SW	RR	LL	Bill Hojohn	NY
" "	S Nantucket, MA	S of Halifax, Nova Scotia	2	372	NE	LL	LL	Walter Quinn NMFS Obs.	MA
" "	S Nantucket, MA	E of Nantucket, MA	4	172	NE	HL	LL	Stephen Connett	RI
" "	SSW Nantucket, MA	SSW Nantucket, MA	14	99	S	HL	LL	Stephen Connett	RI
" "	SW Montauk, NY	W Barbados	29	1,787	SE	RR	RR	Thomas Peterson	CT
" "	SW Montauk, NY	NE Oregon Inlet, NC	5	263	S	RR	LL	Murray Roth	NY
Sandbar shark	SE Montauk, NY	S Charleston Harbor, SC	4	633	SW	RR	LL	Walter Geist	NY
" "	E Little Egg Harbor, NJ	S Little Egg Harbor, NJ	1	13	S	RR	RR	Bill Figley	NY
" "	Great Machipongo, VA	SW Tampa Bay, FL	211	1,168	SW	GN	LL	Biologist	RI
" "	SSW Montauk, NY	Indialantic, FL	6	871	SW	RR	DOB	Warren Hader	NY
" "	SE Shinnecock, NY	SE Cape Hatteras, NC	7	360	SW	RR	TN	Robert Bangston	NY
" "	E Barnegat Inlet, NJ	SE Cape Canaveral, FL	44	779	SW	RR	LL	Steven Rubin	NY
" "	SE Moriches, NY	SE Murrell Inlet, SC	10	518	SW	RR	LL	Tom Leitch	NY
" "	E Stuart, FL	E Cape Canaveral, FL	8	87	N	RR	TN	Craig Paige	VA
" "	Great Machipongo, VA	Nags Head Bch., NC	215	84	S	RR	TOF	Biologist	RI
" "	Ponte Vedra Bch., FL	St. Augustine Bch., FL	<1	5	SE	BS	BS	George Sarkees	FL
" "	Hatteras Is. Pier, NC	Rodenthe Bch., NC	0	5	N	RR	DOB	Mike Raines	VA
" "	E Seaside Heights, NJ	S Chincoteague Bay, VA	35	156	SW	RR	PS	Tom Foselli	FL
" "	S Fire Is., NY	SE Block Is., RI	131	93	NE	RR	RR	Moe Gelina	NY
" "	SE Fire Is., NY	Found in ship's hold	NR	NR	NR	RR	TOF	Phil Reinish	NY
" "	E St. Augustine, FL	NE Charleston, SC	1	188	NE	RR	TN	John H. David	FL
" "	Chincoteague Bay, VA	Greenbackville Bch., VA	<1	31	NE	RR	RR	Biologist	RI
" "	Chincoteague Bay, VA	Greenbackville Bch., VA	<1	31	NE	RR	RR	Biologist	RI
" "	Chincoteague Bay, VA	Greenbackville Bch., VA	<1	31	NE	RR	RR	Biologist	RI
" "	NE Oregon Inlet, NC	E Shinnecock, NY	3	289	NE	LL	TN	Stephen Connett	RI

Table 2. Continued.

SPECIES	GENERAL LOCATIONS: TAGGED	GENERAL LOCATIONS: RECAPTURED	MONTHS/ LIBERTY	DIST. & DIR. TRAVELLED	CAPTURE METHOD: TAGGING	CAPTURE METHOD: RECAPT.	TAGGED BY: TAGGER	TAGGED BY: RESIDENCE
Sandbar shark	Chincoteague Bay, VA	Chincoteague Bay, VA	1	4 S	RR	RR	Biologist	RI
" "	Chincoteague Bay, VA	Chincoteague Bay, VA	<1	1 N	RR	RR	Biologist	RI
" "	Chincoteague Bay, VA	Chincoteague Bay, VA	1	3 S	RR	GN	Biologist	RI
" "	SE Jones Inlet, NY	E Tampico, Mexico	109	1,962 SW	RR	LL	Merv Galvin	NY
" "	S Destin, FL	Seagrove Bch., FL	1	36 W	RR	RR	Phil Gibson	FL
" "	Chincoteague Bay, VA	N Chincoteague Bay Inlet, VA	1	1 SE	RR	GN	Biologist	RI
" "	Chincoteague Bay, VA	Chincoteague Bay, VA	<1	2 N	RR	GN	Biologist	RI
" "	S Block Is., RI	SE Rio Grande, Mexico	26	1,983 SW	RR	LL	Paul D'Angelo	RI
Mako shark	SE Manasquan, NJ	E Cape Hatteras, NC	7	348 S	RR	LL	Steve Pepe	NJ
" "	S Nantucket, MA	E Oregon Inlet, NC	20	317 SW	LL	LL	Stephen Connett	RI
" "	SSE Fire Is., NY	E Cape Hatteras, NC	6	319 SW	RR	LL	John Voltz	NY
" "	SSE Montauk, NY	NE Cape Hatteras, NC	8	320 SW	RR	LL	Robert Flanagan	CT
" "	SSE Marthas Vineyard, MA	NNE Oregon Inlet, NC	7	274 SW	LL	LL	John Rosapepe NMFS Obs.	MA
" "	S Marthas Vineyard, MA	E Rudee Inlet, VA	32	255 SW	LL	LL	Gary Spake NMFS Obs.	MA
" "	SE Marthas Vineyard, MA	NE Oregon Inlet, NC	11	356 SW	LL	LL	Floyd Condit	TX
" "	E Cape Hatteras, NC	NE Oregon Inlet, NC	2	72 N	LL	LL	R/V WIECZNO	Poland
" "	SE Nantucket, MA	E Oregon Inlet, NC	7	400 SW	LL	LL	Jeff Campbell NMFS Obs.	MA
" "	SE Nantucket, MA	E Barnegat Inlet, NJ	11	266 W	LL	RR	Putnam Maclean	NY
" "	NR	SSE Jones Inlet, NY	NR	NR NR	RR	RR	Rich Chemlecki	NY
" "	S Nantucket, MA	ESE Manasquan, NJ	11	155 W	LL	RR	Stephen Connett	RI
" "	S Pascagoula, MS	N Havana, Cuba	39	347 SE	LL	LL	Brad Walters NMFS Obs.	MA
" "	E Beach Haven, NJ	SE Beach Haven, NJ	<1	14 SE	RR	RR	Ed Szewczyk	NJ
" "	E Cape Hatteras, NC	E Barnegat Inlet, NJ	4	292 N	LL	RR	Biologist	RI
" "	SSE Barnegat Inlet, NJ	SE Fire Is., NY	<1	55 NE	RR	RR	Ron Frick	NJ
" "	E Oregon Inlet, NC	S Shinnecock, NY	7	281 NE	LL	RR	C. Idelberger NMFS Obs.	MA
" "	S Nantucket, MA	SW Jones Inlet, NY	12	189 W	LL	RR	Robert Doane NMFS Obs.	MA
" "	ESE Manasquan, NJ	S Nantucket, MA	13	191 E	RR	LL	Robert Dallas	NJ
" "	E Barnegat Inlet, NJ	S Montauk, NY	<1	103 NE	RR	RR	David Mastrojohn	NJ
" "	ESE Barnegat Inlet, NJ	E Indian River, DE	11	78 SW	RR	RR	David Mastrojohn	NJ
" "	NE Oregon Inlet, NC	S Nantucket, MA	3	323 NE	LL	LL	Stephen Connett	RI
" "	S Block Is., RI	SE Montauk, NY	3	42 N	LL	RR	Stephen Connett	RI
" "	ESE Barnegat Inlet, NJ	S Montauk, NY	1	94 NE	RR	LL	Al Wimmershoff	NJ
" "	E Cape Hatteras, NC	SE Ocean City, NJ	7	206 N	LL	LL	Biologist	RI
" "	NE Cape Hatteras, NC	S Nantucket, MA	8	342 NE	LL	LL	Rene Eppi NMFS Obs.	MA
" "	E Oregon Inlet, NC	SE Fire Is., NY	12	301 N	LL	LL	Jeff Campbell NMFS Obs.	MA
" "	E Cape Hatteras, NC	E Virginia Bch., VA	41	97 N	LL	LL	Stephen Connett	RI
" "	E Ocean City, MD	SE Manasquan, NJ	3	111 N	FS	RR	Mark Leggett	MD
Lemon shark	E Bimini, Bahamas	E Bimini, Bahamas	<1	0 --	BR	BR	Dr. S. Gruber	FL
" "	E Bimini, Bahams	E Bimini, Bahamas	3	0 --	BR	BR	Dr. S. Gruber	FL
" "	E Bimini, Bahamas	E Bimini, Bahamas	19	0 --	BR	BR	Dr. S. Gruber	FL
" "	E Bimini, Bahamas	E Bimini, Bahamas	3	0 --	BR	BR	Dr. S. Gruber	FL
" "	E Bimini, Bahamas	E Bimini, Bahamas	<1	0 --	BR	BR	Dr. S. Gruber	FL
" "	E Bimini, Bahamas	E Bimini, Bahamas	3	0 --	BR	BR	Dr. S. Gruber	FL
" "	E Bimini, Bahamas	E Bimini, Bahamas	11	8 NW	LL	LL	Ron Schatman	FL
" "	E Bimini, Bahamas	E Bimini, Bahamas	3	0 --	BR	BR	Dr. S. Gruber	FL
" "	E Bimini, Bahamas	E Bimini, Bahamas	3	0 --	BR	BR	Dr. S. Gruber	FL
" "	E Bimini, Bahamas	E Bimini, Bahamas	12	0 --	BR	BR	Dr. S. Gruber	FL
" "	E Bimini, Bahamas	E Bimini, Bahamas	12	0 --	BR	BR	Dr. S. Gruber	FL
" "	E Bimini, Bahamas	E Bimini, Bahamas	12	0 --	BR	BR	Dr. S. Gruber	FL
" "	E Bimini, Bahamas	E Bimini, Bahamas	12	0 --	BR	BR	Dr. S. Gruber	FL
" "	E Bimini, Bahamas	E Bimini, Bahamas	12	0 --	BR	BR	Dr. S. Gruber	FL
" "	E Bimini, Bahamas	E Bimini, Bahamas	3	0 --	BR	BR	Dr. S. Gruber	FL
" "	E Bimini, Bahamas	E Bimini, Bahamas	4	0 --	BR	BR	Dr. S. Gruber	FL
" "	Key Colony Bch., FL	Key Colony Bch., FL	<1	0 --	RR	RR	William Botten	FL
" "	E Bimini, Bahamas	E Bimini, Bahamas	12	2 E	BR	LL	Dr. S. Gruber	FL
" "	Islamorada Keys, FL	Islamorada Keys, FL	4	2 E	RR	RR	Tom Holloway	FL
Tiger shark	NE San Juan, Puerto Rico	S La Parguera, Puerto Rico	25	145 SW	LL	LL	Butch Winters	FL
" "	S Fire Is., NY	E Limon, Costa Rica	6	1,853 S	RR	LL	Jesse York	NJ
" "	E Bimini, Bahamas	E Bimini, Bahamas	<1	6 SE	LL	LL	Dr. S. Gruber	FL
" "	S Marathon, FL	E Isla Mujeres, Mexico	29	378 SW	LL	LL	Stephen Connett	RI
" "	E Aransas Pass, TX	SE Galveston, TX	4	76 NE	LL	LL	Steve Branstetter	TX
" "	SE Manasquan, NJ	E Cape Hatteras, NC	1	300 S	RR	GN	Mike Marcon, Jr.	NJ
Dusky shark	SW Bermuda	W Bermuda	5	5 NW	LL	LL	Brian Luckhurst	Bermuda
" "	SW Jones Inlet, NY	ESE Cape Lookout, NC	8	351 S	RR	LL	Steve Horton	NY
" "	W Bermuda	W Bermuda	10	21 W	LL	RR	Stephen Connett	RI
" "	WSW Dry Tortugas, FL	S Mobile Bay, AL	66	371 NW	LL	LL	Jonathan Lucas	MA
" "	E Barnegat Inlet, NJ	E Oregon Inlet, NC	2	244 S	RR	TN	Pete Barrett	NJ
" "	N Miami, FL	E Juno Bch., FL	<1	52 N	RR	RR	Dave Kerwin	FL
Atlantic sharpnose	E St. Lucie, FL	SE Charleston, SC	3	261 NE	RR	LL	Bob Pelosi	FL
" "	E Cape Hatteras, NC	Yaupon Bch., NC	11	198 SW	RR	GN	B. W. Wilson	NC
" "	ESE Port Aransas, TX	E Puerto Mezquital, Mexico	36	123 S	RR	RR	Tom Sealy	TX
" "	Walker's Cay Bch., Bahamas	Walker's Cay Bch., Bahamas	22	0 --	RR	DOB	Ron Schatman	FL
" "	S Aransas Pass, TX	SE Rio Grande, Mexico	73	115 S	RR	RR	Todd Baxter	TX
Blacktip shark	E Ponte Vedra Bch., FL	E Fernandina Bch., FL	1	40 N	RR	LL	Steve McEvoy	FL
" "	SW St. Mark's, FL	NW St. Marks, FL	1	30 NW	RR	RR	Bob Lively	GA
Silky shark	N Puerto Rico	W Puerto Rico	5	56 SW	HL	LL	Steve Candileri	FL
" "	E Jacksonville, FL	SE Savannah, GA	2	74 N	LL	HL	Stephen Connett	RI
" "	N Jupiter, FL	W Celestún, Yuc., Mexico	27	723 SW	LL	LL	Stephen Connett	RI
Smooth hammerhead	SE Jacksonville, FL	E Atlantic City, NJ	28	643 NE	RR	RR	Wayne Bazar	FL
" "	S Rudee Inlet, NC	E Great Machipongo, VA	25	82 NE	RR	RR	Bill Moffett	VA
Scalloped hammerhead	E Cape Hatteras, NC	S Vero Bch., FL	5	542 SW	LL	DOB	Steven Connett	RI
Bignose shark	SE Charleston Harbor, SC	E Chinchorro Banks, Mexico	33	1,049 SW	LL	LL	Biologist	RI
Smooth dogfish	S Pascagoula, MS	ENE Mississippi River, LA	12	13 SW	TN	TN	G. Gudmunson NMFS Obs.	MA
Whitetip shark	S Cape Verde Islands	SW Cape Verde Islands	3	998 W	LL	LL	R/V WIECZNO	Poland
White marlin	ESE Ocean City, MD	ESE Machipongo, VA	1	59 SW	LL	LL	Wade Bailey	FL
Porbeagle shark	SE Nantucket, MA	SSE Nantucket, MA	<1	66 SW	TN	LL	A. Poshkus NMFS Obs.	MA
Night shark	SE Charleston, SC	SE Savannah, GA	11	1 S	LL	LL	Ron Schatman	FL
Swordfish	SSE Charleston Harbor, SC	E Georgetown, SC	36	73 NE	LL	LL	Phil Ruhle, Jr.	RI
"	SSE Nantucket, MA	E Pompano Bch., FL	20	971 SW	LL	LL	Harold West NMFS Obs.	MA

NOTE: BR=Block Rig; BS = Beach Seine; DOB=Dead on Beach; FS=Free Swimming; GN=Gill Net; HL=Hand Line; LL=Longline; NR=Not Reported; Obs.=Foreign Fisheries Observer; PS=Purse Seine; RR=Rod & Reel; TN=Trawl Net; and TOF=Tag Only Found.

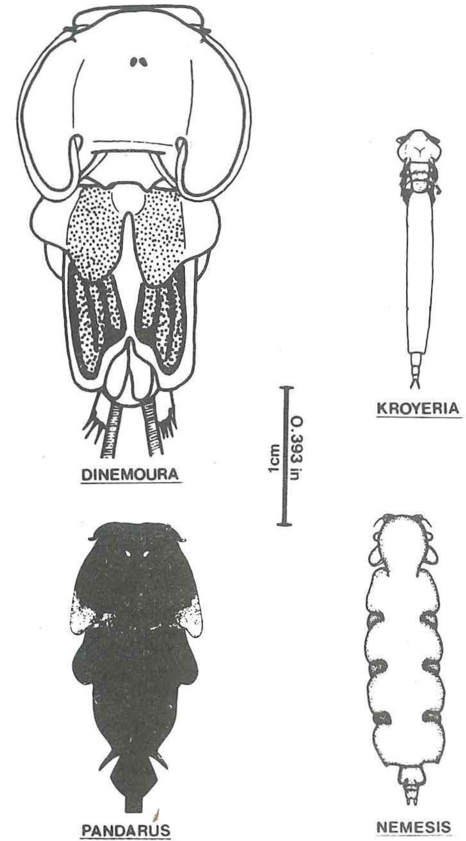
SHARK HITCHHIKERS

George Benz a fisheries biologist with the Connecticut Department of Environmental Protection, is working toward an advanced degree in parasitology at the University of Connecticut. He has worked closely with us in collecting shark parasites and we asked him to write the following account of these poorly understood animals.

"It's a wormy world," my major professor often exclaims . . . and when one considers that of all living organisms, parasites far outnumber nonparasites in both total kinds and numbers, one must regrefully admit he's absolutely correct. To ensure the completion of their life-cycles, parasites must be attuned to the ways and whims of their hosts because to harm their host is to weaken their home. Due to this, valuable insights concerning the natural histories of sharks can be gathered by studying their parasites. With this in mind, I have spent a good deal of time since 1978 picking, poking, prodding, and pulling parasites from sharks and other large oceanic gamefishes landed at sport fishing tournaments and upon research cruises (my thanks to all who have allowed me to examine their catch or have assisted otherwise in my apparently perverse research activities). Here I will present several interesting examples of shark-parasite associations which commonly occur in New England waters.

Many fishermen have probably noticed clusters of what are commonly called "fish lice", or fish crabs, on sharks. These sinister-looking organisms are more formally known as copepods, and being crustaceans, they are in fact related to "true" crabs. The thread-like strands seen trailing from the posteriors of some female individuals are egg sacs. When ruptured, these sacs release many microscopic, free-swimming larvae. Each larva passes through a number of molts, eventually reaching an infective stage which attaches to a shark and subsequently matures. Each species of parasitic copepod generally has a preferred host, and will typically seek a specific attachment location on that host to call its home. For example, most shark fishermen are familiar with shiny brown buttons in clusters around the caudal keel of the shortfin mako. This is the copepod *Dinemoura latifolia* (I must apologize for such tongue twister names, however, not surprisingly, few parasites possess common names). Blue sharks also have their characteristic copepods, and no doubt many are familiar with the large cobblestone-like clusters of black copepods on the blue's pectoral fins. These copepods are *Pandarus satyrus*, and if examined close-up their shape will probably remind you of the villainous character Darth Vader of the movie series "Star Wars". *P. satyrus* feeds on the skin and mucus of the blue shark, and by itself, presumably represents a minor energy tax to its shark host.

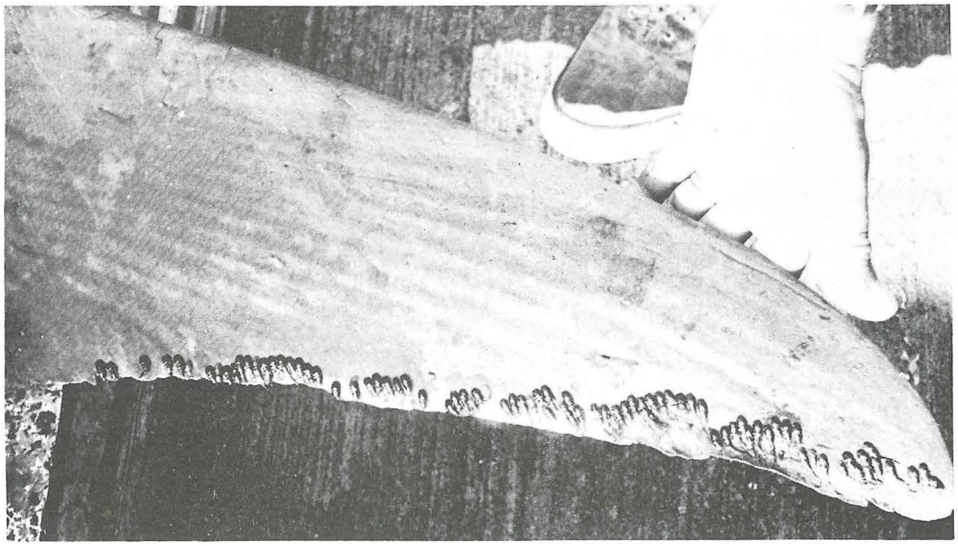
Less often noticed by fishermen is the copepod *Kroyeria carchariaeglauci*. This slender, tubularly-shaped copepod can almost always be found living in the water channels between the gill filaments of the blue shark. *K. carchariaeglauci* are relatively good swimmers, and appear to routinely venture up onto the gill lamellae where they dine on gill tissue and blood. Such a feeding habit could obviously cause considerable problems for a shark if many of these copepods infested the gills. However, concerning the numerous blue sharks I have examined, *K. carchariaeglauci* individuals have been noticed to uniformly distribute themselves over the gills; females, one between each gill filament, and dwarf males, apparently roaming free in search of females. Such a distribution pattern is suggestive of a behavioral response on the part of the copepod



which ultimately reduces the chances of causing extensive gill damage, and thus helps to assure the health of the blue shark and a home for its *K. carchariaeglauci* population.

The shortfin mako also hosts a species of parasitic copepod which prefers to attach to its gills--*Nemesis lamna*. *N. lamna* is a robust copepod with powerful holding appendages which it wraps around a gill filament of its mako host in a fashion similar to a man, hugging a barrel.

Leeches, flukes, and tapeworms also commonly parasitize sharks. Tapeworms are particularly well represented and in a single shark often number in the thousands. Adult tapeworms are found living in the shark's spiral valve (the equivalent of our small intestine), and are acquired by eating food infected with larval stages of these worms. Like copepods, various species of tapeworms parasitize various hosts. A study of tapeworms, therefore, can often reveal information about the diets of fishes without the necessity of finding food remains in their stomachs. As an example, a recently harpooned white shark whose stomach was empty (it possibly had been everted during its life and death struggle) had thousands of mature tapeworms belonging to the genus *Phyllobothrium* in its spiral valve. The fact that the flesh of cetaceans commonly is riddled with late larval stages presumed to be this worm probably indicates that this particular white shark had in the past fed on a whale or porpoise.

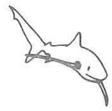


"COPEPOD PARASITES" *PANDARUS SP.* ON BLUE SHARK

(Continued On Page 7)

Shark Hitchhikers (Continued From Page 6)

The list of interesting shark-parasite associations seems endless, and each case gives us some additional tidbit of information about the lives of sharks. Few, if any, of the parasites reported from sharks represent any danger to humans, and when shark flesh is properly cooked, the danger of becoming a parasite's host is virtually nonexistent. So next time you land a shark, feel free to let your inhibitions run wild and do some picking, poking, prodding, and pulling of your own.



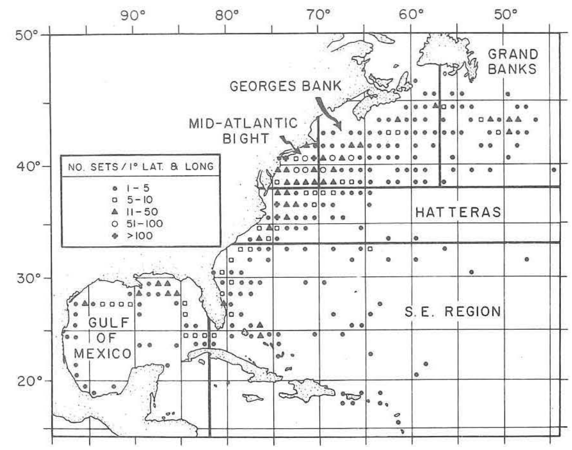


Figure 1. Longline effort from selected research and commercial vessels 1957-1982.

SPECIES COMPOSITION OF PELAGIC LONG-LINE CATCHES

This article by Dr. John Hoey is from his Ph.D. thesis. John worked with us for several years analyzing longline information on swordfish, sharks, and tuna. He is now with the South Atlantic Fishery Management Council.

Longline fisheries directed at swordfish, tuna, and sharks can be better understood by comparing their target species with the other species they capture (their incidental by-catch). With this information we can assess the impact of various pelagic longline fisheries. The results can be considered in developing management strategies and in making decisions about resource allocation. Several nations, including Canada, Cuba, Denmark, Japan, Korea, Norway, and the United States currently engage in longline fisheries primarily for tuna and swordfish in the Western North Atlantic. Danish, Norwegian, and U.S. fishermen have fished commercially for sharks in the past, and U.S. commercial swordfish longliners retain a small portion of their shark by-catch for a limited U.S. market. Use of longline fishing gear has been widespread in the past two decades., However, there is very little information on the size and species composition of the incidental by-catch. We collected information from U.S. fisheries for swordfish, tuna, and sharks. Records from over 2,500 sets of gear accounting for 1.9 million hooks and the capture of over 92,000 sharks and teleosts (bony fishes) were analyzed. The fishing area included the Gulf of Mexico and the east coast of North America to the Tail of the Grand Banks (Figure 1). Information was also obtained from U.S. observers stationed aboard Japanese vessels fishing within the U.S. Fishery Conservation Zone (FCZ). They recorded catches of 143,000 sharks and teleosts on 2,272 sets with total effort exceeding 4.9 million hooks.

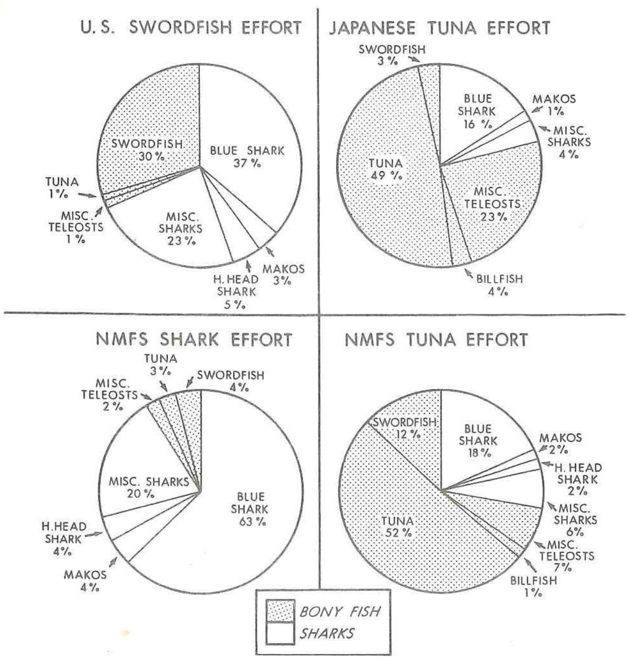


Figure 2. Species composition (%) from longline fisheries in the Western North Atlantic.

The relative proportions of the various species caught by each longline fishery are shown in Figure 2. The U.S. swordfish effort and the Japanese tuna effort are established commercial fisheries, whereas the NMFS shark and tuna effort is more exploratory in nature. Directed tuna effort (both NMFS and Japanese) produces a larger proportional catch of teleosts than does effort directed at swordfish and sharks. Tuna fisheries produce higher proportions of billfish (excluding swordfish) and other teleosts, whereas the swordfish fishery produces a higher shark by-catch. These results indicate similarities in activity patterns between swordfish and sharks which are more active at night, and tunas and billfish, which are more active during the day. Fishermen exploit these differences by fishing primarily during the nighttime for swordfish and during the daytime for tunas. Fishermen also attempt to fish within the preferred temperature range of their target species by regulating the depth of the line and fishing in different geographic areas. Differences in fishing grounds partially account for differences in the proportion of swordfish caught by the Japanese and NMFS tuna fisheries (3.4% vs 12.4%, respectively). The NMFS tuna effort occurred primarily north of Cape Hatteras and was directed at bluefin tuna. The Japanese effort was more evenly distributed throughout the Gulf of Mexico and Atlantic FCZ, and was primarily directed at yellowfin, bigeye, and albacore tuna. Relatively large catches of bluefin tuna were often associated with large catches of swordfish in both the NMFS and Japanese data. This relationship reflects greater similarities in temperature preferences, between swordfish and bluefin tuna than between swordfish and the more tropical tunas. With respect to differences in catch during the day and night, the proportion of billfish (marlins) caught by the NMFS tuna effort (daytime) was double that produced by the commercial swordfish effort (night), despite greater swordfish effort in southern areas where billfish are more abundant.

Information on the species composition in the different longline fisheries is essential for biologists attempting to understand migrations, seasonal distribution, and other elements of the biology of potentially important species, particularly some of the large sharks about which almost nothing is known. Moreover, detailed by-catch information is vital to any attempt to effectively manage this highly pelagic community on a multispecies basis.

NOTE: The data base for the above summary includes 20 years of detailed logbook records from Captain Philip Ruhle (Newport, RI), other commercial catch records, and results from research cruises. We are indebted to Capt. Ruhle for this information. It is ironic that he and other swordfish fishermen who provided us with information have switched to different gear and are no longer in the swordfish fishery.

DISTRIBUTION OF THE WHITE SHARK IN THE WESTERN NORTH ATLANTIC

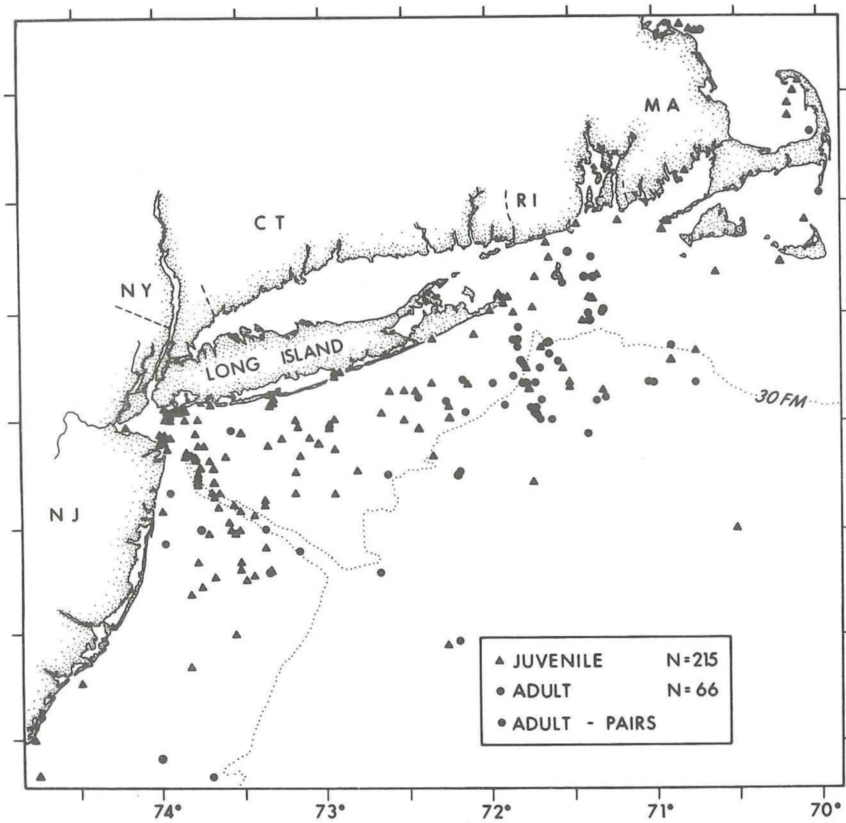
This article is extracted from a paper given by Casey and Pratt at a white shark symposium sponsored by the California Academy of Science in May of 1983.

The white shark, *Carcharodon carcharias*, has been a focus of terrifying tales by seafarers throughout history. In recent years the species has received worldwide attention in several motion pictures and a plethora of popular articles. Despite widespread publicity by the media, the fact remains that the white shark is one of the lesser known large sharks of the world's oceans. Details of its distribution and abundance in the Western North Atlantic have been poorly documented. Observations typically consist of one large white shark being dramatically caught or engaged by a sport or commercial fisherman. Because of confusion with basking sharks and makos, identifications have not always been accurate, even when the shark was landed. Because this apex predator plays a role in the ecology of whales, is actively pursued by recreational fishermen, and infrequently but dramatically interacts with man, we have combined pertinent records from the literature and recent accounts from fishermen with our first-hand observations to clarify the range and distribution of the white shark along the Atlantic coast of North America.

A total of 380 individual white shark records were obtained from: published accounts (88), the authors' data (137), and the NMFS sightings file (155). The sightings file was established by our request in the 1979 issue of *The Shark Tagger* that information on white sharks be sent to us. This is another fine example of how our cooperative taggers have helped our research. The geographical area covered by the data extends from northern Cuba to northern Newfoundland (see Figure 1).

Nearly all the records are from continental shelf waters (200 m)* with many captures and sightings from near shore where depths were less than 75 m. The number of white sharks reported along the North American coast was lowest in the most northern and southern parts of the range, i.e., the Gulf of St. Lawrence region and the Gulf of Mexico-Southeast U.S. regions, respectively. The highest number of occurrences were recorded from the Mid-Atlantic Bight (MAB), the area between Cape Hatteras and Cape Cod.

From all available evidence the white shark is more abundant in the MAB than in any other region in the Western North Atlantic. More young white sharks have been caught there than in any area of comparable size in the world. Historically a low percentage of white sharks have been taken in recreational and commercial fisheries directed toward large sharks, tunas and swordfish. Longline effort in the MAB shows 45 of 105,123 sharks (excluding dogfish) to be white sharks (1:2,336) the ratio of whites to other sharks in the Florida shark fishery during the 1940's and '50's was 1:3,704. Shark fishing tournaments off New York and New Jersey during the past 20 years reveals 26 of 5,465 sharks to be white sharks; a surprising 1:210. These are mostly juveniles. The higher abundance of white sharks in the Mid-Atlantic Bight may, in part, be



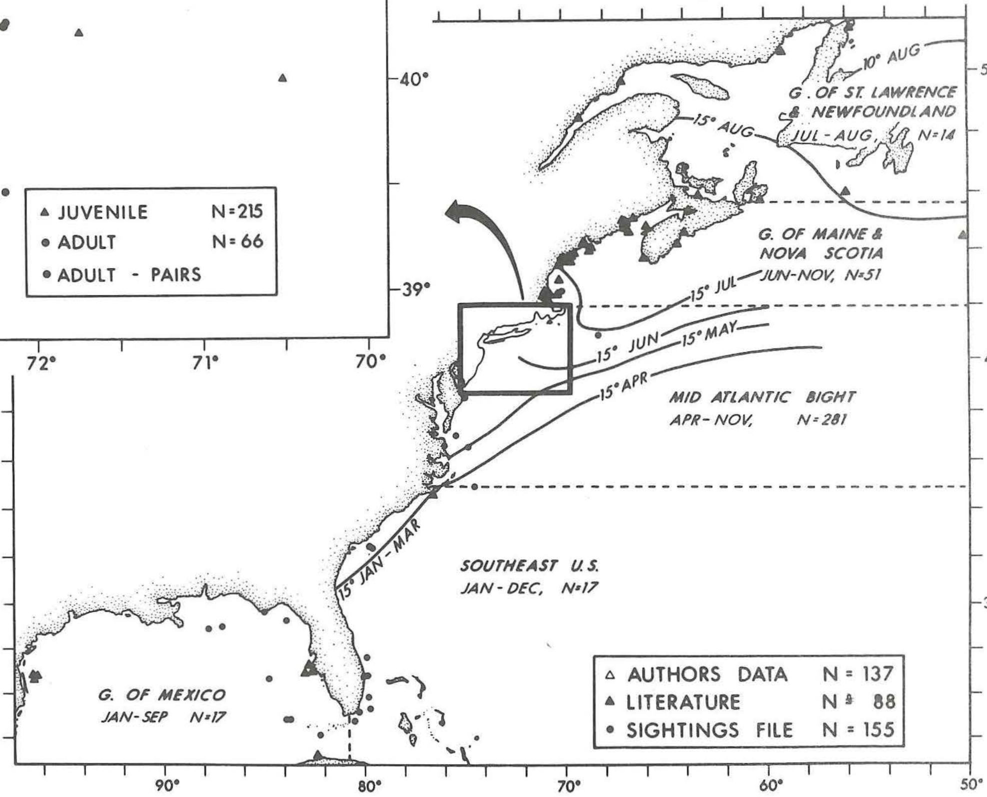


FIGURE 1: LOCATION OF WHITE SHARK CAPTURES OR SIGHTINGS IN THE WESTERN NORTH ATLANTIC

*ENGLISH/METRIC 1 FT = 30.5 CM, 1 LB = 2.2 KG

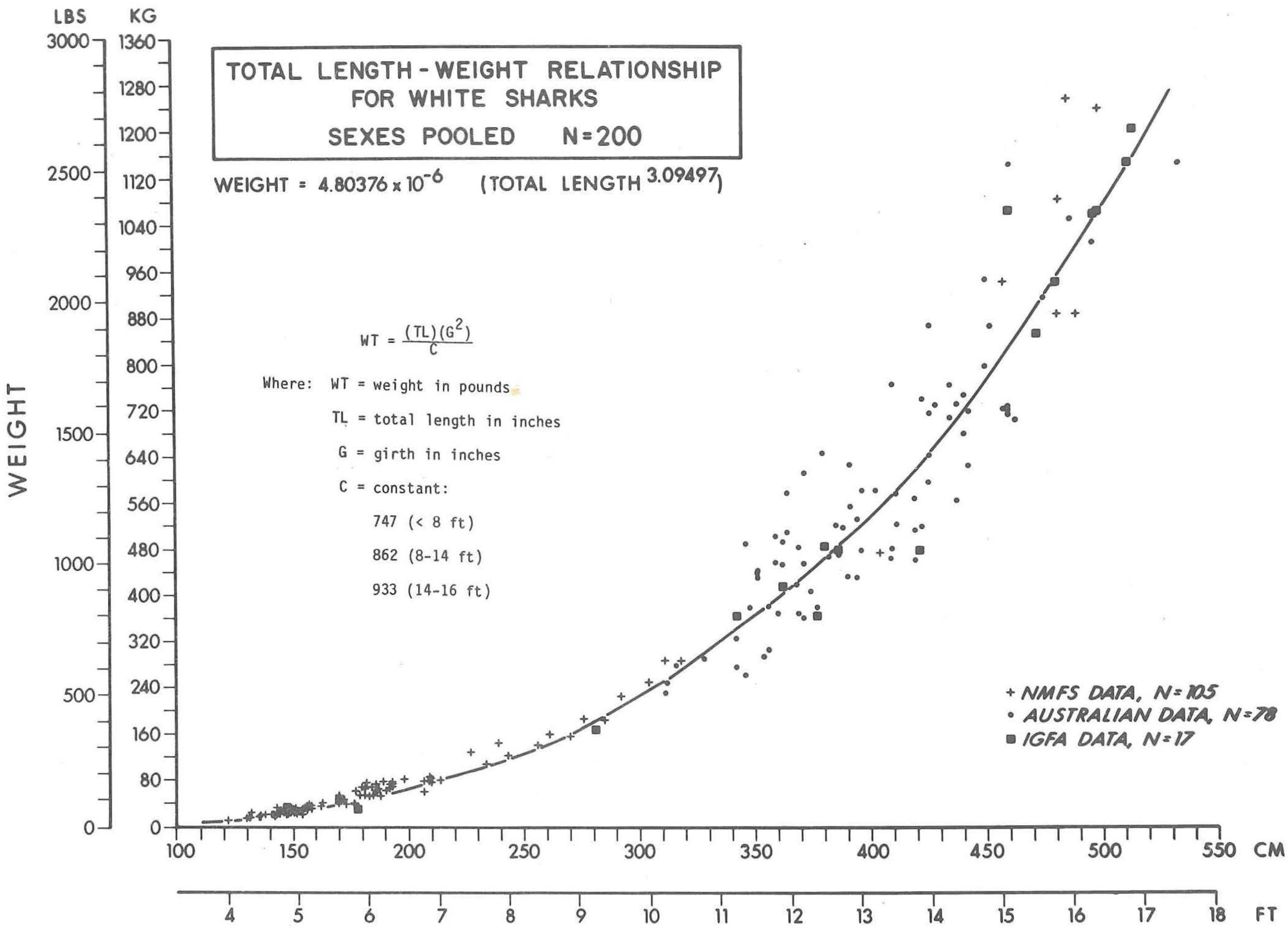


FIGURE 2: TOTAL LENGTH—WEIGHT RELATIONSHIP FOR WHITE SHARKS

explained by other factors including: (1) a disproportionate amount of field work by biologists compared to other regions; (2) more intensive recreational and commercial fisheries in this region; and (3) a closer working relationship between the authors and fishermen in the Mid-Atlantic Bight who are aware of our interest in white sharks.

Regardless of their size white sharks are more likely to occur singly or as scattered, unassociated individuals over several square kilometers. For example, in the 20 yr that 150 boats have fished a two-day tournament at Bay Shore, Long Island, the same boat has never caught more than one white shark, and four individuals is the maximum number landed at this tournament in any year. There are, however, circumstances under which white sharks have aggregated in the same area. With respect to young sharks we observed one such aggregation by catching 10 individuals on approximately 1/2 mile (1 km) of longline (32 hooks) in August, 1964 off Sandy Hook, NJ (see front cover photo). These sharks ranging in size from 132 to 198 cm total length (TL) were caught in 9 m of water approximately 1/4 mile (0.5 km) from a well attended bathing beach. We also caught young white sharks within 2 or 3 km of the beaches at Rockaway and Coney Island, NY, during the early and mid 1960's but chose not to publicize our activities in the interest of public relations. One possible explanation for the aggregation of young white sharks off Sandy Hook was that recreational boats were fishing for bluefish on Shrewsbury Rocks approximately 7 miles (11 km) south of Sandy Hook. As the boats travelled northward along the beach at the end of the day, bluefish were being cleaned and the heads and entrails were thrown overboard. Some of the young white sharks contained bluefish heads that had obviously been discarded by fishermen. Although in this case an opportunistic food source may have had a concentrating effect, the distribution of young white sharks in the inshore zone in the Mid-Atlantic Bight is not unusual and is more likely influenced by other factors including the distribution of natural prey.

With respect to adult white sharks congregating in the same area we are aware of two well documented incidents, both involving dead whales. In 1979 at least five large white sharks (305 to 457 cm TL) (to convert to English measure see Fig. 1) were observed feeding on a dead whale in the area between Montauk Point and Moriches, NY, 8 to 20 miles (13-32 km) from shore. One of these was harpooned and was 425 cm TL, 943 kg. In a similar incident, at least eight large white sharks were attracted to a dead whale floating off Block Island, RI, between August 5 and August 23, 1983. Three of these, (497, 484, and 480 cm TL and weighing 1,245; 1,261; and 1,085 kg, respectively) were harpooned. Two additional whites (518 and 610 cm estimated TL) were tagged by Captain Charles Donilon as they swam near his vessel, and three others were seen or harpooned and lost as they fed on the whale. As we have stated in previous newsletters, as much as our scientific curiosity demands that we take advantage of every opportunity to examine a white shark, we do not recommend that white sharks be indiscriminately harpooned. They are dangerous when provoked, and they are rather rare individuals that deserve to be left alone.

The size range for measured sharks in the literature was from 145 to 640 cm TL. The lengths and weights of white sharks we have examined ranged from 122 cm (12 kg) to 497 cm (1,247 kg). Lengths reported in the sightings file ranged from 105 to 945 cm. Several authors reporting on the maximum size attained by white sharks found no reliable record of a white shark exceeding a 640 cm (21 ft) specimen taken off Cuba in 1945. Although we reviewed newspaper accounts and have received

(Continued On Page 10)

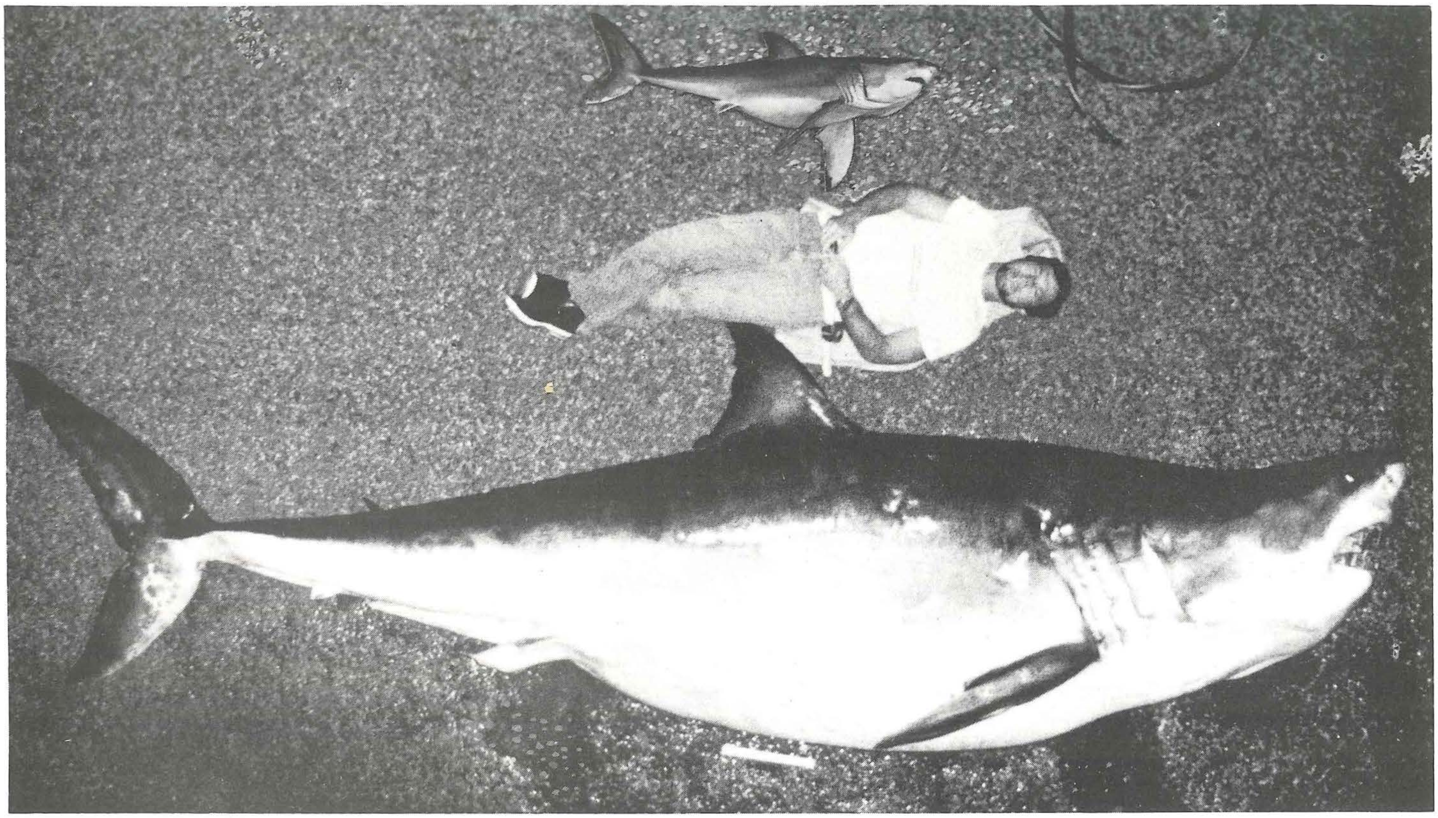


FIGURE 3: THE KNOWN SIZE RANGE OF WHITE SHARKS IN THE NEW YORK BIGHT IS SHOWN BY THESE TWO SHARKS FROM MONTAUK, NY:A 2,390 LB, 16 FT MALE, AND A 27 LB, 3½ FT FEMALE.

reports from fishermen claiming they have seen white sharks between 760 and 945 cm (25-31 ft), we have been unable to confirm any report of white sharks longer than the Cuban specimen. To our knowledge, the next largest white sharks reliably measured from the Atlantic were both 518 cm (17 ft) females. One of these was harpooned off Montauk, NY, in 1964; the other was landed after becoming entangled in a gill net near Prince Edward Is., Nova Scotia, in July 1983. The lengths and weights of the five largest white sharks we have personally examined were adult males of 497 cm (1,247 kg); 484 cm (1,263 kg), 480 cm (1,086 kg), 480 cm (886 kg) and 457 cm (943 kg). The five smallest individuals we have examined from the Atlantic were 136 cm (18 kg), 132 cm (23 kg), two 130 cm specimens each weighing 16 kg, and one 122 cm (12 kg). The latter specimen--caught off Long Island, NY, in September 1983--we believe to be the smallest free-swimming white shark on record. We also received a 122 cm specimen taken off Catalina, CA, in August 1983. This is very likely the smallest recorded specimen from the Pacific.

The length-weight curve (Fig. 2) indicates the white shark is very robust, its weight increasing an average of 456 kg (207 lb) for every 30 cm (one foot) of length between 415 and 549 cm (15 and 18 ft). Weight becomes quite variable for a given length above 11 ft. Although the weight of white sharks is of interest to fishermen and scientists, suitable scales and equipment for weighing large individuals is often not available. Estimates of weight based solely on length are questionable because weights of sharks of the same length can vary considerably due to differences in girth. Based on a total of 119 records that included measurements of length, girth, and weight, the weight of white sharks can be calculated using the formula in Fig. 2.

The capture of several white sharks, large or small, in any area gives rise to public concern that the population is increasing and represents a danger to swimmers and a detriment to the economy of resort communities. From our field studies, review of historical data, and discussions with fishermen over many years, these occurrences are more logically explained by changes in distribution related to food or environmental conditions than by an increase in abundance. Although the presence of large sharks should not be taken lightly, the white shark has not lived up to its sinister reputation off New Jersey and New York where only one shark attack (that by an unknown species) has come to our attention during the past 20 years.

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