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THE WHITE SHARK IN MAINE AND CANADIAN ATLANTIC WATERS

PAUL MOLLOMO [1]

ABSTRACT - Dispelling the popular belief that the white shark (*Carcharodon carcharias*) is accidental to northern waters, the author, through compiling local and literary documentation of the species, suggests that the white shark is a perennial, seasonal visitor to the northern Gulf of Maine.

Recently I called several Downeast Maine commercial and sportfishing companies (pers. comm., July 1997-March 1998) and asked about the presence of the white shark (*Carcharodon carcharias*) in Maine waters. Voicing what seems to be the popular opinion, they all replied: "There are none of them around here—water's too cold." The fishermans' response is, in part, justifiable. For, the white shark is commonly associated with temperate waters (14-22°C; 57-71°F) off California, South Africa and Australia (Compagno 1984). On the Atlantic seaboard, the greatest number of white shark encounters occur in similarly temperate waters of the mid-Atlantic Bight fishing banks, which extend from Cape Hatteras, NC, to Cape Cod, MA (Bigelow and Schroeder 1953, Pratt and Casey 1985).

White shark encounters have been numerous around Cape Cod. Two noteworthy encounters, in 1867 and 1928, both involved white sharks attacking and overturning fishing dories (Bigelow and Schroeder 1953). A white shark is suspected in the fatality of a swimmer off Mattapoisett in Buzzard's Bay on 25 July, 1936, and many have been seen or trapped in water 3 m or less, including off Woods Hole, MA, and Provincetown and Boston Harbors (Bigelow and Schroeder1953). In early August, 1996, a 5.1 m specimen was landed off Salem, MA, by a sports fisherman (Associated Press 1996).

North of Cape Cod, the white shark is considered an accidental visitor (Table 1, Fig. 1). The noticable absence of Maine reports and, with one exception, Atlantic Canadian reports in Ellis and McCosker's (1991) otherwise comprehensive *Great White Shark* also reveals the popular sentiment. However, when compiling the documentation, often revealed in local papers and fishery records, the white shark appears to be a perennial, rather than accidental, visitor to north Atlantic waters.

Native American Mi'kmaq tribes of Atlantic Canada seem to have encountered the white shark. In his recent curatorial report on Harry

[1] 8472 Center Road, Traverse City, MI 49686

Table 1. Chronological record of white shark records from Maine and Canadian Atlantic waters.

Date	Locality	Method	Length (m) and Sex	References
1000-2000 yrs. B.P.	Pig Is., Northumberland Strait, NS	Tooth in oyster stratum	——	Gilhen (1998)
1872 August	Eastport, ME	——	——	Bigelow & Schroeder (1948)
1874	St. Pierre, NS	Dory attack, tooth	*Ca.* 3.9	Putnam (1874)
1920 June 27	Hubbard Cove, NS	Dory attack, tooth	*Ca.* 4.5	Piers (1933)
1930 mid-June	White Head Is., NB	Herring weir	12.95, not authenticated	Vladykov and McKenzie (1935)
1931 Nov.	Casco Bay, ME	Caught in gillnet	3.9	Bigelow & Schroeder (1948)
1932 July 2	Off Digby Gut, NS	Motorboat attack, tooth	*Ca.* 4.5	Piers (1933)
1932 Nov. 22	Harbour De Loutre Campobello Is., NB	Herring weir	7.93	Piers (1933)
1938 August	Wedgeport, NS	Rod and line	2.59 (M)	Anon. (1940) cited in Templemann (1963)
1938 August	Whale Head, N Shore St. Lawrence River	——	——	Vladykov and McAllister (1961)
1942 August	Isle Caribou, N Shore St. Lawrence River	——	2.7	Vladykov and McAllister (1961)
1943 August	St. Lawrence River	——	*Ca.* 3	Vladykov and McAllister (1961)
1949 Aug. 24	Deer Island, NB	Herring weir	3.8 (F)	Scattergood et al. (1951)
1949 Aug. 27	Portneuf River estuary N Shore St. Lawrence R.	Shot	4.6	W.B. Scott
1952 Aug. 20	Between Passamaquoddy Bay &Grand Manan, NB	Observed attack on porpoise	*Ca.* 4.2	Day and Fisher (1954)
1953 July 9	Off Fourchu, Cape Breton Island, NS	Dory attack, tooth	*Ca.* 3.6	Day and Fisher (1954)
1953 July 9-10	Wedgeport, NS	Rod and line	2.4 (M)	Day and Fisher (1954)
1953 August 12	La Have Islands, NS	Herring trap	4.7	Day and Fisher (1954)
1953 August 25	St. Croix River near Dochet Is. betw. ME & NB	Observed seal attack	——	Day and Fisher (1954)
1954 August 3	Mace's Bay, NB	Herring weir	2.5	Leim, Day (1959)
1959 July 23	Pumpkin Rock, off Boothbay Hbr. ME	Harpoon	2.3 (M)	Lou Garcelon
1959 July 23	Pumpkin Rock, ME	Harpoon	1.9 (M)	Pat Elderkin
1959 August 6	Saddleback Ledge, Knox County, ME	Harpoon	3.9 (F)	U.S. Coast Guard
1959 August	Mark Is., Knox Co., ME	Harpoon	2.2	Harry Goodridge
1960 July 17	Knox County, ME	Harpoon	3.4	Harry Goodridge
1960 July 18	Off Boothbay Hbr., ME	Trawl line	*Ca.* 1.9	Lou Garcelon
1960 August	Off Camden, ME	Harpoon	2.7	Lincoln Davis
1960 Aug. 10	Mark Island, ME	Harpoon	3.3 (M)	Harry Goodridge
1960 Aug. 14	New Harbor, ME	Harpoon	*Ca.* 2.2	Sam Morton
1960 Aug. 23	SE of Cape Elizabeth, ME	Gillnet	1.8	Ole Mikkelsen
1960 Aug. 31	Off Damariscove, Whistler, ME	Harpoon	2.2 (F)	Pat Elderkin
1960 late Aug.	Isle au Haut thorofare, ME	Harpoon	*Ca.* 3.2 (M)	Reggie Greenlaw
1962 July 30	Wallace, NS	Hake gillnet	3.0	W.G. Smith
1962 August	Wallace, NS	Hake gillnet	*Ca.* 2.7	W.G. Smith
1962 August	Wallace, NS	2 observed, escaped from hake gillnets	*Ca.* 6.1	L.R. Day
1969	Passamaquoddy Bay, between ME and NB	Observed attack on porpoise	——	P.W. Arnold (1972)
1979-1986	Cross, Libby and Seal Islands, ME	4-5 sharks caught in gillnets	*Ca.* 1.8-2.4	Wendell Long and Millard Uruquart
1980 Sept. 3	Little Machias Bay Cutler, ME	Fisherman observed shark alongside neighboring boat	*Ca.* 5.5-6.1	Richard Mathieu
1983	Prince Edward Island	cod net	*Ca.* 5.2 (M)	Coad (1992)
1988 July	Off Tiverton, PEI	Gillnet	*Ca.* 4.5	Conners Bros. Ltd.

Piers, John Gilhen (1998) notes that a tooth dated 1000-2000 yrs. B.P. was unearthed from an oyster shell midden 45 to 100 cm deep on Pig Island, off Merigomish (Northumberland Strait), Pictou County, NS, 27 July, 1934. Oyster shell strata are indicative of seasonal shellfish harvesting, as noted by French explorer Pierre Biard (1616).

Bigelow and Schroeder (1953) cite several occurrences in Casco Bay, ME, at the turn of the century. More significant perhaps is the number of sharks encountered in northern waters, the Bay of Fundy and even Newfoundland, where the northern Atlantic latitudinal record (51.5 °N) stands. Several northern occurrences involve attacks on fishing dories, where the sharks were identified by fragments of teeth embedded in the oak planking (Piers 1933, Putnam 1874). Piers' (1933) account of the attack on Jeremiah Harnish and John Chandler's motorboat off Hubbard Cove, St. Margarets Bay, NS, in June, 1920, states that the harpooned shark turned on the boat, striking with such force as to throw the standing Chandler into the water. The shark continued biting at the boat, then withdrew, leaving Chandler unharmed (Piers 1933).

Other unprovoked attacks on dories appear in the record. In early July, 1953, off Fourchu, on the northeast coast of Cape Breton Island, a

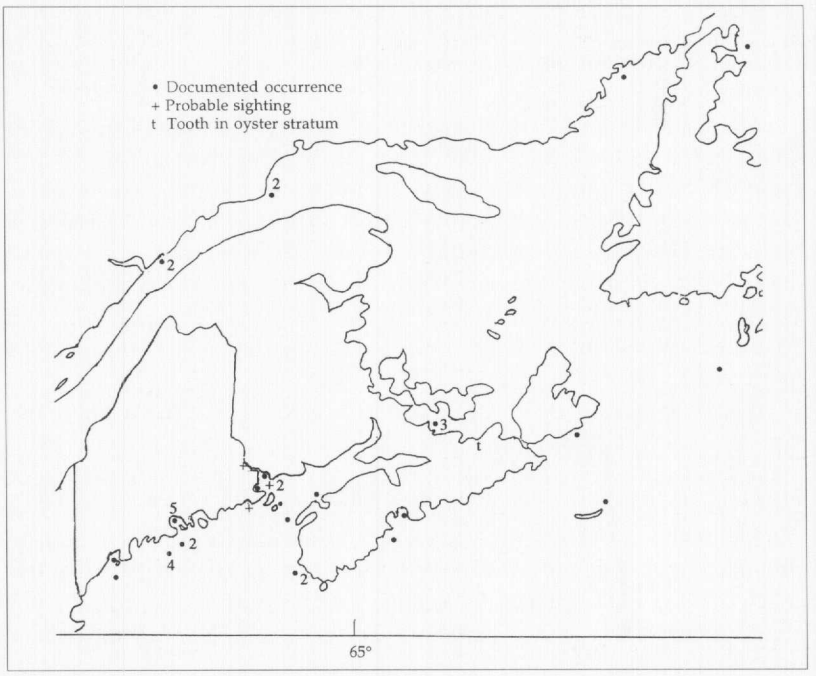

Figure 1: Distribution map of white shark sightings in Maine and Canadian waters.

large shark was seen following a 3.7 m fishing dory—the only dory in the area painted white (Scattergood et al. 1962). On July 9, a fish, thought to be the pursuant shark, smashed a 20 cm hole in the bottom of the dory, resulting in the drowning of one of the two occupants. While in the water, however, the men were unprovoked by the fish. A tooth left embedded in the planking was identified as that of a white shark, about 3.6 m long and over 450 kg.

Other white shark occurrences appear in the record. A 3.6 m specimen was harpooned and landed by Harry Goodridge of Rockport, ME, in 1960, after the shark had bitten Goodridge's pet seal Basil in half (Fig. 2). Mrs. Thalus Goodridge remembers (pers. comm., July 1997) her late husband Harry's encounters with white sharks in the early 1960s. Mrs. Goodridge points out that most people remember her husband as the owner of harbor seal (*Phoca vitulina*) André, but do not know that he also harpooned white sharks. According to Mrs. Goodridge, on August 10, 1960, Harry had led Basil out in the Penobscot Bay for exercise, when he heard a splash. He turned around and saw the water red with blood; the seal was gone. Mr. Goodridge harpooned the circling shark from his 5.8 m outboard, and was subsequently pulled around the Bay for an hour and a half. Upon examining the landed 3.3 m male shark, Goodridge discovered two seals in the gut, including Basil. In the early 1960s, Mr. Goodridge harpooned three other whites in the vicinity of Marks Island, an area he referred to as "shark alley."

Mrs. Goodridge offered a reason why so many white sharks were encountered in shark alley: they were attracted to chicken innards expelled by a chicken processing plant in nearby Belfast, ME. This is plausible, considering that from 1959-60, twelve white shark landings, including Goodridge's, were reported along Maine's coast (Scattergood et al. 1962). Eight captures in 1960, most in the vicinity of shark alley, represents the most white shark recordings for any year along the Atlantic coast. After the poultry plant closed in the mid-1960s, no more white sharks were encountered in the area.

Recent local records illustrate that the white shark is prevalent in the northern Gulf of Maine. In Cutler, ME, on September 3, 1980, three teenagers were fishing in a skiff in Little Machias Bay, only 0.8 km from shore when a shark, estimated to be 6.1 m, lunged out of the water and snagged away a fish on line. Because of the shark's great size and its rounded snout, Richard Mathieu, who was fishing nearby, believed the shark was a white shark. According to the local press release, the sighting coincided with a period of large herring schools and whale migration (Look 1980).

Possible white shark encounters have been reported by Maine fishermen, yet documentation is frequently lacking. Scattergood et al. (1962)

asserted that most sport and commercial fishermen have no interest in identifying sharks. For instance, white sharks have been called cow sharks, a name they also share with the basking shark (*Cetorhinus maximus*). Several questionable yet notable white shark landings were 1.8-2.4 m specimens inadvertantly gillnetted during 1979-1986, in the vicinity of Maine's Cross, Libby, and Seal Islands, by Millard Uruquart

Figure 2: Harry Goodridge and the White Shark that ate Basil, in Rockport Harbor, Maine, August, 1960. Photo courtesy of Mrs. Thalus Goodridge.

of Bucks Harbor, ME. Uruquart remembers (pers. comm., July 1997) that four to five sharks he landed were different from other sharks; they had white bellies and were grey on top. Uruquart stated that Wendell Long, Fisheries Warden in Bucks Harbor, identified one of these sharks as a white shark.

Not only do white sharks frequent the Gulf of Maine, but some of the largest specimens on record have been documented in its northern reaches—Passamaquoddy Bay and the Bay of Fundy. Scott and Scott (1988) cite V.D. Vladykov's account of a huge shark, believed to have been 11.3m, found dead in a herring weir on White Head Island (near Grand Manan) in June, 1930. The Scotts report that although this would be the largest white shark ever reported, confirming evidence is lacking. Again, another large (7.9 m) shark was found trapped in a herring weir off Campobello Island, NB (Piers 1933). However, due to the lack of precise measurements, these accounts remain unauthenticated. Although many unauthenticated reportings have been made exceeding 7.6 m, the largest authenticated white shark seems to be a 7.0 m specimen caught off Malta, in the Meditterranean, in 1987 (Ellis and McCosker 1991).

Explaining the phenomenon of large white sharks in cold waters Casey and Pratt (1985) stated that young white sharks (under 2 m) are abundant in the mid-Atlantic Bight, while specimens over 2 m seem to be able to withstand a broader geographical range, including the northern Gulf of Maine. Two criteria account for this phenomenon: larger white sharks feed primarily on marine mammals such as harbor seal, porpoise (*Phocaena phocaena*) and whales (Casey and Pratt 1985; Scott and Scott 1988), and the larger white sharks may be able to adapt to colder water due to internal heat exchangers, known as rete.

In any event, large white sharks frequent the northern Gulf of Maine. A 5.2 m, 907 kg white shark was caught in an otter trawl in 1971, between Bliss and Whitehorse islands, New Brunswick (Scott and Scott 1988). Dissection of the specimen on Deer Island revealed three harbor porpoise in its stomach. Another 5.2 m specimen was found dead on a Passamaquoddy Bay beach on 18 August,1977, the victim of fatal injuries sustained in a herring weir (Cleaves 1977). W.B. Scott of the Huntsman Marine Science Centre in St. Andrews, New Brunswick, identified the shark as a white shark (Scott and Scott 1988).

Day and Fisher (1954) document an August, 1952 encounter by a porpoise hunter who saw an adult (1.5 m) porpoise bitten in half by a large shark off Grand Manan, New Brunswick. Along with its size and power, the pale gray dorsal side and lighter ventral side suggest the shark could have been a white shark. Referring to this and a similar incident involving a porpoise hunter in 1969, Arnold (1972) deduced that even though authentication of the shark species was absent, the

large sizes and powerful attack capabilities excluded all Canadian Atlantic sharks except the white shark.

When asked about the female white shark, W.B. Scott (pers. comm., July 1997) recalled that numerous "nipping" lacerations on the lower fins and abdomen suggested that the shark had recently been impregnated by a male. Scott speculates that these harmless bites are inflicted during copulation, at which point the male delivers his semen through muscular claspers, into the female shark's genital opening. Evidence of such nipping is significant, for as Ellis and McCosker (1991) point out, white shark mating has never been observed. Could the Deer Island shark's lacerations indicate that Passamaquoddy Bay region is a breeding area for the white shark?

Along with their search for marine mammals, larger white sharks may be able to enter colder water due to rete, or internal heat exchangers. These vascular tissues retain metabolic heat, which in turn keep body temperature slightly higher than the surrounding water (Casey et al. 1985). The authors state that retes, combined with adult sharks' greater body mass and lower metabolic rate, allow adults to frequent colder waters in search of marine mammals, whereas younger sharks are better adapted to warmer waters, feeding on herring.

However, the rete theory is questionable. Scott (pers. comm., July 1997) suggests that as white sharks appear during the summer, they most likely swim in on warm circulation systems. Scott speculates that warm core rings which spiral clockwise off the Gulf Stream, bring pelagic species, such as the white shark and bluefin tuna, into coastal, north Atlantic waters. However, Scott points out that commercial fishing—which is most active in summer months—may explain the seasonal occurrences. At least one sighting has been recorded for late November (Piers 1933).

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