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NOTES ON SOME SHARKS IN THE
WESTERN NORTH ATLANTIC AND
BAHAMA AREAS.—During the period from
July, 1960 to July, 1961 observations were
made on the following sharks, taken in
waters of the Western North Atlantic and
Bahama areas: whitetip shark, *Carcharhinus*

TABLE 1. SHOWING THE LOCATION, SPECIES, WATER DEPTH, WATER TEMPERATURE, AND SEA STATE FOR FOUR SPECIES IN SHARKS IN THE ATLANTIC AND BAHAMA AREAS. POSITIONS OBTAINED BY CELESTIAL AND/OR LORAN FIXES BY THE AUTHOR

Date	Location	Species, Sex, and Number	Depth of Water	Water Temp. F	Sea State
7/12/60	37°30' N 72°37' W	<i>C. longimanus</i> 7 males	2015–2100 fms	63–66°	2–3
10/5/60	35°00' N 72°30' W	<i>C. longimanus</i> 2 males, 1 female	2250 fms	66°	2–3
10/10/60	37°51' N 74°05' W	<i>C. longimanus</i> 3 males, 3 females	2200 fms	63°	2
12/2/60	25°54' N 77°15' W	<i>C. longimanus</i> 2 males, 1 female	20 fms	78–80°	2
12/4/60	25°55' N 77°22' W	<i>C. leucus</i> 2 males	4–6 fms	78–80°	1–2
12/5/60	25°55' N 77°22' W	<i>G. cuvieri</i> 1 male, 2 females	4–6 fms	78–80°	1–2
12/8/60	26°00' N 75°50' W	<i>C. longimanus</i> 1 male <i>P. glauca</i> 1 male, 2 females	2600 fms	68°	0–1
2/18/61	25°50' N 75°50' W	<i>C. longimanus</i> 2 males, 1 female	2600 fms	—	1
2/19/61	25°54' N 75°50' W	<i>C. longimanus</i> 2 males, 4 females	2600 fms	71°	0
2/22/61	25°30' N 75°45' W	<i>C. longimanus</i> 2 males	2300 fms	73°	0–1
4/17/61	36°00' N 69°37' W	<i>C. longimanus</i> 1 male, 3 females	2350 fms	55–79°	2
4/21/61	36°10' N 70°35' W	<i>C. longimanus</i> 3 males	2300 fms	55°	2
5/23/61	37°30' N 70°00' W	<i>C. longimanus</i> 4 males	2440 fms	52–63°	3
6/26/61	39°10' N 70°30' W	<i>C. longimanus</i> 2 males	2400 fms	62–65°	1–2
7/25/61	34°00' N 69°30' W	<i>C. longimanus</i> 4 males	2450 fms	73°	1–2

longimanus (Poey); bull shark, *Carcharhinus leucus* (Müller and Henle); tiger shark, *Galeocerdo cuvieri* (Peron and LeSueur); and the blue shark, *Prionace glauca* (Linnaeus). Identification to species was made using Bigelow and Schroeder (1948, *Mem. Sears Found. Mar. Res. 1(1)*) and, in the case of the whitetip shark, the paper of Backus, et al. (1956, *Deep-sea Research 3: 178–88*). All animals were collected from the Research Vessel *State Star*, operated by the Daystrom Electric Division, Poughkeepsie, N. Y., while lying to on oceanographic stations, or at anchor.

Distribution.—The above animals were taken in positions as indicated in Table 1. By far the most widely distributed shark was

C. longimanus. This species was taken over a depth of 2,600 fathoms off the coast of North Carolina, to a water depth of 20 fathoms off the south coast of Great Abaco Island, B.W.I. Tiger sharks were collected in more shallow waters, less than 15 fathoms, near Great Abaco, as were the bull sharks. The blue sharks were obtained on one station over water 2,600 fathoms deep. Of special note was the occurrence of the whitetip shark in the very shallow water off Great Abaco. The presence of several caudal sections of *C. longimanus* in the stomachs of 3 *G. cuvieri* gave additional proof of the occurrence of the whitetips in the more shallow waters with the tiger sharks.

Size.—There were no exceptionally large

or small specimens taken and all measurements were within the maxima and minima for the four species reported by Bigelow and Schroeder (*op. cit.*). The *C. longimanus* fell within the size described by Backus et al. (*op. cit.*), being between the 150–250 cm total length.

Food.—No attempt was made to study the food habits of the four species collected, except for observations made on several animals during the inspections of the reproductive tracts. As previously noted (Backus, *op. cit.*), the stomachs of whitetips examined by the author had remains of cephalopods, tuna, dolphin (*Coryphaena hippurus*) and the trigger fish. Inspections of the digestive tracts of 3 specimens of *G. cuvieri* indicated they had been feeding on smaller *G. cuvieri*, *C. longimanus*, barracuda, and mackerel.

Behavior.—On oceanographic stations, the *State Star* was adrift for periods of 24–48 hours, giving excellent opportunities for taking sharks and observing their behavior patterns. All of the sharks, except *G. cuvieri*, were taken by drifting hooks baited with meat chunks. The baited shark hooks were suspended about 18 inches beneath orange plastic seine floats using small-link chain leaders. The floats were drifted approximately 100 feet from the side of the vessel on ¼-inch manila line. *G. cuvieri* were taken off the bottom by removing the seine floats and lowering the hooks to the vicinity of the feeding sharks, while lying at anchor.

Of considerable interest were the observations that *C. longimanus* would approach the orange seine floats, nosing them and playing them for a few minutes, prior to diving and taking the baited hooks. On four separate occasions a series of four floats—one orange, one yellow, one blue-green, and one black—were baited as above and drifted from the vessel on separate lines. Of the 17 sharks taken using this method of fishing, all were caught either on orange or yellow floats. This suggests that *C. longimanus* is attracted by orange–yellow colors and search for and find their food both visually and olfactorially. The use of high visibility orange colors in life-saving equipment, therefore, may be attractive to *C. longimanus*.

During a personal communication with watch officers of the submarine U.S.S. *Requiem* (SS 481), the officers indicated that their man-overboard dummy had been attacked by several whitetip sharks. This

dummy was fitted with a regulation Navy high-visibility life jacket. The whitetips were also observed playing with the high-visibility orange seine floats supporting surface hydrophone cables. They made no attempt to take the black coaxial cable supported between the floats.

The use of small, high explosive calibration shots (20 grams of tetryl), fired at depths of 60–80 feet, demonstrated the very rapid adaptation of *C. longimanus* and *P. glauca* to this type of stimulus. Even though the charges were fired in close proximity to the sharks around the vessel, they scattered and took evasive action only at the first or second shot, thereafter taking no heed to the explosives. If anything, the firing of the small charges attracted the sharks to the vessel. During those times when the vessel was drifting on station, and prior to the dropping of the calibration shots, sharks were not seen in the vicinity of the vessel. However, when the charges were commenced, within a short time one to many sharks were seen circling the vessel. This may indicate that the whitetip and great blue sharks were attracted to the vessel by locating the source of the explosive sounds.

The dolphin, *Coryphaena hippurus*, was observed while the *State Star* was on station and surrounded by *C. longimanus*. Even though the dolphins normally avoided close contact with the sharks, they displayed no apparent evasive actions. When the dolphins were taken on lures and hauled toward the *State Star* with rod and reel, however, the sharks immediately attacked and usually all that was retrieved was the dolphin's head. It was possible that the dolphin was too maneuverable for the shark under natural conditions and there was no attempt by the shark to take the dolphin. When the dolphin was hooked and began very rapid and strenuous escape actions, the sharks closed and devoured the captured fish. The rapid swimming movements of a swimmer could attract rather than distract this species.

The whitetip sharks were observed feeding on very closely packed schools of small fish, possibly *Polydactylus* sp., as previously reported by Bullis (1961, *Ecology* 42:194–5). While in transit from Miami, Florida to Poughkeepsie, N. Y. on 20 March 1961, 10 miles off the coast of Northern Florida, closely packed schools of the fish were seen on and very near the surface. At first they

were thought to be large, single animals with sharks attacking. When the dark areas were closed it was apparent that the objects were small fish tightly schooled. The sharks proved to be approximately ten whitetips 4-6 feet in length, slowly circling the school and periodically moving in to take out large bites. An attempt was made to collect specimens of the school but the approach of the vessel caused the school to dive out of reach. Other schools with their accompanying whitetip sharks were seen in the immediate area, the schools of fish being rather small in size, with an estimated diameter of 8-10 feet.

Sea state also had an apparent effect on the abundance of *C. longimanus* in the vicinity of the *State Star*. As noted in Table 1, the whitetip sharks were observed and taken in the sea states of 3 or less. During higher sea states the vessel was either drifting too fast or the surface was too disturbed for the animals. On occasions when the wind dropped and the sea state was still high (in excess of 3), the vessel was drifting very little. Nevertheless, it was not until after the surface waves had dropped that the sharks again appeared.

Reproduction.—A general inspection of the reproductive tracts was not undertaken, but a record was maintained of the liver weight of all females taken. As had been observed in rays by Needham (1950, *Biochemistry and Morphogenesis*. Cambridge University Press:45-8) and Hess (1959, Life history observations on the sting rays, *Dasyatis centroura* and *Dasyatis say*, in Delaware Bay, *Master's Thesis, Univ. of Del.*), the liver lobes of the pregnant sharks taken, and those females that had just delivered, were very small in comparison with the non-pregnant condition, and of a very deep, dark red color in comparison with the normal yellow-brownish color. In the case of one pregnant *P. glauca* the liver weighed 19 pounds with a total body weight of 560 pounds while a non-pregnant female with body weight of 490 pounds had a total liver weight of 48.5 pounds. A male of the same species had a body weight of 505 pounds and a liver weight of 46 pounds. The pregnant *P. glauca* mentioned above had 43 male and 49 female embryos, varying in size from 21 to 30 cm in total length, the embryos being contained almost equally in both uteri.

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