1-1-1976

Movement of Bull Sharks, Carcharhinus Leucas, Between Carribean Sea and Lake Nicaragua Demonstrated by Tagging

Thomas B. Thorson
University of Nebraska-Lincoln

Reprinted from COPEIA, 1971, No. 2, June 1
pp. 336–338
Made in United States of America

MOVEMENT OF BULL SHARKS, *CARCHARHINUS LEUCAS*, BETWEEN CARIBBEAN SEA AND LAKE NICARAGUA DEMONSTRATED BY TAGGING.—The shark that occurs in the fresh water of Lake Nicaragua and the Rio San Juan was first described (as *Eulamia nicaraguensis*) by Gill and Bransford (1877). These authors also first proposed the theory that the sharks, as well as the sawfish and tarpon that occur in the lake, were trapped there by late Pleistocene volcanic activity, which isolated a former bay of the Pacific and resulted in the formation of the present lake. The theory of a landlocked, distinct species, of Pacific origin, has enjoyed wide popular acceptance and for many years was also accepted by professional zoologists, although the idea has been questioned frequently in recent years. Carr (1953) pointed out that the closest taxonomic affinities of the marine species in Lake Nicaragua were clearly with their Atlantic, rather than their Pacific relatives. Bigelow and Schroeder (1961) concluded that the lake sharks are morphologically inseparable from the widely distributed marine bull shark, *Carcharhinus leucas*. Thorson (1964) and Thorson *et al.* (1966) confirmed the conclusion of Bigelow and Schroeder and presented circumstantial evidence that the lake shark population is not landlocked, but consists of marine bull sharks that enter from the sea. Our evidence was the occurrence, throughout the lake and river, of many sharks of the same euryhaline species that occurs at the river mouth and along the coast; that the same species occurs in similar situations in many rivers and some lakes around the world; and that all the rapids in the Rio San Juan are navigable by barges and other vessels that regularly pass up and down the river.

This circumstantial evidence, although convincing, does not constitute definitive proof, which could come only from the recovery, in the lake, of sharks that had been tagged at the mouth of the river. A tagging program has been in progress, largely during the summer months, from 1966 to the present. The objectives have been to determine the general patterns of the movements of *C. leucas* in the freshwater system involved, with the primary aim of learning whether they move the full length of the Rio San Juan and Rio Colorado, in both directions.

Briefly, tagging has been carried out primarily at Barra del Colorado, Costa Rica (Fig. 1), at the main river mouth (Rio Colorado), and to a more limited extent at Tortuguero and the Samay Lagoon Mouth in Costa Rica, and at San Juan del Norte, El Castillo, and San Carlos, Nicaragua. Petersen disc tags used in 1966 and 1967 proved to have poor lasting quality, although they provided many short-term recoveries. They were replaced in 1968 and 1969 with the more durable Jumbo Rototags (Oberarch Patents, Ltd., Dalton Henley, England). An electronic system (Thorson *et al.*, 1969) has also been employed to monitor the movements of sharks carrying ultrasonic tags.

To 1 September 1969, more than 2200 sharks have been tagged and 220 recoveries have been logged, representing numerous movements between coastal points and between points on the river (Fig. 1). In 1969, three sharks that had been tagged on the east coast of Costa Rica were recovered in Lake Nicaragua. One, bearing an ultrasonic tag, was recorded on the San Carlos monitor on 1 August. It was one of a group of 38 sharks that were tagged at the river mouths at Barra del Colorado and Samay at various times between 7 and 29 July and completely traversed the river in 2–25 days. A second shark, tagged with a Rototag at Barra del Colorado on 8 July 1968, was recovered more than a year later, on 28 July 1969, at San Carlos, and was re-released. The third specimen, also bearing a Rototag, was tagged at Barra del Colorado on 3 April 1969 and was recovered and re-released at San Carlos on 4 August 1969.

That the sharks, once in the lake, also move back to the sea, is demonstrated by nine sharks tagged at San Carlos, and later recovered, one at San Juan del Norte, one at Samay, and seven at Barra del Colorado. Three of these, recorded by the electronic system, required from 7 to 11 days to traverse the full length of the river. Of the six carrying conventional tags, three were en route from 32 to 48 days and two were at liberty for 364 and 382 days. The ninth shark was tagged at San Carlos on 13 August 1969, and recovered at San Juan del Norte the next day, after having travelled downstream about 175 km.

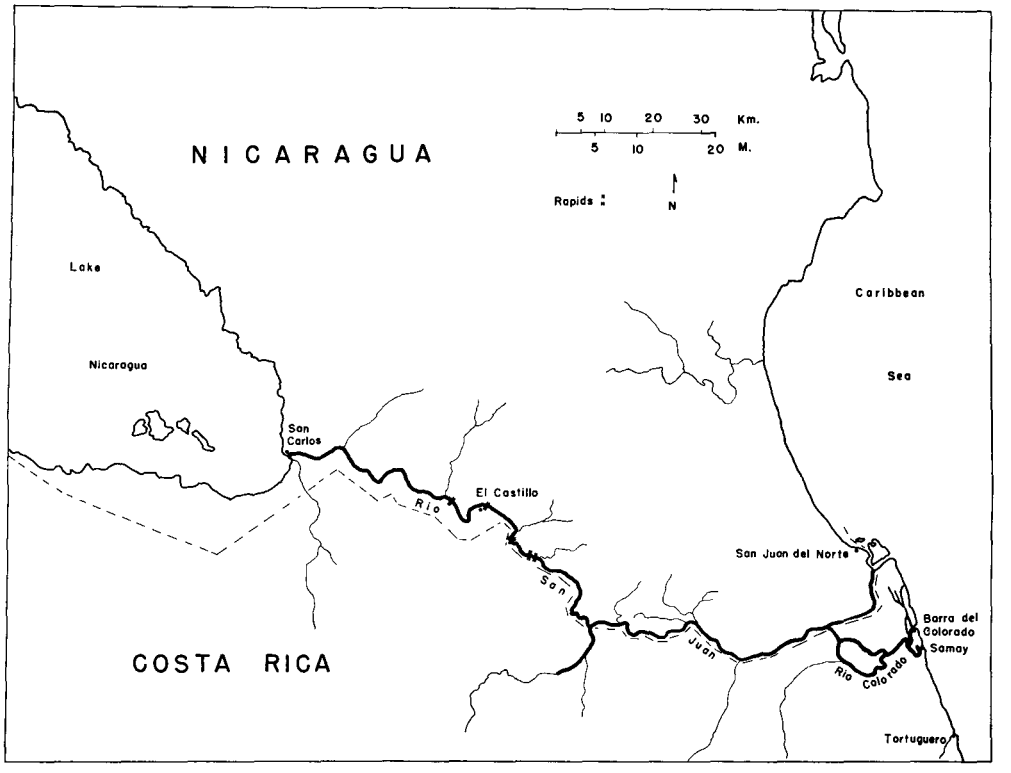

Fig. 1. Map of Lake Nicaragua-Rio San Juan System (Drawn by Jeffery W. Gerst).

There can no longer be any question that the Rio San Juan provides free passage to sharks in both directions for its full length, probably the year around, although periods of unusually low water could conceivably stop movements temporarily. The proposition that the sharks are landlocked is completely untenable, although individual animals may stay in the lake for long periods of time. Several tagged in fresh water have been recovered more than a year later at the same location or at other freshwater sites, but their movements between tagging and recovery are unknown and might conceivably have included excursions into the marine environment.

Studies on the reproduction of the population of bull sharks in this system are still incomplete, but at present it appears that the lake population would very likely not perpetuate itself without reinforcement by new arrivals from the sea.

Acknowledgments

This paper is a report of Studies from the Department of Zoology, University of Nebraska. It was supported by Office of Naval Research Contract No. N00014-66-C0161; by the University Research Council of the University of Nebraska; and, through the loan of equipment and personnel, by the U. S. Bureau of Commercial Fisheries, Seattle, Washington.

Literature Cited

Bigelow, H. B. and W. C. Schroeder. 1961. *Carcharhinus nicaraguensis*, a synonym of the bull shark, *C. leucas*. Copeia 1961(3):359.

Carr, A. 1953. High jungles and low. Univ. Florida Press, Gainesville, Fla.

Gill, T. and J. F. Bransford. 1877. Synopsis of the fishes of Lake Nicaragua. Proc. Acad. Nat. Sci. Phila. 1877:175–191.

Thorson, T. B. 1964. Are the freshwater sharks of Lake Nicaragua landlocked? Am. Zool. 4(3): 275.

———, G. F. Esterberg and J. H. Johnson. 1969. Ultrasonic shark tag monitoring system. Tech. Rep., Office of Naval Research Project No. NR-104-880, Contract No. N00014-66-C0161, 2 June 1969.

———, D. E. Watson and C. M. Cowan. 1966. The status of the freshwater shark of Lake Nacaragua. Copeia 1966(3):385–402.

Thomas B. Thorson, *Department of Zoology, University of Nebraska, Lincoln, Nebraska 68508.*