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BRIEF COMMUNICATION

A juvenile spinner shark in southern New England: A rare visitor or a sign of change?

Joshua K. Moyer[1,2] | Jon F. Dodd[2] | Stephen M. Kajiura[3]

[1]Department of Ecology and Evolutionary Biology, Yale University, New Haven, Connecticut, USA

[2]Atlantic Shark Institute, Wakefield, Rhode Island, USA

[3]Department of Biological Sciences, Florida Atlantic University, Boca Raton, Florida, USA

Correspondence
Joshua K. Moyer, Department of Ecology and Evolutionary Biology, Yale University, New Haven, CT 06520, USA.
Email: joshua.k.moyer@gmail.com

Abstract

A juvenile spinner shark, *Carcharhinus brevipinna*, was captured and released in the coastal waters of Rhode Island, USA, where range delineations based on historic records of spinner sharks and the species' congener, the blacktip shark, *Carcharhinus limbatus*, are plagued by misidentification. The shark in question was within the size range of neonates for *C. brevipinna* and bore a partially healed umbilical wound. This highlights questions concerning the distribution of nursery habitats for the species along the East Coast of North America and how that may be altered by climate change.

KEYWORDS
Atlantic, Carcharhinidae, climate, habitat, identification, juvenile

The spinner shark, *Carcharhinus brevipinna* (Valenciennes in Müller and Henle 1839), has a global distribution in circumtropical waters (Castro, 2011; Compagno, 1984). The species is known to frequent coastal and continental shelf habitats; however, it has been reported offshore at depths of up to 200 m (Ebert et al., 2021). Its diet consists primarily of small bony fishes. Castro (2011) reports that Atlantic menhaden, *Brevoortia tyrannus* (Latrobe 1802), and windowpane flounder, *Scophthalmus aquosus* (Mitchill, 1815), are frequently found in stomachs of specimens taken along the East Coast of North America. In the western North Atlantic, *C. brevipinna* is common throughout the Gulf of Mexico and Florida Keys and northward to the Carolinas (Kohler et al., 1998; Schwartz, 2003). Stoeckle et al. (supplemental table 14: 2023) report the presence of environmental DNA from *C. brevipinna* in the coastal waters of New Jersey, USA. Although nursery area designation for *C. brevipinna* in the western North Atlantic needs further attention, neonates have been reported from South Carolina to Florida (Aubrey & Snelson, 2007; Castro, 1993).

Historically, delineating the northern reaches of its range in the Western North Atlantic has been complicated for *C. brevipinna* by spotty records and likely errors in identification. The Integrated Digitized Biocollections (iDigBio) database reports only two vouchered specimens of *C. brevipinna* taken from points north of Maryland, USA. In each case, the reported locality of collection is suspect. One specimen in the Royal Ontario Museum was reported from a freshwater region of the St. Lawerence River in Ontario, Canada and was likely a discarded souvenir according to the catalog notes. Records of the second specimen, which is accessioned in the Nunnally Ichthyology Collection at the Virginia Institute of Marine Science, indicate a capture location off Virginia, USA, but the latitude and longitude currently given (December, 2024) place the capture location in Québec, Canada.

Morphological similarities between *C. brevipinna* and its congener the blacktip shark, *Carcharhinus limbatus* (Valenciennes in Müller and Henle 1839), make verifiable reports of either species in New England scarce. Bowers and Kajiura (2023) offer a detailed review of the distribution of *C. limbatus* along the East Coast of the United States and point out that previous records of large specimens of *C. limbatus* in the waters of Long Island, New York (i.e., Throne, 1916; Nichols, 1916) are likely misidentifications of *C. brevipinna* based on reported total lengths and the known maximum sizes of each species.

Reports of juvenile specimens of either species in New England are rarer still. Bigelow and Schroeder (1948: p. 351) state that "at least twenty small ones [*C. limbatus*]" were collected from the eastern shore of Buzzards Bay, Massachusetts in 1878, but they preface their discussion by noting uncertainty in the distinction between *C. limbatus* and *C. maculipinnis* [= *C. brevipinna*] in many such accounts. Additionally, no size range is given for the "small" individuals. The waters of southern New England are not currently

recognized as either primary or secondary nursery habitat (*sensu* Bass, 1978) for *C. brevipinna*, thereby making each positively identified specimen, especially juveniles, valuable data points in the delineation of the species' northern range and habitat use.

On September 1, 2024, a juvenile male *C. brevipinna* was captured in a commercial trawl net in the waters south of Charlestown, Rhode Island (Figure 1a). The shark was captured in water with a surface temperature of 21.9°C at a depth of approximately 14.5 m and was approximately 63 cm total length (TL). The fishers recorded a video of the specimen prior to its release in which they briefly handled the shark to measure it. From that video, the authors identified the species based on the following criteria: (1) absence of a visible interdorsal ridge; (2) the presence of visible black tips on the dorsal fins, pectoral fins, and caudal fin; (3) apparent origination of the first dorsal fin slightly posterior to the insertion of the pectoral fins; and (4) approximation of the prenarial length (PRN) relative to distance from the front of the mouth to the nares (here referred to as the oral-to-narial length [ONL] in Figure 1b). According to J. Garrick as relayed by Clark

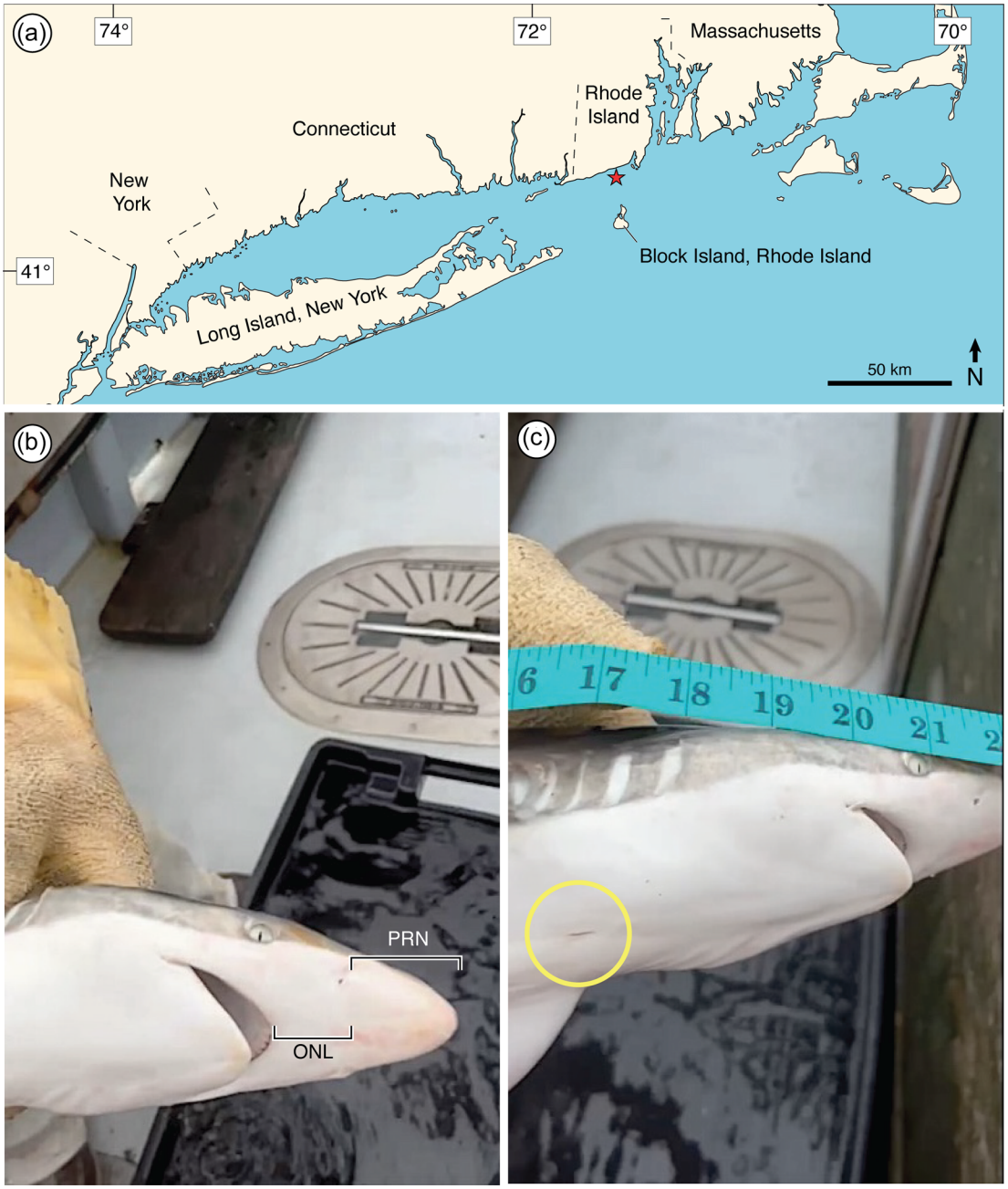

FIGURE 1 Location of capture and notable physical features. (a) Map of region where a juvenile spinner shark, *Carcharhinus brevipinna*, was captured. Red star indicates the location of capture and release. (b) Prenarial length (PRN) and oral-to-narial length (ONL) as approximated during species identification. (c) Partially healed umbilical wound on underside of a juvenile *C. brevipinna*. Umbilical wound circled. Tape measure held by fisher in video frame is marked in inches.

and von Schmidt (1965), PRN is 1.2 to 1.5 times the length of ONL in *C. brevipinna*. Based on approximations measured in pixels in Adobe Photoshop (version 25.12.0) using freeze-frames taken from the video, the PRN:ONL ratio was 1.42. In an adult individual, the absence of a black tip on the anal fin would indicate that the specimen in question likely belongs to *C. limbatus* (provisional to its capture in the Atlantic, as Pacific specimens possess black-tipped anal fins; Castro, 2011). However, variability in analfin markings in specimens of *C. brevipinna* smaller than 70 cm TL (see Branstetter, 1982; Castro, 2011) indicates that this feature does not necessarily contraindicate identification of the specimen in question as *C. brevipinna*.

The video provided by the fishers also showed the presence of what is putatively a partially healed umbilical wound (Figure 1c). This indicates that the specimen was unambiguously a YOY shark and likely still a neonate. Here, we apply the term neonate to refer to a shark on which the umbilical wound is not entirely healed. Traditionally, the neonatal stage of viviparous carcharhiniforms was designated based on the visibility of an umbilical scar (e.g., Castro, 1993; Ulrich et al., 2007). Using the blacktip reef shark, *Carcharhinus melanopterus* (Quoy and Gaimard 1824), as a model species, Debaere et al. (2023) defined the neonatal stage as lasting from parturition until the umbilical wound is fully healed, a process they measured based on the dimensions of umbilical wounds. Though, as Debaere et al. (2023) point out, interspecific and regional differences in the rate of wound healing likely exist, the consensus appears to be that the neonatal stage of most coastal carcharhiniforms lasts between 30 and 68 days, as stated by Castro (1993). Given that the umbilical wound on the specimen of *C. brevipinna* referenced here appears to be partially but not fully healed (note the visible slit in the skin in Figure 1c), the shark in question could reasonably be considered a neonate by any previously employed standard. The TL of the specimen also supports our neonatal designation, as it falls within the size-at-birth estimates for *C. brevipinna* given by multiple authors, which range from 60 to 70 cm TL (Branstetter, 1981; Branstetter, 1987; Capapé et al., 2003; Compagno, 1984). The specimen recorded here measured 63 cm TL.

The designation of any region as a shark nursery assumes that YOY and juvenile sharks are more commonly encountered in that area relative to other parts of the species' range, juvenile sharks remain in or return to the area for extended periods, and the area is used by juveniles across multiple years (Heupel et al., 2007). Consequently, the observation reported here cannot be used to substantiate the waters of southern New England as a nursery ground for *C. brevipinna*. That said, the reported capture of a juvenile specimen of *C. brevipinna* in the waters of Rhode Island does raise noteworthy questions pertaining to a species for which accurate range delineations have been historically complicated. First, how far into New England does the range of *C. brevipinna* extend? Second, does *C. brevipinna* utilize new or unreported nurseries farther north than previously reported? Third, how will the ranges and distribution of nursery habitats of *C. brevipinna* and other coastal sharks be altered by climate change in a region of the Atlantic Ocean that is warming faster than previously thought (see Saba et al., 2016)?

The juvenile *C. brevipinna* reported here supports the inclusion of southern New England in the species' range with identification criteria specifically enumerated. Nevertheless, the question remains, does the shark identified here represent an occasional stray beyond Long Island, New York, or a change in a circumtropical species' nursery habitat in response to a warming ocean?

AUTHOR CONTRIBUTIONS

This communication was conceived by all authors. Original manuscript and figure generation were completed by Joshua K. Moyer. All authors reviewed and edited the manuscript for accuracy.

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ORCID

Joshua K. Moyer https://orcid.org/0000-0003-2638-7568
Stephen M. Kajiura https://orcid.org/0000-0003-3009-8419

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