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# First verified occurrence of the shortnose sturgeon (*Acipenser brevirostrum*) in the James River, Virginia

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**Abstract**—The shortnose sturgeon (*Acipenser brevirostrum*) is an endangered species of fish that inhabits the continental slope of the Atlantic Ocean from New Brunswick, Canada, to Florida. This species has not been documented previously in the freshwater portion of any river of the Chesapeake Bay, except in the Potomac River. On 13 March 2016, a shortnose sturgeon was captured in the freshwater portion of the James River at river kilometer 48. The fish had a fork length of about 75 cm and was likely mature. Genetic analysis confirmed the fish was a shortnose sturgeon and was assigned to the Chesapeake Bay–Delaware population segment. Regardless of whether this shortnose sturgeon was part of a remnant Chesapeake Bay population or whether its capture there is an indicator of an expansion of range from the Delaware River by way of the Chesapeake and Delaware Canal, dedicated research is needed to determine the status of the shortnose sturgeon inhabiting the Chesapeake Bay.

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The shortnose sturgeon (*Acipenser brevirostrum*) is an amphidromous sturgeon reported to inhabit the continental slope of the Atlantic Ocean from New Brunswick, Canada, to Florida (Gruchy and Parker, 1980; Dadswell et al., 1984; Kynard, 1997). However, Dadswell et al. (2013) documented a single shortnose sturgeon captured in a weir in the Minas Basin, an inlet of the Bay of Fundy in Nova Scotia, Canada, and that capture represents a modest extension of the northern range for this species. In the United States, the shortnose sturgeon was listed as endangered in 1967, under the Endangered Species Preservation Act, and is currently protected under the U.S. Endangered Species Act. In 2012, the shortnose sturgeon was listed as a species of concern under the Canadian Species At Risk Act.

The Chesapeake Bay is located roughly in the middle of the reported geographic range of the shortnose sturgeon (Fig. 1), but because of the scarcity of this species, research dedicated to shortnose sturgeon in the Chesapeake Bay has been extremely limited. During 1996–2006, research programs that focused on Atlantic sturgeon (*A. oxyrinchus*) throughout the Chesapeake Bay estuary and that provided a monetary reward for reporting captured sturgeon provided evidence of the capture of shortnose sturgeon, as well (Spells[1]; Welsh et al., 2002; Mangold et al.[2]). Only one genetically verified shortnose sturgeon was collected in Virginia waters as part of these programs (Spells[1]; Welsh et al., 2002). One other fish captured was hypothesized to be a shortnose sturgeon but could not be verified at the species level because no genetic sample was taken (Spells[3]). Both the verified and suspected shortnose sturgeon were collected at the mouth of the Rappahannock River, a marine portion of the Chesapeake Bay estuary. In the Maryland reward pro-

[1] Spells, A. J. 1998. Atlantic sturgeon population evaluation utilizing a fishery dependent reward program in Virginia's major western shore tributaries to the Chesapeake Bay, 5 p. An Atlantic Coastal Fisheries Cooperative Management Act Report for National Marine Fisheries Service. U.S. Fish Wildl. Serv., Charles City, VA. [Available from Harrison Lake National Fish Hatchery, U.S. Fish Wildl. Serv., 11110 Kimages Rd., Charles City, VA 23030-2844.]

[2] Mangold M., S. Eyler, S. Minkkinen, and B. Richardson. 2007. Atlantic sturgeon reward program for Maryland waters of the Chesapeake Bay and tributaries 1996–2006, 22 p. [Summary report] Maryland Fish. Resour. Off., U.S. Fish Wildl. Serv., Annapolis, MD. [Available from website.]

[3] Spells, A. 2014. Personal commun. Harrison Lake National Fish Hatchery, U.S. Fish Wildl. Serv., 11110 Kimages Rd., Charles City, VA 23030-2844.

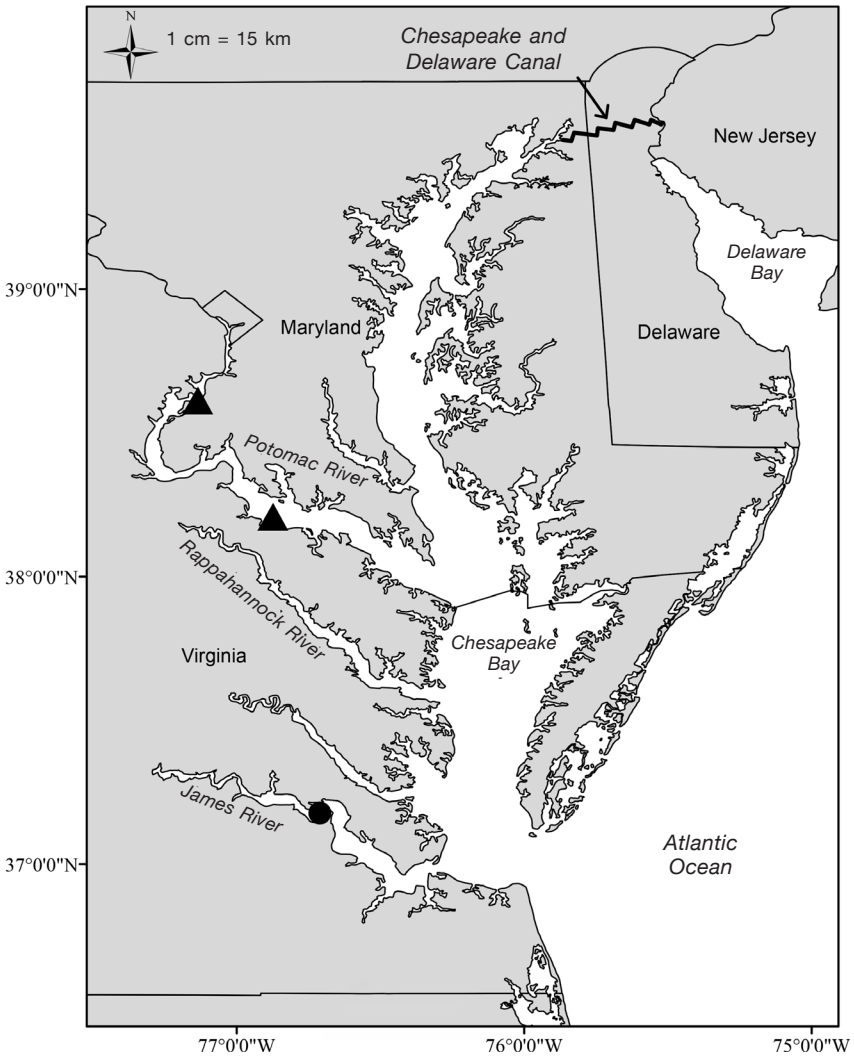


**Figure 1**

Map of the Chesapeake Bay showing, to our knowledge, all known freshwater locations where shortnose sturgeon (*Acipenser brevirostrum*) were captured in the Chesapeake Bay. The black dot marks the location where the shortnose sturgeon was captured on the James River in this study. The 2 triangles are the capture locations on the Potomac River for the 2 gravid female shortnose sturgeon documented by Kynard et al. (2009).

gram, 72 shortnose sturgeon were documented during 1996–2006; however, because of problems with obtaining collection permits, Maryland scientists were not allowed to tag 26 shortnose sturgeon collected after May of 2002 (Mangold et al.[2]). There is a chance that some of the 26 shortnose sturgeon were unknowingly recaptured during the reward program. Results of analysis of the genetic samples taken from shortnose sturgeon as part of the reward program indicated no distinct difference between fish from the Chesapeake Bay and from the Delaware River and Bay; therefore, the 2 groups were assigned to the same population segment (Grunwald et al., 2002; Wirgin et al., 2010; King et al., 2014). Researchers did not mention milt production or egg release for any of the shortnose sturgeon captured during the programs.

Only 2 studies (Welsh et al., 2002; Kynard et al., 2009) were focused specifically on the life history of shortnose sturgeon in the Chesapeake Bay. Welsh et al. (2002) telemetered 13 shortnose sturgeon, which were initially captured and tagged in the marine part of the estuary. Of these 13 fish, 3 shortnose sturgeon were later detected in the Chesapeake and Delaware Canal or in the Delaware River (Welsh et al., 2002). Kynard et al. (2009) focused their research on the life history of shortnose sturgeon in the Potomac River. After extensive sampling and work with commercial fishermen, they captured 2 shortnose sturgeon. Both fish were gravid females, and telemetric and recapture data indicated that one fish spawned in the Potomac River (Kynard et al., 2009). As with the genetic samples collected during the Chesapeake Bay reward program, the 2 gravid females could not be genetically differentiated from Delaware River shortnose sturgeon (King et al., 2014). As of this writing, the only documented occurrence of a shortnose sturgeon has been the sole occurrence of this species in the freshwater portion of a river in the Chesapeake Bay (Welsh et al., 2002; Kynard et al., 2009).

## Materials and methods

On 13 March 2016, a gill net was set at river kilometer 48 of the James River (Fig. 1), Virginia, in an attempt to collect juvenile Atlantic sturgeon (under NOAA Endangered Species Permit no. 16547, VCU IACUC#AD20127). The gill net that captured the shortnose sturgeon was 8.3-cm stretch mesh and had a stretched height of 1.8 m. The net was set parallel to the water current and deployed at a depth of 3.2 m. Water quality data at the capture location was determined by using a calibrated YSI Model 85[4] hydrometer (YSI Inc., Yellow Springs, OH). At the sampling location, the temperature was 12°C, dissolved oxygen was 9.89 mg/L, and salinity was 0.04. The net was set for 2 h and pulled during ebb current just before slack water.

[4] Mention of trade names or commercial companies is for identification purposes only and does not imply endorsement by the National Marine Fisheries Service, NOAA.

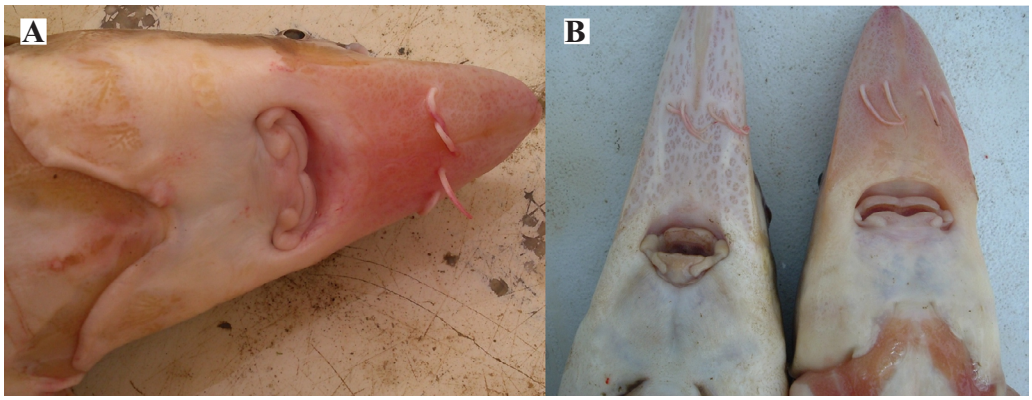


**Figure 2**

Photographs showing the differences in mouths and noses between the Atlantic sturgeon (*Acipenser oxyrinchus*) and the shortnose sturgeon (*A. brevirostrum*). (**A**) Photograph of the shortnose sturgeon, with an estimated 75-cm fork length, described in this article (photo credit M. Balazik, Virginia Commonwealth University). (**B**) Photograph showing the differences in the mouths and noses of an Atlantic sturgeon (65-cm fork length, left) and a shortnose sturgeon (76 cm fork length, right) (photo credit W. Post, South Carolina Department of Natural Resources).

## Results

A sturgeon estimated to be about 75 cm long (in fork length [FL]) was caught during the net set (Fig. 1). This estimated FL reflects the opinion of the experienced researchers and their analysis of photographs that have objects in the background to judge the size of fish. The sturgeon was initially thought to be a subadult Atlantic sturgeon, and standard protocols were followed to process this fish (Kahn and Mohead, 2010). A fin was clipped and taken for genetic purposes, and a passive integrated transponder was placed under the dorsal fin. After the passive integrated transponder was in place, the surface of the fish was noted to be very smooth (Gorham and McAllister, 1974), in contrast with the surface of Atlantic sturgeon. This sturgeon was rolled over to reveal its ventral surface, where pre-anal plates were observed on the ventral median, and the anal fin lacked paired plates (Vecsei and Peterson, 2004). After the placement of plates and smooth skin were noted, it was determined that the fish was most likely a shortnose sturgeon. A picture was taken of the mouth and anal fin, and the fish was released (Fig. 2). No official length measurement of the sturgeon was taken, and the sex was not determined. Genetic analysis verified that the sturgeon caught in the James River was a shortnose sturgeon of the Delaware–Chesapeake Bay stock (King[5]). This collection is the first verified occurrence of a shortnose sturgeon inhabiting the James River.

[5] King, T. 2016. Personal commun. Leetown Science Center, U.S. Geological Survey, 11649 Leetown Rd., Kearneysville, WV 25430.

Shortnose sturgeon mature sexually at approximately 50 cm FL (Dadswell et al., 1984; Bain, 1997); therefore, the fish caught in the James River was likely to have been a mature fish. It was roughly the same size as the 2 gravid females caught in the Potomac River during the Kynard et al. (2009) study. The late-stage shortnose sturgeon caught at river kilometer 63 of the Potomac River was 75 cm FL and was captured on 22 March 2006 (Kynard et al., 2009). The late-stage shortnose sturgeon caught at river kilometer 63 of the Potomac River was 75 cm FL and was captured on 22 March 2006 (Kynard et al., 2009)—at a location and time of capture similar to the documented data for the shortnose sturgeon collected from the James River.

## Discussion

The historical occurrence of shortnose sturgeon in the Chesapeake Bay is unclear. Although numerous fin spines from sturgeons were found in the trash middens of Jamestown Colony, none are thought to be from shortnose sturgeon (Balazik et al., 2010). A more intensive study on the scute material from Jamestown Colony is needed to verify or refute this suggestion. The earliest documentation of shortnose sturgeon in the Chesapeake Bay was a partial skin described by Milner in 1876 (Kynard et al., 2009). Uhler and Lugger (1876a) did not list shortnose sturgeon in their first edition of their list of the fish species of Maryland, but this fish was later added to the second edition (Uhler and Lugger, 1876b). During a study of the fish species in the District of Columbia, Smith and Bean (1899) noted that shortnose sturgeon were not as abundant

as Atlantic sturgeon and that commercial fishermen did not recognize the difference between the 2 sturgeon species. Evermann and Hildebrand (1910) and Hildebrand and Schroeder (1927) did not collect any shortnose sturgeon during their studies of the fish of the Chesapeake Bay drainage. Since records were begun in the late 1800s, shortnose sturgeon have seemed to be rare in the upper Chesapeake Bay and nonexistent in the lower Chesapeake Bay, until the capture in 2016 of the individual described here.

There is debate whether the shortnose sturgeon in the Chesapeake Bay are a remnant of a native population that was almost extirpated or are fish from the Delaware River that entered the Chesapeake Bay through the Chesapeake and Delaware Canal (Welsh et al., 2002; Kynard et al., 2009). The Chesapeake and Delaware Canal was completed in 1829; therefore, it is plausible that the shortnose sturgeon described by Milner in 1876 was a colonizing fish from the Delaware River. Welsh et al. (2002) documented shortnose sturgeon traversing the Chesapeake and Delaware Canal. Genetic results support the hypothesis that shortnose sturgeon have strong, distinct genetic lineages that are river dependent (Grunwald et al., 2002; Wirgin et al., 2005, 2010; King et al., 2014), and because shortnose sturgeon rarely leave their natal drainage (Dadswell et al., 1984; Kynard, 1997), one would expect strong genetic diversity for these fish among rivers. Therefore, if shortnose sturgeon captured in the upper Chesapeake Bay are a remnant of a historical population, one would conclude that there would be strong genetic differentiation from shortnose sturgeon in the Delaware River. Considering the extensive sampling efforts by the Virginia Institute of Marine Science, Virginia Commonwealth University, and researchers working with commercial fishermen in all areas of the James River and the lack of any evidence that they have ever documented the occurrence of a shortnose sturgeon in the James River, the one fish described here is not likely to be a member of a remnant population in the James River. The shortnose sturgeon captured in the James River is probably a colonizing or roaming fish from either the Potomac River, about 120 km away, or from the Delaware River, 340 km away, that entered the area through the Chesapeake and Delaware Canal (Fig. 2).

Whether it was a remnant of the Chesapeake Bay or a colonizer from the Delaware River, Kynard et al. (2009) documented a female shortnose sturgeon that exhibited a spawning migration pattern in the Potomac River (Kynard, 1997; Kynard et al., 2009), and it is logical to conclude that shortnose sturgeon are expanding their range into the rivers of the lower Chesapeake Bay. More research is needed to monitor the status and life history of shortnose sturgeon that inhabit all reaches of the Chesapeake Bay. Specifically, the sex of shortnose sturgeon captured in the Chesapeake Bay should be determined, and the fish should be tagged and tracked electronically. The resulting telemetric data will provide managers with the data required to make informed decisions about the current status of this fish in the Chesapeake Bay. Genetic samples should also be taken from every shortnose sturgeon captured in the Chesapeake Bay to help answer the question of whether they are Delaware fish expanding their range or fish from a historical remnant population.

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