

Genetic Evidence for Relict Atlantic Sturgeon Stocks along the Mid-Atlantic Coast of the USA

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Abstract.—The Atlantic sturgeon *Acipenser oxyrinchus oxyrinchus* is a highly migratory anadromous acipenserid that is distributed along the Atlantic coast of North America. The abundance of Atlantic sturgeon has not increased appreciably in recent years despite the imposition of a moratorium on its harvest in U.S. waters in 1998. Two measures being considered to restore depleted or extirpated populations are designation of Atlantic sturgeon as federally endangered under the U.S. Endangered Species Act and the use of hatchery-reared fish to supplement natural reproduction. Implementation of these approaches requires detailed knowledge of this species' population structure. Previous genetic stock identification studies failed to address the discreteness of Atlantic sturgeon populations along the U.S. mid-Atlantic coast that historically supported two of the largest fisheries for the species. We used mitochondrial DNA (mtDNA) control region sequence data to elucidate the population structure of Atlantic sturgeon in the Delaware River and two tributaries of Chesapeake Bay, the James and York rivers. Haplotypes of individuals from these rivers were compared with those from 14 other estuaries. Levels of mtDNA diversity were moderately high: 45 haplotypes were observed among the 850 specimens analyzed. We found significant temporal instability of haplotypes among collections of subadults made in different years from the Delaware River, including haplotypes not seen elsewhere and others that were common in the adjoining Hudson River and Albemarle Sound. This finding suggests that natural reproduction of a genetically distinct population still occurs in the Delaware River, but that it also hosts migrant subadults from elsewhere. In contrast, temporal instability of haplotype frequencies was absent among collections from different years in the Hudson River. Although private haplotypes were absent from the James and York River samples, significant frequency differences between these collections and those from elsewhere suggest that some tributaries of Chesapeake Bay still host genetically unique populations of Atlantic sturgeon.

The Atlantic sturgeon *Acipenser oxyrinchus oxyrinchus* is a large, late-maturing, long-lived, anadromous acipenserid that spawns in major rivers along the Atlantic coast of North America from the St. Lawrence River to the Altamaha River or Satilla River in Georgia. This species once spawned in at least 26 river and estuarine systems; of these, spawning is thought to persist in 14 to 17 in the USA and 2 in Canada (Waldman and Wirgin 1998; ASSRT 2006). Subadults leave their natal estuaries during their second year or later and move into coastal waters (Dovel and Berggren 1983; Bair et al. 1999). Subadults may also seasonally wander to nonnatal estuaries (Secor et al.

2000). Both subadults and adults spend considerable time at sea, and returns to natal rivers are not always on an annual basis. Their marine movements are not well known, but some may cover great distances. Based on mark-recapture studies, ocean migrations of up to 1,450 km have been recorded (Dovel and Berggren 1983). The population-specific geographic boundaries of coastal movements from individual rivers are largely unknown, although specimens of Atlantic sturgeon have been collected off Labrador, Bermuda, and Venezuela (Lee et al. 1980) and a now-extinct population appears to have been established in the Baltic Sea (Ludwig et al. 2002).

Currently, there is much interest in the status of Atlantic sturgeon because of pronounced declines in the abundances of many, if not most, populations during the 1980s and 1990s. These declines were due in part to newly directed fisheries (Waldman et al.

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