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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 224

[Docket No. 150209121-5941-02]

RIN 0648-XD760

Endangered and Threatened Wildlife; 12-Month Finding on a Petition to Identify and Delist a Saint John River Distinct Population Segment of Shortnose Sturgeon under the Endangered Species Act

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Department of Commerce.

ACTION: Notice of 12-month petition finding.

SUMMARY: We, NMFS, announce a 12-month finding on a petition to identify and "delist" shortnose sturgeon (*Acipenser brevirostrum*) within the Saint John River in New Brunswick, Canada under the Endangered Species Act (ESA). The shortnose sturgeon is currently listed as an endangered species, at the species level, under the ESA. Based on our review of the best scientific and commercial data available, we have determined that the population of shortnose sturgeon from the Saint John River does not qualify as a distinct population segment. Therefore, we did not consider the petition further, and we do not propose to delist this population.

DATES: This finding was made on [*insert date of publication in the FEDERAL REGISTER*].

ADDRESSES: Information used to make this finding is available for public inspection by appointment during normal business hours at NMFS, Office of Protected Resources, 1315 East West Highway, Silver Spring, MD 20910. The petition and the list of the references used in making this finding are also available on the NMFS website at: *www.nmfs.noaa.gov/pr/species/fish/shortnose-sturgeon.html*.

FOR FURTHER INFORMATION CONTACT: Lisa Manning, Office of Protected Resources, 301-427-8466; Stephania Bolden, Southeast Regional Office, 727-824-5312; Julie Crocker, Greater Atlantic Regional Office, 978-282-8480.

SUPPLEMENTARY INFORMATION:

Background

On September 24, 2014, we received a petition from Dr. Michael J. Dadswell, Dr. Matthew K. Litvak, and Mr. Jonathan Barry regarding the population of shortnose sturgeon (*Acipenser brevirostrum*) native to the Saint John River in New Brunswick, Canada. The petition requests that we identify the Saint John River population of shortnose sturgeon as a distinct population segment (DPS) and contemporaneously "delist" this DPS by removing it from the species-wide listing under the Endangered Species Act. On April 6, 2015, we published a positive finding indicating that the petitioned action may be warranted and that we were initiating a status review to consider the petition further (80 FR 18347).

The shortnose sturgeon was originally listed as an endangered species throughout its range by the U.S. Fish and Wildlife Service (USFWS) on March 11, 1967, under the Endangered Species Preservation Act (ESPA, 32 FR 4001). Shortnose sturgeon remained on the endangered species list when the U.S. Congress replaced the ESPA by enacting the Endangered Species

Conservation Act of 1969, which was in turn replaced by the Endangered Species Act of 1973 (ESA, 16 U.S.C. 1531 *et seq*.). We subsequently assumed jurisdiction for shortnose sturgeon under a 1974 government reorganization plan (39 FR 41370, November 27, 1974). In Canada, the shortnose sturgeon falls under the jurisdiction of the Department of Fisheries and Oceans (DFO) and was first assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as "Special Concern" in 1980. This status was reconfirmed in 2005, and the species was listed as Special Concern under the Canadian federal Species at Risk Act (SARA) in 2009. The Special Concern status was reconfirmed again in 2015 (COSEWIC, In Press). Shortnose sturgeon is also listed under Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna (CITES).

Statutory, Regulatory and Policy Provisions

We are responsible for determining whether species are threatened or endangered under the ESA (16 U.S.C. 1531 *et seq.*). To make this determination, we first consider whether a group of organisms constitutes a "species" under section 3 of the ESA, and then we consider whether the status of the species qualifies it for listing as either threatened or endangered. Section 3 of the ESA defines a "species" to include "any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature" (16 U.S.C. 1532(16)). A joint policy issued by NMFS and the U.S. Fish and Wildlife Service (USFWS; collectively referred to as "the Services") clarifies the interpretation of the phrase "distinct population segment" (DPS) for the purposes of listing, delisting, and reclassifying a species under the ESA ("DPS Policy," 61 FR 4722, February 7, 1996). The DPS Policy identifies two criteria for determining whether a population is a DPS: (1) the population must be "discrete" in relation to the remainder of the taxon (species or subspecies) to which it belongs; and (2) the population must be "significant" to the remainder of the taxon to which it belongs.

Congress has instructed the Secretary to exercise the authority to recognize DPS's ''sparingly and only when the biological evidence indicates that such action is warranted'' (S. Rep. 96-151 (1979)). The law is not settled as to the extent of the Services' discretion to modify a species-level listing to recognize a DPS having a status that differs from the original listing. In a recent decision, the United States District Court for the District of Columbia held that the ESA does not permit identification of a DPS solely for purposes of delisting. *Humane Soc'y* v. *Jewell*, 76 F. Supp. 3d 69 (D.D.C. Dec. 19, 2014), *appeal docketed*, No. 15-5041 (D.C. Cir. Feb. 19, 2015) (Western Great Lakes gray wolves) (consolidated with Nos. 15-5043, 15-5060, and 15-5061).

A species, subspecies, or DPS is "endangered" if it is in danger of extinction throughout all or a significant portion of its range, and "threatened" if it is likely to become endangered within the foreseeable future throughout all or a significant portion of its range (ESA sections 3(6) and 3(20), respectively, 16 U.S.C. 1532(6) and (20)). We interpret an "endangered species" to be one that is presently in danger of extinction. A "threatened species," on the other hand, is not presently in danger of extinction, but is likely to become so in the foreseeable future. In other words, the primary statutory difference between a threatened and endangered species is the timing of when a species may be in danger of extinction, either presently (endangered) or in the foreseeable future (threatened). In addition, we interpret "foreseeable future" as the horizon over which predictions about the conservation status of the species can be reasonably relied upon.

Pursuant to the ESA and our implementing regulations, the determination of whether a species is threatened or endangered shall be based on any one or a combination of the following five section 4(a)(1) factors: the present or threatened destruction, modification, or curtailment of habitat or range; overutilization for commercial, recreational, scientific, or educational purposes; disease or predation; inadequacy of existing regulatory mechanisms; and any other natural or manmade factors affecting the species' existence. 16 U.S.C. 1533(a)(1); 50 CFR 424.11(c). Listing determinations must be based solely on the best scientific and commercial data available, after conducting a review of the species' status and after taking into account any efforts being made by any state or foreign nation (or any political subdivision of such state or foreign nation) to protect the species. 16 U.S.C. 1532(b)(1)(A).

Under section 4(a)(1) of the ESA and the implementing regulations at 50 CFR 424.11(d), a species shall be removed from the list if the Secretary of Commerce determines, based on the best scientific and commercial data available after conducting a review of the species' status, that the species is no longer threatened or endangered because of one or a combination of the section 4(a)(1) factors. The regulations provide that a species listed under the ESA may be delisted only if such data substantiate that it is neither endangered nor threatened for one or more of the following reasons:

> (1) *Extinction*. Unless all individuals of the listed species had been previously identified and located, and were later found to be extirpated from their previous range, a sufficient period of time must be allowed before delisting to indicate clearly that the species is extinct.

> (2) *Recovery*. The principal goal of the USFWS and NMFS is to return listed species to a point at which protection under the ESA is no longer required. A species may be delisted on the basis of recovery only if the best scientific and commercial data available indicate that it is no longer endangered or threatened.
>
> (3) *Original data for classification in error*. Subsequent investigations may show that the best scientific or commercial data available when the species was listed, or the interpretation of such data, were in error.

50 CFR 424.11(d).

To complete the required finding in response to the current delisting petition, we first evaluated whether the petitioned entity meets the criteria of the DPS Policy. As we noted in our initial petition finding, a determination whether to revise a species-level listing to recognize one or more DPSs in place of a species-level listing involves, first, determining whether particular DPS(s) exist(s) (based on meeting the criteria of the DPS Policy) and, if that finding is affirmative, complex evaluation as to the most appropriate approach for managing the species in light of the purposes and authorities under the ESA.

Species Description

Below, we summarize basic life history information for shortnose sturgeon. A more thorough discussion of all life stages, reproductive biology, habitat use, abundance estimates and threats are provided in the Shortnose Sturgeon Biological Assessment completed by the Shortnose Sturgeon Status Review Team in 2010 (SSRT 2010; http://www.fisheries.noaa.gov/pr/species/fish/shortnose-sturgeon.html).

There are 25 species and four recognized genera of sturgeons (family Acipenseridae), which comprise an ancient and distinctive assemblage with fossils dating to at least the Upper Cretaceous period, more than 66 million years ago (Findeis 1997). The shortnose sturgeon, *Acipenser brevirostrum*, is the smallest of the three extant sturgeon species in eastern North America. Many primitive physical characteristics that reflect the shortnose sturgeon's ancient lineage have been retained, including a protective armor of bony plates called "scutes"; a subterminal, protractile tube-like mouth; and chemosensory barbels. The general body shape is cylindrical, tapering at the head and caudal peduncle, and the upper lobe of the tail is longer than the lower lobe. Shortnose sturgeon vary in color but are generally dark brown to olive or black on the dorsal surface, lighter along the row of lateral scutes, and nearly white on the ventral surface. Adults have no teeth but possess bony plates in the esophagus that are used to crush hard prey items (Vladykov and Greeley 1963; Gilbert 1989). The skeleton is almost entirely cartilaginous with the exception of some bones in the skull, jaw and pectoral girdle.

Shortnose sturgeon occur along the East Coast of North America in rivers, estuaries, and marine waters. Historically, they were present in most major rivers systems along the Atlantic coast (Kynard 1997). Their current riverine distribution extends from the Saint John River, New Brunswick, Canada, to possibly as far south as the St. Johns River, Florida (Figure 1; Kynard 1997; Gorham and McAllister 1974). Recently available information indicates that their marine range extends farther northward than previously thought and includes the Minas Basin, Nova Scotia (Dadswell *et al*. 2013). The distribution of shortnose sturgeon across their range, however, is disjunct, with no known reproducing populations occurring within the roughly 400 km of coast between the Chesapeake Bay and the southern boundary of North Carolina. Shortnose sturgeon live in close proximity with Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) throughout much of their range. However, Atlantic sturgeon spend more of their life cycle in the open ocean compared to shortnose sturgeon. Within rivers, shortnose sturgeon and Atlantic sturgeon may share foraging habitat and resources, but shortnose sturgeon generally spawn farther upriver and earlier than Atlantic sturgeon (Kynard 1997, Bain 1997).

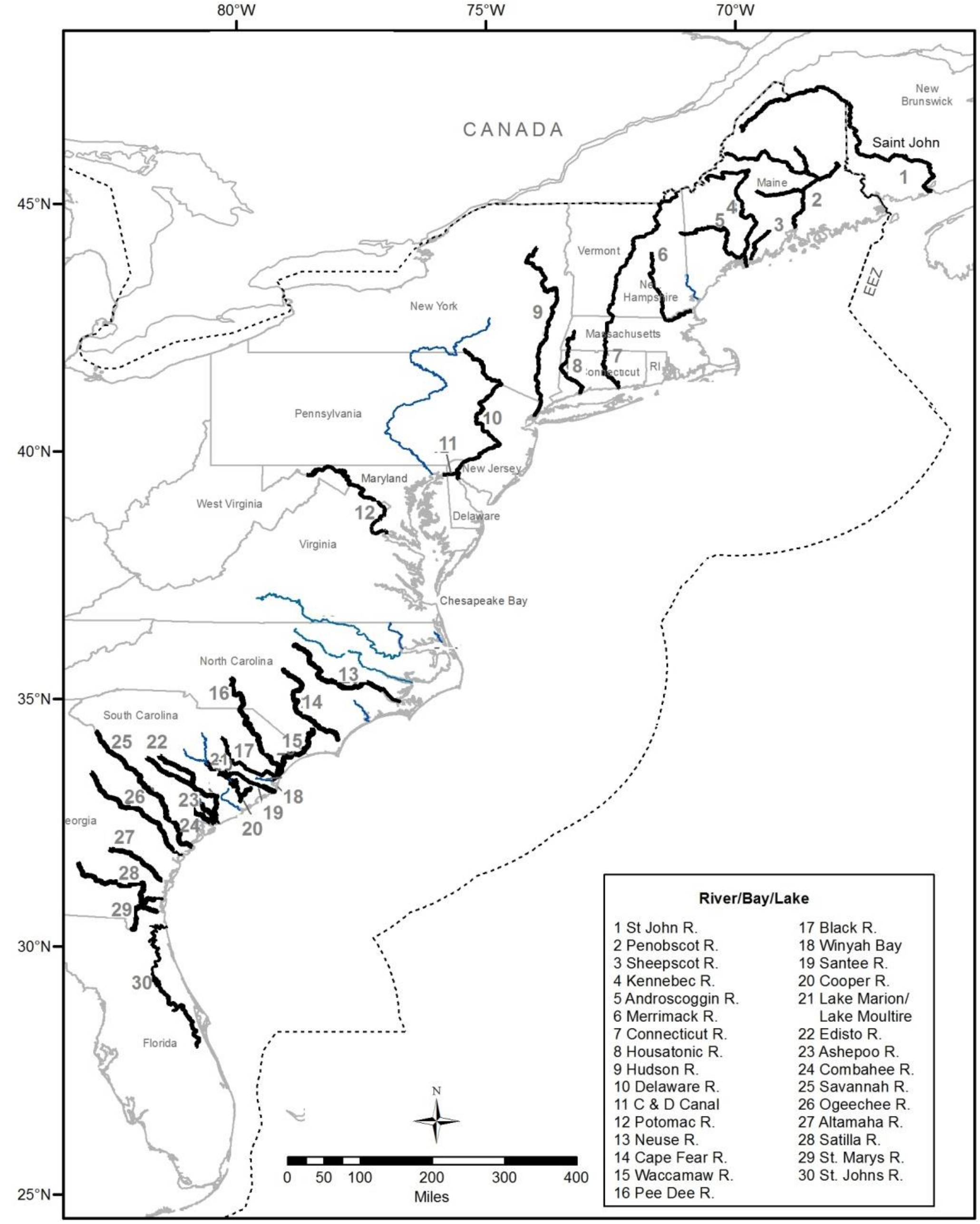

Figure 1. Major river systems within the currently or potentially occupied range of shortnose sturgeon.

Shortnose sturgeon typically migrate seasonally between upstream freshwater spawning habitats and downstream foraging mesohaline (i.e., salinities of 5 to 18 parts per thousand) habitat based on water temperature, flow, and salinity cues. Based on their varied and complex use of freshwater, estuarine, and marine waters, shortnose sturgeon have been characterized in the literature as “anadromous” or “amphidromous” (Bain 1977; Kieffer and Kynard 1993). An anadromous species is defined as one that spawns in freshwater and spends much of its life cycle in marine waters, whereas a freshwater amphidromous species is one that spawns and remains in freshwater for most of its life cycle but spends some time in saline water. Because shortnose sturgeon had historically rarely been detected far from their natal estuary, they were once considered to be largely confined to their natal rivers and estuaries (NMFS 1998). However, more recent research has demonstrated that shortnose sturgeon leave their natal estuaries, undergo coastal migrations, and use other river systems to a greater extent than previously thought (Kynard 1997; Savoy 2004; Fernandes 2010; Zydlewski *et al.* 2011; Dionne *et al.* 2013). The reasons for inter-riverine movements are not yet clear, and the degree to which this behavior occurs appears to vary among river systems.

Shortnose sturgeon are benthic feeders, and their diet typically consists of small insects, crustaceans, mollusks, polychaetes, and small benthic fishes (McCleave *et al.* 1977; Dadswell 1979; Marchette and Smiley 1982; Dadswell *et al*. 1984; Moser and Ross 1995; Kynard *et al*. 2000; Collins *et al*. 2002). Both juvenile and adult shortnose sturgeon primarily forage over sandy-mud bottoms, which support benthic invertebrates (Carlson and Simpson 1987, Kynard 1997). Shortnose sturgeon have also been observed feeding off plant surfaces (Dadswell *et al.* 1984). Sturgeon likely use electroreception, olfaction, and tactile chemosensory cues to forage, while vision is thought to play a minor role (Miller 2004).

Foraging in the colder rivers in the northern part of their range appears to greatly decline or cease during winter months when shortnose sturgeon generally become inactive. In mid-Atlantic areas, including the Chesapeake Bay, and the Delaware River, foraging is believed to occur year-round, though shortnose sturgeon are believed to feed less in the winter (J.O'Herron, Amitrone O'Herron, Inc., pers. comm. 2008 as cited in SSRT 2010). In the southern part of their range, shortnose sturgeon are known to forage widely throughout the estuary during the winter, fall, and spring (Collins and Smith 1993, Weber *et al.* 1999). During the hotter months of summer, foraging may taper off or cease as shortnose sturgeon take refuge from high water temperatures.

Shortnose sturgeon are relatively small compared to most extant sturgeon species and reach a maximum length of about 120 cm total length (TL) and weight of about 24 kg (Dadswell 1979; Waldman *et al.* 2002); however, both maximum size and growth rate display a pattern of gradual variation across the range, with the fastest growth rates and smallest maximum sizes occurring in the more southern populations (Dadswell *et al.* 1984). The northernmost populations exhibit the slowest growth and largest adult sizes. The largest shortnose sturgeon reported in the published literature to date was collected from the Saint John River, Canada, and measured 143cm TL (122 cm fork length (FL)) and weighed 23.6 kg (Dadswell 1979). In contrast, in their review, Dadswell *et al.* (1984) indicated that the largest adult reported from the St. Johns River, Florida, was a 73.5 cm (TL) female. Dadswell *et al.* (1984) compared reported growth parameters across the range and showed that the von Bertalanffy growth parameter K and estimated asymptotic length ranged from 0.042 and 130.0 cm (FL), respectively, for Saint John River fish to 0.149 and 97.0 cm (FL) for Altamaha River, Georgia fish. However, the landlocked shortnose sturgeon population located upstream of Holyoke Dam at river km 140 of the Connecticut River has the slowest adult growth rate of any surveyed, which may at least in part reflect food limitations (Taubert 1980a).

Shortnose sturgeon are relatively long-lived and slow to mature. The oldest shortnose sturgeon reported was a 67 year-old female from the Saint John River, and the oldest male reported was a 32 year-old fish, also captured in the Saint John River (Dadswell 1979). In general, fish in the northern portion of the species' range live longer than individuals in the southern portion of the species' range (Gilbert 1989). Males and females mature at about the same length, around 45-55 cm FL, throughout their range (Dadswell *et al*. 1984). However, age at maturity varies by sex and with latitude, with males in the southern rivers displaying the youngest ages at maturity (see review in Dadswell *et al.* 1984). For example, age at first maturation in males occurs at about 2-3 years of age in Georgia and at about 10-11 years in the Saint John River. Females mature by 6 years of age in Georgia and at about 13 years in the Saint John River (Dadswell *et al.* 1984).

Sturgeon are iteroparous, meaning they reproduce more than once during their lifetime. In general, male shortnose sturgeon are thought to spawn every other year, but they may spawn annually in some rivers (Dovel *et al*. 1992; Kieffer and Kynard 1996). Females appear to spawn less frequently - approximately every 3 to 5 years (Dadswell 1979). Spawning typically occurs during late winter/early spring (southern rivers) and mid-to-late spring (northern rivers) (Dadswell 1979, Taubert 1980a and b, Kynard 1997). The onset of spawning may be cued by decreasing river discharge following the peak spring freshet, when water temperatures range from 8 to 15 °C and bottom water velocities range between 25-130 cm/s, although photoperiod (or day-length) appears to control spawning readiness (Dadswell *et al.* 1984; Kynard *et al.* 2012). Spawning appears to occur in the sturgeons' natal river, often just below the fall line at the farthest accessible upstream reach of the river (Dovel 1981; Buckley and Kynard 1985; Kieffer and Kynard 1993; O'Herron *et al.* 1993; Kieffer and Kynard 1996). Following spawning, adult shortnose sturgeon disperse quickly down river and typically remain downstream of their spawning areas throughout the rest of the year (Buckley and Kynard 1985, Dadswell *et al.* 1984; Buckley and Kynard 1985; O'Herron *et al.* 1993).

In a review by Gilbert (1989), fecundity of shortnose sturgeon was reported to range between approximately 30,000-200,000 eggs per female. Shortnose sturgeon collected from the Saint John River had a range of 27,000-208,000 eggs and a mean of 11,568 eggs/kg body weight (Dadswell 1979). Development of the eggs and transition through the subsequent larval, juvenile and sub-adult life stages are discussed in more detail in SSRT 2010.

A total abundance estimate for shortnose sturgeon is not available. However, population estimates, using a variety of techniques, have been generated for many individual river systems. In general, northern shortnose sturgeon population abundances are greater than southern populations (Kynard 1997). The Hudson River shortnose sturgeon population is currently considered to be the largest extant population (61,000 adults, 95 percent CI: 52,898-72,191; Bain *et al.* 2007; however, see discussion of this estimate in SSRT 2010). Available data suggest that some populations in northern rivers have increased over the past several decades (e.g., Hudson, Kennebec; Bain *et al*. 2000; Squiers 2003) and that others may be stable (e.g., Delaware; Brundage and O'Herron 2006). South of Chesapeake Bay, populations are relatively small compared to the northern populations. The largest population of shortnose sturgeon in the southern part of the range is from the Altamaha River, which was most recently estimated at 6,320 fish (95% CI: 4387-9249; Devries 2006). Occasional observations of shortnose sturgeon have been made in some rivers where shortnose sturgeon are considered extirpated (e.g., St. Johns, St. Mary's, Potomac, Housatonic, and Neuse rivers); the few fish that have been observed in these rivers are generally presumed to be immigrants from neighboring basins.

The most recent total population estimate for the Saint John River dates to the 1970's. Using tag recapture data from 1973-1977, Dadswell (1979) calculated a Jolly-Seber population estimate of 18,000 (±30% SE; 95 percent CI: 7,200- 28,880, COSEWIC, In Press) adults (> 50 cm) below the Mactaquac Dam. Several partial population estimates are also available for the Kennebecasis River, a tributary in the lower reaches of the Saint John River. Litvak (unpublished data) calculated a Jolly-Seber estimate of 2,068 fish (95% CI: 801-11,277) in the Kennebecasis using mark-recapture data from 1998 to 2004 (COSEWIC, In Press). Based on videotaping of overwintering aggregations of shortnose sturgeon on the Kennebecasis River at the confluence of the Hammond River (rkm 35), Li *et al.* (2007) used ordinary Kriging to estimate that 4,836 (95% CI: 4,701- 4,971) adult shortnose sturgeon were overwintering in that area. Usvyatsov *et al.* (2012) repeated this sampling in 2009 and 2011 and, using three different modeling techniques, estimated a total of 3,852- 5,222 shortnose sturgeon in the study area, which suggests fairly stable abundance and habitat use at this site.

Threats that contributed to the species' decline and led to the listing of shortnose sturgeon under the ESA included pollution, overfishing, and bycatch in the shad fishery (USDOI 1973). Shortnose sturgeon were also thought to be extirpated, or nearly so, from most of the rivers in their historical range (USDOI 1973). In the late nineteenth and early twentieth centuries, shortnose sturgeon were commonly harvested incidental to Atlantic sturgeon, the larger and more commercially valuable of these two sympatric sturgeon species (NMFS 1998). Although there is currently no legal directed fishing for shortnose sturgeon in the United States, poaching is suspected, and bycatch still occurs in some areas. In particular, shortnose sturgeon are caught incidentally by bass anglers and in the alewife/gaspereau, American shad, American eel, and Atlantic sturgeon fisheries in the Saint John River; and shad fisheries in the Altamaha River, Santee River, Savannah River, and elsewhere (COSEWIC, In Press; SSRT 2010; Bahn *et al.* 2009; COSEWIC 2005). The construction of dams has also resulted in substantial loss of historical shortnose sturgeon habitat in some areas along the Atlantic seaboard. The construction and operation of dams can impede upstream movement to sturgeon spawning habitat (e.g., Connecticut River, Santee River). Remediation measures, such as dam removal or modification to allow for fish passage have improved access in some rivers, and additional similar restoration efforts are being considered in other areas (e.g., possible removal of the Mactaquac dam in the Saint John River). Other possible and ongoing threats include operation of power generating stations, water diversion projects, dredging, and other in-water activities that impact habitat.

Distinct Population Segment Analysis

The following sections provide our analysis of whether the petitioned entity - the Saint John River population of shortnose sturgeon - qualifies as a DPS of shortnose sturgeon (whether it is both “discrete” and “significant”). To complete this analysis we relied on the best scientific and commercial data available and considered all relevant literature and public comments submitted in response to our 90-day finding (80 FR 18347, April 6, 2015).

For purposes of this analysis, we defined the Saint John River population segment of shortnose sturgeon to consist of shortnose sturgeon spawned in the Saint John River downstream of the Mactaquac Dam. Prior to construction of Mactaquac Dam in 1968/1969, sturgeon occurred upstream of the dam; however, it is unclear whether these were shortnose and/or Atlantic sturgeon and whether any sturgeon are still present upstream of the dam (COSEWIC, In Press). Lacking this information, we cannot consider fish that may be present upstream of the dam in our distinct population segment analysis. Throughout our discussion below we also use the term “population” to refer collectively to all shortnose sturgeon that are presumed to be natal to a particular river rather than using this term to refer strictly to a completely closed reproductive unit.

Discreteness Criterion

The Services' joint DPS Policy states that a population segment of a vertebrate species may be considered discrete if it satisfies either one of the following conditions:

(1) It is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors. Quantitative measures of genetic or morphological discontinuity may provide evidence of this separation.

(2) It is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the ESA (61 FR 4722, February 7, 1996).

There are no physical barriers preventing the movement of Saint John River shortnose sturgeon outside of the Saint John River estuary or along the coast. The Mactaquac Dam, located about 140 km upstream and at the head of tide (Canadian Rivers Institute 2011), is the first upstream physical barrier on the Saint John River. This and other dams on the Saint John River block shortnose sturgeon from accessing upstream habitats, but there are no dams or other physical barriers separating Saint John River sturgeon from other shortnose sturgeon populations.

As mentioned previously, shortnose sturgeon have been documented to leave their natal river/estuary and move to other rivers to varying extents across their range. For example, telemetry data generated by Zydlewski *et al.* (2011) during 2008- 2010 indicate that inter-riverine movements of adult shortnose sturgeon occur fairly frequently among rivers in Maine. Seventy percent of tagged adults (25 of 41 fish) moved between the Penobscot and Kennebec rivers (about 150 km away), and up to 52% of the coastal migrants (13 of 25 fish) also used other, smaller river systems (i.e., Damariscotta, Medomak, St. George) between the Penobscot and Kennebec rivers (Zydlewski *et al.* 2011). Shortnose sturgeon are also known to move between rivers in Maine and (e.g., Kennebec, Saco) and the Merrimack River estuary in Massachusetts, traveling distances of up to about 250 km (as measured by a conservative, direct path distance; Little *et al.* 2013; Wippelhauser *et al.* 2015). At the other end of the range, in the Southeast United States, inter-riverine movements appear fairly common and include movements between the Savannah River and Winyah Bay and between the Altamaha and Ogeechee rivers (Peterson and Farrae 2011; Post *et al*. 2014).

Many inter-riverine movements have been observed elsewhere within the species' range, but patterns are not yet well resolved. For example, some shortnose sturgeon captured and/or tagged in the Connecticut River have been recaptured, detected, or were previously tagged in the

Housatonic River (T. Savoy, CT DEP, pers. comm. 2015), the Hudson River (Savoy 2004), and the Merrimack River (M. Kieffer, USGS, pers. comm. 2015). At this time, the available tagging and tracking information is too limited to determine if Hudson River and Connecticut River shortnose sturgeon are making regular movements outside of their natal rivers and whether movement as far as the Merrimack River is a normal behavior. Movement data from the Chesapeake Bay is also relatively limited, but existing data indicate that shortnose sturgeon do move from the Chesapeake Bay through the Chesapeake and Delaware Canal into the Delaware River (Welsh *et al.* 2002).

The distances of the reported marine migrations vary widely from very short distances - such as between the Santee River and Winyah Bay, which are only about 15 km apart - to fairly long - as in the case of movements between the Merrimack and the Penobscot rivers, which are about 339 km apart at their mouths[1]. In general, the available data suggest that movements between geographically proximate rivers are more common, while movements between more distant rivers do not, or only rarely, occur. A detailed discussion of the physical movements of shortnose sturgeon is provided in SSRT 2010.

The extent of coastal movements of shortnose sturgeon from the Saint John River is currently unknown (COSEWIC, In Press); however, some limited data are available and provide some insight into whether these fish may be geographically isolated from other populations. Any

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[1] Distances between rivers mouths reported here were measured in GIS using the NOAA Medium Resolution Vector Shoreline, 20m bathymetry contour, and a fixed scale of 1:250,000. Estimated distances reported are the average of three, independently drawn and measured paths for each river pair. The assumed travel path between river mouths was the shortest possible distance that followed the general outline of the coast and was constrained by the 20m bathymetry contour, except where the shortest travel path across a deep, narrow inlet or bay crossed the 20m bathymetry contour.

movement between Saint John River sturgeon and the nearest population in the Penobscot River would require a marine migration of about 362 km, a similar travel distance as between the Merrimack and the Penobscot rivers (340 km) and between the Connecticut and Merrimack rivers (348 km)[2]. Dadswell (1979) reported that of 121 marked Saint John River shortnose sturgeon recaptured by commercial fisherman, 13 fish (11 percent) were recaptured in the Bay of Fundy, indicating that a portion of the population migrated into the marine environment. In addition, a confirmed shortnose sturgeon was caught in a fishing weir in the Minas Basin, off the coast of Nova Scotia about 165 km north of the mouth of the Saint John River (Dadswell *et al.* 2013). Fishermen in the Minas Basin also claim to catch about one to two shortnose sturgeon per year in their weirs (Dadswell *et al.* 2013). While it is plausible that the shortnose sturgeon captured in the Minas Bay originated from the Saint John River, data to confirm this are not available. In contrast, limited telemetry data suggest that movements outside of the Saint John River are not common. Of 64 shortnose sturgeon tagged in the Saint John River over the course of about 16 years from 1999 to 2015, none have been detected moving past the farthest downriver acoustic receiver located near the Saint John Harbor Bridge (M. Litvak, pers. comm. July 31, 2015).

Overall, while there is unambiguous evidence that shortnose sturgeon from the Saint John River leave the estuary – at least occasionally - and use the marine environment, and that shortnose sturgeon are capable of making long distance movements between river systems, there are no available data on coastal migrations of Saint John River shortnose sturgeon. To date, there are also no reported observations or detections of shortnose sturgeon from the Gulf of Maine

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[2] Distances reported here were measured following the same methods described in the previous footnote. The distance reported between the Connecticut and Merrimack River assumes a travel path via the Cape Cod Canal. A travel path around Cape Cod would instead result in a marine migration of about 560 km.

rivers moving into the Saint John River. Thus, while it is possible that the Saint John River shortnose sturgeon come in contact with shortnose sturgeon from elsewhere, it is also likely that some degree of geographical isolation by distance is occurring.

Although acoustic telemetry studies have revealed that shortnose sturgeon leave their natal river systems to a much greater extent than previously thought, such movements do not necessarily constitute permanent emigration or indicate interbreeding of populations. Tagging and telemetry studies within several river systems have provided evidence that shortnose sturgeon in those particular systems tend to spawn in their natal river (e.g., Dovel 1981; Buckley and Kynard 1985; Kieffer and Kynard 1993; O‘Herron *et al.* 1993; Kieffer and Kynard 1996). Tag return data for shortnose sturgeon in the Saint John River over the course of a 4-year study completed by Dadswell (1979) suggests there is little emigration from this system as well, and that spawning takes place in the freshwater sections of the upper estuary. The high site fidelity to natal rivers suggested by this and other studies indicates a there is a possible behavioral mechanism for the marked separation of the Saint John River population of shortnose sturgeon from other populations of the species.

A substantial amount of genetic data has become available since the “Final Recovery Plan for Shortnose Sturgeon” was developed in 1998. Below, we summarize the best available genetic data and information, which informed our evaluation of the “discreteness” of the Saint John River population segment. A more in-depth presentation of genetic data, including discussions of types of analyses and assumptions, is available in the Biological Assessment (SSRT 2010).

Much of the published information on population structure for shortnose sturgeon has been based on the genetic analysis of the maternally inherited mitochondrial DNA (mtDNA) due in part to the difficulties of analyzing data from the polyploid nuclear genome (Waldman *et al.* 2008). The analyses have focused on a moderately polymorphic 440 base pair portion of the mtDNA control region - a relatively rapidly evolving region of mtDNA and thus a good indicator of population-level differentiation. Haplotype frequencies and sequence divergence data have consistently indicated an overall isolation-by-distance pattern of genetic population structure across the species' range, meaning that populations of shortnose sturgeon inhabiting rivers and embayments that are geographically more distant tend to be less related than those that are geographically closer (e.g., Walsh *et al*. 2001, Grunwald *et al.* 2002, Waldman *et al*. 2002, and Wirgin *et al.* 2005; Wirgin *et al*. 2009). The haplotypes observed are typically shared across two to four or more adjacent sampled rivers but with little sharing of haplotypes between northern and southern populations (Waldman *et al.* 2002; Wirgin *et al.* 2009). Results for the Saint John River are compatible with these general patterns. For example, in the largest study to date, Wirgin *et al.* (2009) observed eight haplotypes within the Saint John River sample (n=42); and of the eight observed haplotypes, one was exclusive (or "private") to the Saint John River (and observed in 1 of 42 fish), and the remaining haplotypes were shared with two to six other rivers. None of the shared haplotypes were observed in samples south of the Chesapeake Bay. A previously unreported haplotype was recently observed in 2 of 15 shortnose caught from the Kennebecasis River, a tributary of the Saint John (Kerr, 2015; P. Wilson, public comment, May 2015). This new haplotype could indicate an even greater degree of differentiation of the Saint John River fish; however, no other rivers were sampled or analyzed as part of this study.

Despite the localized sharing of haplotypes, frequencies of the observed haplotypes are significantly different in most pairwise comparisons of the rivers sampled (i.e., comparisons of haplotype frequencies from samples from two rivers), including many adjacent rivers (Wirgin *et al.* 2009). Such pairwise comparisons for the Saint John River in particular have indicated that this population is genetically distinct from the geographically closest sampled populations, including the Penobscot, Kennebec, and Androscoggin rivers (Grunwald *et al.* 2002; Waldman *et al.* 2002; Wirgin *et al.* 2005; Wirgin *et al.* 2009). For example, Wirgin *et al.* (2009) reported significant differences ($p<0.0005$) in haplotype frequencies between Saint John River shortnose sturgeon (n=42) and Penobscot (n=44, Chi-square= 37.22), Kennebec (n=54, Chi-square=54.85), and Androscoggin (n=48, Chi-square = 37.91) river samples. The level of genetic differentiation between the Saint John River population and the Penobscot, Kennebec, and Androscoggin rivers also appears substantial, with Phi $_{ST}$ values ranging from 0.213 to 0.291 (where Phi $_{ST}$ ranges from 0 to 1, with 1 indicating complete isolation; Wirgin *et al.* 2009).

Estimates of female-mediated gene flow between the Saint John River and the Gulf of Maine rivers are fairly low. Wirgin *et al.* (2009) estimated female-mediated gene flow between the Saint John River and other Gulf of Maine rivers as 1.90 - 2.85 female migrants per generation based on Phi $_{ST}$ values, and as 1.5 - 1.9 females per generation in a separate, coalescent-based analysis. This result suggests that (if model assumptions are true) no more than three female shortnose sturgeon from the Saint John River are likely to spawn in the other Gulf of Maine rivers (or vice versa) per generation. These results provide additional evidence that the degree of female-based reproductive exchange between the Saint John River population and other nearby shortnose river populations has been relatively limited over many generations.

More recently, King *et al.* (2014) completed a series of analyses using nuclear DNA (nDNA) samples from 17 extant shortnose sturgeon populations across the species range. In contrast to the maternally inherited mtDNA, nDNA reflects the genetic inheritance from both the male and female parents. King *et al*. (2014) surveyed the samples at 11 polysomic microsatellite DNA loci and then evaluated the 181 observed alleles as presence/absence data using a variety of analytical techniques. The population structuring revealed by these analyses is consistent with the previous mtDNA analyses in that they also indicate a regional scale isolation-by-distance pattern of genetic differentiation. Analysis of genetic distances among individual fish (using principle coordinate analysis, PCO) revealed that the sampled fish grouped into one of three major geographic units: 1) Northeast, which included samples from the Saint John, Penobscot, Kennebec, Androscoggin, and Merrimack rivers; 2) Mid-Atlantic, which included samples from the Connecticut, Hudson, and Delaware rivers, as well as the Chesapeake Bay proper; and 3) Southeast, which included samples from the Cape Fear River, Winyah Bay, the Santee-Cooper, Edisto, Savannah, Ogeechee, and Altamaha rivers, and Lake Marion (King *et al.* 2014).

Subsequent analyses revealed that each of the three regions has a different pattern of sub-structuring. Within the Northeast group, two separate analyses (PCO and STRUCTURE) indicated a high degree of relatedness and possible panmixia (i.e., random mating of individuals) among the Penobscot, Kennebec, and Androscoggin rivers; whereas, the Saint John and Merrimack rivers appeared more differentiated from each other as well as from the other Gulf of Maine rivers (King *et al*. 2014). Pairwise comparisons at the population level showed that, within the Northeast region, estimates of genetic differentiation were greatest between the Saint John and Merrimack rivers ($\text{Phi}_{PT} = 0.100$, $p < 0.0004$), the two most distant rivers within this region. Pairwise comparisons of the Saint John River to the remaining rivers within the Northeast region revealed lower but still statistically significant levels of genetic differentiation (Phi $_{PT}$ = 0.068- 0.077; King *et al*. 2014). Relatively low levels of differentiation were observed in pairwise comparisons for all other rivers within the Northeast region (Phi $_{PT}$ = 0.013- 0.087), half of which were not statistically significant (King *et al.* 2014). In comparison, within the Mid-Atlantic group, pairwise comparisons among rivers showed moderate levels of genetic differentiation among most river populations (average Phi $_{PT}$ = 0.077, range = 0.018 – 0.118); whereas, estimates of population level genetic differentiation were very low among samples populations in the Southeast group (average Phi $_{PT}$ = 0.047, range = 0.005 to 0.095; King *et al.* 2014), suggesting a more genetically similar set of populations.

Theoretical estimates of gene flow (derived from Phi $_{PT}$ values) between the Saint John River and the other Northeast rivers ranged from 2.25 to 3.43 migrants per generation (King *et al.* 2014). Gene flow estimates for the Merrimack River were similarly low, ranging from 2.25 to 4.06 (King *et al.* 2014). In contrast, the effective number of migrants per generation estimated to occur between the remaining rivers within the Northeast region was much higher and ranged from 16.42 to 83.08 (King *et al.* 2014).

Overall, the analyses completed by King *et al.* (2014) indicate that differentiation among Northeast populations is less than that observed among the Mid-Atlantic populations and greater than that observed among Southeast populations. However, within the Northeast region, both the Saint John and Merrimack River sample populations are genetically distinct from the other sample populations. Although the estimates of gene flow suggest some connectivity between the Saint John and other rivers within the Northeast, the significantly different allele and haplotype frequencies shown consistently in the nDNA and mtDNA studies provide indirect evidence that the Saint John River population is relatively reproductively isolated.

As highlighted in the DPS Policy, quantitative measures of morphological discontinuity or differentiation can serve as evidence of marked separation of populations. We examined whether the morphological data for shortnose sturgeon across its range provide evidence of marked separation of the Saint John River population. As noted previously, maximum adult size (length and weight) varies across the range, with the largest maximum sizes occurring in the Saint John River at the northernmost end of the range, and the smallest sizes occurring in rivers at the southern end of the range (Dadswell *et al*. 1984). The largest individual reported in the literature (122 cm FL, 23.6 kg) was captured in the Saint John River, although there is also a report of a specimen measuring 124.6 cm FL (M. Litvak, unpublished data, as cited in COSEWIC, In Press). Lengths of shortnose sturgeon captured in surveys of the Saint John River in 1974-1975 ranged from 60 to 120 cm FL (n=1,621). The majority of these fish, however, were smaller than 100 cm FL (1,476 fish), and only six fish were longer than 111 cm FL (Dadswell 1979). To the south, in the Kennebec River, Maine shortnose sturgeon captured during 1980 and 1981 had lengths ranging from 58.5 to 103.0 cm FL, and averaging 80.8 cm FL (n=24; Walsh *et al.* 2001). Smaller size ranges are reported for rivers in the southernmost portion of the range with some occasional captures of larger specimens. For example, adult shortnose sturgeon captured in the Altamaha River, Georgia, in 2010- 2013 ranged from 57.4 – 83.0 cm FL and averaged 70.1 cm long (FL, n=40; Peterson 2014), but a shortnose sturgeon measuring 104.5 cm FL and weighing 8.94 kg was captured in the Altamaha River in summer, 2004 (D. Peterson, UGA, unpubl. data). Overall, the attribute of size appears to display clinal variation, meaning there is a gradual change with geographic location (Huxley 1938). The fact that the Saint John River population segment, which lies at the northernmost end of the range, exhibits the largest sizes does not in itself constitute a morphological discontinuity. Given the apparent gradual nature of the variation in size with latitude, we find that there is no marked separation of the Saint John River population segment on the basis of a quantitative discontinuity in size.

In addition to body size, other attributes such as snout length, head length, and mouth width can provide evidence of a morphological discontinuity and were also considered. Walsh *et al.* (2001) examined six morphological and five meristic attributes for shortnose sturgeon in the Androscoggin, Kennebec, and Hudson rivers. All morphological features measured (i.e., body length, snout length, head length, mouth width, and interorbital width) were largest for the Kennebec River fish and smallest for fish from the southern-most river in the study, the Hudson River (Walsh *et al.* 2001). Meristic features (e.g., scute counts) were similar for the three rivers and were not related to fish size (Walsh *et al.* 2001). Overall, the degree of phenotypic differentiation of fish from the two rivers in Maine (Androscoggin and Kennebec), which share an estuary mouth, was very low, while a much greater degree of differentiation was observed for the fish from the Hudson River (Walsh *et al*. 2001). This result was congruent with results of corresponding mtDNA analyses, which indicated that the Hudson River had a much greater degree of genetic differentiation from, and much lower rate of gene flow with, the two rivers in Maine (Walsh *et al.* 2001). The results of this particular study suggest there could be clinal variation in these other phenotypic characteristics, similar to the pattern observed for body size. As far as we are aware, however, similar studies have not yet been conducted to examine the variation in additional sets of morphological attributes across the range of shortnose sturgeon and relative to the Saint John River population in particular. Therefore, there is no basis to conclude marked separation of the Saint John River population segment on the basis of morphological discontinuity.

In conclusion, although the currently available data do not show that the Saint John River shortnose sturgeon constitute a completely isolated or closed population, we find that available genetic data, evidence of site fidelity, and the likelihood of some degree of geographical isolation together constitute sufficient information to indicate that the Saint John River shortnose sturgeon are markedly separated from other populations of shortnose sturgeon. Thus, after considering the best available data and all public comments submitted in response to our initial petition finding, we conclude that the Saint John River population segment of shortnose sturgeon is "discrete." We therefore proceeded to evaluate the best available data with respect to the second criterion of the DPS Policy, "significance."

Significance Criterion

Under the DPS Policy, if a population segment is found to be discrete, then we proceed to the next step of evaluating its biological and ecological significance to the taxon to which it belongs. As we explained above, a population must be both "discrete" (the first prong of the DPS Policy) and "significant" (the second prong of the DPS Policy) to qualify for recognition as a DPS.

Consideration of significance may include, but is not limited to: (1) persistence of the discrete population segment in an ecological setting unusual or unique for the taxon; (2) evidence that the loss of the discrete population segment would result in a significant gap in the range of a taxon; (3) evidence that the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historical range; and (4) evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics (61 FR 4722, February 7, 1996). These four factors are non-exclusive; other relevant factors may be considered in the "significance" analysis. Further, significance of the discrete population segment is not necessarily determined by existence of one of these classes of information standing alone. Rather, information analyzed under these and any other applicable considerations is evaluated relative to the biological and ecological importance of the discrete population to the taxon as a whole. Accordingly, all relevant and available biological and ecological information is analyzed to determine whether, because of its particular characteristics, the population is significant to the conservation of the taxon as a whole.

Persistence in an Ecological Setting Unusual or Unique for the Taxon

Shortnose sturgeon once occupied most major rivers systems along the Atlantic coast of North America (Kynard 1997). Although extirpated from some areas due mainly to overharvest, bycatch, pollution, and habitat degradation, shortnose sturgeon still occur in at least 25 rivers systems within their historical range (NMFS 1998). Throughout their current range, shortnose sturgeon occur in riverine, estuarine, and marine habitats; and, as adults, generally move seasonally between freshwater spawning habitat and downstream mesohaline and sometimes coastal marine areas in response to cues such as water temperature, flow, and salinity. Like other species of sturgeon (e.g. *A. transmontanus* in the Columbia River, Oregon), shortnose sturgeon are also capable of adopting a fully freshwater existence, as is the case for the population of shortnose sturgeon above the Holyoke Dam in the Connecticut River and in Lake Marion, South

Carolina. While each river system within the shortnose sturgeon's range is similar in terms of its most basic features and functions, each river system differs to varying degrees in terms of its specific, physical and biological attributes, such as hydrologic regime, benthic substrates, water quality, and prey communities. A few examples are discussed briefly below.

The Saint John River begins in northern Maine, United States, travels through New Brunswick, Canada, and empties into the Bay of Fundy within the northeast Gulf of Maine. The river is approximately 673 km long, fed by numerous tributaries, and has a large tidal estuary and a basin area of over 55,000 km^2 (Kidd *et al.* 2011). According to the Nature Conservancy's (TNC) ecoregion classification system, the Saint John River watershed lies within the New England-Acadian (terrestrial), Northeast United States and Southeast Canada Atlantic Drainages (freshwater), and the Gulf of Maine/Bay of Fundy (marine) ecoregions. The mean annual discharge is approximately 1,100 m^3/s, dissolved oxygen levels average 8.5 to 11 mg/l, and benthic substrates downstream of the Mataquac Dam consist largely of shifting sands (Kidd *et al.* 2011). Due to the low slope of the lower reaches and the extreme tidal range of the Bay of Fundy, the head of the tide can extend about 140 km upstream from the river mouth (Kidd *et al.* 2011). During the shortnose sturgeon spring/summer spawning season, water temperatures range from about 10 to 15^o C; and within overwintering areas, water temperature range between 0 and 13^o C (Dadswell 1979; Dadswell *et al.* 1984). Shortnose sturgeon in the Saint John River appear to move to deeper waters when surface water temperatures exceed 21^o C (Dadswell *et al.* 1984). Further to the south, but still within the same terrestrial, freshwater, and marine TNC ecoregions as the Saint John River, is the smaller Penobscot River system in Maine. This river is 175 km long (not including the West and South Branches), has a drainage basin of 22,265 km^2, and an annual average discharge of about 342 m^3/s (Lake *et al.* 2012; USGS 2015). Benthic substrates, consisting of bedrock, boulders, cobble and sand deposits are undergoing changes in response to the removal of two dams - Great Works Dam at rkm 60 and Veazie Dam at rkm 48 - within the past three years (FERC 2010; Cox *et al*. 2014). The Veazie Dam was located close to the head of the tide, and although conditions have since changed, Haefner (1967, as cited in Fernandes *et al*. 2010) stated that, during peak springtime flows, freshwater extends to rkm 17, and that the salt wedge intrudes as far as about rkm 42 when river discharges decrease in summer. Water temperatures in shortnose sturgeon overwintering areas in the Penobscot River range from about 0 ^{o}C to 13.3 ^{o}C, and the fish appear to move out of overwintering areas when water temperatures reach about 2.4 ^{o}C (Fernandes *et al.* 2010). Towards the southern end of the range and occurring within a very different set of ecoregions is the Altamaha River, which is formed by the confluence of the Ocmulgee and Oconee rivers in Georgia. One of the longest free-flowing systems on the Atlantic Coast, the Atlamaha River is just over 220 km long, has a watershed area of about 37,300 km^2, and flows mainly eastward before emptying into the Atlantic Ocean (TNC 2005). Tidal influence extends up to about rkm 40 (DeVries 2006). The average annual discharge is 381 m^3/s, and benthic substrates consist mostly of sands with very few rocky outcrops (Heidt and Gilbert 1979; DeVries 2006). Water temperatures during the winter/spring spawning period have averaged about 10.5 ^{o}C (Heidt and Gilbert 1979), which is consistent with DeVries' (2006) observation that spawning runs appeared to commence when water temperatures reach 10.2 ^{o}C. When water temperatures exceed 27 ^{o}C, shortnose sturgeon typically move above the salt-fresh water interface and aggregate in deeper areas of the river (DeVries 2006); however, shortnose sturgeon have also been observed to use lower portions of the river throughout the summer, even when water temperatures averaged 34 ^{o} C (Heidt and Gilbert 1979; DeVries 2006).

Overall, the variation in habitat characteristics across the range of shortnose sturgeon indicates that there is no single type or typical river system. Despite a suite of existing threats, shortnose sturgeon continue to occupy many river systems across their historical range. The fact that the Saint John River lies at one end of the species' range, and among other attributes, experiences different temperature and flow regimes, does not mean that this particular river is unusual or unique given the variability in habitat conditions observed across the range. Therefore, we conclude that the Saint John River is not an unusual or unique ecological setting when viewed against the range of the taxon as a whole. Furthermore, though not relied up on for our finding, we note that COSEWIC (In Press) recently concluded that shortnose sturgeon from other river systems would probably be able to survive in Canada.

Significant Gap in the Range of the Taxon

The second consideration under the DPS Policy in determining whether a population may be "significant" to its taxon is whether the "loss of the discrete population segment would result in a significant gap in the range of a taxon'' (61 FR 4722, February 7, 1996). Shortnose sturgeon are distributed along the Atlantic coast of North America from the Minas Basin, Nova Scotia to the St. Johns River, Florida, representing a coastal range of roughly 3,700 km. The Saint John River, located at the northern end of the range, represents a small portion of the species' currently occupied geographic range. In addition, although the Saint John River is presumed to contain a relatively large population of shortnose sturgeon, that populaiton is not considered the largest, and it represents one of at least 10 spawning populations (SSRT 2010). Furthermore, relatively recent field data indicate shortnose sturgeon make coastal migrations to a greater extent than previously thought (e.g., Dionne *et al.* 2013) and are capable of making marine migrations of over 300 km (e.g., between Penobscot and Merrimack rivers; M. Kieffer, USGS, pers. comm. 2010). Such data suggest the potential for recolonization of the Saint John River by shortnose sturgeon migrating from populations to the south. Further indirect evidence in support of this possibility comes from the existing genetic data, which indicate some level of gene flow among rivers in the Northeast, including the Saint John River (Wirgin *et al.* 2005; Wirgin *et al.* 2009; King *et al.* 2014). Thus, in light of the potential for recolonization and the fact that the Saint John River population of shortnose sturgeon does not constitute a substantial proportion of the species' range, we conclude that the loss of the Saint John River would not constitute a significant gap in the range of the species.

Only Natural Occurrence of the Taxon

Under the DPS Policy, a discrete population segment that represents the "only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historical range" may be significant to the taxon as whole (61 FR 4722, February 7, 1996). This consideration is not relevant in this particular case, because shortnose sturgeon are present in many river systems throughout their historical range (SSRT 2010).

Genetic Characteristics

As stated in the DPS Policy, in assessing the "significance" of a "discrete" population, we consider whether the discrete population segment differs markedly from other populations of the species in its genetic characteristics (61 FR 4722, February 7, 1996). Therefore, we examined the available data to determine whether the Saint John River shortnose sturgeon differ markedly in their genetic characteristics when compared to other populations. In conducting this evaluation under the second criterion of the DPS policy, we looked beyond whether the genetic data allow for discrimination of the Saint John population segment from other populations (a topic of evaluation in connection with the first criterion of "discreteness"), and instead focused on whether the data indicate marked genetic differences that appear to be significant to the taxon as a whole. In this sense, we give independent meaning to the "genetic discontinuity" of the discreteness criterion of the DPS Policy and the "markedly differing genetic characteristics" of the significance criterion.

Genetic analyses indicate fairly moderate to high levels of genetic diversity of shortnose sturgeon in most river systems across the geographic range (Grunwald *et al.* 2002, Quattro *et al.* 2002; Wirgin *et al.* 2009). Based on the 11 nDNA loci examined in samples from 17 locations, King *et al*. (2014) reported that the number of observed alleles (i.e., versions of a gene at a particular locus; here with overall frequencies >1%) ranged from a low of 55 in the Cape Fear River (n= 3 fish) to a high of 152 in the Hudson River (n= 45 fish); 118 alleles were observed in the Saint John River sample (n=25 fish). Estimated heterozygosity was not reported by river sample, but King *et al*. (2014) noted that it was lowest for the southern rivers relative to the mid-Atlantic and northern river samples. Wirgin *et al.* (2009) reported that haplotypic diversity ranged from 0.500 (Santee River, n=4) to 0.862 (Altamaha River, n= 69) across 15 sample populations, with the Saint John River population having a haplotype diversity index of 0.696 (n=42). The number of individual haplotypes observed in any one river sample ranged from two (Santee River, n=4) to 13 (Winyah Bay, n=46), with eight haplotypes observed in the Saint John River sample (n=42, Wirgin *et al.* 2009). The level of genetic diversity based on the mtDNA was not correlated with population size, and there was also no evidence of population bottlenecks, which may be due to historical recency of most population declines (over past ~100 years, Grunwald *et al.* 2002; Wirgin *et al.* 2009). Overall, the level of genetic diversity observed for the Saint John River population segment is not unusual relative to that observed in the taxon as a whole. However, Grunwald *et al*. (2002) noted that the lack of reduced haplotypic diversity within the northern sample rivers contrasts with findings for other anadromous fishes from previously glaciated rivers. Grunwald *et al.* (2002) hypothesized the high degree of haplotypic diversity and large number of unique haplotypes in the previously glaciated northern region (i.e., Hudson River and northward) may be the result of a northern population having survived in one or more northern refugia.

As discussed previously, at a regional scale, most of the mtDNA haplotypes observed are shared across multiple, adjacent rivers sampled; however, very little sharing of haplotypes has been documented between the northern and southern portions of the range (Quattro *et al.* 2002; Grunwald *et al.* 2002; Wirgin *et al.* 2009). In the analysis conducted by Wirgin *et al*. (2009), the Saint John River sample had one private haplotype (in 1 of 42 fish) and shared the remaining 7 haplotypes with multiple rivers. Of the seven shared haplotypes, two were each shared with two other river systems, including the Hudson and Connecticut rivers, and the remaining five haplotypes were shared across three to six other rivers within the northeast and mid-Atlantic portions of the range (Wirgin *et al.* 2009). In an earlier study by Quattro *et al.* (2002) in which control region mtDNA was sequenced for 211 shortnose sturgeon collected from five southeastern U.S. rivers and the Saint John River, one haplotype was observed in all river samples. This shared haplotype occurred in 1 of 13 fish (7.7%) sampled from the Saint John

River and 1 of 5 fish (20%) sampled from Winyah Bay; the remaining river samples contained this haplotype at higher frequencies (36% - 79%, Quattro *et al.* 2002).

While the shortnose sturgeon from the Saint John River have a fairly high degree of genetic diversity and shared haplotypes with other rivers, they can be statistically differentiated from other river samples based on haplotype frequencies and nDNA distance metrics (Wirgin *et al*. 2009; King *et al.* 2014). However, the same is also true for the majority of rivers across the range of the species. For example, using genetic distances (Phi $_{PT}$), King *et al*. (2014) detected significant differences in all pairwise comparisons except for three rivers in the northeast (Penobscot, Androscoggin, and Kennebec rivers) and three rivers in the southeast (Edisto, Savannah, and Ogeechee rivers). Similarly, significant differences in haplotype frequencies have been reported for most river populations sampled. In Chi-squared analyses, Grunwald *et al.* (2002) reported significant differences for all but 4 of 82 pairwise comparisons of mtDNA nucleotide substitution haplotype frequencies across 10 sample sets (two of which were from different sections of the Connecticut River), and Wirgin *et al.* (2009) reported significant differences for all but 9 of 91 pairwise comparisons of mtDNA haplotype frequencies across 13 river populations.

The magnitude of these genetic differences between individual river systems varies across the range of the species and indicates a hierarchical pattern of differentiation. For example, the mtDNA data reveal a deep divergence between rivers in the northern portion of the range from rivers in the southern portion of the range. Of the 29 haplotypes observed by Grunwald *et al.* (2002), 11 (37.9%) were restricted to northern systems, 13 (44.8%) were restricted to the more southern systems, and only 5 (17.2%) slightly overlapped the two regions.

In the later and larger study by Wirgin *et al.* (2009), the observed haplotypes again clustered into regional groupings: 10 of 38 observed haplotypes (26.3%) only occurred in systems north of the Hudson River, 16 of 38 (42.1%) only occurred in systems south of the Chesapeake Bay, and just 5 of 38 (13.2%) haplotypes overlapped in the mid-Atlantic region. The limited sharing of haplotypes between the north and south regions is consistent with strong female homing fidelity and limited gene flow between these regions. The break in shared haplotypes corresponds with the historical division of the species due to Pleistocene glaciation, which Grunwald *et al.* (2002) stated was probably the most significant event affecting population structure and patterns of mtDNA diversity in shortnose sturgeon.

The recent nDNA analyses of King *et al.* (2014) also indicate an unambiguous differentiation of sample populations into one of three major geographic groupings - Northeast, Mid-Atlantic, or Southeast. When all 17 sample populations were pooled by these three geographic regions, correct assignment to each region was 99.1% for the Northeast and 100% (i.e., zero mi-assigned fish) for the remaining two regions (King *et al.* 2014). Of the 133 fish included for the Northeast group, one was mis-assigned to the Mid-Atlantic. The estimates of effective migrants per generation (based on Phi $_{PT}$) are consistent with the regional zones of genetic discontinuity among Northeast, Mid-Atlantic, and Southeast river systems. The average migrants per generation between regions ranged from less than one migrant (i.e., 0.89) between Northeast and Southeast to nearly two migrants (i.e., 1.89) between Northeast and Mid-Atlantic. In contrast, the range of estimated migrants per generation within regions was 2.25 - 83.08 for the Northeast, 1.87 – 13.64 for the Mid-Atlantic, and 2.38 – 49.75 for the Southeast (King *et al.* 2014). The estimated migrants per generation between the Saint John River in particular and all other rivers within the Northeast ranged from 2.25 – 3.43 (King *et al.* 2014). Taken together, these data indicate that the degree of genetic differentiation between the Saint John River and the rivers within the Gulf of Maine is relatively small or “shallow”, especially relative to the deeper divergence observed among the regional groupings of river populations. A possible explanation for the relatively low level of differentiation within the Northeast is that the those populations are relatively young in a geologic sense due to recent glaciations compared to populations in the more southern part of the range (SSRT 2010).

In conclusion, given the patterns of genetic diversity, shared haplotypes, and relative magnitudes of genetic divergence at the river drainage versus regional scale, we find there is insufficient evidence that the Saint John River population of shortnose sturgeon differs markedly in its genetic characteristics relative to the taxon as a whole so as to meet the test for “significance” on this basis. While the Saint John River population segment can be genetically distinguished from other river populations, available genetic evidence places it into a larger evolutionarily meaningful unit, along with several other river populations sampled. The degree of differentiation among the three larger regional groups is more marked than the differences observed among populations from the Saint John and other nearest rivers, suggesting that the Saint John River population’s differentiation is not “significant” in the context of the whole species. Gene flow estimates are also consistent with the observed deeper zones of divergence detected at the regional scale. Thus, we conclude that these data do not support delineation of the Saint John River population segment as “significant.” In so interpreting the available genetic data, we are mindful of the Congressional guidance to use the DPS designation sparingly.

DPS Conclusion and Petition Finding

We conclude that the Saint John River population of shortnose sturgeon is “discrete” based on evidence that it is a relatively closed and somewhat geographically isolated population segment. It thus satisfies the first prong of the DPS policy. However, we also find that the Saint John River population segment is not “significant” to the taxon as a whole. It thus fails to satisfy the second prong of the DPS Policy. As such, based on the best available data, we conclude that the Saint John River population of shortnose sturgeon does not constitute a DPS and, thus, does not qualify as a “species” under the ESA. Therefore, we deny the petition to consider this DPS for delisting. Our denial of the petition on this ground does not imply any finding as to how we should proceed if the situation were otherwise, i.e., where a population is found instead to meet the criteria to be a DPS. Even if the population had met both criteria of the DPS Policy, and even if the population were also found to have a status that differed from the listed entity, it would not necessarily be appropriate to propose modifications to the current listing, in light of the unsettled legal issues surrounding such revisions. Nor do we resolve here what steps would need to be followed to propose revisions to the species’ listing if the facts had been otherwise; such an inquiry would be hypothetical in this case. It is clear that because the petition at issue here sought identification of a DPS, and because the population at issue is not a DPS, this particular petition must be denied. As this is a final action, we do not solicit comments on it.

References Cited

A complete list of references is available upon request to the Office of Protected Resources (see **ADDRESSES**).

Authority

The authority for this action is the Endangered Species Act of 1973, as amended **(**16 U.S.C. 1531 *et seq*.).

Dated: October 20, 2015.

Samuel D. Rauch III,

Deputy Assistant Administrator for Regulatory Programs,

National Marine Fisheries Service.

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