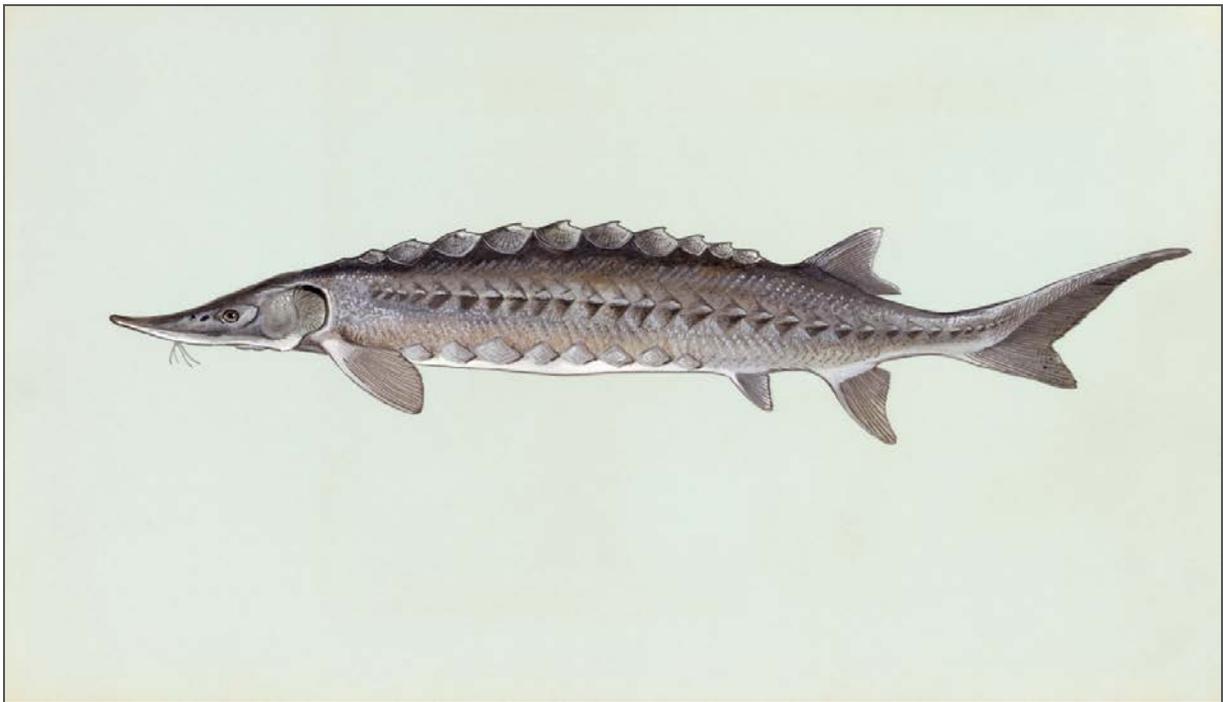


**A Species Action Plan for the
Atlantic Sturgeon**
Acipenser oxyrinchus oxyrinchus

Final Draft
November 1, 2013



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EXECUTIVE SUMMARY

The Florida Fish and Wildlife Conservation Commission (FWC) developed this plan in response to the determination that the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) be recommended for listing as Threatened on the Florida Endangered and Threatened Species List. Subsequent to this determination, the National Marine Fisheries Service designated Atlantic sturgeon in the Southern Distinct Population Segment (DPS) as Endangered under the federal Endangered Species Act (ESA). The goal of this plan is to improve the conservation status of the Atlantic sturgeon in Florida to the point that the species can be removed from the Florida Endangered and Threatened Species List and will not again need to be listed. Until the entire Southern DPS of Atlantic sturgeon is removed from ESA listing, this goal cannot be achieved.

The objectives of this plan are to maintain or increase Florida's Atlantic sturgeon population and preferred habitat types within 10 years of implementation of this plan. A major strategy for achieving this objective is to maintain the existing water quality, water quantity, and habitat characteristics within identified occurrence watersheds. The [Biological Status Review](#) identified poor water quality (e.g., low dissolved oxygen) and habitat degradation (e.g., conversion from agriculture to suburban communities) to be the primary current threats to survival for Atlantic sturgeon in Florida. Because much is unknown about the specific habitat requirements of the Atlantic sturgeon at various life-stages, achieving these objectives will require research and monitoring efforts by cooperating agencies. Specific actions proposed to increase understanding of Atlantic sturgeon biology and its habitat requirement include genetic testing to determine river-of-origin for Florida's Atlantic sturgeon; surveys to determine population densities, habitat associations, and new occurrence locations; monitoring and mitigation of threats to survival; and restoration of riverine habitat. Additional steps may include the development of habitat conservation guidelines, public outreach, and coordination with local governments and agencies for creation of development guidelines and land use planning assistance. Successful management of Atlantic sturgeon through implementation of this plan will require cooperation among local, state, and federal governmental agencies; non-governmental organizations; developmental and industrial interests; private landowners; academic institutions; and the public.

This plan details the actions necessary to improve the conservation status of the Atlantic sturgeon. A summary of this plan will be included in the Imperiled Species Management Plan (ISMP) in satisfaction of the management plan requirements in Chapter 68A-27, Florida Administrative Code, Rules Relating to Endangered or Threatened Species. The ISMP will address comprehensive management needs for 60 of Florida's imperiled species and will include an implementation plan; rule recommendations; permitting standards and exempt activities; anticipated economic, ecological, and social impacts; projected costs of implementation and identification of funding sources; and a revision schedule. The imperiled species management planning process relies heavily on stakeholder input and partner support. This level of involvement and support is also critical to the successful implementation of the ISMP. Any significant changes to this plan will be made with the continued involvement of stakeholders.

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GLOSSARY OF TERMS AND ACRONYMS

ASMFC: Atlantic States Marine Fisheries Commission, a management counsel comprised of representatives of each of the United States bordering the Atlantic Ocean.

BMPs: Best Management Practices. Generally, BMPs represent methods, measures or practices that are developed, selected, or approved by various agencies to protect, enhance and preserve natural resources including wildlife habitat. They include, but are not limited to, engineering, conservation, and management practices for mining, agriculture, silviculture, and other land uses, that are designed to conserve water quality and quantity, soil and associated nutrients, and to simultaneously control nonpoint and point-source pollution and other impacts to natural resources including aquatic and terrestrial wildlife habitat.

BRG: Biological review group, a group of taxa experts convened to assess the biological status of taxa using criteria specified in Rule 68A:27.001, Florida Administrative Code, and following the protocols in the Guidelines for Application of the (International Union for Conservation of Nature (IUCN) Red List Criteria at Regional Levels (Version 3.0) and Guidelines for Using the IUCN Red List Categories and Criteria (Version 8.1).

BSR: Biological status review report, the summary of the biological review group's findings. Includes a Florida Fish and Wildlife Conservation Commission (FWC) staff recommendation on whether or not the species status meets the listing criteria in Rule 68A-27.001. These criteria, based on IUCN criteria and IUCN guidelines, are used to help decide if a species should be added or removed from the Florida Endangered and Threatened Species List. In addition, FWC staff may provide within the report a biologically justified opinion that differs from the criteria-based finding.

DEP: Florida Department of Environmental Protection

DOACS: Florida Department of Agriculture and Consumer Services

DPS: Distinct Population Segment, a distinct subset of an entire population.

EPA: United States Environmental Protection Agency

ERP: Environmental Resource Permitting program, administered by the Florida Department of Environmental Protection and the water management districts under Chapter 373, Florida Statutes.

ESA: Endangered Species Act

Extirpated: Locally extinct. Refers to a species no longer present in a specific part of its original range.

F.A.C.: Florida Administrative Code. The Department of State's Administrative Code, Register and Laws Section is the filing point for rules promulgated by state regulatory agencies. Agency rulemaking is governed by Chapter 120, Florida Statutes, the Administrative Procedures Act. Rules are published in the Florida Administrative Code.

FWC: The Florida Fish and Wildlife Conservation Commission, the state agency constitutionally mandated to protect and manage Florida's native fish and wildlife species.

FWCG: [Florida Wildlife Conservation Guide](#), an online resource that facilitates effective land use planning, project design, and the management of natural communities, with a focus on wildlife conservation.

F.S.: Florida Statutes

GDNR: Georgia Department of Natural Resources

HCP: Habitat Conservation Plan

Incidental Take: Incidental Take (as defined in Rule 68A-27.001(5) F.A.C.): Any taking otherwise prohibited, if such taking is incidental to, and not the purpose of the carrying out of an otherwise lawful activity.

ISMP: Imperiled Species Management Plan

ITP: Incidental Take Permit

IUCN: International Union for Conservation of Nature, a professional global conservation network.

IWRM: Integrated Water Resource Monitoring Network. The Integrated Water Resource Monitoring Network Program is a multi-level or "tiered" monitoring program designed to answer questions about Florida's water quality at differing scales. The program is supported by several DEP water quality monitoring groups in Tallahassee and in regional (district) offices. In general, Tier I addresses statewide and regional (within Florida) questions, Tier II focuses on basin-specific to waterbody-specific questions, while Tier III answers site-specific questions.

LAP: Landowner Assistance Program, a federal cost-share program administered in Florida by the Florida Fish and Wildlife Conservation Commission.

LDR: Local Government Land Development Regulations

MFL: Minimum Flows and Levels: Minimum Flows and Levels are the minimum water flows and levels adopted by the District Governing Board as necessary to prevent significant harm to the water resources or ecology of an area resulting from permitted water withdrawals. MFLs define how often and for how long high, average, and low water

levels and flows should occur to prevent significant harm. When use of water resources alters the water levels below the defined MFLs, significant ecological harm can occur.

NMFS: National Marine Fisheries Service, a unit of the National Oceanic and Atmospheric Administration

NPDES: National Pollutant Discharge Elimination System

NRCS: Natural Resource Conservation Service, a branch of the United States Department of Agriculture and Consumer Services.

Riparian: Relating to or living or located on the bank of a natural watercourse (as a river) or sometimes a lake or a tidewater

SJRWMD: St. Johns River Water Management District

SMFRC: St. Marys Fisheries Restoration Committee: membership composed of staff from FWC, GDNR, SJRWMD, SMRMC, University of Florida, University of Georgia, USGS, NMFS, and USFWS

SMRMC: St. Marys River Management Committee, membership composed of politicians and staff from agencies in counties bordering the St. Marys River in Georgia and Florida

SMZ: Special Management Zone: The SMZ is a BMP that consists of a specific area associated with a stream, lake, or other waterbody that is designated and maintained during silviculture operations. The purpose of the SMZ is to protect water quality by reducing or eliminating forestry-related inputs of sediment, nutrients, logging debris, chemicals, and water temperature fluctuations that can adversely affect aquatic communities. SMZs provide shade, streambank stability, and erosion control, as well as detritus and woody debris that benefit the aquatic ecosystem in general. In addition, the SMZ is designed to maintain certain forest attributes that will provide specific wildlife habitat values. Snags, den, and cavity trees as well as mast-producing trees, left in the SMZ, are necessary to meet habitat requirements for certain types of wildlife.

Take: As defined in 68A-27.001(4), F.A.C. "To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in such conduct."

TMDL: Total Maximum Daily Load. A scientific determination of the maximum amount of a given pollutant that a surface water can absorb and still meet the water quality standards that protect human health and aquatic life.

TNC: The Nature Conservancy

USACE: United States Army Corps of Engineers

GLOSSARY OF TERMS AND ACRONYMS

USFWS: United States Fish and Wildlife Service, the federal agency mandated to protect and manage the nation's native freshwater fish and wildlife resources.

USGS: United States Geological Survey

WQ: Water quality

INTRODUCTION

The Florida Fish and Wildlife Conservation Commission (FWC) developed this plan in response to the determination that the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) be recommended for listing as Threatened on the Florida Endangered and Threatened Species List; it has since been listed as federally Endangered. The purpose of this plan is to provide guidance for protecting the Atlantic sturgeon and its habitat in Florida, address the threats to their survival, and support actions to aid their recovery to the point where they no longer need to be listed.

Biological Background

Atlantic sturgeon are long-lived (40 to 60 years), anadromous fishes, spawning and initially growing in freshwater and thereafter spending much of their adult life in saltwater. Juvenile sturgeon may spend 1 to 3 years in freshwater, prior to entering the marine environment (Atlantic Sturgeon Status Review Team 2007). This species is a bottom-feeder that has a ventral suctorial mouth without teeth, 4 whiskers halfway between the snout and mouth, 5 rows of scutes (armor-like scales), and a tail longer on top than on the bottom. Atlantic sturgeon are capable of growing to 363 kg (800 lb) and well over 4 m (13 ft) in length. Male Atlantic sturgeon become sexually mature in 5 to 10 years, while females become mature from 8 to 15 years (Atlantic Sturgeon Status Review Team 2007). Mature females are significantly larger than mature males, and may produce between 500,000 and 4,000,000 eggs per spawning cycle. Spawning typically occurs in the spring over large gravel or other suitable substrates when flow, pH, and other cues are optimal. Females do not spawn every year, instead skipping 1 to 4 years between spawns (Secor 2008). While natal stream fidelity is the norm, a small percent of the population will stray to other streams to spawn.

Conservation History

Atlantic sturgeon were abundant in the St. Marys and St. Johns rivers prior to 1884, sufficiently to be an impediment to shad (*Alosa* spp.) netting. Hamlen, at that time, recommended sturgeon nets both upstream and downstream of shad nets in order to minimize damage to the shad nets (Hamlen 1884). Over-fishing, habitat alteration, and dam construction (blocking normal spawning runs) led to the massive decline of Atlantic sturgeon population along the entire eastern seaboard of the United States by the beginning of the 20th century. Historically, the St. Marys River sustained a locally important Atlantic sturgeon harvest, but 1974 is the last known record of mature sturgeon in the St. Marys (a capture at Traders Hill). Florida terminated sturgeon harvest in 1994. Seaboard states enacting the Atlantic States Marine Fisheries Commission's (ASMFC) Amendment I (1998) to the Interstate Fishery Management Plan for Atlantic Sturgeon of 1990 terminated all Atlantic sturgeon harvest (ASMFC 1998). In states farther north, by-catch in the gill net and trawl fisheries and ship strikes remain a major source of mortalities, but none of these appear to be issues in Florida.

The St. Marys River constitutes the eastern border between Georgia and Florida and is jointly managed by the Georgia Department of Natural Resources (GDNR) and the St. Johns River Water Management District (SJRWMD) in cooperation with St. Marys River Management Committee (SMRMC), a coalition of political entities and state agencies from both states that serves to coordinate actions between Florida and Georgia. The SMRMC has encouraged the St. Marys Fisheries Restoration Committee (SMFRC), FWC, and GDNR to restore Atlantic

sturgeon to the St. Marys River as a means of expanding eco-tourism. The Nassau River and the St. Johns River watershed are managed and monitored exclusively by the SJRWMD. The Department of Agriculture and Consumer Services (DOACS) has developed numerous agricultural best management practices (BMPs) that are designed to benefit water quality and water conservation while maintaining or enhancing agricultural production. Based on available information, only the silviculture BMP is widely utilized within the 3 watersheds containing Atlantic sturgeons. The silviculture BMP serves to maintain good water quality, minimize murky water (turbidity loading), and maintain the vegetation (riparian buffer) along the water courses of these basins, thereby serving to minimize agricultural water quality threats to Atlantic sturgeon.

Threats and Recommended Listing Status

In 2010, the FWC directed staff to evaluate the status of all species listed as Threatened or Species of Special Concern that had not undergone a status review in the past decade. To address this charge, staff conducted a literature review and solicited information from the public on the status of the Atlantic sturgeon. The FWC convened a biological review group (BRG) of experts on the Atlantic sturgeon to assess the biological status of the species by using criteria specified in Rule 68A-27.001, Florida Administrative Code (F.A.C.). This rule includes a requirement for BRGs to follow the Guidelines for Application of the International Union for Conservation of Nature (IUCN) Red List Criteria at Regional Levels (Version 3.0) and Guidelines for Using the IUCN Red List Categories and Criteria (Version 8.1). FWC staff developed an initial draft of a Biological Status Review report (BSR) which included the BRG's findings and a preliminary listing recommendation from staff. The draft was sent out for peer review and the reviewers' input was incorporated into a final [BSR report](#).

Primary threats to this species include poor water quality, changes in water quantity, fishery by-catch, and habitat degradation issues: including habitat alteration, encroachment of urbanization, and point source and non-point source pollution.

The BRG found the Atlantic sturgeon met the following criteria for listing:

- A(2): An observed, estimated, inferred, or suspected population size reduction of at least 30% over the last 10 years or 3 generations, whichever is longer, where the reduction or its causes may not have ceased or may not be understood or may not be reversible
- C(1): An estimated continuing decline of at least 10% in 10 years or 3 generations, whichever is longer (up to a maximum of 100 years in the future)
- C(2): A continuing decline, observed, projected, or inferred in numbers of mature individuals AND at least one of the following:
 - C(2)a (i): No subpopulation estimated to contain more than 1,000 mature individuals
 - C(2)a (ii): All mature individuals are in one subpopulation
- D(1): Population estimated to number fewer than 1,000 mature individuals
- D(2): Population with a very restricted area of occupancy (typically less than 20 km² [8 mi²]) or number of locations (typically 5 or fewer) such that it is prone to the effects of human activities or stochastic events within a short time period in an uncertain future

Recommended listing status

Based on the literature review, information received from the public, the BRG findings, and peer-reviewed input, FWC staff recommended the Atlantic sturgeon be retained on the Florida Endangered and Threatened Species List. However, due to its listing as Endangered by the National Marine Fisheries Service (NMFS) in April of 2012, the species will be listed as federally Endangered on the Florida Endangered and Threatened Species List.

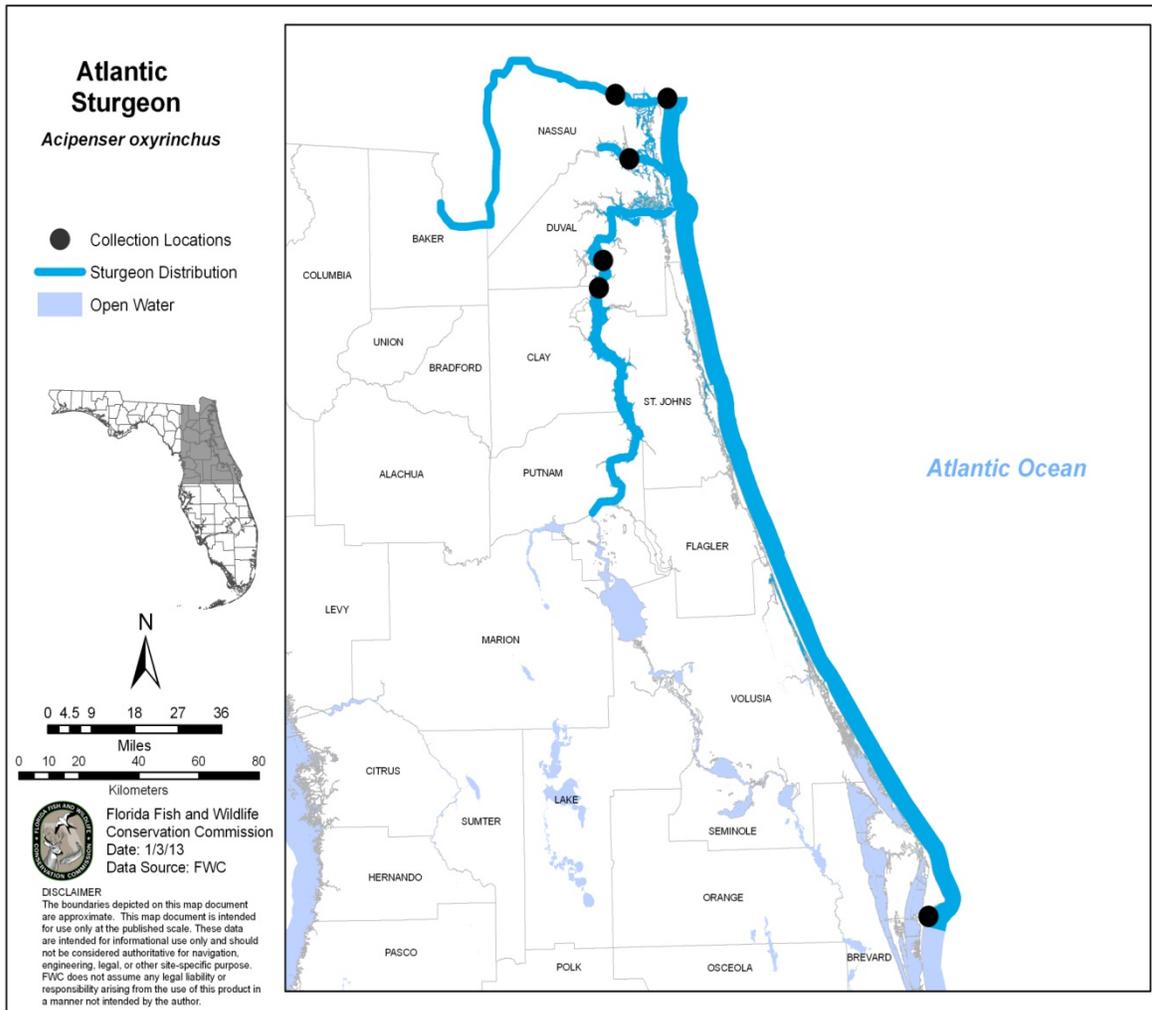


Figure 1. Rivers and collection locations for the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*).

CONSERVATION GOALS AND OBJECTIVES

Goal

Conservation status of Atlantic sturgeon is improved to a point that the species can be removed from the Florida Endangered and Threatened Species List and will not again need to be listed (to achieve this goal, the species must first be removed from the Federal Endangered Species List)

Objectives

I. Determine natal origin of Florida's Atlantic sturgeon.

Rationale

Determination of river of origin for Florida's Atlantic sturgeon will directly impact species management actions. If Florida's Atlantic sturgeon are a surviving remnant of a natural phenomenon and a population of locally spawning fish, replenishing existing stocks becomes difficult because removing even a single spawning female could impact production. In this instance, habitat restoration and water quality protection become the primary means of conservation. If, on the other hand, all Florida stock derives from Satilla or Altamaha river stocks (in Georgia), those rivers can sustain providing different spawning males and females from time to time (maintaining diversity). If all Florida stock derives from Satilla or Altamaha river stocks, it will fall to NMFS to determine whether to declare the St. Marys and St. Johns rivers extirpated, such that authorized stock enhancement would be the only method to rapidly rebuild local stocks.

II. Maintain existing population and improve population to more than 1,000 mature individuals of Atlantic sturgeon in the St. Marys River.

Rationale

The St. Marys River accounts for 30 of the 34 recorded Atlantic sturgeon captures in Florida over the last decade; while the Nassau (1 capture) and St. Johns rivers (3 captures) have not been recently documented to have more than vagrant occurrences. If habitat, water quality (WQ), or quantity changes occurred within a few of the known areas of occupancy in the St. Marys River, there could be substantial decrease in abundance within the entire population (and possibly extirpation). Establishing a population greater than 1,000 mature individuals (an IUCN delisting criterion) should ensure a population size that will sustain genetic diversity. Due to the long lifespan and high reproduction capacity of Atlantic sturgeon, a population of mature individuals numbering significantly less than 1,000 may still provide for long-term sustainability locally.

III. Initiate enhancement or restoration of populations of Atlantic sturgeons throughout their historical range within 10 years of this plan's implementation to increase known areas of occupancy and decrease population fragmentation.

Rationale

In 1884, Hamlen reported that the St. Johns and St. Marys rivers had abundant sturgeon populations, sufficient to be an impediment to shad fishing; both rivers were suitable habitat for sturgeon at that time (Hamlen 1884). Recreational fishermen account for the 3 recorded Atlantic sturgeon captures in the St. Johns River in the last decade. Atlantic sturgeons have not been

CONSERVATION GOALS AND OBJECTIVES

observed in some areas of the St. Johns River since the 1970s. Directed FWC shortnose sturgeon (*Acipenser brevirostrum*) sampling in the St. Johns River (~1,440 hours of net soak time, 1999 to 2002) captured no Atlantic sturgeon and 1 shortnose sturgeon, which implies that sturgeon are presently uncommon in this river system. Restoration of Atlantic sturgeons in each of the river systems within their native range is desirable to avoid substantial losses to or extirpation of the greater population that could result from long-term habitat degradation or a catastrophic event.

CONSERVATION ACTIONS

The following sections describe the conservation actions that will make the greatest contribution toward achieving the conservation objectives. Actions are grouped by category (e.g., Habitat Conservation and Management, Population Management). The Conservation Action Table ([Table 6](#)) provides information on action priority, urgency, potential funding sources, likely effectiveness, identified partners, and leads for implementation.

Habitat Conservation and Management

The specific WQ needs of the Atlantic sturgeon are currently not well known. Monitoring and surveys of WQ, water quantity, instream habitat, and riparian habitat in known sites containing Atlantic sturgeons should provide this information, which will guide habitat conservation and management. Therefore, maintaining populations that are currently present or have persisted in the same watersheds over time is the highest priority ([Figure 1](#)). The focus of the habitat conservation and management actions is to:

- Maintain the aquatic habitat, WQ, and water quantity within the watersheds through a monitoring program and through cooperation and coordination with regulatory entities to ensure that habitats are not significantly altered;
- Maintain riparian or streamside habitat to help filter runoff; and
- Restore or enhance areas that historically contained Atlantic sturgeons to increase their distribution and occupied area of occurrence.

It should be noted the Florida Department of Environmental Protection (DEP), the St. Johns River Water Management District (SJRWMD), the U.S. Army Corps of Engineers (USACE), and the U.S. Environmental Protection Agency (EPA) are the agencies with jurisdiction over water quality and quantity maintenance. Therefore, the majority of the [Habitat Conservation and Management Actions](#) are under the authority of and require active participation by these agencies. As such, [Coordination with Other Entities](#) is critically important to the conservation of this species ([Table 1, Appendix 1](#)).

Water Quality and Quantity

Action 1 Develop and implement sampling and habitat evaluation protocols and provide training to FWC staff and external consultants. This will aid efforts to identify WQ and habitat needs by life stage and estimate the size of Atlantic sturgeon population within its present and historical range. An NMFS Section 10 permit is required to conduct sampling of Atlantic sturgeon.

Action 2 Upgrade or establish a new fisheries database to contain comprehensive, species-specific collection data that include negative capture data, sampling staff, sampling protocol, fish communities, and associated environmental data (e.g., habitat and WQ characteristics, vegetation species and composition, flow conditions, stream characteristics, adjacent land use).

Action 3 Develop a site-occupancy (by life stage) model based on collection data, habitat parameters, and environmental variables to identify potential sampling sites and factors contributing to habitat loss at historical sites. Validate model accuracy by sampling identified potential sites to determine if Atlantic sturgeons of predicted life stages are present. Atlantic sturgeons occupy different habitats depending on their life stage; relating habitat to life stage is important to effective conservation and management. Species that live in a small or

fragmented geographic area with few population locations are vulnerable to natural or manmade catastrophes that can cause permanent extirpation. Thus, the physical habitat and WQ or quantity in these locations must be identified ([Action 1](#)) and associated environmental parameters determined ([Action 2](#)) in order to guide conservation and management. Development of site-occupancy models by life stage ([Action 3](#)) would allow the identification of habitat usage, the prediction of additional sampling sites, and the identification of as many occupied locations as possible. WQ and habitat information obtained from sampling, modeling, model validation, and species habitat needs are anticipated to be provided to the various regulatory agencies for use in their programs.

Action 4 Participate with the SJRWMD, DEP, and local governments in the development of the Minimum Flows and Levels (MFL), regional water supply plans, and regulatory review of various permits in order to identify potential water supply intake locations and other actions within watersheds and sub-watersheds containing Atlantic sturgeons to avoid, minimize, or mitigate any potential impacts.

Action 5 Participate with, and develop outreach material for DEP, SJRWMD, DOACS, local governments, federal agencies, and the public to identify and implement conservation measures that reduce WQ impacts from unpaved roads, agriculture, silviculture, riparian zone management, and development within known areas of Atlantic sturgeon occurrence.

The FWC will participate in monitoring efforts and endeavor to maximize WQ protections for the Atlantic sturgeon ([Action 4](#)). In addition, this information may be used to identify any changes that might result in needed additional sampling and research within the specific basins.

In general, the DEP Environmental Resource Permit Program (ERP) “regulates activities involving the alteration of surface water flows. This includes new activities in uplands that generate stormwater runoff from upland construction, as well as dredging and filling in wetlands and other surface waters. The ERP Program is in effect throughout the State” ([ERP website](#)). Stormwater construction permits under the National Pollutant Discharge Elimination System (NPDES) are issued separately by the DEP or the SJRWMD. The NPDES program areas of regulation include municipal storm sewer systems, industrial stormwater discharge, and stormwater construction activities. The FWC will continue to coordinate with these entities to ensure permitted activities do not degrade Atlantic sturgeon populations or habitat ([Action 4](#)).

In addition to WQ and quantity considerations, a factor that must be considered when issuing permits for construction activities under the ERP and NPDES programs are “whether the activity will adversely affect the conservation of fish and wildlife, including Endangered or Threatened species, or their habitats” (see [s. 373.414\(1\)\(a\), Florida Statutes \[F.S.\] \[2010\]](#)). Coordination with DEP and the SJRWMD on the location of Atlantic sturgeons within the 3 target rivers (St. Marys, Nassau, and St. Johns rivers) will be important in evaluating potential impacts from proposed regulatory projects to Atlantic sturgeon habitats and known locations ([Action 4](#)). The consideration of conservation measures and other measures that may be identified as part of the [Monitoring and Research](#) and [Population Management](#) conservation actions, ERP, and other regulatory permitting will be vital to ensuring maintenance of populations and habitats in the priority areas. The FWC will also coordinate with the DEP, DOACS, and other entities to

identify and implement conservation measures that reduce WQ and quantity impacts from unpaved roads, agriculture, silviculture, riparian zone management, and development within known areas of Atlantic sturgeon occurrence ([Action 5](#)).

Riparian and Streamside Management

Action 6 Increase protection of Atlantic sturgeon habitat through opportunities provided by conservation lands management, county comprehensive plan landuse classification, fee simple or less than fee acquisition, or the potential to develop a U.S. Fish and Wildlife (USFWS) Habitat Conservation Plan (HCP) for northeast Florida river basins for federally listed and certain state-listed fish species.

Riparian zones in Florida include the banks and floodplain of the aquatic system including habitats such as floodplain swamps, bottomland forest, hydric hammock, and alluvial forest. Natural riparian zones tend to have high plant and animal biodiversities. Natural riparian zones provide corridors for wildlife movements and access to drinking water. Riparian zones provide nutrients, vegetative cover, and detritus to riverine systems. Functional riparian zones reduce siltation and pollution, which improves WQ. Improving WQ directly addresses a primary threat to Atlantic sturgeon.

The [DOACS BMPs](#) include riparian buffers for silviculture, the dominant agriculture in Atlantic sturgeon watersheds. This plan recommends that along the mainstem of the rivers that contain Atlantic sturgeon (St. Marys, Nassau and St. Johns rivers) that a silviculture BMP-compliant vegetative riparian buffer be maintained, its width depending upon slope and soil characteristics, and whether the watercourse contains other listed aquatic species. Riparian and streamside management should be considerate of any additional conservation measures and other species requirement measures that may be identified as part of the [Monitoring and Research](#) and [Population Management](#) conservation actions. In addition, riparian zones in the priority watersheds and any restoration areas should be evaluated in future land use maps of the local government comprehensive plans to determine if they are receiving adequate protection ([Appendix 4](#)).

The FWC intends to continue participating with the DEP, SJRWMD, DOACS, and other entities to identify riparian zones associated with Atlantic sturgeon populations ([Action 4](#)) and implement conservation measures that may be developed in the [Monitoring and Research](#) Conservation actions that reduce WQ impacts associated with riparian zone activities ([Action 5](#)). In addition, the FWC will identify opportunities to increase protection of Atlantic sturgeon habitat through county comprehensive plan landuse classification, land acquisition, conservation easements, or development of HCPs in order to protect Atlantic sturgeon populations and habitat ([Action 6](#)). Participation in a federal HCP incorporates avoidance, minimization, and mitigation measures identified to be conservative of federally listed species needs, and serves to avoid individual permitting requirements for incidental take. Developers can elect to participate in a federal HCP or may develop an individual HCP and apply independently for incidental take permitting.

Action 7 Improve Atlantic sturgeon habitat through habitat restoration and enhancement.

Action 8 Enhance or augment Atlantic sturgeon populations throughout their historic range.

Action 9 Monitor the success of measures implemented to protect and or enhance Atlantic sturgeons and their habitat, and implement changes where necessary.

The Nature Conservancy (TNC) and the SMFRC have identified preliminary restoration priority areas (e.g., unpaved stream crossings) and some specific restoration sites on the St. Marys River (S. Herrington, TNC, personal communication). Additional restoration areas may be identified through the [Monitoring and Research](#) and [Population Management](#) conservation actions ([Action 3](#)). Once sites have been identified, individual plans and monitoring will need to be developed based upon the specific site’s needs and specific Atlantic sturgeon habitat requirements ([Actions 5 through 9](#)). Once restoration has occurred, it will be important to maintain the habitat and WQ in these areas through multiple regulatory and inter-governmental mechanisms.

Table 1. Summary of habitat conservation and management preliminary recommendations.

<p>Preliminary recommendations for management of Atlantic sturgeon WQ and quantity habitat</p>	<ul style="list-style-type: none"> • Maintain or enhance WQ and quantity parameters in priority rivers, as depicted in Figure 1, through review and coordination of projects with the SJRWMD, DEP, USACE, EPA, and local governments. • Review permits and coordinate assessments of potential project impacts to Atlantic sturgeon populations, WQ, water quantity, and habitats in priority watersheds and any restored areas with the SJRWMD, DEP, USACE, EPA, and local governments. • Participate with DEP and the SJRWMD in the collection of WQ, water quantity, and habitat information at priority sites for use in the development of WQ and water quantity trend analysis.
<p>Preliminary recommendations for riparian habitat management of Atlantic sturgeon waters</p>	<ul style="list-style-type: none"> • A silviculture BMP compliant riparian vegetative buffer is recommended to be maintained, depending upon slope and soil characteristics, unless other restrictions apply (e.g., it contains federally listed mussels or other listed aquatic species). • Identify parcels in the priority watersheds for possible acquisition or conservation easements through continued participation and coordination with state, local, and non-profit land acquisition agencies.
<p>Preliminary recommendations for habitat restoration in areas of Atlantic sturgeon occurrence or historic range</p>	<ul style="list-style-type: none"> • Identify unpaved roads that transect the 3 target rivers or their tributaries and develop restoration plans, in coordination with state, federal, and local government, and non-profit organizations, to prevent sediment influxes specific to that stream crossing. • Assess historic locations to identify environmental parameters that may be critical to the Atlantic sturgeon survival (see Monitoring and Research).

Population Management

Genetic analyses

Action 10 Describe the genetic characteristics of Florida’s Atlantic sturgeon population and determine river-of-origin (natal river) by collecting and analyzing tissue samples from Florida captures and comparison with other Southern Distinct Population Segment Atlantic sturgeon.

The population structure needs to be examined using appropriate genetic methods, river-of-origin determined, and genetic information used to inform any future reintroductions ([Action 2](#), [Action 10](#)). Determination of natal river will establish whether any Florida rivers retain relict Atlantic sturgeon populations or are merely sinks for populations from rivers farther north. This would significantly influence conservation management decisions. Fin clips or other appropriate tissue samples of Atlantic sturgeons will be collected and analyzed as part of the [Monitoring and Research Conservation Actions](#). Researchers will need to take necessary precautions to decrease mortality of individuals and prevent loss or significant decline of the population. All sampling will be conducted consistent with NMFS protocols (Kahn and Mohead 2010) ([Table 2](#)).

Propagation, Translocation, Reintroduction, and Augmentation

Action 11 Implement hatchery propagation and reintroduction of Atlantic sturgeon (NMFS authorization is required).

Guidelines for propagation, translocation, reintroduction, and augmentation are required by joint USFWS/NMFS propagation protocols (Federal Register, 20 September 2010). Additionally, guidelines recommended by the American Fisheries Society (Williams et al. 1988, George et al. 2009) should be considered prior to undertaking the proposed actions ([Action 8](#) and [Action 11](#)). Any reintroductions will comply with current FWC genetic policy and approval by NMFS. Implementation of this section will be dependent upon the results of the genetic analysis and information from the [Habitat Conservation and Management](#) and [Monitoring and Research](#) conservation actions to determine where reintroduction is needed ([Action 2](#), [Action 3](#), [Action 7](#), [Action 8](#), and [Action 9](#)). Protocols describing reintroduction techniques, propagation methods, and subsequent monitoring requirements are contained in [Appendix 3](#). Restoration should focus on areas where the Atlantic sturgeon historically occurred and reintroduction may increase the number of mature individuals. This would address [BSR](#) criteria that resulted in the listing of the Atlantic sturgeon.

Invasive species control

Action 12 Monitor and address the occurrence of invasive species that affect Atlantic sturgeons, whether the effect is direct (predation) or indirect (influence on habitat).

Flathead catfish (*Pylodictis olivaris*) have been reported to consume juvenile Atlantic sturgeon (Flowers et al. 2011). However, it is not known whether this predation is having any significant impact on survival of Atlantic sturgeons. Brown hoplo (*Hoplosternum littorale*), an armored

catfish, are known to be impacting plant communities in the St. Johns River, potentially negatively impacting sturgeon habitat.

Table 2. Summary of preliminary recommendations for population management of the Atlantic sturgeon.

Genetic Analysis	<ul style="list-style-type: none"> • Assay and maintain native genetic diversity. • Conduct genetic analysis of the Atlantic sturgeons within the St. Marys, Nassau and St. John’s rivers to determine river-of-origin.
Propagation, Reintroduction, and Augmentation	<ul style="list-style-type: none"> • Develop a site-enhancement or a reintroduction plan prior to conducting any enhancement or reintroduction activities. • Develop a plan to monitor the survival of the reintroduced Atlantic sturgeons prior to stocking, if that option is determined to be needed and approved.
Invasive Species Control	<ul style="list-style-type: none"> • Monitor rivers and streams that contain Atlantic sturgeons to determine if invasive species are present and are negatively affecting Atlantic sturgeons. Develop methods for control if necessary.

Monitoring and Research

The BRG determined that existing data, literature, and knowledge may not be sufficient to address the objectives and actions necessary to achieve the goal of removing the species from the Florida Endangered and Threatened Species List. The following research and monitoring actions may address the data gaps and can be broken into unique categories such as desktop habitat analysis, habitat and population studies, and genetic analysis ([Table 3](#)).

Desktop Analysis

Development of a comprehensive, species-specific database is needed. [Figure 1](#) shows the distribution of Atlantic sturgeons based upon current database information. However, this database does not include sufficient information needed for additional analysis such as: sampling staff, sampling methods, description of associated environmental and fish community parameters, or sites where the Atlantic sturgeons were sought but not collected (negative data) ([Action 2](#)).

Prioritization

The database will assist with development of prioritization models or schemes. Prioritization is necessary to differentiate between locations within these watersheds that:

- Have high conservation value for Atlantic sturgeons and are protected (state, federal, SJRWMD, local government lands) and should continue to be protected;
- Have high conservation value for Atlantic sturgeons but are potentially at risk of future alteration (through development, invasive species, etc.); and
- Have good habitat for Atlantic sturgeons but are in currently developing or threatened areas

Sites could be further ranked based on the type of future alteration likely to occur. Risk from future alterations is difficult to assess given the lack of knowledge regarding Atlantic sturgeon habitat needs and tolerances. Historical locations once occupied by Atlantic sturgeon and which contain suitable habitat should be considered for reintroduction efforts with high priority over historical sites that need habitat restoration. The prioritization and information learned from additional survey and monitoring activities may also aid in the identification of new locations and conservation opportunities ([Action 1](#)).

Habitat and Population Studies

Site-specific sampling is needed to determine persistence, probability of detection and to characterize site occupancy on a microhabitat level ([Action 1](#) and [Action 2](#)). This multi-scale approach will allow inferences about population status and trends on both a temporal (watershed) and spatial (site-specific) scale (Fausch et al. 2002, Rahal and Jackson 2007).

Sampling design and collection methods.

Atlantic sturgeons are rare and often not recaptured, and non-detection cannot necessarily be attributed to extirpation or changes in the population; non-detection may be attributed to gear detection differences. Furthermore, the best sampling method varies based on the objective: while side-scan sonar may be the best method for monitoring, gill and trammel nets may be best when collecting fish for propagation and augmentation ([Action 1](#)). Sampling must conform to the NMFS protocol (Kahn and Mohead 2010) and be conducted only with a Section 10 permit.

Habitat information.

Development of a better understanding of how Florida populations of Atlantic sturgeon are influenced by water quality, vegetation, micro-habitat, riparian requirements, stream flow conditions, fish associates, and fish community structure is necessary. Fish community data may be necessary for inclusion with Atlantic sturgeon presence and abundance data. Physical habitat information is necessary for inclusion with Atlantic sturgeon presence and abundance data, so that important species-habitat preferences can be further delineated ([Action 3](#)).

Current FWC (Fish and Wildlife Research Institute Fishery Independent Monitoring) protocols recommend the collection of physical habitat characteristics and fish community data for each sampled transect (Bonvechio 2009, Strickland et al. 2011). Additional habitat characteristics may be considered for collection in future Atlantic sturgeon sampling efforts ([Action 1](#)). Habitat and WQ preferences are anticipated to become part of the conservation measures that are to be developed. These habitat characteristics should also provide information on where additional sampling should occur to determine if Atlantic sturgeons are present in new areas.

Genetic analyses

Tissue samples should be collected from Atlantic sturgeons to examine genetic variability, within and among riverine populations, for comparison to diversity and population structure from sites throughout the Atlantic sturgeon range ([Action 10](#)). Tissue samples should also be collected from donor populations and recipient populations (see Kahn and Mohead 2010) prior to population re-introduction or augmentation to insure genetic compatibility ([Action 8](#)).

Propagation, Reintroduction and Augmentation Techniques

The propagation or reintroduction of Atlantic sturgeons has not yet been conducted in Florida. The USFWS has been successfully propagating Altamaha River Atlantic sturgeon at Bears Bluff National Fish Hatchery following the guidelines recommended by the joint USFWS/NMFS protocols (USFWS 2003, NMFS 2010) for the purpose of augmentation of the St. Marys River Atlantic sturgeon population should genetic analysis support this and the NMFS, FWC, GDNR, SMRMC, SMFRC and ASMFC concur. The [Population Management Conservation Actions](#) and [Appendix 3](#) provide further details on propagation and reintroduction procedures ([Action 1](#), [Actions 7 through 11](#)).

Table 3. Summary of monitoring and research preliminary recommendations.

<p>Habitat and Population Studies</p>	<ul style="list-style-type: none"> • Developing a training program on fish identification for individuals and stakeholder groups to avoid violating incidental take restrictions during recreational and commercial fishing. • Determine river-of-origin for St. Marys River Atlantic sturgeon and determine appropriate broodstock for propagation, reintroduction, or augmentation efforts.
<p>Development of BMP assessment research</p>	<ul style="list-style-type: none"> • Participate in evaluation of current agricultural practices and the effectiveness of existing water quality BMPs applicable to land uses in known Atlantic sturgeon habitats.

Rule and Permitting Intent

As a federally-listed Endangered species, the Atlantic sturgeon is protected under the federal Endangered Species Act and Chapter [68A-27, F.A.C.](#), Rules relating to Endangered or Threatened Species. All permitting is the jurisdiction of the NMFS.

It may be necessary to move Atlantic sturgeon from Rule 68A-27.003 (Designation of Endangered and Threatened Species; Prohibitions) to Rule 68A-27.0031 (Marine Endangered and Threatened Species), F.A.C., per Article XII, Section 22, of the revised Florida Constitution.

Law Enforcement

Action 13 Develop a training module for FWC Law Enforcement and commercial fishermen to identify Atlantic sturgeon.

The FWC’s Division of Law Enforcement, in conjunction with federal, state and local partners, is responsible for enforcing Florida’s wildlife and fisheries laws. FWC biologists and other Atlantic sturgeon experts will educate law enforcement officers through the development, circulation, and interpretation of Atlantic sturgeon identification tools, distribution maps, and other training materials ([Action 13](#)). FWC law enforcement officers understand the importance of explaining wildlife laws to the public to avoid unintentional violations ([Action 4](#) and [Action 5](#)).

Incentives and Influencing

Action 14 Develop comprehensive voluntary wildlife conservation measures that identify management needs and protect Atlantic sturgeon habitat.

Influencing

County growth management plans and land development regulations (LDRs) provide the avenue by which FWC can inform and influence land and water uses that are relevant to the conservation of Florida's fish and wildlife, including state-listed species. [Figure 1](#) identifies priority watershed areas known or having potential to harbor Atlantic sturgeon. The [BSR](#) and this plan identify the threats to the Atlantic sturgeon. The FWC offers conservation planning services to local governments during growth management plan amendments as well as during consideration of plan amendments and associated development proposals ([Actions 4 through 6](#) and [Table 4](#)).

To promote an understanding of technical assistance and incentives available to landowners, FWC typically provides information to local governments regarding species management plans, permitting options and incentive programs that are available to applicants, developers and landowners, as well as the general public.

The FWC Landowner Assistance Program (LAP) advances species conservation objectives through public-private conservation partnerships. These programs are voluntary and some offer financial assistance to landowners implementing conservation plans (see [Incentives Programs](#)). Evaluating the effects of development practices on the Atlantic sturgeon population would help provide FWC necessary information to develop better avoidance, minimization, and mitigation options for agriculture and development on private landowners' property ([Action 5](#)).

Incentive Programs

The FWC currently takes advantage of several programs that promote conservation by providing technical and financial assistance to private landowners ([Action 6](#)). The FWC partners with other state and federal agencies to administer the Forest Stewardship Program, Wildlife Habitat Incentives Program, Wetlands Reserve Program, Environmental Quality Incentives Program, Partners for Fish and Wildlife Program, and the Cooperative Conservation Blueprint. These programs are voluntary and some may provide financial incentives, depending on annual appropriation, for wildlife conservation and habitat management on private lands. Florida also provides tax incentives, including property tax exemptions under [s. 196.26, F.S.](#), for landowners that put a perpetual conservation easement on their land. Additional incentives may include exemption from permits for activities that enhance wildlife activities; these activities may include as mowing, roller-chopping, and tree stand thinning, as long as they are not a precursor to development. Any number of these incentive programs may be applicable for protecting the riparian habitat and water quality in the Atlantic sturgeon priority sub-watersheds identified in [Figure 1](#).

The HCP concept was originally developed as a required piece of the application for a federal Incidental Take Permit. ITPs authorize the take, as defined in the Endangered Species Act, of listed species incidental to a lawful activity. The intent of the HCP is to make sure the effects of issuing a take permit are adequately minimized and mitigated. The FWC is investigating the

potential for the development of a “watershed-based HCP” for multiple aquatic species that are either state- or federally listed in the basins containing the Atlantic sturgeon.

Conservation banking is another program available to private landowners interested in habitat conservation. Conservation banking for listed species is comparable to mitigation banking in that lands are permanently protected and can be used to offset development related adverse impacts to wildlife resources, including habitats. The FWC may consider developing or supporting a conservation banking program for species in the same watersheds as the Atlantic sturgeon.

Guidelines for Wildlife Conservation Measures

Approximately 65% of Florida is in some form of agricultural land use. Florida’s fish and wildlife, including many state-listed species, occur on lands or in streams adjacent to lands utilized for agriculture. The FWC is currently working with the DOACS and landowners engaged in agriculture to evaluate the effectiveness of existing water quality DOACS BMPs ([Action 5](#)).

The FWC may also develop guidelines for wildlife conservation measures for lands slated for development. Application of these wildlife conservation measures could preserve or enhance additional habitat or avoid take of the Atlantic sturgeon by identifying such things as the preferred timing of clearing and construction, methods of clearing and re-vegetating, preferred locations and methods of stormwater management features, preservation of onsite ecosystem features, preferred location of open greenspace conservation areas, inclusion of development or density buffers, or inclusion of conservation easements over conservation areas.

Table 4. Summary of incentives and influencing preliminary recommendations for local governments and private landowners in the priority areas and areas under restoration.

<p>Influencing</p>	<ul style="list-style-type: none"> • Provide assistance to local governments on the conservation measures that should be considered for incorporation into their local LDRs. • Provide an information packet to local governments detailing incentives to both public and private entities for the purchase, conservation, restoration, or enhancement of listed species habitat. • Provide conservation measures and wildlife conservation guidelines to local governments and landowners to address Atlantic sturgeon and its habitat needs.
<p>Incentive Programs</p>	<ul style="list-style-type: none"> • Provide through the LAP, outreach to landowners in the priority and restoration areas regarding the various incentive programs available for the conservation of the species. • Provide assistance to the SJRWMD, DEP, local governments, and other land acquisition entities in establishing conservation easements when the property cannot be purchased fee-simple or to acquire riparian habitat adjacent to known locations of Atlantic sturgeon. • Provide information to landowners and local governments on the development of a watershed-based HCP that could replace the need for individual federal ITP requests.
<p>Wildlife Conservation Guidelines</p>	<ul style="list-style-type: none"> • Determine the effectiveness of the existing agricultural BMPs and identify land development conservation guidelines that may be needed for the protection of Atlantic sturgeon habitat.

Education and Outreach

Education and outreach are important components of managing imperiled aquatic species ([Action 5](#), [Action 14](#)). Citizens who are well informed about the merits of an imperiled species and its habitat can make better decisions and can support sound conservation measures to secure a species’ continued survival. Both formal and informal settings can offer opportunities to inform Floridians about species on the brink. The Atlantic sturgeon is a species that could be seen as by-catch for commercial fishermen; proper identification tools for fishermen will be important to preventing violations of Florida’s wildlife laws.

A unified and comprehensive approach to education and outreach will serve to inform the public, at their own pace regarding the means and needs to protect Atlantic sturgeons.

Coordination with Other Entities

The development of specific wildlife conservation measures ([Action 14](#)) should also provide additional guidance to the regulatory agencies for use in their various programs. The FWC will continue to collaborate with and provide information to local governments regarding species management plans, permitting guidelines, and assistance programs that are available to landowners and the general public. The FWC offers conservation planning services to local governments during growth management plan development as well as during consideration of plan amendments and associated development proposals. Early coordination with FWC can streamline FWC’s review and approval process. Land development is governed by a variety of federal, state, and local government growth management and permitting processes or

requirements. The FWC offers conservation planning services to these planning and regulatory agencies and encourages early meetings and coordination efforts to determine presence or absence of listed species onsite as well as other important fish, wildlife, and habitat issues ([Actions 4 through 6](#) and [Table 5](#)).

The [Florida Wildlife Conservation Guide](#) (FWCG) is an online resource that facilitates effective land use planning, project design, and the management of natural communities with a focus on wildlife conservation. The FWCG aims to provide a common platform of ecologically based wildlife information based on best available scientific information. As a dynamic resource, it is maintained with current guidelines and recommendations for wildlife management and protection and includes numerous links to relevant external sources of information. The FWCG will have the specific information related to the Atlantic sturgeon and necessary conservation measures once they are developed ([Action 13](#)).

Local governments and other agencies also play a substantial role in Atlantic sturgeon conservation and management by providing protected and managed areas for the species. Many local governments have created habitat acquisition and management programs, which can provide important assistance in achieving the goal and objectives of this plan. The FWC will continue to coordinate with local governments and other agencies to help ensure that local land acquisition programs and the comprehensive plan's implementing ordinances and policies are consistent with the goal and objectives of this plan and focus on acquisition priorities for Atlantic sturgeon and other important wildlife species ([Action 6](#)).

Table 5. Summary of coordination with local governments and state and federal agencies preliminary recommendations.

<p>The FWC will continue to assist and encourage local governments and state and federal agencies to do the following:</p>	<ul style="list-style-type: none"> • Ensure that WQ and quantity parameters are maintained at existing or improved levels in priority watersheds, and that regulatory projects consider impacts to Atlantic sturgeon populations and habitats if these could be affected. • Coordinate with the FWC before they issue permits that may affect WQ, water quantity, or habitat in priority Atlantic sturgeon watersheds. • Consider information on Atlantic sturgeon habitat needs and WQ and quantity needs that could be used in the development of MFLs. • Coordinate with the FWC prior to and during planning for the development of water supply reservoirs, continuous large water withdrawals and their potential impacts to Atlantic sturgeon populations and habitats. • Identify riparian habitat abutting the 3 target rivers for possible acquisition or conservation easements. • Incorporate into LDRs and other regulatory provisions a requirement to maintain appropriate riparian vegetative buffers depending upon slope and soil characteristics. • Identify unpaved road crossings that transect sensitive streams or riparian buffers and develop restoration plans to prevent sediment influxes specific to that stream crossing. • Evaluate historic occurrence locations to identify environmental parameters that may be critical to the Atlantic sturgeon survival.
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Table 6. Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) Conservation Action Table

NOTE: An explanation of acronyms used is below the table.

Objective(s) Addressed	Team Assigned Priority Level	Action Item Number	Action Items	Conservation Action Category	Ongoing, Expanded or New Effort?	Authority	Man Power	Estimated Cost To Implement	Funding Source(s)	Lead for Implementation: FWC Program(s) and/or Section(s)	External partners	Likely Effectiveness	Feasibility	Urgent?
1	1	1	Develop and implement sampling and habitat evaluation protocols and provide training to FWC staff and external consultants. This will aid efforts to identify water quality and habitat needs by life-stage and estimate the size of Atlantic sturgeon population within its present and historical range. A NMFS Section 10 permit is required to conduct sampling of Atlantic sturgeon.	Habitat Conservation & Mgmt, Population Mgmt, Monitoring & Research, Coordination with Other Entities	NEW	YES	YES	\$0-25k	Unknown	FWRI	DEP/USFWS/ USGS/ Universities	High likelihood of success.	Very feasible.	Yes- needed to fill in data gaps; needed to help implement the sampling program and ensure that non-agency staff or volunteers understand the proper collection methods.
1	2	2	Upgrade or establish a new fisheries database to contain comprehensive, species-specific collection data that includes negative capture data, sampling staff, sampling protocol, fish communities, and associated environmental data (habitat and water quality characteristics, vegetation species and composition, flow conditions, stream characteristics, adjacent land use).	Habitat Conservation & Mgmt, Population Mgmt, Monitoring & Research	EXPANDED	YES	YES	\$0-25k	Unknown	FWRI	DEP	High likelihood of success.	Very feasible.	Yes- This may be as simple as adding tables to the existing database that FWRI maintains.
1	3	3	Develop a site-occupancy (by life-stage) model based on collection data, habitat parameters and environmental variables to identify potential sampling sites and factors contributing to habitat loss at historical sites. Validate model accuracy by sampling identified potential sites to determine if Atlantic sturgeons of predicted life stages are present.	Habitat Conservation & Mgmt, Population Mgmt, Monitoring & Research	NEW	YES	YES	\$25-50k	Unknown	FWRI	Universities	This will take some time to develop and will rely on the data collected from the monitoring program.	Very feasible, but requires initial sampling to occur at known locations first.	Yes- needed to fill in data gaps.
1	1	4	Participate with the SJRWMD, DEP, and local governments in the development of the Minimum Flows and Levels (MFL), regional water supply plans and regulatory review of various permits, in order to identify potential water supply intake locations, and other actions within watersheds and sub-watersheds containing Atlantic sturgeons to avoid, minimize, or mitigate any potential impacts.	Habitat Conservation & Mgmt, Protections & Permitting, Law Enforcement, Incentives & Influencing, Coordination with Other Entities	ONGOING	NO	YES	\$0-25k	Unknown	HSC	SJRWMD, DEP, local governments, Georgia Department of Natural Resources	High likelihood of success.	Very feasible.	This is needed as part of ERP and other permitting reviews.; This will be done once NWFWMD or the Counties re-start the after supply planning process; This will be done once NWFWMD starts the MFL process.
1	1	5	Participate with, and develop outreach material for DEP, SJRWMD, DOACS, local governments, federal agencies, and the public to identify and implement conservation measures that reduce water quality impacts from unpaved roads, agriculture, silviculture, riparian zone management, and development within known areas of Atlantic sturgeon occurrence.	Habitat Conservation & Mgmt, Monitoring & Research, Protections & Permitting, Law Enforcement, Incentives & Influencing, Education & Outreach, Coordination with Other Entities	EXPANDED	NO	YES	\$25.50k	Unknown	HSC	SJRWMD, DEP, DOACS, Federal agencies, local governments, conservation organizations, private landowners	Some effort to reduce sedimentation from unpaved roads in some of the counties has occurred, but continued funding and commitment are necessary. This will have moderate effectiveness depending on who the audience for the various outreach products are developed.	Very feasible.	Can be done at any time in the process. Correcting unpaved road issues may have differing urgency depending upon where the project is located.
1	1	6	Increase protection of Atlantic sturgeon habitat through opportunities provided by conservation lands management, county comprehensive plan land use classification, fee simple or less than fee acquisition, or the potential to develop a U.S. Fish and Wildlife (USFWS) Habitat Conservation Plan (HCP) for Northeast Florida river basins for federally-listed and certain state-listed fish species.	Habitat Conservation & Mgmt, Incentives & Influencing, Coordination with Other Entities	NEW	NO	YES	TBD	Federal Grant with State Match; unknown	HSC	Local Government, DEP, SJRWMD, DOACS, TNC, Universities, Georgia Agencies	Could be effective if local government and landowners consent to the land use change; HCP process could be very effective but will be a substantial process.	Very feasible but will be dependant on support and cooperation of outside entities.	HCP process and land use change can be done at any point the process. However, if the HCP process is started early it may provide a start for data collection and early implementation of management.
2	3	7	Improve Atlantic sturgeon habitat through habitat restoration and enhancement.	Habitat Conservation & Mgmt, Population Mgmt, Monitoring & Research	NEW	YES	YES	TBD, though could be as high as \$3-5 million	Unknown	FWRI/FFM	USFWS	This is something that will be dependant on funding availability.	This will be require multiple actions over many years.	Moderate urgency.
2	4	8	Enhance or augment Atlantic sturgeon populations throughout their historic range.	Population Mgmt, Monitoring & Research	NEW	YES	NO	\$100k+	Unknown	FWRI/FFM	USFWS	This may be moderately effective and will require completion of other actions to implement.	The feasibility will be determined by the information collected from other actions.	Must be done after other actions are taken.
1&2	2	9	Monitor the success of measures implemented to protect and or enhance Atlantic sturgeon and their habitat, and implement changes where necessary.	Habitat Conservation & Mgmt, Population Mgmt, Monitoring & Research	NEW	YES	NO	\$50-100k	Unknown	FWRI	DEP/USFWS/ USGS/Universities	This may be moderately effective and will require completion of other actions to implement.	The feasibility will be determined by the information collected from other actions.	Must be done after other actions are taken.

Table 6. Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) Conservation Action Table

Objective(s) Addressed	Team Assigned Priority Level	Action Item Number	Action Items	Conservation Action Category	Ongoing, Expanded or New Effort?	Authority	Man Power	Estimated Cost To Implement	Funding Source(s)	Lead for Implementation: FWC Program(s) and/or Section(s)	External partners	Likely Effectiveness	Feasibility	Urgent?
1	2	10	Describe the genetic characteristics of Florida's Atlantic sturgeon population and determine river-of-origin (natal river) by collecting and analyzing tissue samples from Florida captures and comparison with other Southern Distinct Population Segment Atlantic sturgeon.	Population Mgmt, Monitoring & Research	NEW	YES	NO	\$25-50k	Unknown	FWRI	Universities, USFWS, NMFS, Georgia Department of Natural Resources	High likelihood of success.	Very feasible.	Yes- needed to fill in data gaps.
2	4	11	Implement hatchery propagation and reintroduction of Atlantic sturgeon (NMFS authorization required).	Habitat Conservation & Mgmt, Population Mgmt, Monitoring & Research	NEW	YES	YES	\$100k+	Unknown	FWRI/FFM	NMFS, USFWS	This may be moderately effective and will require completion of other actions to implement.	The feasibility will be determined by the information collected from other actions.	May be done after other actions are taken.
2	5	12	Monitor and address the occurrence of invasive species that affect Atlantic sturgeons, whether the effect is direct (predation) or indirect (influence on habitat).	Monitoring & Research, Protections & Permitting, Incentives & Influencing, Coordination with Other Entities	NEW	YES	YES	\$50-100k	Unknown	FWRI/HSC	USFWS/DOACS	Likelihood of success.	Very feasible.	Unknown- Potentially critical to conservation of the species.
1	1	13	Develop a training module for FWC Law Enforcement and commercial fishermen to identify Atlantic sturgeon.	Law Enforcement, Education & Outreach	NEW	YES	YES	\$0-25k	Unknown	OPAWVS	USFWS	This would allow Law Enforcement to be able to adequately enforce regulations.	Very feasible	Can be done at any time in the process.
1	2	14	Develop comprehensive voluntary wildlife conservation measures that identify management needs and protect Atlantic sturgeon habitat.	Monitoring & Research, Protections & Permitting, Incentives & Influencing, Coordination with Other Entities	NEW	YES	YES	\$0-25k	Unknown	FWRI/HSC	USFWS/DOACS	High likelihood of success.	Very feasible.	Yes- Very critical to conservation of the species.

Acronyms used in this table:

- DEP: Florida Department of Environmental Protection
- DOACS: Florida Department of Agricultural and Consumer Services
- FWC: Florida Fish and Wildlife Conservation Commission
- FWRI: Fish and Wildlife Research Institute, the research branch of the Florida Fish and Wildlife Conservation Commission
- HCP: Habitat Conservation Plan
- NMFS: National Marine Fisheries Service
- SIRWMD: St. Johns River Water Management District
- TBD: To be determined
- TNC: The Nature Conservancy
- USFWS: United States Fish and Wildlife Service
- USGS: United States Geological Survey

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APPENDICES

Appendix 1. Cooperating agencies and programs aimed at maintaining aquatic habitat quality

The Department of Environmental Protection (DEP) created the Integrated Water Resource Monitoring Network (IWRM) Program as a multi-resource, multi-level comprehensive monitoring network, designed to answer questions about Florida's water quality (WQ) at differing scales. Tier I monitoring is comprised of two monitoring efforts, status monitoring and trend monitoring, which are designed to answer state-wide to regional questions. Tier II monitoring includes basin assessments and monitoring required for Total Maximum Daily Load (TMDL) development.

The status monitoring network performs a statewide sweep each year to report on the overall condition of Florida's waters. The surface water trend-monitoring network consists of 76 fixed locations in streams and rivers that are sampled on a monthly basis. The sites are usually located at the lower end of a drainage basin and, where possible, are placed at or close to a U.S. Geological Survey flow gauging station. These sites enable DEP to obtain chemistry, discharge, and loading data at the point that integrates the land use activities of the watershed ([DEP TMDL website](#)). Data from the both networks comprise part of Florida's biannual Water Quality Assessment 305(b) Report to the U.S. Environmental Protection Agency, a requirement of the federal Clean Water Act.

The DEP must develop TMDLs for waterbodies where 1 or more WQ standards are not met. The TMDL is a scientific determination of the maximum amount of a given pollutant that surface water can absorb and still meet the WQ standards that protect human health and aquatic life. Waterbodies that do not meet WQ standards are identified as "impaired" for the particular pollutants of concern (e.g., nutrients, pathogens, metals, etc.) and TMDLs must be developed, adopted, and implemented for those pollutants to reduce the level of impairment. The threshold limits on pollutants in surface waters are set forth primarily in Rule [62-302, F.A.C.](#) DEP provides information on the status and development of TMDLs through their website ([DEP TMDL website](#)). Coordination with DEP on the location of Atlantic sturgeons and any WQ and habitat information collected at inhabited sites will be important to improving or maintaining the aquatic habitat.

The St. Johns River Water Management District has several programs related to ensuring that water supply needs of both people and natural systems are met. Minimum Flows and Levels (MFLs) are established for lakes, streams, rivers, wetlands, springs, and aquifers in order to prevent significant harm to the water resources or ecology of an area resulting from permitted water withdrawals. Establishing MFLs is a requirement of the State Legislature under s. [373.042, Florida Statutes](#). MFLs identify a range of water flows and levels above which water might be permitted for consumptive use. Consumptive Use Permits allow the holder to withdraw a specified amount of water, either from the ground or a surface water such as a canal, lake, or river. The water can be used for a public water supply; to irrigate crops, nursery plants, or golf courses; or for industrial processes. Individual homeowners using water from their own private well for household purposes do not need Consumptive Use Permits. The water management

districts develop regional water supply plans for meeting the needs of future development within their basins while also maintaining protection of natural systems. The plans may identify the additional use of traditional supplies, such as ground and surface waters, or the development of alternative supplies such as use of reclaimed water, demineralization of brackish water, desalination of seawater or increased water conservation.

The St. Johns River Water Management District has developed MFLs in most of the river systems that contain Atlantic sturgeons. As part of the [Monitoring and Research](#) actions, information that is gathered regarding specific habitat and WQ needs of the Atlantic sturgeon will be provided for consideration while they develop the 5-year priority lists and timeframes for MFL plan development and in the actual development of individual MFLs in waterbodies containing Atlantic sturgeons.

Appendix 2. Riparian buffers and management

Best management practices (BMPs) are designed to protect water quality (WQ) by reducing or eliminating inputs of sediments, nutrients, logging debris, and chemicals, as well as controlling temperature fluctuations from development, mining, silvicultural and agricultural practices. The silviculture BMP (Department of Agriculture and Consumer Services 2011) identifies a Special Management Zone (SMZ) whose width is based on the size and type of waterbody, soil type (erodible), and slope of the site. The SMZ ranges in size from 35 ft to 300 ft (10.7 m to 91.4 m). The U.S. Fish and Wildlife Service has recommended 100-ft (30.5-m) riparian buffers for streams and rivers containing listed mussel habitat for various agricultural practices receiving federal funding (National Resource Conservation Service 2011). The Florida Natural Areas Inventory (2011) and the Critical Lands and Waters Identification Project (Oetting et al. 2012) have also identified for planning purposes 1,000-ft (304.8-m) buffers along all rivers and streams based upon the need for removal of nutrients from septic tanks and upland land uses. However, regulatory requirements under ERP/non-point source permitting typically only require 25-ft (7.6-m) buffers from wetlands for specific WQ parameters.

If direct land acquisition is not feasible for the preservation of areas containing Atlantic sturgeons, alternative conservation methods may need to be considered. Conservation easements are one of the most effective tools available for the permanent conservation of private lands in Florida. “A conservation easement is a restriction placed on a piece of property to protect its ecological or open space values. It is a voluntary, legally binding agreement that limits certain types of uses or prevents development from taking place now and in the future. In a conservation easement, a landowner voluntarily agrees to donate or sell certain rights associated with his or her property, such as the right to subdivide, and a private organization or public agency agrees to hold the landowner’s promise not to exercise those rights” (The Nature Conservancy 2003). The application of conservation easements by private landowners has successfully protected and retained large tracts of wildlife habitat while meeting expectations for natural resource conservation. Parcels greater than 40 ac (16.2 ha) under permanent conservation easements are eligible for a tax exemption under [s.196.26, Florida Statutes](#); parcels less than 40 acres must meet other requirements and be approved by the Acquisition and Restoration Council. In some cases, conservation easements enable the landowner to qualify for tax benefits under the Internal Revenue Service rules. Additional information on Conservation Easements and Acquisition can be found through in the [Florida Wildlife Conservation Guide](#).

Appendix 2, Literature Cited

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Appendix 3. Protocols for propagation, translocation, reintroduction, and augmentation

All propagation actions undertaken are to be conducted in a manner consistent with [NMFS/USWFS controlled propagation policy](#) (2010) and the [FWC Genetics Policy for the Release of Finfish in Florida](#), Final Draft, January, 2007; specifically Sections 3A, 4B, 4C, 4D, 5, and 9. Furthermore, all actions must be consistent with the U.S. Fish and Wildlife Service's culture Manual for Atlantic sturgeon (Mohler 2003) and the Atlantic States Marine Fisheries Commission (ASMFC) Breeding and Stocking Protocol for Cultured Atlantic Sturgeon (AMFSC 1996). No reintroduction actions will be taken without approval by the National Marine Fisheries Service (NMFS), St. Marys River Management Committee, Georgia Department of Natural Resources, St. Johns River Water Management District, the Florida Fish and Wildlife Conservation Commission.

Donor populations

Within the distribution, populations vary in size and proximity to other populations and may differ significantly in allele frequency. Because of these differences, the rehabilitation strategies of each population will also vary. For example, some rehabilitation efforts will focus on supplementation of remnant stocks and others will involve the repatriation of extirpated populations. In each case, the broodstock or donor population selected for use in rehabilitation or repatriation should be the most appropriate source to maintain the genetic variability and within- and among-population diversity and structuring of the remnant populations. All stock collection will be consistent with NMFS' sturgeon handling protocols (Kahn and Mohead 2010), and only under a Section 10 permit from NMFS.

A donor population should be a natural population having a sufficient number of individuals to minimize the loss of individuals from the reproducing population. Protection of the donor population must be ensured, as the population must be sufficiently abundant to support gamete collection, post-spawn egg or larval collection or adult transfers without harm. For many populations, the most appropriate source for supplementation may be its own stock, if that stock has maintained an appropriate level of genetic diversity. If the donor stock cannot be from the source population then the donor population should be from a metapopulation with similar genetic characteristics (i.e., allele frequencies) or ecological and environmental attributes. Gamete collection and mating techniques should strive to maximize representation of a large number of adults to the recipient population and minimize reproductive variance among adult males and females.

Propagation

Rearing methods or techniques must take into consideration the genetic principles for aquatic organisms as well as fish health and disease transmission issues. Rearing methods should maximize physical and genetic fitness of stocked fish.

The biology, life history, and genetics of Atlantic sturgeons in Florida are poorly known. Therefore, controlled propagation will be treated as experimental in nature, and will require detailed proposals prior to issuance of appropriate permits.

In general, any parties wishing to conduct controlled propagation must abide by the following propagation guidelines:

- Present a detailed plan to FWC outlining their expertise, facilities and methodology, species to be propagated, source of stock, disposition of progeny, etc.
- Provide justification for the work, including benefits.
- Obtain all necessary state and federal permits.
- Take all necessary precautions to prohibit introduction or spread of diseases, parasites, and non-native species into controlled environments or suitable habitat.
- Conduct all activities in a manner that will prevent the escape or accidental introduction of individuals outside of their historic range.
- Document all data concerning life history observations, fecundity, survival and mortality, water chemistry, seasonality, and any other conditions or observations important to successful propagation.

A sub-sample of reared Atlantic sturgeons will be sacrificed for genetic analysis from to-be-stocked individuals and recipient populations prior to stocking in order to evaluate final parental contribution (in situations where pair-wise breeding does not occur).

Re-introduction, release techniques and site selection

Although many streams have been highly modified, a number of opportunities exist to improve aquatic populations through controlled augmentations and reintroduction. In order to protect genetic integrity, biological diversity, and to avoid conflicts, all activities will be coordinated with appropriate partners (e.g., riparian landowner, affected federal agency).

In an attempt to maximize survival, individuals should be released into receiving waters at locations where wild individuals are known or would be expected to reside at that period in their life history. In addition, stocking techniques consistent with maximizing survival should be employed such as providing acclimation bags or pens in the river and dispersing releases over time and in habitats suitable for the life stage(s) being released.

A site-augmentation and re-introduction plan should be completed prior to conducting any activities. Site plans for potential activities will be developed and distributed to appropriate FWC regional personnel prior to propagation. Site augmentation/re-introduction plans should include as much information as possible, including:

- The exact location where the organisms are to be introduced
- Demographic status of the target species at the site and statement of why propagation is necessary
- Spatial relationship of the site to other populations of the target species
- Documentation of current habitat conditions at the site
- Assessment of possible limiting factors at the site (e.g., recruitment)
- The source of organisms used for reintroduction (hatchery-produced or wild)
- Detailed monitoring plan and detailed predictions
- List of cooperating and responsible partners
- Copies of all appropriate permits and any other pertinent information
- Gamete collection targets and mating techniques

- Stocking numbers
- Rearing techniques

All recovery partners and any other affected private or public entities identified by the partners will be notified of planned activities, and will be provided, upon request, the site-augmentation and re-introduction plan prior to relocating or releasing organisms in the wild.

Sites for augmentation and re-introduction activities should be selected based on criteria and Actions identified above, including historical and current distribution of species; habitat conditions (e.g., water quality, recruitment); and past, present, or future threats. Since methods are experimental in nature, activities for a species should be restricted to discrete sites within a specific drainage. The site should be used for augmentation and monitored for a period of years, or until there is evidence of success or failure.

A detailed monitoring plan should be prepared prior to stocking. It is important to obtain information at the proposed stocking site that includes suitable habitat, aquatic organism assemblages, and aquatic organism density prior to and after stocking. Fragility may prevent marking fish for recapture and hinder future examination of stocking success. Also, the rarity and low detection probability may require multiple stockings and subsequent sampling to evaluate the success of establishing a new population or augmenting an existing population.

Recovery partners conducting hatchery propagation studies, population augmentation, and population reintroduction will provide an imperiled species recovery partner report of activities to FWC detailing and documenting the following:

- A description of their propagation program
- Objectives and population data status
- A list of all agencies involved
- Means by which success or failure will be measured
- Documentation of all activities conducted, all locations involved, number of juveniles released, and duration of release efforts
- Report on all obstacles encountered during the research, propagation, and reintroduction efforts

Appendix 3, Literature Cited

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Appendix 4. Intergovernmental coordination

Florida's growth management law places significant responsibility for land and water use decisions on local governments. Achievement of Florida's species conservation plans will necessitate local government land and water use plans and regulations that recognize important state fish and wildlife resources, including habitat, and provide adequate provision for their conservation. The Florida Fish and Wildlife Conservation Commission (FWC) will continue to collaborate with and provide information to local governments regarding Species Action Plans, permitting guidelines, and assistance programs that are available to landowners, as well as the general public.

[Section 163.3177, Florida Statutes](#), requires that county comprehensive growth management plans include a conservation element. The conservation element must include the identification of areas within the county that are locations of important fish, wildlife (including state-listed species), or habitat resources. This element must contain principles, guidelines, and standards for conservation that restrict activities known to adversely affect the survival of these species. The FWC is identified as a state agency authorized to review county growth management plans and plan amendments to ensure important state fish, wildlife, and habitat resources are adequately considered. Further, local government LDRs require conditions for land or water use that specify how uses will be administered consistent with the conservation element of the county growth management plan.

County growth management plans and LDRs provide an avenue by which FWC can inform and influence land and water uses that are relevant to the conservation of Florida's fish and wildlife, including state-listed species. Because local governments use the LDRs or ordinances to govern development and expansion under their jurisdiction, coordination with FWC can streamline FWC's review process. This could be implemented by FWC in coordination with the local government by adding questions to their development applications asking for information on which listed-species surveys have been conducted on the property, or by inspecting parcels for the presence or absence of imperiled species (simplified survey protocol). Requiring notification of FWC staff that an imperiled species or its habitat has been identified onsite prior to issuing clearing or building permits should expedite FWC's review.

Land development is governed by a variety of federal, state, and local government growth management and permitting processes or requirements. Some of the processes may include Joint Coastal Permits, Environmental Resource Permits (wetland, stormwater, or non-point source), Sector Plans, Developments of Regional Impacts, Master Planned Unit Developments, and Mitigation Banking Permits. Most state and water management district permits require consideration of potential impacts to listed species and their habitats. Local governments and other state or federal agencies often conduct site visits prior to clearing and development. These site visits occur early in the regulatory process, often well before permitting begins. By participating in site visits, project scoping meetings and pre-application reviews as part of an interagency review team, FWC can help determine presence or absence and help address avoidance, minimization, and mitigation prior to the permitting process. An Interagency Review Team would also provide FWC the opportunity to participate in large-scale local government planning efforts, would be able to coordinate with other permitting agencies to reduce

redundancy in recommended conditions, and would be able to help large developments plan to avoid habitat impacts. These early meetings and coordination efforts also give local governments and other agencies the opportunity to determine presence or absence of listed species onsite as well as other important fish, wildlife, and habitat issues.

The FWC will develop and provide protocol for determining the presence/absence of imperiled species to assist local governments and the regulatory agencies in protecting habitat for the imperiled species. Once presence is determined, FWC can provide assistance to the applicant to avoid incidental take permitting by providing conservation measures such as appropriate site design, or FWC could provide mitigation options such as purchase of land, contribution to a trust fund for conservation of the species, or participation in an Habitat Conservation Plan. This is also a good opportunity to make the applicant aware of any FWC incidental take permits or authorizations.

Local governments and other agencies also play a substantial role in imperiled species conservation and management by providing protected and managed areas for imperiled species. Many local governments have created habitat-acquisition and management programs, which can provide important assistance in achieving the goal and objectives of this plan. The FWC will continue to coordinate with local governments and other agencies to help ensure that local land-acquisition programs and the comprehensive plan's implementing ordinances and policies are: 1) consistent with the goal and objectives of this plan and 2) focus on acquisition priorities for imperiled species and other important wildlife species.