A Species Action Plan for Four Saltmarsh Songbirds:

Scott's Seaside Sparrow *(Ammodramus maritimus peninsulae)*
Wakulla Seaside Sparrow *(Ammodramus maritimus juncicola)*
Marian's Marsh Wren *(Cistothorus palustris marianae)*
Worthington's Marsh Wren *(Cistothorus palustris griseus)*

Final Draft
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This plan is dedicated to the memory of Herbert W. Kale II, who also appreciated these little brown birds.

Cover photographs courtesy of Larry Gridley:
Wakulla seaside sparrow (left) and Marian's marsh wren (right)

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EXECUTIVE SUMMARY

The goals of this plan are to improve the conservation status of the Scott's seaside sparrow (*Ammodramus maritimus peninsulae*), Wakulla seaside sparrow (*Ammodramus maritimus juncicola*), Marian's marsh wren (*Cistothorus palustris marianae*), and Worthington's marsh wren (*Cistothorus palustris griseus*) (collectively referred to as saltmarsh songbirds) to the point that each subspecies is secure within its historic range. The Florida Fish and Wildlife Conservation Commission (FWC) developed this plan in response to the determination of the threatened status of these birds.

Seaside sparrows and marsh wrens may never meet the criteria for delisting of the International Union for the Conservation of Nature because of their small population sizes and restricted distributions. However, management strategies outlined here are intended to help maintain stable populations. Information on distribution, abundance, and basic biology is needed for the proper management of these little-known birds.

Objectives are to maintain or increase the areas of occupancy and the size of current populations, and clarify genetic relationships to better evaluate their listing status. Extirpation, high fluctuation in local populations, and rapid decline are some of the documented factors affecting saltmarsh songbird populations in Florida.

Because little is known about the specific reasons for decline of each taxon, a major component of this plan is the collection of information necessary to determine management activities that achieve population stability within the subspecies' historic ranges. This information includes identification of threats and factors limiting populations, identification of management actions that may improve habitat quality and population trends, and identification of conditions necessary for re-colonization of formerly occupied habitat. Proposed actions include habitat conservation and management, surveys of distribution and abundance, health and genetic assessments, nesting and banding studies, habitat assessments, determination of vulnerability to disturbance, education and outreach, and local government coordination. Seaside sparrows and marsh wrens benefit from the protection of saltmarsh habitat; thus, continued protection of this habitat is considered a critical measure to successfully maintain populations.

This plan details the actions necessary to improve the conservation status of the saltmarsh songbirds. 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

Area of Occupancy: The area within its extent of occurrence (see Extent of Occurrence), which is occupied by a taxon, excluding cases of vagrancy. This reflects the fact that a taxon will not usually occur throughout the area of its extent of occurrence, which may contain unsuitable or unoccupied habitats (as defined by IUCN).

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 (F.A.C.), and following the protocols in the Guidelines for Application of the IUCN Red List Criteria at Regional Levels (Version 3.0) and Guidelines for Using the IUCN Red List Categories and Criteria (Version 8.1).

DEP: Florida Department of Environmental Protection

Disturbance: Action which results in alteration of a bird's normal behavior to such an extent that harm to the bird, its nest, or young may occur.

DOD: United States Department of Defense

Extent of Occurrence: The geographic area encompassing all observations of individuals of a species, including intervening areas of unoccupied habitat. Synonymous with range. See also Areas of Occupancy (as defined by IUCN).

FNAI: The Florida Natural Areas Inventory, a non-profit organization administered by Florida State University and dedicated to gathering, interpreting, and disseminating information critical to the conservation of Florida's biological diversity.

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

FWRI: The Florida Fish and Wildlife Research Institute, the fish and wildlife research branch of the FWC.

HSC: Habitat and Species Conservation, a division of FWC.

ISMP: Imperiled Species Management Plan

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

IUCN Red List: (IUCN Red List of Threatened Species) An objective, global approach for evaluating the conservation status of plant and animal species, the goals of which are to: Identify and document those species most in need of conservation attention if global extinction rates are to be reduced; and provide a global index of the state of change of biodiversity.

MMWR: Marian's marsh wren

NGO: Non-governmental organization

NOAA: National Oceanic and Atmospheric Administration

OPAWVS: Office of Public Access and Wildlife Viewing Services, an office of FWC.

Saltmarsh songbirds: Refers to all 4 subspecies for which this plan was written: Scott's seaside sparrow, Wakulla seaside sparrow, Worthington's marsh wren, and Marian's marsh wren.

SCP: Species Conservation Planning Section, a division of FWC.

SSSP: Scott's seaside sparrow

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

WMD: Water Management District

WMWR: Worthington's marsh wren

WSSP: Wakulla seaside sparrow

INTRODUCTION

The Florida Fish and Wildlife Conservation Commission (FWC) developed this plan in response to the determination that the Scott's seaside sparrow, Wakulla seaside sparrow, Marian's marsh wren, and Worthington's marsh wren—collectively referred to in this plan as *saltmarsh songbirds*—be recommended for listing as Threatened. Because of significant commonality in behavior and habitat, as well as overlap in distribution and shared geographic range, the combined management needs of all 4 subspecies are addressed in this multi-species plan.

Biological Background

Nine subspecies of seaside sparrows are generally accepted on the basis of plumage, geographical distribution, and migratory behavior. Five subspecies are resident in the coastal marshes of Florida—the Scott's seaside sparrow, Wakulla seaside sparrow, MacGillivray's seaside sparrow (*A. m. macgillivraii*), the Endangered Cape Sable seaside sparrow (*A. m. mirabilis*), and the Louisiana seaside sparrow (*A. m. fisheri*). Two extinct Florida subspecies are the Smyrna seaside sparrow (*A. m. pelonotus*) and the dusky seaside sparrow (*A. m. nigrescens*).

About 14 subspecies of marsh wrens are recognized. Subspecies designation is being based on plumage, wing length, and geographic lines. Two subspecies, the Marian's marsh wren and the Worthington's marsh wren breed in Florida.

The taxonomy of seaside sparrows and marsh wrens is complex and in need of revision. While the sub-specific status of Florida's 2 breeding marsh wrens is not currently controversial, it is likely that the Wakulla seaside sparrow will be subsumed into the Scott's seaside sparrow due to weak and gradual morphological differences between the 2 subspecies.

Distinguishing Characteristics

Seaside sparrow plumage is weakly patterned and varies among subspecies, but is generally grayish-brown on the back and lighter with some streaking underneath. There is a patch of yellow in front of the eye and at the bend of the wing, and a grayish moustache (or malar) stripe separated from a white throat by a dark lateral throat stripe. The bill is long and slender for a sparrow. The male's territorial song consists of a weak introductory note followed by a buzzy trill. Adults weigh about 22 g (.77 oz) and are 14 to 15 cm (5.5 to 5.9 in) in total length. Life history information is in Post and Greenlaw (2009).

Figure 1. Wakulla seaside sparrow. Photograph by Larry Gridley.

The plumage of the Marian's marsh wren is cinnamon brown to dark brown above and grayish-brown underneath. The plumage of the Worthington's marsh wren is grayish-brown above and pale gray underneath. Both subspecies have a distinct white eyebrow line and a darker triangular patch with pale streaking on the back. The 2 Florida subspecies are smaller and darker than other marsh wrens. The male's primary song is a loud series of rapid notes and rattles. Adults weigh from 9 to 14 g and are 10 to 12 cm (3.9 to 4.2 in) in total length. The life history of Florida's resident marsh wrens has not been systematically studied and little information is available. Additional species information is in Kroodsma and Verner (1997).

Figure 2. Marian's marsh wren. Photograph by Larry Gridley.

Breeding Behavior

Marsh wrens typically nest from mid-April through mid-July in Florida in salt marshes dominated by smooth cordgrass (*Spartina alterniflora*) and black needlerush (*Juncus roemerianus*) and nest in taller vegetation along tidal creeks. Marsh wrens have a polygynous mating system, although the percentage of males attracting more than one female varies among populations; studies in Georgia salt marshes suggest the degree of polygyny is low (5%) in southeastern populations (Kale 1965), compared to northern and western populations (12.5 to 54%) (Welter 1935; Verner 1964, 1965; Leonard and Picman 1987). In contrast, seaside sparrows are monogamous; they begin nesting as early as late February and continue through late June at similarly vegetated sites. Nest site selection for all 4 subspecies is determined by the highest spring tides and the tallest, stable vegetation with adequate protective cover (Kroodsma and Verner 1997, Post and Greenlaw 2009).

Current Distribution

The saltmarsh songbirds are resident at breeding locations in Florida and are considered non-migratory. Further research is required to determine current distribution, but earlier studies show historic distribution (Figures 3 and 4).

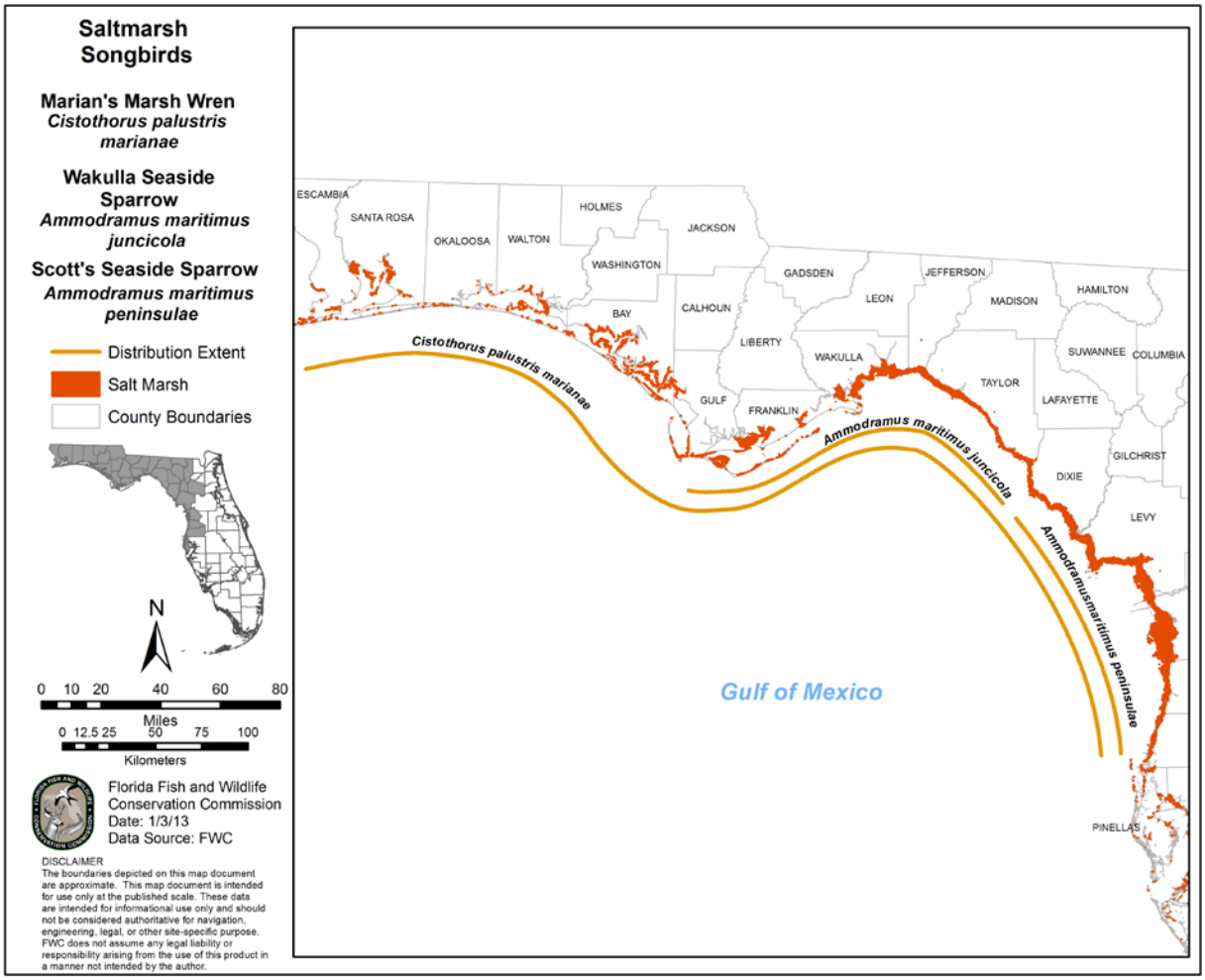

Figure 3. Ranges of Scott's (*A. m. peninsulae*) and Wakulla (*A. m. juncicola*) seaside sparrows, and Marian's marsh wren (*C. p. marianae*). From Kale (1983), McDonald (1988).

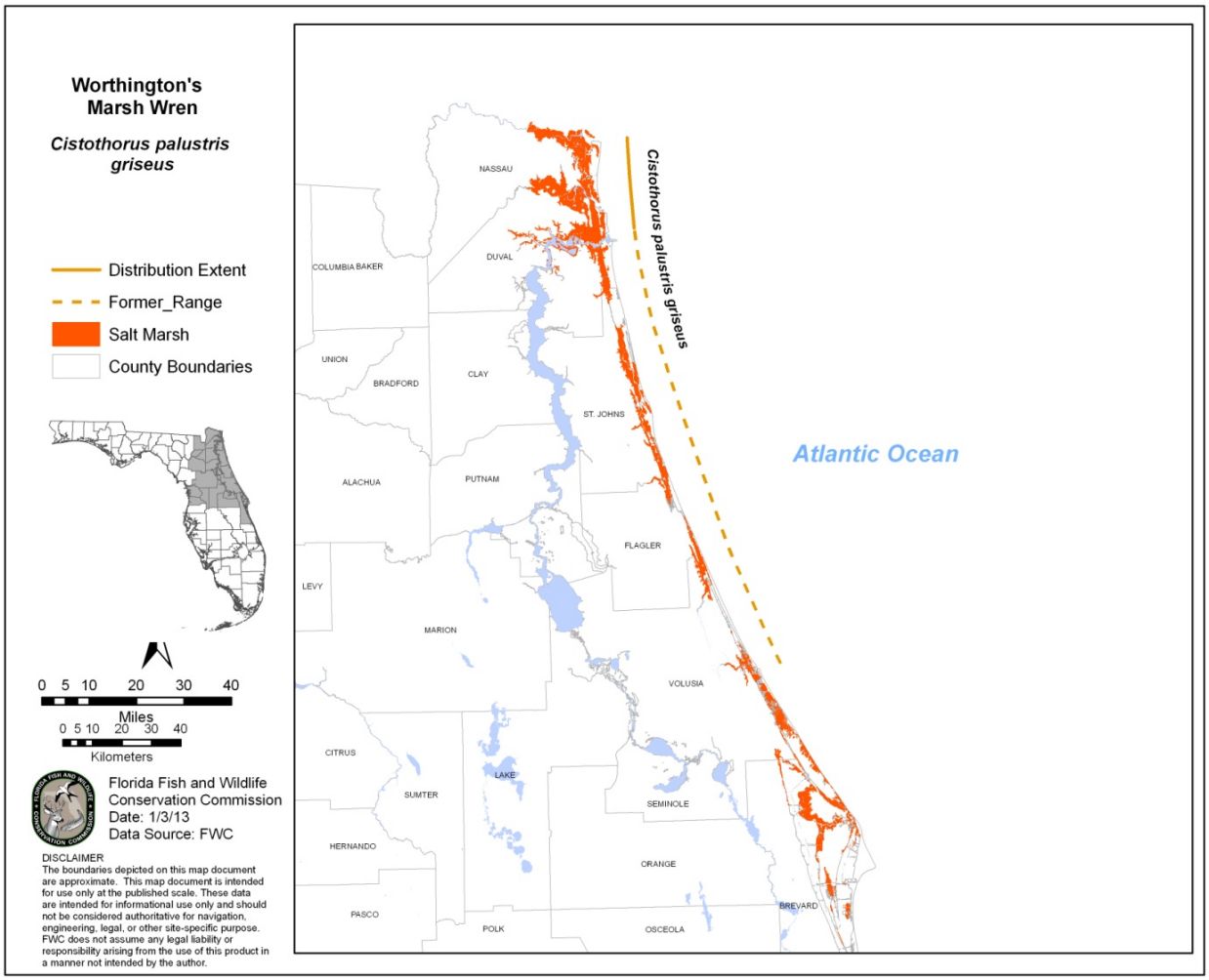

Figure 4. Range and former range of Worthington's marsh wren (*C. p. griseus*). From Stevenson and Anderson (1994), Kale (1996*b*), NeSmith and Jue (2003).

Habitat

Unlike other subspecies of marsh wren, resident Florida forms are restricted to salt marsh. In Florida, their existence is dependent on unaltered salt marshes. Seaside sparrows are habitat specialists usually confined to extensive stands of salt marsh. Saltmarsh preservation is critical to the continued survival of saltmarsh songbirds in Florida.

Salt marshes in Florida (Figure 5) are coastal ecotones of non-woody, salt-tolerant plants that form a transitional zone between marine and terrestrial communities (Montague and Wiegert 1990). Salt marshes are found in coastal areas where mangroves are sparse or absent and wave energy is low. They often encompass tidal creeks, a preferred foraging habitat for these birds. Plant diversity is relatively low and determined by tidal inundation and salinity, often resulting in unevenly distributed vegetation. Saltmarsh songbirds require coastal wetlands that include a mosaic of dense and sparse herbaceous vegetation maintained by intertidal disturbance and fire.

This unique habitat is considered to be among the most productive natural communities in the world (FWC 2005). Statewide wetland protection, including delineation guidelines, is regulated

by the Florida Department of Environmental Protection (DEP). Additionally, most (71%) of Florida's estimated 1,534 km^2 (592 mi^2) of coastal salt marsh is in public ownership (publicly available unpublished data from FWC's Fish and Wildlife Research Institute [FWRI] from 2010); however, the current condition of saltmarsh habitats in Florida is considered "poor and declining" (FWC 2005).

Figure 5. Florida saltmarsh habitat. FWC photograph.

Conservation History

Saltmarsh songbirds are protected under the Migratory Bird Treaty Act of 1918 (16 U.S.C. 703–711), which established measures to prohibit the take of birds (and their nests and eggs) native to North America. Conservation measures for both seaside sparrows and marsh wrens in Florida have included prior state listing as Species of Special Concern (Kale 1996*a*). Conservation measures for dusky seaside sparrows include federal listing as Endangered and subsequent recovery plans (United States Fish and Wildlife Service [USFWS] 1979, USFWS 1983). Recovery efforts for the dusky seaside sparrow highlight the need to understand how human activities in and around wetlands impact wetland habitats and species. Seaside sparrows and marsh wrens also benefit from the protection of saltmarsh habitat through state and federal regulations that protect wetlands. The federal Clean Water Act and Florida's Warren S. Henderson Wetlands Act of 1984 (Ch. 84-79 Laws of Florida) each require a permit for dredging and filling activities unless specifically exempted. Both acts are designed to minimize adverse

impacts to wetlands and to provide mitigation when impacts are unavoidable that will replace the function and value of the loss. Under Florida law, fish and wildlife use of wetlands (with emphasis on listed species) is one of 7 factors used to evaluate projects prior to permit issuance. In addition, the state of Florida has acquired a substantial amount of saltmarsh habitat for conservation purposes in the past several decades. For example, 76% (535 km^2 [206 mi^2]) of the saltmarsh habitat for WSSP, SSSP, and MMWR are now located within conservation areas. For the WMWR, 50% (165 km^2 [64 mi^2]) of saltmarsh habitat within its current and former range occurs within conservation areas.

Threats and Recommended Listing Status

Because of their dependence on intact salt marsh, the saltmarsh songbirds face significant threats due to historic and continued habitat loss. Their narrow range increases their vulnerability to habitat loss, alteration, and fragmentation from dredging and filling in conjunction with coastal development, impoundments for mosquito control and waterfowl, flooding from severe storms and hydrological changes, sea level rise, and chemical and oil spills. Hydrological changes can negatively impact the vegetative composition of nesting habitat, either resulting in encroachment of woody vegetation (including mangroves) or flooding of nest sites. Each of the saltmarsh songbird subspecies is potentially threatened by single events such as hurricanes or oil and chemical spills. The vulnerability of seaside sparrows and marsh wrens is exemplified by their rapid decline, extirpation, and extreme fluctuation in numbers (Nicholson 1950, Delany et al. 1981, Stevenson and Anderson 1994, Federal Register 2007). Difficulty in conducting surveys in salt marsh, which is largely inaccessible, has resulted in limited monitoring. Thus, information on saltmarsh songbird abundance, distribution, and population trends is limited, as is information on factors affecting abundance and distribution. The Biological Status Review identified these threats and evaluated the listing status of each species.

Scott's seaside sparrow (SSSP)

Met the following criteria for listing as Threatened:

- Criterion B, Geographic Range. The SSSP is endemic to Florida and is one of 5 resident subspecies of seaside sparrow found in the state. Land cover information indicated 376.2 km^2 (145.3 mi^2) of potential saltmarsh habitat within this range (Water Management Districts, photography dates 1999 through 2008). There was evidence of range contraction at the southernmost extent of the subspecies' range.
- Criterion C, Population Size and Trend. No information was available on population size or trend within the past 10 years. The population in 1979 was estimated at 2,500 to 3,500 pairs. It is expected that the decline in number of mature individuals (1.3% annual decline from 1966 to 2007) will continue.
- Criterion D, Population Very Small or Restricted. Based on surveys along the Gulf coast during 1979, an estimated 2,500 to 3,500 pairs were found from Pasco County to Dixie County, Florida.

Wakulla seaside sparrow (WSSP)

Met the following criteria for listing as Threatened:

- Criterion B, Geographic Range. The WSSP is endemic to Florida and is one of 5 resident subspecies of seaside sparrow found in the state. The historic range of the subspecies appears to be along the Gulf coast from Taylor County to Bay County, Florida. Land

cover information indicated 191.3 to 275.2 km^2 (73.9 to 106.3 mi^2) of potential saltmarsh habitat within this range. There was evidence of range contraction and fluctuation of populations at the westernmost extent of the subspecies' range.

- Criterion C, Population Size and Trend. No information was available on population size or trend within the past 10 years. Although population estimates based on surveys conducted from 1979 through 1999 varied and included SSSPs, the Biological Review Group (BRG) concluded that the preponderance of evidence indicated that the criterion of fewer than 10,000 mature individuals was met.
- Criterion D, Population Very Small or Restricted. The WSSP population exists in less than 5 locations that are prone to the effects of human activities.

Marian's marsh wren (MMWR)

Met the following criteria for listing as Threatened:

- Criterion B, Geographic Range. The MMWR is one of 2 resident subspecies of marsh wren found in Florida. Land cover information indicated 566.0 to 701.0 km^2 (218.5 to 270.7 mi^2) of saltmarsh habitat within this range. The range of the MMWR extends into coastal Alabama. Adult marsh wrens are sedentary (Kroodsma and Verner 1997), so a rescue effect from extra-regional populations was deemed unlikely.
- Criterion C, Population Size and Trend. No information was available on population size or trend within the past 10 years. Based on surveys conducted in 1979, there were an estimated 2,000 to 3,000 breeding pairs along the Gulf coast from Pasco County to Escambia County, Florida. Distribution was sparse west of Wakulla County.
- Criterion D, Population Very Small or Restricted. The MMWR population exists in less than 5 locations that are prone to the effects of human activities.

Worthington's marsh wren (WMWR)

Met the following criteria for listing as Threatened:

- Criterion B, Geographic Range. The WMWR is one of 2 resident subspecies of marsh wren found in Florida. Land cover information indicated 200.1 to 330.3 km^2 (77.3 to 127.5 mi^2) of potential saltmarsh habitat within this range. A range contraction from Volusia County to the St. Johns River represents an estimated 40% decrease in extent of occurrence. An accompanying population decline was suspected. The range of the WMWR extends into coastal South Carolina. A rescue effect from extra-regional populations was deemed unlikely.
- Criterion C, Population Size and Trend. No information was available on population size or trend within the past 10 years. Based on surveys conducted along the Atlantic coast from 1975 to 2001, an estimated 1,000 to 2,000 pairs were found from the Florida state line to the St. Johns River (Duval County), Florida.
- Criterion D, Population Very Small or Restricted. The population exists in 1 location that is prone to the effects of human activities.

Based on the literature review, information received from the public, the BRG findings, and peer-reviews, FWC staff recommends that the SSSP, WSSP, MMWR, and WMWR each be retained as Threatened species on the Florida Endangered and Threatened Species List.

CONSERVATION GOALS AND OBJECTIVES

Goal

The conservation status of the Marian's marsh wren, Worthington's marsh wren, Scott's seaside sparrow, and Wakulla seaside sparrow is improved to the point that each subspecies is secure within its historical range.

Objectives

I. Maintain or increase current area of occupancy for each taxon within the next 10 years.

Rationale

Land cover information indicates less than 700 km^2 (270.3 mi^2) of potential saltmarsh habitat within the range of each of the saltmarsh songbirds, which is within the geographic range criterion for listing of 20,000 km^2 (7722.0 mi^2). The narrow coastal range and restricted distribution of the saltmarsh songbirds makes them vulnerable to the negative effects of human activities and stochastic events, such as coastal development, impoundments, flooding, sea level rise, and chemical and oil spills. In addition, there is evidence of range contraction of the saltmarsh songbirds, particularly the WMWR, which has experienced an estimated 40% decrease in extent of occurrence. Although the extent of occurrence of the saltmarsh songbirds may never be high enough to overcome the general threshold of 20,000 km^2 (7722.0 mi^2), maintaining or increasing the area of occupancy will help overcome subcriteria, in particular the continuing decline and extreme fluctuations of area of occupancy.

II. Maintain or increase current population of each taxon within the next 10 years.

Rationale

No information is available on population size or trend of the saltmarsh songbirds within the past 10 years. However, the MMWR population was an estimated 2000 to 3000 pairs in 1979, the WMWR population was an estimated 1000 to 2000 pairs between 1975 and 2001, the SSSP population was an estimated 2500 to 3500 pairs in 1979, and the WSSP population varied between 1979 and 1999. Despite the lack of recent data, the preponderance of evidence indicates that the populations of all 4 taxa are fewer than 10,000 mature individuals. In addition, a continued decline is projected, based on the current condition of saltmarsh habitat in Florida, which is considered poor and declining. Taken together, these 2 subcriteria place the saltmarsh songbirds within the criteria for listing.

III. Determine the taxonomic relationships between each of the four saltmarsh songbirds relative to similar taxa.

Rationale

The taxonomy of seaside sparrows and marsh wrens is complex and in need of revision. According to studies conducted in the 1980s and 1990s, it appears that WSSPs and SSSPs overlap in range and morphological characteristics. It is likely that the WSSP will be combined with the SSSP, but a modern study of these variations is needed prior to taxonomic changes. Merging subspecies may affect their listing status. While the subspecies designation of marsh

wrens is not currently controversial, it is complex, and genetic comparisons of coastal and inland subspecies may clarify their taxonomic relationships.

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 1) provides information on action priority, urgency, potential funding sources, likely effectiveness, identified partners, and leads for implementation.

Habitat Conservation and Management

Action 1 Restore appropriate areas of unoccupied habitat for each taxon.

Action 2 Recommend management actions for the conservation of each taxon, including minimum habitat requirements.

Habitat conservation and management needs of saltmarsh songbirds in Florida are difficult to evaluate because little is known about their habitat requirements and demographic response to land management. Because of this uncertainty, an experimental approach that uses adaptive resource management is recommended. Management of current habitat and restoration of unoccupied habitat is important for the conservation of each taxon. However, there are many gaps in our knowledge of the habitat and conservation needs of these species, and further research is needed before either of these actions can be implemented (see Monitoring and Research).

Information on the conservation of seaside sparrows and marsh wrens from other locations, and in some cases information on the conservation of other grassland bird species, may apply to the management of saltmarsh songbirds in Florida. However, specific information on habitat requirements of Florida saltmarsh songbirds is needed before habitat management needs can be fully assessed. Also, species-specific management may be necessary to prevent the local extirpation of seaside sparrows (Post and Greenlaw 2009) and marsh wrens (D. E. Kroodsma, Amherst College, personal communication).

Suitable habitat for resident saltmarsh songbirds must provide favorable conditions during both breeding and over-wintering periods. Breeding seaside sparrows require nest sites above spring tides, and sparse vegetation for effective foraging (Post and Greenlaw 2009). Optimal habitat is salt marsh dominated by medium-high cordgrass (*Spartina* spp.), and relatively open areas of sparse vegetation and exposed ground. However, protective cover is needed for foraging and nesting. Gulf coast seaside sparrows in Florida usually foraged along tidal creeks near smooth cordgrass within 4.9 m of water, and used black needlerush as protective cover (Post et al. 1983). Large contiguous areas that provide both feeding and nesting areas are preferred (Post 1974, Post et al. 1983).

In Florida, marsh wrens use areas along tidal creeks dominated by cordgrass, black needlerush, and, occasionally, sawgrass (*Cladium jamaicense*) (Stevenson and Anderson 1994). Breeding marsh wrens in Georgia marshes used similar habitat with a >2-m vegetation height along tidal creeks (Kale 1965). Compared to seaside sparrows, marsh wrens may be more tolerant of reduced patch area (Benoit and Askins 2002). Research is needed to provide minimum habitat

requirements for each taxon and recommendations on how these can be achieved (see Action 11).

Mitchell et al. (2006) provide a review of impacts of prescribed fire, structural marsh management, and open-water marsh management on "non-target" saltmarsh species, and emphasize the need for additional research. In particular, additional information on the efficacy of prescribed fire as a management tool is needed before specific guidelines for saltmarsh songbirds can be recommended. Salt marshes have burned naturally, although naturally occurring fire is probably more common in high marsh and adjacent uplands, which is not the primary habitat for saltmarsh songbirds. Salt marshes are sometimes managed with prescribed fire during the dormant season for waterfowl, although prescribed fire is not routinely used to manage salt marshes on state lands in Florida because of difficulty in containment (C. Parenteau, DEP, personal communication). The response of saltmarsh songbirds to burning is difficult to predict, and studies provide conflicting results. Seaside sparrows forage on the ground and increased cover has been positively correlated with abundance (Gabrey and Afton 2004). However, infrequent fires that remove dense dead vegetation may benefit seaside sparrows by providing open areas for effective foraging (Gabrey et al. 2001). Marsh wrens seem to tolerate more dense vegetation, but abundance may increase following fire (Gabrey and Afton 2004). The seasonality and spatial extent of burns can be detrimental to wildlife and estuarine food webs, and caution should be used in the application of prescribed fire in salt marsh (Nyman and Chabreck 1995). However, marsh fires that create a habitat mosaic of burned and unburned patches would provide diversity in vegetation structure that may be desirable. Data obtained from nesting and banding studies can be used to determine information on the effects of fire frequency, seasonality, and intensity on vegetation associations and the demography of saltmarsh songbirds (see Action 11).

Action 3 Maintain and restore habitat for saltmarsh songbirds by preventing reduction of the total area of contiguous tracts of salt marsh and by removing artificial barriers (e.g., canals, causeways) that divide the marsh and reduce patch size.

Saltmarsh songbirds, particularly seaside sparrows, may occur more frequently in smaller marshes, so salt marshes that are fragmented by artificial barriers may have a negative effect on the abundance of these species (Benoit and Askins 2002). Marsh restoration may be as simple as removing the structures that fragment it (Benoit and Askins 2002), but additional methods are typically necessary; detailed methods of saltmarsh restoration are described in Woodhouse (1979). Information on habitat restoration methods specifically for Florida saltmarsh songbirds is needed (see Action 11).

Population Management

Small populations of grassland birds can quickly become extirpated (M. Delany, FWC, personal observation). For example, the dusky seaside sparrow (Figure 6) rapidly declined from more than 900 individuals in 1968 to only13 in 1979 due to habitat loss and degradation. In response, the FWC initiated emergency recovery efforts, including intensive surveys for remaining birds, ecological studies of SSSPs, and the development of captive maintenance and breeding methods for seaside sparrows. Captive breeding methods were developed using SSSPs (Post and Antonio 1981, Webber and Post 1983), and 6 of 7 remaining male dusky seaside sparrows were taken into

the breeding program in 1980 (Delany et al. 1981). Although efforts to save the dusky seaside sparrow were unsuccessful due to a lack of information on the importance of phylogenetic relationships of the different subspecies, the results demonstrated that the species can breed successfully in captivity. Methods to collect and preserve seaside sparrow genetic material were developed and are described in Gee and Sexton (1983). Translocation and reintroduction procedures for seaside sparrows are described in Post and Antonio (1981). Although captive breeding and translocations of Threatened and Endangered species are considered a last-resort effort for recovery, methods are available and applicable should SSSP and WSSP populations experience drastic declines.

Figure 6. The extinct dusky seaside sparrow. FWC Photograph.

Monitoring and Research

Habitat Assessment

Action 4 Identify areas of formerly-occupied habitat for restoration.

Habitat variables and scales (e.g., ditching, patch size and configuration, elevation, connectivity, adjacent habitats, and land use) derived from a compilation of land use and land cover information may help predict species distributions and identify critical management areas for conservation. Of 701 km^2 of salt marsh within the range of the MMWR, SSSP, and WSSP, 535 km^2 (76%) are within conservation areas. Of 330 km^2 of salt marsh within the current and former range of the WMWR, 165 km^2 (50%) are within conservation areas. After additional remote sensing and Geographic Information System applications to identify and map potential habitat, ground and aerial assessments may be needed to verify habitat suitability and determine habitat restoration needs for saltmarsh songbirds. Once areas are identified and prioritized, managers should conduct restoration efforts as called for in Action 1. Increasing suitable habitat will help overcome the continuing decline and may reduce fluctuation of saltmarsh songbird populations. Since marsh wrens are poor dispersers, restocking may be necessary after restoration.

Action 5 Investigate the causes of extirpation of saltmarsh songbirds, especially WMWRs, in parts of their former range, and the conditions necessary for recolonization.

The examination of characteristics of occupied and abandoned locations may provide insight into current patterns of distribution and minimum habitat patch size for each taxon. This information is especially important for determining causes of extirpation of WMWR from its historic range, but also is important for determining causes of contractions in the southern range of SSSP and the Panhandle range of MMWR and WSSP. An understanding of vegetation requirements and how the spatial scale of available salt marsh influences distribution and abundance will be critical for management success.

Surveys and Monitoring

Action 6 Develop a simple survey protocol by which presence or absence of saltmarsh songbirds can be developed.

Local governments and regulatory agencies may lack the information to determine where protection for saltmarsh songbirds is needed because these species have not been recently surveyed. The development of a simple survey protocol by which presence/absence of saltmarsh songbirds can be easily determined will assist these governments and agencies in permitting activities. Once presence is determined, permit applicants will be able to avoid incidental take permits by providing conservation measures, such as appropriate site design, or by providing mitigation options, such as purchase of land or contribution to a trust fund for conservation of the species.

Action 7 Determine the breeding distribution of each taxon by conducting distribution surveys in potential habitat.

Difficulty in conducting surveys in relatively inaccessible salt marsh has limited bird monitoring, and information on distribution and abundance of songbirds in salt marsh is sparse. Breeding Bird Survey routes in Florida do not adequately sample saltmarsh habitat (M. Delany, FWC, personal observation). The Florida Breeding Bird Atlas (FWC 2003) provides confirmed and probable breeding locations of saltmarsh songbirds; a second Florida Breeding Bird Atlas project began in 2011 and will run through 2016. The eBird program of the Cornell Laboratory of Ornithology and the National Audubon Society is a citizen-science program that documents bird observations, including those of saltmarsh songbirds. These resources provide limited information that is inadequate for determining current distribution and density or management needs.

Accurate information on the distribution, abundance, and population trends of Florida's saltmarsh songbirds is needed to continue to assess the status of each taxon. Surveys need to be conducted in previously searched and unsearched locations to determine current distribution and abundance. Banding and genetic studies (Actions 9 and 11) would also shed additional light on the distribution of each taxon and movement between subspecies. The cooperative effort of public land managers from various agencies, researchers, and contracted cooperators will be necessary to fulfill this action.

Action 8 Estimate the size of the breeding population of each taxon.

Estimates of distribution and abundance of seaside sparrows and marsh wrens during the 1980s were based on presence/absence observations at 0.25-km intervals along transect surveys usually conducted by boat (Kale 1983, McDonald 1988). These population estimates were sometimes "extremely crude" (Kale 1983). More recent surveys of WMWRs (NeSmith and Jue 2003) provided a better estimate of population size.

An array of coastal point-count stations should be established in potential habitat to determine the distribution and abundance of saltmarsh songbirds. Count points should remain fixed and be

representative of available marshes. Count points could be located along transects surveyed by boat and also located in interior marsh areas accessible along tidal creeks or on foot. We recommend using survey methods for saltmarsh songbirds used in previous surveys (see NeSmith and Jue 2003) and methods described in Conway and Droege (2006), Conway (2009), and Rush et al. (2009) to maintain consistency and ensure that detected changes in populations are not artifacts of methods used. Results from previous surveys (NeSmith and Jue 2003) may be useful in calculating the appropriate survey radius and density of count points needed, and a desired level of precision.

The following are survey protocol recommendations: At each count point, monitoring should be conducted 3 times from May to July. Seaside sparrows and marsh wrens are usually found together, and all individuals detected (visually and audibly) should be recorded during a 10-minute observation period. Abundance and detectability within the sample area can be estimated by modeling variation at the level of the count points (Royle and Nichols 2003). Other methods of determining detection probability (e.g., double-observer, distance sampling) are reviewed in McCallum (2005). Applying density estimates from a sampled area to the entire (unsampled) area of potential habitat for each taxon would provide a maximum estimate of abundance. Point-count surveys should be conducted at 3-year intervals to monitor distribution and trends in abundance. Although surveys may be conducted throughout the day, early morning and late afternoon surveys are best for calculating more precise population estimates. Tidal influences may affect species detectability. Seaside sparrows exhibit a positive increase in detection relative to tidal height, while marsh wren detections are negatively related to tidal height (Rush et al. 2009). Therefore, surveys should incorporate covariates of abundance (e.g., landscape and vegetation features, fire history) and detection (e.g., time of day and date, tide, observer) during the collection of data and in their analyses. If conducting distribution surveys only, a recorded territorial song of male seaside sparrows and marsh wrens could be played to elicit responses from males. Surveys conducted for the WMWR should also record observations of the MacGillivray's seaside sparrow for use in its evaluation for possible state listing.

Genetic Assessment

Action 9 Examine the genetic structure and variability among taxa to determine subspecies relationships and taxonomic status.

Both seaside sparrows and marsh wrens represent diverse genetic assemblages. Seaside sparrow subspecies designation is in need of revision; taxonomic changes may be necessary after further study of geographic variation (Post and Greenlaw 2009). Genetic examination of seaside sparrows in Florida found evidence of 2 phylogenetically distinct groups between Atlantic and Gulf coast subspecies (Avise and Nelson 1989). Along the Gulf coast, there appears to be an overlap of range and morphological gradation between SSSPs and WSSPs (Kale 1983). Based on distribution and weakly developed morphological characteristics, Kale (1996*a*) and McDonald (1988) recommended merging the SSSP and the WSSP into 1 subspecies. The subspecies designation of marsh wrens also is complex, being based on plumage, wing length, and geographic lines (Kroodsma and Verner 1997).

Information is needed on the genetic variability of saltmarsh songbirds to detect dangerously low levels of genetic variation (genetic bottlenecks) that can negatively affect demographic performance. The level of genetic variation may influence a population's growth rate and ability to adapt to changing environmental conditions (Leberg 1993). Genetic comparisons of marsh wrens in Florida to inland subspecies may clarify taxonomic relationships. Merging subspecies of seaside sparrows based on genetic similarity may affect their listing status. For example, some criteria for IUCN listing (e.g., population size and extent of occurrence) may not be met if subspecies are combined.

Tissue samples (e.g., blood or feather pulp) should be collected to investigate the taxonomic status of the SSSP relative to the WSSP, and results should be published to justify the merger of the 2 subspecies. Appropriate statistical methods and software should be used to test for genetic variability among populations of the seaside sparrow, and for comparisons of the MMWR and the WMWR to inland species.

Health Assessment

Action 10 Determine baseline levels of pathogens and parasites, and concentrations of contaminants for each taxon.

Little is known about diseases, parasites, and contaminants affecting saltmarsh songbirds (Kroodsma and Verner 1997, Forrester and Spalding 2003, Post and Greenlaw 2009; but see Hunter and Quay 1953). Following the 2010 Deepwater Horizon oil spill in Louisiana, Evers et al. (2011) found 5 to 6% of captured seaside sparrows (*A. m. fisheri*) to be visibly oiled, and 27 to 62% showed evidence of oil under ultraviolet fluorescence. Information on levels of pathogens, parasites, and contaminants may be useful in identifying causes of population declines of saltmarsh songbirds and evaluating the impacts of chemical or oil spills.

Some tissue samples collected for genetic examination (Action 9) also may be used for health assessment. In conjunction with nesting and banding studies, there may be an opportunity to salvage eggs from abandoned nests and carcasses from mist-netting mortalities for analysis. The prevalence and intensity of disease organisms and parasites of saltmarsh songbirds should be determined. Toxicology results will provide information on relative exposure to contaminants (e.g., heavy metals and PCBs). Results will provide baseline information on levels of pathogens and parasites for future evaluations.

Nesting and Banding Studies

Action 11 Use nesting and banding studies to determine the habitat needs for each taxon; these factors should include potential micro-habitat, optimal breeding conditions, factors affecting demographics, and minimum habitat patch size.

Knowledge of the demographic aspects of small populations is essential for understanding underlying processes affecting population trends and evaluating management actions (Belovsky et al. 1994, Winter and Faaborg 1999). Data from nesting and banding studies is needed to provide insight on the causes of population declines and range contractions. Nesting studies

would provide information on factors affecting reproductive success and sources of nest failure, and optimal breeding habitat and nest site criteria. Banding studies would provide information on juvenile and adult survival, dispersal, the role of conspecific attraction, winter ecology, and the interactive effects of saltmarsh management (e.g., prescribed fire, drainage, patch size) on saltmarsh songbirds and vegetation composition and structure.

Features of vegetation structure important for grassland birds include vegetation height and density, litter depth and cover, amount of bare ground, height and cover of woody vegetation, and proportion of residual (dead) vegetation. The availability of suitable foraging areas (i.e., sparsely vegetated locations and wrack deposits) along tidal creeks and shorelines appears to be important for saltmarsh songbirds in Florida. Detailed descriptions of how these variables are measured and analyzed are in Wiens (1969), Post et al. (1983), O'Meara and Marion (1987), Conway and Droege (2006), and Almario et al. (2009). Many factors (e.g., conspecific attraction, climate, food availability, and predation) can influence habitat use and make interpretation of habitat relationships difficult. Further, the density of saltmarsh songbirds may not necessarily be correlated with habitat quality (see Van Horne 1983). Research is needed to provide minimum habitat requirements for each taxon and recommendations on how these can be achieved. Information is needed on the effects of fire frequency, seasonality, and intensity on vegetation associations and the demography of saltmarsh songbirds. Information is also needed on the feasibility of using prescribed fire to slow the northward expansion of mangroves and how this might affect saltmarsh songbirds. Data obtained from nesting and banding studies can be used to determine the effects of wetland impoundments and water levels, effects of nutria and other non-native species, set-back distances for disturbances, and factors affecting winter resident populations. Banding studies could also help determine whether there is movement between the 2 subspecies of seaside sparrows and would further clarify the distribution of these taxa (Action 7).

The following are recommendations for nesting and banding study protocols: Spot-mapping techniques (International Bird Census Committee 1970) can be used to delineate territories and supplemented with observations to determine pairing status and other measures of breeding activity (see Vickery et al. 1992). Nests within established study plots can be identified systematically by walking transects at 50-m intervals. Observations of females being flushed from nests or other behavioral cues (e.g., nesting materials or food being delivered to a site) can be used to locate nests. The fate of individual nests can be monitored by visual inspection every 3 to 5 days for the collection of demographic information on hatching success and fledgling survival. Daily survival probabilities of nests can be estimated (Mayfield 1975, Stanley 2004). Measurements of vegetation composition and structure should be made at nest sites (only after fledging or documented loss of the nest to avoid disturbance) and along random transects within the breeding territory. Dispersal and shifts in territory locations should be recorded. Information on landscape features (e.g., elevation, hydrology, distance to marsh edge), and land management activities (e.g., frequency and seasonality of fire) on the study area should be obtained and related to sparrow movements and reproductive success. Study methods are described in Kale (1965), Post et al. (1983), and Almario et al. (2009). Banding and re-sighting data can be examined to estimate survival and capture (re-sighting) probabilities and territory size. Statistical models can be developed to examine associations between saltmarsh songbird movements and

reproductive success, and land management activities. The FWRI Center for Biostatistics and Modeling should be consulted for analysis methods prior to detailed study design.

Action 12 Investigate possibility for rescue effect from WMWRs in Georgia.

The possible rescue effect from WMWR populations in Georgia should be investigated. Adult marsh wrens in migratory populations will disperse to locate suitable habitat (Kroodsma and Verner 1997). However, adults in sedentary populations are less likely to disperse (D. Kroodsma, personal communication). Because of the failure of the WMWR to recolonize habitat south of the St. Johns River, a rescue effect from extra-regional populations seems unlikely. However, dispersal patterns of WMWR populations in bordering Georgia counties are unknown and may impact management strategies, especially across state lines. Extensive banding and territory mapping in both states will be necessary to understand dispersal and the possibility of a rescue effect by outside populations of WMWR. This information, coupled with the accomplishment of Actions 5, 7, and 8, will be essential to maintaining populations of Florida's saltmarsh songbirds.

Vulnerability to Habitat Disturbance

Disturbance maintains vegetation in an early successional stage required by grassland birds, and populations usually vary over space and time in response to habitat instability (Wiens 1973, Cody 1985). Salt marshes are relatively stable, being maintained by tidal inundation and, to a lesser extent, fire. However, their narrow configuration, coastal location, and low-relief landscape make them especially vulnerable to natural and human-induced disturbances (reviewed in Greenberg 2006). For this plan, disturbance is considered to be habitat alterations that negatively affect populations of saltmarsh songbirds. An understanding of the vulnerability of saltmarsh songbirds to disturbance is important for management decisions. An assessment of vulnerability may be obtained through monitoring programs and the design of research projects. However, documenting unambiguous associations from survey data alone can be difficult (Temple and Wiens 1989).

Action 13 Evaluate levels of protection necessary to maintain population levels of each taxon.

Development in coastal areas can alter saltmarsh habitat and disturb nesting birds. Piers (Banning 2007) and other structures (Benoit and Askins 2002) in salt marshes may increase disturbance, act as barriers that fragment habitat, and negatively affect the abundance of marsh birds. Restriction of tidal flow and changes in hydrology from structural marsh management (i.e., canals and impoundments for mosquito control and waterfowl management) also can disrupt natural inundation and affect habitat suitability. Declines in freshwater discharge and groundwater levels, especially in the Big Bend area, could allow salinity levels that would preclude saltmarsh establishment. Dredging in contiguous or nearby rivers that have a tidal connection to saltmarsh habitats may alter salinity regimes and potentially influence vegetation composition. Ditches can affect the shape and size of breeding territories of seaside sparrows (Post 1974). Contaminant runoff from urban and agricultural areas and oil deposits from spills in marine environments can degrade a salt marsh. Disturbance to a salt marsh can foster the establishment and proliferation of invasive species of plants and animals that can further disrupt the saltmarsh ecosystem. Other improvements to nearby shorelines, including re-contouring, restoration, or constructions of revetments, can also be a cause of disturbance to saltmarsh

songbirds. Until currently unknown factors, such as breeding distribution, habitat requirements, demographic needs, vulnerability to contaminants, and other types of disturbance are addressed, defining or evaluating protection levels necessary to maintain or increase current population sizes will be difficult and likely incomplete. This action should be accomplished only after information gathered from Actions 5, 7, 8, 10, and 11 are gathered and analyzed.

Action 14 Determine the potential impacts of sea level rise on saltmarsh songbirds.

The impacts of sea level rise on saltmarsh songbirds are not known at this time and are difficult to predict because of variation in shoreline characteristics and the uncertainty of changes in vegetation and avian response to habitat shifts. Saltmarsh songbirds may be vulnerable to nest flooding and habitat loss under predictions of sea level rise and increased storm frequency. Fluctuations in water levels and salinity also may affect marsh vegetation and invertebrate food availability. Saltmarsh habitat may also be lost or degraded as a result of reduced or altered rainfall patterns. Predictive modeling using the Sea Level Affecting Marshes Model simulation indicates that some coastal areas may actually exhibit a net increase in saltmarsh habitat as sea level rises (Geselbracht et al. 2011). Nevertheless, sea level changes may impact the saltmarsh songbirds in this plan differently. For example, Gulf coast seaside sparrows may persist due to the projected accretion or increase in the overall extent of their habitat, whereas MMWRs, which occur mostly in tall marsh vegetation bordering tidal creeks (Kale 1996*b*), may not persist if transitional habitats are lost despite an increase in saltmarsh acreage (Geselbracht et al. 2011).

Information on projected sea level rise at specific locations along the Florida coastline is available (Walton 2007) and should be updated. These data and information on distribution, abundance, and habitat use may be useful in assessing the effects of sea level rise on saltmarsh songbirds. Estimates of projected habitat changes to coastal marshes should be regularly reviewed to stay current on their potential impacts on saltmarsh songbirds. The use of predictive models may help estimate the effects of sea level rise on saltmarsh songbirds.

The use of predictive models may help estimate the effects of sea level rise on saltmarsh songbirds. However, more data needs to be collected, especially regarding the measuring of accretion rates in marsh areas that are predicted to be important to these subspecies over the next 50 years. For example, the establishment of Surface Elevation Table (SET) stations in critical marshes (Cahoon and Lynch 2010) is encouraged.

Rule and Permitting Intent

Action 15 Outline acceptable forms of take for saltmarsh songbirds.

Intentional or incidental take of saltmarsh songbirds for which a permit may be issued consists of scientific collection or conservation purposes that intend to further the conservation or survival of the species or will result in data needed for conservation or management purposes.

Intentional Take.—Permits to take saltmarsh songbirds for scientific or educational purposes will be considered on a case-by-case basis.

Incidental Take.—Permits to incidentally take saltmarsh songbirds may be issued for otherwise legal activities, including those permitted by local, state, and federal agencies that may cause a take of birds. Such permits should be issued if there will be a scientific or conservation benefit and only upon demonstration by the applicant that the permitted activity will not have a negative impact on the survival potential of the species.

Action 16 Outline measures, guidelines, and criteria to avoid and minimize impacts to saltmarsh songbirds.

Research and monitoring actions listed in this plan are intended to identify impacts to habitat used by saltmarsh songbirds and will provide guidance for regulatory agencies issuing permits. Avoidance and minimization efforts will need to be assessed and modified as ongoing research and monitoring activities identify and clarify those actions likely to cause adverse impacts to habitat and potential mitigation opportunities.

Activities currently identified that may have a negative impact on saltmarsh songbirds and their habitats include, but are not limited to:

- Dredging and filling in conjunction with coastal development.
- Impoundments or ditching for mosquito control by restricting tidal flow and negatively impacting the hydrology of saltmarsh habitat.
- Construction of piers, dams, or other structures in saltmarsh habitat by increasing disturbance and act as barriers to saltmarsh songbird populations.
- Other activities that require removal of saltmarsh vegetation.

Prior to conducting activities that will impact saltmarsh songbird habitat, surveys should be conducted in effort to minimize impact to saltmarsh songbirds. Measures taken to minimize impact should include the following:

- Determine presence or absence of species.
- Prohibit activity within breeding habitat, creating a primary buffer. The setback distance for the primary buffer will need to be determined. Activity or habitat modification within the breeding habitat may negatively impact saltmarsh songbirds by infringing upon the required habitat patch size needed for successful breeding.
- Avoidance of activities in a larger, secondary buffer area during the breeding season. Prolonged human disturbance near active breeding habitat may negatively impact breeding behavior.
- Control of encroaching woody vegetation at buffers, berms, and impoundments. The spread of woody vegetation can adversely impact saltmarsh habitat. Man-made berms and impoundments may also increase the spread of invasive species.

Law Enforcement

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's law enforcement officers are vital to the success of achieving the goals and objectives of this plan because they both ensure the enforcement of conservation laws and educate the public on how to identify and report violations. Ongoing Law Enforcement actions will meet the needs of these subspecies, and there is no need for more specific law enforcement actions.

Incentives and Influencing
No actions specific to saltmarsh songbirds are currently identified.

Education and Outreach

Action 17 Provide public information and outreach about saltmarsh songbirds and their habitat via electronic and social media outlets as well as traditional outreach methods.

Saltmarsh habitat and saltmarsh songbirds seem to be obscure to the public, and the need for further public education should be assessed. A saltmarsh songbird educational outreach program with basic information, including photographs of seaside sparrows and marsh wrens, life history background, and conservation threats for all 4 subspecies, as well as the value of saltmarsh habitat, is the most important educational resource for local governments, teachers, and the general public. This type of program also may include links to audio files of vocalizations of seaside sparrows and marsh wrens, links to best management practices, management recommendations, pertinent literature, etc. Targeted groups such as developers, county planners, mosquito control professionals, waterfowl managers, and those in the chemical and oil transportation fields will also benefit from public education about the value of saltmarsh management and protection. These same individuals would benefit from information on methods to mitigate damage to saltmarsh songbird populations that are vulnerable to habitat loss and fragmentation due to a variety of human activities.

Coordination with Other Entities

Action 18 Create and maintain a database to store biological and management information about saltmarsh songbirds.

A database to house relevant conservation and management information about these taxa will be necessary, especially to share data with other agencies and partners involved with planning decisions and management actions affecting saltmarsh songbirds. At a minimum, the database would include locations occupied by each taxon, current and potential habitat, landowners' and managers' contact information, current management practices, and status of occupancy.

Action 19 Facilitate coordination among agencies and landowners on research, habitat needs, and protection.

Working with local government, other state agencies, and non-governmental entities (such as local Audubon chapters) to create and maintain a database of saltmarsh habitat locations, landowners and managers' contact information, and current management practices is crucial to saltmarsh songbird conservation. Coordination among agencies and landowners on research, habitat needs, and protection of saltmarsh species and habitat can be facilitated using this shared information. Coordination among entities can also facilitate the development of an oil spill response plan that will specifically address the protection of saltmarsh habitat and these subspecies.

It will be necessary to work with the Florida Department of Environmental Protection and other agencies to ensure regulations protecting salt marsh (such as the Warren S. Henderson Wetlands Act of 1984) are applied in such a way as to be compatible with the conservation of these taxa. The FWC's commenting staff will need to review and provide comments on projects that may affect saltmarsh habitat.

Chapter 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 wildlife or habitat resources, including State-listed species. 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, including any amendments to ensure important state fish, wildlife, and habitat resources are adequately considered. In addition, local government land development regulations require conditions for land and water uses that specify how such uses will be administered to be consistent with the conservation element of the county growth management plans. Therefore, interagency collaboration on the review and development of the conservation element of these plans is essential for ensuring that they consider wildlife habitat within the county.

Following research findings, it will be necessary to develop criteria for preserving saltmarsh songbird habitat on coastal lands. These criteria include:

- Minimum acreages required to support a sustainable population
- Buffer distances around saltmarsh songbird habitat to avoid degradation
- Activities that cause permanent disturbance to the habitat and have impacts to saltmarsh songbirds
- Compatible land uses in or near saltmarsh songbird habitat
- Guidelines for habitat purchase and/or contribution to a fund for use in purchasing and managing lands for saltmarsh songbird conservation
- Local government policies that facilitate habitat shifts to ensure saltmarsh migration due to sea level rise and other hydrological changes

Development of such criteria will form the basis of a permitting program or habitat acquisition program in the future. As information on saltmarsh songbirds is developed, coordination between local governments, other state agencies (i.e., DEP, Florida Forest Service, Florida Department of Transportation, and the water management districts), federal agencies, and FWC will be important in developing habitat acquisition and management guidelines. Coordination between agencies will also be necessary to secure funding sources for these programs, such as the Florida Forever program, conservation mitigation banks, or wetland mitigation banks for purchase and management of listed species habitat.

Table 1. Saltmarsh Songbird Conservation Action Table

(Scott's Seaside Sparrow, Wakulla Seaside Sparrow, Marian's Marsh Wren, Worthington's Marsh Wren)

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	Restore appropriate areas of unoccupied habitat for each taxon.	Habitat Conservation & Mgmt	NEW	NO	NO	TBD	Unknown	HSC	DEP, USFWS, WMDs, DOD, NGOs	High. It will increase the range and distribution of the species.	Yes, it can be done; there are already programs that address purchase and conservation of lands, such as private lands programs.	Yes, it is important to the conservation of the species, but some of this action must be done after other actions are taken.
2	2	2	Recommend management actions for the conservation of each taxon, including minimum habitat requirements.	Habitat Conservation & Mgmt	NEW	YES	YES	TBD	Unknown	FWRI, OPAWVS	Universities, DEP, USFWS, WMDs	High. It raises awareness of the conservation and habitat requirements of the species.	Very feasible.	Yes, it is important to maintain the current occupancy and range of the species, but some of this action must be done after other actions are taken.
1	2	3	Maintain and restore habitat for saltmarsh songbirds by preventing reduction of the total area of contiguous tracts of salt marsh and by removing artificial barriers (e.g., canals, causeways) that divide the marsh and reduce patch size.	Habitat Conservation & Mgmt	NEW	NO	NO	TBD	Unknown	HSC	DEP, USFWS, WMDs, DOD, NGOs	High. It would increase the potential range and distribution of the species.	It would be dependent on the cooperation of outside agencies.	Yes, it is important to maintain the current occupancy and range of the species, but some of this action must be done after other actions are taken.
1	1	4	Identify areas of formerly-occupied habitat for restoration.	Monitoring & Research	NEW	YES	YES	$25-50k	Unknown	FWRI	Universities, DEP, DOD	High. It would increase the potential range and distribution of the species.	It would be dependent on the cooperation of outside agencies.	Yes, it must be done before Action 1 can be completed.
1	1	5	Investigate the causes of extirpation of saltmarsh songbirds, especially WMWRs, in parts of their former range, and the conditions necessary for recolonization.	Monitoring & Research	NEW	YES	YES	TBD	Unknown	FWRI	Universities, FNAI	High. It would expand the knowledge of habitat needs for each taxon.	It would be dependent on the cooperation of outside agencies.	Yes, it must be done before some other actions can be completed.
2	2	6	Develop a simple survey protocol by which presence/absence of saltmarsh songbirds can be determined.	Protections & Permitting	NEW	YES	YES	TBD	Unknown	FWRI	USFWS	High. It would allow permit applicants to avoid incidental take.	Very feasible.	No, but it is important for the conservation of the species.
1	3	7	Determine the breeding distribution of each taxon by conducting distribution surveys in potential habitat.	Monitoring & Research	NEW	YES	YES	$50-100k	Unknown	FWRI	Universities	Moderate. It is important to understand the distribution but not necessarily critical to survival of the species.	It is very feasible, but dependent on the involvement of other entities.	No, but it is important to understand the distribution of the species.
2	3	8	Estimate the size of the breeding population of each taxon.	Monitoring & Research	NEW	YES	YES	TBD	Unknown	FWRI, HSC	DEP, FNAI, USFWS, universities	Moderate, important to understand the breeding population but not necessarily critical to survival of the species.	It is very feasible, but dependent on the involvement of other entities.	No, but it is important to understand current breeding population size for each species.
3	4	9	Examine the genetic structure and variability among taxa to determine subspecies relationships and taxonomic status.	Monitoring & Research	NEW	YES	YES	TBD	Unknown	FWRI	Universities	High. It would increase understanding of subspecies relationships and possibly affect listing status.	Very feasible.	No, but it is important to understand the relationships of the subspecies.
2	4	10	Determine baseline levels of pathogens and parasites, and concentrations of contaminants for each taxon.	Monitoring & Research	NEW	YES	YES	TBD	Unknown	FWRI	Universities	High	Very feasible.	No, but it is necessary to establish baselines before the need for them arises.

Table 1. Saltmarsh Songbird Conservation Action Table

(Scott's Seaside Sparrow, Wakulla Seaside Sparrow, Marian's Marsh Wren, Worthington's Marsh Wren)

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?
2	1	11	Use nesting and banding studies to determine the habitat needs for each taxon; these factors should include potential micro-habitat, optimal breeding conditions, factors affecting demographics, and minimum habitat patch size.	Monitoring & Research	NEW	YES	YES	$100k+	Unknown	FWRI	Universities, FNAI	High. It is extremely important for conservation of the species.	It is very feasible, but dependent on the involvement of other entities.	Yes, it must be done before some other actions can be completed.
2	3	12	Investigate possibility for rescue effect from WMWRs in Georgia.	Monitoring & Research	NEW	YES	NO	TBD	Unknown	FWRI	Universities	Moderate, but it is important for the conservation of the species.	Moderate. It is dependent on the involvement of other entities.	No, but it is important for the conservation of the species.
2	1	13	Evaluate levels of protection necessary to maintain population levels of each taxon.	Monitoring & Research	NEW	YES	YES	TBD	Unknown	FWRI	DEP	High. It would enable regulations to conserve habitat.	Moderate. It is dependent on the involvement of other entities.	Yes, it is necessary to develop protections prior to further habitat loss.
2	5	14	Determine the potential impacts of sea level rise on saltmarsh songbirds.	Monitoring & Research	NEW	YES	NO	TBD	Unknown	FWRI	NOAA, Universities, DEP	Low to moderate, but it may allow responsive measures.	TBD	No, but it may be critical to long-term survival of the species.
2	2	15	Outline acceptable forms of take for saltmarsh songbirds.	Protections & Permitting	NEW	YES	YES	TBD	Unknown	TBD	USFWS	High. It is extremely important for conservation of the species.	Very feasible.	Yes, but it must be done after other actions are taken.
2	2	16	Outline measures, guidelines, and criteria to avoid and minimize impacts to saltmarsh songbirds.	Protections & Permitting	NEW	YES	YES	TBD	Unknown	TBD	USFWS	High. It is extremely important for conservation of the species.	Very feasible.	Yes, but it must be done after other actions are taken.
2	3	17	Provide public information and outreach about saltmarsh songbirds and their habitat via electronic and social media outlets as well as traditional outreach methods.	Education & Outreach	NEW	YES	YES	TBD	Unknown	OPAWVS	All applicable audiences	Moderate. It is important but would primarily reach the informed public.	Very feasible.	No, but it is important for long-term survival of the species.
2	2	18	Create and maintain a database to store biological and management information about saltmarsh songbirds.	Coordination with Other Entities	NEW	YES	YES	TBD	Unknown	SCP	Applicable land managers	High. It would contribute to the conservation and knowledge of the species.	Very feasible.	Yes, it is necessary for the completion of other actions.
2	2	19	Facilitate coordination among agencies and landowners on research, habitat needs, and protection.	Coordination with Other Entities	NEW	NO	NO	TBD	Unknown	SCP	Applicable land managers	High. Most other actions would be facilitated by cooperation.	Very feasible. Most relationships are already in place.	No, but most other actions would be facilitated by this action.

Acronyms used in this table:

DEP: Florida Department of Environmental Protection
DOD: Department of Defense
FNAI: Florida Natural Areas Inventory
FWC: Florida Fish and Wildlife Conservation Commission
FWRI: Fish and Wildlife Research Institute, the research branch of the Florida Fish and Wildlife Conservation Commission
HSC: Habitat and Species Conservation, a Division of the Florida Fish and Wildlife Conservation Commission
NGO: Non-governmental organization(s)
NOAA: National Oceanic and Atmospheric Administration
OPAWVS: Office of Public Access and Wildlife Viewing Services, administered by the Florida Fish and Wildlife Conservation Commission
SCP: Species Conservation Planning, a Section of the Florida Fish and Wildlife Conservation Commission's Division of Habitat and Species Conservation
TBD: To be determined
USFWS: United States Fish and Wildlife Service
WMD: Water Management District(s)
WMWR: Worthington's marsh wren

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