C-111 PROJECT & CAPE SABLE SEASIDE SPARROW SUBPOPULATION D
ANNUAL REPORT – 2014

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Contents

1.0 Executive Summary

The main purpose of this report is to provide current data on Cape Sable seaside sparrows (CSSS or the “sparrow”) breeding in small sparrow subpopulation D during implementation of the C-111 Spreader Canal Western Phase I Project (C-111 SC Project), which began operations in summer 2012. The C-111 SC Project was designed to restore the quantity, timing and distribution of water delivered to Florida Bay via Taylor Slough and to improve hydroperiod and hydropattern in the area south of the C-111 Canal known as the Southern Glades and Model Lands. The U.S. Fish and Wildlife Service (USFWS or the “Service”) issued a Biological Opinion dated August 25, 2009 addressing concerns over potential effects of the C-111 SC Project on CSSS populations and designated sparrow critical habitat, including subpopulation D which is located in the eastern portion of the Everglades just east of Taylor Slough and west of the C-111 Canal. As part of the USFWS Biological Opinion, the South Florida Water Management District (SFWMD or the “District”) is required to measure the impact of the C-111 SC Project on sparrows and habitat in subpopulation D. As a result, we were contracted by the District to monitor and provide expert advice regarding potential effects to sparrows breeding in CSSS subpopulation D.

This report is divided into two main sections. **Section 2.0** is an introduction to this report, providing a brief overview of the C-111 SC Project and outlining potential effects on breeding sparrows in CSSS subpopulation D. **Section 3.0** reports the results of field research on sparrow distribution and demography conducted during the 2014 sparrow breeding season. An overview of each of these sections is provided below. The final two sections of this report provide literature cited (**Section 4.0**) and appendices (**Section 5.0**).

Section 2.0

In the USFWS Biological Opinion dated August 29, 2009, the Service concurred with the determination by the U.S. Army Corps of Engineers (USACE or the “Corps”) that the C-111 SC Project “may affect, and is likely to affect” the endangered CSSS, and that the project “will affect” designated CSSS critical habitat. Computer simulation modeling indicated that local conditions within CSSS subpopulation D critical habitat may be adversely affected by the C-111 SC Project resulting in an increased hydroperiod in the area. In recent years CSSS numbers have been extremely low in subpopulation D (<10 sparrows typically), and there has been concern over recent declines in all of the small, spatially isolated sparrow subpopulations. The recent declines across all small sparrow subpopulations (A, C, D and F) have been attributed to anthropogenic changes in water flows in the Everglades ecosystem. The federally endangered CSSS is restricted to short-hydroperiod marl prairies in the southern Everglades, and this habitat has been adversely affected by hydrologic changes ranging from too much water in some areas (e.g., subpopulations A and D) to too little water in other areas (e.g., subpopulations C and F). Further, high water levels have been associated with reduced occupancy of sites and reduced reproductive performance. Due to the restricted range of the CSSS and the limited number (and condition) of remaining subpopulations, the potential loss of any sparrow subpopulation increases the probability of extinction for the entire species. Thus, any potential anthropogenic changes to hydrologic conditions in subpopulation D that may adversely affect sparrow breeding habitat must be monitored closely.

Baseline data related to the condition of critical habitat, hydrologic conditions and the sparrow population breeding in CSSS subpopulation D before completion and operation of the C-111 SC Project were established in 2011. All major components of the C-111 SC Project were completed by March 2012, and operations began in summer 2012. The present report focuses on field data collected during 2014 in CSSS subpopulation D only as part of a continuing study to examine possible effects of the C-111 SC Project on sparrows breeding in this important CSSS subpopulation.

Section 3.0

We observed many encouraging trends in Cape Sable seaside sparrow subpopulation D during the 2014 breeding season. While the overall population size remains extremely low in subpopulation D, we observed a substantial increase in the number of sparrows in the subpopulation with 11 males and three females observed during 2014. Despite the continued small population size, we made several other positive observations during 2014 indicating that this ephemeral sparrow subpopulation is still persisting during the operational testing and monitoring stage of the C-111 SC Project. The presence of a third female sparrow in subpopulation D this year was very positive, and this is the third year in a row that multiple females have been observed in the subpopulation. Only one of the three breeding pairs in subpopulation D nested successfully in 2014; however, this pair was able to fledge three broods resulting in the highest productivity we have witnessed in the subpopulation since monitoring began. While overall productivity remains very low in subpopulation D due to the small size of this subpopulation, it is very promising that successful breeding did occur for the third consecutive year.

The main problems facing CSSS subpopulation D continue to be the low population size and highly male-biased sex ratio. Eight of 11 males found in subpopulation D apparently remained unmated in 2014, continuing the trend seen in previous years. Two of the males observed in subpopulation D this year were returning birds that were members of the breeding population in the previous year. This represents the third consecutive year that these individuals returned to breed in subpopulation D; however, one of these males remained unmated in 2014. We observed the return of a breeding female for the first time in subpopulation D this year, and this female nested successfully for the second consecutive year albeit with a different mate. We also observed the recruitment of two previously color-banded nestlings as breeders into subpopulation D in 2014; one was a female originally banded as a nestling in subpopulation D in 2013 and the other was a male originally banded as a nestling in subpopulation B in 2012. The overall return rate of sparrows in subpopulation D was much improved in 2014, which is another very positive trend for this subpopulation.

We continue to recommend that intensive ground surveys and nest monitoring be conducted annually to rapidly identify any negative changes that may be caused by future operations of the C-111 SC Project. Banding of sparrows should also be continued because the demographic information being obtained in this small sparrow subpopulation is invaluable. We also suggest that future research be focused on trying to understand causes for the male-biased sex ratio and possible ways to reduce the bias (perhaps through translocation of females, but only if habitat conditions in subpopulation D improve to the point that this is not detrimental to the overall sparrow population). Finally, we recommend that monitoring be initiated in CSSS subpopulation C since components of the C-111 SC Project are predicted to have potential effects on designated critical habitat in this area, and as of now no monitoring of this small sparrow subpopulation is being conducted.

Acknowledgements

We would like to thank Martha Nungesser and Jason Godin from the South Florida Water Management District for their support and valuable input into the project. We thank Richard Fike, Kevin Palmer and Sandra Sneckenberger from the U.S. Fish and Wildlife Service for all of their help and input related to the project. We would like to thank many at Everglades National Park, especially Tylan Dean, Alicia LoGalbo and Mario Alvarado, for providing valuable input and support for all of our sparrow research over the years. We thank Jay Sah and Mike Ross at Florida International University for sharing their valuable information regarding vegetation in sparrow habitat across the species' entire range. We thank Gary Slater at Ecostudies Institute for his valuable input into our project this year. We also thank Dr. Rick Lathrop, John Bognar and Jim Trimble from the Grant F. Walton Center for Remote Sensing and Spatial Analysis at Rutgers University for their continued support and assistance with GIS analyses.

2.0 Introduction

2.1 Purpose

The Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*) is an endangered subspecies of the seaside sparrow that is restricted to short-hydroperiod marl prairies of the southern Everglades ecosystem. First listed under the Endangered Species Preservation Act in 1967, the Cape Sable seaside sparrow (hereafter CSSS or just "sparrow") has become an important indicator species for the Everglades and its restoration since the fate of the marl prairies, and thus the sparrow, is closely tied with the seasonal timing and spatial extent of water flows through the Everglades. Recent and past anthropogenic changes to water flows have negatively affected the entire Everglades ecosystem changing the vegetation in sparrow habitat dramatically. Over the past several decades the CSSS has experienced severe population declines due in large part to widespread degradation of the Everglades ecosystem (Pimm et al. 2002; Cassey et al. 2007). However, the sparrow may benefit from unprecedented large-scale habitat restoration efforts currently underway. The Comprehensive Everglades Restoration Plan (CERP) was authorized by the United States Congress as part of the 2000 Water Resources Development Act with a primary goal of restoring natural water flows to the Everglades (CERP 2010). Estimates for the total cost of CERP projects have reached $13.5 billion in 2013, with completion of all projects expected to take 50 years (Stern 2013). Since passage of CERP in 2000, the federal government has provided only $1 billion in funding through fiscal 2013 so substantial costs are yet to be incurred. Overall progress towards Everglades restoration is falling short of initial goals; however, the majority of the estimated 390,000 acres of land needed to accomplish CERP projects has already been acquired (Stern 2013). The main purpose of this report is to monitor potential effects on the CSSS by one of the first major CERP restoration projects to be completed and implemented: the C-111 Spreader Canal Western Phase I Project (C-111 SC Project).

The C-111 SC Project is the first CERP project that will directly benefit Everglades National Park (ENP). The project was designed to restore the quantity, timing and distribution of water delivered to Florida Bay via Taylor Slough and to improve hydroperiod and hydropattern in the area south of the C-111 Canal known as the Southern Glades and Model Lands. The C-111 SC Project was designed to use a complex system of water detention areas, existing canals, canal plugs, levees, weirs and pump stations to reduce seepage losses from Taylor Slough, Southern Glades and Model Lands (**Figure 2.1**). The U.S. Army Corps of Engineers (USACE or the “Corps”) and the South Florida Water Management District (SFWMD or the “District”) are the parties responsible for the design, construction and implementation of the C-111 SC Project. The U.S Fish and Wildlife Service (USFWS) issued a Biological Opinion dated August 25, 2009 addressing concerns over potential effects of the C-111 SC Project on CSSS populations and designated sparrow critical habitat (USFWS 2009). In this opinion, USFWS concurred with the Corps’ determination that the proposed project “may affect, and is likely to affect” the endangered CSSS, and that the project “will affect” designated CSSS critical habitat. These affects are restricted to three of the six extent CSSS subpopulations (B, C and D; **Figure 2.2**). One of these CSSS subpopulations (D) is located directly in the area predicted to be affected by the C-111 SC Project, with the current distribution of this subpopulation centered in the northwestern-central portion of designated critical sparrow habitat located east of Taylor Slough and west of the C-111 Canal. Baseline data related to the condition of critical habitat, hydrologic conditions and the sparrow population breeding in CSSS subpopulation D before completion and operation of the C-111 SC Project were established in 2011 (Virzi et al. 2011a).

Major construction began on the C-111 SC Project during SFWMD water year 2011 (WY2011; 01-May 2010 – 30-Apr 2011). By the end of WY2011 most earthwork and major construction of all project components were completed. During WY2012, the C-111 SC Project was entirely completed (March 2012). During WY2013, operations commenced (summer 2012). Presently, the project is in the operational testing and monitoring stage. Hydrologic monitoring results are reported annually, and the first *Annual Permit Report for C-111 Spreader Canal Phase I (Western) Project* was completed in 2014 (SFWMD 2014a).

Operations of the C-111 SC Project are in accordance with the Interim Operational Plan (IOP) for protection of the CSSS. As part of IOP requirements, pumping from project pump stations must cease when gages in certain water monitoring stations located within CSSS designated critical habitat exceed predetermined limits (10 cm) during the critical portion of the CSSS nesting season (15-Mar – 30-Jun) as identified by USFWS. There are 10 water monitoring stations covered in the hydrometeorologic monitoring plan (**Figure 2.3**). Two of the stations collect rainfall data (S-177 and S-18C), and the other stations measure flows and/or stages in the project area. The main water station being monitored in CSSS designated critical habitat is SWEVER4; two additional stations were installed by SFWMD in areas in closer proximity to known CSSS breeding locations (CSSSD1 and CSSSD2).

Since our initial baseline report issued in 2011 (Virzi et al. 2011a), annual monitoring of breeding sparrows in CSSS subpopulation D has been conducted (Virzi and Davis 2012a, Virzi and Davis 2013a). The present report focuses on field data collected during the 2014 sparrow breeding season in CSSS subpopulation D only as part of our continuing study to examine the potential effects of the C-111 SC Project on sparrows breeding in this important CSSS subpopulation.

2.2 Figures

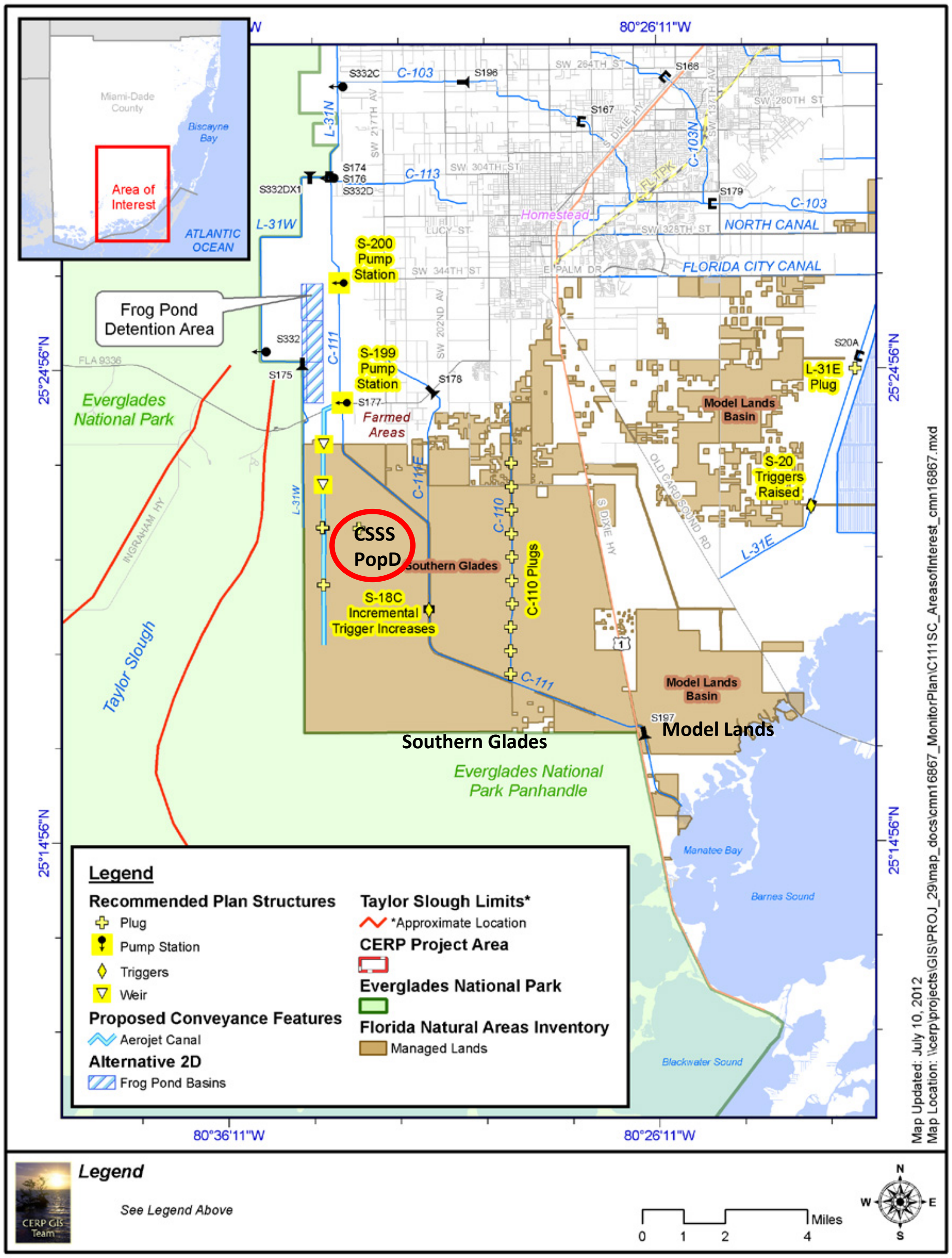


Figure 2.1: Map of C-111 SCW Project Features. Map taken from SFWMD *Annual Permit Report for C-111 Spreader Canal Phase I (Western) Project* (SFWMD 2014a). Approximate location of Cape Sable seaside sparrow (CSSS) subpopulation D indicted by red circle (added to map).

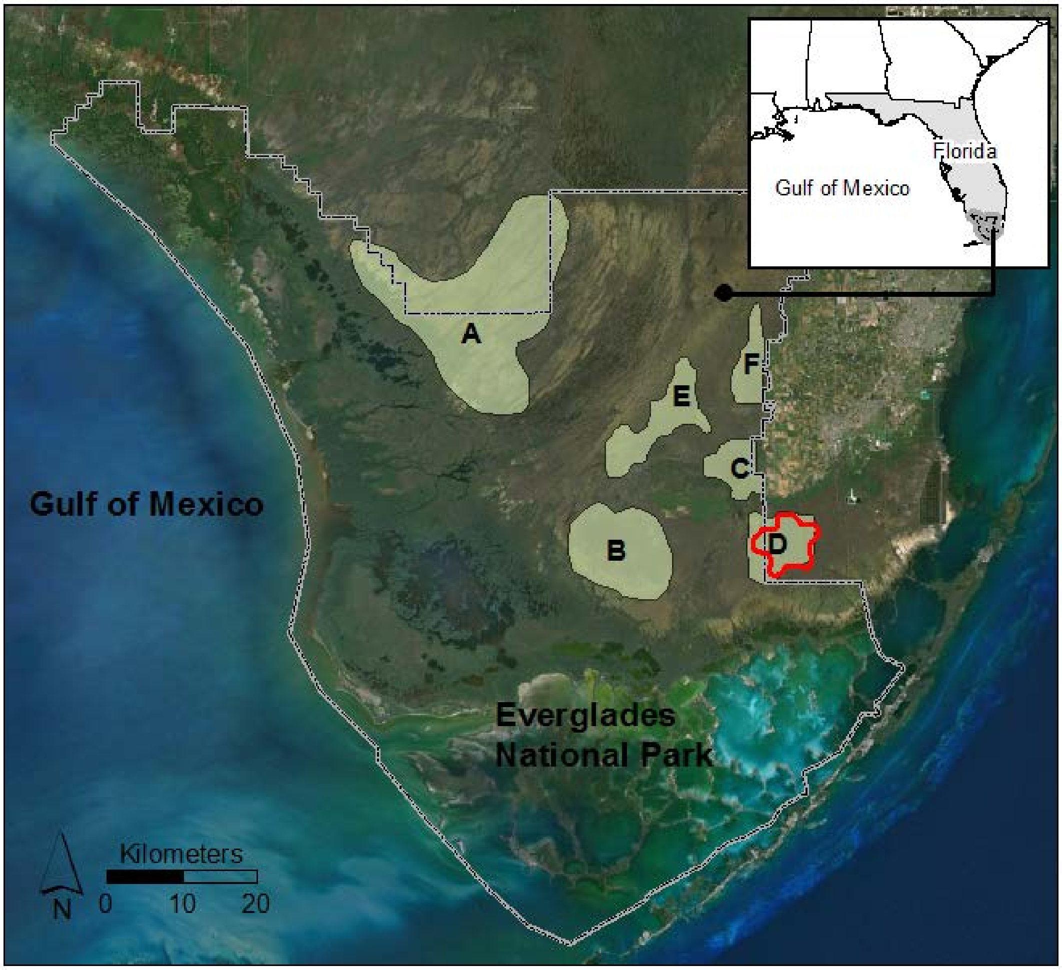


Figure 2.2: Cape Sable seaside sparrow (CSSS) distribution in the Florida Everglades. Green-shaded areas represent historic extent of CSSS habitat (2000 data) by sparrow subpopulation (A through F). Red line indicates current (2007) CSSS critical habitat boundary in sparrow subpopulation D. Dashed line indicates boundary of Everglades National Park.

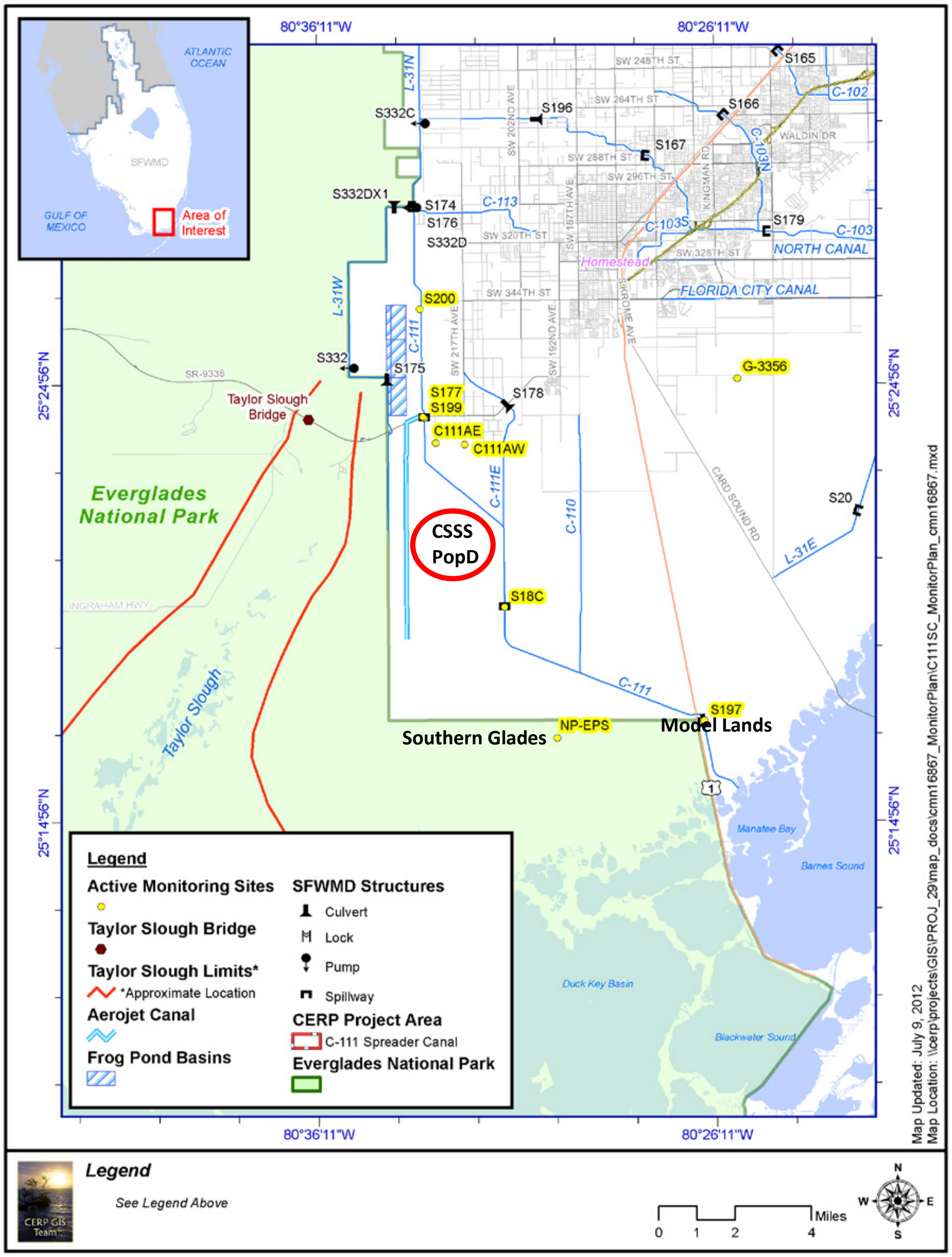


Figure 2.3: Map of C-111 SCW Project Monitoring Stations. Map taken from SFWMD *Annual Permit Report for C-111 Spreader Canal Phase I (Western) Project* (SFWMD 2014a). Approximate location of Cape Sable seaside sparrow (CSSS) subpopulation D indicted by red circle (added to map). Monitoring stations located in CSSS designated critical habitat (SWEVER4, CSSSD1, CSSSD2) not included on map; stations are located within red circle added to map.

3.0 Cape Sable Seaside Sparrow Distribution and Demography in Subpopulation D

3.1 Background

Early field research on Cape Sable seaside sparrows breeding in subpopulation D began in 1981 when Everglades National Park (ENP) conducted the first rangewide surveys for sparrows in all suitable habitat found in all sparrow subpopulations identified (A through F; see **Figure 2.2** above). These surveys, conducted annually since 1992, have provided valuable information about trends in the status and distribution of sparrows in subpopulation D over the past three decades. More intensive field research was started by Rutgers University in 2006, providing the first information on the breeding success and dispersal of sparrows in subpopulation D. This research, funded by ENP and the U.S. Fish and Wildlife Service (USFWS), was conducted annually until 2010 providing a wealth of demographic data about the sparrows recently attempting to breed in subpopulation D (USFWS 2009, Lockwood et al. 2010). During 2011-2014 additional sparrow research in CSSS subpopulation D was funded by the South Florida Water Management District (SFWMD or the "District") to gather baseline data about sparrows breeding in this subpopulation and to study potential effects caused by hydrologic changes that are anticipated to occur in this CSSS subpopulation as a result of the C-111 SC Project, which could have detrimental effects on sparrow habitat in this area (Virzi et al. 2011a, Virzi and Davis 2012a, Virzi and Davis 2013a). During 2014, we were contracted by the District to conduct additional field research during the sparrow breeding season in an ongoing effort to study the effects of the C-111 SC Project during the operational testing and monitoring period. Our main objective of the current study was to gather distributional and demographic data on sparrows breeding in CSSS subpopulation D.

3.2 Methods

3.2.1 Ground Surveys

During 2014, we conducted intensive ground surveys in subpopulation D throughout the CSSS breeding season. Ground surveys began on 03-Apr and continued until 18-Jun; fieldwork began somewhat later than previous years due to a delay in funding in 2014. Similar to previous years, ground surveys were discontinued because of poor field conditions in subpopulation D caused by heavy rain events; however, these rains arrived in early June which is later than usual. In fact, our field season was extended almost a month longer than usual until the end of June due to prolonged dry field conditions in subpopulation D in 2014. Thus, our field season was slightly longer than most years, and was initiated about two weeks later than usual.

Surveys were conducted two days per week on average, typically by one researcher. Researchers walked into the core area in sparrow subpopulation D east of Aerojet Road and south of the East-West Road, intensely surveying the area between the following ENP helicopter survey sites: rprse-22 to 24 and rprse-31 to 33 (**Figure 3.1**). An Additional survey was conducted in the habitat restoration area north of the East-West Road in an effort to detect sparrow use of the recently restored habitat in this area. We had originally intended to deploy remote field recorders to aid in detection of sparrows in this area in 2014, similar to the pilot study conducted in 2013, but the delayed start to our fieldwork prohibited deployment of the recorders this year. Our ground surveys were focused on the core area since this is where sparrows nested in subpopulation D in recent years (2006-2013) and where intensive monitoring was conducted to obtain baseline data in 2011 (Virzi et al. 2011a, Virzi and Davis 2012a, Virzi and Davis 2013a). Further, we expected sparrows to establish territories in 2014 in the same area where males held territories in 2013 due to strong philopatry and the influence of conspecific attraction on territory establishment of any returning or new male sparrows in the subpopulation this year (Virzi et al. 2012).

During ground surveys researchers recorded the location of any sparrows observed and documented behavior. Locations were recorded with a handheld GPS device (Garmin GPSmap

76CSx) for later analysis in a geographic information system including territory mapping. During surveys, singing male sparrows typically are observed first since they are more conspicuous. Females are more difficult to locate. As such, any time a male sparrow was encountered additional time was spent in that area in an attempt to document the presence of a female on the territory (typically 1-2 hrs, often over several occasions). If a female was observed on a particular territory additional time was spent in an attempt to document breeding. Often, an entire morning may be spent trying to locate a single nest if breeding behavior is observed.

In addition to our intensive ground surveys and nest monitoring in CSSS subpopulation D, we also obtained and reviewed real-time data from the ENP rangewide helicopter surveys conducted in the subpopulation during 2014. If any sparrows were detected in areas in subpopulation D that were outside our study plot we planned to conduct intensive ground surveys in those areas, if feasible, in order to determine if sparrows were breeding since the ENP rangewide helicopter surveys only detect presence/absence of sparrows and do not confirm breeding.

3.2.2 Nest Monitoring

We monitored all nests found in subpopulation D until completion of the nesting attempt (fledging or failing). After nests were found the locations were recorded with a handheld GPS device and marked with flagging tape tied to vegetation in order to facilitate relocation of the nests for monitoring. Nests were visited multiple times (2 days per week on average) during the incubation and brooding periods (approximately 12 and 9 days, respectively) in order to determine their fate. Researchers recorded the fate of nests as successful (fledged at least one nestling) or failed (loss of entire brood) and documented any evidence of probable cause of failure. We report apparent productivity measures (e.g., hatch rate, fledge rate, nestlings per successful pair, clutch size) rather than more sophisticated daily nest survival rates (e.g., using logistic models in Program MARK) due to the small sample size expected in subpopulation D. Hatch rate is the proportion of nests found that hatch; fledge rate is the proportion of broods (hatched nests) that fledge at least one nestling; nestlings per successful pair is the total number of nestlings fledged in the subpopulation divided by the total number of successful broods; clutch size is the total number of eggs laid in a single nest attempt.

3.2.3 Mark-Recapture Data

In order to study demographic patterns in subpopulation D we continued to color-band individual sparrows and resight previously color-banded individuals to gain information for a long-term mark-recapture study of the CSSS. Sparrows were captured on breeding territories using mist-nets, following well-established protocols. Leg bands were applied to all sparrows captured to enable later identification of individuals. We placed a metal USFWS band and three plastic color bands on each sparrow's legs: the combination of which identifies an individual. Our ground surveys included resighting previously color-banded individuals which could be done with binoculars or a spotting scope rather than recapturing individuals thus limiting handling.

3.3 Results and Discussion

3.3.1 Current Status and Distribution

Despite continuing to hold very few Cape Sable seaside sparrows, 2014 was an encouraging year for subpopulation D. For the third consecutive year sparrows nested successfully in subpopulation D. Further, we report the first evidence of multi-brooding in this small sparrow subpopulation. However, most encouraging is the increase in the total number of sparrows present in the subpopulation in 2014; we observed a substantial increase in the number of territorial males and a marginal increase in the number of breeding females. While it is too soon after commencement of operations of the C-111 SC Project to evaluate the success of the project, our data clearly indicates that sparrows are still able to use habitat in subpopulation D and breed successfully after initial implementation of the project. One caveat, however, is that in 2014 meteorologic conditions were very favorable for breeding sparrows so our data should not be used as an indication that the C-111 SC Project is currently improving sparrow habitat in subpopulation D. Still, we are encouraged by our data and SFWMD is also encouraged by the observed hydrologic patterns in Taylor Slough so far, indicating that the project has operated smoothly and as expected (SFWMD 2014a).

The positive data coming out of CSSS subpopulation D in 2014 is welcomed. This subpopulation had experienced a continual decline since its 1981 estimate of 400 sparrows. Since 2000, habitat in this area appeared to have suffered from high water levels. Consequently, sawgrass continues to dominate the area with only small drier patches of muhly grass acting as island refuges for breeding sparrows. These patches of suitable habitat may have increased moderately in recent years, due in part to prolonged drought conditions that prevailed recently in South Florida (Virzi et al. 2011a). It is possible that the sparrow population has responded favorably in recent years as a result of these recent habitat changes, and we did observe some additional positive trends during the 2012 and 2013 breeding seasons (Virzi and Davis 2012a, Virzi and Davis 2013a).

Periodic intensive ground surveys were conducted in subpopulation D over a 12-week period during the 2014 sparrow breeding season. All sparrows detected in our ground surveys in subpopulation D during 2014 were located between Aerojet Road and the C-111 Canal, all on SFWMD land (**Figure 3.2** and **Appendix 2**). The core CSSS population was located in the same area where sparrows occurred in subpopulation D in the previous three years. We walked into our study plot from Aerojet Road to the ENP helicopter survey site “rprse-22” along the dirt road created by SFWMD to a new water monitoring station (CSSSD1) that was constructed in 2011, which is still marginally visible on the landscape. We intensively surveyed the area extending from “rprse-22” east to “rprse-24”, then south to “rprse-33” and west to “rprse-31”.

As mentioned previously, we observed a substantial increase in the number of territorial male sparrows in subpopulation D in 2014. Eleven male sparrows were observed in our study plot in subpopulation D in 2014, which is eight more males than we observed in 2013 and the highest number of males observed in any year subpopulation D has been monitored (since 2006). Three of the males were observed on well-established territories in our main study plot, and were paired with females. Two of the male sparrows detected on our study plot were only observed on a single day, but the remaining males were observed on territories in subpopulation D throughout the 2014 breeding season. Two male sparrows were also detected by ENP during their rangewide helicopter surveys (37 survey sites were visited in subpopulation D during 2014; M. Alvarado, personal communication); however, these sparrows were detected in areas or in close proximity to our main study plot in subpopulation D so they were likely males that we already recorded in the population. Thus, we have confidence that the total number of male sparrows in subpopulation D in 2014 was 11.

Two of the male sparrows detected in our study plot in 2014 were returning males that were also present in subpopulation D in 2013 (see **Section 3.3.3** below); however, only one of these males was mated in 2014. A third male sparrow that established a territory, but remained unmated, in subpopulation D in 2014 was a newly-recruiting male originally banded as a nestling in subpopulation B in 2012. The remaining eight male sparrows in our study plot were captured and color-banded this year, thus all territorial male sparrows known to be in our study plot in subpopulation D were marked and could be identified by individual during 2014. Territory mapping showed that all of these males had well-established territories during the course of the breeding season (**Figure 3.2**). Territory mapping began on 03-Apr and ended on 27-Jun (territory polygons shown in **Figure 3.2** reflect an average of 10.0 GPS points per individual tracked).

Three female sparrows were observed in subpopulation D during the 2014 breeding season, and all were mated with a male. During 2013 and 2012 we observed only two mated female sparrows; during 2011 only one unmated female sparrow was observed. While it is encouraging that three female sparrows were observed in subpopulation D in 2014, eight of the 11 male sparrows observed in subpopulation D (73%) apparently remained unmated. This resulted in a highly male-biased sex ratio of 0.79 in 2014, which is substantially higher than the rate reported in subpopulation D in 2013 (0.60; Virzi and Davis 2013a) but similar to the higher rates reported in previous years (Virzi et al. 2011a, Virzi and Davis 2012a). This is a consistent trend that we have observed in other small sparrow subpopulations in general (Virzi et al. 2011b, Virzi and Davis 2012b, Virzi and Davis 2013b). Two of the three females observed in subpopulation D in 2014 were returning individuals color-banded in previous years. One was a returning female that nested successfully in 2013 marking the first time a female CSSS has been observed in subpopulation D in successive years (see **Sections 3.3.2** and **3.3.3** below for further discussion). The second returning female to subpopulation D mated and nested with a male sparrow that was apparently new to the subpopulation in 2014. This female was a newly-recruiting sparrow in the breeding population that was originally banded as a nestling in subpopulation D in 2013. The third female sparrow observed in subpopulation D remained unbanded, thus only two of the three known females in the breeding population in our study plot were marked by the end of the 2014 breeding season.

3.3.2 Nest Monitoring Results

We located four sparrow nests in subpopulation D in 2014 (**Figure 3.2** and **Appendix 1**), documenting breeding in this subpopulation for the third consecutive breeding season. A fifth nesting attempt was documented in subpopulation D in 2014; one of the breeding pairs in the subpopulation was found feeding young that were already fledged on our first day of fieldwork on 03-Apr. During 2014, we documented three breeding pairs of sparrows in subpopulation D: recorded as pairs D 12, D 13 and D 14 in our data.

One of the males in these pairs (RDDP_ORAL) was a returning male that was banded as an adult in subpopulation D in 2012 (see **Section 3.3.3** below). This male was present in subpopulation D for three consecutive years; however, this was the first year that this male was able to find a mate. This male mated successfully in 2014 with the returning female found in subpopulation D in 2013 (RDBK_ORAL). This breeding pair (D 14) was very successful in 2014 fledging three separate broods (see below). It is likely that experience and individual fitness contributed towards the strong breeding success of this breeding pair.

The second breeding male (PUYL_ORAL) was new to the subpopulation and was banded in 2014. This male mated with a newly-recruiting female (BKGR_ORAL) into the subpopulation that was originally banded as a nestling in subpopulation D in 2013. Interestingly, this female was a fledgling from a successful brood in 2013 by the returning female (RDBK_ORAL) described in the previous paragraph. During 2014, this pair (D 12) had at least one failed nesting attempt.

Since we know that the female in this pair is a first-time breeder it is possible that inexperience contributed towards this pair's failure to breed successfully, but this is only speculation.

The third breeding male (WKWH_ORAL) was also new to subpopulation D in 2014 and was mated with the unbanded female in the subpopulation. Since both female sparrows present in our study plot in subpopulation D in 2013 were color-banded, it is likely that this female was new to the subpopulation in 2014. Like the previous pair, this pair (D 13) had at least one failed nest attempt in 2014.

Four of the five nest attempts documented in subpopulation D in 2014 were early-season nests (i.e., nests initiated before 01-Jun), which typically have higher nest survival rates than late-season nests (Baiser et al. 2008). As mentioned previously, one nest for pair D 14 was found post-fledging on the first day of fieldwork on 03-Apr. This pair's second nest was found on 07-May during the brooding period making it the second early-season nest attempt by this pair. The third and final nest for this pair was found on 06-Jun during the incubation period making it the sole late-season nest found in subpopulation D in 2014. All three nest attempts made by pair D 14 were successful. The first nest fledged one to two nestlings (exact number uncertain), the second fledged two nestlings, and the third fledged four nestlings. This is the first time that multi-brooding has been documented in subpopulation D. Our research in other CSSS subpopulations has shown that this is a rare occurrence, especially in small sparrow subpopulations, so this is an encouraging field observation for the subpopulation (Virzi and Davis 2013b).

The remaining two pairs (D 13 and D 12) each had at least one failed nest attempt. Both pairs successfully hatched their nests, but both failed during the brooding period. Each nest hatched three nestlings. Predation was suspected as the likely cause of failure for both broods, with rodent predation suspected for one of the broods. Both of these nests were early-season nests; the nest for pair D 13 was found on 16-Apr during the incubation period, and the nest for pair D 12 was found on 07-Apr also during the incubation period.

The mean clutch size for four nests found and monitored in subpopulation D was 3.25 eggs per nest (SD = 0.50). All of the nests found hatched (100% hatch rate), and two of the four nests monitored fledged six nestlings in 2014 (50% fledge rate). Another one to two nestlings fledged from the first successful nest attempt by pair D 14; the exact number of nestlings fledged is uncertain. Thus, between seven and eight nestlings in total fledged from subpopulation D in 2014. This equates to an average 2.3 to 2.7 chicks/breeding pair, which is similar to the rate reported in large sparrow subpopulation B in 2014 (M. Davis and G. Slater, personal communication). This is the second year in a row that we reported stronger than average productivity for subpopulation D, and 2014 was the highest annual productivity reported for this subpopulation since we began monitoring it in 2006.

While annual productivity in subpopulation D was improved in 2014 (seven to eight chicks fledged in 2014 vs. six chicks fledged in 2013), recruitment remains extremely low due to the small population size. Although small sample size limits comparative analyses, the average clutch size, apparent hatch and fledge rates, and total productivity compare favorably to similar rates observed in other Cape Sable seaside sparrow subpopulations and provide evidence that successful breeding can still occur in subpopulation D as the C-111 SC Project entered its operational testing and monitoring phase (Baiser et al. 2008, Lockwood et al. 2010, Boulton et al. 2011, Virzi et al. 2011b, Virzi and Davis 2012b, Virzi and Davis 2013b, Gilroy et al. 2012a).

3.3.3 Mark-Recapture Data

During 2014, three male sparrows that were color-banded in previous years were observed in subpopulation D. One of these male sparrows (GRBL_ORAL) was a returning individual that was mated and nested successfully in subpopulation D in 2013; however, this male remained unmated in 2014. The female that this male mated with in 2013 did not return to subpopulation D in 2014. This male sparrow was originally color-banded as an adult in subpopulation D in 2012 making this the third consecutive year that this individual was present in the breeding population. This is the first ever observation of a male sparrow returning to subpopulation D for three consecutive years.

A second male sparrow (RDDP_ORAL) originally banded as an adult in subpopulation D in 2012 also returned to the subpopulation for the third consecutive year. This male sparrow was unmated in 2012 and 2013, but was mated and nested successfully with the returning female (RDBK_ORAL) in 2014. This female was a successful breeder in 2013, but was mated with a different male that did not return to subpopulation D in 2014. Thus, we are seeing evidence of mate changing between years for some individuals that could be the result of adult mortality.

The third previously color-banded male sparrow (WKRW_RDAL) observed in subpopulation D in 2014 was a newly-recruiting male that was originally banded in as a nestling in subpopulation B in 2012. This male remained unmated during 2014. This is the first confirmed movement of a CSSS from this large, core sparrow subpopulation into subpopulation D. The distance between this sparrow's original natal banding site located in the Dogleg Plot off Main Park Road in CSSS subpopulation B and its territory in subpopulation D was approximately 25 km, which is near the maximum distance that CSSS are predicted to disperse (Van Houtan et al. 2010). This is also one of the first observed recruitment events into the subpopulation D breeding population of a sparrow that was banded as a nestling in any subpopulation (see below for another documented recruitment event this year).

Also during 2014, two female sparrows that were color-banded in previous years were observed in subpopulation D. As stated previously, one of these females (RDBK_ORAL) was a returning breeder that nested successfully in subpopulation D in 2013 and returned to breed with a different male in subpopulation D in 2014. This female, originally banded as an adult in subpopulation D in 2013, has become the first adult female in this subpopulation to be resighted in subsequent years. Until now there has been complete turnover in females in subpopulation D between years. There have been other successful breeding females in subpopulation D that have not returned to breed in subsequent years, but it is presently unknown if this is due to mortality or dispersal.

The second returning female sparrow in subpopulation D in 2014 (BKGR_ORAL) was a newly-recruiting sparrow that was originally banded as a nestling in subpopulation D in 2013. This resight represents the second recruitment event observed into subpopulation D during 2014. Recruitment of previously color-banded sparrows has rarely been observed in any sparrow subpopulation monitored (Virzi and Davis 2013b). As discussed previously, this female was mated and had at least one failed nest attempt in 2014.

In total, during 2014 we resighted three of the five color-banded adult sparrows (two of three males and one of two females) that were present in the breeding population in 2013. Thus, we observed a return rate of 0.60 for adult sparrows, which is exactly in line with the rate expected (~0.60) based on previous CSSS research (Boulton et al. 2009, Gilroy et al. 2012b). We banded the remaining unbanded male sparrows observed in our study plot in subpopulation D in 2014. This brought the total color-banded sparrow population to 13 adult sparrows by the end of the 2014 field season (**Table 3.1**). One female sparrow remained unbanded at the end of the 2014 field season.

The recruitment of the female sparrow into subpopulation D described above was the only return of a previously color-banded nestling that was banded in the subpopulation in the previous year. In total, five nestlings were banded in subpopulation D in 2013; so the return of a single individual in this cohort equates to a 0.20 return rate, which is in line with expectations for juvenile sparrows (Boulton et al. 2009, Gilroy et al. 2012a). During 2014, we color-banded all 12 of the nestlings found in the four nests that hatched in subpopulation D. All six of the color-banded nestlings from the two unsuccessful broods died before fledging. All of the remaining six color-banded nestlings from the two successful broods fledged. Thus, six of the 12 nestlings that were color-banded in subpopulation D in 2014 fledged.

3.3.4 Hydrologic Data

In our 2013 annual report to SFWMD, we noted that during the first there years of our research in connection with the C-111 SC Project (2011-2013) there appeared to be a shrinking in the total extent of habitat used by CSSS breeding in our study area each year (Virzi and Davis 2013a). During 2014, we saw a reversal in this trend that merits some discussion in this report. We place this discussion here because analysis of current year hydrologic data reveals a potential explanation of this trend.

To show the trend in habitat extent used by CSSS in subpopulation D from 2011-2013 we used our sparrow occupancy data to derive a color-ramped kernel density plot for each year to demonstrate the probability of habitat use by sparrows in the subpopulation (Virzi and Davis 2013a). The kernel density probability distributions clearly showed a contraction in CSSS habitat use towards a single area within our study plot by 2013. During 2014, we performed the same analysis using the same method and variables to compare the current habitat extent to the previous year (**Figure 3.3**). Our results for 2014 show that sparrows are much more spread out across the landscape, using areas further towards the south and east of our study plot that have not been occupied since 2011. We offer three hypotheses for the observed expansion of CSSS habitat extent in 2014: (1) the increased number of sparrows in subpopulation D in 2014 caused density to be high enough to force sparrows to spread out across the study area, (2) habitat conditions improved in areas where sparrows have not attempted to breed in recent years, and (3) favorable current year hydrologic/meteorologic conditions led to more favorable breeding conditions across a larger area of habitat in subpopulation D.

The first hypothesis could be supported by the large increase of sparrows in subpopulation D in 2014. While we cannot rule out this hypothesis entirely, the large size of male CSSS territories in subpopulation D would indicate that the area where sparrows have historically nested could support a higher density of territories. Thus, we do not think that sparrow density is the sole reason for the observed pattern in CSSS habitat extent expansion in subpopulation D.

The second hypothesis is unlikely because hydrologic conditions in subpopulation D have not improved to the point that would create more favorable CSSS habitat conditions (J. Sah, personal communication). Further, the only sparrows to actually nest in subpopulation D this year remained in the area of higher ground where sparrows have nested successfully in recent years. This could be an indication that habitat in this area is still more favorable for breeding, but it could also be due to strong site fidelity or the influence of conspecific attraction, both of which are known to occur in the CSSS (Virzi et al. 2012).

A brief analysis of 2014 hydrologic data supports the third hypothesis, making it the most likely hypothesis explaining the greater extent of habitat used by CSSS in subpopulation D this year.

Data from the SFWMD DBHYDRO database for water depths at all three monitoring stations within CSSS designated critical habitat in subpopulation D (SWEVER4, CSSSD1 and CSSSD2) were reviewed (SFWMD 2014b). These data show that the 2014 sparrow breeding season was much drier than the previous two years, which is the time when we observed the initial contraction in sparrow habitat extent. Mean and maximum water depths were substantially lower in 2014 compared to 2012-2013 (**Figure 3.4**), which likely created drier conditions across the entire landscape in our study area. During 2014, hydrologic conditions in subpopulation D were more similar to those reported during 2011, and sparrows returned to areas further south and east where they occurred in that year.

The favorable local meteorologic conditions throughout the 2014 sparrow breeding season likely also contributed to the strong breeding success in subpopulation D this year. Water depths rose substantially later in 2014 than in 2013 (**Figure 3.5**), which likely contributed to the ability of pair D 14 to fledge three broods in 2014.

3.3.5 Conclusions

Our research in CSSS subpopulation D in 2014 continued to show some encouraging trends for this small and ephemeral sparrow subpopulation. First and foremost we observed a substantial increase in the number of territorial male sparrows in subpopulation D in 2014 with 11 males detected over the course of the breeding season. Nine of these males had well established territories throughout the breeding season. Second, we documented the presence of three female sparrows in the subpopulation in 2014, one more than either of the previous two years. Thus, we reported three breeding pairs in subpopulation D during 2014, more than any other year since intensive monitoring began in this subpopulation in 2006.

Only one of the three pairs in subpopulation D nested successfully in 2014; however, this pair was able to successfully fledge three broods (seven to eight nestlings in total) during the breeding season. This represents the first evidence of multi-brooding ever in subpopulation D. This is a very positive observation since the ability of sparrows to multi-brood in a single breeding season is thought to be critically important for CSSS population viability (Curnutt et al.

1998), and multi-brooding has been a rare occurrence in small sparrow subpopulations (Virzi and Davis 2013b). Dry conditions and the individual fitness of this known experienced pair likely contributed towards this pair's high reproductive success, but this is still an exciting observation from our 2014 field research. While the overall productivity in subpopulation D remains extremely low due to the very small population size and a continued lack of enough females so that all males could be mated, the data collected this year offers evidence that this subpopulation continues to persist during the operational testing and monitoring phase of the C-111 SC Project.

The overall return rate of sparrows in subpopulation D was much improved in 2014, which is another positive trend for this subpopulation. The return rate in subpopulation D has typically been close to zero, especially for female sparrows; however, the return rate in 2014 was closer to the rate expected based on previous CSSS research. Two of the males observed in subpopulation D this year were returning birds that were found in the breeding population in the previous year. This represents the third consecutive year that these individuals returned to breed in subpopulation D; however, one of these males remained unmated in 2014. We observed the return of a breeding female for the first time in subpopulation D this year; this female nested successfully with the different mate in 2014. We also observed the recruitment of two new breeders into subpopulation D in 2014; one was a female originally banded as a nestling in subpopulation D in 2013 and the other was a male originally banded as a nestling in subpopulation B in 2012. The latter observation provides the first evidence that sparrows can and do disperse from other distant CSSS subpopulations into subpopulation D.

Although there are once again encouraging signs that CSSSS subpopulation D is persisting, we continue to offer a word of caution regarding this small sparrow subpopulation. It should be stressed that this subpopulation remains well below the size predicted to be necessary for a healthy Cape Sable seaside sparrow subpopulation (20 pairs) and thus is still subject to extreme risk of local extinction. Thus, intensive monitoring of this CSSS subpopulation is recommended in order to detect any rapid changes in demographic parameters or population declines.

3.4 Tables and Figures

Table 3.1: Color-banded adult Cape Sable seaside sparrows resighted or newly-banded in subpopulation D in 2014. Eight adult sparrows were newly-banded in 2014 (all male). Three male sparrows were originally color-banded in 2012 (two in subpopulation D and one in subpopulation B). Two female sparrows were originally color-banded in 2013 (both in subpopulation D). Three sparrows were returning breeders and two were originally banded as nestlings (as indicated below). Colors: AL = aluminum, BK = black, BL=blue, DP=dark pink, GR = green, LG = light green, OR = orange, PU = purple, RD = red, RW = red-white, WH=white, WK = white-black, YL = yellow.

USFWS Band #	Banding_Date	Color_Left	Color_Right	Sex	Notes
1861-40090	04/02/12	GRBL	ORAL	M	Returning breeder from Pop D
2291-49530	05/11/12	RDDP	ORAL	M	Returning breeder from Pop D
2291-49565	07/20/12	WKRW	RDAL	M	Originally banded as nestling in Pop B
2291-49584	04/22/13	BKGR	ORAL	F	Originally banded as nestling in Pop D
2291-49586	04/22/13	RDBK	ORAL	F	Returning breeder from Pop D
2291-49630	04/04/14	WKWH	ORAL	M	Newly banded adult
2291-49631	04/04/14	PUYL	ORAL	M	Newly banded adult
2291-49632	04/11/14	LGRW	ORAL	M	Newly banded adult
2291-49636	04/23/14	WKRD	ORAL	M	Newly banded adult
2291-49660	05/12/14	ORBL	ORAL	M	Newly banded adult
2291-49663	05/23/14	YLDP	ORAL	M	Newly banded adult
2291-49664	05/23/14	BKOR	ORAL	M	Newly banded adult
2291-49665	05/27/14	GRDP	ORAL	M	Newly banded adult

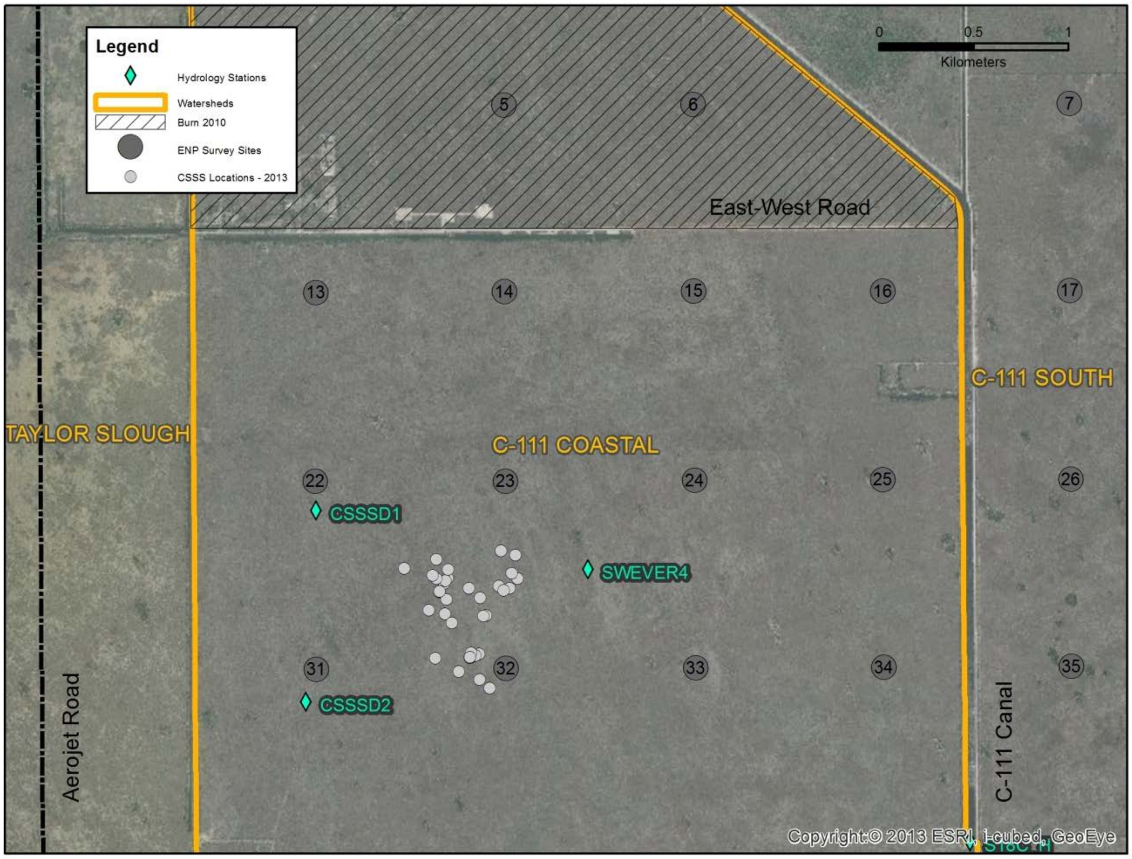


Figure 3.1: Map of 2014 study area in Cape Sable seaside sparrow (CSSS) subpopulation D. CSSS ground surveys were conducted in all areas east of Aerojet Road and west of the C-111 Canal where sparrows were located during the 2013 field season (small grey circles). Survey effort was generally greatest in the area between Everglades National Park helicopter survey sites (large, numbered grey circles) rprse-22 to 24 and rprse-31 to 33. However, surveys were also conducted in areas north and east of the main study area, including north of the East-West Road in the habitat restoration area where a controlled burn was conducted in 2010 and where woody vegetation removal was conducted in 2012.

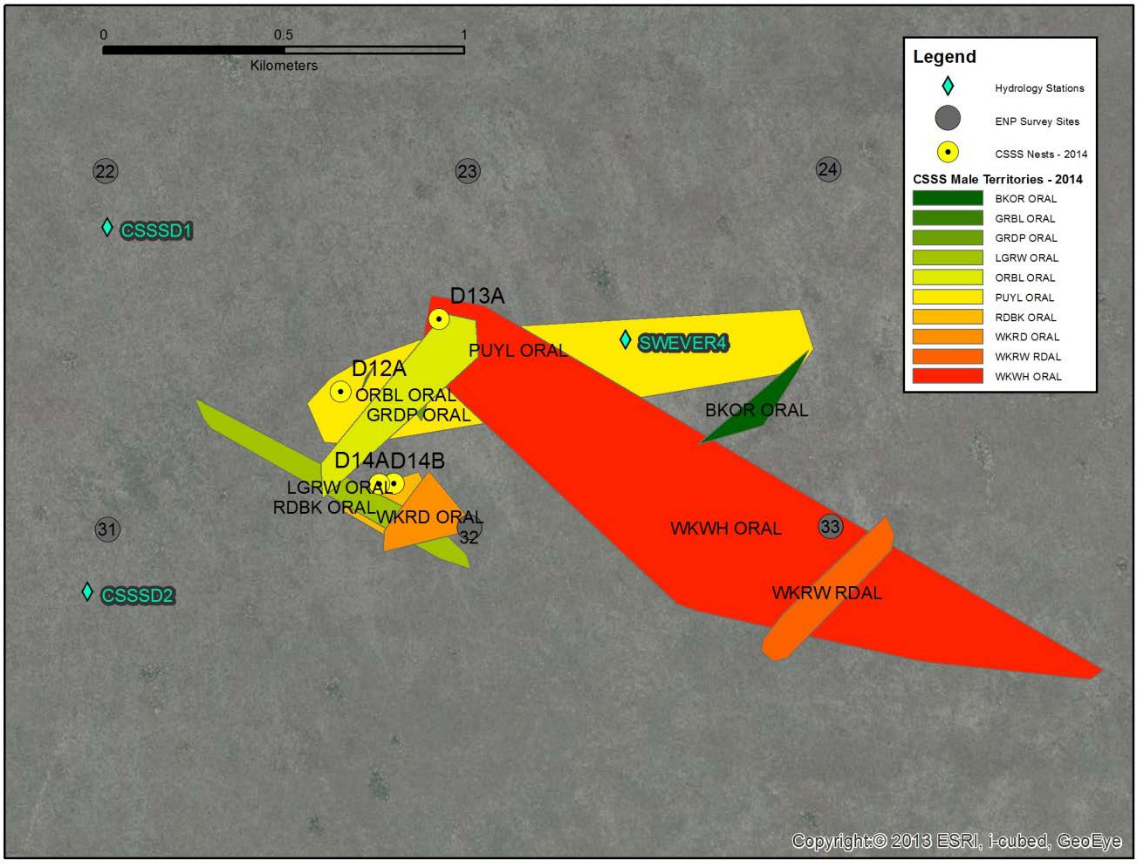
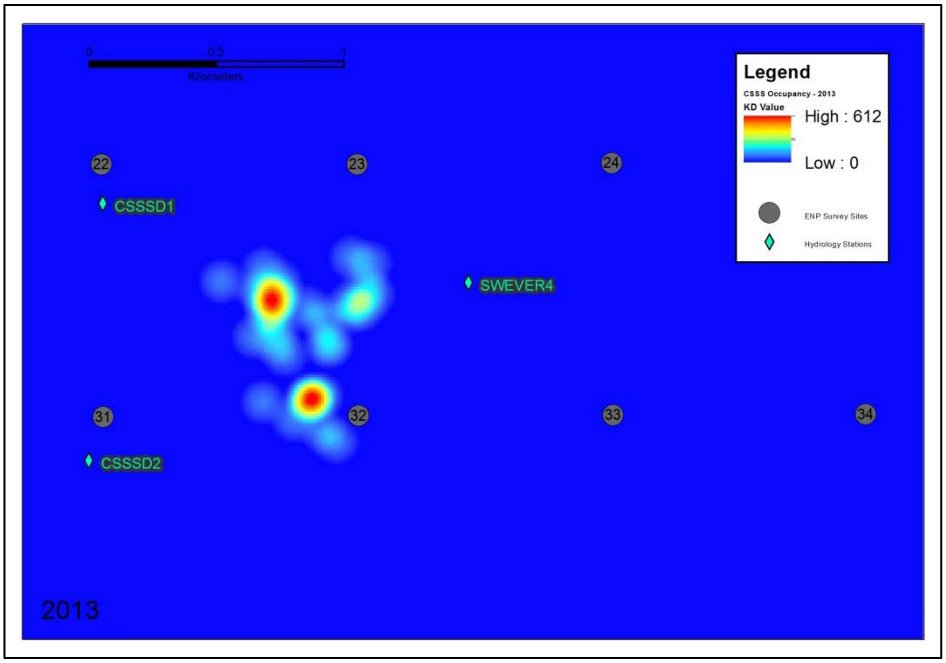
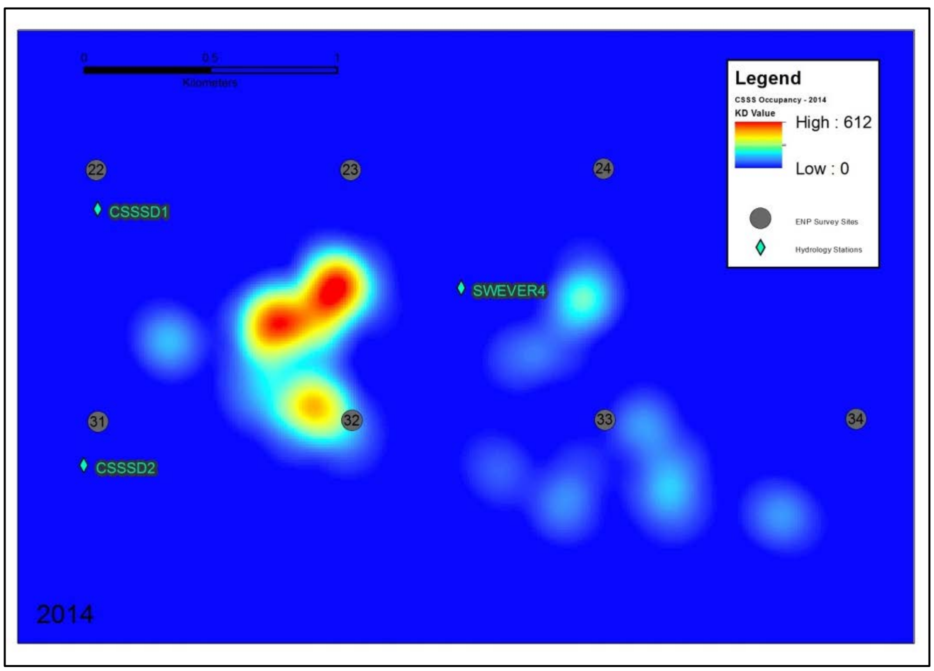


Figure 3.2: Location of Cape Sable seaside sparrow (CSSS) territories in subpopulation D during the 2014 breeding season. Numbered grey circles correspond to Everglades National Park helicopter survey sites. Eleven male sparrows were observed singing on apparent territories during 2014; three of these males were paired and nested. Territories are color-coded by unique color-band combinations for each male sparrow. Yellow circles correspond to locations of sparrow nests monitored during 2014.

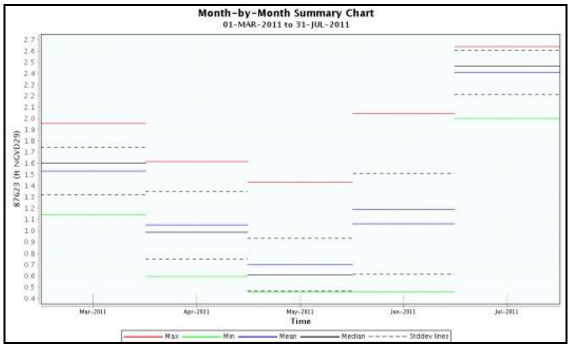


(a)

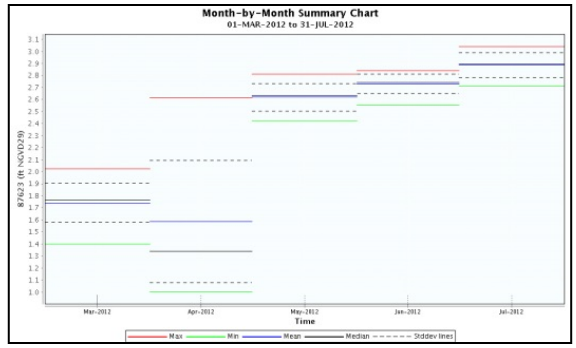


(b)

Figure 3.3: Color-ramped kernel density probability distribution plots showing extent of Cape Sable seaside sparrow habitat use in Subpopulation D during the 2013 (a) and 2014 (b) breeding seasons. Red colors represent highest probability of site occupancy (i.e., habitat use) by sparrows; blue colors represent lowest probabilities; dark blue indicates no use of habitat by sparrows.



(a)



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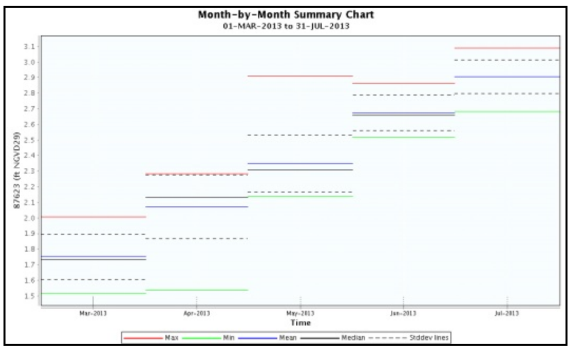
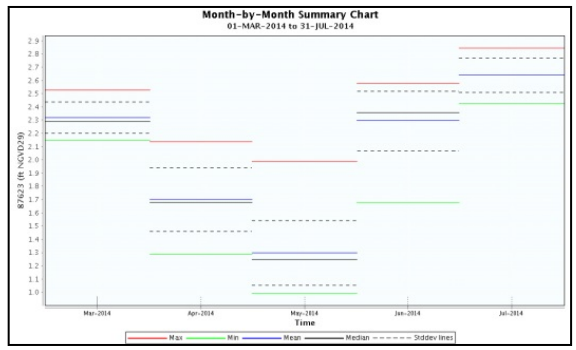
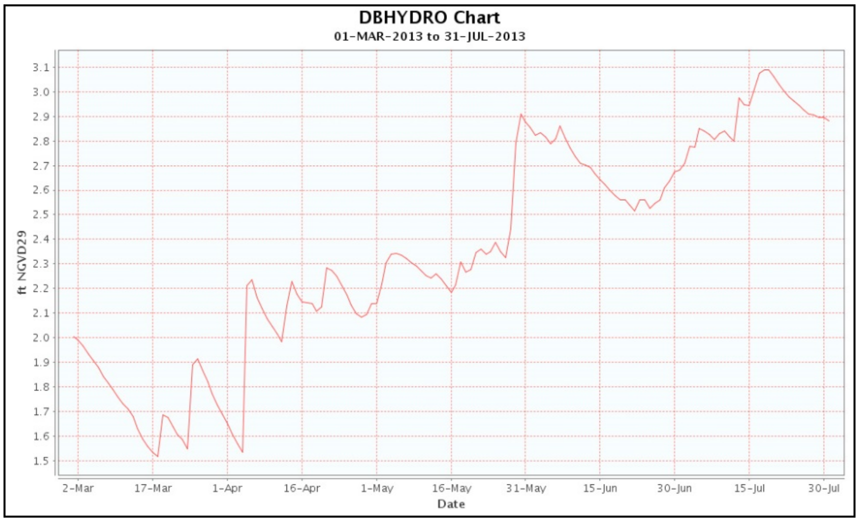


(c)

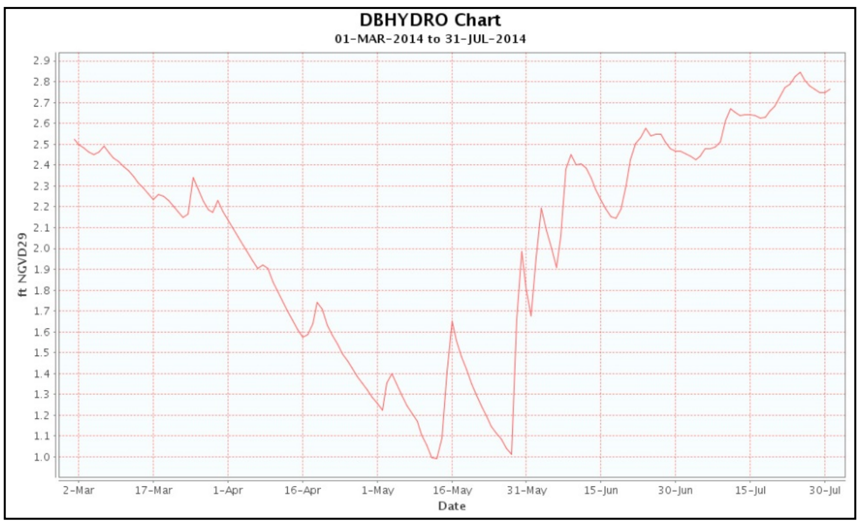


(d)

Figure 3.4: Monthly mean water depth plots for the CSSSD1 monitoring station during the Cape Sable seaside sparrow breeding season (March – July) for the past four years: (a) 2011, (b) 2012, (c) 2013, and (d) 2014. Plots include lines for maximum (red), minimum (green), mean (blue), median (black), and standard deviation (dashed). Data for other monitoring stations (CSSSD2 and SWEVER4) not presented here, but showed similar trends. Plots taken from the South Florida Water Management DBHYDRO Database (SFWMD 2014b).



(a)



(b)

Figure 3.5: Daily mean water depth plots for the CSSSD1 monitoring station during the Cape Sable seaside sparrow breeding season (March – July) for the past two years: (a) 2013 and (b) 2014. Data for other monitoring stations (CSSSD2 and SWEVER4) not presented here, but showed similar trends. Plots taken from the South Florida Water Management DBHYDRO Database (SFWMD 2014b).

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5.0 Appendices

5.1 Appendix 1

Appendix 1: Location of all Cape Sable seaside sparrow nests found in subpopulation D in 2014 and their coordinates. The coordinates are in WGS 1984. Nests were found for three pairs during the 2014 breeding season (D 12, D 13 and D 14) on the dates indicated. Pair D 14 had a third nest that had already fledged when fieldwork began; thus the location of this nest is not known and coordinates are not available. Color combination of male and female sparrow leg bands indicated for each individual in each breeding pair (UNB = unbanded).

Nest_ID	Month	Day	Year	Latitude	Longitude	Male_ID	Female_ID
D12A	4	7	2014	25.342441	-80.552918	PUYL ORAL	BKGR ORAL
D13A	4	16	2014	25.344251	-80.550195	WKWH ORAL	UNB
D14A	5	7	2014	25.340142	-80.551454	RDDP ORAL	RDBK ORAL
D14B	6	6	2014	25.340127	-80.551850	RDDP ORAL	RDBK ORAL

5.2 Appendix 2

Appendix 2: Location of all Cape Sable seaside sparrow detections in subpopulation D in 2014 and their coordinates. The coordinates are in WGS 1984. Color combination for leg bands indicated when observed (UNK = unknown).

GPS_ID	Month	Day	Year	Color_Combo	Latitude	Longitude
1	4	3	2014	PUYL ORAL	25.341411	-80.552541
2	4	3	2014	PUYL ORAL	25.341850	-80.552722
3	4	3	2014	PUYL ORAL	25.342111	-80.552399
4	4	3	2014	GRBL ORAL	25.342458	-80.552352
4	4	3	2014	PUYL ORAL	25.342458	-80.552352
5	4	3	2014	GRBL ORAL	25.342801	-80.552230
6	4	3	2014	GRBL ORAL	25.343083	-80.551996
6	4	3	2014	PUYL ORAL	25.343083	-80.551996
7	4	3	2014	PUYL ORAL	25.343287	-80.551583
8	4	3	2014	PUYL ORAL	25.342968	-80.551216
9	4	3	2014	PUYL ORAL	25.343956	-80.549991
10	4	3	2014	WKWH ORAL	25.343308	-80.550484
11	4	3	2014	PUYL ORAL	25.342915	-80.550733
12	4	4	2014	WKWH ORAL	25.344040	-80.550258
13	4	4	2014	PUYL ORAL	25.342561	-80.551102
14	4	4	2014	RDDP ORAL	25.340426	-80.550786
15	4	4	2014	UNK Fledgling	25.340028	-80.550667
16	4	4	2014	RDDP ORAL	25.339902	-80.550451
17	4	4	2014	RDBK ORAL	25.340040	-80.550680
18	4	7	2014	WKWH ORAL	25.343026	-80.550565
19	4	7	2014	WKWH ORAL	25.342715	-80.550222
20	4	7	2014	WKWH ORAL	25.342969	-80.550142
21	4	7	2014	WKWH ORAL	25.343675	-80.550661
22	4	7	2014	WKWH ORAL	25.344325	-80.550379
25	4	7	2014	BKGR ORAL	25.342760	-80.552894
26	4	8	2014	PUYL ORAL	25.341691	-80.551265
27	4	8	2014	PUYL ORAL	25.341930	-80.550679
28	4	8	2014	PUYL ORAL	25.342307	-80.550514
29	4	8	2014	WKWH ORAL	25.344592	-80.548939
30	4	8	2014	WKWH ORAL	25.343864	-80.548920
31	4	8	2014	WKWH ORAL	25.343522	-80.549384
32	4	8	2014	WKWH ORAL	25.343620	-80.549944
33	4	8	2014	WKWH ORAL	25.344457	-80.550117
34	4	8	2014	WKWH ORAL	25.344860	-80.550410

GPS_ID	Month	Day	Year	Color_Combo	Latitude	Longitude
35	4	11	2014	RDDP ORAL	25.339439	-80.550959
36	4	11	2014	LGRW ORAL	25.339155	-80.550343
37	4	11	2014	LGRW ORAL	25.338846	-80.551274
38	4	11	2014	RDDP ORAL	25.338687	-80.551395
39	4	11	2014	LGRW ORAL	25.338267	-80.550234
40	4	11	2014	LGRW ORAL	25.338374	-80.549460
41	4	11	2014	LGRW ORAL	25.337988	-80.549345
42	4	11	2014	BKGR ORAL	25.342554	-80.553086
43	4	11	2014	PUYL ORAL	25.342809	-80.553185
44	4	11	2014	PUYL ORAL	25.341116	-80.552529
45	4	11	2014	PUYL ORAL	25.342417	-80.552638
68	4	16	2014	PUYL ORAL	25.343988	-80.549891
69	4	16	2014	PUYL ORAL	25.343833	-80.550438
78	4	23	2014	WKRD ORAL	25.338963	-80.551726
79	4	23	2014	WKRD ORAL	25.338423	-80.551752
80	4	23	2014	WKRD ORAL	25.339077	-80.549869
81	4	23	2014	WKRD ORAL	25.338995	-80.549168
82	4	23	2014	WKRD ORAL	25.338928	-80.549955
83	4	23	2014	WKRD ORAL	25.339014	-80.550392
84	4	23	2014	WKRD ORAL	25.339183	-80.550072
85	4	23	2014	WKWH ORAL	25.342992	-80.548558
113	4	30	2014	WKRD ORAL	25.339345	-80.550520
114	4	30	2014	WKRD ORAL	25.339606	-80.550381
115	4	30	2014	RDDP ORAL	25.339881	-80.551239
116	4	30	2014	RDDP ORAL	25.339766	-80.552090
117	4	30	2014	RDDP ORAL	25.339488	-80.552911
145	5	7	2014	PUYL ORAL	25.341614	-80.552018
146	5	7	2014	PUYL ORAL	25.341535	-80.552491
147	5	7	2014	BKGR ORAL	25.341290	-80.552841
175	5	12	2014	ORBL ORAL	25.343340	-80.550079
176	5	12	2014	ORBL ORAL	25.343188	-80.550073
177	5	12	2014	ORBL ORAL	25.343391	-80.549676
180	5	19	2014	ORBL ORAL	25.343395	-80.549679
181	5	19	2014	ORBL ORAL	25.343310	-80.549116
182	5	19	2014	ORBL ORAL	25.343919	-80.549193
183	5	19	2014	ORBL ORAL	25.344223	-80.549192
184	5	19	2014	ORBL ORAL	25.344405	-80.550063
185	5	19	2014	ORBL ORAL	25.344099	-80.550075
186	5	19	2014	GRDP ORAL	25.342228	-80.550519
187	5	19	2014	GRDP ORAL	25.341870	-80.550813
188	5	19	2014	GRDP ORAL	25.342558	-80.551135
189	5	19	2014	PUYL ORAL	25.342580	-80.551220

GPS_ID	Month	Day	Year	Color_Combo	Latitude	Longitude
190	5	19	2014	PUYL ORAL	25.343207	-80.552412
191	5	19	2014	BKGR ORAL	25.343063	-80.552288
192	5	19	2014	PUYL ORAL	25.343067	-80.552288
204	5	21	2014	WKRW RDAL	25.337345	-80.540199
205	5	21	2014	WKRW RDAL	25.336846	-80.540742
206	5	21	2014	WKRW RDAL	25.336216	-80.541299
207	5	21	2014	WKRW RDAL	25.335918	-80.541346
208	5	21	2014	WKRW RDAL	25.335651	-80.541014
209	5	21	2014	WKRW RDAL	25.335741	-80.540627
210	5	21	2014	WKWH ORAL	25.337424	-80.536786
211	5	21	2014	WKWH ORAL	25.337752	-80.536594
212	5	21	2014	WKWH ORAL	25.337069	-80.536577
213	5	21	2014	WKWH ORAL	25.336604	-80.536452
220	5	23	2014	WKWH ORAL	25.337641	-80.543950
221	5	23	2014	WKWH ORAL	25.337103	-80.543663
222	5	23	2014	WKWH ORAL	25.336917	-80.543119
223	5	23	2014	WKRW RDAL	25.338497	-80.538239
224	5	23	2014	WKRW RDAL	25.338422	-80.537753
225	5	23	2014	WKRW RDAL	25.338821	-80.537668
226	5	23	2014	YLDP ORAL	25.343481	-80.539870
227	5	23	2014	YLDP ORAL	25.343963	-80.540160
228	5	23	2014	YLDP ORAL	25.344485	-80.540233
229	5	23	2014	YLDP ORAL	25.343456	-80.539999
230	5	23	2014	BKOR ORAL	25.343447	-80.540019
231	5	23	2014	BKOR ORAL	25.342950	-80.540304
232	5	23	2014	BKOR ORAL	25.342918	-80.540692
259	5	27	2014	GRDP ORAL	25.341711	-80.550695
260	5	27	2014	PUYL ORAL	25.342166	-80.552498
261	5	27	2014	PUYL ORAL	25.342169	-80.552498
262	5	27	2014	PUYL ORAL	25.343249	-80.551208
263	5	27	2014	WKWH ORAL	25.343925	-80.550264
264	5	27	2014	RDDP ORAL	25.339745	-80.550989
265	5	27	2014	RDDP ORAL	25.339534	-80.551781
266	5	27	2014	RDDP ORAL	25.340044	-80.551949
267	5	27	2014	RDDP ORAL	25.339574	-80.552671
268	5	27	2014	ORBL ORAL	25.339762	-80.553434
292	5	30	2014	YLDP ORAL	25.343183	-80.540534
293	5	30	2014	YLDP ORAL	25.342923	-80.540308
294	5	30	2014	YLDP ORAL	25.343365	-80.540098
295	5	30	2014	YLDP ORAL	25.342877	-80.540956
296	5	30	2014	BKOR ORAL	25.341237	-80.542683
297	5	30	2014	BKOR ORAL	25.341095	-80.543074

GPS_ID	Month	Day	Year	Color_Combo	Latitude	Longitude
298	5	30	2014	BKOR ORAL	25.341421	-80.542415
299	5	30	2014	BKOR ORAL	25.341577	-80.541467
300	5	30	2014	BKOR ORAL	25.341561	-80.541274
301	6	2	2014	WKWH ORAL	25.335929	-80.536277
302	6	2	2014	WKWH ORAL	25.336337	-80.537296
303	6	2	2014	WKWH ORAL	25.336859	-80.537287
304	6	2	2014	WKRW RDAL	25.338791	-80.538048
305	6	2	2014	WKRW RDAL	25.339297	-80.537886
306	6	2	2014	WKWH ORAL	25.336599	-80.537790
307	6	2	2014	WKWH ORAL	25.335683	-80.537137
308	6	2	2014	WKWH ORAL	25.335606	-80.536660
309	6	2	2014	WKWH ORAL	25.335736	-80.532885
310	6	2	2014	WKWH ORAL	25.335416	-80.531916
311	6	2	2014	WKWH ORAL	25.335179	-80.532270
312	6	2	2014	WKWH ORAL	25.335625	-80.532867
313	6	2	2014	WKWH ORAL	25.335802	-80.532634
354	6	6	2014	PUYL ORAL	25.342163	-80.553843
355	6	6	2014	PUYL ORAL	25.342829	-80.553112
356	6	6	2014	PUYL ORAL	25.343063	-80.552378
357	6	6	2014	PUYL ORAL	25.342760	-80.552315
358	6	6	2014	PUYL ORAL	25.342015	-80.552327
360	6	6	2014	ORBL ORAL	25.340657	-80.553475
361	6	6	2014	ORBL ORAL	25.340197	-80.553346
373	6	9	2014	LGRW ORAL	25.342090	-80.556648
374	6	9	2014	LGRW ORAL	25.342313	-80.556943
375	6	9	2014	LGRW ORAL	25.341789	-80.556705
376	6	9	2014	LGRW ORAL	25.341537	-80.556502
377	6	9	2014	LGRW ORAL	25.341591	-80.556308
378	6	9	2014	LGRW ORAL	25.341846	-80.556216
381	6	13	2014	WKRD ORAL	25.339257	-80.551164
382	6	13	2014	WKRD ORAL	25.339118	-80.550828
383	6	13	2014	WKRD ORAL	25.339780	-80.550539
384	6	13	2014	WKRD ORAL	25.340079	-80.550466
385	6	13	2014	WKRD ORAL	25.340453	-80.550498
387	6	13	2014	ORBL ORAL	25.344196	-80.550139
388	6	13	2014	ORBL ORAL	25.344051	-80.549804
389	6	13	2014	ORBL ORAL	25.343610	-80.549524
390	6	13	2014	ORBL ORAL	25.343630	-80.550020
391	6	13	2014	PUYL ORAL	25.342477	-80.551345
392	6	13	2014	PUYL ORAL	25.341837	-80.552395
413	6	18	2014	ORBL ORAL	25.342274	-80.550418
414	6	18	2014	PUYL ORAL	25.341180	-80.553370