2022

Winter Abundance and Survival of Sharp-tailed Sparrows at the Eastern Shore of Virginia NWR: Year 2022 Report

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Black Rail Inventory at Cape Lookout and Cape Hatteras National Seashores

Progress Report/Interim Report for 2022: Surveys of Cape Lookout National Seashore.

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Project Partners:
The United States Department of Interior National Park Service
The Center for Conservation Biology

The Center for Conservation Biology is an organization dedicated to discovering innovative solutions to environmental problems that are both scientifically sound and practical within today's social context. Our philosophy has been to use a general systems approach to locate critical information needs and to plot a deliberate course of action to reach what we believe are essential information endpoints.

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EXECUTIVE SUMMARY

The eastern black rail (*Laterallus jamaicensis jamaicensis*) is one of two subspecies that occur in North America. The form is listed as endangered in six states along the Atlantic Coast and has been recently listed as threatened at the federal level. Black rails have experienced a southward range contraction within historical times and a catastrophic decline over the past 30 years at least throughout the northern portion of the breeding range. Historic population size was likely in the tens of thousands but is now believed to be in the low thousands to hundreds. The underlying cause for declines of coastal populations is believed to be ongoing rises in sea-level and associated drops in key demographic parameters though the expansion of *Phragmites australis australis* throughout the east coast may have also contributed to their decline.

Given the secretive nature of this marsh dwelling bird, and associated bird species, little is known about its occurrence, distribution, and abundance at Cape (CALO) Lookout or Cape Hatteras (CAHA) National Seashores. An Inventory of marsh birds is required to inform management decisions on a cabin relocation project (demolition and construction), road/trail construction, dock construction, and dredging projects associated with hurricane recovery in a near marsh habitat. In addition, accurate population surveys for the eastern black rail would benefit CALO management of future critical habitat designations.

During the 2022 field season, we conducted 613 surveys at 219 survey points on North Core, South Core, and Shackleford Island. We conducted an additional 16 surveys at 16 points at Cedar Island National Wildlife Refuge. These surveys resulted in the detection of 209 Clapper Rails at 97 points, 150 Seaside Sparrows at 60 points, 18 Virginia Rails at 10 points, a single Marsh Wren, and 11 Black Rails at 7 points. Black Rails detections on CALO were restricted to the high marsh habitat on the northern end of North Core Banks. 6 detections were recorded at three points. Detections at 3 points result in a raw occupancy of 1.37%.

BACKGROUND

Context

The eastern black rail (*Laterallus jamaicensis jamaicensis*) is one of two subspecies that occur in North America. The eastern black rail is listed as endangered in six states along the Atlantic Coast and has recently been listed as threatened at the federal level (Atlantic Coast Joint Venture 2020). Although the status of the form has never been well-documented, available evidence suggests that the population has experienced a southward range contraction within historical times and a catastrophic decline over the past 30 years at least throughout the northern portion of the breeding range (Watts 2016). Historic population size was likely in the tens of thousands but is now believed to be in the low thousands to hundreds. Concern for the population has led to the establishment of an Eastern Black Rail Working Group, the development of a conservation plan and a coordinated effort to conduct status surveys throughout virtually all coastal states from Connecticut through Texas (Atlantic Coast Joint Venture 2020). Since 2014, 8,000+ locations have been surveyed along the Atlantic and Gulf Coasts to determine status and distribution.

The underlying cause for declines of coastal populations is believed to be ongoing rises in sea-level and associated drops in key demographic parameters (Wilson et al 2014, Wilson et al 2015), though expansion of *Phragmites australis australis* may have also contributed to their decline (USFWS 2018). Most (90%) eastern black rail occurrence records have been associated with tidal salt marshes along the outer coast, but the species has been documented within inland freshwater and brackish wetlands (*L. j. coturniculus*) (Watts 2016). Of particular significance is a population found in South Carolina that primarily uses tidally influenced impoundments (Hand et al. 2019).

Within North Carolina, recent surveys have found the breeding populations of Black Rails have been reduced to a few locations within marshes of the Pamlico Sound, with the majority occurring at Cedar Island NWR. Prior to the surveys conducted in 2022, no widespread, systematic surveys for Black Rail have been conducted on the Core Banks.

Given the secretive nature of this marsh dwelling bird, and associated bird species, little is known about its occurrence, distribution, and abundance at Cape (CALO) Lookout or Cape Hatteras (CAHA) National Seashores. Hurricane Dorian in 2019 caused extensive structural damage to park assets and to the landscape at CALO. Historic sound side flooding caused 54 major breaches through the marsh and across the island of North Core Banks. An Inventory of marsh birds is required to inform management decisions on a cabin relocation project (demolition and construction), road/trail construction, dock construction, and dredging projects associated with hurricane recovery in a near marsh habitat. In addition, accurate population surveys for the eastern Black Rail would benefit CALO management of future critical habitat designations.

METHODS

Survey Network

The focal area for the effort in 2022 was Shackleford Island, South Core Bands, and North Core Banks (south of the new inlet south of Portsmouth Village (Figure 1). All reasonably accessible black rail habitat was saturated with survey points. We used 2018 vegetation mapping of the park to identify black rail habitat. For these surveys we considered black rail habitat as any non-regularly inundated non-forested wetland, forest, shrub thicket, dune swale, and especially high marsh, if they contained or were associated with a *Spartina*, or needle rush component. Points were situated along the high marsh/forested wetland and upland ecotone, within habitat patches and along the shoreline of habitat patches with approximately 400m between the closest adjacent points (Figures 2 and 3) (Appendix I). An additional single survey was conducted at 16 previously surveyed points on Cedar Island NWR (Figure 3).

Survey Protocol

Crepuscular surveys were conducted during both the morning and evening. Morning surveys were conducted from 2 hours before sunrise to 2 hours after sunrise, and evening surveys from 2 hours before sunset to 2 hour after sunset. Efforts were made to survey each point once of 3 survey rounds. Survey periods were: 1 (May 2-May 24), 2 (May 25-June 19) and 3 (June 20-July 15).

FoxPro callers, directed into the habitat patch, were placed on 4-foot garden shepherd hooks sunk in the ground and surveyors stood approximately 5 m away from the caller to facilitate detections of any responses. Sound pressure on callers were set to approximately 80 db. The broadcast sequence included silent listening periods alternating with black rail vocalizations. Vocalizations used included a combination of ki-ki-kerr, churt, growl and eek-eek calls that are consistent with broader effort throughout the east coast. Duration of point counts were 10 minutes. Environmental variables were collected at each point that may have influenced detection including date, wind speed, sky conditions, and background noise. All focal species (Black Rail, Sora, Marsh Wren, and Sedge Wren) vocalizing during this period were recorded as well as the estimated direction and distance to the bird. Other rail species, including Virginia Rail and Clapper Rail, and Seaside Sparrows were also recorded at each point. Tallies of both Common Nighthawk and Chuck-wills-widow were also recorded.

Figure 1. Focal area for surveys at Cape Lookout National Seashore

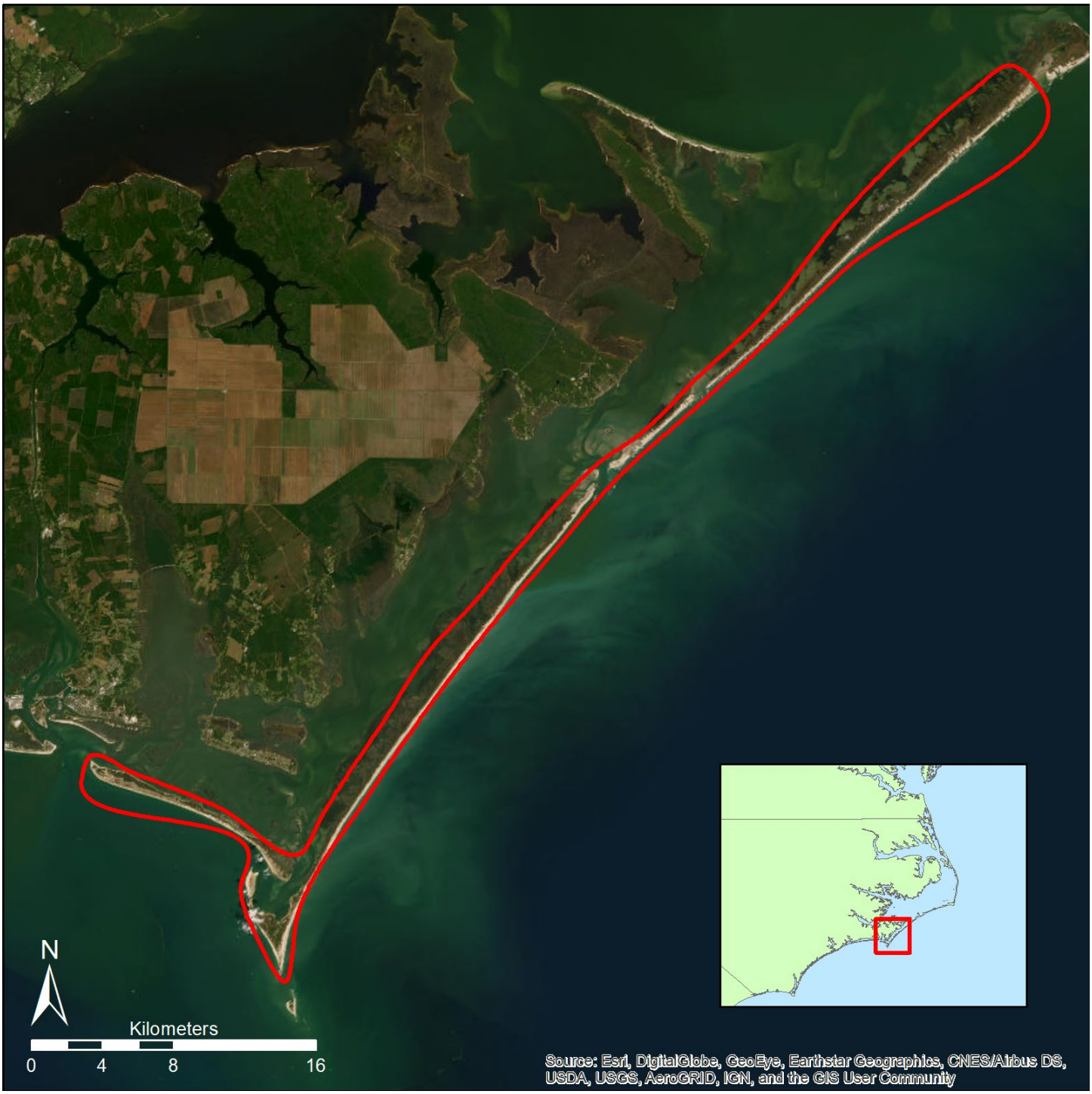

Figure 2. Survey points on Shackleford Island and South Core Banks.

Figure 3. Survey points on Cedar Island NWR and North Core Banks.

RESULTS

During the 2022 field season, we conducted 629 surveys at 235 survey points (Figures 2 and 3). The majority of points (189) on CALO were surveyed once during each of the survey periods. The remaining 30 and 16 points were surveyed once or twice, respectively, during the survey periods primarily due to expansion of bird closures and difficulty of access (Figure 4 and 5). During all survey rounds, 11 Black Rail detection were made at 7 survey points with 6 of those detections occurring on North Core at 3 survey points (Figure 6). The remaining 5 detections were on Cedar Island NWR at 4 different points. The maximum number of detections (4) on North Core occurred during the last survey round with 2 detections at point P71 and single detections at points P72 and P73. Based on timing, distance, and direction of calls, it is believed that the 2 detections at point 71 were a single bird moving towards the caller during the survey.

In addition to black rail detections, on CALO we detected 2 Virginia Rails at 2 points (Figure 7), 148 Seaside Sparrows at 58 points (Figure 8), 205 Clapper Rails at 93 points (Figure 9) and a single Marsh Wren at point CB52 on South Core (Figure 10).

Figure 4. Number of survey rounds conducted at each point on Shackleford Island and South Core Banks.

Figure 5. Number of survey rounds conducted at each point on Cedar Island and North Core Banks.

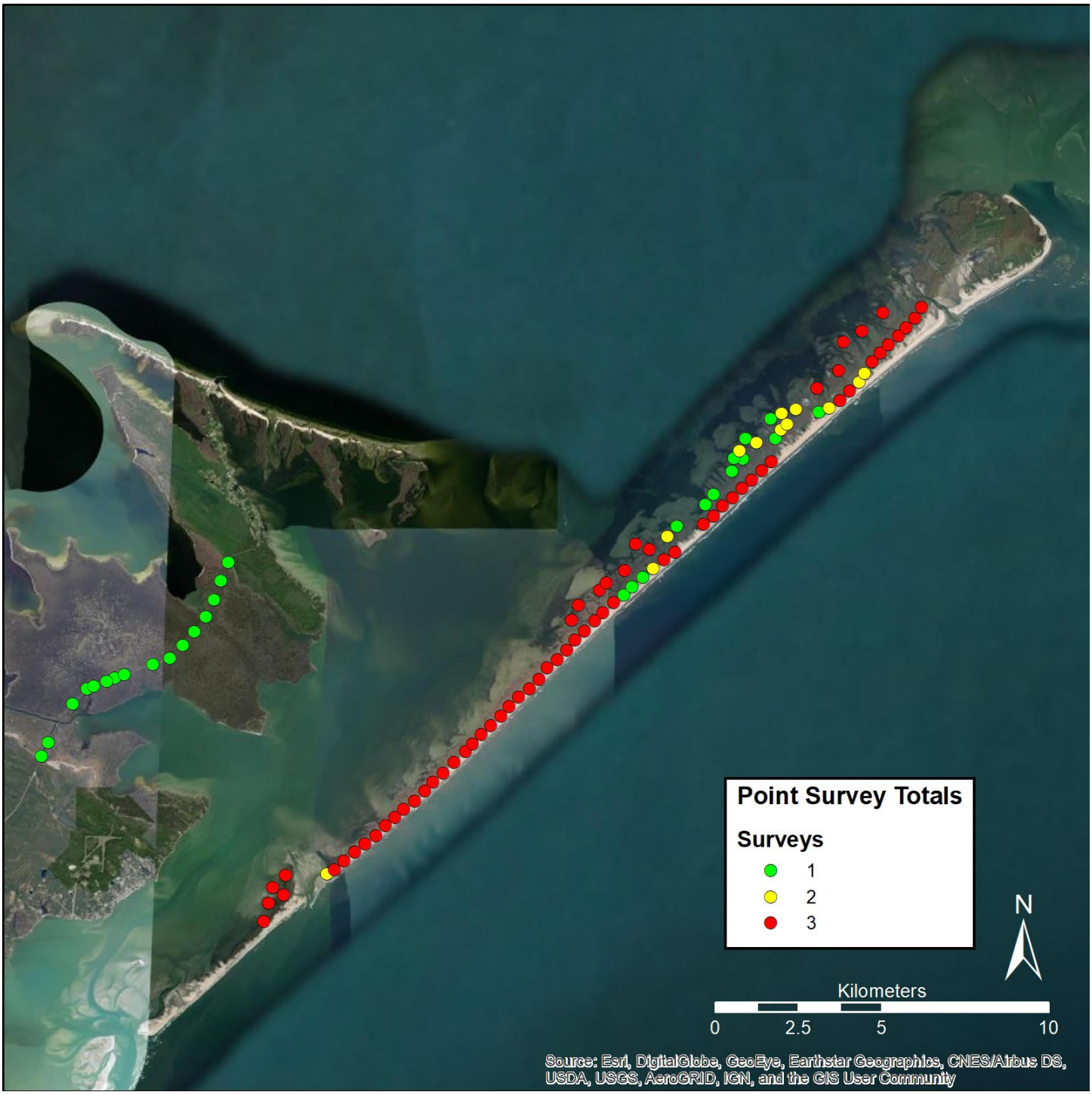

Figure 6. Detections of Black Rails on Cedar Island NWR and North Core Banks.

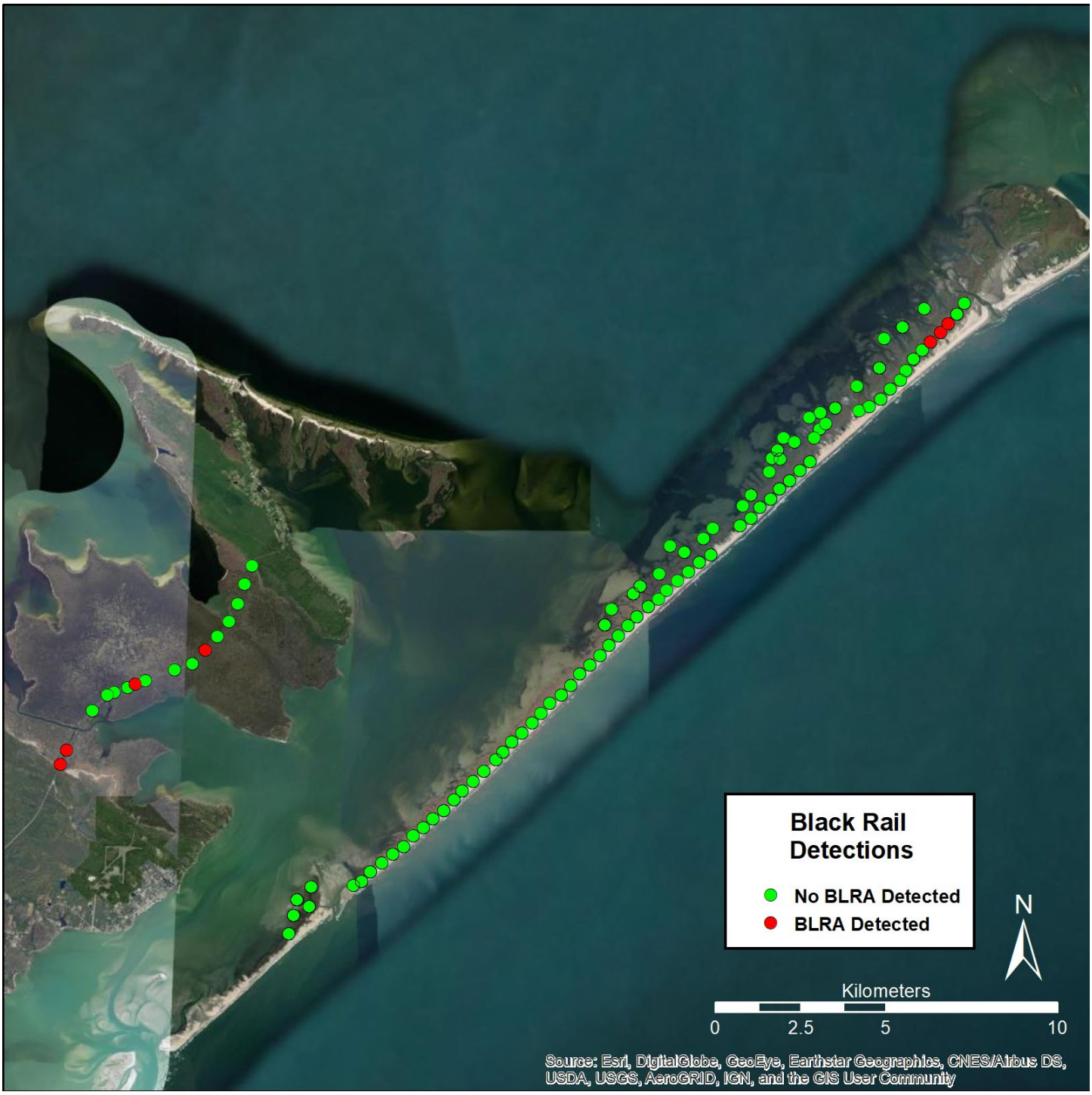

Figure 7. Detections of Virginia Rails on Cedar Island NWR, North Core Banks, and Shackleford Island.

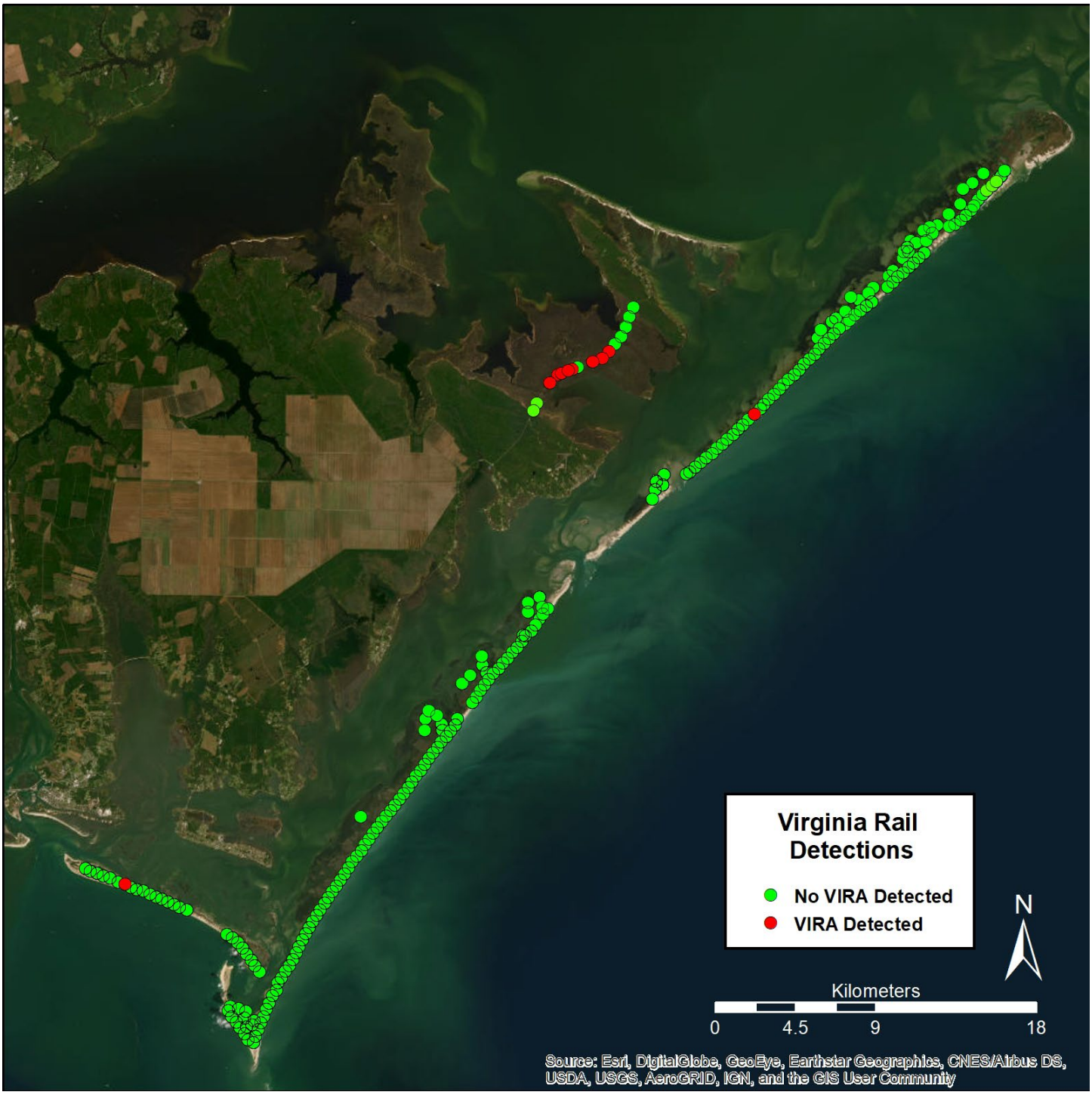

Figure 8. Detections of Seaside Sparrows on Cedar Island NWR, North Core Banks, and South Core Banks.

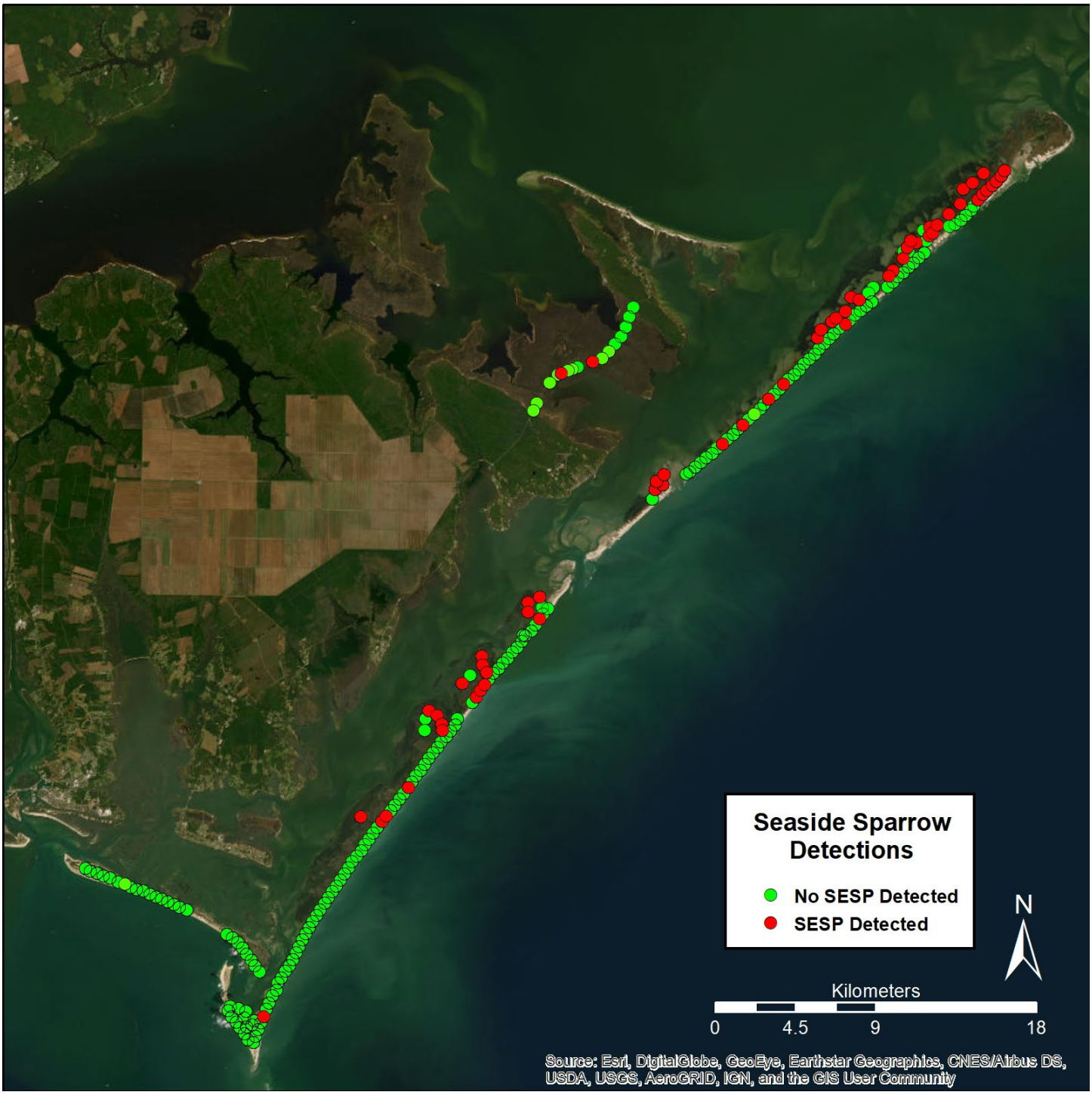

Figure 9. Detections of Clapper Rails on Cedar Island NWR, Shackleford Island, North Core Banks, and South Core Banks.

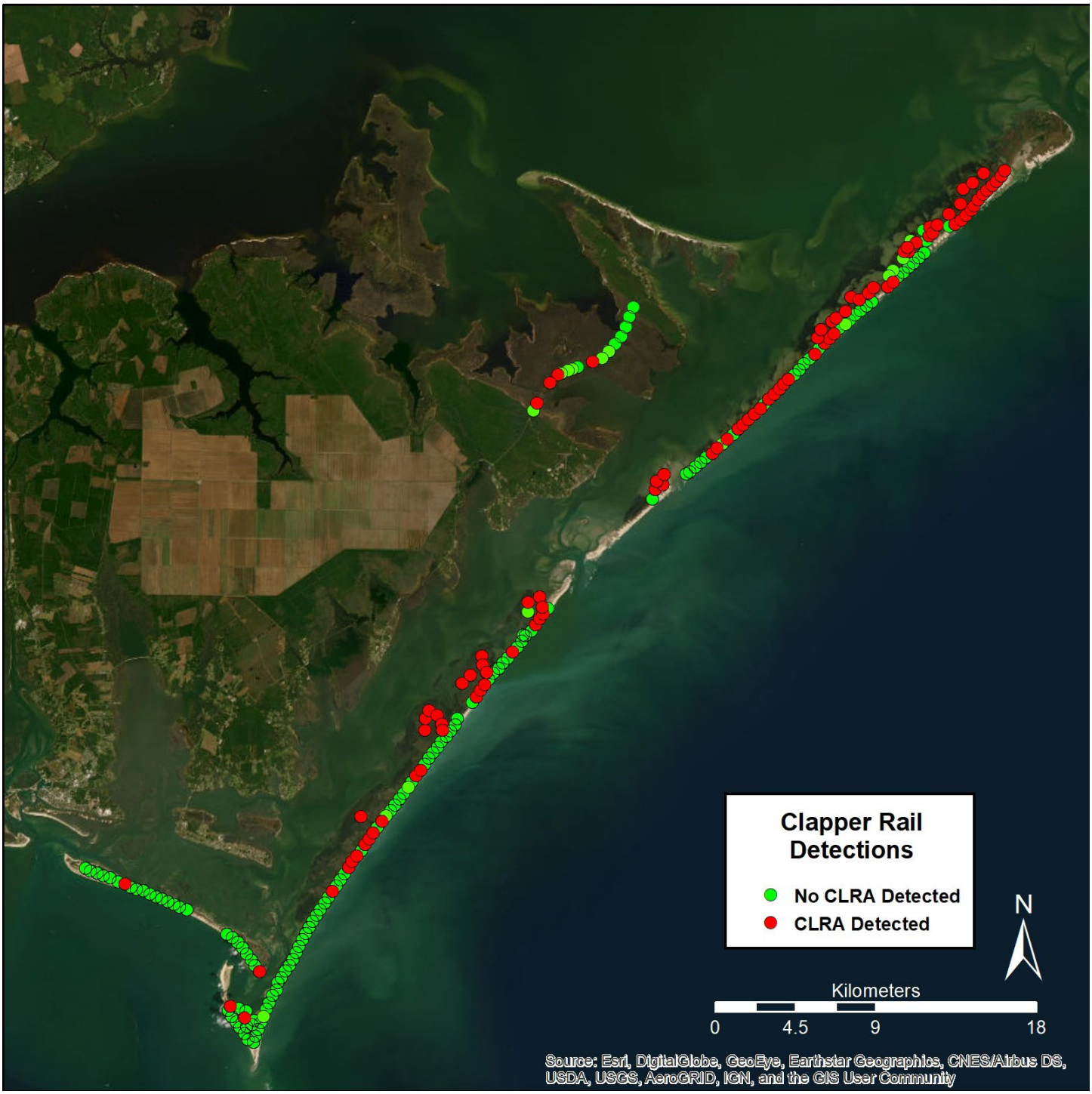

Figure 10. Detection of Marsh Wren on South Core Banks.

ACKNOWLEDGMENTS

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Appendices

Appendix I. List of points, total survey rounds, and coordinates.

Island	Survey Point	Number of Surveys	Period Yes	Period 2	Period 3	Longitude	Latitude
South Core	CB1	3	Yes	Yes	Yes	-76.535226	34.607102
South Core	CB10	3	Yes	Yes	Yes	-76.551018	34.612118
South Core	CB100	3	Yes	Yes	Yes	-76.410774	34.778868
South Core	CB101	3	Yes	Yes	Yes	-76.405832	34.783279
South Core	CB102	3	Yes	Yes	Yes	-76.398889	34.792944
South Core	CB103	3	Yes	Yes	Yes	-76.398653	34.788330
South Core	CB104	3	Yes	Yes	Yes	-76.395995	34.784633
South Core	CB105	3	Yes	Yes	Yes	-76.370989	34.820218
South Core	CB106	3	Yes	Yes	Yes	-76.371096	34.815636
South Core	CB107	3	Yes	Yes	Yes	-76.364139	34.823179
South Core	CB11	3	Yes	Yes	Yes	-76.548906	34.608962
South Core	CB12	3	Yes	Yes	Yes	-76.546026	34.606287
South Core	CB13	3	Yes	Yes	Yes	-76.543748	34.603341
South Core	CB14	3	Yes	Yes	Yes	-76.540857	34.600432
South Core	CB15	3	Yes	Yes	Yes	-76.538484	34.597418
South Core	CB16	3	Yes	Yes	Yes	-76.535425	34.596010
South Core	CB17	3	Yes	Yes	Yes	-76.534040	34.599271
South Core	CB18	3	Yes	Yes	Yes	-76.532480	34.602539
South Core	CB19	3	Yes	Yes	Yes	-76.530921	34.605976
South Core	CB2	3	Yes	Yes	Yes	-76.536525	34.604838
South Core	CB20	3	Yes	Yes	Yes	-76.529427	34.609301
South Core	CB21	3	Yes	Yes	Yes	-76.527841	34.613019
South Core	CB22	3	Yes	Yes	Yes	-76.526108	34.616053
South Core	CB23	3	Yes	Yes	Yes	-76.524251	34.619985
South Core	CB24	3	Yes	Yes	Yes	-76.521603	34.622769
South Core	CB25	3	Yes	Yes	Yes	-76.520913	34.626555
South Core	CB26	3	Yes	Yes	Yes	-76.518995	34.628946
South Core	CB27	3	Yes	Yes	Yes	-76.516271	34.632202
South Core	CB28	3	Yes	Yes	Yes	-76.514147	34.635228
South Core	CB29	3	Yes	Yes	Yes	-76.511931	34.638323
South Core	CB3	3	Yes	Yes	Yes	-76.539701	34.603883
South Core	CB30	3	Yes	Yes	Yes	-76.509990	34.641553
South Core	CB31	3	Yes	Yes	Yes	-76.508240	34.644808
South Core	CB32	3	Yes	Yes	Yes	-76.506212	34.648208
South Core	CB33	3	Yes	Yes	Yes	-76.504468	34.651374
South Core	CB34	3	Yes	Yes	Yes	-76.502402	34.654543
South Core	CB35	3	Yes	Yes	Yes	-76.500424	34.657538

Appendix I. List of points, total survey rounds, and coordinates. Continued.

Island	Survey Point	Number of Surveys	Period Yes	Period 2	Period 3	Longitude	Latitude
South Core	CB36	3	Yes	Yes	Yes	-76.497831	34.660826
South Core	CB37	3	Yes	Yes	Yes	-76.495730	34.663665
South Core	CB38	3	Yes	Yes	Yes	-76.493115	34.666854
South Core	CB39	3	Yes	Yes	Yes	-76.490745	34.669782
South Core	CB4	3	Yes	Yes	Yes	-76.540974	34.608278
South Core	CB40	3	Yes	Yes	Yes	-76.488397	34.672785
South Core	CB41	3	Yes	Yes	Yes	-76.485899	34.675843
South Core	CB42	3	Yes	Yes	Yes	-76.483625	34.678820
South Core	CB43	3	Yes	Yes	Yes	-76.481027	34.681825
South Core	CB44	3	Yes	Yes	Yes	-76.478869	34.684903
South Core	CB45	3	Yes	Yes	Yes	-76.476671	34.688014
South Core	CB46	3	Yes	Yes	Yes	-76.473880	34.690820
South Core	CB47	3	Yes	Yes	Yes	-76.471181	34.693633
South Core	CB48	3	Yes	Yes	Yes	-76.468820	34.696697
South Core	CB49	3	Yes	Yes	Yes	-76.466500	34.699775
South Core	CB5	3	Yes	Yes	Yes	-76.540370	34.611637
South Core	CB50	3	Yes	Yes	Yes	-76.464226	34.702689
South Core	CB51	3	Yes	Yes	Yes	-76.461435	34.705587
South Core	CB52	3	Yes	Yes	Yes	-76.458827	34.708516
South Core	CB53	3	Yes	Yes	Yes	-76.456171	34.711324
South Core	CB54	3	Yes	Yes	Yes	-76.453450	34.714287
South Core	CB55	3	Yes	Yes	Yes	-76.450963	34.717150
South Core	CB56	3	Yes	Yes	Yes	-76.448238	34.720042
South Core	CB57	3	Yes	Yes	Yes	-76.445654	34.722857
South Core	CB58	3	Yes	Yes	Yes	-76.442964	34.725905
South Core	CB59	3	Yes	Yes	Yes	-76.441004	34.728798
South Core	CB60	3	Yes	Yes	Yes	-76.438233	34.731793
South Core	CB61	3	Yes	Yes	Yes	-76.435624	34.734773
South Core	CB62	3	Yes	Yes	Yes	-76.433031	34.737686
South Core	CB63	3	Yes	Yes	Yes	-76.430579	34.740803
South Core	CB64	3	Yes	Yes	Yes	-76.428100	34.743574
South Core	CB65	2	Yes	No	Yes	-76.425482	34.746548
South Core	CB66	3	Yes	Yes	Yes	-76.423364	34.749373
South Core	CB67	3	Yes	Yes	Yes	-76.420135	34.752100
South Core	CB68	3	Yes	Yes	Yes	-76.417609	34.754951
South Core	CB69	3	Yes	Yes	Yes	-76.414784	34.757845
South Core	CB7	3	Yes	Yes	Yes	-76.544884	34.612996

Appendix I. List of points, total survey rounds, and coordinates. Continued.

Island	Survey Point	Number of Surveys	Period Yes	Period 2	Period 3	Longitude	Latitude
South Core	CB70	3	Yes	Yes	Yes	-76.413461	34.761192
South Core	CB73	3	Yes	Yes	Yes	-76.404433	34.769333
South Core	CB74	3	Yes	Yes	Yes	-76.401994	34.772292
South Core	CB75	3	Yes	Yes	Yes	-76.399459	34.775507
South Core	CB76	3	Yes	Yes	Yes	-76.397135	34.778438
South Core	CB77	3	Yes	Yes	Yes	-76.394576	34.781257
South Core	CB78	3	Yes	Yes	Yes	-76.391809	34.784203
South Core	CB79	3	Yes	Yes	Yes	-76.388679	34.786688
South Core	CB8	3	Yes	Yes	Yes	-76.549594	34.614069
South Core	CB80	3	Yes	Yes	Yes	-76.386118	34.789606
South Core	CB81	2	Yes	Yes	No	-76.383053	34.792125
South Core	CB82	3	Yes	Yes	Yes	-76.380401	34.794990
South Core	CB83	3	Yes	Yes	Yes	-76.377486	34.797671
South Core	CB84	3	Yes	Yes	Yes	-76.374725	34.800545
South Core	CB85	3	Yes	Yes	Yes	-76.372428	34.803347
South Core	CB85-B	3	Yes	Yes	Yes	-76.373649	34.803712
South Core	CB86	3	Yes	Yes	Yes	-76.368990	34.805921
South Core	CB87	3	Yes	Yes	Yes	-76.366558	34.808940
South Core	CB88	2	Yes	No	Yes	-76.364061	34.812041
South Core	CB89	2	Yes	No	Yes	-76.361943	34.814582
South Core	CB90	1	Yes	No	No	-76.358830	34.817362
South Core	CB92	3	Yes	Yes	Yes	-76.362434	34.818109
South Core	CB93	3	Yes	Yes	Yes	-76.471672	34.710834
South Core	CB94	3	Yes	Yes	Yes	-76.433479	34.755038
South Core	CB95	3	Yes	Yes	Yes	-76.433112	34.761013
South Core	CB96	3	Yes	Yes	Yes	-76.431001	34.765129
South Core	CB97	3	Yes	Yes	Yes	-76.426190	34.762752
South Core	CB98	3	Yes	Yes	Yes	-76.423061	34.758119
South Core	CB99	3	Yes	Yes	Yes	-76.422350	34.755014
Cedar Island	CI1	1	No	Yes	No	-76.354864	34.935545
Cedar Island	CI14	1	No	Yes	No	-76.345923	34.938571
Cedar Island	CI15	1	No	Yes	No	-76.342795	34.939492
Cedar Island	CI194	1	No	Yes	No	-76.316246	34.955399
Cedar Island	CI2	1	No	Yes	No	-76.352629	34.936314
Cedar Island	CI200	1	No	Yes	No	-76.311320	34.965260
Cedar Island	CI201	1	No	Yes	No	-76.313510	34.960080
Cedar Island	CI202	1	No	Yes	No	-76.319960	34.951440

Appendix I. List of points, total survey rounds, and coordinates. Continued.

Island	Survey Point	Number of Surveys	Period Yes	Period 2	Period 3	Longitude	Latitude
Cedar Island	CI203	1	No	Yes	No	-76.323680	34.947700
Cedar Island	CI204	1	No	Yes	No	-76.327760	34.944120
Cedar Island	CI205	1	No	Yes	No	-76.333360	34.942380
Cedar Island	CI207	1	No	Yes	No	-76.359610	34.931420
Cedar Island	CI208	1	No	Yes	No	-76.367550	34.920930
Cedar Island	CI3	1	No	Yes	No	-76.348415	34.937646
Cedar Island	CI30	1	No	Yes	No	-76.369537	34.917152
Cedar Island	CI6	1	No	Yes	No	-76.309030	34.970200
North Core	P100	3	Yes	Yes	Yes	-76.175295	34.976642
North Core	P101	3	Yes	Yes	Yes	-76.170601	34.975190
North Core	P102-A	1	No	Yes	No	-76.149574	34.990308
North Core	P102-BA	1	No	Yes	No	-76.152201	34.987492
North Core	P104-A	1	No	Yes	No	-76.143747	34.996566
North Core	P105-A	1	No	Yes	No	-76.140256	34.999915
North Core	P107-A	2	Yes	Yes	No	-76.135883	35.004441
North Core	P108	1	No	Yes	No	-76.143064	35.000058
North Core	P109	2	Yes	Yes	No	-76.141267	35.002198
North Core	P110	1	No	Yes	No	-76.139258	35.005504
North Core	P111	3	Yes	Yes	Yes	-76.116108	35.019287
North Core	P112	3	Yes	Yes	Yes	-76.108982	35.024231
North Core	P113	3	Yes	Yes	Yes	-76.107477	35.031939
North Core	P114	3	Yes	Yes	Yes	-76.101526	35.034987
North Core	P114-B	3	Yes	Yes	Yes	-76.094722	35.039959
North Core	P12	2	Yes	No	Yes	-76.275227	34.886367
North Core	P13	3	Yes	Yes	Yes	-76.272809	34.887462
North Core	P14	3	Yes	Yes	Yes	-76.269842	34.889828
North Core	P15	3	Yes	Yes	Yes	-76.266281	34.892250
North Core	P16	3	Yes	Yes	Yes	-76.262911	34.894583
North Core	P17	3	Yes	Yes	Yes	-76.259425	34.896733
North Core	P18	3	Yes	Yes	Yes	-76.256384	34.899573
North Core	P19	3	Yes	Yes	Yes	-76.253140	34.901799
North Core	P20	3	Yes	Yes	Yes	-76.250246	34.904163
North Core	P21	3	Yes	Yes	Yes	-76.246715	34.906364
North Core	P22	3	Yes	Yes	Yes	-76.243591	34.909154
North Core	P23	3	Yes	Yes	Yes	-76.240917	34.911514
North Core	P24	3	Yes	Yes	Yes	-76.237465	34.914052
North Core	P25	3	Yes	Yes	Yes	-76.233958	34.916893

Appendix I. List of points, total survey rounds, and coordinates. Continued.

Island	Survey Point	Number of Surveys	Period Yes	Period 2	Period 3	Longitude	Latitude
North Core	P26	3	Yes	Yes	Yes	-76.230137	34.919902
North Core	P27	3	Yes	Yes	Yes	-76.228058	34.921904
North Core	P28	3	Yes	Yes	Yes	-76.225240	34.924530
North Core	P29	3	Yes	Yes	Yes	-76.221995	34.926960
North Core	P30	3	Yes	Yes	Yes	-76.218794	34.929670
North Core	P31	3	Yes	Yes	Yes	-76.216095	34.932252
North Core	P32	3	Yes	Yes	Yes	-76.213093	34.934872
North Core	P33	3	Yes	Yes	Yes	-76.209523	34.937093
North Core	P34	3	Yes	Yes	Yes	-76.206489	34.939693
North Core	P35	3	Yes	Yes	Yes	-76.203781	34.942780
North Core	P36	3	Yes	Yes	Yes	-76.200517	34.945053
North Core	P37	3	Yes	Yes	Yes	-76.197310	34.947703
North Core	P38	3	Yes	Yes	Yes	-76.194602	34.950386
North Core	P39	3	Yes	Yes	Yes	-76.191542	34.952962
North Core	P40	3	Yes	Yes	Yes	-76.188411	34.955673
North Core	P41	3	Yes	Yes	Yes	-76.185581	34.957924
North Core	P42	3	Yes	Yes	Yes	-76.182118	34.960634
North Core	P43	1	Yes	No	No	-76.178732	34.962767
North Core	P44	1	Yes	No	No	-76.176147	34.964987
North Core	P45	1	Yes	No	No	-76.172680	34.967619
North Core	P46	2	Yes	Yes	No	-76.169315	34.969958
North Core	P47	3	Yes	Yes	Yes	-76.165846	34.972417
North Core	P48	3	Yes	Yes	Yes	-76.162290	34.974530
North Core	P49	2	No	Yes	Yes	-76.164682	34.978809
North Core	P50	1	No	Yes	No	-76.161702	34.981479
North Core	P51	3	Yes	Yes	Yes	-76.152870	34.982197
North Core	P52	3	Yes	Yes	Yes	-76.149562	34.984367
North Core	P53	3	Yes	Yes	Yes	-76.146630	34.987123
North Core	P54	3	Yes	Yes	Yes	-76.143345	34.989439
North Core	P55	3	Yes	Yes	Yes	-76.140358	34.992033
North Core	P56	3	Yes	Yes	Yes	-76.137233	34.994203
North Core	P57	3	Yes	Yes	Yes	-76.133885	34.996927
North Core	P58	3	Yes	Yes	Yes	-76.130730	34.999317
North Core	P6	3	Yes	Yes	Yes	-76.295785	34.873323
North Core	P60	1	No	Yes	No	-76.129580	35.005608
North Core	P61	1	No	Yes	No	-76.131124	35.010901
North Core	P61-B	2	No	Yes	Yes	-76.127845	35.007960

Appendix I. List of points, total survey rounds, and coordinates. Continued.

Island	Survey Point	Number of Surveys	Period Yes	Period 2	Period 3	Longitude	Latitude
North Core	P62	2	No	Yes	Yes	-76.127703	35.012333
North Core	P62-B	2	No	Yes	Yes	-76.125801	35.009429
North Core	P62-C	2	No	Yes	Yes	-76.122835	35.013486
North Core	P63	1	Yes	No	No	-76.115320	35.012842
North Core	P64	2	Yes	No	Yes	-76.111960	35.014071
North Core	P65	3	Yes	Yes	Yes	-76.108412	35.016105
North Core	P66	3	Yes	Yes	Yes	-76.105328	35.018668
North Core	P67	2	Yes	Yes	No	-76.102167	35.021167
North Core	P68	2	Yes	Yes	No	-76.100385	35.023569
North Core	P69	3	Yes	Yes	Yes	-76.098052	35.026659
North Core	P7	3	Yes	Yes	Yes	-76.294322	34.878254
North Core	P70	3	Yes	Yes	Yes	-76.095337	35.029126
North Core	P71	3	Yes	Yes	Yes	-76.092723	35.031295
North Core	P72	3	Yes	Yes	Yes	-76.089444	35.033752
North Core	P73	3	Yes	Yes	Yes	-76.087030	35.036028
North Core	P74	3	Yes	Yes	Yes	-76.084208	35.038569
North Core	P75	3	Yes	Yes	Yes	-76.081861	35.041442
North Core	P7-B	3	Yes	Yes	Yes	-76.289456	34.880529
North Core	P8	3	Yes	Yes	Yes	-76.293206	34.882381
North Core	P9	3	Yes	Yes	Yes	-76.288820	34.885855
North Core	P95	3	Yes	Yes	Yes	-76.195810	34.955740
North Core	P96	3	Yes	Yes	Yes	-76.193660	34.959876
North Core	P97	3	Yes	Yes	Yes	-76.186794	34.964041
North Core	P98	3	Yes	Yes	Yes	-76.184621	34.966071
North Core	P99	3	Yes	Yes	Yes	-76.178727	34.969326
Shackleford	S10	3	Yes	Yes	Yes	-76.608227	34.672523
Shackleford	S11	3	Yes	Yes	Yes	-76.604056	34.671887
Shackleford	S12	3	Yes	Yes	Yes	-76.600012	34.670022
Shackleford	S13	3	Yes	Yes	Yes	-76.596261	34.668888
Shackleford	S14	3	Yes	Yes	Yes	-76.592767	34.667760
Shackleford	S15	3	Yes	Yes	Yes	-76.589174	34.666554
Shackleford	S17	3	Yes	Yes	Yes	-76.585194	34.665270
Shackleford	S17-B	3	Yes	Yes	Yes	-76.581884	34.663938
Shackleford	S18	3	Yes	Yes	Yes	-76.577103	34.662433
Shackleford	S2	3	Yes	Yes	Yes	-76.639545	34.682712
Shackleford	S24	3	Yes	Yes	Yes	-76.552753	34.650619
Shackleford	S25	3	Yes	Yes	Yes	-76.549336	34.648762

Appendix I. List of points, total survey rounds, and coordinates. Continued.

Island	Survey Point	Number of Surveys	Period Yes	Period 2	Period 3	Longitude	Latitude
Shackleford	S26	3	Yes	Yes	Yes	-76.545914	34.646528
Shackleford	S27	3	Yes	Yes	Yes	-76.542751	34.643646
Shackleford	S28	3	Yes	Yes	Yes	-76.540147	34.640613
Shackleford	S29	3	Yes	Yes	Yes	-76.537462	34.637620
Shackleford	S3	3	Yes	Yes	Yes	-76.636688	34.681358
Shackleford	S30	3	Yes	Yes	Yes	-76.535202	34.634913
Shackleford	S31	3	Yes	Yes	Yes	-76.532205	34.631855
Shackleford	S4	3	Yes	Yes	Yes	-76.632685	34.680217
Shackleford	S5	3	Yes	Yes	Yes	-76.628752	34.679104
Shackleford	S6	3	Yes	Yes	Yes	-76.624560	34.678048
Shackleford	S7	3	Yes	Yes	Yes	-76.619697	34.675989
Shackleford	S8	3	Yes	Yes	Yes	-76.615436	34.674904
Shackleford	S9	3	Yes	Yes	Yes	-76.611590	34.673463