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Re-Survey and Population Status Update of the Black Rail in Virginia

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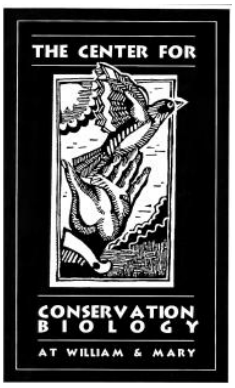


The Center for Conservation Biology is an organization dedicated to discovering innovative solutions to environmental problems that are both scientifically sound and practical within today's social context. Our philosophy has been to use a general systems approach to locate critical information needs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

Executive Summary

The Black Rail is the most imperiled bird species along the Atlantic Coast. This species is undergoing a conservation crisis that without emergency management intervention may be extirpated from many portions of its Atlantic Coast range in our lifetime. Black Rails have undergone significant reduction in it breeding range, loss of breeding sites in the core stronghold of its population, and has a dim future in the face of sea-level rise and other disturbances.

The objective of this study was to provide an update of the population status of Black Rails in Virginia. We conducted a previous study for Black Rails in 2007 that marked the first time that a systematic survey of the species was conducted in the Commonwealth. Results of that survey effort showed that Black Rails were only detected in 10 of 212 survey points located on the Delmarva Peninsula and were completely absent from 40 additional survey locations on the western shore of the Chesapeake Bay. Based on the low detection rates, and apparent population decline from earlier decades, a re-survey of the lower Delmarva Peninsula was considered critical to provide current trends and distribution.

We conducted surveys for Black Rail in 2014 on Virginia's eastern shore (i.e., the lower Delmarva Peninsula) by selecting all 12 survey points with positive occurrences in the 2007 survey effort, 114 survey points that were a subset of locations without Black Rail occurrences from the 2007 survey, and a selection of 9 new points never before surveyed on the Chincoteague National Wildlife Refuge (total points surveyed = 134). Black Rails were only detected at 2 survey locations. Both of these detections were of single birds from the Saxis Wildlife Management Area. Black rails were absent from 10 other survey locations where they were detected in 2007.

Population numbers of the Black Rail in Virginia has reached an all-time low in Virginia. Traditional strongholds such as the Saxis WMA have held more than 20 Black Rails as recent as the 1990s have become significantly reduced.

Reasons for the decline of Black Rails are not completely understood but are likely a result of a combination of factors that degrade or remove their required habitat, disrupt breeding productivity, or lower survival. High marsh habitats that Black Rails rely upon are particularly vulnerable to loss and transformation as a result of sea-level rise and receive high visitation by nest predators that can disrupt breeding. Overall, the dramatic population loss of Black Rails in the Mid-Atlantic provides indication that the ecosystem they rely on is no longer suitable. Emergency management actions are required to prevent further population loss and begin restoration. A critical management need for the Black Rail is to create and manage habitats that are not influenced by sea-level rise. Artificial habitats such as managed impoundments offer the best opportunity to fit these demands. Impoundments could be placed inland to avoid rising seas and could be fenced to reduce predator visitation. A broad strategy and site-specific recommendations for managing impoundments to benefit Black Rails are still in need of development through experimentation.

We recommend continual monitoring of the Black Rail population in Virginia into the future using the same protocol as 2007 and this 2014 study. Monitoring of Saxis WMA should occur annually and the remaining survey locations should be visited every 4 to 5 years. Survey points with no rail detections from 2007 and not surveyed in 2014 should be rotated into future survey designs to be assess whether or not birds are not moving in the landscape between monitoring benchmarks.

Introduction

The Black Rail (*Laterallus jamaicensis*) may be the most imperiled bird along the Atlantic Coast. Black Rail populations have undergone dramatic declines over the last 15-20 years and have reached levels that are at a high risk of extirpation throughout the Mid-Atlantic region. Emergency intervention and management is now required to halt population declines and ensure this species' long-term conservation.

The Black Rail is taxonomically divided into multiple subspecies. In North America, the California Black Rail (*L. j. couturniculus*) is distributed throughout portions of California and Arizona (Eddleman et al. 1994) whereas the eastern Black Rail (*L. j. jamaicensis*) breeds in scattered locations in Kansas and the Midwest and along the Atlantic and Gulf coastal states (Eddleman et al. 1994). Eastern coastal populations breed from New York to Florida along the Atlantic Coast and in Florida and Texas along the Gulf coast. Historically, the northern edge of this breeding range may have once extended as far as Massachusetts but contracted south to New York sometime in the early twentieth century (Eddleman et al. 1994). Eastern Black rails spend the winter along Atlantic coasts from New Jersey to Florida and along the Gulf Coast from Florida to Texas. Breeding populations of the eastern United States may also winter in Cuba and the West Indies.

Population losses within the Mid-Atlantic region are widespread. Anecdotal evidence suggests that Black Rails may have become extirpated from New York in the early 2000s and have declined greatly in New Jersey. Likewise, the number of breeding locations and total numbers for Black Rails in Delaware appear to be a small fraction compared to historical records. Systematic surveys conducted in Maryland between 1992 and 2014 have indicated a > 90% decline in the number of detected locations and individual birds. In Virginia, a 2007 survey detected birds in only 12 of 212 locations on the Delmarva Peninsula with no birds being found in some marshes that had historical records of occurrence (Wilson et al. 2009). Moreover, the total number of birds detected at strongholds such as Saxis Marsh appeared to be substantially lower compared to older reports (D. Schwab, S. Rottenborn, personal communication).

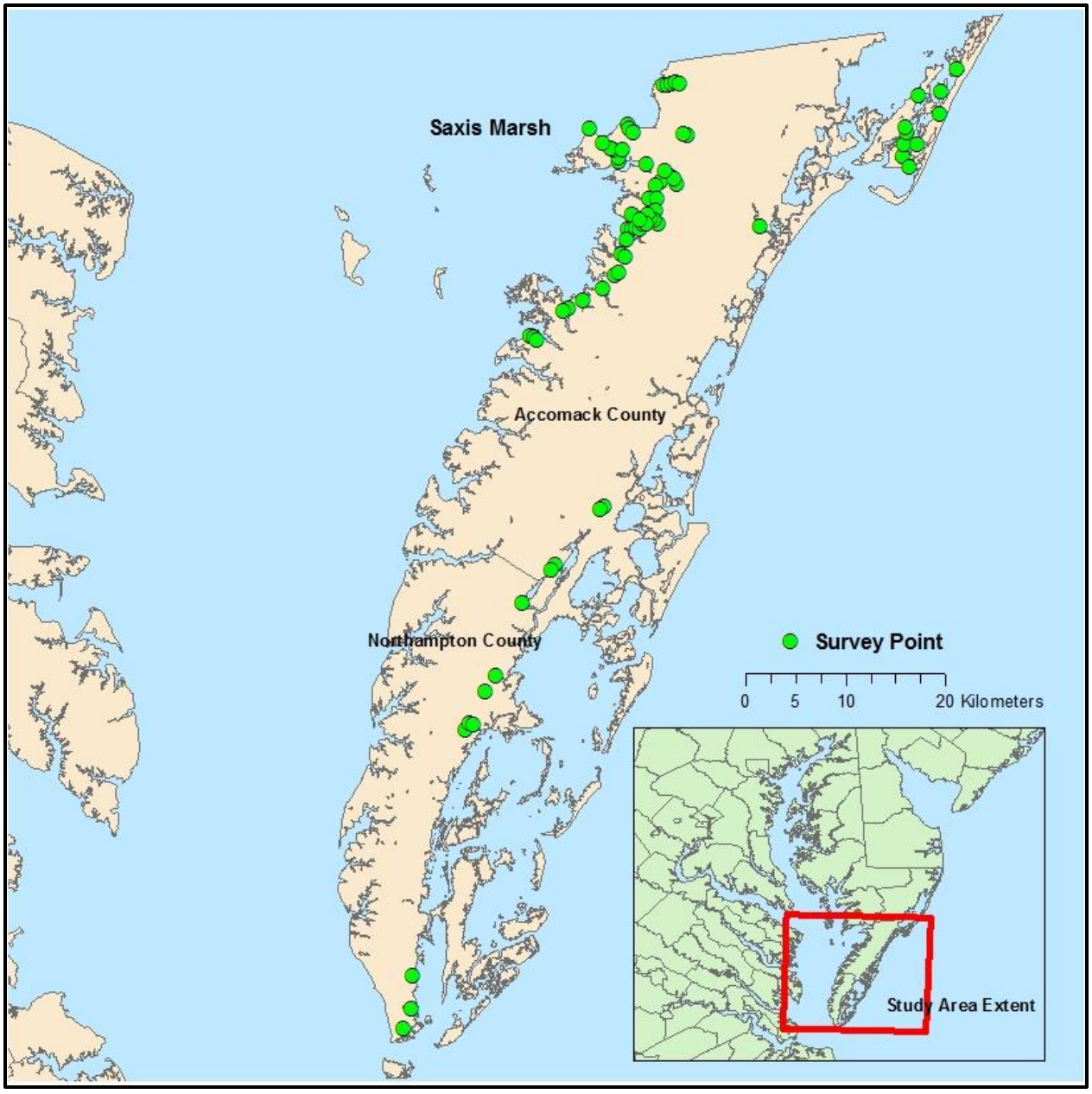
The objective of this study was to provide an update on the status of Black Rails in Virginia. The 2007-2008 survey (Wilson et al. 2009) was the first time a systematic survey for this species was conducted in Virginia. Moreover, determining the patterns of occurrence is important to effectively plotting a course for this species conservation in the Commonwealth.

Methods

We conducted field work on Virginia's eastern shore (i.e., the lower Delmarva Peninsula) by selecting all 12 survey points with positive occurrences in the 2007 survey effort, 114 survey points that were a subset of locations without Black Rail occurrences from the 2007 survey, and a selection of 9 new points never before surveyed on the Chincoteague National Wildlife Refuge (total points surveyed = 134) (Figure 1). The general method used to select points in 2007 was to target as many appropriate high marsh patches for survey that contained either historical records of occurrence for Black Rails or that contained appropriate vegetation and topography as possible. Black rails occupy the upper elevational zone of salt marshes known as the high marsh (Davidson 1992, Eddleman et al 1994,). The high marsh is only inundated during extreme high tide events and dominated by plants such as salt meadow hay (*Spartina patens*), saltgrass (*Distichlis spicata*), and often interspersed with shrubs such as marsh elder (*Iva frutescens*) or saltbush (*Baccharis hamilifolia*) (Cowardin 1977). On the eastern shore

of Virginia, this included marshes along the bayside of the Delmarva Peninsula from the Virginia - Maryland border south to Hyslop Marsh in Accomack County, and marshes along the mainland edge of the seaside of the peninsula from Chincoteague Bay south to tip of the peninsula.

Figure 1. Distribution of 134 Black Rail survey points used in 2014 on the Delmarva Peninsula of Virginia.



We surveyed all point locations three times between 21 April and 24 June, 2014. Surveys were conducted at night, beginning 30 min after sunset and ending before sunrise. We used a call-response technique (Gibbs and Melvin 1993) that was specifically designed for Black Rail surveys as originated and used by the Maryland Department of Natural Resources (DNR), Wildlife and Heritage Service during 1991-1992 and 2007 (D. Brinker, pers. comm.) and also used in Virginia in 2007. This specific protocol is also being used in Maryland, North Carolina, South Carolina, and Georgia in 2014 and will be used additionally in New Jersey in 2015. The call-response survey consisted of a 10-min sequence of alternating silent listening periods and species playback in the following order; 1) 2 minutes of silence, 2) 4 minutes of Black Rail calls (Ki-Ki-Ker, growls, Ki-Ki doo); 3) 1 minute of silence; 3) 2 minutes Virginia Rail calls; 4) 1 minute of silence. The species playback sequence also had interstitial moments of silence to allow detection of calling birds. All rail detections were registered with respect to distance from the observer, orientation of detection, time of first detection, and mapped to produce an estimated location in the marsh.

Black rails have low detection rates that can vary greatly according to changes in breeding disposition, time of year, and weather (Brinker 1997, Legare et al. 1999). Legare et al. (1999) estimated that only 23-38 % of radio-tagged individuals responded to call-playbacks during evening and morning trials. To incorporate the influence of detection on point use we applied a site occupancy model (MacKenzie et al. 2002) that incorporates detection probability using the program Presence ver. 2.4 (Hines 2006). Because of the low number of detection in this current study, we applied the detection probability obtained in the 2007 survey (Wilson et al. 2009). This method allows us to compare the proportion of points where birds were detected during surveys to an estimated proportion of points (p) adjusted for detection probability (Ψ). The assumptions of this model are: 1) the sites remain occupied during the study period, no extinction, emigration or colonization occurs, 2) the detection probability of Black Rails is greater than zero, and 3) the detection of a Black Rail at a point is not influenced by the detection at other points. Having a value for detection probability also allows us to calculate the probability of not detecting a Black Rail that is present (F) using the following equation: $F = (1-p)^N$; where p is the detection probability and N is the number of visits. We applied results from the 2007 analysis that provided an overall $\Psi = 0.43$ and $F = 0.33$.

Results

Black Rails were only detected at 2 locations among the total 134 survey points visited. Both detections from these points occurred on 21 April at the Saxis Wildlife Management Area (WMA) (Figure 2). Each of these detections was believed to be comprised of 2 individual Black Rails based on the distance between survey points where they were detected. Black Rails were not detected at these two locations during subsequent surveys on 11 May or 19 June.

Black Rails were only detected at 2 of the 12 survey points where they were detected in 2007 (Table 1, Figures 3 A-C). All of the 2007 detections were on the bayside of the Delmarva Peninsula. During that year, the same individual bird was detected at 3 survey points in 2007 so an adjusted total of unique detections would yield 16 Black Rails at 10 points including 4 survey points at Saxis WMA. Saxis WMA had the greatest concentration of Black Rails in 2007 with 6 calling birds and the remaining 10 birds detected at 6 different locations. In 2014, Black Rails disappeared from marshes where they were detected in 2007 along the Pokomoke River, Island Field Creek, Guilford Creek, and Doe Creek areas. There were no birds detected on the seaside of the Delmarva Peninsula in 2007 or 2014.

Figure 2. Location of survey points and Black Rail detctions in Saxis Marsh from 2014 surveys.

Table 1. Comparison of point count locations and survey results between Black Rails in 2007 and the current 2014 study.

	2007 Survey			2014 Survey		
General Location	**Number of points surveyed**	**Number of occupied points**	**Number of birds detected**	**Number of points surveyed**	**Number of occupied points**	**Number of birds detected**
Delmarva Peninsula						
Bayside						
Pocomoke River/ Bullbegger Creek	10	1	1	5	0	0
Saxis	20	4	8	10	2	2
Michael Marsh	13	1	1	9	0	0
Byrds Marsh	16	0	0	2	0	0
Island Field Creek to Guilford Creek	13	2	3	11	0	0
Guilford Creek to Hunting Creek	13	3	1	3	0	0
Willis Gut (Doe Creek) to Deep Creek	2	1	1	0	-	-
Big Marsh	9	0	0	1	0	0
Parkers Marsh	9	0	0	3	0	0
Onancock Creek to Pungoteauge	7	0	0			
Hack's Neck to Nandua Creek (Hyslop Marsh)	7	0	0	0	-	-
Seaside						
Chincoteague Bay / Chincoteague Inlet	32	0	0	9	0	0
Wallops Island to Metompkin Island	24	0	0	0	-	-
Parramore Island & Lagoon	13	0	0	0	-	-
Hog Island	5	0	0	0	-	-
Cobb Island	4	0	0	0	-	-
Mainland - seaside	20	0	0	14	0	0
Mockhorn Island	6	0	0	0	-	-
Smith Island	5	0	0	0	-	-

Figures 3 A-C. Comparison of survey points and results between Black Rail surveys in 2007 and 2014.

Figure 3A)

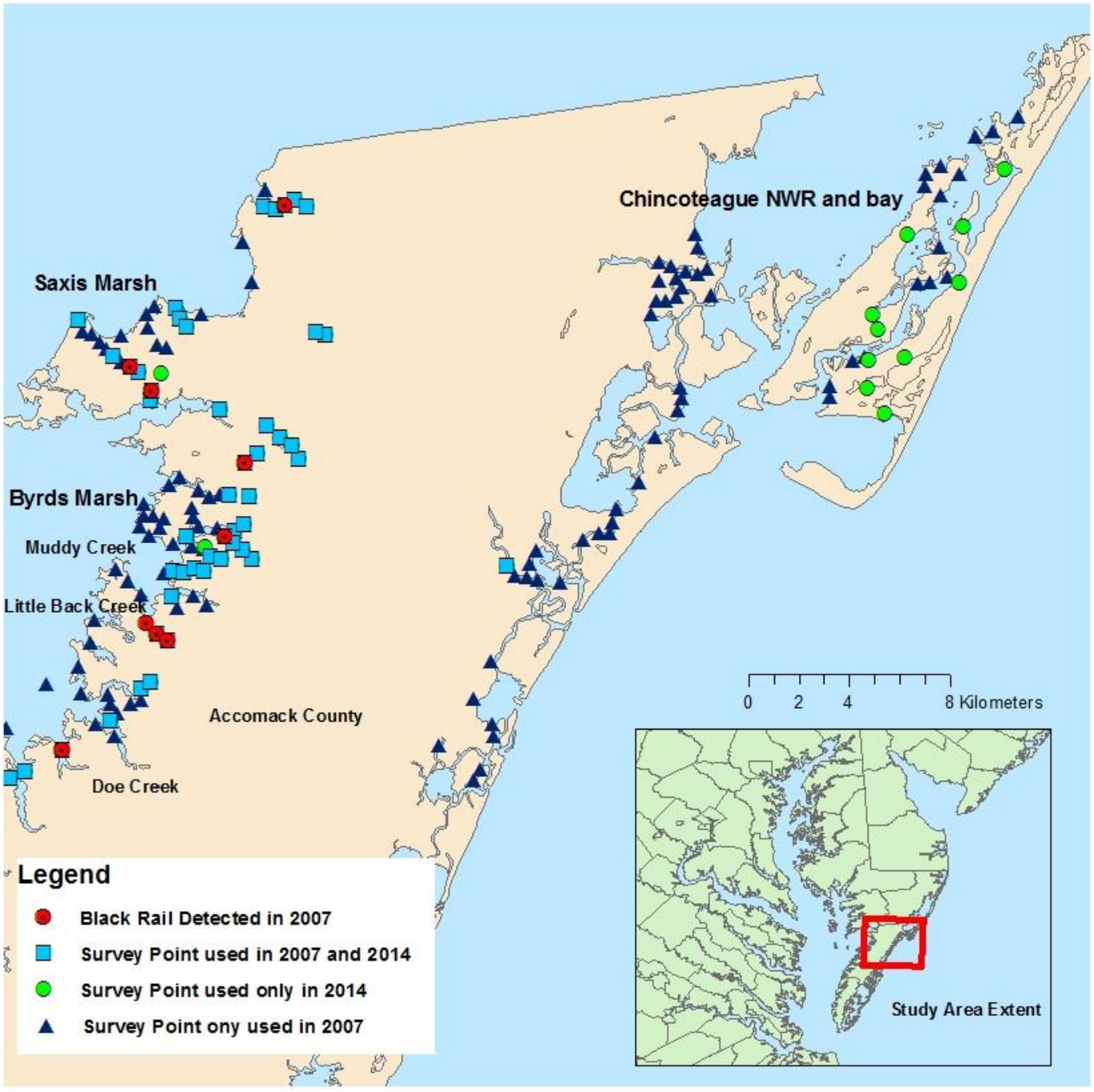


Figure 3B.

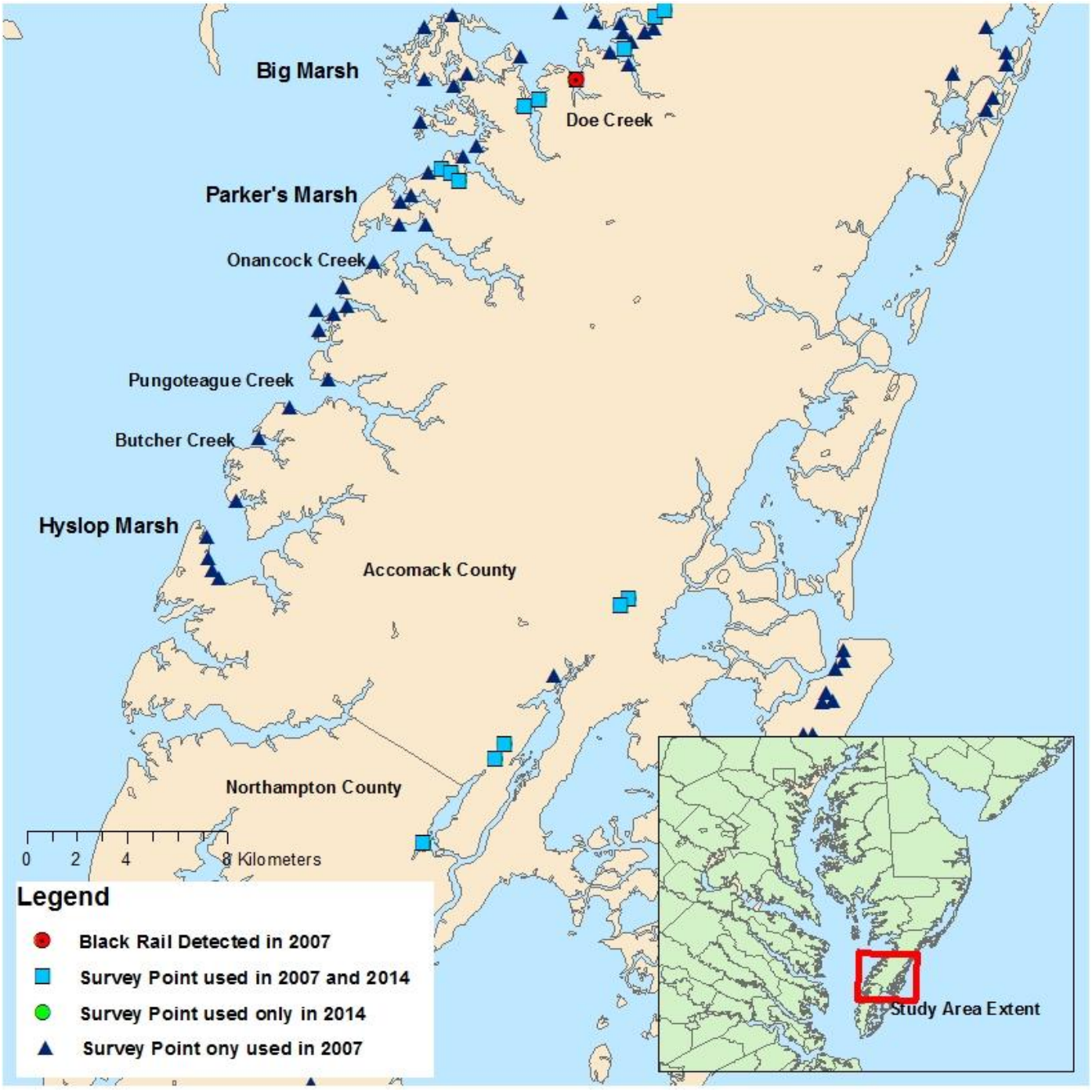
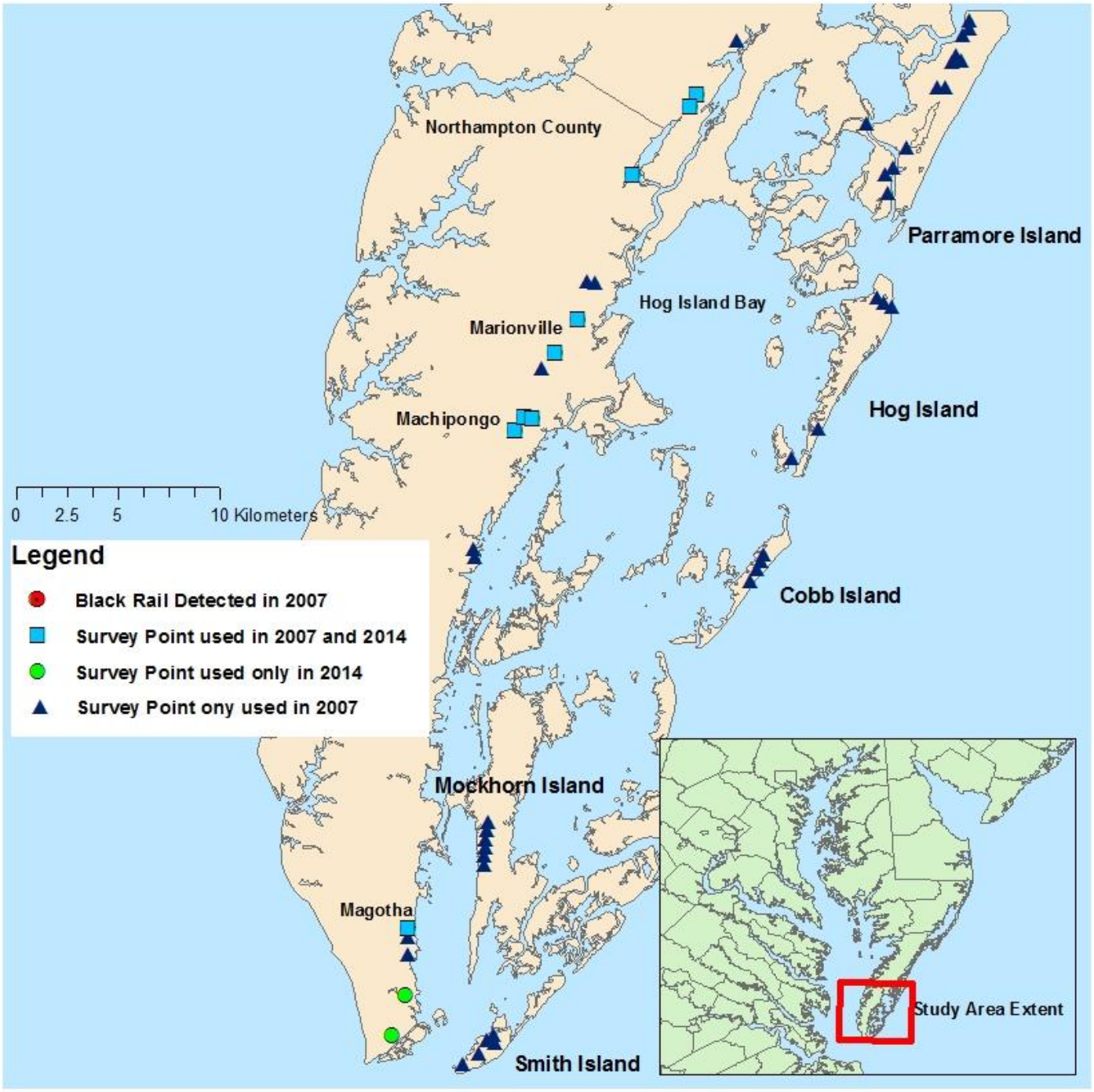

Big Marsh
Doe Creek
Parker's Marsh
Onancock Creek
Pungoteague Creek
Butcher Creek
Hyslop Marsh
Accomack County
Northampton County
0 2 4 8 Kilometers
Legend
Black Rail Detected in 2007
Survey Point used in 2007 and 2014
Survey Point used only in 2014
Survey Point ony used in 2007
Study Area Extent

Figure 3C.


Northampton County
Parramore Island
Hog Island Bay
Marionville
Machipongo
Hog Island
0 2.5 5 10 Kilometers
Legend
Black Rail Detected in 2007
Survey Point used in 2007 and 2014
Survey Point used only in 2014
Survey Point ony used in 2007
Cobb Island
Mockhorn Island
Magotha
Smith Island
Study Area Extent

Discussion

Population numbers of the Black Rail in Virginia has reached an all-time low and the species current status should be considered a conservation crisis. Birds have declined or have been lost from historical strongholds such as Saxis Marsh and WMA and the barrier islands. Traditional strongholds such as the Saxis WMA have held more than 20 Black Rails as recent as the 1990s (Rottenborn and Brinkley 2005, D. Schwab personal comm.). We only detected 6 birds at Saxis WMA in 2007 and only 2 birds in 2014. There has also been a distinguishable loss of Black Rail locations throughout the bayside of the Delmarva Peninsula. Steve Rottenborn and O'Connell (personal comm.) detected Black Rails in a number of bayside marshes in 1991. We detected birds in 3 of the 4 locations in 2007 as Rottenborn did in 1991 but only detected birds in one of these locations in 2014. Black Rails have also been previously detected in Hyslop Marsh (N. Brinkley, personal comm.) but not found there in 2007.

Black Rails were known to inhabit the Virginia Barrier Islands through the early 1900s but were not detected during the 2007 survey. We did not survey any of the Barrier Islands locations in 2014. Harold H. Bailey (1927) documents that his father, Harold B. Bailey collected a nest from Cobb Island and eggs from six to seven nests from Hog Island in 1917. Charles Handley reported a nest on Gull Marsh in 1938 (Clapp 1997). There is one record from the seaside mainland near Locustville in the early 1990s (Bob Cross, unpublished). However, we did not detect any Black Rails on the seaside mainland in 2007 or 2014. There is no clear indication of what date birds disappeared from the Barrier Islands.

Black Rails have a relatively low probability of detection so it is possible that we missed detection of birds in some marshes. Aside from the Saxis WMA, Black Rails were detected most frequently as single birds in other marshes in 2007. This low number would presumably make detection even more difficult. However, when occupancy analysis adjusted for detection probability there was only a small increase (possibly 3 points) in the number of locations where Black Rails may occur but were not detected. When populations become as low as Black Rails are currently in Virginia, it is possible that single birds may move around the landscape from year to year. So it is possible birds could have occupied locations not surveyed in 2014 where they were not detected in 2007. The decision to not survey all points from 2007 was primarily to reduce the project survey cost. Most of the points dropped from the survey between 2007 and 2014 were those that had to be accessed by boat. Therefore many locations not surveyed again in 2014 were on the fringing shoreline of marshes along the bayside and the barrier islands. We also chose not to survey many locations in Chincoteague Bay but rather established many new survey locations that could be accessed from land.

There has never been a strong indication that Black Rails occupied the western shore of the Chesapeake Bay in Virginia. We did not detect any birds among 40 survey points along the western shore in 2007 and did not survey this area in 2014. The only Black Rail occurrences for the western shore of the Chesapeake Bay is from Seaford (York County) where a bird was flushed on 21 August, 1949 (Scott 1950) and another bird flushed from Grandview Beach on 11 May, 1968 (Buckley and Buckley 1968). One-time observations on these dates make it unclear if they were local breeding birds or dispersing birds from other locations. There have been several Black Rail records from Back Bay including a detection during the Virginia Breeding Bird Atlas Project 1985-1989) (Trollinger and Reay 2001). We did not detect Black Rails from surveys on the Back Bay National Wildlife Refuge in 2007 and did not survey this area in 2014.

The decline of Black Rails in the Mid-Atlantic region, particularly the Chesapeake Bay, has been dramatic. Historically, the stretch of marshes from Dorchester County, Maryland through Accomack

County, VA has been long considered the core stronghold of the Black Rail populations in the Mid-Atlantic. Dave Brinker (Maryland Department of Natural Resources, Wildlife and Natural Heritage Service) has coordinated surveys for Black Rails in 1992, 2007, and 2014 along the bayside and seaside of the Delmarva Peninsula in Maryland. Over this time frame, there has been a > 90 % reduction in the number of locations in Maryland where they have been detected and a decline in numbers from 141 birds in 1992 to 7 birds in 2014 (personal comm).

Reasons for the decline of Black Rails are not completely understood but are likely a result of a combination of factors that degrade or remove their required habitat, disrupt breeding productivity, or lower survival. High marsh habitats that Black Rails rely upon are particularly vulnerable to loss and transformation as a result of sea-level rise. The rate of sea-level rise in the Chesapeake Bay is nearly two times greater than the global average and has been accelerating over recent decades (Zervas 2001). In many areas of the Chesapeake Bay region, large portions of marshes are already being submerged where the sea is rising faster than marshes can accumulate sediments to maintain elevation. As sea-levels rise, increased flooding of marshes will convert many areas of high marsh to low marsh even if the total area of marsh remains constant. Over a regional scale, changes in the composition in marshes resulting from sea-level rise may be enough to affect the entire system state of an ecosystem and habitat availability for Black Rails. Recent evidence suggests that marshes where Black Rails have declined or disappeared in Virginia have undergone significant transformations by losing portions of high marsh to low marsh (Wilson et al, 2014 A). One specific example is the northern tip of Saxis WMA known as Pig Point. Pig Point supported birds according to Rottenborn's surveys in 1991 but no birds were detected there in 2007 or 2014. An analysis of marsh change at Pig Point between 1994 and 2006 showed significant reduction of high marsh at the expense of new low marsh formation (Wilson et al 2014 A).

Marshes in the mid-Atlantic that have supported Black Rails for substantial portions of time such as Saxis Marsh in Virginia or Elliot's Island in Maryland are critical for this species conservation. These marshes have long supported the bulk of the populations in each state and represent the last, consistent standouts among a larger marsh landscape. On April 13, 2014, Saxis Marsh suffered a significant fire that burned 1,200 ha (3,000 acres). The burned marsh was relegated to the area north of Saxis road and outside the area typically inhabited by Black Rails. It is unclear whether or not this fire affected the Black Rail population but it does signify the risk that this species is currently facing. With only a few birds known to occur in Virginia, deleterious events can have pronounced negative effects on population size. Fire, whether wild or prescribed, can be advantageous to marsh birds by removing dead vegetation and opening marsh grasses to new growth. However, if this fire moved south it would have removed vegetation cover in the Black Rail portion of the marsh immediately before the breeding season and could potentially cause unwanted bird mortality. Obviously, incidents such as wildfire are difficult to prevent but can have pronounced negative effects when populations have become so low. Special care should be made to protect Saxis Marsh from wildfire and other perturbations that could harm this species.

There is a substantial amount of available habitat that remains unoccupied by Black Rails. In general, landscapes supporting seemingly suitable habitat that are not filled to capacity by individuals may be an indication of underlying demographic problems. This notion suggests that the low percentage of occupied marshes by Black Rails in the Chesapeake Bay may also be a result of poor demographic rates such as low breeding productivity or adult survival. Rising sea levels not only reduce the amount of habitat for Black Rails, but also lower the demographic value of existing patches as well. An increase of tidal flooding above historic tide lines can inundate areas used for nesting and drown

eggs. Black Rails likely have evolved behaviors that have shaped their current timing and placement of nests above high tide lines within high marshes. The amount and duration of flooding across the marsh surface has continued to increase and is expected to accelerate as water continues to rise relative to the land. Episodic flooding of high marshes at heights greater than historic values is not likely to produce noticeable changes in marsh composition over the short-term, but its effect on Black Rail breeding should be assessed. The possibility of the "silent killing" of Black Rail populations by an increase of tidal flooding suggests that populations will continue to decline faster than we would expect due to habitat loss alone. Conservation tools that investigate recent changes in tidal heights and forecast the effect of increasing tidal heights and penetration across the marsh surface into the future are needed to understand the exposure risk of Black Rails and other high marsh nesting birds to flooding of nesting habitat.

Another factor that can limit Black Rail demographic rates is nest predation. Black Rails using high marshes for breeding are highly susceptible to nest predators (Wilson et al., 2014 B). High marshes allow easy access to predators because of their low water levels and proximity to the upland. A recent study on the Delmarva Peninsula of Virginia investigated the nesting potential of high marsh nesting birds by investigating predation rates on artificial nests placed in high marsh (Wilson et al. 2014 B). Results of this study indicated that 90% of artificial nests were predated within 20 days of exposure. The incubation period of the Black Rail is estimated at 20-21 days suggesting that this species is at high risk of nest predation at a level that could cause poor breeding productivity at the population level.

Although perhaps not a critical limiting factor in Virginia, mosquito control measures in Maryland can have significant negative impacts to the Black Rail population. Management practices associated with mosquito control can degrade marshes for Black Rails both physically and demographically. Historically the practice of ditching marshes for mosquito control has been pervasive throughout the Northeast. Marsh ditching severely impacts marsh hydrology by altering tidal patterns. More recently, the technique of Open Marsh Water Management (OMWM) has been employed to drain the water in marshes to a central pool so mosquitoes can be controlled by fish predation or insecticides. Both ditching and OMWM methods of mosquito control alter natural hydrology and have specifically been used to target high marsh habitats that Black Rails rely on and the specific patches which they are known to inhabit. In addition, mosquito control using insecticides has been prevalent for decades but is utilized more prevalently in recent time. Insecticides have sometimes been chosen as an alternative to OMWM. The relatively common practice in the use of insecticides have been to broadcast spray both larvalcides and adulticides. Insecticides pose a significant threat to Black Rail populations based on the broad spatial extent that it is used and the fact that insecticides are not mosquito-specific but can also depress organisms utilized as prey by Black Rails. The dramatic decline of Black Rails in the Chesapeake Bay co-occurred with a shift in the use of insecticides from previous use of OMWM for mosquito control (Dave Brinker, personal comm). The influence that mosquito control may have on decreasing Black populations is recommended as a priority research action in the Northeastern U.S.

It is also possible that the decline of Black Rails in the Chesapeake Bay could be a result of events occurring on the wintering grounds further south. The influence of the non-breeding season on Black Rail population levels and adult survival is not known. Limiting factors such as marsh loss or transformation from sea-level rise, and flooding of habitats through impoundment management are common factors influencing Black Rails throughout the annual cycle. In addition, incompatible use of prescribed fire in the southeast has been implicated on having a direct influence on Black Rail populations by increasing mortality rates of wintering adults through direct take or reducing vegetation cover.

Overall, the dramatic population loss of Black Rails in the Northeastern U.S. provides indication that the ecosystem they rely on is no longer suitable. Emergency management actions are required to prevent further population loss and begin restoration. However, some of the limiting factors on Black Rails are so pervasive that they are beyond management control. For instance, halting the loss of high marsh from sea-level rise may be considered unfathomable. Furthermore, nest predators may be distributed too widely and exist in greater numbers than could be controlled through management and marshes are too large to undergo predator exclusion. However, basic management actions in the face of sea-level rise should include preventing any shoreline armoring that prevents natural marsh transgression into the upland. Similarly, management actions such as water control, prescribed fire, or mosquito control should be made compatible with Black Rail conservation with selected focal areas.

A critical management need for the Black Rail is to create and manage habitats that are not influenced by sea-level rise. Artificial habitats such as managed impoundments offer the best opportunity to fit these demands. Impoundments could be placed inland to avoid rising seas and could be fenced to reduce predator visitation. A broad strategy and site-specific recommendations for managing impoundments to benefit Black Rails are still in need of development through experimentation. Black Rails respond positively to impoundments that are managed under proper conditions. Basic requirements would be a cover of dense grasses and very low water levels (i.e, centimeters in depth). This would require specific flooding and draw down events timed specifically to produce optimal conditions for Black Rails.

We recommend continual monitoring of the Black Rail population in Virginia into the future using the same protocol as 2007 and 2014. Monitoring of Saxis WMA should occur annually and the remaining survey locations should be visited every 4 to 5 years. Survey points with no rail detections from 2007 and not surveyed in 2014 should be rotated into future survey designs to be assess whether or not birds are not moving in the landscape between monitoring benchmarks.

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