Black Rail Conservation Plan

Atlantic Coast Joint Venture partners working to conserve an imperiled species.

ATLANTIC COAST JOINT VENTURE

EXECUTIVE SUMMARY

The goal of this plan is to serve as a guide to conserving the Black Rail from southern New England to Florida. An inhabitant of high marsh with dense vegetative canopy and very shallow water, the species is one of the most poorly understood in North America. Recent and fairly comprehensive survey efforts along the Atlantic coast have revealed that the population has undergone precipitous declines in most of the region along with a range contraction of more than 450 kilometers (280 miles). Current population estimates for this area are between 355 to 815 breeding pairs with an estimated rate of decline of 9 percent per year since the 1990s. The decline represents a loss of more than 90 percent of the population. The U.S. Fish and Wildlife Service proposed the Black Rail subspecies found on the Atlantic Coast, the Eastern Black Rail, as Threatened under the Endangered Species Act in October 2018. Continued threats to its habitat, primarily from sea level rise and associated nest flooding, will result in additional losses and population declines if immediate action is not taken.

Although the range of the Eastern Black Rail extends westward to the Rocky Mountains, the Atlantic Coast states have long served as a stronghold for the subspecies. A consortium of partners from New York to Florida has been working together since 2009 to dedicate resources and expertise to arrest declines and achieve a sustainable population. Given the responsibility the Atlantic Coast region has to sustaining overall Eastern Black Rail populations, the Atlantic Coast Joint Venture (ACJV) Management Board selected the species as one of three flagship species in 2016 and assumed coordination of the Black Rail Working Group within the ACJV region. The Working Group has since worked to set population and habitat goals and has developed a set of six priority conservation strategies designed to most quickly and effectively allow partners to reach and maintain those goals within the context of the major threats facing the species. These strategies include:

- Create New Non-tidal Black Rail Habitat
- Promote Targeted Impoundment Management
- Develop and Promote Black Rail-Friendly Fire Best Management Practices (BMPs)
- Develop and Promote Black Rail-Friendly Agricultural BMPs
- Develop and Implement BMPs to Facilitate Marsh Migration
- Develop Landowner Assurances Program

These strategies rely heavily on habitat creation and enhancement actions in the non-tidal portions of the Black Rail range and the marsh migration zone. Past survey and occurrence data strongly suggest that the species cannot persist in tidal marsh habitats into the future. Although these habitats historically supplied the vast majority of the Black Rail observations, sea level rise is quickly rendering most of them unsuitable for breeding. However, Black Rails are able to nest in a variety of natural and artificial fresh and brackish marshes where suitable conditions are met, representing a critical opportunity to shift the population to inland habitats where they can be safe from flooding tides. Identifying BMPs that create and enhance habitat where Black Rails can successfully reproduce is an urgent need that must be acted upon immediately across the ACJV range. We must likewise make it easier for private landowners, who own much of the potential non-tidal habitat, to partner with us on Black Rail conservation through the development of a Landowner Assurances Program that reduces the regulatory consequences of attracting Black Rails to one's land.

Collectively, these strategies represent the most promising approach to halting the decline and growing the population to achieve a stable and secure population of Black Rails along the Atlantic coast. As we continue to learn by doing, we expect to update this plan and the strategies within it every five years, increasing our conservation effectiveness and leading to greater success in the recovery of this species.

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Cover photo credit: Black Rail, Bob Gress
Back photo credit: Salt marsh habitat, Ray Hennessy, rayhennessy.com
Design: Debra Reynolds, USFWS
Editing: Roxanne Bogart, USFWS
Citation*: Recommended citation: Atlantic Coast Joint Venture. 2020. Eastern Black Rail Conservation Plan for the Atlantic Coast. www.acjv.org*

INTRODUCTION

BACKGROUND

The Black Rail (*Laterallus jamaicensis*) is the most secretive of the secretive marsh birds and one of the least understood bird species in North America. It is also the smallest and rarest of the rail species. Its existence was not confirmed in North America until 1836, when an adult and young were captured near Philadelphia (Allen 1900). Over the next 150 years, researchers slowly developed a picture of its North American distribution along with rudimentary knowledge of its ecology. Two North American subspecies have been identified — the California Black Rail (*L. j.coturniculus*), which is found in portions of California, Arizona, and Baja California, Mexico, and the Eastern Black Rail (*L. j. jamaicensis*), which is found in isolated populations across the Great Plains to the Atlantic and Gulf Coasts of the United States and Mexico. The eastern subspecies also occurs in several countries in Central America, the Caribbean, and Brazil. Within the Eastern Black Rail range, the greatest concentrations of rails have historically occurred in coastal salt marshes of the Atlantic Coast from Connecticut to Florida (Figure 1) and along the Gulf Coast from Florida to Texas .

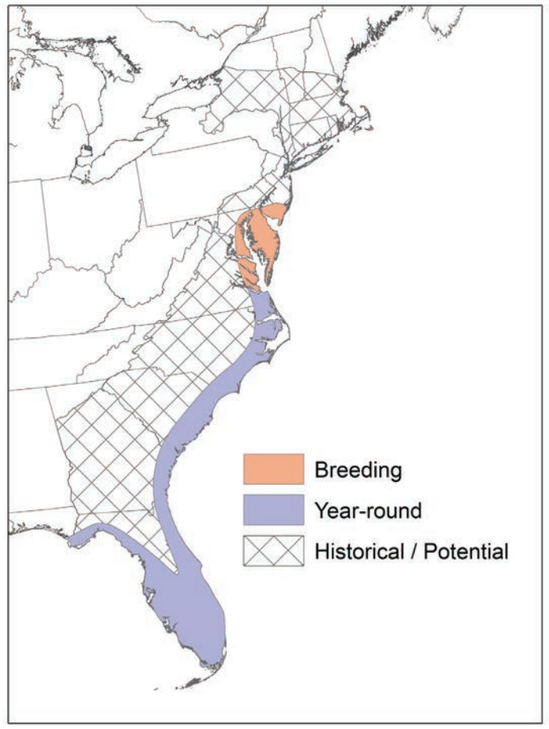


Figure 1: Black Rail range within the ACJV boundary.

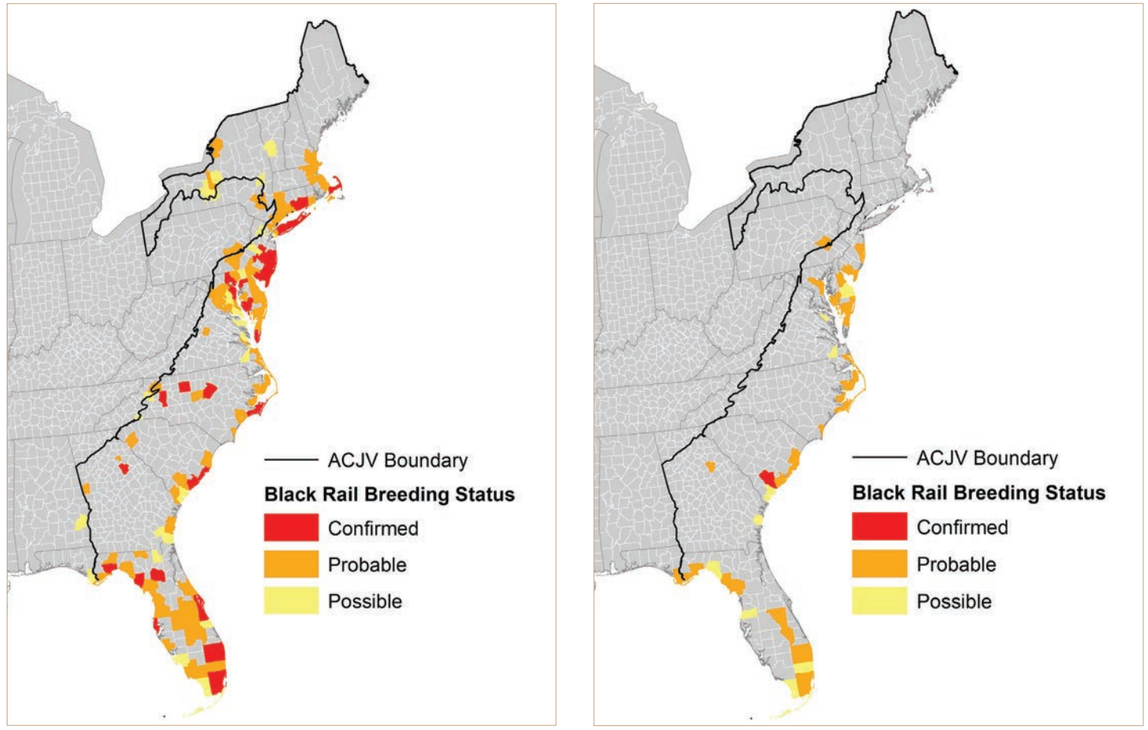
The Eastern Black Rail (or Black Rail) is a sparrow-sized bird that nests on or near the ground in dense vegetative cover over water or moist soil (U.S. Fish and Wildlife Service 2018). Black Rails produce mean clutch sizes of 7 eggs and will renest rapidly upon nest failure (Legare and Eddleman 2001). The breeding season lasts approximately from mid-March to August, with latitudinal and local variation in nest timing. Adult Black Rails go through a three-week flightless molt period during July to October (U.S. Fish and Wildlife Service 2018; Hand 2019a, pers. comm.). The more northerly population of Atlantic Coast Black Rails are suspected to be migratory, while populations from southern Virginia south appear to be residents (Eddleman et al. 1994; Taylor and van Perlo 1998). Some anecdotal observations suggest Black Rails can rapidly disperse to new patches of suitable habitat.

Black Rails inhabit very shallowly flooded, densely vegetated salt, brackish, and freshwater marshes. They appear to tolerate a very narrow range of conditions within these habitats with the unifying features being persistent water coverage and extremely dense herbaceous vegetation. Too much or too little water at any time during the breeding season results in abandonment of the site. Historically, the relatively large populations within the Atlantic Coast range indicate that ideal conditions have most consistently been met in the highest and driest portions of coastal salt marshes, where flooding is infrequent and marsh is interspersed with very shallow water. However, smaller numbers of Black Rails have also been found in impoundments, freshwater wetlands, coastal prairies, and grassy fields where the proper habitat conditions are met (Watts 2016).

The first targeted surveys of Eastern Black Rails began in the late 1980s but it wasn't until the mid 2010s that comprehensive surveys were initiated across their full coastal breeding range (Watts 2016). The results of these surveys, combined with historical records compiled over the previous 150 years, reveal that the breeding population within the Atlantic Coast region has been experiencing a catastrophic decline over the past 30 years (Figure 2). Declines are particularly evident in the northern portion of the range where the species has experienced a range contraction of more than 450 kilometers (280 miles) (from Massachusetts to New Jersey; Watts 2016). The status of inland populations is more poorly understood as most inland records date to the late 19th and early 20th century (Watts 2016), although recent inland records suggest that remnant birds remain.

CONSERVATION NEED

On average, the Black Rail population across the Atlantic Coast range has experienced an estimated annual decline of 9% with a total estimated population loss of >90% since the 1990s (Watts 2016). Historical strongholds, including Elliott Island, MD and Cedar Island, NC, which once supported the largest concentrations of the species ever recorded, have dwindled to just a handful of birds or disappeared entirely during this time period (Watts 2016). In 2016, the Atlantic Coast population size was estimated at 355-815 breeding pairs (Watts 2016).



a. All records: 1836 - 2016

b. Recent records: 2011 - 2016

Figure 2: Counties with credible records of Eastern Black Rails during the breeding period (April 1-August 31; Watts 2016).

The Black Rail is now listed as a species of Greatest Conservation Need in all nine coastal states with historical populations from New York south to Florida. The subspecies is a Northeast and Southeast Regional Species of Greatest Conservation Need (RSGCN) of "Very High Concern" (one of only three bird species on the Northeast RSGCN list and one of ten in the Southeast) and is listed as state Endangered in five states along the Atlantic Coast and extirpated in one (Connecticut). The U.S. Fish and Wildlife Service (USFWS) has proposed that

the subspecies be listed as Threatened under the Endangered Species Act (ESA) (83 FR 50610, October 9, 2018).

Cedar Island National Wildlife Refuge high marsh Black Rail habitat. Craig Watson

Highly specific habitat requirements and a preference for high marsh habitats have presumably made Black Rails more vulnerable to a host of human stressors. Historical activities prior to 1980, including marsh ditching, draining, and conversion to agriculture or development have negatively impacted more than 90% of tidal marsh habitat in some states (Bourne and Cottam 1950) and have undoubtedly impacted the population, though very few data are available from this time period (Watts 2016). Large-scale conversion and draining of freshwater wetlands along with intensification of agricultural activities over the past century have also likely limited the availability of suitable inland habitats. However, recent survey data suggest that accelerated population declines began in the 1990s, after the impacts of many historical stressors had been absorbed by the population or alleviated through laws and policies (Watts 2016). Around this time, the rate of global sea level rise began to accelerate from 1.2 mm/yr between 1901-1990 (Hay et al, 2015) to 3.2 mm/yr between 1993-2010 (IPCC Report 2014). The area from Cape Hatteras, NC to Boston, MA experienced sea level rise three to four times greater than the global average (Sallenger et al, 2014), leading to more frequent inundation and loss of salt marsh habitat. This trend, along with nearly identical rates of decline over the same time period for the highly studied Saltmarsh Sparrow (Wiest et al. 2016) — also a high marsh specialist —has led scientists to presume that the primary driver of declines over the past three decades is nest loss associated with tidal inundation.

For a ground nesting species whose habitat requirements appear vulnerable to even small shifts in hydrological conditions, the relatively novel threat of accelerated sea level rise is unprecedented. The projected rate of sea level rise that is expected along the Atlantic Coast during the next century will challenge the persistence of this species in its historical tidal marsh habitats. Thus, urgent attention is required by partners across the species' coastal range to develop management practices that address the rapid loss of existing habitat and provide refugia —and ultimately, new habitat —to save Black Rails from the threat of extinction.

PURPOSE

The Black Rail Conservation Plan (hereafter "Black Rail Plan" or "plan'') outlines the key actions needed to restore and maintain a self-sustaining population of Black Rails along the Atlantic Coast and Florida Gulf Coast. It presents the major threats facing this species and its habitats, prioritized strategies needed to address these threats, and the collaborative actions necessary for long-term success. It represents the views of the ACJV Black Rail Working Group (hereafter "Working Group") and the larger network of partners working in salt marsh and Black Rail conservation. This plan includes discrete strategies with measurable and time-bound objectives that partners can use to evaluate success over time.

Eastern Black Rail. Michael L. Gray

SCOPE OF PLAN

This plan covers the portion of the Eastern Black Rail range that falls within the boundaries of the ACJV—from New York south along the Atlantic Coast and including both the Atlantic and Gulf Coasts of Florida. Collectively, this geography likely supports roughly 60% of the coastal population of Eastern Black Rail, with the remainder largely found along the Gulf Coast of Texas. The ACJV Management Board selected Black Rail as one of three flagship species and the scope of the plan is designed to provide a road map for ACJV member and partner organizations to implement conservation actions that conform to the extent of their various management authorities. However, the ACJV coordinated with Gulf Coast partners on the development of the plan, including establishment of population objectives, monitoring protocols, and development of conservation strategies that have relevance across the Black Rail coastal range.

Although most (90%) records of Black Rail in the ACJV region have been associated with coastal habitats (Watts 2016), this species can be found anywhere that suitable habitat conditions are met, including a variety of non-tidal inland wetlands. Given that Black Rails are experiencing precipitous population declines in salt marsh systems, the value of non-tidal habitats to sustain their populations is significant. This plan presents strategies for conservation that encompass the full spectrum of wetland habitats capable of supporting Black Rails, including salt marsh, impoundments, and managed and natural freshwater systems.

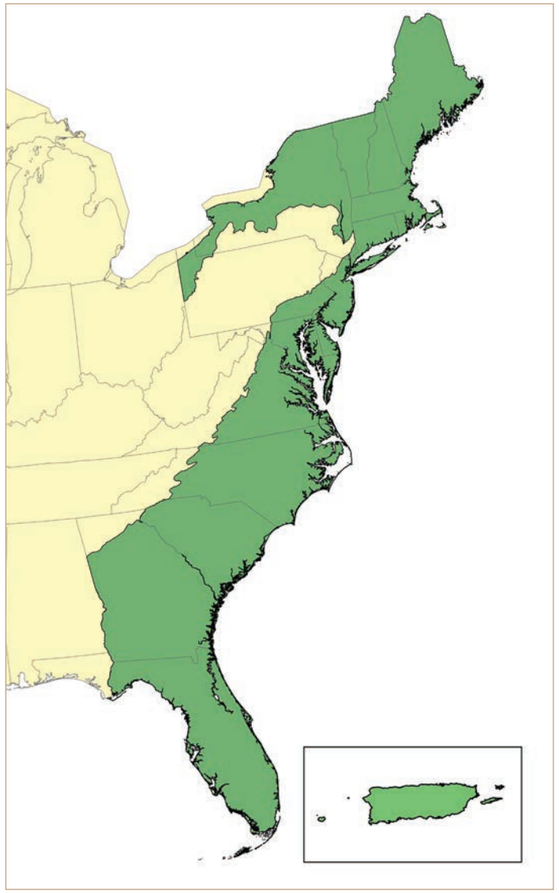


Figure 3: The Atlantic Coast Joint Venture is a regional partnership that collaborates to restore and sustain native bird populations and habitats throughout the ACJV region. The ACJV is comprised of 16 state wildlife agencies from Maine to Florida and the territory of Puerto Rico; federal and regional habitat conservation agencies; and other organizations that share our vision.

SALT MARSH BIRD CONSERVATION PLAN

The Black Rail Plan builds upon and expands on the foundational strategies developed through the Salt Marsh Bird Conservation Plan (hereafter 'Salt Marsh Plan') (Atlantic Coast Joint Venture 2019). The Salt Marsh Plan was developed to outline conservation strategies that will benefit the entire suite of salt marsh dependent bird species, including Black Rail. When developing the Black Rail Plan, the Working Group evaluated each of the eight strategies developed for the Salt Marsh Plan along with those strategies proposed specifically for Black Rail. Although all of the strategies in the Salt Marsh Plan are designed to benefit high marsh habitat and, presumably, the Black Rail, the Black Rail Plan includes only the Salt Marsh Plan strategy that is considered to be most critical to achieving Black Rail population objectives. The Black Rail Plan also expands the habitat scope of the Salt Marsh Plan to include non-tidal habitats that are likely to be critically important to conserving this species.

ACJV BLACK RAIL WORKING GROUP

An Eastern Black Rail Conservation and Management Working Group was established in 2009 out of growing concern for the population of this Black Rail subspecies. Chaired by the Center for Conservation Biology, the goal of the group was to bring biologists, managers, researchers and other interested partners together to collect and share information for the purposes of understanding the population status of the Eastern Black Rail and developing a conservation strategy. This original Working Group held numerous meetings, professional presentations and workshops over the next several years to raise the profile of the species and to develop momentum for conservation action. They also coordinated a series of Black Rail population surveys conducted across coastal portions of key states. Between 2014 and 2018, partners in New Jersey, Maryland, Virginia, North Carolina, South Carolina, Georgia, and Florida all completed surveys across priority habitats within their geographies. Data from this survey effort, along with a concurrently developed historical compilation of published and unpublished literature on the subspecies (Watts and Greene 2016), informed the development of an Eastern Black Rail status assessment (for Atlantic and Gulf Coast populations). This publication raised the alarm about Black Rail population declines and established an important benchmark on which to base future comparisons and conservation action.

Role of the Atlantic Coast Joint Venture

In 2016, the ACJV Management Board selected the Black Rail as one of three flagship species on which the partnership would dedicate coordinated conservation attention (along with Saltmarsh Sparrow and American Black Duck). The goal of the ACJV was to establish population and habitat objectives and to promote effective conservation action among partners across the Black Rail's range within the ACJV region. Due to the partnership's commitment to advancing Black Rail conservation, coordination of the Working Group within the ACJV region and development of a Black Rail Conservation Plan was transferred to the Joint Venture and the name was changed to the ACJV Black Rail Working Group. As of 2018, efforts to advance conservation of Black Rail in the Western Gulf and Great Plains regions were being coordinated by the Black Rail Working Group-Western Gulf Coast and Great Plains.

ACJV Black Rail Working Group Participants

Participation on the ACJV Black Rail Working Group is broad and includes members from each of the state wildlife agencies from New York to Florida, federal agencies, academic institutions, non-profit groups, municipalities and partners from the Gulf Coast region. The following members comprise the Core and Extended Teams of the Working Group:

The Center for Conservation Biology, Delaware Division of Fish & Wildlife, East Carolina University, Florida Fish and Wildlife Conservation Commission, Georgia Department of Natural Resources, Maryland Department of Natural Resources, Mississippi State University, National Audubon Society, New Jersey Division of Fish and Wildlife, New York State Parks, North Carolina Wildlife Resources Commission, Rutgers University, South Carolina Department of Natural Resources, Town of Kiawah Island, University of Connecticut, USFWS (Ecological Services, Landscape Conservation Cooperatives, Migratory Birds and National Wildlife Refuge System programs), and Virginia Department of Game and Inland Fisheries.

Additional state-level working groups have also been established to address conservation needs in key states and include members beyond those listed above. A full list of Working Group members can be found here.

In the western portion of the Eastern Black Rail range, conservation planning and associated activities have been coordinated by the Black Rail Working Group-Western Gulf Coast and Great Plains. This effort was specifically coordinated by the Texas Comptroller's Office and Texas Parks and Wildlife Department and included a host of partners similar to the ACJV Black Rail Working Group. The group has met three times since 2017, outlined the scope and vision for conserving the Black Rail in this region, developed science and conservation needs, and described the ongoing collaborative efforts of the partners in this region. Several key

individuals were members of both groups to ensure coordination and collaboration between the two regions. As of 2019, changes in staff and resource limitations within state agencies makes the status and future of this group unclear.

ACKNOWLEDGMENTS

This Black Rail Plan is the result of a great deal of work by many individuals and organizations from across the Atlantic and Gulf Coasts. The ACJV sought to engage every state and federal wildlife agency in the ACJV portion of the Black Rail range along with non-profit organizations and academic institutions. The bulk of the plan was developed by the ACJV Black Rail Working Group's Core Team members: Whitney Beisler, Ruth Boettcher, David Brinker, Christina Davis, Chris Elphick, Christy Hand, Kevin Kalasz, Mike Legare, Todd Schneider, Amy Schwarzer, Amy Tegeler, Bryan Watts, Craig Watson, and Aimee Weldon with additional help from John Stanton, Mark Woodrey, and Woody Woodrow. Caitlin Snyder, Nicole Rankin, Jennifer Wilson, Woody Woodrow, and Whitney Beisler led the development of the Eastern Black Rail Species Status Assessment from which much of the background text for this plan was drawn. Adrienne Marvin and Caroline Stem from Foundations of Success provided significant support in coordinating development of the plan's components. Dozens of other partners participated in the Working Group's planning workshop and numerous conference calls and reviewed and edited the plan, including members of the Black Rail Working Group's Extended Team.

Members of the ACJV Black Rail Working Group. Aimee Weldon

BLACK RAIL HABITAT

Black Rails are extremely secretive in nature and often inhabit remote locations that are inaccessible to humans. Little is known about their life history or the specific habitat features Black Rails require. Large areas of seemingly suitable habitat often support no rails, suggesting that they are responding to something in their environment that is not perceptible or not known to human observers. In the areas where Black Rails are known to occur, common habitat features include:

- **Dense, herbaceous vegetation**. Overall, plant structure appears to be more important than species composition (Flores and Eddleman 1995) although grassy vegetation typically dominates vegetative cover (>80%) (See Table 4). The dominant vegetation recorded in Black Rail habitats can range from *Spartina* species in salt marsh habitats to bulrushes, sedges and cattails in brackish and freshwater marshes provided there is high stem density and canopy coverage (multiple sources, U.S. Fish and Wildlife Service 2018). Black Rails also fly very little during the breeding and wintering seasons and depend on dense vegetation to provide overhead cover as they navigate on foot through tunnels under marsh grasses (Taylor and van Perlo 1998).

- **Very shallow permanent water**. Water generally ranges from moist soil to ~3 cm in depth. Importantly, these conditions must be perennially available - areas where persistent shallow water conditions can be maintained appear to be favored while areas that tend to dry up in the summer or that pool more deeply or seasonally (e.g., depressional wetlands, some impoundments managed for waterfowl) tend to be avoided by Black Rails (Richmond et al. 2010).

- **Topographic diversity**. Topographical variation provides resiliency in nesting by providing elevated refugia to escape high water events caused by rainfall or tidal inundation while nearby depressional areas can support small invertebrate food sources that rails depend upon (Eddleman et al. 1994).

Black Rails can occupy relatively small wetlands within a metapopulation structure. Black Rail home ranges for males within the ACJV region averaged 5.75 acres across two studies in Florida (Legare and Eddleman 2001) and Maryland (Weske 1969). Gulf coast home ranges averaged 2.9 acres across two studies in Texas (Haverland 2019) and Louisiana (Johnson and Lehman 2019) while California Black Rail home ranges averaged 1.2 acres from studies in California (Flores and Eddleman 1991) and Arizona (Tsao et al. 2009).

COMMON HABITATS THAT SUPPORT BLACK RAIL WITHIN THE ACJV

Tidal Salt Marshes

This habitat has historically supported the most recorded Black Rails. Black Rails are associated most closely with high marsh habitat near the wetland-upland transition zone where flooding occurs infrequently on the highest lunar or storm-driven tides. Salt marsh vegetation varies throughout the ACJV geography but is often dominated by *Spartina* species and can include shrubs near the upland edges.

Impoundments

Impoundments include a variety of habitats where water is actively or passively managed to permit water level control for purposes such as waterfowl habitat creation, aquaculture, agriculture, flood control, hurricane protection, mosquito control, and control of marsh subsidence and erosion (US Army Corps of Engineers). Examples include, but are not limited to, managed tidal impoundments, moist soil units, old rice fields, and wetland mitigation sites. Water levels are manipulated using pumps, rice trunks, riser boards, and other water control structures. Most impoundments are too deep for Black Rail use during the breeding season if managed

without consideration of the species' habitat preferences; however, when appropriate conditions exist, portions of managed tidal impoundments have been shown to attract and retain Black Rails (Roach and Barrett 2015; Hand et al. 2019).

Freshwater Wetlands

This habitat includes a variety of non-tidal emergent wetlands, including wet meadows and prairies, cattail and sawgrass marshes, and natural or managed areas of sheet flow with dense vegetation. The vast sawgrass meadows and inland prairies of South Florida likely provide abundant nesting habitat. North of South Florida, continuous overhead vegetation is most commonly found in tidal marsh lands. However, at least 10% of historical records originated from non-tidal wetlands (Watts 2016). Likely much more common before intensification of agriculture, suitable freshwater habitat conditions can still be found or created on lands where perennial water sources result in consistently wet, but shallow marsh lands with dense vegetation. Sloped wetlands (Nadeau and Conway 2015) with gently flowing water may be particularly attractive due to the ability for Black Rails to move to higher elevations during high water events and for reliable water levels to be more easily maintained throughout the nesting season (Richmond et al. 2010). In South Florida, Black Rails appear to occupy areas with some topographical variation that results in either wet areas in an otherwise dry landscape or dry areas in an otherwise wet landscape (Watts 2020 pers. comm.). Although non-tidal habitats historically played a minor role in supporting Eastern Black Rail populations, the value of freshwater wetlands will continue to rise as tidal marshes become increasingly unsuitable due to sea level rise.

Black Rail habitat in the Everglades. Craig Watson

GOALS & OBJECTIVES

POPULATION ESTIMATE AND OBJECTIVES

The most recent Black Rail population estimate within the ACJV region is 355-815 breeding pairs (Watts 2016). The ACJV Black Rail Working Group developed a population objective for the ACJV region that considers both short-term and long-term phases needed to maintain a viable population. The immediate need is to stabilize the population and prevent it from experiencing a prolonged period below a minimum population size threshold that is expected to have adverse genetic consequences. A long-term effort will be required to recover the population to a size and distribution where it is both self-sustaining and resilient.

Short-Term Objective: Stabilize the population at >300 pairs across four population centers by 2025.

The current generic recommendation for an effective population size required to avoid inbreeding depression is to ensure the population does not drop below 100 individuals for more than five generations (Frankham et al. 2014). Genetic assessments indicate that a ratio of actual population size to effective population size of 10:1 is not unusual (Frankham 1995), suggesting a loss of genetic robustness as the population dips below 1,000 individuals. Given the most recent population estimate of 355-815 pairs and the fact that the population has become highly fragmented over the past two decades, the Black Rail may already be losing genetic diversity. In order to slow additional loss of genetic diversity, we propose to stabilize the population above 300 pairs by 2025. This proposed population floor is considered appropriate based on our limited data and the feasibility of the ACJV partnership to affect the estimated trajectory of the population.

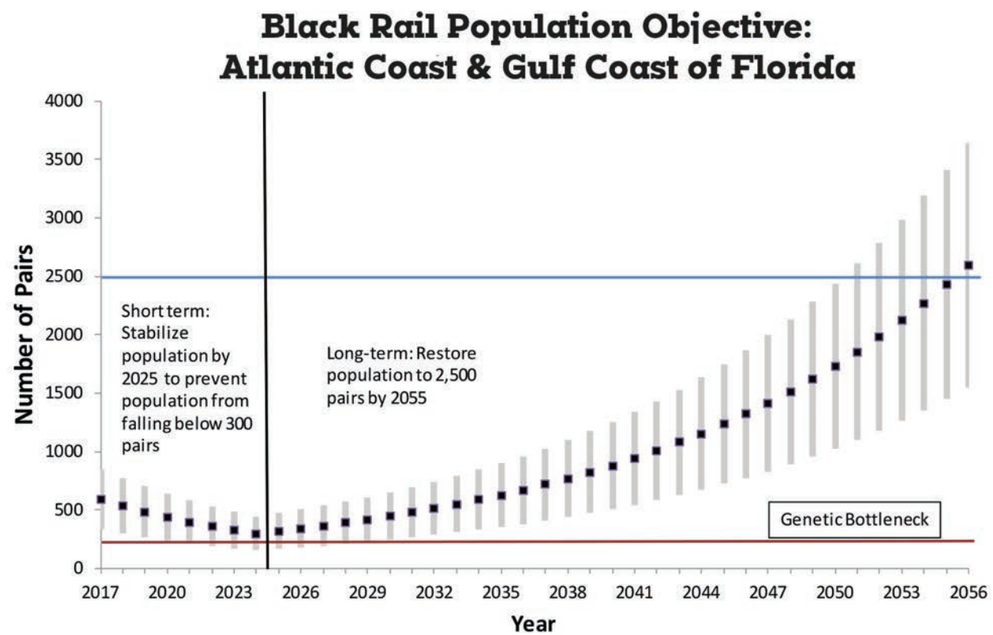


Figure 4: Diagram of hypothetical population trajectory for Black Rail and recovery to population objective for the Atlantic Coast Joint Venture geographic area.

In order to facilitate future recovery and maintain genetic diversity, the Working Group proposed to maintain at least four population centers, initially:

1. New Jersey (40 pairs)
2. North Carolina (40 pairs)
3. South Carolina (40 pairs)
4. Florida (180 pairs)

As of 2017, these four states supported the greatest abundance of breeding Black Rails, although populations outside of Florida appear to be declining rapidly. However, the best available information suggests that conservation action should focus on stabilizing and growing populations in these centers. Additional centers will also be identified and established, as appropriate, in historical locations where suitable habitat conditions can be created or restored, and/or where populations can be linked by dispersal to existing Black Rail populations as determined through recent survey data and habitat prioritization mapping.

Long-Term Objective: Grow population to 2,500 pairs with at least five viable population centers by 2070.

Several studies have examined minimum viable population estimates for a variety of species across taxonomic groups and mean values consistently fall within the range of 4,000 (Traill et al. 2007) to 7,000 (Reed et al. 2003) individuals. Since sustaining a viable population along the Atlantic Coast is the ultimate goal, meeting a biological threshold of 5,000 individuals is reasonable. Because resiliency is an additional consideration, the objective is to grow and maintain a minimum of five population centers distributed throughout the Black Rail's historic range. Population build-out should occur through progressive expansion of existing nodes into areas once inhabited by breeding Black Rails that no longer support them (see Table 1). Existing population centers should be maintained in New Jersey, North Carolina, South Carolina, and at least two populations in Florida. Mid-term expansion of the population should include historical locations within reasonable dispersal distance from existing nodes where additional suitable habitat could be created (Maryland, Delaware and Georgia) while long-term expansion would include building out to repopulate areas in southern New England, Pennsylvania and Virginia where Black Rails have largely been extirpated (Table 1).

Population growth efforts should also aim to greatly expand the amount of suitable Black Rail habitat in non-tidal locations. At least 50% of the Black Rail population will need to be supported outside of natural tidal marshes in order to achieve the 2,500 pair goal (Table 1).

Suitable habitat is imperative for population growth. Christy Hand, South Carolina Department of Natural Resources

Table 1: Near term and long-term objectives by state based on 2016 estimates (Watts 2016). Population estimates will be updated as new data become available.

		Near Term (2025) Population Objectives (pairs)			Long-term (2056) Population Objectives (pairs)		
Conservation Region	**State**	**Population Center Goals**	**2016 Estimated**	**% of population (based on avg of 585 pairs)**	**Non-tidal**	**Tidal**	**Total**
Florida	Florida	180	200-500	59.8%	725	725	1,450
South-Atlantic/ Piedmont	North Carolina	80	100-200	25.6%	313	313	625
	South Carolina						
	Georgia						
Mid-Atlantic	Pennsylvania	40	55-115	14.5%	163	163	325
	New Jersey						
	Delaware						
	Maryland						
	Virginia						
Southern New England	Massachusetts	0	0	0.0%	50	50	100
	Rhode Island						
	Connecticut						
	New York						
	Total	**300**	**355-815**	**100%**	**1,250**	**1,250**	**2,500**
Current Population Center							
Near-term restoration/habitat creation							
Long-term restoration/habitat creation							

Currently, demographic information and life history metrics are inadequate to estimate population growth potential for the Eastern Black Rail. However, Black Rails generally lay large clutches, re-lay rapidly after nest failure, and anecdotal evidence indicates they can produce a second successful brood within a breeding season (Hand 2017a), suggesting that without current constraints, population growth could be rapid. Growth rates for similar species range from 5-10% per year under optimal circumstances, so a growth rate of 7% per year was used to estimate the long-term recovery period (Newton 1998). However, this estimate is largely theoretical given our lack of knowledge of what is limiting populations and how to address the threats. Even under this optimistic scenario, achieving an increase in population size to 2,500 pairs would require approximately 40 years. Establishment of future centers (i.e., creation, enhancement or restoration of habitat and recruitment of birds) will draw from the strategies outlined in this plan along with lessons learned on the ground through an adaptive management framework. This strategy to rebuild Black Rail populations includes a 5-year evaluation cycle.

Habitat Objectives

The long-term habitat objective is to provide sufficient habitat to support 2,500 breeding pairs of Black Rails across the ACJV range. The average home range size from two studies conducted within the ACJV area (5.75 acres) (Legare and Eddleman 2001; Weske 1969) was used as a conservative estimate to calculate sufficient habitat to support this population. Assuming that an occupied patch is occupied by a pair, roughly 14,375 acres of high quality habitat would be needed to support the population objective. However, it is important to note that these 14,375 acres must be embedded in a much larger landscape of potentially suitable wetland habitats since the exact conditions preferred by Black Rails shift over space and time and birds will only be able to use a fraction of the available habitat at any given time.

Building the Population

In the near term, the aim is to create or enhance suitable Black Rail habitat in close proximity to occupied habitat so that Black Rails can relocate should their preferred patches become unsuitable or should they need refugia during storms or other high water events. These population centers include coastal locations in New Jersey, North Carolina, and South Carolina, and coastal and inland locations in Florida. In the medium term, habitat acreage must expand to new or historical locations that have supported Black Rails in recent history and are relatively close to existing centers, including areas in Delaware, Maryland, and Georgia. As the Black Rail population successfully expands into more recently occupied habitats, the focus can turn to reestablishing Black Rail habitat in areas of Southern New England (Massachusetts, Rhode Island, Connecticut, New York) and parts of the Mid-Atlantic (Pennsylvania and Virginia) farther from existing nodes/centers and where populations have been lost for some time.

Increasing Non-tidal Habitat

Since the ability of natural tidal marshes to support breeding Black Rails will continue to diminish as sea level rise renders many locations unsuitable, the habitat goal includes creating enough acreage to support at least 50% of the future Black Rail population in non-tidal locations where they are removed from the threat of sea level rise. Exactly where this habitat should exist on the landscape remains to be determined and it is therefore too difficult to predict what the long-term contribution of each state will be to supporting future Black Rail populations at this time. Likely the future distribution of Black Rails will look very different from the current distribution with some states playing a much larger role in supporting Black Rail populations in inland habitats than they have historically played in supporting coastal populations. At this time, the habitat objectives represent an even split between tidal and non-tidal locations. This table will be updated in future iterations of this plan as on-the-ground management helps to inform how to successfully create new non-tidal habitat (Table 2).

Table 2: Population estimates and associated minimum long-term habitat objectives by region.

Conservation Region	State	Non-tidal population objectives (pairs)	Tidal population objectives (pairs)	Total (pairs)	Non-tidal habitat objectives (acres)	Tidal habitat objectives (acres)	Total (acres)
Florida	Florida	725	725	1,450	4,168	4,168	8,336
South-Atlantic/ Piedmont	North Carolina	313	313	625	1,800	1,800	3,600
	South Carolina						
	Georgia						
Mid-Atlantic	Pennsylvania	163	163	325	935	935	1,870
	New Jersey						
	Delaware						
	Maryland						
	Virginia						
Southern New England	Massachusetts	50	50	100	285	285	570
	Rhode Island						
	Connecticut						
	New York						
	Total	**1,250**	**1,250**	**2,500**	**7,188**	**7,188**	**14,375**

Current Population Center

Near-term restoration/habitat creation

Long-term restoration/habitat creation

Acreages were calculated by multiplying the number of breeding pairs by the average home range size of Black Rails in the ACJV area (5.75 acres)

An Adaptive Management Approach

Black Rail populations are declining rapidly while managers have little understanding of which conservation and management actions are most effective at reversing those declines. Success in achieving population objectives hinges on our ability to learn quickly and implement the most effective management practices on the ground in the shortest amount of time possible. To this end, ACJV partners in collaboration with the U.S. Geological Survey (USGS) are developing an adaptive management framework to evaluate performance among a range of management actions across the Black Rail range in the ACJV region.

The adaptive management framework consists of two parts: 1) development of a decision support tool and 2) development and testing of on-the-ground projects. Partners will identify critical research questions, management objectives, and a list of priority management strategies to evaluate. This information will be used to develop a decision support tool that gathers management, bird, and habitat data and uses it to make predictions about which strategies are most beneficial to the Black Rail. Interested partners will then test and monitor the effectiveness of these management strategies on a pilot scale from New Jersey to Florida to help inform the tool. As more projects are added, the performance of each management action can be more effectively evaluated and the strength of the predictions will continue to grow. Using this framework, partners can actively inform future management decisions and ensure that the amount of suitable habitat increases as quickly as possible.

As part of this project, USGS in partnership with the ACJV Black Rail Working Group will develop the following products:

- Standardized protocols for bird surveys and habitat response;
- List of priority research questions;
- List of priority management activities/strategies to test;
- A database to enter and track data related to management action; and
- A modeling framework to inform decision-making.

Pilot testing of promising management techniques has already begun with partners in SC, FL, and MD who are implementing or exploring projects focused on hydrological manipulation of impoundments, experimental burns, and artificial creation of sheet flow wetlands.

Testing water level management and vegetation response with a rice trunk for Black Rail habitat management. Craig Watson

MAJOR THREATS

THREATS ASSESSMENT

Evaluating threats is a central part of conservation planning and forms the basis for prioritizing and selecting conservation strategies. Threats were identified and rated by a broad group of partners and experts (Table 3). To quantify threats, the following three criteria were considered for each category of threat, using a four-point qualitative scale (for more details, see this guide):

- **Scope or Extent**. Geographic area of impact on the biodiversity target (where the target naturally occurs) that can reasonably be expected within 10 years under current circumstances (i.e., given the continuation of the existing situation).
- **Severity**. The level of damage to the conservation target that can reasonably be expected within 10 years under current circumstances (i.e., given the continuation of the existing situation).
- **Irreversibility**. Degree to which the effects of a threat can be undone (and the target restored).

See Appendix 1 for the individual criteria scores, which were used to determine the overall threat rating for Black Rail (Table 7). The suite of threats that we considered are described below.

Table 3. Black Rail Threat Ratings

Direct Threats	Summary Threat Rating
Loss of Habitat and Potential Nest Flooding due to Sea Level Rise*	Very High
Loss of Habitat due to New Residential Development ᴪ	Very High
Loss of Habitat Quality due to Increased Temperature & Drought ᴪ	High
Direct Mortality and Nest Loss due to Storms and Flooding*	High
Agricultural Practices Incompatible with Black Rail Habitat*	High
Marsh Burning Inconsistent with Species Needs*	High
Land Use Incompatible with Marsh Migration*	High
Incompatible Management of Impoundments*	Medium
Existing Development Impacting Black Rail Habitatᵞ	Medium
Invasive Non-native Speciesᵞ	Medium
Degradation of Habitat due to Open Marsh Water Managementᴪ	Medium
Disease (e.g., West Nile)ᴪ	Medium
Problematic Native Speciesᵞ	Medium
Transportation Infrastructure that Restricts Tidal Flowᵞ	Medium
Shoreline Hardeningᵞ	Low
Disruptive Birding, Recreation, & Researchᴪ	Low
Oil spillsᵞ	Low

*Key: * Covered in the Black Rail Conservation Plan; ᵞ Covered in the Salt Marsh Bird Conservation Plan; ᴪ Not covered in either plan*

HISTORICAL THREATS

Historically, the primary threats to the Eastern Black Rail included habitat degradation and fragmentation. Black Rails use the highest and driest portions of the salt marsh, making their habitat particularly vulnerable to human impacts. Reclamation programs in the late 1800s and early 1900s converted much of this high marsh habitat to agriculture and urban lands (Tiner 1984;Dahl 1990), including construction of major cities such as New York, Boston, and Philadelphia, which all sit on historical Black Rail sites (Watts 2016). Marsh ditching for mosquito control and agriculture was also prevalent through much of this time period and by the 1940s, more than 90% of the marshes from Virginia to Maine had been ditched (Bourne and Cottam 1950) while 50% of marshes in the mid-Atlantic had been impounded or altered (Smith et al. 2017). Extensive habitats were converted to pasture in some areas, including the vast inland prairie systems of Florida. In the Piedmont and mountain regions, Black Rails were regularly found in hay meadows that were harvested by hand (Watts 2016). With the dawn of the tractor and other modern farming practices, much of this habitat was lost by the 1950s.

THREATS ADDRESSED IN THIS PLAN

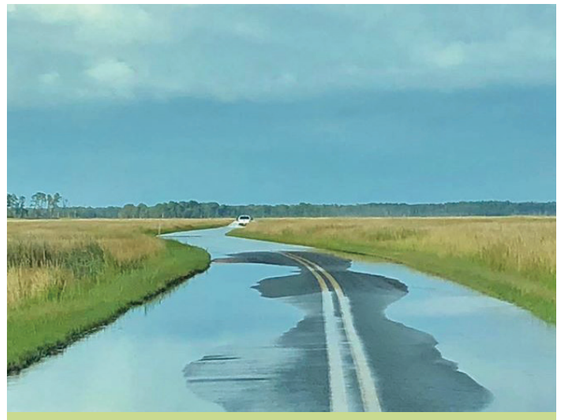
Although much more regulated today, historical threats, including urban expansion and impacts to hydrology, continue throughout much of the Black Rail range. These impacts are presumed to be exacerbated by modern threats related to ongoing sea level rise, proliferation of invasive species such as *Phragmites*, expansion of new residential and transportation development, and disease (e.g., West Nile).

The conservation strategies for this plan were developed to address the threats the Working Group determined to be highly detrimental to Black Rail populations and could be measurably influenced. Therefore, some high priority threats over which partners have little control are not addressed in this plan, such as Loss of Habitat Quality due to Increased Temperature and Drought and Loss of Habitat due to New Residential Development. A strategy was also developed around one Medium threat, Incompatible Management of Impoundments. The Working Group agreed that addressing this threat represents a significant conservation opportunity because of improved impoundment management techniques that may yield future Black Rail habitat. Several of the medium and low priority threats not addressed in the Black Rail Plan are comprehensively covered in the Salt Marsh Plan (see Table 2 key in this Plan), which is designed to benefit the entire suite of salt marsh dependent birds. The text below summarizes each of the major threats addressed in this plan much of which has been adapted from the Eastern Black Rail Species Status Assessment Version 1.2 with permission (U.S. Fish and Wildlife Service 2018).

Direct Mortality and Nest Loss due to Flooding

Sea Level Rise

Global mean sea level has risen about 20.3 to 22.9 cm since 1880, with approximately one-third of that rise occurring since 1993 (Sweet et al. 2017a). In the United States, the rate of sea level rise has been higher than the global rate along the Northeast Atlantic coast over the last several decades (Sweet et al. 2017b) and is projected to have amplified relative sea level rise greater than the global average under almost all future sea level rise scenarios through 2100 (Sweet et al. 2017b). In South Carolina, sea level has risen by 3.3 cm (1.3 in) per decade, nearly double the global average, and the number of tidal flood days has increased (Runkle et al. 2017b). Similarly in Florida, sea level rise has resulted in an increased number of tidal flooding days, which are projected to increase into the future (Runkle et al. 2017a). Although little is known about the precise cause of Black Rail declines, their narrow habitat and hydrological requirements suggest that nest flooding is an important



Flooded roads due to sea level rise. Craig Watson

driver of population declines. Increased high tide flooding from sea level rise will continue to exacerbate this threat.

Storms and Flooding

As global climate changes and temperatures increase, extreme weather events will become more frequent and intense. Severe storms and rainfall events (e.g., hurricanes, tropical storms, thunderstorms, and precipitation fronts) are predicted to increase in number and intensity (Bender et al. 2010). Major rain events can inundate Black Rail habitat and can completely displace Black Rails for long periods of time. An increase in the intensity and frequency of flooding events will lead to greater nest losses. Young chicks can also perish if water levels rise above ~2.5cm unless elevated refugia are available for escape (U.S. Fish and Wildlife Service 2018). Likewise, adults undergo a full post-breeding molt that renders them flightless for several weeks (U.S. Fish and Wildlife Service 2018). This molt coincides with hurricane season, making them more vulnerable to major storms and flooding events and increased predation during this time, particularly in marshes that lack elevated refugia and/or that drain slowly (e.g., impoundments). Extreme flooding forces rails from their usual dense cover or to swim in search of higher ground, making them susceptible both to drowning and to aerial predators (Evens & Page 1986).

Climate change causes more frequent and heavy storms which in turn causes marsh shorelines to erode like this one near the Karen Noonan Center in Crocheron, MD. Will Parson/ Chesapeake Bay Program

Loss of Habitat

Increased flooding from sea level rise and storm events will impact habitat as high marsh areas that historically flooded only on peak high tides begin flooding more frequently. This is overwhelming habitat persistence and reducing the availability of suitable habitat for the Black Rail as high marsh vegetation converts to more flood tolerant vegetation or open water (Warren and Niering 1993; Morris et al. 2002).

Agricultural Practices Incompatible with Black Rail Habitat

Haying and Mowing

Haying and mowing are used throughout the range of the Eastern Black Rail. These practices can have detrimental impacts to the Black Rail when used too frequently or during breeding or flightless molt periods. When mowing is alternated across a site to allow areas of unmown habitat at all times, the site can continue to support cover-dependent wildlife such as the Black Rail (U.S. Fish and Wildlife Service 2018).

Grazing

Cattle grazing occurs on public and private lands throughout the ACJV range of the Black Rail. Because Black Rails occupy drier areas in wetlands—or wetter areas in dry habitats—and require dense cover, they are believed to be more susceptible to grazing impacts than other rallids (Eddleman et al. 1988). Based on current knowledge of grazing and Black Rail occupancy, the specific timing, duration, and intensity of grazing will result in varying impacts to the Black Rail and its habitat. Light to moderate grazing may be compatible with occupancy under certain conditions, while intensive or heavy grazing that removes dense overhead cover is likely to have negative effects on Black Rails and the quality of their habitat (U.S. Fish and Wildlife Service 2018).

Marsh Burning Inconsistent with Species Needs

Fire suppression has been detrimental in allowing woody plant encroachment into habitats used by the Black Rail. Without fire or alternate methods for disturbing woody vegetation, such as mowing, the amount of suitable habitat for Black Rails is expected to decrease in some regions (Grace et al. 2005). Therefore, prescribed fire can maintain habitat for this subspecies at the desired stage of ecological succession.

When conducting growing season prescribed fires, there are tradeoffs between the long-term benefits to Black Rail habitat and the short-term direct impacts on individual Black Rails. Fall and winter season burns are more likely to avoid reproductive season impacts (Nyman and Chabreck 1995). However, early growing season burns are more successful at reducing shrub encroachment than are dormant season burns (Strong et al. 1993; Drewa et al. 2002; Barlow et al. 2015), and a failure to control such encroachment will lead to eventual loss of suitable breeding habitat conditions. Using spring fire can promote growth of *Spartina patens* over *Schoenoplectus americanus*, reinforcing the important role that fire can play in establishing preferred vegetation for Black Rail (Nyman and Chabreck 1995). Given the suite of tradeoffs between mortality and long-term maintenance of habitat conditions, land managers and Black Rail experts need to collaborate to determine best practices for prescribed fire in Black Rail habitat.

The pattern and extent of prescribed fire can have profound negative effects on birds. Prescribed fire can result in indirect rail mortality as avian predators attracted to smoke are able to capture rails escaping these fires (Grace et al. 2005). Additionally, ring, expansive, or rapidly moving fires are not conducive to rail survival (Legare et al. 1998; Grace et al. 2005), as this could result in direct mortality of Black Rails concealed in cover and/or not able to escape the fire. Prescribed fire designed to allow patches of cover to remain unburned may positively influence Black Rail survival. For example, burning 90% of a 2,400-acre marsh in Florida resulted in direct mortality of at least 39 Black Rails, whereas a mosaic of unburned vegetation patches 0.1-2.0 acres in size facilitated Black Rail survival during a 1,600-acre prescribed fire (Legare et al. 1998). Unburned strips of vegetation within a marsh occupied by Black Rails provide escape cover from fire and avian predators.

Land Use Incompatible with Marsh Migration

The marsh migration zone—the area upslope of existing salt marshes where marshes are expected to migrate landward—is a promising target for Black Rail habitat creation. Black Rails are restricted to the highest and driest portions of the salt marsh where frequency of flooding is lowest. The marsh migration zone may offer a last place of refugia within the salt marsh system for Black Rails. However, these lands are threatened by development and agricultural land uses. From Massachusetts to Florida, over 40% of the land below one meter is currently developed and almost 60% of the remaining land (Titus et al. 2009) is expected to be developed in the future. Associated shoreline hardening (via sea walls, dikes, bulkheads, jetties etc.) designed to protect coastal communities now covers 14% of the entire U.S. coastline and affects >50% of the shoreline (Gittman et al. 2015) in some areas. Hardened land uses associated with development block the migration of tidal wetlands inland. Marsh plants up against migration barriers are unable to keep pace with sea level rise and eventually die off, converting to open water. Shoreline armoring also exacerbates wave energy in adjacent areas, which erodes (National Research Council 2007) existing beach or shore and ultimately

Residential developments impeding marsh migration. Tony Zarimba

increases water depth. This can lead to 'cascading degradation' (Scyphers et al. 2015) where hardening by some landowners encourages or necessitates hardening by others who face increased erosion; in some places this has left little or no intertidal habitat (i.e., vegetated marsh) on the seaward side of barriers. Marshes in these developed areas are experiencing a 'coastal squeeze', where sea level rise and erosion continuously shrink and submerge salt marsh.

Incompatible Management of Impoundments

Throughout the range of the Eastern Black Rail, large areas of marsh on both public and private lands have been impounded (altered by physical means to permit water level control) and are managed primarily for migratory waterfowl. Current management prescriptions of most impoundments result in water levels that are too deep for Black Rail use and thus provide unsuitable habitat. Because Black Rails have such precise habitat requirements, waterfowl habitat management practices that are compatible with several other rallid species still may not support Black Rails (Eddleman et al. 1988). Extreme rain events can also create catastrophic flooding that results in nest failure (Legare and Eddleman 2001) within impoundments, which are designed to retain water and often are slower to drain than unimpounded tidal marsh. During flooding events, predation of birds may occur when rails are forced to leave the cover of vegetation to move to higher ground. Storms occurring during August and September, when adult rails are temporarily flightless during molt and some juvenile rails have not fully fledged, may lead to particularly high mortality (Hand 2018).

THREATS TO BLACK RAIL NOT ADDRESSED IN THIS PLAN

There are a number of threats that the Working Group identified as influencing the Black Rail population. They are not included in the plan because the Working Group decided that partners had little ability to influence these threats, they were not the main threats impacting Black Rails, and/or they were already being addressed in the Salt Marsh Plan. These threats include New and Existing Development; Shoreline Hardening; Transportation Infrastructure; Loss of Habitat Due to Increased Temperature and Drought; Degradation of Habitat Due to Open Marsh Water Management; Invasive Non-native Species; Disease; Problematic Native Species; Disruptive Birding, Recreation and Research; and Oil Spills. See Appendix 2 for a more comprehensive description of these threats.

Well protected and managed habitat improves conditions for Black Rail survival. Woody Woodrow

IMPLEMENTATION STRATEGIES

The strategies, actions, and objectives developed for this plan were selected by members of the ACJV Black Rail Working Group at a planning workshop in 2018. The Working Group identified seven new strategies thought to be important for addressing priority threats to the Black Rail and evaluated them along with seven strategies that were developed for the Salt Marsh Plan. The group then ranked these 14 strategies according to which had the greatest ability to achieve the ACJV Black Rail population objective (see Appendix 3). Five priority strategies were selected, one of which includes a strategy developed for the Salt Marsh Plan. These strategies address what the Working Group has identified as the most promising actions to conserve Black Rail in the ACJV region. They include the following:

Habitat Conservation Strategies (protect, restore, enhance)

- Create New Non-tidal Black Rail Habitat
- Promote Targeted Impoundment Management
- Develop and Promote Black Rail-Friendly Fire Management BMPs
- Develop and Promote Agricultural BMPs
- Develop and Implement BMPs to Facilitate Marsh Migration and Offset Losses

Outreach, Engagement and Policy Strategy

- Develop a Landowner Assurance Program

Strategies were developed using logic models, also known as "results chains." Each diagram illustrates the sequence of actions needed to produce a desired result, including assumptions underlying each step in the chain. The goal is for results chains to clearly articulate a set of actions believed to influence a situation, explicitly defining relationships among actions, impacts of actions, and how they lead to the desired outcomes. All strategies are designed to move us toward the shared goal of achieving a sustainable population of at least 2,500 breeding pairs of Black Rail (Figure 4). See Appendix 3 for a list of the strategies that were considered by the Black Rail Working Group for inclusion in the plan.

PRIORITY CONSERVATION STRATEGIES AND DESCRIPTIONS

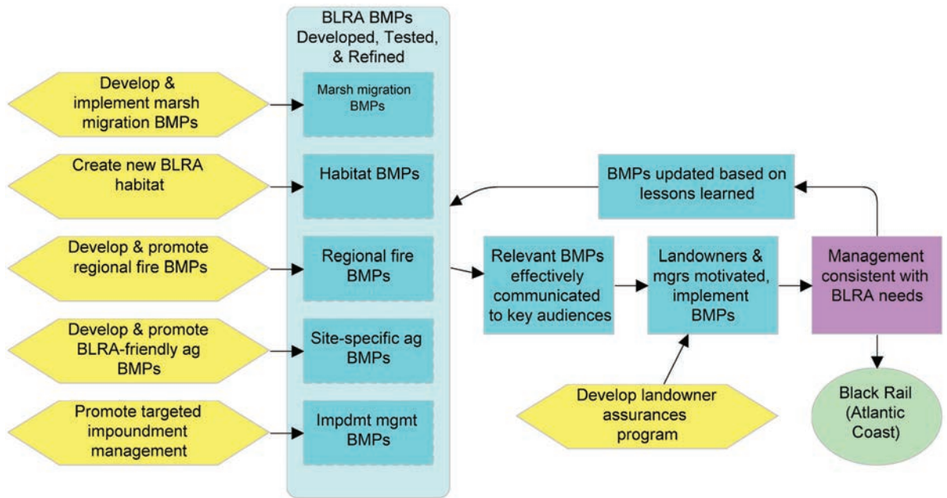


Figure 5. Simplified diagram of habitat conservation strategies.

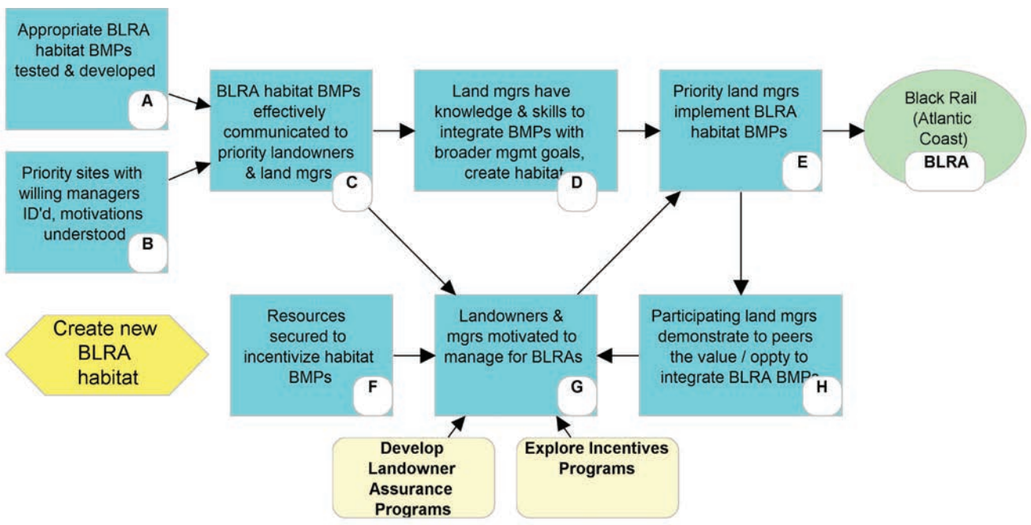
CREATE NEW NON-TIDAL BLACK RAIL HABITAT

Inland non-tidal sites such as the Easton Water Treatment Plant holds promise for providing future habitat for Black Rails. Easton Water Treatment Plant

Historically, the vast majority of Eastern Black Rail records have come from the outer coast, most commonly in coastal high marsh habitats. However, Black Rails are not salt marsh obligates and at least 10% of recorded observations have come from inland locations. The majority (>60%) of these records were recorded before 1950, likely due to more widespread availability of habitat prior to mechanical farming techniques as well as greater likelihood of observation by those working the land. However, inland observations continue to the present, suggesting that if suitable habitat is available, it can be colonized by Black Rails. These habitats will become increasingly important as historical tidal marsh habitats continue to degrade due to sea level rise. Although Black Rails are adapted to some level of flooding, they do not appear to be capable of absorbing the rapid changes this system is undergoing and are not likely to persist in most natural tidal habitats.

In order to achieve the population objective, the Working Group estimated that new inland habitat must be created to support at least 1,250 pairs (~50%) of our 2,500 pair goal. This will require developing new methodologies to create suitable habitat in freshwater systems to expand the availability of Black Rail habitat. Early efforts to create or restore non-tidal habitat should focus on those places most likely to attract Black Rails—either through expansion of nearby occupied habitat or creation of habitat in areas that historically supported relatively large numbers of Black Rails.

Strategy Logic



Strategy Description

This strategy is designed to help increase and improve Black Rail habitat in inland systems. More specifically, implementing this strategy will allow us to identify, develop, and test Black Rail habitat BMPs (A). Relevant to this and other strategies is the importance of understanding Black Rail habitat needs and using this understanding to select priority sites for habitat creation and willing managers across those sites (B). The Working Group would share appropriate practices across priority sites with key landowners and managers in a format that is suitable to their needs and that provides the guidance they need to take action (C). If we are successful in effectively reaching these landowners and managers, then we expect they will have the knowledge and skills needed to integrate and implement BMPs and habitat management practices favorable to Black Rail, while also considering the needs of other species (D & E). To help these landowners and managers to implement appropriate habitat practices, it will be important to have the right incentives and sufficient resources in place that will help motivate them to manage for Black Rails (F & G). Participating landowners must also demonstrate to their peers the benefits of integrating the Black Rail habitat practices on their land (H). We expect that where habitats are created and managed according to these recommended practices, potential Black Rail habitat will increase, both in quantity and quality, ultimately leading to an increase in the overall population of Black Rails.

Non-tidal Habitat Requirements

Black Rails require similar habitat conditions in non-tidal systems as in tidal salt marshes— availability of persistent shallow water, very high stem density, and microtopographical diversity. In South Florida, occupied sites tend to be those where wet conditions are found in an otherwise dry matrix (e.g., depressional areas that remain saturated) or where dry conditions are found in an otherwise wet matrix (e.g., dry ridges or higher mounds that provide refugia within lower areas that are consistently inundated), suggesting that Black Rails select habitats at the boundary between wet and dry systems using subtle habitat cues (Watts 2020, pers. comm.). In non-tidal locations north of South Florida, occupied sites often include open grassy areas associated with or adjacent to freshwater wetlands or floodplains (Watts 2016). Recreating similar wetland/grassland complexes that include a range of wet to dry conditions may be important in these areas.

Historical Habitat Use

Of 308 historical properties with documented Black Rail use, 12% were found in freshwater wetlands, 6% in coastal prairies, and 6% in grassy fields (usually hay but sometimes grain crops or fallow fields). Coastal prairie habitats in Florida have the greatest potential to support an undetermined population of Black Rails although grazing and conversion have reduced habitat extent and quality. Little survey or management effort has been conducted in these expansive habitats and more work is needed to determine the exact habitat conditions used by Black Rails in order to create, restore or maintain these habitats. Other non-tidal sites supporting Black Rails in the past include a wide variety of natural and artificial wetlands such as rice fields, wetland mitigation sites, spoil deposition sites, abandoned mines, farm ponds and bog turtle (*Glyptemys muhlenbergii*) wetlands. Most occupied freshwater wetlands were composed of headwaters or fallouts around reservoirs and depressional wetlands within pastures (Watts 2016 and refs therein).

Shallow Water and Sheet Flow are Important

Shallow flowing water (i.e., sheet flow) appears to be an important feature of many non-tidal habitats, especially north of South Florida. Habitat quality appears to be enhanced where sites are fed by a source of perennial water (e.g., irrigation water, waste water, springs or streams) rather than rain water, which can create unpredictable dry and wet periods. The actual movement of the water is likely less important than the consistently saturated, but not flooded, conditions that are created by sheet flow systems. Gentle slopes allow perennial water to flow across the land at a consistently shallow depth that can be reliably maintained during both rain and drought events.

It is important to note that sheet flow is not a requirement for non-tidal Black Rail habitat. Similar conditions can be maintained or created in other areas, such as down gradient from springs, beaver meadows, bog turtle wetlands, broad floodplains, irrigated pastures, wastewater wetlands, and other systems that remain consistently saturated without a sheet flow component. However, where natural conditions do not already exist to support saturated substrates, they can most easily be created and maintained on gentle slopes with a constant source of water—either natural or artificial.

Successful Examples of Black Rails Using Non-tidal Managed Wetlands

There are several notable examples of Eastern Black Rails using managed wetlands.

- The 90-acre Easton Water Treatment Facility in Easton, MD used constructed wetlands planted with reed canary grass as a biofilter for effluent prior to discharge into the Choptank River. Black Rails were regularly heard at this site in the dense grass with very shallow water sheetflow. In 2007, the facility was upgraded with tertiary treatment. As a result, the sheet water wetlands were decommissioned and the rails ceased using the site. There is interest in restoring a portion of the property back to Black Rail habitat.
- A wetland mitigation site created to offset construction of the Dulles Greenway in Virginia also attracted Black Rails until the site became unsuitable through woody succession (Cross 1999).
- In California, gently sloping wetlands (~1-12 degrees) (Beissinger pers. comm. 2019) created through intentionally or unintentionally leaky irrigation pipes or similar water sources, reliably support breeding California Black Rails (Richmond et al. 2010).
- The Curtis Sand Pit freshwater wetland in the Piedmont region of Georgia supported Black Rails in the early 1990s and the site held relatively high numbers of rails until 2010 when the habitat became unsuitable (Sykes et al. 2010). Recent conversations indicate a potential to restore the marshes to attract Black Rails back to the site.

Importantly, these examples demonstrate that Black Rails are able to find and colonize new sites outside the salt marsh system and that we can build and maintain suitable habitat that they can use.

Habitat Creation Strategies

The goal is to quickly develop a list of BMPs for creating non-tidal Black Rail habitat and inform and motivate land managers and agencies engaged in private lands conservation, such as the Natural Resources Conservation Service (NRCS), to implement them. **A minimum of 1,200 acres of experimental pilot-scale projects will be necessary** to evaluate the effectiveness of the most promising management actions. These efforts will then need to be scaled up to meet our habitat goal. Although we know the general characteristics required by Black Rails, very little work has been done to try to recreate suitable conditions through management. In South Florida, managing for dense overhead vegetation in areas that contain appropriate topographical diversity and shallow water may be important. Moving perennial water in the form of shallow sheet flow on gentle slopes may be an important characteristic to manage for in other parts of the range. Sheet flow can be created through artificial systems, such as perforated irrigation pipes constructed along gentle slopes or downslope of farm pond outfalls, which could provide a consistent source of gravity-fed water. Floodplain wetlands may also hold opportunities to provide suitable conditions for Black Rails through shallow berms that maintain appropriate vegetation and water depth. In order to determine which of these habitat strategies performs best and where, we must test and evaluate replicates of each on a pilot scale across the four population centers (see An Adaptive Management Approach above).

Key Objectives and Activities

Type	Description		Timing
Action	**Identify Priority Sites to Test BMPs**		
Objective 1	Develop a list of habitat conditions needed by Black Rail.		2020
	Activity 1.1	Develop GIS tools to assess landscape conditions that may be conducive to supporting Black Rail habitat.	2020
	Activity 1.2	Develop criteria to select pilot sites.	2020
Action	**Develop and Test BMPs**		
Objective 2	Develop pilot projects on ~1,200 acres of land with replicates on sloped wetlands, pond outfalls, and floodplain wetlands across the four population centers.		2024
	Activity 2.1	Develop a set of metrics to evaluate pilot project success and to inform adaptive management.	2020
	Activity 2.2	Develop a set of monitoring protocols and a tracking database.	2020
Action	**Incentivize and Implement BMPs**		
Objective 3	Ensure that NRCS and USFWS Coastal and Partners Program staff in each of the four population center states understand the importance of creating Black Rail habitat.		2021
Objective 4	Ensure each NRCS office has a menu of practices and scoring criteria to evaluate Black Rail habitat projects.		2021
	Activity 4.1	Meet with NRCS to develop Black Rail practices/Working Lands for Wildlife ideas.	2020
Objective 5	Ensure that eligible landowners covering at least 5,000 acres are enrolled in cost-share programs.		2024
Objective 6	Implement Black Rail BMPs on sufficient habitat to support 1,250 breeding pairs.		2030
Action	**Facilitate Knowledge and Information Exchange among Land Managers**		
Objective 7	Develop a communications plan to reach priority land managers.		2021
	Activity 7.1	Develop a white paper describing land management protocols for managers.	2022
	Activity 7.2	Establish a forum for Black Rail exchange among land managers to share experiences and lessons learned.	2020
	Activity 7.3	Host at least four targeted workshops with land managers.	2021

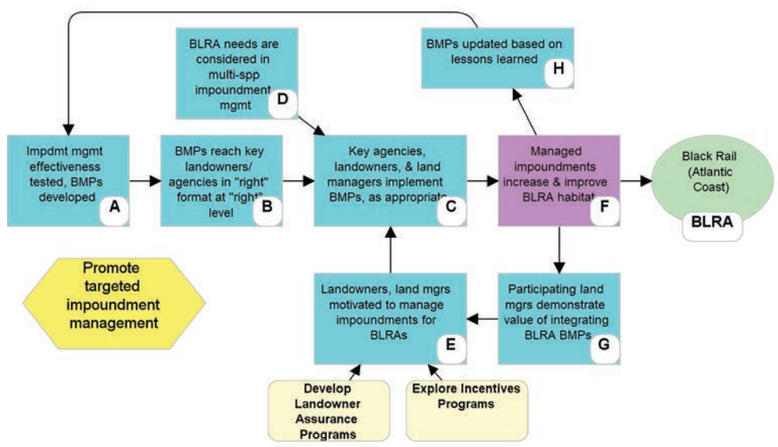
PR0MOTE TARGETED IMPOUNDMENT MANAGEMENT

Cross dike construction for Black Rail management at Nemours Plantation, South Carolina. Nemours Wildlife Foundation

Throughout the range of the Eastern Black Rail, hundreds of thousands of wetland acres have been impounded (altered to permit water level control) for agriculture and other purposes. Individual impoundments range in size from tens of acres to over 1,000 acres. Through the manipulation of vegetation (i.e., mechanical or chemical treatments), water depth, and sometimes salinity, impoundment management is used to produce desired water levels and vegetation composition and structure. This strategy focuses on impounded wetlands possessing the infrastructure (i.e., sufficient berms and water control structures/mechanisms to retain, raise, lower and circulate water), microtopography (i.e., surface relief and roughness; Ahn and Schmidt 2019) and elevation necessary to support high quality Black Rail habitat. In contrast to the New Habitat Creation strategy, this strategy focuses on incorporating targeted management for Black Rails within existing impoundments that are or could be managed under a multi-species management plan to benefit a variety of species.

Tidally influenced impoundments use tidal forces to move fresh or brackish water to implement some management activities. Within these impoundments, marsh habitats are protected from the daily forces of tides and rising seas, which are causing increasing rates of flooding in the high marsh habitats where Black Rails historically nested. Tidally influenced impoundments remain vulnerable to sea level rise impacts and thus may be most beneficial in the short and intermediate terms rather than the long-term. Inland impoundments, which are not adjacent to tidal waters, provide greater and longer term protection from sea level rise threats. In both types of impoundments, compatible management may help to mitigate the pressures of drought and/or heavy precipitation events.

Strategy Logic



Strategy Description

This strategy is designed to help influence the way impoundment management happens so that it can increase and improve Black Rail habitat where appropriate, while also considering the needs of waterfowl and other conservation targets. More specifically, we expect that by implementing this strategy, we will be able to identify, develop, and test impoundment BMPs (A). Based on what we learn, we will share appropriate practices with key landowners and agencies in a format that is suitable for their needs and one which provides them with the information they need to take action (B). If we are successful in effectively reaching these landowners and agencies, then we expect they will implement impoundment management practices favorable to Black Rail, while continuing to provide for the needs of other species (C & D). To help these landowners and agencies to implement targeted impoundment management practices that support Black Rails, it will be important to have the right incentives in place that will help motivate them to manage for the species (E). We expect that where impoundments are managed according to these recommended practices, potential Black Rail habitat will increase, both in quantity and quality (F), ultimately leading to an increase in the overall population of Black Rails. Moreover, we anticipate that those impoundment managers adopting the practices will find them beneficial for supporting additional native species, which could help motivate others to adopt similar practices (G). Finally, we recognize it will be critical to monitor the effectiveness of the BMPs and use the information gathered to inform and improve promoted practices in the future (H & A). Most importantly, we want to avoid impoundments functioning as ecological sinks for Black Rail populations.

Managing Impoundments for Black Rails

In order for impoundments to provide conditions suitable for supporting high quality Black Rail habitat, they must be managed for dense vegetative cover, areas with moist soil or shallow water depths (< 3 cm), and shallow pools (1-6 cm) that support invertebrate prey bases for Black Rail nestlings (Hand 2017b; pers. comm.). Water circulation is also important for avoiding stagnation and poor water quality, so slight fluctuations in water depth are necessary even during the nesting season. In the absence of adequate rainfall, circulation can be achieved by temporarily raising water levels within the impoundment. Some microtopographical variation in the elevation of the marsh bed is also required. Black Rails and their chicks require elevated refugia (e.g., hummocks or other high ground) with dense cover to survive high water events (e.g., storms) and avoid predation when these events force them from their usual habitats (Evens and Page 1986). In California, management recommendations for Black Rail include dense cover, a gradient of water depths ranging from moist soil to 10 cm, and gradual slopes contained therein to allow Black Rails to move higher on the elevation gradient in response to unexpected increases in water level (Nadeau and Conway 2015). Areas managed in this way showed increased numbers of Black Rails using the units after management recommendations were implemented.

Impoundments with strong potential for supporting Black Rails contain the following characteristics:

- Are near existing occupied Black Rail habitat or in a historical location for breeding Black Rails.
- Contain adequate elevational gradient and microtopographical variation (i.e., higher elevated portions within an impoundment to provide for high-water escape sites) within the high elevation portion of the impoundment.
- Have the ability to manage for <3 cm of water within shallowest portions of an impoundment during the nest-building, egg-laying and chick-rearing life stages.
- Can maintain active, prolonged flooding cycles (i.e., periodic flooding for an entire growing season), and mechanical, prescribed fire and/or chemical treatment of vegetation to maintain the desired vegetation seral stages, cover, plant richness, and density.
- Have or allow for the creation of gentle slopes within or around impoundment edges to provide multiple locations for Black Rails to place their nests.
- Support dense and diverse vegetation (e.g., grasses, sedges, and rushes).
- Can mimic vegetation structure found in historical Black Rail habitats (see Table 4).

Tidally Influenced Impoundments

High marsh habitat within managed tidal impoundments in South Carolina was identified as important Black Rail habitat during the first statewide marsh bird surveys in 1991-1992 (Cely et al. 1993). Subsequent assessments have brought to attention the valuable habitat impoundments can provide in the face of sea level rise (Roach and Barrett 2015) and their current value supporting Black Rails that are successfully breeding and raising young (Hand 2017a; Hand et al. 2019). However, water levels in the majority of managed tidal impoundments, which are managed primarily to provide wintering habitat for migratory waterfowl, are often too deep or too variable to maintain habitat for Eastern Black Rail (Eddleman et al. 1988). In addition, some impoundments with high potential for Black Rail management but relatively low value for other wildlife objectives may not receive adequate maintenance for continued functionality as Black Rail habitat if impacted by storm events. If sites with promising impoundments are managed to create and support Black Rail habitat conditions, they hold great potential as important sources of refugia from rising seas and are an important tool in the recovery of the species.

Tidal brackish wetland management at the Kinloch Plantation in South Carolina. Marshall Sasser

Managed tidal impoundments encompassing high elevation marsh habitat, in particular, can facilitate successful nesting by Black Rails (Hand et al. 2019) when managed to produce desired conditions. However, in some impoundments (i.e., those managed using traditional rice trunks), suitable rainfall conditions are also required for successful nesting and brood rearing as it is not feasible to manage water levels with adequate precision (centimeter scale) during periods of drought or heavy rainfall. Impoundments using water pumps to control water levels may offer greater precision during variable weather conditions.

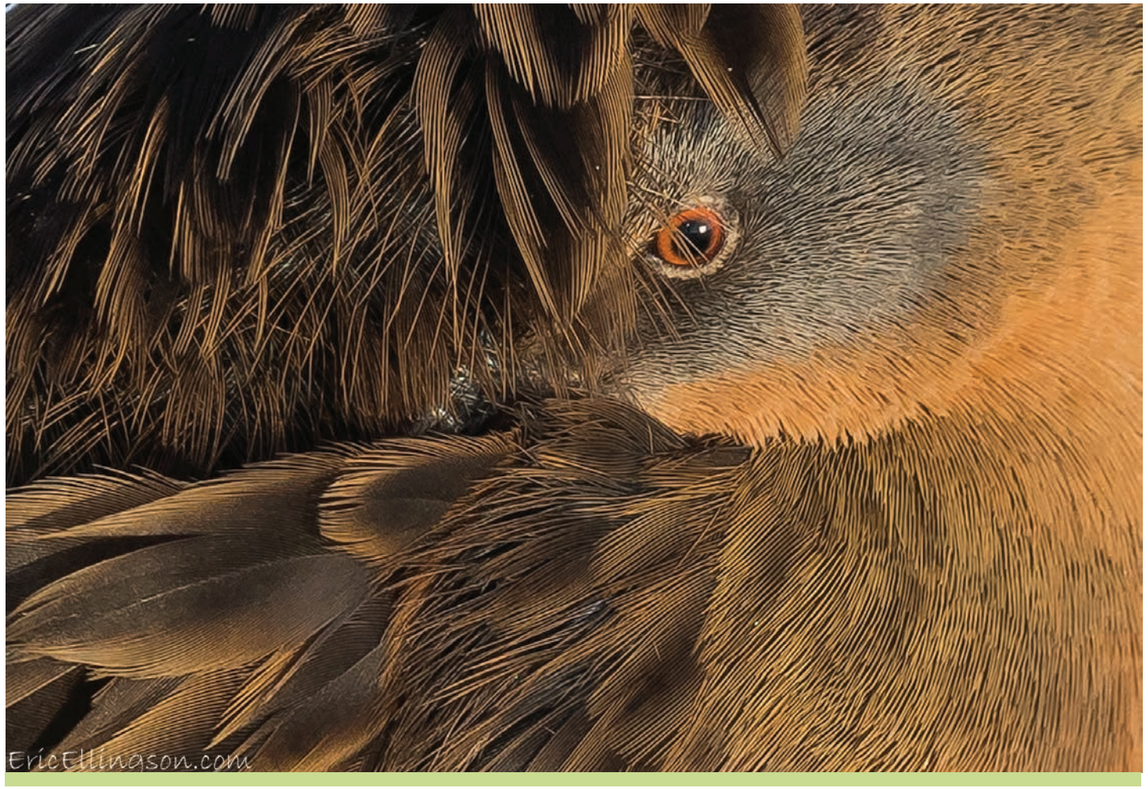
Non-tidally Influenced Impoundments

Thousands of acres of non-tidally influenced impoundments have been created and managed over the past 60+ years for wetland-associated wildlife. These impoundments provide wetland managers the ability to manipulate water levels and/or perform mechanical manipulations (e.g., disking, prescribed burning, etc.) to encourage the germination of native wetland plants that produce abundant and energy-rich seeds and invertebrates for migrating and wintering waterfowl as well as many other wetland-associated avian species (Fredrickson and Taylor 1982). Although individual impoundments have varying degrees of water level management, they all contain some form of water control structure (e.g flash-board riser, pipe and screw gate, etc.). In addition, some impoundments have associated wells and pumps to supply water to them on demand while others rely only on local rainfall contained in adjacent ditches, canals or ponds to supply water via gravity feed.

Like tidally influenced impoundments, seasonal control of water levels is possible in most freshwater impoundments. Two types of vegetative communities are usually present in freshwater impoundments—native wetland plants and/or agricultural cereal grains (e.g., corn, milo, rice, or millets). The timing of seasonal water levels within impoundments that contain only native wetland plants may permit shallow conditions (~ 6cm or less) during the spring and thus support breeding Black Rails. In addition, the topography of the ground within an impoundment managed for native wetland plants may vary several inches to a few feet and would also permit shallow water conditions (~ 6cm) within higher elevated portions of the impoundment.

Multi-species Management

Many impoundments can accommodate management for a variety of types of waterbirds including waterfowl, shorebirds, wading birds, and marsh birds (Folk et al. 2016). A subset of these impoundments possess characteristics that also allow for compatible management for Black Rails during the spring and summer (Folk et al. 2016). Breeding habitat for Black Rails can be successfully managed within a portion of an impoundment or an impoundment complex if conditions are suitable. Higher elevation areas within an impoundment basin can create suitable patches of dense grassy vegetation for Black Rails when water levels are managed to prevent flooding too deeply or too frequently. In some managed tidal impoundments containing high marsh areas and elevational differences of > 1.5 meters between the deepest areas in the higher elevation “bed” (Hand 2019b, pers comm), the deeper areas of the impoundment can be managed to provide winter foraging habitat for waterfowl and foraging habitat for shorebirds during spring and fall migration, while the high elevation areas are managed for Black Rail breeding habitat (Folk et al. 2016). During the post-breeding season, Black Rails (as well as Sora, Virginia, and Yellow Rails) have also been found in managed tidal impoundments that do not provide suitable breeding habitat but do provide abundant food resources (e.g., seeds from *Panicum* and *Schoenoplectus* species, invertebrates; Hand 2019b, pers. comm. and Laurie 2015). Although some impoundments can provide valuable habitat for Black Rails, attempts to incorporate management for Black Rails in multi-species management efforts may result in reproductive failure if suitable conditions are not maintained. Careful selection of impoundments with suitable characteristics and communication with property owners and managers about goals and capabilities are paramount to successfully implement BMPs.



Virginia Rail are often found in managed impoundments. Improving these habitats for Black Rail will help associated species as well. EricEllinason.com, Creative Commons

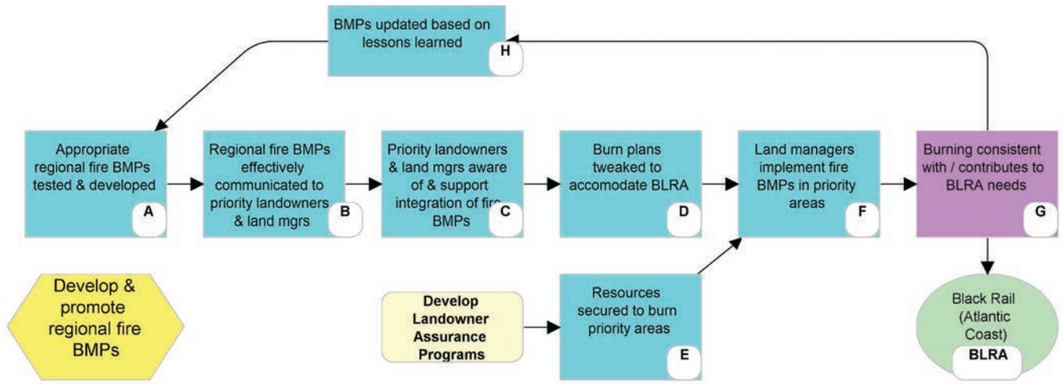
Key Objectives and Activities

Type	Description	Timing
Action	**Identify Habitat Conditions Needed by Black Rails**	
Objective 1	Develop guidance on habitat conditions preferred by Black Rail.	2020
Activity 1.1	Prioritize impoundments for Black Rail management within the context of multi-species management.	2021
Objective 2	Develop an understanding of where Black Rail are and are not at the landscape scale and why.	2022
Action	**Develop and Test BMPs**	
Objective 3	Develop 10 pilot projects in priority areas (MD, SC, NJ, NC, FL) in multiple settings using multiple designs.	2024
Activity 3.1	Engage local stakeholders in developing coordinated multi-species impoundment management regimes and BMPs.	2022
Activity 3.2	Identify funding options for Black Rail impoundment management.	2022
Activity 3.3	Determine local benefits of Black Rail impoundment management for landowners.	2024
Action	**Landowners and Agencies Implement BMPs**	
Objective 4	Within five years of identifying impoundment BMPs, priority agencies/landowners include Black Rail impoundment BMPs in their work plans.	
Objective 5	Within eight years of identifying impoundment BMPs, impoundment land managers implement Black Rail BMPs in impoundments where Black Rails can realistically be managed in the context of multi-species management objectives.	
Objective 6	Within two years of implementing impoundment BMPs, all participating impoundments have suitable Black Rail habitat.	
Action	**Incentivize BMPs**	
Objective 7	Ensure that NRCS, USFWS Partners for Fish and Wildlife Program and Coastal Programs in each of the four population center states recognize the importance of creating Black Rail habitat.	2021
Objective 8	Ensure that each NRCS office has a menu of practices and scoring criteria to address Black Rail conservation.	2021
Objective 9	Enroll eligible landowners in incentive programs.	2024

A firefighter burns out a marsh during a prescribed fire in February 2006 at St. Johns NWR. Jeff Schardt/USFWS

Prescribed fire is an essential management tool for maintaining suitable habitat for populations of Eastern Black Rail and the species is well-adapted to habitats with regular fire exposure. However, application of prescribed fire that deviates sharply from naturally ignited wildland fire behavior may result in excessive mortality of Black Rails. Naturally occurring fires (e.g., via lightning strikes) often start from one or a few ignition points with the fire progressing in a way that birds can move ahead of the flames and eventually find refugia by walking to lower wet areas to survive the event. Prescribed fires are often conducted using multiple ignition points, with the intent to maximize acres burned in as little time as practicable and with flames moving and merging into each other. Such fires may result in trapping Black Rails and and are known to result in excessive mortality (Legare et al. 1998; Grace et al. 2005).

Strategy Logic



Strategy Description

This strategy is designed to help influence the way that fire is managed regionally in order to be consistent with Black Rail needs. More specifically, we expect that by implementing this strategy, we will be able to identify, develop, and test regional fire BMPs (A). Based on what we learn, we will share appropriate practices with key landowners and managers in a format that is suitable to their needs and which provides the guidance they need to take action (B). If we are successful in effectively reaching these landowners and managers, then we expect they will support the fire management practices favorable to Black Rail and incorporate them into their burn plans (C & D). To help these landowners and agencies to implement

appropriate fire management practices (F), we believe it will be important to have the right incentives and sufficient resources in place (E). Where fire is managed according to these recommended practices, we expect it to contribute positively to Black Rail habitat needs (G), ultimately leading to an increase in the overall population of Black Rails. Finally, we recognize it will be critical to monitor the effectiveness of the BMPs and use the information to inform and improve the promoted practices in the future (H & A). In particular, we would want to make sure that new fire management practices do not harm the Black Rail population or habitat.

Prescribed fire is an important management technique for Black Rail. Susan McRae

Proper Use of Prescribed Fire

To effectively support Black Rail needs, prescribed fire must be done in a way that creates suitable habitat conditions while minimizing the risk of mortality. Potential for mortality can be greatly reduced if prescribed fires are conducted in a way that allows them to move slowly across a marsh, leaving patches of unburned vegetation similar to what occurs in naturally ignited wildland fire. Burning during the breeding season may temporarily affect breeding success of individual Black Rails, however, adults that lose their nest will readily renest, as do many marshbird species adapted to fire-maintained habitats. Overall, the methods of prescribed burn application appear to be more important than seasonal considerations.

High priority habitats with restoration potential include inland marshes, transitional estuarine marshes where hardwood encroachment is a major cause of Black Rail habitat loss, and the marsh transition zone between estuarine marsh and upland maritime forest. Burns in transition zone marshes should mimic the natural progression of fire moving from upland elevations down into marshland habitats without the need for firebreaks on the downslope areas of the fire. Hardwood encroachment is often best controlled with prescribed burns conducted concurrently with the breeding period. Highly encroached habitats have low occupancy probability and direct mortality from prescribed fire would be anticipated to be minimal if BMPs are followed. Upland marshes require a more frequent fire return interval to manage hardwoods and maintain suitable habitat conditions, while tidally influenced marshes may require longer fire return intervals due to more regular saltwater influence.

Potential BMPs include:

- Short flanking fires or similar approaches are recommended. Prescribed fires should avoid head fires, strip-head fires, ring fires, or fires that have long, unbroken boundaries that consume all emergent vegetation and prevent species dependent on dense cover from escaping a fire.
- Burn only 25-50% of the total area at any one time, regardless of the area covered by contiguous marsh habitat. Up to 90% of a single burn unit can be burned, but prescriptions should require that small dispersed patches remain post fire.
- Prescribed fires should always be conducted with consideration for escape routes and refugia (e.g., low wet spots not burned) to prevent mortality. Prescribed burning should proceed as slowly as possible to allow for escape.
- Aerial ignition should not be used to burn a marsh quickly, and strip heads and head fires that come together in a short period of time should also be avoided. Using short flanking fires into prevailing wind to reduce intensity and speed is recommended.
- Prescribed fire should be applied under conditions that are most likely to result in patchy persistence of unburned marsh to serve as refugia for Black Rails (including ground and/or surface moisture and/or relative humidity). Patches can be small (e.g., 100 square feet) but should be numerous enough to support multiple Black Rails.

Key Objectives and Activities

Type	Description	Timing
Action	**Develop and Test BMPs**	
Objective 1	Agree upon specific ecological hypotheses and how to evaluate effectiveness of fire management practices under different conditions.	2021
Activity 1.1	Convene fire and Black Rail experts to share information and develop a coordinated approach to test and determine optimal management.	2021
Objective 2	By 2022, establish replicated treatment sites to evaluate fire management BMPs.	2022
Activity 2.1	Test fire practices in various habitats with Black Rail potential.	
Objective 3	Within three-five years of testing/evaluating, develop draft BMPs.	
Objective 4	At least every five years, update regional fire BMPs to reflect new information.	
Action	**Integrate BMPs into Land Management**	
Objective 5	Within two years of developing BMPs, state agencies and other priority partners have agency or organization-level prescribed burning plans that include BMPs for Black Rail.	
Activity 5.1	Develop a communications plan to reach priority land managers.	
Activity 5.2	Within two years of developing BMPs, reach 50% of priority land managers identified in communications plan.	
Objective 6	Within two years of developing BMPs, 100% of priority areas that would benefit from burning have annual work plans that incorporate appropriate burning for Black Rail needs.	
Activity 6.1	Prioritize areas for burning.	
Activity 6.2	Develop accessible documents describing BMPs for land managers (e.g., white paper, fact sheets).	
Activity 6.3	Develop communications materials for the public describing rationale for burning.	
Objective 7	Within five years of developing BMPs, 100% of priority acres are burned using Black Rail-friendly methods, (including timing and frequency.	

DEVELOP & PROMOTE AGRICULTURAL BMPs

Agricultural lands can provide habitat for Black Rail through implementation of Best Management Practices. Graham Williams

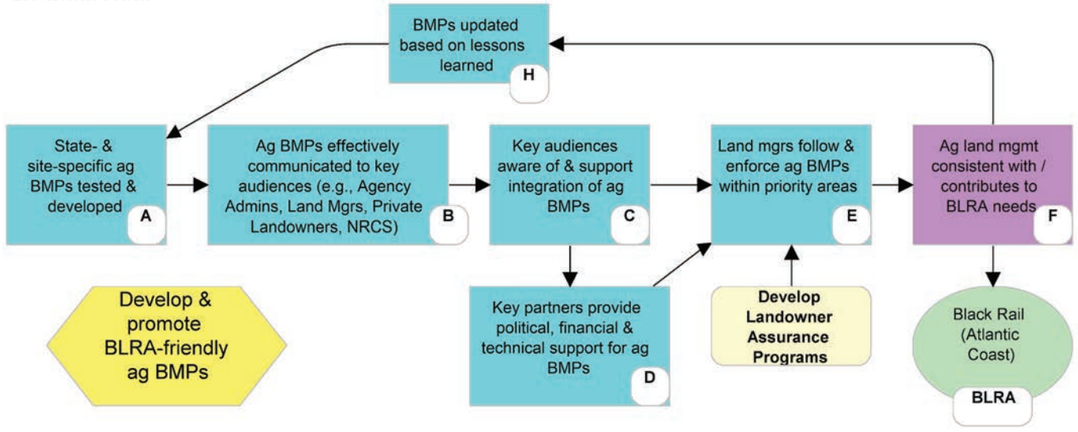
Conversion of wetlands to agriculture has historically been one of the driving factors of wetland loss, degradation, and conversion (Dahl 1990). Efforts to drain and convert wetlands took place in the mid-1800s to mid-1900s, led primarily by government programs to support agricultural activities, and resulted in significant losses of wetlands during this period (Dahl and Allord 1996). Although there is limited information that tracks changes in the specific habitats needed by Black Rails, it is likely that a substantial portion of the species' habitat was affected by these practices. While much of the agricultural pressure on existing tidal marshes has subsided, as methods such as salt marsh haying are no longer practiced on broad scales, other forms of agriculture, particularly grazing, may continue to impact Black Rail habitat.

Within the ACJV region, grazing is most common in inland habitats in central and south Florida and, with proper management, presents opportunities for Black Rail conservation. Grazing in Florida occurs in part in palustrine wetlands, wet prairies, and ephemeral depressional wetlands that have been documented to contain Blacks Rails (Schwarzer et al. 2018). While Black Rail surveys were conducted on public lands only, it is likely that adjacent private lands with similar hydrology either currently support Black Rails or could do so under modified management practices. Grazing strategies can be designed to have minimal to no effect on Black Rail habitat or used as a tool to reset the seral grassland stage so that both the needs for livestock production and the Black Rail are met. Similar approaches have been used for Northern Bobwhite, Sage Grouse, Greater Prairie-chicken and other grassland-dependent species where grazing is employed. Light to moderate continuous grazing has the potential to be compatible with Black Rail occurrence as long as the dense cover required by rails is maintained. Conversely, heavy continuous grazing almost certainly has negative effects on the habitat needed by Black Rails. Other grazing strategies that include rotational and exclusionary designs can promote both livestock production and habitat for Black Rails as well as other species dependent upon dense cover.

Beyond lands used for grazing, south Florida also supports crop agriculture in areas where Black Rails have been found, often during the winter. While it is unclear the extent to which wintering and/or breeding rails rely on crop agriculture and whether it could be modified to better suit Black Rails, future BMPs addressing crop

agriculture may be appropriate as more data are collected.

Strategy Logic



Strategy Description

This strategy is designed to help influence the way that agriculture is managed in order to be consistent with and support Black Rail habitat needs. More specifically, we expect that by implementing this strategy, we will be able to identify, develop, and test state and site-specific agriculture best management practices (A), with an emphasis on grazing. Based on what we learn, we will share appropriate practices with key landowners and managers in a format that is suitable to their needs and which provides the guidance they need to take action (B). If we are successful in effectively reaching these landowners and managers, then we expect they will support the agriculture management practices favorable to Black Rail and incorporate them into their land management plans, grazing leases, and/or livestock production (C). To help these landowners and agencies implement grazing and crop agricultural practices consistent with Black Rail needs (E), we believe it will be important to have the right incentives and sufficient resources in place (D). We also believe that many private landowners will need the support of a Landowner Assurance Program before they will participate. Where grazing and crop agriculture are managed according to these recommended practices, we expect the efforts to contribute positively to Black Rail habitat needs (F), ultimately leading to an increase in the overall population of Black Rails. Finally, we recognize it will be critical to monitor the effectiveness of the BMPs and use the information to inform and improve the promoted practices in the future (H & A). In particular, we want to make sure that new agriculture management practices do not harm existing Black Rail populations or habitats or harm new populations or habitats in the future.

Testing Agriculture Practices

Unlike other strategies, where distinct hypotheses or practices have been identified and outlined in the plan, less is known about the effects of grazing and other agricultural practices on Black Rail habitats and populations. As suggested in the table below in Activities 1.1 and 1.2, it is necessary to convene a group of experts to develop hypotheses and construct a program to test them. Early tests may include examining the effects of various grazing strategies (including the exclusion of grazing) on Black Rail occupancy and habitat features such as stem count, vegetation type, vegetation height, and amount of cover. Grazing may also have interactions with fire management, so any testing may need to include an explicit examination of these interactive effects. The timing of grazing may influence the effects grazing has on habitat. For instance, grazing during the growing season may have reduced impacts as vegetation may recover quickly, while grazing during the non-growing season may have longer lasting effects on vegetation regrowth. Other factors that need to be considered may be identified by the group of experts.

Key Objectives and Activities

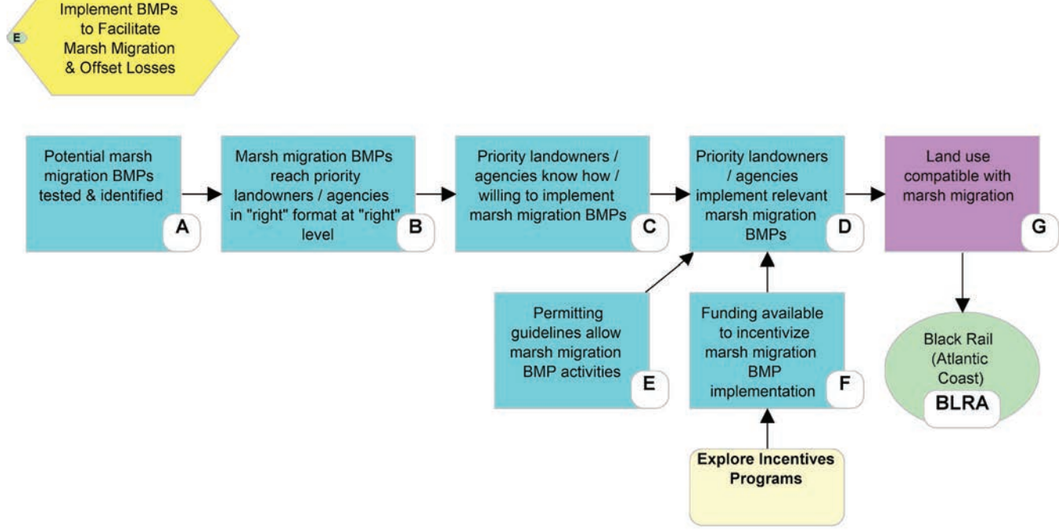
Type	Description	Timing
Action	**Develop Black Rail-Friendly Agricultural BMPs**	
Objective 1	Collaborate with national experts to promote development, testing, and planning for BMPs.	2021
Activity 1.1	Convene national group of agriculture and Black Rail experts and stakeholders.	2021
Activity 1.2	Test promising agricultural practices through at least five pilot projects in various habitats.	2022
Activity 1.3	Identify priority areas for implementing agricultural BMPs for Black Rail.	2022
Objective 2	Update regional agricultural BMPs for Black Rail based on testing.	Every 5 years
Action	**Engage Key Agencies in Conservation**	
Objective 3	Within one year of developing BMPs, key audiences (e.g., agency administrators, organizations, land managers) receive them in a format that is useful for their needs.	2025
Activity 3.1	Translate BMPs into friendly language and format for land managers.	
Activity 3.2	Conduct outreach and provide support to priority land managers.	
Activity 3.3	Conduct outreach to NRCS to discuss integration of agricultural BMPs for Black Rail into Farm Bill programs.	
Objective 4	Within 3 years of identifying BMPs, state agencies, National Wildlife Refuges, The Nature Conservancy, Audubon, NRCS and other key players have institutional-level priorities that include agricultural BMPs for Black Rail.	2028
Activity 4.1	Agencies provide outreach and technical and financial support to private landowners.	
Activity 4.2	NRCS integrates agricultural BMPs for Black Rail into Farm Bill programs.	
Action	**Landowners and Agencies Implement BMPs**	
Objective 5	Within five years of learning about agricultural BMPs for Black Rail, private landowners in priority areas covering at least 5,000 acres are following agricultural BMPs (also, see Engage Landowners in Safe Harbor Program strategy).	2030
Objective 6	Within 10 years of identifying agricultural BMPs for Black Rail, all renegotiated cattle leases on public conservation lands with potential Black Rail habitat reference agricultural BMPs.	2035

DEVELOP & PROMOTE BMPs TO FACILITATE MARSH MIGRATION

Ghost forests - remnants of a once thriving forest giving way to new Black Rail habitat. Craig Watson

Given the need for Black Rails to nest in the highest and driest portions of a salt marsh, the marsh migration zone may be a particularly important conservation target. In many tidal marsh systems, the upland/marsh transition may be all that remains of potentially suitable habitat. If managed appropriately to allow marsh migration, these areas could be expanded to continue to provide new habitat into the future. Simply protecting land in the marsh migration zone, however, may not be sufficient to ensure that marshes of the appropriate quality and quantity needed by Black Rails can migrate inland. Whether and how to facilitate marsh migration into suitable areas must also be determined to ensure that adequate habitat exists for Black Rails.

Strategy Logic



Strategy Description

As sea levels rise and landscapes change, salt marsh acreage is being lost. A portion of the acreage lost can, theoretically, be replaced with new marsh that forms along the upland edge. However, this process can be compromised by incompatible land use, invasive species, and the presence of dead and dying trees. This strategy is designed to help identify BMPs to facilitate marsh migration to ensure that sufficient and suitable marsh habitat is available for Black Rails in the marsh migration zone. We expect that by implementing this strategy, we will be able to identify, develop, and test BMPs to effectively facilitate

marsh migration that meets the habitat needs of Black Rails (A). These BMPs will then need to be shared with priority landowners and agencies in a format that is suitable for their needs and which provides the guidance they need to take action (B). Outreach to priority audiences should include an emphasis on practical guidance and access to experts, funding options, incentives, and equipment so that landowners know how to implement the marsh migration BMPs (C). Landowners will also need the right monetary incentives (F) and regulatory framework (E) (i.e., permitting guidelines that allow marsh migration efforts) to support implementation of these marsh migration BMPs (D). If landowners implement these BMPs, then we expect that land use will be compatible with marsh migration (G), marshes will migrate, and high marsh areas suitable for Black Rails will increase and/or high marsh losses will decrease, ultimately leading to an increase in the overall population of Black Rails.

Successful Migration Requires Management

Marsh migration is occurring naturally in many places, particularly in areas of gentle topography where saltwater intrusion is rendering cropland unuseable and creating 'ghost forests' of dead and dying trees. However, in some areas, salt marsh has not migrated into adjacent uplands presumably because of steeper slopes (Field et al. 2016), lower rates of saltwater intrusion (Smith 2013), or the occurrence of *Phragmites*. Even where topography promotes saltwater intrusion, uplands do not always convert effectively to high marsh habitat. Ghost forests can persist for many years after high marsh vegetation has colonized the ground layer, and transitional zones are particularly vulnerable to *Phragmites* invasion (Smith 2013) because of their lower salinity and partial shade. Transition zones can also become waterlogged and convert to open water instead of high marsh.

Examples of experimental management techniques to facilitate marsh migration are limited and more work is needed to understand how and where to facilitate this process where possible (Anisfeld et al. 2017) and to ensure that new marsh created includes adequate high marsh. Given the rapid rate of sea level rise and how long it takes for plant communities to form and birds to find and use new habitats, there is a pressing need to implement replicated pilot projects throughout the Atlantic Flyway to develop effective management methods for facilitated marsh migration.

Several different management actions exist that could facilitate the transition of salt marsh into adjacent uplands. The optimal strategy will depend on a variety of site-specific factors such as slope and geomorphology. These include:

Remove snags in "ghost forests"

In many areas of the Eastern Black Rail range, "ghost forests" have formed where rising seas have resulted in saltwater intrusion into forested uplands. The presence of snags may deter colonization by salt marsh birds and increase nest predation rates by providing elevated perches for avian predators. There are limited studies (Taillie et al. 2019) of how snags influence occupancy of salt marsh birds, but at least one study (Marshall 2017) demonstrated that perceived openness, measured by the angle to the horizon, was a greater predictor of abundance for Saltmarsh Sparrow than patch size and thus should be a prioritized marsh characteristic. At least one experiment, at Blackwater National Wildlife Refuge (NWR), is investigating the impacts of snag removal on habitat use by salt marsh birds, including Black Rail.

An example of a ghost forest in Maryland. Craig Watson

Remove Phragmites in priority marsh migration zones

Areas in the marsh migration zone can become dominated by invasive *Phragmites*, which inhibits establishment of native tidal marsh plants. Ensuring that habitat in migration zones becomes suitable high marsh may require control of *Phragmites* on an ongoing basis until salinity levels rise sufficiently to control it naturally.

Terrace/contour slopes adjacent to existing marshes to expand marsh platform and increase accretion rates

Vertical marsh development processes are critical (Cahoon et al. 2019) to keep pace with sea level rise. That process is typically driven by sediment capture and accumulation of organic matter—both above and below ground— through vegetation growth. The width and total area of tidal marsh adjacent to upland areas is directly related to the marsh's ability to buffer wave erosion and keep up with sea level rise. Narrow marshes do little to attenuate waves or prevent saltwater from reaching adjacent uplands. They also have limited accretion potential compared to wider and larger expanses of marsh grass. Contouring areas adjacent to salt marshes could have several benefits, including: expanding the horizontal extent of marsh vegetation, increasing the marsh's capacity for buffering and accretion, creating suitable slopes to facilitate marsh migration, and protecting agricultural fields at higher elevations from saltwater intrusion. A series of flat terraces (i.e., step-like shelves of similar elevation) may provide greater size and functionality of salt marsh at any given time compared to a narrow fringe of marsh. Narrow marsh zones may have greater ability to gradually migrate up a linear slope as sea level rises but they provide little ecological or economic value during that process. A terraced slope may facilitate greater accretion and would presumably still allow for marsh migration.

Remove barriers that are impeding marsh migration

Barriers include any structures (e.g., berms, dikes, undersized culverts) that impede inland migration of marsh habitat. Removing barriers has great potential to restore and improve salt marsh habitat where sediment supply and elevation are conducive to restoring tidal flow and creating high marsh habitat. However, care must be taken with this practice to avoid unintended conversion of high marsh behind a barrier to low marsh (Hinkle & Mitsch 2005) or open water. This can happen if there is not sufficient migration space, sediment supply, or elevation behind the barrier, all of which are required to ensure that high marsh habitat is created. Done appropriately in sites with the right conditions, barrier removal can have great potential in allowing migration.

Convert agricultural/open areas to marsh habitat

Marsh migration may occur most rapidly at sites with open conditions that facilitate a transition to salt marsh habitat. This includes agricultural areas that are experiencing crop failures due to salt water intrusion and fallow or old fields adjacent to existing salt marshes. Such areas present opportunities to facilitate migration as salinity and elevation conditions are already conducive to supporting marsh grass development, provided that invasive *Phragmites* is controlled. Open areas experiencing marsh migration may be occupied by salt marsh birds much faster than ghost forests, which may have very slow rates of avian colonization (Taillie et al. 2019).

Extend tidal creeks in transitional marshes to drain areas that have become ponded

In low-lying landscapes, the gentle topography that promotes saltwater intrusion can also jeopardize the persistence of newly established high marsh on former uplands. This can happen at sites where tree mortality is accompanied by root ball shrinkage and ground surface collapse. These sites become waterlogged because they are isolated from the tidal creek network, causing interior erosion of high marsh vegetation (Lerner et al. 2013). Maryland Audubon-DC has identified many such sites on the Delmarva Peninsula using spatial modeling and has piloted the extension of tidal creeks into ponded areas to drain surface water and reinvigorate marsh vegetation, such as at Farm Creek Marsh in Maryland.

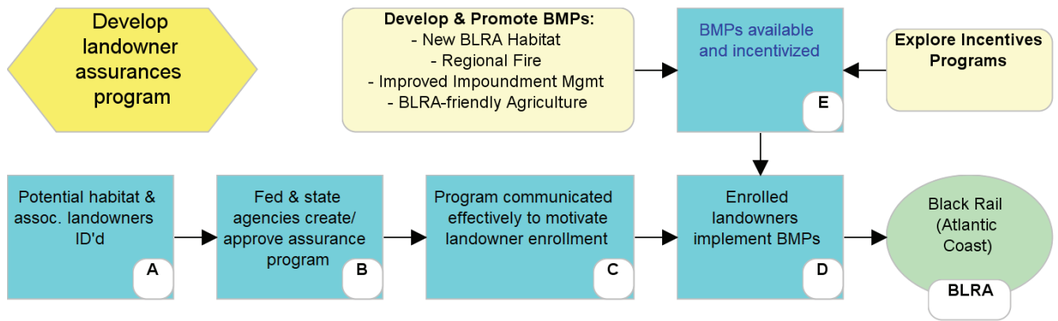
Key Objectives and Activities

Type	Description	Timing
Action	**Develop and Test BMPs**	
Objective 1a	Implement experimental projects in at least 25% of priority migration corridors to identify effective management methods to facilitate marsh migration.	2023
Objective 1b	Institute monitoring protocols to evaluate the effectiveness of various management actions and develop BMPs for marsh migration that support Black Rail habitat.	2023
Objective 2	Within five years of pilot project initiation, convene partners to exchange information and recommend regional BMPs for marsh migration.	2028
Action	**Facilitate Knowledge, Information, and Equipment Exchange Among Land Managers**	
Objective 3	Within three years of BMP development, ensure that 100% of landowners and managers of priority areas can access BMPs in usable format.	2031
Objective 4	Within five years of BMP development, ensure that landowners covering at least 50% of priority areas have the capacity (e.g., knowledge, equipment available to use, incentives, funds, etc.) to manage marsh migration.	2033
Activity 4.1	Develop and circulate a list of experts in facilitated marsh migration.	2026
Activity 4.2	Develop and circulate a list of funding options for facilitated marsh migration.	2026
Activity 4.3	Develop and circulate a list of heavy and low ground pressure equipment that can be made available to managers for marsh migration projects.	2026
Activity 4.4	Conduct workshops to promote the most promising techniques, share lessons learned, and stimulate additional work in at least five high priority landscapes.	2028
Activity 4.5	Use the publicly accessible ACJV Project Inventory Tool to house information on marsh migration projects throughout the ACJV.	ongoing
Action	**Engage Landowners in Implementing BMPs**	
Objective 5	Within three years of BMP development, all state permitting agencies develop permitting guidelines that allow BMP activities.	2031
Objective 6a	Within eight years of BMP development, ensure priority land managers and landowners are managing marsh migration on at least 25% of priority marsh migration corridors.	2036
Activity 6.1	ACJV states, federal agencies and conservation organizations include facilitated marsh migration in their annual plans.	2031
Objective 6b	Within ten years of BMP development, assist priority landowners with NRCS sign-ups to implement BMPs on at least 10% of priority marsh migration areas.	2038

Working with landowners to construct a 550-foot living shoreline, including saltmarsh cordgrass and saltmeadow hay. Will Parson/ Chesapeake Bay Program

A large portion of potential habitat for Black Rails occurs on non-federal property. Private landowners will therefore play an important role in the conservation and recovery of this species in the Atlantic Flyway. Opportunities on privately owned property that maintain existing Black Rail habitat and create new suitable habitat will be crucial to the long-term viability of Black Rail in certain focal areas (e.g., the ACE Basin in South Carolina). However, although private property owners are often willing partners in efforts to recover listed species, some landowners may be reluctant to undertake activities that support or attract listed species on their properties due to concern about future property use limitations related to the ESA (e.g., restrictions on activities such as mowing, haying, or grazing). To address this concern, a landowner assurance program, known as a Safe Harbor Agreement (SHA), should be implemented to ensure that future property use limitations will not be required by the USFWS on the property.

Strategy Logic



Strategy Description

This strategy is designed to help incentivize private landowners to manage their property for Black Rails by providing assurances that doing so will not result in increased regulation. To be strategic, it will be important to first identify the priority habitat areas and their associated landowners (A). This strategy also involves providing assistance to states to identify and develop the most appropriate program for each state. With this assistance, we expect that relevant federal and state agencies will create and approve appropriate Safe Harbor Agreement Programs (B). If the program is approved, we assume the relevant agency will effectively communicate assurance options to eligible landowners to encourage them to enroll (C). Once enrolled, we expect priority landowners to implement the relevant best management practices (D), which may come from any number of other BMP strategies this Black Rail Plan promotes (E). If priority

landowners implement the relevant BMPs, we expect them to have positive impacts on the Black Rail population, as further detailed in more specific BMP strategies.

Successful implementation of this strategy will require that each state develop and actively promote a Safe Harbor Agreement Program to key priority landowners in their state. This will include conducting workshops with priority stakeholders and actively working to enroll landowners. Although it is important that all states in the Black Rail range participate, initial demonstration sites in Florida and South Carolina are especially important to develop as these states have the largest Black Rail populations in the ACJV area with large potential for habitat conservation on privately owned lands. Important partners who work with private landowners such as the NRCS and the USFWS Partners for Fish and Wildlife and Coastal Programs, should be engaged in providing incentives and technical expertise to help landowners effectively manage their land for Black Rail under the Safe Harbor Agreement Program.

Safe Harbor Agreements

A SHA is a voluntary agreement involving private or other non-federal property owners whose actions contribute to the recovery of species listed as Endangered or Threatened under the ESA. The agreement is between cooperating non-federal property owners and the USFWS. In exchange for actions that contribute to the recovery of listed species on non-federal lands, participating property owners receive formal assurances from USFWS that if they fulfill the conditions of the SHA, USFWS will not require any additional or different management activities by the participants. Landowners may withdraw from the program at any time, but then will no longer receive regulatory assurances for future management activities. Likewise, if the agreement reaches its expiration date, participants may choose to renew or not renew the agreement. If the agreement is not renewed, the assurances tied to the agreement expire and the landowner is no longer protected from “take” prohibitions in the ESA, although the landowner may return the property to its original (baseline) conditions that existed at the beginning of the agreement if they so choose.

Species like the Sedge Wren and Common Yellowthroat benefit from conservation efforts for the Eastern Black Rail.
Ray Hennessy, rayhennessy.com

Key Objectives and Activities

Type	Description	Timing
Action	**Identify Habitat Priorities on Private Lands**	
Objective 1	Complete focal area maps and private landowner database.	2021
Action	**Develop Assurance Program**	
Objective 2	Form a committee that works to develop the program.	2021
Activity 2.1	Secure funding and assign staff to run assurance program.	2022
Activity 2.2	Provide assistance to states to create Safe Harbor Agreement Programs/ assurance program.	2022
Objective 3	Within three months of BMP development (see other chains), committee refines assurance program to reflect current BMPs.	variable
Action	**Engage Landowners in Safe Harbor Agreement Program**	
Objective 4	Within three months of developing the Safe Harbor Agreement Program, develop an outreach strategy to promote it.	2022
Objective 5	Once outreach strategy is in place, state agencies conduct outreach to promote the program on an ongoing basis.	2023
Activity 5.1	Within six months of program initiation, conduct workshops with priority stakeholders in each state.	2023
Objective 6	Within one year of program initiation, enroll at least one landowner in the Safe Harbor Agreement Program in each participating state.	2024
Objective 7	Within six months of program creation, develop two demonstration sites in Florida and one in South Carolina.	2024
Objective 8	On an ongoing basis, ensure that all landowners enrolled in the Safe Harbor Agreement Programs are implementing the BMPs specified in their agreements.	Annually
Objective 9	Protect enough Black Rail habitat on private land to supplement Black Rail habitat on public lands to stabilize population above 300 pairs.	2024

Table 4: Target Vegetation for Black Rail Habitat Management - Tidal Wetlands

Conservation Region	Target Vegetation	Secondary Vegetation
Southern New England (MA, RI, CT, NY)	salt meadow cordgrass (*Spartina patens*); black needlerush (*Juncus gerardii*)	coastal saltgrass (*Distichlis spicata*); short form smooth cordgrass (*Spartina alterniflora*);
Mid-Atlantic (PA, NJ, DE, MD, VA)	salt meadow cordgrass (*S. patens*); smooth cordgrass (*S. alterniflora*); coastal saltgrass (*D. spicata*); blackgrass (*J. gerardii*); and chairmaker's bulrush (*Schoenoplectus americanus*)	In higher elevations (transition zone): shrubs such as Jesuit's bark (*Iva frutescens*) and eastern baccharis (*Baccharis halimifolia*) In high marsh: black needlerush (*Juncus roemerianus*)
South Atlantic/ Piedmont (NC, SC, GA)	North of Charleston, SC: salt meadow cordgrass (*S. patens*) and coastal saltgrass (*D. spicata*) South of Charleston, SC: predominantly sand cordgrass (*Spartina bakeri*) (Schmalzer et al. 1991); salt meadow cordgrass; chairmaker's bulrush (*S. americanus*)	In higher elevations (transition zone): eastern baccharis (*B. halimifolia*) In tidal wetlands: marsh fimbry (*Fimbristylis castanea*); chairmaker's bulrush (*S. americanus*); sand cordgrass (*S. bakeri*); black needlerush (*J. roemerianus*); and sea oxeye daisy (*Borrichia frutescens*) (Hand 2018). In managed tidal impoundments: sand cordgrass; chairmaker's bulrush; saltmeadow cordgrass (*S. patens*); coastal saltgrass (*D. spicata*); sturdy bulrush (*Bolboschoenus robustus*); and cattails (*Typha spp.*) (Roach and Barrett 2015, Hand 2018).
Florida	In tidal wetlands: Matrix dominated by sand cordgrass (*S. bakeri*), salt meadow cordgrass (*S. patens*); coastal saltgrass (*D. spicata*) In brackish wetlands: sand cordgrass, Jamaica swamp sawgrass (*Cladium jamaicense*)	In tidal wetlands: black needlerush (*J. roemerianus*) (Mendelssohn et al. 2017), glasswort (*Salicornia spp.*) and saltwort (*Batis maritima*) in matrix with target vegetation, and possibly eastern baccharis (*B. halimifolia*) (Florida Fish and Wildlife Conservation Commission 2003).

High marsh grasses in tidal habitat for Eastern Black Rail. Craig Watson

Table 5: Target Vegetation for Black Rail Habitat Management - Non-Tidal Wetlands

Conservation Region	Target Vegetation	Secondary Vegetation
Southern New England (MA, RI, CT, NY)	cattail (*Typha latifolia*); bulrush (*Scirpus fluviatilis*); sedges (Carex *sp.*)	Dense overhead vegetation (structure more important than floristic composition)
Mid-Atlantic (PA, NJ, DE, MD, VA)	In wet meadows and freshwater marshes: cattail (*Typha latifolia*); bulrush (*Scirpus fluviatilis*); rice cut grass (*Leersia oryzoides*); *carex sp.*	Dense overhead vegetation (structure more important than floristic composition)
South Atlantic/ Piedmont (NC, SC, GA)	In managed non-tidal impoundments, wet meadows and freshwater marshes: bulrush spp.; sedge spp.; spikerush spp.; and cattails (*Typha spp.*)	Dense overhead vegetation (structure more important than floristic composition)
Florida	Central wet prairies: Quite diverse but dominated by grass spp. on the edges of or near ephemeral ponds Lake Okeechobee littoral marshes: mixed grasses, including sand cordgrass (*S. bakeri*) and bluestem spp. (*Andropogon spp.*) Everglades: Jamaica swamp sawgrass (*C. jamaicense*)	Central wet prairies: mixed forbs including *Hypericum spp.* Lake Okeechobee littoral marshes: unknown Everglades: potentially muhly grass (*Muhlenbergia filipes*)

Inland non-tidal Black Rail habitat at St. Johns National Wildlife Refuge, Brevard County, Florida. Adam Smith/USFWS

BLACK RAIL SCIENCE & RESEARCH NEEDS

The ACJV Black Rail Working Group developed a prioritized list of science and research needs for Black Rail to help guide future conservation efforts (Table 6). The highest priority needs fall into four primary groups of activities:

1) **Habitat Management**: Determine which habitat features support Black Rails at the site and regional scales and use this knowledge to identify/recreate those features on the ground to create new habitat;

2) **Monitoring**: Develop common monitoring protocols for habitat and population response and consistently apply them at the site and regional scales;

3) **Demographics**: Evaluate which vital rates are impacting populations the most and assess distribution and survival in the nonbreeding season; and

4) **Methodology**: Develop methodology around handling captured Black Rails and evaluating new technologies (e.g., ARUs, nanotags).

Science Needs Prioritization Process

Each need was scored according to the following criteria:

Conservation Priority - Across the ACJV region, how important is this action for the species?
1 = high; 2 = medium; 3 = low

Immediacy - How soon does this action need to be taken?
1 = 0-2 yrs; 2 = 3-5 yrs; 3 = 5+ yrs

Scores were averaged and then ranked according to the combined average of the 'conservation priority' and 'immediacy' scores. Actions were divided into three priority Tiers based on natural breaks in the average score. Table 5 includes the action items in order of priority. Please visit the ACJV website to see the full table, with additional information (e.g., scale, cost, feasibility).

Specific research has been identified that will inform when, how, where, and what to do for conservation of the Eastern Black Rail. Christy Hand

Table 6. ACJV Black Rail (Black Rail) Prioritized Science Needs. Avg (average) Score is the mean of Priority (conservation priority) and Imm (immediacy) scores.

Tier	Category	Action	Priority	Imm	Avg
1	Habitat Mgt	Determine what combination of habitat features attracts rails and promotes population growth.	1	1.278	1.139
1	Monitor	Develop common protocols for assessing habitat (vegetative/ hydrologic) and population responses to habitat modifications.	1.278	1.222	1.250
1	Habitat Mgt	Develop and test the effectiveness of various management strategies in both saltwater and freshwater systems.	1.111	1.444	1.278
1	Habitat Mgt	Assess what makes some locations better than others in continuing to support Black Rails and apply this knowledge to identifying refugia and suitable habitat across the Black Rail range.	1.111	1.444	1.278
1	Popn Dem	Determine which vital rates are having the greatest impact on population growth (or decline).	1.222	1.444	1.333
1	Monitor	Set up a long-term monitoring program and determine best approach across range (e.g., index sites, broad surveys, etc.).	1.333	1.444	1.389
1	Monitor	Develop common monitoring (e.g., occupancy and abundance) protocols and determine if regional protocols are necessary.	1.44	1.333	1.389
1	Habitat Mgt	Map Black Rail habitat across range and identify/prioritize potential areas for management.	1.5	1.5	1.500
1	Method	Develop best practices for trapping, banding, and attaching transmitters/tags to Black Rail.	1.556	1.444	1.500
1	Method	Assess the value of new technologies (e.g., ARUs, nanotags).	1.722	1.333	1.528
1	Popn Dem	Identify wintering areas and examine the distribution, abundance, and survival of Black Rail across those areas.	1.5	1.588	1.544
2	Habitat Mgt	Model the effects of Sea Level Rise on coastal habitat and determine feasibility of building marsh resiliency/facilitate marsh migration in key areas.	1.556	1.647	1.602
2	Popn Dem	Determine if severe storm events negatively impact adult survival on a broad scale.	2.056	1.706	1.881
2	Popn Dem	Determine the preferred boundaries of management units based on biologically, geophysically, or politically significant factors.	2.222	1.647	1.935
2	Habitat Mgt	Determine whether social attraction (e.g., broadcast calls) can be used to populate new habitat.	2.222	1.75	1.986
3	Popn Dem	Determine which Black Rail populations are migratory and what areas they use in migration.	2.333	1.944	2.139
3	Popn Dem	Determine whether high density Black Rail congregations are due to habitat preferences or colonial behavior.	2.500	1.941	2.221

MONITORING & EVALUATING SUCCESS

The success of the Black Rail Plan depends on the ability to monitor and assess performance and collective progress toward the plan's objectives. In the short- and medium-term it is imperative to ensure that the plan's objectives are being implemented and the efficacy of its approaches assessed to be able to be adaptive and make course corrections along the way. Over the long-term, it is critical to understand the effects of collective actions on Black Rail populations. The ultimate measure of success will be reaching and maintaining the goal of 2,500 breeding pairs of Black Rails. To achieve both short- and long-term goals, the following monitoring and evaluation needs have been identified.

Eastern Black Rail Surveys at Salt Lake Wildlife Management Area, Florida. Amy Schwarzer.

Conservation Action Tracking

This plan includes 44 distinct objectives across six different conservation strategies. These objectives include science, management, outreach, and engagement activities and rely upon ACJV partners working in a coordinated fashion to advance Black Rail conservation throughout the joint venture region. A centralized and publicly accessible tracking tool will be necessary to measure the status of the overarching strategies, the various actions taken, and progress towards agreed-upon objectives. This tracking tool will provide current information about the approaches and actions underway and the stakeholders or landowners involved. It will allow managers to search for examples of successful management actions, and identify gaps in coverage across the landscape. The tool will provide a centralized location for partners to track progress in general and on specific objectives (e.g., number of acres of a particular management practice put in place on the ground). The tracking tool website will also provide partners with various data products and conservation tools that have been developed. We intend to model this tool after the Atlantic Flyway Shorebird Initiative (AFSI) 'Dashboard', which is used to track objectives laid out in the AFSI Business Plan. Completion of this tool is anticipated in 2020.

Monitoring Black Rail Populations

Monitoring Black Rail populations is difficult due to the highly secretive nature of the birds. Traditionally, surveys for Black Rails have been point counts that used either a single-species or multi-species playback protocol. These surveys almost always took place during the breeding season. Detection rates during this type of survey can be as low as ~10% (Tolliver et al. 2018). Many questions remain about the methodology and timing of surveys. For instance, the time of day during which Black Rails are most responsive seems to vary considerably on a regional level, and possibly even by locale. Another hurdle is that deriving accurate abundance estimates is generally infeasible given low detection rates and variability in individual response rates at different stages of the breeding cycle (Legare et al. 1999), leading some researchers to adopt a metapopulation approach within an occupancy framework (Beissinger 2017, pers. comm). However, applying this approach in the East, where habitat patches are not necessarily discrete from one another, presents its own challenges. Programs such as Saltmarsh Habitat and Avian Research Program (SHARP) and the Standardized North American Marsh Bird Monitoring Protocol (Conway 2009) have devised methods to tackle similar questions, but their methods need to be examined in a Black Rail-specific context to determine if they are appropriate for creating a regional Black Rail sampling scheme.

Given the numerous difficulties surveying these birds, the outstanding methodological and design questions, and the availability of emerging technologies, such as autonomous recording units (ARUs) and game cameras, a group of partners convened a team in spring 2019 to examine these issues across the Eastern Black Rail range and develop recommendations. Those efforts are ongoing. In the meantime, methods that are currently being used by partners to survey for Black Rails are presented below.

Breeding Surveys

Targeted comprehensive surveys for Black Rails throughout the Atlantic and Gulf Coast states began in 2014 and continue to this day. These surveys led to the current population estimates for coastal Black Rail populations (Watts 2016). At a minimum, a comprehensive regional survey of breeding Black Rails in the ACJV region should be conducted once every 5 years in order to track population status and success of conservation efforts.

Survey Protocols

A typical breeding season protocol will include point counts with a playback recording that includes 2-5 minutes of passive listening followed by a variety of Black Rail calls interspersed with silence, and ending with another passive listening period (e.g., Schwarzer et al. 2018 and Tolliver et al. 2018). It may also include calls of conspecific rallids known to elicit Black Rail calls. While the North American Marsh Bird Monitoring Protocol (Conway 2015), or 'Conway Protocol', includes Black Rail as part of its playback sequence, that protocol is generally not as effective at eliciting responses as a Black Rail-specific protocol (Conway et al. 2004). However, data gathered from such surveys should not be discounted as an important source of information and can be used in analyses under the right circumstances. The 'Maryland protocol' is a commonly used adaptation of the 'Conway Protocol' in the Mid-Atlantic states and several other states have created their own variations of these two protocols. In addition, some surveys have begun to use ARUs (e.g., Bobay et al. 2018) for breeding surveys, which does increase detections, but a standard protocol for their use does not exist at this time.

Non-breeding Surveys

To date, one study in Louisiana utilized two methodologies for detecting Black Rails during the breeding and non-breeding seasons: point count surveys and drag line surveys (Johnson and Lehman 2019). Haverland (2019) also utilized several techniques to detect Black Rails in coastal Texas, including call-playback surveys and the bottle-line and audio-lure methods. Point counts and call-playback were generally used to determine presence and habitat occupancy, while the bottle-line method, audio-lure method, and dragline surveys were used to capture Black Rails to study home range and territory. Additional testing is needed on these and other techniques (e.g., playback, drag-line, etc.) to examine applicability and efficacy. A comprehensive survey of Black Rails during the non-breeding season is needed to understand which areas are most important during the winter or migration.

Evaluating Management Actions

Monitoring performance of management and restoration actions will provide an improved understanding of Black Rail response to a given action and inform future decisions regarding Black Rail conservation actions. It is also helpful to assess the amount of time it takes birds and the vegetation and food resources they rely on to respond to different techniques. Priority management and restoration actions and standardized monitoring protocols will

It will be important to monitor management strategies for the Eastern Black Rail such as this freshwater marsh in coastal South Carolina. Craig Sasser

be identified and developed through the Black Rail Adaptive Management Project (see p.13) and will be used to answer additional questions about the effect of management activities on Black Rail occupancy and abundance.

Monitoring Reproductive Success

The ultimate goal of this plan is to stabilize and then increase Black Rail populations in the ACJV region. To accomplish this, it is imperative to have some ability to gauge reproductive success, especially at managed or restored sites, to understand how/whether conservation actions are affecting population growth. Demographic data collection such as nest monitoring is intensive, expensive and could cause unintended impacts to Black Rail nest success through disturbance or predation. Therefore, it may only be feasible to determine how management affects population growth at a small sample of managed sites and then extrapolate those results to other sites managed similarly.

Vegetation Monitoring

Because Black Rails do not always occupy seemingly suitable habitat, vegetation monitoring is only recommended when it is tied to Black Rail survey or productivity efforts. Measuring habitat structure and vegetation characteristics may not provide sufficient information to inform management decisions as factors such as sea level rise may impact Black Rail reproductive success more quickly than they affect habitat structure. Some habitats that appear to be suitable based on vegetation characteristics may actually be functioning as sinks due to increased nest flooding rates. The vegetation itself may not change in a noticeable way until Black Rails have long since abandoned the site. Therefore, vegetative surveys and avian monitoring in response to conservation actions should always be integrated. The SHARP protocols provide a simple approach to sampling vegetation characteristics, however, they may need some modification in the Southeast.

Members of the Black Rail Working Group are directing studies to determine the best management techniques to increase the population of the Eastern Black Rail. Craig Watson

Black Rail. Mark J. Rauzon, McCaully Library

APPENDIX 1: THREAT ASSESSMENT

Evaluating threats is a central part of conservation planning and forms the basis for prioritizing the main strategies selected to address the threats and improve Black Rail populations. Threats were identified and rated for Black Rail by a broad group of partners and experts via a workshop and conference calls in 2018. To quantify threats, the following criteria were considered for each category of threat using a four-point qualitative scale (for more details, see this guide):

Criteria for Rating Threats

Scope or Extent. Geographic area of impact on the biodiversity target (where the target naturally occurs) that can reasonably be expected within 10 years under current circumstances (i.e., given the continuation of the existing situation).

Very High: The threat is likely to be very widespread or pervasive in its scope, and affect the conservation target throughout the target's occurrences at the site.

High: The threat is likely to be widespread in its scope, and affect the conservation target at many of its locations at the site.

Medium: The threat is likely to be localized in its scope, and affect the conservation target at some of the target's locations at the site.

Low: The threat is likely to be very localized in its scope, and affect the conservation target at a limited portion of the target's location at the site.

Severity. The level of damage to the conservation target that can reasonably be expected within 10 years under current circumstances (i.e., given the continuation of the existing situation).

Very High: The threat is likely to destroy or eliminate the conservation target over some portion of the target's occurrence at the site.

High: The threat is likely to seriously degrade the conservation target over some portion of the target's occurrence at the site.

Medium: The threat is likely to moderately degrade the conservation target over some portion of the target's occurrence at the site.

Low: The threat is likely to only slightly impair the conservation target over some portion of the target's occurrence at the site.

Irreversibility. Degree to which the effects of a threat can be undone (and the target restored).

Very High: The effects of the threat are not reversible (e.g., wetlands converted to a shopping center).

High: The effects of the threat are technically reversible, but not practically affordable (e.g., wetland converted to agriculture).

Medium: The effects of the threat are reversible with a reasonable commitment of resources (e.g., ditching and draining of wetland).

Low: The effects of the threat are easily reversible at relatively low cost (e.g., off-road vehicles trespassing in wetland).

Table 7: Criteria scoring for threats assessment. Individual ratings are rolled up to produce the summary rating. For more information on threat rating algorithms, see "Reference Materials" folder here.

Direct Threat	Scope	Severity	Irreversibility	Summary Threat Rating
Loss of Habitat & Potential Nest Flooding due to Sea Level Rise	Very High	Very High	High	Very High
Loss of Habitat due to New Residential Development	High	High	Very High	Very High
Loss of Habitat Quality due to Increased Temperature & Drought	Very High	High	High	High
Direct Mortality & Nest Loss due to Storms and Flooding	Very High	High	High	High
Agricultural Practices Incompatible with Black Rail Habitat	High	High	Medium	High
Marsh Burning Inconsistent with Species Needs	High	High	Medium	High
Land Use Incompatible with Marsh Migration	High	Very High	High	High
Incompatible Management of Impoundments	Medium	Medium	Medium	Medium
Existing Development Impacting Black Rail Habitat	Medium	Very High	High	Medium
Degradation of Habitat due to Open Marsh Water Management	Medium	Very High	High	Medium
Disease (e.g., West Nile)	Very High	Medium	High	Medium
Problematic Native Species	Medium	Medium	Medium	Medium
Transportation Infrastructure that Restricts Tidal Flow	High	Medium	High	Medium
Invasive Non-native Species	Medium	Medium	Medium	Medium
Shoreline Hardening	Low	High	High	Low
Disruptive Birding, Recreation, & Research	Low	Medium	Medium	Low
Oil spills	Low	Medium	High	Low

APPENDIX 2: THREATS NOT ADDRESSED

DEVELOPMENT

Loss Of Habitat Due To New Residential Development

New residential development brings a host of threats to Black Rail habitat and populations. When development occurs near high marsh habitats, upland habitats prevent marsh migration as sea level rises and reduce the extent and amount of high marsh available to Black Rails. Additionally, surface runoff of pesticides, fertilizers, and other contaminants may impact the quality of any high marsh remaining after development.

Residential development, along with hardened shorelines is a leading cause of Black Rail habitat loss. Chesapeake Bay Program

Existing Development Impacting Black Rail Habitat

Approximately 50% of the wetlands in the conterminous U.S. have been lost over the past 200 years (Dahl 1990). Similarly, most of the native grassland/prairie habitats associated with Black Rail habitat have been lost since European settlement (Samson and Knopf 1994). Existing development has resulted in direct loss of habitat for Black Rails and is a hard barrier to marsh migration, preventing naturally occurring marshes from migrating into transitional uplands to form new marsh.

Shoreline Hardening

From Massachusetts to Florida, over 40% of the land below 1m above mean sea level is currently developed and almost 60% (Titus et al. 2007) is expected to be developed in the future. Associated shoreline hardening (via sea walls, dikes, bulkheads, jetties etc.) designed to protect coastal communities now covers 14% of the entire U.S. coastline, and affects >50% of the shoreline (Gittman et al. 2015) in some areas. These hardened shorelines directly affect the ability of a marsh to migrate, eventually eliminating most of the high marsh available for use by Black Rails.

Transportation Infrastructure that Restricts Tidal Flow

Roads and railways (hereafter "transportation infrastructure") are one of the most frequent causes of tidal restrictions, fragmenting coastal marshes and eliminating or reducing the natural flow between tidal water from coastal areas and freshwater from adjacent uplands. Construction of roadways and/or train tracks often requires construction of earthen embankments to keep them level and allow them to pass through wetlands or other low-lying areas. Within and around wetlands, these berms tend to function as dikes, and can dramatically affect wetland hydrology. Transportation-related changes to salt marshes have also led to the establishment and proliferation of invasive species, such as P*hragmites australis* (common reed), *Lythrum salicaria* (purple loosestrife), and narrowleaf cattail (*Typha angustifolia*), which now dominate many areas that were formerly salt marshes. The historical impacts to coastal wetlands are considerable and new transportation infrastructure continues to encroach upon marsh ecosystems

CLIMATE CHANGE

Loss of Habitat Quality due to Increased Temperature and Drought

Along with sea level rise, climate changes resulting in more frequent droughts pose significant threats to the Black Rail throughout its range. Without adequate water, availability of prey (i.e., aquatic macroinvertebrates) may decline and limit reproductive success. Too little water and too much water may be equally detrimental to

reproductive success; more information about water level fluctuations and the resiliency of nests and chicks to water level fluctuations is needed.

The best available information indicates climate change will result in increased temperatures, decreased precipitation, and an increase of severe weather events, such as drought and storms within the range of the subspecies, and are likely to have significant influences on the future resiliency of Black Rail populations. These trends are expected to exacerbate the challenges related to past and ongoing habitat loss, making it less likely for populations to withstand extreme weather events that are likely to increase in frequency and severity (U.S. Fish and Wildlife Service 2018).

Phragmites in Dorchester County, Maryland. Ducks Unlimited, Inc.

Increased temperatures also influence estuarine systems by allowing salt marsh habitat encroachment by mangrove species. Black Rails may be able to tolerate the early invasion of salt marshes by mangroves, but will presumably abandon a site when mangroves become more established (U.S. Fish and Wildlife Service 2018). From 1984 to 2011, mangroves have doubled their spatial extent (Cavanaugh et al. 2014), and have no doubt influenced the amount of habitat available to Black Rail in more southern latitudes.

OTHER THREATS

Invasive Non-native Species

Where marshes are disturbed through construction activities for levees, dikes, drainage canals, and water control structures, invasive plant species such as *Phragmites* are quick to invade and establish in areas of high marsh. This can lead to shrub- and tree-dominated landscapes rendering these habitats unsuitable for Black Rail. Tidal restrictions that reduce or eliminate tidal influence on wetlands upstream of the restriction can also promote dominance of *Phragmites*, which cannot tolerate more saline conditions. *Phragmites* encroachment is a particular problem in the northern portion of the Black Rail range.

Exotic species are a major issue in Florida, and occupy vast areas (i.e., 200k-300k acres) of the Everglades. Introduced plant species, in particular, are posing serious long-term threats to Florida salt marshes, including Brazilian pepper (*Schinus terebinthifolius*), Australian pine (*Casuarina equisetifolia*), melaleuca (*Melaleuca quinquenervia*), seaside mahoe (*Thespesia populnea*), lather leaf (*Colubrina asiatica*), and old world climbing fern (*Lygodium microphyllum*).

Imported red fire ants have been shown to decrease the arthropod abundance in grasslands, decreasing brood survival of young quail and Dark-eyed Junco (Suarez et al. 2005), and there is one documented case of fire ants depredating a hatching Black Rail chick (Legare and Eddleman 2001).

Burmese pythons, introduced through the pet trade, have expanded their range in Florida considerably (Harvey et al. 2008). Out of 343 Burmese python stomachs examined, birds were found in 89 stomachs and 19 of the 73 birds identified were rallids, although none were Black Rails (Dove et al. 2011).

Degradation Of Habitat Due To Open Marsh Water Management

An example of open marsh water management from Deal Wildlife Management Area in Maryland. Craig Watson

An alternative approach to ditching is Open Marsh Water Management (OMWM), which addresses mosquito populations in marshes while ameliorating the negative impacts of grid ditching, has been developed in the past few decades but is considered a potential threat to Black Rails (Mitchell et al. 2006). This approach specifically targets the high tide marsh considered to be optimal nesting habitat for Black Rails. This is because high tide marshes are irregularly flooded and leave isolated pocket depressions filled with water and suitable for mosquito production. OMWM creates ponded areas on the marsh and/or plugs previously constructed ditches in order to fill the pocket depressions and maintain access to mosquito larvae by fish. This approach is not entirely accepted by wetland experts and land managers due to the need to alter, fragment, and convert pristine marshes to create the ponded areas. Heavy equipment compacts emergent marsh, which changes the vegetation community and allows invasion of shrubs and non-native species due to elevation changes (Mitchell et al. 2006). While OMWM does have potential benefits to some wildlife species (e.g., increased forage base and feeding habitats for waterbirds, addition of perching and nesting substrates for wetland birds), the effects on the Eastern Black Rail have not been evaluated.

Disease

There are no documented cases of disease for the Black Rail subspecies as a whole (Eddleman et al. 1994). The recent introduction of the West Nile virus in 1999 resulted in significant avian mortality in some types of birds, especially corvids (crow family) (McLean 2006, entire; McLean and Ubico 2007). Although no specific data exists regarding the effects of West Nile virus on Eastern Black Rails, the virus is speculated to be a leading driver of recent local extinction events in the Sierra Foothills population of the California Black Rail (Risk et al. 2011). The exact relationship between disease, specifically West Nile virus, and the Eastern Black Rail is not well defined; however, increased drought conditions can increase concentrations of vectors and hosts and, being a relatively new virus to North America, the Eastern Black Rail may not have adapted to its presence and could be at risk.

Problematic Native Species

Due to increasing temperatures and sea level rise, estuarine systems in the southern U.S. are experiencing encroachment by mangrove species, and Black Rails will presumably abandon high marsh habitat where mangroves are establishing (U.S. Fish and Wildlife Service 2018).

Black Rail are vulnerable to predators like raccoons. Todd Schneider

Predators are sometimes attracted to habitats close to human habitation where food wastes artificially support elevated predator densities (Gompper and Vanak 2008; DeCesare et al. 2010; Newsome et al. 2015). Predation of Black Rails by various native species has been documented, including northern harrier (*Circus cyaneus*), snakes, coyote (*Canis latrans*), raccoon (*Procyon lotor*), great egret (*Ardea alba*), and barn owl (*Tyto alba*) (Eddleman et al. 1994). Predation of California Black Rails during abnormally high tides has also been documented (Evens and Page 1986) and is likely an important driver of Black Rail predation in tidally influenced marshes as well as managed wetlands where flooding rains can force Black Rails to the tops of dikes where they are vulnerable to predators.

Disruptive Birding, Recreation, and Research

Rare birds are often desired by birders to add to their "Life List" – a list of every bird species identified within a birder's lifetime. While amateur and professional birding have made important contributions to our understanding of rare species distributions, like the Black Rail, some birders may be more likely to pursue a sighting of a rare bird, as they may perceive the benefits of observing the bird to outweigh the impacts to the bird (Bireline 2005). As a result, methods may be employed to increase the likelihood of observing a rare bird, including the use of vocalized calls or audio recordings, as is the case for Black Rails, or approaching birds in order to get a sighting (Beans and Niles 2003; Bireline 2005). These methods have the potential to disturb nesting birds, trample nests or eggs, and may lead to increased predation (Todd 1977, Beans and Niles 2003).

Trespassing has been documented on private lands and in areas on public lands specifically closed to the public to protect nesting Black Rails (Hand 2017b, pers. comm.; Roth, 2018, pers. comm.). Trespassing may not only disturb the bird, but can also result in trampling of the bird's habitat as well as eggs and nests. There is concern among state resource managers and researchers that releasing locations of Black Rail detections may increase human disturbance and harassment to the subspecies (U.S. Fish and Wildlife Service, 2018). Currently, eBird has designated the Black Rail as "sensitive" and all past, current, and future reports through eBird are hidden from general public view, thus alleviating some of the concern from disturbance by birders. However, this data can be made available for research and scientific purposes and must be requested officially through the eBird system.

Oil Spills

In general, the frequency and amount of oil released into the environment of the U.S. has decreased over time (Etkin 2001). While there is little documentation of impacts to Black Rails from oil spills, there are data demonstrating impacts to secretive marsh bird species and their habitat that often overlap with habitat used by Eastern Black Rails (Bergeon Burns et al. 2014; Bonisoli-Alquati et al. 2016; Deepwater Horizon Natural Resource Damage Assessment Trustees 2016; Hester et al. 2016). While spills are infrequent, the significance of a single event could have drastic short-term and long-term impacts to local habitats and populations of fish and wildlife, including Black Rails (Gerber et al. 2004; Boehm and Page 2007).

APPENDIX 3: PRIORITIZED LIST OF STRATEGIES

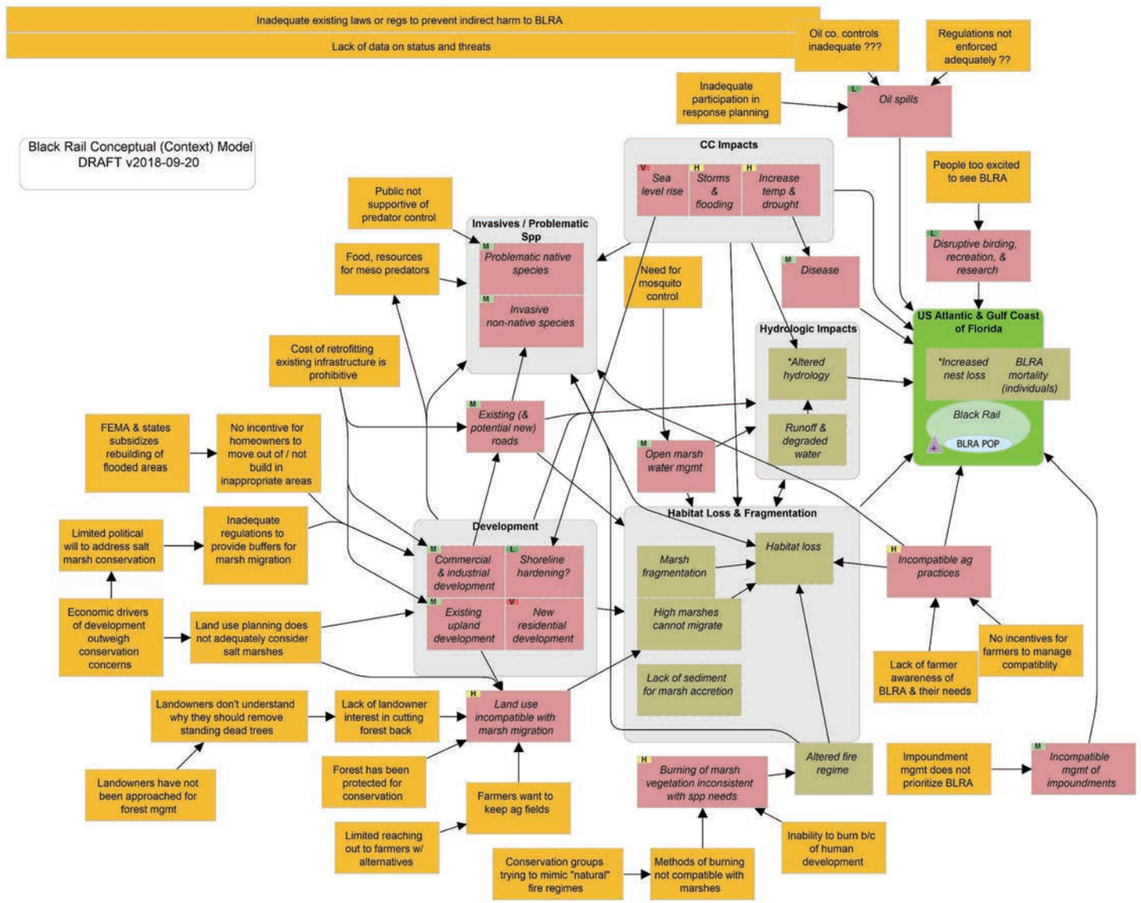
Prioritized list of strategies identified at the Black Rail Action Planning Workshop:

	# Votes	Strategy	Description	Comments
Strategies included in the plan	28	Create New Black Rail Habitat	Includes creation of new habitat in marsh migration zone as well as non-tidal areas, including agricultural lands, wet meadows, irrigation areas, water treatment facilities etc. Excludes impoundments	This strategy was later separated into two strategies: Create New Non-tidal Black Rail Habitat and Facilitate Marsh Migration (from Salt Marsh Plan)
	16	Promote Targeted Impoundment Management	Alternative management of impoundments or portions of impoundments to benefit Black Rail	
	12	Develop & Promote Black Rail-Friendly Fire BMPs	Develop BMPs for use of fire to reduce mortality and create suitable habitat	
	4	Develop & Promote Black Rail-Friendly Agricultural BMPs		This strategy is very focused on Florida populations. The group only gave it 4 votes but elevated it as a priority after it was noted that Florida supports 2/3 of the Black Rail population and that there is great potential to support Black Rails on ag/ranch lands. Six participants then indicated they would have voted for this strategy with this additional information
	12	Develop a Landowner Assurances Program (Safe Harbor Agreements)	Provides landowners certainty that land use will not be limited if management actions result in Black Rail occupancy	
Other strategies evaluated	8	Protect Transition Zone	Identify and protect important marsh migration zones	From Salt Marsh Bird Conservation Plan
	7	Integrate Salt Marsh Conservation into Farm Bill Programs (and other incentive programs)	Develop cost share/incentives for Black Rail management	From Salt Marsh Bird Conservation Plan plus addition in parentheses from Black Rail planning workshop
	6	Restore degraded saltmarsh: Identify & promote BMPs for Open Marsh Water Management		Refinement of Salt Marsh Bird Conservation Plan strategy
	5	Engage/improve local land use planning process	ID key local/state planners to engage in key population areas	From Salt Marsh Bird Conservation Plan
	3	Develop engaged network of practitioners interested in Black Rail management		
	2	Beneficial use of dredge material	Use of dredge to improve marsh resiliency	From Salt Marsh Bird Conservation Plan
	0	Ecological Services programmatic consultations with Department of Transportation/Federal Highways Administration		
	0	Alleviate impacts from pollution, contaminants, and spills		From Salt Marsh Bird Conservation Plan
	0	Engage transportation agencies to improve transportation infrastructure		From Salt Marsh Bird Conservation Plan

APPENDIX 4: CONCEPTUAL MODEL

The Black Rail Plan started with partners developing an overarching conceptual diagram/model of all factors thought to positively and negatively influence populations of the Eastern Black Rail. This, along with the threats assessment described in Appendix 1 and the population objectives, were used to inform the implementation strategies developed by the Working Group.

Conceptual Model



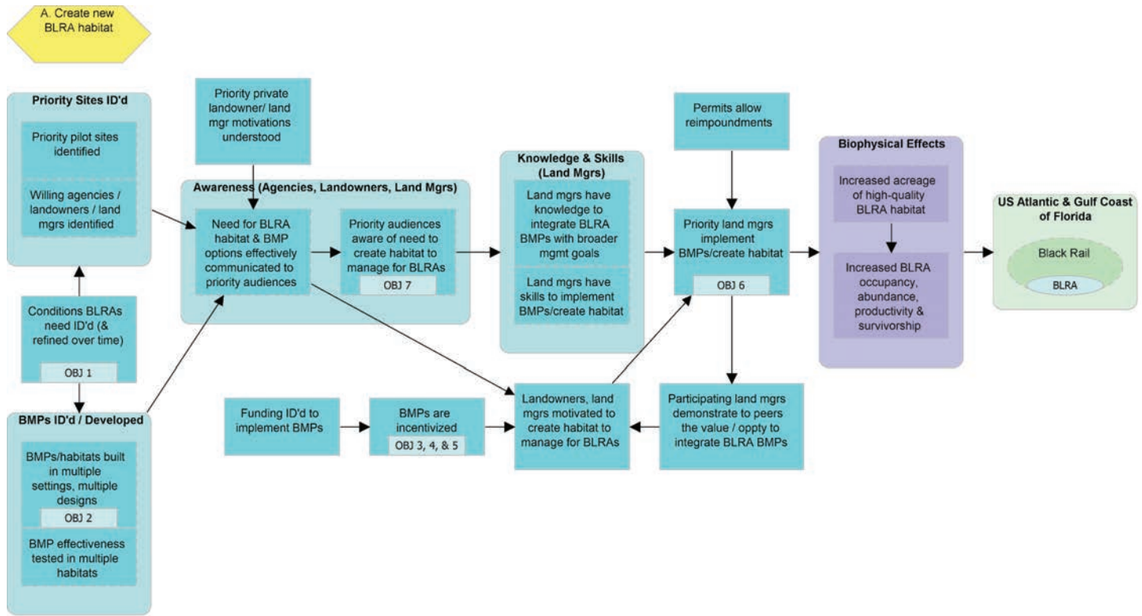
APPENDIX 5: RESULT CHAINS

The Black Rail Conservation Plan includes results chains for six major strategies:

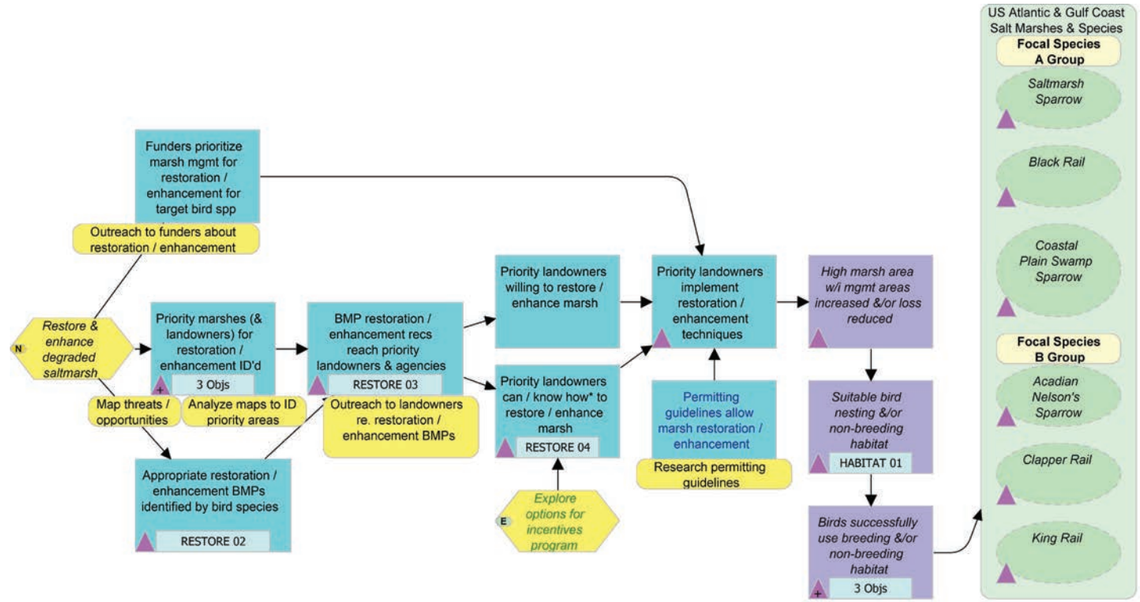
1) Create New Non-tidal Black Rail Habitat
2) Facilitate Marsh Migration (from Salt Marsh Plan)
3) Promote Improved Impoundment Management
4) Develop and Promote Black Rail-Friendly Fire Management BMPs
5) Develop and Promote Agricultural BMPs
6) Develop a Landowner Assurances Program

The ultimate goal of all strategies is to reverse declines of and increase Black Rail populations to reach population goals. Final results chains are below, for each strategy/action listed above:

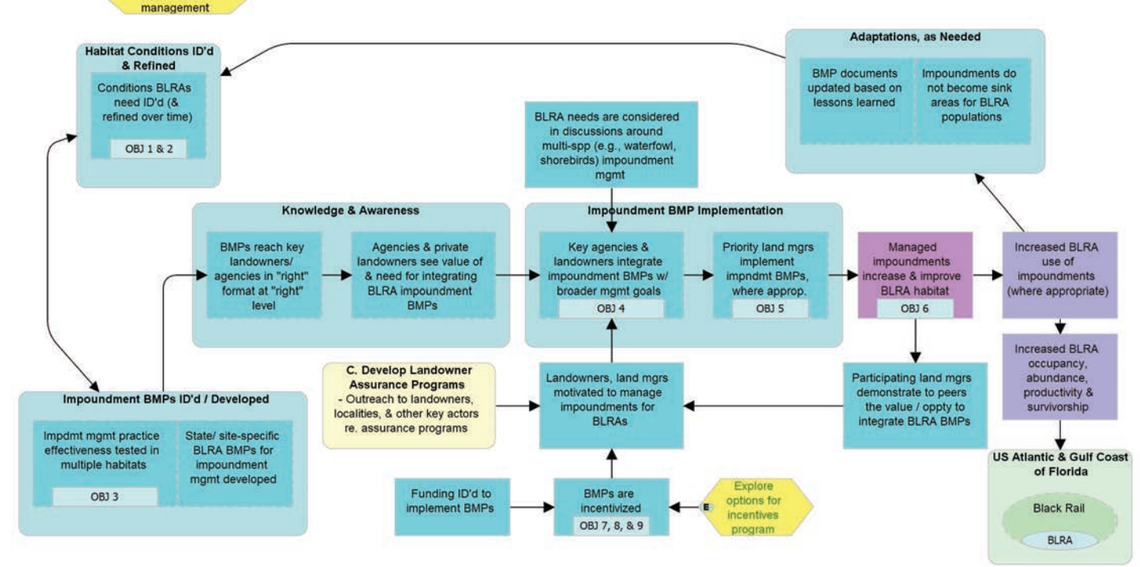
1) Create New Black Rail Habitat



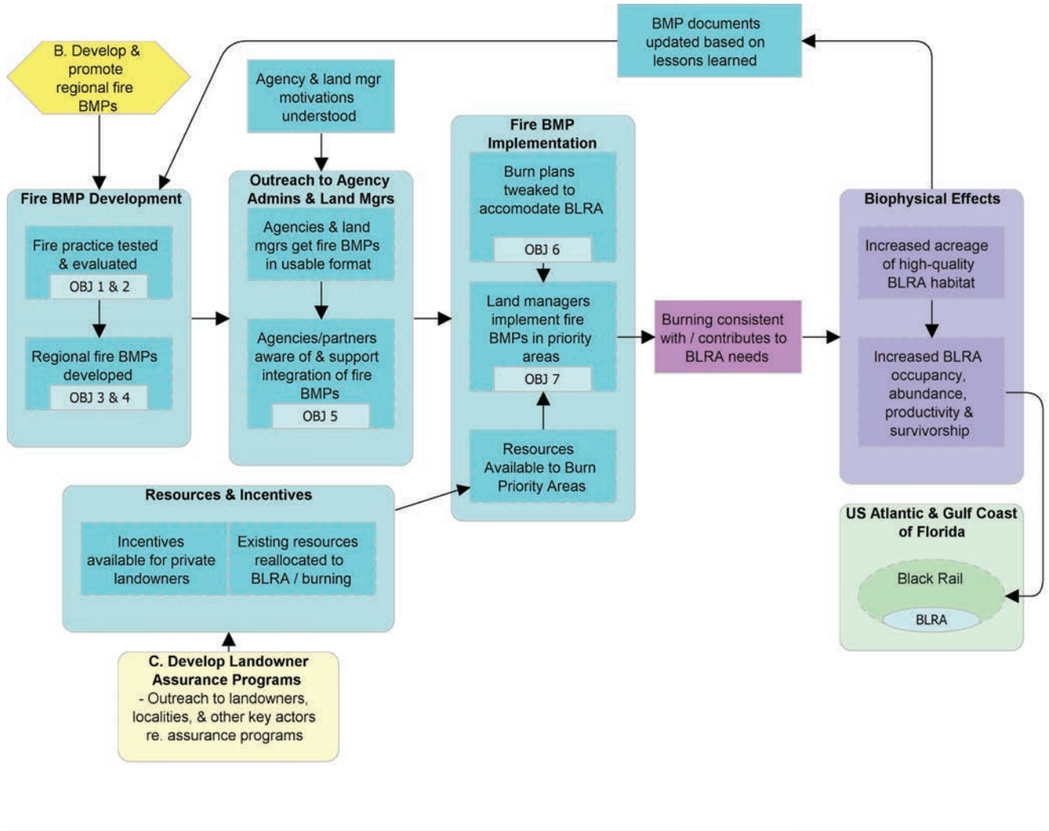
2) Facilitate Marsh Migration (from Salt Marsh Plan)



3) Promote Targeted Impoundment Management

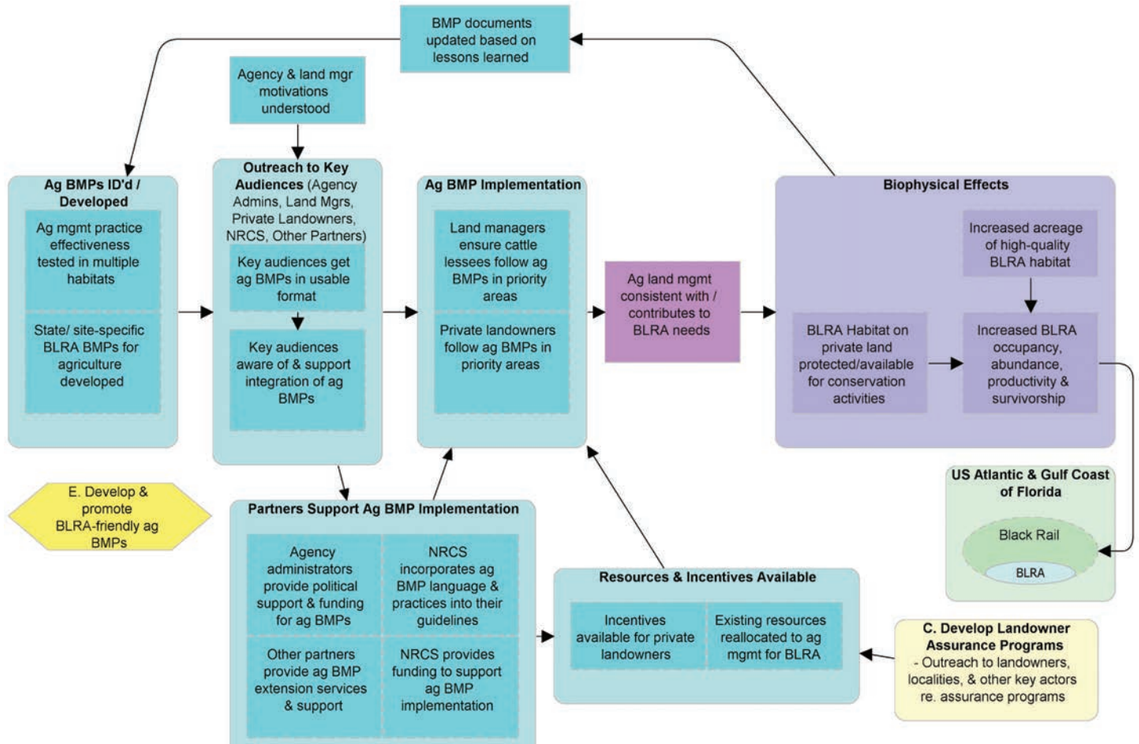


4) Develop and Promote Black Rail-Friendly Fire Management BMPs

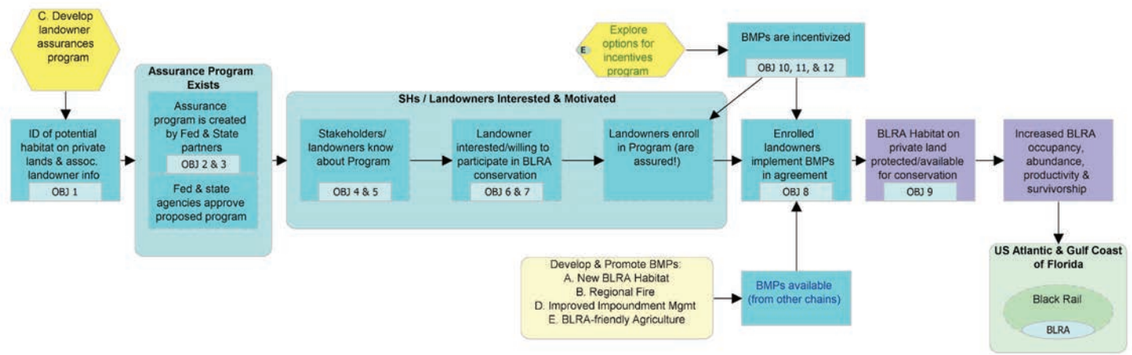


Prescribed fire in open marsh benefits Black Rail. Joachim Treptow, SCDNR

5) Develop and Promote Agricultural BMPs



6) Develop a Landowner Assurances Program



APPENDIX 6: STRATEGY DEVELOPMENT PARTICIPANTS

Table 8: List of participants that helped to develop each strategy.

		Strategy				
First Name	**Last Name**	**A. New Habitat**	**B. Fire BMPs**	**C. Landowner Assurance**	**D. Impoundments**	**E. Ag BMPs**
Mike	Allen	X				
Daniel	Barrineau		X			
Whitney	Beisler			X	X	
Steve	Beissinger	X				
Ruth	Boettcher	X		X	X	
Gwen	Brewer	X	X	X	X	
Dave	Brinker	X	X			
John	Carpenter			X		
Kathleen	Cullen				X	
David	Curson	X				
Christina	Davis	X			X	
Audrey	DeRose-Wilson	X		X	X	
Chris	Elphick	X		X		
Craig	Faulhaber		X			
Auriel	Fournier		X			
Christy	Hand	X	X	X	X	
Mitch	Hartley	X	X		X	
Pete	Henn					X
Carmen	Johnson		X			

		Strategy				
First Name	**Last Name**	**A. New Habitat**	**B. Fire BMPs**	**C. Landowner Assurance**	**D. Impoundments**	**E. Ag BMPs**
Tim	Jones				X	
Kevin	Kalasz				X	
Kirsten	Luke				X	
Rich	Mason				X	
Erin	McLaughlin	X				
Jake	McPherson				X	
Sue	McRae	X	X			
David	Norris	X				
Todd	Schneider		X	X		
Amy	Schwarzer	X	X	X	X	X
John	Stanton		X		X	
Dan	Sullivan					X
Amy	Tegeler			X		
Tim	Towles					X
Nathan	Van Schmidt	X				
Wendy	Walsh	X				
Craig	Watson	X			X	
Bryan	Watts	X				
Aimee	Weldon	X			X	X
Graham	Williams					X
Troy	Wilson				X	
Mark	Woodrey		X			
Woody	Woodrow					X
	Totals	**20**	**13**	**10**	**18**	**6**

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