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Wetland Management Strategies that Maximize Marsh Bird Use in the Midwest

Annual Performance Report

Period: 1 July 2016 – 30 June 2017

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INHS Technical Report 2017 (30)

Prepared for:

Unites States Fish and Wildlife Service
Contract Number: F14AP00485

Issue Date: 28 September 2017

Unrestricted – Release immediately

ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Introduction

Marsh birds are an understudied guild of wetland-associated species that can be valuable indicators of wetland health and condition (Conway 2011). As wetlands have declined in Illinois, likely so have marsh birds due to habitat loss (Bolenbaugh et al. 2011), but until recently, lack of standardized monitoring protocols made assessing population size and wetland occupancy difficult (Conway et al. 1994, Eddleman et al. 1988). In the past, the Breeding Bird Survey (BBS) data served as the sole large-scale source of information on marsh bird abundance, distribution, and population trends despite the known biases for this group of relatively inconspicuous birds (Sauer et al. 2004, Conway 2011). However, recent work by the U.S. Fish and Wildlife Service (USFWS) and other partners has resulted in a framework for coordinated survey design, sampling methods, and data collection and sharing for marsh bird monitoring. Despite existence of this framework and support from a large number of entities, a nationwide program similar to the BBS for marsh birds may not be feasible or financially sustainable. Therefore, there is currently a need for regional-scale, multi-objective projects that adopt approved marsh bird monitoring protocols and produce estimates that can be scaled up to inform a national monitoring effort.

Wetland management in the Midwest is often used to increase energetic carrying capacity for waterfowl, primarily dabbling ducks. Other conservation initiatives encourage multi-species design and management, but often waterfowl are a primary focal group (King et al. 2006, DeStevens & Gramling 2012). It is widely assumed that waterfowl management activities benefit other birds, but few studies have quantified those benefits or evaluated tradeoffs among management strategies for multiple species (O'Neal et al. 2008, Gray et al. 2013). A key assumption of several conservation planning documents is that waterbird (e.g., shorebird, secretive marsh bird) habitat and population objectives can be accomplished by fulfilling waterfowl habitat objectives (e.g., shorebirds, waterbirds). However, few researchers have examined the relationship between wetlands managed for waterfowl and the provision of habitat for other migratory birds, especially in the breeding season. In fact, the Illinois Department of Natural Resources Wetlands Campaign identifies the "contribution of moist-soil management to wildlife objectives" as an important information gap, which requires additional research.

Moreover, intrinsic vegetation characteristics may be less important than wetland surroundings (DeLuca et al. 2004) and size (Brown and Dinsmore 1986) in site occupancy of marsh birds. However, wetland characteristics, such as emergent vegetation type and height, can influence occupancy rates of wetland complexes, but associations with intrinsic and extrinsic factors are highly variable in the Midwest, perhaps because habitat is limited (Bolenbaugh et al. 2011). Thus, wetlands managed for other species (e.g., dabbling ducks) may provide benefits to marsh birds collectively or a subset of species (e.g., rails).

We determined marsh bird use across a wide range of wetland types (e.g., emergent, non-vegetated, riparian), hydrologic regimes (e.g., temporary, seasonal, semi-permanent), management practices (e.g., active, passive, unmanaged), and past disturbance regimes (e.g., natural and restored, impounded and unimpounded) in Illinois during late spring and early summer in 2015–2017. Our objectives were to 1) compare marsh bird use of restored and natural wetlands, 2) determine characteristics of wetlands and the surrounding landscape that influence marsh bird use of restored and natural wetlands, 3) compare marsh bird use of wetland impoundments managed for waterfowl across a continuum of management intensities and strategies to predict how these actions can increase use by both waterfowl and marsh birds. Additionally, we surveyed marsh birds using the standard protocols on wetlands concurrently surveyed within the Illinois Critical Trends Assessment Program (CTAP) for comparison of methodologies. We will provide marsh bird and other wetland-associated bird data to the Midwest Avian Data Center and the Avian Knowledge Network (AKN) and other conservation partners. Our data will be used as a basis for establishment of multi-group management strategies for marsh birds in the Midwest. These data will be especially useful as the Illinois Department of Natural Resources (IDNR) finalizes their Wetlands Campaign and Conservation Strategy as part of the Illinois Comprehensive Wildlife Conservation Plan and Strategy (i.e., wildlife action plan; ICWCPS). Moreover, our research addresses several priorities outlined in the Midwest bird monitoring framework outlined by Koch et al. (2010), including furthering understanding of the ecology and conservation priorities for migrating birds, evaluating effectiveness of conservation actions such as wetland restoration, and increasing access to bird data relative to landscape characteristics for use in conservation planning.

Our project will produce data that can be used within the AKN to track the status and trends of marsh bird populations over time in the Midwest. Our results will inform recommendations for wetland conservation in Illinois through the IDNRs ICWCPS and contribute to knowledge gaps of the Upper Mississippi River Great Lakes Region (UMRGLR) Joint Venture. We will identify management practices in wetlands managed for dabbling ducks that promote marsh bird use and determine if those objectives are compatible. We will work with the IDNR, the Joint Venture, USFWS National Wildlife Refuges, and other interested parties to implement management and conservation recommendations for waterfowl-managed wetlands that increase use by marsh birds. We expect our data to readily contribute to several conservation planning documents currently under revision or finalization. We will produce a detailed report of our findings and recommendations and a subsequent peer-reviewed publication.

Study Area

The study area for this project spans wetlands outlined by National Wetland Inventory (NWI) in Illinois on both public and private land. Illinois has lost approximately 90% of its wetlands due primarily to conversion and draining of wetlands for agricultural use (Havera 1999). However, despite human alteration, Illinois continues to support large populations of migrating waterbirds as well as some breeding populations. Illinois lies within the heart of the Mississippi Flyway with breeding grounds primarily to the north and wintering grounds to the south. Illinois has many floodplain wetlands surrounding the rivers that flow through Illinois (i.e. Mississippi, Illinois, Sangamon, Kaskaskia rivers etc.) (Havera 1999).

Methods

We devised three distinct sample populations for marsh bird surveys: 1) random wetlands, 2) focal wetlands (managed or restored), and 3) CTAP wetlands (Fig. 1). For random wetlands, we stratified Illinois by natural division and allocated survey effort in proportion to wetland density within natural divisions. We consolidated NWI polygons into 6 classes (Freshwater Pond, Lake, Freshwater Emergent [herbaceous only], Freshwater Scrub-Shrub/Forested, Riverine, and Other) and used total wetland area to determine the number of sample plots in each natural division with Neyman allocation (160 plots as maximum sampling effort). We then used the Reversed Randomized Quadrant-Recursive Raster tool in ArcMap to assign plot locations within wetland area inside each natural division, which will create a more spatially-balanced sample population than simple random allocation. We established 1-km^2 plots as sample units and used aerial photos to determine if wetlands within each plot would likely contain emergent aquatic vegetation. If wetlands likely contained suitable habitat conditions for marsh birds, they were retained and entered into a sample population. We chose approximately 20 random wetlands from this population for sampling. A sample population of focal wetlands was made by communicating with private landowners, state and federal agency personnel, and Illinois Natural History Survey staff until approximately 50 wetlands managed for waterfowl were identified. We randomly choose approximately 20 of those wetlands for sampling. Similar to random plots, we obtained the corresponding 2015, 2016, and 2017 CTAP wetland sampling schedule and used field notes and aerial photographs to determine a sample population where marsh bird habitat would be present.

Prior to marsh bird surveys, observers visited each wetland and established 1–5 fixed sample points that were readily accessible and within or adjacent to emergent aquatic vegetation. Sample points were marked with GPS coordinates. Points were spaced ≥400 m apart and the number of points per wetland was determined by size and configuration given the spacing constraints. We restricted the maximum number of survey points to five allowing observers to survey multiple wetlands in a single sampling period (Fig. 2). Wetlands less than 0.5 ha in size were not sampled (Conway 2011). All points within each wetland would be considered a survey “route” and all surveys were conducted between half hour before sunrise and two hours after sunrise (Bolenbaugh et al. 2011). We used a 5-min passive survey followed by 1-min alternating series of calls and silence of least bittern (*Ixobrychus exilis*), yellow rail (*Coturnicops noveboracensis*), black rail (*Laterallus jamaicensis*), king rail (*Rallus elegans*), Virginia rail (*Rallus limicola*), sora (*Porzana carolina*), common gallinule (*Gallinula galeata*), American bittern (*Botaurus lentiginosus*), American coot (*Fulica americana*), and pied-billed grebe (*Podilymbus podiceps*). Calls were broadcasted using Western Rivers Pursuit (Maestro Game Calls, LLC., Dallas, Texas, U.S.A.) and Primos Turbo Dogg (Primos Hunting, Flora, Mississippi, U.S.A.) electronic game calls. Game calls were pointed toward emergent vegetation at each point, subsequent surveys at each survey point were conducted in the same cardinal direction. Calls were broadcasted at a volume of 80-90 dB. Observers estimated distance and direction of each individual marsh bird detected by sight or sound by species and record covariates possibly important for estimating detection probability (e.g., ambient noise level, wind speed, cloud cover, precipitation, etc.). We estimated density and abundance using distance methods (Buckland et al. 2001, Johnson et al. 2009) and occupancy modeling (Alexander and Hepp 2014, Machenzie and Royle 2005, Tozer etal. 2016). We calculated means and standard errors from raw count data compared between wetland types and survey periods.

Following surveys, we evaluated wetland vegetation and condition using a modified version of the Ohio Rapid Assessment Method (ORAM). We used the ORAM procedure to identify potential stressors as indicators of wetland condition, yet inclusive of metrics indicative of wetland quality for marsh birds under a wide variety of modified conditions specific to the Midwest region (e.g., management of hydrology, presence of water control structures, drawdown timing, etc.) and were recorded as ordinal variables of varying scales depending on the assessed factors. These potential stressor and indicators of wetland condition acted as this study’s predicting variables. Using the ordinal values obtained though the ORAM procedure, we were able to assess correlation values between marsh bird occupancy and varying wetland quality metrics using occupancy modeling code in R software (Alexander and Hepp 2014, Machenzie and Royle 2005, Tozer et al. 2016). Methods were approved by the University of Illinois Institutional Animal Care Use Committee (#15029) and permissions and permits were acquired from all federal (USFWS), state (IDNR), and private sites (The Nature Conservancy) where required.

Timeline

July 2016 – March 2017	Prepare for field season; obtain permits and permissions to conduct surveys; ground-truth study sites; select sampling units; hire and train field personnel
April – June 2017	Conduct marsh bird surveys and collect vegetation and wetland condition data
July – September 2017	Perform QA/QC on data, analyze data, summarize results, compile reports, and present findings; share data with project collaborators and deposit within AKN

Results and Discussion

We surveyed 25 random sites, 17 focal sites, and 13 CTAP sites during 18 April through 15 June 2017 (Fig. 1). We visited each site 3 times at approximately two-week intervals, once during each biweekly survey period at the appropriate latitude. We surveyed 13 points across CTAP sites (1.0 point/site), 57 points across focal sites (3.4 points/site), and 39 points at random sites (1.6 points/site), and conducted 295 total marsh bird surveys across time periods and sites. Our study sites overlapped two latitudinal zones across Illinois and resulted in the southern surveys initiating 15 April–30 April and the northern surveys commenced 1 May–15 May.

We detected 68.7% of individuals during our first survey period, followed by 25.1% during our second survey period, and 6.1% during our third survey period. American coot, pied-billed grebe, sora and Virginia rail detections declined with survey period whereas common gallinule and least bittern increased with survey period. American bittern, black rail, king rail, and yellow rail detections were relatively uncommon and showed no pattern in relation to survey period. American coot (51.9%) and sora (35.0%) were the most common species and accounted for 86.9% of detections (Table 1).

Sites where wetland management practices were evident (active; 4.6 ± 1.3 detections/survey/site) had similar detections to sites with less intense practices (passive; 6.6 ± 2.0 detections/survey/site), but had more than those without management practices present (unmanaged; 0.8 ± 0.2 detections/survey/site; Fig. 3). Total marsh bird detections were greatest on focal sites (6.5 ± 1.5 detections/survey/site), followed by random (1.5 ± 0.2 detections/survey/site) and CTAP sites (0.2 ± 0.1 detections/survey/site; Fig. 4). Marsh bird detections were positively related to waterfowl management intensity and wetland habitat complexity across site types, but negatively related to wetland–river connectivity; however, these relationships were weak (R^2 = 0.03–0.15; Figs. 5–7).

Generally, marsh bird use of wetlands was related to presence of persistent emergent vegetation, although some species (e.g., sora) regularly occurred in wetlands dominated by non-persistent emergent vegetation (e.g., moist-soil vegetation). Marsh bird detections were dramatically greater at focal wetlands managed for waterfowl than random wetlands or CTAP wetlands. However, within focal wetlands, intensity of waterfowl management activities was negatively related to marsh bird use suggesting that wetland management activities for emergent vegetation encouraged marsh bird use but intensive wetland management for waterfowl may not be compatible with high-quality marsh bird habitat (e.g., encouragement of moist-soil vegetation, food plots, early and annual drawdowns, disking, etc.).

We intend to model marsh bird detections by wetland management actions and generate density estimates corrected for detection probabilities. We will also compare marsh bird detections from our survey with detections from the CTAP program and Wetland Reserve Program Easements, pending data availability.

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Table 1. Number of marsh bird detections by species during three survey periods and at focal, random, and Illinois Critical Trends Assessment Program (CTAP) sites in spring 2017.

Species	Survey Period						
	1	2	3	CTAP	Focal	Random	Total
Sora	264	117	18	7	264	128	399
American Coot	476	111	4	0	585	6	591
Common Gallinule	4	18	18	0	39	1	40
Pied-billed Grebe	26	15	14	0	50	5	55
American Bittern	2	2	1	0	2	3	5
King Rail	0	1	2	0	3	0	3
Virginia Rail	9	10	0	0	12	7	19
Yellow Rail	0	0	0	0	0	0	0
Black Rail	0	0	0	0	0	0	0
Least Bittern	2	12	13	0	18	9	27
Total	783	286	70	7	973	159	1139

Figure 1. Locations of random (orange), focal (gold), and Illinois Critical Trends Assessment Program (CTAP) (green) sites where marsh bird surveys were conducted during spring 2017 across Illinois.

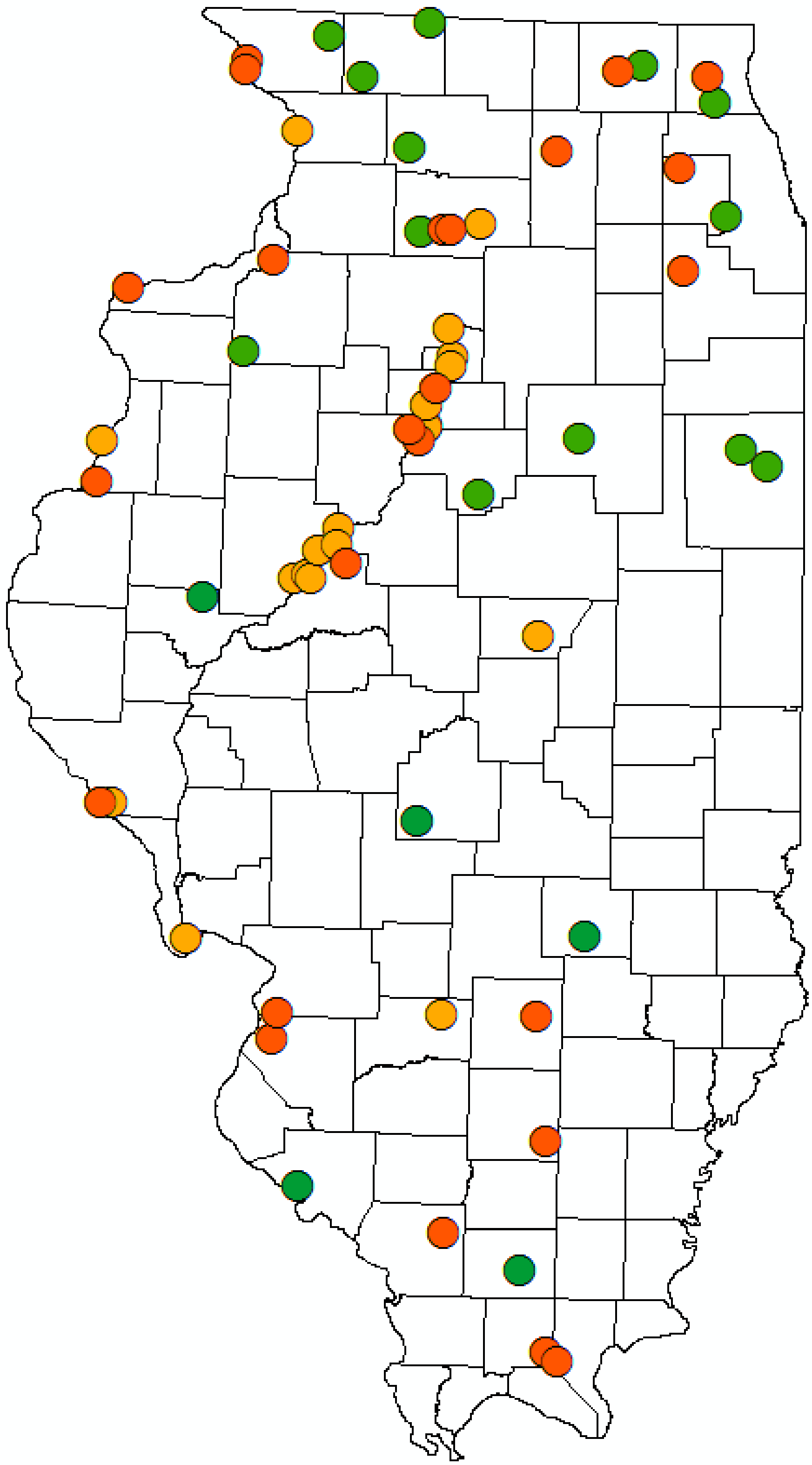


Figure 2. Aerial photo of The Emiquon Preserve, a focal site managed by The Nature Conservancy, and the five points surveyed at that site.

Figure 3. Mean number (with standard error bars) of marsh bird detections per point in relation to wetland management practices in Illinois during spring 2017.

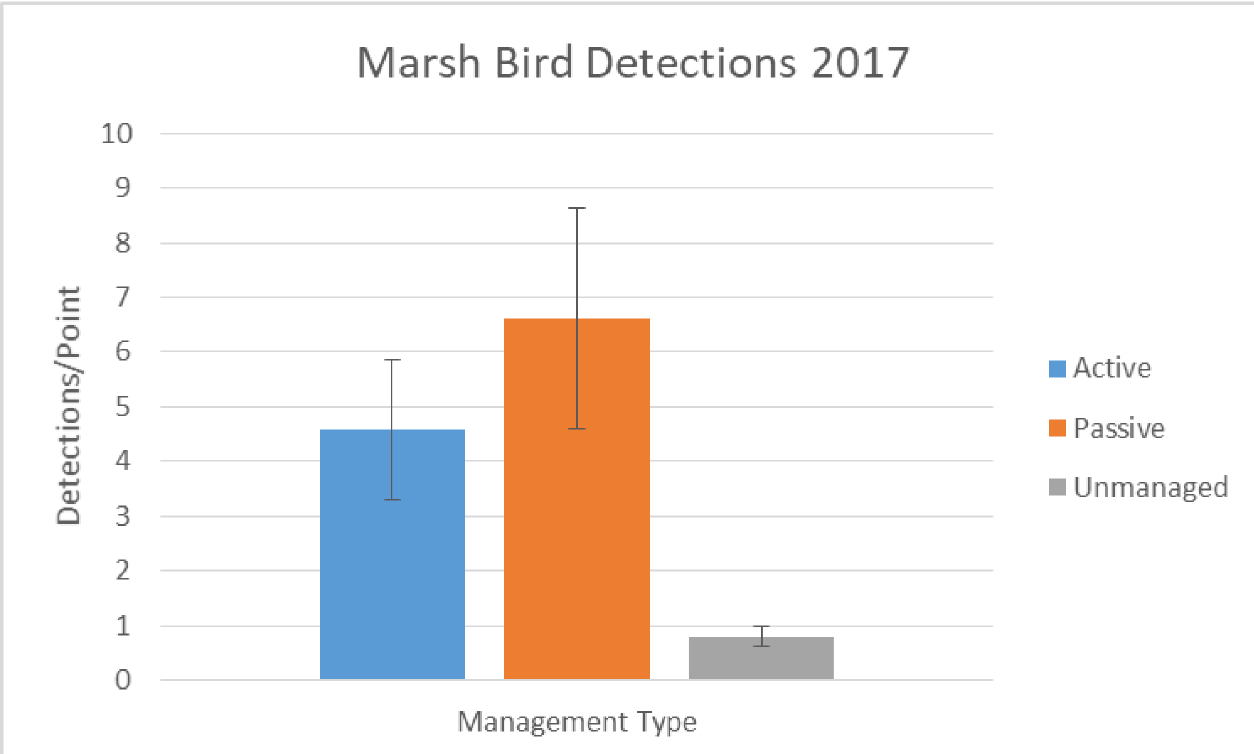


Figure 4. Mean number (with standard error bars) of marsh bird detections per point in relation to wetland category in Illinois during spring 2017.

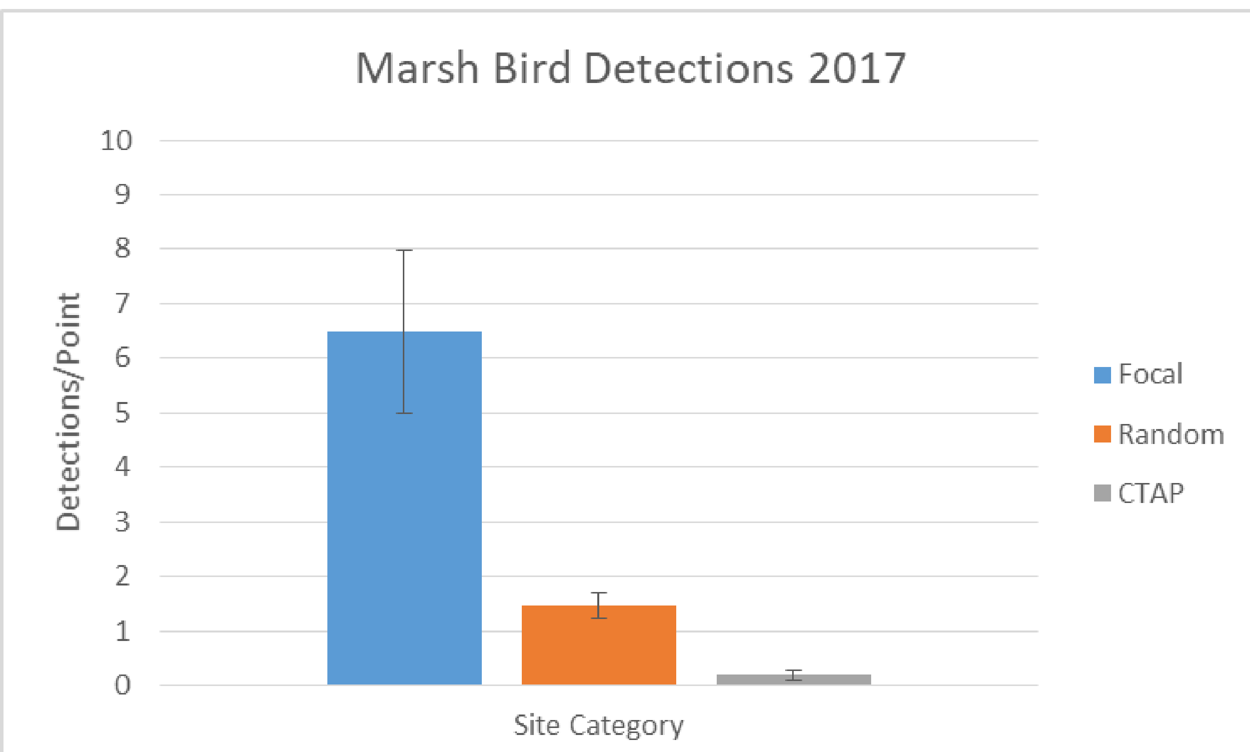


Figure 5. Average marsh bird detections per site in relation to average waterfowl management intensity per site in Illinois during spring 2017.

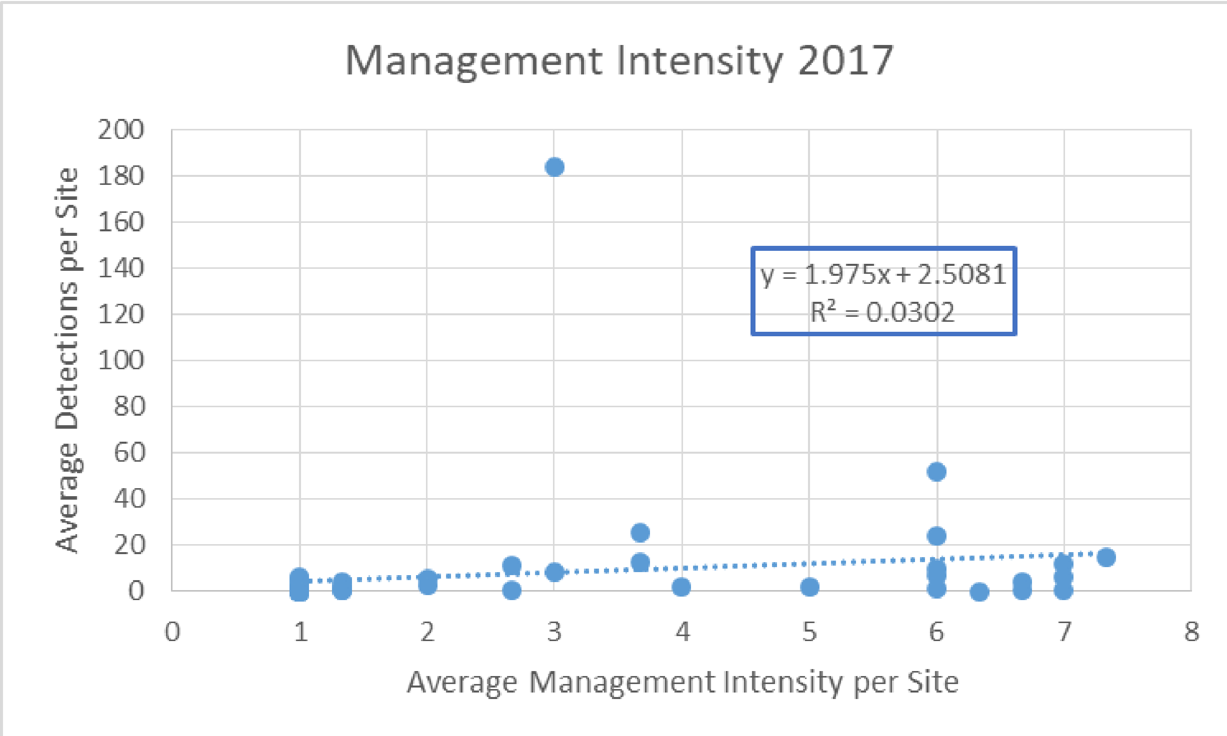


Figure 6. Average marsh bird detections per site in relation to average wetland habitat complexity per site in Illinois during spring 2017.

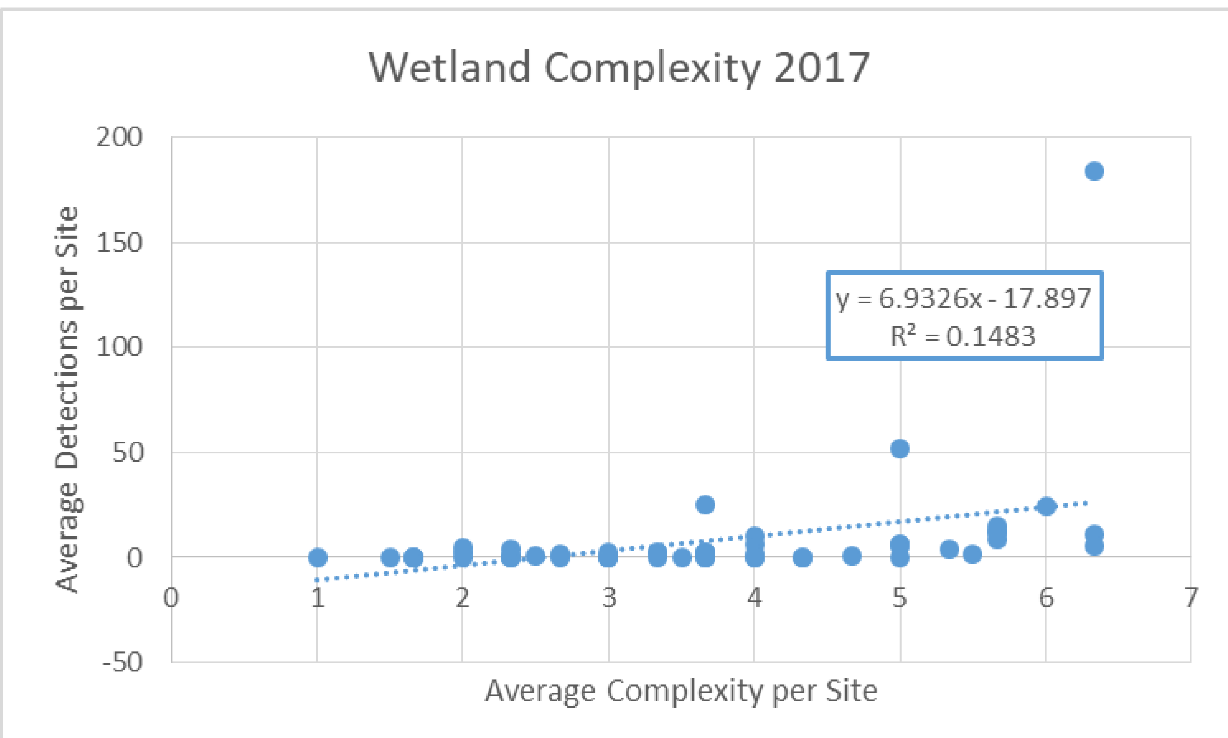
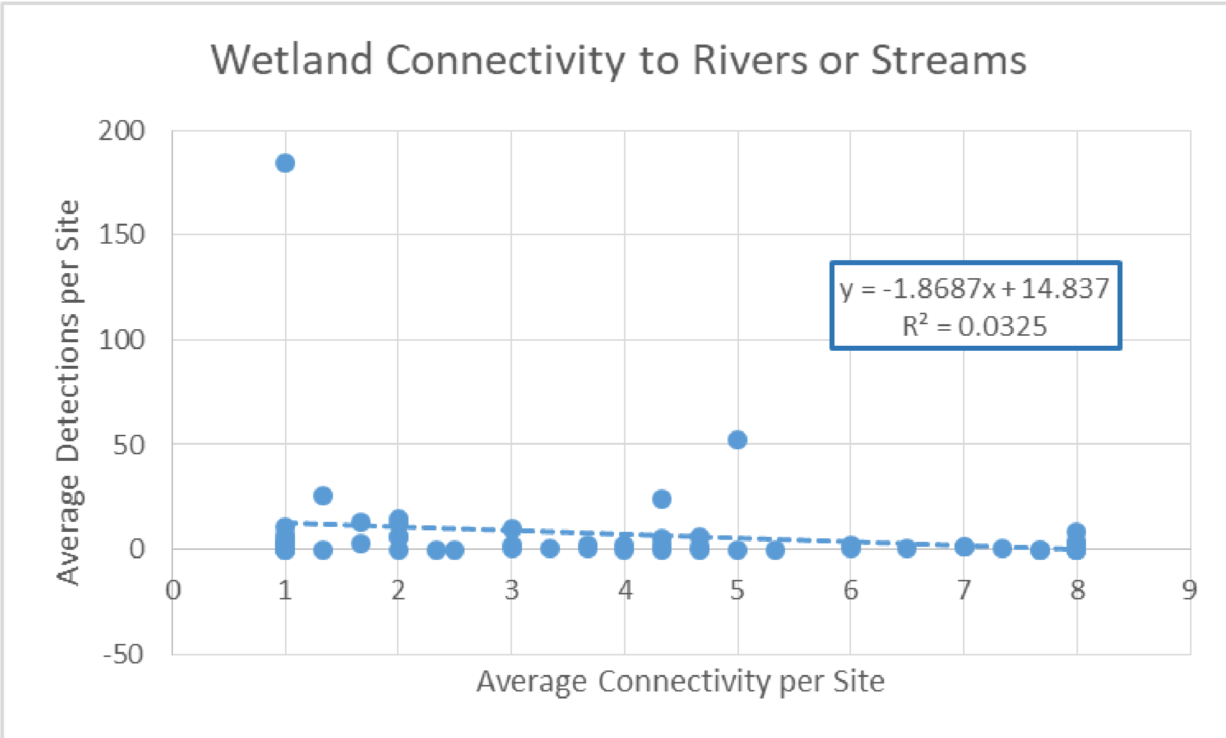


Figure 7. Average marsh bird detections per site in relation to average hydrologic connectivity of the wetland to a river or stream per site in Illinois during spring 2017.



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Date: 28 September 2017