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Wetland Management Strategies that Maximize Marsh Bird Use in the Midwest

Annual Performance Report

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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 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 (Soulliere et al. 2007a). Other conservation initiatives encourage multi-species design and management, but often waterfowl are a primary focal group (King et al. 2006, Soulliere et al. 2007b, 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 [Upper Mississippi Valley / Great Lakes Shorebird Conservation Plan; de Szalay et al. 2000, Potter et al. 2007], waterbirds [Illinois Wetlands Campaign; Schultheis and Eichholz 2013]). 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 Resoures 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). Ancillary observations indicate that wetland drawdowns during the summer for emergent vegetation production attract several secretive marsh bird species (Heath Hagy, INHS, personal observation); however, data on densities, timing of occupancy, and associated management practices (e.g., drawdown timing, vegetation species composition, etc.) are unknown.

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 2016. Our objectives were to 1) 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 groups, 2) compare marsh bird use of restored and natural wetlands, and 3) determine characteristics of wetlands and the surrounding landscape that influence marsh bird use of restored wetlands. 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.

Methods

We devised three distinct sample populations for marsh bird surveys: 1) random wetlands, 2) focal wetlands (managed or restored), and 3) CTAP wetlands. For random wetlands, we stratified Illinois by natural division and allocated survey effort in proportion to wetland density within natural divisions. We consolidated National Wetland Inventory (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 created 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 likely contained emergent aquatic vegetation. If wetlands likely contained suitable habitat conditions for marsh birds, they were retained and entered into a sample population. We subsequently chose approximately 20 random wetlands from this population for sampling. A sample population of focal wetlands was built 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 these wetlands for sampling. Similar to random plots, we obtained the 2016 CTAP wetland sampling schedule and used field notes and aerial photographs to determine a sample population where marsh bird habitat was present. Due to a limited sample size, we sampled all CTAP wetlands where there was evidence of emergent aquatic vegetation and landowner permission was acquired.

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. Point were spaced at least 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 5 allowing observers to survey multiple wetlands in a single sampling period. Wetlands less than 0.5 ha in size were not sampled (Conway 2011). All points within each wetland were considered a survey "route" and all surveys were conducted between ½ hour before sunrise and 2 hours after sunrise (Bolenbaugh et al. 2011). We used a 5-min passive survey followed by a 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 broadcast 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, while repeated surveys at each survey point were conducted in the same cardinal direction. Calls were broadcast 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 recorded covariates possibly important for estimating detection probability (e.g., ambient noise level, wind speed, cloud cover, precipitation, etc.). In subsequent years when more data are available, we will estimate density and abundance using distance methods (Buckland et al. 2001, Johnson et al. 2009). Subsequently, we report means and standard errors from raw count data compared between wetland types and survey periods.

Following surveys, investigators evaluated wetland vegetation and condition using a modified version of the Environmental Protection Agency's National Wetland Condition Assessment rapid assessment method (USA-RAM; Gray et al. 2012). The USA-RAM procedure used 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 (e.g., management of hydrology, presence of water control structures, drawdown timing, etc.). 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 (Illinois DNR), and private sites (The Nature Conservancy) where they were required.

Timeline

July 2015 – March 2016	Prepare for first field season; obtain permits and permissions to conduct surveys; work with USFWS and other conservation partners to finalize survey design; ground-truth study sites; select sampling units; hire and train field personnel
April – June 2016	Conduct marsh bird surveys and collect vegetation and wetland condition data
July – September 2016	Perform QA/QC on data, analyze data, summarize results, compile reports, and present findings; share data with project collaborators and deposit within the avian knowledge network

Results and Discussion

We surveyed 25 random sites, 21 focal sites, and 11 CTAP sites during 20 April through 16 June 2016 (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 15 locations across CTAP sites (1.4 stations / site), 70 locations across focal sites (3.3 stations / site), and 45 locations at random sites (1.8 stations / site), and conducted 389 total marsh bird surveys across time periods and sites. Our study sites overlapped two latitudinal zones across Illinois resulting in a portion of the surveys being initiated during 15 April–30 April and a portion of sites where surveys began during 1 May–15 May.

We detected 57.1% of individuals during our first survey period, followed by 24.5% during our second survey period and 18.4% during our third survey period. American coot, pied-billed grebe, and sora detections declined with survey period whereas common gallinule and least bittern increased with survey period. American bittern, Virginia rail, and yellow rail detections were relatively uncommon and showed no pattern in relation to survey period. American coot (48.1%) and sora (38.7%) were the most common species and accounted for >85% of detections (Table 1).

Total marsh bird detections were greatest on focal sites (2.1 ± 0.4 detections/survey/site), followed by random (0.7 ± 0.2 detections/survey/site) and CTAP sites (0.4 ± 0.1 detections/survey/site). Sites where wetland management practices were evident (active; 1.0 ± 0.3 detections/survey/site) had similar detections than those without management practices present (passive; 1.2 ± 0.3 detections/survey/site; Fig. 2). 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 = 0.03–0.11; Figs. 3–5).

Generally, marsh bird use of wetlands appeared to be related to presence of persistent emergent vegetation, although some detections regularly occurred for some species (e.g., sora) 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 slightly negatively related to marsh bird use suggesting that wetland management activities for emergent vegetation encourage marsh bird use but intensive wetland management for waterfowl may not necessarily be compatible with high-quality marsh bird habitat (e.g., encouragement of moist-soil vegetation, food plots, early and annual drawdowns, disking, etc.).

In future years when more data are available, we will model marsh bird detections by various 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 2016.

Species	Survey Round			CTAP	Focal	Random	Total
	1	2	3				
Sora	152	89	35	14	196	66	276
American coot	216	62	65	0	321	22	343
Common gallinule	3	13	12	0	28	0	28
Pied-billed grebe	25	6	10	1	36	4	41
American bittern	2	1	2	0	3	2	5
King rail	0	0	0	0	0	0	0
Virginia rail	9	4	6	0	8	11	19
Yellow rail	0	0	1	0	1	0	1
Black rail	0	0	0	0	0	0	0
Least bittern	0	1	3	0	4	0	4
Total	407	175	131	15	593	105	713

Figure 1. Locations of random, focal, and Illinois Critical Trends Assessment Program (CTAP) sites where marsh bird surveys were conducted during spring 2016 across Illinois.

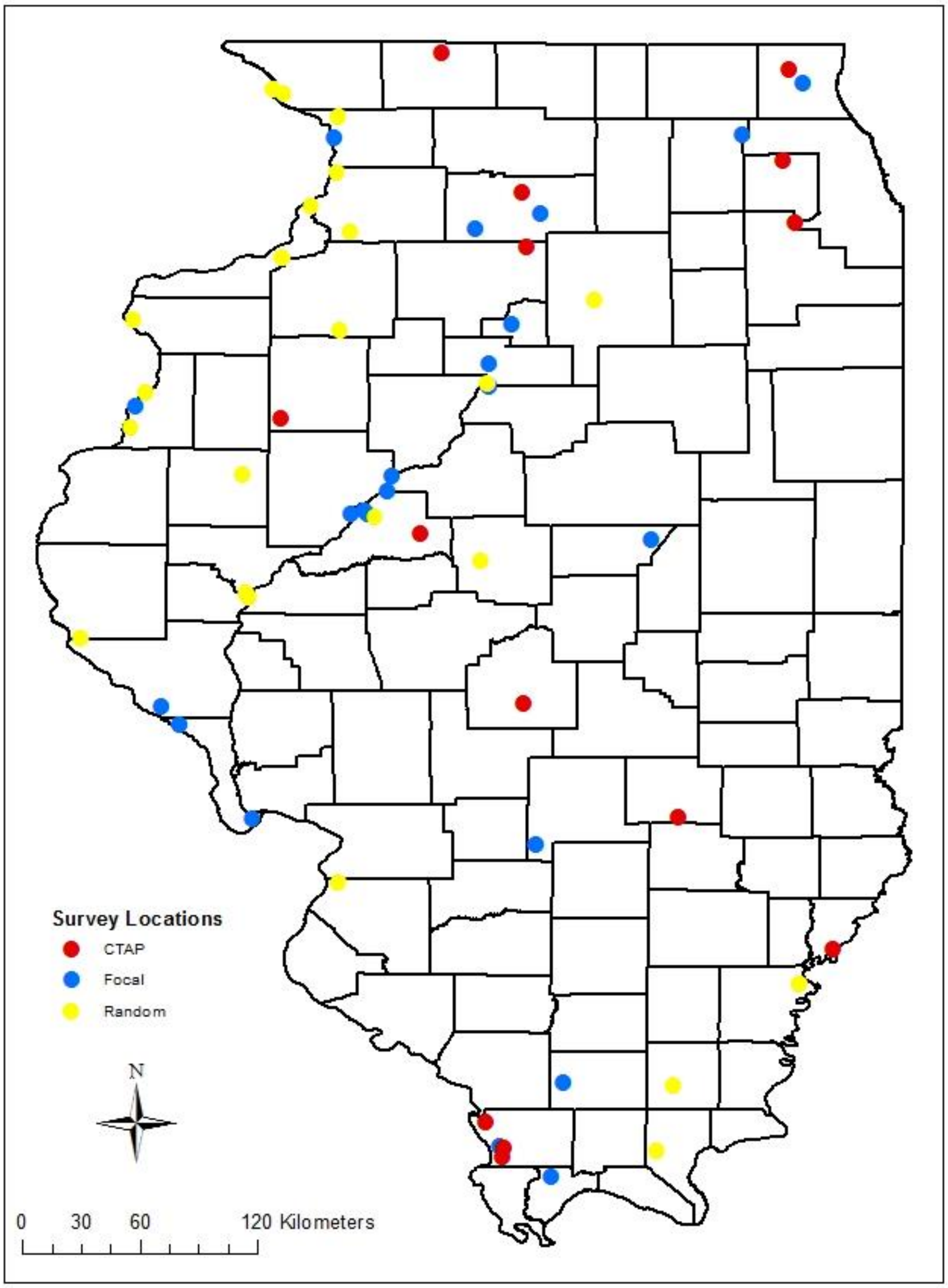


Figure 2. Number of marsh bird detections in relation to wetland management practices in Illinois during spring 2016.

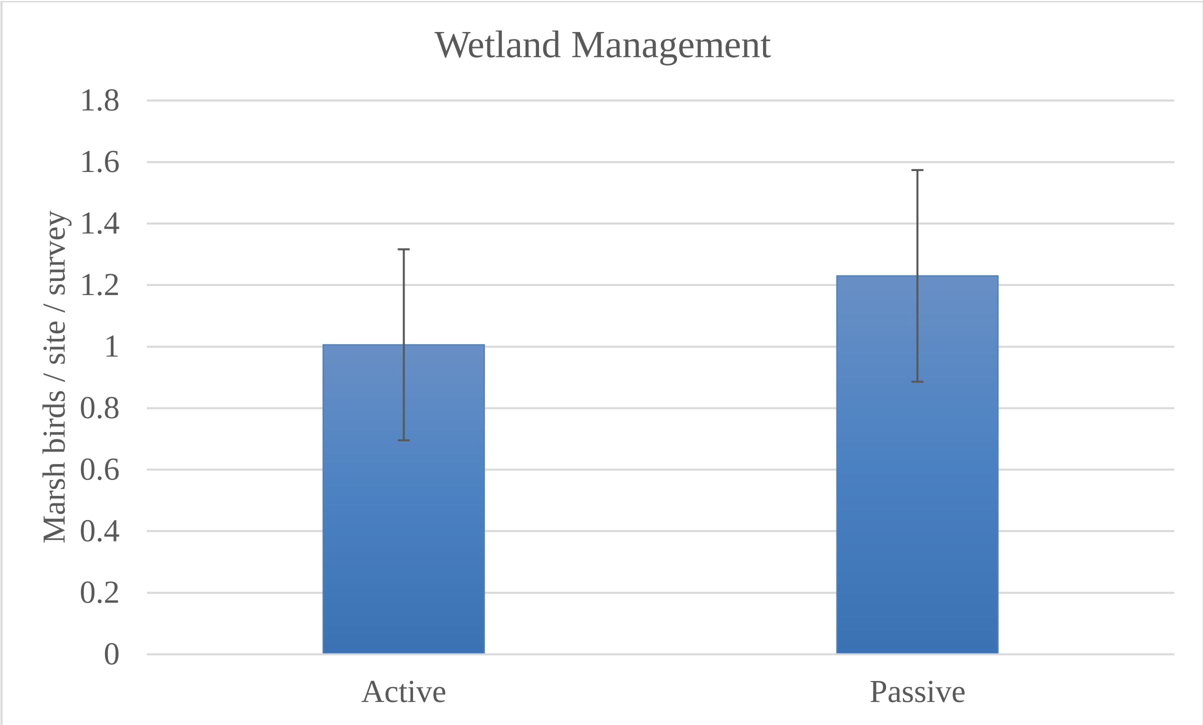


Figure 3. Number of marsh bird detections in relation to a categorical measure of waterfowl management intensity in Illinois during spring 2016.

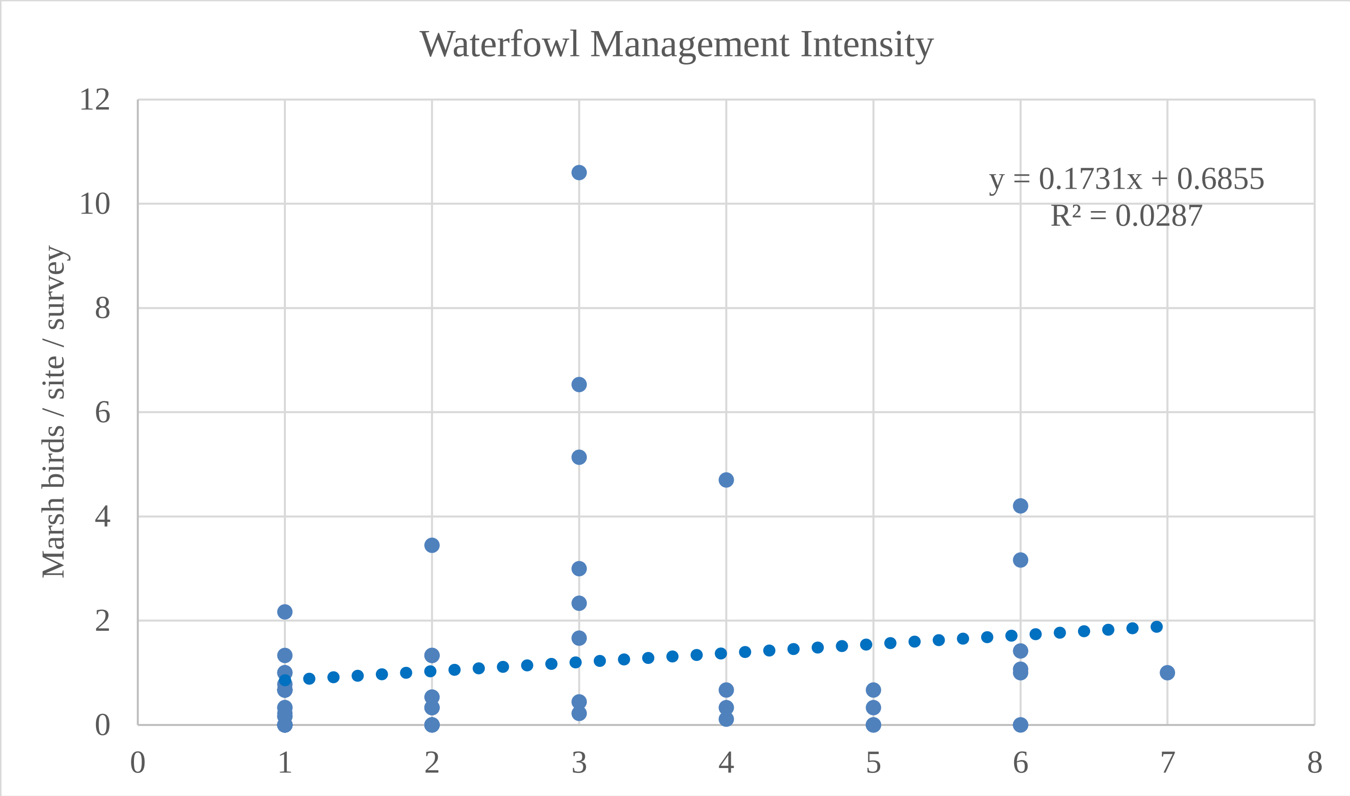


Figure 4. Number of marsh bird detections in relation to a categorical measure of wetland habitat complexity in Illinois during spring 2016.

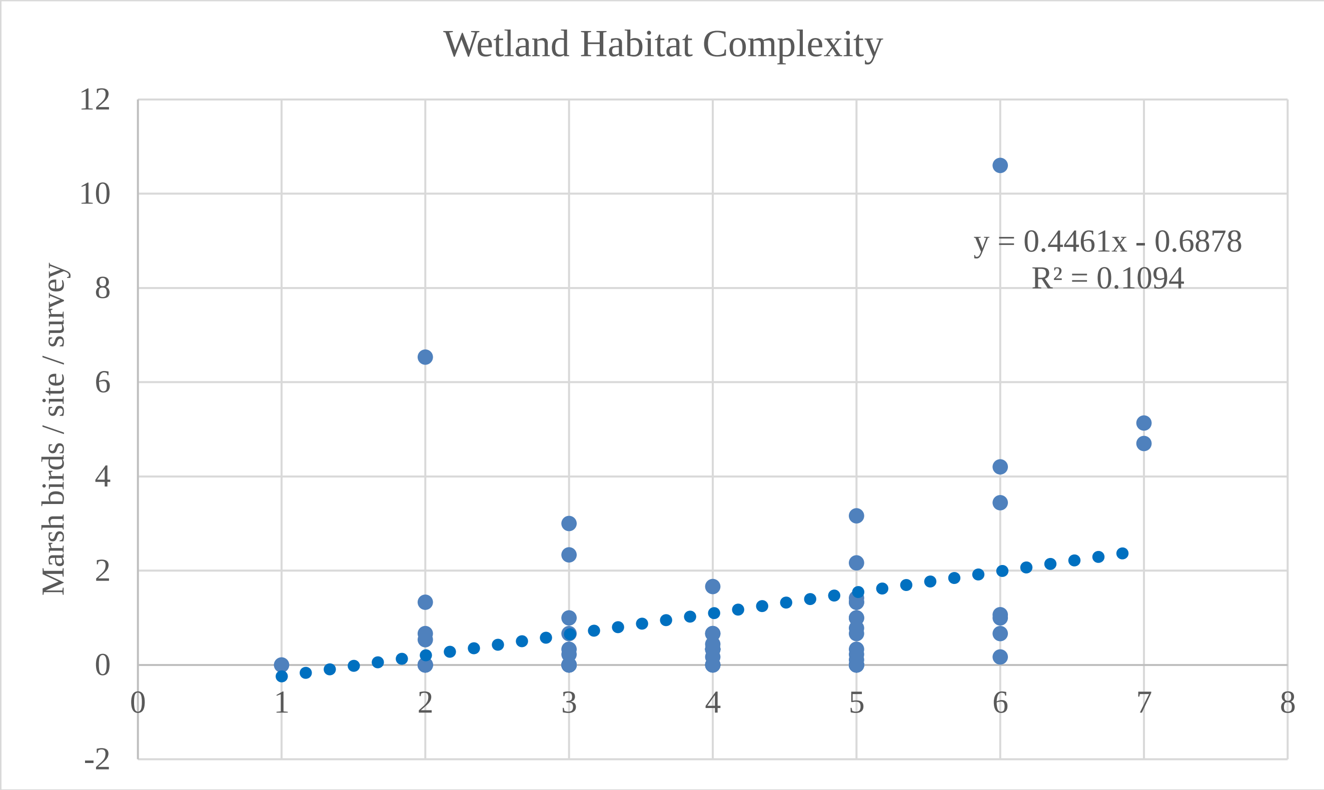
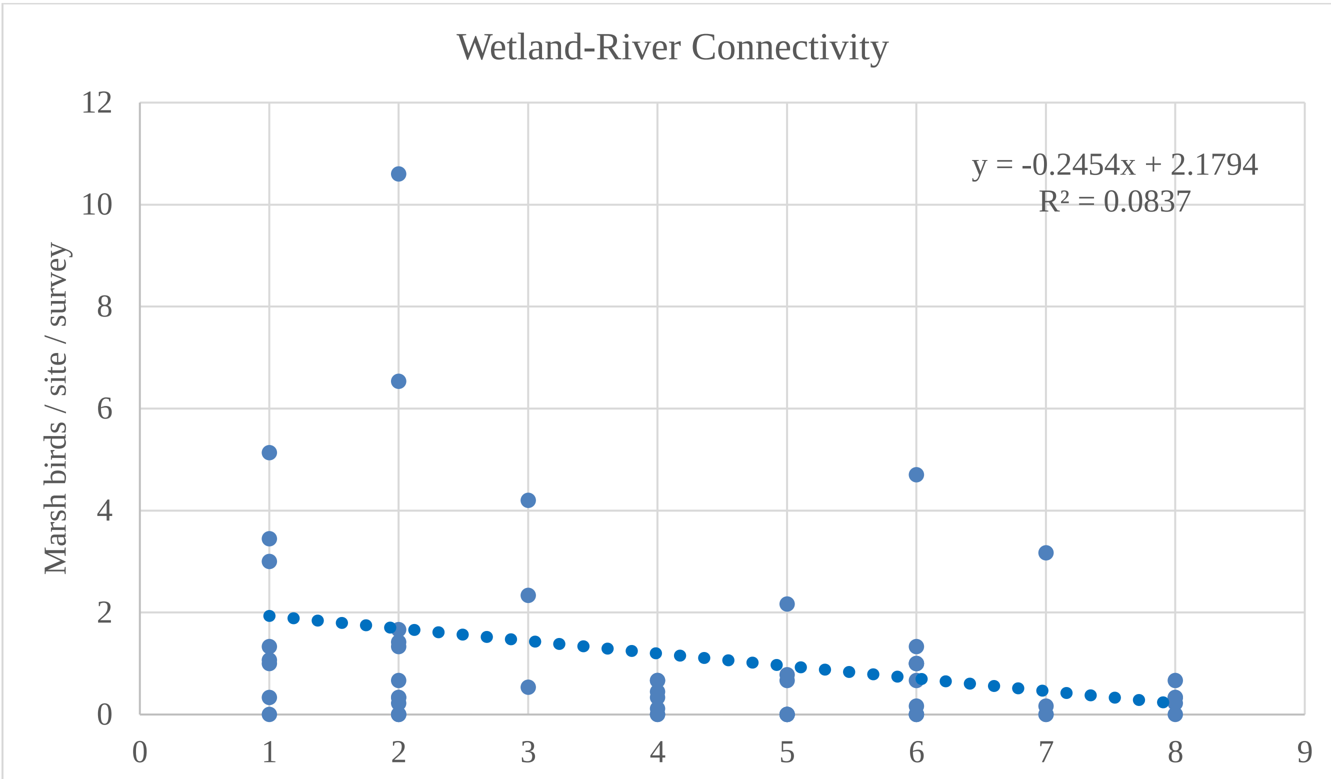


Figure 4. Number of marsh bird detections in relation to a categorical measure of hydrologic connectivity of the wetland to a river or stream in Illinois during spring 2016.



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