
Evaluation of farmed playa wetlands as avian habitat using survey data and two rapid assessment techniques

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Playa wetlands contribute to the biological diversity of the southern Great Plains, yet many are modified by current farming practices. We surveyed 12 farmed playa wetlands from 1998-99 to (1) document seasonal avian use of these habitats and (2) assess the performance of two rapid assessment techniques, the Habitat Assessment Technique and the Wetland Evaluation Technique. Thirty-six bird species were observed on farmed playa wetlands, 42% of which are dependent on wetland habitats. In contrast, only 5 species were observed on upland reference sites in 1999, and none were dependent on wetlands. Collectively, both rapid assessment techniques rated farmed playa wetlands as poor habitats because of the physical characteristics of study sites. Based on field observations and published work, we conclude that farmed playa wetlands provide habitat for many avian species and the rapid assessment techniques examined are unsuitable for assessing playa wetlands as avian habitat in Kansas.

Keywords: farmed wetland, Habitat Assessment Technique, playa wetland, stopover habitat, and Wetland Evaluation Technique.

INTRODUCTION

In the Great Plains region of North America, few areas are as important as wetlands in providing critical habitat for vertebrates (Bolen, Baldassarre and Guthery 1989; Bolen, Smith and Schramm 1989; Haukos and Smith 1994; Laubhan and Frederickson 1997). For example, nearly 40 species of shorebirds use wetlands in the Great Plains during seasonal migrations between breeding and wintering areas (Helmers 1992; Skagen and Knopf 1993). Despite comprising a limited portion of the landscape, Great Plains wetlands play a disproportionate role in the conservation and management of many wetland-dependent species because of the many ecological roles they provide (e.g. stopover habitats for migrant shorebirds).

Since European settlement, about 47 million ha (ca. 53%) of wetlands in the lower United States have been destroyed through human activities (Dahl 1990; Tiner 1998). Technological advances in mechanized agriculture led to large-scale drainage of many wetlands in an attempt to expand the amount of arable land from the late 1940s through the mid-1980s (U.S. Department of Interior 1994; National Research Council 1995). Today, many wetlands are protected by state and federal legislation, yet some continue to be disturbed by human activities, particularly agricultural practices. For example, approximately 2.8 million ha of wetlands in the United States are farmed legally under current legislation (National Research Council 1995). In the Great Plains, playa wetlands continue to be impacted by agricultural practices.

Playa wetlands (hereafter playas) are closed, circular depressions restricted to the southern Great Plains in North America that are often cultivated because of their highly variable hydrology (Bolen, Smith and Schramm 1989). Playas undergo drying episodes that may extend for several years because their shallow basins receive all hydrological inputs from localized, unpredictable precipitation events. Shortly thereafter, playas lose water rapidly through evaporation and percolation (Haukos and Smith 1994). Playas are often planted to crops during dry periods, and if a playa basin remains dry throughout the growing season, a crop may be harvested.

Playas provide habitat for many wetland-dependent species and contribute disproportionately to the biological diversity of the southern Great Plains relative to their surface area (Iverson, Vohs and Tacha 1985; Bolen, Smith and Schramm 1989; Haukos and Smith 1994; Davis and Smith 1998; Anderson, Haukos and Anderson 1999; Anderson and Smith 2000). For example, an estimated 2 million ducks and nearly 400,000 sandhill cranes (*Grus canadensis*) are found on playa wetlands in the Southern Great Plains in a typical winter (Iverson, Vohs and Tacha 1985; Bolen, Smith and Schramm 1989). Yet, little is known about seasonal avian use of farmed playas at the northern edge of their distribution in the southern Great Plains. In addition, it is unknown how rapid wetland assessment techniques perform in farmed playas. Because these techniques are often used to identify and measure the functions of wetlands for legal purposes, it is vital to understand how these techniques perform under typical survey conditions.

We documented seasonal avian use of farmed playas in Kansas and evaluated two rapid habitat assessment techniques using data from field surveys. We limited our investigation to small, hydrologically unmodified playas because they are the most abundant type of playa in southwestern Kansas (T. Flowers,

pers. comm.). We assumed that a bird observed on a farmed playa was selecting it as habitat, and that species richness was a reasonable index of habitat quality. Both assumptions appear reasonable given that habitat selection by birds is thought to be adaptive, and because our study sites were similar in size, depth, and location.

METHODS

Study area

Twelve farmed playas in Meade County, southwestern Kansas (37°18'N, 100°35'W) were examined during 1998-99. We selected farmed playas based on landowner cooperation and the following criteria: (1) total area of farmed playa <6 ha, (2) hydrologic functions had not been altered (*i.e.* no tiling or draining had taken place on the playa), and (3) farming occurred in one or both years of study. We limited our investigation to farmed playas meeting these criteria because they are the most characteristic type of playa in southwestern Kansas (T. Flowers, pers. comm.). All playas were planted to winter wheat (the dominant crop in Meade County) in at least one of the two years and winter wheat surrounded all but one site, which was planted to grain sorghum. We were unable to examine directly the influence of farming on reference sites because we could not locate similar-sized playas in Meade County that lacked historical farming activities. Instead, we surveyed farmed uplands in 1999 to document bird species composition in the matrix surrounding farmed playas (see below). The 12 farmed playas examined in this study averaged 1.1 ha (\pm SE 0.32, range: 0.3-4.5 ha) and were considered to be spatially independent of each other. Annual precipitation measured at a long-term weather station in Meade County, Kansas averaged 45.2 cm ($n = 51$ yr) from March to September (the period of our field surveys); precipitation from the same period totaled 42.4 cm in 1998 and 63.5 cm in 1999.

Bird surveys

Surveys were conducted twice during each of three periods: spring (early March to mid-May), summer (mid-May to early July), and autumn (late July to mid-October) of 1998-99, totaling 12 surveys for each farmed playa during our study. Most surveys were conducted during early morning or late evening hours; however, a limited number occurred in early to mid-afternoon due to logistical constraints. At each site, a single observer traversed the entire site slowly, recording all individuals heard or observed. Species flying over sites were typically excluded from our tally, with exceptions made for aerial predators (*e.g.* swallows, raptors) that were believed to be foraging over study sites. Each survey was terminated after the entire wetland had been traversed; thus, surveying effort was unequal among farmed playas. Therefore, we restrict our discussion of avian communities to simple descriptive measures and avoid comparisons among surveys or between individual playas.

In 1999, six farmed upland sites (0.8 ha each) were established as reference sites within large (~260 ha) wheat fields and located >1 km from a farmed playa. Reference sites were surveyed five times during 1999 during the second spring visit, both summer visits, and both autumn visits. Reference sites were surveyed by slowly walking along a dirt road that bordered one side of the reference site and recording all birds heard or seen during a 10-min period. Although the survey techniques used in farmed uplands differed from those used in farmed playas, they provide a description of the species that used farmed uplands near our study sites and allow for a general comparison with farmed playas.

Wetland evaluation procedures

A recent review by Bartoldus (1999) of 40 wetland assessment procedures concluded

that the Habitat Assessment Technique (Cable, Brack and Holmes 1989) and the Wetlands Evaluation Technique (Adamus, Clairain *et al.* 1987) were the only techniques available for rapid assessment of farmed playas in Kansas.

The Habitat Assessment Technique (HAT) is a procedure that evaluates the suitability of an individual wetland based on its avian richness (*i.e.* the number of bird species observed using a wetland) relative to its area (Cable, Brack and Holmes 1989). In the field, a wetland is surveyed and all bird species present are tallied. Next, a point value is assigned to each observed species by local experts based on its relative abundance within an established geographical area (*e.g.* the political boundaries of a state) such that common species receive a lower point value than rare species. In this study, HAT species points were assigned based on the relative abundances for birds in Kansas (Thompson and Ely 1989, 1992) because information about the relative abundances of birds in farmed wetlands in southwestern Kansas is currently lacking. Following Cable, Brack and Holmes (1989), we assigned a value of 80 points to species whose status was rare, 40 points to species whose status was uncommon, 30 points to species whose status was uncommon to common; 20 points to species whose status was common, 15 points to species whose status was common to abundant, and 10 points to species whose status was abundant. Once HAT species points are assigned, they are summed for all species observed using an individual wetland, and this sum is divided by the size of the wetland to produce a 'faunal index.' The faunal index is used to compare wetlands relative to their suitability as habitat for avian species. In this examination, we used the actual size (in ha) of farmed wetlands as the area factor instead of incorporating an 'optimum size' for wetlands, which is based on species-area equilibrium data (see Cable,

Brack and Holmes 1989 for details). We used data from bird surveys to implement the HAT procedure on farmed playas.

The Wetlands Evaluation Technique (WET) is a procedure that poses specific questions about the characteristics of an individual wetland (e.g. soils, hydrology) and compares the responses to these questions to a WET 'reference' file for one of 325 species or groups of interest (Adamus, Clairain *et al.* 1987). Each question is answered with one of three responses (*i.e.* yes, no, or no information) which are entered into a WET 'field data' file. When all responses are entered, WET is used to compare the WET field data file to one or more WET 'reference' files that is considered suitable habitat for the species or group under examination. WET then provides one of three ratings (*i.e.* low, moderate, or high potential for wildlife habitat) based on the field data collected and the species/group under examination.

We compared our WET field data files to four WET reference files: (1) stopover and wintering habitat for prairie dabbling ducks, (2) breeding habitat for prairie dabbling ducks, (3) stopover habitat for the Least Sandpiper (*Calidris minutilla*), and (4) stopover habitat for the Greater Yellowlegs (*Tringa melanoleuca*). The WET reference files for prairie dabbling ducks were based on habitat associations of the Gadwall (*Anas strepera*), American Wigeon (*Anas americana*), Mallard (*Anas platyrhynchos*), Mottled Duck (*Anas fulvigula*), Blue-winged Teal (*Anas discors*), Cinnamon Teal (*Anas cyanoptera*), Northern Shoveler (*Anas clypeata*), Northern Pintail (*Anas acuta*), and Green-winged Teal (*Anas crecca*). Reference files were chosen because they provided the most similar comparisons to the species observed on farmed playas to those available in WET reference files, although some species on which data files are based may only use playas infrequently (e.g. Mottled Duck).

WET field data files were compared to the WET reference file for stopover and wintering habitat for prairie dabbling ducks for the spring and autumn visits of both years (4 surveys x 12 playas = 48 comparisons). WET field data files were compared to the WET reference file for prairie dabbling duck breeding habitat during the summer visits of both years (2 surveys x 12 playas = 24 comparisons). Reference files for Least Sandpiper and Greater Yellowlegs stopover habitat were compared with WET field data files from all surveys because these species move throughout Kansas during spring, summer, and fall (2 reference files x 6 surveys x 12 playas = 144 comparisons). In total, 216 comparisons were made between WET field data files and reference files.

As part of the WET procedure, vegetation surveys were conducted during the second summer visit in both years to determine the presence of plants preferred by waterfowl. In both years, mechanical disturbance destroyed vegetation prior to sampling and precluded sampling three sites in 1998 and six sites in 1999. When vegetation was present, we used two perpendicular transects to measure plant species composition and frequency. Transects originated in the center of each farmed playa and extended to the outer wetland boundary between the mudflat zone (*i.e.* the open, mostly unvegetated mud flat area surrounding the water of a playa) and the upland zone (*i.e.* the area immediately surrounding a playa composed of small-grain cropland; see Flowers 1996 for details). The bearing of the first transect was randomly selected; the second transect was situated 90° in a clockwise direction from the first. In 1999, new transects were established to measure vegetation on each farmed playa.

Once established, transects were measured for length, divided into 50 equidistant points, and a point-intercept method was used to measure species composition and frequency (Brower, Zar and von Ende 1998). Plants were

identified to species (where possible) following the nomenclature and classification of the Great Plains Flora Association (1986). Plant data were used to describe the relative frequency of plants recorded on farmed playas. In addition, those plant species that were considered by WET to be preferred waterfowl food were recorded in WET field data files and used in comparisons with WET reference files.

RESULTS

Thirty-six bird species (23 in 1998, 32 in 1999) were observed on farmed playas (Table 1). Of this total, nearly half (42%) were considered to be dependent on wetland habitats. Eleven species of shorebirds (Charadriiformes) were found on farmed playas, 10 of which are classified as wetland-dependent species. In addition, 4 species of dabbling ducks (Anseriformes) also were observed over the same period (Table 1). In contrast to farmed playas, only five species were observed on reference sites (Table 1), and none were dependent on wetlands. The number of species observed on reference sites (5) was markedly lower than the number of species observed on even the six most species-poor farmed playas.

Both wetland evaluation procedures produced ratings that indicated that farmed playas were poor habitat for birds. HAT produced mean faunal indices (computed as the sum of faunal indices from all surveyed sites divided by the total number of sites visited) of 11.3-23.4 in 1998 and from 7.1-34.9 in 1999 (Table 2). Most HAT values were low because few rare and uncommon avian species were encountered on sites (*i.e.* 1 rare and 5 uncommon species observed on all study sites during 1998-99), and most species were classified as common or abundant in Kansas (Table 1). To determine if the lack of birds on sites markedly decreased HAT values, a modification of the faunal index was calculated for each period based only on those

farmed playas on which birds were observed. However, these values were similar to the low faunal indices calculated via the traditional HAT technique (Table 2), indicating that including sites that lacked birds in the calculation of mean faunal indices had little influence on results.

The WET method rated farmed playas as poor avian habitat for over 93% (201/216) of the comparisons made from WET field data files. Exceptions occurred on one farmed playa that had a high rating for the WET reference file for migrating/wintering prairie dabbling ducks during an autumn visit in 1998, a spring visit in 1999, and a summer visit in 1999. The other site that received a high rating did so during both years when field data were compared to both WET reference files (*i.e.* breeding and migrating/wintering) for prairie dabbling ducks.

Vegetation surveys indicated that 19 plant species occurred on farmed playas over the course of the study (Table 3): 9 species were recorded in 1998 ($n = 9$ sites) and 15 species were recorded in 1999 ($n = 6$ sites). During both years, pink smartweed (*Polygonum bicorne*), junglerice (*Echinochloa colona*), and bearded sprangletop (*Leptochloa fascicularis*) were the dominant plants on most farmed playas (Table 3).

DISCUSSION

Importance of playas to wetland birds

Species observed in farmed playas in this study can be placed into three general groups: migrant shorebirds, dabbling ducks, and facultative wetlands users (*i.e.* those species that use wetlands but do not require them). Shorebirds were observed foraging and resting in farmed playas during the spring and autumn surveys whereas dabbling ducks were typically recorded on farmed playas during summer surveys. Facultative wetland users will not be considered further because they tend to be characteristic of other habitats

Table 1. Total number of birds observed on 12 farmed playas (1998-99) and six upland reference sites (1999). HAT score is based on the status of the species in the state (see text for details). Nomenclature follows the AOU checklist (AOU 1998).

Species	Wetland Dependent	Farmed Playas		Upland 1999	HAT Score
		1998	1999		
White-faced Ibis (<i>Plegadis chihli</i>)	Y	0	2	0	80
Mallard (<i>Anas platyrhynchos</i>)	Y	14	41	0	15
Blue-winged Teal (<i>Anas discors</i>)	Y	0	53	0	15
Northern Shoveler (<i>Anas clypeata</i>)	Y	0	6	0	15
Green-winged Teal (<i>Anas crecca</i>)	Y	2	6	0	20
Northern Harrier (<i>Circus cyaneus</i>)	N	1	2	0	30
Red-tailed Hawk (<i>Buteo jamaicensis</i>)	N	0	1	0	20
Prairie Falcon (<i>Falco mexicanus</i>)	N	1	0	0	40
Ring-necked Pheasant (<i>Phasianus colchicus</i>)	N	5	21	1	20
Northern Bobwhite (<i>Colinus virginianus</i>)	N	1	0	0	20
Black-bellied Plover (<i>Pluvialis squatarola</i>)	Y	0	4	0	40
Killdeer (<i>Charadrius vociferus</i>)	N	37	57	0	20
American Avocet (<i>Recurvirostra americana</i>)	Y	0	9	0	20
Lesser Yellowlegs (<i>Tringa flavipes</i>)	Y	1	20	0	20
Solitary Sandpiper (<i>Tringa solitaria</i>)	Y	0	2	0	40
Western Sandpiper (<i>Calidris mauri</i>)	Y	0	4	0	20
Least Sandpiper (<i>Calidris minutilla</i>)	Y	0	2	0	40
Pectoral Sandpiper (<i>Calidris melanotos</i>)	Y	3	1	0	20
Unidentified Sandpiper (<i>Calidris</i> sp.)	Y	6	9	0	--
Long-billed Dowitcher (<i>Limnodromus scolopaceus</i>)	Y	5	13	0	20
Common Snipe (<i>Gallinago gallinago</i>)	Y	11	0	0	20
Wilson's Phalarope (<i>Phalaropus tricolor</i>)	Y	0	40	0	20
Mourning Dove (<i>Zenaidura macroura</i>)	N	19	1	0	15
Horned Lark (<i>Eremophila alpestris</i>)	N	42	40	0	20
N. R.-winged Swallow (<i>Stelgidopteryx serripennis</i>)	N	0	0	1	20
Cliff Swallow (<i>Petrochelidon pyrrhonota</i>)	N	37	17	11	20
Barn Swallow (<i>Hirundo rustica</i>)	N	0	9	0	20
American Pipit (<i>Anthus rubescens</i>)	N	12	0	0	40
Lark Sparrow (<i>Chondestes grammacus</i>)	N	11	7	0	20
Lark Bunting (<i>Calamospiza melanocorys</i>)	N	0	15	0	20
Savannah Sparrow (<i>Passerculus sandwichensis</i>)	N	48	6	0	20
Grasshopper Sparrow (<i>Ammodramus savannarum</i>)	N	15	27	2	20
Harris's Sparrow (<i>Zonotrichia querula</i>)	N	1	35	0	20
Unidentified Sparrow	N	0	6	0	--
Dickcissel (<i>Spiza americana</i>)	N	15	1	0	20
Red-winged Blackbird (<i>Agelaius phoeniceus</i>)	N	117	164	18	20
Western Meadowlark (<i>Sturnella neglecta</i>)	N	19	18	0	20
Common Grackle (<i>Quiscalus quiscula</i>)	N	0	18	0	20
Great-tailed Grackle (<i>Quiscalus mexicanus</i>)	N	7	5	0	20

Table 2. HAT mean faunal indices from farmed playas in Kansas 1998-99. Note that excluding farmed playas that lacked birds from calculation of mean faunal index had little influence on mean faunal indices.

Year	Survey	n ¹	Mean faunal index ²	n ³	Modified mean faunal index ⁴
1998	1	11	16.9	8	23.3
	2	11	23.4	9	28.6
	3	11	11.3	7	17.8
	4	12	15.3	5	36.7
	5	12	13.9	8	20.8
	6	12	18.9	5	45.2
1999	1	12	7.1	5	17.0
	2	12	34.9	12	34.9
	3	12	33.3	11	36.3
	4	12	30.9	10	37.1
	5	12	30.3	9	40.4
	6	12	21.0	7	35.9

1. Total number of sites sampled during each period.
2. Computed by dividing sum of faunal indices from all sites sampled by the total number of sites sampled.
3. Number of sites with at least one species present.
4. Computed by dividing the sum of faunal indices from sites with at least one species present by the total number of sites with at least one species present.

and can provide only limited evidence for the suitability of farmed playas as avian habitat. Several species of migrant shorebirds were observed using farmed playas, comprising nearly one-third (11/36) of the species observed. Farmed playas are important to many species of migrant shorebirds when they hold water because they are one of the few stopover habitats available in the Great Plains during spring and fall migration (Baldassarre and Fischer 1984; Helmers 1992; Flowers 1996; Davis and Smith 1998). Migrant shorebirds use flooded playas to rest and replenish energy reserves depleted by seasonal movements between breeding and wintering areas (Baldassarre and Fischer 1984; Davis

and Smith 1998). Mechanical disking of farmed playas likely benefits shorebirds by providing a food base for their invertebrate prey while increasing their ability to detect predators while foraging and resting (Helmers 1992; Davis and Smith 1998). Although farmed playas appear to provide shorebirds with suitable habitat during migration, other factors associated with farming (e.g. soil loss, pesticide application) must be examined in detail before absolute conclusions are made.

Dabbling ducks were most often observed on farmed playas during summer surveys, suggesting these birds may be using these areas in conjunction with nesting. Flowers (1996, pers. comm.) reported that the Mallard and Blue-winged Teal breed in upland habitats adjacent to farmed playas in Meade County. This appears to have occurred on at least one farmed playa in this study as a female Mallard was observed during the summer of 1999 foraging with 2-3 day old young in a farmed playa containing shallow water. In addition to providing habitat for ducks during the breeding season, farmed playas in Kansas are probably similar to playas in Texas in providing suitable habitat for wintering ducks. Farmed playas in this study were dominated by several moist-soil plants (e.g. *Polygonum* sp., *Echinochloa* sp., *Leptochloa* sp.; see Table 3) that are known to provide food for migrating and overwintering ducks in the Great Plains (Guthery and Stormer 1984; Bolen, Baldassarre and Guthery 1989; Haukos and Smith 1993). Although we did not quantify winter use of farmed playas in Kansas, we speculate that the seeds of these moist-soil plants were important food sources for migrating and wintering ducks.

Assessment of HAT and WET Procedures

With few exceptions, the HAT and WET procedures characterized Kansas farmed playas as poor habitat. This result suggests that either farmed playas were poor habitats

Table 3. Mean frequency of plant species (based on two perpendicular transects), size, and total number of plant species observed for each farmed playa. One site was not sampled in either year due to agricultural disturbances and is excluded. Nomenclature follows the Great Plains Flora Association (1986). Total coverage may add up to values > 100% because of rounding errors.

Species	Playa Site (ha)										
	1 ^a (0.9)	2 ^b (0.3)	3 ^b (1.1)	4 ^a (0.5)	5 ^b (4.5)	6 ^a (0.4)	7 ^c (0.7)	8 ^a (0.3)	9 ^c (1.0)	10 ^b (1.4)	11 ^b (0.8)
<i>Kochia scoparia</i>	--	--	--	--	64.7	--	--	0.8	--	2.7	--
<i>Salsola iberica</i>	--	--	6.6	--	--	--	--	--	--	0.9	3.7
<i>Polygonum bicorne</i>	20.5	42.6	1.9	27.9	--	37.6	20.5	8.8	--	--	6.4
<i>P. ramosissimum</i>	--	--	--	--	--	--	1.6	5.5	--	--	--
<i>Ammannia coccinea</i>	--	--	--	--	--	0.6	3.2	--	18.7	--	--
<i>Bacopa rotundifolia</i>	--	--	--	--	--	0.3	--	--	--	--	--
<i>Ambrosia grayi</i>	0.9	14.8	--	2.8	5.9	18.3	--	--	--	8.0	0.9
<i>Helianthus annuus</i>	--	--	--	--	--	--	--	10.3	--	--	0.9
<i>Sagittaria longiloba</i>	--	--	--	10.0	--	2.5	--	--	--	--	--
<i>Potamogeton gramineus</i>	0.3	--	--	9.3	--	1.9	--	--	15.9	--	--
<i>Cyperus</i> sp.	--	--	--	0.4	--	1.9	--	--	--	--	--
<i>Scirpus</i> sp.	1.2	--	--	--	--	--	--	--	0.9	--	--
<i>Echinochloa colona</i>	13.7	32.0	16.0	17.9	16.0	12.5	1.6	18.3	--	37.2	22.0
<i>Echinochloa crusgalli</i>	5.5	--	--	5.4	--	5.6	6.3	20.3	--	--	--
<i>Leptochloa fascicularis</i>	33.1	--	--	3.2	--	7.1	34.7	20.3	13.1	--	--
<i>Setaria glauca</i>	0.3	--	--	--	--	--	--	--	--	--	--
Unknown I	--	--	--	0.5	--	--	--	--	--	0.9	--
Unknown II	--	--	--	--	--	--	--	--	--	0.9	0.9
Unknown III	--	--	--	--	--	0.6	0.8	--	--	--	--
Bare Ground	24.5	10.7	75.5	22.8	13.5	11.1	31.5	15.6	51.4	49.6	65.1
Total Number of Species	8	3	3	9	3	11	7	7	4	6	6

^a Relative composition based on mean of 1998-99 data.

^b Relative composition based on 1998 data.

^c Relative composition based on 1999 data.

-- Species was not recorded on transects.

for birds, or they were suitable as habitat but were not differentiated as such by the HAT and WET methods. Survey data, in contrast to HAT and WET, indicated that farmed playas provide habitat for a number of birds. This was especially true for migrant shorebirds and dabbling ducks, two wetland-dependent groups that are of ecological and conservation importance (Bolen, Baldassarre and Guthery

1989; Helmers 1992). That HAT and WET ratings conflict with empirical data from farmed playas indicate they are unsuitable assessment techniques for these habitats. It should be noted that additional surveys would likely result in more records of species in both of these groups because (1) new species were observed throughout the study, and (2) more extensive work by Flowers (1996)

reported 26 species of migrant shorebirds and 10 species of dabbling ducks using farmed playas in Meade County. Thus, additional surveys would likely provide additional support for the importance of farmed playas as avian habitat.

We attribute the poor habitat ratings of HAT and WET to the general nature of these techniques. HAT scores birds according to their relative abundance with other species: rare species are assigned higher point values than common species. Yet, by definition, rare species are unlikely to be recorded on a given site if the number of surveys on that site is limited. Thus, the most common species with the lowest point values have the highest likelihood of being observed on a given wetland at a given time, and will tend to lead to poor habitat ratings by HAT. For example, consider a sampling scheme that results in 5 surveys to each of 10 wetlands. Because a limited number of surveys are conducted, the majority of observed species will be common species with low species point values. In turn, low species point values will sum to a low faunal index, and will generate a poor site rating. A poor HAT rating is even more likely to result from a situation where logistical or financial considerations will limit sampling to a single survey. One solution to this problem is to survey individual wetlands repeatedly over a long period; however, it is typically not feasible because surveys are often conducted within a relatively short period with limited resources. A better solution is to use an established, comprehensive species list that contains relative abundance information for species at a given location. Using such a list, however, restricts the HAT method to areas that have adequate data on local abundance of avian species. Unfortunately, these data are currently lacking for farmed playas in Kansas and render HAT an unsuitable assessment technique in these habitats.

WET ratings are based on general patterns and determined from many factors, yet two

factors appeared to have a particularly strong influence on the habitat ratings. The two sites that received high ratings differed from other farmed playas in their total wetland size and the interspersion of vegetation. When all other responses were held constant and these two characteristics were altered, the WET ratings for these two sites changed from high to low, indicating an unequal weighting of these wetland characteristics. Thus, the WET procedure assigns a low value to a small wetland that lacks vegetation interspersion because it only considers physical characteristics of the wetland and ignores the diversity or abundance of species that may be observed on a wetland. In the playa system, WET may consider some farmed playas as poor habitat even though wetland size may be independent of habitat quality and vegetation interspersion may favor some species (*e.g.* shorebirds; Helmers 1992; Davis and Smith 1998). Indeed, many shorebirds in this study were observed on small, farmed playas that had little or no vegetation. These observations conflict directly with the results of the WET method, indicating WET, like HAT, is currently unsuitable for assessing farmed playas in Kansas as avian habitat.

The HAT and WET assessment methods are currently inappropriate for evaluating farmed playas in Kansas, probably because they rely on broad, generalized patterns of habitat use that are more typical of perennial wetlands. Farmed playas are often small, devoid of water, and lack vegetation, characteristics that typically lead to poor habitat ratings by HAT and WET. Yet, our results demonstrate that small, farmed playas lacking vegetation do provide habitat for wetland-species when they hold water. We recommend that neither HAT, WET, nor any other rapid assessment technique be used alone on farmed playas because of the variable nature of these systems. Instead long-term surveys that allow for documentation of the natural variation in the playa ecosystem, such as those initiated by Flowers (1996) should be the focus of

assessment efforts because they will provide the most detailed information about the importance of farmed playas as avian habitat in the southern Great Plains.

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