Avian Use of Small Aquatic Habitats in South Texas

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Abstract: Monthly censuses for 18 months were taken of avian communities on 12 ponds in South Texas. Ponds were classified into 4 types: stock, semi-permanent pasture, semi-permanent field, and temporary field ponds. Thirty-eight families represented by 132 species and 17,912 individuals were observed. Anatidae, represented by 22 species and 7,839 individuals, had the highest importance value of any bird family. Bird densities were similar across all pond types within each of 3 major time periods.

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The Texas Coastal Bend region serves as a major breeding, wintering, and migration area for numerous species of aquatic and terrestrial birds (Oberholser et al., 1974, Blacklock 1976, Rappole 1978). Studies by Chamberlain (1959), Koenig (1969), McMahan (1970), and Cornelius (1977) have alluded to the importance of marine environments of the region to waterfowl, but Singleton (1965) pointed out that inland aquatic habitats historically have been important to migrating waterfowl in the region. He added that increased human development of marine ecosystems will put added pressure on inland habitats to supply the needs of aquatic birds. To date, few studies have investigated the total avian community in these environments. The objectives of this study were to determine the abundance and diversity of the avian community of 4 pond types in South Texas and to compare bird abundance among these pond types.

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Methods

Study Area

Study ponds were located in Kleberg County, Texas, in the southern portion of the Coastal Bend Region. The relatively flat topography and poorly-drained soils have created conditions suitable for the retention of run-off in natural and manmade depressions. Average annual rainfall is 76.2 cm, with May and September being the wettest months. Annual rainfall is highly variable with frequent and often severe drought. Summers are hot and humid with strong southeasterly winds and winters are mild with light northerly winds and few days below freezing. The 12-month period preceding August 1980 was one of intensive drought. In that month, Hurricane Allen inundated the study area with more than 46 cm of rain in 3 days. Most inland bodies of water exceeded their holding capacities and widespread flooding occurred. In September 1980, when water levels of most ponds had receded into their normal depressions, study sites were selected, data collecting began, and continued through February 1982.

An artificial classification system was developed based on permanence of water and land-use of the pond area. Three ponds were selected from each of 4 pond types including: manmade stockponds, semi-permanent pasture ponds, semi-permanent field ponds, and temporary field ponds (Table 1).

Typical vegetation found in and around stock and pasture ponds included: coontail (*Ceratophyllum chinatum*), spikebrush (*Eleocharis montevitensis*), smartweeds (*Persicaria* spp.), water primrose (*Ludwigia peploides*), huisache (*Acacia farnesiana*), mesquite (*Prosopis glandulosa*), and bermuda grass (*Cynodon dactylon*). Typical natural vegetation in and around semi-permanent and temporary field ponds included: water nymph (*Najas guadalupensis*), arrowhead (*Sagittaria longiloba*), barnyard grass (*Echinochloa crusgalli*), umbrella sedge (*Cyperus digitatus*), smartweeds (*Persicaria* spp.), rattlebush (*Sesbania drummondii*), doveweed (*Croton* sp.), water primrose, and spiny aster (*Aster spinosa*). Crops planted in these ponds' watersheds included cotton, grain sorghum, oats, cucumbers, and watermelons.

Avian Community

A total census of birds of each pond was conducted monthly from September 1980 through February 1982. Each pond was observed for 1 hour from a vantage where the whole pond could be viewed using binoculars and a spotting scope. Care was taken not to disturb birds on the pond. In areas where counting birds was a problem due to rank vegetation or other obstruction, the final 15 minutes of the census period were used to walk through and flush all birds from these areas. All observations began within 3 hours of sunrise (Hall 1964) and starting times were divided equally among the ponds (Shields 1977). All birds actively utilizing the pond, whether on the surface or in the air, were included in the census. Identification was based on field

Table 1. Physical characteristics of the 4 pond types chosen for study in South Texas from September 1980 through February 1982.

Pond type	Average area (Ha)	Average shorelength (m)	Average depth (m)	Water regime	Land-use	Soil
Stock	2.3	533	4.17	Permanent	Pasture	Heavy clay
Pasture	3.6	719	2.75	Semi-permanent	Pasture	Clay-loam
Field	3.3	641	1.33	Semi-permanent	Agricultural fields	Sandy-loam
Temporary	0.96	394	0.33	Temporary	Agricultural fields	Sandy-clay

marks, songs, and calls; the same observer conducted all censuses. Birds were identified according to species, and AOU standardized common names are used throughout the manuscript (American Ornitholigists Union 1957, 1982). Birds were counted individually by species except when large concentrations made it impractical to count individuals. These large flocks were estimated by counting a small group and then estimating the number of groups that size in the flock. No observations were made on days with winds greater than 30 km/hr, heavy rain, or temperatures less than −5° C (Kendeigh 1944).

Vegetation

A qualitative description of each pond's vegetation was obtained by using a line-intercept sampling method modified from Canfield (1941). Each pond was sampled bimonthly to record seasonal changes in vegetation. A 100-m linear transect was selected so that it made a typical cross-section of the pond. The transect was laid out with a rope marked off in 2-m increments. Vegetation was recorded by species as percent cover of each 2-m increment and totaled for the entire transect. Plants were recorded if they touched the rope or overlapped it above or below the surface. Open water, organic debris, bare ground, terrestrial plants, and aquatic plants were included so that each transect totaled 100%. Plants were identified according to and appear as in Correll and Johnston (1979) and Jones (1975).

Bird density was computed by dividing the total number of birds observed by the total area of each pond type for each month.

Importance values (IV) were calculated as a means of comparing bird taxa by summing relative frequency (the number of censuses in which a taxon was observed divided by the total for all taxa) and relative abundance (the number of individuals of a taxon divided by the total number of individuals of all taxa) (Boyer and Psujek 1977). The assumption in computing the IV was that frequency and abundance were equally important.

The study period was divided into 3 6-month periods based roughly on migration patterns, as follows:

1. Fall-winter 1980–1981, including September 1980 through February 1981.

2. Spring-summer 1981, including March 1981 through August 1981.

3. Fall-winter 1981–1982, including September 1981 through February 1982.

An analysis of variance (ANOV) was performed to test the effect of the 4 pond types on bird densities for the 3 time periods. Sources of variation were partitional into pond type, pond (pond type), time period, the interaction of pond type with time period, and the estimate of the variation between ponds in the same pond type during the same time period. The test for pond-type differences used the pond (pond type) mean square for the F-ratio denominator. The tests for time period differences and an interaction between pond type and time period used the time period × pond (pond type) mean square for the F-ratio denominator. A similar analysis was used to test for monthly differences within the time periods.

Results

Fifteen orders of birds, representing 38 families, 132 species, and 17,912 individuals were observed (Briggs 1982). Anatidae (IV = 71.5) was by far the most abundant family with 7,839 individuals of 22 species (Table 2). Northern pintail (*Anas acuta*) was the most numerous species and had the highest IV of all species (Table 3).

Highest bird numbers were recorded during the fall-winter periods and the lowest in the spring-summer period. The largest numbers were recorded in January 1981, October 1980, and December 1980 with 2,632, 2,048, and 1,504 individuals, respectively. The lows of 214 and 291 in May and June 1981 corresponded to the peak nesting season of most summer resident species (Oberholser et al. 1974).

Analysis of variance for bird density indicated no significant ($P = 0.33$) interaction between time period and pond type. Also, there was no significant ($P > 0.20$) interaction between month and pond type within each time period. No significant ($P = 0.07$) differences were found among pond types for all 3 time periods combined. Also, no significant ($P > 0.30$) differences were found among pond types within each time period. No significant ($P > 0.40$) differences were found among months within time periods 1 or 3 (Sep. 1980–Feb. 1981; Sep. 1981–Feb. 1982). However, there was a significant ($P = 0.02$) difference among months in time period 2 (Mar.–Aug. 1981) and among time periods ($P = 0.01$) for all pond types.

Discussion

The geographic location of the Coastal Bend Region concentrates large numbers of migrating and wintering waterfowl (Singleton 1965, Bellrose 1976, White and James 1978) as well as other aquatic and terrestrial birds (Oberholser et al. 1974, Rappole 1978). While the majority of waterfowl winter in marine environments in the region, inland aquatic habitats are also important, especially to waterfowl, as indicated by the high IV of Anatidae on all pond types in this study.

Freshwater ponds in the region contain important features that attract aquatic birds and a variety of terrestrial birds. First, the emergent vegetation in the ecosystems of these ponds generally becomes very rank by late summer offering concealment and shelter. Second, many of the plant species found in these ecosystems are recognized waterfowl and aquatic bird food sources (Martin et al. 1961). Krapu (1974) found that invertebrates played a major role in the diets of pre-laying pintail hens and Newland (pers. commun.) found invertebrates in abundance in pond ecosystems of South Texas. Fluctuating waters and gentle slopes associated with the ponds in this study created extensive mud flats that several species of shorebirds used. This diversity of shorebirds, according to Recher (1966), was a reflection of the diversity of invertebrates in the substrate. Stock and pasture ponds did not have the large mud flat areas associated with semi-permanent and temporary field

Table 2. Number of species (*N* sp), frequency (Fr), number of individuals (*N* Ind), and Importance Values (IV)[a] of 38 bird families observed on 12 ponds in South Texas from September 1980 through February 1982.

Family	*N* sp	Fr	*N* Ind	IV
Anatidae	22	426	7,839	71.5
Scolopacidae	20	276	1,887	27.0
Icteridae	6	127	3,147	25.1
Rallidae	4	59	1,768	13.4
Ardeidae	10	164	309	11.5
Laridae	9	107	478	9.0
Charadriidae	5	103	319	7.9
Hirundinidae	4	53	432	5.6
Podicipedidae	3	68	261	5.5
Columbidae	2	29	249	3.1
Threskiornithidae	2	25	258	2.9
Phalacrocoracidae	2	18	243	2.4
Fringillidae	7	23	177	2.4
Recurvirostridae	2	30	117	2.4
Accipitridae	7	32	32	2.1
Caprimulgidae	1	20	38	1.4
Alcedinidae	1	20	20	1.3
Anhingadae	1	17	33	1.2
Gruidae	1	10	69	1.0
Motacillidae	1	13	31	1.0
Paruldidae	2	10	32	0.8
Alaudidae	1	3	81	0.6
Tyrannidae	4	8	8	0.5
Pelicanidae	1	3	31	0.4
Turdidae	1	6	6	0.4
Falconidae	2	5	5	0.3
Troglodytidae	1	4	7	0.3
Apodidae	1	3	3	0.2
Laniidae	1	3	3	0.2
Phasianidae	1	2	6	0.2
Cuculidae	1	3	5	0.2
Cathartidae	1	1	1	0.1
Picidae	1	1	1	0.1
Rynchopidae	1	1	10	0.1
Mimidae	1	1	1	0.1
Sturnidae	1	2	4	0.1
Sylviidae	1	1	1	0.1
Total	132	1,683	17,912	200.0

[a] Importance Value (IV) = % abundance + % frequency.

Table 3. Frequency (Fr), number of individuals (*N* Ind), and Importance Values (IV)[a] of bird species with IV greater than 2.0 observed on 12 ponds in South Texas from September 1980 through February 1982.

Species/scientific name	Fr	*N* Ind	IV
Northern pintail *Anas acuta*	54	2,000	14.4
Red-winged blackbird *Agelaius phoeniceus*	53	1,732	12.8
American coot *Fulica americana*	43	1,592	11.4
Blue winged teal *Anas discors*	46	805	7.2
American wigeon *Ana americana*	32	924	7.1
Black bellied whistling duck *Dendrocygna autumnalis*	40	800	6.8
Kill deer *Charadrius vociferus*	86	261	6.6
Great-tailed grackle *Quiscalus mexicanus*	35	714	6.1
Green-winged teal *Anas crecca*	40	645	6.0
Gadwall *Anas strepera*	28	737	5.8
Mottled duck *Anas fulvigula*	54	384	5.4
Pied-billed grebe *Pedilymbus podiceps*	58	251	4.9
Laughing gull *Larus atricilla*	53	308	4.9
Northern shoveler *Anas clypeata*	32	521	4.8
Least sandpiper *Calidris minutilla*	38	309	4.0
Great blue heron *Ardea herodias*	53	69	3.5
Barn swallow *Hirundo rustica*	29	317	3.5
Common snipe *Galinago galinago*	37	180	3.2
Dowitcher sp. *Limnodromus* sp.	18	386	3.0
Mourning dove *Zanaida macroura*	25	235	3.0
Brewer's blackbird *Euphagus cyanocephalus*	4	495	3.0
Greater yellowlegs *Tringa melanoleuca*	39	98	2.9
Double-crested cormorant *Phalacrocorax auritis*	23	206	2.8
Ring-necked duck *Aythya colaris*	22	266	2.8
White-faced ibis *Plegadis chihi*	20	240	2.5
Eastern meadowlark *Sturnella magna*	29	119	2.4

[a] Importance Values (IV) = % abundance + % frequency.

ponds but probably had much higher populations of invertebrates because of large amounts of detritus in the substrate that many shorebirds occupied when exposed. Stock and pasture ponds had varying amounts of brush-to-pond ecotone that many migrant passerine birds used. Several Fringillid species used dry semi-permanent and temporary field ponds, probably due in part to feeding opportunities in weedy areas of the ponds and to casual use as birds passed from one riparian habitat to another.

The results of the ANOV for bird density indicated that these ponds had similar numbers of birds and by that measure were similar habitats. Since large numbers of waterfowl were observed on all pond types, the needs of many Anatids seem to have been met in all pond types. Although large numbers of waterfowl during fall-winter periods may have biased the data, these results point to the importance of Anatidae to the avian community of the region. Broken down by month, Anatidae had the highest IV in all but 4 months (Sep., Apr., May, and June) and was second highest in these months. It should be noted that IV is used as an indicator of abuandance and frequency for comparing bird taxa. Generally the taxa with low IV's were found in specific habitats found on only a single pond and taxa with higher IV's were found in all pond types. Therefore, all pond types were similarly important to many taxa, and the results of the ANOV's were reasonably accurate.

Conclusions

The avian communities in the ecosystems represented in this study were diverse, but many taxa were present in relatively low numbers, and others were relatively numerous.

This condition may have biased the analyses of the data.

Waterfowl were the most important users of these ponds in terms of abundance and frequency of use.

Similarities in structure for all pond types resulted in bird densities that were not significantly different within each of 3 major time periods.

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