Nongame Session

Shorebird Migration at a Mississippi River Wastewater Treatment Plant

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Abstract: Surveys of shorebirds from a 13-year period were compiled from the T. E. Maxson wastewater treatment plant in Memphis, Tennessee, a site bordering the Mississippi River. The data represent one of the few long-term shorebird surveys from the Mississippi River valley. Data were used to produce a migrational chronology for species both in spring and fall based on mean abundance. Least sandpipers (*Calidris minutilla*), pectoral sandpipers (*C. melanotos*), killdeer (*Charadrius vociferus*), and lesser yellowlegs (*Tringa flavipes*) were the most abundant migratory species recorded. Fall migration occurred over a much longer period than did spring migration, and most species were more abundant during this time; however, shorebirds used the facility throughout the survey period of March to November. This information is useful in providing wetland management guidelines on timing and duration of flooding for migratory shorebird conservation.

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Surveys of shorebirds east of the Mississippi River are generally limited to the coastal areas of the Atlantic flyway (Urner and Storer 1949, Pfister et al. 1992, Clark et al. 1993, Morrison et al. 1994). Published accounts of shorebird migration chronologies along the Mississippi River are few and are primarily restricted to the upper Mississippi Alluvial Valley (Brooks 1965, Keller 1972, Reid et al. 1983). The entire Mississippi Alluvial Valley is an important migrational pathway on both northbound and southbound flights for many species of shorebirds (Reid et al. 1983). Publications on shorebird management for the interior flyways (Rundle and Frederickson 1981, Helmers 1992) provide guidelines for the creation and maintenance of freshwater wetland habitats required by migrating shorebirds; however, much of the data is applicable on a regional basis only and is frequently not site-specific. Additional information on the occurrence and chronology of shorebirds using the lower Mississippi Valley is essential for the creation of the best management practices necessary for the shorebirds of the lower Mississippi Valley.

This paper summarizes 13 years of shorebird surveys from a wastewater treatment facility. These facilities can provide suitable habitat for migrating shorebirds (Keller 1972, Neill and Kuban 1986), depending on the methods used for treating sewage effluent (Fuller and Glue 1980). Management techniques at wastewater treatment plants can vary widely according to cost, needs and current environmental regulations, but these managed water areas have the potential to provide predictable stopover sites for migrating shorebirds during both the fall and spring.

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Methods

The T. E. Maxson wastewater treatment plant is an 1,822 ha-public facility situated along the Mississippi River on the southwestern edge of Memphis, Tennessee. In 1982, 45 ha were set aside for use as a drying cell for biosolids. Currently, there are approximately 73 ha of drying cells consisting of a variety of lagoons and fields for effluent at varying stages of treatment in the anaerobic drying process. The depth and total amount of water have varied seasonally depending on management needs and rainfall conditions; however, some water has consistently been available in the lagoons and fields at the site since the surveys began in 1982. Although there has been no sampling of the macroinvertebrate population at the facility, other studies of similar areas have noted large populations of adult and larval insect (primarily Diptera) populations that serve as an important food source for shorebirds (Keller 1972, Neill and Kuban 1986).

Complete counts of shorebirds using spotting scopes began in 1982 by TOS members and continued through 1994. The counts were conducted at irregular intervals from March through November, with the exception of 1982 and 1984 when the counts began in July. The total number of individual surveys varied among years, ranging from a low of 19 in 1984 to a maximum of 62 in 1991 (mean = 42.8±11.2). The entire 75 ha area was usually surveyed by ≥2 observers during the afternoon, although there were occasional morning surveys.

To determine peak migration periods in fall and spring, each month in the sampling year was divided into 3-, 10-, or 11-day intervals depending on the length of a given month. All surveys completed within a specified 10- or 11-day period were then grouped together and the largest number of birds seen during that interval was then recorded for each species (Weir and Cooke 1976). This approach estimated the maximum number of birds that traveled through at any time period while reducing the possibility of counting the same birds twice. Those numbers were then averaged over the 13-year period to arrive at a mean abundance for each species for each sampling interval. In some years no surveys were done during a given sampling interval, particularly when few shorebirds were present at the site in early spring and

late fall. Those years were excluded from the calculation of mean abundance for that interval.

Results and Discussion

Twenty-eight species of shorebirds were detected during the 13 years the surveys were conducted. Of those, least sandpipers, pectoral sandpipers, lesser yellowlegs and killdeer were the most abundant species (Fig. 1). Killdeer were the only shorebirds that consistently used the site on a year-round basis; however, an additional migratory population passed through in the fall and spring. Lesser yellowlegs, least sandpiper, and common snipe (*Gallinago gallinago*) were all present when the surveys were discontinued for the year and were present during the first survey of the spring, indicating that some birds overwintered at the site.

Many species were found more frequently during either the spring or fall migra-

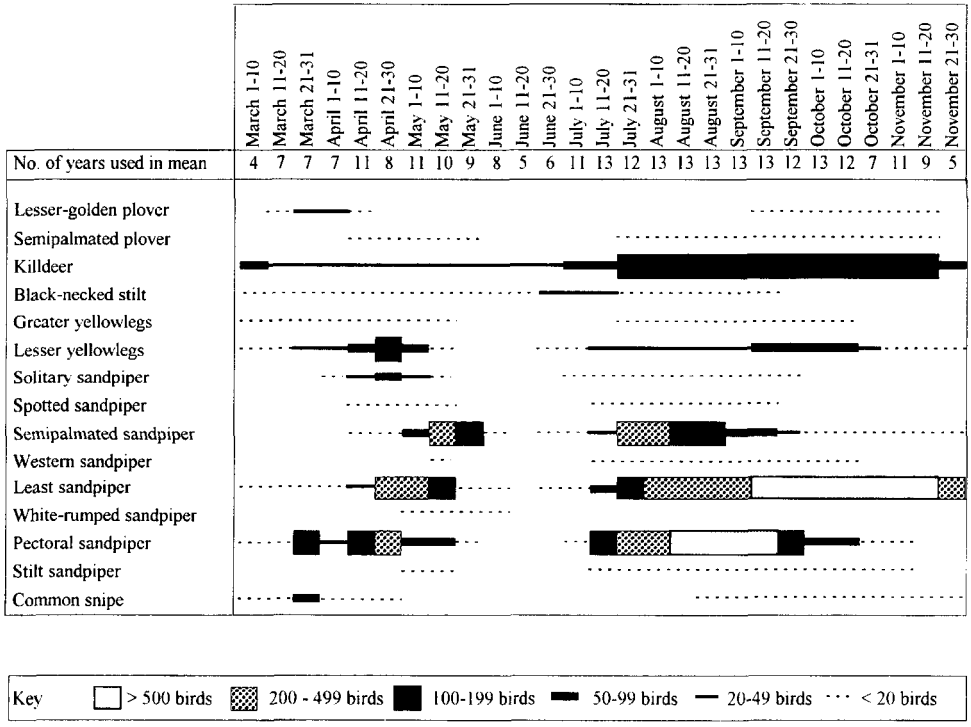

Figure 1. Mean maximum abundance of 15 migrant shorebirds at the T. E. Maxson Wastewater Treatment Plant, Memphis, Tennessee, 1982–1994. The highest number of individuals of each species seen during each 10- or 11-day survey period averaged over the entire 13-year period are represented. The number of years used in calculating the mean are indicated.

tion, primarily due to the elliptical pattern of many shorebirds during migration (Morrison and Myers 1987). This phenomenon was exemplified by both the western (*Calidris mauri*) and white-rumped sandpiper (*Calidris fuscicollis*). As expected, the white-rumped sandpiper was usually found only during the spring migration because they generally travel over the Atlantic in the fall (Weir and Cooke 1976). The western sandpiper usually appeared only during the fall because this species travels a more westerly route during the spring (Senner and Martinez 1982), and was only observed infrequently at the facility in April-May.

As noted in other studies of shorebirds of interior regions, the spring migration occurred over a relatively short time period compared with the fall (Keller 1972, Weir and Cooke 1976, Colwell et al. 1988, Smith et al. 1991). The least, pectoral, and solitary sandpiper (*Tringa solitaria*), and lesser yellowlegs all had their peak migration of the spring during the survey interval of 21–30 April (Fig. 1). The lesser-golden plover (*Pluvialis dominica*), solitary sandpiper, and common snipe were all more common during the spring migration than in the fall; however, there were still migrant shorebirds present at the facility until the first week of June. Black-necked stilts (*Himantopus mexicanus*) arrive early in the spring and have nested at the site since 1984. Although only a few pairs were observed in 1984, in 1994 there were 149 breeding individuals at the facility.

The longer fall migration is often attributed to a differential migration of adults and juveniles on the flight south (Weir and Cooke 1976, Howe et al. 1989, Smith et al. 1991). The first southward migrants, primarily least and semipalmated sand-pipers and lesser yellowlegs, arrived at the site in late June. Many migrants were still observed at the site by the end of November. The least sandpiper was recorded in highest numbers during the fall, with observations exceeding 500 birds as late as November. Pectoral sandpipers were recorded in similar numbers during fall migration; however, their peak began in early August and continued through mid-September. Many rare or infrequent species have been recorded at the facility during the fall migration and include the American avocet (*Recurvirostra americana*), red-necked phalarope (*Phalaropus lobatus*), sanderling (*Calidris alba*), and ruff (*Philomachus pugnax*).

The largest number of observed individuals recorded during an individual survey from the entire 13-year study period occurred during the later years of the study (Table 1). We believe this resulted from a combination of 2 factors. Fewer surveys were completed in the first years of the study and, therefore, there were fewer opportunities to record a higher number of birds. Also, because the site only began its current management practices in 1982, the greater numbers may simply reflect increasing numbers of birds using a predictable stopover site on a yearly basis.

Management Implications

A migratory bird conservation plan that includes shorebirds is now under development in the lower Mississippi Alluvial Valley (MAV) (Loesch et al., in press). This plan is based on the energetic needs of migrating shorebirds. The plan assumes that

Table 1. The 18 most common shorebirds observed at the T. E. Maxson Sewage Treatment Plant, Memphis, Tennessee, 1982–1994. The highest number recorded for the spring and fall migration on any single day for the entire 13-year survey period is provided.

Species[a]	Highest number recorded in spring (date)	Highest number recorded in fall (date)
Lesser golden-plover (*Pluvialis dominica*)	217 (4/85)	12 (9/89)
Semipalmated plover (*Charadrius semipalmatus*)	32 (4/86)	45 (8/93)
Killdeer (*Charadrius vociferus*)	62 (3/85)	375 (9/89)
Black-necked stilt (*Himantopus mexicanus*)	125 (6/94)[b]	149 (7/94)
Greater yellowlegs (*Tringa melanoleuca*)	150 (4/90)	45 (10/90)
Lesser yellowlegs (*Tringa flavipes*)	661 (4/92)	328 (10/89)
Solitary sandpiper (*Tringa solitaria*)	298 (4/91)	47 (7/91)
Spotted sandpiper (*Actitis macularia*)	13 (5/88)	14 (7/86)
Semipalmated sandpiper (*Calidris pusilla*)	690 (5/92)	800 (8/90)
Western sandpiper (*Calidris mauri*)	15 (5/93)	150 (8/93)
Least sandpiper (*Calidris minutilla*)	1,595 (4/92)	2,938 (10/91)
White-rumped sandpiper (*Calidris fuscicollis*)	85 (6/91)	9 (8/84)
Pectoral sandpiper (*Calidris melanotos*)	1,800 (4/92)	4,000 (8/91)
Dunlin (*Calidris alpina*)	18 (5/90)	69 (10/89)
Stilt sandpiper (*Calidris himantopus*)	35 (5/90)	110 (10/93)
Short-billed dowitcher (*Limnodromus griseus*)	27 (5/91)	60 (11/90)
Long-billed dowitcher (*Limnodromus scolopaceus*)	15 (4/90)	21 (11/90)
Common snipe (*Gallinago gallinago*)	90 (3/90)	36 (10/91)

[a]Only species recorded in numbers >10 on any single occasion during the 13 years are listed.

[b]Nested on facility.

typical shallow wetland habitat will provide a predictable biomass of invertebrates adequate to support the migration of a specified number of shorebirds. As of now, the plan is designed to provide habitat for 500,000 shorebirds that are assumed to use the lower Mississippi Valley for 10 days during migration or a total of 5 million bird use-days. An estimated need of 2,000 ha of suitable habitat was calculated, which is currently provided in the lower MAV.

However, if current plans are carried through, the T. E. Maxson treatment facility will change its wastewater treatment methods so that these shallow ponds, now available all year, will be essentially eliminated. The effect of the loss of this habitat on shorebird populations can be estimated by simple examination of the area or bird use-days lost. The amount of adequate shorebird habitat at the facility is approximately 73 ha, which is 3.65% of the estimated total area of 2,000 ha needed in the MAV. The loss of bird use-days can be estimated using instantaneous-count methods described by Schreuder et al. (1975). Using the most recent data from 1994 only, the estimated number of bird use-days during the fall migration period (15 Jul–15 Nov) was 168,305 (S.E. = 20,955.5). This estimate represents approximately 3.4% of the total 5 million bird use-days estimated to be available to shorebirds in the lower MAV. A more detailed analysis is planned, because this current estimate is based on only 1 year of counts and does not take into account the size of the birds using the site.

While the loss of this site may not be large compared to the total amount needed for the entire Mississippi valley, all of the 73 ha is usually available to shorebirds for foraging and we believe that this area contains high densities of invertebrate prey. On the other hand, unless flooded early, diked impoundments used to manage waterfowl usually contain land that is not available to shorebirds at all times. It remains to be seen if the loss of this site can be compensated for on other management lands in the area.

Literature Cited

Brooks, W. S. 1965. Effect of weather on autumn shorebird migration in east-central Illinois. Wilson Bull. 77:45–54.

Clark, K. E., L. J. Niles, and J. Burger. 1993. Abundance and distribution of migrant shorebirds in Delaware Bay. Condor 95:694–705.

Colwell, M. A., S. D. Fellows, and L. W. Oring. 1988. Chronology of shorebird migration at Last Mountain Lake National Wildlife Area, Saskatchewan, Canada. Wader Study Group Bull. 52:18–22.

Fuller, R. J. and D. E. Glue. 1980. Sewage works as bird habitats in Britain. Biol. Conserv. 17:165–181.

Helmers, D. L. 1992. Shorebird management manual. West. Hemisphere Shorebird Reserve Network. Manomet, Mass. 58pp.

Howe, M. A., P. H. Geissler, and B. A. Harrington. 1989. Population trends of North American shorebirds based on the International Shorebird Survey. Biol. Conserv. 49:185–199.

Keller, C. E. 1972. Shorebird migration at the Indianapolis sewage disposal plant. Ind. Audubon Quarterly 50:124–135.

Loesch, C. R., K. Tripp, W. C. Hunter, M. S. Woodrey, and D. J. Twedt. In press. Development of management objectives for waterfowl and shorebirds within the Mississippi Alluvial Valley Migratory Bird Initiative. Strategies for Bird Conservation: The Partners in Flight Planning Process. Cornell Univ. Press, Ithaca, N.Y.

Morrison, R. I. G., C. Downes, and B. Collins. 1994. Population trends of shorebirds on fall migration in eastern Canada, 1974–1991. Wilson Bull. 106:431–447.

——— and J. P. Myers. 1987. Wader migration systems in the New World. Wader Study Group Bull. 49 (suppl): 57–69.

Neill, R. L. and J. F. Kuban. 1986. Shorebird migration at Arlington, Texas: 1977–1986. Bull. Texas Ornithol. Soc. 19:13–20.

Pfister, C., B. A. Harrington, and M. Lavine. 1992. The impact of human disturbance at a migration staging area. Biol. Conserv. 60:115–126.

Reid, F. A., W. D. Rundle, M. W. Sayre, and P. R. Covington. 1983. Shorebird migration chronology at two Mississippi River Valley wetlands of Missouri. Biol. Conserv. 47:103–115.

Rundle, W. D. and L. H. Frederickson. 1981. Managing seasonally flooded impoundments for migrant rails and shorebirds. Wildl. Soc. Bull. 9:80–87.

Schreuder, H. T., G. L. Tyre, and G. A. James. 1975. Instant and interval-court sampling: two new techniques for estimating recreation use. Forest Sci. 21:40–44.

Senner, S. E. and E. F. Martinez. 1982. A review of western sandpiper migration in interior North America. Southwest Nat. 27:149–159.

Smith, K. G., J. C. Neal, and M. A. Mlodinow. 1991. Shorebird migration at artificial fish ponds in the prairie-forest ecotone of northwestern Arkansas. Southwest. Nat. 36:107–113.

Urner, C. A. and R. W. Storer. 1949. The distribution and abundance of shorebirds on the north and central New Jersey coast, 1928–1939. Auk 66:177–194.

Weir, R. D. and F. Cooke. 1976. Autumn migration of shorebirds in the Kingston area of Ontario, 1964–1976. Can. Field-Nat. 90:103–113.