February 1997

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Abstract: During 1996, we evaluated the effectiveness of mylar flags for deterring herring gulls (Larus argentatus) from 2 nesting colonies (roof and breakwall) and herring and ring-billed (L. deglawarensis) gulls from 2 loafing sites at a landfill. Mylar flags (15 cm x 1.0 m) attached to wire or lathe supports were positioned at 6-m intervals at nesting colonies and 3- to 12-m intervals at loafing areas. For both nesting colonies, time of nest initiation, nest density, and clutch size in 1996 when flags were present was similar to or greater than values obtained for these parameters at the same colonies in 1995 when flags were not present. The maximum number of chicks observed at the roof colony in 1996 was also similar to the maximum number of chicks observed in 1995. At the landfill, we observed fewer gulls ($P < 0.05$) at 1 loafing site during the 2 weeks when mylar flags (6- and 12-m spacing) were present than during the 2 weeks when flags were not present. In contrast, gull use of the second loafing area did not appear influenced by the presence of mylar flags (3- and 6-m spacing), likely because of its small size (6 x 90 m) and proximity to a frequently used pond. We conclude that mylar flags are ineffective in deterring herring gulls (and likely other gulls) from nesting colonies but can reduce herring and ring-billed gull use of loafing areas.

Pages 73-80 *in* C. D. Lee and S.E. Hygnstrom, eds. Thirteenth Great Plains Wildl. Damage Control Workshop Proc., Published by Kansas State University Agricultural Experiment Station and Cooperative Extension Service.

Key Words: deterrent, gulls, Larus spp., mylar flags, wildlife damage management

Populations of ring-billed gulls (Larus delawarensis) and herring gulls (L. argentatus) have increased throughout the Great Lakes region in recent years. For example, the nesting population of ring-billed gulls along the Canadian portion of the lower Great Lakes increased from about 56,000 pairs to 283,000 pairs between 1976-1990 (Blokpoel and Tessier 1992). Winter populations of ring-billed and herring gulls along the south shore of Lake Erie increased 21- and 6-fold, respectively, from the 1950s to the early 1980s (Dolbeer and Bernhardt 1986). Potential causes for these increases include protection of breeding colonies, the ability of gulls to exploit anthropogenic food sources, and a greater availability of human-made nesting habitat (e.g., roofs, dredge disposal islands) (Kadlec and Drury 1968; Blokpoel and Tessier 1984, 1992; Belant et al. 1993, 1995a).

Dramatic increases in gull use of roofs and other urban sites for nesting, loafing, or feeding have occurred in recent years (Monaghan 1979, Blokpoel and Tessier 1986, Dolbeer et al. 1990, Vermeer 1992). For example, Dwyer et al. (1996) documented >7,900 breeding pairs of ring-billed and herring gulls in 1994 at 30 roof colonies on the U.S. portion of the Great Lakes. This prevalence of gull use of urban areas has caused an increase in gull/people conflicts. Gulls frequently are considered a nuisance and health hazard when nesting on roofs because they cause structural damage by obstructing drainage with feathers and debris, harass maintenance personnel, and defecate on nearby vehicles (Belant 1993). Gulls nesting in urban areas near airports also can create hazards to aircraft (Dolbeer et al. 1993). Also, large concentrations of gulls in loafing areas, such as landfills or reservoirs, can cause nuisance and public health concerns (Jones et al. 1978, Belant et al. 1995b, Hatch 1996).

Techniques available to reduce gull use of nesting and loafing areas include egg oiling, nest and egg removal, overhead wires, and various harassment or frightening devices (Blokpoel and Tessier 1992, Belant 1997). Many of these techniques, however, are expensive, require multiple years to achieve desired results, or have not been evaluated quantitatively.

Reflective tape (mylar) is a material that may deter gulls from nesting or loafing sites. Reflective tape positioned in parallel transects has reduced bird damage to various crops (Bruggers et al. 1986, Dolbeer et al. 1986), although limitations in effectiveness have been documented (Tobin et al. 1988, Conover and Dolbeer 1989). Mylar flags have also been used to deter geese from fields (Heinrich and Craven 1990, Summers and Hillman 1990, Mason and Clark 1994). We are unaware of any study that has evaluated mylar as a deterrent for nesting or loafing gulls. Our objective was to determine if mylar flags would reduce herring gull use of nesting areas and ring-billed and herring gull use of loafing areas at a landfill.

STUDY AREA

Nest Colonies

We assessed the effectiveness of mylar flags at 2 herring gull nesting colonies (roof and breakwall) in northern Ohio. The roof of the Microsheen building, 2.8 km south of Lake Erie, contained the largest herring gull nesting colony in Cuyahoga County (Belant et al. 1995a). The 1.7-ha roof has numerous structures (e.g., vents) on a primarily light-colored gravel surface. The roof also has 6 distinct sections, the heights of which differ $\leq$2 m.

Herring gulls nesting on breakwalls at Cedar Point in Erie County, Ohio are part of the Sandusky Bay, Lake Erie concentration, one of the largest concentrations of nesting herring gulls (4,250 nests in 1989) on the Great Lakes (Dolbeer et al. 1990). The breakwalls consisted typically of large, irregular-shaped boulders, with no vegetation. Gull nests were restricted to the occasional flat, horizontal surfaces. An exception was part of the south breakwall, which consisted of rubble substrate with primarily herbaceous and low-growing woody vegetation along the center. We placed flags along this section of the south breakwall (120 m [L], 10-20 m [W]) because numerous herring gull nests were recorded here previously (R. A. Dolbeer, unpubl. data).

Landfill

The Erie County, Ohio, landfill is located 7 km south of Lake Erie. This solid-waste landfill averaged 222 metric tons of refuse a day, 6 days a week (Belant et al. 1995b). The mean number of gulls (primarily herring and ring-billed) observed per visit throughout the year at the landfill is 811, with maximum numbers of >10,000 occasionally observed during November-January (Belant et al., unpubl. data).

METHODS

Bird Scaring Tape (Nishizawa [USA] Limited, Los Angeles, CA) is a synthetic resin film made of mylar. The tape we used was 15 cm wide, 0.025 mm thick, and metallic red and silver on opposite sides. The tape flashes in sunlight and makes a humming sound during windy conditions.

Field Trials at Nest Colonies

To make the flags, we cut 1.2-m lengths of the mylar, then rolled 20 cm of one end and wrapped this end in duct tape. Taped ends of the flags were attached individually to loops at the top of 1.2-m, 9-gauge wire supports (finished height).

A circular base was made from the opposite end of the support wire. Flags were held upright by placing a concrete block (40 x 19 x 4 cm) over the base of each wire support. At Microsheen, 426 flags were positioned in a 6-m grid over 1.4 ha of the 1.7-ha roof on 11-12 March. Repair work on the remaining 0.3-ha of roof precluded placement of flags in this section. This section of roof was resurfaced about 4 weeks later with black rubber roof material. At Cedar Point, 53 flags were positioned in 2 parallel rows along the 120-m section of breakwall on 25 March. Rows were about 6 m apart and flags within rows were at 6-m intervals.

We monitored gull activity at each colony once each week from early April-late May. Observations were discontinued when the number of nests with eggs or chicks present began to decline. We also compared dates that eggs were first observed, maximum number of nests, clutch size, and number of chicks observed in flagged portions of the colonies in 1996 to similar data collected at Microsheen and Cedar Point during 1995 (Belant et al. 1995, Dolbeer, unpubl. data). At Microsheen, we also compared nest density in the unflagged portion of roof (0.3 ha) to nest density in the adjacent flagged portion of roof (0.3 ha), which together comprised the roof section of greatest nest density in 1995 (Belant, unpubl. data).

Field Trial at Landfill

Mylar flags were prepared as described previously and attached individually to 1 x 3 x 122-cm wood lathe. Flags were positioned by driving the lathe into the ground.

We established 2 plots at the landfill in areas where gulls were previously observed loafing. Both plots were 200-300 m north of the active face of the landfill. Plot boundaries were delineated with wood lathe. Plot 1 (6 x 90 m) was a grass-covered bank bordered by a 0.5-ha pond and dirt access road. Plot 2 (42 x 55 m) was located about 100 m from Plot 1 on a grass slope.

We conducted a 4-week experiment (28 Oct-24 Nov) consisting of 2 alternating, 1-week no treatment and treatment periods. No flags or lathe were in Plots 1 or 2 during no-treatment periods (weeks 1 and 3). During the first treatment period (week 2), 28 flags at Plot 1 were positioned at 6-m intervals in 2 parallel lines 3 m apart. The 2 lines of flags in Plot 1 were offset 3 m. Flags ($\underline{n}$ = 63) in Plot 2 were positioned in a 6-m grid. During the second treatment period (week 4), flags ($\underline{n}$ = 58) in Plot 1 were positioned at 3-m intervals in 2 parallel lines 3 m apart. Flags ($\underline{n}$ = 32) in Plot 2 were positioned in a 12-m grid.

We estimated the number of gulls by species present at the entire landfill and within each Plot at 1000 and 1400 hrs, 4-5 days each week (see Belant et al. 1995b). To determine the effectiveness of mylar flags for deterring gulls, we compared the total number of gulls and the number of gulls by species observed at each Plot and at the entire landfill during no treatment and treatment periods using Kruskal-Wallis chi-square approximations (SAS Inst. Inc. 1988).

RESULTS

Field Trials at Nest Colonies

At Microsheen, nests with eggs were first observed in flagged portions of the roof on 17 April 1996; incubation in 1995 was estimated to begin on 23 April. The date the maximum number of nests with $\geq$1 egg or chick was observed in 1996 (22 May) was similar to the date the maximum number of nests was observed in 1995 (17 May). Also, the density of nests observed on the flagged portion of roof in 1996 (133 nests/ha; 172 nests) was 13% greater than the density of nests observed on the entire roof in 1995 (116 nests/ha; 198 nests). Mean clutch size (2.6 eggs) and the number of chicks (202) observed 1 week after the maximum number of nests were present in flagged areas during 1996 was similar to mean clutch size (2.7) and the number of chicks observed (205) in 1995.

On 29 May 1996, 53 nests were present in the unflagged portion of roof (0.3 ha), a density of 177 nests/ha. In contrast, the density of nests (67 nests, 223/ha) in the adjacent flagged portion of this same section of roof (also 0.3 ha) on 29 May was 26% greater.

At Cedar Point, nests with eggs in the flagged section of breakwall were first observed on 17 April. In 1996, a maximum of 279 nests were recorded on the flagged area; a maximum of 426 nests were recorded on the entire breakwall. In 1995, 372 nests were recorded on the entire breakwall, 13% fewer than in 1996. Clutch size in 1996 was larger in the flagged area (2.6 eggs) than on the entire breakwall during 1995 (1.8 eggs). Increases in the number of nests and clutch size observed in 1996 are attributed in part to high waves in 1995 which destroyed numerous nests prior to the nest count.

We observed 4 Canada goose (Branta canadensis) nests and 1 mallard (Anas platyrhynchos) nest on the flagged section of breakwall. One goose nest was within 1 m of a flag.

Mylar flags remained attached to the wire supports throughout the study; however, most frayed into small (<1 cm) strips. Although no flags were replaced, we spent up to 20 min during each site visit untangling flags from the wire supports.

At least 5 adult and 1 hatching-year herring gull died as a consequence of entanglement in the mylar flags and supports at Microsheen and Cedar Point; 1 during the study, the remainder after the study was completed. Some gulls' legs or feet became entangled in the wire loops used to attach the flags; remaining gulls were entangled in frayed mylar flags.

Field Trial at Landfill

The number of ring-billed gulls observed at Plot 1 differed ($X^2 = 7.86$, 3 df, $P < 0.05$) among weeks, with fewer gulls observed during the second treatment period (Figure 1a). The number of herring gulls observed at Plot 1 was similar among weeks ($X^2 = 6.75$, 3 df, $P = 0.08$). For both species combined, fewer gulls than expected were observed during the second treatment period ($X^2 = 7.97$, 3 df, $P < 0.05$).

At Plot 2, fewer ($X^2 = 13.30$-17.13, 3 df, $P < 0.01$) ring-billed gulls, herring gulls, and all gulls were observed during the 2 1-week treatment periods than during the 2 weeks when mylar flags were not present (Figure 1b). During the first treatment period, up to 1,050 gulls were observed adjacent to the Plot but generally did not enter it. In contrast, almost no gulls were observed near Plot 2 during the second treatment period.

We did not observe gulls landing in either Plot when mylar flags were present; rather, they landed near the Plots and walked into them. During the first treatment period, the number of gulls present in each plot generally increased across days.

The total number of ring-billed gulls and all gulls observed at the entire landfill were similar among the 4 weeks of the study ($X^2 = 2.55$ and 2.95, 3 df, $P = 0.47$ and 0.39, respectively) (Figure 1c). In contrast, the number of herring gulls observed was lower ($X^2 = 7.89$, 3 df, $P < 0.05$) than expected during the second no treatment period (week 3) than during other periods (weeks 1, 2, and 4).

Mylar flags remained attached to the lathe during the treatment periods; however, several flags were blown over from wind and had to be repositioned.

DISCUSSION

Mylar flags positioned in a 6-m grid (about 300/ha) did not appear to reduce the number of herring gulls nesting at Cedar Point or Microsheen. Dates first eggs were observed, clutch size, and density of nests at these colonies were similar to or higher than values obtained in 1995 at these same areas when flags were not present. Herring gull nesting activities at Microsheen and Cedar Point also were similar to nesting activities measured at other herring gull colonies in northern Ohio (Dolbeer et al. 1990, Belant 1993, Belant and Dolbeer unpubl. data). Also, that a greater density of nests was observed on a flagged portion of roof than on the adjacent unflagged portion of roof further demonstrates the ineffectiveness of this technique.

In contrast, gulls were deterred for 1 week from a loafing area at a landfill with mylar flags placed in a 6-m grid. That gulls were not deterred from the loafing area that was adjacent to the pond may be a consequence of the plot width being too narrow to allow flags to be effective. Also, that this loafing area was adjacent to a pond may have increased its relative attractiveness, which caused gulls to use the site. That few gulls were observed north of the active face of the landfill during the second treatment period, even in areas where flags were not present, suggests that the reduction in gull use of treated Plots during this period could not be attributed only to the mylar flags.

Mylar flags (15 cm x 1.5 m) used at a density of 2-3/ha reduced Canada goose and snow goose (Chen caerulescens) presence in fields (Heinrich and Craven 1990, Mason and Clark 1994). Also, mylar tape (11-mm width) positioned in parallel transects at 3-10-m intervals reduced avian damage to several agricultural crops (Bruggers et al. 1986, Dolbeer et al. 1986). There was variation, however, in species response to mylar tape in these latter 2 studies. For example, Dolbeer et al. (1986) found that mylar tape deterred blackbirds (Icteridae) and house sparrows (Passer domesticus) but not mourning doves (Zenaida macroura) or American goldfinches (Carduelis tristis).

That herring gulls were deterred from a loafing area but not nesting colonies with mylar flags placed at a density of 300 flags/ha demonstrates intraspecific variation in response to these flags, probably a consequence of the relative availability and importance of the respective areas treated. Herring gulls exhibit strong fidelity to nesting colonies among years (Parsons and Duncan 1978, Ludwig 1963). Although not quantified in this study, there are likely more suitable loafing areas than suitable nesting colony areas. Several alternate loafing sites were available at the landfill during this study. The effectiveness of deterrents with other avian species also appears associated with the relative attractiveness of the area being protected (Belant et al. 1996, 1997). Thus, herring gulls (and other birds) appear more difficult to deter from nesting sites than from loafing areas.

We conclude that mylar flags are ineffective in deterring herring gulls (and likely other gulls) from nesting colonies but have potential to reduce herring and ring-billed gull use of loafing areas. Additional research evaluating the long-term effectiveness of mylar flags in deterring gulls at loafing areas at landfills and other areas is warranted.

ACKNOWLEDGMENTS

We thank C. R. Bartholomew, C. D. Lovell, E. J. Marshall, R. G. McLean, T. W. Seamans, L. A. Tyson, S. Ubica, and S. E. Wright for field assistance. M. Tedesco (Paris Development Co.) and personnel from Cedar Point provided access to nest colonies; T. Crawford provided access to the Erie County landfill. Funding and support for this research was provided by the Federal Aviation Administration (FAA), Office of Airport Safety and Standards, Washington, D.C., and Airports Division, Airport Technology Branch, FAA Technical Center, Atlantic City International Airport, New Jersey.

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Figure 1. Number of ring-billed gulls (RBGU), herring gulls (HERG), and all gulls observed at 420 m^2 (Plot 1) and 2,310 m^2 (Plot 2) loafing areas with and without mylar flags and number of gulls observed at entire landfill, Erie County, Ohio, landfill, 28 October–24 November 1996. Each treatment was conducted for 1 week.