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OVERHEAD WIRES REDUCE ROOF-NESTING BY RING-BILLED GULLS AND HERRING GULLS

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ABSTRACT: The authors evaluated the effectiveness of overhead wires in reducing roof-nesting by ring-billed gulls (*Larus delawarensis*) and herring gulls (*L. argentatus*) at a 7.2 ha food warehouse in Bedford Heights, Ohio during 1994-1995. In 1994, stainless steel wires (0.8 mm diameter) were attached generally in spoke-like configurations between 2.4 m upright metal poles spaced at 33.7 m intervals over the main portion of roof. The 6 to 14 wires radiating from each pole created a mean maximum spacing between wires of about 16 m. Nesting by ring-billed and herring gulls was reduced by 76% and 100% in 1994 and by 99% and 100% in 1995, respectively, compared to 1993 pretreatment levels (1,011 ring-billed gull nests and 98 herring gull nests). Ring-billed gulls that constructed nests after wire installation gained access to the roof where wires were not installed along the roof edge, where wires were broken, by hovering over wires and landing between them, or from structures such as air conditioners that were at or above the level of surrounding wires. Initial placement of overhead wires above roof structures and regular maintenance of broken wires is recommended to increase effectiveness. Mean maximum spacing of 16 m between wires was effective in excluding nesting by herring gulls; however, narrower spacing is necessary to exclude nesting by ring-billed gulls. Also, many of the ring-billed gulls displaced by wires from the warehouse in 1994 relocated to nest on an adjacent building without overhead wires. Thus, although overhead wires can be effective in reducing nesting by gulls on roofs and in other urban situations, management should be considered at a scale broader than specific problem sites as displacement of nesting gulls may cause relocation of the colonies to surrounding areas.

KEY WORDS: animal damage control, exclusion, gulls, *Larus* spp., overhead wires

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INTRODUCTION

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 and 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, 1995).

Although gulls have reportedly nested on roofs for about 100 years (Goethe 1960), dramatic increases in the use of roofs and other urban sites for nesting by gulls have occurred only in recent years (Monaghan 1979; Blokpoel and Tessier 1986; Dolbeer et al. 1990; Vermeer 1992). This prevalence of roof-nesting has caused an increase in gull/people conflicts. Gulls are frequently 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). Gull nesting in urban areas near airports can also create hazards to aircraft (Dolbeer et al. 1993).

Several techniques are available to reduce roof-nesting by gulls including egg oiling, nest and egg removal, and various harassment or frightening devices (Christens and Blokpoel 1991; Blokpoel and Tessier 1992). Use of overhead wires is another technique that has successfully reduced nesting, feeding, or loafing by gulls (Amling 1980; Blokpoel and Tessier 1984; McLaren et al. 1984; Dolbeer et al. 1988). Optimal spacing and configuration of overhead wires, however, has not been determined.

In response to large concentrations of nesting ring-billed and herring gulls, personnel of a large food warehouse in northern Ohio installed an overhead wire system in 1994 to reduce the prevalence of nesting on their roof. The objective was to evaluate the efficacy of this overhead wire system to reduce roof-nesting by ring-billed gulls and herring gulls.

STUDY AREA

Riser Foods Warehouse (RFW), 21 km south of Lake Erie in an industrial area of Bedford Heights, Cuyahoga County, Ohio, has a 7.2 ha roof covered with gravel and small stones (<10 cm diameter). The roof contains numerous vents and other structures, including a large refrigeration unit that creates an area of open water ≤ 80 m^2 on Section 7 (Figure 1). Ring-billed and herring gulls have nested on RFW since at least 1990, when about 50 nests were observed (E. C. Cleary, U.S. Dept. Agric., pers. commun.). During 1993, 1,011 ring-billed gull and 98 herring gull nests were observed on RFW (Gabrey et al. 1993).

METHODS

Installation of overhead wires

Overhead wires were installed by RFW personnel during spring 1994. On the main roof (Sections 1 to 7), stainless steel wires (0.8 mm diameter) were installed creating a series of spoke configurations (Figure 2). Wires typically were attached from the top of 2.4 m high metal poles spaced at 33.7 m (SD = 6.5 m, $\underline{n}$ = 22) intervals to adjacent poles or the roof edge. Poles were anchored in automobile tires filled with cement. Usually 6 to 14 wires radiated from each pole. This arrangement of wires created openings 8.4 to 73.4 m^2 (41.8 $\pm$ 19.2 m^2 [$\bar{x} \pm$ SD], $\underline{n}$ = 10). Some wires were also attached to existing roof structures (e.g., vents, air conditioners). Wires along the roof edge were often attached horizontally and/or diagonally between adjacent poles, perpendicular to the roof. On the lower sections of roof (Sections 8 to 11), wire was attached primarily from eyebolts on the main roof to eyebolts on the lower roof. As with the main roof, some wires on lower roof sections were attached to pre-existing structures. Maintenance personnel replaced broken wires with stainless steel wire or monofilament line (1.1 mm diameter).

An X,Y coordinate system was used to document the location of each pole and wire installed on the roof. The area of each section of roof was also measured. The authors then calculated the total length of wire installed, length of wire (m) installed by section of roof, and length of wire (m)/m^2 of roof by section.

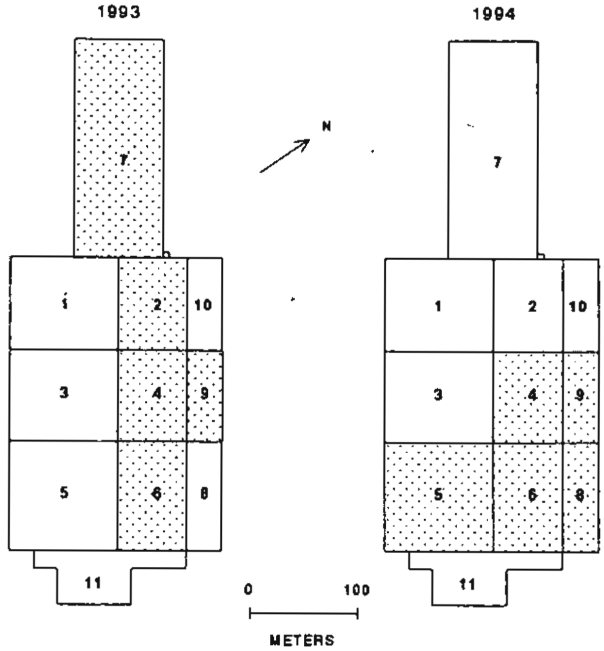

Figure 1. Location of nesting concentrations (stippled areas) of ring-billed gulls during 1993 (before overhead wire installation) and 1994 (after wire installation) by roof section, Riser Foods Warehouse, Bedford Heights, Ohio. Stippled roof sections contained $\geq$90% of nest locations in 1993 ($\underline{n}$ = 1,477) and 1994 ($\underline{n}$ = 254). Herring gull nests occurred primarily in Sections 2 to 4 during 1993; no herring gull nests were observed in 1994.

Nest Monitoring and Removal

During 1994, RFW was monitored for nests on April 19 and April 26, then weekly from May 13 to June 24. During each visit the number of nests, clutch size, and species using each nest was recorded. Also, on April 19, May 27, and June 17 the location of each nest was recorded to the nearest 0.1 m using an X,Y coordinate system before removing all eggs and nest material. In 1995 nest searches were conducted on RFW at three-week intervals from April 27 to August 2. Data were collected as during 1994 except that no nest and egg removals were conducted.

During July 1994, the X,Y coordinates were used to relocate each 1994 nest location. For each nest the authors determined the shortest distance to each wire ($\underline{n}$ = 2-5) which immediately bordered the nest location, and the height of wire at each of these points. The minimum and maximum distances were measured between wires that bordered the nest location, using the center of the nest location as a point on the line. The distance from the nest location to the nearest structure was also measured. The authors used Pearson correlation analyses (SAS Institute, Inc. 1988) to determine the association between the maximum number of ring-billed gull nest locations observed in 1994 and the length of wire (m)/m^2 of roof, the number of structures present, and the maximum number of ring-billed gulls nest locations recorded in 1993 by roof section.

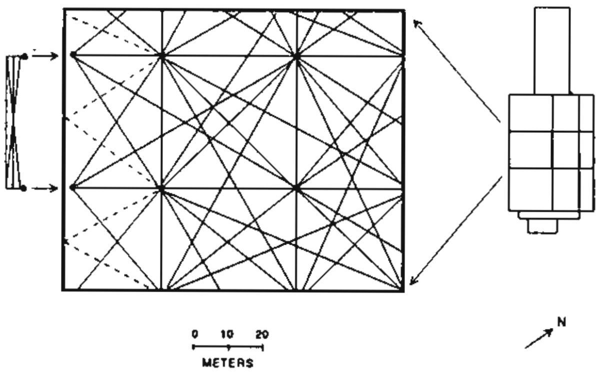

Fig. 2. Spoke configuration of overhead wires on Section 4 of roof of Riser Foods Warehouse, Bedford Heights, Ohio, 1994. Solid lines represent wires attached between adjacent poles; dashed lines are wires attached between a pole and the roof. Inset represents wires installed at the roof edge, perpendicular to the roof.

RESULTS

Maintenance personnel installed 25 km of wire on RFW. Cost of materials, including poles, tires and cement for mounting poles, and wire was $6,000 (Meuti, RFW, pers. commun.). Installation of the overhead wires required 16 person-weeks labor at a cost of $15,000. Thus, total cost of the system was $21,000 or about $3,000/ha. Maintenance costs in 1994 and 1995 were minimal, associated with occasional replacement of wires.

Compared to 1993 levels (1,011 ring-billed gull nests and 98 herring gull nests), nesting by ring-billed and herring gulls in 1994 was reduced by 76% and 100%, respectively. Nesting was further reduced in 1995 by 99% and 100% for ring-billed gulls and herring gulls, respectively.

In 1994, initiation of ring-billed gull nesting occurred in mid-April, with a maximum of 246 nests recorded on May 27 (Figure 3). Three nest and egg removals comprising 254 nests total were conducted. Most ring-billed gull nests (70%) occurred on Sections 5, 6, and 8 (Table 1). Ring-billed gulls that constructed nests after wire installation were observed accessing the roof where wires were not installed along the roof edge, where wires were broken, by hovering over wires and landing between them, or from structures such as air conditioners that were at or above the level of surrounding wires.

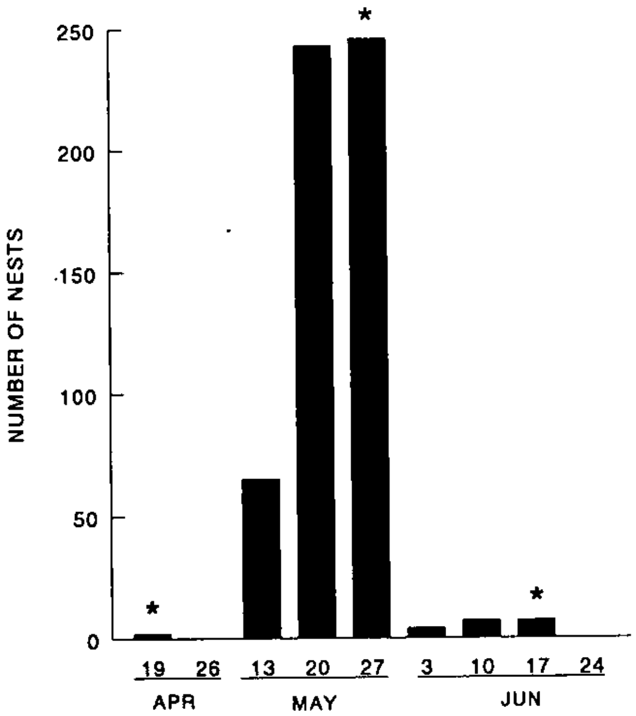

Figure 3. Number of ring-billed gull nests present after installation of overhead wires, Riser Foods Warehouse, Bedford Heights, Ohio, 1994. Asterisks indicate dates nests and eggs were removed.

Fourteen ring-billed gull nests were observed on Section 11 on May 31, 1995. Gulls likely entered this section of roof using several large structures with few adjacent wires. On June 21 only two ring-billed gull nests were present on this section. Maintenance personnel stated that additional overhead wires were installed on Section 11 on June 7 and that existing nests (about 14) had been removed. No additional ring-billed gull nests were observed during prior or subsequent searches.

There was no association ($\underline{r}$ = -0.23, $\underline{P}$ = 0.49, $\underline{n}$ = 11) between the number of ring-billed gull nest locations by roof section in 1994 and the number of nest locations by roof section in 1993 (Table 1). Also, the number of ring-billed gull nests by roof section in 1994 was not correlated with the number of structures present or the mean length of wire/m^2 by roof section ($\underline{r}$ = 0.13 and 0.09, $\underline{P}$ = 0.69 and 0.78, respectively, $\underline{n}$ = 11). The number of structures by section of roof ranged from 26-86. The length of wire/m^2 of roof also varied among sections (0.17-0.53 m/m^2).

The mean minimum and maximum distances between wires surrounding ring-billed gull nest locations were 6.2 and 16.4 m, respectively, (Table 2). The mean distance from the nest location to adjacent wires was 3.8 m. Mean height of wires that encompassed nests was 2.2 m. Ring-billed gulls on average nested 0.4 m from roof structures.

DISCUSSION

In this study, a mean maximum spacing between wires of about 16 m was effective in preventing nesting by herring gulls but not ring-billed gulls. In contrast to the spoke configuration of wires used in this study, most previous studies have evaluated parallel overhead wires. Parallel wires at 0.3 m to 2.5 m intervals were used to exclude ring-billed gulls from nesting and loafing areas (Blokpoel and Tessier 1983, 1988, 1992). Forsythe and Austin (1984) also reduced ring-billed gull use of a landfill using parallel overhead wires with 6 m spacing. McLaren et al. (1984) deterred ring-billed gulls and herring gulls from feeding sites with wire spacing of 6 m and 12 m, respectively. Amling (1980) effectively excluded gulls from reservoirs using parallel wires at 15 m intervals. Wires spaced at 3 m intervals over a landfill excluded herring and great black-backed (*L. marinus*) gulls but not laughing gulls (*L. atricilla*) (Dolbeer et al. 1988). Thus, it appears that herring gulls (and possibly other large gull species) can be excluded from nesting, loafing, or feeding areas with parallel overhead wires at $\leq$16-m intervals whereas exclusion of ring-billed gulls would likely require wire spacing of $\leq$6 m. Additional research is required to determine optimal wire spacing and configuration necessary to exclude various gull species.

Height of wires above ground or roof level is probably less critical than the spacing interval used and is more dependent on the type of human activities at each site. In this study, wires were on average 2.2 m above the roof to provide access for maintenance personnel. In areas not used by people, Blokpoel and Tessier (1992) placed lines only 30 to 40 cm above ground to exclude ring-billed gulls. Dolbeer et al. (1988) evaluated lines placed 24 m above ground that reduced gull activity yet allowed large trucks to transport refuse underneath the wires.

To prevent gulls from using roof structures as access to roofs, overhead wires should be installed higher than any structures present on the area to be protected. Regular maintenance of broken wires is also recommended to maximize effectiveness. To prevent gulls from accessing the site laterally, wires perpendicular to the roof should be installed along the roof edge. Similarly, adjacent wires should be suspended at the same elevation to reduce lateral access. Dolbeer et al. (1988)

Table 1. Characteristics of overhead wire system, number of structures, and maximum number of ring-billed gull nest locations by roof section, Riser Foods Warehouse, Bedford Heights, Ohio, 1993 to 1995.

Roof Section	Section Area (m^2)	Wire Length (m)	Wire Length/m^2	Number of Structures	Maximum Number of Nests Observed In: 1993	1994	1995
1	8288	2273	0.27	49	17	0	0
2	8483	1405	0.17	49	528	1	0
3	7898	2512	0.32	72	0	12	0
4	5225	1722	0.33	46	157	29	0
5	9555	3041	0.32	83	49	79	0
6	6321	2456	0.39	74	144	62	0
7	16137	8525	0.53	77	400	6	0
8	2974	880	0.30	36	5	38	0
9	2471	598	0.24	26	97	27	0
10	2593	778	0.30	86	80	0	0
11	2336	862	0.37	60	0	0	14
Total	72281	25052	0.35	569	1477	254	14

Table 2. Characteristics of overhead wires and structures nearest to ring-billed gull nest locations ($\underline{n}$ = 253), Riser Foods Warehouse, Bedford Heights, Ohio, 1994.

Parameter	Distance (m) $\bar{x}$ (SD)	Range
Minimum distance between wires bordering nests[a]	6.2 (6.8)	0.0-24.1
Maximum distance between wires bordering nests[a]	16.4 (9.1)	2.4-40.2
Mean distance from next to bordering wire(s)	3.8 (1.2)	1.8-8.1
Mean height of wires bordering nests	2.2 (1.3)	0.0-2.3
Distance to nearest structure	0.4 (0.6)	0.0-3.8

[a]Measured using the center of the nest location as a point along the line.

speculated that variation in elevations of adjacent lines of $\leq$1.5 m may have allowed laughing gulls to penetrate overhead wires at a landfill. Differences in heights of adjacent wires in this study could have provided openings large enough for ring-billed gulls to fly through. Some gulls may also have gained access from the roof edge, as side wires perpendicular to the roof on some sections occasionally were attached only at the top of adjacent poles, rather than diagonally between them.

In a comparison of eight techniques used to control nuisance gulls, Blokpoel and Tessier (1992) ranked installation of overhead lines as third for overall effectiveness. Advantages of overhead wires included high effectiveness in excluding gulls from nesting or loafing and a moderate level of permanence. Disadvantages included high initial cost and the need for specialized skills during installation. Permanent habitat alteration was suggested as the best method to reduce overall gull use of an area. Although modifications to roofs such as reducing the number of structures present or changing the roof substrate from gravel to tar or metal will likely reduce nesting (Belant 1993), the ability of gulls to nest on almost any substrate suggests that roof modifications alone will be only partially effective (Blokpoel and Tessier 1992) and that other methods, including overhead wires, should be considered.

In this study, many ($\leq$470 pairs) of the ring-billed gulls displaced by overhead wires at RFW in 1994 apparently relocated about 300 m to nest on an adjacent building without overhead wires (Dwyer et al. 1994). Gulls had not previously nested on this building. Blokpoel and Tessier (1983, 1988, 1992) also stated that ring-billed gulls displaced from nesting or loafing areas by overhead lines moved to nearby areas to loaf or recolonize.

Overhead wires are an effective technique for reducing nesting by gulls on roofs and in other urban situations. Management should be considered at a scale broader than specific problem sites, however, as displacement of nesting or nuisance gulls may cause relocation of the problem to surrounding areas.

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