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BIRD ABUNDANCE AT ACCOMACK COUNTY SOUTHERN LANDFILL, MELFA, VIRGINIA, IN RELATION TO VARIOUS MANAGEMENT ACTIVITIES

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Abstract: Birds, especially gulls (*Larus* spp.), are attracted to landfills, and when landfills are close to airports, birds can pose a threat to aircraft safety. We conducted a 1-year ecological study to address concerns of the Federal Aviation Administration (FAA) and Accomack County, Virginia, officials over potential wildlife hazards caused by the Accomack County Southern Landfill. During 48 surveys conducted from December 1995 to December 1996, we observed 112,693 birds at the landfill (\bar{x} = 503). Nine species represented 97% of all observations. Bird numbers varied during the year, increasing during winter and declining during summer. Bird abundance appeared unaffected by trash baling, with 629 and 612 birds per observation before and after implementation of a trash baling program on 24 January 1996, respectively. Bird management methods instituted by the landfill included harassment, exclusion, repellents, shooting, and habitat alteration. Pyrotechnics and pyrotechnics supplemented with shooting were used inconsistently and had only limited and temporary effects. Bird abundance actually increased 43% and 172% for gulls and crows (*Corvus brachyrhynchos*), respectively, while harassment supplemented by shooting was being conducted. Birds appeared to prefer bare (unvegetated) ground or trash habitats. We recommend continuing harassment of birds with pyrotechnics supplemented with shooting and limiting the amount of bare ground. Wildlife damage management should be conducted by professional biologists because when methods are applied inappropriately or inconsistently, desired results are difficult to achieve.

Key Words: bird abundance, damage, Eastern Shore, gulls, landfill, *Larus* spp., nuisance, Virginia, wildlife damage management

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INTRODUCTION

Landfills are known to attract birds, which are potential hazards to aircraft, especially during take-off and landing. Because of the potential to attract birds and other wildlife, Federal Aviation Administration (FAA) Order 5200.5A recommends a 10,000-ft buffer between an airport and a landfill when turbine-powered planes use the airport. Accomack County Southern Landfill (ACSL) is located 9,000 feet from Accomack County Airport. The flight pattern takes aircraft over the landfill where soaring birds may pose a hazard to aircraft.

Gulls are abundant in this region of Virginia. Over 80% of gulls on the Eastern Shore of Virginia nest on the numerous islands and

marshes on the ocean side of the peninsula (Barry Truitt, The Nature Conservancy, pers. commun.). Herring gulls (*Larus argentatus*) first began nesting on the Eastern Shore in 1955 and nesting pairs now number in the tens of thousands (Barry Truitt, The Nature Conservancy, pers. commun.).

At the request of FAA and Accomack County officials, we conducted a study of bird use at ACSL. Objectives were to identify species and numbers of birds by season, behavioral activity, and habitat, and to evaluate bird management techniques at the landfill from December 1995 to December 1996.

Accomack County is located at the northern end of the Eastern Shore of Virginia, a narrow

peninsula bordered by the Atlantic Ocean on the east and the Chesapeake Bay on the west. ACSL is located in southwestern Accomack County. The landfill facility is 113 acres with an active face of 1,000 square feet. The landfill handled almost 18,000 tons of trash in 1996, approximately 49 tons per day. Trash is compacted into 1-ton bales (5.0 x 4.0 x 2.5 ft [L x W x H]), stacked, and buried. After baling began, the active face (where trash was dumped) increased to approximately 3 acres.

METHODS

Bird surveys were conducted 1 day/week using a completely randomized design. Four surveys were conducted each day, at sunrise, 09:30 hr, 12:30 hr, and 15:00 hr. Birds were surveyed for 5 minutes at 3 observation sites. The observation site that initiated each observation period was drawn randomly for each survey. During each 5-minute interval, the following data were recorded: species, number, activity, habitat type, location, and any other significant information (e.g., any deterrent in use at the time of observation). Locations were recorded using maps of the landfill overlain with a 100-ft grid system. Binoculars (7 x 35mm) and spotting scope (10 x 60mm) were used to identify birds. Data were analyzed using descriptive statistics (i.e., mean, variance, standard error, standard deviation, and range), and frequency distributions per month were displayed.

RESULTS

Bird Abundance Trends

Over the 48 surveys conducted, 112,693 birds and 50 species were recorded. Nine species representing 97% of all bird observations were grouped into 4 different bird groups: blackbirds (European starlings [*Sturnus vulgaris*], red-winged blackbirds [*Agelaius phoeniceus*], common grackles [*Quiscalus quiscula*], brown-headed cowbirds [*Molothrus ater*]); crows (American crows [*Corvus brachyrhynchos*]); gulls (greater black-backed [*Larus marinus*], herring, laughing [*L. atricilla*], ring-billed gulls [*L. delawarensis*]); and vultures (black [*Coragyps atratus*], turkey vultures [*Cathartes aura*]).

Bird abundance varied greatly among months and ranged from 1,064 mean birds per observation in

January to 187 mean birds per observation in June (Table 1). There also were substantial differences in abundance among the 4 bird groups (Fig. 1). Gulls comprised 74% of all birds observed, followed by crows (12%), blackbirds (9%), and vultures (2%).

Gulls were the most abundant bird group at the landfill. A maximum of 852 gulls per observation was observed in January, whereas only 135 gulls per observation were seen in June (Fig. 1). Herring gulls were the most abundant bird, comprising 47% of all birds observed. Herring gulls, and the less abundant greater black-backed gull, were most numerous during the winter (Fig. 2). Laughing gulls were the second most numerous bird species and were observed from late March to October. Ring-billed gulls also were numerous, though only present from December through March. Crows, the second largest bird group, were nearly 6 times less numerous than gulls. Crows were observed all year; a high of 151 crows per observation was observed in October and a low of 9 crows per observation was seen in June (Fig. 1). American crow was the only crow species observed.

Blackbirds were present consistently throughout the study, although their populations fluctuated greatly. Mean numbers per observation ranged from 123 in December 1996 to only 1 in August 1996 (Fig. 1). Starlings were the most numerous of the blackbirds (88% of total) and were present each month. Red-winged blackbirds, the only other blackbird species seen, were observed frequently (9% of total).

Vulture population numbers fluctuated seasonally, increasing in fall and winter and decreasing in spring and summer (Fig. 3). In December 1996, vulture numbers reached a mean of 40 birds per observation and then, in May, the population decreased to a mean of 4 vultures per observation (Fig. 1). Turkey vultures were more abundant than black vultures and their population peaked in December 1996, whereas black vulture populations peaked in October (Fig. 3).

Habitat Types Used by Birds

When birds were on the ground at the landfill, they were found in only a few habitat types. Birds were observed on bare ground (57%), trash habitat (13%), short grass (<10 in.) (6%), agricultural fields (6%), and structures (5%) (Table 2). Habitat use was similar among all bird species, with only slight variations (Table 2). However, blackbirds, primarily starlings, used structures more often than all other birds (15% vs. 5%, respectively). Few birds other than gulls used asphalt or temporary pools of standing water (Table 2).

Bird Management

Baling is a method of handling waste where refuse is compacted into dense blocks to reduce the amount of exposed surface area. To address FAA concerns about potential wildlife hazards caused by ACSL, a baling operation was implemented in January 1996 to reduce the attractiveness of the landfill to birds. On 6 survey days prior to baling, a mean of 634 birds per observation was recorded; in contrast, 615 birds per observation, on average, were seen on the first 6 survey days after baling had begun. Of the 4 bird species (European starling, American crow, turkey vulture, herring gull) present in sufficient numbers both pre- and post-baling, none appeared to be affected by baling (Fig. 4).

Landfill staff conducted harassment of gulls. Loud noises (e.g., human voices, clapping of hands) and physically chasing birds out of and away from buildings were used. Pyrotechnics first were used on 5 June 1996 and inconsistently thereafter until October. Other methods of harassment used included spraying gulls with water from a hose, spraying the taste repellent ReJeX-iT[®] (methyl anthranilate) on loose trash, bales, and standing water, and shooting as a supplement to harassment. Shooting to supplement harassment began in November and only after a Migratory Bird Depredation Permit was obtained. Shooting was conducted by a County Animal Control officer.

Initially, pyrotechnics alone were only temporarily effective because of inconsistent use. Birds grew accustomed to the noise and quickly would return to the active face after flying to a field across the

street or towering over the landfill for 5-10 minutes. Later, better results in reducing bird numbers were obtained when pyrotechnics were fired more consistently and aggressively. Harassment with pyrotechnics supplemented with shooting also was conducted inconsistently; shooting was confined to 2 days during the 2-week period of use and only 14 herring and ring-billed gulls were shot. During the first 2 surveys after harassment was supplemented with shooting, bird populations increased from a mean of 332 to 407 birds per observation (Fig. 5). Blackbird and vulture numbers decreased slightly after shooting began (Fig. 5).

Water spray directed from a hose was an effective, yet temporary, harassment technique. Groups of up to 75 gulls were observed avoiding the spray, but returned when the water was turned off.

The taste repellent ReJeX-iT[®] did not repel birds from feeding on trash bales. During 2 surveys in August, bales and temporary puddles of water were sprayed with the repellent, but birds continued to feed. Laughing gulls that fed on repellent-laced trash were observed drinking water frequently.

Overhead wire grids were installed at approximately 8-ft intervals to reduce gull access to bales at the rear of the baling building. Although overhead wire grids deterred ring-billed and herring gull, laughing gulls were able to easily maneuver between the wires.

Approximately 13 ac of landfill were devoid of vegetation (i.e., bare ground), including the active face. Birds, particularly gulls, were observed more often on bare ground sites than on vegetated sites (Table 2). Several sites of bare ground were seeded with grass and gulls avoided seeded areas once the grass grew ≥ 6 in. tall.

CONCLUSION

Bird Abundance Trends

Landfills are dynamic situations where bird populations fluctuate greatly during the year depending on many factors, including seasonal migrations, available food resources, and breeding behavior (Belant et al. 1995). Due to within year

fluctuations in bird abundance, we were unable to identify a primary factor responsible for reducing bird numbers. ACSL implemented an integrated wildlife damage management (IWDM) program during this study, which included baling, installing overhead wire grids, harassing birds with pyrotechnics and water spray, applying ReJeX-iT[®], shooting to supplement harassment, and altering habitat.

Gull abundance decreased during November. Gulls were absent or low in abundance at the landfill during mornings in October and November compared to previous months. Also, gull populations fluctuated in response to local farming activities (e.g., gulls visited nearby fields that had been plowed recently during the period May through September).

Blackbird populations remained constant from October through December, whereas most other bird groups decreased. Blackbirds usually start flocking during the late fall and winter and consequently were seen in higher numbers. Blackbirds usually fed on bare ground near the bales, waiting for herring gulls to drop food scraps while feeding on the bales.

Crow abundance was reduced in November and December. Crows responded well to harassment efforts and easily were disturbed from bare ground sites during November and December.

Vultures were observed each month and were most numerous in the fall and winter. Turkey vultures were more abundant than black vultures. Like the other 3 bird groups, most vultures were observed on bare ground, except when vultures took cover from pyrotechnics in the woodland habitats. Vultures were wary of human activity and generally fed at the end of the day. When frightened, vultures loafed in nearby trees and returned to feed on bales only when they perceived the threat was gone. Vultures remained at the landfill until sunset, when they flew back to the roost.

Bird Management

Several factors may have affected bird populations at the landfill, yet it is unclear to what extent each factor was responsible. Baling trash

appeared to have little effect on overall bird numbers. The baling operation began in late January, around the time when many bird species were observed at their yearly maximum. Also, surveys were not equally divided between pre- and post-baling, which would have facilitated comparison of the efficacy of baling in reducing bird abundance, and many species of birds were not present until after baling had started.

Compacting trash into bales made it more difficult for birds to get at food items. Because of their strong beaks, gulls were able to pick food items from the bales. Birds quickly discovered that trash stored inside the baling building awaiting compaction was an easier meal. Gulls and starlings entered the front and rear of the baling building, and walked or rode the conveyor belt used to move the bales. Chasing birds out of the building, closing doors when not in use, and installation of an overhead wire grid largely resolved these problems.

Gulls and other birds avoided areas with tall grass, presumably because it obscured visibility. Areas seeded with grass were visited less frequently by birds than those without grass. Also, fewer birds were observed in short grass (<10 in) than in tall grass (≥10 in).

Similar to other studies (e.g., Curtis et al. 1995), we found that ReJeX-iT[®] did not deter birds from feeding on trash. However, laughing gulls that had fed on the methyl anthranilate-covered bales drank water more frequently than those feeding on untreated bales, indicating a possible side effect of the repellent. Given their more stout beak, laughing gulls were able to pick out food items from below the surface and continued to feed on repellent covered trash.

Although pyrotechnic use started in June, they were not used consistently by landfill staff until October. When used consistently, they were effective in harassing gulls and crows. After pyrotechnics initially were fired, gulls remained in the air a few minutes, but then attempted to return. If harassed vigilantly, gulls would fly to a nearby field or borrow pits, and return only gradually to the landfill. Few gulls were observed on several mornings in October and November,

probably due to intensified harassment. Crows and vultures also were frightened by pyrotechnics.

Shooting began in November and reinforced the use of pyrotechnics. However, harassment was inconsistent at a time when bird numbers were increasing at the landfill (migrating herring gulls). Gull and crow numbers increased by 43% and 172%, respectively, during the period when harassment with pyrotechnics was supplemented with shooting. In contrast, blackbird and vulture numbers decreased 11% and 34%, respectively, after harassment supplemented by shooting was implemented. However, the increase in bird abundance after shooting may be an artifact of the small number of observations (only 2 surveys before and after shooting) rather than a meaningful increase. Additionally, ring-billed and herring gulls were believed migrating onto the Eastern Shore of Virginia for the winter during the evaluation period. Shooting has been shown to greatly reduce bird abundance when combined with pyrotechnics. (B.U. Constantin and D.T. Blasky, U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Animal Damage Control, unpubl. data; K.J. Preusser and J.E. Forbes, U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Animal Damage Control, unpubl. data).

MANAGEMENT RECOMMENDATIONS

The IWDM program, as currently implemented at the landfill to reduce bird abundance, should continue. However, to ensure a consistent and effective program, Accomack County should consider securing a private contract for bird management at the landfill or devote a county employee solely accountable for bird management.

Grass on the landfill site should be maintained at a height of 7-14 inches. The Virginia Department of Environmental Quality (DEQ) permits vegetation on the active face at landfills, but suggests that grass be kept <18 inches tall (Milt Johnston, Virginia Department of Environmental Quality, pers. commun.).

Baling of trash should continue because it reduces the exposed surface area, and theoretically reduces the trash's availability to wildlife. However, even these exposed bales create an attraction for wildlife and must be covered daily.

Pyrotechnics should continue to be used to harass blackbirds, crows, gulls, and vultures. When birds were harassed aggressively and consistently, their numbers were reduced. Whenever possible, harassment should be conducted from the heavy equipment to deter birds from associating the equipment with food (the "pied piper" effect). Because birds may become accustomed to the noise of pyrotechnics, the current shooting program should continue as a means to supplement harassment.

LITERATURE CITED

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- Curtis, P.D., C.R. Smith, and W. Evans. 1995. Techniques for reducing bird use at Nanticoke Landfill near E. A. Link Airport, Broome County, New York. *Proceedings of the Eastern Wildlife Damage Control Conference* 6:67-78.

Table 1. Number of birds recorded per observation by month at the Accomack County Southern Landfill, Virginia, from December 1995 to December 1996.

Month	Number of Birds per Observation ^a				
	N	Mean	Standard Deviation	Minimum	Maximum
December	18	498	289.36	0	1148
January	23	1064	582.44	97	2578
February	24	655	307.16	26	1184
March	18	449	312.97	58	1303
April	16	378	190.14	79	735
May	16	272	169.62	56	691
June	16	187	107.30	52	362
July	16	323	189.13	70	774
August	16	663	486.11	202	2146
September	16	657	255.52	239	1191
October	16	561	437.37	26	1472
November	16	289	180.53	19	547
December	4	551	423.59	52	1088
Overall Mean	17	503	302.36	75	1171

^a An observation consisted of 3 consecutive 5-minute periods, each covering a section of the landfill. There were 4 observations per day for 4 days per month.

Table 2. Habitat use by the four most numerous bird groups observed at Accomack County Southern Landfill, Virginia, from December 1995 to December 1996^a.

Habitat Type	Percent of Birds Observed				
	Gulls	Blackbirds	Crows	Vultures	All Birds
Agricultural Field	8	0	2	0	6
Asphalt	4	0	0	0	3
Bare Ground	61	44	47	41	57
Bare Ground (Trash)	12	11	16	17	13
Long Grass (>14 in)	1	1	0	2	0
Short Grass (<10 in)	6	7	8	9	6
Marsh	1	5	1	1	1
Shrubs	0	3	0	0	0
Structure	5	15	2	4	5
Temporary Standing Water	2	0	0	0	2
Unpaved Road	0	0	0	0	0
Woodland	0	12	23	24	5
Total Birds Observed	84251	10328	13501	2770	112693

^a There were 4 5-minute observations per day on 4 days per month.

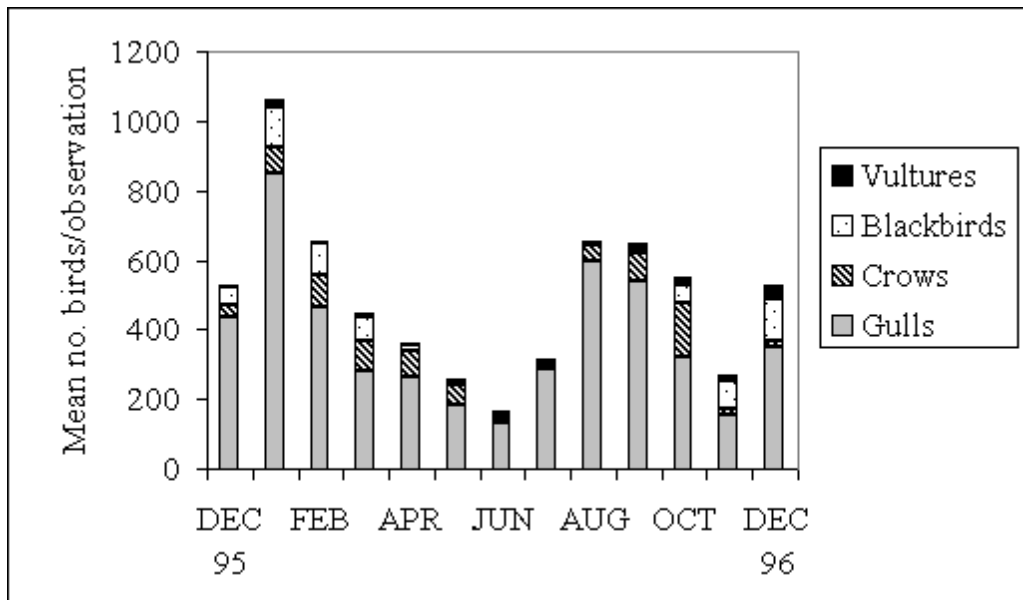


Fig. 1. Mean number of birds per observation for the four most numerous bird groups at Accomack County Southern Landfill, Virginia, from December 1995 to December 1996. There were 4 5-minute observations per day on 4 days per month. Bird groups include: blackbirds (European starlings, common grackles, red-winged blackbirds, and brown-headed cowbirds), crows (American crows), gulls (laughing, herring, ring-billed, and greater black-backed gulls), and vultures (black and turkey vultures).

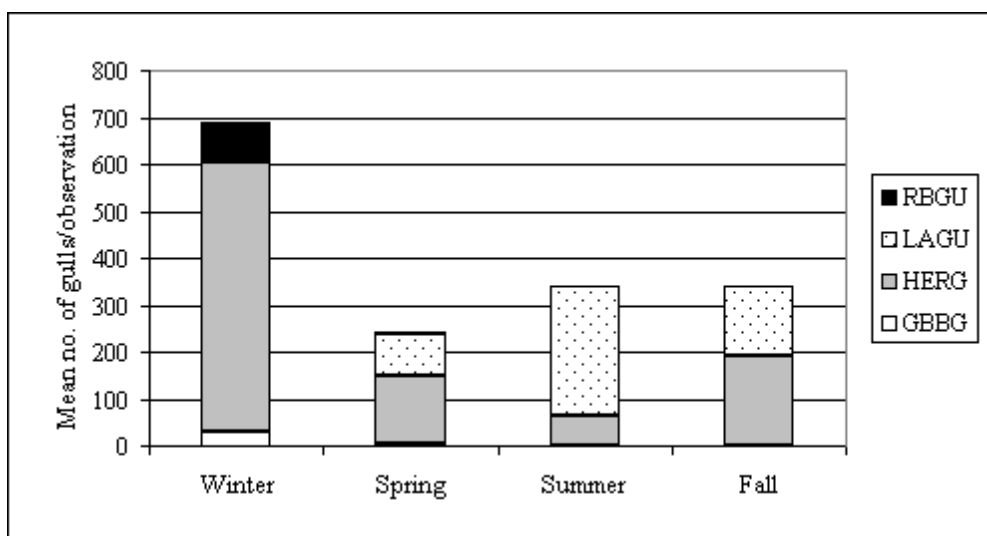


Fig. 2. Mean number of gulls by species per observation at Accomack County Southern Landfill, Virginia, from December 1995 to December 1996. Gull species include ring-billed (RBGU), laughing (LAGU), herring (HERG), and greater black-backed (GBBG). There were 4 5-minute observations per day on 4 days per month.

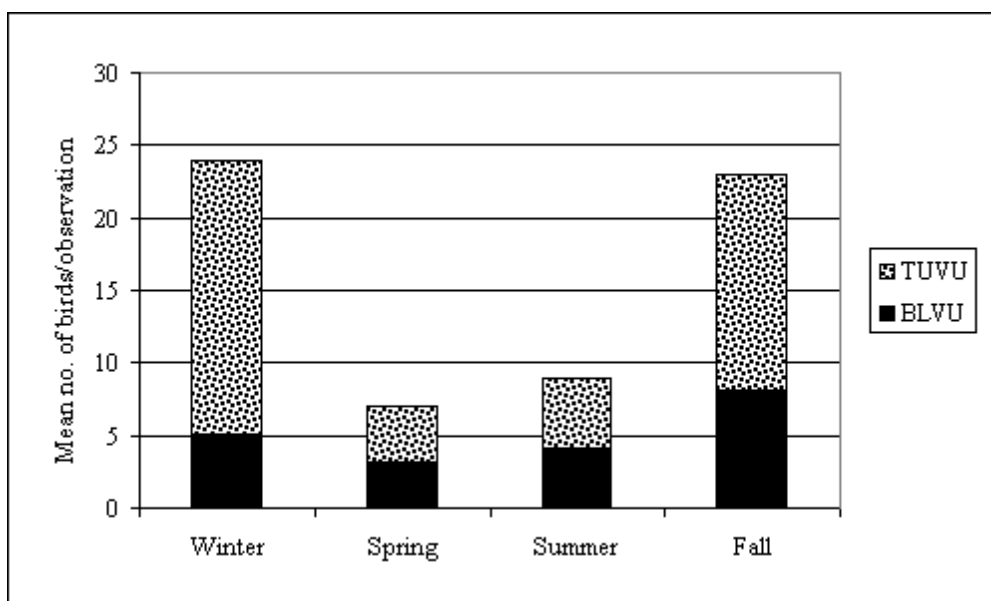


Fig. 3. Mean number of vultures by species per observation at Accomack County Southern Landfill, Virginia, from December 1995 to December 1996. Vulture species include black (BLVU) and turkey (TUVU). There were 4 5-minute observations per day on 4 days per month.

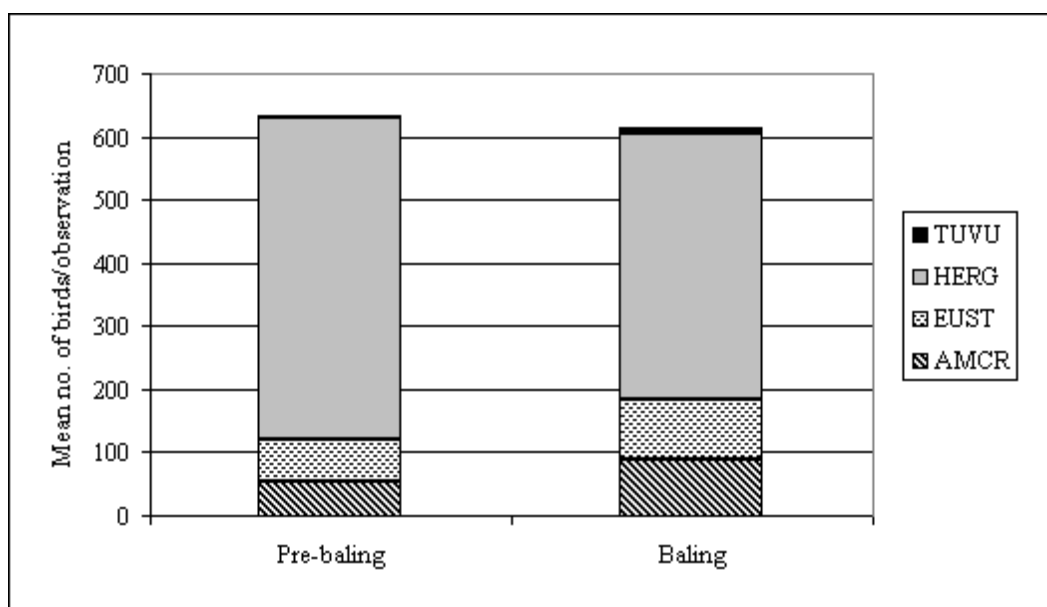


Figure 4. Mean number of birds per observation period for turkey vultures (TUVU), American crows (AMCR), European starlings (EUST), and herring gulls (HERG) that were observed during 6 survey days before baling and 6 survey days after baling had commenced at Accomack County Southern Landfill, Virginia. Baling began on 24 January 1996. There were 4 5-minute observations per day on 4 days per month.

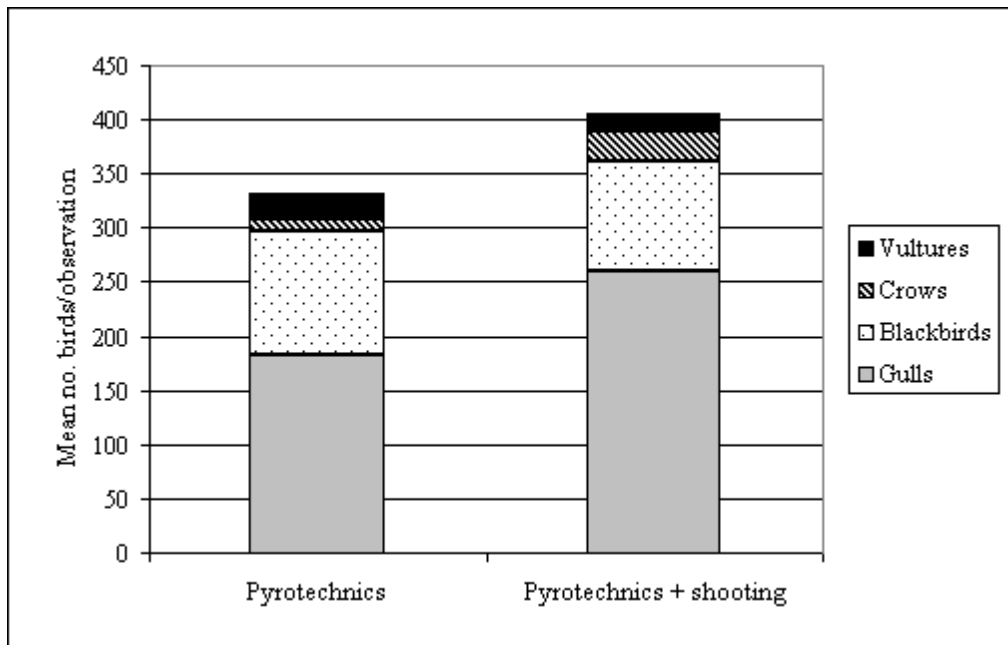


Figure 5. Mean number of birds per observation for 2 survey days using pyrotechnics and for 2 survey days using pyrotechnics combined with shooting to harass birds. Shooting program began in November 1996. There were 4 5-minute observations per day on 4 days per month.