



Avian use of solid waste transfer stations

Brian E. Washburn*

United States Department of Agriculture, Wildlife Services, National Wildlife Research Center, 6100 Columbus Avenue, Sandusky, OH 44870, USA

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ABSTRACT

Transfer stations are an important component of modern solid waste management systems. Solid waste management facilities (e.g., landfills) are very attractive to and used by many birds, resulting in a variety of health and safety problems, including disease transmission to humans and increased risk of wildlife–aircraft collisions. In the United States, the Federal Aviation Administration recommends municipal solid waste management facilities (e.g., landfills, transfer stations) not be sited within 8 km of an airport. Little information is available regarding the attractiveness of transfer stations to birds or the factors that might influence avian use, particularly on a national scale. The objectives of my study were to: (1) quantify avian use of transfer stations, (2) determine if building design features influence their attractiveness to birds, and (3) determine if other factors (e.g., season, geographic location, operational procedures) influence bird use. Twenty-nine waste transfer facilities and 4 control sites, located in 7 states (representative of various U.S. geographical regions) were studied. Avian abundance and activity was quantified at each facility and control site twice per week for one year. Nuisance bird species commonly observed using transfer stations (e.g., feeding on refuse) included gulls, European starlings, and crows. Patterns of wildlife use at transfer stations varied by season, geographic location, transfer station building design, and on-site management characteristics. Overall, this study demonstrates that wildlife use of transfer stations, particularly by nuisance birds, can be substantial.

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1. Introduction

Management and disposal of municipal solid waste is a major challenge world-wide, particularly in highly urbanized areas and in developing countries (Kollikkathara, Feng, & Stern, 2009; Zhen-shan, Lie, Xiao-Yan, & Yu-mei, 2009). Solid waste transfer stations (hereafter, transfer stations) are important parts of modern solid waste management systems, within both metropolitan and rural areas (Bovea, Powell, Gallardo, & Capuz-Rizo, 2007; EPA, 2002; Zhen-shan et al., 2009). Transfer stations are light-industrial facilities where municipal solid waste is unloaded from smaller refuse collection trucks (e.g., curbside collection trucks) and reloaded into larger transport vehicles (e.g., container trucks, rail cars) for transport to a final disposal site, such as a landfill or materials recovery facility (Bovea et al., 2007; EPA, 2002). Recently, there has been an increase in the number of transfer stations within municipal solid waste management systems, a trend that will likely continue into the future (Kollikkathara et al., 2009; Rahman & Kuby, 1995).

Waste management facilities (e.g., traditional putrescible-waste landfills) provide abundant feeding opportunities for scavenging birds and thus large numbers of birds, especially gulls (*Larus* spp.),

corvids (*Corvus* spp.), and European starlings (*Sturnus vulgaris*), are frequently present at such locations (Baxter & Allan, 2006; Belant, Seamans, Gabrey, & Dolbeer, 1995; Coulson, Butterfield, Duncan, & Thomas, 1987; Rock, 2005). Large concentrations of scavenging birds at waste management facilities often lead to a variety of problems, including interference with daily operations of the facilities, nuisance issues for neighboring landowners and local residents, and threats to public health and human safety. Gulls, European starlings, rock pigeons (*Columba livia*), and other birds are known carriers of human pathogens (e.g., *Salmonella*, *Escherichia coli*, avian botulism) and can contaminate water supplies through defecation and carrying waste off-site (Benton, Khan, Monaghan, Richards, & Sneddon, 1983; Monaghan, Sheddson, Ensor, Fricker, & Girdwood, 1985; Ortiz & Smith, 1994; Weber, 1979). In addition, solid waste management facilities can pose a hazard to safe aircraft operations if these facilities are located near airports or result in birds making regular movements across an airfield or through critical airspace (Baxter & Allan, 2006; Belant, Ickes, & Seamans, 1998; Cook, Rushton, Allan, & Baxter, 2008). In the United States, the Federal Aviation Administration (FAA) currently recommends municipal solid waste management facilities (e.g., landfills, transfer stations) not be sited within eight km of an airport [see FAA Advisory Circulars (AC) 150/5200-33B and 150/5200-34] due to the potential risks of increased bird strikes (i.e., collisions between birds and aircraft) associated with these types of facilities.

* Tel.: +1 419 625 0242; fax: +1 419 625 8465.

E-mail address: brian.e.washburn@aphis.usda.gov

Table 1

Geographic location and distribution of transfer station building designs among 27 transfer stations and 4 reference sites studied during 2003–2005.^a

Geographic region of the USA	States	Building designs (number of each)
Northeast	MA, CT	Reference site (1) Completely open (1) 3-Sided bays (2) Fully enclosed (1)
Midwest	OH, MO	Reference site (1) Completely open (1) 3-Sided bays (5)
Northwest	WA	Reference site (1) Completely open (1) 3-Sided open (3) Semi-enclosed (5) Fully enclosed (2)
Southwest	AZ	Reference site (1) 3-Sided open (2) 3-Sided bays (2) Fully enclosed (2)

^a A fully enclosed waste transfer station in Connecticut and a semi-enclosed transfer station in California were also studied. However, these two facilities were not included in data analyses because of they had an overriding influence and biased the data.

Similar to other solid waste handling and treatment facilities, transfer stations have the potential to attract nuisance birds and therefore increase the potential for conflict situations. Little information is available regarding the attractiveness of transfer stations by birds. Previous studies of the bird use of transfer stations have been very limited in geographic location (i.e., within a single county) and in the number of facilities studied (Caccamise, Reed, & Romanowski, 1996; Gabrey, 1997; Stevens, Schafer, & Washburn, 2005). Whether or not transfer stations of various building designs (e.g., open-sided, fully enclosed) are used by birds, particularly on a national scale, is currently unknown. I examined bird use of transfer stations of various building designs located in different geographic regions of the United States.

The objectives of my study were to: (1) document and quantify avian use of transfer stations, (2) determine if the building design characteristics of transfer stations influence their attractiveness to birds, and (3) determine if season, geographic location, operational characteristics of transfer stations, or other factors influence bird use of waste transfer stations.

2. Methods

2.1. Study areas

I conducted an inventory of transfer stations available for study in various regions of the United States using a variety of information sources (e.g., state listings of transfer stations, personal contacts within the waste management industry). During the inventory period, I personally visited each transfer station and reference site, met with management personnel at each facility, and obtained direct on-site information regarding pertinent transfer station building design and operational characteristics of each facility. Ultimately, 29 transfer stations and 4 reference sites (i.e., grocery stores) located within seven states (Arizona, Ohio, Massachusetts, Connecticut, Washington, California, and Missouri) were selected for study (Table 1). These states were selected to represent different geographic regions of the United States (e.g., northeast, southwest).

2.2. Bird observations

Bird observations were conducted between 18 October 2004 and 20 January 2006 using a modified fixed-radius point count

surveys (Hutto, Pletschet, & Hendricks, 1986; Sorace et al., 2000). Two 15-min point counts were conducted successively at two predetermined observation locations, selected to provide (in sum) a complete view of the facility. At most facilities, the area being surveyed was essentially a semi-circular area that allowed for a clear view of only one side of the facility.

Avian surveys were conducted on two randomly chosen days per week (Monday through Friday) for a 1-year period at each reference site and transfer station. In total, each transfer station and reference site was surveyed from 44 to 111 days (average of 94 days) during this period, resulting in an average of 47 h of observation per facility. Bird surveys were randomly stratified so that individual surveys were conducted evenly during morning (06:00–11:00 h), mid-day (11:00–16:00 h), and evening (16:00–21:00 h) periods each month at each individual location.

A total of 18 individuals (including myself) conducted the bird observations at the transfer stations and reference sites during the study. Prior to starting the surveys, I personally trained all observers individually to ensure consistency in data collection and categorization of bird behaviors among observers. During each individual 15-min survey, the number and behavior of all birds that were observed within 100 m (328 feet) of the transfer station or reference site were recorded. Bird behavior was recorded by species and placed into 1 of 8 categories: (1) “pass” flying over the site; (2) “locally” flying over or around the site; (3) loafing (i.e., resting) on the ground; (4) foraging on the ground or in vegetation; (5) loafing on a refuse-transport vehicle; (6) foraging on a refuse-transport vehicle; (7) loafing or in the transfer station or building; (8) feeding on or in the transfer station or building.

2.3. Transfer station building designs

Although considerable variation existed in the design and ‘openness’ of transfer station buildings, I placed each facility into 1 of 5 categories: ‘completely open’, ‘3-sided open’, ‘3-sided bays’, ‘semi-enclosed’, and ‘fully enclosed’ (Table 1). Completely open transfer stations ($n=3$) had no walls or were surrounded by only a chain-link fence (Fig. 1a). Transfer stations classified as 3-sided open ($n=5$) had three walled sides and the fourth side was completely open (Fig. 1b). Three-sided bays facilities ($n=9$) had three walled sides and the fourth side consisted of a series of bay doors that were left open (Fig. 1c). Semi-enclosed transfer stations ($n=6$) had four walled or chain-link-fenced sides with large openings on two sides of the building (Fig. 1d). Fully enclosed transfer stations ($n=6$) had four walled sides and small doors that were just large enough to allow refuse-collection vehicles to enter or exit (Fig. 1e). Reference sites (i.e., grocery stores) consisted of a building similar in size and shape to transfer station buildings where no refuse was present.

2.4. Transfer station characteristics

Site-specific information about transfer stations, including the average tons per day of refuse processed at the facility and the size of the transfer station building or work area (in m²), was obtained by interviewing the management personnel at each facility. In addition, I determined the linear distance (in km) from each individual transfer station and reference site to the nearest major body of water (e.g., ocean, lake, or major river).

During each 15-min survey, the number of commercial (i.e., curbside collection trucks) and private (e.g., pickup trucks and trailers) vehicles that were present or arrived at the facility were counted. Any instances where refuse fell off or out of a refuse-transport vehicle was also recorded. In addition, at the start of each individual survey, the amount of uncontained refuse that

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