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Management of bayberry in relation to tree-swallow strikes at John F. Kennedy International Airport, New York

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***Abstract**:* Tree swallows (*Tachycineta bicolor*) have been a periodic bird-strike problem at John F. Kennedy International Airport (JFKIA), New York, New York, causing runway closures, flight delays, and damage to aircraft following the ingestion of bird flocks into engines. We examined 65 tree swallows collected at JFKIA in October 2001 to determine food sources that were attracting the birds to the airport. Digestive tracts of all 65 specimens contained northern bayberry fruits (*Myrica pensylvanica*), averaging 15.6 fruits per bird or 3.4% of the bird's body mass in specimens where the entire tract was dissected. Bayberry fruits are a highly attractive food source for tree swallows, especially during fall migration when insects are limited. Beginning late in 2001, a bayberry removal program was instituted at JFKIA. We examined tree swallow strike reports from JFKIA before and after this program began and found a 75% reduction in the number of strikes after removal of bayberry bushes. Removal of bayberry from coastal airports like JFKIA may facilitate the dispersal of tree swallow flocks that use airports as resting sites during their migration and may reduce the risk to birds and dangerous encounters with aircraft, thus limiting problems caused by runway closures and flight delays.

***Key words*:** airport, bayberry, bird strike, human–wildlife conflicts, *Myrica, Tachycineta bicolor,* tree swallow

Large flocks of tree swallows (*Tachycineta bicolor*) occasionally are a problem at coastal airports in the United States, where they present a bird-strike hazard to aircraft and interfere with aircraft movements. When a bird or group of birds is struck by an aircraft, it is referred to as a bird strike (Dale 2009, Dolbeer and Wright 2009). The Federal Aviation Administration (FAA) received reports of 145 strikes involving tree swallows during 1990–2007 in the United States. Of those reported strikes, 54 (37%) involved multiple tree swallows per incident (Dolbeer and Wright 2008). Although swallows are not birds that rank high in collision damage (Dolbeer et al. 2000), they are costly to airports in terms of inspections after swallow strikes, runway closings, and flight delays.

Tree swallows have been a problem at John F. Kennedy International Airport (JFKIA), New York, New York, especially during fall migration (Hixon 1963). For example, a Boeing 767 aircraft landing at JFKIA on September 30, 1995, struck approximately 100 tree swallows. On October 3, 1997, 163 tree swallow carcasses were found on an active runway, although no pilot reported the strike (Dolbeer et al. 2003). On multiple occasions, runways have been closed for several hours because of tree-swallow activity. Bird patrol personnel at JFKIA reported that conventional bird dispersal tools, such as pyrotechnics, generally have been ineffective against tree swallows (S. Nowak, Port Authority of New York and New Jersey, personal communication).

Elsewhere, bird hazards have been reduced by removing vegetation that attracts birds

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(Linnell et al. 2009, Washburn et al. 2007, Seamans et al. 2007.) Bayberry bushes (*Myrica pensylvanica*) were common prior to 2002 along parts of the southern and eastern perimeter of JFKIA, adjacent to runways 13R-31L, 4R-22L and 4L-22R. Before 1963, bayberry bushes were planted at JFKIA (then known as Idlewild Airport) to control soil erosion. Because tree swallows are known to feed on bayberry fruits (Martin et al. 1951, Hall 1977), these shrubs were suspected to serve as an attractant for the tree swallows on the airfield. Our objective was to examine the digestive system contents from a sample of tree swallows collected at JFKIA during fall migration to determine if bayberry fruits were present and to compare bird-strike reports before and after bayberry bushes were reduced on the airfield.

Methods

On October 9 and 10, 2001, 65 tree swallows resting in flocks on 3 runways and taxiways were collected with shotgun by JFKIA Bird Patrol personnel under a U.S. Fish and Wildlife Service depredation permit. Several flocks of tree swallows were observed on the airfield during both days, including 200 to 1,000 swallows that were seen eating bayberries on October 9, 2001. Multiple large flocks resting on runways and taxiways also were observed (L. Francour, Port Authority of New York and New Jersey, personal communication). The birds examined in this research were shot in an attempt to disperse the flocks because the use of nonlethal pyrotechnics had failed to disperse the birds from the airport over the previous several days (S. Novak, Port Authority of New York and New Jersey, personal communication). The swallows were frozen and sent to the U.S. Department of Agriculture's National Wildlife Research Center, Ohio Field Station, in Sandusky, Ohio.

Prior to dissection, we thawed frozen tree swallows at room temperature for 24 hours and then weighed them on a digital balance to the nearest 0.1 g. We removed the stomachs from 26 birds and examined both the stomachs and intestines that we cut from 39 of the birds. We removed the contents and examined them under a 15x binocular dissecting microscope. We tallied the number of bayberry fruits and other items that we found in each bird stomach and intestine.

Figure 1. Bayberries.

After the fall migration of 2001, a program to reduce bayberry bushes at JFKIA was begun. Maintenance personnel cut the bushes near runways in late 2001. The bushes were cut with a large rotary type brush cutter. The bayberry bushes close to the runways have been re-cut but not on a set schedule. (L. Francour, Port Authority of New York and New Jersey, personal communication). We examined reported bird strikes of tree swallows at that airfield from before and after the reduction program began. We counted a bird strike if evidence of a single aircraft collision with ≥1 killed or injured birds was found or reported by a pilot. We gathered this information from the FAA Wildlife Strike Database (FAA 2008).

Results

All 65 digestive tracts that we dissected contained bayberry fruits (Figure 1), ranging from 1 to 24 per bird. Except for a trace amount of insect remains in 2 of the birds, we detected no other food. The mean number of bayberry fruits per stomach per collection site ranged from 8.7 (SD 3.3) to 13.0 (SD 3.4) (n = 65) for the 3 locations where we made collections. The mean number of berries per intestine per site was 2.1 (SD 1.8) and 3.9 (SD 2.9) for the 2 sites from which the intestines were examined (n = 39); Table 1). The mean mass of bayberries per stomach was 0.72 g, or 3.4% of a tree swallow's total body mass. Approximately 70% of the fruits retained a waxy coating, whereas the remainder were in various stages of digestion. The fact that many bayberry fruits retained a waxy coating indicated that the swallows had ingested berries shortly before they were killed (Place and Stiles 1992). The intestinal

Table 1. Mean (SD) body mass and mean number of bayberry fruits in digestive tracts of 65 tree swallows collected from John F. Kennedy International Airport, October 9–10, 2001.

			Mean (SD) number of bayberry fruits		
Location[a]	*n*	Mean (SD) body mass (g)	Stomach	Intestine	Total
A	26	21.0 (1.8)	8.7 (3.3)	b	8.7 (3.3)[b]
B	23	21.1 (1.3)	13.0 (3.4)	2.1 (1.8)	15.1 (4.3)
C	16	21.1 (1.5)	12.3 (4.9)	3.9 (2.9)	16.3 (4.2)

[a] A = Taxiway Z between runways 4R and 31L; B = Intersection of runway 31L and taxiway Z; C = Between runways 31L and 4L.
[b] Intestines were not examined in this group of swallows.

samples where only the bayberry seeds were found indicated that the swallows were indeed digesting berries.

Bayberry control operations began at JFKIA after the fall migration of 2001. During the 7 years prior to the beginning of bayberry control (1995 through 2001), 20 tree-swallow strikes were reported. Of those strikes, fourteen involved multiple birds; eight involved 2–10 birds, 5 involved 11–100 birds, and one involved >100 birds. Eleven of the strikes occurred in October, seven in September, and two in August (FAA Wildlife Strike Database, unpublished data).

Control operations on JFKIA resulted in an estimated 75% reduction of bayberry bushes located within 0.8 km of runways, and 50% elsewhere on the airfield (L. Francour, Port Authority of New York and New Jersey, personal communication). During the 7 years (2002–2008) after Bayberry control began, 5 tree-swallow strikes were reported at JFKIA. One strike involved 2–10 birds and four involved a single bird. This was a reduction of 75% in the number of strikes and a reduction of 92.9% in the number of strikes involving multiple tree swallows. All of these strikes occurred in October (FAA Wildlife Strike Database, unpublished data; L. Francour, Port Authority of New York and New Jersey, personal communication 2008).

Discussion

Bayberry fruits are an important seasonal source of food for tree swallows and may comprise as much as 50% of their diet at some times of the year (Martin et al. 1951, Hall 1977). Our study demonstrated that nearly the entire diet of the birds examined was bayberry. Inland, tree swallows also may ingest small amounts of eastern red cedar (*Juniperus virginiana*) and dogwood (*Cornus* spp.) fruits (Martin et al. 1951).

Various species of bayberry are generally confined to coastal areas in the United States, with a range that extends along the east coast and the Gulf of Mexico (Symonds 1963). Tree swallows are one of a few bird species capable of digesting the waxy coating of bayberry fruits (Elphick et al 2001). Another well-known avian consumer of bayberry fruits is the yellow-rumped warbler (*Dendrioca coronata*). According to Place and Stiles (1992), these 2 species are capable of efficiently digesting the wax of the fruit, which is composed primarily of saturated long-chain fatty acids. Yellow-rumped warblers, however, do not occur in large flocks and pose no substantial threat to aviation, although they are occasionally struck by aircraft (Dolbeer and Wright 2008).

Bayberry bushes at JFKIA and other coastal airports provide an attractive food source to tree swallows, especially during fall migration. Indeed, the ability to digest bayberry fruits may allow tree swallows to maintain a more northerly range during the winter than related species (Place and Stiles 1992). At JFKIA bird strikes involving tree swallows declined sharply after an ongoing regime of bayberry control began. The population of tree swallows in the region declined only slightly during the years following the start of control. The number

of breeding tree swallows in USFWS Region 5, which comprises the geographic area the airport tree swallows most likely migrate from, dropped from an average of 6.8 (sd 0.36) birds per Breeding Bird Survey route during 1996–2001 to 6.4 (sd 0.40) birds per route during 2002–2007 (Saur et al. 2008). This indicates a reduction of 5.8%, far less than the bird-strike reduction. The removal of bayberry bushes from the proximity of runways and taxiways at coastal airports, such as JFKIA, may reduce the number of tree swallows attracted to airports and facilitate the dispersal of flocks that use airport surfaces as resting sites during migration. Tree swallows would benefit in that they would be likely to choose less hazardous feeding and resting places during their migration. Likewise, the threat of potential damage and flight delays caused by tree swallow flocks (Dolbeer et al. 2000) would be reduced if this highly attractive food source were removed.

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Glen E. Bernhardt has worked part-time as a biological technician for the U.S. Department of Agriculture at the National Wildlife Research Center (NWRC) Ohio Field Station since the early 1980s. He has been involved with projects ranging from bird-damage to corn, woodchuck-control methods, and determining the physical density of birds. He has been a coauthor on >20 publications resulting from that work. He is a well-known and respected naturalist, writing several articles per month about northern Ohio flora and fauna for a regional historical, cultural, and ecological newspaper. He often addresses the public, as well as classes at local colleges, regarding aspects of natural history. Thirty-eight years ago, he started a chapter of the National Audubon Society. He is a graduate of Ohio State University with a B.S. degree in comprehensive science education. Although he continues to work intermittently for the USDA, he and his wife Marje run a store specializing in selling toy marbles and teach children how to play marbles and other vintage games.

Zachary J. Patton holds a B.S. degree in biology from John Carroll University and an M.S. degree in biology from Cleveland State University where he researched the mating behavior, physiology, and ecology of a desert-dwelling fruit fly, *Drosophila mojavensis.* He worked for 3 years at the NWRC Ohio Field Station as a biological technician. He has worked on a variety of projects, including bird and mammal use of manipulated grassland habitat, deer repellents, and techniques to disperse vultures. Currently, he operates a successful house-painting business in the Cleveland vicinity. He lives in a Cleveland suburb with his wife Julie and son Owen.

Lisa A. Kutschbach-Brohl has a B.S. degree in natural resources management and an M.S. degree in environmental science, with emphasis on wetland ecology, from Ohio State University. Her research interests include wetlands, birds, and insects. In addition to her work as a part-time biological technician at the USDA NWRC Ohio Field Station, she teaches courses in local flora at Ohio State University Stone Laboratory and is active with the Lake Erie Islands chapter of Black Swamp Conservancy. She also operates a summer nature camp for children. She and her husband live year-round on a small Lake Erie island.

Richard A. Dolbeer recently retired from his position as the national coordinator for the U.S. Department of Agriculture (USDA) Airport Wildlife Hazards Program. He has been a scientist with USDA Wildlife Services for 35 years where he has led a series of research projects to resolve conflicts between humans and wildlife. His research has covered population dynamics of pest species, economic assessment of losses, development of practical management techniques for resolving conflicts, and integrated pest management programs in the USA and abroad (Africa, Asia, Latin America). He has published >170 scientific papers and book chapters. He was honored in 2000 by the 65,000-member Air Line Pilots Association for "scientific integrity and worldwide leadership in the reduction of wildlife hazards to aviation." He was the 2005 winner of the U.S. Federal Aviation Administration Excellence in Aviation Research award. He has been recognized twice with the Excellence in Research award by the Jack H. Berryman Institute for Wildlife Damage Management. He served for >10 years as chairperson of Bird Strike Committee–USA. He received degrees from the University of the South (B.A., Biology), the University of Tennessee (M.S., Zoology), and Colorado State University (Ph.D.).