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# An Integrated Management Approach for Nesting Osprey to Protect Human Safety and Aircraft at Langley AFB, Virginia

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**ABSTRACT:** North American osprey are increasingly becoming a serious aviation safety concern to both military and civilian aircraft. Since 1985, the United States Air Force documented 25 osprey strikes with aircraft, resulting in excess of \$1 million dollars in damage. In 50% of the osprey strikes reported to the National Wildlife Strike Database, the aircraft was damaged. Osprey are present from March through September at Langley Air Force Base, where more than 2 dozen nesting pairs have been identified on or immediately adjacent to the airfield. The habituated nesting and breeding behavior of osprey at Langley predisposes this species to impacting aircraft arriving or departing the airfield. The apparent strike risk and flight safety concerns associated with nesting osprey resulted in the development of an integrated hazard/damage management program. As part of the 1<sup>st</sup> Fighter Wing Bird Aircraft Strike Hazard Plan, the program incorporated a diverse management approach that included nest surveys, behavior monitoring, exclusionary practices, nest removals, egg oiling, traditional hazing, lethal reinforcement, and nestling translocation. Preliminary analysis of the project (2000-2004) suggests the number of nest sites remain constant (range 26-36) from year to year; however, airfield use by osprey has declined 62% since the inception of the program. Exclusion practices, egg oiling, and juvenile translocation are presumed to be the most effective strategies in discouraging nesting and reducing airfield occurrences. Traditional hazing and nest removals had no effect on discouraging osprey behavior or nest site preference. This program will continue to integrate and evaluate management techniques for resolving aviation and human conflicts associated with nesting osprey and may ultimately serve as a technical guide for professional wildlife damage agencies, aviation safety personnel, and natural resource managers.

**KEY WORDS:** aircraft strike, egg oiling, monitoring, nesting population, osprey, *Pandion halietus*, recruitment, translocation

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## INTRODUCTION

The recovery of the North American osprey (*Pandion halietus*) is a true example of a successful conservation management initiative. Nearly 30 years ago, the unregulated use of dichloro-diphenyl-trichlorethane (DDT) nearly eliminated this species from the Chesapeake Bay region and throughout the United States. Following the ban on the use of DDT in 1973, and supported by intensive research studies and employed recovery programs, a resurgence of osprey populations began. Thriving populations can now be found along the Atlantic seaboard, where populations have increased 7.54% per year during the past 20 years (Migratory Bird Data Center, Breeding Bird Survey, unpubl. data). There are over 3,000 nesting pairs within the Chesapeake Bay region alone (Watts *et al.* 2004), encompassing 20% of the nation's total (Henny 1983). Healthy osprey populations can also be found in the Great Lakes region and in the Northwest Territories from California to Alaska.

In many of these areas, osprey are facing repercussions of their own success (Byrd 1986). Exceeding carrying capacities, combined with this species' ability to adapt to human encroachment, has resulted in a growing concern for the aviation industry, wildlife damage management agencies, and natural resource managers. The USDA National Wildlife Research Center ranked osprey as the 5<sup>th</sup> most hazardous bird species to aviation (Dolbeer *et al.* 2000). From 1985 through 2003, the Federal Aviation Administration documented more than 75 osprey strikes (Cleary *et al.* 2004), while the U.S. Air Force

reported 25 osprey strikes totaling \$1,494,511 in aircraft damage (P. Windler, USAF BASH Team, unpubl. data). In 50% of the osprey strikes reported to the National Wildlife Strike Database, the aircraft was damaged (Dolbeer *et al.* 2000). During summer 2000, an F15 Eagle stationed at Langley Air Force Base (LAFB), Virginia, collided with an osprey, causing over \$750,000 in engine damage, forcing the pilot to terminate the mission and conduct an emergency landing.

In response to this incident, LAFB developed an Integrated Osprey Hazard Management Program (IOHMP). As part of the 1<sup>st</sup> Fighter Wing (1 FW) Bird Aircraft Strike Hazard Plan, the program implemented strict monitoring periods and integrated various wildlife hazard/damage control methods. The program's goal was to mitigate osprey aircraft strike potential by reducing activity and nesting within the airfield environment. The methodology employed involved identifying the size of the nesting population and the birds' behavior in relation to the airfield.

## METHODS

Through the cooperative efforts of a multi-agency team of state, federal, and military organizations, the IOHMP was developed to protect human safety and aircraft at LAFB. Langley AFB is a 1,167-ha (2,833-acre) urban research and military complex jointly occupied by 3 flying squadrons of the 1 FW, headquarters for the Air Combat Command and National Aeronautics and Space Administration Langley Research Center. The study area

encompassed the Langley airfield (located at 37 05.00 North and 76 22.30 West) and 2 tributaries of the Chesapeake Bay, the Back and Harris Rivers.

The experimental design incorporated both population monitoring and hazard management of nesting osprey within the study area. Both immediate and long-term management strategies were developed and executed over a 5-year period. For the purpose of the present study, we examined IOHMP data collected from June 1999 through September 2004.

### **Population Monitoring**

Monitoring is essential in determining trends in population growth and behavior, and to measure the effectiveness of control measures; therefore, monitoring efforts included both airfield and nest surveys. Airfield surveys were conducted to quantify airfield use and behavior, while nest surveys determined active nest site locations as well as reproductive success.

#### ***Airfield Surveys***

Airfield use was derived from osprey observation data collected during standardized airfield point-count surveys conducted at LAFB. Airfield surveys were conducted 2 days each month, and each survey day was broken into 3 survey periods: dawn, mid-day, and dusk. All birds were observed for 5 minutes from each of the 7 observation points strategically placed to provide a clear view of the aircraft operating area, including approach and departure zones. The species of birds observed while in transit between fixed observation points were also recorded. Data recorded included date, weather, temperature, wind direction and speed, sunrise, sunset, time, observation point, grid cell, species, number observed, cover type, behavior, direction of travel, and height above ground level. Bird locations were plotted on a map of the airfield upon which a 0.3-km (1,000-ft) grid matrix was superimposed. Birds were assigned to a grid location with the use of an alphanumeric code.

#### ***Nest Surveys***

Nest surveys were conducted throughout the breeding period from March through August. Nest surveys were scheduled as recommended by Postupalsky (1974) and were scheduled to occur every 7-14 days, contingent upon weather conditions. Off-shore nests were located and monitored from a 4.9-m (16-ft) aluminum johnboat along the study area tributaries. Nests were considered as active, following similar procedures established by Henny *et al.* (1974) and again by Watts *et al.* (2004). Nests that contained reproductive evidence (i.e., eggs, broken shells, chicks, etc.), and/or nests that showed the continual presence of osprey on or near the nesting structure, were determined to be active. Inland nests identified as active were monitored for reproductive success on 3 separate occasions during the nesting season. Data recorded included: date, the number of osprey present on or near the nest, sex and behavior, structure type, and the number of eggs, chicks, and fledglings produced. Each nest site was marked using a global positioning system and given identification title (e.g., CM25, channel marker, or DB201, duck blind) according to the type of structure.

### **Hazard Management**

Airfield wildlife hazard management encompasses a diverse strategy of control methods that are both passive and active in nature (USAF 2004). This project included the adaptive implementation of various wildlife control methods that included nest removals, exclusionary practices, egg oiling, nestling translocation, traditional hazing, and lethal reinforcement. The employment of each method was determined by the location of each nest and/or osprey in relation to the airfield. The “control zone” was the term used to delineate active nests located on the airfield and/or within the perimeter of the east end runway control zone. The control zone was a hypothetical boundary, where flight safety officers assumed nesting osprey posed the greatest danger to aircraft arriving or departing the Langley airfield. Nests located outside the control zone were subject only to monitoring and nestling translocation. Pyrotechnics were not effective at hazing osprey from the airfield, which justified limited shooting as a means of lethal reinforcement only under bona fide emergency situations. All methods were conducted under a federal U.S. Fish and Wildlife Service depredation permit and a Virginia Department of Game and Inland Fisheries scientific collection permit, both listing Langley AFB and Wildlife Services employees as authorized permittees.

#### ***Nest Removal***

Nest removals were conducted in an effort to discourage breeding pairs from establishing a nest within the control zone, while attempting to influence the selection of an alternate nesting structure. Nest removals were defined as the physical destruction of a nest, to include any eggs contained therein and/or any material that would indicate the construction of a nest on a particular structure. The date, nest identification, and number of osprey and/or eggs present were documented.

#### ***Nest Exclusion***

Nest inhibition and modification attempts were conducted to prevent a nest from being created inside the control zone. Design and installation of each inhibitor and/or modification differed, according to structure type. Lighting poles that displayed evidence of nesting attempts were affixed with a 0.6 × 0.9-m (2 × 3-ft) nylon flag inhibitor, mounted at the apex of the structure. Aids to navigation (ATONs), commonly referred to as “channel markers”, were also modified inside the control zone. Modifications were made according to the type of ATON, characterized as either day or night beacons (A. Grimes, USCG, pers. commun.). Day beacons had signboards that were modified by lowering the board 0.3 m (12 in) from the top of the pylon. Night beacons were equipped with a signboard spaced by a 0.7 × 1.2-m (2 × 4-ft) plywood platform, mounted with an elevated light powered by a 24-volt rechargeable battery. Modifying the lighted ATONs was accomplished by removing the platform, replacing the existing light unit with a single solar-powered light, and also lowering the signboard, as done for the day beacons (Figures 1 a,b). The date and nest identification were recorded after every exclusionary attempt.



Figure 1 a. Pre-modified ATON night beacon with platform constructed during the late 1970s to encourage nesting and population resurgence.

b. ATON night beacon modified in 2003 to discourage nesting within the east end runway control zone.

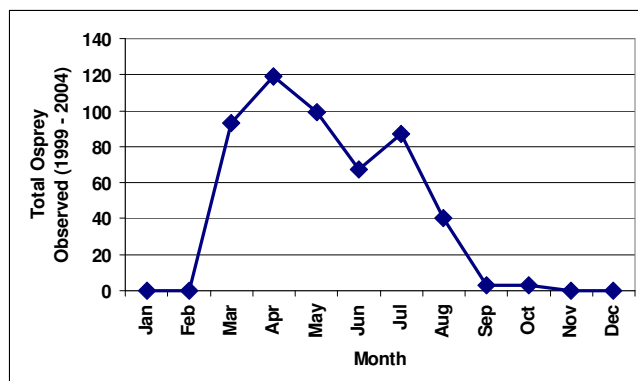


Figure 2. The total number of osprey observed per month during standardized airfield point count surveys at Langley Air Force Base, Virginia, from June 1999 through May 2004.

### Egg Oiling

Egg oiling/addling is a common population management strategy for gulls, cormorants, and nuisance waterfowl, but its effectiveness on osprey is unknown. This approach was implemented to induce unsuccessful reproduction, in the hope that nesting pairs might imprint the negative experience associated from hatching failure and then move nesting attempts away from the airfield the following nesting season. Oiling attempts were made only in the control zone, where nests containing eggs were hand-treated with corn oil and addled on a single occasion during the incubation period. Eggs treated with oil were identified by marking the shell with a fine-point marker. Oiled nests were monitored during nest surveys; the date, number of eggs, nest identification, and the number of osprey present were recorded.

### Nestling Translocation

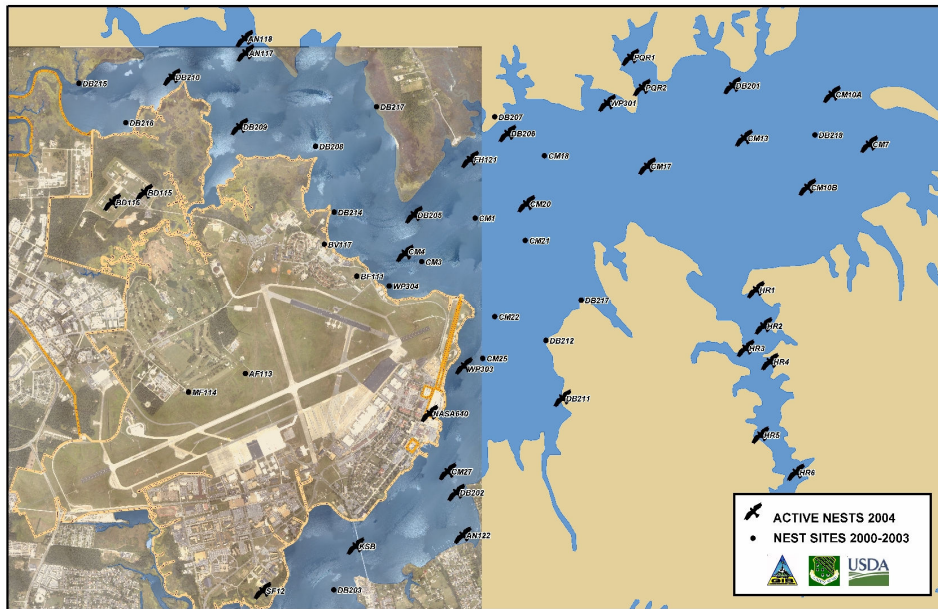
Translocation is defined as the movement of eggs, young, or adults for reintroduction to new areas where populations need restoration (Martell *et al.* 2002). Translocation efforts were implemented to reduce fledgling strike hazard risk and to control annual recruitment rates, while also supporting recovery initiatives in Ohio and Indiana. At the age of 35-49 days, nestlings were caught by hand, placed inside 28 × 45.7 × 88.9-cm (11 × 18 × 35-in) cardboard carriers, and transported by aircraft to specific hack locations in the recovery state for their release into the wild. Nestlings were selected from various active nests in the study area. The number of nestlings translocated per nest was dependent upon the availability of nestlings at the appropriate age during the time of collection. The date, nest identification, number of nestlings translocated, and the hacking state were recorded.

## RESULTS AND DISCUSSION

### Monitoring

A total of 511 osprey were observed during airfield surveys conducted from June 1999 through May 2004. Osprey were abundant each year at LAFB for a 6-month period from March through August (Figure 2). Forty-seven percent of the observations were made during the mid-day survey period, when osprey were found flying within the airfield environment (33%) and/or nesting on various inland or offshore structures (32%). We determined that osprey were most active on and near the airfield in April ( $n = 119$ ) and May ( $n = 99$ ) (Figure 2). Also, we concluded that aircraft strike risk is correlated to breeding behavior described by Poole (1989). Nesting pairs are extremely active during the peak of nest-building (just prior to incubation) in April, again during hatching development in May, and when fledglings depart from the nest in July. Although only 17% of airfield observations occurred in July, we believe this percentage had the potential of being significantly higher. Prior to the implementation of nestling translocation in 2001, July observations represented 35% of the total observations per month.

Fifty-three nest surveys were conducted documenting 50 different nesting pairs of osprey from March of 2000 through August 2004 (Figure 3). Osprey preferred to nest



**Figure 3. Active nest site locations identified during the Integrated Osprey Hazard Management Program at Langley Air Force Base, Virginia from October 2000 through September 2004.**

on off-shore structures (80%) such as ATONs (32%), duck blinds (27%), and artificial platforms (18%). Inland nests (20%) were primarily found on utility poles. Eleven active nests (4 airfield and 7 off-shore) were located within the boundaries of the control zone. The number of active nests per year averaged 29 (range 26-36); producing a total of 125 fledglings (Table 1). The lowest number of nests was documented in 2001 ( $n = 26$ ), while the greatest number of nests was found in 2004 ( $n = 36$ ). The increase in 2004 was due to the expansion of the study area and should not be interpreted as a growth in the size of the nesting population. Reproductive rates ranged from 1.63 (2004) to 1.83 (2000) young per active nest (Table 1). We determined that hatching failures ( $n = 55$ ) and chick mortality ( $n = 17$ ) occurred from natural causes throughout the monitoring period. The mean reproductive rate (# fledged / study nests; Postupalsky 1974) averaged 1.71, well above the range (0.95-1.30) needed to maintain population densities in a geographic area (Levenson and Koplín 1984).

### Management

Nest removals occurred in 2000 and 2001, where 98 nests were removed and/or eggs destroyed from 11 nests located in the control zone. Nest removals were performed 81 times over a 26-day period, while nest/egg destructions were performed 17 times to 9 control zone nests. Nesting pairs appeared to show no overt signs of site abandonment in reaction to nesting control measures, often continuing to rebuild at the site minutes after a removal event. However, osprey did exhibit a natural intrinsic abandonment when surrounding nests began to fledge young in June or July. Our nest removal actions support conclusions by Fernandez and Fernandez (1977), where osprey are faithful in order of preference to their respective territory, nest, and mate.

**Table 1. The number of nests identified as active, control zone, and the reproductive data collected for study nests during the Integrated Osprey Hazard Management Program at Langley AFB, Virginia, October 2000 through September 2004.**

Data Category	Project Year			
	2001	2002	2003	2004
<b>Active Nests</b>	27	26	28	36
<b>Control Zone Nests</b>	11	10	8	5
<b>Study Nests</b>	12	17	20	24
<b>No. Eggs</b>	30	43	56	68
<b>No. Chicks</b>	22	31	47	42
<b>No. Fledge</b>	22	28	36	39
<b>Reproductive Nests</b>	1.83	1.65	1.65	1.63

Exclusionary practices were limited to 2 basic structure types, lighting poles and channel markers. Exclusionary attempts were performed on 16 nesting structures inside of the control zone. Flag inhibitors were used in 2001 and 2002 on 9 utility poles located on the airfield. In 2003, 7 ATON nesting structures (3 day beacons and 4 night beacons) were modified after nesting pairs migrated out of the area for the winter. In 2004, the number of ATON nests reduced from 7 to 4. Both exclusionary methods showed variable effectiveness in preventing or discouraging nesting structure preference. Utility pole flag inhibitors were successful at preventing nesting and nesting attempts, while ATON modifications appeared to be more effective at discouraging structure preference rather than in preventing nesting. Although the number of ATON nests decreased, modification efforts could not entirely prevent an osprey from constructing a nest. We believe that ATON modification efforts could have been



successful at influencing returning nesting pairs to choose an alternate nesting structure outside of their territory, while new pairs entering the study areas were successful at constructing nests on 4 of the ATONs. This assumption is based on preliminary banding data we collected during the 2004 nesting season, when none of the banded osprey were observed throughout the entire study area.

Egg oiling was implemented in 2003 and 2004. A total of 20 eggs were oiled, inducing hatching failure at 7 different nests located in the control zone. Of the oiled nests, nesting pairs averaged a 73-day incubation period. Once nesting pairs abandoned the incubation process, we observed a notable decline in their presence at the nest during surveys. We believe nesting pairs had deserted their respective nesting territory several weeks earlier than if hatchlings or fledglings were produced.

Translocation efforts began in 2001 and continued through 2004, where 71 nestlings were collected from 23 different nests within the project area. In 2001-2003, all nestlings ( $n = 44$ ) were translocated to selected wildlife conservation areas in Ohio. In 2004, a total of 27 nestlings were translocated to selected wildlife conservation areas in Indiana ( $n = 16$ ) and Ohio ( $n = 11$ ). We estimated 57% of the nestling/fledgling population was translocated per year from the project area. Translocation efforts proved to be a conservation approach that reduced immediate fledgling strike hazards and controlled natal recruitment over the next 7 years, while supporting osprey reintroduction efforts in other states.

## DISCUSSION

Osprey migration, nest productivity, and translocation programs are well researched; however, the effectiveness of wildlife hazard/damage management on a wild nesting population was uncertain. Through applied management research, this paper evaluated the implementation of an integrated management program aimed at mitigating aircraft strike threats of nesting osprey at LAFB. The IOHMP identified strategies for resolving osprey-aircraft conflicts by discouraging airfield use, preventing nesting on and near the airfield, and defining periods of increased strike potential.

Monitoring efforts determined that aircraft arriving or departing the Langley airfield were most vulnerable to a collision with an osprey during mid-afternoon periods in March, April, or May (Figure 2). Fifty active nests were found within an 8-km (5-mi) radius of the Langley airfield (Figure 3). Similar to results from Trimper *et al.* (1998), reproduction in the nesting population within our project area was not disturbed significantly by aircraft operations. Annual fledgling production (1.71 young per active nest) throughout the project period exceeded the reproductive rate needed to sustain a healthy population (Levenson and Koplin 1984). This indicated a need for population control actions to mitigate strike threats associated with a nesting population at or above carrying capacity. A diversity of control methods were employed, with each approach evaluated according to the objectives and results. Nest removals proved to be ineffective at discouraging osprey from constructing a nest. In addition, we concluded that nest removals on or near the airfield may actually increase the threat of a strike. Nesting

pairs exerted more time rebuilding rather than hunting or incubating; as a result, osprey may have frequented the airfield more often to collect nesting materials for reconstruction than if nest removal had not occurred. Modification efforts were an effective and feasible means of deterring osprey from nesting on specific structures. This technique is highly recommended; however, structure accessibility and surface area proportions may limit application or effectiveness.

The ethics of egg oiling were strongly considered when considering the value of this control technique. Oiling should be considered at airfields where high concentrations of reproductively stable nesting populations exist. Oiling the eggs of selected osprey nests will reduce fledgling strike potential, and if applied scientifically, recruitment rates could be managed with a reduced aircraft strike potential. In addition, oiling attempts may induce nest abandonment the following nesting season, when pairs choose an alternate nesting structure in another territory (Judge 1983). The translocation of animals in wildlife hazard/damage management is a scrutinized technique (Craven *et al.* 1998) that is not warranted in some situations. However, IOHMP translocation efforts were validated and strongly warranted. To adhere to wildlife hazard/damage management policies, the translocation of nestling osprey should be implemented only to support reintroduction and/or recovery projects authorized by state wildlife agencies. It is important to note that pyrotechnics and limited shooting were used during the initial stages of program implementation and determined to be an ineffective long-term management strategy.

Overall, the IOHMP provided successful strategies for resolving osprey-aircraft conflicts at LAFB. Based on monitoring data analysis, airfield observations decreased 62% when comparing the study year of June 1999-May 2000 to the project year of June 2003-May 2004 (Figure 4). There was also a 55% decrease in the number of active nests in the control zone during the same time period. Nest exclusion, egg oiling, and nestling translocation were determined to be the most effective management approaches to allow aircraft and osprey to co-exist in a

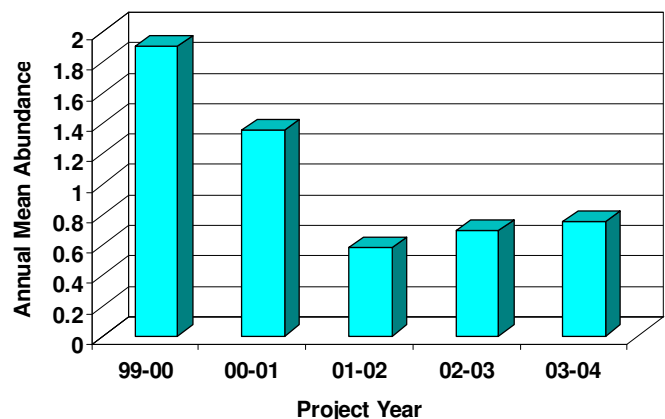


Figure 4. Annual mean abundance of osprey during standardized airfield point count surveys at Langley Air Force Base, Virginia, from June 1999 through May 2004.

potentially safer operating environment. We hope this program will serve as a guide for professional wildlife damage agencies, aviation safety personnel, and natural resource managers in managing osprey damage/hazards.

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