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## **RAPTOR STRIKE AVOIDANCE AT SEATTLE-TACOMA INTERNATIONAL AIRPORT: A BIOLOGICAL APPROACH**

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### **Abstract**

In June 2001 we initiated a Raptor Strike Avoidance Program to monitor raptor activity and develop a biologically-based approach to reduce raptor densities at Seattle-Tacoma International Airport (SEA), King County, WA. Weekly surveys established the species, sighting frequencies, and distributions of raptors. Red-tailed Hawks (RTHAs), our most common raptor, occur as both resident and migrant/wintering hawks. We attached colored leg bands, backpack radio-transmitters and wing-tags to 8 of 12 resident RTHAs to identify individuals, locate nests and to assist in defining territories. These adult RTHAs were released onsite with the expectation that they would act as “sentinel” hawks by driving the young and inexperienced birds away from the airport. Numerous observations of resident and non-resident RTH interactions have supported the decision to mark/release territorial resident RTHAs back at SEA. Migrating and wintering RTHAs, and other frequently occurring raptors such as American Kestrels (AMKEs) and Cooper’s Hawks (COHAs), were captured at SEA and released at an agricultural site with higher prey abundance 70 miles to the north. To alleviate the problem of young RTHAs being more commonly struck by aircraft, we relocated three-week old RTHAs from their nests and hacked (raised/released) them 70 miles away at the same release site. As of 14 June 2005, we have captured 110 raptors, including 70 RTHAs, 20 AMKEs, 14 COHAs, 2 Sharp-shinned Hawks (SSHAs), 1 Peregrine Falcon (PEFA) and 3 Great Horned Owls (GHOWs). No relocated birds are known to have returned from the “superior” habitat. This paper summarizes our activities, presents a partial list of our results, and discusses techniques now under development.

### **Introduction**

Seattle-Tacoma International Airport (SEA), owned and operated by the Port of Seattle (POS), has long recognized the threat of wildlife strikes to aviation safety. Wildlife strikes have been monitored at SEA, King County, WA since 1977 when a full time wildlife biologist was hired to address wildlife hazards there. Over the years the average number aircraft operations and strikes has grown from 210,000 and 15 to nearly 400,000 and 50 a year, respectively. (Most certainly, the increased number of birds struck per 10,000 aircraft movements over the years is due, in part, to an increased awareness of wildlife hazards within the industry and more accurate strike reporting). Concurrent with the construction of a new runway and the expectation of increase air traffic, the POS is also expanding and improving its Wildlife Hazard Mitigation and Conservation Program (WHMCP) in an attempt to reduce its growing strike rate. Of the > 750 reported wildlife

strikes at SEA, 20 percent of the identified strikes were raptors followed by 13 percent for each of the following groups: waterfowl, gulls, and blackbirds/starlings. Other than Red-tailed Hawks, at least eight other raptor species have been struck by aircraft at SEA including American Kestrels, Barn Owls, Cooper's Hawks, Great Horned Owls, Merlins, Peregrine Falcons, Short-eared Owls, and Snowy Owls. In June 2001 we initiated a Raptor Strike Avoidance Program to monitor raptor activity and develop a biologically-based approach to reduce raptor densities at SEA. This paper summarizes our activities, presents a partial list of our results, and discusses techniques now under development.

## **Study Area**

SEA, located 2 miles east of Puget Sound, is surrounded by a mixture of residential, light industrial/commercial, coniferous/deciduous forest, and parklands, all suitable for supporting resident and migrant raptor populations. Several small lakes, impoundment ponds and streams are located within and adjacent to airport property.

## **SEA Raptor Strike Avoidance Activities**

Our plan is based on the monitoring and analysis of raptor behavior at SEA. By developing a broader understanding of local raptor populations, we believe their natural behaviors can be used to our advantage in reducing bird strike hazards. Our goal is to reduce the number of raptor-aircraft collisions at SEA by manipulating raptor densities in a downward direction using biological approaches. The plan contains the following activities.

Raptor Species Identification - An experienced raptor biologist drives through the airport and surrounding area searching for raptors on one day each week. We record the species, age, location, time, perch type, flight activity and sex (when possible) of each hawk observed. Sighting locations are marked on a map. A total of 15 raptor species have been sighted on or around SEA, including Bald Eagle, Red-tailed Hawk, Rough-legged Hawk, Sharp-shinned Hawk, Cooper's Hawk, Osprey, Northern Harrier, Turkey Vulture, American Kestrel, Merlin, Peregrine Falcon, Great Horned Owl, Snowy Owl, Barn Owl and Short-eared Owl. This is a typical raptor population in the Pacific Northwest.

Seasonal Presence - It is important to document the seasonal arrival and departure dates of all migrant/wintering raptors on the AOA so that we know when each species might be expected on or around the airfield. This includes spring and fall migrants (Turkey Vultures), summer breeders (Ospreys) and wintering birds (Rough-legged Hawks or Snowy Owls). This information is best obtained during weekly surveys of the area. To understand the SEA hawk population in detail, it is necessary to know if a particular hawk is a resident breeding bird, fall migrant, wintering bird, or spring migrant. For example, knowing which species occur as resident breeders allows us to focus on their fledglings in summer. At SEA, we have identified 7 breeding species, the Red-tailed Hawk, Cooper's Hawk, American Kestrel, Osprey, Bald Eagle, Great Horned Owl and Barn Owl.

Raptor Distribution at SEA - To identify the threat from raptor strikes, it is essential to know where hawks occur on and around the airfield. During our surveys, we collect data on range, pair behavior, hunting behavior, territoriality, and breeding activity. These data allow us to identify the home/winter ranges of the different species and the frequency of use of different areas (and perches) on the AOA. We may then take specific actions to discourage raptor use in those particular areas. For example, certain perches that are consistently used have been removed or altered (e.g. porcupine wire), especially on the airfield. Observations of raptor behavior at SEA provide a useful, in-depth understanding of hawk activities. For example, behavior such as courtship alerts us to the onset of biological events that can be used for managing the hawks at the nest site. Hunting behavior assists us in identifying the prey species utilized by hawks at SEA. It also helps define the food chain that supports prey. A reduction of these prey species may result in a reduction of use by raptors.

Risk Assessment - Current data indicate that the most vulnerable group of raptors at SEA is recently fledged hawks, particularly RTHAs and AMKEs. Birds in this group are generally inexperienced, curious, fearless and relatively weak flyers. They are attracted to open spaces around the airport for hunting. Their evasive behaviors are undeveloped and as a result they are at greater risk of being struck by aircraft. Matthew Klope, (pers. comm.) reports that juvenile Red-tailed Hawks are the most commonly struck raptor at the Whidbey Island Naval Air Station, also located in NW Washington. We evaluated and ranked each raptor species based on the frequency of air strikes that have occurred at SEA. The species that have experienced the greatest rate of strikes should receive the highest priority for management and therefore, we direct most of our capture and relocation efforts at these species. This at risk groups, listed from most to least hazardous are: (1) post-fledgling, (2) immature hawks, (3) migrant hawks, (4) wintering hawks and (5) resident Hawks.

Resident Adult Red-tailed Hawks - Red-tailed Hawks are the most common raptor at SEA and most of our efforts involve them. Red-tails may establish and maintain specific home ranges for many years. In fact, they can live to 28 years, 10 months in the wild (Bird Banding Laboratory, Laurel, MD). To identify resident individuals after capture, we placed a bright yellow, vinyl wing-tag (marked with a single black letter) to the dorsal surface of the patagium. Females were tagged on the right wing, males on the left. The tag can be seen and read with a spotting scope at distances of a mile or more. We banded each adult with a colored/numbered VID (visual identification) leg band and a USFWS aluminum numbered leg band. We also attached a 6 gram, VHF radio transmitter backpack (Holohil mfg.) to 12 adults, some residents, some migrants. We mounted the radios with a Teflon tape harness devised by T. Maechtle. The radios have a theoretical life of 3 years and allow for long-term data collection. By using radios, we track hawks directly to their nest sites in spring, potentially saving us days of search effort. We also do a rapid "presence/absence check" each day by radio, another timesaving advantage.

The Concept of "Sentinel Hawks" - We do not advocate the capture and removal of all raptors from an airport on an indiscriminate basis. Instead we have learned to utilize the resident adult Red-tailed Hawks to assist us in "guarding" the airport. We consider these

birds to be an asset to our management program. We base this concept on the following features of Red-tail behavior and ecology. Breeding pairs are present on the airport year round and have very discrete territories. Individual hawks may live at SEA for decades. As a result, we believe these birds develop an expertise in avoiding aircraft over the years. As breeding adults, they naturally defend their territories and drive other, newly-arrived Red-tails out of the area. We have observed this behavior repeatedly. Adult Red-tails therefore assist us in clearing the runways of other less experienced raptors that are more vulnerable to air strikes. The “educated” Red-tails remain and the “naïve” juveniles are driven out. Finally, if you capture and remove the experienced adults, they will only be replaced with more naïve hawks, creating a never ending cycle as new, less experienced birds continue to fill the vacancies that created. In a similar vein, we have a wintering adult female Peregrine Falcon that perches on an office building (Sea-Tac Towers) adjacent to SEA. She has been present at this site for over 10 years and winters there from mid-August through March each year, or over 200 days annually. Her primary prey is Rock Pigeons. We estimate that she consumes between 100-150 of these birds per year, providing free assistance to Wildlife Services in their efforts to trap and remove Rock Pigeons at SEA.

Relocation of Migrant and Wintering Raptors - Our goal is to capture and relocate all immature and migrant (i.e. non-resident) hawks that occur at SEA. To date, we have captured 110 raptors of 6 species (Table 1). Our policy is that if a raptor is present on the AOA, it is a potential strike victim, whatever species it may be, and it must be moved from the area. We advocate capture, transport and release as an effective, humane, and non-controversial means of controlling birds of prey.

Table 1. Raptors captured at the Seattle-Tacoma International Airport, 1 June 2001 to 14 June 2005.

Species	Relocated	Marked and Released at SEA*	Total
Red-tailed Hawk	58	12	70
American Kestrel	20	0	20
Cooper's Hawk	14	0	14
Great-horned Owl	3	0	3
Sharp-shinned Hawk	2	0	2
Peregrine Falcon	1	0	1
Grand Total	98	12	110

\* Territorial "Sentinel Hawks".

We use a variety of safe, effective and time-tested traps and capture methods to catch hawks. The primary device is the Bal-chatri although each species of hawk may require a different method of capture. We use rats, mice, European Starlings, Rock Pigeons and House Sparrows as live attractor species. We sometimes “pre-bait” hawks that are difficult to capture. Most are caught opportunistically by means of road trapping. We immediately hood all raptors upon capture to reduce their stress level. We then wrap the

body and feet of each hawk with elastic Vet-Wrap to quiet them and restrain them safely. We note the species, age and sex of the bird and weigh (g.) and measure them (wing and tail in mm). Finally, we apply a numbered US Fish and Wildlife aluminum band to its leg. This number is sent to the US Bird Banding Laboratory in Laurel, MD and entered into their database. If the bird is recovered at a later date, we are notified. We record all our data in field notebooks. A copy of each data sheet is duplicated and filed in an additional notebook with the POS biologist (Osmek). Hawk captures should not take place on a random basis unless the action coincides with the objectives in the management plan. There may be only one opportunity to catch an individual adult bird and it should not be wasted needlessly. Resident adult hawks should not be captured during the breeding season as it may result in the death of their eggs or nestlings.

We transport each captured hawk to the Samish Flats area in Skagit County, WA, approximately 75 miles north of SEA. We intentionally selected this area for its abundance of ideal raptor habitat, prey density and winter raptor populations. We hypothesized that transporting a raptor away from an airport was not enough. We decided that it would be most effective to move it to a “superior” habitat to reduce its chances of returning to SEA. Apparently this approach has been successful as we have an extremely low rate of return (0%) over the 4 year study period with 98 hawks relocated.

Manipulation of Nestlings - Data from SEA and other airports indicate that fledglings from local nests are one of the most vulnerable groups of raptors causing bird strikes. These birds are naïve and have no experience with aircraft. They are attracted to the open space around the field for hunting purposes and their evasive behaviors are largely undeveloped. As a result, they are at great risk of being struck, particularly when they inhabit the areas between runways. To alleviate this problem, we make a special effort to locate all of the nest sites of each resident pair of hawks on and around the airfield. Since they usually produce young each spring/summer, it is important to locate all nest structures on and in the immediate vicinity of the AOA. If a nest is active in a given year, we will remove and re-locate the nestlings away from the airport and “short circuit” the breeding cycle.

Nest Surveys - To locate nests, we monitor hawk breeding activity in late winter and early spring, and check the status of each known nest. During March, Red-tails engage in conspicuous courtship activities, particularly mutual soaring, vocalizing, and territorial defense. Once a resident pair is identified, we make every attempt to locate their nest. We find new nests by using several methods; visual searches during winter when the trees have lost their leaves, seeing pairs perched together, observing adults carrying sticks to the nest, watching for prey transfers, copulation, listening for food-begging young, seeing fledglings in nearby trees and, of course, by radio-tracking. We have located six breeding pairs of Red-tailed Hawks on or near SEA. We have located the nest sites of five. All nest in trees, including Black Cottonwoods, Douglas Firs, and Red Alder. Three of the nests are located on airport property, one in an adjacent cemetery and one in a county park. In addition, two pairs of American Kestrels, one pair of Great Horned Owls, Barn Owls and Cooper’s Hawks breed here. An unknown number of other pairs breed in the vicinity (more than a mile) of the airport. We term these birds “second tier pairs”.

Removal of Nestlings - Since fledgling hawks are the single most “at risk” raptor group at SEA, we remove both Red-tail and American Kestrel young from their nests and raise/release them in Skagit County, 75 miles north of the airport. Each year, we allow the adult hawks to engage in their breeding cycle up to a certain point. Nest-building, egg laying, incubation, hatching and brooding young are all intensive activities that keep one and sometimes both of the adult hawks occupied at the nest site and away from the runways. When the young have reached three weeks of age and can stay warm on their own, we remove them from the nest and transport them from the airport area. The sudden absence of the young immediately reduces the number of hunting flights by the adults (many of them to the AOA). Normally these hunts would be increasing exponentially at this time. In order for this technique to work, timing is essential. In spring, we establish occupancy at each nest and determine the beginning of incubation to establish the timing for nestling removal. With the incubation date established, it is then necessary to monitor the nest and check on the development of the young.

Raising (Hacking) the Young - We place the nestlings in an outdoor flight cage with a tame, injured adult female Red-tail for the first week to prevent human imprinting. They are given food several times a day without associating with humans. After 1-2 weeks, they are moved to a 2’X3’artificial nest platform 50’ high in a tree. The birds are raised on the platform and then allowed to fledge on their own, a process known as hacking. They learn to fly on their own and begin hunting approximately 10 days after fledging. They reach independence within approximately five weeks of their first flight. An alternative process is fostering, i.e. placing nestlings into the active nest of another raptor of the same species. We will be applying this technique to Osprey young this summer. Osprey use of cellular telephone towers is an emerging problem at SEA as well as in many other areas of the United States.

Nest Boxes as a Management Tool - Over the last three years, we have consistently had a problem with fledgling American Kestrels on the runways at SEA in July. These birds are difficult to trap as they do not yet recognize mice as prey, are wary, leave the area when flushed, and feed almost exclusively on grasshoppers. Each summer several kestrels have been struck by aircraft at SEA. At least two pairs of American Kestrels inhabit the area but breed well off the AOA and we have been unable to locate their nests.

In 2004 we placed four Kestrel nest boxes around the AOA in hopes of specifically attracting both pairs to an area where we could better manage them. The Kestrels did select both boxes and both pairs laid eggs. One pair failed at the egg stage and the other successfully hatched 4 young. We removed the young at 21 days of age and hacked them in Skagit County. We captured the parent pair and relocated them to Cheney, WA, several hundred miles east to discourage them from returning to SEA. They have not returned to SEA as of this writing (16 June 2005). We will monitor the AOA this summer to see if this method reduced the usual Kestrel numbers on the runways. We have also placed 5 Barn Owl nest boxes at SEA but have had no nesting events during the first year.