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Migration Routes, timing, and nest site fidelity…

Introduction

Central Labrador is a notable breeding area for Osprey (*Pandion haliaetus*) and Bald Eagles (*Haliaetus leucocephalus*). It is also the location of the North Atlantic Treaty Organization's (NATO) Low level Training Area (LLTA) for fighter aircraft, covering an area of approximately 130,000 km^2 over Labrador and north-eastern Québec. Currently, military aircraft based in Goose Bay, Labrador annually conduct 5,000-7,000 sorties and are permitted to conduct up to 18,000 per flying season (DND 1995). The interaction between the two is frequently fatal for the bird and potentially so for the aircraft and pilot.

Since the early 1990s, the Department of National Defence (DND) has been monitoring Osprey and Bald Eagles populations in Labrador and north-eastern Québec, within the LLTA, as part of a long-term Environmental Mitigation Program (DND 1995, JWEL 2000). Several studies have been conducted on Bald Eagles and Osprey in Labrador, pertaining to the distribution and productivity of Osprey and Bald Eagles (Wetmore and Gillespie 1976), the diets of nesting Osprey (Chubbs and Trimper 1998) as well as the influence of low-level jet aircraft noise on the behavior of nesting Osprey (Thomas 1998, Trimper *et al*. 1998) in Labrador. While some literature does exist on Osprey and Bald Eagles and their activities at nest sites in Labrador (Wetmore and Gillespie 1976, DND 1995, Chubbs and Trimper 1998, Thomas 1998, Trimper *et al*. 1998), there is little information on a host of other key factors that must be considered when attempting to mitigate the incidence of bird-aircraft strikes. For example, the arrival and departure times from breeding sites, the raptors use of the training area typical breeding and home ranges for an active nest site, nest site fidelity, spring and fall migration routes, wintering areas, and migration flight altitudes.

The purpose of this study is to track juvenile and adult Osprey and Bald Eagles from nest sites on their fall and spring migration to determine their arrival and departure dates from the LLTA. Studying raptor migration routes and timing is critical for bird strike risk assessment that is an essential information for safe flight planning.

Background

The Osprey is one of the most widely distributed bird species within the Northern Hemisphere, breeding in temperate areas between 40° and 70° latitude and migrating long distances to southern and tropical regions during winter (Poole 1989, Hake *et al.* 2001). In Canada, Ospreys are present from April to October (Jamieson *et al.* 1982), and commonly nest on top of black spruce, balsam fir trees, and powerlines (Wetmore and Gillespie 1976, Chubbs and Trimper 1998). Comparatively, Bald Eagles have been studied more intensely due to concerns of their continental decline during 1950-1970, from the effects of organochlorine contaminants (Postupalsky 1974, Poole 1989). Bald Eagles are widely distributed across North America however nest generally at lower densities than Osprey (Wetmore and Gillespie 1976, Godfrey 1986). Little is known about the migratory patterns and behavior of Osprey and Bald Eagles in Labrador.

In general, most avian migration occurs between 10,000 and 15,000ft above sea level, with eagles, vultures, and hawks traveling at records of 25,000ft (Dr. D.M. Bird pers. comm.). Airspace used while at the nest and hunting is recorded at much lower altitudes, Osprey often concentrating their hunting altitude between 27-115ft above water bodies. These activities add to possible bird strike hazards as the jet fighters are flying at very low altitudes.

Labrador Populations

The first population surveys for Ospreys and Bald Eagles in Labrador were conducted between 1969-1973 and covered an area of 56,200 km^2 in western Labrador and 46,600 km^2 in east-central Labrador (Wetmore and Gillespie 1976). They estimated that there were 2.59 and 3.11 Osprey nesting territories (occupied and unoccupied) per 100 km^2 respectively. Numbers of active Osprey nests averaged 45 annually (range 36-54)

in the western region and 58 (range 45-77) in the east-central region. During the four year study, a total of 18 Bald Eagle nests were located; 13 in the western region and 5 in the east-central region, with the highest density estimated at 0.52 active nests per 100 km^2 in the western region.

Since 1989, DND and Jacques Whitford Environmental Consultants Limited (JWEL), have located over 800 raptor nest as part of an ongoing mitigation program. Our study includes these previously located raptor nest sites (occupied and unoccupied) in and around the LLTA over an area of approximately 130,000 km^2 (DND 1995, JWEL 1999a,1999b.). In 1997 and 1998, a total of 168 and 276 active nest sites in this area respectively. As systematic surveys to estimate densities were not conducted, comparison with Wetmore and Gillespie's (1976) study is not appropriate. Since 1994, DND has also identified 33 Bald Eagle nest sites in the study area with 1998 registering the most number of active nests.

Low Level Training in Labrador and Bird-strikes

The LLTA is home to the NATO Allies extensive range for low level jet fighter training. It provides an area to fly and train at altitudes less than 1,000ft, with an estimated 50% being at 500ft or below and approximately 15% as low as 100ft above ground level. Such flight activities are at an added risk of bird strikes as they are preformed at similar altitudes flown by both Bald Eagles and Osprey. Within Goose Bay, allied detachments have experience 11.6 birdstrikes over the past 5 years and an annual average rate of 2.6 bird strikes over the last three years (DND unpublished data), with collateral damages in the excess of $3 million dollars (Figure 2). Table 1 outlines the number of allied bird strikes in correspondence to the number of sorties. Unfortunately, prior to 1999, bird strike reports were not as accurately recorded as they are now. Given the large number of aircraft flying and transiting through Goose Bay and the imperative to increase pilot and passenger safety and decrease costly damages, studying the movement patterns of such large birds is beneficial. As noted, gaining an understanding of the raptors' movements is a critical element of reducing the bird-strike problem. Therefore, the objectives of this study are intended to largely focus on raptor site fidelity, migration routes and timings.

The Study

Study Area

The study area includes several eco-regions within the LLTA, with most concentration focused on raptor activity in the vicinity of the Smallwood Reservoir in central Labrador (53° 30'N; 64° 00'W). The study area comprised some 130,000 kms^2 and most of the water bodies situated in it had prominent rock islands, isolated erratics and rock outcrops that could support stable nesting sites. Known rock nests within the LLTA, all situated about the Smallwood Reservoir (Figure 1) were approached.

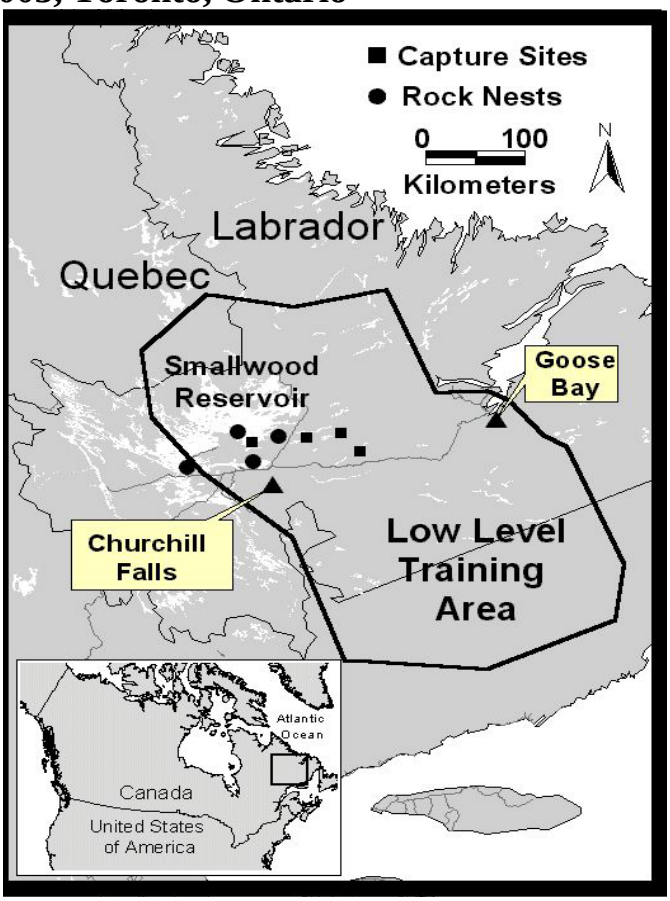
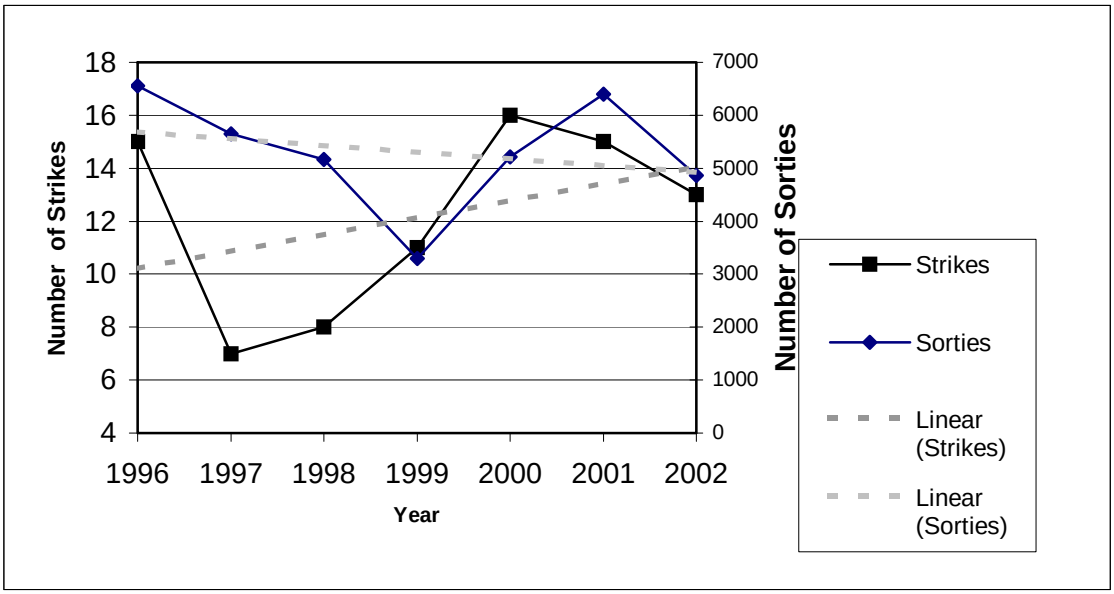


Figure 1: The LLTA is located in Central Labrador. Capture sites were situated about the Smallwood Reservoir, and nearby rock nests will be approached in the 2003 field season.

Figure 2: Two examples of canopy damage to military aircraft caused by Osprey .



Graph 1: Table outling the number of strikes and sorties over seven years. Prior to 1999, DND had difficulty retrieving NATO Allied bird strike reports.

Telemetry

Satellite telemetry provides more information on the ecology and life history of raptors than could possibly be gathered in decades of conventional telemetry and banding. Banding most often can only produce two confident locations (if found at all), the site in which the bird was first caught and the site in which the band was retrieved. Other problems surrounding band use is that most are likely retrieved in areas with high human densities. Satellite telemetry is a tool that can effectively produce a wealth of useful information including the entire schedule of annual movement, complete with wintering ground and stop over details.

Methodology

For this particular study 9 transmitters (5 juvenile Bald Eagles, 4 juvenile Osprey) were deployed during the 2002 field season, and it is anticipated to deploy a minimum of 12 transmitters in the 2003 field season. Due to the inaccessibility of tree nests, juvenile raptors were captured from rock nests. Once captured, the raptor was fitted with a Platform Transmitter Terminal (PTT, Microwave Telemetry Inc., Columbia, MD). PTTs were affixed in a back-pack fashion using Teflon ribbon. Ospreys fitted with a 35g, solar PTT-100, and Bald Eagles equipped with a 95g battery PTT-100 (Figure 3), with a pre-set duty cycle to transmit more frequently during possible periods of migration. Once deployed, transmission data from the PTT to the satellite is processed by ARGOS and immediately received via email. Location data is then entered into a database prior to processing the locations with a Geographic Information System (GIS). Using the Animal Movement Extensions available for Arcview GIS 3.2 (ESRI, Redlands, CA) locations of raptors are plotted using GIS, enabling movement patterns to be analyzed in comparison to Low Level Jet Fighter flight patterns.

Figure 3: 95g PTT affixed in a pack-back fashion on a juvenile Bald Eagle.

The Results

Preliminary Results

Using the movement information gained from the transmissions of these terminals, it has been possible to plot raptor movements (Figure 5.0) and compare them to flight track and bird strike data provided by DND. Preliminary results suggest that these raptors are moving out of the LLTA as early as the last week of September and may depart as late as the first week of November (Figure 4.1). Preliminary fall migration analysis of Bald Eagles also indicates that the earliest movement out of the training area was 8 of October 2002 and the latest movement out of the training area occurred around 8 of November 2002 (Figure 4.1).

All Bald Eagles travelled to the northshore of Quebec, with one remaining there during winter, while others migrated inland around the Gulf of St. Lawrence and continued into the United States. Two eagles migrated south-west stopping at Lake Ontario, and wintering in Virginia and West Virginia. The remaining eagles moved more directly south towards the eastcoast of the United States possibly feeding along the state borders of Vermont and New Hampshire before wintering in New York State and Connecticut. The average length of stay at the wintering grounds was three and a half months with departures between 11 and 29 March 2003. During spring migration eagles followed similar routes returning to the Gulf of St. Lawrence coast between 11 and 30 April 2003. As of 6 May 2003 one eagle returned to Central Labrador, travelling through the LLTA between the 6and 9 May 2003.

Unfortunately, Osprey transmitters ceased transmission during the latter part of October; however migratory status out of the LLTA was recorded for two of the birds. One Osprey exited during the last week of September, and the other travelled through the southeast section of the LLTA during the first week of October.

Preliminary Interpretations

While exact locations of birdstrikes are difficult to identify as most strikes are discovered some time after the collision, preliminary analysis of available bird strike data suggests that bird strikes occur more frequently during the months of May, September, and October. Analysis also indicates that collisions may occur in more remote regions, in the vicinity of larger water bodies (a favourable foraging site for both species). The increase in strikes apparently corresponds to an increase of use of the southern LLTA by jet fighters for training during high frequency peak periods of migration (Figure 4.2).

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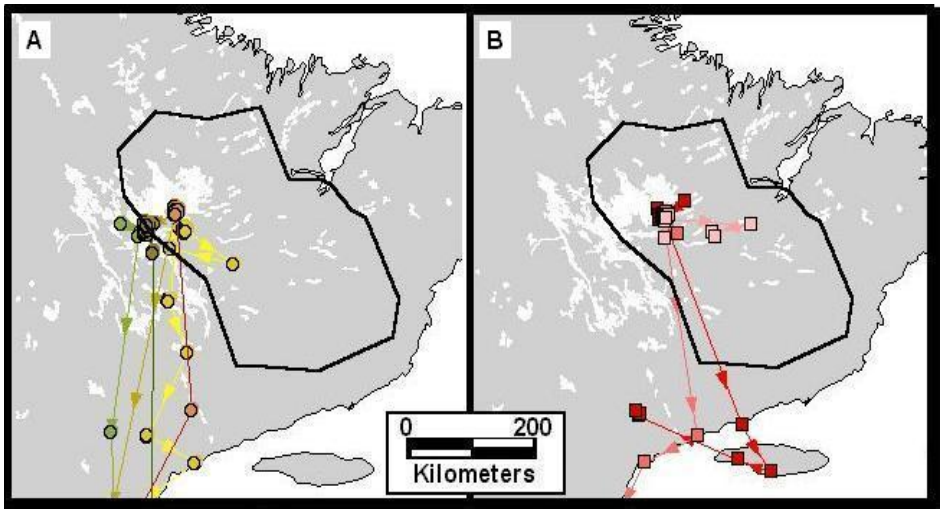

Figure 4.1: Eagle (A) and Osprey (B) movement patterns out of the LLTA during spring migration 2002. Eagles departed the LLTA between 8 Oct and 8 Nov. Osprey departed the LLTA between 30 Sept and 9 Oct.

Poole (1989) states that it is very likely that Osprey may choose the same routes of migration in spring as in fall and more recent research (Meyburg *et al.* 1995, Hake *et al*. 2001, Kjellen *et al*. 2001, Martell *et al*. 2001) indicates that while there may be differences in behaviour between sexes, ages, and geographical location, these raptors prefer to travel along coastlines, avoiding over-water crossings of more than 10-15km. We found this type of behaviour to correspond to the Bald Eagles locations transmitted during our study.

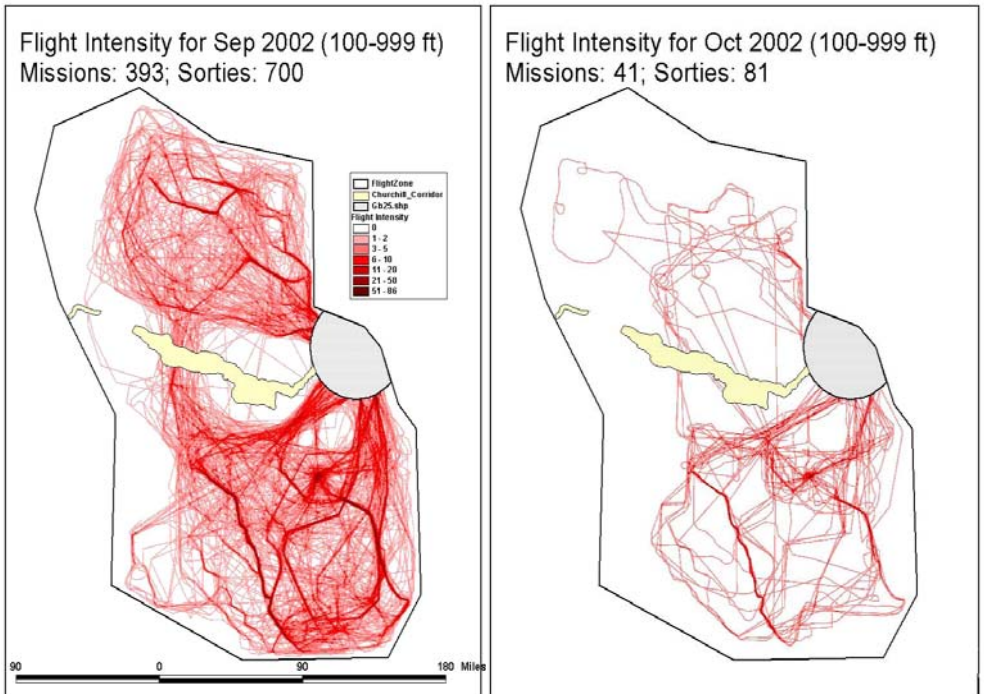

Figure 4.2: Flight track intensity as recorded by DND-GBO during the months of September and October 2002. Comparatively the southern part of the LLTA is used much more frequently than the northern region.

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http://www.birdstrikecanada.com/ and http://wildlifedamage.unl.edu

Interpretation Summary and Preliminary Findings

To date, it is noted that:

1. Fall migration may occur much later than previously thought. The latest departure for Ospreys was the first week of October (2/10/02) and for the Bald Eagles the latest departure was mid-Nov. (11/18/02). Therefore, mitigation measures for raptors such as Bald Eagles may require modification to reflect the later departure dates during fall migration.
2. As of 6 May 2003, it is now known that juvenile Bald Eagles are returning to the training area mid-spring. Modifications to flight plans may also be required to accommodate possible early arrivals of these raptors.
3. Raptors tend to migrate along large watercourses and reservoirs. This may identify these areas as higher risk of bird strikes (15 Oct-15 Nov).
4. Preliminary data analysis appears to indicate that migration may occur during the night as well as during the day. This may have implications if there is an increase in night training.
5. Osprey and Bald Eagles do not immediately leave the nesting area once fledged. Further assessment of home ranges in LLTA during the fledgling period will be examined.
6. Further refinement of the analysis in support of this study would be assisted by an increased effort to record all instances of birdstrikes and to identify the species involved.

Conclusion

Our knowledge and understanding of these raptors in Labrador has been greatly expanded through the use of telemetry. Complementing movement patterns in and out of the LLTA has revealed possible seasonal migration patterns of juvenile eagles (Figure 5.0), as well as raptors home range movements while at nesting sites. Nest contents were investigated and morphological measurements of both raptor species were obtained.

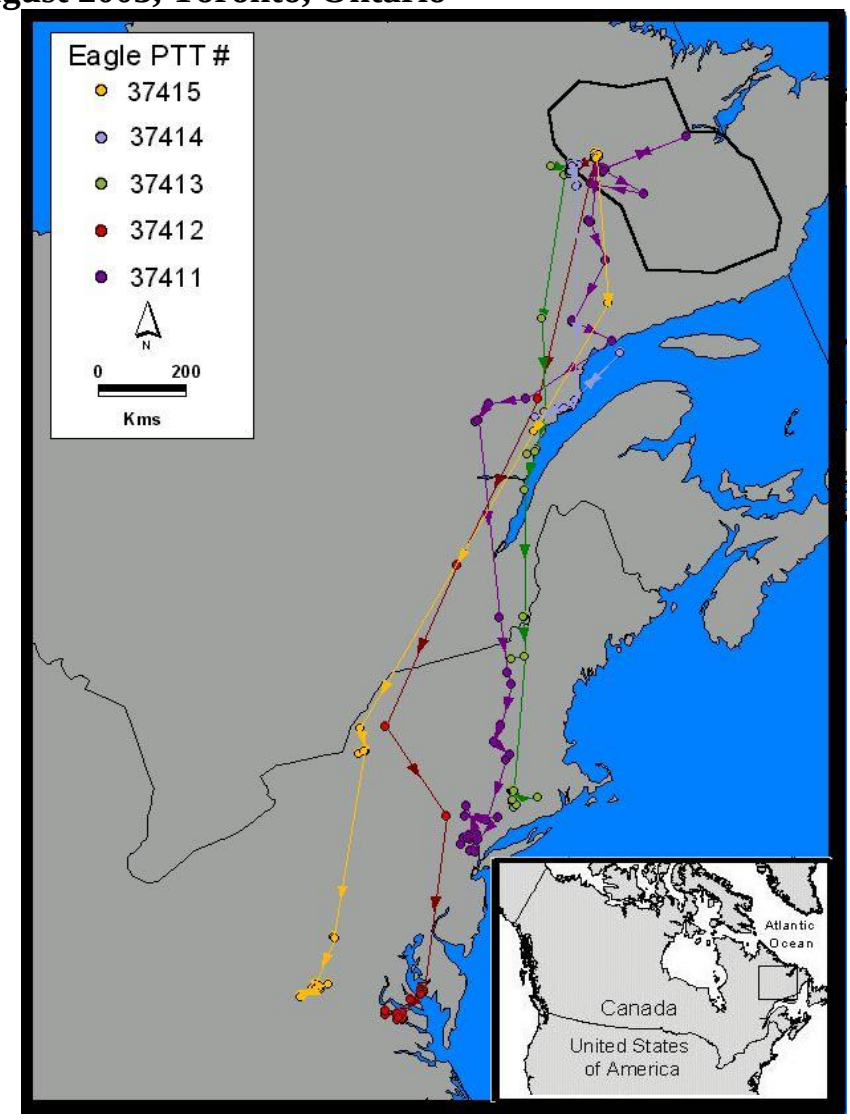

Figure 5.0: Migratory routes taken by juvenile eagles between 5 Sept. 2002-10 March 2003.

Acknowledgements

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