

# Delta Basin Winter Raptor Habitat Preference Survey 2003-2004



Prepared for:

**Doug Ransome, Wildlife Management Instructor**  
Fish, Wildlife and Recreation Program  
British Columbia Institute of Technology  
Burnaby, BC,

and

**Markus Merkens, Wildlife Biologist**  
Delta Farmland and Nature Trust  
Ladner, BC

Prepared by:

**Benjamin Crook**  
**Blair Reilly**  
**Gord Gadsden**

Fish, Wildlife and Recreation Program Students  
British Columbia Institute of Technology

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## **Abstract**

The Fraser River Delta in Ladner, B.C. is a fertile land that is very important agriculturally as well as for migrating and over-wintering raptors. The Delta Farmland and Wildlife Trust has implemented various programs to integrate agriculture farming and ecological balance.

Our objectives in this study were to monitor raptor use of our study area and to determine the habitat type each species preferred. Habitat in the study area was categorized into eight field types; tall grass, short grass, winter cover, berry crops, crop residue, corn stubble, bare field and other. We recorded each individual raptor to species, age, sex, behavior and field type it was using. This survey followed RISC road transect methodology modified slightly by adding five minute survey stations and a smaller crew size. Study crew was divided into three groups to cover the study area with a minimal amount of time bias. Data collection occurred at least every two weeks beginning on November 5, 2003 and ending February 4, 2004.

Eleven species of raptor were detected in the study with bald eagles and northern harriers being the most abundant species. Sharp-shinned hawk, Cooper's hawk, red-tailed hawk, rough-legged hawk, merlin, American Kestrel, gyrfalcon, peregrine falcon and short-eared owl were also recorded in varying abundance during the study. Abundance of bald eagles increased throughout the winter while northern harriers appeared to decrease in numbers towards the end of winter. Red-tailed hawks and rough-legged hawks displayed a consistent abundance level. Trends could not be calculated for the other species due to low numbers detected. Merlin abundance decreased significantly from previous studies.

Northern harriers were found to strongly prefer tall grass habitat. Bald eagles showed preference for short grass and winter cover habitats. Red-tailed hawks preferred tall grass and bare field habitat. Habitat preference was not calculated for the other species due to low detections of these species.



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## 1.0 Introduction

### 1.1 Background

The Fraser River Delta is located in the Pacific flyway, which extends down the Pacific coast from Alaska to Mexico. This flyway is used annually by millions of migratory birds (Reifel Bird Sanctuary, 2003). This area was the depositional location for the Fraser River, which flooded the area for centuries depositing nutrient rich soil throughout the valley. This area has created highly successful agricultural land because of its high quality soils, long growing periods and flat landscape. This area also historically provided tidal marsh and grasslands (Figure 1). Migrating birds and many species of small mammals use the surrounding habitat for feeding. This large supply of food generates an influx of predatory birds into the Delta basin. Migratory waterfowl supply resident and migratory raptors with valuable winter food. Species richness of raptors ranges from 15 to 20 species (Toochin, pers. comm.) using various agricultural areas as hunting grounds during winter months. These species include:

- Northern harrier (*Circus cyaneus*) (NOHA)
- Sharp-shinned hawk (*Accipiter striatus*) (SSHA)
- Cooper's hawk (*Accipiter cooperii*) (COHA)
- Red-tailed hawk (*Buteo jamaicensis*) (RTHA)
- Rough-legged hawk (*Buteo lagopus*) (RLHA)
- Bald eagle (*Haliaeetus leucocephalus*) (BAEA)
- Merlin (*Falco columbarius*) (MERL)
- American kestrel (*Falco sparverius*) (AMKE)
- Gyr Falcon (*Falco rusticolus*) (GRYF)
- Peregrine falcon (*Falco peregrinus*) (PEFA)
- Short-eared owl (*Asio flammeus*) (SEOW)

These species are found in varying abundances in the study area. Most have specific habitat requirements and food sources in order to successfully survive. This makes it very important to learn what habitat types are necessary to sustain viable raptor populations in the Delta area. With growing urbanization in the Delta area, pressure on





remaining wildlife habitat has increased. If appropriate land use decisions are to be made, knowledge of the wildlife and the habitat they rely on is of utmost importance.

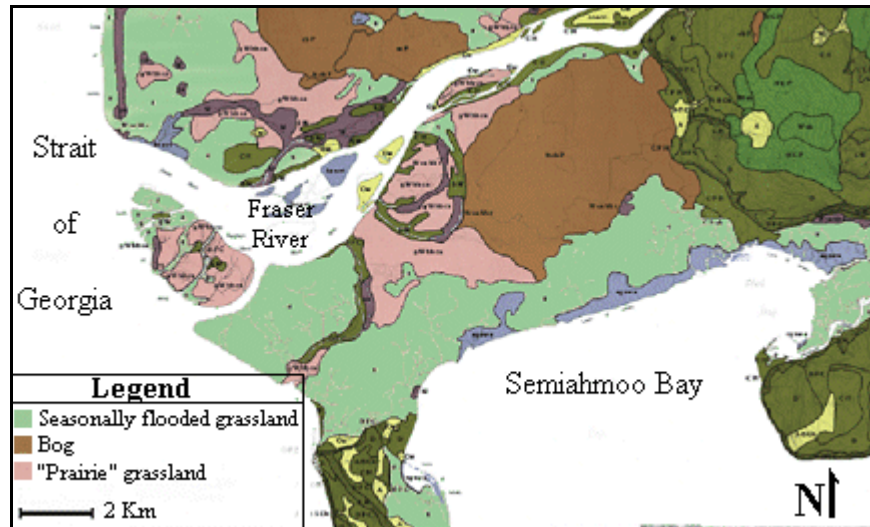


Figure 1. Vegetation composition of the study area prior to European settlement (adapted from M. Merckens, 2004.).

## 1.2 Delta Farmland and Wildlife Trust

Delta Farmland and Wildlife Trust (DF & WT), a non-profit society, works to preserve farmland and wildlife habitat. DF & WT was established in 1993 by farmers and conservationists who both had an invested interest in Delta's farmland. An important collaborative effort has been formed between farmers and conservationists to maintain wildlife habitat and agricultural fields in an area with a rapidly growing urban population. Programs initiated by this society are designed to benefit both farmers and wildlife. Grassland set asides programs, for example, rest and replenish nutrients in soils used for agricultural purposes. The fields are left natural for five years and provide natural and highly important raptor habitat. Then, the grassland set aside field is tilled for agriculture. As a replacement, another agriculture field is then left in place to develop into a grassland set aside. Part of DF & WT field programs is monitoring and evaluating of their programs. Frequent monitoring is vital to determine program success and to decide if modifications or changes to their programs are necessary.



### **1.3 Objectives**

Our main objective of this study was to identify which field types raptors prefer, and which types they avoid. In addition, we estimated relative abundance of species most frequently encountered. Addressing these objectives will provide information needed by DF & WT to create programs to sustain healthy populations of wintering raptors. Knowing which field types raptors prefer will help DF & WT direct their habitat restoration programs. This study is a continuation of previous studies conducted in previous years by British Columbia Institute of Technology students and the DF & WT.

### **2.0 Study Area**

Our study area was in southwestern British Columbia, Canada, in the districts of Ladner and Delta (Figure 2). This area bordered on the edge of Semiahmoo Bay (Boundary Bay) and consisted of large tracts of agricultural lands, a golf course, two small airports, and residential areas. Approximately 7000 ha of land fell in our study area. For the purpose of the study, the area was broken down into eight categories. These categories included old field grassland set-asides, short grass pasture, winter cover, berry crops, crop residue, corn stubble and bare field. An 'other' field type was designated to cover all other areas that do not fall into previous categories.

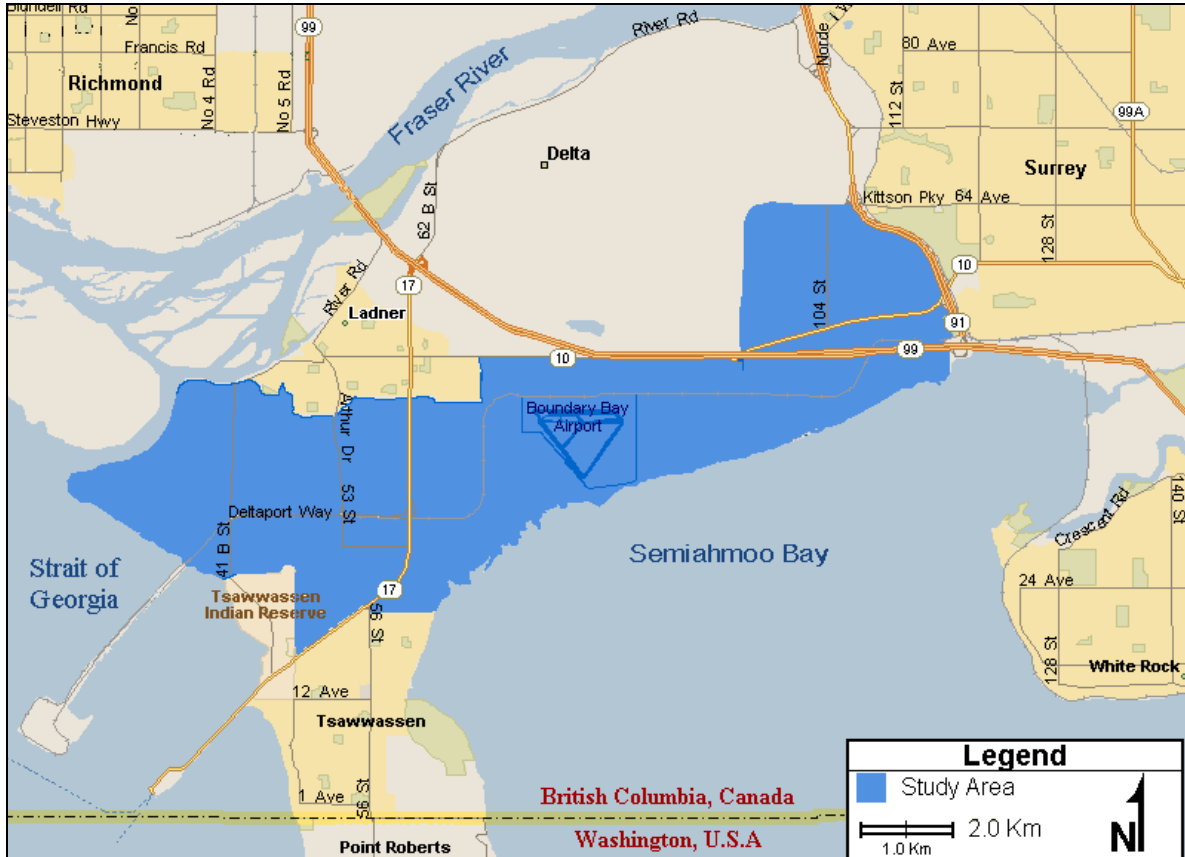


Figure 2. Map of Delta raptor research study area located in the city of Delta, southwestern British Columbia (adapted from: Mapquest, 2003).

## 2.1 Field Descriptions

The eight field types identified in the study area offer many different habitat values for raptors. Some of these field types fall under DF & WT programs. The following descriptions of each field type indicates the current attributes for each as well as the size percentage of each found in the study area.

### 2.1.1 Tall Grass

Tall grass habitats, shown in Figure 3, accounted for 8% of the study area. Tall grass habitats were often grassland set-asides as created by the DF & WT. Grassland set-asides are a patch of land that has been set aside for natural process, wildlife and to allow the land to recover from agricultural use. These fields are left for five years before being



used again for agricultural uses. A field that is to be left as a grassland set-aside is prepared with laser leveling and drainage management prior to planting. A mix of grasses is planted with species including orchardgrass, tall fescue and timothy (DF & WT, 2000). This planting soon results in field rich in cover and food, the preferred habitat for small mammals such as Townsend's voles (*Microtus townsendii*), and deer mice (*Peromyscus maniculatus*), a main food source for many raptor species (Merkens, pers. comm.). Supervised mowing takes place in some Grassland Set-asides to increase wildlife-habitat value (DF & WT, 2000). This diversity in vegetation, compared to a crop field, creates prime habitat for raptors, and is the main field type used by northern harriers, American kestrels and short-eared owls (Merkens, pers. obs.).



**Figure 3. A typical tall grass field type found in the study area (photo: G. Gadsden, 2003).**

### **2.1.2 Short Grass**

Short grass habitats (Figure 4) covered 25% of the study area. This includes residential lawns, golf courses, turf farms and pasture. Short grass habitats of lawns and turf farms were often monogamous stands of one type of grass which are mowed frequently. Pasture grass is kept short by grazing activities of animals such as dairy cows, horses and sheep, and consists of many species of grass and weeds. Many of the pastures are well fenced providing perches for raptors. These habitats, primarily livestock pasture, are often favored by rough-legged hawks (Ehrlich, et al., 1988.).



**Figure 4. An example of the short grass field type surveyed in the study area (photo: G. Gadsden, 2003).**

### **2.1.3 Winter Cover**

Under the winter cover program of DF & WT 12% of farmland in Delta was covered by winter cover crops (Figure 5). These fields are planted with winter crops such as oats, barley and most commonly, rye and wheat. These crops are planted in late summer or fall, right before or soon after the primary crop is harvested. Primary crops are often food crop such as corn. Winter cover is used to lessen impacts of soil erosion during winter months and are ploughed under in spring as fertilizer. These fields create perfect food habitat for birds, especially waterfowl. Bald eagles and peregrine falcons were often observed using this field type (pers. obs.).



**Figure 5. An example of a winter cover field type surveyed during the study (photo: B. Reilly, 2003).**



#### **2.1.4 Berry Crops**

Around 2% of the land base is covered in strawberry, blueberry and cranberry fields (Merkens, pers. comm.). These fields are generally small, as they are more for private use or additions to farmer's gardens. These field types are distinguishable by containing plants located on slightly mounded rows of soil year round (Figure 6). Raptor use was observed to be very low (pers. obs.).



**Figure 6. A strawberry field representing the berry crop field type found in the study area (photo: B. Reilly, 2003).**

#### **2.1.5 Crop Residue**

Crop residue accounted for 7% of the study area. These fields contained a uniform crop that was planted in rows (Figure 7). The most common type of crop planted is pumpkins, cabbage, turnips, and cauliflower. These fields are usually seeded in late spring and harvested by late fall. During winter, they are either planted with winter cover or left bare. These fields allowed for very little diversity in vegetation and are often compacted with discarded crop vegetation. Minimal use has been observed here by raptors (pers. obs.).



**Figure 7. An example of crop residue field type surveyed in the study area (photo: G. Gadsden, 2004).**

### **2.1.6 Corn Stubble**

A corn stubble field is what remained from corn that was grown during summer and harvested in early fall (Figure 8). After harvest, stalks of about 12 cm in height are left over winter until they are tilled under in spring. Some fields are seeded in late summer with winter cover crop. During winter, these fields appeared to provide little cover for small mammals. This field type was most often used by waterfowl, bald eagles and peregrine falcons (pers. obs.). Corn stubble fields covered 5% of the study area.



**Figure 8. A typical example of a corn stubble field type surveyed in the study area (photo: G. Gadsden, 2004).**



### **2.1.7 Bare Field**

Bare fields (Figure 9) encompassing 24% of the study area are usually the result of harvested potato fields. Potatoes are grown during summer and harvested in early fall. During winter months, they are left tilled and mostly bare. Some fields are purposely flooded during winter and drained in spring as a biological control for potato pests (Merkens, pers. comm.). Potatoe residue left after harvest attract waterfowl. Bald eagles were often observed using this field type (pers. obs.).



**Figure 9. Harvested potato field creating an example of a bare field habitat type found in the study area (photo: B. Reilly, 2003).**

### **2.1.8 Other**

These various habitats include constructed structures such as dirt piles, dykes, farmyards, green houses, railroad tracks, residential areas and roads; accounting for 17% of the study area. Raptors encountered in the other habitat types were most often using trees and telephone poles as perches or detected while in flight over these habitats.

## **3.0 Methods and Materials**

To compare our data with past years, we used the same methodology, transects, and survey points as those used previous inventories (Bland et al, 2000). Nine transect lines were placed on existing roads to completely cover the whole study area (Figure 10).





Stations were placed every 500 metres on each transect (Appendix 1). Data collection took place by observing all raptor species for a five-minute period at each survey station. All raptors observed had their locations marked on the map as well as time, weather, behavior, age and sex added to a data sheet (Appendix 2). The entire study area was inventoried on the same day with each inventory separated by 7 to 14 days. Inventory days began one-half hour after sunrise throughout the study to eliminate time of day bias. Surveys took place by partitioning the study area into three sections for each team member to reduce time bias. Each team member alternated between sections throughout the data collection period to reduce observer bias. Materials used for this study included our vehicle's odometer, wristwatch, 10 x 50 binoculars, 15x-60x spotting scopes and bird identification guides.

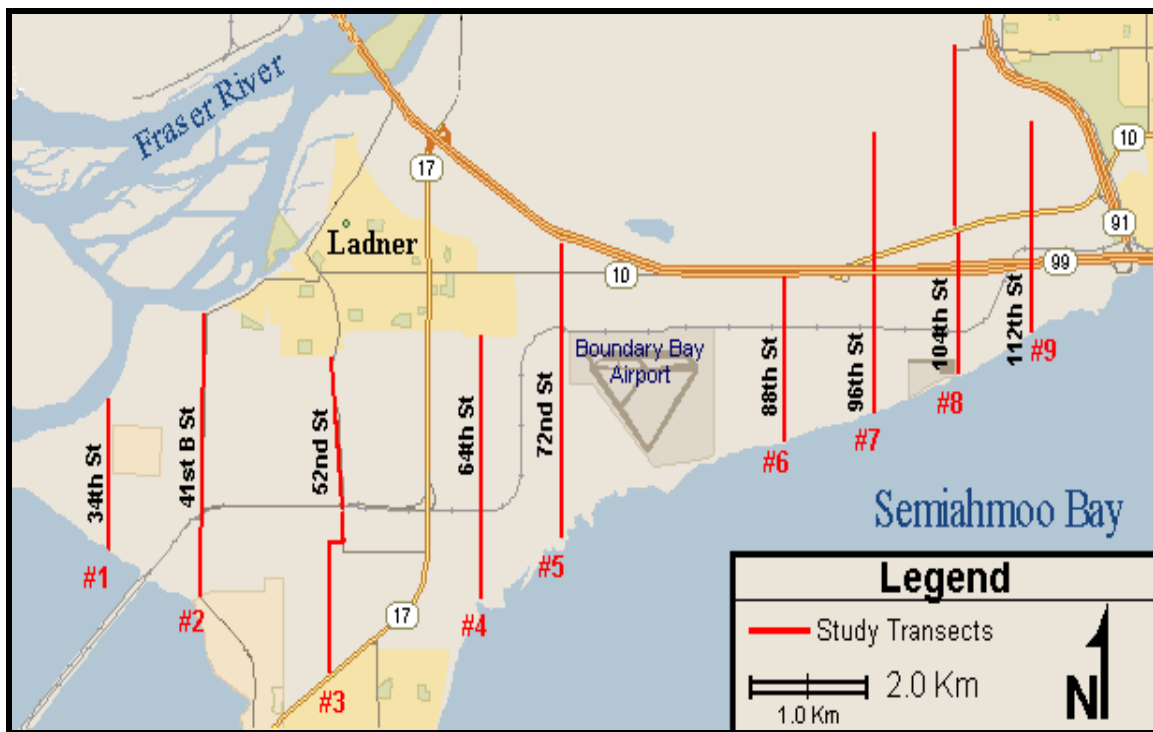


Figure 10. Locations of study transects used during the study (adapted from: Mapquest, 2003).



### 3.1 Raptor Species Identification

Proper identification is vital to ensure quality data collection. Currently, 14 different diurnal raptor species have been recorded in our study area (Toochin, pers. com.). Identification features of these birds are generally simple with few species being difficult to differentiate from one another.

#### 3.1.1 Northern Harrier

Northern harriers, commonly found in the study area, are distinct with all ages and sexes having a visible white rump patch and an owl-like facial disc (Figure 11). Adult males have slate gray backs and heads with a brown mottled white breast. When seen in flight, males display black wingtips. Females are brown overall with a brown-streaked white breast. Juveniles in their first winter are similar to females but have a buffy-orange breast. Northern harriers feeding techniques require fields with habitat suitable for rodents but with few trees, shrubs and other obstructions. Northern harriers in the Delta area feed mainly on small mammals and favor old field grassland set asides (Merkens, pers. com.). Their specialized hunting tactics and dependence on certain habitat types make Northern harriers a specialist species who are sensitive to habitat modification. Northern harriers winter in high numbers in the Delta area and leave in the spring for breeding grounds. The timing of their arrival and departures from the Delta area is often weather dependant. Northern harriers will winter longer in the Delta area during cold winters and have shorter winter stays during mild winter (Merkens, pers. com.).



Figure 11. Examples of juvenile northern harrier in flight (left) female perched (center) and male in flight (right) as seen during the study period (photos: G. Gadsden, 2003).



### 3.1.2 Sharp-shinned Hawk

Sharp-shinned hawks are commonly seen in the study area, and are very similar in appearance to Cooper's hawks. Adults (Figure 12) have dark gray back and head, and a square ended tail thinly tipped with white. Their breast is white with horizontal rufous bars. Juveniles display a similar tail to adults, but have brown backs and heads with a white breast coarsely streaked with brown (Figure 12). Hedgerows along field borders are favorite hunting grounds for small birds such as sparrows (Ehrlich et al., 1988.).



Figure 12. Examples of juvenile (left) and adult (right) sharp-shinned hawks as seen during the study period (photos: G. Gadsden, 1996).

### 3.1.3 Cooper's Hawk

Generally uncommon but regular in the study area, (Toochin, pers. com.) adult Cooper's hawks are identified with dark gray backs, a dark cap on their head and a rounded tail widely tipped with white. Their breast is white with horizontal rufous bars. Juveniles show a similar tail to adults, but have brown backs and heads with a white breast thinly streaked with dark brown (Figure 13). The tarsus of all ages is thicker than that of the smaller sharp-shinned-hawk. Found in residential areas and hedgerows, small birds and the occasional small mammal are preyed upon (Ehrlich et al., 1988.).



**Figure 13. An example of a juvenile Cooper's hawk as found in the study area (photo: G. Gadsden, 1999).**

#### **3.1.4 Red-tailed Hawk**

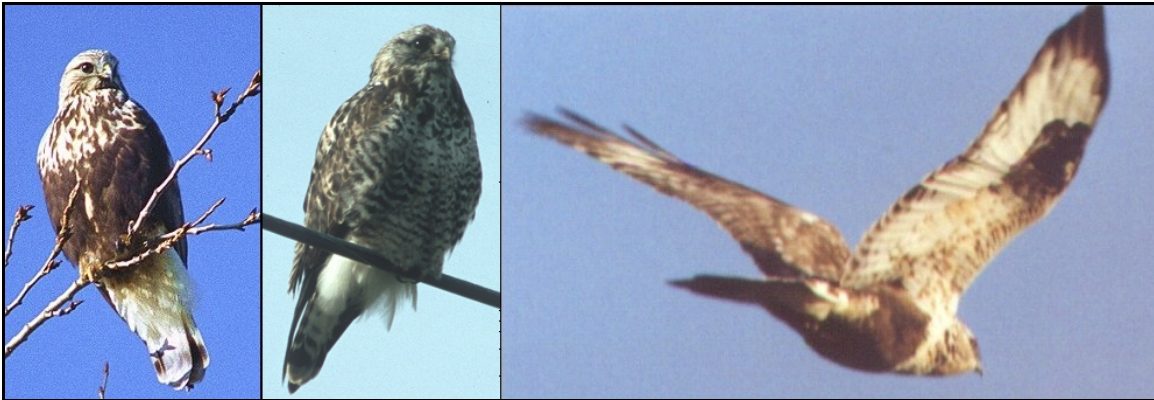
Red-tailed hawks are common in the study area throughout the year (Bland et al., 2001). They have variable plumage, but most adults exhibit a rusty-red-colored tail (Figure 14). They have buffy breasts and bellies with varying amounts of brown streaks that often creates a belly-band (Figure 14). Their backs and head are brown. Juveniles are similar to adults but lack a rusty-red tail and have white breasts variably streaked with brown. Red-tailed hawks feed mainly on small mammals and irregularly on waterfowl (Ehrlich et al., 1988.). They often perch on trees, telephone poles and wires over a field, often tall grass habitats to watch for prey. Once prey is sighted, they swoop down to make a kill. Red-tailed hawks will also soar over hunting grounds while looking for food (Ehrlich et al., 1988.). This makes red-tailed hawks a more generalist species less sensitive to modifications to a specific habitat type.



**Figure 14. Examples of an adult red-tailed hawk perching (left) and in flight (right) as found in the study area (photos: G. Gadsden, 2004).**

### **3.1.5 Rough-legged Hawk**

Generally uncommon but regularly found in the study area during the winter, (Bland et al., 2001.) rough-legged hawks are sometimes confused with red-tailed hawks. Rough-legged hawks are unlike red-tailed hawks, lacking red tails and buffy breasts (Figure 15). A light phase bird displays a light head with dark breast band and a dark-banded white tail. Dark phase birds are more rare, and lack white body parts but retain a dark banded white tail. In flight, light phase rough-legged hawks of all ages display diagnostic dark wrists and dark belly band (Figure 15). All color phases have a feathered tarsus unlike red-tailed hawks. Small mammals are a main food source, often caught while hunting their favored short grass habitats (Ehrlich et al., 1988.).



**Figure 15. Examples of light phase female (left), light phase male (middle) and juvenile in-flight (right) examples of a rough-legged hawk as seen in the study area (photos: G. Gadsden, 2003).**

### **3.1.6 Bald Eagle**

Bald eagles were the largest and most abundant raptor recorded in the study area. Their white head and tail, dark brown bodies and massive yellow bill easily identify adults, both male and female, from other raptors (Figure 16). Juvenile birds lack complete white heads and tails, but have dark brown bodies with white mottling on body and wings (Figure 16). In the study area, waterfowl and dead animals are their main food supply. Bald eagles were seen in every habitat in the study area (pers. obs.) which suggests bald eagles are a generalist species who do not depend solely on a single or few habitat types.



**Figure 16. Immature (left), sub adult (middle) and adult (right) examples of a bald eagle as found in the study area (photos: G. Gadsden, 2003).**



### 3.1.7 Merlin

Uncommon but regularly found during winter in the study area, (Toochin, pers. com.) merlins are similar to peregrine falcons. Merlins are much smaller than peregrines and lack a distinctive ‘helmet’ and ‘mustache’. They have non-uniform dark bellies. Their wingtips do not reach their tail tip. Main food sources are small birds and large flying insects such as dragonflies. Forest edges and hedgerows are favorite habitat types (Ehrlich et al., 1988.).

### 3.1.8 American Kestrel

The smallest raptor in the study area is the American kestrel. Adult males show blue-gray wings and rufous and black barred backs (Figure 17). Their head has a blue-gray crown with dark sideburns and mustache extending down their face. Females are similar to males, but lack blue-gray wings and a less strongly patterned face. Juvenile males and females are similar to their respective adult. Kestrels feed mainly on small mammals and large insects often in tall grass and grassland set asides (Merkens, pers. com.).



Figure 17. A typical adult male American kestrel as would be seen in the study area (photo: G. Gadsden, 2004).



### 3.1.9 Gyrfalcon

Gyrfalcons are a large robust falcon, often confused with peregrine falcons. Rarely found in the study area as their range rarely extends from Arctic tundra (Sibley, 2000).

When in flight, gyrfalcons have bluntly tipped broad wings with underwing remiges paler than underwing coverts (Figure 18). When perched, wingtips do not reach tip of tail.

Overall, body plumage is uniformly patterned and head plumage displays a weak 'mustache' stripe. Coloration is often gray, but dark and white morphs occur (Sibley, 2000). Gyrfalcons feed almost exclusively on birds such as waterfowl and shorebirds and are found in habitats that provide large amounts of food sources such as corn stubble or flooded fields (Toochin, pers. com.).



**Figure 18. An example of a gray phase gyrfalcon perched (left) and in flight (right) as would be seen in the study area. (photos: G. Gadsden, 1996)**

### 3.1.10 Peregrine Falcon

Peregrine falcons are a medium sized falcon common in the study area during winter (Bland, et al., 2001.). Their plumage is a uniform dark gray on their back, with uniformly patterned dark streaks on white on their belly and under-wing (Figure 19). Immature birds are similar but brown (Figure 19). Their head displays a dark 'helmet' with dark 'mustache' extending down below their eye. Wingtips on perched birds extend to the tail tip. Peregrine falcons mainly feed on birds such as waterfowl and small birds, and were often found hunting in various field types except grassland set-asides (pers. obs.).

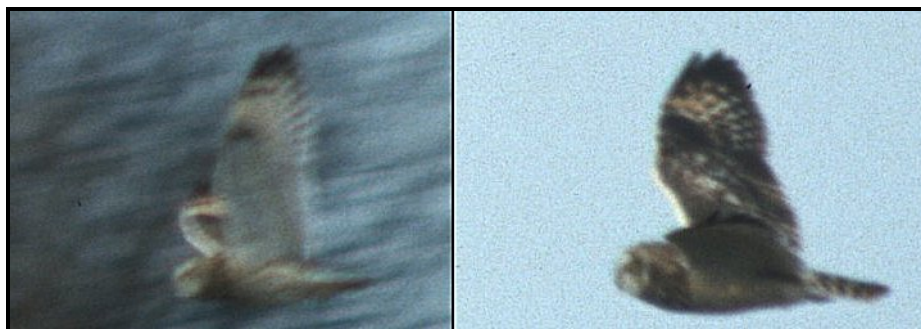




**Figure 19. Typical immature (left) and adult (right) examples of peregrine falcons as found in the study area (photos: G. Gadsden, 2003).**

### **3.1.11 Short-eared Owl**

An uncommon diurnal owl in the study area, (Bland, et al., 2001.) short-eared owls are similar in size to northern harriers. Their plumage is spotted on their backs, streaked on their bellies. They have a distinct owl facial disk and very short tails. Flight patterns are floating and buoyant, not dissimilar to the flight of a butterfly (pers. obs.). Their long wings are light below and distinctively barred at the wingtips (Figure 20). Small mammals caught while hunting long grass habitats are a primary food source (Merkens, pers. com.).



**Figure 20. Example of the underwing (left) and upperwing (right) of a short-eared owl as found in the study area (photos: G. Gadsden, 2003).**



## 4.0 Results and Discussion

Eleven species of raptor were identified during the study. Bald eagles were most commonly encountered followed by northern harriers (Figure 21). Gyrfalcon and merlin were encountered the least. In many instances the same bird, evident by unique plumage markings and being found in the same location, was counted each study day. This was most obvious for rough-legged hawks but very likely occurred for each species. With this in mind, the following information indicates relative abundance rather than size of a population.

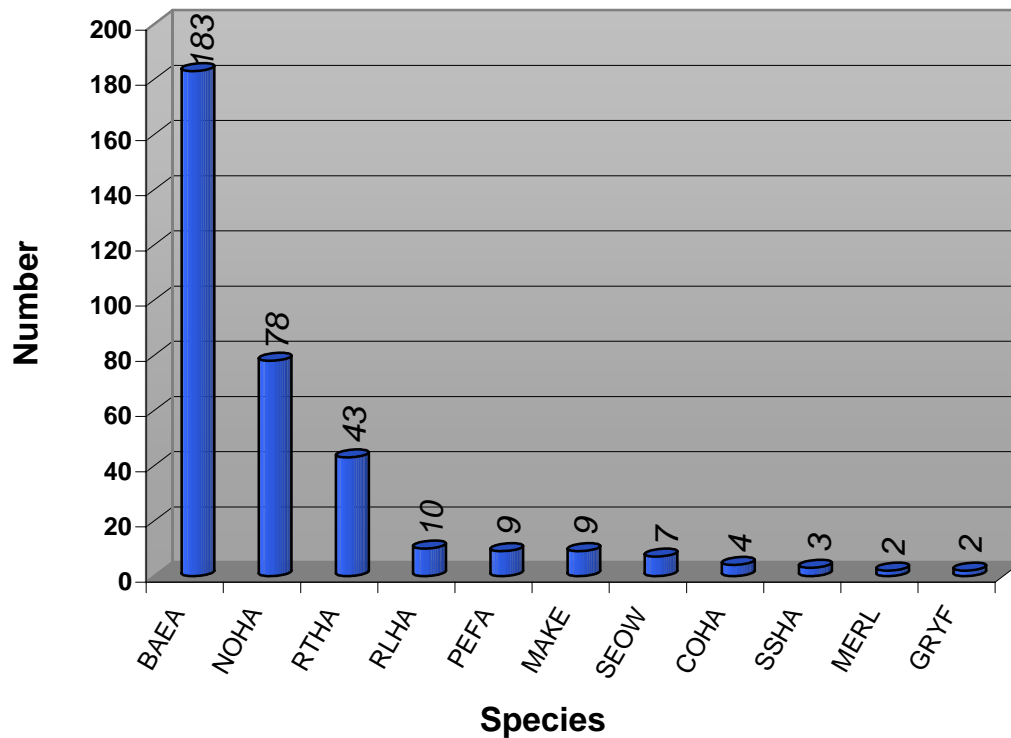


Figure 21. Total encounters of each raptor species for the entire study. Species are indicated by their species code.



## 4.1 Abundance Trends

Abundance trends were calculated for some raptor species encountered during the survey. These species included bald eagle, northern harrier and red-tailed hawk as they had high detections allowing accurate trend calculations. Trends could not be detected for the rest of the species encountered in the study as they occurred in low numbers not allowing accurate trends to be calculated.

### 4.1.1 Northern Harrier

Northern harrier detections were consistent through out the first five study days but dropped dramatically towards the end of the survey (Figure 22 ). This trend is consistent with northern harrier behavior of wintering in the delta and leaving by late winter for breeding areas. This trend is often weather dependent. During mild winters northern harriers leave for breeding grounds sooner than during harsh winters where they remain longer in the delta (Merkens, pers. com.). As this was a relatively mild winter, the harriers apparently left for breeding areas earlier than in 2001 (Bland et al., 2001).

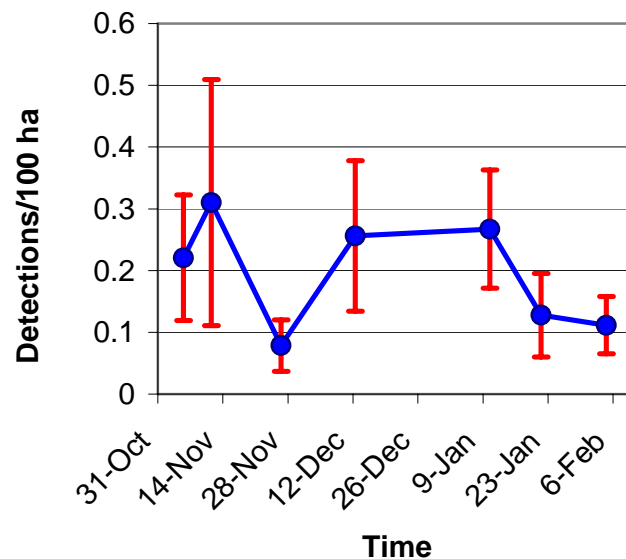


Figure 22. Population trend of northern harriers determined to 90% confidence level as detected during the study.



#### 4.1.2 Red-tailed Hawk

The detection rate for red-tailed hawks remained fairly consistent during the survey (Figure 23). As red-tailed hawks remain in the area for the whole winter and do not experience much movement until early spring, variance in number of detections are possibly attributed to factors such as weather and study crew variance rather than actual abundance change.

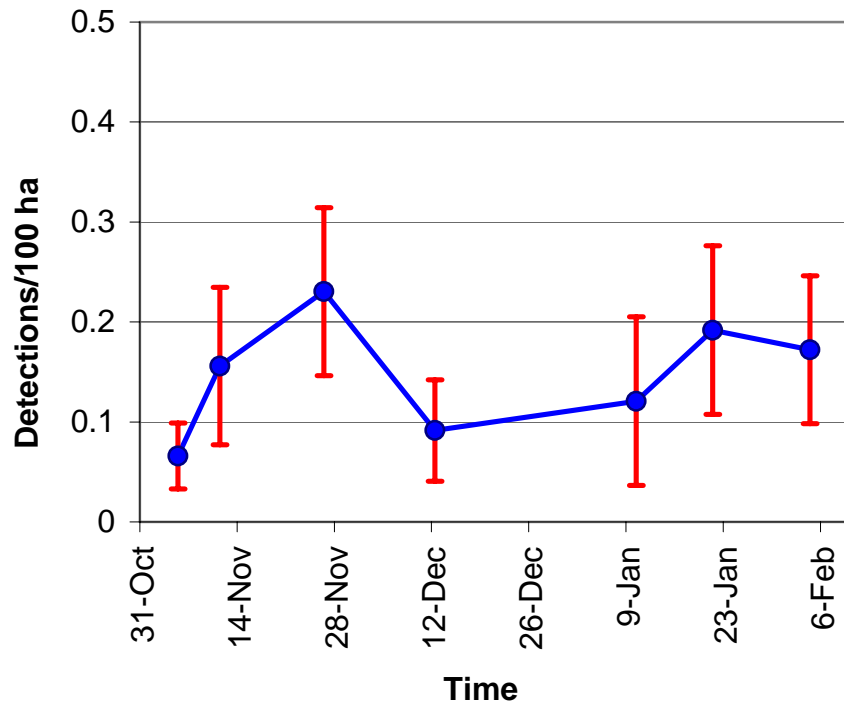


Figure 23. Population trend of red-tailed hawks determined to 90% confidence level as detected during the study.

#### 4.1.3 Rough-legged Hawk

Due to low numbers, we could not calculate abundance trends for rough-legged hawks. From our observations, we found that most rough-legged hawks we detected during the study were the same bird found in the same general location. This indicates that there was possibly little or no movement of individuals in or out of the study area for the duration of the study.



#### 4.1.4 Bald Eagle

The abundance of bald eagles progressively increased throughout the study (Figure 24). This could indicate that food supplies that sustained the eagles during the first part of the winter in other areas had disappeared. This lack of food would cause the eagles to move to new areas, such as the study area, to find food. This hypothesis is supported by fish carcasses, a main food source for eagles, tends to fluctuate in abundance and is often hard to find later in winter (Dunwiddie and Kuntz, 2000).

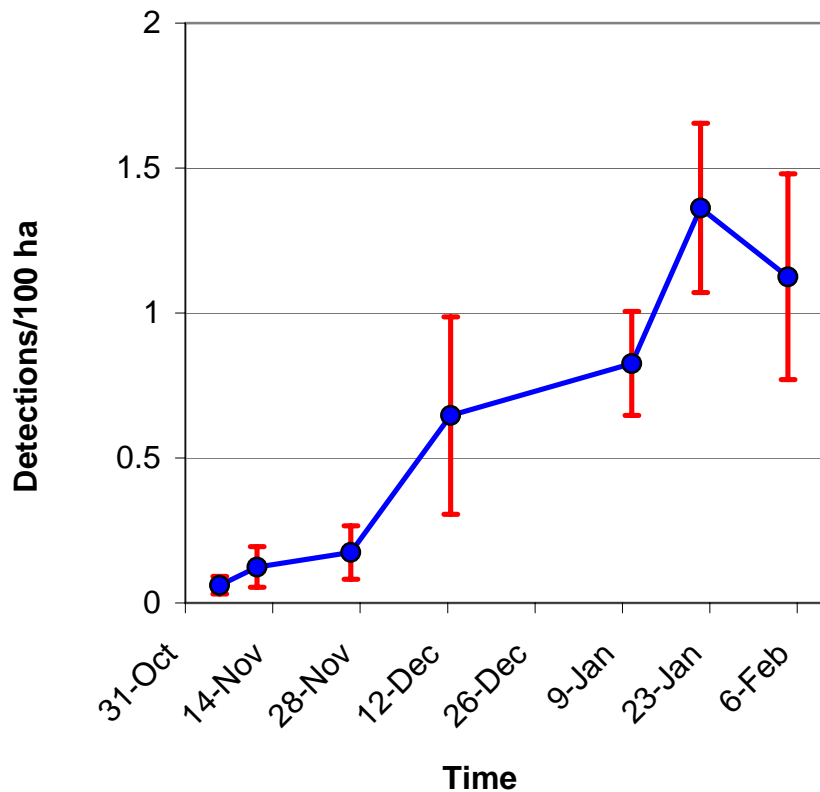


Figure 24. Population trend of bald eagles determined to 90% confidence level as detected during the study.

#### 4.1.5 Merlin

Two merlins were detected throughout the entire study. This differs significantly from the study conducted in 2000-01 with nineteen merlin detections. Possible reasons for the discrepancy could be misidentifications with peregrine falcons or a variation of wintering



merlin numbers. This variation in wintering numbers often depends on population number fluctuations or whether the winter is cold or mild. Variations in population sizes and weather patterns can effect the number of merlins found in the study area from year to year (Merkens pers, com.).

## **4.2 Habitat Type Usage**

Habitat type usage was only calculated for northern harriers, red-tailed hawks and bald eagles. These species had high enough number of detection rates to allow habitat preference or avoidance calculations while the rest had too few detection numbers to allow accurate habitat type usage calculations. Using the proportion of each habitat type available in the study area and comparing the number of detections of each species using each field type, we were able to calculate habitat preference and avoidance. Habitat preference was discovered where number of detections are higher than the habitat type's proportion. Where number of detections are lower than the habitat type proportion, habitat avoidance was revealed.

### **4.2.1 Northern Harrier**

Northern harriers slightly preferred winter cover crop and bare field types. A strong preference was shown for tall grass habitat (Figure 25) as high detections were recorded for the study area's lowest proportion habitat type. Northern harriers displayed habitat avoidance towards the remaining field types. Detections in these types were often birds in flight heading towards tall grass habitats and not utilizing the avoidance type habitat for hunting but rather as an access corridor between preferred habitats. This indication of strong relationship between northern harriers and tall grass habitats, makes northern harriers dependant on this habitat type. Northern harrier's tendency to utilize the cover provided by tall grass is a major reason this habitat type is needed by this species. Their preferred food and hunting methods are also complimented by tall grass habitat types. With lower available tall grass habitat than historically existed in the Delta area, the current ability for the Delta to sustain historical wintering northern harrier numbers has



decreased. Increased intense urbanization and development trends in the area will surely threaten northern harrier's ability to winter in the area if this habitat type is not protected.

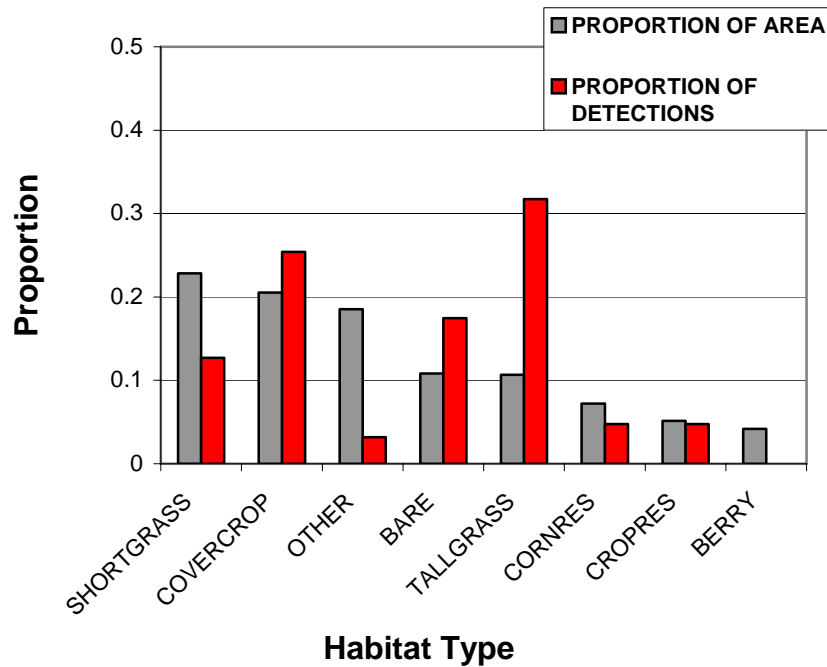


Figure 25. Graph showing habitat type usage and avoidance by northern harriers during the study.

#### 4.2.2 Red-tailed Hawk

A slight preference for crop residue and winter cover crop habitat types was calculated (Figure 26). A stronger preference for tall grass and bare field habitat types was calculated. This data indicates that red-tailed hawks are not highly dependant on one field type and are capable of utilizing several different field types. A strong avoidance tendency was identified for the other field type, suggesting that red-tailed hawks avoid human-made structures in their habitats.

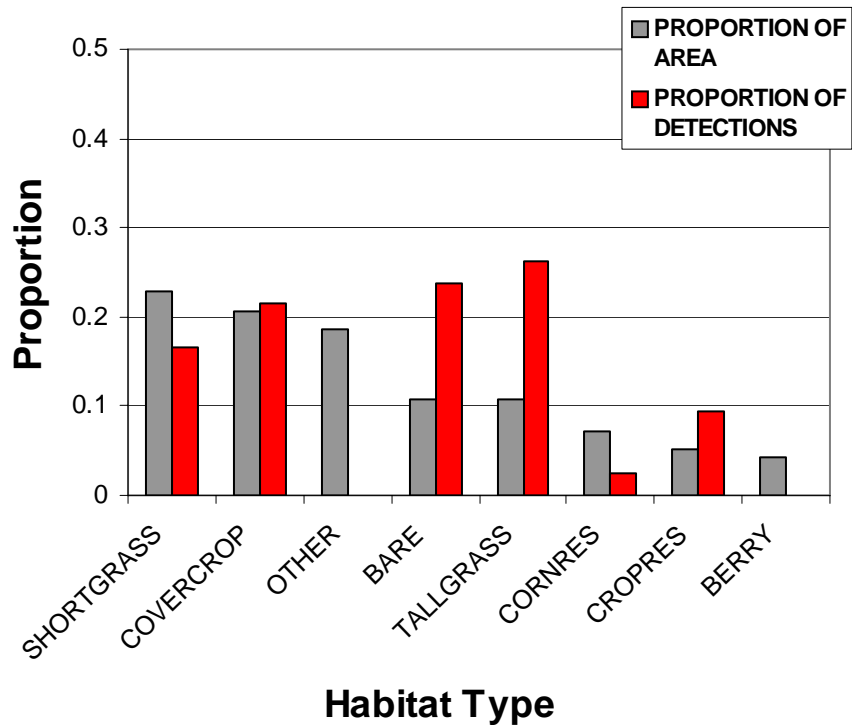


Figure 26. Graph showing habitat type usage and avoidance by red-tailed hawks during the study.

#### 4.2.3 Bald Eagle

Bald eagles showed preference for different habitat types than found with the previous species discussed. Winter cover crop and short grass habitat types were preferred while crop residue and other habitat types were avoided (Figure 27). Bald eagles feed on waterfowl and are attracted to habitat types that attract high numbers of waterfowl (Merckens, pers. com.).



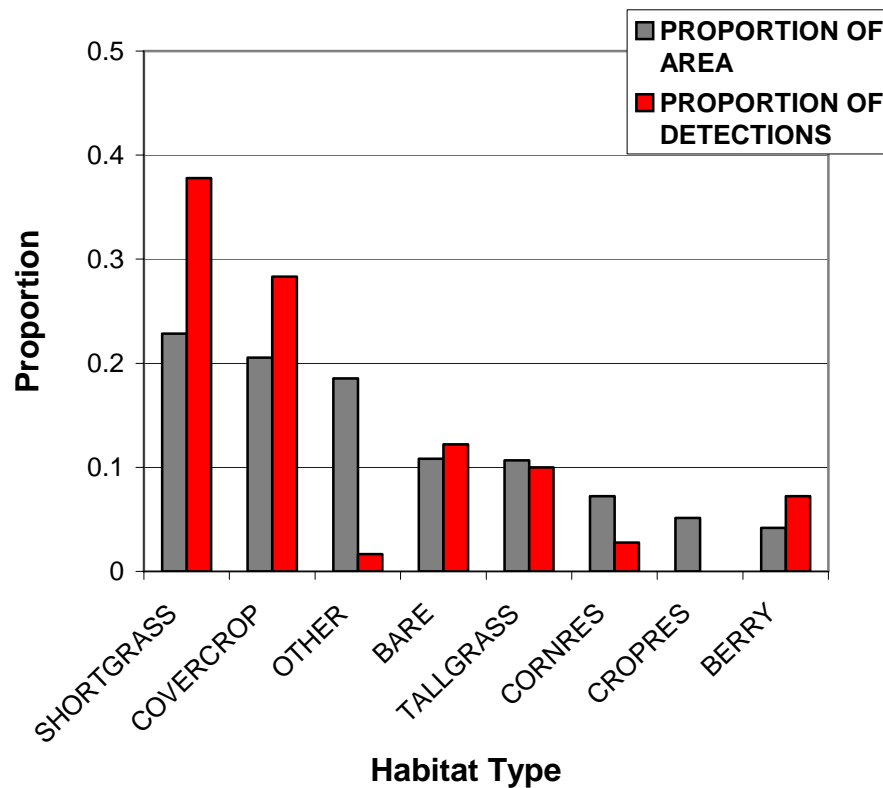


Figure 27. Graph showing habitat type usage and avoidance by bald eagles during the study.

### 4.3 Limitations of Survey Techniques

Weather conditions was one of the main limiting factors in the study. Although weather conditions were fairly consistent for study days during our study, the potential for weather bias was there. Light winds and weather variation extremes of clear days to cloudy days with light showers were found on the study days. A minimal amount of weather bias was introduced in this study. As cited in the RISC 2001 manual, winds over 30 km/h and heavy rains can cause raptors change their behavior from being easily detected while actively hunting to being hard to see while they seek shelter in dense cover. The consequence from adverse weather conditions is the introduced bias it presents on a study's results. In a study such as ours with limited time available to collect



data, the potential for adverse weather conditions to reduce the number of useable study days was a real threat.

Northern harrier's tendency to perch in tall grass thus making them difficult to detect introduced detectability bias. This was compensated for by removing all detections of perched northern harriers. Bald eagles are easily seen as they tend to perch conspicuously in trees and on open ground. The detectability of each species in the study area should be considered when comparing one species' habitat use tendencies against others'.

## **5.0 Recommendations**

In order to observe long term trends of raptors in the Delta area, studies that follow the same methodology should be conducted each winter. Extending surveys to include summer would be useful to determine summer usage of the area.

The DF & WT should continue to protect tall grass habitats. This habitat is heavily depended upon by northern harriers. A loss of northern harrier numbers could be the result if tall grass habitats are lost.

Weather records should be located to correspond with this study and ones done in the past. These records could be important to help interpret population trends and arrival and departure dates of wintering raptors in the study area.

Bald eagle movements into the Delta area during mid winter likely correspond to their movements out of other areas at a similar timing. Obtaining data from areas where bald eagles congregate in late fall may display some interesting facts.



Incorporating more survey days from the current eight to perhaps twelve or more will allow freedom to discard survey days biased by weather or other factors while still allowing enough study days to obtain enough data.

Short grass habitat types, consisting of pasture, turf farms, golf courses and residential lawns may need to be separated. Turf farms, golf courses and residential lawns are heavily modified with herbicides and frequently mowed to benefit one species of grass to grow, creating an unnatural landscape. Pasture fields are grazed by livestock and consist of a more natural conglomeration of several grass species and weeds. Combining the pastures with the other short grass habitat members may make turf farms, golf courses and residential lawns seem more beneficial than they truly are. An example would be that most rough-legged hawks detected on this study were found on short grass habitats. More accurately, each short grass habitat detection for rough-legged hawks were made on pasture fields and not turf farms or golf courses.



## 6.0 References

### 6.1 References Cited

Anonymous. n.d. Available from: *www.mapquest.com* via the internet. Accessed 2003 Dec 23.

Delta Farmland and Wildlife Trust. 2000. *Farmland & Wildlife: Grassland Set-Asides*. Jan: No. 2.

Dunwiddie, P. Kuntz, R. 2000. *Long-Term Trends of Bald Eagles in Winter on the Skagit River, Washington*. *Journal Of Wildlife Management* 65(2):290-299.

Ehrlich, P., Dobkin, D., Wheye, D. 1988. *The Birder's Handbook*. New York: Simon and Schuster Inc.

Reifel Bird Sanctuary. *International Significance of the Fraser River Estuary*. <http://www.reifelbirdsanctuary.com/fraser2.html>. Accessed 2003 Dec 16.

RISC 2001. Components of British Columbia's Biodiversity No. 11. *Inventory Methods for Raptors*. Ministry of Water, Land and Air Protection. Victoria. B.C.

Bland, J., Kalyn, S., Rogers, D., Saunders, L. 2001. Winter Raptor Abundance and Habitat Use Delta, British Columbia 2000 –2001. BCIT

Sibley, D. 2000. *The Sibley Guide to Birds*. New York: Alfred A Knopf, Inc.

### 6.2 Personal Communication

Markus Merkens, Wildlife Biologist. Delta Farmland and Nature Trust. 604-940-3392

Doug Ransome, RENR 3220 Instructor. BCIT. 604-431-4985

Rick Toochin, Vancouver Natural History Society. Private contact at contact's request.

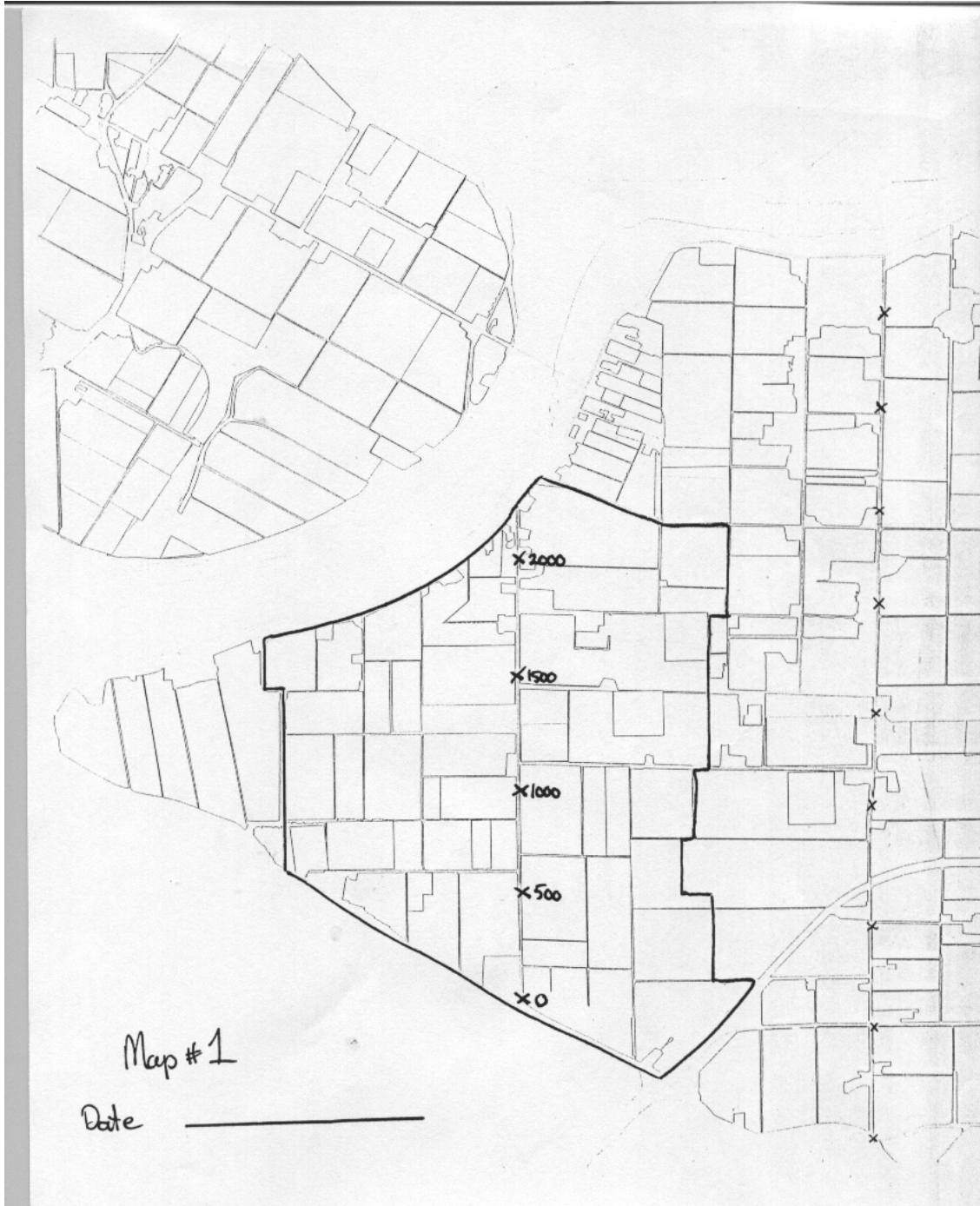
### 6.3 Additional References

Kaufman, K. 1990. *A Field Guide to Advanced Birding*. New York: Houghton Mifflin Company.

RISC. 1998. Components of British Columbia's Biodiversity No. 11 [Forms]. *Inventory Data forms for Raptors*. Ministry of Water, Land and Air Protection. Victoria. B.C.



**Appendix 1: Sample transect map displaying a portion of Figure 10 showing the boundary of transect #1 outlined in black. 0 through 2000 are survey stations positioned 500 metres apart along the transect line located on 34<sup>th</sup> St.**





**Appendix 2: Sample data sheet on which data collected in the field was recorded for the study.**

Map	Trans	Station	Ref #	Time	Rain	Wind	Cloud	Species	Sex/age	Behaviour	Notes