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# Wildlife Risk Management at Vancouver International Airport

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### **Wildlife Risk Management at Vancouver International Airport**

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### **INTRODUCTION**

The Vancouver International Airport (YVR) is the second busiest airport in Canada. YVR is located on Sea Island in the Fraser River Estuary - a world-class wintering and staging area for hundreds of thousands of migratory birds. The Fraser Delta supports Canada's largest wintering populations of waterfowl, shorebirds, and raptors. The large number of aircraft movements and the presence of many birds near YVR pose a wide range of considerable aviation safety hazards. Until the late 1980s when a full-time Wildlife Control Program (WCP) was initiated, YVR had the highest number of bird strikes of any Canadian commercial airport.

Although the risks of bird strikes associated with the operation of YVR are generally well known by airport managers, and a number of risk assessments have been conducted associated with the Sea Island Conservation Area, no quantitative assessment of risks of bird strikes has been conducted for airport operations at YVR. Because the goal of all airports is to operate safely, an airport wildlife management program strives to reduce the risk of bird strikes. A risk assessment establishes the current risk of strikes, which can be used as a benchmark to focus wildlife control activities and to assess the effectiveness of the program in reducing bird strike risks. A quantitative risk assessment also documents the process and information used in assessing risk and allows the assessment to be repeated in the future in order to measure the change in risk over time in an objective and comparative manner.

This study was undertaken to comply with new Canadian legislation expected to take effect in 2006 requiring airports in Canada to conduct a risk assessment and develop a wildlife management plan. Although YVR has had a management plan for many years, it took this opportunity to update the plan and conduct a risk assessment.

### **Study Area**

YVR is located on Sea Island, a 1538 ha island at the outer edge of the Fraser Delta, between Vancouver and Richmond, British Columbia. The Fraser River delta qualifies as an area of international significance for migratory birds under terms from the Ramsar Convention of 1971. The estuarine marshes at the mouth of the Fraser River and the salt marshes and beaches of Boundary Bay are the most important habitats in this area, but farmlands and uplands that are adjacent to these marshes and beaches are used as feeding and roosting areas. Up to 1,200,000 shorebirds, 750,000 waterfowl and 180,000 gulls may pass through and use the Fraser River delta each year during migration. Sea Island is an important component of the Fraser River foreshore and delta wildlife habitats. The mild winters combined with the abundant productivity of vegetation during the summer season attract large numbers of migrating and wintering raptors, great blue herons, gulls, shorebirds and waterfowl.

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### Methodology

The process of risk assessment used in this document generally follows that of Allan (2001). In this study, risk is defined as the product of the probability and severity of bird strikes during a predefined period (Figure 1).

Severity is best described as the percentage of strikes causing damage. However, data are often inconsistent in this respect since some aircraft operators report the bird strike, but do not report the damage sustained. However, there is a very high correlation between the weight of a bird and the probability that it will cause damage if struck by an airplane (Dolbeer et al. 2000). This approach has been further developed by LGL Limited using weight of each species and flocking behaviour to assign species to one of six hazard categories which I have used as synonymous with severity for the purpose of risk assessment.

Probability is measured variously according to the specific risk assessment being conducted. Those measures include numbers of birds present, numbers of strikes, and weight of struck birds. The probability parameters are discussed in the appropriate paragraphs below.

Risk was assessed in a variety of ways to examine the risk posed to aircraft by individual species or species groups without the wildlife control program and the residual risk with the current wildlife control program. Risk was also assessed for all species on a monthly and annual basis.

Severity Category	Probability					Hazard Category
	Very Low	Low	Moderate	High	Very High	
Very High	High	Very High	Very High	Very High	Very High	Category 1
High	Moderate	High	High	Very High	Very High	Category 2
Moderate	Low	Moderate	Moderate	High	High	Category 3
Low	Very Low	Low	Low	Moderate	Moderate	Category 4
Very Low	Very Low	Very Low	Low	Low	Low	Cat 5 & 6
<b>Bird Days Since 2000</b>	0-14,160	14,161-28,320	28,321-70,800	70,801-141,600	>141,600	
<b>Annual number of strikes</b>	0-1	>1-2	>2-5	>5-10	>10	

**Figure 1. Risk assessment matrix.**

### Results and Discussion

#### Avian Risks without a Bird Control Program

Because the measure of risk is defined as the probability that a species or group of birds will cause a strike times the associated harm that is likely to occur, we need to develop a measure for

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each of those parameters. The probability of a strike without a bird control program is likely to be somewhat related to the number of birds present in the vicinity of the airport. This measure is not completely related to the likelihood of birds being struck by aircraft because some species are either more adept at avoiding aircraft or more wary of aircraft movements and thus avoid being struck. Nevertheless, abundance at YVR should be a relatively good measure of probability. Because of issues with variable survey efforts during bird monitoring surveys since 2000, probability was based on the number of bird days a species or group of species is present at the airport. A bird day is simply one bird present at the airport for 1 day. Thus, for example, 10 bird days can occur when one bird is present for 10 days or 10 birds are present for 1 day.

Using number of bird days since 2000 for probability and hazard category for severity, the resulting risk assessment matrix is presented in Figure 1 above. The probability is divided into five categories of number of bird days and range from very low to very high.

The information required to determine the risk levels from Figure 1 is summarized by bird group in Table 1 with the associated risk assigned. The detailed results of the risk assessment are presented in Appendix 1.

**Table 1. Risk assessment (no control) results by bird groupings.**

Species	No. Bird Days	Hazard Category	Risk
Loons	10,710	2-3	Moderate
Grebes	27,864	2-4	Moderate
Cormorants	57,076	2-3	Moderate
Hérons & Bitterns	29,842	2	High
Waterfowl	3,553,780	1-3	Very High
Swans	3,202	1	High
Geese	664,879	1-2	Very High
Ducks	2,885,699	2-3	Very High
Raptors	24,574	2-5	Moderate
Hawks & Eagles	23,928	2-4	Moderate
Falcons	630	4-5	Very Low
Pheasants	464	3	Low
Coots	15,765	3	Moderate
Shorebirds	1,306,036	3-5	Low
Gulls	424,070	2-4	Very High
Terns	6,919	3-4	Low
Pigeons & Doves	58,986	3-4	Moderate
Owls	422	2-4	Low
Swallows & Swifts	60,124	5-6	Low
Kingfishers	155	5	Very Low
Woodpeckers	1,286	5	Very Low
Jays, Crows & Ravens	226,559	3-5	High
Starlings	501,499	4	Moderate
Other Passerines	62,419	4-6	Low

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### Residual Risks

The use of birdstrikes as a measure of probability has advantages and disadvantages. The advantages are that this measure encompasses the effectiveness of the wildlife control program, as well as bird abundance, movement, behaviour and other traits that make birds more or less susceptible to being struck by aircraft. The disadvantages are that relatively long time series are required to derive accurate probabilities and biological (e.g., species abundance, movement patterns, etc.) and operational (e.g., aircraft movements, aircraft types, etc.) attributes may change over the time period rendering the derived probabilities invalid for present or future conditions. Recognizing the limitations, the rate of birdstrikes was used as the measure of probability of birdstrikes with control in place. While birdstrike data are available for YVR dating back many years, only the data since 2000 are considered in this risk assessment as representative of current conditions at YVR.

The information required to determine the risk levels from the risk assessment matrix presented in Figure 1 is given in Table 2. The risk levels generated from the data are entirely dependent upon the grouping chosen. Obviously, the larger the group the more strikes per year there will be thus raising the probability level. Large groups also complicate assigning a hazard level since birds from two or more hazard levels may be grouped together. While grouping birds by species is the logical and least subjective approach, this may not always be the best approach from an operational viewpoint where species are controlled as a group (e.g., ducks) rather than as individual species (e.g., Bald Eagles).

The results of the risk assessment whether conducted by bird abundance (bird days) or by number of strikes/year produce similar, though not identical, results (Table 3). It should come as no surprise that the large, flocking, and abundant birds at YVR such as ducks, geese and gulls pose the greatest risk. Swans are not abundant at YVR, but because of their size pose a high risk regardless of numbers.

About one-third of the groups of birds representing more than one-half of the bird days of use of YVR had a reduction in risk level when bird behaviour and the wildlife control program was factored in (i.e., risk was assessed by number of strikes). Species such as grebes, cormorants and coots typically spend a large portion of their time in the water and when they do fly, they do so at very low altitudes and generally do not fly over land at YVR. Thus they would be expected to pose a lower risk than their numbers would suggest. Rock pigeons tend to occupy buildings associated with the terminals, hangars and other airport buildings and tend not to fly far from these structures. They too would be expected to be a lower risk than determined by their abundance. Northwestern crows have a much lower risk as determined by strikes than by abundance. Crows appear to be able to avoid striking aircraft through behavioural responses and thus a lower risk than expected is consistent with general knowledge of this species with respect to bird hazards to aircraft.

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Table 2. Risk assessment data and risk levels.

Bird Type	Risk Level	No. Strikes	Strikes/Yr	No. Struck	No Struck/Yr	TC Category	Weight (g)	Notes
<b>Loons Common &amp; Red-throated)</b>	<b>Moderate</b>	0	0.0	0	0.0	2	1551-4134	
<b>Grebes (Horned &amp; Western)</b>	<b>Low-Moderate</b>	0	0.0	0	0.0	2-3	453-1477	
<b>Cormorants (Double-crested)</b>	<b>Low</b>	0	0.0	0	0.0	3	1674	
<b>Great Blue Heron</b>	<b>Moderate</b>	5	1.2	5	1.2	2	2390	
<b>Waterfowl</b>	<b>High-Very High</b>	39	9.0	86	19.9	1-3		
<b>Ducks</b>	<b>High-Very High</b>	30	6.9	67	15.5	2-3		
American Wigeon	Moderate	8	1.8	25	5.8	3	755.5	
Gadwall	Low	3	0.7	4	0.9	3	919.5	
Mallard	Moderate	1	0.2	1	0.2	2	1082	
Northern Pintail	Moderate	1	0.2	1	0.2	2	1010.5	
Unidentified Teal	Low	1	0.2	1	0.2	3	363.5	+++
Unidentified Duck	Moderate	15	3.5	31	7.2	3	795.4	*
Unidentified Duck & Dunlin	Low	1	0.2	4	0.9	3	936.1	
<b>Geese</b>	<b>Very High</b>	9	2.1	19	4.4	1		
Canada Goose	High	1	0.2	1	0.2	1	5786	
Snow Goose	Very High	8	1.8	18	4.2	1	2630.5	
<b>Swans</b>	<b>High</b>	0	0.0	0	0.0	1	10850	
<b>Raptors</b>	<b>Moderate-High</b>	30	6.9	35	8.1	2-5		
Bald Eagle	Moderate	4	0.9	4	0.9	2	4740	
Merlin	Very Low	1	0.2	1	0.2	5	190.5	
<b>Hawks</b>	<b>Moderate-High</b>	25	5.8	26	6.0	3-4		
Northern Harrier	Low	8	1.8	8	1.8	4	435.5	
Rough-legged Hawk	Very Low	2	0.5	2	0.5	4	956	
Red-tailed Hawk	Moderate	8	1.8	8	1.8	3	1126	
Unidentified Hawk	Low	7	1.6	8	1.8	4	539.6	***
<b>Ring-necked Pheasant</b>	<b>Low</b>	0	0.0	0	0.0	3	1135	
<b>American Coot</b>	<b>Low</b>	0	0.0	0	0.0	3	642	
<b>Shorebirds</b>	<b>Low</b>	21	4.8	431	99.5	5		
Dunlin	Low	19	4.4	423	97.7	5	46.9	
Western Sandpiper	Very Low	1	0.2	3	0.7	5	23.3	
Unidentified Sandpiper	Very Low	1	0.2	1	0.2	5	46.7	+
<b>Gulls</b>	<b>High</b>	23	5.3	24	5.5	3		
Unidentified Gull	Moderate	21	4.8	22	5.1	3	766.75	**
Unidentified Gull & Dunlins	Low	1	0.2	5	1.2	3	954.35	
Unidentified Gull & Barn Swallow	Low	1	0.2	2	0.5	3	782.75	
<b>Terns</b>	<b>Low</b>	0	0.0	0	0.0	3-4	655	
<b>Pigeons &amp; Doves</b>	<b>Low</b>	0	0.0	0	0.0	3	335	
<b>Owls</b>	<b>Moderate</b>	34	7.9	34	7.9	2-4		
Common Barn-owl	Low	16	3.7	16	3.7	4	523.5	
Short-eared Owl	Low	6	1.4	6	1.4	4	346.5	
Snowy Owl	Moderate	1	0.2	1	0.2	2	2042.5	
Unidentified Owl	Low	11	2.5	11	2.5	4	543.4	^
<b>Belted Kingfisher</b>	<b>Very Low</b>	0	0.0	0	0.0	5	148	
<b>Northern Flicker</b>	<b>Very Low</b>	0	0.0	0	0.0	5	132	
<b>Perching Birds</b>	<b>Low-Moderate</b>	124	28.6	242	55.9	3-6		
Northwestern Crow	Low	4	0.9	4	0.9	3	391.5	
European Starling	Moderate	23	5.3	38	8.8	4	82.3	
Savannah Sparrow	Very Low	1	0.2	4	0.9	6	20.1	
Snow Bunting	Very Low	1	0.2	6	1.4	5	42.5	
<b>Swallows</b>	<b>Low</b>	95	21.9	190	43.9	5		
Barn Swallow	Low	62	14.3	124	28.6	5	16	
Cliff Swallow	Very Low	1	0.2	1	0.2	5	21.6	
Unidentified Swallow	Low	32	7.4	65	15.0	5	16.0	++
<b>Unidentified Bird</b>		177	40.9	180	41.6		264.7	^^
<b>Grand Total</b>		453	104.6	1034	238.8			

\* Weighted average of strikes with ducks of known species at YVR

\*\* Average of Average of Thayers, Ring-billed, Mew & Glaucous-winged Gulls

\*\*\* Weighted average of strikes with hawks of known species at YVR

+ Weighted average of Dunlin and Western Sandpiper strikes at YVR

++ Weighted average of Barn & Cliff Swallow strikes at YVR

+++ Average of Green-winged and Blue-winged Teal

^ Weighted average of strikes with owls of known species at YVR

^^weighted average of all strikes at YVR

^^^Avian surveys are not conducted at night and, therefore, do not accurately census owls

**Table 3. Summary of risk levels with and without bird control at YVR.**

Species/Group	Risk Level (No Control)	Risk Level (With Control)
Geese	Very High	Very High
Ducks	Very High	High-Very High
Gulls	Very High	High
Trumpeter Swans	High	High
Great Blue Herons	High	Moderate
Northwestern Crows	High	Low
Loons	Moderate	Moderate
Grebes	Moderate	Low-Moderate
Cormorants	Moderate	Low
Hawks & Eagles	Moderate	Moderate-High
American Coots	Moderate	Low
Pigeons & Doves	Moderate	Low
European Starlings	Moderate	Moderate
Ring-necked Pheasants	Low	Low
Shorebirds	Low	Low
Terns	Low	Low
Owls	Low	Moderate
Swallows	Low	Low
Other Passerines	Low	Low-Moderate
Falcons	Very Low	Very Low
Kingfishers	Very Low	Very Low
Woodpeckers	Very Low	Very Low

Of equal interest are those species or groups of birds whose assessed risk is higher using strikes as the measure of probability rather than abundance. The higher risk associated with owls is easily explained in that the abundance of owls is underestimated by monitoring surveys conducted during the daytime thus under-representing the probability and hence the overall risk posed by owls. However, this likely does not reflect the entire difference in assessed risks for two reasons: nocturnal owls are difficult to control because they are difficult to see at night and do not react readily to most wildlife control procedures, and owls, especially immature owls, seem more-or-less oblivious to aircraft while hunting and thus are prone to being struck. Hawks have a slightly higher assessed risk on the basis of strikes than by abundance, likely due to the fact that they are difficult to control and spend a large amount of time hunting on the airfield in the air.

The results of the risk assessment can be used to set priorities for wildlife control at YVR as well as providing a measure (though not the sole measure) of the success of the wildlife control program.

### **Total Risk at YVR Posed by Birds**

The assessment of risk by species and species groups is a useful tool to understand what birds contribute most to the overall risk. This information is essential in order to direct effort in wildlife control programs towards the most hazardous species as determined by risk assessment.

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However, the assessment of risk is not complete without a discussion of the total seasonal and annual risk posed by birds at YVR. In order to assess total risk, it is necessary to be able to combine strikes caused by birds with very different body sizes and masses in a manner that acknowledges the different risks posed by various-sized birds. Previously, I introduced the concept of using strike weight rather than strike numbers to track the risk posed by strikes (Searing 2001). This approach lends itself very well for assessing total risk posed by birds to aircraft. Severity of damage was assessed using the mean weight of strikes divided into the weight categories that separate the various hazard categories used in Figure 1. Probability was represented by total weight of birds struck at YVR during the period. Risk was assessed by month and by year using this approach (see Figure 2 and Table 4).

Figure 2. Monthly risk assessment for YVR.

	Total Weight					
	<2500g	2501-5000	5001-10000g	10001-20000	>20000g	
Mean Weight	>1800 g			MY04		NO02 DE01
	1001-1800g	FE05		JA05 OC03 OC02 AP02 FE02 FE01	DE03 FE00 AP05	
	301-1000g	MR05 DE04 MY03 MR03 MY01	MY05 MR04 AP03 FE03 SE02 JN02	AP04 FE04 JA03 MY02 MR02 JA02 OC01 JN01 MR01 OC00 MR00 JA00	JA04 NO03 NO01 AP01 NO00	NO04
	101-300 g	JL04 JN04 JL03 JN03 AU02 JL02 JL00	SE04 AU03 AU01 JN00 MY00	OC04 DE02 JA01 AU00	AP00	DE00
	0-100g	SE03 SE01 JL01	AU04	SE00		

  

	Very Low
	Low
	Moderate
	High
	Very High



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Table 4. Risk frequency by month at YVR.

Month	Very Low	Low	Medium	High	Very High
January	0	1	0	5	0
February	0	0	2	3	1
March	0	2	1	3	0
April	0	0	2	3	1
May	0	3	1	1	1
June	0	3	1	1	0
July	1	4	0	0	0
August	2	4	0	0	0
September	3	1	1	0	0
October	0	1	0	4	0
November	0	0	0	4	1
December	0	2	1	0	2

Generally, the winter months when large numbers of large-bodied and/or flocking birds are present at YVR are the highest risk periods. Surprisingly, the month of December was often an exception with high risk in only 2 of the 5 years for which data were analysed. Similarly, the summer months of June-September were periods of lower risk resulting from fewer and typically smaller birds being present at the airport.

In order to assess the risk posed by birds during the course of an entire year, a similar approach is used with the exception that the total weight categories were multiplied by 12 to account for the 12 months of the year. Accordingly, the years 2000 and 2003 were considered to be moderate risk, whereas 2001, 2002 and 2004 were considered years with high risk.

The use of quantitative monthly and annual risk measurements provide a useful tool to assess hazard conditions at the airport and allow managers to make immediate adjustments to the wildlife control program when increased risks warrant. The measurement, monitoring and management of risk produces a more effective environment for wildlife management at airports than a simple focus on reducing the total number of strikes which has dominated the mindset of many airport wildlife managers in recent times. Risk management forces managers and wildlife controllers to assess whether the effort spent on control is being directed at those species that contribute most to risk and whether the actions taken are contributing to a reduction in the overall risk to aircraft. Oftentimes this risk assessment approach results in a paradigm shift in the manner in which airport wildlife control programs are structured, managed and implemented resulting in real reductions in the risks posed to aircraft by birds at Canadian airports.

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## APPENDICES

### Appendix 1. Detailed results of risk assessment using bird-days as the measure of probability.

Species	No. Bird Days	TC Hazard	Risk
<b>Loons</b>	<b>10,710</b>	<b>2-3</b>	<b>Moderate</b>
Common Loon	2,541	2	Moderate
Pacific Loon	32	3	Low
Red-throated Loon	8,125	2	Moderate
Yellow-billed Loon	13	2	Moderate
<b>Grebes</b>	<b>27,864</b>	<b>2-4</b>	<b>Moderate</b>
Clark's Grebe	14	2	Moderate
Eared Grebe	76	4	Very Low
Horned Grebe	9,613	3	Low
Pied-billed Grebe	2,635	3	Low
Red-necked Grebe	828	2	Moderate
Western Grebe	14,700	2	High
<b>Cormorants</b>	<b>57,076</b>	<b>2-3</b>	<b>Moderate</b>
Double-crested Cormorant	56,182	3	Moderate
Pelagic Cormorant	167	3	Low
Unidentified Cormorant	727	2	Moderate
<b>Hérons &amp; Bitterns</b>	<b>29,842</b>	<b>36560</b>	<b>High</b>
American Bittern	51	4	Very Low
Great Blue Heron	29,428	2	High
Green-backed Heron	364	5	Very Low
<b>Waterfowl</b>	<b>3,553,780</b>	<b>1-3</b>	<b>Very High</b>
<b>Swans</b>	<b>3,202</b>	<b>1</b>	<b>High</b>
Trumpeter Swan	3,202	1	High
<b>Geese</b>	<b>664,879</b>	<b>1-2</b>	<b>Very High</b>
Brant	62	2	Moderate
Canada Goose	137,737	1	Very High
Greater White-fronted Goose	158	1	High
Snow Goose	526,922	1	Very High
<b>Ducks</b>	<b>2,885,699</b>	<b>2-3</b>	<b>Very High</b>
American Black Duck	40	2	Moderate
American Wigeon	1,005,294	3	High
Barrow's Goldeneye	5,097	2	Moderate

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Species	No. Bird Days	TC Hazard	Risk
Black Scoter	36	2	Moderate
Blue-winged Teal	2,612	3	Low
Bufflehead	12,284	3	Low
Canvasback	49,548	3	Moderate
Cinnamon Teal	2,223	3	Low
Common Goldeneye	3,022	2	Moderate
Common Merganser	1,452	2	Moderate
Dabbling Duck	2,813	2	Moderate
Diving Duck	13,930	2	Moderate
Eurasian Wigeon	517	3	Low
Gadwall	62,554	3	Moderate
Greater Scaup	109,450	3	High
Green-winged Teal	310,264	3	High
Hooded Merganser	3,102	3	Low
Lesser Scaup	37,095	3	Moderate
Long-tailed Duck	1,156	3	Low
Mallard	208,687	2	Very High
Northern Pintail	245,941	2	Very High
Northern Shoveler	31,688	3	Moderate
Red-breasted Merganser	13,541	2	Moderate
Redhead	44	2	Moderate
Ring-necked Duck	163	3	Low
Ruddy Duck	22,515	3	Moderate
Surf Scoter	311,118	3	High
Tufted Duck	29	3	Low
Unidentified Duck	169,013	2	Very High
Unidentified Merganser	32	2	Moderate
Unidentified Scaup	6,426	3	Low
Unidentified Scoter	245,825	3	High
White-winged Scoter	8,196	2	Moderate
<b>Raptors</b>	<b>24,574</b>	<b>2-5</b>	<b>Moderate</b>
Turkey Vulture	16	3	Low
<b>Hawks &amp; Eagles</b>	<b>23,928</b>	<b>2-4</b>	<b>Moderate</b>
Bald Eagle	8,738	2	Moderate
Cooper's Hawk	620	4	Very Low
Golden Eagle	7	2	Moderate
Northern Harrier	7,760	4	Very Low
Red-tailed Hawk	6,568	3	Low
Rough-legged Hawk	190	3	Low
Sharp-shinned Hawk	32	4	Very Low
Swainson's Hawk	9	3	Low
Unidentified Hawk	6	3	Low
<b>Falcons</b>	<b>630</b>	<b>4-5</b>	<b>Very Low</b>
American Kestrel	150	5	Very Low

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Species	No. Bird Days	TC Hazard	Risk
Merlin	204	5	Very Low
Peregrine Falcon	277	4	Very Low
<b>Pheasants</b>	<b>464</b>	<b>3</b>	<b>Low</b>
Ring-necked Pheasant	464	3	Low
<b>Coots</b>	<b>15,765</b>	<b>3</b>	<b>Moderate</b>
American Coot	15,765	3	Moderate
<b>Shorebirds</b>	<b>1,306,036</b>	<b>3-5</b>	<b>Low</b>
Baird's Sandpiper	7	5	Very Low
Black Turnstone	128	4	Very Low
Black-bellied Plover	212	4	Very Low
Wilson's Snipe	478	5	Very Low
Dunlin	1,189,644	5	Low
Greater Yellowlegs	464	5	Very Low
Killdeer	5,445	5	Very Low
Least Sandpiper	225	5	Very Low
Lesser Yellowlegs	507	5	Very Low
Long-billed Dowitcher	6,574	4	Very Low
Marbled Godwit	15	3	Low
Pectoral Sandpiper	281	4	Very Low
Semipalmated Plover	17	5	Very Low
Short-billed Dowitcher	52	4	Very Low
Solitary Sandpiper	59	6	Very Low
Spotted Sandpiper	1,198	5	Very Low
Unidentified Sandpiper	3,804	5	Very Low
Unidentified Shorebird	120	3	Low
Unidentified Yellowlegs	8	4	Very Low
Western Sandpiper	96,779	5	Low
Whimbrel	6	3	Low
Wilson's Phalarope	17	4	Very Low
<b>Gulls</b>	<b>424,070</b>	<b>2-4</b>	<b>Very High</b>
Black-legged Kittiwake	22	3	Low
Bonaparte's Gull	1,646	4	Very Low
California Gull	1,502	3	Low
Glaucous Gull	11	2	Moderate
Glaucous-winged Gull	250,416	2	Very High
Herring Gull	2,451	2	Moderate
Mew Gull	53,719	3	Moderate
Ring-billed Gull	27,283	3	Moderate
Sabine's Gull	17	4	Very Low
Thayer's Gull	22,187	2	High
Unidentified Gull	64,773	2	High
Western Gull	46	2	Moderate
<b>Terns</b>	<b>6,919</b>	<b>3-4</b>	<b>Low</b>
Caspian Tern	6,560	3	Low

## The Wildlife Control Program at YVR

Species	No. Bird Days	TC Hazard	Risk
Common Tern	359	4	Very Low
<b>Pigeons &amp; Doves</b>	<b>58,986</b>	<b>3-4</b>	<b>Moderate</b>
Band-tailed Pigeon	30	3	Low
Mourning Dove	22	4	Very Low
Rock Pigeon	58,934	3	Moderate
<b>Owls</b>	<b>422</b>	<b>2-4</b>	<b>Low</b>
Great Horned Owl	15	3	Low
Short-eared Owl	396	4	Very Low
Snowy Owl	12	2	Moderate
<b>Swallows &amp; Swifts</b>	<b>60,124</b>	<b>5-6</b>	<b>Low</b>
Barn Swallow	36,632	5	Low
Black Swift	58	6	Very Low
Cliff Swallow	4,946	5	Very Low
Northern Rough-winged Swallow	1,008	5	Very Low
Tree Swallow	9,559	5	Very Low
Violet-green Swallow	7,921	5	Very Low
Unidentified Swallow	1920	5	Very Low
<b>Kingfishers</b>	<b>155</b>	<b>5</b>	<b>Very Low</b>
Belted Kingfisher	155	5	Very Low
<b>Woodpeckers</b>	<b>1,286</b>	<b>5</b>	<b>Very Low</b>
Northern Flicker	1,286	5	Very Low
<b>Jays, Crows &amp; Ravens</b>	<b>226,559</b>	<b>3-5</b>	<b>High</b>
Common Raven	553	3	Low
Northwestern Crow	225,984	3	High
Steller's Jay	22	5	Very Low
<b>Starlings</b>	<b>501,499</b>	<b>4</b>	<b>Moderate</b>
European Starling	501,499	4	Moderate
<b>Other Passerines</b>	<b>62,419</b>	<b>4-6</b>	<b>Low</b>
American Goldfinch	635	5	Very Low
American Pipit	859	5	Very Low
American Robin	10,583	4	Very Low
Blackbird species	675	4	Very Low
Brewer's Blackbird	11,624	4	Very Low
Bushtit	1,178	5	Very Low
Cedar Waxwing	3,487	4	Very Low
Dark-eyed Junco	550	5	Very Low
House Finch	8,655	6	Very Low
Northern Shrike	223	6	Very Low
Red-winged Blackbird	9,416	4	Very Low
Savannah Sparrow	10,992	6	Very Low
Snow Bunting	196	5	Very Low
Western Meadowlark	767	5	Very Low
Yellow-headed Blackbird	662	4	Very Low