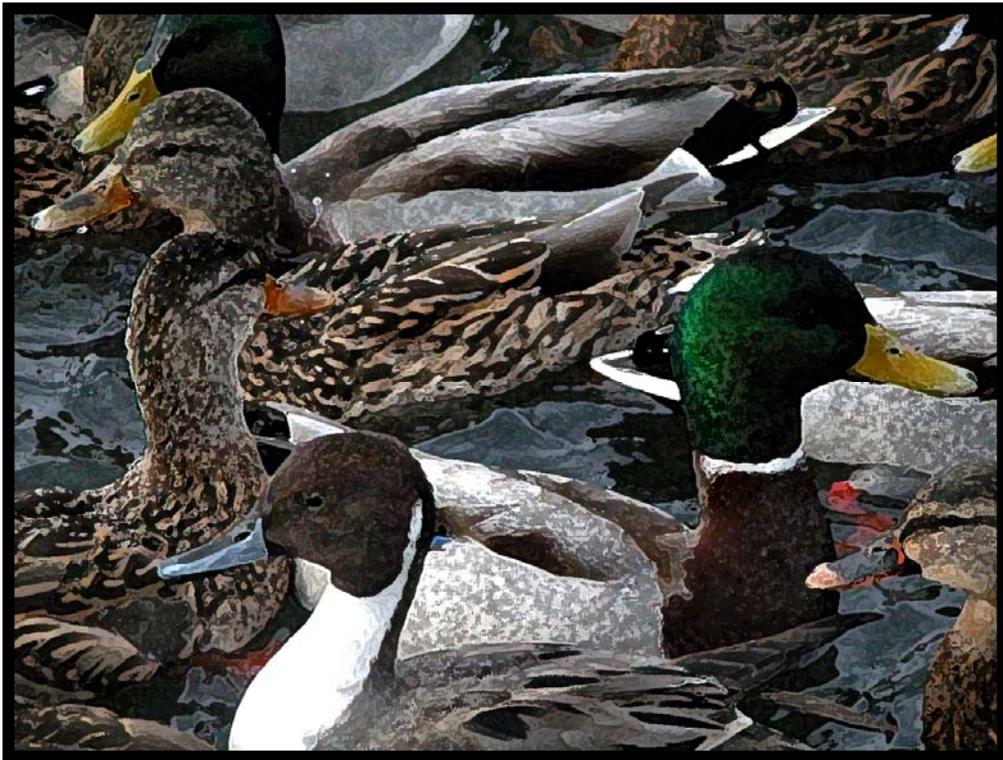


**DISTURBANCE TO BIRDS ON  
ESQUIMALT LAGOON MIGRATORY BIRD SANCTUARY**

**IN THE PERIOD FROM  
APRIL 1<sup>ST</sup> TO MAY 30<sup>TH</sup>, 2008**



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## ABSTRACT

Bird counts and observations of disturbance to birds were recorded from April 1<sup>st</sup> to May 30<sup>th</sup>, 2008 at Esquimalt Lagoon Migratory Bird Sanctuary. We showed that numbers of birds declined from a maximum of 1406 birds to a minimum of 196 birds as species left the sanctuary to travel to their breeding grounds. Most migratory birds left the lagoon by May 15.

Human-initiated disturbance accounted for 51% and natural disturbances for 49% of all disturbances. Disturbance from boats accounted for 63% of human-initiated disturbance. We measured the rate of disturbance from natural causes to be 1.0 event per hour and human-initiated causes was also 1.0 event per hour. Disturbance from boating, a subset of human initiated events, occurred at a rate of 0.51 events per hour.

The duration of disturbances from boats was 26 times the duration of disturbances from natural events (57 minutes versus 2.2 minutes). Institutional boating was responsible for 81% of disturbance events from boats.



## INTRODUCTION

There is a public interest in protecting and enjoying wild birds. It may have started with a desire to conserve birds as a lasting resource of food and sport, but today people also enjoy viewing, photographing and otherwise interacting with wild birds.

The first international agreement to protect migratory birds was the Migratory Bird Treaty Act, enacted in 1916 between the United States and Great Britain, acting on behalf of Canada. In the following years several Migratory Bird Sanctuaries were created in Canada. Esquimalt Lagoon was established as a Migratory Bird Sanctuary by Order in Council (SOR) in Ottawa, on December 1931 (SOR/2008-75 in Appendix 1). The sanctuary encompasses the waters of the lagoon, the adjacent land up to 300 feet above the high water mark, and the land of the Coburg Peninsula (Fig. 1). In the Order in Council establishing the sanctuary, the Governor General of Canada ordered:

*”... that the killing, hunting, capturing, injuring, taking or molesting of migratory game, migratory insectivorous or migratory non-game birds or the taking, injuring, destruction or molestation of their nests or eggs be and it is hereby prohibited at all times within the said sanctuary.” (SOR/2008-75)*

Today Esquimalt Lagoon is a public resource used by the community for a diverse range of activities. People come to enjoy the view, photograph nature, birdwatch, feed birds, take leisurely strolls, run, walk their dogs, fly kites, canoe, kayak, and sail. In his review of Migratory Bird Sanctuaries in 1986, Laszlo Retfalvi cited boating and residential development as the two main “sources of threat” to migratory birds at Esquimalt Lagoon (Retfalvi, 1986). Residential development and boating have likely increased in the subsequent twenty-two years, and along with it, a probable increase in disturbance to birds within the sanctuary.

A disturbance can be any event that interrupts a bird’s natural behaviour. Animals have evolved to be efficient; their behaviours attempting to maximize overall reproductive success (Campbell, 1996; Dawkins, 1989). For wintering birds, the ability to maintain and increase energy stores to carry on to the breeding grounds is vital to their reproductive success. Disturbance that has a negative effect on energy stores can have a population level effect on bird species (Mikola et al., 1994). Disturbance in a migratory bird sanctuary can have the additional effect of causing the birds to leave the sanctuary (Batten, 1977; Burger, 1981).

When birds flee at the approach of a human or other disturbance stimulus, they perceive the disturbance as a risk of predation (Frid and Dill, 2002; Gill et al., 1996). They suffer a



cost when fleeing, both because they are expending energy to fly, and also because they may be interrupted from activities that enhance their survival and reproduction.

This study was initiated by the Esquimalt Lagoon Stewardship Initiative (ELSI), a society interested in improving the ecological health of Esquimalt lagoon. The community had expressed a concern about the increase in boating in the sanctuary and the disturbance it is causing to birds. The purpose of the study is to evaluate the amount and source of human-initiated disturbance to birds and to offer suggestions for mitigation from both a scientific and environmental perspective.

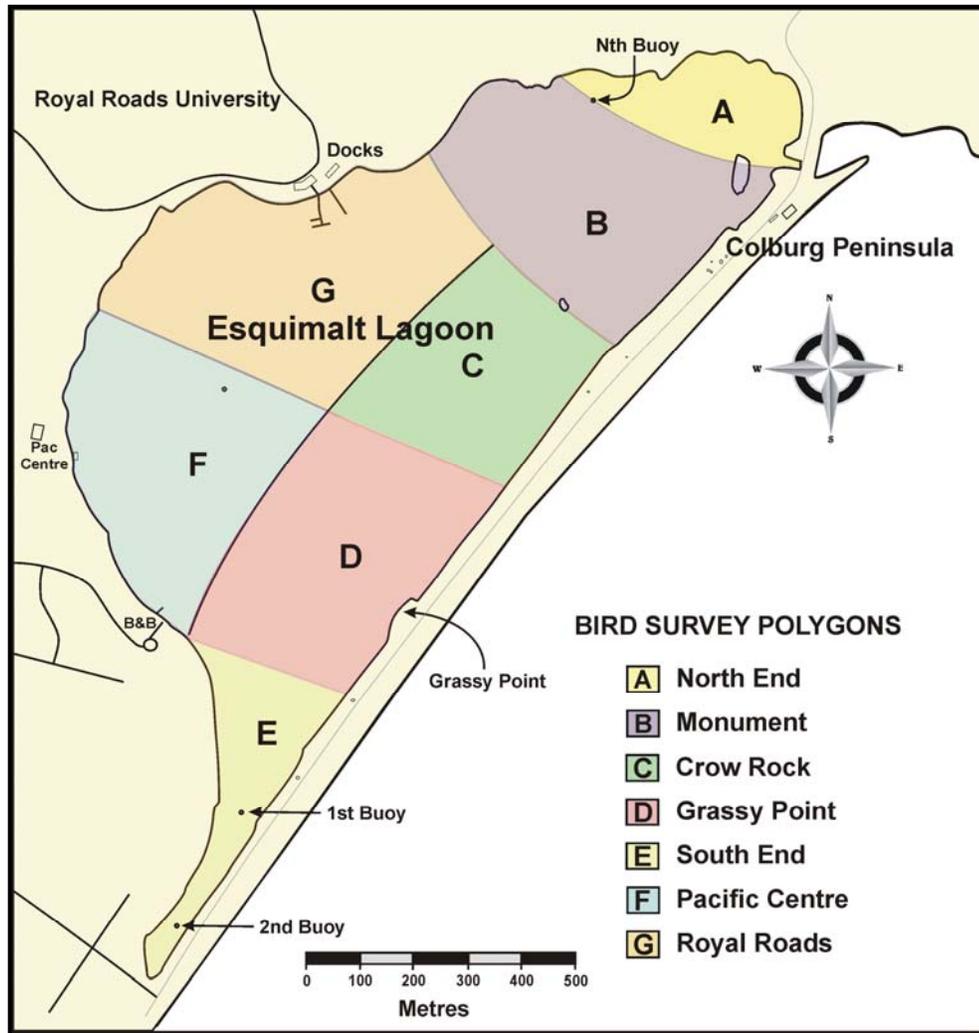


Figure 1. Site plan of the Esquimalt Lagoon Migratory Bird Sanctuary.



## METHODS

### Definitions of Terms

**“Migratory” birds:** For the purposes of this study, the term designates birds that utilised the lagoon only during the non-breeding season. They leave local waters in the spring, and travel to their breeding grounds. Examples: Buffleheads, grebes, loons, scoters, scaups, mergansers, Green-winged Teal, goldeneyes, Mew Gulls, Dunlin.

**“Non-migratory” birds:** For the purposes of this study, the term designates birds that are resident year-round and that breed locally. Examples: Canada Geese, Mallards, Double-crested Cormorants, Mute Swans, Great Blue Herons, Black Oystercatchers, Glaucous-winged Gulls.

**Disturbance:** We defined disturbance as any factor, other than weather-related, which disrupts a bird’s natural behaviour and causes it to expend energy or causes it to lose an opportunity to gain energy, or to engage in activities that are important to its survival and reproduction. Disturbance causing net energetic loss may occur when boats, people, or dogs cause birds to fly off or to discontinue foraging. The feeding of birds by humans, on the other hand, results in a net energetic gain to the birds and is not considered disturbance in this discussion.

**Natural Disturbance:** Disturbance not caused by human-initiated events. They are events that can be considered as naturally occurring, such as caused by predators and other animals, and to abiotic factors.

**Human Disturbance:** Disturbance caused by humans or human-initiated events.

**Institutional boating:** Boating undertaken by an organization, foundation, business, club, or society.

**Recreational boating:** Boating undertaken by individuals on a casual, non-scheduled and unorganized basis.

### Observations

We observed birds on the Esquimalt Lagoon Migratory Bird Sanctuary from April 1<sup>st</sup> to May 30, 2008. The sampling period was selected to encompass the spring migration of the local marine birds (Campbell et al., 1990). We collected two types of data, 1) counts of numbers and species of birds on the lagoon and 2) records of disturbance to birds.



### **Seasonal Distribution Surveys**

One day in each week of the study period was randomly selected to conduct a bird count (Table 3 in Appendix 2). Counts were started between 8:00 and 9:00 am. Three skilled observers sequentially covered all areas of the lagoon, viewing from the shoreline using binoculars and a spotting scope, counting all species of marine and shoreline birds. Surveyors recorded weather conditions, time, species identification, number of species and their location and behaviour, and disturbance events. The survey polygons are shown in Figure 1. Observations were recorded on data sheets and later transcribed to digital format.

### **Disturbance Sampling**

Observations of disturbance to birds were collected in two ways, 1) during randomly selected two-hour sampling periods, and 2) while conducting weekly bird counts. The natural rate of disturbance at Esquimalt Lagoon was estimated by randomly selecting 22 two-hour sampling periods during daylight hours (Table 4 in Appendix 2). Observers recorded and described all disturbances to birds during each sampling period.

We recorded events when birds initiated movement as the result of the disturbance, either by swimming away from the source or by flying (flushing). This is a conservative definition of disturbance since it does not recognise forms of disturbance that may more subtly alter normal behaviour. The flush response of birds increases with the physical size of the predator, the speed of approach, and group size of the predators (Frid and Dill, 2002; Ronconi and St.Clair, 2002). The energetic state of the bird also affects its response to disturbance. Birds in better condition can afford an energetically costly response to disturbance (Gill and Sutherland, 2000). That means that birds in better foraging habitat or birds receiving supplemental feeding will flush sooner than those in poorer condition and those not being fed. Granivorous birds at Esquimalt Lagoon receive supplemental feeding on a daily basis, but species relying on fish and invertebrates do not. How does this affect our research? Since any effect of supplemental feeding would equally affect birds disturbed by natural and human-related causes, it will not alter the results of this study.

Disturbance was classified in relation to its cause, as either human or natural. Human-caused disturbances were further classified as 1) humans alone, 2) humans and dogs, or 3) boating. We attempted to record the duration of disturbance events but were often unable to do so if the birds flushed and travelled beyond view. We recorded the cause of natural events and classified them as caused by birds, mammals, or unknown factors. Events where we could not identify the cause were counted as natural events. Observations of boating disturbance were also supplied by volunteer observers from shoreline sites at the lagoon (total of 19 additional observations).



## RESULTS

### Seasonal Distribution

We recorded 39 species of marine-associated birds in our surveys, with the number of birds counted on each survey ranging from 1406 on April 5<sup>th</sup> to 196 on May 15<sup>th</sup> (Fig. 2; Table 5 in Appendix 3). The total number of marine birds declined as many species left the area to travel to their breeding grounds. Apart from an influx of Caspian Terns (CATE), most migratory birds had departed the lagoon by May 15<sup>th</sup>, 2008 (Table 1; Fig. 2).

**Table 1.** Summary of changes in number of species and migratory birds at Esquimalt Lagoon in spring, 2008.

Date	Number of migratory species	Number of migratory birds
April 5	17	846
April 11	10	502
April 19	14	287
April 23	13	251(11)*
April 28	14	338(14)
May 5	12	94(6)
May 15	6	7(13)
May 20	3	2 (11)
May 30	2	2 (63)

\* (Numbers of Caspian Terns)

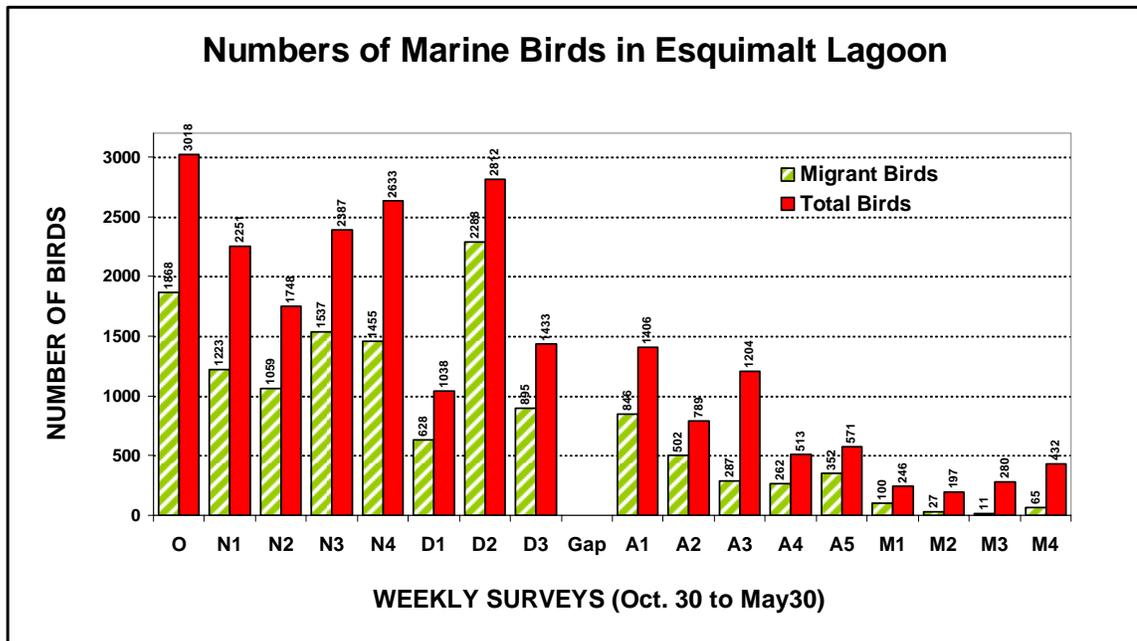
### Disturbance

#### *Rate of Disturbance*

For analysis of all disturbances I pooled all observations, random and non-random, during the 61-day period. We recorded 134 events of disturbance (Table 2). Natural events were 49% of the disturbances and human associated events were 51%. The human-initiated rate of disturbance was 1 event per hour (52 events in 52.9 hours). The human-associated events included 43 (63%) events where humans in boats caused the disturbance. The rate of disturbance from boats was 0.51 events per hour (27 events in



52.9 hours). Disturbance from natural sources is assumed to be a random event. The mean rate of natural disturbances at Esquimalt Lagoon in 22 two-hour observation periods (44 hours) was 2 events per period ( $n=20$ ,  $SE=0.25$ ), or 1.0 event per hour.



**Figure 2.** Weekly changes in total number of birds and of migratory birds at Esquimalt Lagoon Migratory Bird Sanctuary during the period October 30, 2007 (Clowater, 2008) to May 30, 2008. (O, last week of Oct.; N1, 1st week of Nov.; D1, 1st week of Dec.; A1, 1st week of Apr.; M1, 1st week of May)

### *Duration of Disturbances*

When possible, the duration of disturbances was recorded. If the birds remained visible after the disturbance, the duration was recorded as the time from flushing to when the birds returned to the site or could be seen to land elsewhere. In the case of most natural events, the predator or the stimulus was present for only a brief time. In the case of an eagle flying over the lagoon, the stimuli lasted only while the eagle was visible. If the eagle perched, even if within the view of the birds, its disturbance effect diminished below the flushing threshold. This is in accordance with Frid and Dill (2002) who found that movement is a key factor in the flush response to predators. Perching eagles did not appear to exclude birds from marine habitat. Birds appeared more sensitive to water borne stimuli, and were noted to move out of the water at the approach of a floating log.



Boats disturbed birds and also excluded them from the habitat the boats traversed. They differ from most natural sources of disturbance because they tend to remain on the lagoon and visible to the birds for a longer duration than natural stimuli. Fast moving boats, such as training sculls and motor boats traversed the lagoon sequentially flushing birds and excluding them from that habitat.

We considered the duration of disturbances from boats to be the total time we observed them on the lagoon. In the case of rowing sculls and motor boats this is likely an appropriate estimation, but in the case of slow-moving or stationary boats this may be an over-estimation. However, even with slow-moving or stationary boats, if they exclude birds from prime habitat, the effect of their disturbance will remain for the duration of their occupation of the habitat.

### *Durations*

- The mean duration of natural disturbances was 2.2 minutes (Table 2).
- The mean duration of human-initiated disturbances was 49 minutes (Table 2).
- The mean duration of boating disturbances was 57 minutes (Table 2).

### *Disturbance from Boating*

The disturbance by boaters in our study period came from two distinctly different sources.

- 1) **Recreational boating:** We observed 8 events involving recreational boaters on Esquimalt Lagoon (Fig. 5). Recreational boaters arrived at the lagoon either by vehicle on Coburg Peninsula or entered the lagoon from the ocean by paddling under the bridge at the north end. The group size of recreational boaters was 1 to 3 (n=8). The mean duration of recreational boating events was 39 minutes (n=2) (Table 2).
- 2) **Institutional boating:** We observed 35 events involving institutional boater on Esquimalt Lagoon (Fig. 3; Fig. 4). In 32 of 35 of these events the boats can be positively identified as originating from “Go Rowing and Paddling Association of Canada”. In the other 3 events, the boats originated from the “Go-Rowing” facility and were considered institutional because of the nature of their activity on the lagoon.

At Esquimalt Lagoon institutional boats were easily identified because:

- a) they were launched from the “Go-Rowing and Paddling Association of Canada” facilities at the Royal Roads University campus and
- b) most had “Go-Rowing” insignia stencilled on the boat (Fig.3 , Fig. 4)
- c) They were engaged in programs offered by “Go-Rowing” or “Go-Rowing” associates, such as rowing scull instruction and coaching, or eco-educational programs.
- d) The sculls were accompanied by small motor craft with “Go-Rowing insignia (Fig. 3).



Our sample of disturbance durations for institutional boating included both rowing sculls and eco-educational dragon boats. The mean disturbance duration of all institutional boating events was 60 minutes (n=14) (Table 2).

Our data show the mean duration of the rowing scull events was 72 minutes (n=7). Note that the durations we recorded were affected by when we arrived and left the lagoon. In most cases the actual duration of the scull events was 90 minutes (personal observation, Go-Rowing Schedule, 2008). Eco-educational programs involved a multi-passenger dragon boat accompanied by a canoe. They carried groups from Royal Roads dock to the north end of the lagoon for programs (Fig. 4). These events had a mean duration of 48 minutes (n=7).

**Table 2.** Summary of disturbances to birds in observations at Esquimalt Lagoon Migratory Bird Sanctuary during the period April 1 to May 30, 2008.

Type	Events (%)	Mean Duration min. (n)	Subtype	Events (%)	Mean Duration min. (n)	Subtype	Events (%)	Mean Duration min. (n)
<b>Human</b>	68 (51%)	49 (19)	Human	13 (19%)	4 (3)			
			Human and dog	12 (18%)	ND*			
			Human and boat	43 (63%)	57 (16)	Institutional Boating	35 (81%)	60 (14)
						Recreational Boating	8 (19%)	39 (2)
				68 (100%)			43 (100%)	
<b>Natural</b>	66 (49%)	2.2 (27)						
			Birds	42 (63%)	2.5 (20)			
			Mammals	5 (8%)	2 (1)			
			Unknown	19 (29%)	1.1 (6)			
	134 (100%)			66 (100%)				

\* ND = no data



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**Figure 3.** Institutional rowing sculls on Esquimalt Lagoon Migratory Bird Sanctuary.



**Figure 4.** An institutional eco-educational program at the north end of Esquimalt Lagoon Migratory Bird Sanctuary.



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**Figure 5.** A recreational boater photographing birds on Esquimalt Lagoon Migratory Bird Sanctuary.



## DISCUSSION

### **Seasonal Distribution of Marine Birds**

Disturbance will impact fewer birds when seasonal bird populations are lower. The number of birds on Esquimalt Lagoon is greatest in the winter months, as summer approaches birds leave for their breeding grounds. Surveys during the months of October to December 2007, showed a maximum number of 3,018 birds and a maximum number of 53 marine-associated species (Fig. 2)(Clowater, 2008). The present study, spanning April and May 2008, recorded a maximum of 1406 birds and 39 species. In late winter and spring, most marine birds off southern Vancouver Island leave to travel to their breeding grounds. The bird counts in Esquimalt Lagoon show a decrease in numbers and species as summer approaches, with most migrating birds leaving by May 15<sup>th</sup> (Table 1; Fig. 2). We have no data for the period of May 30<sup>th</sup> to October 30<sup>th</sup>, but many species return to local waters as early as mid August (Campbell et al., 1990; Clowater pers. observations). It is likely that migrants start returning to Esquimalt Lagoon as early as August 15<sup>th</sup>.

### **Disturbance to Birds**

As suggested by Retfalvi in 1986, we found that the most disturbance to birds on Esquimalt Lagoon results from human activity (Table 2). This is reflected in the number of instances observed (51%) and even more so in the duration of the disturbances, whereby the duration of human disturbances is 22 times longer than natural disturbances (49 min. vs. 2.2 min. Table 2). Among the human activities we recorded, disturbance by boats was responsible for 63% of the human-initiated events.

Whether disturbance directly affects a bird's survival is a difficult question to prove since there are a multitude of potentially contributing factors. There is, however, much scientific support to suggest that disturbance has an energetic cost to wintering birds (Frid and Dill, 2002; Gill and Sutherland, 2000). In the present study we are not trying to prove that disturbance causes a decrease in survival; we are examining the amount of human-caused disturbance in relation to what birds may expect from natural causes.

Birds perceive disturbance in the same manner as they perceive a threat of predation. High levels of predation risk or disturbance can affect survival by causing birds to expend energy or divert time from activities that enhance body condition and reproductive success (Rees et al., 2005; Frid and Dill, 2002; Hik, 1995; Lima, 1998). As a result of increased disturbance, birds may also be more susceptible to predation (Mikola et al., 1994; Keller, 1991). Animals in poor condition may choose riskier behaviour and



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environments (Frid and Dill, 2002; Abrahams and Dill, 1989; Cardoni et al., 2008; Gill et al., 1996; Pfister et al., 1992; Kahl, 1991; Korschgen et al., 1985; Quan et al., 2002). At Esquimalt Lagoon we saw birds being displaced from habitats by disturbance from boating. We were unable to track the destination of most birds flushed by boats, but we observed birds being sequentially flushed by sculls that were travelling from end to end on the lagoon.

Perhaps human-caused disturbance has already had an effect on the kinds of species seen on Esquimalt Lagoon. Some species, once disturbed, do not return to the same location (Bellefleur et al., 2008). Repeated disturbances over several seasons may be a mechanism causing a permanent shift in habitat use by wintering birds. Whether habitat exclusion has already taken place at Esquimalt Lagoon requires the analysis of historical data and is beyond the scope of the present study. If boating is restricted in the future, the data collected in this study would provide counts to determine future recovery.

### **Disturbance by Boats**

Boats cause the greatest disturbance to birds on Esquimalt Lagoon. Although natural events caused 49% of all disturbances while boats caused 32% (63% of 51% from Table 2), events involving boats had a greater impact because the duration of boating events was 26 times greater than natural events (57 minutes versus 2.2 minutes).

Recreational boating was observed on 8 occasions during this study period. In the instances we observed, recreational boaters travelled slower than institutional rowing sculls. Institutional Boating was observed in 35 instances during the study period. Institutional boating has a greater disturbance effect on birds than recreational boating because:

- 1) The mean duration of institutional boating events was 1.5 times (60m vs. 39m) greater than recreational boating events (Table 2). If we consider rowing sculls, the mean duration of those events were 1.8 times the duration of recreational boating events (72 m vs. 39m). The small sample size of the durations for recreational boating events (n=2, Table 2), reflects the difficulty obtaining that data when the event was comparatively rare and observation periods were of set duration.
- 2) Institutional boating has a 4.4 times greater frequency of occurrence (35 events vs. 8 events) than recreational boating. Institutional boating events are scheduled to occur throughout the yearly cycle. Recreational boating primarily occurs in the summer when the weather is more amenable. Institutional boating also offers programs to schools, resulting in an increase in rowing programs that coincide with the Spring (March, April, May) and the Fall (September, October, November) migrations (Clowater, 2008).



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- 3) In busy seasons, institutional boating programs are offered several times a week and often 3 sessions a day (scull training and eco-educational events; Go Rowing 2008).
- 4) Instructional rowing programs (sculls) involve many quickly-moving boats accompanied by one or more motor boats. Since the flush response of birds increases with a greater number of boats and a greater speed of approach, then the effect of multiple boat rowing programs is greater than the occasional recreational canoe or kayak.
- 5) Rowers involved in instructional or coaching programs are, by that nature, more focused on their rowing skills, and in the instances we observed, appeared less aware of the birds and did not avoid disturbing them.

### Summary

- We document the seasonal change of migratory birds at Esquimalt Lagoon. Most migratory birds left the lagoon by May 15. Human activities that may cause disturbance to migratory birds will affect fewer birds after this date.
- Disturbance from human-initiated events occurred during the study period at approximately the same rate as natural disturbance events (1 per hour). This results in birds tolerating a level of disturbance twice as great as they would expect from natural stimuli alone.
- Among human-initiated events, boating caused the greatest number of disturbances to birds (63%). Boating may cause a greater impact on birds because the duration of boating events was 26 times the duration of disturbances from natural causes.
- Among boating disturbances, Institutional boating was responsible for 81% of the events. Institutional boating cause a greater disturbance effect than recreation boating because of the greater mean duration of events (60 vs. 39), the speed and number of boats involved, and the fact that boating programs are offered year-round, with peak occurrences (school programs) that coincide with the migrations of birds. Disturbance from the spring programs may have an even greater impact because this is when birds are storing energetic reserves to take to the breeding grounds.



## A COMMUNITY PERSPECTIVE

The Esquimalt Lagoon Migratory Bird Sanctuary is a community resource used by the public for many diverse activities. As a free, shared community resource, the lagoon is susceptible to resource abuse that can degrade its value. The idea of common resource abuse was introduced to modern resource managers in 1968 by Garrett Hardin. The original idea was put forward in the Tragedy of the Commons by W.F. Lloyd in 1833, but even before that, progressive thinkers, like Aristotle, recognized the problem.

*“For that which is common to the greatest number has the least care disposed upon it.*

*Everyone thinks chiefly of his own, hardly at all of the common interest ...”*

*(Aristotle, 350 B.C)*

A common resource is any free resource that is open for use by all members of the community. A common resource suffers abuse when individuals overuse or degrade the resource to further their own personal gain while degrading the resource for others. In this case, institutional boating operators in the pursuit of their own interest, are degrading the sanctuary’s value for wild birds as well as for other users.

Esquimalt Lagoon was established as a migratory bird sanctuary. A sanctuary is “a place of refuge and safety”. In a migratory bird sanctuary, one would expect the primary focus would be on maintaining a safe refuge for migratory birds. In their review of the Federal Migratory Bird Sanctuaries, Dawe and Morrison recommend:

*“...the addition of restrictions to the sanctuary regulations prohibiting boating or the use of other floating devices on the lagoon from October to April, ... (Dawe and Morrison, 1983)”.*

In his review of Migratory Bird Sanctuaries, Retfalvi (1986) also identifies boating as a threat to migratory birds on Esquimalt Lagoon. We document that boating is causing a much greater impact than would be expected from naturally occurring events. It is further exacerbated by the operation of an institutional rowing business within the sanctuary boundary. The original intention of the act establishing the sanctuary was to prohibit the molestation of migratory birds (SOR/2008-75). In light of this mandate, it is difficult to see why boating is permitted on Esquimalt Lagoon.



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## OPTIONS TO REDUCE DISTURBANCE

1. All boating banned during the period of August 15<sup>th</sup> to May 15<sup>th</sup>.
2. Institutional boating programs could be specifically banned from the lagoon in the period of August 15<sup>th</sup> to May 15<sup>th</sup>. Recreational boating, at present levels, and because of the seasonality and the much lower instances of occurrence, could coexist with migratory birds. With sufficient signage, voluntary compliance may be adequate with recreational boaters.
3. Establish an active management infrastructure than manages Esquimalt Lagoon as a bird sanctuary and discourages activities that negatively impact birds.



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## APPENDIX 1

SOR/2008-75 March 11, 2008

### 3. Order in Council of December 12, 1931

AT THE GOVERNMENT HOUSE AT OTTAWA

Saturday, the 12<sup>th</sup> day of December, 1931.

PRESENT:

HIS EXCELLENCY THE GOVERNOR GENERAL IN COUNCIL

WHEREAS the Minister of the Interior reports that a petition signed by all the owners of property adjacent to Salt Lagoon known locally as Esquimalt Lagoon on Vancouver Island, near Esquimalt, in the Province of British Columbia, has been received in which it is requested that the said Lagoon be established as a bird sanctuary;

That both the Chief Federal Migratory Bird Officer for the Western Provinces — Mr. J. A. Munro — and Mr. A. Bryan Williams, Game Commissioner for the Province of British Columbia, state that it is most desirable that this sanctuary be established;

That the Department of Indian Affairs concurs provided that the rights of the Indians in respect to digging clams and catching crabs are not interfered with;

Therefore His Excellency the Governor General in Council, on the recommendation of the Minister of the Interior and under and by virtue of the provisions of Section 4 (2) of the Migratory Birds Convention Act, Chapter 130, R. S. 1927, is pleased to order that the lands hereinafter described be and they are hereby created a bird sanctuary, to be known as the “Esquimalt Lagoon Bird Sanctuary”, provided that the Indians, notwithstanding the creation of such sanctuary, shall have the right of digging clams and catching crabs as heretofore;

***Description:***



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All and singular, that certain parcel or tract of land, and lands covered by water, situated in Esquimalt District, Province of British Columbia, which lands may be more particularly described as follows: —

Salt Lagoon, known locally as Esquimalt Lagoon, Coburg Peninsula, known locally as the Lagoon Sand Spit, also a strip of land three hundred feet in width extending inland from high water mark of the said Lagoon, all as shown on the map of Esquimalt Harbour, Vancouver Island, Province of British Columbia, issued in A.D. 1918–1919, under the orders of the Minister of the Naval Service of Canada.

His Excellency in Council is further pleased to order that the killing, hunting, capturing, injuring, taking or molesting of migratory game, migratory insectivorous or migratory non-game birds or the taking, injuring, destruction or molestation of their nests or eggs be and it is hereby prohibited at all times within the said sanctuary.

**E.J. LEMAIRE,**  
Clerk of the Privy Council.



## APPENDIX 2

**Table 3.** Schedule of marine bird counts at Esquimalt Lagoon in 2008.

Date	Type	Time
<b>April 5</b>	bird count	0804 to 0902
<b>April 11</b>	bird count	0808 to 0924
<b>April 19</b>	bird count	0817 to 0909
<b>April 23</b>	bird count	0816 to 0910
<b>April 28</b>	bird count	0809 to 0921
<b>May 5</b>	bird count	0800 to 0904
<b>May 15</b>	bird count	0808 to 0856
<b>May 20</b>	bird count	0758 to 0849
<b>May 30</b>	bird count	0804 to 0900

**Table 4.** Schedule of randomly-selected two-hour disturbance observation periods at Esquimalt Lagoon in 2008.

Date	Observation Time	Date	Observation Time
<b>April 12</b>	<b>0800-1000</b>	<b>April 25</b>	<b>1000-1200</b>
<b>April 13</b>	<b>1000-1200</b>	<b>May 1</b>	<b>1800-2000</b>
<b>April 16</b>	<b>1200- in 20081400</b>	<b>May 7</b>	<b>1800-2000</b>
<b>April 16</b>	<b>1600-1800</b>	<b>May 12</b>	<b>0800-1000</b>
<b>April 17</b>	<b>1800-2000</b>	<b>May 16</b>	<b>1000-1200</b>
<b>April 17</b>	<b>0800-1000</b>	<b>May 16</b>	<b>1600-1800</b>
<b>April 21</b>	<b>0800-1000</b>	<b>May 17</b>	<b>1200-1400</b>
<b>April 21</b>	<b>1800-2000</b>	<b>May 17</b>	<b>1600-1800</b>
<b>April 22</b>	<b>1400-1600</b>	<b>May 19</b>	<b>0800-1000</b>
<b>April 22</b>	<b>1800-2000</b>	<b>May 26</b>	<b>1800-2000</b>
<b>April 24</b>	<b>0800-1000</b>	<b>May 27</b>	<b>0800-1000</b>



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## APPENDIX 3

**Table 5.** Numbers of marine birds counted in weekly surveys at Esquimalt Lagoon. Species codes with common and scientific names are in Table 6 in Appendix 4.

Species Code	Mig. * Code	DATE IN APRIL					DATE IN MAY			
		05	11	19	23	28	05	15	20	30
AMCO	M	1								
AMWI	M	26	24	31	8	2	3	4	1	
BAEA	R			1	5				4	2
BAGO	M	1		2						
BEKI	R				1					
BLOY	R	5		1	2					
BLTU	M	10		20		28	13			
BUFF	M	339	305	127	183	92	35	3		
CAGO	R	14	11	1	11	16	28	58	117	147
CAGU	M				9					
CATE**	R				11	14	6	13	9	63
COGO	M	15	13	4		5	1			
COLO	M			1	2	2				
COME	M		4	3		6	3			
CORA	R					1				
DCCO	R		2	6	29	20	7	3	5	
DOWIT	M								1	
DUNL	M	40			1					
GBHE	R	3		3	1	1	2	10	1	17
GRYE	M	1			1					
GULL	R	2		1			4	4	1	72
GWGU	R	51	47	33	40	25	2	34	18	14
GWTE	M	7	2	3	2	3	24	4		
HOME	M	1	1	2		2				
KILL	R	1		1	4	2	3	6	3	3
LESC	M	77	16	22	23		5			
MALL	R	469	215	322	142	91	91	38	102	97
MEGU	M	151	97	38		198				
MERG	M							1		
MUSW	R	14	12	15	16	18	8	16	14	14



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**Table 5** (continued) Numbers of marine birds counted in weekly surveys at Esquimalt Lagoon. Species codes with common and scientific names are in Table 6 in Appendix 4.

Species Code	Mig.* Code	DATE IN APRIL				DATE IN MAY				
		05	11	19	23	28	05	15	20	30
NOPI	Code	172	38	30	15	10	1			
NOSL	M			2				2		2
OSPR	M			2						
PEEP	M					15				
RBME	M	1	1	2	3	4	1			
RTLO	M	1								
SEPL	M				1		2			
TRUS	M	2	1	1		2			1	1
TUVU	M								2	
UNK	M			529		4				
WEGU	M	1					6			
WESA	M				3	10				
<b>TOTAL</b>		1406	789	1204	513	571	246	196	280	432

\***Mig. Code:** Migration code, migrant (M) or Resident (R).

\*\* Caspian Terns were present during their nesting period (egg laying: April 15 to May 20). In the United States, the species is being excluded from some of its nesting sites on the Columbia River, and have established a breeding colony at Dungeness Spit National Wildlife Refuge in Washing State. The breeding population at this colony in 2007 was 2,294 (1147 breeding pairs)(Roby et al. 2007). It is believed that Caspian Terns seen at Esquimalt Lagoon in this period are members of the Dungeness Spit Colony (Dan Roby, personal comm. 2008).

**APPENDIX 4****Table 6.** Species and species codes of birds observed at Esquimalt Lagoon.

<b>Species Code</b>	<b>Scientific Name</b>	<b>Common Name</b>
AMCO	<i>Fulica americana</i>	American Coot
AMWI	<i>Anas americana</i> Gmelin	American Wigeon
BAEA	<i>Haliaeetus leucocephalus</i> (Linnaeus)	Bald Eagle
BAGO	<i>Bucephala islandica</i> (Gmelin)	Barrow's Goldeneye
BEKI	<i>Ceryle alcyon</i>	Belted Kingfisher
BLOY	<i>Haematopus bachmani</i> Audubon	Black Oystercatcher
BLTU	<i>Arenaria melanocephala</i> (Vigors)	Black Turnstone
BUFF	<i>Bucephala albeola</i> (Linnaeus)	Bufflehead
CAGO	<i>Branta canadensis</i>	Canada Goose
CAGU	<i>Larus californicus</i> Lawrence	California Gull
CATE	<i>Sterna caspia</i> Pallas	Caspian Tern
COGO	<i>Bucephala clangula</i> (Linnaeus)	Common Goldeneye
COLO	<i>Gavia immer</i>	Common Loon
COME	<i>Mergus merganser</i> Linnaeus	Common Merganser
CORA	<i>Corvus corax</i>	Common Raven
DCCO	<i>Phalacrocorax auritus</i> (Lesson)	Doubled-crested Cormorant
DOWIT	<i>Limnodromus griseus</i> (Gmelin)	Short-billed Dowitcher
DUNL	<i>Calidris alpina</i> (Linnaeus)	Dunlin
GBHE	<i>Ardea herodias</i> Linnaeus	Great Blue Heron
GRYE	<i>Tringa melanoleuca</i> (Gmelin)	Greater Yellowlegs
GWGU	<i>Larus glaucescens</i> Naumann	Glaucous-winged Gull
GWTE	<i>Anas crecca</i> Linnaeus	Green-winged Teal
HOME	<i>Lophodytes cucullatus</i> (Linnaeus)	Hooded Merganser
KILL	<i>Charadrius vociferus</i> Linnaeus	Killdeer
LESC	<i>Aythya affinis</i> (Eyton)	Lesser Scaup
MALL	<i>Anas platyrhynchos</i> Linnaeus	Mallard
MEGU	<i>Larus canus</i> Linnaeus	Mew Gull
MUSW	<i>Cygnus olor</i>	Mute Swan
NOPI	<i>Anas acuta</i> Linnaeus	Northern Pintail
NOSL	<i>Anas clypeata</i> Linnaeus	Northern Shoveler
OSPR	<i>Pandion haliaetus</i> (Linnaeus)	Osprey



**Table 6 (continued).** Species and species codes of birds observed at Esquimalt Lagoon.

Species Code	Scientific Name	Common Name
RBME	<i>Mergus serrator</i> Linnaeus	Red-breasted Merganser
RTLO	<i>Gavia stellata</i>	Red-throated Loon
BBPL	<i>Pluvialis squatarola</i> (Linnaeus)	Black-bellied Plover
SESA	<i>Calidris pusilla</i> (Linnaeus)	Semipalmated Sandpiper
TRUS	<i>Cygnus buccinator</i> Richardson	Trumpeter Swan
TUVU	<i>Cathartes aura</i>	Turkey Vulture
WEGU	<i>Larus occidentalis</i> Audubon	Western Gull
WESA	<i>Calidris mauri</i> (Cabanis)	Western Sandpiper