Stanley Park
Barrow's Goldeneye and Surf Scoter Survey
2004 - 2005

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Table of Contents

List of Figures

List of Tables

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Thanks to all of the students who have contributed to the survey in the past. By viewing the final copies of the year end reports, it becomes very apparent that this project has been carried out with the highest regard.

A special thanks to Brenda Andres for developing the original project and providing key information.

1.0 Introduction

1.1 Background and Objectives

The western coast of British Columbia (B.C.) plays a significant role in providing wintering habitat for many different species of shorebirds and waterfowl. Two seaduck species that winter in large numbers along the south coast of British Columbia are the Barrow's Goldeneye *(Bucephala islandica)* and the Surf Scoter (*Melanitta perspicallata)*. The majority of the continental population of Barrow's Goldeneye winter along the Pacific coast (Figure 1) (Johnsgard, 1975).

Waters around Vancouver have the largest known winter concentrations of Barrow's Goldeneye in the world, as documented by the Vancouver Natural History Society's (V.N.H.S) Christmas bird counts (Aitchison, 2001).

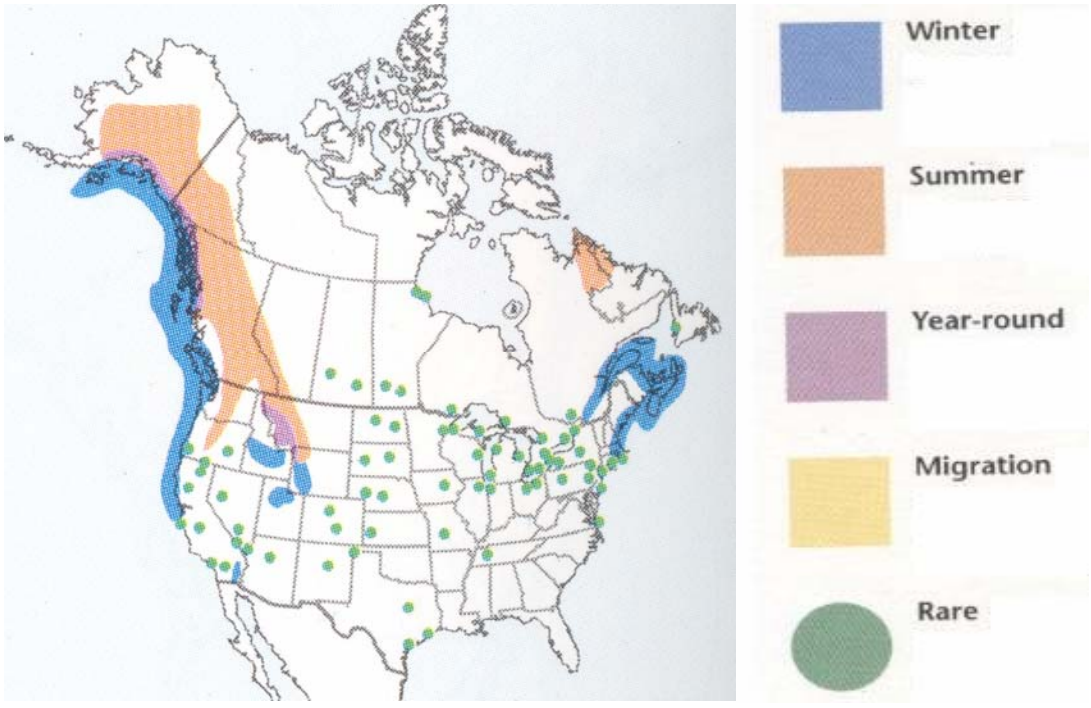

Figure 1. Range map of the Barrow's Goldeneye (source: Sibley, 2000).

A local abundance of food rather than availability of nest sites determine distribution patterns of this species in British Columbia (Johnsgard, 1975). Tidal areas are the

primary winter feeding locations for Barrow's Goldeneye and Surf Scoters (Guiguet,1978). The foreshore of Stanley Park, located in Vancouver, provides the ideal set of resources for birds seeking winter food in the form of fish and invertebrates.

For the purpose of this study, the term "seabirds" includes: loons (family Gaviidae); grebes (Podicipedidae); cormorants (Phalacrocoracidae); bitterns, herons and allies (Ardeidae); swans, geese and ducks (Anatidae); shorebirds (Charadriidae, Haematopodidae, Recurvirostrade, and Scolpacidae); auks, murres, and puffins (Alcidae); and kingfishers (Alcedinidae) (Marshall et. al., 2003).

This survey is the sixth in a series of year long projects carried out by the Fish, Wildlife and Recreation students at the British Columbia Institute of Technology (B.C.I.T.), in cooperation with the Canadian Wildlife Service (C.W.S.)(Rotinsky, 1999)(Marshal et. al., 2003).

We set out to achieve three main objectives in this study for the period of October 2004 to April 2005.

1. Determine the relative abundance and distribution of the Barrow's Goldeneye, Surf Scoters, and all other seabirds along the foreshore of Stanley Park.

2. Collect sex, age, and pairing data on the Barrow's Goldeneye and Surf Scoters along the foreshore of Stanley Park.

3. Collect Global Positioning (G.P.S) data, defining all of the survey zones within the study area around the Stanley Park seawall.

1.2 Life History

1.2.1 Barrow's Goldeneye

Environment Canada indicates that the world population of Barrow's Goldeneye consists of approximately 200,000 individuals. Over 90% breed west of the Rockies, while the remaining live in scattered pockets in eastern North America (Environment Canada, 2004). The majority of the western population occupies a range that extends from Alaska to California, with the central distribution located in British Columbia (Figure 1). Smaller populations breed in Iceland, southwest Greenland, and northern Labrador.

The Barrow's Goldeneye is a secondary cavity nesting duck using pre-existing holes in trees for nesting. The species builds its nest close to productive cold water lakes, pools, or rivers. The female Barrow's Goldeneye is territorial during breeding season and will defend against intrusions (Todd, 1979).

The Barrow's Goldeneye is a diving sea duck (Figure 2) whose primary winter food source is blue mussels (*Mytilus ssp*.) and aquatic invertebrates (Johnsgard, 1975). These mussels are abundant along the south west Stanley Park foreshore.

Figure 2. A pair of Barrow's Goldeneye, male in the forefront, female in the background (source: Learn for Life website, 2003).

1.2.2 Surf Scoter

The Surf Scoter is a large seaduck that breeds in North America from western Alaska, through the Yukon and Nunavik to southern Hudson Bay, as well as Quebec's interior (Johnsgard, 1975). Surf Scoters nest in bushy or wooded habitat along freshwater lakes, rivers, bogs, and in open tundra, often a distance away from water. Surf Scoters winter on the ocean and in large coastal bays, from Alaska to California and from Newfoundland south to Florida (National Wildlife Federation, 2004) (Figure 3). Like the Barrow's Goldeneye, Surf Scoters winter in large numbers along the coast of British Columbia, attracted by their primary winter food source of blue mussels (Johnsgard, 1975).

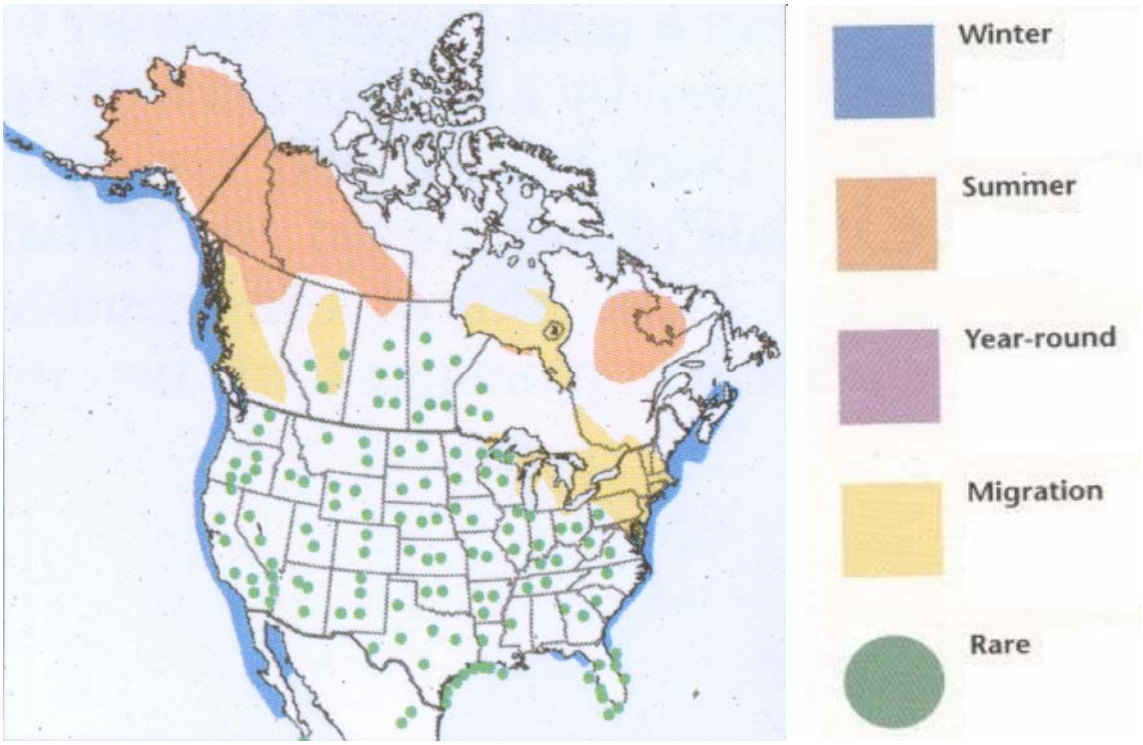

Figure 3. Range map of the Surf Scoters in North America (source: Sibley, 2000).

2.0 Study Area

2.1 Site Description

Stanley Park, arguably the most famous urban park in Canada, is a 405 ha (1,000 acres) peninsula of beautiful forests, gardens, freshwater lakes and saltwater shorelines, located next to Vancouver's densely populated West End (Figure 4) (Aitchison, 2001). The park is situated in between two bodies of water, English Bay to the west, and Burrard Inlet to the east and north.

Figure 4. Stanley Park lies directly between English Bay and Burrard Inlet, British Columbia (source: Vancouver Parks Board of Recreation, 2004)

Along the outer edge of Stanley Park is an 8.85 kilometer seawall which provides an ideal surface for viewing waterfowl and seabirds (Figure 5). The seawall is continually

expanding and it is now possible to walk from the downtown harbour side all the way around the Park, and on around English Bay and False Creek.

Figure 5. Portion of the Stanley Park seawall between the commemorative Smallbone bench and Discovery Bridge (Zone 64) (source: Vancouver Parks Board of Recreation, 2004)

Because the park itself is a peninsula, the habitat and microclimates along its shores can vary greatly with differing exposure to rain, wind and sun (Marshall et. al., 2003).

2.2 Survey Area and Zones

The seawall was broken down into twenty-two survey zones (Figure 6). Commemorative benches, notable trees, and various land marks were used to identify the boundary markers. The seawall polygons were delineated for the Burrard Inlet Environmental Action Program bird survey in 1996 (Watts and Breault, 1996). They were first adapted for the Barrow's Goldeneye study by C.W.S. in 1997, and subsequently followed by B.C.I.T students (Rotinsky, 1999).

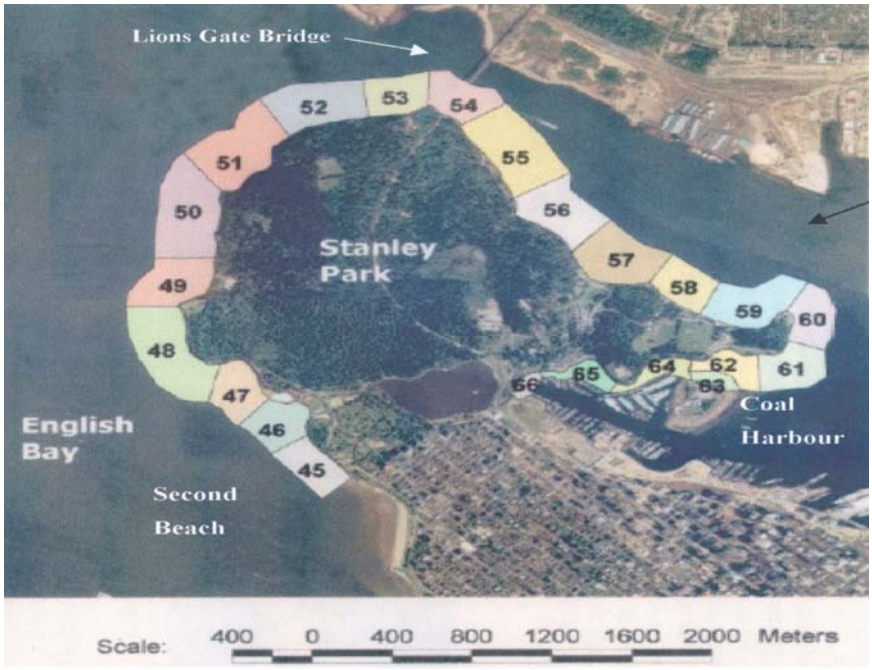

Figure 6. Orthophoto of Stanley Park showing the twenty-two survey zones (source: Watts and Breault, 1996 in Williams, 2000)

The foreshore of Stanley Park has a variety of habitats which accommodate many species of marine birds. Zone 45 to Zone 47 consists of a sandy shoreline that is exposed at low tide. Zone 48 to Zone 54 is predominately rocky, providing substrate for mussel beds and is only exposed during the lowest of low tides. These mussel beds are a special feature that attracts the wintering population of Barrow's Goldeneye and Surf Scoter. Zone 55 to Zone 59 consists of a sandy shoreline and shallow water depths. Zone 60 and 61 is predominately deep water. Zones 62 to 66 consist of a sheltered sandy shoreline that is exposed during low tides.

3.0 Materials and Methods

3.1 Materials

The observers used the following equipment during the surveys:

- Binoculars – Bushnell (7-15 x 25)
- Spotting scopes 15 – 45x spotting scope
- Adjustable tripods
- High visibility field vest

- Sibley Field Guide to Birds (2000)
- Field data book
- Waterproof paper
- Pencil

3.2 Bird Survey Procedures

Once a week, two observers conducted the survey. Every Wednesday, from October 13, 2004 to April 16, 2005 the observers either walked, or cycled the survey route. The start time was approximately 0900 hrs. This start time of 0900 hrs was selected to remain consistent with previous year surveys for comparable data. Additionally, a morning survey was originally selected because it was shown to be the best time to see Barrow's Goldeneyes along the Stanley Park foreshore (Rotinsky, 1999).

To avoid bias the starting point and direction of the route was alternated every survey week. The starting point was either Zone 66 (Coal Harbor) or Zone 45 (English Bay) (Figure 6).

At the beginning of each survey, the date, time, and weather were recorded. Vantage points were used within each zone to set up spotting scopes and scan for birds. The survey zone boundaries extended 250 meters perpendicular to the seawall. Birds at short range were identified using binoculars.

Within each zone, the total number of male, female, and juvenile Barrow's Goldeneye and Surf Scoter was recorded. Pairing data was collected for both species. To be classed as "pairs" birds had to exhibit pairing behavior. One example is when two birds traveled in the same direction in close proximity to each other. If a pair of birds were observed diving for mussels at the same general location (within an estimated five meters of each other), they were also recorded as a pair. Abundance of all other seabirds species observed in the survey zone was also recorded.

Species identification and abundance estimations were carried out by both observers. If there was a discrepancy in bird identification, both observers referred to Sibley's Field

Guide (2000). Once observers agreed on the species the birds were counted (or estimated) by each observer the two totals were then averaged and recorded. Sex ratios were estimated using this same method. There were challenges estimating large flocks that included the behaviour of synchronous diving, milling and large scale dispersal.

3.2.1 Synchronous Diving Behavior

Barrow's Goldeneye and the Surf Scoter displayed synchronous diving behavior. When in a group, these birds will dive in search of food, one after another, in short succession. To achieve accurate estimations of birds displaying this behavior, a factor representing the portion of birds that were underwater was multiplied by the total number of birds. For example, if there were one-hundred birds on top of the water and an estimated twenty percent was underwater, we would multiply .20 x 100 to get the number of birds that were underwater to add to the number of birds that were above water. This approach was used throughout the survey to ensure an accurate estimate of abundance.

3.2.2 Milling

Within large groups of Barrow's Goldeneye and Surf Scoter both species displayed great deal of motion, milling behavior. It is our belief that the early stages of pairing, in particular, produced the greatest amount of milling. When counting large groups, there was a chance of counting the same bird twice, or to miss the bird entirely. To account for this, we multiplied a factor (that was representative of the portion of birds that would be counted twice) by the total number of birds. We would then subtract the achieved figure from the total number of birds counted. For example, if ten percent of the birds doubled back and would normally be counted twice in a group of one hundred birds, we would multiply .10 x 100. Finally we would subtract ten birds from one hundred birds to get ninety birds.

3.2.3 Large Scale Dispersal

Bird distribution was occasionally affected during the survey due to disturbance by motorboats and kayakers. Several times during the survey, we witnessed motorboats and kayakers encroaching on dormant flocks of birds. Based on our personal observation these birds would disperse relocating to a nearby area. We tried our best to complete our

count before dispersal. If an exact count was not possible we would estimate the number of birds. Birds dispersing in the opposite direction of the survey would be estimated. Birds dispersing in the direction the survey was being conducted were not estimated to avoid a double count if they relocated in an upcoming survey zone.

3.2.4 Large Scale Counts

Determining the total number of individuals in large flocks was challenging. The number of individuals in large flocks of birds was estimated by counting the number of birds in a given space. The number of birds in this given space was noted. The number of times this given space fit into the overall area of the flock was counted and multiplied by the numbers of birds counted in the original given space. This method was conducted a second and sometimes a third time to calculate the amount of birds in groups with ranging densities. By using this method, we were able to estimate the total flock. This method was used throughout the entire survey.

3.3 Bird Species Identification

3.3.1 Barrow's Goldeneye

This extremely distinctive species bears no resemblance to any other duck, except the Common Goldeneye. The three most distinguishing features of the adult male are the white spots on its upper sides, its low, flat crown, and the crescent shaped white patch located just aft of the beak (Figure 7). The adult female Barrow's Goldeneye has a chocolate brown head, a grey body, and a yellow-orange beak (Figure 7).

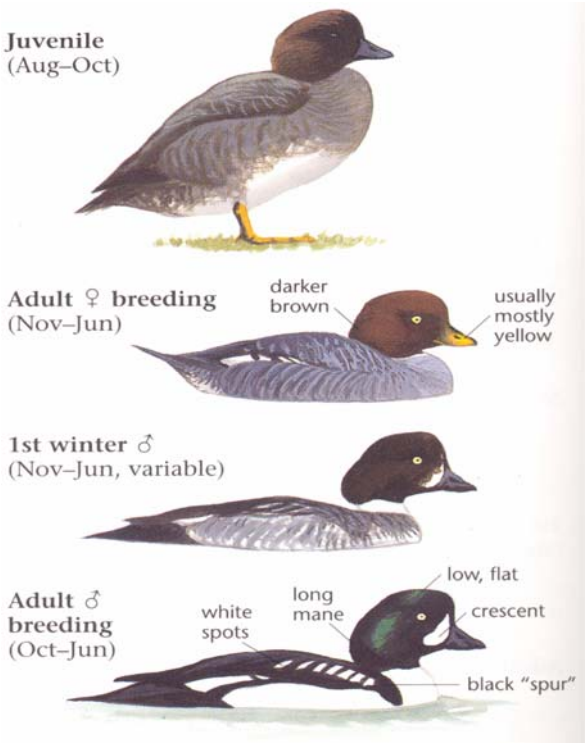

Figure 7. Identification features of Barrow's Goldeneye (source: Sibley, 2000).

The male Barrow's Goldeneye differs from the Common Goldeneye by forward-leaning head shape, white crescent on lores, and further black coloring on its flanks (Sibley, 2000). The male Common Goldeneye also has a white marking just aft of the beak, however it is relatively round compared to the crescent shape displayed by the Barrow's Goldeneye (Figure 8). The female Barrow's Goldeneye can be distinguished from the Common Goldeneye by two main features; a small bill usually mostly yellow in color, and a darker brown head that is drawn into its neck (Figure 8).

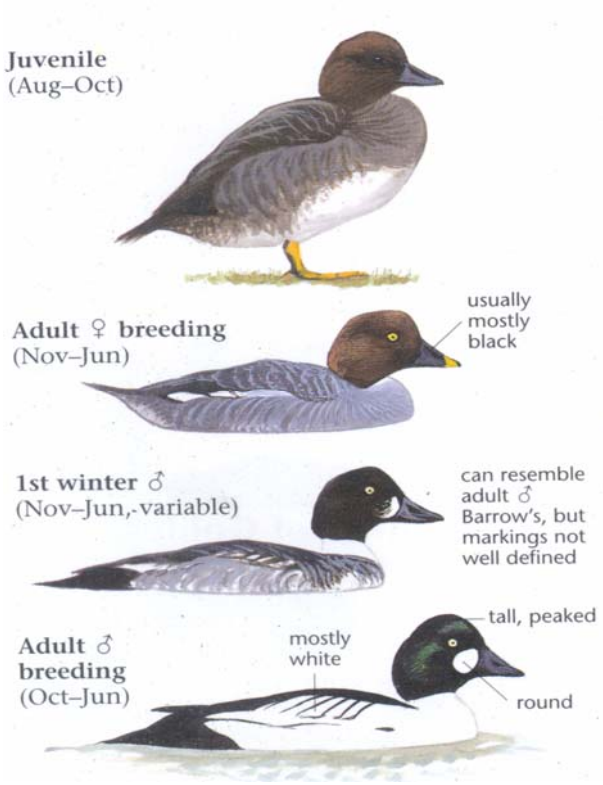

Figure 8. Identification features of the Common Goldeneye (source: Sibley, 2000).

3.3.2 Surf Scoter

Male and the female Surf Scoter are quite distinctive (Figure 9). Their heavy, triangular bill forms a wedge shaped head (Sibley, 2000). The upper mandible is elongated, swollen, and merging imperceptivity with the top of the head (Guiguet, 1978). The coloration on the male's bill is highly decorative and recognizable. The bill is multi-colored with orange and yellow on the upper side and is largely white at the base (Figure 9).

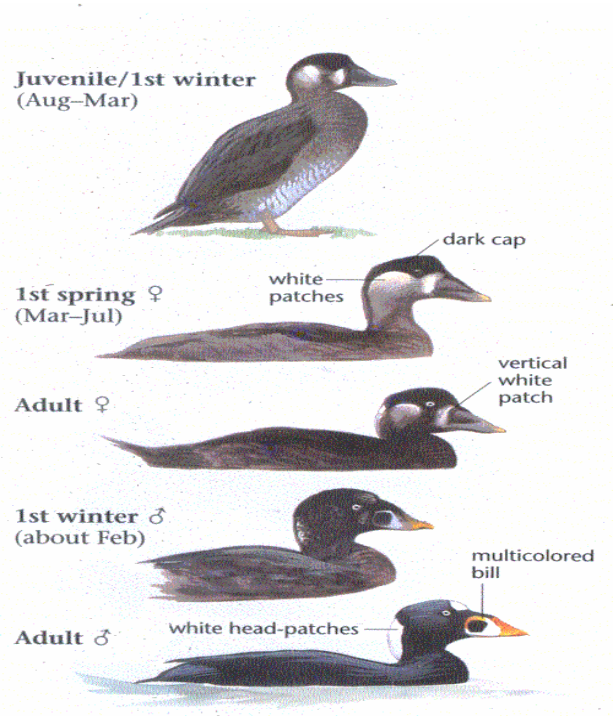

Figure 9. Identification features of the Surf Scoter (source: Sibley, 2000).

The male body is dominated by black plumage and displays white head patches. The female is mostly grey to black in color. The female has two distinct markings, the pale patch on its cheeks and the vertical white loral patch (Sibley, 2000). The adult female is light below, dull brownish to slate on the sides and back. The female bill is swollen to a lesser extent than is that of the male and is without bright coloring (Figure 9) (Guiguet, 1978).

3.4 Bird Data Analysis

The data were recorded initially in the field notebook, and then transferred over to a Microsoft Excel database. Data were analyzed to determine trends in abundance and distribution of Barrow's Goldeneye and Surf Scoters in the overall study area from October 13, 2004 – April 13, 2005. Data were also analyzed to identify trends in sex ratios as well as juvenile, and pair abundance in both species. Data collected on all other marine species were analyzed to identify trends in abundance and distribution. Excel was used to create histograms.

3.5 G.P.S. Data

A Geoexplorer 3, G.P.S. unit (model 138376-00) was used to record zone boundaries. The G.P.S. readings were taken at commemorative benches, landmarks and notable trees that were used to mark the beginning of each zone. The data were collected on March 2, 2005 utilizing a range of four to seven satellites to confirm each zones co-ordinate. We were unable to obtain the GPS coordinates for Zone 54 due to lack of satellites. Table 1 outlines each zone by stating the Global Positioning Co-ordinates of northing (N) and easting (E).

Table 1. G.P.S. coordinates recorded for each zone boundary along the Stanley Park seawall. These coordinates were recorded on March 2, 2005 and will insure consistency of zone boundaries for future year's surveys. The data was collected on a Geoexplorer 3, G.P.S. unit (model 138376-00).

Zone Boundary	G.P.S. Data
Zone 45 – Stairs leading to First Beach	N. 5459454.12m / E. 489607.39m
Zone 46 – "Roland Burrdit" bench	N. 5460001.36m / E. 489106.26m
Zone 47 – Rock Breaker on west end of pool	N. 5460325.10m / E. 488885.45m
Zone 48 – "Sean Gibson" bench	N. 5460533.07m / E. 488593.77m
Zone 49 – "Elizabeth from Manrico" bench	N. 5460960.06m / E. 488464.42m
Zone 50 – " James Armstrong" bench	N. 5461310.50m / E. 488633.28m
Zone 51 – Siwash Rock	N. 5461777.26m / E. 488657.20m
Zone 52 – "Thelma N. Coulson" bench	N. 5462071.05m / E. 488921.83m
Zone 53 – Water drain	N. 5462237.10m / E. 489188.93m
Zone 54 – Overhanging Cedar on washed out sandstone	Information not available.
Zone 55 – "15 km" sign where bike trail reenters seawall	N. 5462193.25m / E. 489872.47m
Zone 56 – "Jack Kennedy" bench	N. 5461745.32m / E. 490118.27m
Zone 57 – Middle bench in round lookout (west of playground)	N. 5461383.12m / E. 490410.03m
Zone 58 – "Filmore and Hickson" bench	N. 5461112.00m / E. 490810.75m
Zone 59 – "Tom and Billie Dolphin" bench	N. 5460840.52m / E. 491109.62m
Zone 60 – Lighthouse	N. 5460908.07m / E. 491492.03m
Zone 61 – "Kendell" bench	N. 5460690.24m / E. 491500.11m
Zone 62 – Discover bridge to "Playguide Tours" bench	N. 5460600.78m / E. 491358.36m
Zone 63 – Opposite shoreline	Opposite Shoreline – No access
Zone 64 – Discover Bridge	N. 5460552.11m / E. 491024.77m
Zone 65 - "Don Smallbone" bench	N. 5460396.79m / E. 490656.29m
Zone 66 – "Anne Elizabeth Mercer" bench	N. 5460479.90m / E. 490330.32m

4.0 Results and Discussion

4.1 Seawall Closures

Heavy precipitation caused seawall closures due to mud slides on the west facing slopes of the seawall, from January 19 to February 9, 2005 (Figure 10). The closure area extended from zones 50 to 55. There was a second closure period from April 6 to April 13, 2005 for cliff scaling and blasting to stabilize the banks (Figure 11). Bird surveys were not conducted on days the seawall was closed.

Figure 10. Mudslides due to heavy precipitation on the west side of the Stanley Park seawall. (source: Vancouver Parks Board of Recreation, 2004).

Figure 11. Seawall closures due to mudslides, cliff scaling, and blasting closed public access to the seawall from south of Siwash Rock to east of the Lions Gate Bridge (source: Vancouver Parks Board of Recreation, 2004).

4.2 Barrow's Goldeneye

The total number of Barrow's Goldeneye observed on each survey day is shown in Figure 12. In October and November the Barrow's Goldeneye migrates from their breeding grounds to the coast to winter, and are observed along the British Columbia coast (Guiguet, 1978).

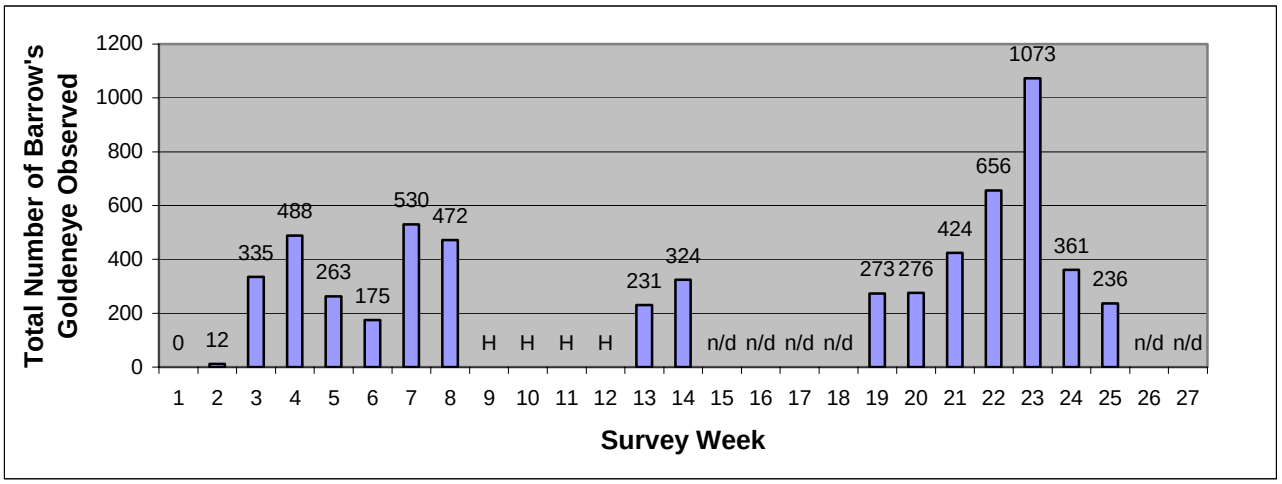

Figure 12. Abundance of Barrow's Goldeneye observed along the Stanley Park foreshore. October 13, 2004 to April 13, 2005. The n/d indicates weeks when the survey was not conducted due to a seawall closure. An H indicates a week the survey was not conducted due to a holiday).

Our first survey was conducted on October 13, 2004. No Barrow's Goldeneye were observed at that time. The numbers increased steadily up until the beginning of

November, and then dropped down to 175 (week 6). The numbers more than doubled over the next two weeks. This rise and fall of numbers may be due to the arrival and departure of different flocks of migrating Barrow's Goldeneye. Upon arrival the Barrow's Goldeneye disperse in search of unoccupied territory in surrounding areas that do not necessarily include the Stanley Park foreshore. For example, groups of Barrow's Goldeneye were spotted throughout the winter season on the Kitsilano foreshore. Several other factors may have contributed to this rise and fall of numbers: Days with high winds fewer birds were observed we believe this is due to the Barrow's Goldeneye taking refuge in protected areas. Due to seawall closures and Christmas break, there are ten survey weeks that were not conducted. Even though this years survey is missing data, when comparing data to the previous two years (Boisclair-Joly and Worcester, 2002) and (Marshal et. al., 2003), we find similar trends in abundance.

A comparison in the abundance of Barrow's Goldeneye observed along the Stanley Park foreshore from October 13, 2004 to April 16, 2005 was made with the previous Barrow's Goldeneye studies of 2003 and 2004 is shown in Figure 13.

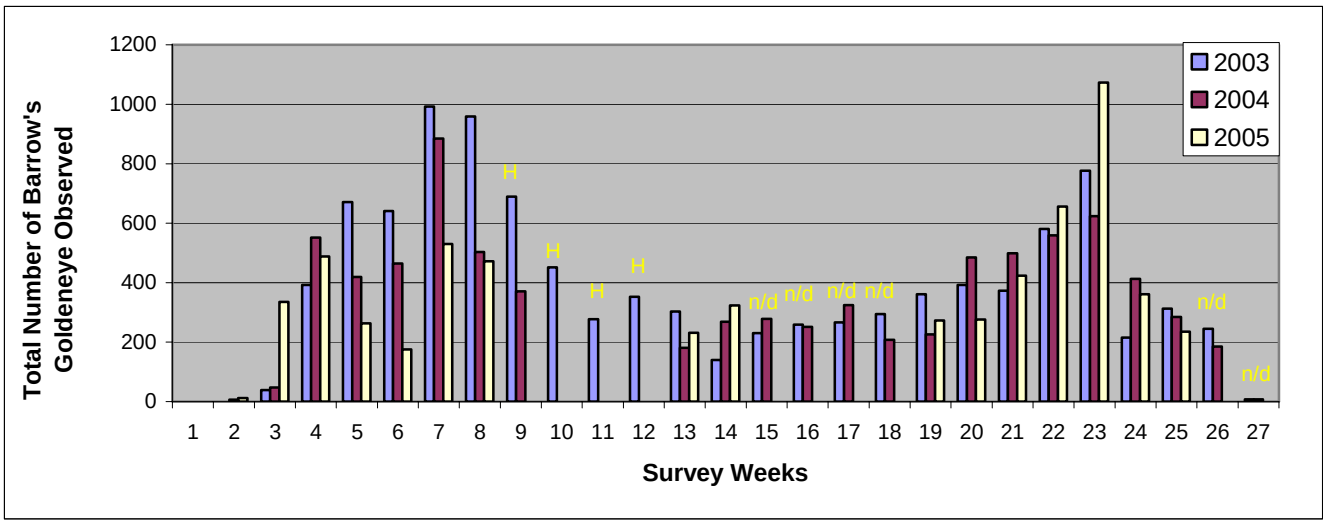

Figure 13. Comparison in abundance of Barrow's Goldeneye along the Stanley Park foreshore from October to April 2003, 2004, 2005. (An H indicates a week that the survey was not conducted due to a holiday. An n/d indicates a week the survey was not conducted due to a seawall closure). Data from previous years from (Boisclair-Joly and Worcester, 2002) and (Marshal et. al., 2003).

All years show a steady increase from the beginning of October to the end of November (week 7). Due to seawall closures a true comparison can not be achieved; however, there

is enough data to identify a relatively similar set of trends from year to year. The number of Barrow's Goldeneye observed started to decrease in November yet increase in February to peak at 1,073 Barrow's Goldeneye observed on March 16, 2005. This peak in the twenty-third survey week is consistent with the 2003 and 2004 previous Barrow's Goldeneye surveys. Our personal opinion is this peak is due to flocks of Barrow's Goldeneye arriving from farther south wintering grounds (e.g. Washington, Oregon, California) and using the Stanley Park foreshore for staging on route to their breeding grounds.

The average distribution of Barrow's Goldeneye observed between the 22 survey zones of the study area is shown in Figure 14.

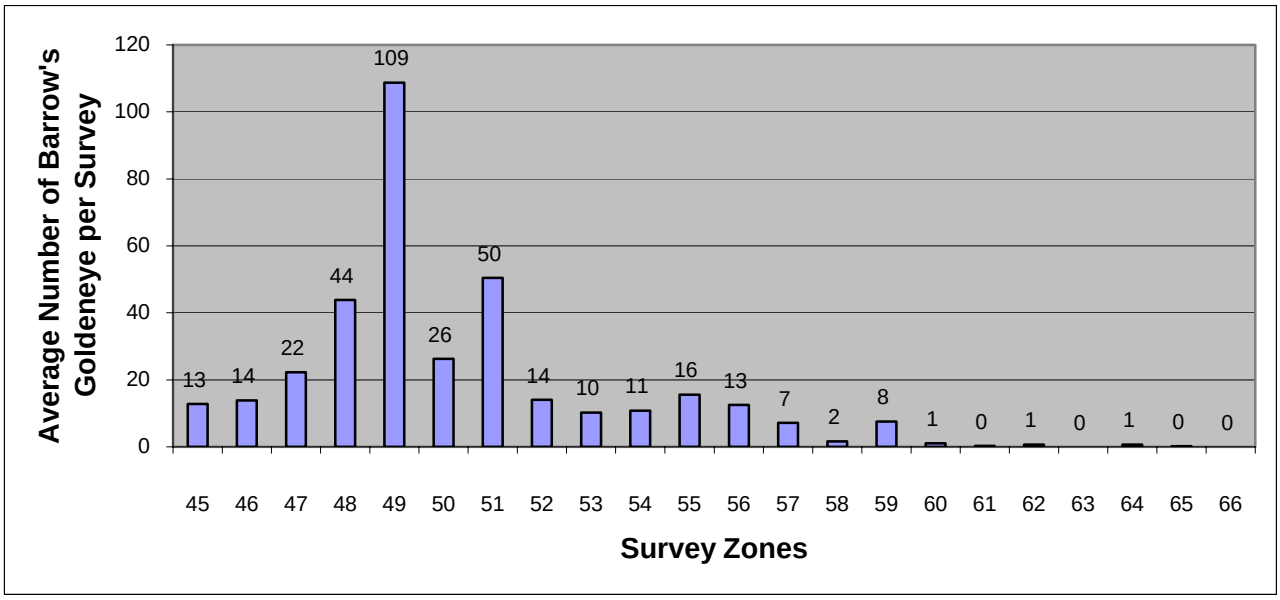

Figure 14. Average number of Barrow's Goldeneye per survey in the 22 survey zones along the Stanley Park foreshore, October 13, 2004 to April 13, 2005.

The highest average number of Barrow's Goldeneye was observed off of Fergusson Point (Zone 49). The majority of the Barrow's Goldeneye was observed between Second Beach and Siwash Rock (zones 48 to 51). Their numbers are higher in rocky zones that support the growth of blue mussels, for blue mussels are the Barrow's Goldeneye main winter food source. Very few Barrow's Goldeneye was observed between zones 60 to 66. Zones 55 to 66 are composed of sandy beaches, lacking the attraction of blue mussels for

the Barrow's Goldeneye. It is important to note that the numbers in Figure 14 are under estimated due to ten weeks of survey data that was not conducted due to holidays and seawall closures.

Age, sex and pairing characteristics of the over wintering Barrow's Goldeneye are shown in Figure 15.

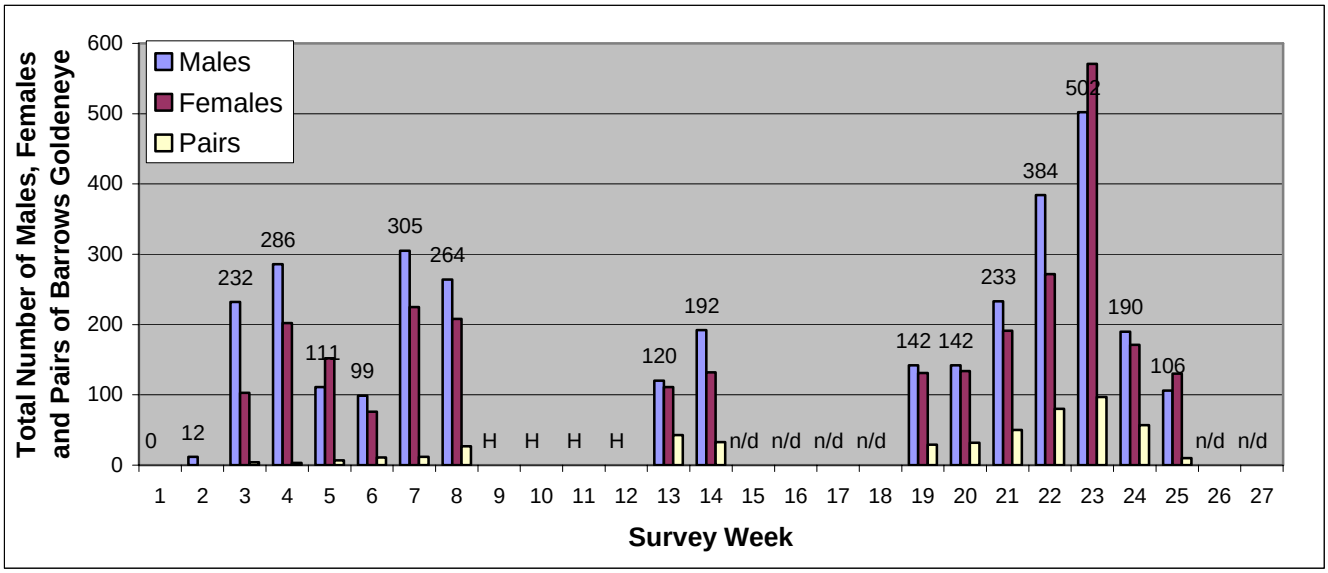

Figure 15. Males, females, and pairing totals of the Barrow's Goldeneye observed along the Stanley Park foreshore October 13, 2004 to April 13, 2005. (An H indicates a week the survey was not conducted due to a holiday. An n/d indicates a seawall closure).

Zero Barrow's Goldeneye was observed in week one of this survey (October 13, 2004). Every survey week (with the exception of week 25, March 30, 2005) resulted in a higher count of males than females. The distribution was more evenly distributed by February 16, 2005. On October 27, 2004, the first pair of Barrow's Goldeneye was observed (week 3). On March 16, 2005, the highest number of pairs was recorded at 97 (week 23). A gradual increase in pairs, starting in late October, levels out at around thirty pairs per survey throughout February and peaks in March. Age and sex ratios for the Barrow's Goldeneye are similar to previous years observations. The males were observed to arrive in greater numbers during the first portion of the survey. As the fall migration ended, the ratio of males to females became relatively even. This occurs because males leave the females and the first years at the breeding grounds when they begin their migration to the winter grounds.

Total numbers of Barrow's Goldeneye juveniles observed are shown in Figure16.

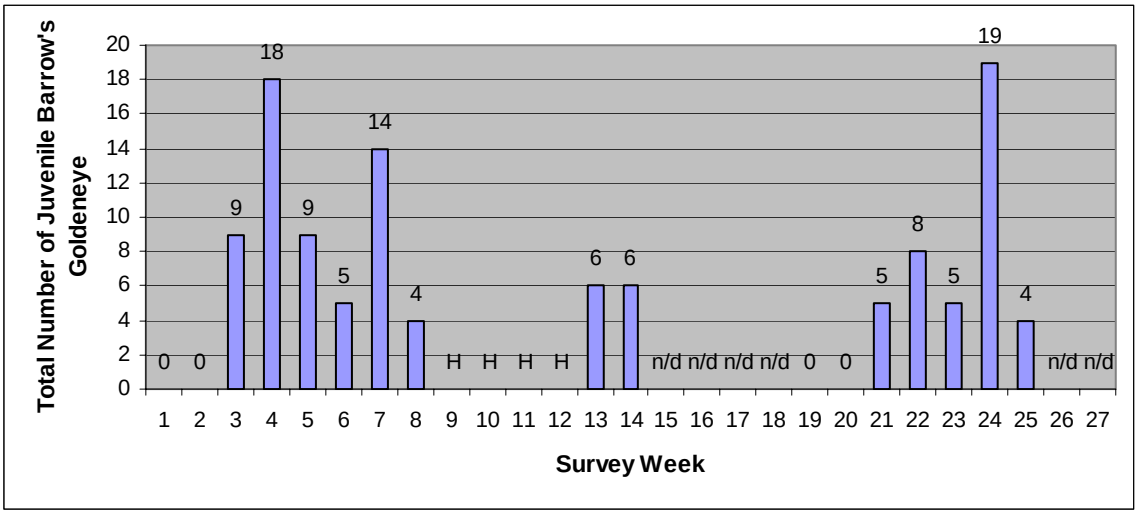

Figure 16. Total number of juvenile Barrow's Goldeneye observed along the Stanley Park foreshore October 13, 2004 to April 13, 2005. (An H indicates a week the survey was not conducted due to a holiday. An n/d indicates a seawall closure).

The juveniles are the last to leave the breeding grounds and the last to arrive at the wintering grounds. There was no juvenile Barrow's Goldeneye observed during the first two weeks of the survey (October 13 and October 20). Numbers of juveniles fluctuated greatly with the largest number of juveniles observed being 19 on March 23, 2005 (week 24). March 23, 2005 was the peak number of males, females, and juveniles Barrow's Goldeneye observed through out the 2005 Barrow's Goldeneye survey.

4.3 Surf Scoter

Trends in abundance of Surf Scoters observed during the surveys are shown in Figure 17.

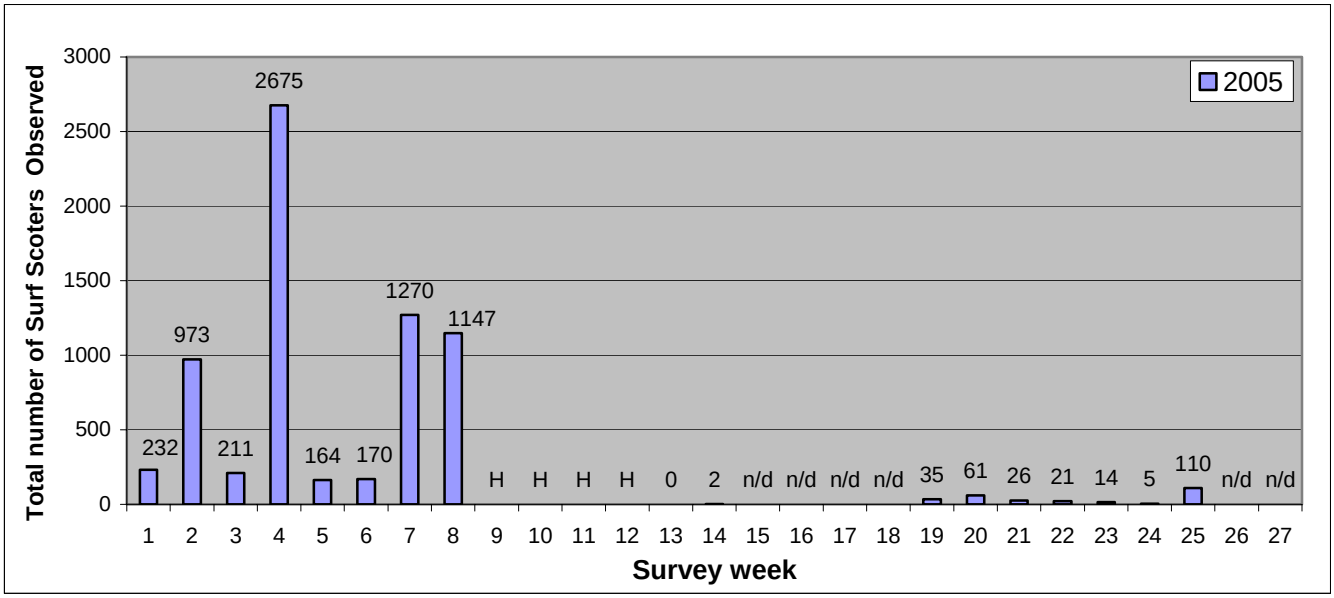

Figure 17. Total number of Surf Scoters observed along the Stanley Park foreshore from October 13, 2004 to April 13, 2005. (An H indicates a week the survey was not conducted due to a holiday. An n/d indicates a seawall closure).

In April and May Surf Scoters migrate from the southern wintering grounds to the breeding-grounds, moving north again in late September and October, (Guiguet, 1978). This corresponds with our survey observations, which found a population of Surf Scoters to already be present in early October. Surf Scoter numbers grew to a maximum in the beginning of November reaching 2,675, and than declined in December to 1,147. Christmas break and seawall closures create a four week gap in data. On January 5, 2005, there were zero surf scoters observed (week 13). The following week there were only two Surf scoters observed (week 14). The peak abundance in early fall may be accounted for by the Surf Scoters using the Stanley Park foreshore as a staging area before continuing south on their migration towards other southern wintering grounds. An increase in Surf Scoters in February and March may be explained by these birds staging on the northward migration to their breeding grounds. These trends are similar, when comparing this year's data with 2003, and 2004 data (Boisclair-Joly and Worcester, 2002) and (Marshal et. al., 2003).

A comparison in the abundance of Surf Scoters observed along the Stanley Park foreshore from October 13, 2004 to April 13, 2005 was made with those observed during the studies over the same time period in 2003 and 2004. This is shown in Figure 18.

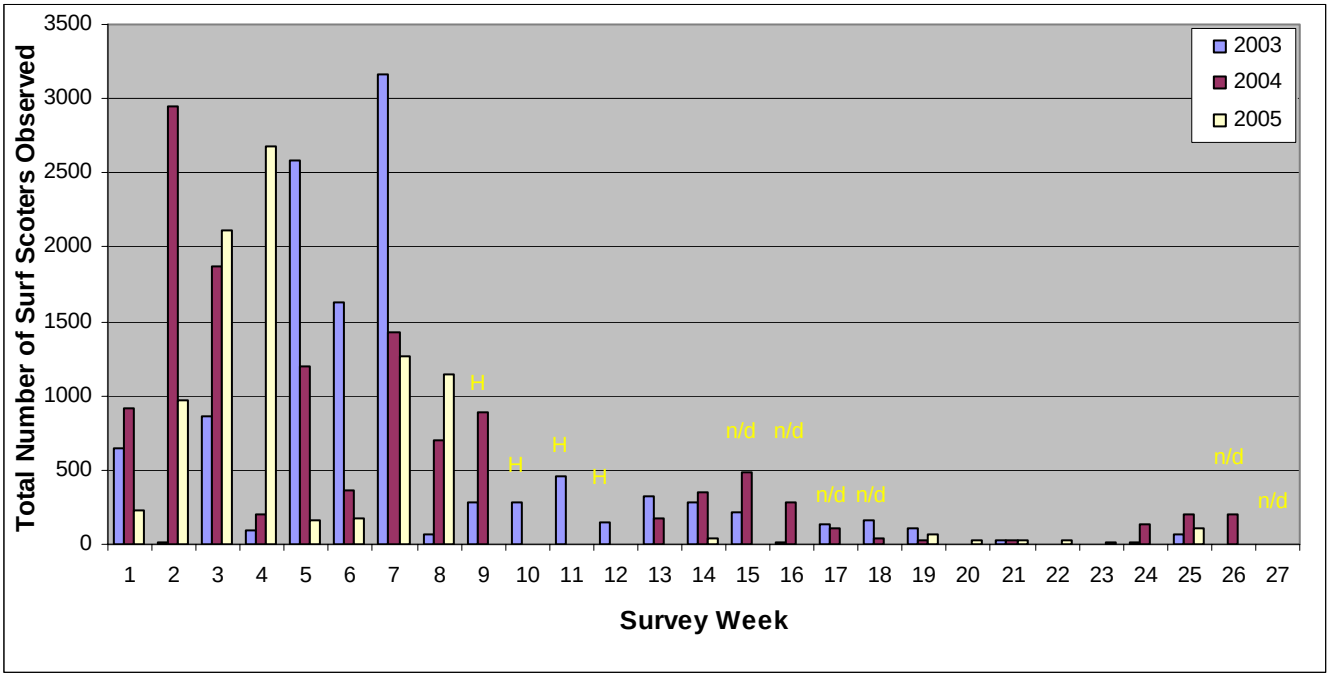

Figure 18. Comparison of Surf Scoter abundance along the Stanley Park foreshore from October to mid April 2003, 2004, 2005. Previous years data from (Boisclair-Joly and Worcester, 2002) and (Marshal et. al., 2003). (An H indicates a week the survey was not conducted due to a holiday. An n/d indicates a seawall closure).

There is a great deal of variability between the numbers observed during the three years of the survey, however there is an identifiable trend throughout most of the data. For all three years, Surf Scoter abundance is at its highest between mid October, and the end of November (weeks 2 to 7). The maximum amount of Surf Scoters ranges from 2,675 in 2005 to 3,167 Surf Scoters in 2003. Although the gaps in this years data clouds the trend, it is still evident that the numbers decline steadily between the end of November to the end of December (weeks 7 to 10). The total number of surf Scoters levels out at relatively low numbers during the following 12 weeks.

The distribution of Surf Scoters observed within the 22 survey zones of the study area is shown in Figure 19.

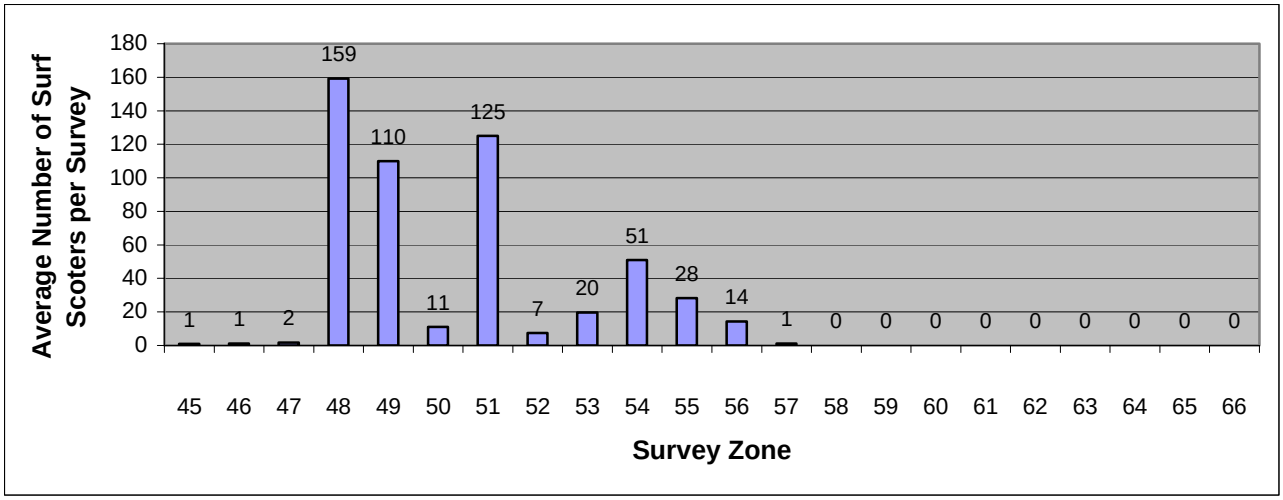

Figure 19. Distribution of Surf Scoter along the 22 survey zones of the Stanley Park foreshore from October 13, 2004 to April 13, 2005.

The majority of Surf Scoters were observed between Second Beach and Siwash Rock (zones 48 to 51). The remainder Surf Scoters was observed in zones 52 to 57. An average of four Surf Scoters was observed between zones 45 and 47. Surf Scoters are attracted to rocky locations and remain in these areas feeding on the blue mussel beds that grow on the rocks and on the seawall itself. Zones 55 to 66 mainly composed of sandy beaches, lacking an abundant supply of blue mussels for the Surf Scoters to feed on. It is important to note that the numbers in Figure 19 are under estimated due to ten weeks of survey data that was not conducted due to holidays and seawall closures.

Observations regarding the age, sex, and pair characteristics of the Surf Scoter are shown in Figure 20.

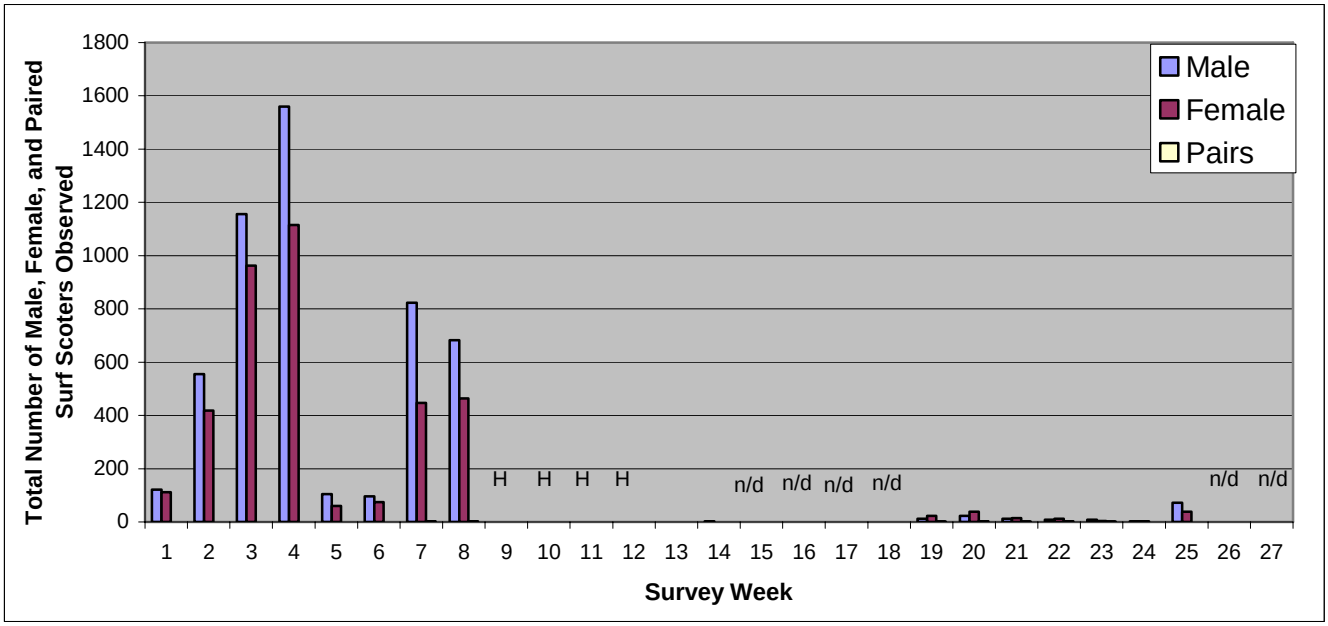

Figure 20. Abundance of male, female and paired Surf Scoters along the Stanley Park foreshore from October 13, 2004 to April 13, 2005. (An H indicates a week the survey was not conducted due to a holiday. An n/d indicated a week the survey was not conducted due to a seawall closure)

Throughout the survey, there were far more males observed than females. Due to a lack of data, it is difficult to identify clear trends, however it appears that the ratio becomes relatively even by February (week 19). Five pairs (this number is to small to show on the above histogram) of Surf Scoters were observed between November 24 and December 4, 2004 (weeks 7 to 8). From February 16th (week 19) to March 30th (week 27) only 10 pairs of Surf Scoters were observed. Zero Surf Scoters were found in week 13, and only two male Surf Scoters were observed in week 14. Age and sex ratios for the Surf Scoter are similar to previous year's observations (Boisclair-Joly and Worcester, 2002) and (Marshal et. al., 2003). The males arrived first followed by the females. This is a result of the males leaving the breeding grounds first. As the fall migration ended, the ratio became relatively even.

Total numbers of juvenile Surf Scoters observed are shown in Figure 21.

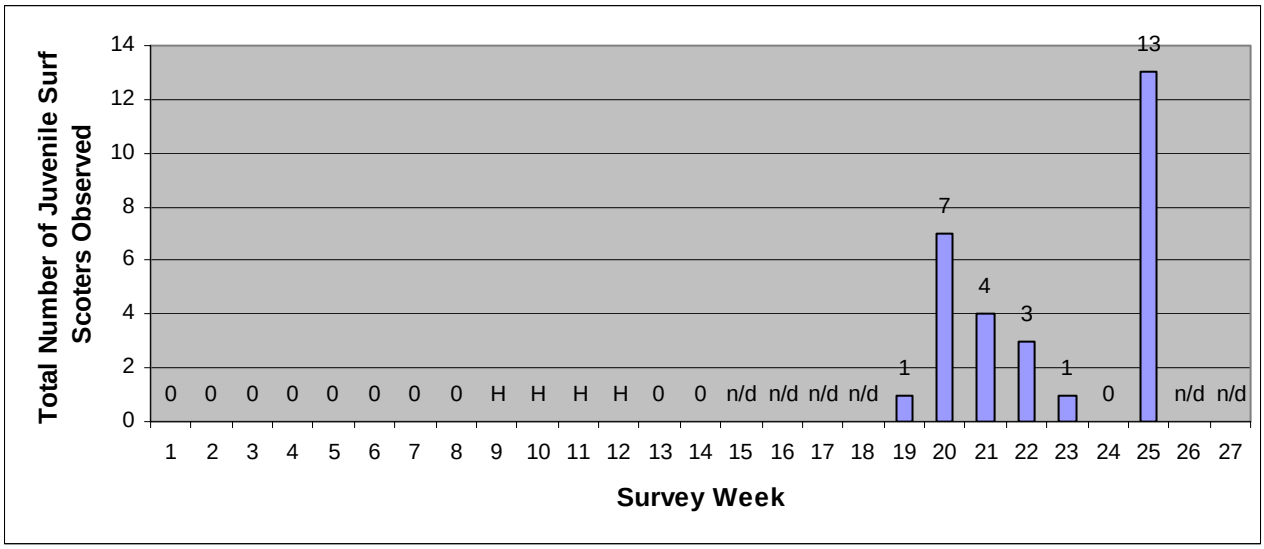

Figure 21. Abundance of juvenile Surf scoters observed on the Stanley Park foreshore from October 13, 2004 to April 13, 2005 (An H indicates a week the survey was not conducted due to a holiday. An n/d indicates a week the survey was not conducted due to a seawall closure).

There were no Surf Scoter juveniles observed until February 16, 2005 (week 19). During the week 19 survey, one juvenile was observed. The next week, there were 7 juvenile Surf Scoters observed (week 20). Numbers declined over the next four weeks to zero on March 23, 2005 (week 24). The maximum number of Surf Scoter juveniles was observed on March 30, 2005 (week 25). Juveniles are the last to leave the breeding grounds because they are increasing their stored fat and strength for the migration south. The greatest numbers were observed in March as a result of these birds using the Stanley Park foreshore as a staging ground before migrating north to their breeding grounds. When in large groups juveniles may have been mistaken for adults due to their similar plumage.

4.4 Other Species Observed

Figure 22 represents the total number of seabirds observed, excluding the Barrow's Goldeneye and Surf Scoter, per survey week. The total number of seabirds fluctuates drastically per survey week during October 13, 2004 – Dec 1, 2004, (weeks 1 – 8) yet starts to become more consistent from February 19, 2005 – March 30, 2005 (weeks 13 –

25). The greatest number of seabirds totaling 2,223 was recorded in the first eight survey weeks. In the remaining nine surveys a total of 1,663 seabirds were observed.

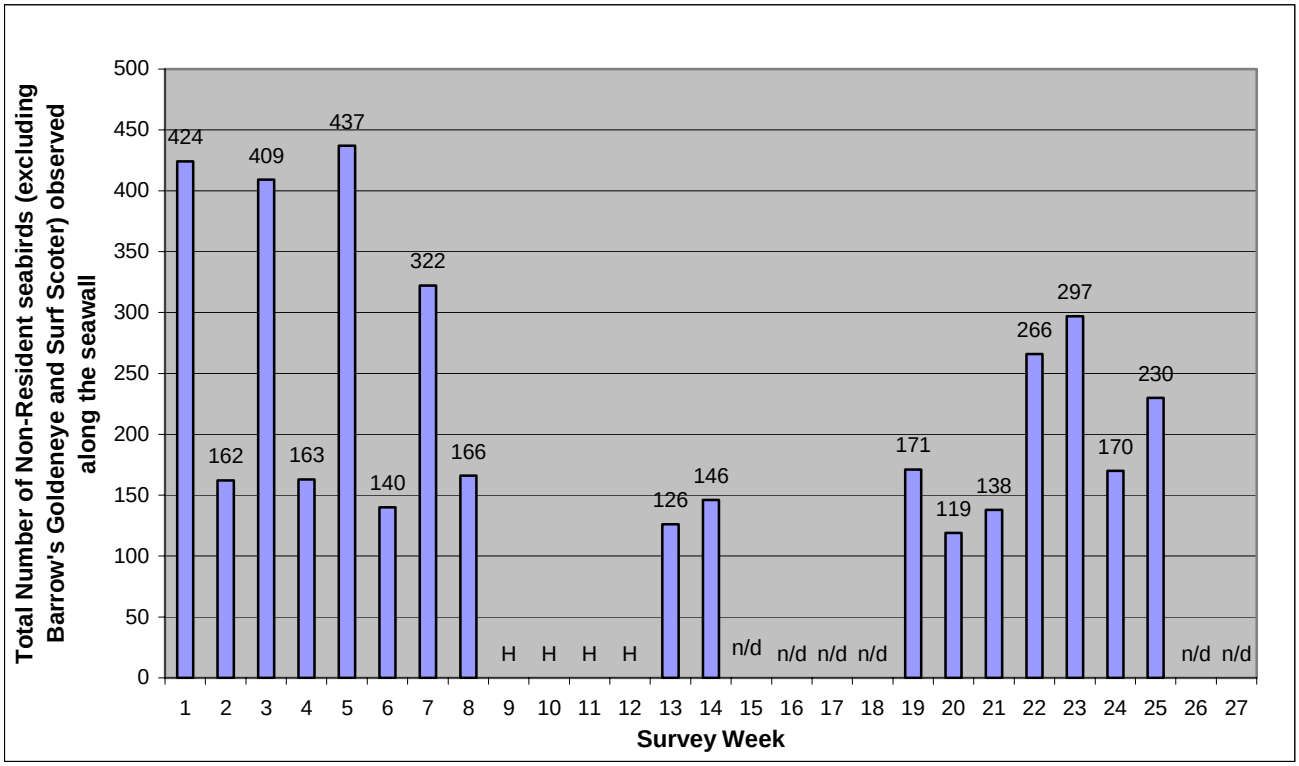

Figure 22. Abundance of seabirds (excluding the Barrow's Goldeneye and Surf Scoter) observed along the Stanley Park foreshore, October 13, 2004 to April 13, 2005. (An H indicates a week the survey was not conducted due to a holiday. An n/d indicates a week the survey was not conducted due to a seawall closure).

Twenty-seven different seabird species were observed along the seawall and are listed in Table 2 below.

Table 2. All seabird species observed during the 2004-2005 Barrow's Goldeneye and Surf Scoter survey along the Stanley Park seawall.

Common Name	Scientific Name	Species Code
Lesser Scaup	*Aytha affinis*	B-LESC
Long-tailed Duck	*Clangula hyemalis*	B-LTDU
Mallard	*Anas platyrhynchos*	B-MALL
Red-breasted Merganser	*Mergus serrator*	B-RBME
Surf Scoter	*Melanitta perspicillata*	B-SUSC
Family Alcidae		
Pigeon Guillemot	*Cepphus columba*	B-PIGU

Family Charadriidae – Plovers		
Killdeer	*Charadrius vociferus*	B-KILL
Family Haematopodidae - Oystercatchers		
Black Oystercatcher	*Haematopus bachmani*	B-BLOY
Family Gaviidae – Loons		
Common Loon	*Gavia immer*	B-COLO
Red – throated Loon	*Gavia stellata*	
Family Podicipedidae – Grebes		
Horned Grebe	*Podiceps auritus*	B-HOGR
Western Grebe	*Aechmophorus occidentalis*	B-WEGR
Family Phalacrocoracidae - Cormorants		
Double-crested Cormorant	*Phalacrocorax auritus*	B-DCCO
Pelagic Cormorant	*Phalacrocorax pelagicus*	B-PECO
Red-faced Cormorant	*Phalacrocorax urile*	
Family Ardeidae – Herons		
Great Blue Heron	*Ardea herodias*	B-GBHE
Family – Anatidae – Geese and Ducks		
American Wigeon	*Anas Americana*	B-AMWI
Barrow's Goldeneye	*Bucephala islandica*	B-BAGO
Bufflehead	*Bucephala albeola*	B-BUFF
Canada Goose	*Branta Canadensis*	B-CAGO
Common Goldeneye	*Bucephala clangula*	B-COGO
Common Merganser	*Mergus merganser*	B-COME
Eurasian Wigeon	*Anas penelope*	
Greater Scaup	*Aythya marila*	B-GRSC
Harlequin Duck	*Histronicus histronicus*	B-HADU
Hooded Merganser	*Lophodytes cucullatus*	B-HOME
Family Scolopacidae – Sandpipers		
Dunlin	*Calidris alpina*	B-DUNL
Sanderling	*Calidris alba*	B-SAND

4.5 Rare Species

A total of twenty-seven seabirds species were observed including rare sightings that included the Eurasian Wigeon (*Anas Penelope)* (Figure 23), Long-tailed Duck (*Clangula hyemalis)* (Figure 24) and the Red-faced Cormorant (*Phalacrocorax urile*) (Figure 25).

Figure 23. Eurasian Wigeon (source: Parigo website, 2004).

Figure 24. Long-Tailed Duck (source: Birds of Kolkata website, 2005).

Figure 25. Red-faced Cormorant (source: Observe Tours website, 2004).

5.0 Recommendations

The data collected in this survey is most beneficial when compared to data collected in previous years. The base-line data must continue to be collected to monitor the trends in over wintering populations of Barrow's Goldeneye and Surf Scoters. Recommendations for future Stanley Park Bird Surveys include:

- Record weather conditions for every survey week with special emphasis on wind speed. (We believe decreased numbers in weeks 5 and 6 were directly related to high winds).

- Establish distribution and abundance data for the blue mussels that feed the over wintering bird populations.

- Establish a standard data gathering procedure (field data forms and database), that remains constant from year to year.

- Examine the tidal effects on overwintering birds and their feeding behavior and timing.

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7.0 Appendix

13-Oct-04

BAGO	Male	Female	Juvenile	Pairs
0	0	0	0	0
SUSC	**Male**	**Female**	**Juvenile**	**Pairs**
233	121	112	0	0

Species	
AMWI	134
BAGO	0
BLOY	2
COLO	2
DCCO	9
GBHE	4
HADU	4
MALL	29
PECO	20
SUSC	233
Gulls	220
Daily Total	656

20-Oct-04

BAGO	Male	Female	Juvenile	Pairs
12	12	0	9	0
SUSC	**Male**	**Female**	**Juvenile**	**Pairs**
973	555	418	0	0

Species	
AMWI	67
BAGO	12
COLO	5
DCCO	6
HADU	17
HOGR	2
MALL	2
PECO	30
SUSC	973
Gulls	33
Daily Total	1147

27-Oct-04

BAGO	Male	Female	Juvenile	Pairs
335	232	103	18	4
SUSC	**Male**	**Female**	**Juvenile**	**Pairs**
2118	1156	962	0	0

Species	
AMWI	182
BAGO	335
BUFF	2
COGO	75
COLO	1
DCCO	1
GBHE	2
HADU	6
MALL	13
PECO	20
SUSC	2118
Gulls	107
Daily Total	2862

3-Nov-04

BAGO	Male	Female	Juvenile	Pairs
488	286	202	9	3
SUSC	**Male**	**Female**	**Juvenile**	**Pairs**
2675	1560	1115	0	0

Species	
AMWI	68
BAGO	488
BUFF	4
COLO	1
DCCO	7
GRSC	6
HADU	9
HOGR	2
LTDC	4
PECO	15
SUSC	2675
Gulls	47
Daily Total	3326

10-Nov-04

BAGO	Male	Female	Juvenile	Pairs
263	111	152	5	7
SUSC	**Male**	**Female**	**Juvenile**	**Pairs**
164	104	60	0	0

Species	
AMWI	235
BAGO	263
BLOY	10
BUFF	13
COGO	21
COLO	1
DCCO	4
DUNL	1
EUWI	1
GADW	2
GRSC	1
HADU	11
HOGR	8
MALL	59
PECO	23
EUWI	1
SAND	8
SUSC	164
Gulls	38
Daily Total	864

18-Nov-04

BAGO	Male	Female	Juvenile	Pairs
175	99	76	14	11
SUSC	**Male**	**Female**	**Juvenile**	**Pairs**
170	96	74	0	0

Species	
AMWI	87
BAGO	175
BUFF	3
COGO	4
COME	3
DCCO	3
HADU	3
HOGR	9
SUSC	170
WEGR	27
Gulls	1
Daily Total	485

	24-Nov-04			
BAGO	**Male**	**Female**	**Juvenile**	**Pairs**
530	305	225	1	12
SUSC	**Male**	**Female**	**Juvenile**	**Pairs**
1270	823	447	0	2
Species				
AMWI	81			
BAGO	530			
BLOY	5			
BUFF	18			
COGO	11			
COLO	3			
COME	6			
DCCO	5			
EUWI	1			
GBHE	1			
GRSC	1			
HADU	8			
HOGR	8			
LTDC	1			
MALL	72			
PECO	6			
SAND	60			
SUSC	1270			
Gulls	35			
Daily Total	2122			

1-Dec-04

BAGO	Male	Female	Juvenile	Pairs
472	264	208	4	27
SUSC	**Male**	**Female**	**Juvenile**	**Pairs**
1147	683	464	0	3

Species	
AMWI	68
BAGO	472
BUFF	11
CAGO	14
COGO	8
DCCO	2
GBHE	2
GRSC	8
HADU	6
HOGR	1
LTDC	3
PECO	4
SUSC	1147
WEGR	29
Gulls	10
Daily Total	1785

5-Jan-05

BAGO	Male	Female	Juvenile	Pairs
231	120	111	6	43
SUSC	**Male**	**Female**	**Juvenile**	**Pairs**
0	0	0	0	0

Species	
AMWI	27
BAGO	231
BUFF	13
CAGO	22
COGO	3
COME	2
DCCO	1
HADU	8
HOGR	10
MALL	4
PECO	13
RBME	5
SAND	6
SUSC	0
WEGR	3
Gulls	9
Daily Total	357

12-Jan-05

BAGO	Male	Female	Juvenile	Pairs
324	192	132	6	33
SUSC	**Male**	**Female**	**Juvenile**	**Pairs**
2	2	0	0	0

Species	
AMWI	18
BAGO	324
BUFF	8
CAGO	13
COGO	10
COLO	1
DCCO	2
DUNL	1
HADU	6
LESC	5
MALL	2
PECO	13
RBME	2
SAND	2
SUSC	2
Gulls	63
Daily Total	472

16-Feb-05

BAGO	Male	Female	Juvenile	Pairs
273	142	131	0	29
SUSC	**Male**	**Female**	**Juvenile**	**Pairs**
35	12	23	1	1

Species	
AMWI	45
BAGO	273
BUFF	10
CAGO	2
DCCO	1
GRSC	2
HADU	15
HOGR	1
LESC	1
LTDC	1
MALL	19
PECO	10
RBME	1
SUSC	35
Gulls	63
Daily Total	479

23-Feb-05

BAGO	Male	Female	Juvenile	Pairs
276	142	134	0	32
SUSC	**Male**	**Female**	**Juvenile**	**Pairs**
61	23	38	7	3

Species	
AMWI	17
BAGO	276
BLOY	2
BUFF	14
CAGO	17
COLO	1
COME	1
DCCO	10
HADU	2
LESC	4
MALL	6
PECO	16
RBME	3
SUSC	61
Gulls	26
Daily Total	456

2-Mar-05

BAGO	Male	Female	Juvenile	Pairs
424	233	191	3	49
SUSC	**Male**	**Female**	**Juvenile**	**Pairs**
26	12	14	1	4

Species	
AMWI	35
BAGO	424
BUFF	10
CAGO	4
COGO	3
DCCO	2
GBHE	1
GRSC	5
HADU	14
LTDC	1
MALL	14
PECO	25
SUSC	26
Gulls	24
Daily Total	588

16-Mar-05

BAGO	Male	Female	Juvenile	Pairs
1073	502	571	5	97
SUSC	**Male**	**Female**	**Juvenile**	**Pairs**
14	8	4	0	0

Species	
AMWI	47
BAGO	1073
BUFF	16
CAGO	4
COGO	13
COME	103
DCCO	6
HADU	4
MALL	66
PECO	10
PIGU	2
SUSC	14

23-Mar-05

BAGO	Male	Female	Juvenile	Pairs
361	190	171	19	56
SUSC	**Male**	**Female**	**Juvenile**	**Pairs**
5	3	2	1	2

Species	
AMWI	75
BAGO	361
BLOY	1
BUFF	9
CAGO	5
COGO	3
DCCO	5
GBHE	3
HADU	2
LESC	3
MALL	4
PECO	6
SUSC	5

		30-Mar-05		
BAGO	**Male**	**Female**	**Juvenile**	**Pairs**
236	106	130	4	1
SUSC	**Male**	**Female**	**Juvenile**	**Pairs**
110	72	38	0	0

Species	
AMWI	36
BAGO	236
BUFF	15
CAGO	2
COGO	2
COME	9
DCCO	6
GBHE	5
GRSC	30
HADU	1
MALL	13
PECO	13
PIGU	1
RBME	4
SUSC	110