

**ROBERTS BANK TERMINAL 2
TECHNICAL DATA REPORT
Coastal Birds
Pacific Dunlin Regional Distribution Study**

Prepared for:
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Technical Report / Technical Data Report Disclaimer

The Canadian Environmental Assessment Agency determined the scope of the proposed Roberts Bank Terminal 2 Project (RBT2 or the Project) and the scope of the assessment in the [Final Environmental Impact Statement Guidelines](#) (EISG) issued January 7, 2014. The scope of the Project includes the project components and physical activities to be considered in the environmental assessment. The scope of the assessment includes the factors to be considered and the scope of those factors. The Environmental Impact Statement (EIS) has been prepared in accordance with the scope of the Project and the scope of the assessment specified in the EISG. For each component of the natural or human environment considered in the EIS, the geographic scope of the assessment depends on the extent of potential effects.

At the time supporting technical studies were initiated in 2011, with the objective of ensuring adequate information would be available to inform the environmental assessment of the Project, neither the scope of the Project nor the scope of the assessment had been determined.

Therefore, the scope of supporting studies may include physical activities that are not included in the scope of the Project as determined by the Agency. Similarly, the scope of supporting studies may also include spatial areas that are not expected to be affected by the Project.

This out-of-scope information is included in the Technical Report (TR)/Technical Data Report (TDR) for each study, but may not be considered in the assessment of potential effects of the Project unless relevant for understanding the context of those effects or to assessing potential cumulative effects.

EXECUTIVE SUMMARY

Port Metro Vancouver (PMV) is assessing the potential to develop the Roberts Bank Terminal 2 Project (RBT2 or the Project), a new three-berth marine terminal at Roberts Bank in Delta, B.C. The Project is part of PMV's Container Capacity Improvement Program (CCIP), a long-term strategy to deliver projects to meet anticipated growth in demand for container capacity to 2030. This study was conducted as part of an environmental program for RBT2 Project, and focused on developing an understanding of the existing conditions in the study area.

The objective of the Pacific Dunlin (*Calidris alpina* ssp. *pacifica*) Regional Distribution Study was to assess the importance of the Fraser River estuary as over wintering habitat for Pacific dunlin in the context of the entire population overwinter in the entire Pacific range. The overall objective of this study was to ensure that adequate information is available to inform a future effects assessment of the Project.

North American Christmas Bird Count (CBC) data (National Audubon Society 2011) for Pacific dunlin were compiled. The data compilation included CBC sites (termed circles within the CBC program) that: a) registered five or more Pacific dunlin in at least one year from 1975 to 2010; b) had at least 30 years of counts; and c) had more than five years of consecutive surveys (i.e., the filter). The filter captured 93 circles for Pacific dunlin, covering most of the winter range and the majority of the population, and representing 3,348 surveys across the 36 years of data. Total annual counts were determined by summing data from all sites. The rate of change in numbers between years was calculated as the difference between the natural logarithms of total annual counts. Estimated annual mean number of Pacific dunlin across the region was 168,000 (range of 77,000 to 265,000). The total annual numbers of overwintering Pacific dunlin fluctuated strongly, with numbers varying more than threefold over the 36 year study. No long-term trend in the population numbers was noted; therefore, the subspecies does not appear to be declining as has been suggested in Canadian and U.S. Shorebird Conservation Plans. The Ladner CBC circle (representative of the Fraser River estuary) contains the largest single concentration of Pacific dunlin in the entire dataset. On average, more than 40% of the Pacific dunlin wintering population was located at three sites: Ladner B.C. (~20%), Gray's Harbor, WA (~16%), and Leadbetter Point, WA (~7%). The Ladner CBC circle encloses almost all of the mudflats of Boundary Bay, the Inter-causeway Area, Roberts Bank, and Westham Island.

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1.0 INTRODUCTION

This section provides an overview of the Pacific Dunlin (*Calidris alpina* ssp. *pacifica*) Regional Distribution Study, including project background information, rationale for the study being conducted, and Study components and major objectives.

1.1 PROJECT BACKGROUND

The Roberts Bank Terminal 2 Project (RBT2 or Project) is a proposed new three-berth marine terminal at Roberts Bank in Delta, B.C. that could provide 2.4 million TEUs (twenty-foot equivalent unit containers) of additional container capacity annually. The Project is part of Port Metro Vancouver’s (PMVs) Container Capacity Improvement Program, a long-term strategy to deliver projects to meet anticipated growth in demand for container capacity to 2030.

Hemmera was retained by PMV to undertake environmental studies related to the Project. This technical data report describes the results of the Pacific Dunlin Regional Distribution Study prepared by Dr. Ron Ydenberg of Simon Fraser University on behalf of Hemmera.

1.2 PACIFIC DUNLIN REGIONAL DISTRIBUTION STUDY OVERVIEW

A review of available information and state of knowledge was undertaken to identify key data gaps and areas of uncertainty regarding the nonbreeding distribution of Pacific dunlin, with the objective of assessing the importance of the Fraser River estuary (FRE), including the RBT2 area, for Pacific dunlin. The overall objective of this study was to ensure that adequate information is available to inform a future effects assessment of the Project. Study component, major objectives, and a brief overview are provided in **Table 1**.

Table 1 Pacific Dunlin Regional Distribution Study Components and Major Objectives

Component	Major Objective	Brief Overview
Pacific Dunlin Regional Distribution	<ul style="list-style-type: none"> Estimate the numbers of Pacific dunlin at all wintering sites along the Pacific coast. Investigate trends in wintering Pacific dunlin numbers across sites through time. Determine importance of the FRE as a wintering site. 	<ul style="list-style-type: none"> Christmas Bird Count (CBC) data from all sites along the Pacific coast were compiled for the years 1975 to 2010. Data were analysed to determine annual size of Pacific dunlin population and rate of change across sites. Importance of the FRE site relative to remaining sites was inferred.

The FRE is a major wintering site for Pacific dunlin, supporting the northernmost large (> 10,000 birds) population (Warnock and Gill 1996). The purpose of this report is to evaluate how important FRE is to Pacific dunlin by compiling information from the entire Pacific wintering range.

2.0 REVIEW OF AVAILABLE LITERATURE AND DATA

The Pacific dunlin is the only subspecies of dunlin (of 5 to 13 subspecies recognised worldwide) occurring in western North America. Pacific dunlin breed on the tundra of western Alaska from the Alaska Peninsula to Point Hope (Warnock and Gill 1996). The breeding season begins in mid-May and continues through to the end of July (Holmes 1971). After breeding, they travel to nearby coastal areas where they undergo post-nuptial moult and stage (Holmes 1971, Gill and Handel 1990), and by early- to mid-fall begin their southward migration to nonbreeding grounds from B.C. to Mexico (Warnock and Gill 1996, Gill and Handel 2013). On coastal wintering sites, they remain from October through to spring northward migration in April. During winter, Pacific dunlin forage on mudflats primarily for small marine invertebrates such as molluscs and polychaetes. They are ‘tide followers’, moving up and down the mudflat with the rise and fall of tides (Jimenez et al. submitted). At many locations, including the FRE, their marine diet is supplemented by terrestrial invertebrates collected in upland agricultural areas at night (Evans Ogden et al. 2004).

The Canadian Shorebird Conservation Plan (Donaldson et al. 2000) and its counterpart in the U.S. (Brown et al. 2001), list Pacific dunlin as a subspecies of concern (due to declining populations). Warnock and Gill (1996) estimate the loss of Pacific dunlin winter habitat to be between 30 and 91%, and the U.S. Shorebird Conservation Plan (Brown et al. 2001) attributes dunlin declines to habitat loss along the Pacific, Atlantic, and Gulf coasts. Research on European wintering grounds has related dunlin declines to anthropogenic changes to wetland habitats (Goss-Custard and Moser 1988).

3.0 METHODS

Descriptions of the spatial and temporal scopes of the Pacific Dunlin Regional Distribution Study, plus methods are provided below.

3.1 STUDY AREA

The study area includes almost the entire wintering range of Pacific dunlin, which extends from central B.C. to Baja California (**Appendix A: Figure 1**). The area is extensively covered by the Audubon Society's Christmas Bird Count (CBC), providing an excellent opportunity for a range-wide assessment.

3.2 TEMPORAL SCOPE

CBC data was assembled for 36 years, from 1975 to 2010.

3.3 STUDY METHODS

Survey data for Pacific dunlin were compiled from North American CBC (National Audubon Society 2011) data. The Audubon Society organises CBC surveys continent-wide (see <http://birds.audubon.org/christmas-bird-count>), compiles the data, and makes them available free of charge. Each count is based on a 15 mile (24 km) diameter count site or 'count circle' surveyed in a single 24 hour period between December 14 and January 5. Bird surveys are conducted by volunteers along a specified route within a count circle, and there are usually multiple survey teams per circle. Count circles do not overlap. Every bird heard or seen is recorded, along with data such as weather, time afield, and distance covered. The methodology is designed to encourage volunteers, whose aim is often to record as many different species as possible. However, this approach appears well-suited for counting Pacific dunlin as they occur almost exclusively in large aggregations in known locations and habitats. The number of Pacific dunlin in a flock can be estimated reasonably accurately by experienced volunteers. The mudflats on coastal estuaries where Pacific dunlin occur are well covered by CBC count circles throughout most of the winter range.

3.3.1 Data Analysis

To provide broad but consistent representation, the data compilation included CBC circles that: a) registered five or more Pacific dunlin in at least one year from 1975 to 2010; b) had at least 30 years of counts; and c) had more than five years of consecutive surveys. The filter captured 93 circles for Pacific dunlin, covering most of the winter range and the majority of the population, and representing 3,204 surveys (**Appendix A: Figure 1**). In addition, 104 missing annual values (i.e., missing surveys, 3.25%) were calculated using population marginal means (Searle et al. 1980), to give a total of 3,308 surveys across the 36 survey years. Total annual counts were determined by summing data from all sites, and rate of change in numbers between years was calculated as the difference between the natural logarithms of total annual counts.

4.0 RESULTS

This section presents the results of the Pacific Dunlin Regional Distribution Study.

4.1 STUDY RESULTS

The estimated annual mean number of Pacific dunlin is 168,000 (162,000 in the filtered data) with wide annual variability (i.e., 77,000 to 265,000, or 76,000 to 254,000 in the filtered data) (**Appendix A: Figure 2**). The rate of change in number of Pacific dunlin among years varied from -0.64 to 0.52 (**Appendix A: Figure 3**), but no long-term trend was apparent (least-squares linear regression: $r^2 = 0.03$, $p = 0.32$).

The mean number of Pacific dunlin counted per site was 1,803 (1,830 in the filtered data), which is 1.07% of the annual total. Of the 93 sites, only two (two in filtered data) represent more than 10% of the annual total, six represent more than 5% (3% in the filtered data), and 22 represent from 1 to 5% (21 in the filtered data). This analysis indicates that the population is concentrated at few sites, and that most sites represent less than 1% of the total population. Overall, the Ladner B.C. circle (representative of the Fraser River estuary) was the single largest site for Pacific dunlin use, and on average, more than 40% of the Pacific dunlin wintering population was located at just three sites: Ladner B.C. (~20%), Gray's Harbor, WA (~16%), and Leadbetter Point, WA (~7%). Along with two additional sites, Hayward - Freemont, CA and White Rock, B.C., more than 50% of the population overwinters at just five sites (**Appendix A: Figure 4**).

5.0 DISCUSSION

A discussion of the major results arising from the Pacific Dunlin Regional Distribution Study and data gaps are provided below.

5.1 DISCUSSION OF KEY FINDINGS

This analysis of CBC data led to several findings of interest to RBT2 Project. Firstly, total annual numbers of Pacific dunlin fluctuated strongly, with numbers varying more than threefold over the 36 year study. No long-term trend in the population numbers was noted; therefore, the subspecies does not appear to be declining as has been suggested in Canadian and U.S. Shorebird Conservation Plans. The reasons for the strong population swings are unknown, but an analysis by Xu et al. (submitted) found that a model combining strong density-dependence (presumed to act during the nonbreeding period) and several meteorological factors is able to back cast the population trajectory with good accuracy, which suggests that the population swings are a natural occurrence.

Secondly, the Ladner CBC circle contains the largest single concentration of Pacific dunlin in the entire dataset. Over the 36 year record, Ladner contained on average ~20% of the total Pacific dunlin wintering population of all CBC circles surveyed in North America. In an average winter, this amounts to about 40,000 Pacific dunlin. The Ladner circle encloses almost all of the mudflats of Boundary Bay, the Inter-causeway Area, Roberts Bank, and Westham Island. It does not include Sturgeon Bank (nor does the Vancouver CBC circle). Within the FRE, Pacific dunlin are known to forage at several sites including Boundary Bay, Roberts Bank, and Sturgeon Bank, with numbers highest at Boundary Bay, lower at Roberts Bank, and lowest at Sturgeon Bank (Fry 1980, Hemmera 2014). Approximately twice as many birds forage at Boundary Bay as at Roberts Bank. Numbers peak during the fall and spring migratory periods, with numbers easily doubling the winter averages.

5.2 DATA GAPS AND LIMITATIONS

The most significant gap is the underrepresentation of inland sites in the Pacific region, particularly the Willamette and Central valleys, and a lack of sites from Baja California, Mexico, and the Skagit River Estuary (because of gaps between circles). Comparison with inland sites in California suggests that the majority of the population resides on coastal sites; however, there may be several tens of thousands of Pacific dunlin wintering in Baja California and the Skagit estuary. As a result, population totals reported here are underestimates; however, the basic conclusions regarding large natural annual fluctuations in Pacific dunlin numbers and the importance of the FRE as a wintering site are unlikely to be affected.

6.0 CLOSURE

Major authors and reviewers of this technical data report are listed below, along with their signatures.

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8.0 STATEMENT OF LIMITATIONS

This report was prepared by Ron Ydenberg (Centre for Wildlife Ecology, Simon Fraser University), based on work conducted by Ron Ydenberg, for the sole benefit and exclusive use of Port Metro Vancouver. The material in it reflects Ron Ydenberg's best judgment in light of the information available to it at the time of preparing this Report. Any use that a third party makes of this Report, or any reliance on or decision made based on it, is the responsibility of such third parties. Ron Ydenberg accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this Report.

Ron Ydenberg has performed the work as described above and made the findings and conclusions set out in this Report in a manner consistent with the level of care and skill normally exercised by members of the environmental science profession practicing under similar conditions at the time the work was performed.

This Report represents a reasonable review of the information available to Ron Ydenberg within the established Scope, work schedule and budgetary constraints. The conclusions and recommendations contained in this Report are based upon applicable legislation existing at the time the Report was drafted. Any changes in the legislation may alter the conclusions and/or recommendations contained in the Report. Regulatory implications discussed in this Report were based on the applicable legislation existing at the time this Report was written.

In preparing this Report, Ron Ydenberg has relied in good faith on information provided by others as noted in this Report, and has assumed that the information provided by those individuals is both factual and accurate. Ron Ydenberg accepts no responsibility for any deficiency, misstatement or inaccuracy in this Report resulting from the information provided by those individuals.

APPENDIX A

Figures

Figure 2 Estimated Annual Mean Number of Pacific Dunlin Across 93 Christmas Bird Count Survey Sites

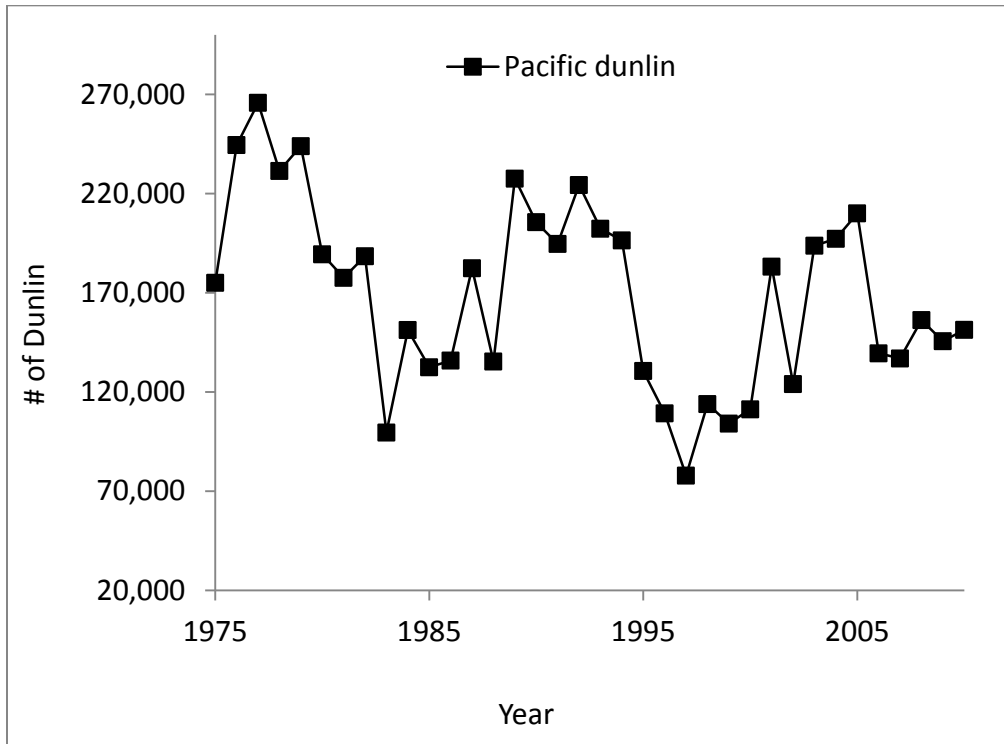


Figure 3 Rate of Change in Number of Wintering Pacific Dunlin among Years

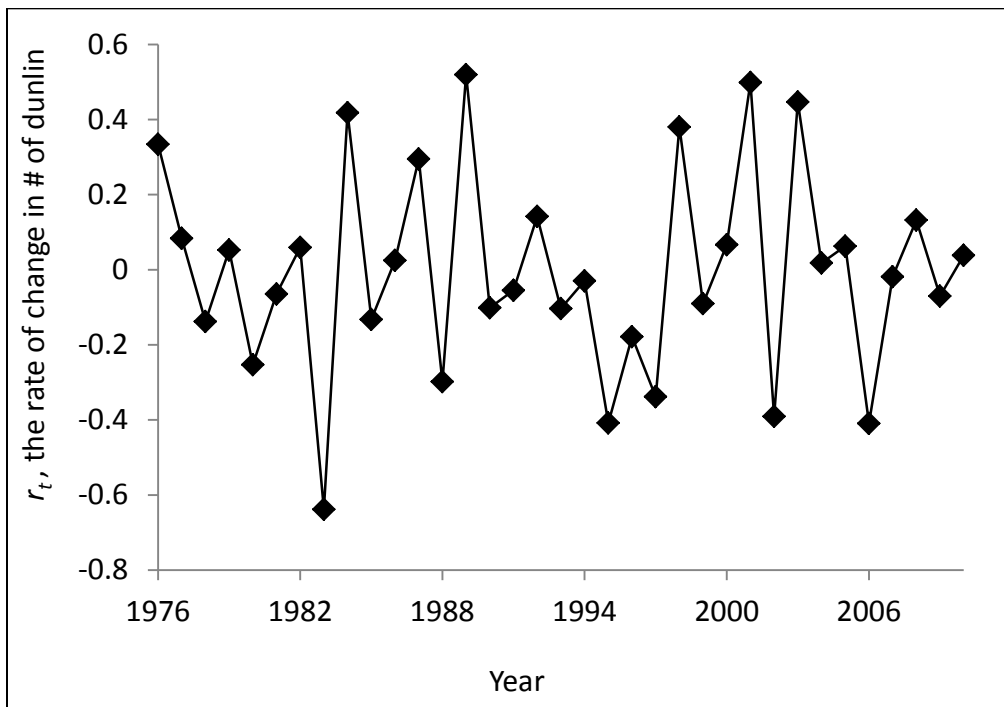
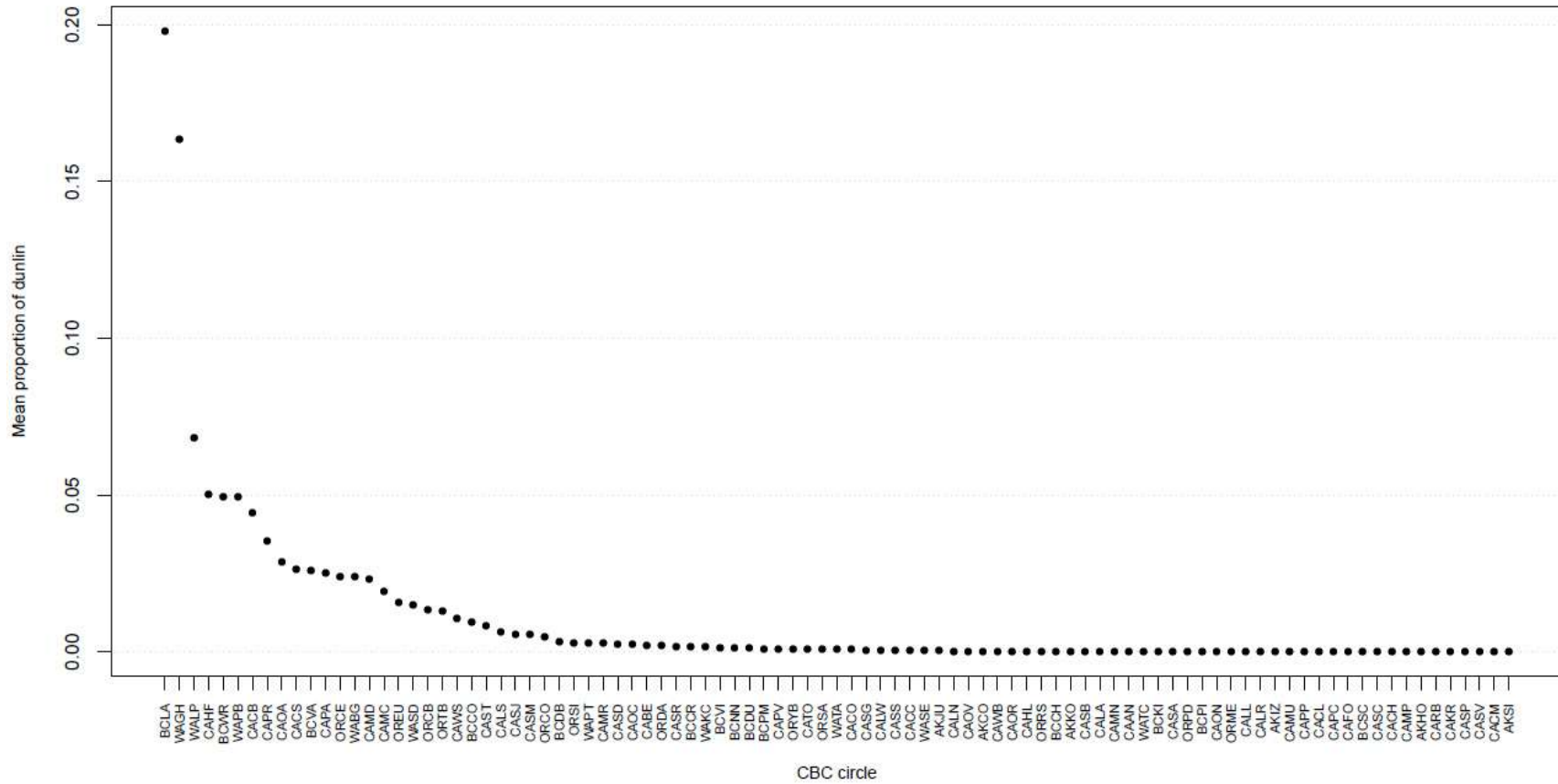


Figure 4 Mean Proportion of Pacific Dunlin Counted (Y axis) at each Site (X axis) from 1975 to 2010, Plotted from Largest to Smallest Mean (filtered, imputed dataset) (see Appendix B for CBC circle codes)

Mean proportion of dunlin counted at each site between 1975 – 2010, plotted from largest to smallest mean (filtered, imputed dataset)



APPENDIX B

Tables

Appendix B Christmas Bird Count (CBC) Sites by State\Province

Count Circle Code	Circle Name
Alaska	
AKCO	Cordova
AKHO	Homer
AKIZ	Izembek N.W.R.
AKJU	Juneau
AKKO	Kodiak
AKSI	Sitka
British Columbia	
BCCH	Chilliwack
BCCO	Comox
BCCR	Campbell River
BCDB	Deep Bay
BCDU	Duncan
BCKI	Kitimat
BCLA	Ladner
BCNN	Nanaimo
BCPI	Pender Islands
BCPM	Pitt Meadows
BCSC	Sunshine Coast
BCVA	Vancouver
BCVI	Victoria
BCWR	White Rock
California	
CAAN	Año Nuevo
CABE	Benicia
CACB	Centerville Beach to King Salmon
CACC	Contra Costa County
CACH	China Lake
CACL	Clear Lake
CACM	Claremont
CACO	Chico
CACS	Crystal Springs
CAFO	Folsom
CAHF	Hayward-Fremont
CAHL	Honey Lake
CAKR	Kern River Valley
CALA	Los Angeles
CALL	Lost Lake-Fresno
CALN	Lancaster
CALR	Lake Almanor
CALS	Los Baños
CALW	LaGrange-Waterford
CAMC	Marin County (southern)
CAMD	Moss Landing
CAMN	Manchester
CAMP	Monterey Peninsula
CAMR	Morro Bay
CAMU	Malibu
CAOA	Oakland
CAOC	Orange County (coastal)

Count Circle Code	Circle Name
California (cont.)	
CAON	Orange County (northeastern)
CAOR	Oroville
CAOV	Oceanside-Vista-Carlsbad
CAPA	Palo Alto
CAPC	Putah Creek
CAPP	Palos Verdes Peninsula
CAPR	Point Reyes Peninsula
CAPV	Peace Valley
CARB	Red Bluff
CASA	Santa Ana River Valley
CASB	Santa Barbara
CASC	Santa Cruz County
CASD	San Diego
CASG	Santa Maria-Guadalupe
CASJ	San Jose
CASM	Sacramento
CASP	Springville
CASR	Santa Rosa
CASS	Salton Sea (south)
CAST	Stockton
CASV	San Fernando Valley
CATO	Thousand Oaks
CAWB	Wallace-Bellota
CAWS	Western Sonoma County
Oregon	
ORCB	Coos Bay
ORCE	Columbia Estuary
ORCO	Corvallis
ORDA	Dallas
OREU	Eugene
ORME	Medford
ORPD	Portland
ORRS	Roseburg-Sutherlin
ORSA	Salem
ORSI	Silverton
ORTB	Tillamook Bay
ORYB	Yaquina Bay
Washington	
WABG	Bellingham
WAGH	Grays Harbor
WAKC	Kitsap County
WALP	Leadbetter Point
WAPB	Padilla Bay
WAPT	Port Townsend
WASD	Sequim-Dungeness
WASE	Seattle
WATA	Tacoma
WATC	Tri-Cities