Iona Island Bird Observatory
2016 Annual Report

Prepared for WildResearch by:

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Iona Island Bird Observatory (IIBO) is a program run by non-profit organization, WildResearch, whose mission is to build, train, and educate a community that contributes to conservation science

The Iona Island Bird Observatory is situated at Iona Regional Park. Use of the park is permitted by Metro Vancouver Regional Parks.

Major Funding for IIBO for 2016 was provided by the Sitka Foundation.

Additional funding from BC Nature and the BC Naturalists' Foundation for the purchase of professional photography equipment.

Cover Photo of a male Myrtle Warbler by Leslie Bol, 2016

ACKNOWLEDGEMENTS

The Iona Island Bird Observatory is a citizen science run program that could not operate efficiently without the help of our truly fantastic volunteers, and we admire your enthusiasm and dedication to the program. We thank the many WildResearch members that volunteered at IIBO this year and assisted with banding, extraction, and data recording (see Appendix A for a list of 2016 volunteers) .

Significant thanks and gratitude is owed to many supporters of IIBO in 2016, including the following individuals and collaborators:

- Metro Vancouver Regional Park has supported and facilitated the use of Iona Beach Regional Park for IIBO from 2010-2016. Big thanks to Iona Beach Regional Park Facilitators, Melanie Blendell for assistance with lane clearing, path upgrades, Markus Merkens and Robyn Worcester, Parks West Area *Natural Resource Management Specialist* for permitting support in 2016.
- Major funding for 2016 was generously provided the Sitka Foundation, allowing for equipment purchase, and wages towards seasonally hired contractors (bander-in-charge and assistant banders). Additional funding for wages for the Spring Migration Monitoring Program was generously provided by the City of Richmond. BC Nature and BC Naturalists' provided additional funding Foundation club grant for the purchase of the camera equipment (camera body and flash).
- Volunteer scheduling software for the 2016 IIBO program was made possible by a grant from the Mountain Equipment Co-op (MEC) for purchase Better Impact. We thank Mikaela Davis, Angela Bond, and Renae Mackas for coordinating volunteer requests from volunteers and for preparing the Better Impact schedule and sending reminder shift emails to those signed up to attend volunteer shifts.
- Special thanks to the Fairmont Vancouver Airport, and General Manager, Ken Flores, for collaborating with WildResearch and promoting guest packages for immersing in IIBO and learning about bird banding and bird-watching.
- Photography services were kindly donated by the following individuals: Jess Findlay, Leslie Bol, and Natasha Pirani. We thank "Meet your Neighbours" for the exceptional photography techniques used to capture images of birds in the hand at IIBO.
- Finally, several banders contributed to IIBO as paid contractors in 2016, including: Andrew Huang, Azim Shariff, Dan Froehlich, Sarah Nathan, and Kiirsti Owen, and unpaid volunteer banders, Paul Levesque and Christine Rock. Thank you for going that extra mile to provide a positive learning environment for volunteers, encouraging training and development for those attending IIBO, and for highlighting WildResearch's work at IIBO to park attendees and visiting groups.

Program Management in 2016 was by WildResearch President, Christine Rock. Duties included: completing annual permitting reporting and grant requests/reporting; contractor and data management; program and volunteer outreach; support to authors/review of annual IIBO reports and 2010-2015 cumulative report; scheduling banding demonstration group visits; managing collaborations, and overseeing site maintenance. The current report was reviewed and edited by Andrew Huang, Azim Shariff, and Christine Rock.

WildResearch

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

Iona Island Bird Observatory (IIBO) is located in Iona Beach Regional Park in Richmond, BC and was founded in the spring of 2010, and is the site of WildResearch's core programs: the Spring Migration Monitoring Program (SMMP) and the Fall Migration Monitoring Program (FMMP). WildResearch is a registered non-profit organization, whose mission is to build, train, and educate a community that contributes to conservation science. WildResearch's primary goals are research and monitoring of wildlife, environmental education, and community engagement through training and outreach.

At IIBO, passive mist-netting is used in both the SMMP and FMMP, which aim to monitor population and migratory trends, as well as, collect information about annual and long-term trends in breeding productivity. This information, as well as local information about site stopover length is also of interest to Metro Vancouver, who manages Iona Beach Regional Park.

During the 2016 SMMP (15 April to 30 May 2016), 1,232 individuals were captured across 2790 net hours at IIBO for a capture rate of 0.44 birds/net hour. Of these, 743 individuals were new (previously unbanded) individuals captured at a rate of 0.27 new birds/net hour and 261 were recaptured individuals (banded on a previous day, season, or year) at a rate of 0.09 birds/net hour. Forty-seven different species were monitored at IIBO with Wilson's Warbler being the most common species captured. The overall capture rate at IIBO was lower than in previous years; capture rates were 0.89, 0.99, 0.58 birds/net hour in years 2013, 2014, and 2015, respectively.

Point count surveys and daily estimated total surveys were completed as a component of the SMMP monitoring methods in 2016. Through this supplemental survey methodology, 11,261 individuals of 87 species of birds were recorded around IIBO. Point count surveys allowed for monitoring of species using Iona Beach Regional Park that were not represented in capture data. Data from point count surveys, banding, and daily observations at IIBO were combined for daily estimated totals. A total of 126 species were recorded at IIBO during the 2016 SMMP. Of these 126 species, 61 species were recorded during point count surveys that were not captured during passive mist-netting.

During the 2016 FMMP (August 21 to October 30, 2016), a total of 1,735 individuals were monitored over 1646 net hours at IIBO. Of these, 1,219 were new individuals captured at a rate of 0.75 birds/net hour and 490 were recaptured individuals at a rate of 0.3 birds/net hour. The capture rate for the 2016 FMMP was much higher than in 2015 (0.35 birds/net hour), but similar to previous years (i.e., 1.2 and 1.6 birds/net hour in 2013 and 2014 respectively). Forty-two different species were monitored at IIBO during the 2016 FMMP with the most common species being Yellow Warbler, making this species the top species banded for 5 out of 7 years of the FMMP. The high recapture rates for Yellow Warblers suggests these species use Iona Beach Regional Park as a primary fall migration route.

Avian monitoring at IIBO would not be possible without help from our numerous supporters and volunteers. WildResearch would like to acknowledge support from Metro Vancouver, funding from the Sitka Foundation, City of Richmond, BC Nature, and BC Naturalists' Foundation. Ninety volunteers contributed 2,146 hours of their time to run the two migration monitoring programs at IIBO in 2016. We extend our sincere appreciation to all those who donated their time at IIBO. It was the hard work and dedication of so many enthusiastic individuals that ensured the success of the monitoring programs this year.

Moving forward, WildResearch believes there is an opportunity to collaborate with students and researchers who wish to use the growing dataset from the migration monitoring programs at IIBO. This could help identify trends in the data or answer important questions about wild bird populations that use Iona Beach Regional Park during spring and fall. Collaborating with students or researchers directly relates to WildResearch's mission and would be an additional method to help reach WildResearch's primary goals.

1 INTRODUCTION

1.1 WildResearch

WildResearch is a charitable organization founded in 2010, whose goals involve wildlife research and monitoring, environmental education, and community engagement through training and outreach. This organization believes that use of these semi-natural habitats by wildlife is important for supporting biological communities, and should be further investigated. The Iona Island Bird Observatory (IIBO) program serves to increase our knowledge of such communities.

WildResearch manages several wildlife monitoring programs such as Nightjar Surveys, Butterfly Monitoring, and their flagship program, migration and songbird monitoring at IIBO.

1.2 Iona Island Bird Observatory

The same attributes which draw urban development near large bodies of water, estuaries, rich productive land and/or riparian areas make these areas biologically important. The residual urban green spaces provide refuges, resource sources, dispersal corridors, wintering habitat and migratory stopovers for avian species that traditionally relied on the landscape that urban areas now occupy (Ohmart 1994; Bolger et al. 2001; Melles et al. 2003; Sandström et al. 2006).

The IIBO is located within Iona Beach Regional Park, north of the Vancouver International Airport in the Greater Vancouver Regional District of Richmond, BC (Figure 1). BirdLife International and its local partners, Bird Studies Canada and BC Nature, have designated Iona Beach Regional Park as an Important Bird Area (IBA) as part of the Boundary Bay – Roberts Bank - Sturgeon Bank IBA. This urban park functions as an isolated patch of riparian and meadow habitat that is surrounded by an expanding matrix of residential, commercial and industrial development. The park has been demonstrated in previous years to act as a stopover site for a variety of passerines (IBA Canada 2016; Toochin 2014). In addition to fitting the criteria for a suitable urban study site, IIBO's close proximity to an easily accessible public park also allows for ample opportunity for training and public outreach. The IIBO operations throughout 2016 were based out of a small station building that was erected in the spring of 2013.

The IIBO is currently one of nine bird observatories in British Columbia, and one of two bird observatories operating in the Greater Vancouver Regional District. It is also one of the most westerly located banding stations in Canada, second to Rocky Point Bird Observatory on Vancouver Island. This allows for the opportunity to compare data at a local and regional scale within British Columbia.

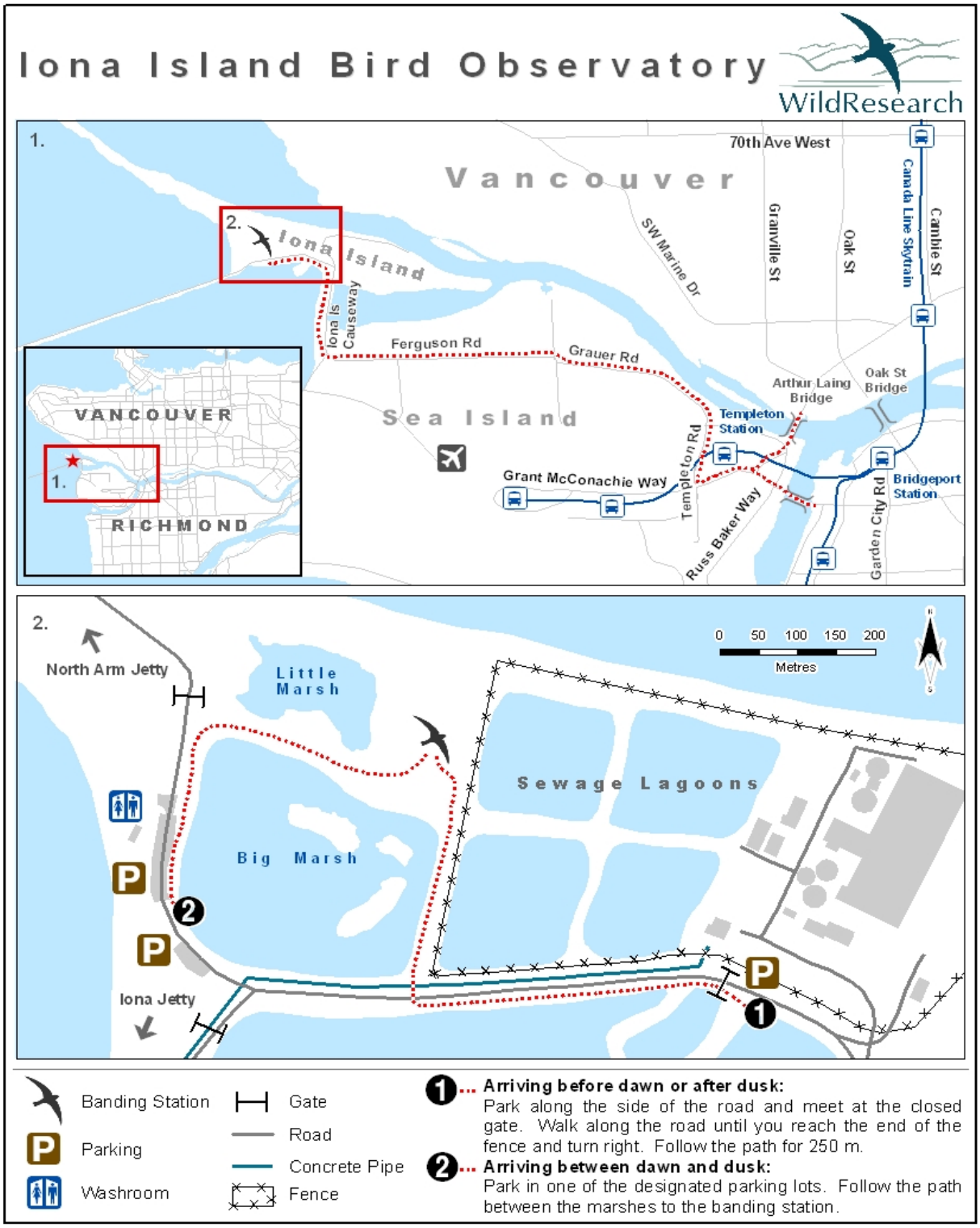

Figure 1. The Iona Island Bird Observatory is located within Iona Beach Regional Park.

1.3 Migration Monitoring Programs at IIBO

In 2016, WildResearch conducted two monitoring programs at IIBO: Spring Migration Monitoring Program (SMMP) and Fall Migration Monitoring Program (FMMP). A third program, the Winter Songbird Monitoring Program, was conducted at IIBO in previous years. However, a cumulative 6-year IIBO analysis of Winter Songbird Monitoring Program (WSMP) from 2010 to 2015 indicated insufficient data collection during winter months. The WSMP was therefore not completed in 2016, and will not be discussed further in the current report.

The main objective of the SMMP and FMMP programs was to monitor the abundance, diversity, annual productivity, survival and stopover ecology of birds that use Iona Beach Regional Park during the two migration seasons.

Many species of migratory birds are not adequately monitored on their breeding or wintering grounds due to time and cost limitations. Migration monitoring offers an opportunity to generate population trends, and can provide information on productivity, migratory trends, and stopover length (Crewe et al. 2008). Stopover length, body condition, and age can also provide information regarding habitat quality for migrant birds (Yong et al. 1998; Crewe et al. 2008). Increases and declines in populations can be reliable indicators of the health of not just a particular species, but also of the ecosystems that they utilize (Landres et al. 1988).

1.4 Outreach Initiatives

WildResearch's mission is to build, train, and educate a community that contributes to conservation science. This mission is achieved by creating innovative programs that contribute to conservation science, provide members with training and education in conservation science, and conduct conservation outreach. Avian monitoring at IIBO involves multiple outreach initiatives that include:

- Banding operations contributed largely to by volunteers;
- Group visits to the bird observatory from local school or university groups, naturalist clubs, and outdoors clubs; and
- Visits from Iona Beach Regional Park users who show an interest in bird monitoring at IIBO.

The location of IIBO within the very populated Greater Vancouver Area, allows for many opportunities for conservation outreach, which is important to garner more support for conservation programs, as well as public awareness and interest in conservation efforts and concerns in Metro Vancouver and beyond.

1.5 Report Objectives

The 2016 Iona Island Bird Observatory Annual Report summarizes the IIBO program activities in 2016. The 2016 report marks the 7th annual program in IIBO's history. This report presents the results of two major programs at IIBO from March 2016 to October 2016. The report also compares results with data from the cumulative report (2010 –

2015; Kissel & Scholefield 2016). The 2016 report also summarizes outreach initiatives and success stories from the 2016 period.

WildResearch believes that easy access to yearly activities and results will benefit the scientific community as well as the general public, thus the report will be freely accessible from the WildResearch website. In addition, this report will be distributed to WildResearch members, funders, and land managers that allow WildResearch use of their property.

2 SPRING MIGRATION MONITORING

2.1 Introduction

WildResearch initiated the Spring Migration Monitoring Program (SMMP) in 2010 as a pilot project. Now in its seventh year, the goals remain the same: to determine the abundance and diversity of migrants that use the area as a stopover site; to monitor the arrival dates of spring migrants and the departure dates of birds that migrate south to overwinter; and to maintain a focus on public education and outreach.

Over the past seven years, the Spring Migration Monitoring Program has consisted mainly of mist-netting and banding songbirds. A new edition to the 2016 report is the reporting of the point counts and daily estimated totals.

2.2 Methods

2.2.1 Mist-netting and Banding

The Spring Migration Monitoring Program (SMMP) occurred every day from mid-April to the end of May, as long as weather permitted. This intensive month and a half of mist-netting and banding allows WildResearch to have a better understanding of the abundance and diversity of songbird species migrating through the area as they move towards their breeding grounds.

The SMMP used 14 net lanes with nets 12 meters long in predetermined locations in a section of Iona Beach Regional Park (Figure 2). Net locations were selected in 2010 and 2011 to represent the diversity of wetland and riparian habitat and plant species compositions found within Iona Regional Park (Bishop and Forrester 2012; Shariff 2015). Net locations have remained the same (or nearly) to their original locations. However, the numbering of the nets was changed in the spring of 2015. Net numbers shown in figure 2 reflects current numbering scheme.

The fourteen nets were clustered in a way that allows monitoring of the nets in a timely manner, ensuring bird and volunteer safety. The nets were opened half an hour before sunrise and left open for 6 hours, weather permitting. Nets were closed if weather conditions such as temperature, wind or rain endangered the health or safety of the birds. Nets were checked every 15 to 30 minutes, depending on temperature, and the birds were extracted from the nets and brought back to the station for processing. Due to an unusually high water table in April 2016, net lanes 13 and 14 were not used until later in the season. Net 13 was first opened on 28 April 2016 and net 14 was first opened on 9 May 2016.

The SMMP involved constant-effort mist-netting and collection of morphometric and other data (age, sex, wing chord, weight, fat reserves, capture net and time of capture) from each bird captured. During the SMMP, feather wear/condition and shape, plumage variation, and eye colouration, were primarily used to categorize passerines into two age classifications: after-second year (ASY) and second year (SY). In some cases when these cues were not measurable or distinct enough for classification, individuals were classified as being of unknown age, or after-hatch year (AHY). Given that the SMMP aligns with when many early nesting birds are producing broods, some individuals were aged as hatch-year (HY), meaning that they were individuals born during the 2016-breeding season.

Figure 2. Map of IIBO net lanes 1 to 14 used in the 2016 Spring and Fall Migration Monitoring Programs.

2.2.2 Point Counts and Daily Estimated Totals

Using a standardized point count system to monitor bird abundance, diversity, habitat use, and migration timing can provide information on a variety of birds that are typically not caught in mist-nets (Ministry of Environment, Lands and Parks 1999; Boyd 2012). Combining the use of a standardized point count system with a standardized mist-netting operation provides a secondary survey method for monitoring the birds present at IIBO. Six point count stations (Figure 3) were established in representative habitat types at IIBO (wetland/pond, shoreline, sand dune and riparian). During the 2016 SMMP, an attempt

was made to conduct point counts at these six stations each banding day. Starting station and direction were determined using a randomized method (i.e. rolling a die to determine starting station, then again to determine direction). All six stations were completed within two hours after sunrise.

Point count data, along with capture data and observations around that station, were compiled to give a daily estimated total (DET). The DET is an estimate of the total number of birds present at IIBO during each day of monitoring.

Figure 3. Map of six point count station locations within IIBO used during the Spring Migration Monitoring Program in 2016. Solid lines represent mist-net locations.

2.3 Results & Discussion

2.3.1 Mist-netting and Banding

During the 2016 Spring Migration Monitoring Program, monitoring occurred on 44 days over seven weeks from 15 April to 30 May 2016 for a total of 2,790 hours. Over these 44 days, a total of 1,232 birds were captured at IIBO at a rate of 0.44 birds/net hour (0.015 birds/hr/m^2). Of these 1,232 individuals, 743 were new individuals captured at a rate of 0.27 new birds/net hour (0.009 birds/hr/m^2), which accounts for 60% of the birds captured during the 2016 SMMP. Of the total number of birds captured, 261 individuals were recaptured birds caught at a rate of 0.09 birds/net hour (0.003 birds/hr/m^2), which

accounts for 21% of birds captured during the 2016 SMMP. The remaining 228 individuals were unbanded (19% of the total), which could include birds that escaped during banding, species that IIBO was not authorized to band under federal permit, or birds that had previous injuries or conditions of which the bander felt a band might cause distress to the bird. One of the most common species groups that were left unbanded at IIBO during the program was hummingbirds. The IIBO federal station banding permit does not include authorization to band hummingbirds. Due to their small leg size, slightly different banding methods are required and therefore all hummingbirds caught in mist-nets at IIBO were released after careful extraction without banding.

Capture rates across the 2016 SMMP are presented in Figure 4. The highest capture rate of the program was observed on 18 April (0.98 birds/net hour) with a total of 54 individuals captured during 55 net hours. However, on 20 May, 2016 the highest absolute number of individuals were captured (n = 77), representing the second highest capture rate of the season (0.92 birds/net hour). Of these, 43% were Wilson's Warblers (n = 33), which was the most common species captured during the 2016.

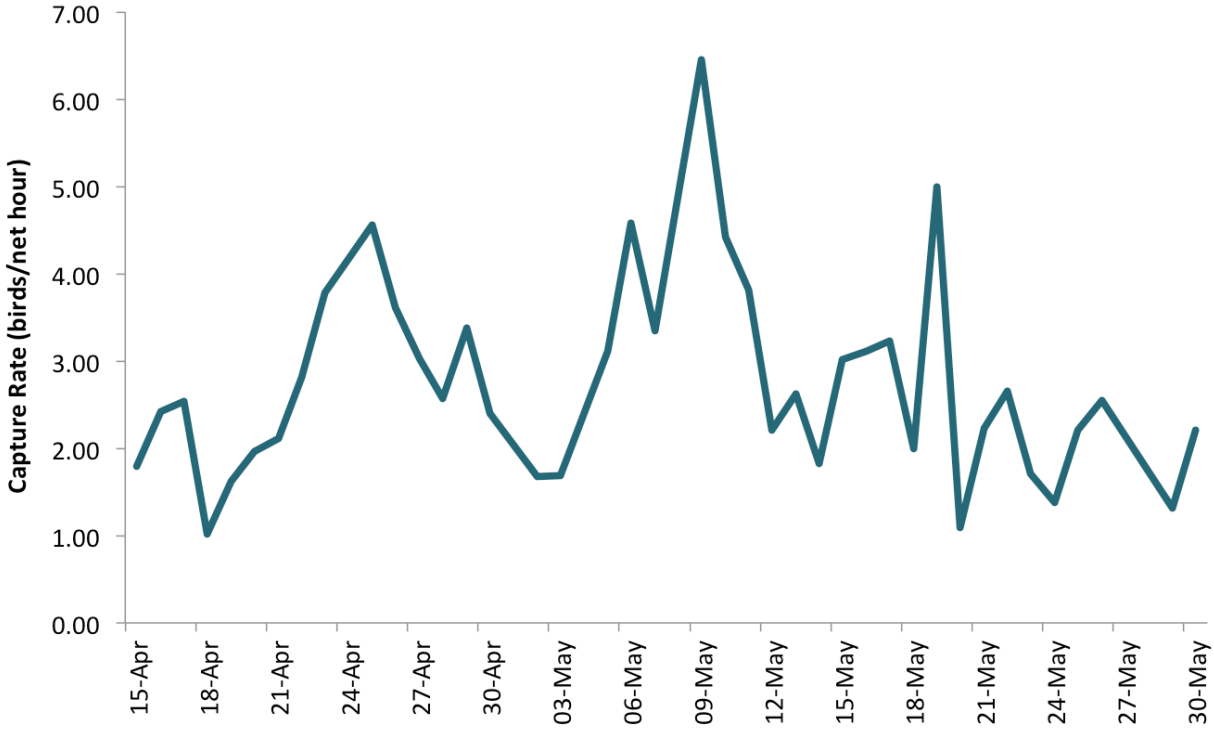

Figure 4. Capture rate (birds/net hour) across the duration of the Spring Migration Monitoring Program at IIBO in 2016.

The 1,232 individuals banded during the SMMP consisted of 47 unique species (Appendix B), which was higher than the average species richness (42 species) of the SMMP across the past seven years (Kissel & Scholefield 2016). Wilson's Warbler, Rufous Hummingbird, Orange-crowned Warbler, Common Yellowthroat, and Lincoln's Sparrow were the most

common species captured during the 2016 SMMP. Without including Rufous Hummingbirds since they were not banded, these four species accounted for 74% (n = 410) of new individuals captured and banded during the SMMP and 32% (n = 83) of recaptured individuals. Wilson's Warbler was the most common species captured at IIBO, consistent with five of the previous seven years of the SMMP. Lincoln's Sparrow is a new species to IIBO's history of top five most common birds captured during the SMMP (Table 1), however the Lincoln's Sparrow has been captured in low numbers across all years of study (Kissel & Scholefield 2016).

Numbers of Rufous Hummingbird captures were unusually high in the spring of 2016. Banding of hummingbirds is not included in IIBO's banding permit; therefore, it is difficult to know how many unique individuals were caught during the season. Each hummingbird caught was considered a 'new' individual, though it is likely that a number of individuals were recaptured throughout the season. The high numbers of Rufous Hummingbird may not adequately represent migratory individuals as it is probable that breeding pairs nested in IIBO and were continually captured in our nets. Rufous Hummingbird arrive to breeding locations along coastal BC in late March or early April and will brood until late May, these dates coincide with the SMMP at IIBO (eBird 2016).

The majority of the individuals of the most common species captured during the SMMP were aged to Second-year or After-second-year (Table 2). During spring, as migratory birds arrived at, or passed through IIBO en route to their breeding grounds, the age ratio of migrants was relatively close to 1:1 for four of the five species. However for Lincoln's Sparrow, more Second-year individuals were captured at IIBO than After-second-year with a ratio of 3.3:1 (SY:ASY; Table 2).

Because the timing of the SMMP coincides with the breeding period for early nesting species, some captured individuals were aged as hatch-year (HY), meaning they were born in the 2016 breeding season. A total of 82 individuals of six species were aged HY during the 2016 SMMP with 52% of these individuals being hummingbirds of two species: Anna's (n = 13) and Rufous (n = 40) Hummingbirds.

Peaks in capture rates throughout the SMMP corresponded with the arrival of the top five most common species captured at IIBO. Orange-crowned Warbler, Lincoln's Sparrow, and Common Yellowthroat arrived in large numbers earlier in the season and were followed by Wilson's Warbler and Rufous Hummingbird arriving later in the season (Figure 5).

During the 2016 SMMP, 1,232 individuals were caught over 44 days of banding. Compared to previous years' SMMPs, this number is relatively low. The capture rate for new individuals in the 2016 SMMP was 0.27 birds/net hour, which is the lowest capture rate over the last four years of spring migration monitoring at IIBO (Table 3). Capture rates from recent years at IIBO show a general decreasing trend; it will be important to continue monitoring spring migration at IIBO to see if this trend continues in this pattern.

Table 1. Top 5 species monitored (i.e. new, recaptured, and unbanded birds) during Spring Migration Monitoring Programs over the past seven years at IIBO

Rank	2010	2011	2012	2013	2014	2015	2016
1	Wilson's Warbler	Violet-green Swallow	Audubon's Warbler	Wilson's Warbler	Wilson's Warbler	Wilson's Warbler	Wilson's Warbler
2	Orange-crowned Warbler	Audubon's Warbler	Myrtle Warbler	Yellow Warbler	Audubon's Warbler	Orange-crowned Warbler	Rufous Hummingbird
3	Ruby-crowned Kinglet	Song Sparrow	Wilson's Warbler	Orange-crowned Warbler	Myrtle Warbler	Audubon's Warbler	Orange-crowned Warbler
4	Lincoln's Sparrow	Red-winged Blackbird	Orange-crowned Warbler	Myrtle Warbler	Orange-crowned Warbler	Myrtle Warbler	Common Yellowthroat
5	Audubon's Warbler	Tree Swallow	Ruby-crowned Kinglet	Audubon's Warbler	Ruby-crowned Kinglet	Yellow Warbler	Lincoln's Sparrow

Table 2. Top 5 species captured during 2016 Spring Migration Monitoring at IIBO with age ratios for individuals aged to SY and ASY

Species	Newly Captured Individuals	Percent of Total New Individuals	Recaptured Individuals	Percent of Total Recaptured Individuals	Number Aged to SY or ASY	Age Ratios (SY:ASY)
Wilson's Warbler	204	27%	25	3%	229	1.3:1
Rufous Hummingbird*	142	-	0	-	124	0.7:1
Orange-crowned Warbler	102	14%	12	2%	113	0.7:1
Common Yellowthroat	96	13%	45	6%	81	1.2:1
Lincoln's Sparrow	69	9%	1	0.1%	69	3.3:1

* Hummingbirds were not banded at IIBO; therefore all captures were considered "new"; percent of totals were not calculated for Rufous Hummingbirds since 'unbanded' birds were not included in the figure used to calculate percent.

Lower capture rates could be due to a drier than average winter season (i.e., November 2015 to March 2016) that was experienced in many parts of the world where many western migratory songbirds overwinter (i.e., Mexico, the Caribbean and Central and South America) (NOAA 2016). Many studies have shown that dry conditions can have adverse carry-over effects on breeding and survival of neotropical migrants during their migration and breeding seasons (Nott et al. 2002; LaManna et al. 2012; Sillett et al. 2000). Of the potential overwintering areas utilized by neo-tropical migrant species captured at IIBO, some areas reported record low precipitation levels during December to February 2016 (NOAA 2016). In order to assess whether trends at IIBO are similarly low at other monitoring stations, data from the 2016 SMMP at IIBO should be compared to other banding stations. This would help us understand if low capture rates during IIBO's 2016 SMMP was part of a general trend experienced across North America. At the time the current report was prepared, other bird banding stations had not yet made their 2016 annual reports publically available.

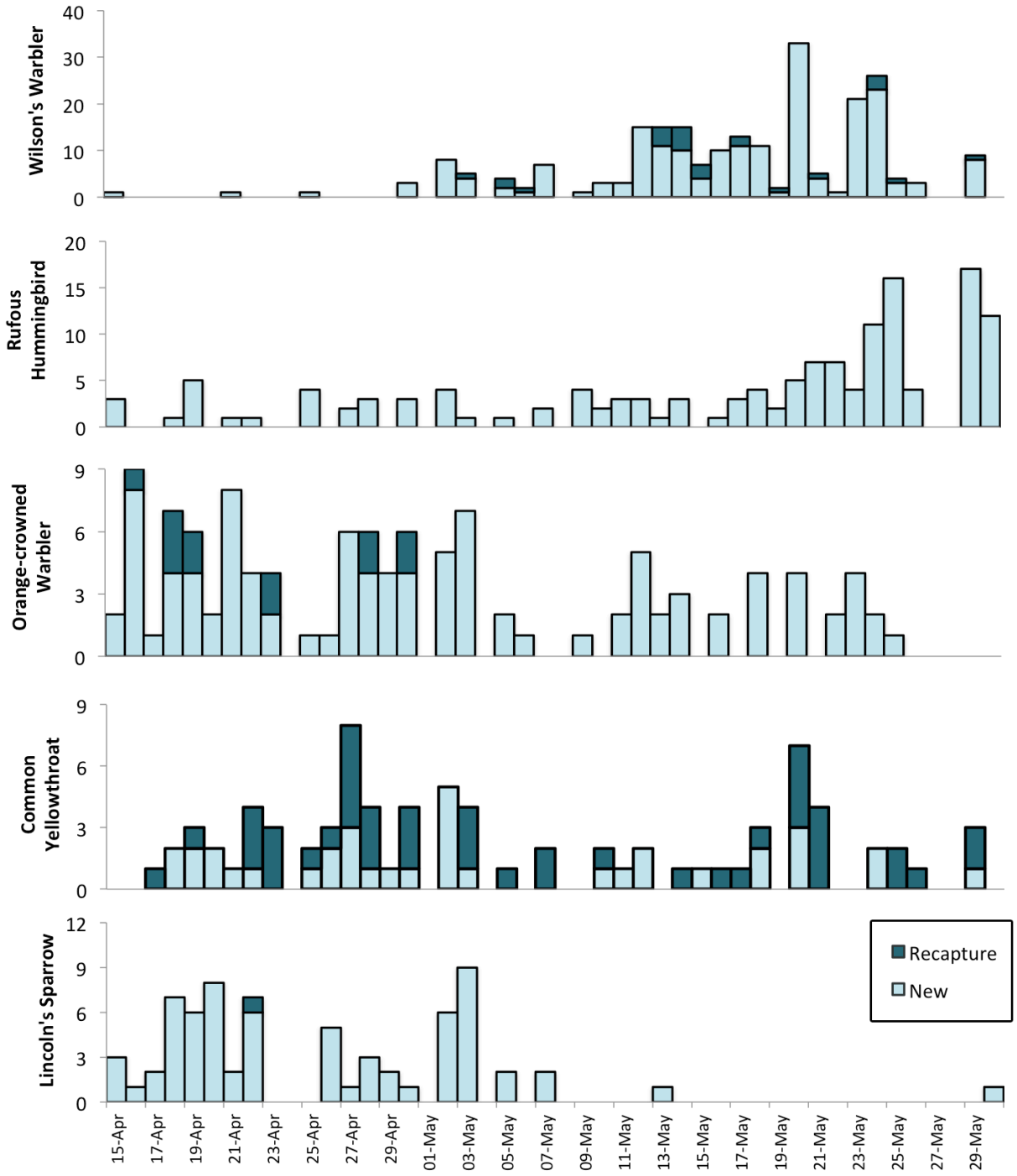

Figure 5. Individuals of the top 5 most common species from the 2016 Spring Migration Monitoring Program captured at IIBO over the course of the season. Bars represent total individuals captured with new birds and recaptured birds represented in different shades. Note that no hummingbirds were banded at IIBO, therefore all Rufous Hummingbirds are considered "new birds" and numbers therefore may not represent unique individuals.

Table 3. Capture Rates for Past Four Years of the Spring Migration Monitoring Program at IIBO

Year	Newly Captured Individuals	Recaptured Individuals	Total Individuals
2013	0.70	0.19	0.89
2014	0.83	0.16	0.99
2015	0.51	0.06	0.58
2016	0.27	0.09	0.44

Notable species captured during the 2016 SMMP included Sora (Figure 6) and Virginia Rail (Figure 7), both new species captured for the first time at IIBO. Both of these species are detected at IIBO during the spring during other survey methods (See Section 2.3.2), but rarely near the nets. Other less frequently monitored species captured included Calliope Hummingbird, Downy Woodpecker, Western Wood-Pewee, Dusky Flycatcher, Western Tanager, and Cliff Swallow.

Figure 6. Sora captured and banded on 28 April 2016, a new species captured for the first time at IIBO during the 2016 SMMP. Photo credit: Dan Froehlich.

Figure 7. Virginia Rail captured and banded on 30 May 2016, a new species captured for the first time at IIBO during the 2016 SMMP. Photo credit: Andrew Huang

1.1.1. Point Counts and Daily Estimated Totals

With the addition of point count and daily observation data, the Daily Estimated Totals (DETs) during the 2016 SMMP had a total number of 126 species recorded at IIBO. April 27th had the highest species richness recorded with a total of 55 unique species.

Point counts occurred on 33 of the 44 days of SMMP at IIBO. To avoid observer bias, point counts were conducted by the SMMP's two contracted banders. Point counts did not occur on days when IIBO was understaffed or when weather was inclement.

A total of 11,261 individuals of 87 species (Appendix C) were observed during point counts (Figure 8). Of these 87 species, 61 species were not recorded in banding data at IIBO and included many species from groups of larger birds such as waterfowl, gulls, and birds of prey. The greatest species richness during point counts was observed on 23 April 2016 (n = 38); the second highest number of individuals recorded during point counts was also observed on this day (n = 940). The highest number of individuals observed during point counts was on 5 May 2016 (n = 1209).

The top five species observed during point counts were Red-winged Blackbird (n = 1894), Tree Swallow (n = 2,553), Dunlin (n = 1,578), Green-winged Teal (n = 1,282) and European Starling (n = 952).

The Iona Island Bird Checklist describes a total of 327 species, with 207 species being observed at least once per year at Iona Beach Regional Park (Toochin 2014). In 2016, WildResearch monitored 39% of the total species ever recorded at Iona Beach Regional Park and 61% of the species seen at Iona Beach Regional Park at least once per year. Through the combined efforts of point count surveys, mist-netting and banding, and general observations at IIBO, WildResearch is successfully monitoring more than half of the species that are regularly observed at IIBO.

The 2016 SMMP was the first time that point counts and DETs were summarized annually. Ideally point count and daily observation data should be collected in future migration monitoring programs to gain a better understanding of trends in other species groups that use Iona Beach Regional Park during spring and fall.

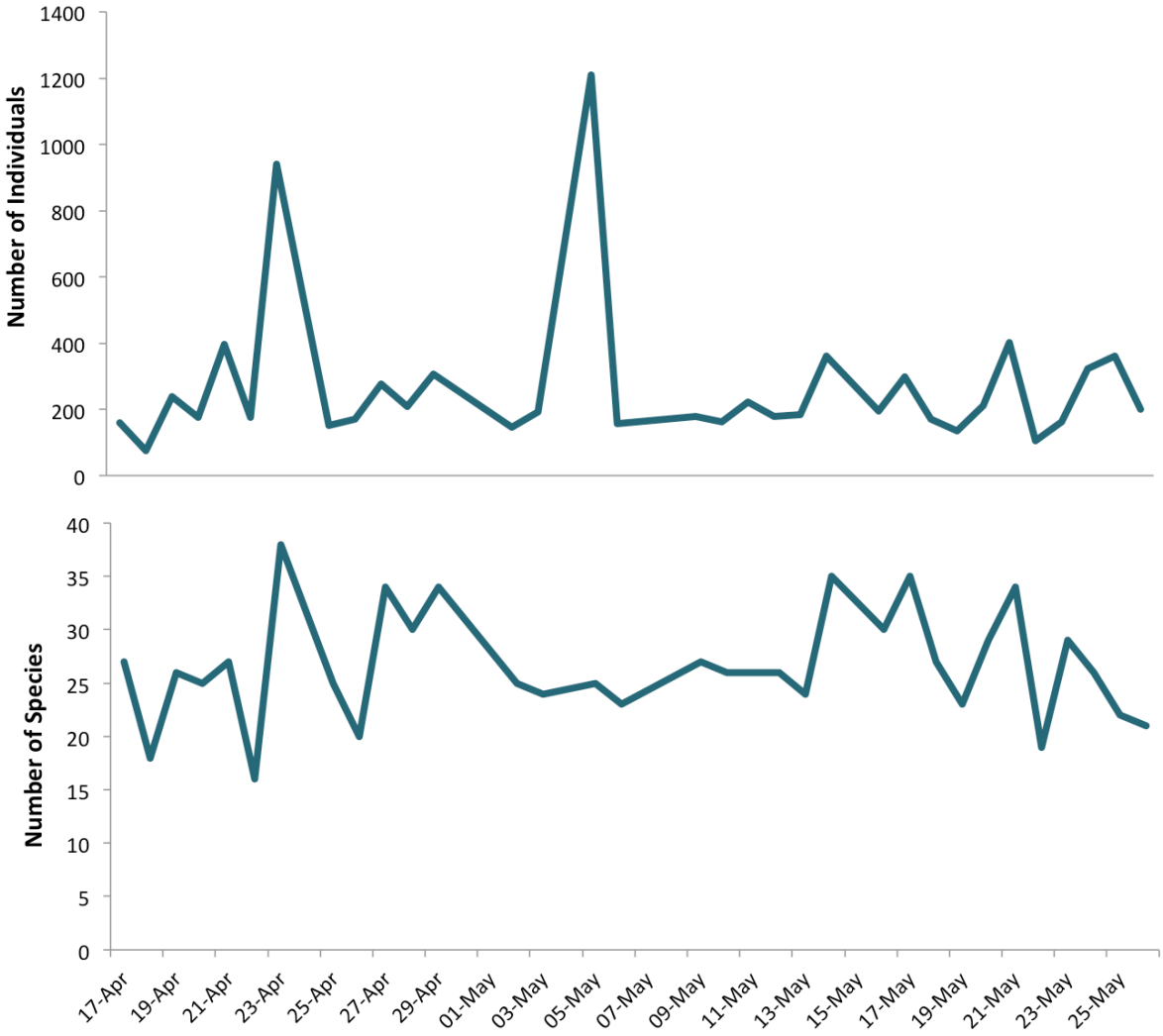

Figure 8. Total number of individuals (top) and number of species (bottom) observed during point counts conducted across six stations at IIBO during the 2016 SMMP.

3 FALL MIGRATION MONITORING

3.1 Introduction

The Fall Migration Monitoring program (FMMP) at IIBO was initiated in 2010. Like the SMMP, the FMMP is in its seventh year and the goals remain the same as the SMMP: to determine the abundance and diversity of migrants that use the area as a stopover, to monitor the arrival dates of fall migrants and the arrival dates of wintering birds, and to maintain a focus on public education and outreach.

3.2 Methods

Methods for the Fall Migration Monitoring Program (FMMP) were similar to the Spring Migration Monitoring Program; constant-effort mist-netting occurred in the same fourteen net lanes as the SMMP (see Figure 2 in section **Error! Reference source not found.**).

The FMMP began in mid-August and finished on the last weekend of October. Unlike the SMMP, the FMMP only occurred three days of the week (Friday, Saturday, and Sunday). Mist-netting and banding only occurred on fair weather scheduled banding days throughout the two and a half month period. The FMMP was spread out over a longer time period than the SMMP because studies of migratory birds suggest that fall migration is usually more leisurely with longer stopover periods and more time spent foraging. In spring, migration is more constrained in an effort to arrive earlier at breeding locations and set up suitable territories. Studies have shown that individuals that arrive earlier to breeding locations are more successful in acquiring a mate and rearing successful offspring (Aebischer et al. 1996).

Unlike the SMMP, in their fall migration passerines can be aged into two main age classifications hatch year (HY) and after-hatch year (AHY) by both skull pneumatisation (degree of bone ossification) and feather shape. Due to the preciseness of these cues for aging, very few birds were classified as being of unknown age during the FMMP compared to the SMMP where the cues were less apparent.

3.3 Results & Discussion

During the 2016 Fall Migration Monitoring Program, monitoring occurred up to three days per week for a total of 22 days and 1,646 net hours at Iona Island Bird Observatory. Over these 22 days, a total of 1,735 birds were captured at IIBO at a rate of 1.05 birds/net hour (0.035 birds/hr/m^2). Of these 1,735 individuals, 1,219 were new individuals captured at a rate of 0.75 new birds/net hour (0.025 birds/hr/m^2), which accounted for 70% of birds captured during the 2016 FMMP. Of the total, 490 individuals were recaptured birds caught at a rate of 0.3 birds/net hour (0.01 birds/hr/m^2), which accounted for 28% of birds captured during the 2016 FMMP. The remaining 23 individuals were unbanded. Capture rates during the 2016 FMMP were much higher than in 2015 (0.35 birds/net hour) (Buehler & Nathan 2016). However, compared to other years at IIBO, 2016's fall capture rate was similar (Arbeider 2015, Tirrul 2014, Boyd et al. 2011, Boyd et al. 2010).

Capture rates across the season are presented in Figure 9. Note that banding did not occur on every possible banding day or weekend. October 9th had the highest capture rate of the season (2.15 birds/net hour) with a very high number of Ruby-crowned Kinglets banded that day (n = 46 newly banded individuals). The capture rate on the first day of banding, (August 21st,), was relatively low at 0.75 birds/net hour suggesting that fall migration was still in its early stages with capture rates increasing by the next weekend of banding. October 1st and 2nd had relatively low capture rates (0.58 and 0.57 birds/net hour respectively). However, the last day of the season, October 30th, had the lowest capture rate at 0.41 birds/net hour. It is likely that by October 30th most birds had completed migration and the birds captured that day were mainly individuals overwintering in the area around IIBO.

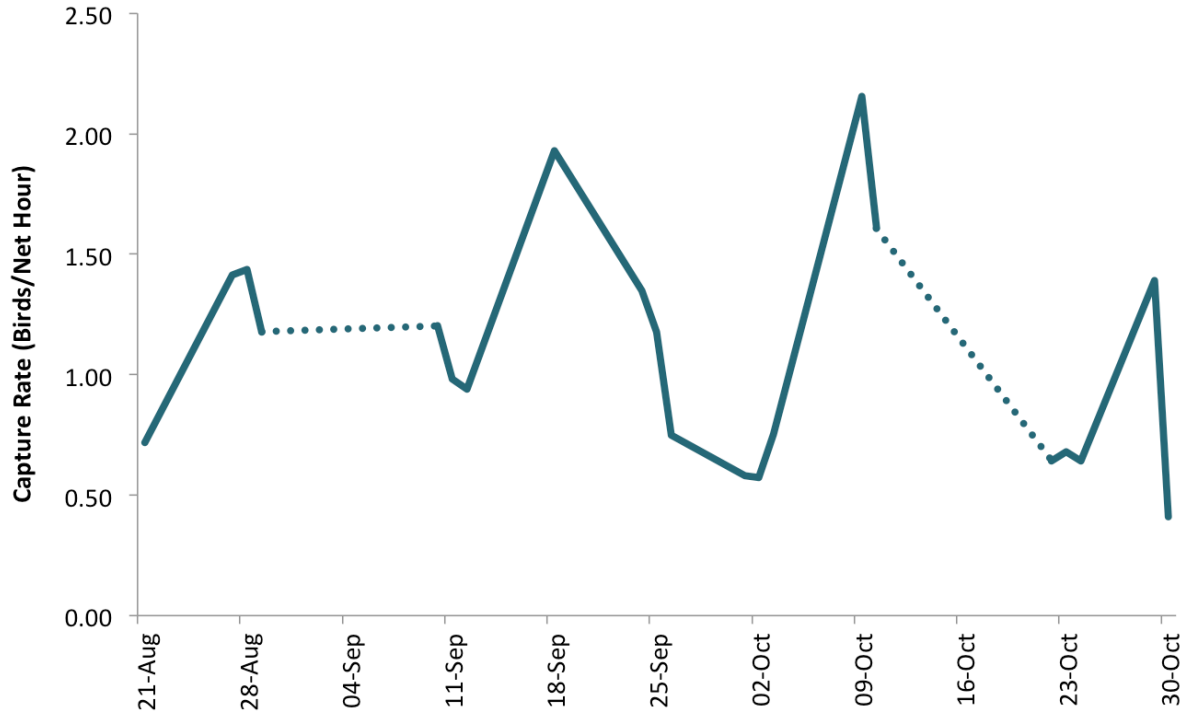

Figure 9. Capture rate (birds/net hour) across the duration of the Fall Migration Monitoring Program at IIBO in 2016. Dotted lines represents entire weekends where banding did not occur.

The 1,735 individuals consisted of 42 different species (Appendix B), with the top five most common species captured during the 2016 FMMP being Yellow Warbler, Ruby-crowned Kinglet, Song Sparrow, Common Yellowthroat, and Fox Sparrow (Table 4). Yellow Warbler was the most common species captured at IIBO in 2016, which was the case for five of the seven years of the FMMP.

Table 4. Top 5 species monitored (ie. New and Recaps) during Fall Migration Monitoring Programs over the past seven years at IIBO

Rank	2010	2011	2012	2013	2014	2015	2016
1	Yellow Warbler	Fox Sparrow	Yellow Warbler	Yellow Warbler	Yellow Warbler	Song Sparrow	Yellow Warbler
2	Orange-crowned Warbler	Song Sparrow	Audubon's Warbler	Orange-crowned Warbler	Audubon's Warbler	Fox Sparrow	Ruby-crowned Kinglet
3	Common Yellowthroat	Yellow Warbler	Song Sparrow	Fox Sparrow	Myrtle Warbler	Golden-crowned Kinglet	Song Sparrow
4	Lincoln's Sparrow	House Finch	Orange-crowned Warbler	Song Sparrow	Song Sparrow	Ruby-crowned Kinglet	Common Yellowthroat
5	Wilson's Warbler	Lincoln's Sparrow	Fox Sparrow	Ruby-crowned Kinglet	Unidentified Yellow-rumped Warbler*	Yellow Warbler	Fox Sparrow

* Unidentified Yellow-rumped Warbler refers to Yellow-rumped Warblers that couldn't be identified to Audubon's or Myrtle subspecies

The majority of the birds captured during the FMMP were aged as hatch-years, meaning they were born during the 2016 breeding season. However, for Common Yellowthroat the number of individuals aged hatch-year or after-hatch-year was almost the same (ratio of 1.1:1 HY:AHY). For the other four species, the ratio ranged from roughly 5:1 to 10:1 (Table 5).

Table 5. Top 5 species captured during 2016 Fall Migration Monitoring at IIBO with age ratios for individuals aged to HY and AHY

Species	Newly Captured Individuals	% of Total New Individuals	Recaptured Individuals	% of Total Recaptured Individuals	Number Aged to HY or AHY	Age Ratios (HY:AHY)
Yellow Warbler	194	16	62	13	251	11 : 1
Ruby-crowned Kinglet	128	11	72	15	193	5.7 : 1
Song Sparrow	112	9	61	12	165	4.5 : 1
Common Yellowthroat	96	8	41	8	136	1.1 : 1
Fox Sparrow	56	5	56	11	110	9.5 : 1

Warbler species were captured in highest numbers in the beginning of the season, as well as flycatchers and vireos. Later in the season, sparrow and kinglet species were more commonly caught, as wablers, flycatchers, and vireos became an increasingly rare capture towards the end of the program. This is reflected in capture trends of the top five most common species from the 2016 FMMP presented in Figure 10. The same trend was observed in the 2015 FMMP, which had similar top five species as in 2016 (Buehler & Nathan 2016).

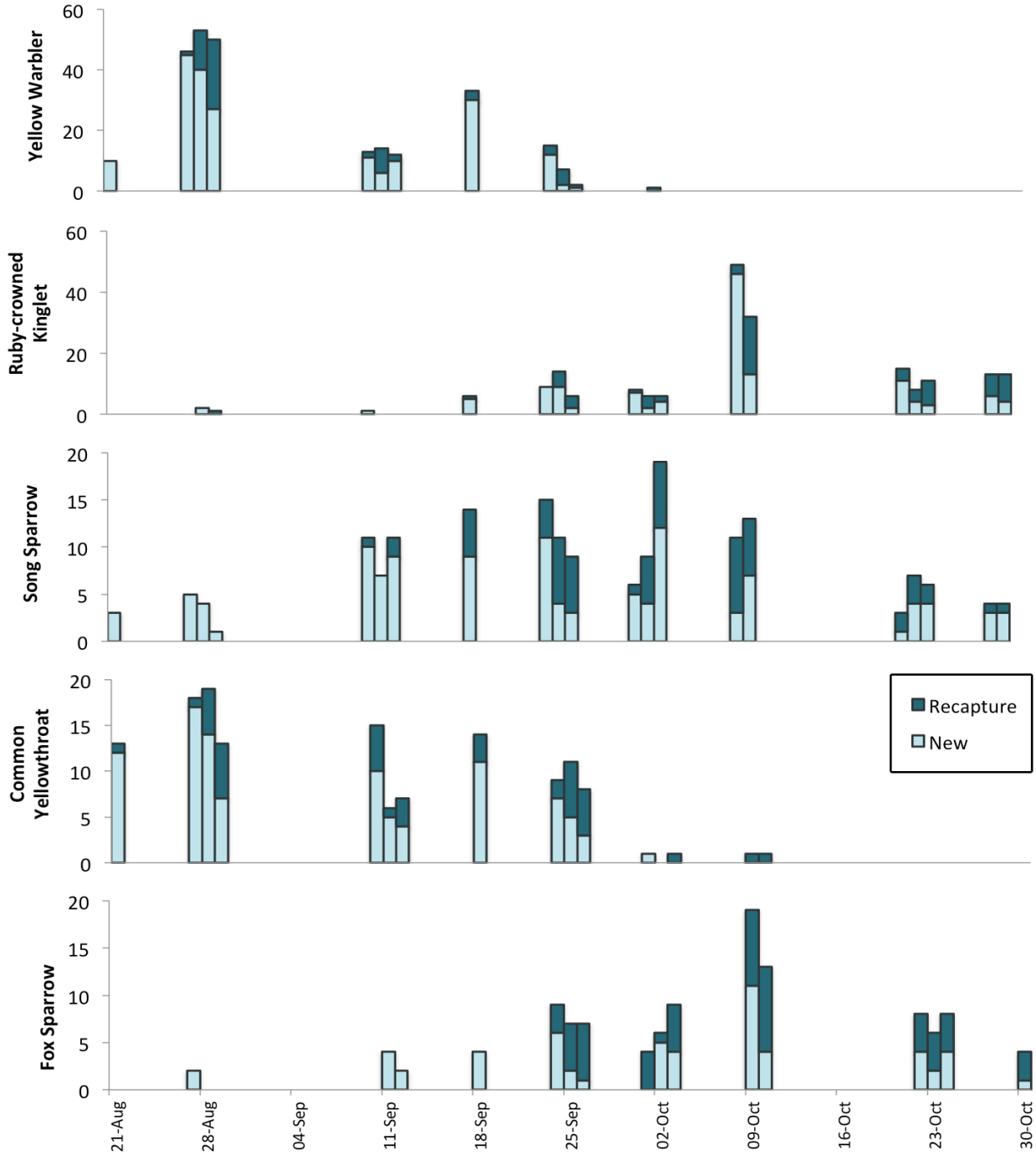

Figure 10. Individuals of the top 5 most common species from the 2016 Fall Migration Monitoring Program captured at IIBO over the course of the season. Bars represent total individuals captured with new birds and recaptured birds represented in different shades. *note: banding did not occur on every day or weekend during this period (including the entire weekends of Sept 3-5 and Oct 16-18).

Notable species captured during the 2016 FMMP included a Western Palm Warbler (Figure 11), which was only the second individual of this species banded at IIBO since operations began in 2010. This individual represents the 25th recorded individual of this species observed on Iona Island (Toochin and Levesque 2001). Another notable species includes the Northern Waterthrush (Figure 12), which is an uncommon capture at IIBO, especially during the fall, as sightings of this species at Iona Beach Regional Park have been restricted to the months of May and August (Toochin 2014). Other uncommon captures included Downy Woodpecker and White-throated Sparrow.

Figure 11. Western Palm Warbler captured at banded on 1 October 2016 was only the second individual of this species banded at IIBO. Photo credit: Kiirsti Owen.

Figure 12. Northern Waterthrush banded on 11 September 2016 is an uncommon species for IIBO. Photo credit, Kiirsti Owen.

4 VOLUNTEER AND OUTREACH SUMMARY

4.1 Introduction

Outreach and citizen science are at the heart of WildResearch's mission to build a community that is educated, trained, and involved in conservation science. Outreach initiatives at IIBO include group visits from different community groups including nature clubs, class visits from elementary to post-secondary level students, and Girl Guides and Scouts. The location of IIBO in Iona Beach Regional Park allows for opportunities to engage with park users as well, who often stop by the banding station and show an interest in monitoring activities.

Volunteers contribute largely to all of WildResearch's programs and this includes all activities carried out at IIBO. WildResearch acknowledges the contributions of volunteers who donate their time to engage in migration monitoring activities during the SMMP and FMMP each year. It is because of their generous contributions that migration monitoring at IIBO is possible.

4.2 IIBO Volunteer Summary

Volunteers contribute significantly to all of WildResearch's wildlife monitoring programs. Apart from two contracted banders, everyone who contributes time at IIBO during the migration monitoring programs does so as a volunteer. The data presented in this report is collected by these volunteers who collectively contribute to over a 2,000 hours at IIBO per year. Training provided by experienced banders resulted in many beginner volunteers rising to intermediate and advanced training levels, ensuring the continued success of the migration monitoring programs at IIBO and allowing volunteers to gain practical biological field skills. Many of the volunteers had little to no previous experience banding birds, and were very enthusiastic about the opportunity to be involved in banding, especially their first bird in the hand (Figure 13).

Figure 13. Volunteer Carina holds a Spotted Towhee on her first shift as a volunteer with WildResearch after first visiting IIBO the weekend before as a group visit with her 4th-year Ornithology class at UBC. Photo credit: Christine Rock

In 2016, a total of 90 volunteers contributed to 2,146 hours at Iona Island Bird Observatory over the duration of the two migration monitoring programs (including work parties at IIBO to prepare and close up the banding station; Figure 14). During the 2016 Spring Migration Monitoring Program at IIBO, 61 volunteers contributed to 1,077 volunteer hours at IIBO over 44 days of banding and two days of preparing or closing up the banding station. A number of advanced Banders also contributed to hands-on training weekends

that were hosted by WildResearch at the beginning of the SMMP and FMMP. These training sessions are designed to provide one-on-one training for volunteers that are new to bird banding. During the 2016 Fall Migration Monitoring Program at IIBO, 53 volunteers contributed to 1070 volunteer hours at IIBO over 22 days of banding and two days of preparing or closing up the banding station. A tribute to all volunteers who contributed to IIBO in 2016 is listed in Appendix A.

While the number of unique volunteers in 2016 was slightly lower than in the previous year, the general trend across the seven years shows an increase in volunteers involved in monitoring programs at IIBO (Figure 14). Volunteer hours changes from year to year and is influenced not only by number of volunteers, but also by which programs are run each year (ie. SMMP, FMMP, and/or the Winter Songbird Monitoring Program or WSMP) and how many days of banding are permitted per program due to weather. The general increase in IIBO volunteers over time suggests that WildResearch continues to grow in popularity while engaging the community in wildlife conservation and outreach.

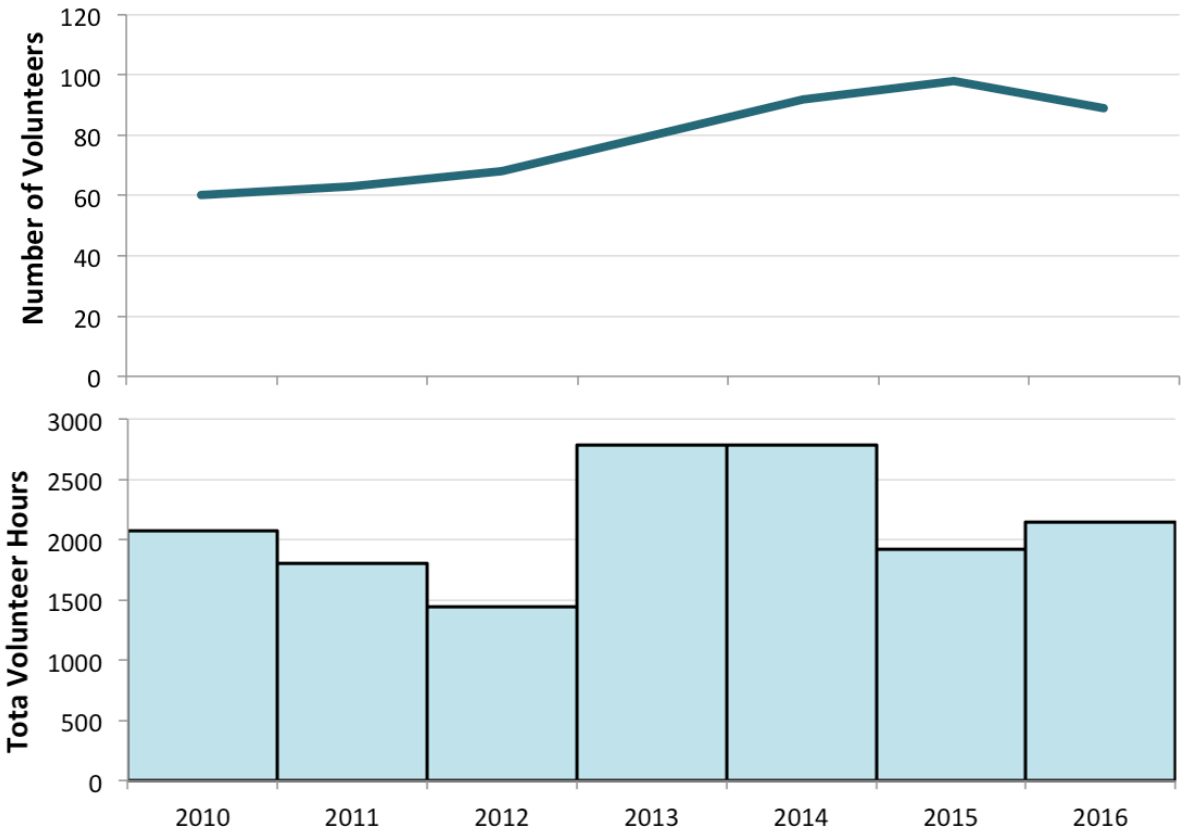

Figure 14. Total number of volunteers (top) and total volunteer hours (bottom) by year for Iona Island Bird Observatory from 2010 to 2016.

4.3 Group Visits

In 2016, WildResearch hosted eleven group visits at IIBO, including a total of 194 participants. Four of these group visits were during the SMMP with 45 participants and seven visits were during the FMMP with 149 participants. Group visits are summarized in Table 6.

Table 6. Group Visits hosted at IIBO during the 2016 SMMP and FMMP

Group Name	Number of Participants	Date
BCIT Restoration Class	20	April 23, 2016
Fairmont Vancouver Airport's Sustainability Committee	7	April 28, 2016
NatureKids – Vancouver Chapter	10	May 7, 2016
NatureKids – Eastern Fraser Valley Chapter	8	May 15, 2016
NatureKids – Tricities Chapter	26	September 18, 2016
Girl Guides – Renfrew District	36	September 25, 2016
UBC Ornithology Class	30	September 25, 2016
BCIT – Applied Conservation Class	30	October 2, 2016
NatureKids – Easter Fraser Valley Chapter	13	October 22, 2016
Fraser Valley University	2	October 23, 2016
Girl Guides – Burnaby District	13	October 23, 2016

4.4 Case Studies

4.4.1 Sponsoring Master's Degree Practicum at IIBO

During the 2016 FMMP, Natasha Pirani, a Masters student of the Environmental Practice program at Royal Roads University, completed her practicum at IIBO. The purpose of the practicum was to have students investigate a sustainability or environmental situation or issue and contribute a minimum of 75 hours working with a sponsoring organization. With a background in marketing, communication and administration, Natasha was a great fit for a new initiative WildResearch that involved producing a gallery of professional quality photos of birds in the hand (Figure 15).

Figure 15. Spread-wing photo of a Downy Woodpecker in the hand. Photo credit: Natasha Pirani.

This new photography initiative was made possible through a generous grant donation from BC Nature and BC Naturalists' Foundation that was received in the spring of 2016. The grant was put towards the purchase of high quality photo equipment, which was used during Natasha's practicum in the fall. Not only was Natasha involved in taking photos of birds captured during migration monitoring, she also captured photos of volunteers and group visits at IIBO. These photos are instrumental in increasing public awareness of WildResearch's efforts at IIBO and garnering more support for programs.

During her practicum at IIBO, Natasha learned about techniques used in migration monitoring, identification tips for a variety of species, and skills to use while photographing birds in the hand (Figure 16). Of her experience at IIBO, Natasha said, "I am enjoying capturing the unique features of different bird species in-the-hand, and capturing and highlighting the very dedicated and enthusiastic volunteers at IIBO. I have also had the opportunity to network and work with like-minded individuals. I'm so grateful for this opportunity, as it has been one of the most positive learning experiences."

Figure 16. Natasha Pirani, MSc. candidate from Royal Roads, learning how to band songsbirds with Bander-in-charge, Azim Shariff at IIBO during the FMMP. Photo credit: Christine Rock

4.4.2 NatureKids – Fraser Valley chapter

On 15 May 2016, during the SMMP, WildResearch hosted the Fraser Valley chapter of NatureKids at IIBO. Eight participants, that included children and parents, visited the banding hut all the way from the Chilliwack and Abbotsford area to learn about bird monitoring methods and see birds up close in the hand (Figure 17). Upon finishing the visit, the group leader said, "We had an amazing day with you and we can't thank you enough for an experience we will never forget."

After the visit, one participant wrote about her experience at IIBO and said it was her favourite NatureKids' field trip ever. She explained how she was given the opportunity to carefully release an American Goldfinch after it had been banded at the station. "I lifted my fingers, and it fluttered away and up into a tree. It perched there, lifted its head, and sang a pretty song. I loved this day!" The group returned in larger numbers (13) during the FMMP to experience IIBO and was equally as excited about their second IIBO experience.

For many group visitors, the opportunity to hold and release a bird is a memorable experience. This experience helps group visitors understand the delicacy of small birds and creates an awareness of the vulnerability of migrating birds. Through group visits to IIBO, WildResearch aims to provide group participants with a better understanding and appreciation of wild bird populations and monitoring efforts.

Figure 17. WildResearch President, Christine, shows NatureKids participants proper bird handling techniques at IIBO on 16 May 2016. Photo credit: Paul Levesque.

5 CONCLUSION

WildResearch has successfully conducted the Spring Migration Monitoring Program (SMMP) and Fall Migration Monitoring Programs (FMMP) for the past seven years (2010-2016) at the Iona Island Bird Observatory (IIBO). In 2016, a total of 2,967 birds were monitored over 4,435 net hours. The diversity and volume of birds that use IIBO are two important benefits of having the IIBO station situated on the Pacific Flyaway in Iona Beach Regional Park.

Capture rates during the 2016 SMMP were lower than in recent years (0.27 birds/net hour for new birds, 0.09 birds/net hour for recaptures) with a total of only 1,232 individuals captured (743 new, 261 recaptures). By comparison, capture rates were 0.89, 0.99, 0.58 birds/net hour in years 2013, 2014, and 2015, respectively. Continuation of IIBO Programs should seek to identify and characterize any potential declines, or continued patterns of decline. To determine whether low capture rates experienced at IIBO were indicative of general trends for neotropical migrant species, 2016 capture rates should be compared from other Banding Stations as 2016 annual reports become published and publically available. At the time the current report was published, annual reports from other stations were not available.

An additional monitoring method conducted during the SMMP (point count surveys) were summarized and included in the 2016 IIBO annual report for the first time. Point counts

were conducted around IIBO to gather data on birds using the area that may not be represented in the capture data. During the 2016 SMMP, 11,261 individuals of 87 species were monitored during point counts in the spring in 2016. Point count data was combined with capture data and daily observations to give Daily Estimated Totals of each banding day, this amounted to 126 species recorded at IIBO during the 2016 SMMP. Point counts should be continued at IIBO in the future so that results from each year can be compared and trends can be analyzed over time.

During the 2016 FMMP, capture rates were 0.75 birds/net hour for new birds, 0.3 birds/net hour for recaptures, with a total of 1,735 individuals (1,242 new, 490 recaptures) monitored at IIBO during the fall. Capture rates during the 2016 FMMP were higher than in 2015 (0.35 birds/net hour) (Buehler & Nathan 2016). However, compared to other years at IIBO, 2016's fall capture rate was similar (Arbeider 2015, Tirrul 2014, Boyd et al. 2011, Boyd et al. 2010).

As the effects of climate change and habitat loss intensify, the SMMP and FMMP programs at IIBO may contribute to management decisions at Iona Beach Regional Park and other natural areas in the Metro Vancouver area, in order to maintain avian species diversity and abundance.

In 2016, ninety volunteers contributed 2,146 hours at IIBO across the two migration monitoring programs. Their contributions were essential to the success of these programs and in return, each volunteer that came out to IIBO was provided with the opportunity to increase their experience and understanding in migration monitoring techniques employed at IIBO.

WildResearch hosted eleven group visits for a total of 194 participants at IIBO in 2016. People from a variety of ages and backgrounds attended group visits; all participants learned about banding operations, explored the bird observatory, had an opportunity to see a birds in the hand, and learn about the importance of migration monitoring at IIBO.

Through the two migration monitoring programs, WildResearch is accomplishing their three main goals of research and monitoring of wildlife, environmental education, and community engagement. This report is intended to fulfill the research portion of WildResearch's goals and to help contribute to a shared knowledge base that can inform conservation efforts.

6 FUTURE DIRECTIONS

Over the past seven years, WildResearch has collected a large amount of migration and songbird monitoring data at IIBO. The cumulative report (2010 – 2015) analyzed five years of banding data and explored trends in survival rates, fat accumulation, and arrival times of migrants (Kissel and Scholefield 2016). The results of this analysis suggested that after-hatch-year birds had higher survival rates than hatch-year birds and that weather had an impact on survival rates. The analysis also suggested that individuals spending more time at Iona Beach Regional Park during migration showed higher fat scores, suggesting that migratory birds benefit from being able to use Iona Beach Regional Park as a stopover site. The study did not, however, find significant changes in arrival times across years of study for warbler or sparrow species (Kissel and Scholefield 2016). As WildResearch continues the operation of IIBO and collect additional years of monitoring data at Iona Beach Regional Park, it would be valuable to reassess the research questions explored in Kissel and Scholefield (2006).

After the mutually beneficial experience of Natasha Pirani's MSc. practicum at IIBO in the fall of 2016, WildResearch would like to further collaborate with students or individuals interested in analyzed research questions from our growing dataset.

Some potential research questions that could be addressed using this dataset include:

1. What are the population trends for migratory bird species that use IIBO? How do they compare to other regional estimates (e.g. Christmas Bird Count, Breeding Bird Surveys)?
2. Is there a relationship between the return rates of neotropical migrants and the climatic and environmental conditions on their breeding, wintering, and migration areas?
3. Do the temporarily defined waves of migrating birds represent different breeding populations?
4. What is the dietary profile of migratory birds that forage at Iona Beach Regional Park?

As part of WildResearch's goal to build, train and educate a community that contributes to conservation science, we believe that collaborating with students on research projects aligns with our objectives. As WildResearch continues monitor bird populations at IIBO, it will be important to have students and researchers analyze these data and determine whether significant trends exist. This will help us better understand the health, behavior, and population changes in the wild bird populations that use Iona Beach Regional Park during spring and fall. These studies are particularly important in face of climate change and urban growth that could potentially impact migratory bird populations. Studies using IIBO's dataset will further assist wildlife and land managers in making important decisions that relate to Iona Beach Regional Park so that these populations can continue to persist and use this area for many years to come, and people can enjoy the biodiversity that Iona Beach Regional Park offers.

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7 APPENDICES

Appendix A – List of 2016 IIBO Volunteers

Aaron Ritchie
Agathe Lebeau
Alan McKenzie
Alecia Lannan
Andrew Huang
Alfred Bond
Angel Lai
Angela Bond
Angela Hansen
Anna Szeitz
Annika Flores
Azim Shariff
Bill Plummer
Brandon Law
Cadi Schiffer
Caitlin Pierzchalski
Carina Helm
Carolyn Shores
Carrie Kwok
Catriona Leven
Cecilia Montauban
Chelsea Brager
Chelsea Nerpio
Chloe Boynton
Christine Bishop
Christine Rock
Cindy Ederis
Conny Bregman
Courtney Lahue
Donna McKenzie
Else Mikkelsen
Eric Kerluck
Ernesto J Carrillo
Hana Hermanek
Hana Nicholson
Hannah Nieman
Hilary Miller
Jacqueline Huard
Jacqeline Feffer
Janice Kwo
Jared Ellenor
Jaryd Turner
Jayme Brooks
Jeff Groh
Jeff Shannon
Jesse Kemp
Johanna Stewart
Jorgen Hookham
Julien St Amand
Jun Hotaya
Justin Saunders
Karine Malouin
Katherine Loewen
Kathleen Thiele
Kayi Chan
Keila Stark
Ken Flores
Ken Willis
Kiirsti Owen
Laura Corey
Mackenzie Wong
Madelyn Ore
Margaret Munro
Marianna Dimauro
Merle Crombie
Micah Scholer
Moriah Tanguay
Murray Lashmar
Myles Lamont
Natasha Pirani
Nathalie Scott-Hsiung
Nina O. Morrell
Paul Chiu
Paul Levesque
Rebecca Seifert
Sabine Fedder
Samantha Mertens
Sara Tremblay-Boyer
Sarah Nathan
Seth Bennett
Shane White
Silu Wang
Steven Fedder
Stevie Hale-Jones
Stormy MacKay
Tyler Rogers
Vanessa Smith
Zachary Fedder

WildResearch

Appendix B – Species Lists by Program

Total species captured during 2016 Spring Migration Monitoring Program with number of individuals captured during the program (total includes new, recaptured, and unbanded individuals)

American Goldfinch	34	Myrtle Warbler	7
American Robin	31	Orange-crowned Warbler	114
Anna's Hummingbird	35	Oregon Junco	7
Audubon's Warbler	15	Pacific Wren	2
Black-capped Chickadee	14	Pacific-slope Flycatcher	6
Brown-headed Cowbird	9	Puget Sound White-crowned Sparrow	11
Black-headed Grosbeak	2	Purple Finch	2
Bullock's Oriole	1	Ruby-crowned Kinglet	19
Calliope Hummingbird	1	Rufous Hummingbird	142
Cedar Waxwing	7	Red-winged Blackbird	54
Cliff Swallow	1	Savannah Sparrow	19
Common Yellowthroat	81	Sora	1
Downy Woodpecker	4	Song Sparrow	69
Dusky Flycatcher	1	Spotted Towhee	30
European Starling	20	Swainson's Warbler	3
Fox Sparrow	7	Tree Swallow	23
Golden-crowned Kinglet	5	Virginia Rail	1
Golden-crowned Sparrow	31	Warbling Vireo	2
Hammond's Flycatcher	1	Western Tanager	1
Hermit Thrush	6	Western Wood-pewee	3
House Finch	11	Willow Flycatcher	2
Lincoln's Sparrow	69	Wilson's Warbler	229
Marsh Wren	52	White-throated Sparrow	1
Magnolia Warbler	11	Yellow Warbler	34

Total species caught during 2016 Fall Migration Monitoring Program with number of individuals captured during the program (total includes new, recaptured, and unbanded individuals)

American Robin	3
Anna's Hummingbird	4
Audubon's Warbler	41
Black-capped Chickadee	55
Bewick's Wren	5
Bushtit	1
Common Yellowthroat	137
Downy Woodpecker	3
Dusky Flycatcher	1
Fox Sparrow	112
Golden-crowned Kinglet	104
Golden-crowned Sparrow	62
Hermit Thrush	28
House Finch	45
Lincoln's Sparrow	49
Marsh Wren	15
Myrtle Warbler	35
Northern Waterthrush	1
Northern Rough-winged Swallow	1
Orange-crowned Warbler	66
Oregon Junco	8
Pacific Wren	59
Pacific-slope Flycatcher	6
Puget Sound White-crowned Sparrow	21
Purple Finch	6
Ruby-crowned Kinglet	200
Red-shafted Flicker	1
Rufous Hummingbird	1
Savannah Sparrow	20
Song Sparrow	174
Unidentified Sparrow	1
Spotted Towhee	84
Swainson's Thrush	5
Traill's Flycatcher	48
Unidentified Yellow-rumped Warbler	19
Warbling Vireo	29
White-crowned Sparrow	5
Willow Flycatcher	5
Wilson's Warbler	12
Western Palm Warbler	1
White-throated Sparrow	1
Yellow Warbler	257

Appendix C – Point Count Species Totals

Audubon's Warbler	2	Downy Woodpecker	4
Myrtle Warbler	2	Dunlin	1578
American Coot	6	Eurasian Collared Dove	16
American Goldfinch	75	Eurasian Starling	952
American Robin	154	Eurasian Teal	2
American White Pelican	8	Fox Sparrow	2
American Wigeon	268	Gadwall	362
Anna's Hummingbird	8	Glaucous-winged Gull	300
Bald Eagle	39	Golden-crowned Kinglet	6
Bank Swallow	5	Golden-crowned Sparrow	34
Barn Swallow	63	Great Blue Heron	370
Black-capped Chickadee	64	Greater Yellowlegs	14
Black-headed Grosbeak	11	Green-winged Teal	1282
Blue-winged Teal	26	Unknown gull sp.	16
Bonaparte's Gull	50	Herring Gull	2
Brewer's Blackbird	4	House Finch	138
Brown-headed Cowbird	248	Killdeer	134
Bufflehead	12	Least Sandpiper	290
Cackling Geese	1	Lincoln's Sparrow	10
Canada Geese (*moffittii*)	637	Mallard	470
Caspian Tern	122	Marsh Wren	788
Cedar Waxwing	18	McGillivray's Warbler	2
Cinnamon Teal	12	Merlin	2
Cliff Swallow	7	Northern Pintail	66
Common Merganser	9	Northern Rough-winged Swallow	38
Common Raven	4	Northern Shoveler	68
Common Yellowthroat	358	Northwestern Crow	491
Dark-eyed Junco	14	Orange-crowned Warbler	22
Double-crested Cormorant	208	Osprey	40

(continued)

Pacific slope flycatcher	4	Spotted Sandpiper	8
Pectoral Sandpiper	12	Spotted Towhee	525
Pied-billed Grebe	48	Tree Swallow	2553
Purple Martin	20	Turkey Vulture	2
Red-tailed Hawk	4	Violet-Green Swallow	8
Red-winged Blackbird	1894	Virginia Rail	8
Redhead	16	Warbling Vireo	4
Ring-billed Gull	139	Western Sandpiper	621
Ruby-crowned Kinglet	18	White-crowned Sparrow	49
Rufous Hummingbird	143	Wilson's Warbler	83
Sandpiper sp.	780	Unknown woodpecker sp.	2
Savannah Sparrow	20	Yellow Warbler	33
Unknown scaup sp.	12	Yellow-headed Blackbird	181
Snow Goose	80	Yellow-rumped Warbler	16
Song Sparrow	205		