

# DATA REPORT

Bird Monitoring and Banding Project  
at Buttertubs West Marsh, Nanaimo, BC

2013



Report prepared by:

Dr. Eric Demers (Vancouver Island University)

03 November 2013

## Table of Contents

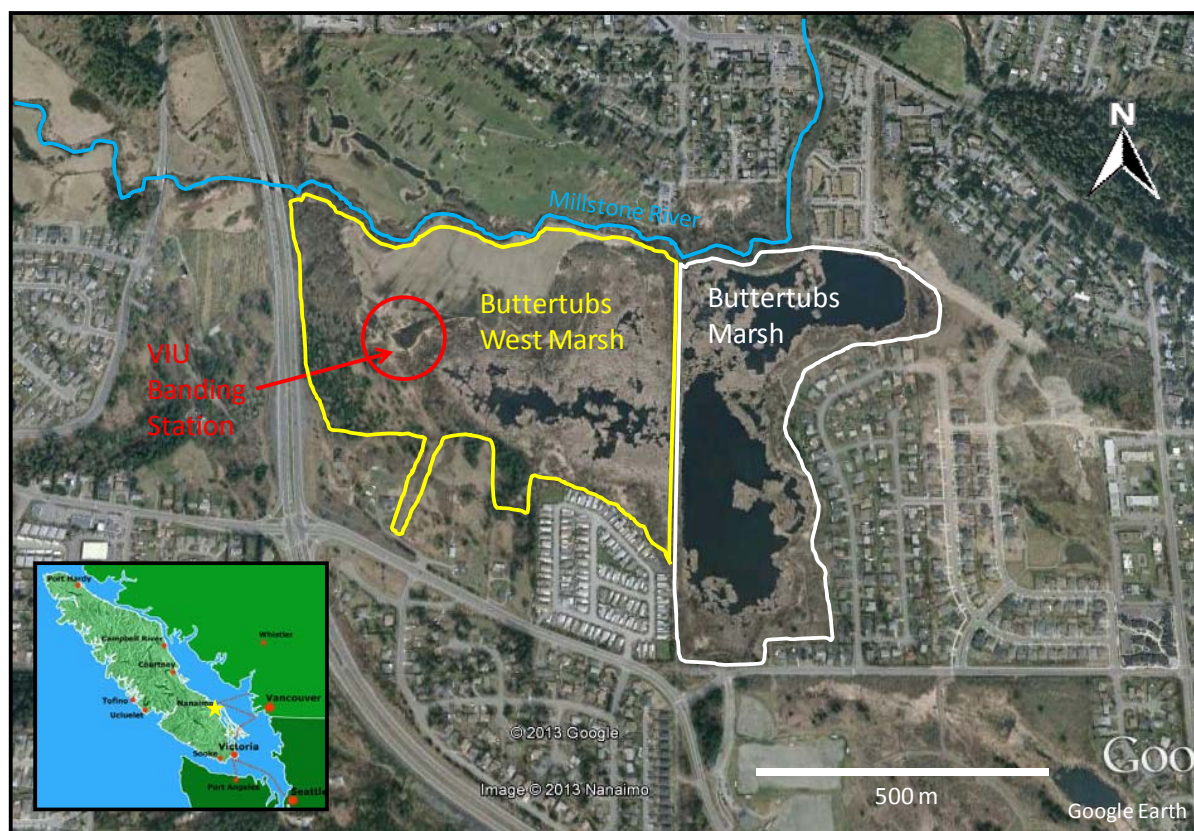
<b>1. Introduction</b> .....	3
<b>2. Songbird Monitoring and Banding</b> .....	4
2.1. <u>Methods</u> .....	4
2.1.1. <i>Songbird Banding</i> .....	4
2.1.2. <i>Incidental Observations</i> .....	5
2.1.3. <i>Weekly Census</i> .....	6
2.2. <u>Results</u> .....	6
2.2.1. <i>Songbird banding</i> .....	6
2.2.2. <i>Overall Species Presence / Absence</i> .....	12
<b>3. Swallow Nest Box Monitoring</b> .....	12
3.1. <u>Methods</u> .....	12
3.2. <u>Results</u> .....	13
<b>4. Nocturnal Owl Monitoring and Banding</b> .....	14
4.1. <u>Methods</u> .....	14
4.2. <u>Results</u> .....	15
<b>5. Volunteer Effort and Training</b> .....	16
<b>6. Public Demonstrations and Education</b> .....	18
<b>7. Acknowledgements</b> .....	18
<b>8. References</b> .....	19
<b>9. Appendix</b> .....	20

### Disclaimer Note:

This report is a compilation of a field project conducted by Vancouver Island University, in partnership with the City of Nanaimo, Ducks Unlimited Canada and the Vancouver Avian Research Centre. Neither Vancouver Island University, nor any of its employees or students, nor any of the named partners, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or for any third party use or the results of such use of any information disclosed.

## 1. Introduction

In the summer of 2012, the City of Nanaimo and Ducks Unlimited Canada jointly acquired the 27-hectare Buttertubs West Marsh property. This property, which is located west of the Buttertubs Marsh Conservation Area and east of the Nanaimo Parkway (Figure 1), encompasses a mixture of ecosystem types, including marsh and shallow water, riparian areas, upland forest and old-field habitats. Altogether, the Buttertubs West Marsh and adjacent Buttertubs Marsh represent approximately 53 hectares of productive parkland habitat with significant ecological value in an otherwise fragmented urban landscapes (Lepczyk and Warren, 2012). In particular, these green spaces can provide important breeding, stopover and wintering habitats for various bird species (North American Bird Conservation Initiative, 2012).



**Figure 1.** Aerial photograph of the Buttertubs West Marsh in Nanaimo, BC, including the location of the Vancouver Island University (VIU) bird monitoring and banding project.

During March-October 2013, Vancouver Island University established and operated a bird monitoring and banding project at Buttertubs West Marsh, with overall objectives to:

- monitor migrant and resident birds to contribute to regional and continent-wide efforts to monitor changes in population levels of these species;

- provide practical educational and training opportunities for VIU students and community volunteers; and,
- conduct public demonstrations where people of all ages can learn about bird identification, ecology, evolution and conservation.

This project was conducted in close collaboration with the Vancouver Avian Research Centre, which operates a bird monitoring and banding station at Colony Farm Regional Park, in Coquitlam, BC, and in partnership with the City of Nanaimo and Ducks Unlimited Canada.

This report summarizes the activities and results of the first year of this project. Project activities are described in the sections below and included:

- songbird monitoring and banding;
- swallow nest box monitoring; and,
- nocturnal owl monitoring and banding.

Summaries of volunteer effort / training and public demonstration / education are also included.

## 2. Songbird Monitoring and Banding

### 2.1. Methods

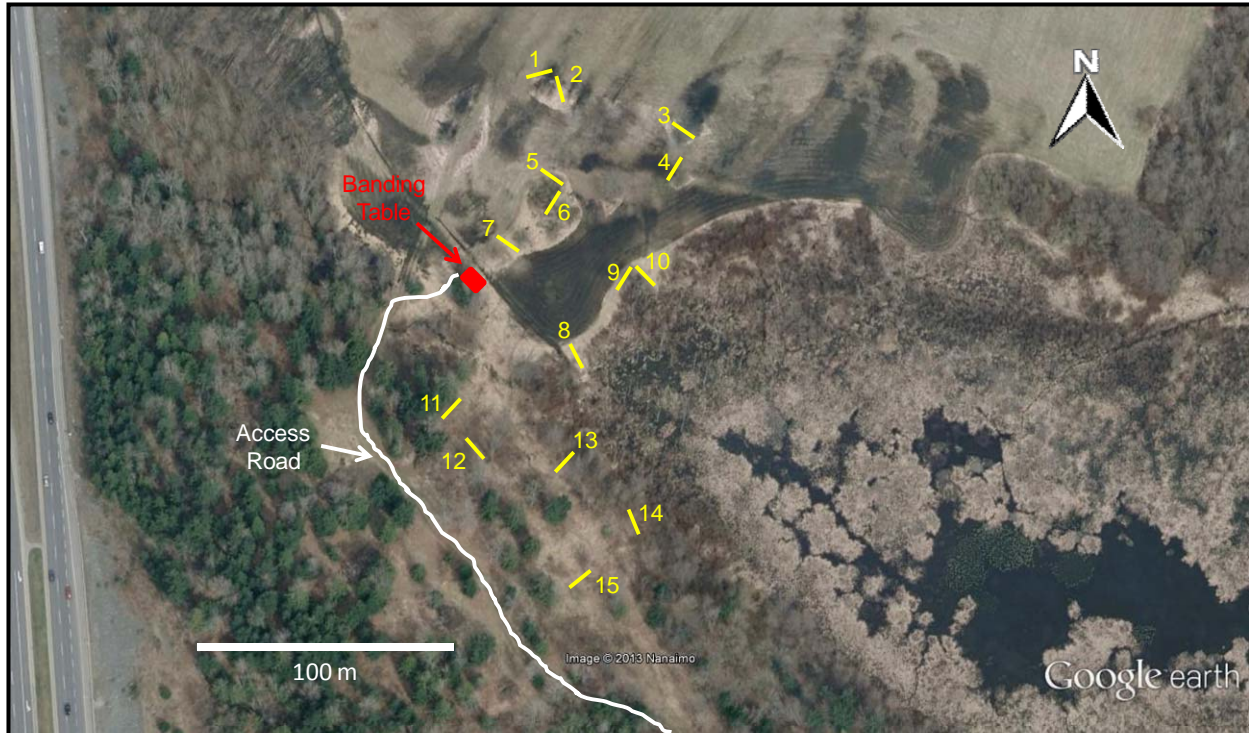
The general approach used for songbird monitoring and banding included a combination of three activities: bird banding, incidental observations and a weekly census.

#### 2.1.1. *Songbird Banding*

Songbird banding activities were conducted in accordance with Vancouver Island University Animal Use Protocol No. 2012-10-R, Canadian Wildlife Service Bird Banding Office Scientific Permit No. 10720D, and following procedures and guidance established in the VIU Bird Monitoring and Banding Manual (Demers, 2012), the North American Banding Council (2001a, b), and the Institute for Bird Populations (IBP, 2012).

Between March and October 2013, fifteen mist nets were installed for use at the site. Each mist net consisted of a 12 m long by 2.6 m high panel, made of polyester yarn, with 30 mm mesh size. The location of these nets was stratified among the habitat types present at the site (Figure 2). Ten nets (nets no. 1-10) were located in old-field habitat dominated by open expanses of reed canarygrass (*Phalaris arundinacea*) and shrub / tree patches consisting of hardhack (*Spiraea douglasii*) and willows (*Salix* sp.). Five nets (nets no. 11-15) were located in upland forest habitat consisting of Douglas fir (*Pseudotsuga menziesii*), western red cedar (*Thuja plicata*), bigleaf maple (*Acer macrophyllum*), red alder (*Alnus rubra*), English oak (*Quercus robur*), and a shrubby understory consisting of thimbleberry (*Rubus parviflorus*), salmonberry (*R. spectabilis*), ocean spray (*Holodiscus discolor*), hardhack and Himalayan blackberry (*R. armeniacus*). Nets were installed in stages with ten nets installed in late March (nets 1, 5-7, 8, 10-14), four nets installed in early May (nets 2-4, 9) and one net installed in late October (net 15).





**Figure 2.** Locations of mist nets and banding table used for songbird banding at Buttertubs West Marsh during March-October 2013.

Bird banding activities were conducted 1-4 days each week between 21 March and 27 October 2013. During each banding day, nets were operated from 30 minutes before sunrise and for a period of up to 6 hours (i.e., until 5.5 hours after sunrise). Nets were checked every 20-30 minutes. No songbird banding activities were conducted during the month of September.

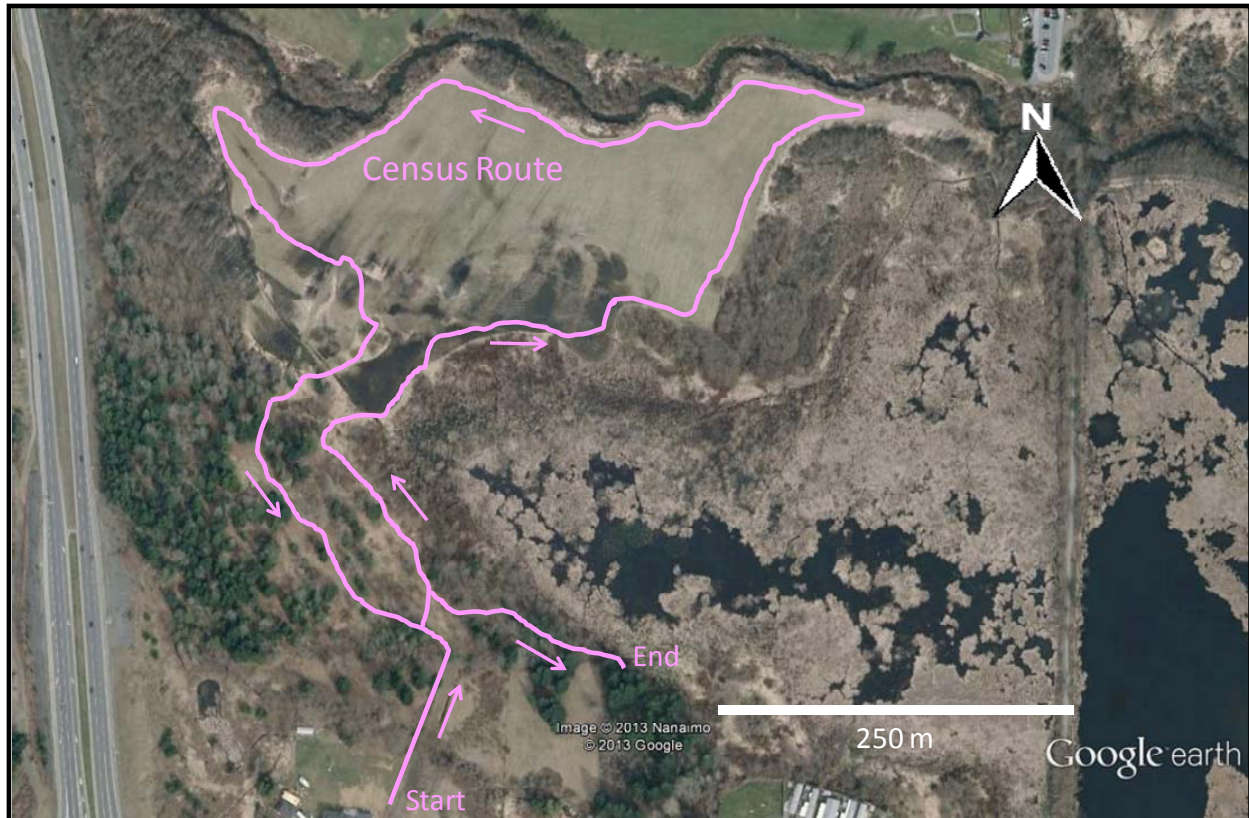
Each captured bird was extracted from the net and transferred into a cloth bag until further processing at the banding table. The banding process for most birds typically involved the following steps: species identification, band application, age and sex determination, fat score, biometrics (wing chord, tail length, weight), and photography (if applicable). Most birds were processed within about 1-2 minutes and then released.

### *2.1.2. Incidental Observations*

During bird banding days, all birds detected by sight and sound (other than those captured in mist nets) were counted and recorded as incidental observations. These observations were especially important to account for species that were not targeted by mist netting operations (e.g., waterfowl, raptors, etc). The combination of banding totals (number of birds captured) and incidental observations provided an estimate to the number of species and individuals present at the site.

### 2.1.3. Weekly Census

During most weeks between March and October 2013, a weekly census was conducted along a standardized route (Figure 3). The route started at the gate located on the access road to the site, proceeded counter-clockwise through the upland forest and old-field habitats, and ended on the south side of the marsh where an open view of the open water is possible. The census typically took place about 1-1.5 hours after sunrise and was typically completed within 1.5-2 hours. During each census, one or more observers recorded all birds detected by sight and sound.



**Figure 3.** Path of the weekly census at Buttertubs West Marsh during March-October 2013.

## 2.2. Results

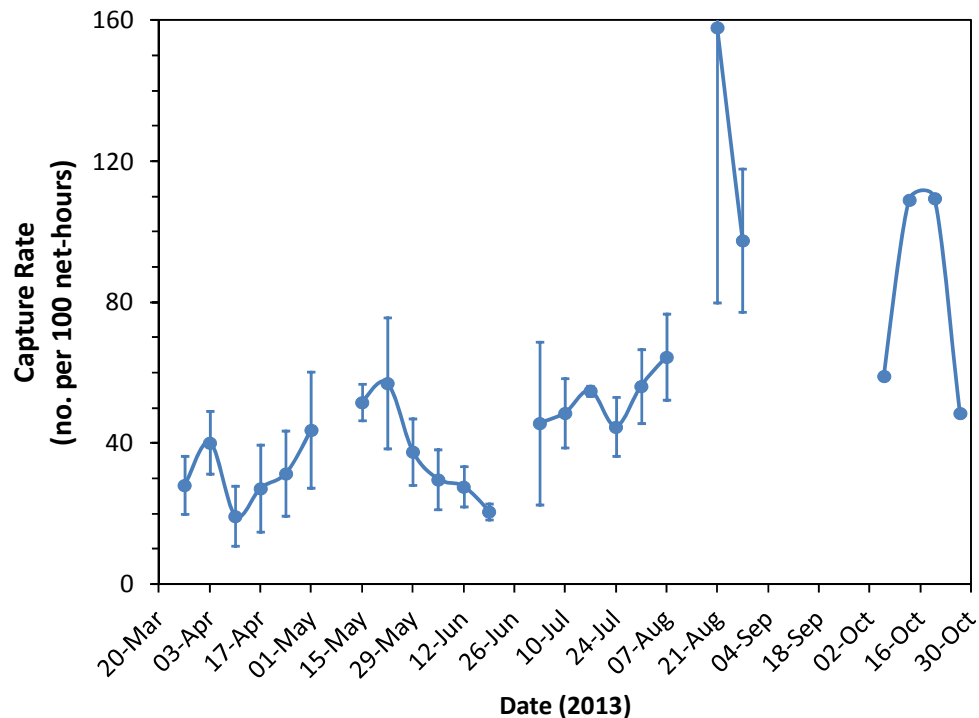
### 2.2.1. Songbird banding

Songbird banding activities were conducted during a total of 62 days between 21 March and 27 October 2013, with a total mist netting effort of 3,316 hours (average: 57.1 hours / day) (Table 1). A total of 1,690 birds were caught from 49 species. Of these, 1,130 birds were banded and 560 birds (33.1%) were recaptures of previously banded birds. An additional 106 birds were captured and released unbanded (primarily hummingbirds). The average capture rate for the duration of this project was 51.0 birds / 100 net-hours.

**Table 1.** Mist net capture statistics at Buttertubs West Marsh during March-October 2013.

Parameter	Value
Capture effort (net-hours)	3,316
Number of birds banded	1,130
Number of recaptures	560
Total	1,690
Recapture rate (%)	33.1%
Number of species	49
Capture rate (birds per 100 net-hours)	51.0

Weekly capture rate varied between seasons and reflected changes in songbird activity with season (Figure 4). Capture rate was initially low during March and April and consisted mainly of over-wintering birds. During late April and May, capture rate increased in response to the arrival / passage of spring migrants. Capture rate declined in June during the main breeding season for most migrant songbirds. Post-breeding dispersal in July and August resulted in an increase in capture rate, which peaked in late August at the start of fall migration and remained high until October and the end of fall migration.



**Figure 4.** Average weekly capture rate ( $\pm 1$  standard deviation) in mist nets at Buttertubs West Marsh during March-October 2013. Error bars are absent for the month of October as banding activities occurred only one day each week during this month.

The capture rate of mist nets varied across the project site (Table 2). Overall, capture rates were higher for nets located in the old-field habitat (i.e., nets 1-10) than for nets located in the upland forest habitat. However, the proportion of birds captured in the forest habitat increased during the colder months of March-April and October (not shown), suggesting changes in species / habitat use between seasons.

**Table 2.** Capture statistics by net at Buttertubs West Marsh during March-October 2013. Capture rate was not calculated for net 15 as this net was only installed at the end of the project period.

Net Number	Date Installed	Number Banded	Number Recaptured	Total Number Captured	Net Hours	Capture Rate (Birds / 100 Net hours)
1	25 March	52	18	70	225	31.1
2	3 May	66	27	93	176	52.8
3	2 May	70	27	97	182	53.3
4	3 May	81	54	135	174	77.6
5	25 March	61	22	83	249	33.3
6	25 March	73	30	103	268	38.4
7	25 March	113	64	177	268	66.0
8	25 March	211	93	304	272	111.8
9	2 May	42	33	75	177	42.4
10	26 March	116	60	176	265	66.4
11	25 March	85	35	120	267	44.9
12	25 March	45	26	71	265	26.8
13	25 March	45	26	71	263	27.0
14	25 March	53	36	89	259	34.4
15	20 October	6	6	12	8	---
Totals		1,119	557	1676	3,094	

Overall, Common Yellowthroat (*Geothlypis trichas*) was by far the most captured species and represented 29.1% of all birds caught during this project (Table 3). Song sparrow (*Melospiza melodia*) was the next most common species and accounted for 17.2% of all birds caught. Bushtit (*Psaltriparus minimus*) was the third most common species and this species was often captured in groups of 5-10 individuals from actively foraging flocks. Although abundant at Buttertubs Marsh, Marsh Wren (*Cistothorus palustris*) were not captured until post-breeding dispersal in early July, after which they were commonly caught. All species listed in Table 2 are local breeders at Buttertubs Marsh, with the exception of Fox Sparrow (*Passerella iliaca*) and Lincoln's Sparrow (*M. lincolni*). Tables A.1 and A2 in Appendix provides a complete summary of all species captured during this project.



**Table 3.** Fifteen most common species captured in mist net at Buttertubs West Marsh during March-October 2013.

Common Name	Number Banded	Number Recaptured	Total Number Captured
Common Yellowthroat	250	243	493
Song Sparrow	150	140	290
Bushtit	75	16	91
American Robin	65	23	88
Marsh Wren	57	28	85
Chestnut-backed Chickadee	54	20	74
Orange-crowned Warbler	56	5	61
Spotted Towhee	46	11	57
Bewick's Wren	31	24	55
Yellow Warbler	48	6	54
Fox Sparrow	32	9	41
Swainson's Thrush	18	9	27
Lincoln's Sparrow	23	0	23
Purple Finch	19	2	21
Wilson's Warbler	21	0	21

The age composition of birds captured varied between seasons and reflected the recruitment of young birds (hatch-year birds) to the population and changes in age assignment associated with the annual molt that occurs after the breeding season (Table 4). Second-year birds (hatched in 2012) were the dominant age group between March and May, while hatch-year birds (hatched in 2013) were the dominant age group between July and October. Overall, 50.1% of birds banded were birds hatched in 2013.

Birds store fat as a readily accessible source of energy, especially during migration. As expected, the proportion of birds that displayed any visible fat (i.e., fat score >0) was highest during spring (April-May) and fall migration (August, October) (Table 5). Overall, the majority of birds banded (84.0%) did not display any visible fat (fat score = 0).

The 560 recapture events reported in this project involved 304 banded birds (Table 6). Most recapture events involved birds that were recaptured only once during the project period. However, 129 individuals were recaptured more than once, and at least 15 individuals were recaptured 5 or more times. These frequently recaptured individuals are listed in Table 7. This included a Song Sparrow and a Common Yellowthroat which were recaptured 15 and 11 times, respectively.

**Table 4.** Age structure of birds banded at Buttertubs West Marsh during March- October 2013.

<b>Month</b>	<b>Hatch Year (HY)</b>	<b>Second Year (SY)</b>	<b>After Hatch Year (AHY)</b>	<b>After Second Year (ASY)</b>	<b>Other Ages</b>	<b>Total</b>
March	0	28	6	3	0	37
April	0	80	15	33	1	129
May	7	72	19	29	1	128
June	45	45	10	21	0	121
July	182	42	30	17	2	273
August	265	7	42	0	10	324
October	73	0	28	0	17	118
<b>TOTAL</b>	<b>572</b>	<b>274</b>	<b>150</b>	<b>103</b>	<b>31</b>	<b>1,130</b>

**Table 5.** Fat score of birds banded at Buttertubs West Marsh during March-October 2013.

<b>Month</b>	<b>0</b>	<b>1-2</b>	<b>3-5</b>	<b>Total</b>
March	28	8	1	37
April	87	19	19	125
May	91	27	9	127
June	104	6	1	111
July	263	7	0	270
August	256	27	30	313
October	92	20	2	114
<b>TOTAL</b>	<b>921</b>	<b>114</b>	<b>62</b>	<b>1,097</b>

**Table 6.** Frequency of recaptures of birds banded at Buttertubs West Marsh during March-October 2013.

<b>Number of Times Recaptured</b>	<b>Number of Birds</b>
1	175
2	72
3	29
4	13
5	7
6-15	8
<b>TOTAL</b>	<b>304</b>

**Table 7.** List of individuals recaptured five or more times at Buttertubs West Marsh during March-October 2013.

Band Number	Species	Age	Sex	Number of Times Recaptured	Date Banded	Date of Last Recapture
0942-98712	American Robin	SY	Male	5	17 April	18 June
2581-70120	Song Sparrow	SY	Male	9	25 March	27 October
2581-70121	Song Sparrow	ASY	Male	5	26 March	20 October
2581-70122	Song Sparrow	ASY	Male	15	26 March	20 October
2700-93364	Common Yellowthroat	ASY	Male	6	05 April	31 August
2700-93366	Common Yellowthroat	ASY	Male	6	09 April	19 June
2700-93367	Common Yellowthroat	ASY	Male	11	12 April	25 August
2700-93385	Common Yellowthroat	ASY	Female	5	20 April	18 July
2700-93386	Common Yellowthroat	SY	Male	6	22 April	25 July
2700-93387	Common Yellowthroat	SY	Male	8	22 April	18 July
2700-93399	Common Yellowthroat	SY	Male	6	25 April	13 June
2700-93592	Common Yellowthroat	HY	Unknown	5	18 July	30 August
2700-93602	Common Yellowthroat	HY	Unknown	5	23 July	21 August
2700-93642	Common Yellowthroat	HY	Male	5	01 August	31 August

Notable recaptures included a Ruby-crowned Kinglet (*Regulus calendula*) and a Fox Sparrow which were banded during early spring and were recaptured again in October (Table 8). Since these two species are not known to breed locally, these birds would have migrated to some unknown breeding location and were then recaptured upon their return to Buttertubs West Marsh in the fall. These recapture events represent examples of site fidelity in birds which return to the same habitat between seasons.

Another notable recapture was a Spotted Towhee (*Pipilo maculatus*) which was banded at an unknown location and was caught as a recapture at Buttertubs West Marsh (i.e., foreign recapture) (Table 8). At the time of production of this report, the location where this bird was originally banded remained unknown. None of the banding stations contacted about this bird (in British Columbia or elsewhere) reported having banded this bird. This recapture is noteworthy as the rate of foreign recaptures is estimated to occur for 1 in every 10,000 banded birds.

**Table 8.** List of notable recaptured individuals at Buttertubs West Marsh during March-October 2013.

Band Number	Species	Age	Sex	Date Banded	Date Recaptured
2310-79322	Ruby-crowned Kinglet	SY	Female	26 March	20 October
2561-03635	Fox Sparrow	ASY	Unknown	2 April	6 October
2581-03264	Spotted Towhee	HY	Male	Unknown	6 October

### 2.2.2. Overall Species Presence / Absence

Twenty-two censuses (near weekly) were conducted between March and October 2013. The number of species observed during these censuses averaged 32 species / census, and ranged from 23 (5 September) to 44 (24 April) species / census. It should be noted, however, that the timing, duration and personnel skills were not standardized among census.

Together with banding totals (number of birds captured), incidental observations and weekly census were compiled in the online eBird database ([ebird.org](http://ebird.org)). eBird is a public database of bird observations providing scientists, researchers and amateur naturalists with real-time data about bird distribution and abundance. The eBird database can be queried to obtain detailed accounts of species presence / absence and abundance for a given site.

A total of 102 species were observed at Buttertubs West Marsh between March and October 2013 based on a combination of banding totals, incidental observations and weekly census (Table A.2 in Appendix).

## 3. Swallow Nest Box Monitoring

### 3.1. Methods

Ten nest boxes were installed in the old-field habitat at Buttertubs West Marsh on 10 April 2013 and subsequently monitored for use by swallow species (Figure 4). Each nest box was installed approximately 1.5 m above ground and secured to a 2.4-m length of studded T-post. A 0.4-0.6 m length of 10-cm diameter PVC pipe was installed around the T-post below each nest box to act as a terrestrial predator guard (see Photos A.1 in Appendix). For each nest box, one of the side walls could be opened to allow for examination of its content.

Nest box monitoring followed the procedures outlined in the VIU Swallow Nest Box Monitoring Manual (Demers, 2013). Nest boxes were monitored every 1-3 days between 6 May and 25 June 2013. Nest boxes were examined for signs of nest building, amount and composition of nesting material, presence and number of eggs, and presence and number of nestlings. Nestlings were banded and weighed when they were approximately 12 days of age. In addition, adults (parents) were captured during the nestling period by setting a trap door in their nest box. Each adult was



identified, banded, assessed for age, sex, fat score and biometrics (wing chord, tail length, weight), and released.



**Figure 6.** Locations of the ten swallow nest box at Buttertubs West Marsh during May-June 2013.

### 3.2. Results

Five of the ten nest boxes were occupied by Tree Swallows (*Tachycineta bicolor*) and had signs of nest building activities (Table 9). Clutches of five eggs were eventually laid in nest boxes 4, 8, 9 and 10. Nest box 7 was abandoned and no subsequent nesting activity was observed for this nest box. Although Violet-green Swallows (*T. thalassina*) were frequently observed around the old-field habitat, this species did not breed in these nest boxes.

The eggs in nest boxes 8 and 10 hatched on 31 and 28 May, respectively, while the eggs in nest boxes 4 and 9 never hatched and they were eventually abandoned. Four nestlings were banded and weighed in nest boxes 8 and 10. The fate of the fifth nestling in each of these clutches is unknown. Both adults from nest boxes 8 and 10 were captured and banded, while only the adult female was captured and banded at nest boxes 4 and 9.

**Table 9.** Results of nest box monitoring at Buttertubs West Marsh during May-June 2013.

Nest Box	Nest Building	Number of Eggs	Complete Clutch Date	Mean Hatch Date	Number Fledged	Individuals Banded
1	No	0				
2	No	0				
3	No	0				
4	Yes	5	20 May	Did not hatch	0	Adult female
5	No	0				
6	No	0				
7	Yes	0				
8	Yes	5	14 May	31 May	4	All fledglings, both adults
9	Yes	5	30 May	Did not hatch	0	Adult female
10	Yes	5	12 May	28 May	4	All fledglings, both adults

## 4. Nocturnal Owl Monitoring and Banding

### 4.1. Methods

Targeted mist-netting effort for Northern Saw-whet Owls (*Aegolius acadicus*) was conducted between 19 September and 11 October 2013. The general approach followed the guidance provided by Project OwlNet ([www.projectowl.net.org](http://www.projectowl.net.org)). Procedures were similar to those used for songbird capture and banding, but the differences are highlighted here.

Mist-netting for owls was conducted at night, from 30 minutes after sunset and for a 6-hour period (i.e., until 6.5 hours after sunset). During each mist-netting night, eight mist nets (12 m long by 2.6 m high panel, made of polyester yarn) were used (Figure 7). These included nets 11-15 (30 mm mesh size) and three 60-mm mist nets set up in a square configuration with net 15. An automated audiolure system (mp3 player, amplifier and speaker) was located at the centre of the “net square” and continuously broadcasted the breeding call of the Northern Saw-whet Owl. Nets were checked at least every 30 minutes. Processing for each bird captured was similar to the methods used for songbird banding.



**Figure 7.** Locations of mist nets and banding table used for nocturnal owl banding at Buttertubs West Marsh during September-October 2013.

#### 4.2. Results

Nocturnal owl banding was conducted during five nights between 19 September and 11 October 2013 (Table 10). Barred Owl (*Strix varia*) and Great-horned Owl (*Bubo virginianus*) were observed during some of these nights, but no Northern Saw-whet Owl was heard or seen. One second-year Barred Owl of unknown sex was captured in net 15 and banded on 11 October 2013.

**Table 10.** Results of nocturnal owl banding at Buttertubs West Marsh during September-October 2013.

Date (2013)	Owls Heard or Seen	Capture
19 September	None	None
26 September	One Barred Owl heard	None
27 September	One Great-horned Owl heard and seen	None
04 October	None	None
11 October	Two Barred Owls heard and seen	One Barred Owl

Based on the capture effort deployed and the absence of any detection of Northern Saw-whet Owl, it was determined that Buttertubs West Marsh was not an optimal location for capture of

this species. The noise from the nearby Nanaimo Parkway and nighttime urban lighting conditions may deter the movement of Northern Saw-whet Owl near Buttertubs West Marsh.

## 5. Volunteer Effort and Training

As stated above, one of the main objectives of this project was to provide practical educational and training opportunities for Vancouver Island University students and community volunteers. Indeed, this project was only made possible with the participation of many dedicated volunteers. The tasks accomplished by volunteers included, but were not limited to:

- Site preparation and maintenance – vegetation clearing, grass cutting and trimming, footpath maintenance and improvements, net installation and removal, net maintenance.
- Bird monitoring – weekly census, incidental observations.
- Songbird and owl banding – net extraction, bird banding and processing, photography, data scribing, data entry.
- Swallow nest box monitoring – nest box building and installation, monitoring of nest box contents, banding and processing of nestlings and adults, photography, data scribing.
- Training and public education – training of project volunteers and bird banders, providing public education for guests and visitors.

A total of 56 volunteers dedicated 2,185 hours to this project (Table 11). Volunteers included students, graduates and employees of Vancouver Island University as well as members of the community. Volunteers are recognized by name in the Acknowledgements section of this report.

**Table 11.** Number of volunteers and hours volunteered for the bird monitoring and banding project at Buttertubs West Marsh during March-October 2013.

<b>Volunteer Grouping</b>	<b>Number of Volunteers</b>	<b>Hours on Project</b>
VIU students	19	790
VIU graduates	11	376
VIU employees	10	645
Community volunteers	16	374
<b>TOTAL</b>	<b>56</b>	<b>2,185</b>

Volunteer training was conducted by Dr. Eric Demers (Bander-in-Charge), and by Master Bander Derek Matthews from the Vancouver Avian Research Centre (on 13 June 2013). Thirty-one volunteers received training in bird banding activities and contributed to the processing of birds captured as part of this project (Table 12).



**Table 11.** Volunteers (by bander code) who participated in the processing of birds captured as part of the bird monitoring and banding project at Buttertubs West Marsh during March-October 2013.

Bander Code	Number of Birds Processed		
	Banded	Recaptures	Total
AMKL	1	4	5
BLDU	85	29	114
CHTO	22	14	36
DERM	4	0	4
ELHA	41	18	59
EMTR	7	4	11
ERDE	96	78	174
GEDU	93	45	138
HACA	35	29	64
HEWA	8	7	15
HEVA	89	39	128
HIKI	66	34	100
JAME	142	51	193
KIWE	77	42	119
LEWA	2	0	2
LYPA	7	0	7
MABA	28	18	46
MAKO	54	18	72
MEMO	8	9	17
PAGR	6	3	9
PARE	20	4	24
ROST	8	5	13
RYAB	12	8	20
RYCA	133	46	179
SACH	22	8	30
SAFR	19	17	36
SAGO	1	0	1
STWO	10	11	21
TRBA	12	7	19
TRDO	20	9	29
WESI	3	3	6
<b>TOTAL</b>	<b>1,131</b>	<b>560</b>	<b>1,691</b>

## 6. Public Demonstrations and Education

Public demonstrations and education were also main objectives of this project. This was achieved through public and scientific presentations about the project, through guided on-site visits by individual guests and groups, and off-site public demonstrations. The following public demonstrations and education events were conducted between March and October 2013:

- On-site demonstration to over 20 individual visitors and guests, many of which subsequently became project volunteers.
- On-site group demonstration for the VIU RMOT 401 (Wildlife Management) class (2, 5 April).
- Class presentation to the VIU BIOL 329 (Vertebrates of BC) class (3 April).
- Presentation to the Nanaimo Parks, Recreation and Culture Commission (24 April).
- On-site group demonstration for the Nanaimo Parks, Recreation and Culture Commission (19 June).
- Off-site public demonstrations at Milner Gardens & Woodland, Qualicum Beach (8 July, 5 August).
- Off-site public demonstrations for the Nanaimo Science and Sustainability (NS3) Kids Camps, VIU Nanaimo Campus (17, 24 July).
- Poster presentation at the Society of Canadian Ornithologists annual meeting in Winnipeg, MB (13, 14 August).
- On-site group demonstration for the Nanaimo Backyard & Nature Store Birder Group (25 August).
- Presentation to the VIU Board of Governors (26 September).

## 7. Acknowledgements

This project would not have been possible without a dedicated group of volunteers, contributors and partners: R. Abbott, T. Barrington, K. Barry, M. Baxter, G. Bell, H. Blackburn, J. Blackburn, D. Buffett, R. Cannings, H. Carolsfeld, R. Cathers, S. Chalmers, B. Cousens, L. Demattia, E. Demers, T. Douglas, B. Dudeck, G. Duncan, A. Ellison, S. Fraser, M. Funk, L. Gillis, T. Goater, S. Gordon, P. Greig, S. Greenway, L. Hammond-Kaarremaa, E. Hampshire, M. Hampshire, R. Harding, C. Hedden, L. Henderson, R. Hocken, C. Josefsson, J. Kadera, H. Kimura, A. Kletchko, G. Klimes, M. Kondoh, C. Lee, C. Matthews, D. Matthews, H. McCabe, J. Melvin, B. Merrilees, M. Morgan, P. Morrison, L. Nelson, D. Nickel, L. Parker, O. Peer, B. Pennell, P. Reid, S. Ringel, M. Rowland, C. Seibert, J. Semper, W. Simms, R. Stevens, C. Tong, E. Tranfield, H. Wathen, L. Ware, J. Watson, K. Wetten, S. Wetten, J. Whitelaw, A. Wilschut, S. Wood, and H. van Vliet.

This project was conducted as a close partnership with the Vancouver Avian Research Centre and under the guidance of Master Bander Derek Matthews.

Vancouver Island University, the City of Nanaimo, the Nanaimo Parks, Recreation and Culture Commission, Ducks Unlimited Canada, Milner Gardens & Woodland, the Nanaimo and

Sustainability Society (NS3) and the Backyard Wildbird and Nature Store are acknowledged for their support of this project.

Funding was provided by the Vancouver Island University Research Awards Committee Research Fund, the Andy Spencer Bamfield Research Fellowship, the VIU Travel & Conference Fund, the VIU Work-Opportunities program and the VIU employee Professional Development Fund.

Bird banding activities were conducted in accordance with Vancouver Island University Animal Use Protocol No. 2012-10-R and VIU Standard Operating Procedure No. ACC-010 and ACC-011, and Canadian Wildlife Service Bird Banding Office Scientific Permit No. 10720D (Eric Demers) and 10720 (Derek Matthews) and to capture and band migratory birds, including authorization to use mist nets for the capture of passerines, other landbirds, Northern Saw-whet Owl and hummingbirds (Derek Matthews).

## 8. References

- Demers, E. 2012. Bird Monitoring and Banding Manual. Vancouver Island University, Nanaimo, BC. 51 p.
- Demers, E. 2012. Swallow Nest Box Monitoring Manual. Vancouver Island University, Nanaimo, BC. 7 p.
- Institute for Bird Population (IBP). 2012. Monitoring Avian Productivity and Survivorship (MAPS) Manual. Institute for Bird Population, Point Reyes Station, California. 79 p.
- Lepczyk, C.A., and P.S. Warren. 2012. Urban Bird Ecology and Conservation. University of California Press, Los Angeles, CA. 344 p.
- North American Banding Council. 2001a. The North American Banders' Study Guide. North American Banding Council, Point Reyes Station, California. 66 p.
- North American Banding Council. 2001b. The North American Banders' Manual for Banding Passerines and Near Passerines (Excluding Hummingbirds And Owls). North American Banding Council, Point Reyes Station, California. 15 p.
- North American Bird Conservation Initiative, Canada. 2012. The State of Canada's Birds, 2012. <http://www.stateofcanadasbirds.org/>

## 9. Appendix

**Table A.1.** List of all species captured in mist nets at Buttertubs West Marsh during March-October 2013. Subspecies are included in parentheses where applicable.

Common Name	Number banded	Number recaptured	Total number captured
Common Yellowthroat	250	243	493
Song Sparrow	150	140	290
Bushtit	75	16	91
American Robin	65	23	88
Marsh Wren	57	28	85
Chestnut-backed Chickadee	54	20	74
Orange-crowned Warbler	56	5	61
Spotted Towhee	46	11	57
Bewick's Wren	31	24	55
Yellow Warbler	48	6	54
Fox Sparrow	32	9	41
Swainson's Thrush	18	9	27
Lincoln's Sparrow	23	0	23
Purple Finch	19	2	21
Tree Swallow	17	4	21
Wilson's Warbler	21	0	21
Ruby-crowned Kinglet	18	2	20
Cedar Waxwing	16	0	16
MacGillivray's Warbler	11	5	16
Dark-eyed Junco (Oregon)	16	0	16
Downy Woodpecker	8	5	13
Willow Flycatcher	12	0	12
Red-winged Blackbird	10	0	10
Brown-headed Cowbird	5	4	9
Brown Creeper	5	3	8
Yellow-rumped Warbler (Myrtle, Audubon)	7	0	7
Chipping Sparrow	6	0	6
Golden-crowned Kinglet	5	0	5
Golden-crowned Sparrow	5	0	5
Hermit Thrush	5	0	5
American Goldfinch	4	0	4
Pacific Wren	3	1	4
Savannah Sparrow	4	0	4
Black-headed Grosbeak	3	0	3
Pine Siskin	3	0	3
Warbling Vireo	3	0	3
Anna's Hummingbird	2	0	2
Barn Swallow	2	0	2
Pacific-slope Flycatcher	2	0	2
Red-breasted Sapsucker	2	0	2
Rufous Hummingbird	2	0	2
White-crowned Sparrow (Puget Sound)	2	0	2
Barred Owl	1	0	1
Hairy Woodpecker	1	0	1
House Finch	1	0	1
Hutton's Vireo	1	0	1
Northwestern Crow	1	0	1
Steller's Jay	1	0	1
Varied Thrush	1	0	1
Violet-green Swallow	1	0	1
<b>TOTAL</b>	<b>1,131</b>	<b>560</b>	<b>1,691</b>



**Table A.2.** Number of all species captured during each day of mist netting at Buttertubs West Marsh during March-October 2013.

Date	Anna's Hummingbird	Rufous Hummingbird	Red-breasted Sapsucker	Downy Woodpecker	Hairy Woodpecker	Willow Flycatcher	Pacific-slope Flycatcher	Hutton's Vireo	Warbling Vireo	Steller's Jay	Northwestern Crow	Tree Swallow	Violet-green Swallow	Barn Swallow	Chestnut-backed Chickadee	Bushtit	Brown Creeper	Pacific Wren	Marsh Wren	Bewick's Wren	Golden-crowned Kinglet	Ruby-crowned Kinglet	Swainson's Thrush	Spotted Towhee	Hermit Thrush	American Robin	Varied Thrush	Cedar Waxwing	Orange-crowned Warbler	MacGillivray's Warbler	Common Yellowthroat	Yellow Warbler	Yellow-rumped Warbler	Wilson's Warbler	Chipping Sparrow	Savannah Sparrow	Fox Sparrow	Song Sparrow	Lincoln's Sparrow	White-crowned Sparrow	Golden-crowned Sparrow	Dark-eyed Junco	Black-headed Grosbeak	Red-winged Blackbird	Brown-headed Cowbird	Purple Finch	House Finch	Pine Siskin	American Goldfinch	Total	
25-Mar															2							1														4	1		3												15
26-Mar															2	2			2			1	1		2												1	3													14
28-Mar															1	1								2														1	2												7
29-Mar																							1	1													5	1												8	
02-Apr			1												1				1			1	2		2					1							3	4												16	
04-Apr				1											2							1			1												3	1											9		
05-Apr															1	1			1			1	1		2				1							1	1		1										11		
08-Apr																				1		2	1														3												7		
09-Apr																						1																1											3		
12-Apr															1																2					1	1	2											7		
15-Apr																			1		4									2																			7		
16-Apr																														3		1															1			6	
17-Apr															2										1			4	1								2							2					12		
20-Apr																			2		2				2			1	4							1	5	1								1			19		
22-Apr																														4								1											6		
23-Apr															1											1			2	1							1	1	1										13		
25-Apr												2							1		1							1	5	1					2	1	3		1				2					20			
26-Apr			1																				1					1	6								5	1											15		
29-Apr			1														1						2	1	2			2	5																				16		
30-Apr																								1	2				1	1									1	1					1					8	

Table A.2. Continued

Date	Anna's Hummingbird	Rufous Hummingbird	Red-breasted Sapsucker	Downy Woodpecker	Hairy Woodpecker	Willow Flycatcher	Pacific-slope Flycatcher	Hutton's Vireo	Warbling Vireo	Steller's Jay	Northwestern Crow	Tree Swallow	Violet-green Swallow	Barn Swallow	Chestnut-backed Chickadee	Bushtit	Brown Creeper	Pacific Wren	Marsh Wren	Bewick's Wren	Golden-crowned Kinglet	Ruby-crowned Kinglet	Swainson's Thrush	Spotted Towhee	Hermit Thrush	American Robin	Varied Thrush	Cedar Waxwing	Orange-crowned Warbler	MacGillivray's Warbler	Common Yellowthroat	Yellow Warbler	Yellow-rumped Warbler	Wilson's Warbler	Chipping Sparrow	Savannah Sparrow	Fox Sparrow	Song Sparrow	Lincoln's Sparrow	White-crowned Sparrow	Golden-crowned Sparrow	Dark-eyed Junco	Black-headed Grosbeak	Red-winged Blackbird	Brown-headed Cowbird	Purple Finch	House Finch	Pine Siskin	American Goldfinch	Total	
02-May			1												1					3		2	3	2				3	1	9		1		2	4	1														34	
03-May														1								1						2		11		2		3	3							2	2		1				28		
16-May								1						1					2		1		2				2	1	6	1	5		1	5			1							1					30		
17-May														2								1						1	1	5	4																2		16		
24-May												3	1	2	3		1				1	2	1		1		2	1	2	7	1						1												30		
26-May			2														1								2		1		3	2													1		3				18		
27-May																	2					2								3			3																13		
31-May												2								1							10	1		8	6																			33	
03-Jun			1									1									1	1								3														1					11		
04-Jun														1								4	1		1		4		7	2																			21		
06-Jun			1									3		2						3	1									1	3	1														1				21	
08-Jun					1							1	2	3						1		3	1		7		1	1	1	3	1												1		2	1	2				39
11-Jun												8													7					3	3														3					28	
13-Jun	2	2	1																	1						3		1		7	1															1				23	
18-Jun														1						1						7			5																	1					15
19-Jun			1		5															1		1	1					1		8	1																			21	

Table A.2. Continued

Date	Anna's Hummingbird	Rufous Hummingbird	Red-breasted Sapsucker	Downy Woodpecker	Hairy Woodpecker	Willow Flycatcher	Pacific-slope Flycatcher	Hutton's Vireo	Warbling Vireo	Steller's Jay	Northwestern Crow	Tree Swallow	Violet-green Swallow	Barn Swallow	Chestnut-backed Chickadee	Bush-tit	Brown Creeper	Pacific Wren	Marsh Wren	Bewick's Wren	Golden-crowned Kinglet	Ruby-crowned Kinglet	Swainson's Thrush	Spotted Towhee	Hermit Thrush	American Robin	Varied Thrush	Cedar Waxwing	Orange-crowned Warbler	MacGillivray's Warbler	Common Yellowthroat	Yellow Warbler	Yellow-rumped Warbler	Wilson's Warbler	Chipping Sparrow	Savannah Sparrow	Fox Sparrow	Song Sparrow	Lincoln's Sparrow	White-crowned Sparrow	Golden-crowned Sparrow	Dark-eyed Junco	Black-headed Grosbeak	Red-winged Blackbird	Brown-headed Cowbird	Purple Finch	House Finch	Pine Siskin	American Goldfinch	Total	
02-Jul															1					3		1	1	1				1	1	8	1							6					1	1					26		
04-Jul															2	14			2					2																12			1		1					43	
05-Jul															1			1											3										3						1				15		
09-Jul				2											5	3			4				1			1														15			1		1			48			
11-Jul							1								5	1				1	2																								1		4	1		33	
16-Jul							1								7				2	1						1																				1				44	
18-Jul															2					4					1		1		4	1										14		1							47		
23-Jul															5				7	1				2	1	2				2																			36		
25-Jul															5	1			4																															38	
30-Jul															4				3	1				1				2		1																		1			41
01-Aug															1				3	2				1		1																								49	
03-Aug					1	2									3	16	1		5	1			1			2			1	1																				75	
06-Aug															4	1			2					1						2	1																			33	
08-Aug															2	1	1		5								5			1																					47
21-Aug															2				7	2						1																									72
25-Aug															9				6	2				1																											92
30-Aug															3				8	3				1		1																									94
31-Aug															3				9	1			2																												67
06-Oct				1											2				8	1				9																											39
13-Oct															6	5			2	7	2	1																													64
20-Oct															9	8			2	3	2	3	4		6		4																								69
27-Oct															3								1	2		2	1																							17	
Total	2	2	2	13	1	12	2	1	3	1	1	21	1	2	74	91	8	4	85	55	5	20	27	57	5	88	1	16	61	16	493	54	7	21	6	4	41	290	23	2	5	16	3	10	9	21	1	3	4	1,691	

**Table A.2.** List of all species observed at Buttertubs West Marsh during March-October 2013 based on a combination of banding totals, incidental observations and weekly censuses. Green rectangles indicate that a species was observed during a given time period. Areas in gray checkerboard indicate that no data are available. The size of the green rectangles represents the proportion of surveys for which a species was detected. Data compiled in and extracted from eBird database.

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<a href="#">Cackling Goose</a>	<a href="#">MAP</a>				■								
<a href="#">Canada Goose</a>	<a href="#">MAP</a>			■	■	■	■	■	■	■	■	■	
<a href="#">Mute Swan</a>	<a href="#">MAP</a>		■										
<a href="#">Trumpeter Swan</a>	<a href="#">MAP</a>				■								
<a href="#">Wood Duck</a>	<a href="#">MAP</a>			■	■	■	■	■			■		
<a href="#">American Wigeon</a>	<a href="#">MAP</a>				■								
<a href="#">Mallard</a>	<a href="#">MAP</a>			■	■	■	■	■	■	■	■	■	■
<a href="#">Northern Pintail</a>	<a href="#">MAP</a>							■			■		
<a href="#">Ring-necked Duck</a>	<a href="#">MAP</a>				■	■							
<a href="#">Hooded Merganser</a>	<a href="#">MAP</a>						■						
<a href="#">California Quail</a>	<a href="#">MAP</a>			■	■	■	■						
<a href="#">Pied-billed Grebe</a>	<a href="#">MAP</a>					■							
<a href="#">Double-crested Cormorant</a>	<a href="#">MAP</a>				■								
<a href="#">Great Blue Heron</a>	<a href="#">MAP</a>			■	■	■	■	■	■		■	■	
<a href="#">Green Heron</a>	<a href="#">MAP</a>					■							
<a href="#">Turkey Vulture</a>	<a href="#">MAP</a>			■	■	■	■	■	■	■	■		
<a href="#">Osprey</a>	<a href="#">MAP</a>				■	■							
<a href="#">Northern Harrier</a>	<a href="#">MAP</a>											■	
<a href="#">Sharp-shinned Hawk</a>	<a href="#">MAP</a>			■	■				■		■	■	
<a href="#">Cooper's Hawk</a>	<a href="#">MAP</a>				■		■		■				
<a href="#">Bald Eagle</a>	<a href="#">MAP</a>		■	■	■	■	■	■	■		■	■	
<a href="#">Red-tailed Hawk</a>	<a href="#">MAP</a>		■	■	■	■	■	■	■		■		
<a href="#">Virginia Rail</a>	<a href="#">MAP</a>			■	■	■	■	■			■	■	
<a href="#">Killdeer</a>	<a href="#">MAP</a>						■				■		
<a href="#">Spotted Sandpiper</a>	<a href="#">MAP</a>								■				
<a href="#">Wilson's Snipe</a>	<a href="#">MAP</a>				■	■							
<a href="#">California Gull</a>	<a href="#">MAP</a>											■	
<a href="#">Glaucous-winged Gull</a>	<a href="#">MAP</a>			■	■			■			■		
<a href="#">Rock Pigeon</a>	<a href="#">MAP</a>				■			■	■				
<a href="#">Band-tailed Pigeon</a>	<a href="#">MAP</a>			■	■		■	■	■	■	■	■	
<a href="#">Eurasian Collared-Dove</a>	<a href="#">MAP</a>				■	■	■	■	■				
<a href="#">Great Horned Owl</a>	<a href="#">MAP</a>									■			
<a href="#">Barred Owl</a>	<a href="#">MAP</a>		■	■	■		■	■		■	■	■	
<a href="#">Common Nighthawk</a>	<a href="#">MAP</a>							■					

(continued on next page)

**Table A.2.** (continued)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<a href="#">Vaux's Swift</a>	<a href="#">MAP</a>												
<a href="#">Anna's Hummingbird</a>	<a href="#">MAP</a>												
<a href="#">Rufous Hummingbird</a>	<a href="#">MAP</a>												
<a href="#">Belted Kingfisher</a>	<a href="#">MAP</a>												
<a href="#">Red-breasted Sapsucker</a>	<a href="#">MAP</a>												
<a href="#">Downy Woodpecker</a>	<a href="#">MAP</a>												
<a href="#">Hairy Woodpecker</a>	<a href="#">MAP</a>												
<a href="#">Northern Flicker</a>	<a href="#">MAP</a>												
<a href="#">Pileated Woodpecker</a>	<a href="#">MAP</a>												
<a href="#">Merlin</a>	<a href="#">MAP</a>												
<a href="#">Peregrine Falcon</a>	<a href="#">MAP</a>												
<a href="#">Olive-sided Flycatcher</a>	<a href="#">MAP</a>												
<a href="#">Willow Flycatcher</a>	<a href="#">MAP</a>												
<a href="#">Pacific-slope Flycatcher</a>	<a href="#">MAP</a>												
<a href="#">Northern Shrike</a>	<a href="#">MAP</a>												
<a href="#">Cassin's Vireo</a>	<a href="#">MAP</a>												
<a href="#">Hutton's Vireo</a>	<a href="#">MAP</a>												
<a href="#">Warbling Vireo</a>	<a href="#">MAP</a>												
<a href="#">Steller's Jay</a>	<a href="#">MAP</a>												
<a href="#">Northwestern Crow</a>	<a href="#">MAP</a>												
<a href="#">Common Raven</a>	<a href="#">MAP</a>												
<a href="#">Northern Rough-winged Swallow</a>	<a href="#">MAP</a>												
<a href="#">Purple Martin</a>	<a href="#">MAP</a>												
<a href="#">Tree Swallow</a>	<a href="#">MAP</a>												
<a href="#">Violet-green Swallow</a>	<a href="#">MAP</a>												
<a href="#">Barn Swallow</a>	<a href="#">MAP</a>												
<a href="#">Chestnut-backed Chickadee</a>	<a href="#">MAP</a>												
<a href="#">Bushtit</a>	<a href="#">MAP</a>												
<a href="#">Red-breasted Nuthatch</a>	<a href="#">MAP</a>												
<a href="#">Brown Creeper</a>	<a href="#">MAP</a>												
<a href="#">Pacific Wren</a>	<a href="#">MAP</a>												
<a href="#">Marsh Wren</a>	<a href="#">MAP</a>												
<a href="#">Bewick's Wren</a>	<a href="#">MAP</a>												
<a href="#">Golden-crowned Kinglet</a>	<a href="#">MAP</a>												
<a href="#">Ruby-crowned Kinglet</a>	<a href="#">MAP</a>												

(continued on next page)



**Table A.2.** (continued)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<a href="#">Swainson's Thrush</a>	<a href="#">MAP</a>												
<a href="#">Hermit Thrush</a>	<a href="#">MAP</a>												
<a href="#">American Robin</a>	<a href="#">MAP</a>												
<a href="#">Varied Thrush</a>	<a href="#">MAP</a>												
<a href="#">European Starling</a>	<a href="#">MAP</a>												
<a href="#">Cedar Waxwing</a>	<a href="#">MAP</a>												
<a href="#">Orange-crowned Warbler</a>	<a href="#">MAP</a>												
<a href="#">MacGillivray's Warbler</a>	<a href="#">MAP</a>												
<a href="#">Common Yellowthroat</a>	<a href="#">MAP</a>												
<a href="#">Yellow Warbler</a>	<a href="#">MAP</a>												
<a href="#">Yellow-rumped Warbler</a>	<a href="#">MAP</a>												
<a href="#">Black-throated Gray Warbler</a>	<a href="#">MAP</a>												
<a href="#">Townsend's Warbler</a>	<a href="#">MAP</a>												
<a href="#">Wilson's Warbler</a>	<a href="#">MAP</a>												
<a href="#">Spotted Towhee</a>	<a href="#">MAP</a>												
<a href="#">Chipping Sparrow</a>	<a href="#">MAP</a>												
<a href="#">Savannah Sparrow</a>	<a href="#">MAP</a>												
<a href="#">Fox Sparrow</a>	<a href="#">MAP</a>												
<a href="#">Song Sparrow</a>	<a href="#">MAP</a>												
<a href="#">Lincoln's Sparrow</a>	<a href="#">MAP</a>												
<a href="#">White-crowned Sparrow</a>	<a href="#">MAP</a>												
<a href="#">Golden-crowned Sparrow</a>	<a href="#">MAP</a>												
<a href="#">Dark-eyed Junco</a>	<a href="#">MAP</a>												
<a href="#">Western Tanager</a>	<a href="#">MAP</a>												
<a href="#">Black-headed Grosbeak</a>	<a href="#">MAP</a>												
<a href="#">Red-winged Blackbird</a>	<a href="#">MAP</a>												
<a href="#">Brewer's Blackbird</a>	<a href="#">MAP</a>												
<a href="#">Brown-headed Cowbird</a>	<a href="#">MAP</a>												
<a href="#">Bullock's Oriole</a>	<a href="#">MAP</a>												
<a href="#">House Finch</a>	<a href="#">MAP</a>												
<a href="#">Purple Finch</a>	<a href="#">MAP</a>												
<a href="#">Red Crossbill</a>	<a href="#">MAP</a>												
<a href="#">Pine Siskin</a>	<a href="#">MAP</a>												
<a href="#">American Goldfinch</a>	<a href="#">MAP</a>												
<a href="#">Evening Grosbeak</a>	<a href="#">MAP</a>												

**Photos A.1.** Sample photographs for the VIU Bird Monitoring and Banding Project at Buttertubs Marsh West during 2013. Photos courtesy of R. Cathers and E. Demers.



Mist net no. 7



Swallow nest box no. 3



Lincoln's Sparrow



Orange-crowned Warblers



Chestnut-backed Chickadee



Purple Finch