

# DATA REPORT

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

2018



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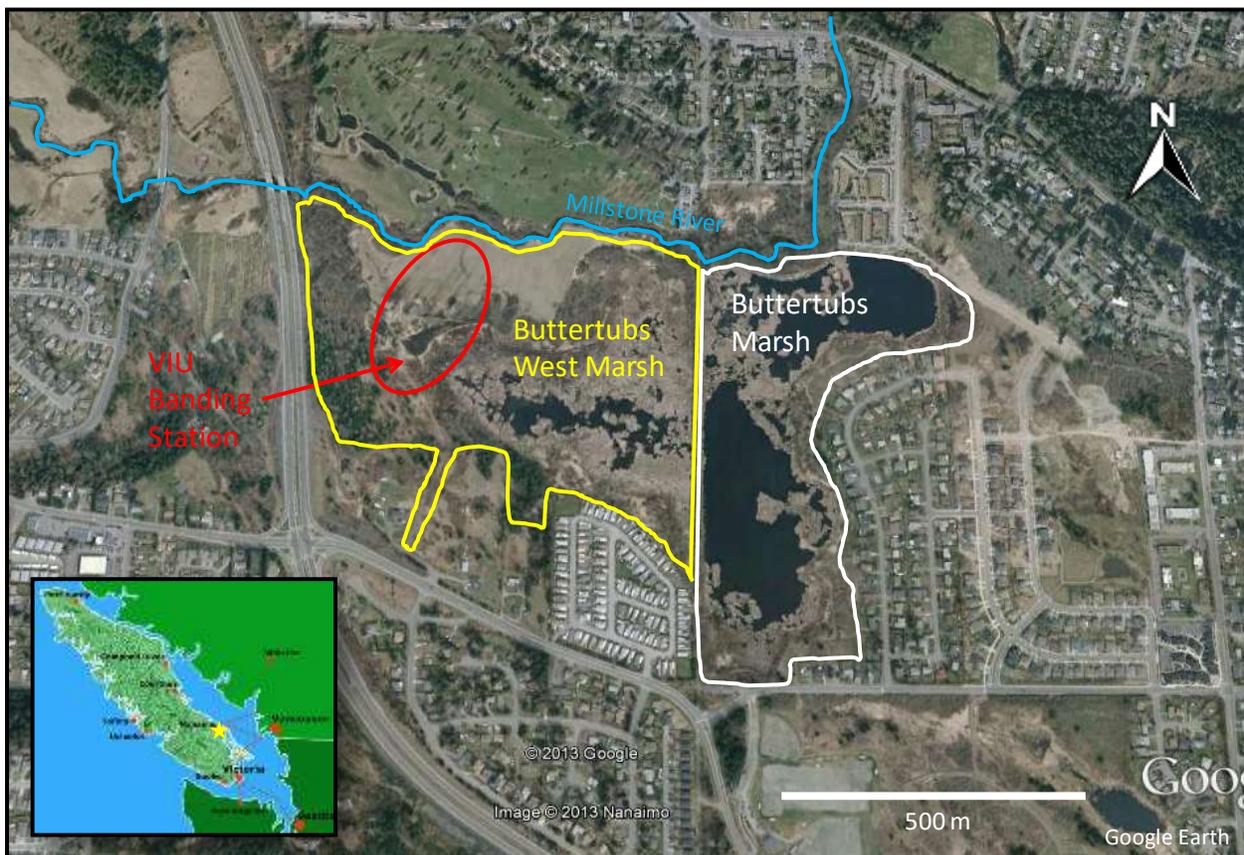
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### Disclaimer Note:

This report is a compilation of a field project conducted by Vancouver Island University, in partnership with the City of Nanaimo and Ducks Unlimited Canada. 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 landscape (Lepczyk and Warren, 2012). These green spaces can provide important breeding, stopover and wintering habitats for various bird species (NABCI, 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.

Since 2013, Vancouver Island University (VIU) has 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 partnership with the City of Nanaimo and Ducks Unlimited Canada.

This report summarizes the activities and results of this project during 2018. Project activities are described in the sections below and included:

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

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

## 2. Songbird Monitoring and Banding

### 2.1. Methods

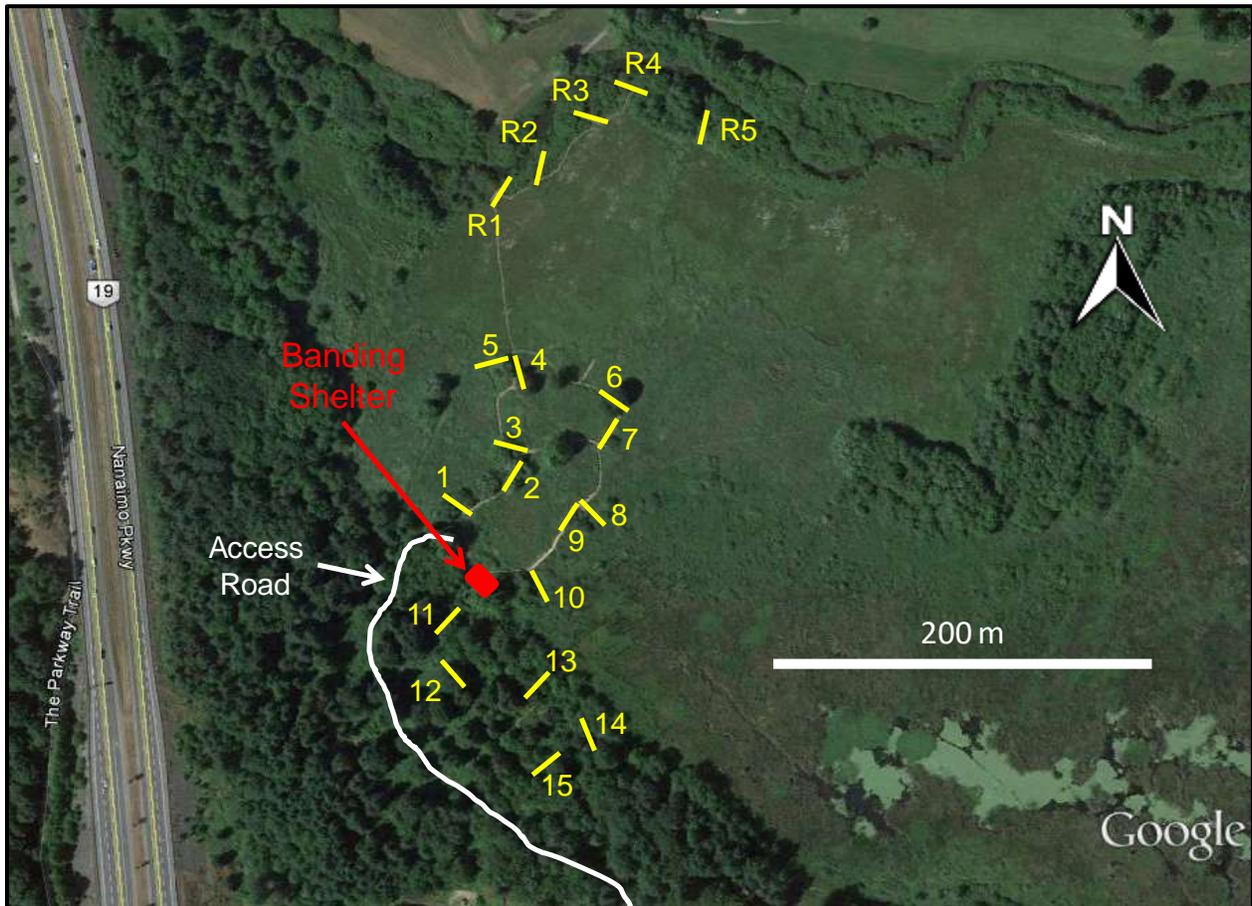
The general approach used for songbird monitoring and banding included a combination of two activities: bird banding and incidental observations.

#### 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. 10885 and 10885A, and following procedures and guidance established in the VIU Bird Monitoring and Banding Manual (Demers, 2015), the North American Banding Council (NABC, 2001a,b), and the Institute for Bird Populations (IBP, 2012).

Between April and October 2018, 20 mist nets were installed for use at Buttertubs West Marsh. 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*). Five nets (nets no. R1-R5) were located in riparian habitat along the Millstone River consisting of Nootka rose (*Rosa nutkana*), hardhack, salmonberry, and Himalayan blackberry.

Unlike the last few years of this project, net no. 1 was operated as a single net rather than as a double-stacked net.



**Figure 2.** Locations of mist nets and banding shelter used for songbird banding at Buttertubs West Marsh during 2018.

Bird banding activities were conducted 1-2 days most weeks between 17 April and 27 October 2018. 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 15-20 minutes.

Each captured bird was extracted from the net and transferred into a cloth bag until further processing at the banding shelter. The banding process for most birds typically involved the following steps: species identification, band application (if unbanded), 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 of the number of species and individuals present at the site.

## 2.2. Results

### 2.2.1. *Songbird banding*

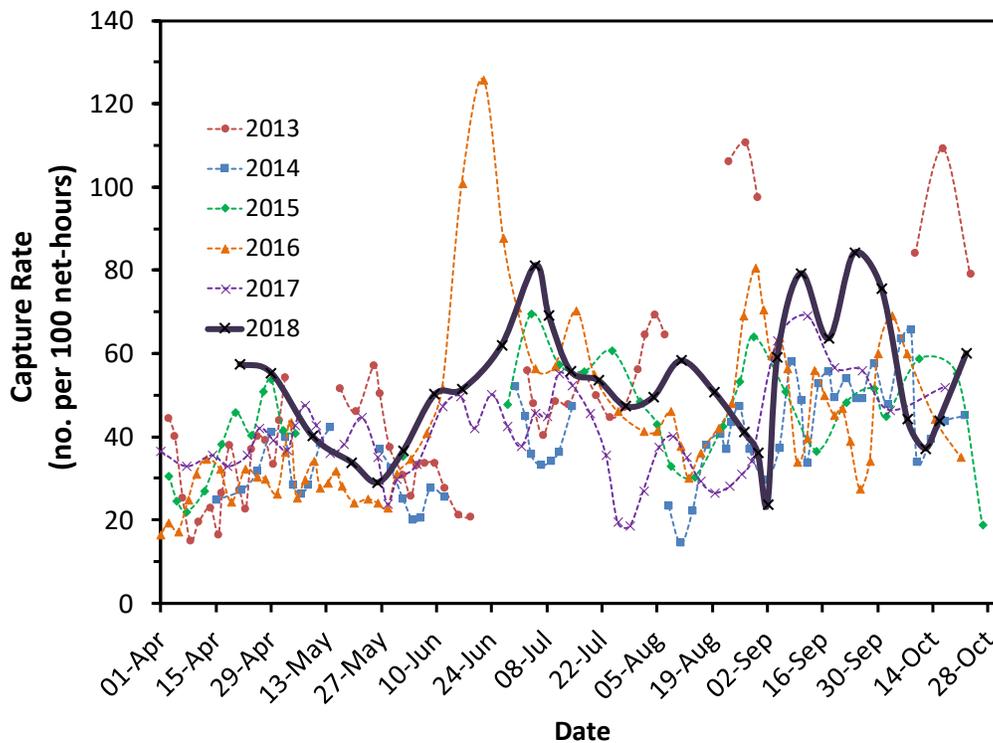
Songbird banding activities were conducted during 30 days between 17 April and 27 October 2018, with a total mist netting effort of 3,340 hours (average: 111.3 net hours / day) (Table 1). A total of 1,747 birds were caught from 49 species. Of these, 1,279 birds were banded and 468 birds (26.8%) were recaptures of previously banded birds. An additional 98 birds were captured and released unbanded (primarily hummingbirds). The average capture rate in 2018 was 52.3 birds / 100 net-hours.

The total capture effort deployed in 2018 (3,340 net-hours) was the lowest in the last 5 years (Table 1). There was no change in layout or number of nets used between 2017 and 2018, although net 1 was no longer used as a double-stacked net in 2018. Capture rate in 2018 (52.3 birds per 100 net-hours) was the highest observed since the beginning of the project in 2013. Reasons for the higher capture rates in 2018 are unknown but may include inter-annual variation in habitat use, breeding success, weather conditions, and the number and timing of banding days. The total number of species captured in 2018 (49 species) was slightly lower than for the last few years (52-57 species in 2015-2017).

**Table 1.** Mist net capture statistics at Buttertubs West Marsh during 2014-2018.

Parameter	Value				
	2014	2015	2016	2017	2018
Capture effort (net-hours)	4,960	4,358	8,648	5,874	<b>3,340</b>
Average daily effort (net-hours / day)	88.6	117.8	118.5	122.4	<b>111.3</b>
Number of birds banded	1,212	1,359	2,352	1,661	<b>1,279</b>
Number of recaptures	654	556	1,212	717	<b>468</b>
Total number of birds captured	1,866	1,915	3,564	2,378	<b>1,747</b>
Recapture rate (%)	35.0	29.0	34.0	30.2	<b>26.8</b>
Number of species	46	52	57	55	<b>49</b>
Capture rate (birds per 100 net-hours)	37.6	43.9	41.2	40.5	<b>52.3</b>

Compared to previous years, capture rates were generally high in April, June and September 2018 (Figure 3). There was no strong increase in capture rates during May in response to the arrival / passage of spring migrants. Unlike previous years, capture rates remained high during early to mid-August when they typically decreased during previous years. Capture rates during fall migration in 2018 (September) were higher compared to previous years, although banding occurred during fewer fall days.



**Figure 3.** Weekly moving average of capture rate in mist nets at Buttertubs West Marsh during 2013-2018.

The capture rate of mist nets varied across the project site (Table 2). Overall, capture rates were the highest for nets located in the riparian habitat (i.e., nets R1-R3), and for nets located near the interface between the old-field and marsh habitats (i.e., nets 8-10). This pattern was generally consistent with previous years.

Overall, Common Yellowthroat (*Geothlypis trichas*) was the most captured species and represented 16.1% of all birds caught during 2018 (Table 3). Song sparrow (*Melospiza melodia*) was the next most common species and accounted for 10.7% of all birds caught. These two species have been the most commonly caught species each year since 2013. All species listed in Table 3 are local breeders at Buttertubs Marsh, except for Lincoln's Sparrow (*M. lincolnii*). Tables A.1 and A.2 in Appendix provide a complete summary of all species captured during 2018.

**Table 2.** Capture statistics by net at Buttertubs West Marsh during 2018.

Net Number	Number Banded	Number Recaptured	Total Number Captured	Net Hours	Capture Rate (Birds / 100 Net hours)
1	59	28	87	169	51.6
2	65	17	82	169	48.7
3	53	18	71	169	42.1
4	50	24	74	169	43.9
5	31	12	43	169	25.5
6	24	14	38	169	22.6
7	57	18	75	169	44.5
8	134	46	180	169	106.8
9	69	30	99	169	58.8
10	96	52	148	169	87.8
11	25	10	35	169	20.7
12	25	23	48	163	29.4
13	22	16	38	169	22.5
14	49	20	69	169	40.8
15	33	20	53	169	31.3
R1	155	34	189	167	113.5
R2	119	35	154	167	92.0
R3	87	18	105	159	66.2
R4	64	21	85	161	52.7
R5	62	12	74	161	45.9
Totals	1,279	468	1,747	3,340	---

There were changes in the rankings for the top 10 species captured during 2018 (Table 4). The most significant changes were increases in capture of Lincoln's Sparrow (*Melospiza lincolni*), Bushtit (*Psaltriparus minimus*) and Purple Finch (*Haemorhous purpureus*) compared to previous years. The rankings for Orange-crowned Warbler (*Vermivora celata*) moved from the 5<sup>th</sup> position (2015-2017) to the 8<sup>th</sup> position in 2018.

New species captured at Buttertubs West Marsh in 2018 included Townsend's Warbler (*Setophaga townsendi*; 8 August) and Merlin (*Falco columbarius*; 29 August). Although Townsend's Warbler can be common in coniferous forest in the region, this species is uncommon at Buttertubs Marsh during migration or post-breeding dispersal. Only a few individuals have been observed at the site since the beginning of the project in 2013. Merlin are commonly observed around Buttertubs Marsh, but this species had eluded capture since the beginning of the project.

**Table 3.** Fifteen most common species captured in mist nets at Buttertubs West Marsh during 2018.

Common Name	Number Banded	Number Recaptured	Total Number Captured
Common Yellowthroat	171	110	281
Song Sparrow	98	89	187
Lincoln's Sparrow	120	13	133
Bushtit	81	39	120
American Robin	101	19	120
Spotted Towhee	71	31	102
Purple Finch	65	13	78
Orange-crowned Warbler	68	9	77
Chestnut-backed Chickadee	37	30	67
Savannah Sparrow	60	6	66
Bewick's Wren	28	27	55
Yellow Warbler	41	12	53
Swainson's Thrush	32	18	50
Oregon Junco	37	6	43
Marsh Wren	32	4	36

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 moult that occurs after the breeding season (Table 5). Second-year birds (hatched in 2017) were the dominant age group between April and May, while hatch-year birds (hatched in 2018) were the dominant age group between June and October. Overall, 64.3% of birds banded were birds hatched in 2018.

**Table 4.** Number captured and rank (in parentheses) of the ten species most captured in mist nets at Buttertubs West Marsh during 2014-2018.

<b>Common Name</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
Common Yellowthroat	310 (1)	304 (1)	605 (1)	361 (1)	<b>281 (1)</b>
Song Sparrow	279 (2)	207 (2)	349 (2)	253 (2)	<b>187 (2)</b>
Lincoln's Sparrow	86 (8)	79 (8)	293 (3)	121 (7)	<b>133 (3)</b>
American Robin	114 (4)	130 (4)	232 (4)	163 (3)	<b>120 (4.5)</b>
Bushtit	148 (3)	114 (6)	132 (9)	97 (9)	<b>120 (4.5)</b>
Spotted Towhee	95 (7)	137 (3)	210 (6)	144 (4)	<b>102 (6)</b>
Purple Finch	46 (10)	55 (11)	117 (12)	90 (11)	<b>78 (7)</b>
Orange-crowned Warbler	99 (6)	121 (5)	216 (5)	143 (5)	<b>77 (8)</b>
Chestnut-backed Chickadee	107 (5)	112 (7)	138 (8)	95 (10)	<b>67 (9)</b>
Savannah Sparrow	26 (15)	44 (13)	162 (7)	120 (8)	<b>66 (10)</b>

**Table 5.** Age structure of birds banded at Buttertubs West Marsh during 2018.

<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>
April		72	12	19	1	104
May	6	55	6	24		91
June	60	34	9	5	2	110
July	249	26	29	17	2	323
August	157	4	25			186
September	247	1	45		10	303
October	104		38		20	162
<b>TOTAL</b>	<b>823</b>	<b>192</b>	<b>164</b>	<b>65</b>	<b>35</b>	<b>1,279</b>

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 (September-October) (Table 6). Overall, the majority of birds banded (70.3%) did not display any visible fat (fat score = 0).

**Table 6.** Fat score of birds banded at Buttertubs West Marsh during 2018.

Month	0	1-2	3-5	Total
April	31	38	34	103
May	57	23	7	87
June	73	20		93
July	269	42	1	312
August	136	38	9	183
September	186	73	37	296
October	111	35	8	154
TOTAL	863	269	96	1,228

The 468 recapture events recorded in 2018 involved 319 banded birds (Table 7), of which 40 individuals were banded in 2013-2015, and 36, 68, and 175 individuals were originally banded in 2016, 2017, and 2018, respectively. Overall, 1% of individuals banded in 2013-2015 were recaptured in 2018, 1.5% of individuals banded in 2016 were recaptured in 2018, 3.9% of individuals banded in 2017 were recaptured in 2018, and 12.4% of individuals banded in 2018 were recaptured in 2018. These percentages provide crude estimates of between- and within-year survival and site fidelity, although they do not account for individuals which may still have been at the site in 2018 but were not recaptured.

**Table 7.** Number and percentage of individuals recaptured in 2018 which were originally banded in 2015 or before, 2016, 2017 or 2018 for the ten most commonly recaptured species.

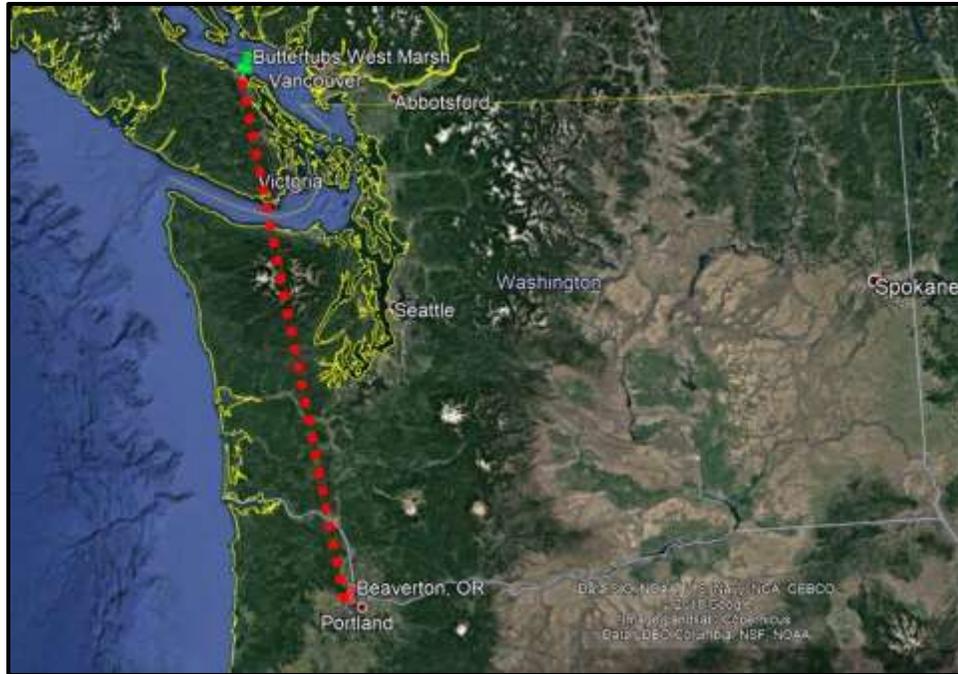
Species	Banded in 2015 or before		Banded in 2016		Banded in 2017		Banded in 2018	
	No.	%	No.	%	No.	%	No.	%
Common Yellowthroat	7	1.2	10	3.1	12	7.1	26	15.2
Song Sparrow	7	1.9	4	2.7	10	7.1	23	23.7
Bushtit	0	0.0	2	2.9	5	7.4	25	30.9
Spotted Towhee	4	2.0	6	4.8	4	4.8	11	15.5
Chestnut-backed Chickadee	2	1.3	2	4.0	4	7.7	17	45.9
Bewick's Wren	0	0.0	0	0.0	3	10.7	7	25.0
American Robin	3	1.2	1	0.6	5	4.6	4	4.0
Swainson's Thrush	2	3.1	0	0.0	0	0.0	7	21.9
Lincoln's Sparrow	0	0.0	0	0.0	0	0.0	12	10.0
Purple Finch	0	0.0	2	2.1	1	1.4	9	13.8
All species	40	1.0	36	1.5	68	3.9	175	12.4

Most recapture events involved birds that were recaptured only once during 2018. However, 155 individuals were recaptured more than once since they were banded, and at least 40 individuals were recaptured 6 or more times since they were banded. Some of these frequently recaptured individuals are listed in Table 8. This included Common Yellowthroat 2700-93399 (“Wayne”) and Song Sparrow 2581-70122 (“Blair”) recaptured over 35 times or more since their original banding date.

**Table 8.** List of selected individuals recaptured in 2018, which have been recaptured 6 or more times at Buttertubs West Marsh during 2013-2018.

Band Number	Species	Sex	Number of Times Recaptured Since Banded	Date Banded	Date of Last Recapture
0942-98803	AMRO	Female	13	26 Ap. 2014	4 Jul. 2018
2631-65055	BEWR	Unknown	13	27 Jun. 2017	18 Oct. 2018
2691-51461	BHCO	Female	6	6 Jun. 2016	14 Jun. 2018
2730-48724	CBCH	Male	7	7 Apr. 2016	14 Jun. 2018
2700-93399	COYE	Male	46	25 Apr. 2013	14 Jun. 2018
2710-96371	OCWA	Male	12	15 May 2014	29 May 2018
2581-70122	SOSP	Male	35	26 Mar. 2013	5 Jun. 2018
2561-03799	SPTO	Female	7	28 Jun. 2014	19 Jun. 2018
2691-51276	SWTH	Male	8	11 Aug. 2015	23 May 2018
2591-72599	TRES	Male	8	28 May 2014	5 Jun. 2018
2700-93449	YEWA	Male	13	17 May 2013	14 Jun. 2018

For the first time since the beginning of the project, one of the birds banded at Buttertubs Marsh was reported away from the Nanaimo area. Spotted Towhee 2531-28667 was banded as a hatch-year bird on 27 September 2017. It was found dead from a window strike on March 16, 2018, in Beaverton, Oregon, a suburb of Portland (about 420 km south of Nanaimo; Figure 4). This was the 7,816<sup>th</sup> bird banded at Buttertubs Marsh. Since a large proportion of local Spotted Towhee are non-migratory and can be recaptured throughout the year, this distant encounter indicates that at least some individuals migrate substantially.



**Figure 4.** Map showing the distance between banding and encounter locations for Spotted Towhee 2531-28667. This bird was banded on 27 September 2017 and found dead from a window strike on March 16, 2018 in Beaverton, Oregon.

### 2.2.2. Overall Species Presence / Absence

Banding totals (number of birds captured) and incidental observations 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 114 species were observed at Buttertubs West Marsh during 2018 (Table A.3 in Appendix). New species observed in 2018 were Canvasback (*Aythya valisineria*), Greater Scaup (*Aythya marila*), Lesser Scaup (*Aythya affinis*), American Coot (*Fulica americana*) and Palm Warbler (*Setophaga palmarum*). Only Palm Warbler was observed in the area of the banding station (by a local birder), while the waterfowl species were most likely observed by birders from the Buttertubs Marsh walking trail. A total of 136 species have been observed at Buttertubs West Marsh since the beginning of this project in 2013.

### 3. Swallow Nest Box Monitoring

#### 3.1. Methods

Thirty nest boxes were available in the old-field habitat at Buttertubs West Marsh and monitored for use by swallow species (Figure 5). Each nest box was installed approximately 1.5 m above ground and secured to a 2.4-m length of studded T-post. For each nest box, one of the side walls could be opened to allow for examination of its content. Nest boxes are cleaned out each year after the nesting season.

Nest box monitoring followed the procedures outlined in the VIU Swallow Nest Box Monitoring Manual (Demers, 2013). Nest boxes were monitored every 3-5 days between 1 May and 31 July 2018. 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 (if unbanded), assessed for age, sex, fat score and biometrics (wing chord, tail length, weight), and released.



**Figure 5.** Locations of the 30 swallow nest boxes at Buttertubs West Marsh during 2018. Green and red squares indicate whether eggs were deposited in the nest box or not, respectively.

**Table 9.** Results of nest box monitoring at Buttertubs West Marsh during 2018. Nest boxes no. 24, 25, and 27 received two clutches (see text). DNH = Did not hatch; F = Female; M = Male; N = Nestlings.

Nest Box	Nest Building	Number of Eggs	Complete Clutch Date	Mean Hatch Date	Number Fledged	Individuals Banded / Processed
1	No					
2	No					
3	Yes	6	13 May	27 May	3	F, M, N
4	Yes	3	29 May	DNH	0	F
5	No					
6	No					
7	Yes	6	May 15	May 28	3	F, M, N
8	Yes	4	May 22	Jun. 6	3	F, M, N
9	Yes	4	May 24	Jun. 8	2	F, M, N
10	Yes	6	May 15	May 29	2	F, N
11	Yes	6	May 14	May 28	2	F, M, N
12	Yes	6	May 11	May 24	3	F, M, N
13	Yes	5	May 26	Jun. 11	3	F, M, N
14	Yes	6	May 10	May 24	2	F, M, N
15	Yes	6	May 14	May 28	3	F, M, N
16	Yes	4	May 27	Jun. 13	4	F, M, N
17	No					
18	Yes	5	May 11	May 25	3	F, M, N
19	Yes	6	May 10	May 24	4	F, M, N
20	No					
21	Yes	7	May 15	May 28	3	F, M, N
22	Yes	7	May 12	May 26	4	F, M, N
23	Yes	6	May 11	May 25	3	F, M, N
24	Yes	5, 5	May 10, Jul. 4	May 24, Jul. 17	3, 0	Clutch 1: F, M, N Clutch 2: F
25	Yes	6, 3	May 11, Jun. 26	May 25, Jul. 11	3, 2	Clutch 1: F, M, N Clutch 2: F, N
26	Yes	3	May 19	DNH	0	F
27	Yes	6, 1	May 11, Unknown	May 24, DNH	4, 0	Clutch 1: F, M, N Clutch 2: F
28	Yes	1	Unknown	DNH	0	F
29	Yes	6	May 11	May 25	0	F, M, N
30	Yes	6	May 17	May 19	3	F, M, N
Total		135			62	

**Table 10.** Summary of Tree Swallow nesting productivity at Buttertubs West Marsh during 2014-2018.

Parameter	2014	2015	2016	2017	2018
Number of boxes	25	30	30	37	<b>30</b>
Number of boxes with eggs (% of boxes with eggs)	12 (48%)	19 (63%)	20 (67%)	22 (59%)	<b>24 (80%)</b>
Number of eggs laid	59	109	115	138	<b>135</b>
Mean clutch size (range)	4.9 (2-6)	5.1 (4-6)	5.0 (2-6)	5.1 (1-7)	<b>5.0 (1-7)</b>
Number of eggs hatched (% eggs hatched)	46 (78%)	83 (76%)	78 (68%)	82 (59%)	<b>115 (85%)</b>
Number of nestlings banded (% nestlings banded)	41 (89%)	74 (89%)	68 (87%)	69 (84%)	<b>105 (91%)</b>
Number fledged (% nestlings fledged)	30 (65%)	61 (73%)	46 (59%)	52 (63%)	<b>62 (54%)</b>
Fledging rate (young per pair)	2.5	3.2	2.1	2.0	<b>2.3</b>

### 3.2. Results

Twenty-four of the 30 nest boxes were occupied by Tree Swallows (*Tachycineta bicolor*) and had signs of nest building activities (Table 9). Clutch sizes ranged from 1-7 eggs with an average of 5.0 eggs per clutch, which was consistent with previous years. Nest boxes no. 24, 25, and 27 were the site of repeated nesting attempts involving different females during the first and second nests.

Twenty-six adult females and 20 adult males were captured. One female nested in boxes no. 4 and 28, but the eggs failed to hatch in both attempts. One female nested in box no. 29 where all 6 nestlings died, and re-nested in box no. 25 where two of her three nestlings fledged. Of the 26 adult Tree Swallows captured, 8 individuals had nested at Buttertubs West Marsh during 2014 and 2015 (4 female, 4 males), and 20 individuals had nested at Buttertubs West Marsh during 2017 (11 females, 9 males). Interestingly, the same pair that occupied nest box no. 3 during 2018 nested together in 2016 and 2017. Five females and 3 males that were originally banded as nestlings at Buttertubs West Marsh returned to nest in 2018. This was the first year since the beginning of the project that females born at Buttertubs West Marsh returned to nest at the site.

Out of 135 eggs laid, 115 eggs hatched (hatching success: 85%), 105 nestlings were banded around day 12 (nestling survival to day 12: 91%), and 62 young birds fledged (nestling survival to fledging: 54%) (Tables 9 and 10). Fledging success was variable between nest boxes, with some boxes fledging no young while others fledged up to 6 young. The average fledging rate for the entire nest box colony was 2.3 young per nesting pair.

Overall, the fledging productivity was similar to 2016 and 2017 (2.0-2.1 young per nesting pair), but lower compared to 2014 and 2015 (2.5 and 3.2 young per nesting pair, respectively). Hatching rate was higher in 2018 (85%) compared to 2014-2017 (59-78%). Survival of young from hatching to day 12 was also high (91%) compared to 2014-2017 (84-89%). However, survival from hatching to fledging in 2018 (54%) was lower than the range observed in 2014-2017 (59-73%). These results suggest that the lower fledging success in 2018 was mainly due to reduced survival during the days leading to fledging. Field observations suggested that a 6-day period of cool and wet weather on 8-13 June 2018 (mean temperature: 12.6°C; total rainfall: 20 mm) may have in part led to reduced productivity. Although weather conditions were favourable during the rest of the nesting period, these rainy days coincided with the vulnerable pre-fledging days when nestling feeding rates are the highest.

Nestlings in two nest boxes (no. 10 and 13) were infested with parasitic blowfly larvae (*Trypocalliphora braueri*; Order Diptera, Family Calliphoridae), which burrow subcutaneously through a nestling's flesh. One of four nestlings in box 10 and four of five nestlings in box 13 were host to 3-9 blowfly larvae. The presence of blowflies did not necessarily reduce the probability of fledging as nestlings with 3-5 blowflies still managed to fledge. These parasites had not been observed in Tree Swallows at Buttertubs Marsh since 2014.

#### 4. Volunteer Effort and Training

As stated above, one of the main objectives of this project is to provide practical educational and training opportunities for Vancouver Island University students and community volunteers. Indeed, this project is 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 – incidental observations, census.
- Songbird 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 42 volunteers dedicated 1,495 hours to this project during 2018 (Table 10). 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 2018.

<b>Volunteer Grouping</b>	<b>Number of Volunteers</b>	<b>Hours on Project</b>
VIU students	24	1,003
VIU graduates	10	170
VIU employees	3	268
Community volunteers	5	53
<b>TOTAL</b>	<b>42</b>	<b>1,495</b>

Volunteer training was conducted by Dr. Eric Demers and Kim Wetten, with assistance from numerous already-trained volunteers. Volunteers received training in bird banding and monitoring activities, and contributed to the processing of birds captured as part of this project (Table 12).

## 5. Public Demonstrations and Education

Public demonstrations and education are also main objectives of this project. This is achieved through public 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 in 2018:

- On-site demonstration to over 30 individual visitors and guests. This included the following groups: High School @ VIU (May 29); VIU Grandkids University (July 6).
- On-site demonstration for 35 students: VIU GEOG 101 Environmental Geography (July 4); VIU BIOL 375 Ecological Methodology course (September 28).
- Off-site demonstration for 25 kindergarten children: École Hammond Bay (June 1; VIU Nanaimo Campus).
- Off-site presentation for students in VIU BIOL 202 Ecology (March 16); VIU CREATE Conference (April 13).

Social media plays a large part in public outreach and education of this project. Project news, results and photos are shared on the project website (<http://wordpress.viu.ca/viubirdbanding/>) and Facebook page (<https://www.facebook.com/VIUBandingStation>). This allows online followers to not only learn about the project, but to also gain insight on banding procedures, species identification, bird behaviour and more.

\*

**Table 12.** 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 2018. The numbers listed include birds processed as part of regular bird banding and swallow nest box monitoring.

Bander Code	Number of Birds Processed		
	Banded	Recaptures	Total
ALBA	47	31	78
AMFR	3	3	6
ANLE	15	5	20
AVBR	43	7	50
BELA	28	7	35
BRJU	85	39	124
CAFU	17	3	20
CANG	41	18	59
CHBR	35	12	47
CHYO	58	27	85
EMBA	3	1	4
EMRA	16	4	20
ERDE	122	59	181
ERSG	2	1	3
EVHE	65	18	83
GABE	67	17	84
GEVA	65	8	73
HAHA	8	5	13
HEVA	11	4	15
HIKI	47	17	64
KAOV	24	12	36
KIBA	58	11	69
KIWE	49	8	57
MAWA	5	7	12
MCBA	34	28	62
MEKO	18	2	20
PAMO	70	29	99
RYHA	17	10	27
SAHU	2		2
SASP	189	69	258
STWE	11		11
SUCR	1	1	2
TABR	23	5	28
<b>TOTAL</b>	<b>1,279</b>	<b>468</b>	<b>1,747</b>

## 6. Acknowledgements

This project would not be possible without a dedicated group of volunteers, contributors and partners (any omission is unintended): A. Badger, E. Barnewall, M. Barrera, K. Barrett, G. Beisel, A. Boxwell, C. Brewster, A. Brophy, T. Brouwer, G. Bruce, S. Crowe, E. Demers, B. Dudeck, A. Friesen, M. Funk, N. Gagne, T. Goater, J. Gorrell, D. Gullison, H. Hall, K. Hall, R. Hardisty, E. Hessels, S. Hunt, B. Judson, G. Khatkar, H. Kimura, M. Kollman, B. Laforge, P. Monteiro, C. Nguyen, K. Ovcharov, E. Radziul, R. Segal, S. Simard-Provencal, W. Simms, E. Sowerby-Greene, H. Van Vliet, G. Van der Voort, M. Wagenaar, K. Wetten, S. Wetten, M. Wilkins, M. Wright, and C. Youngren.

Vancouver Island University, the City of Nanaimo, Ducks Unlimited Canada, and the Nature Trust of BC are acknowledged for their support of this project.

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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 in accordance with Canadian Wildlife Service Bird Banding Office Scientific Permit No. 10885 (Eric Demers) and 10885A (Kim Wetten) to capture and band migratory birds, including authorization to use mist nets for the capture of passerines and other landbirds.

## 7. References

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## 8. Appendix

**Table A.1.** List of all species captured in mist nets at Buttertubs West Marsh during 2018. Subspecies are included in parentheses where applicable.

Common Name	Number banded	Number recaptured	Total number captured
Common Yellowthroat	171	110	281
Song Sparrow	98	89	187
Lincoln's Sparrow	120	13	133
Bushtit	81	39	120
American Robin	101	19	120
Spotted Towhee	71	31	102
Purple Finch	65	13	78
Orange-crowned Warbler	68	9	77
Chestnut-backed Chickadee	37	30	67
Savannah Sparrow	60	6	66
Bewick's Wren	28	27	55
Yellow Warbler	41	12	53
Swainson's Thrush	32	18	50
Dark-eyed Junco (Oregon)	37	6	43
Marsh Wren	32	4	36
Fox Sparrow	26	6	32
Cedar Waxwing	24	6	30
Willow Flycatcher	28	1	29
Yellow-rumped Warbler (Myrtle)	19		19
Tree Swallow	8	10	18
Ruby-crowned Kinglet	18		18
Black-headed Grosbeak	11	5	16
Wilson's Warbler	12		12
American Goldfinch	8	1	9
Pacific Wren	8		8
Chipping Sparrow	7		7
Brown-headed Cowbird	2	5	7
White-crowned Sparrow (Puget Sound)	7		7
Golden-crowned Sparrow	6		6
MacGillivray's Warbler	5	1	6
Pacific-slope Flycatcher	6		6
Red-breasted Sapsucker	4	2	6
Red-winged Blackbird	4	1	5
Golden-crowned Kinglet	4		4
Downy Woodpecker	2	2	4
Warbling Vireo	4		4
House Finch	4		4
Hermit Thrush	3		3
Hammond's Flycatcher	3		3
Yellow-rumped Warbler (Audubon)	3		3
Brown Creeper	2	1	3
Hutton's Vireo	1	1	2
Townsend's Warbler	1		1
Northern Shrike	1		1
Hairy Woodpecker	1		1
Barred Owl	1		1
Pine Siskin	1		1
Merlin	1		1
Swamp Sparrow	1		1
White-throated Sparrow	1		1
<b>TOTAL</b>	<b>1,279</b>	<b>468</b>	<b>1,747</b>

**Table A.2.** Number of all species captured during each day of mist netting at Buttertubs West Marsh during 2018.

Date	Barred Owl	Red-breasted Sapsucker	Downy Woodpecker	Hairy Woodpecker	Merlin	Willow Flycatcher	Hammond's Flycatcher	Pacific-slope Flycatcher	Northern Shrike	Hutton's Vireo	Warbling Vireo	Tree Swallow	Chestnut-backed Chickadee	Bushitit	Brown Creeper	Pacific Wren	Marsh Wren	Bewick's Wren	Golden-crowned Kinglet	Ruby-crowned Kinglet	Swainson's Thrush	Hermit Thrush	American Robin	Cedar Waxwing	House Finch	Purple Finch	Pine Siskin	American Goldfinch	Chipping Sparrow	Fox Sparrow	Dark-eyed Junco	White-crowned Sparrow	Golden-crowned Sparrow	White-throated Sparrow	Savannah Sparrow	Song Sparrow	Lincoln's Sparrow	Swamp Sparrow	Spotted Towhee	Red-winged Blackbird	Brown-headed Cowbird	Orange-crowned Warbler	MacGillivray's Warbler	Common Yellowthroat	Yellow Warbler	Yellow-rumped Warbler	Townsend's Warbler	Wilson's Warbler	Black-headed Grosbeak	Total	
17-Apr												3	3	1					7	1	4				1				8				3	6	11		4	1					3	1							57
25-Apr	1												4	1			1		1				5						4	1	2		8	6	13		3		1	7		14	9							81	
03-May									2			6	1				1				1	2	1										2	6	2	6		2			8	12							52		
16-May												2					1		3			3	2		3			2							6		1		2	3	1	4	5				2	40			
23-May		1											1				1		2			4	2		2											1	7		1	1	1	2	5	3			1	35			
29-May												1	1					1		2		3	5		1			1							5				5	2						1	33				
05-Jun		2										3	4		1		1		3			13	2		3			2							5			2	3	5	4				2	55					
14-Jun						1						2	7	7		1	1		3			4	2		6										5		5	1	3	2	12	4				5	71				
19-Jun		1				2					1	4	8				3		3			3	1		4								2	5		3			6	8	2	1			1	58					
04-Jul						1							4		6	8		1		10	1	4	5		2						1		8	12		4		4		19	1						91				
06-Jul						1						2	12		4	7		2		3	4		8		8			1			1		1	21		6		1		28	1				1	104					
11-Jul		1				1						3	3		7	3		3		2	2		2		2			1	2												16					1	62				
17-Jul		1										2		1	3	3		5		2	5		2		2															2	25	4			1	72					
25-Jul						1						4	10		2	3		1		2				2		2						1		1	2		3		1	5	3						41				
31-Jul						1	1					3	11		2	3		1		2			2		3																12	4			2			57			

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Table A.2. (continued)

Date	Barred Owl	Red-breasted Sapsucker	Downy Woodpecker	Hairy Woodpecker	Merlin	Willow Flycatcher	Hammond's Flycatcher	Pacific-slope Flycatcher	Northern Shrike	Hutton's Vireo	Warbling Vireo	Tree Swallow	Chestnut-backed Chickadee	Bushtit	Brown Creeper	Pacific Wren	Marsh Wren	Bewick's Wren	Golden-crowned Kinglet	Ruby-crowned Kinglet	Swainson's Thrush	Hermit Thrush	American Robin	Cedar Waxwing	House Finch	Purple Finch	Pine Siskin	American Goldfinch	Chipping Sparrow	Fox Sparrow	Dark-eyed Junco	White-crowned Sparrow	Golden-crowned Sparrow	White-throated Sparrow	Savannah Sparrow	Song Sparrow	Lincoln's Sparrow	Swamp Sparrow	Spotted Towhee	Red-winged Blackbird	Brown-headed Cowbird	Orange-crowned Warbler	MacGillivray's Warbler	Common Yellowthroat	Yellow Warbler	Yellow-rumped Warbler	Townsend's Warbler	Wilson's Warbler	Black-headed Grosbeak	Total
08-Aug						2						1	3					1		2	3												2	6			3			7	13	3		1		1	50			
14-Aug		1	1			9	1			3					1			2		3	1	1					1						1	5		1			10	3	26	2			6	78				
25-Aug						2	1	1				3	9			1						3		2									1	3	2		1			1	11	1			2	44				
29-Aug					1	3								9			2	3			3	2											1	4	9								13	2			55			
1-Sep		1				2	1					3				2	1			2	1			1										1	7		2					5	3				32			
3-Sep						2	1					3				1				5				1											7		1						3				24			
6-Sep		1				1						9	1					2		3	3			5						1	1	1		10	5	41		5		5	19	4					117			
15-Sep							1	1		1								1	1	1	3			3								1		7	3	6		5		4	8	4			1	51				
20-Sep							1					2			1				2	1	1	11			10		1		2				4	8	15		1		8	7	1			1		77				
28-Sep												1	11					1	2			6		6					4	8		2	2	13	9		5				2	3				75				
4-Oct												2			1	1	1			1	1								2	3	1			4	1	10						1	7				36			
11-Oct	1								1							2	4		1		2			1					5	6				2	10	2		7					1			45				
13-Oct												1	4		1	1	1		3		3						1		1	10			1	2	6	1	1	5								42				
18-Oct												5	12			1	2		1		7			3					2	9				5	2		9									58				
27-Oct												7	6		3	1			3		14			1					3	6				1	1		8									54				
Total	1	6	4	1	1	29	3	6	1	2	4	18	67	120	3	8	36	55	4	18	50	3	120	30	4	78	1	9	7	32	43	7	6	1	66	187	133	1	102	5	7	77	6	281	53	22	1	12	16	1,747

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**Table A.3.** List of all species observed at Buttertubs West Marsh during 2018 based on a combination of banding totals and incidental observations. Green rectangles indicate that a species was observed during a given time period. The size of the green rectangles represents the proportion of surveys for which a species was detected. Areas in gray checkerboard indicate that no data are available. Data compiled in and extracted from eBird database.

114 species (+6 other taxa)		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<a href="#">Snow Goose</a>													
<a href="#">Cackling Goose</a>													
<a href="#">Canada Goose</a>													
<a href="#">Trumpeter Swan</a>													
<a href="#">Wood Duck</a>													
<a href="#">American Wigeon</a>													
<a href="#">Mallard</a>													
<a href="#">Green-winged Teal</a>													
<a href="#">Canvasback</a>													
<a href="#">Ring-necked Duck</a>													
<a href="#">Greater Scaup</a>													
<a href="#">Lesser Scaup</a>													
<a href="#">Bufflehead</a>													
<a href="#">Hooded Merganser</a>													
<a href="#">Common Merganser</a>													
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
duck sp.													
<a href="#">California Quail</a>													
<a href="#">Pied-billed Grebe</a>													
<a href="#">Rock Pigeon</a>													
<a href="#">Band-tailed Pigeon</a>													
<a href="#">Eurasian Collared-Dove</a>													
<a href="#">Common Nighthawk</a>													
<a href="#">Black Swift</a>													
<a href="#">Vaux's Swift</a>													
<a href="#">Anna's Hummingbird</a>													
<a href="#">Rufous Hummingbird</a>													
<a href="#">Virginia Rail</a>													
<a href="#">American Coot</a>													
<a href="#">Killdeer</a>													
<a href="#">Wilson's Snipe</a>													

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**Table A.3.** (continued)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<a href="#">Greater Yellowlegs</a>	 												
<a href="#">Glaucous-winged Gull</a>	 												
<a href="#">gull sp.</a>	 												
<a href="#">Double-crested Cormorant</a>	 												
<a href="#">Great Blue Heron</a>	 												
<a href="#">Turkey Vulture</a>	 												
<a href="#">Osprey</a>	 												
<a href="#">Northern Harrier</a>	 												
<a href="#">Sharp-shinned Hawk</a>	 												
<a href="#">Cooper's Hawk</a>	 												
<a href="#">Bald Eagle</a>	 												
<a href="#">Red-tailed Hawk</a>	 												
<a href="#">Great Horned Owl</a>	 												
<a href="#">Barred Owl</a>	 												
<a href="#">Belted Kingfisher</a>	 												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<a href="#">Red-breasted Sapsucker</a>	 												
<a href="#">Downy Woodpecker</a>	 												
<a href="#">Hairy Woodpecker</a>	 												
<a href="#">Pileated Woodpecker</a>	 												
<a href="#">Northern Flicker</a>	 												
<a href="#">American Kestrel</a>	 												
<a href="#">Merlin</a>	 												
<a href="#">Peregrine Falcon</a>	 												
<a href="#">falcon sp.</a>	 												
<a href="#">Western Wood-Pewee</a>	 												
<a href="#">Willow Flycatcher</a>	 												
<a href="#">Hammond's Flycatcher</a>	 												
<a href="#">Pacific-slope Flycatcher</a>	 												
<a href="#">Northern Shrike</a>	 												
<a href="#">Hutton's Vireo</a>	 												

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**Table A.3.** (continued)

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<a href="#">Cassin's Vireo</a>														
<a href="#">Warbling Vireo</a>														
<a href="#">Steller's Jay</a>														
<a href="#">Northwestern Crow</a>														
<a href="#">Common Raven</a>														
crow/raven sp.														
<a href="#">Northern Rough-winged Swallow</a>														
<a href="#">Purple Martin</a>														
<a href="#">Tree Swallow</a>														
<a href="#">Violet-green Swallow</a>														
<a href="#">Barn Swallow</a>														
<a href="#">Chestnut-backed Chickadee</a>														
<a href="#">Bushtit</a>														
<a href="#">Red-breasted Nuthatch</a>														
<a href="#">Brown Creeper</a>														
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<a href="#">Pacific Wren</a>														
<a href="#">Marsh Wren</a>														
<a href="#">Bewick's Wren</a>														
<a href="#">Golden-crowned Kinglet</a>														
<a href="#">Ruby-crowned Kinglet</a>														
<a href="#">Varied Thrush</a>														
<a href="#">Swainson's Thrush</a>														
<a href="#">Hermit Thrush</a>														
<a href="#">American Robin</a>														
<a href="#">European Starling</a>														
<a href="#">Cedar Waxwing</a>														
<a href="#">Evening Grosbeak</a>														
<a href="#">House Finch</a>														
<a href="#">Purple Finch</a>														
House/Purple Finch														

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**Table A.3.** (continued)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<a href="#">Red Crossbill</a>													
<a href="#">Pine Siskin</a>													
<a href="#">American Goldfinch</a>													
<a href="#">finch sp.</a>													
<a href="#">Chipping Sparrow</a>													
<a href="#">Fox Sparrow</a>													
<a href="#">Dark-eyed Junco</a>													
<a href="#">White-crowned Sparrow</a>													
<a href="#">Golden-crowned Sparrow</a>													
<a href="#">White-throated Sparrow</a>													
<a href="#">Savannah Sparrow</a>													
<a href="#">Song Sparrow</a>													
<a href="#">Lincoln's Sparrow</a>													
<a href="#">Swamp Sparrow</a>													
<a href="#">Spotted Towhee</a>													
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<a href="#">Red-winged Blackbird</a>													
<a href="#">Brown-headed Cowbird</a>													
<a href="#">Brewer's Blackbird</a>													
<a href="#">Orange-crowned Warbler</a>													
<a href="#">MacGillivray's Warbler</a>													
<a href="#">Common Yellowthroat</a>													
<a href="#">Yellow Warbler</a>													
<a href="#">Palm Warbler</a>													
<a href="#">Yellow-rumped Warbler</a>													
<a href="#">Black-throated Gray Warbler</a>													
<a href="#">Townsend's Warbler</a>													
<a href="#">Wilson's Warbler</a>													
<a href="#">Western Tanager</a>													
<a href="#">Black-headed Grosbeak</a>													
<a href="#">House Sparrow</a>													

**KEY:** = insufficient data | = rare to widespread

**Photos A.1.** Sample photographs for the VIU Bird Monitoring and Banding Project at Buttertubs West Marsh during 2018. Photos courtesy of E. Demers.



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Photos A.1. (continued)



Photos A.1. (continued)

