

DATA REPORT

Bird Monitoring and Banding Project at Buttertubs West Marsh, Nanaimo, BC 2023



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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, 2019).



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, Ducks Unlimited Canada, and The Nature Trust of BC.

This report summarizes the activities and results of this project during 2023. 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. 100063, Canadian Wildlife Service Bird Banding Office Scientific Permit No. 10885, 10885B and 10885D, and following procedures and guidance established in the VIU Bird Monitoring and Banding Manual (Demers, 2019), the North American Banding Council (NABC, 2001a,b), and the Institute for Bird Populations (IBP, 2012).

Between March and October 2023, 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, common hawthorn (*Crataegus monogyna*), and Himalayan blackberry.

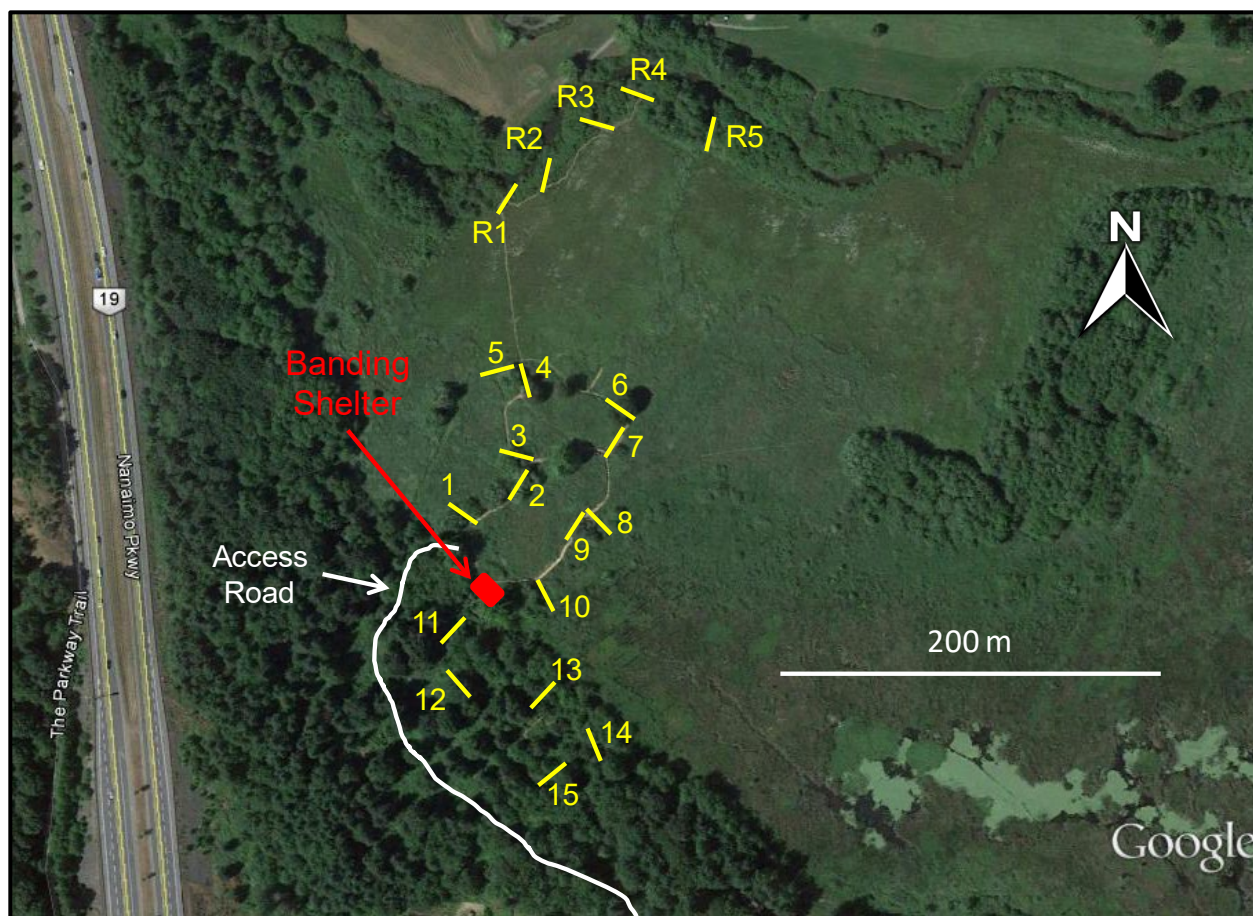


Figure 2. Locations of mist nets and banding shelter used for songbird banding at Buttertubs West Marsh during 2023.

Bird banding activities were conducted 1-3 days most weeks between March 28 and October 22, 2023. 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.

In 2023, the VIU Bird Banding participated in the Bird Genoscape Project (BGP), coordinated by researchers at Colorado State University in an effort to map the population-specific migratory routes of 100 species of migratory songbirds by utilizing genomics. To help contribute to this project, feathers from up to 10 individuals were collected from the following 21 target species: American Goldfinch (*Spinus tristis*), American Robin (*Turdus migratorius*), Black-headed Grosbeak (*Pheucticus melanocephalus*), Brown Creeper (*Certhia americana*), Chipping Sparrow (*Spizella passerina*), Dark-eyed Junco (*Junco hyemalis*), Fox Sparrow (*Passerella iliaca*), Hairy

Woodpecker (*Leuconotopicus villosus*), Lincoln's Sparrow (*Melospiza lincolnii*), MacGillivray's Warbler (*Geothlypis tolmiei*), Northern Shrike (*Lanius borealis*), Orange-crowned Warbler (*Leiothlypis celata*), Ruby-crowned Kinglet (*Corthylio calendula*), Song Sparrow (*Melospiza melodia*), Spotted Towhee (*Pipilo maculatus*), Swainson's Thrush (*Catharus ustulatus*), Warbling Vireo (*Vireo gilvus*), White-crowned Sparrow (*Zonotrichia leucophrys*), White-throated Sparrow (*Zonotrichia albicollis*), Western Tanager (*Piranga ludoviciana*), and Yellow-rumped Warbler (*Setophaga coronata*). For each individual, two rectrices (tail feathers) were sampled: one central (r1) and one outer (r6) rectrix. Feathers from each bird were placed in BGP-provided pre-printed envelope and filled out with the species name, band number, date, location, age, sex, breeding condition (as determined by brood patch or cloacal protuberance), and whether the bird was a recapture. Feather samples were shipped to the BGP at the end of the year.

In 2023, the VIU Bird Banding also participated in the Songbirds as Pollinators project (SaP), coordinated by researchers at Colorado State University (CSU) in an effort to explore the relationships between North American songbirds and flowering plants. To help contribute to this project, pollen swabs from up to 30 individuals were collected from the following 13 target species: Anna's Hummingbird (*Calypte anna*), Black-throated Gray Warbler (*Setophaga nigrescens*), Bushtit (*Psaltiriparus minimus*), Common Yellowthroat (*Geothlypis trichas*), MacGillivray's Warbler, Orange-crowned Warbler, Ruby-crowned Kinglet (*Regulus calendula*), Rufous Hummingbird (*Selasphorus rufus*), Warbling Vireo, Western Tanager, Wilson's Warbler (*Cardellina pusilla*), Yellow-rumped Warbler, and Yellow Warbler (*Setophaga petechia*). For each individual, a sterile swab was used to swab the face and bill for pollen. The swab from each bird were placed in a pre-labelled swab, placed in a pre-printed envelope, and filled out with the species name, band number, date, location, age, sex, breeding condition (as determined by brood patch or cloacal protuberance), and whether the presence/absence of visible pollen. Swab samples were shipped to CSU at the end of the year.

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.

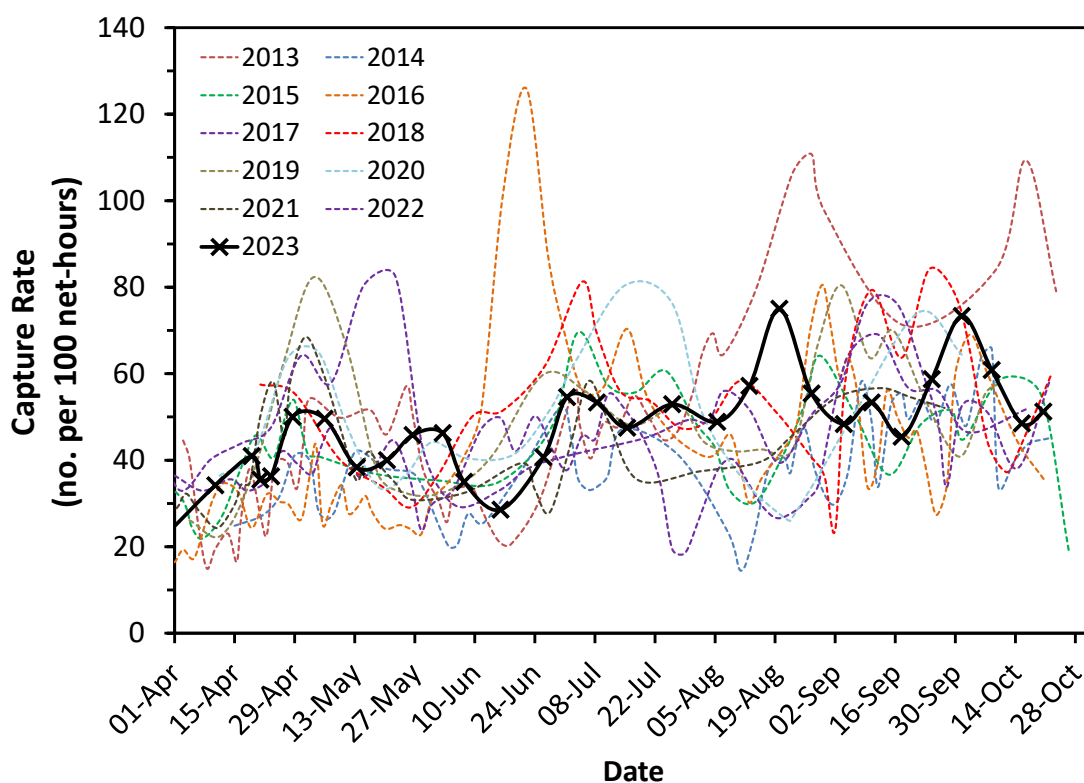
2.2. Results

2.2.1. Songbird banding

Songbird banding activities were conducted during 31 days between March 28 and October 22, 2023, with a total mist netting effort of 3,621 hours (average: 116.8 net hours / day) (**Table 1**). A total of 1,720 birds were caught from 55 species. Of these, 1,256 birds were banded and 464 birds (27.0%) were recaptures of previously banded birds. An additional 101 birds were captured and released unbanded (primarily hummingbirds). The average capture rate in 2023 was 47.5 birds / 100 net-hours.

Table 1. Mist net capture statistics at Buttertubs West Marsh during 2019-2023.

Parameter	Value				
	2019	2020	2021	2022	2023
Capture effort (net-hours)	3,263	2,981	3,776	3,461	3,621
Average daily effort (net-hours / day)	116.6	76.4	94.4	108.2	116.8
Number of birds banded	1,204	1,105	1,120	1,305	1,256
Number of recaptures	427	406	488	454	464
Total number of birds captured	1,631	1,511	1,608	1,759	1,720
Recapture rate (%)	26.2	26.9	30.3	25.8	27.0
Number of species	48	53	50	51	55
Capture rate (birds per 100 net-hours)	50.0	50.7	42.6	50.8	47.5

**Figure 3.** Weekly moving average of capture rate in mist nets at Buttertubs West Marsh during 2013-2023.

The total capture effort deployed in 2023 (3,621 net-hours) was the second highest in the last 5 years (**Table 1**). There was no change in layout or number of nets used since 2016. Capture rate in 2023 (47.5 birds per 100 net-hours) was slightly lower than the average of the last 5 years. The

total number of species captured in 2023 (55 species) was the highest compared to the last few years (48-55 species in 2019-2023).

Compared to previous years, capture rates were near average throughout the season, except for high capture rate events in mid-August and late September mainly attributed to migratory warblers and sparrows (**Figure 3**).

The capture rate of mist nets varied across the project site (**Table 2**). Overall, capture rate was the highest for net R2 located in the riparian habitat. This pattern was generally consistent with previous years.

Table 2. Capture statistics by net at Buttertubs West Marsh during 2023.

Net Number	Number Banded	Number Recaptured	Total Number Captured	Net Hours	Capture Rate (Birds / 100 Net hours)
1	42	36	78	183	42.5
2	44	22	66	183	36.0
3	34	18	52	183	28.5
4	37	15	52	181	28.7
5	34	15	49	183	26.7
6	28	20	48	172	27.9
7	75	20	95	183	51.8
8	138	27	165	179	92.0
9	76	26	102	172	59.3
10	91	26	117	183	63.8
11	18	20	38	183	20.7
12	20	19	39	183	21.3
13	33	19	52	178	29.2
14	54	27	81	178	45.5
15	20	20	40	178	22.5
R1	141	26	167	183	91.1
R2	147	42	189	183	103.1
R3	86	14	100	183	54.5
R4	84	40	124	183	67.6
R5	54	12	66	183	36.0
Totals	1,256	464	1,720	3,621	47.5

Overall, Common Yellowthroat was the most captured species and represented 11.6% of all birds caught during 2023 (**Table 3**). American Robin and Song Sparrow were the second and third most common species, and they accounted for 8.6% and 8.2% of all birds caught, respectively. Most species listed in **Table 3** are local breeders at Buttertubs Marsh, except for Ruby-crowned Kinglet, Fox Sparrow, and Lincoln's Sparrow (*Melospiza lincolnii*). **Tables A.1** and **A.2** in Appendix provide a complete summary of all species captured during 2023. Photos of some of the birds captured in 2023 are shown in **Photos B.1** in Appendix.

Table 3. Fifteen most common species captured in mist nets at Buttertubs West Marsh during 2023.

Common Name	Number Banded	Number Recaptured	Total Number Captured
Common Yellowthroat	125	75	200
American Robin	121	27	148
Song Sparrow	73	69	142
Spotted Towhee	82	50	132
Bushtit	71	42	113
Chestnut-backed Chickadee	42	41	83
Swainson's Thrush	45	36	81
Orange-crowned Warbler	67	8	75
Bewick's Wren	28	36	64
Yellow Warbler	45	14	59
Purple Finch	56	2	58
Fox Sparrow	35	15	50
Ruby-crowned Kinglet	44	4	48
Lincoln's Sparrow	46	1	47
Cedar Waxwing	35	4	39

There were changes in the rankings for the top 10 species captured during 2023 (**Table 4**). Common Yellowthroat reclaimed top rank as the most commonly caught species. There an increase in ranking for American Robin, Spotted Towhee, Bushtit and Swainson's Thrush (*Catharus ustulatus*), and a decrease in ranking for Savannah Sparrow (*Passerculus sandwichensis*), Lincoln's Sparrow and Wilson's Warbler compared to previous years. Three new species were captured at Buttertubs West Marsh in 2023: American Tree Sparrow (*Spizelloides arborea*), Rusty Blackbird (*Euphagus carolinus*), and Tennessee Warbler (*Leiothlypis peregrina*). None of these species were expected captures for the time of year or for this location. A total of 81 species have now been captured at Buttertubs West Marsh between 2013 and 2023.

A rare male Anna's x Rufous Hummingbird hybrid was captured on March 28, 2023. A photo of this individual is included in **Appendix B.1**.

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 2021) were the dominant age group between April and May, while hatch-year birds (hatched in 2022) were the dominant age group between June and October. Overall, 57.1% of birds banded were birds hatched in 2023. This percentage was similar to previous years.

Table 4. Number captured and rank (in parentheses) of the ten species most captured in mist nets at Buttertubs West Marsh during 2019-2023.

Common Name	2019	2020	2021	2022	2023
Common Yellowthroat	231 (1)	206 (1)	147 (2)	177 (2)	200 (1)
American Robin	82 (7)	92 (4)	90 (6)	125 (4)	148 (2)
Song Sparrow	143 (3)	122 (2)	153 (1)	142 (3)	142 (3)
Spotted Towhee	108 (4)	76 (7)	65 (10)	84 (7)	132 (4)
Bushtit	91 (5.5)	72 (10)	63 (11)	67 (10)	113 (5)
Chestnut-backed Chickadee	74 (9)	59 (11)	76 (9)	91 (5)	83 (6)
Swainson's Thrush	61 (11)	48 (13)	53 (12)	54 (14)	81 (7)
Orange-crowned Warbler	168 (2)	75 (8)	101 (4)	81 (8)	75 (8)
Bewick's Wren	78 (8)	81 (5)	80 (8)	55 (13)	64 (9)
Yellow Warbler	55 (12)	98 (3)	88 (7)	67 (10)	59 (10)

Table 5. Age structure of birds banded at Buttertubs West Marsh during 2023.

Month	Hatch Year (HY)	Second Year (SY)	After Hatch Year (AHY)	After Second Year (ASY)	Other Ages	Total
March		4	6	2		12
April		72	26	35		133
May	6	126	14	37		183
June	55	34	16	9	1	115
July	104	18	12	4		138
August	218	4	22	2		246
September	204	1	37		10	252
October	130		31		16	177
TOTAL	717	259	164	89	27	1,256

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 (75.5%) did not display any visible fat (fat score = 0).

Table 6. Fat score of birds banded at Buttertubs West Marsh during 2023.

Month	0	1-2	≥3	Total
March	10	1	1	12
April	77	23	30	130
May	121	36	19	176
June	98	12	0	110
July	123	10	0	133
August	199	38	3	240
September	171	51	18	240
October	118	46	10	174
TOTAL	917	217	81	1,215

The 464 recapture events recorded in 2023 involved 312 banded birds (**Table 7**), of which 41 individuals were banded in 2013-2020, and 29, 86, and 156 individuals were originally banded in 2021, 2022 and 2023, respectively. Overall, 0.3% of individuals banded in 2013-2020 were recaptured in 2023, 2.1% of individuals banded in 2021 were recaptured in 2023, 5.8% of individuals banded in 2022 were recaptured in 2023, and 10.5% of individuals banded in 2023 were recaptured in 2023. These percentages provide crude estimates of between- and within-year survival and site fidelity, although they do not account for individuals which may have been at the site in 2023 but were not recaptured.

Most recapture events involved birds that were recaptured only once during 2023. However, 87 individuals were recaptured more than once, and at least 13 individuals were recaptured 5 or more times. Some of these frequently recaptured and older individuals are listed in **Table 8**. The oldest known recaptured bird was a Red-breasted Sapsucker (*Sphyrapicus ruber*), which was originally banded as a second-year individual on May 10, 2014. This bird was 10 years old in 2023, which was a new North American longevity record for this species. A male Common Yellowthroat was recaptured for the 29th time since it was originally banded as a second-year individual in 2017.

Table 7. Number and percentage of individuals recaptured in 2023 which were originally banded in 2020 or before, 2021, 2022 or 2023 for ten most commonly recaptured species.

Species	Banded in 2020 or before		Banded in 2021		Banded in 2022		Banded in 2023	
	No.	%	No.	%	No.	%	No.	%
Common Yellowthroat	8	0.5	1	1.4	11	11.2	16	12.8
Song Sparrow	7	0.7	3	3.8	9	12.9	15	20.0
Bewick's Wren	0	0.0	1	2.9	7	23.3	13	44.8
Bushtit	0	0.0	1	2.2	8	19.0	20	28.2
Spotted Towhee	4	0.5	3	8.8	6	8.5	22	25.3
Swainson's Thrush	4	1.5	1	3.3	3	7.5	10	22.2
Chestnut-backed Chickadee	2	0.4	5	12.5	14	31.8	16	29.6
Yellow Warbler	2	0.4	3	4.7	2	4.0	2	4.4
American Robin	2	0.2	5	9.4	5	4.9	4	3.3
Fox Sparrow	1	0.4	2	5.4	3	6.1	3	8.3
All Species	41	0.3	29	2.1	86	5.8	156	10.5

Table 8. List of selected individuals recaptured in 2023, which were originally banded at Buttertubs West Marsh at least 5 years earlier.

Band Number	Species	Sex	Number of Times Recaptured Since Banded	Date Banded	Date of Last Recapture	Estimated Age
2780-62381	COYE	Female	20	Jun. 29, 2016	May 5, 2023	8
2810-45471	COYE	Male	29	Jun. 27, 2017	Jul. 19, 2023	7
2741-85827	DOWO	Male	1	Jun. 14, 2017	May 2, 2023	≥7
2561-03789	RBSA	Unknown	7	May 10, 2014	May 2, 2023	10
2691-51530	SOSP	Male	20	Jun. 29, 2016	Oct. 10, 2023	7
2561-31863	SPTO	Female	2	Aug. 18, 2016	Oct. 12, 2023	7
2741-85716	SWTH	Unknown	2	Sep. 22, 2016	Jul. 12, 2023	7
2780-62215	YEWA	Male	6	1 Jun. 2016	Jul. 12, 2023	8

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). 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 104 species were observed at Buttertubs West Marsh during 2023 (**Table A.3** in Appendix). Seven new species were observed in 2023: American Coot (*Fulica americana*), Least Sandpiper (*Calidris minutilla*), Say's Phoebe (*Sayornis saya*), Pine Grosbeak (*Pinicola enucleator*), American Tree Sparrow, Rusty Blackbird, and Tennessee Warbler. A total of 142 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-six nest boxes were available in the old-field habitat at Buttertubs West Marsh and 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. 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.

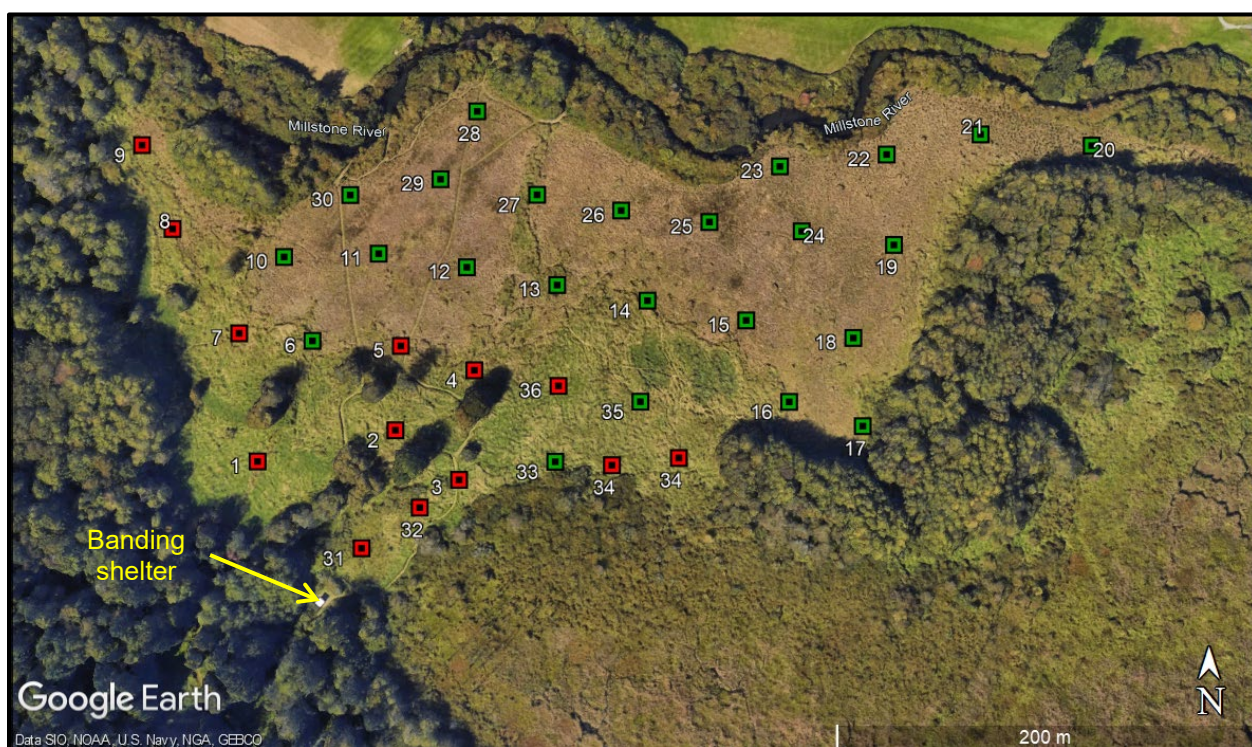


Figure 4. Locations of the 36 swallow nest boxes at Buttertubs West Marsh during 2023. Green and red squares indicate whether eggs were deposited in the nest box or not, respectively.

Nest box monitoring followed the procedures outlined in the VIU Swallow Nest Box Monitoring Manual (Demers, 2019). Nest boxes were monitored every 3-5 days between April 27 and August 4, 2023. 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, adult females 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.

3.2. Results

Twenty-four of the 36 nest boxes were occupied in 2023 and had signs of nest building activities (**Table 9**). Most boxes were occupied by Tree Swallows (*Tachycineta bicolor*) although one box was occupied by Violet-green Swallows (*Tachycineta thalassina*) and one box occupied by Bewick's Wren (*Thryomanes bewickii*).

Clutch sizes for Tree Swallows ranged from 3-6 eggs with an average of 5.3 eggs per clutch (**Table 10**), which was near average compared to previous years. Four nest boxes were the site of repeated nesting attempts, all of which involving a different female during the first and second nests.

Twenty-one individual adult females were captured. Only four males were captured in 2023 due to the significantly longer time required to capture males. Of the 21 adult female Tree Swallows captured, 8 individuals had nested at Buttertubs West Marsh in 2022, 5 individuals had nested in 2021, and 3 individuals had nested in 2020. One female nested at Buttertubs West Marsh for the 6th consecutive year. Two each of the females and males who nested at Buttertubs West Marsh in 2023 were hatched at the same location.

Out of 138 Tree Swallow eggs laid, 120 eggs hatched (hatching success: 87%), 97 nestlings were banded around day 12 (nestling survival to day 12: 81%), and 83 young birds fledged (nestling survival to fledging: 69%) (**Tables 9 and 10**). Fledging success in 2023 was the second highest observed since 2013, and only three nests failed to fledge any young. The average fledging rate for the entire nest box colony was 3.2 young per nesting pair.

No nestlings were infested with parasitic blow fly larvae, *Trypocalliphora braueri*, in 2023.

Table 9. Results of nest box monitoring at Buttertubs West Marsh during 2023. Nest boxes no. 11, 15, 19 and 25 received two clutches (see text). TRES = Tree Swallow, VGSW = Violet-green Swallow, BEWR = Bewick's Wren, DNH = Did not hatch; F = Female; M = Male; N = Nestlings.

Nest Box	Nest Building	Species	Number of Eggs	Complete Clutch Date	Mean Hatch Date	Number Fledged	Individuals Banded / Processed
1	No						
2	No						
3	No						
4	No						
5	No						
6	Yes	TRES	6	May 18	Jun. 1	2	F, N
7	No						
8	No						
9	No						
10	Yes	TRES	4	May 20	DNH	0	---
11	Yes	TRES	Clutch 1: 5 Clutch 2: 3	May 16 Jul. 2	May 30 Jul. 16	4 0	F, N F
12	Yes	TRES	5	May 31	Jun. 14	5	F, N
13	Yes	TRES	5	May 19	Jun. 2	2	F, N
14	Yes	TRES	6	May 15	May 29	4	N
15	Yes	TRES VGSW	Clutch 1: 5 Clutch 2: 6	May 16 Jun. 17	May 30 Jul. 1	DNH 0	--- ---
16	Yes	TRES	5	May 18	Jun. 1	4	F, N
17	Yes	BEWR	4	May 8	May 22	2	---
18	Yes	TRES	6	May 18	Jun. 1	4	F, N
19	Yes	TRES	Clutch 1: 6 Clutch 2: 5	May 15 Jun. 29	May 29 Jul. 13	5 2	F, N F, N
20	Yes	TRES	5	May 20	Jun. 3	3	F, N
21	Yes	TRES	5	May 17	May 31	3	F, N
22	Yes	TRES	6	May 12	May 26	6	F, N
23	Yes	TRES	5	May 26	Jun. 9	0	F, N
24	Yes	TRES	6	May 16	May 30	5	F, N
25	Yes	TRES	Clutch 1: 5 Clutch 2: 5	May 9 Jun. 23	May 23 Jul. 7	4 5	F, N F, M, N
26	Yes	TRES	6	May 14	May 28	3	M, N
27	Yes	TRES	6	May 10	May 24	4	F, N
28	Yes	TRES	6	May 17	May 31	4	F, N
29	Yes	TRES	6	May 13	May 27	2	F, N
30	Yes	TRES	6	May 19	Jun. 2	5	F, M, N
31	No						
32	No						
33	Yes	TRES	5	May 25	Jun. 8	3	---
34	No						
35	Yes	TRES	5	May 25	Jun. 8	4	M, N
36	No						
Total			194			102	

Table 10. Summary of Tree and Violet-green Swallow nesting productivity at Buttertubs West Marsh during 2019-2023.

Parameter	2019	2020	2021	2022	2023
Number of boxes	30	36	36	36	36
Number of boxes with eggs (% of boxes with eggs)	21 (70%)	29 (81%)	27 (75%)	20 (56%)	24 (67%)
Number of eggs laid	141	193	194	131	138
Mean clutch size (range)	5.0 (2-7)	5.1 (2-7)	5.1 (3-7)	5.7 (2-7)	5.3 (3-6)
Number of eggs hatched (% eggs hatched)	106 (75%)	148 (77%)	119 (61%)	116 (89%)	120 (87%)
Number of nestlings banded (% nestlings banded)	97 (92%)	92 (62%)	88 (74%)	115 (99%)	97 (81%)
Number fledged (% nestlings fledged)	84 (79%)	76 (51%)	50 (42%)	102 (88%)	83 (69%)
Fledging rate (young per pair)	3.0	2.0	1.3	4.4	3.2

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 36 volunteers dedicated 2,788 hours to this project during 2023 (**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 2023.

Volunteer Grouping	Number of Volunteers	Hours on Project
VIU students	18	1,270
VIU graduates	6	252
VIU employees	3	424
Community volunteers	9	843
TOTAL	36	2,788

Volunteer training was overseen by Dr. Eric Demers, with assistance from many experienced banders. 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 2023:

- On-site demonstration for RMOT 101 - BC Wildlife students (Apr. 3).
- Demonstration and training for 26 students (Buttertubs West Marsh, VIU Nanaimo Campus): VIU RMOT 275 - Wildlife Techniques (Sep. 29; Oct. 6, 13, 19).
- Public demonstration and presentations: Research and Creative Activity Symposium (Apr. 28); VIU DiscoverFest (Oct. 21), .
- Guest lectures for BIOL 202 - Ecology (Mar. 15) and FRST 235 - Forest Ecology II: Ecosystems & Management (Oct. 18), and Berwick on the Lake Retirement Community (Nov. 16).

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 2023. 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
AIBE	2	1	3
ALBA	6	8	14
ALBO	169	36	205
ALUN	12	3	15
ANKA	3	1	4
ANKE	123	42	165
BEWA	57	16	73
BLAW	69	25	94
CHSH	1	2	3
CHWA	82	20	102
DALA	13	9	22
ELHI	4	3	7
ELMI	2	1	3
EMWH	73	25	98
ERDE	27	23	50
ERWI	2	1	3
FAHE	6	2	8
HEHO	167	52	219
HEVA	12	8	20
HIKI	3		3
JADI	2	1	3
KADY	9	5	14
KAMC	3		3
KEDO	68	25	93
KEMC	2	1	3
LASC	9	1	10
LISU	130	45	175
MAWA	1	1	2
MAWI	11	7	18
MERO	1	1	2
MOWA	5	5	10
NIWI	1		1
OLFO	16	11	27
OLZA	1	1	2
RYHA	48	11	59
SADE	57	17	74
TAHU	62	27	89
TRST	1	3	4
VISU	101	40	141
TOTAL	1,361	480	1,841

6. Acknowledgements

This project would not be possible without a dedicated group of volunteers, contributors, and partners (any omission is unintended): A. Badger, A. Bernard, A. Boudreau, M. Curtis, E. Demers, S. Detillieux, K. Dinh, J. Diwag, K. Dodds, K. Dyke, O. Fournier, R. Hardisty, F. Henrichsen, E. Hillbrecht, H. Holmes, T. Hunt, A. Kavenney, A. Kennedy, H. Kimura, D. Lacasse, B. Lawson, M. Lester, K. MacKenzie, K. McRae, E. Miller, V. Moraes, S. Pearce, M. Roy, L. Schmalz, C. Shamash-McLaughlin, S. Simard-Provençal, L. Singh, K. Sjolie, T. Stolberg, L. Surry, V. Surry, A. Unger, H. van Vliet, M. Wagenaar, M. Wallace, B. Walton, C. Watts, E. Wilson, E. Wharin, M. Winchester, T. Wolowicz, N. Williams, and O. Zanette.

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Bird banding activities were conducted in accordance with Vancouver Island University Animal Use Protocol No. 100063, 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), 10885B (Samuelle Simard-Provençal) and 10885D (Heidi van Vliet) to capture and band migratory birds, including authorization to use mist nets for the capture of passerines and other land birds.

7. References

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8. Appendix

Table A.1. List of all species captured in mist nets at Buttertubs West Marsh during 2023. Subspecies or morphs are included in parentheses where applicable.

Common Name	Number banded	Number recaptured	Total number captured
Common Yellowthroat	125	75	200
American Robin	121	27	148
Song Sparrow	73	69	142
Spotted Towhee	82	50	132
Bushtit	71	42	113
Chestnut-backed Chickadee	42	41	83
Swainson's Thrush	45	36	81
Orange-crowned Warbler	67	8	75
Bewick's Wren	28	36	64
Yellow Warbler	45	14	59
Purple Finch	56	2	58
Fox Sparrow	35	15	50
Ruby-crowned Kinglet	44	4	48
Lincoln's Sparrow	46	1	47
Cedar Waxwing	35	4	39
Oregon Junco	37	2	39
Savannah Sparrow	29	1	30
Willow Flycatcher	22	4	26
Wilson's Warbler	20		20
Audubon's Warbler	20		20
Chipping Sparrow	17	1	18
Myrtle Warbler	17		17
Warbling Vireo	13	2	15
American Goldfinch	15		15
Tree Swallow	6	7	13
Black-headed Grosbeak	9	4	13
Downy Woodpecker	5	8	13
European Starling	11		11
Brown-headed Cowbird	7	3	10
House Finch	10		10
Varied Thrush	8	1	9
Red-winged Blackbird	9		9
Golden-crowned Sparrow	9		9
Marsh Wren	8	1	9
Hermit Thrush	8		8
MacGillivray's Warbler	8		8
Puget Sound White-crowned Sparrow	8		8
Red-breasted Sapsucker	5	1	6
Hairy Woodpecker	4	2	6
Pacific Wren	3	2	5
Brown Creeper	4	1	5
Steller's Jay	4		4
Golden-crowned Kinglet	3		3
Black-throated Gray Warbler	3		3
Pacific-slope Flycatcher	3		3
Red-shafted Flicker	2		2
Barn Swallow	2		2
Unknown Yellow-rumped Warbler	2		2
Violet-green Swallow	2		2
Rusty Blackbird	1		1
American Tree Sparrow	1		1
Sharp-shinned Hawk	1		1
Hutton's Vireo	1		1
Tennessee Warbler	1		1
Western Tanager	1		1
White-throated Sparrow	1		1
Northern Shrike	1		1
TOTAL	1,256	464	1,720

Table A.2. Number of all species captured during each day of mist netting at Buttertubs West Marsh during 2023.

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Table A.2. (continued)

Date	Sharp-shinned Hawk	Red-breasted Sapsucker	Downy Woodpecker	Hairy Woodpecker	Northern Flicker	Willow Flycatcher	Hutton's Vireo	Warbling Vireo	Northern Shrike	Steller's Jay	Chestnut-backed Chickadee	Tree Swallow	Violet-green Swallow	Barn Swallow	Bushtit	Ruby-crowned Kinglet	Golden-crowned Kinglet	Brown Creeper	Pacific Wren	Pacific-slope Flycatcher	Marsh Wren	Bewick's Wren	European Starling	Varied Thrush	Swainson's Thrush	Hermit Thrush	American Robin	Cedar Waxwing	House Finch	Purple Finch	American Goldfinch	Chipping Sparrow	American Tree Sparrow	Fox Sparrow	Dark-eyed Junco	White-crowned Sparrow	Golden-crowned Sparrow	White-throated Sparrow	Savannah Sparrow	Song Sparrow	Lincoln's Sparrow	Spotted Towhee	Red-winged Blackbird	Brown-headed Cowbird	Rusty Blackbird	Tennessee Warbler	Orange-crowned Warbler	MacGillivray's Warbler	Common Yellowthroat	Yellow Warbler	Yellow-rumped Warbler	Black-throated Gray Warbler	Wilson's Warbler	Western Tanager	Black-headed Grosbeak	Total	
Aug. 02			1	3	1			4				6		1			6		1	7	1	8	2	2										7	3	6						2	7	5		1				74							
Aug. 09				5	1							2					2		1	6		1	3		3		1							3	5								8	2							43						
Aug. 17				4	1			2				5			1	6		3	2	2		6						1						4	2	2					7	3	29	11		1				94							
Aug. 23	1			4	1	5				3		7		1	1	5		8	1		5	3				1		5	3					1			8		2			9	18	2		1					86						
Sep. 01			1	1						3		1		1	1		1			9	9					5								2			2	2	1				1	6			1				47						
Sep. 07								1		9		5					2		8	6		3	2				1	1						1	1		3	5	6	4			1	11			1				69						
Sep. 14												10		1		1		9	1	7	1					3									1	6	1	9					8								59						
Sep. 21										3		3				1	1			1	7					1	7		1					5			2	3	3	12				2		5	1						50				
Sep. 28			1	1						3		10					2		1	6			1				1							8	1	5	1	1	7	2	9		1	1	14		5	1	9					91			
Oct. 05		1	1						1	1		8	5				1	4	2	1	13	1		4				4	1					4	1			1	5	1	14				5				11					85			
Oct. 12			1						2	1		3	6				1	2	2			5					5							8	6				7		15						2							61			
Oct. 19								1	1	3		17			1		1	2			5					5	2							5	2				3	1	5				1											48	
Oct. 22	1	1										1	4	2	1	1			1	2		3	1											5	19		1	1	2	1	4																51
Total	1	6	13	6	2	26	1	15	1	4	83	13	2	2	113	48	3	5	5	3	9	64	11	9	81	8	148	39	10	58	15	18	1	50	39	8	9	1	30	142	47	132	9	10	1	1	75	8	200	59	39	3	20	1	13	1,720	

Table A.3. List of all species observed at Buttertubs West Marsh during 2023 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.

104 species (+1 other taxa)			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Snow Goose														
Greater White-fronted Goose														
Cackling Goose														
Canada Goose														
Trumpeter Swan														
Wood Duck														
Mallard														
Bufflehead														
California Quail	*													
Rock Pigeon	*													
Band-tailed Pigeon														
Eurasian Collared-Dove	*													
Common Nighthawk														
Black Swift														
Anna's Hummingbird														
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rufous Hummingbird														
Anna's x Rufous Hummingbird (hybrid)														
Virginia Rail														
American Coot														
Killdeer														
Wilson's Snipe														
Least Sandpiper														
Glaucous-winged Gull														
Great Blue Heron														
Turkey Vulture														
Osprey														
Northern Harrier														
Sharp-shinned Hawk														
Cooper's Hawk														
Bald Eagle														

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Table A.3. (continued)































































































































































































































































































































































































			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Red-tailed Hawk														
Great Horned Owl														
Barred Owl														
Belted Kingfisher														
Red-breasted Sapsucker														
Downy Woodpecker														
Hairy Woodpecker														
Pileated Woodpecker														
Northern Flicker														
American Kestrel														
Merlin														
Olive-sided Flycatcher														
Western Wood-Pewee														
Willow Flycatcher														
Western Flycatcher														
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Say's Phoebe														
Hutton's Vireo														
Warbling Vireo														
Northern Shrike														
Steller's Jay														
American Crow														
Common Raven														
Chestnut-backed Chickadee														
Tree Swallow														
Violet-green Swallow														
Purple Martin														
Northern Rough-winged Swallow														
Barn Swallow														

Table A.3. (continued)

















































































































































































































































































































































































































































































































































































































			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Golden-crowned Kinglet														
Red-breasted Nuthatch														
Brown Creeper														
Pacific Wren														
Marsh Wren														
Bewick's Wren														
European Starling	*													
Mountain Bluebird														
Varied Thrush														
Swainson's Thrush														
Hermit Thrush														
American Robin														
Cedar Waxwing														
Pine Grosbeak														
House Finch														
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Purple Finch														
Pine Siskin														
American Goldfinch														
Chipping Sparrow														
American Tree Sparrow														
Fox Sparrow														
Dark-eyed Junco														
White-crowned Sparrow														
Golden-crowned Sparrow														
White-throated Sparrow														
Savannah Sparrow														
Song Sparrow														
Lincoln's Sparrow														

Table A.3. (continued)

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Red-winged Blackbird														
Brown-headed Cowbird														
Rusty Blackbird														
Brewer's Blackbird														
Tennessee Warbler														
Orange-crowned Warbler														
MacGillivray's Warbler														
Common Yellowthroat														
Yellow Warbler														
Yellow-rumped Warbler														
Black-throated Gray Warbler														
Townsend's Warbler														
Wilson's Warbler														
Western Tanager														
Black-headed Grosbeak														

KEY:  = insufficient data |  = rare to widespread

Photos B.1. Sample photographs for the VIU Bird Monitoring and Banding Project at Buttertubs West Marsh during 2023. Photos courtesy of E. Demers and S. Detilleux.



(continued on next page)

Photos B.1. (continued)

