

DATA REPORT

Bird Monitoring and Banding Project at Buttertubs West Marsh, Nanaimo, BC 2022



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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).

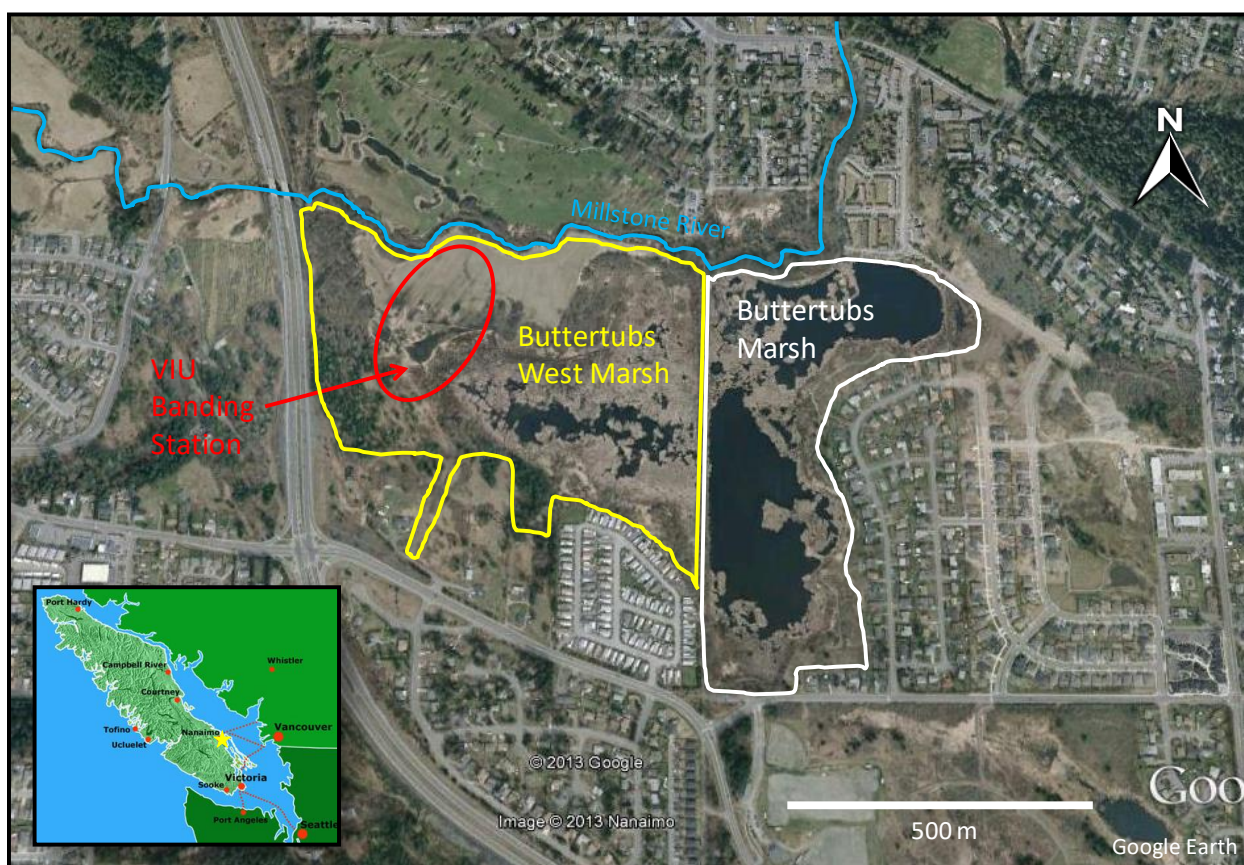


Figure 1. Aerial photograph of the Buttertubs West Marsh in Nanaimo, BC, including the location of the Vancouver Island University (VIU) bird monitoring and banding project.

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 2022. 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 and 10885B, 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 2022, 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.

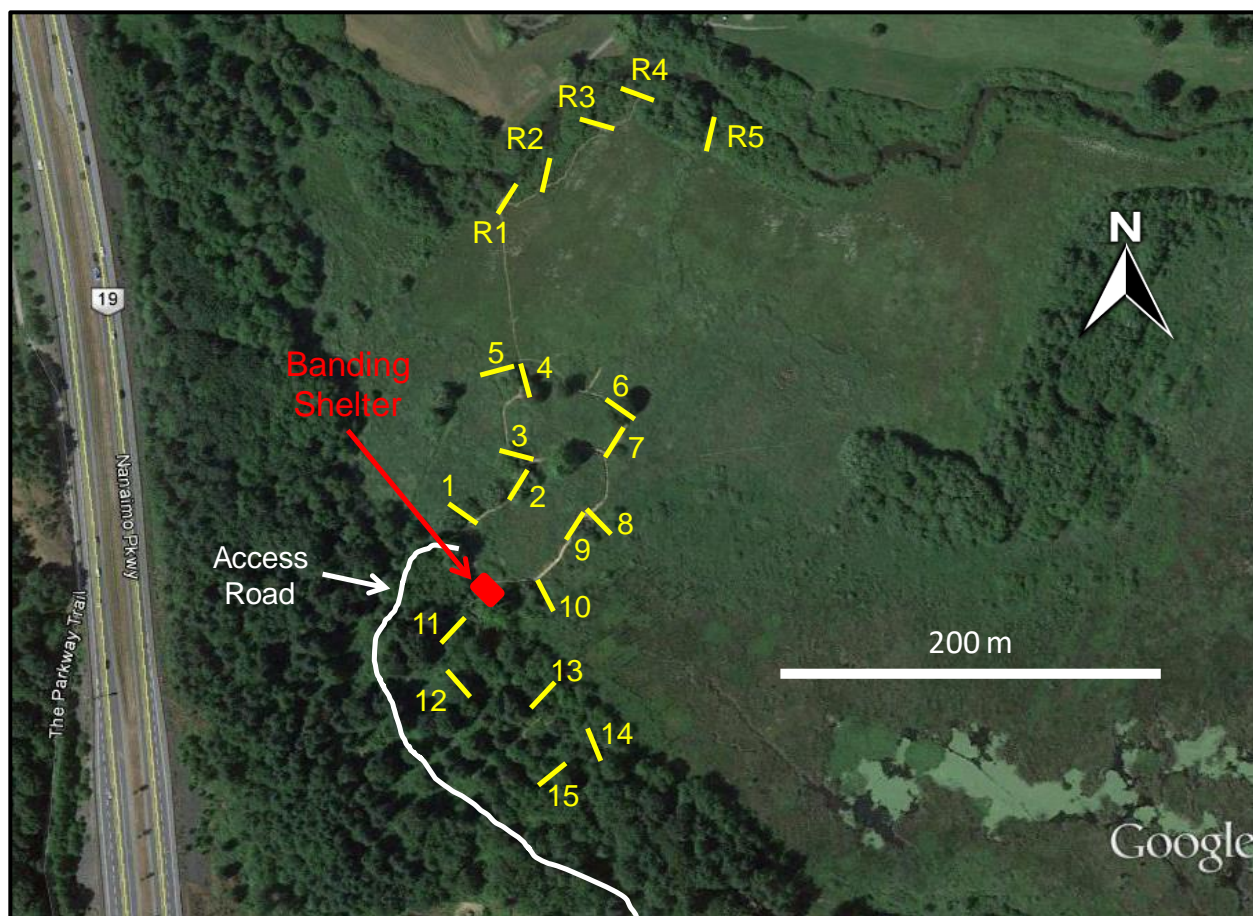


Figure 2. Locations of mist nets and banding shelter used for songbird banding at Buttertubs West Marsh during 2022.

Bird banding activities were conducted 1-3 days most weeks between March 25 and October 26, 2022. 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 2022, the VIU Bird Banding participated in the Bird Genoscape Project (BGP), launched 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 22 target species: American Goldfinch (*Spinus tristis*), American Robin (*Turdus migratorius*), Black-headed Grosbeak (*Pheucticus melanocephalus*), Chipping Sparrow (*Spizella passerina*), Common Yellowthroat (*Geothlypis trichas*), Dark-eyed Junco (*Junco hyemalis*), Fox Sparrow (*Passerella*

iliaca), Hermit Thrush (*Catharus guttatus*), Lincoln's Sparrow (*Melospiza lincolnii*), MacGillivray's Warbler (*Geothlypis tolmiei*), Orange-crowned Warbler (*Leiothlypis celata*), Pine Siskin (*Spinus pinus*), 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*), Willow Flycatcher (*Empidonax traillii*), Wilson's Warbler (*Cardellina pusilla*), Yellow Warbler (*Setophaga petechia*), and Yellow-rumped Warbler (*Setophaga coronata*). For each individual, two rectrices (tail feathers) were be 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.

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 32 days between March 25 and October 26, 2022, with a total mist netting effort of 3,461 hours (average: 108.2 net hours / day) (**Table 1**). A total of 1,759 birds were caught from 51 species. Of these, 1,305 birds were banded and 454 birds (35.8%) were recaptures of previously banded birds. An additional 94 birds were captured and released unbanded (primarily hummingbirds). The average capture rate in 2022 was 50.8 birds / 100 net-hours.

The total capture effort deployed in 2022 (3,461 net-hours) was the second highest in the last 5 years (**Table 1**). There was no change in layout or number of nets used between 2018 and 2022. Capture rate in 2022 (50.8 birds per 100 net-hours) was similar to previous years, except in 2021 when capture rate was lower. The total number of species captured in 2022 (51 species) was average compared to the last few years (48-53 species in 2018-2022).

Compared to previous years, capture rates were high in April and May, but near average during other months, except for a 2-week period in mid-September when capture rates were also high (**Figure 3**). The peaks in capture rates in spring and fall coincided with peak high captures of migratory warblers (May) and sparrows (September), respectively.

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 1. Mist net capture statistics at Buttertubs West Marsh during 2018-2022.

Parameter	Value				
	2018	2019	2020	2021	2022
Capture effort (net-hours)	3,340	3,263	2,981	3,776	3,461
Average daily effort (net-hours / day)	111.3	116.6	76.4	94.4	108.2
Number of birds banded	1,279	1,204	1,105	1,120	1,305
Number of recaptures	468	427	406	488	454
Total number of birds captured	1,747	1,631	1,511	1,608	1,759
Recapture rate (%)	26.8	26.2	26.9	30.3	25.8
Number of species	49	48	53	50	51
Capture rate (birds per 100 net-hours)	52.3	50.0	50.7	42.6	50.8

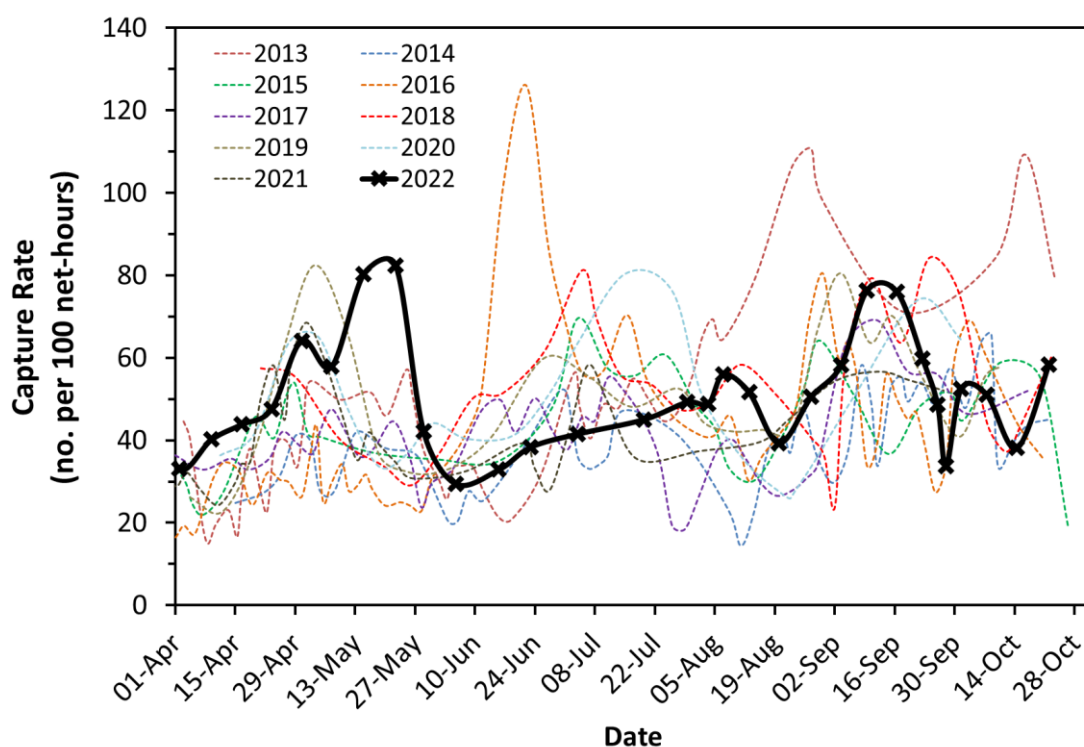
**Figure 3.** Weekly moving average of capture rate in mist nets at Buttertubs West Marsh during 2013-2022.

Table 2. Capture statistics by net at Buttertubs West Marsh during 2022.

Net Number	Number Banded	Number Recaptured	Total Number Captured	Net Hours	Capture Rate (Birds / 100 Net hours)
1	59	36	95	180	52.8
2	60	23	83	180	46.1
3	51	18	69	180	38.3
4	44	14	58	180	32.2
5	39	15	54	180	30.0
6	29	16	45	180	25.0
7	68	27	95	172	55.4
8	107	32	139	180	77.2
9	77	30	107	180	59.4
10	79	37	116	177	65.7
11	28	14	42	159	26.4
12	33	26	59	159	37.1
13	29	16	45	162	27.8
14	28	31	59	163	36.3
15	36	22	58	153	37.8
R1	109	19	128	178	72.0
R2	188	35	223	178	125.4
R3	92	15	107	174	61.5
R4	85	16	101	174	58.0
R5	64	12	76	174	43.7
Totals	1,305	454	1,759	3,461	50.8

Overall, Lincoln's Sparrow was the most captured species and represented 11.3% of all birds caught during 2022 (**Table 3**). Common Yellowthroat was the second most common species and accounted for 10.1% of all birds caught. Most species listed in **Table 3** are local breeders at Buttertubs Marsh, except for Lincoln's Sparrow, Wilson's Warbler, and Fox Sparrow. **Tables A.1** and **A.2** in Appendix provide a complete summary of all species captured during 2022. Photos of some of the birds captured in 2022 are shown in **Photos B.1** in Appendix.

There were changes in the rankings for the top 10 species captured during 2022 (**Table 4**). For the second year in a row, Common Yellowthroat was not the most commonly caught species. Instead, Lincoln's Sparrow was the most captured species in 2022, with 67.8% (135) captures obtained in September. There was also an increase in ranking for Savannah Sparrow (*Passerculus sandwichensis*) and Chestnut-backed Chickadee (*Poecile rufescens*), and a decrease in ranking for Bewick's Wren (*Thryomanes bewickii*), Fox Sparrow, and Purple Finch (*Haemorhous purpureus*)

compared to previous years. Wilson's Warbler was among the top 10 most captured species for the first time since the start of this project, although this resulted from a large capture event of 52 individuals on May 19 (89.7% of total captures for the year). Only one new species was captured at Buttertubs West Marsh in 2022, a Sharp-shinned Hawk (*Accipiter striatus*). A total of 78 species have been captured at Buttertubs West Marsh between 2013 and 2022.

Table 3. Fifteen most common species captured in mist nets at Buttertubs West Marsh during 2022.

Common Name	Number Banded	Number Recaptured	Total Number Captured
Lincoln's Sparrow	167	32	199
Common Yellowthroat	98	79	177
Song Sparrow	68	74	142
American Robin	101	24	125
Chestnut-backed Chickadee	44	47	91
Savannah Sparrow	82	3	85
Spotted Towhee	54	30	84
Orange-crowned Warbler	74	7	81
Wilson's Warbler	69		69
Bushtit	42	25	67
Yellow Warbler	50	17	67
Fox Sparrow	46	19	65
Bewick's Wren	30	25	55
Swainson's Thrush	40	14	54
Purple Finch	37	4	41

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 March and May, while hatch-year birds (hatched in 2022) were the dominant age group between June and October. Overall, 54.7% of birds banded were birds hatched in 2022. This percentage was similar to previous years.

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) (**Table 6**). Overall, the majority of birds banded (69.6%) did not display any visible fat (fat score = 0).

Table 4. Number captured and rank (in parentheses) of the ten species most captured in mist nets at Buttertubs West Marsh during 2018-2022.

Common Name	2018	2019	2020	2021	2022
Lincoln's Sparrow	133 (3)	91 (5.5)	74 (9)	109 (3)	199 (1)
Common Yellowthroat	281 (1)	231 (1)	206 (1)	147 (2)	177 (2)
Song Sparrow	187 (2)	143 (3)	122 (2)	153 (1)	142 (3)
American Robin	120 (4.5)	82 (7)	92 (4)	90 (6)	125 (4)
Chestnut-backed Chickadee	67 (9)	74 (9)	59 (11)	76 (9)	91 (5)
Savannah Sparrow	66 (10)	24 (16)	52 (12)	51 (13)	85 (6)
Spotted Towhee	102 (6)	108 (4)	76 (7)	65 (10)	84 (7)
Orange-crowned Warbler	77 (8)	168 (2)	75 (8)	101 (4)	81 (8)
Wilson's Warbler	12 (23)	18 (19)	20 (19)	24 (21)	69 (9)
Bushtit	120 (4.5)	91 (5.5)	72 (10)	63 (11)	67 (10)

Table 5. Age structure of birds banded at Buttertubs West Marsh during 2022.

Month	Hatch Year (HY)	Second Year (SY)	After Hatch Year (AHY)	After Second Year (ASY)	Other Ages	Total
March		27	10	9	0	46
April		96	12	18	0	126
May	6	144	12	71	1	234
June	41	38	5	8	0	92
July	60	6	12	4	0	82
August	196	4	31		0	231
September	313		48		7	368
October	98		18	1	19	126
TOTAL	714	315	148	111	17	1,305

Table 6. Fat score of birds banded at Buttertubs West Marsh during 2022.

Month	0	1-2	≥3	Total
March	31	8	6	45
April	55	36	33	124
May	85	65	75	225
June	79	7	0	86
July	67	9	0	76
August	184	43	1	228
September	270	72	16	358
October	112	14	0	126
TOTAL	883	254	131	1,268

The 454 recapture events recorded in 2022 involved 298 banded birds (**Table 7**), of which 51 individuals were banded in 2013-2019, and 25, 40, and 182 individuals were originally banded in 2020, 2021 and 2022, respectively. Overall, 0.4% of individuals banded in 2013-2019 were recaptured in 2022, 1.8% of individuals banded in 2020 were recaptured in 2022, 2.9% of individuals banded in 2021 were recaptured in 2022, and 12.2% of individuals banded in 2022 were recaptured in 2022. 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 2022 but were not recaptured.

Table 7. Number and percentage of individuals recaptured in 2022 which were originally banded in 2019 or before, 2020, 2021 or 2022 for ten most commonly recaptured species.

Species	Banded in 2019 or before		Banded in 2020		Banded in 2021		Banded in 2022	
	No.	%	No.	%	No.	%	No.	%
Common Yellowthroat	9	0.7	4	3.3	3	4.3	19	19.4
Song Sparrow	9	1.0	1	1.4	4	5.0	24	34.3
Bewick's Wren	1	0.4	1	2.1	1	2.9	8	26.7
Bushtit	3	0.5	1	1.9	4	8.9	14	33.3
Spotted Towhee	7	1.0	2	3.5	2	5.9	12	16.9
Swainson's Thrush	3	1.2	1	4.8	0	0.0	5	12.5
Chestnut-backed Chickadee	5	1.1	1	2.7	6	15.0	15	34.1
Yellow Warbler	2	0.5	1	1.3	1	1.6	5	10.0
American Robin	4	0.5	0	0.0	7	13.2	5	4.9
Fox Sparrow	1	0.4	2	7.7	1	2.7	10	20.4
All Species	51	0.4	25	1.8	40	2.9	182	12.2

Most recapture events involved birds that were recaptured only once during 2022. However, 87 individuals were recaptured more than once, and at least 11 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 an American Robin which was originally banded as a second-year individual on April 22, 2015; this bird was 8 years old in 2022. A male Common Yellowthroat was recaptured for the 24th time since it was originally banded as a second-year individual in 2017.

Table 8. List of selected individuals recaptured in 2022, 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
1352-50114	AMRO	Male	7	Apr. 22, 2015	Apr. 27, 2022	8
2770-54264	BUSH	Female	3	Jun. 7, 2017	Sep. 29, 2022	≥5
2780-62486	CBCH	Unknown	5	Aug. 14, 2016	Mar. 25, 2022	6
2780-62381	COYE	Female	19	Jun. 29, 2016	Sep. 29, 2022	7
2810-45471	COYE	Male	24	Jun. 27, 2017	Sep. 29, 2022	6
2691-51321	SOSP	Male	5	Sep. 17, 2015	May 19, 2022	7
2561-31862	SPTO	Male	13	Aug. 10, 2016	Oct. 4, 2022	6
2780-62215	YEWA	Male	4	1 Jun. 2016	May 26, 2022	7

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 101 species were observed at Buttertubs West Marsh during 2022 (**Table A.3** in Appendix). Four new species were observed in 2022: Blue-winged Teal (*Anas discors*), Cinnamon Teal (*Anas cyanoptera*), American Pipit (*Anthus rubescens*), and Mountain Bluebird (*Sialia currucoides*). A total of 135 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.

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 25 and July 26, 2022. 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.

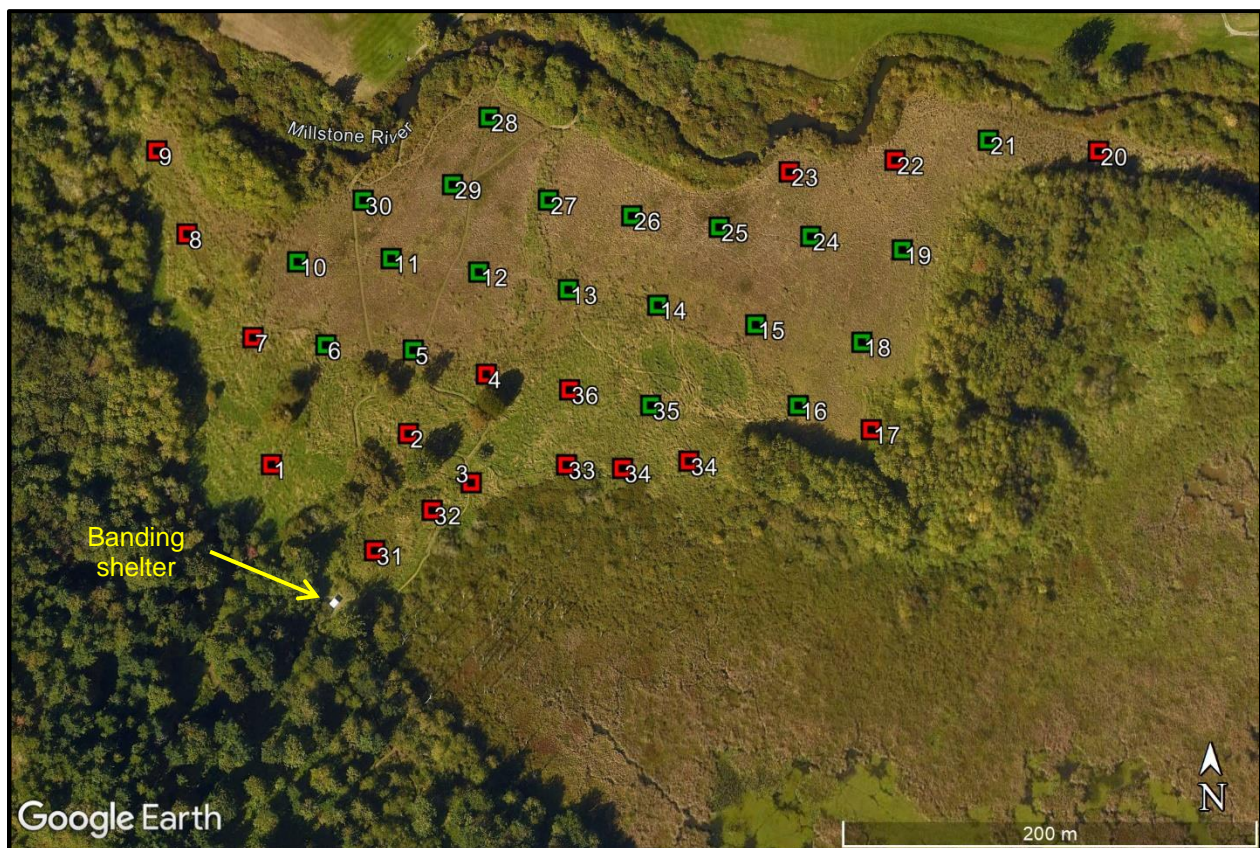


Figure 4. Locations of the 36 swallow nest boxes at Buttertubs West Marsh during 2022. Green and red squares indicate whether eggs were deposited in the nest box or not, respectively.

3.2. Results

Twenty-three of the 36 nest boxes were occupied by swallows and had signs of nest building activities (**Table 9**). Most boxes were occupied by Tree Swallows (*Tachycineta bicolor*) although

one boxes was occupied by Violet-green Swallows (*Tachycineta thalassina*) and one box occupied by Bewick's Wren. The latter two species did not lay any eggs in 2022.

Table 9. Results of nest box monitoring at Buttertubs West Marsh during 2022. Nest boxes no. 14, 18 and 28 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	Yes	TRES	7	May 27	Jun. 10	5	F, N
6	Yes	TRES	2	N/A	DNH		
7	No						
8	No						
9	No						
10	Yes	TRES	7	May 24	Jun. 7	6	F, N
11	Yes	TRES	6	May 23	Jun. 6	6	F, N
12	Yes	TRES	6	May 16	May 30	3	F, N
13	Yes	TRES	6	May 16	May 30	6	F, N
14	Yes	TRES	Clutch 1: 6 Clutch 2: 5	May 13 Jun. 11	May 27 Jun. 25	0 5	--- F, N
15	Yes	TRES	5	May 18	Jun. 1	5	F, N
16	Yes	TRES	6	May 22	Jun. 5	6	F, N
17	Yes	BEWR	0				
18	Yes	TRES	Clutch 1: 6 Clutch 2: 5	May 9 Jul. 1	May 23 Jul. 15	5 4	F, N F, N
19	Yes	TRES	6	May 14	May 28	5	F, N
20	Yes	VGSW	0				F
21	Yes	TRES	6	May 25	Jun. 8	4	F, N
22	No						
23	No						
24	Yes	TRES	6	May 14	May 28	5	F, N
25	Yes	TRES	6	May 17	May 31	6	F, N
26	Yes	TRES	6	May 15	May 29	6	F, N
27	Yes	TRES	6	May 15	May 29	6	F, N
28	Yes	TRES	Clutch 1: 6 Clutch 2: 4	May 9 Jun. 28	May 23 Jul. 12	5 4	F, N F, N
29	Yes	TRES	6	May 19	Jun. 2	5	F, N
30	Yes	TRES	6	May 21	Jun. 4	4	F, N
31	No						
32	No						
33	No						
34	Yes	TRES	0				
35	Yes	TRES	6	May 18	Jun. 1	1	F, N
36	No						
Total			194			102	

Table 10. Summary of Tree and Violet-green Swallow nesting productivity at Buttertubs West Marsh during 2018-2022.

Parameter	2018	2019	2020	2021	2022
Number of boxes	30	30	36	36	36
Number of boxes with eggs	24	21	29	27	20
(% of boxes with eggs)	(80%)	(70%)	(81%)	(75%)	(56%)
Number of eggs laid	135	141	193	194	131
Mean clutch size	5.0	5.0	5.1	5.1	5.7
(range)	(1-7)	(2-7)	(2-7)	(3-7)	(2-7)
Number of eggs hatched	115	106	148	119	116
(% eggs hatched)	(85%)	(75%)	(77%)	(61%)	(89%)
Number of nestlings banded	105	97	92	88	115
(% nestlings banded)	(91%)	(92%)	(62%)	(74%)	(99%)
Number fledged	62	84	76	50	102
(% nestlings fledged)	(54%)	(79%)	(51%)	(42%)	(88%)
Fledging rate	2.3	3.0	2.0	1.3	4.4
(young per pair)					

Clutch sizes for Tree Swallows ranged from 2-7 eggs with an average of 5.7 eggs per clutch (**Table 10**), which was by far the highest compared to previous years. Three nest boxes were the site of repeated nesting attempts, all of which involving the same female during the first and second nests. The metal pole for one nest box (no. 14) was strongly bent by a black bear (*Ursus americanus*), causing the nesting attempt to fail. After straightening the pole, the same female re-nested successfully in this nest box. The other two re-nesting attempts successfully fledged young during the first and second attempt. This was unusual because re-nesting has rarely involved the same female at this site in previous years.

Twenty individual adult females were captured. No male was captured in 2022 due to the significantly longer time required to capture males and reduced volunteer availability. Of the 20 adult female Tree Swallows captured, 13 individuals had nested at Buttertubs West Marsh in 2021, 10 individuals had nested in 2020, and 3 individuals had nested in 2019. Only two of the females who nested at Buttertubs West Marsh in 2022 were hatched at the same location.

Out of 131 Tree Swallow eggs laid, 116 eggs hatched (hatching success: 89%), 115 nestlings were banded around day 12 (nestling survival to day 12: 99%), and 102 young birds fledged (nestling survival to fledging: 88%) (**Tables 9 and 10**). Fledging success was very high in 2022, when every single nest with hatched eggs fledged at least one young. In 8 nesting attempts, all eggs eventually resulted in a fledged young. The average fledging rate for the entire nest box colony was 4.4 young per nesting pair.

In 2022, the number of nesting attempts and the number of eggs laid was the lowest in the last 5 years. However, the overall fledging rate was the highest by far since 2013. In addition, all nesting stages resulted in the highest success rates since the start of this project. Interestingly, the weather during the nesting period was cooler and more humid than typically observed in previous years during the same period (2022: average temperature = 13°C, average humidity = 79%; 2018-2021: average temperature = 14-16°C, average humidity = 74-77%). These weather conditions may have resulted in better than average insect abundance throughout the nesting period, despite the cooler than average temperatures.

Only two nestlings in one nest box were infested with parasitic blow fly larvae, *Trypocalliphora braueri*, in 2022. Both of these nestlings fledged successfully.

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.

Table 11. Number of volunteers and hours volunteered for the bird monitoring and banding project at Buttertubs West Marsh during 2022.

Volunteer Grouping	Number of Volunteers	Hours on Project
VIU students	17	617
VIU graduates	13	636
VIU employees	4	466
Community volunteers	8	402
TOTAL	42	2,121

Volunteer effort for the project in 2022 returned to levels observed before the COVID-19 pandemic. A total of 42 volunteers dedicated 2,121 hours to this project during 2022 (**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 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 2022. 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
AAJO	2	1	3
ALBA	76	29	105
ALBO	181	40	221
BEWA	162	44	206
CAWH	3	1	4
CHBR	22	7	29
COCY	1	1	2
DALA	53	19	72
ERDE	44	42	86
EVBL	2		2
GEDE		1	1
HEHO	196	62	258
HEVA	40	13	53
HIKI	37	4	41
HISA	3		3
JAMU	12	2	14
JEMC	60	24	84
JJCK	7		7
JOFM	5	4	9
JOHO	8	2	10
KADY	32	4	36
KEDO	162	61	223
KELO	2	1	3
KEMO	1		1
KIWE	2	1	3
LISI	45	15	60
LISU	11	10	21
MAWA	3		3
MERO	13	6	19
NIWI	5	4	9
OLMU	7	4	11
PHME	22	9	31
REGO	10		10
RYHA	57	21	78
SADE	12	6	18
SAHO	1		1
SASP	110	34	144
TAMW	2		2
TAST	8	2	10
TEEH	1		1
THRO	3		3
TYST	3		3
TOTAL	1,426	474	1,900

Volunteer training was conducted by Dr. Eric Demers and Samuelle Simard-Provençal. 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 2022:

- On-site demonstration for RMOT 101 students (Apr. 6), City of Nanaimo park staff (Apr. 27), VIU media (May 11), North American Wildlife Technology Association conference attendees (Jun. 21), VIU Navigator (Sep. 1), Nanaimo Science (Sep. 13), and BIOL 325 students (Sep. 29).
- Off-site demonstration and training for 26 students: VIU RMOT 275 Wildlife Techniques (Sep. 12, 26; Oct. 3, 11, 17).
- Guest lectures for FRST 242 (Mar. 8), BIOL 202 (Mar. 30), and FRST 235 (Oct. 12).

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.

6. Acknowledgements

This project would not be possible without a dedicated group of volunteers, contributors, and partners (any omission is unintended): M. Angelstad, A. Badger, G. Beisel, A. Boudreau, C. Brager, B. Chapman, E. Demers, S. Detillieux, K. Dodds, K. Dyke, T. Ewen-Holdom, J. Filgate-Mcnabb, K. Forbes, R. Golat, R. Hardisty, C. Heatcoat, J. Holden, H. Holmes, H. Kimura, D. Lacasse, M. Lester, K. Long, J. McColman, P. Mercier, T. Molenaar-Wilson, J. Muir, O. Murphy, M. Roy, H. Sato, S. Simard-Provençal, L. Singh, T. Styner, L. Surry, E. Upham-Mills, H. van Vliet, J. Vandermeer, M. Wagenaar, B. Walton, K. Watson, K. Wetten, C. Whitaker, and N. Williams. We thank members of Backcountry Hunters and Anglers and friends (with coordination by D. Ewen) who volunteered to remove invasive common hawthorn at Buttertubs West Marsh and donated owl nest boxes.

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

Funding was provided by the VIU Research Awards Committee (VIURAC Inquiry Grant, No. 101466), VIU employee Professional Development Fund, and Great Canadian Birdathon.

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) and 10885B (Samuelle Simard-Provençal) 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 2022. Subspecies or morphs are included in parentheses where applicable.

Common Name	Number banded	Number recaptured	Total number captured
Lincoln's Sparrow	167	32	199
Common Yellowthroat	98	79	177
Song Sparrow	68	74	142
American Robin	101	24	125
Chestnut-backed Chickadee	44	47	91
Savannah Sparrow	82	3	85
Spotted Towhee	54	30	84
Orange-crowned Warbler	74	7	81
Wilson's Warbler	69		69
Bushtit	42	25	67
Yellow Warbler	50	17	67
Fox Sparrow	46	19	65
Bewick's Wren	30	25	55
Swainson's Thrush	40	14	54
Purple Finch	37	4	41
Chipping Sparrow	36	1	37
Oregon Junco	26		26
Golden-crowned Sparrow	25	1	26
Ruby-crowned Kinglet	21	4	25
Willow Flycatcher	21		21
Cedar Waxwing	20	1	21
Marsh Wren	16	5	21
Red-winged Blackbird	18		18
Yellow-rumped Warbler (Myrtle)	18		18
Downy Woodpecker	4	10	14
Brown Creeper	2	11	13
Red-breasted Sapsucker	5	7	12
Pacific-slope Flycatcher	10		10
Tree Swallow	6	4	10
Pacific Wren	7	2	9
Black-headed Grosbeak	4	3	7
MacGillivray's Warbler	7		7
Brown-headed Cowbird	4	2	6
Yellow-rumped Warbler (unknown ssp.)	6		6
White-crowned Sparrow (Puget Sound)	6		6
American Goldfinch	3	2	5
Hermit Thrush	5		5
Northern Flicker (Red-shafted)	5		5
Yellow-rumped Warbler (Audubon)	5		5
Pine Siskin	3		3
Warbling Vireo	3		3
Golden-crowned Kinglet	3		3
Hairy Woodpecker	1	1	2
Hammond's Flycatcher	2		2
Violet-green Swallow	2		2
Red-breasted Nuthatch	1		1
Hutton's Vireo	1		1
House Wren	1		1
Sharp-shinned Hawk	1		1
Black-throated Gray Warbler	1		1
Traill's Flycatcher	1		1
European Starling	1		1
Steller's Jay	1		1
Virginia Rail	1		1
TOTAL	1,305	454	1,759

Table A.2. Number of all species captured during each day of mist netting at Buttertubs West Marsh during 2022.

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Table A.2. (continued)

























































































Date	American Goldfinch	American Robin	Bewick's Wren	Black-headed Grosbeak	Black-throated Gray Warbler	Brown Creeper	Brown-headed Cowbird	Bushtit	Cedar Waxwing	Chestnut-backed Chickadee	Chipping Sparrow	Common Yellowthroat	Downy Woodpecker	European Starling	Fox Sparrow	Golden-crowned Kinglet	Golden-crowned Sparrow	Hairy Woodpecker	Hammond's Flycatcher	Hermit Thrush	House Wren	Hutton's Vireo	Lincoln's Sparrow	MacGillivray's Warbler	Marsh Wren	Orange-crowned Warbler	Oregon Junco	Pacific Wren	Pacific-slope Flycatcher	Pine Siskin	White-crowned Sparrow	Purple Finch	Red-breasted Nuthatch	Red-breasted Sapsucker	Northern Flicker	Red-winged Blackbird	Ruby-crowned Kinglet	Savannah Sparrow	Sharp-shinned Hawk	Song Sparrow	Spotted Towhee	Steller's Jay	Swainson's Thrush	Trail's Flycatcher	Tree Swallow	Violet-green Swallow	Virginia Rail	Warbling Vireo	Willow Flycatcher	Wilson's Warbler	Yellow Warbler	Yellow-rumped Warbler	Total
Aug. 02	2	4	2					9	1	5	7	15												1	1	3			1								2	4	3	2								1	2	4	69		
Aug. 05	4	5								1	8	8												1	1	2			2		1					1	5	1	2									1	43				
Aug. 09		2			1			5	2	11	4	18	2											2	4	6			2		1	4				1	6	1	4							3	1	6	86				
Aug. 17	3	6			1					3	2	6													1	1						3			1			2	1	2					4	2	38						
Aug. 23	2		1					5		2	3	13											1		1	1						2				1	3	1	6					6			48						
Sep. 01	1	1								2	6	12											19		1						4				1	2		5										54					
Sep. 06	1	1		1				4		1		11	1										30		1						1				5	1	3	9						1	4			75					
Sep. 13	6	2						2		9	1	11			1	4							27	1	3			1			2			2		18	3	3	2	1				1	2	5	1	108					
Sep. 20	10	2						2		3	2	1	6	4									18	1							1				13	3	5	2											73				
Sep. 25	12	1						2		5	1	3		4									17	1	2						1	1			1	4	3	7										4	69				
Sep. 27	5	1								4	1	1	7										13	1	1	1					1							7	3									2	48				
Sep. 29	6	1						1	1		2		2	1									11				1								1	2	4												33				
Oct. 04	7							9		8	1		5	4								1	9	1	2										4	3	4												4	62			
Oct. 11	3	1								1				2	1								5			1	1				1					3		7	2												28		
Oct. 18	6	4						10				2	4	1									6	2	2	3									5	10	7													62			
Oct. 26	2	1						5						2									3	2	1	4									1	3		3	12												39		
Total	5	125	55	7	1	13	6	67	21	91	37	177	14	1	65	3	26	2	2	5	1	1	199	7	21	81	26	9	10	3	6	41	1	12	5	18	25	85	1	142	84	1	54	1	10	2	1	3	21	69	67	29	1,759

Table A.3. List of all species observed at Buttertubs West Marsh during 2022 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.

101 species (+4 other taxa)			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Canada Goose														
Trumpeter Swan														
Wood Duck														
Blue-winged Teal														
Cinnamon Teal														
American Wigeon														
Mallard														
Northern Pintail														
Green-winged Teal														
Ring-necked Duck														
Hooded Merganser														
Common Merganser														
California Quail														
Rock Pigeon														
Band-tailed Pigeon														
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Eurasian Collared-Dove														
Vaux's Swift														
Anna's Hummingbird														
Rufous Hummingbird														
Virginia Rail														
Killdeer														
Wilson's Snipe														
Greater Yellowlegs														
Glaucous-winged Gull														
Great Blue Heron														
Turkey Vulture														
Osprey														
Northern Harrier														
Sharp-shinned Hawk														
Cooper's Hawk														













































































































































































































































































































































































(continued on next page)

Table A.3. (continued)

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sharp-shinned/Cooper's Hawk														
Bald Eagle														
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														
Willow Flycatcher														
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hammond's Flycatcher														
Pacific-slope Flycatcher														
Empidonax sp.														
Hutton's Vireo														
Warbling Vireo														
Steller's Jay														
American Crow														
Common Raven														
Chestnut-backed Chickadee														
Northern Rough-winged Swallow														
Purple Martin														
Tree Swallow														
Violet-green Swallow														
Tree/Violet-green Swallow														
Barn Swallow														



















































































































































































































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Table A.3. (continued)

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

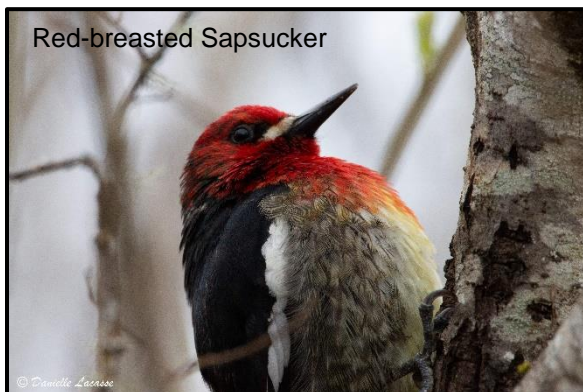
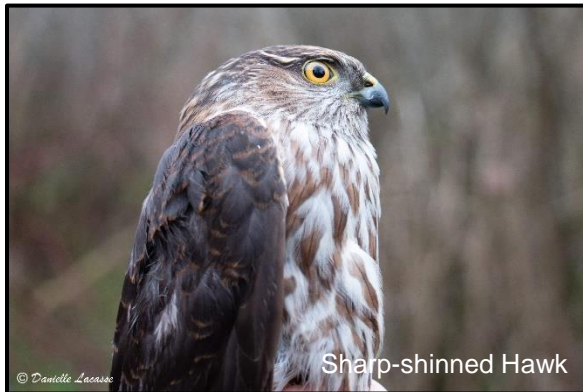
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Table A.3. (continued)

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lincoln's Sparrow	 													
Spotted Towhee	 													
Red-winged Blackbird	 													
Brown-headed Cowbird	 													
Brewer's Blackbird	 													
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 2022. Photos courtesy of E. Demers, S. Detilleux, D. Lacasse, M. Roy, and S. Simard-Provençal.



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Photos B.1. (continued)



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Photos B.1. (continued)

