British Columbia Community Bat Program

Annual Bat Count (2012-2022)

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FESBC
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Executive Summary

White-nose syndrome (WNS) is an emerging fungal disease that results in high mortality of susceptible bat species. Not yet detected in British Columbia, it is spreading northwards in Washington State and is expected in BC in the near future. The BC Annual Bat Count is one potential method to assist with monitoring the spread of the disease, identify species-specific impacts, and track recovery of affected species.

The Annual Bat Count involves repeated emergence counts at bat roosts in anthropogenic structures including buildings, bridges, and bat boxes. Currently, it is the only long-term roost-monitoring program in the province. It covers much of BC and is cost-effective due to the large volunteer component and implementation through the BC Community Bat Program. The Annual Bat Count is also a valuable engagement tool that may lead to increased appreciation of bats and increased roost stewardship, and the project provides ecological data on bats species in anthropogenic structures. Begun in 2012, the Annual Bat Count has data on seven bat species at 879 anthropogenic roost sites. Species with the largest number of known roost sites are Little Brown Myotis and Yuma Myotis, both of which are susceptible to WNS.

Challenges in using the data for trend monitoring include that not all sites are monitored each year due to change in land ownership and/or availability of people to count sites, high variability observed in count data within and between years, movement of bats between different roost sites (roost switching), the small sample size of roosts for some species, and the occurrence of multi-species roosts, where a structure is used by two or more species.

Bat Count sites may provide valuable information on bat population declines without statistical analyses, if catastrophic declines occur such as those observed in bat populations of eastern North America. However, additional work is needed to address the complications in using statistics to detect lesser changes. This work is beyond the scope of the BC Community Bat Program and partnerships are needed to advance the utility of the monitoring program.

Key successes of the Annual Bat Count in 2022 are:

1. Contributions to WNS surveillance and population monitoring, specifically:
    - 1120 counts at 281 roost sites across the province in 2022; 218 of the sites are in the regions where WNS is first expected (Fraser Valley/ Vancouver, Sunshine Coast, Vancouver Island /Gulf Islands, Okanagan, Kootenay),
    - Identification of species of bat by genetics or acoustics at 45 % of sites,
    - an increasing network of roost stewards who can monitor for spring mortality events associated with WNS.

2. Increased stewardship and participation:
    - continued increase in hours of volunteer participation, and

- increased number of roost sites monitored by volunteers.

3. Contributions to knowledge of bat ecology across BC, specifically:
    - Contribution to provincial knowledge of species that use anthropogenic structures. For example, the Bat Count has confirmed use of anthropogenic roosts by Californian Myotis in coastal BC and the Okanagan, and Long-legged Myotis in coastal BC and the Cariboo,
    - Information on the timing of use of structures and dates of first pups across the province,
    - Monitoring for and documenting impacts from unusual weather events (e.g., cold rainy June 2022, heat wave of late June/early July 2021), and
    - Collection of carcasses from mortalities at roost sites for research into cause of death.

This report provides a summary of the data available to-date, to identify gaps and prioritize future data collection efforts. Review of the data up to 2022 has highlighted the need to continue to emphasize the same key actions, to ensure that the Annual Bat Count develops into a more effective, robust monitoring program. These recommendations for 2023 include:

- improving retention of all interested homeowners and volunteers through communication and outreach, to increase the number of multi-year samples,
- improving sample sizes and multi-year data collection first at priority sites and then across all regions and for all species. To achieve this, we need to:
    - communicate and follow-up (including an early-June check-in) with regional coordinators and volunteers to ensure priority sites are counted and secure other counters if needed,
    - emphasize conducting at least **two** counts in the pre-pup period especially at priority sites, to better estimate maximum colony size, and
    - emphasize annual, multi-year sampling especially at priority sites, for data to contribute to trend analysis,
- identify species, particularly at priority sites and other sites with multi-year monitoring, by communicating (to regional coordinators and volunteers) where there are data gaps and directly encouraging sample collection and submission,
- develop consistent methodology to flag sites showing potential population declines (e.g. significant percent decrease in maximum pre-pup counts) in a timely way for immediate action (e.g. swabbing sites for Pd, testing preventions/cures),
- continue to work with the North American Bat Monitoring Program (NABat) and the BC government to incorporate count data into NABat and initiate analyses, and
    - continue to work with the province and research partners (Wildlife Conservation Society Canada) on methods to assess composition of bat species in multi-species roost sites.

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Introduction

White-nose syndrome (WNS) is an emerging, invasive disease of North American bats caused by the introduced fungus, *Pseudogymnoascus destructans* (Pd). The disease has killed over six million bats in eastern North America since 2006. It has nearly extirpated (90% -100% mortality) some previously abundant species (e.g. Little Brown Myotis (*Myotis lucifugus*) and Northern Myotis (*M. septentrionalis*)), in some areas. These two species are now listed by the *Species at Risk Act* (SARA) as endangered in Canada (B.C. Conservation Data Centre 2021). In March 2016, WNS was detected for the first time west of the Rocky Mountains, in Washington State within 150 km of the British Columbia (BC) border, putting BC's bats at extreme risk from the disease. Many of BC's 15 bat species have not yet been exposed to WNS, and it is unknown what the full impact of the disease in BC might be.

Bats are important to our environment and our economy, helping to control forest, agricultural, and urban pests. The endangered Little Brown Myotis can eat 600 mosquitoes per hour (Griffin et al. 1960) and researchers estimate that bats provide billions of dollars in pest control services annually in the United States (Kunz et al. 2011, Kasso and Balakrishnan 2013). A rapid response to WNS is required to understand and mitigate this significant threat, protect our bat populations, and reduce economic impacts.

One component of WNS response is monitoring the impacts to, and potential recovery of, different species of bats. The ability to reliably detect trends in bat populations through counts depends on a number of factors, including years sampled, number of sites counted, number of bats per site, and annual variation (Walsh et al. 2001). Statistically robust methods for monitoring bat populations have been developed in several European countries in response to long-term population declines and the need to determine if recovery targets are reached (e.g. Walsh et al. 2001, Warren and Witter 2002, Barlow et al. 2015).

The BC Community Bat Program independently conducts the only long-term roost monitoring project in the province. Beginning in 2012 with the Kootenay Community Bat Project, the BC Community Bat Program has expanded remarkably quickly across the province. One facet of the Program is the Annual Bat Count, which involves exit counts conducted at summer day roost sites in anthropogenic structures. Goals of the Annual Bat Count include raising awareness of bats, promoting stewardship of colonies, and ultimately providing information on bat species and numbers.

The Annual Bat Count is coordinated at the provincial level, providing consistent methods and datasheets, plus data management and storage. On the ground, the Annual Bat Count is implemented by regional coordinators. As part of their contribution to the Program, regional coordinators are responsible for ensuring that a number of counts occur in their regions. Coordinators usually do several counts themselves, particularly at strategically important sentinel roost sites. They also recruit, organize, and train volunteers to assist with counts, as is done in the United Kingdom's National Bat Monitoring Program (Barlow et al. 2015).

Volunteer involvement varies by region and depends in part on the direction and goals of the Regional Community Bat Project. Overall, the program has included diverse volunteers including private

landowners, local stewardship groups, interested citizen-scientists, and government staff (e.g. BC Parks, FLNRO and ENV biologists, Canadian Wildlife Service).

The Annual Bat Count has a strong potential to provide trend data for those bat species in BC that regularly use anthropogenic structures. The program has expanded greatly in the past four years, but continues to need focus on some aspects of the program to obtain statistically robust trends, most notably on ensuring retention of sites to establish multi-year trends. Specific recommendations to prioritize and improve data collection have been made prior to past field seasons (Kellner 2019). Several of these recommendations have been addressed, while new recommendations have also been added for 2023.

The purposes of this report are to:

1) update the summary of available BC Annual Bat Counts from across the province to include data from 2022,
2) assess the success of the program in meeting the recommendations made prior to the 2022 field season, and
3) continue to provide recommendations to improve the program in order to make it an effective tool for monitoring the arrival, impacts, and response of selected bat populations to WNS and other threats.

This report is preliminary in nature and does not include any statistical analyses of the data.

Acknowledgements

The BC Community Bat Program is a joint venture of regional bat projects across the province. It is funded by Habitat Conservation Trust Foundation, Forest Enhancement Society of BC, Habitat Stewardship Program, the Province of BC, and many regional funding partners. Thank you to all the Regional Coordinators who locate roost sites, identify candidate sites for the Annual Bat Count, and engage, organize, and train volunteers. BC Parks has done an exceptional job of ongoing counts at many sites over the years. Orville Dyer (retired from BC MoE) has provided valuable guidance and input to the program, as well as participating in bat counts. We especially thank Juliet Craig and the Kootenay Community Bat Project, who started the Annual Bat Count in BC. Finally, the Annual Bat Count could not occur without our many dedicated volunteers, who collect data for the program.

Methods

The Annual Bat Count is a repeated count of bats as they leave a roost site in summer (i.e. emergence count or exit count). It focusses on day roosts in anthropogenic structures (e.g. houses, barns, bat houses). These roost sites are usually identified through the work of the BC Community Bat Program. Regional Coordinators conduct and promote volunteer participation in conducting bat exit counts at roost sites during designated sampling periods. The program covers much of BC, although sites tend to be clustered where there is a longer history of bat programs or a larger human population (Figure 1).

Roost sites and roost locations

The terms 'site' and 'location' have specific meanings in this report. Counts are done at day roost sites; there are occasionally several sites at one location, with each site being counted separately and ideally on the same night. The location is the larger area with the roost sites. For example, a property with an attic roost and two bat boxes in the yard would be one location with three count sites, and multiple counts are done at each site. Data are generally analyzed by site, a structural feature with bats exiting (or not), instead of by location, which is a subjective grouping of known roost sites in an area.

Roost sites are classified into ten structure types: barn, unoccupied house, occupied house, church, outbuilding, bridge, tree, bat box/condo, other (e.g., cave, woodpile), and unknown.

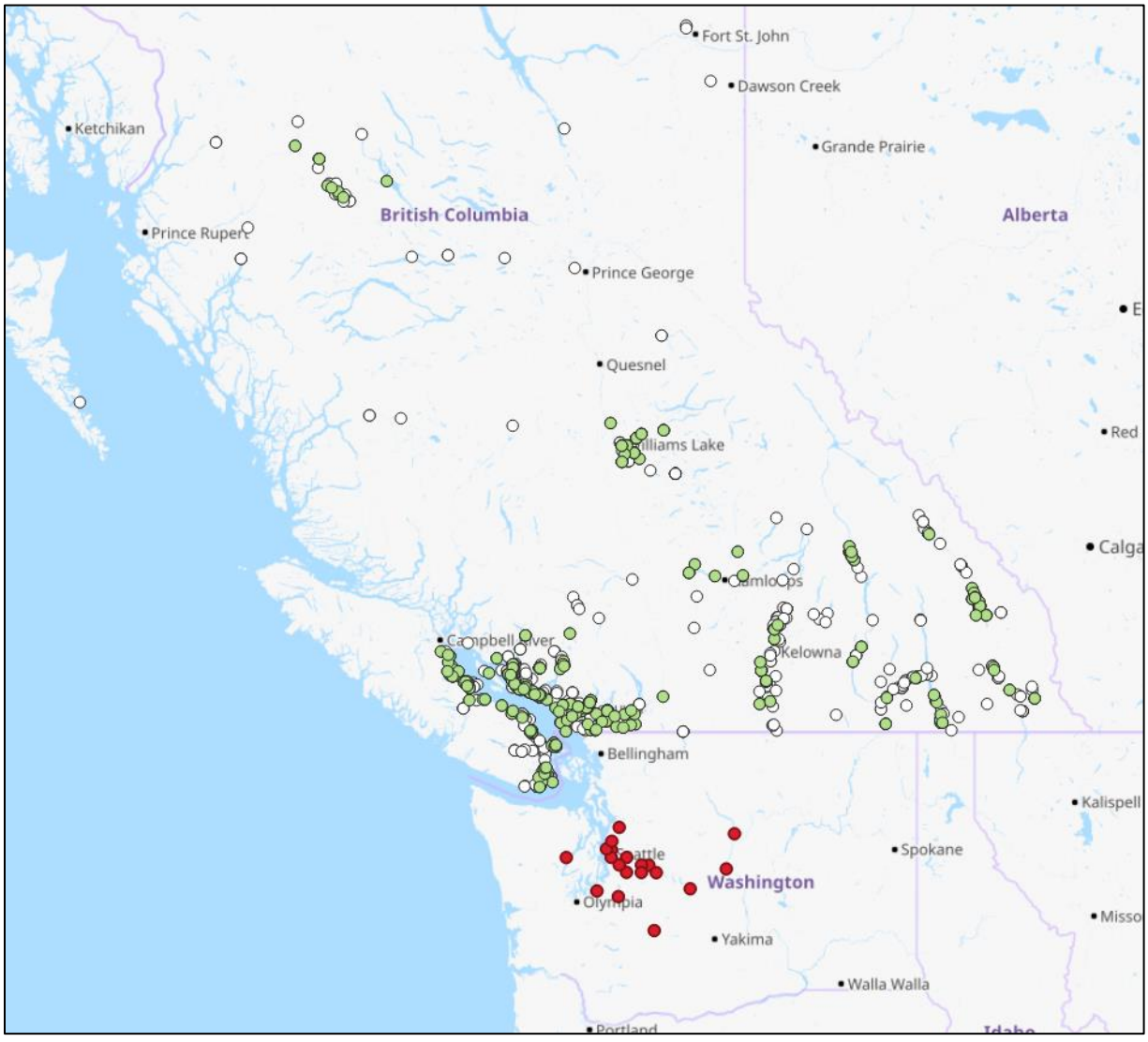


Figure 1. Map of sites sampled in the Annual Bat Count (2012 to 2022). Green dots are roost sites counted in 2022 in the BC Annual Bat Count; white are sites counted in previous years but not 2022. Red dots indicate WNS or Pd detection sites in Washington State to-date.

Coordinators and/or volunteers conduct between one and four visual counts of bats exiting roosts at dusk. Ideally, two counts occur between June 1 and 21 (the 'pre-pup period', i.e. before pups can fly).

These counts are the highest priority, and are consistent with North American Bat Monitoring Program (NABat) protocols (Loeb et al. 2015). Two more counts are recommended once pups are flying (called the 'post-pup period'). In 2018, dates for post-pup counts were switched to July 11 – August 5 (from July 21 – Aug 15 in 2017 and earlier), because of many reports of colonies being vacated by early to mid-August. We hoped that the earlier count window would facilitate counts before colonies began to disperse.

In 2019, we began requesting multiple independent counts on the same night, when possible, given the constraints of volunteer time / availability. This was based on discussion with the NABAT team and is intended to provide a measure of observer error and assess variability.

The Annual Bat Count is meant to be repeated yearly for as long as possible, but depends on funding, access to count sites, and volunteer availability. Data are recorded for each count and submitted to the regional or provincial coordinator, BC Ministry of Environment and Climate Change Strategy staff or Ministry of Forests, Lands, Natural Resource Operations and Rural Development staff. Ultimately, count data are entered into the BC Wildlife Species Inventory database[1]. Detailed methods can be found on our website[2] .

Species identification

Verification of the species using a roost site may be done through DNA analysis of guano samples. To date, our DNA analysis has been completed by Wildlife Genetics International, Nelson. Alternatively, some regional coordinators have access to ultrasonic bat detectors (e.g. Echometer Touch (Wildlife Acoustics), Anabat Walkabout (Titley Electronics), RoostLogger (Titley Electronics)), which can inform species identification. Identifications based solely on acoustics are taken as confirmation if the acoustic files are analyzed by a trained bat biologist. Species identification may also be done by qualified biologists through identification of dead bats or live capture by mist-netting. Although these three methods 'confirm' species identification for this report, final confirmation of species presence generally requires genetic verification and is the preferred method, if available.

Criteria for identifying maternity roosts

Several methods of identifying maternity roosts have been investigated (BC Community Bat Program 2021). Sightings of pups, including mortalities found at the roost, can be used to confidently confirm a site as a maternity roost. However, confirmed pup sightings are not available for the majority of sites. The two methods employed in this report are a) to compare the maximum counts from the pre-pup and post-pup periods - sites where the maximum count increased between periods were considered maternity colonies, and b) sites with more than 20 bats. Rationale was explored in previous reports (Kellner 2019). Potential maternity sites were identified using both methods, and sites were manually reviewed to ensure that known maternity colonies were correctly identified.

Trends across years: screening for declines

[1] http://a100.gov.bc.ca/pub/siwe/search_reset.do
[2] http://www.bcbats.ca/index.php/get-involved/participate-in-the-bc-bat-count.

Maximum pre-pup counts were graphed for each roost site, and the results visually screened for declines. Subjective assessment was used to identify sites that needed further follow-up. These sites were then individually investigated to determine if there were known causes for decline. In 2018, variation within the pre-pup period and post-pup period were assessed. Methods to quantitatively assess yearly variation in relation to this within-year variation have not yet been employed.

Results

Volunteer involvement

Volunteer involvement is essential to the Annual Bat Count, providing many or most of the bat counts in some regions. Volunteers either assist regional coordinators or conducted counts on their own. Volunteers may have assisted at more than one count, and many counts required multiple volunteers to ensure all exits were monitored, so the number of unique volunteers is unknown. Recording volunteer effort began in 2016. Volunteers participated in a minimum of 338/403 counts (84%) in 2016, 418/550 counts (76%) in 2017, 540/809 counts (67%) in 2018, 612/920 counts (66 %) in 2019, 772/1003 counts (77%) in 2020, 913/948 counts (96%) in 2021, and 969/1120 (86%) in 2022 (Figure 2). The number of volunteer-evenings was a minimum of 465 in 2016, 430 in 2017, 613 in 2018, 1308 in 2019, 1635 in 2020, 1932 in 2021, and 1809 in 2022 with the very large increase from 2018-2019 likely due to better tracking of volunteer effort.

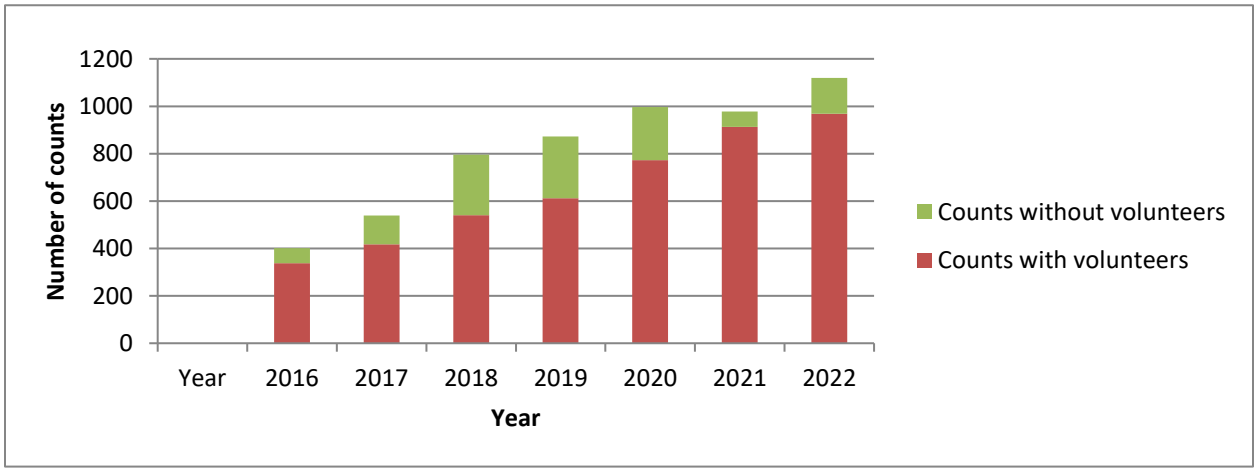


Figure 2. The number of bat counts done with volunteer involvement, from 2016 to 2022. Counts with volunteers include those done entirely by volunteers, such as landowners with a colony, and counts with a CBP coordinator and volunteers.

Number of sites and counts

Six thousand one hundred and eighty-seven (6187) counts have been conducted at 879 sites between 2012 and 2022 (Figure 1; Table 1). Sites counted in one year may not have been counted in subsequent years, and sites counted for multiple years were often but not always counted in consecutive years. The

number of sites increased with the expansion of the Community Bat Program across the province and increased efforts by coordinators to establish count sites and gather baseline pre-WNS data.

Table 1. Number of locations, roost sites, and counts per year. Not all sites from a year were counted in successive years.

Year	Locations	Roost sites	Counts
2012	11	11	27
2013	24	31	85
2014	36	45	114
2015	54	77	207
2016	116	157	404
2017	138	189	552
2018	172	229	812
2019	252	341	928
2020	242	353	988
2021	236	329	950
2022	199	281	1120
Unique locations, roost sites and counts, all years	630	879	6187

Number of sampling years

Sites have been monitored for between one and eleven years. Although there is one location with eleven years of data, there are no sites within locations with 11 continuous years of data (Table 2).

Sites that have been monitored for two or more years can be used in trend analysis using the methods employed in UK's National Bat Monitoring Programme (Bat Conservation Trust 2019). As of 2022 in BC, there are 450/879 sites (51 %) with two or more years of data, for all species combined (Table 2).

Table 2. Number of roost sites that have from one to ten years of count data, and the percentage of sites sampled two or more years. Sites with two or more years of data can be used in trend analysis (Bat Conservation Trust 2019).

Number of years counted	Number of roost sites as of							Number of locations
	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2022**
1	136	156	219	344	443	302	429	315
2	34	45	93	113	146	131	173	120
3	12	32	35	52	53	61	103	64
4	7	9	21	33	53	34	64	52
5	1	14	9	19	21	23	36	21
6		1	11	10	22	23	37	25
7			1	8	4	5	14	15
8				1	8	5	10	5
9					1	6	7	6
10						2	6	6
11							0	1
Total	190	257	389	580	751	835	879	630
Percent with 2+ years	28	39	44	41	41	64	51	50

Distribution of sites

Roost count sites are distributed throughout B.C. but are focused in areas of higher human habitation and where Community Bat Programs have been established for longer times (Table 3, Figure 1).

Table 3. Distribution of roost sites counted in the Annual Bat Count, by region and year

	Year										
Region	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Fraser Valley/ Lower Mainland	0	0	0	1	11	21	28	62	70	78	63
Sunshine Coast	0	0	0	0	31	41	48	105	61	83	54
Southern Vancouver Island/ Gulf Islands	0	7	7	11	21	35	44	52	54	57	44
Kootenay	10	20	20	31	25	26	29	46	64	33	36
Cariboo	0	0	1	1	9	14	18	17	28	21	22
Okanagan	1	3	15	17	31	30	39	28	34	19	22
North Island	0	0	0	0	0	0	0	0	10	12	12
Skeena	0	0	0	11	13	8	6	12	13	10	9
Columbia Shuswap	0	0	0	1	6	8	4	7	6	9	7
Mid Island	0	0	0	1	2	1	2	3	5	5	6
Thompson	0	1	1	2	3	2	3	2	3	1	6
Other	0	0	0	1	2	0	5	4	3	1	0
Peace	0	0	1	0	3	3	3	3	2	0	0
All sites	11	31	45	77	157	189	229	341	353	329	281

[1]Includes data from bat programs on Salt Spring, Thetis, Mayne, Gabriola, Denman/Hornby, and Texada Islands.
[2] Other includes sites in Lillooet, Haida Gwaii and Omineca/Prince George.

Structure type

Most roost sites that were monitored from 2012 to 2022 were occupied houses (399 sites; 48%) and bat boxes or bat condos (308 sites; 37%; Table 4).

Bat species

There are seven species of bats recorded roosting in anthropogenic structures in the Annual Bat Count data. These are Little Brown Myotis (*Myotis lucifugus*), Yuma Myotis (*M. yumanensis*), Big Brown Bat (*Eptesicus fuscus*), Californian Myotis (*M. californicus*), Long-legged Myotis (*M. volans*), Long-eared Myotis (*M. evotis*), and Townsend's Big-eared Bat (*Corynorhinus townsendii;* Table 5). DNA identification from guano, which is used to confirm species, used only one pellet per site so species that rarely use structures or are a small percentage of the bats using the site are likely under-represented in these data, especially at sites with large numbers of bats. This method also leads to under-estimation of roosts where multiple species occur, as often only one sample is analyzed per site. At present, 20 % (77/393) roost sites are believed to be used by multiple species of bats (Table 5).

Table 4. Type of structure for each site monitored during the Annual Bat Count, 2012-2022, by region.

Region	Unoccupied house	Occupied house	Outbuilding / barn	Bat box / bat condo	Other[1]	Unk	Total
Sunshine Coast	9	127	22	41	26	3	228
Kootenay	4	51	16	70	0	0	141
Fraser Valley/Lower Mainland	3	80	14	36	4	0	137
Southern Vancouver Island/Gulf Islands	0	66	8	57	0	2	133
Okanagan	3	25	12	39	2	0	81
Cariboo	1	11	3	33	0	0	48
Skeena	0	18	2	10	0	0	30
Columbia Shuswap	0	9	0	16	0	0	25
Northern Vancouver Island	0	15	0	1	0	0	16
Mid Vancouver Island	0	5	2	5	0	0	12
Other	0	4	1	6	1	0	12
Thompson	0	3	1	8	0	0	12
Peace	0	1	0	3	0	0	4
Sum	20	415	81	325	33	5	879
Percent of all roosts	2	47	9	37	4	1	100

[1] 'Other' includes 'Umbrella' (n=26), 'Rock/cave' (n=2), 'Church' (n=1), 'Tree' (n=1), and 'Bridge' (n=3).

For all sites across years, there are 393/879 (45 %) sites that have a species identified, with an additional 15 sites classified as *Myotis* species. There are an additional 30 sites with samples submitted and genetic results pending. If all samples are successful, there will be 423/879 (48 %) total sites with species id. Many of the unidentified sites have not been visited for several years and it is unlikely that the bat species using these sites will ever be determined.

For sites counted in 2022, the proportion of sites with species ID is larger. Of the 281 roost sites counted in 2022, thirty-seven (37) sites had a count of 0 bats, so no identification is possible. Of the 244 sites with bats in 2022, 153 (63 %) have a species ID. There are 16 samples from 2022 pending analysis, for a total of 169/244 (69%) sites with ID.

Little Brown Myotis are more commonly found in artificial structures than any other bat in BC (Table 6) and occur alone or with other species at 214/393 (54%) of sites with confirmed species identification. When multiple species are identified at a roost, Little Brown Myotis are commonly found with Yuma Myotis, and sometimes co-roost with Big Brown Bat, California Myotis, Long-legged Myotis or Long-eared Myotis (Table 6).

Yuma Myotis are the second most common bat in anthropogenic structures and are confirmed at 143/391 (37 %) of sites. They often are found in roosts with Little Brown Myotis and occasionally co-

roost with other species including Big Brown Bat, California Myotis and Townsend's Big-eared Bat (Table 6).

Table 5. Species, number of roost sites monitored for which species has been confirmed, and regions monitored by the Annual Bat Count.

Species	Number of roost sites with confirmed species identification (percent of all 393 roost sites with an ID)[1]	Regions
Little Brown Myotis	214 (54%)	All
Yuma Myotis	143 (36%)	All except Peace and interior portion of Skeena
California Myotis	51 (13%)	Southern Vancouver Island/ Gulf Islands, Sunshine Coast, Okanagan
Big Brown Bat	42 (11%)	Southern Vancouver Island/Gulf Islands, Fraser Valley / Lower Mainland, Columbia-Shuswap, Kootenay, Thompson, Okanagan, Cariboo, Skeena
Long-eared Myotis	14 (4%)	Haida Gwaii, Southern Vancouver Island/Gulf Islands, Sunshine Coast, Fraser Valley / Lower Mainland
Townsend 's Big-eared Bat	12 (3%)	Fraser Valley / Lower Mainland, Kootenay, Southern Vancouver Island/ Gulf Islands, Sunshine Coast
Long-legged Myotis	7 (2%)	Southern Vancouver Island/Gulf Islands, Fraser Valley / Lower Mainland, Cariboo, Skeena
Multi-species roost suspected	**77 (20%)**	
Total	393[1]	

[1] Note that more than one species can occupy the same roost site.

There are fourteen sites identified as having Long-eared Myotis, including a bat box, a cave, and occupied buildings. Long-eared Myotis were also confirmed genetically at a bat box roost in the Skeena Region in 2015. However, this site has since been identified as Little Brown Myotis through improved DNA analysis procedures including testing for a gene (muc-11) to positively differentiate Long-eared Myotis from a coastal genotype of Little Brown Myotis. This improved testing from 2016 onwards allowed differentiation of these species. The confirmed bat box site (in the Kootenays) was tested genetically in 2017, after the testing method for MYEV was improved. A maternity colony in a cave in Haida Gwaii was identified through capture as a mixed colony of Long-eared Myotis and Little Brown Myotis. A dead bat on-site, paired with acoustics, identified Long-eared Myotis in a mixed colony in a house on the Sunshine Coast. Acoustic identification was used in 2017 to identify Long-eared Myotis in a mixed colony at a house on Southern Vancouver Island.

California Myotis was confirmed genetically or through capture at occupied houses, barns, and bat boxes on Southern and Northern Vancouver Island, the Gulf Islands, the Sunshine Coast, Fraser Valley / Lower Mainland, and in a bat box in the Okanagan.

Long-legged Myotis was genetically confirmed using building roosts (including under cedar siding on an occupied house), a barn, and several bat boxes.

Table 6. Species assemblages and the number of roost sites found for each species and species group, at 879 anthropogenic roost sites in BC.

Species in roost site	# roost sites	% of all 879 roost sites	% of 393 roost sites with known species ID
Little Brown Myotis	145	16	37
Little Brown Myotis / Yuma Myotis	43	5	10
Little Brown Myotis / Yuma Myotis / Big Brown Bat	2	< 1	1
Little Brown Myotis / Yuma Myotis / California Myotis	8	1	2
Little Brown Myotis / California Myotis	2	< 1	< 1
Little Brown Myotis / Big Brown Bat	1	< 1	< 1
Little Brown Myotis / Long-legged Myotis	1	< 1	< 1
Little Brown Myotis /Long-eared Myotis	11	< 1	3
Little Brown Myotis /Long-eared Myotis / Big Brown Bat	1	< 1	< 1
Yuma Myotis	85	10	23
Yuma Myotis/ California Myotis / Long-eared Myotis	1	< 1	< 1
Yuma Myotis/ California Myotis	1	< 1	< 1
Yuma Myotis/ Big Brown Bat	2	< 1	< 1
California Myotis / Small-footed Myotis	`1	<1	<1
California Myotis / Long-eared Myotis	1	< 1	< 1
California Myotis	35	4	9
Long-legged Myotis	7	< 1	1
Townsend's Big-eared Bat	12	1	3
Townsend's Big-eared Bat / Big Brown Bat	1	< 1	< 1
Big Brown Bat	41	4	9
Myotis spp.	15	2	
No ID	441	51	
TBD	30	3	
Total	879		

Identification of maternity colonies

Using the criteria defined in the Methods of colonies > 20 bats and colonies showing an increase in numbers between first and second count periods, 57 % (515/879) of all sites monitored to-date are maternity colonies.

Maternity colonies were found in all types of structures monitored. The majority of maternity colonies were found in occupied houses (96/209 maternity colonies, 46 %) and bat boxes / bat condos (74/209,

35 %, Figure 3, Table 8). These results are very similar to those for all roost sites monitored including the sites not flagged as possible maternity roosts (e.g. 47 % in occupied houses, 37 % in bat boxes).

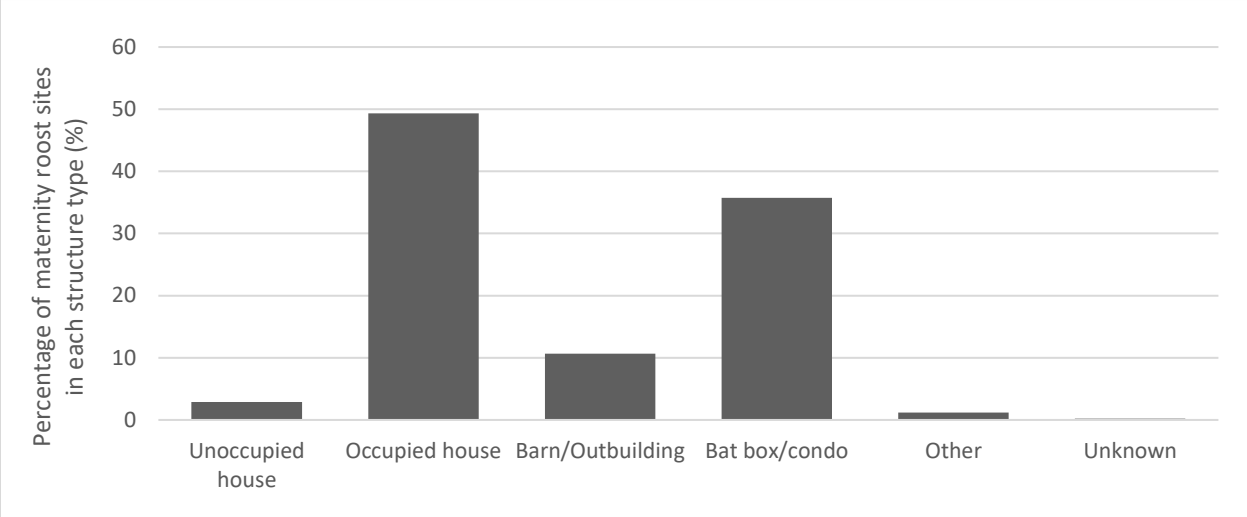


Figure 3. The distribution of 515 maternity roost sites by structure type. Maternity roost sites were identified through an increase in counts from pre- to post-pup periods or by having 20+ bats.

Table 7. Summary of roost sites by structure type and colony type.

Structure type	Maternity sites	Total sites	% of structure type housing a maternity colony	% of all maternity roosts in a given structure type
Unoccupied house	15	20	75	3
Occupied house	254	415	61	49
Outbuilding /barn	55	81	68	11
Bat box/ bat condo[1]	184	325	57	36
Other	6	33	18	1
Unknown	1	5	20	<1
Total	515	879	59	100

One hundred and seventy-nine (179/515, 35 %) of these maternity colony roost sites were confirmed as Little Brown Myotis, either alone or with other species (Table 9). Little Brown Myotis maternity roost sites were in all structure types with may colonies in occupied houses (82/254, 33 %) and in bat boxes/ bat condos (66/184, 36 %; Table 9).

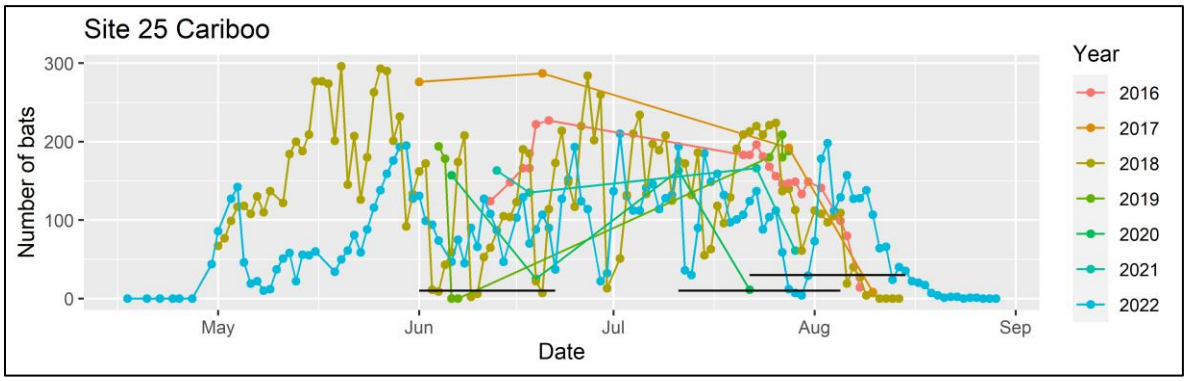
Table 8. Number of maternity colonies by species and structure type.

Species	**Little Brown**	**Little Brown mix**	Yuma	Myotis mix, no Little Brown	Long-legged	California	Townsend's	Townsend's / Big Brown	Big Brown	TBD	Myotis spp.	NoID	Sum	**% of total with Little Brown**
Unoccupied house	**2**	**4**	2	0	0	0	1	1	0	0	0	5	15	**40**
Occupied house	**55**	**28**	32	7	2	10	1	0	14	5	7	93	254	**33**
Outbuilding/barn	**13**	**8**	5	0	0	1	5	0	0	5	0	18	55	**38**
Bat box/ bat condo	**49**	**17**	25	0	1	5	0	0	8	7	4	68	184	**36**
Other[1]	**0**	**3**	1	0	0	0	0	0	1	1	0	0	6	**50**
Unknown	**0**	**0**	1	0	0	0	0	0	0	0	0	0	1	**0**
Total	**119**	**60**	66	7	3	16	7	1	23	18	11	184	515	**35**

[1] 'Other' includes 'Umbrella', 'Rock/cave', and 'Other' categories.

Variability within count periods

There is large variation in count results within a site and within designated count periods. There is also variation between years in the timing of when colonies reach maximum size and then begin to decline (Figure 4). The observed variability emphasizes the importance of doing at least two counts, to better estimate maximum number of bats in the roost and to be able to estimate variability for that site.



(Figure 4 continues on the following page)

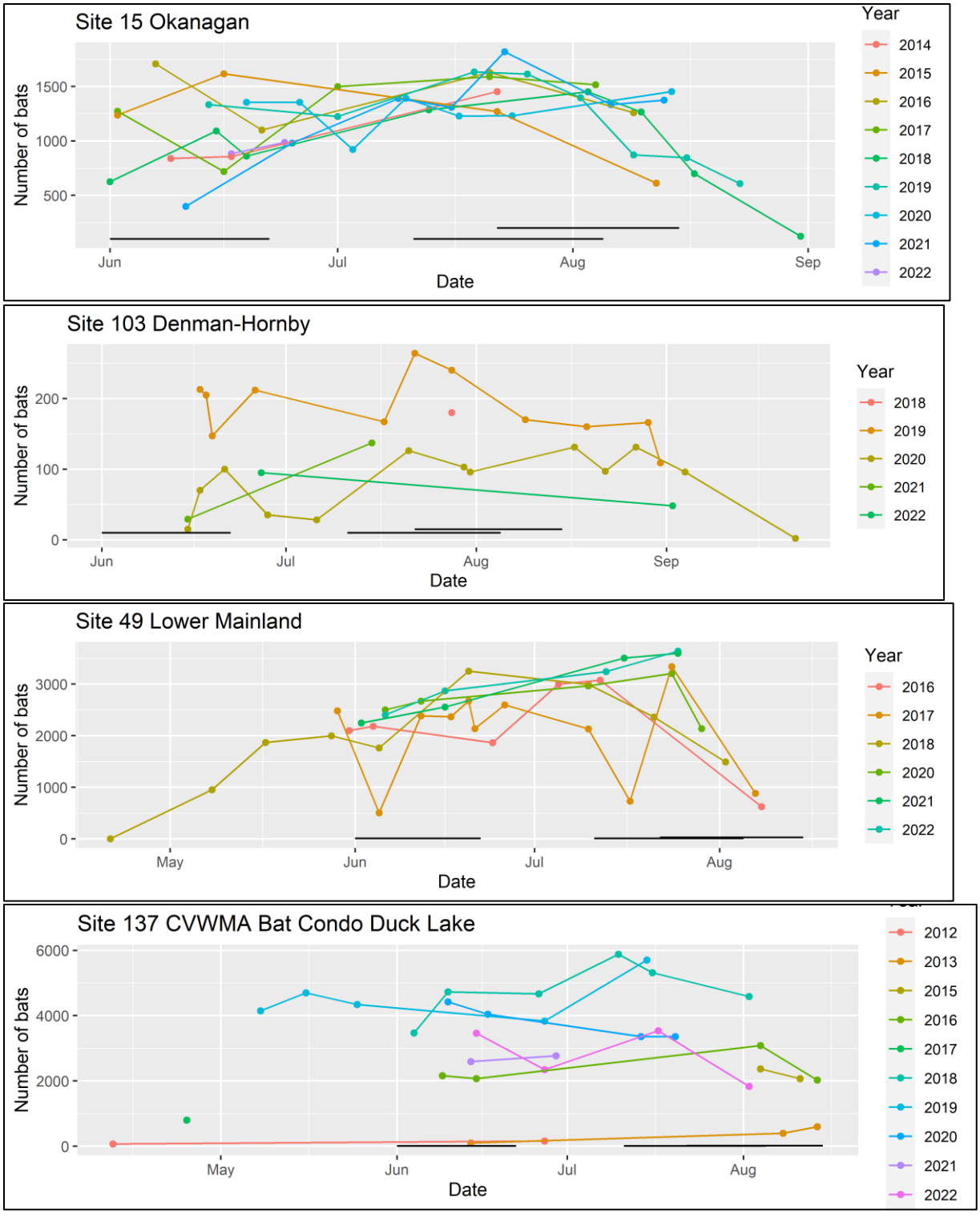


Figure 4. Counts for five sites with more than four counts in a year, showing nightly and yearly variation in count numbers. Horizontal lines indicate Bat Count periods in the pre-pup (Jun 1-22) and post-pup (Jul 22- Aug 15 (pre-2018) / Jul 11- Aug 5 (2018 onwards) count periods.

Dates of first pups

Observations of first pups of the year were obtained from several roost sites (Table 10). These observations show yearly variability in the start of parturition. These dates also suggest that any counts prior to ~ July 9 would not include volant pups (assuming around three weeks until pups begin flying). The current pre-pup count period is June 1 – 22 and therefore prior to volancy of pups. The current post-pup count period is July 11 – August 4.

Table 9. Dates of first pup (or lactating female) observed, by Region.

Region	Species	Year	Date
Kootenay	MYLU	2016	Jun 16
Okanagan	MYLU/MYYU	2017	Jun 26
Peace	MYLU	2017	Jun 30
Cariboo	MYLU	2018	Jun 18
Okanagan	MYLU/MYYU	2018	Jun 21
Peace	MYLU	2018	Jun 21
Kootenay	MYYU	2019	Jun 14
Okanagan	MYLU/MYYU	2019	Jun 16
Okanagan	COTO	2019	Jun 18
Sunshine Coast (Clowhom)	MYLU/MYYU/MYCA	2019	Jun 17
Sunshine Coast (Jervis Inlet)	MYLU/MYYU/MYCA	2019	Jul 19
Vancouver Island/Gulf Islands	MYLU/MYYU	2019	Jun 16
Cariboo	UNK	2020	Jul 1
Okanagan	MYLU/MYYU	2020	Jun 26
Peace	MYLU	2020	Jun 28
Thompson	MYLU/MYYU	2020	Jun 19
Vancouver/Fraser Valley	MYLU/MYYU	2020	Jun 19
Vancouver/Fraser Valley	MYLU/MYYU	2020	Jun 24
Okanagan	MYYU	2021	Jun 17
Okanagan	MYLU	2021	Jun 22
Shuswap	UNK	2021	Jul 1
Vancouver/Fraser Valley	MYLU/MYYU	2021	Jun 26
Vancouver/Fraser Valley	MYLU/MYYU	2021	Jun 26
Vancouver/Fraser Valley	MYLU/MYYU	2021	Jul 4
Okanagan	MYLU/MYYU	2022	Jul 10
Omineca	UNK	2022	Jul 12
Vancouver/Fraser Valley	MYLU/MYYU	2022	Jun 25

Trends across years

Four hundred and fifty (450) sites have two or more years of count data. Three hundred and fifteen (315) of these sites have multiple years of pre-pup count data and were screened for year-to-year declines in the pre-pup period (Appendix 2).

Visual inspection of sites with two or more years of pre-pup data subjectively identified sixteen of these sites as having a ‘large’ decline in maximum pre-pup counts. These sites were investigated individually to determine if there were obvious causes for declines (excessive heat, bat exclusion, new roost sites

nearby, large amount of variation normally at the site, etc.; Appendix 2, Table 13). Changes in maximum pre-pup counts between years must be considered in context of the large variation within count periods in a year (see Variability, above) and the observed variability between years.

The majority of the sites with potentially large declines were assessed as being affected by other factors, and not actually having a real trend of declining bat counts. These other factors were:

- exclusion,
- cool June temperatures impacting bat use of structures,
- only two years of sampling and/or no repetition of sampling within 2022, making decline impossible to tell from expected levels of variability in emergence and use,
- low pre-pup numbers but with post-pup numbers as expected, and
- suspected or known movement around a roost complex (all of which may or may not get counted).

Discussion

Participation and support

Volunteer participation is the foundation of the BC Annual Bat Count. Participation has steadily increased between 2012 and 2022. Although participation has been high, in 2022 several regions did report that recruiting volunteers was quite challenging to impossible. New approaches should be explored to engage, retain, and 'reward' volunteers since the success of this broad-scale monitoring program depends on recruiting and retaining volunteers. The program currently recruits new colonies and volunteer counters through community presentations, press releases, and our website. Program evaluation should be done to identify if volunteers are retained and for how long, what proportion of volunteers are new recruits, and if conducting a bat count on your own or other property leads to increased conservation actions such as increased interested in colony protection.

The large number of volunteers has allowed for the monitoring of additional sites, as well as more counts at sites. There are multiple benefits of volunteer involvement, including increasing the number of counts done, increasing the geographic scope of the project, and (we believe) increased local awareness and stewardship. However, the growth of this component of the Community Bat Program also dramatically increases the number of hours, and associated cost, invested by regional coordinators to train, coordinate, and follow-up with volunteers.

Continued financial support for Annual Bat Count provincial and regional coordinators is critical to ensure that priority roost sites are counted yearly. Coordination is required at the provincial level to set program priorities and goals, monitor progress, analyze results and ensure that the results are available to guide species monitoring and recovery actions. Regional coordinators need to have time to review data, contribute to or modify the priority site list generated at the provincial-level, organize volunteers and landowners, assist in conducting counts, and enter data. Without adequate time for planning and

coordinating the many volunteers, sampling is left in the hands of volunteers who may not be trained, and may or may not participate in the program, and it is unlikely that all targeted sites will be counted.

The primary sources of funding to-date for the Annual Bat Count at the provincial level have been from Habitat Conservation Trust Foundation / Forest Enhancement Society of BC, the BC Ministry of Environment and Climate Change Strategy. Federally, the support has been primarily from the Habitat Stewardship Program for Species at Risk. Regional bat projects are encouraged to apply for and access other funds to support additional counts. As the program has expanded across the province and new sites are sought out and added to the long-term monitoring program, funding levels for this aspect of the Community Bat Program have not increased accordingly. Future growth of the program will likely be hampered by available funding. We need to secure alternate funds at the provincial level, plus encourage and support regions to apply for region-specific grants. One promising avenue is increasing partnerships with BC Parks across the province.

Species identification and multi-species roosts

One ongoing recommendation to improve the Bat Count data has been to increase the number of sites with confirmed species identification. Species identification is necessary to understand the implications of any changes in colony size. As in 2022, species identification in 2023 should target:

- species at all sentinel sites, and
- sites with 2+ years of monitoring data.

At other roosts, species identification should occur as budget allows. To encourage species identification at sentinel sites, data gaps will be highlighted with regional coordinators. Coordinators will be responsible for ensuring sample collection for these sites, or for remote sites, obtaining mailing addresses to which we can send a DNA collection kit.

Many large roosts are composed of multiple bat species. The method used to identify species at a roost involves analysis of a single pellet. Often if multiple pellets are analyzed, in the same or different years, other species will be detected. This is interpreted as the site being a mixed species roost. 'Community' analyses of pooled guano samples should be considered to improve our understanding of which roosts are indeed multi-species roosts.

The data from monitoring of mixed-species roosts is challenging to use for assessing changes in the size of a colony, because a decrease in one species may be hidden by an increase in other species. Research is underway at several Annual Bat Count sites, in partnership with Wildlife Conservation Society Canada and BC Land Water and Resource Stewardship, to explore using acoustic samples to estimate the proportion of Little Brown:Yuma Myotis in mixed-species roosts.

Providing identification of the species in a roost also serves to engage landowners and encourage stewardship. However, many new roost sites are now reported to the CBP yearly. Although the costs and effort to collect samples are low and volunteers/landowners can easily accomplish collection, DNA analysis of guano from all sites each year is not usually financially realistic. Increased reliance on acoustic monitoring may help identify species at non-sentinel sites. The CBP has bat detectors available for use, but capturing useful calls for ID usually requires a user with some knowledge of acoustic equipment and

sampling. Acoustic monitoring may be useful when trained regional coordinators can be on-site, but is not applicable for many volunteers/landowners.

Potential for monitoring population trends

Number of sites and duration of monitoring

Population trend data are important for monitoring population changes that are expected from white-nose syndrome. Catastrophic declines are expected for species that are susceptible to WNS – for example, bat counts at hibernacula of some species in eastern North America declined by 30 – 99 % yearly after WNS arrived (Frick et al. 2010). Detection of such large declines is easily done and does not require statistical analyses.

However, the different winter and summer roosting ecology of western bats compared to bats east of the Rockies may result in a different, perhaps slower, response, which would require more sites and longer sampling duration to detect. Recovery rates will also obviously be slow and will definitely require many sites and a long sampling duration to detect trends with high confidence.

The power of the BC Annual Bat Count as a trend monitoring program can be improved in several ways including:

- Increase within-year replication (Walsh et al. 2001) - Many BC sites continue to have only one count per year; replication should continue to be emphasized in 2023.
- Aim to reduce variation by increasing understanding of roost-switching and potentially adjusting sampling times or combining sites into biologically-meaningful locations (likely requires focussed an site-specific research), and
- Increase sample sizes and number of sites with multiple years of monitoring (ongoing into 2023).

Species monitored

Bats appear to have different vulnerabilities to WNS, based on patterns of mortality in affected species (WNS.org 2022) so species-specific trends are needed to monitor impacts and recovery. The Annual Bat Count focuses on anthropogenic structures so will only be useful for monitoring BC species that regularly use these structures. The two species with the largest number of roosts are Little Brown Myotis (214 roosts) and Yuma Myotis (143 sites). However, many of these may be in multi-species roosts so analysis will rely on solving the challenges of discerning species in mixed-species roosts or only using data from single-species roosts. For many other species, there are too few roost sites to detect anything other than catastrophic decline. .

Methods for detecting declines

Yearly variation in pre-pup counts was assessed graphically to identify sites of potential concern. In future, declines in sites should be quantitatively assessed. One option is to compare the percent decrease in pre-pup count to the variation observed in pre-pup counts in previous years. Reviewing site-specific variation over previous years should assist in determining a realistic value for concern (e.g., 20 % decline). In 2018, the average percent difference in first and second pre-pup counts was assessed as

146 % across all counts (Kellner 2019); this reflects the large range in colony sizes and the need to use site-specific variation to assess changes at each site.

Additionally, methods to analyze repeated count data should be investigated (e.g. program TRIM - Trends and Indices for Monitoring data (van Strien et al 2004), Generalized Additive Models (Bat Conservation Trust 2019), and power analyses should be run to determine if counts have power to detect a pre-determined level of change. Again, this level of change should be determined in consultation with provincial biologists and after considering the normal variation seen in counts pre-WNS.

Bat boxes and the Annual Bat Count

The large number of bat boxes deployed through the Community Bat Program over time has potential to increase our knowledge about the effectiveness of bat boxes as habitat enhancement and mitigation. Data on bat box installation and use by bats can be captured through the Annual Bat Count or through visual inspection and/or guano catchers. There are currently 325 bat boxes in the Annual Bat Count database; however, many are lacking data on box type and installation details. To increase the value of monitoring these boxes, data gaps should be filled when possible. To ensure installed bat boxes contribute to population monitoring goals, it is necessary to continue to:

- promote registration of installed bat boxes with the Community Bat Program,
- promote yearly monitoring for occupancy by using a guano catcher or looking into the box, and
- promote monitoring during the Annual Bat Count.

These additional priorities need to be communicated to regional coordinators and volunteers, and data submitted online through our "Register Your Bat Box" link.

Summary of recommendations and priorities for 2023

Volunteer recruitment and retention

1) Increase information flow back to program participants
   a) In addition to the provincial public summary, prepare regional summaries, for use by regional coordinators and distribution to volunteers and landowners. Topics should include:
      - level of volunteer involvement,
      - number of counts and for which species, to identify regions that require more roost counts for effective species monitoring,
      - map showing colonies currently monitored (and species), plus historical colonies and species,
      - # of sampling years per site,
      - multi-year trends by species to identify sites where data has not been continuously collected and may require extra attention (e.g. landowner follow-up, recruitment or organization of volunteers).
   b) Ensure genetic results on bat species are communicated to roost owners/stewards.

2) Emphasize re-contact with bat counters and home owners, sharing a summary of results to-date, public celebration of volunteers, email reminders to counters before and in early June, and tokens of gratitude (pencils, stickers).

3) Develop and distribute questions to bat count participants to determine the effect of participation in bat counts on their intent and actions to protect roost habitat for bats. Questions can be easily incorporated as part of the data form used for monitoring.

Promoting ongoing monitoring at priority sites

4) Monitoring of priority sites will be promoted by:
   a) reviewing the Bat Count goals and identified priority sites with regional coordinators to ensure these sites are recognized as important,
   b) providing coordinators with a pre-filled datasheet clearly identifying priority sites,
   c) reminding coordinators to contact landowners individually to provide feedback on past counts and encourage participation to ensure counts happen at these locations, and
   d) checking in with roost stewards/volunteer counters in early June to allow arrangement for alternate counters if needed.
      - Sites identified as lower priority/not sentinel sites will continue to be monitored for community engagement and stewardship promotion.

5) Promote continuing roost counts at sites with strong volunteer support even if the sites are not flagged as priority, to encourage stewardship, increase the number of multi-year samples to support detection of statistical trends, and scan for significant colonies. At all sites, it will be important to:
   a) continue monitoring of previously-counted sites, to increase the number of sites with 2+ years of data,
   b) obtain two or more counts in the pre-pup period, and
   c) when possible, obtain independent counts on the same night, and
   d) make efforts to encourage continuing participation, retaining interested homeowners and trained volunteers, to obtain multi-year samples.

Increasing effectiveness for monitoring

6) Continue to work with partners and seek new partnerships to investigate
   a) statistical methods for trend analyses,
   b) roost switching, and
   c) methods to assess percent composition of multispecies roosts.

7) Coordinate with broader-scale bat monitoring programs, including data submission to NABAT.

8) Identify methods (e.g. % decrease in yearly prep-pup counts) that can be used to flag sites with declining counts
    a) Develop standard, simple, and rapid R-scripted methods: Visual screening of graphs has been used to-date and this is time consuming and could introduce unnecessary errors. Analyses should consider the site-specific within-year and between-year variation.
    b) Based on the results of a power analysis, modify Annual Bat Count protocols if needed to ensure counts and replicates occur in the ideal time periods

9) Ensure species are confirmed through genetics and/or acoustic means in 2023 by specifically approaching regional coordinators/ roost stewards to communicate data gaps,

10) Seek out new funding sources to support the growing Annual Bat Count.
    a) Regional programs are encouraged to source regional funding.
    b) Partnerships with BC Parks has ensured counts are done in Okanagan and Skagit Parks.
    c) Develop relationships with other Parks to encourage stewardship and bat counts.
    d) Seek funding for 'tokens of appreciation' for bat counters/roost stewards (e.g., PCAF).

References

B.C. Conservation Data Centre. 2021. BC Species and Ecosystems Explorer. B.C. Minist. of Environ. Victoria, B.C. Available: http://a100.gov.bc.ca/pub/eswp/ (accessed Dec 14, 2021).

Barlow, K. E., P. A. Briggs, K. A. Haysom, A. M. Hutson, N. L. Lechiara, P. A. Racey, A. L. Walsh, and S. D. Langton. 2015. Citizen science reveals trends in bat populations: the National Bat Monitoring Programme in Great Britain. Biological Conservation 182 (2015): 14-26.

Bat Conservation Trust, 2019. The National Bat Monitoring Programme Annual Report 2018. Bat Conservation Trust, London. Available at http://www.bats.org.uk/pages/nbmp_annual_report.html

Environment Canada, 2015. Recovery strategy for little brown myotis (Myotis lucifugus), northern myotis (Myotis septentrionalis), and tri-colored bat (Perimyotis subflavus) in Canada [Proposed]. Species at Risk Act Recovery Strategy Series.

Frick, W.F., J.F. Pollock, A.C. Hicks, K.E. Langwig, D.S. Reynolds, G.G. Turner, C.M. Butchkoski, and T.H. Kunz. 2010. An emerging disease causes regional population collapse of a common North American bat species. Science, 329(5992), pp.679-682.

Griffin, D.R., Webster, F.A. and Michael, C.R., 1960. The echolocation of flying insects by bats. *Animal behaviour*, *8*(3-4), pp.141-154.

Kasso, M. and M. Balakrishnan. 2013. Ecological and economic importance of bats (Order Chiroptera). ISRN Biodiversity, Article ID 187415, 9 pp doi:10.1155/2013/187415

Kellner, M. 2019. British Columbia Community Bat Program Annual Bat Roost Counts (2012-2018). Working report prepared for the BC Ministry of Environment, Penticton.

Kellner, M. and O. Dyer. 2017. British Columbia Community Bat Program Annual Bat Roost Counts (2012-2016). Working report prepared for the BC Ministry of Environment, Penticton.

Kunz, T.H., E. Braun de Torrez, D., Bauer, T. Lobova, and T.H. Fleming. 2011. Ecosystem services provided by bats. Annals of the New York Academy of Sciences, 1223(1), pp.1-38.

Loeb, S.C., T.J. Rodhouse, L.E. Ellison, C.L. Lausen, J.D. Reichard, K.M. Irvine, T.E. Ingersoll, J.T. Coleman, W.E. Thogmartin, J.R. Sauer, and C.M. Francis. 2015. A plan for the North American bat monitoring program (NABat). Gen. Tech. Rep. SRS-208. Asheville, NC: US Department of Agriculture Forest Service, Southern Research Station., 208, pp.1-100.

Moosman, P.R., Veilleux, J.P., Pelton, G.W. and Thomas, H.H., 2013. Changes in capture rates in a community of bats in New Hampshire during the progression of white-nose syndrome. *Northeastern Naturalist*, *20*(4), pp.552-558.

Nagorsen, D.W., and R.M. Brigham. 1993. Bats of British Columbia. Royal British Columbia Museum Handbook. Volume 1. The Mammals of British Columbia.

Safi, K. and G. Kerth. 2007. Comparative analyses suggest that information transfer promoted sociality in male bats in the temperate zone. The American Naturalist. 170:465-472.

Van Strien, A., J. Pannekoek, W.Hagemeijer, and T. Verstrael. 2004. A loglinear Poisson regression method to analyse bird monitoring data. *Bird*, *482*, pp.33-39.

Walsh, A., C. Catto, A.M. Hutson, P.A. Racey, P. W. Richardson, and S. Langton. 2001. The UK's National Bat Monitoring Programme – Final report 2001. Bat Conservation Trust, London. DEFRA - DETR Contract No. CR018.

Warren, R.D. and M.S. Witter. 2002. Monitoring trends in bat populations through roost surveys: methods and data from Rhinolophus hipposideros. Biological Conservation 105(2): 255-261.

WNS.org. 2022. Bats affected by WNS. https://www.whitenosesyndrome.org/static-page/bats-affected-by-wns Accessed Dec 1,2022

Appendix 1. Yearly trends

Maximum bat counts in the pre-pup period, by region, species and location over time. Colours represent different roost sites; dots are counts and lines connect counts across years. 'Other' includes counts from Skagit and Omineca areas. Note that the y-axis scale varies with region and species group to facilitate looking for changes.

Species categories are: MYLU (colonies with Little Brown Myotis), MYLU+ (colonies with Little Brown Myotis and other species, usually Yuma Myotis), MYYU/MYYU+ (colonies with Yuma Myotis or Yuma Myotis and other species but NOT Little Brown Myotis), and Other (colonies with other species, other mixed species, and where species is unknown).

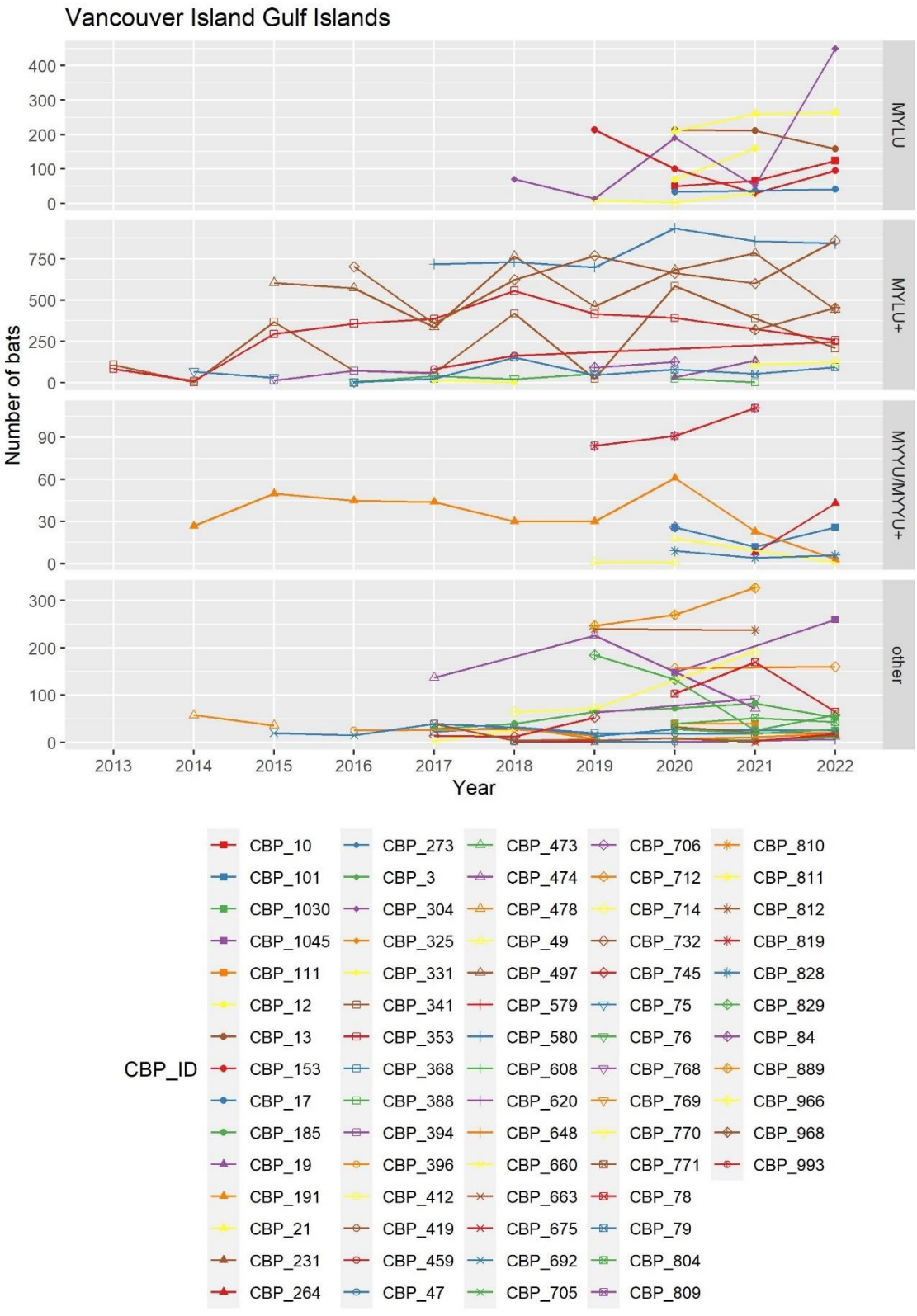


Figure 5. Vancouver Island Region yearly maximum pre-pup counts.

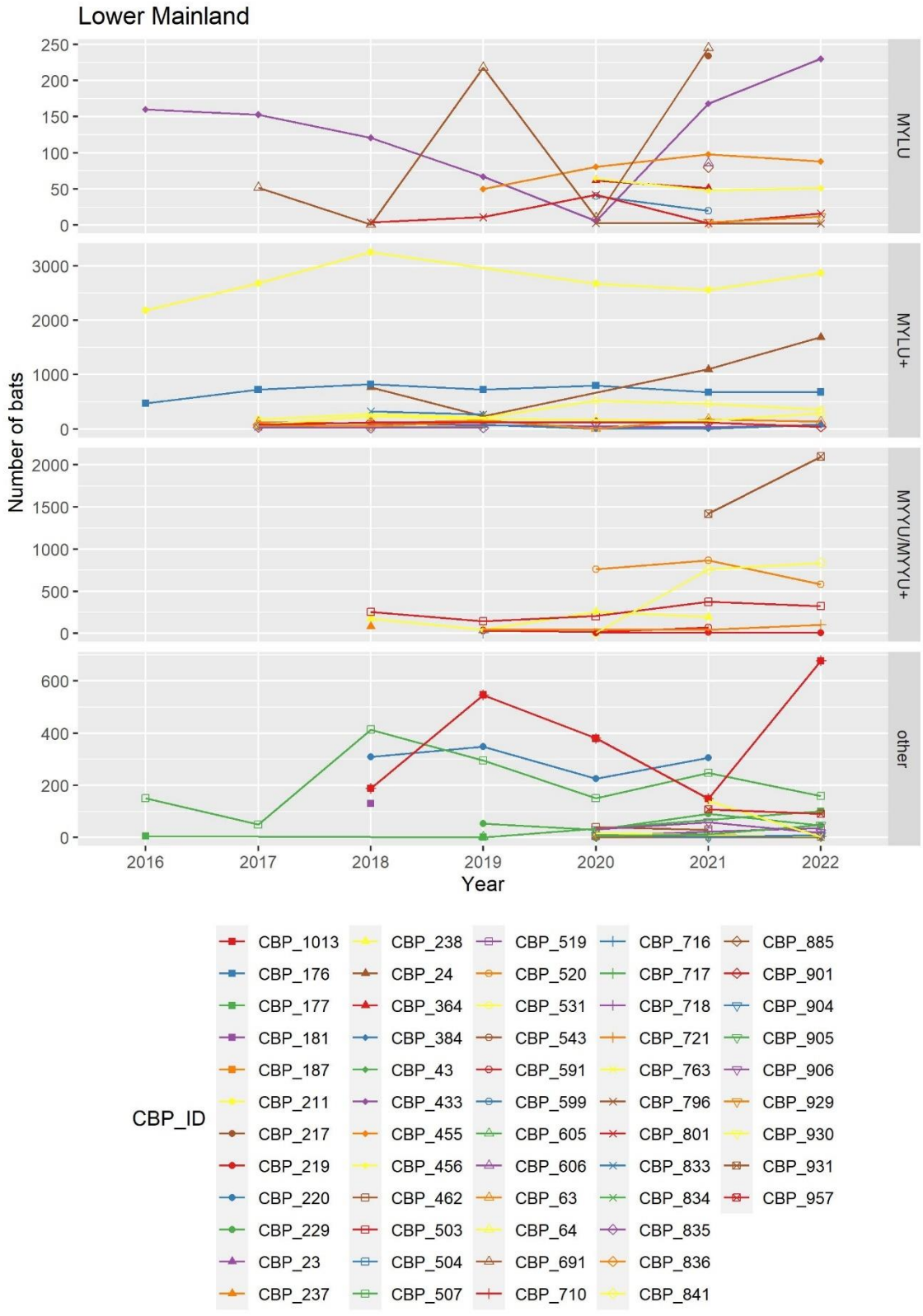


Figure 6. Fraser Valley/Vancouver Region yearly maximum pre-pup counts.

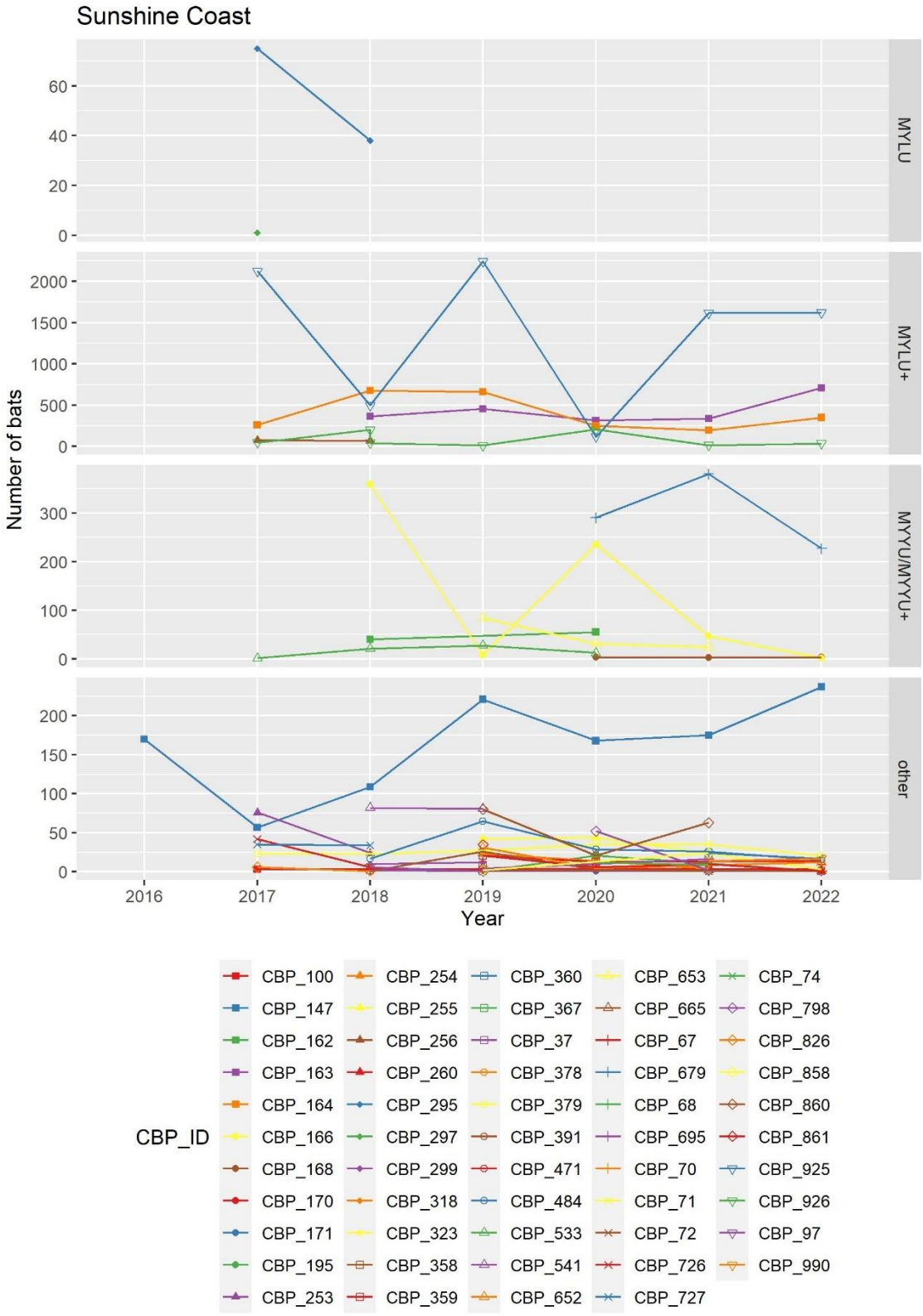


Figure 7. Sunshine Coast Region yearly maximum pre-pup counts.

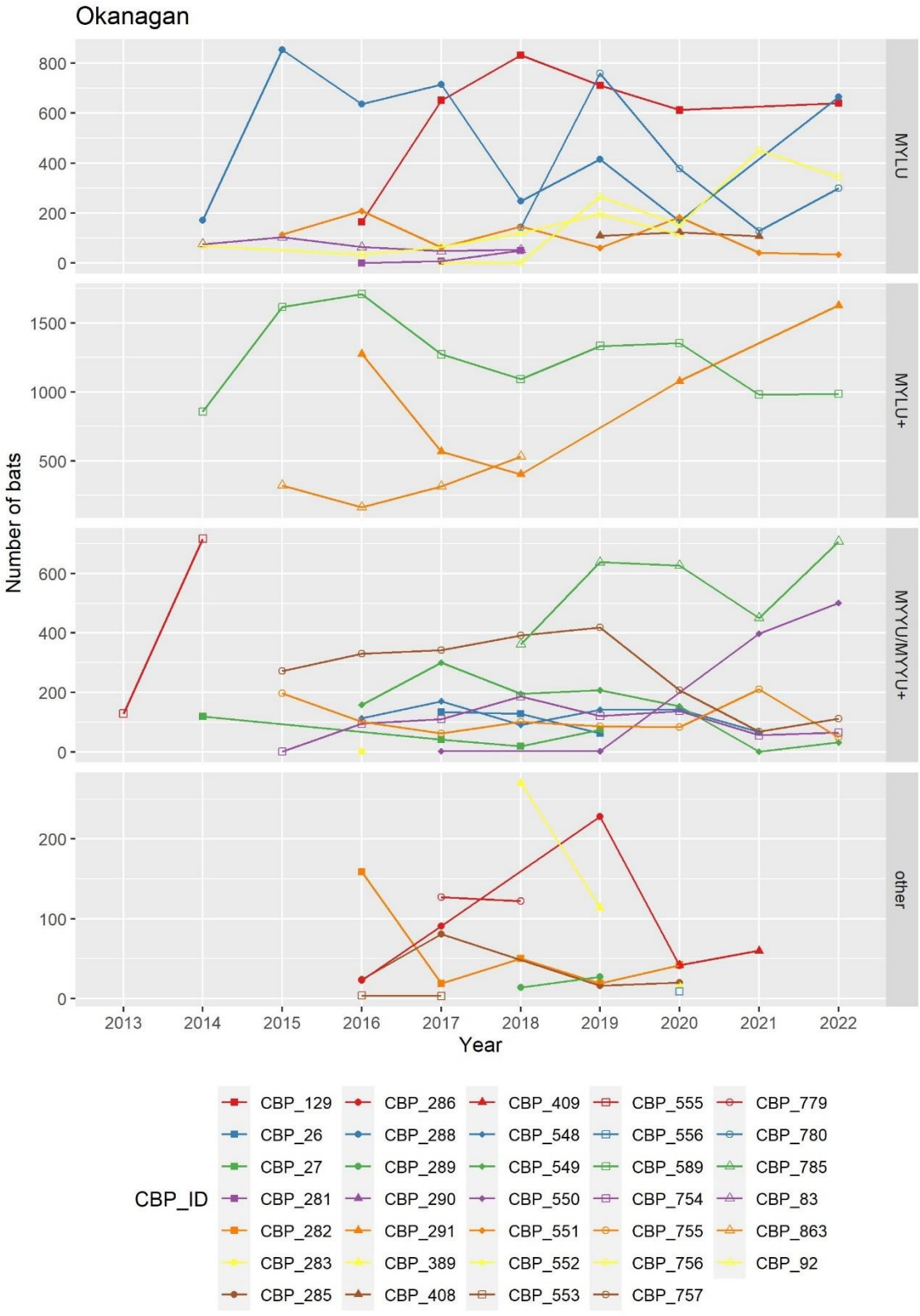


Figure 8. Okanagan Region yearly maximum pre-pup counts.

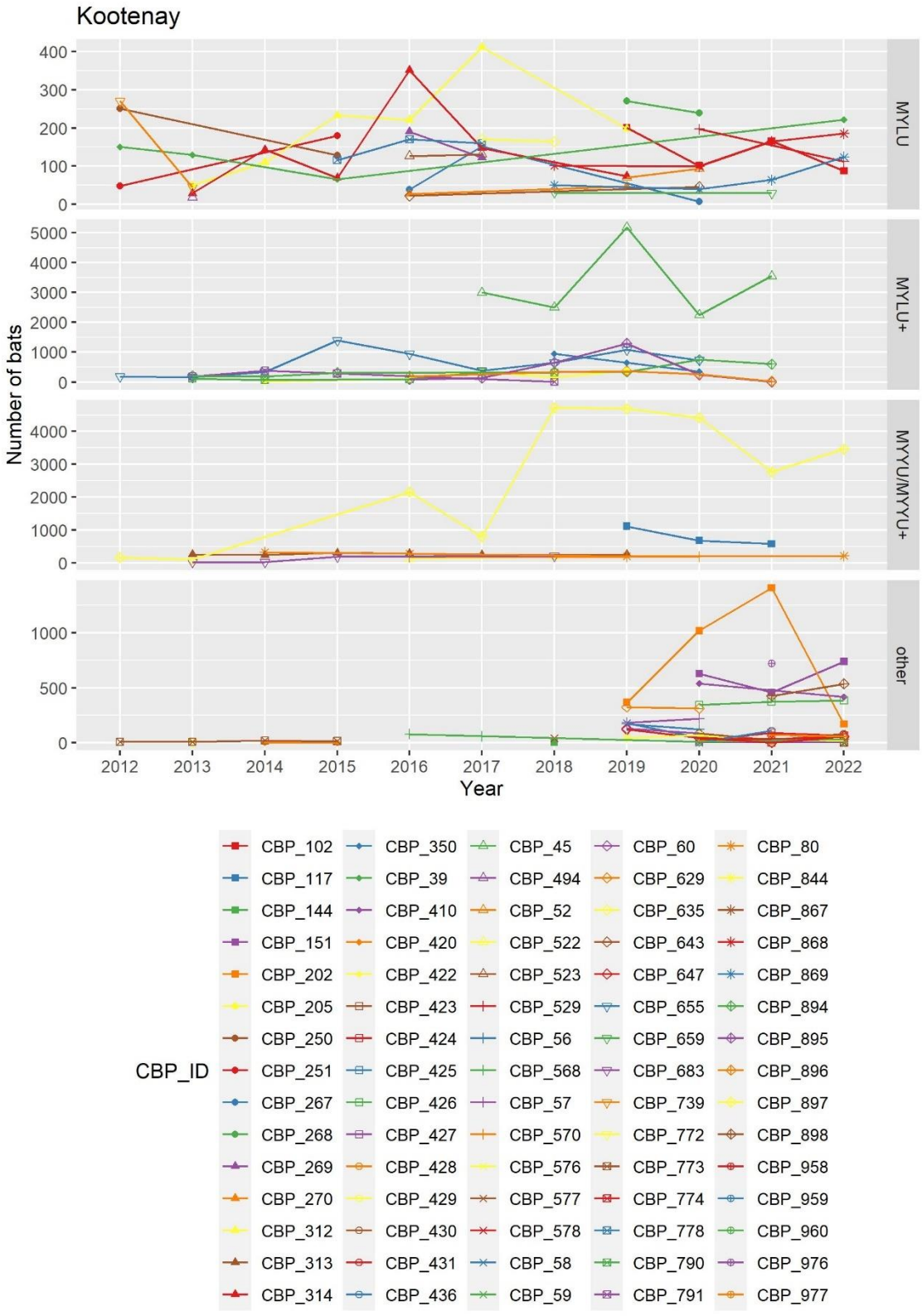


Figure 9. Kootenay Region yearly maximum pre-pup counts.

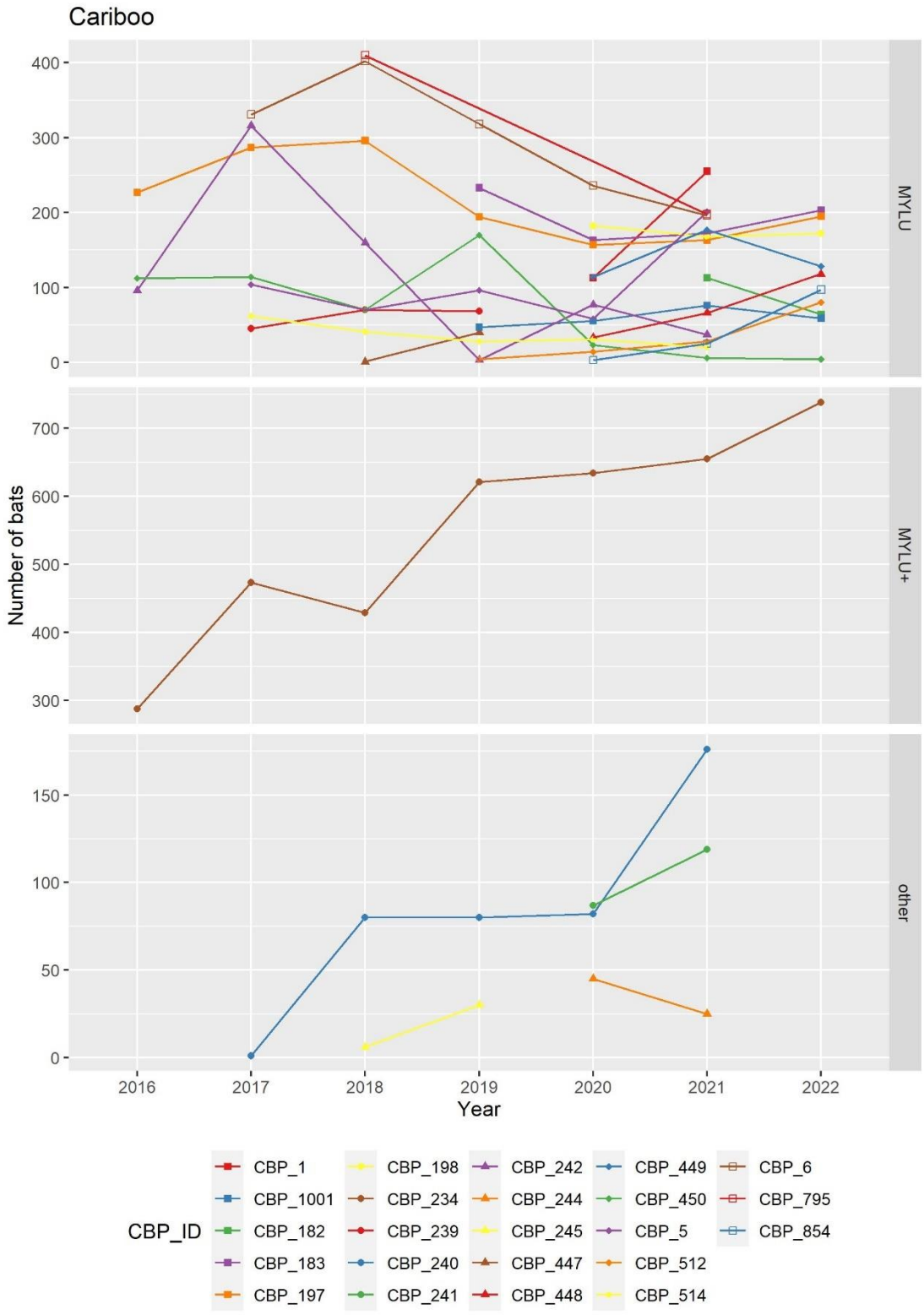


Figure 10. Cariboo Region yearly maximum pre-pup counts.

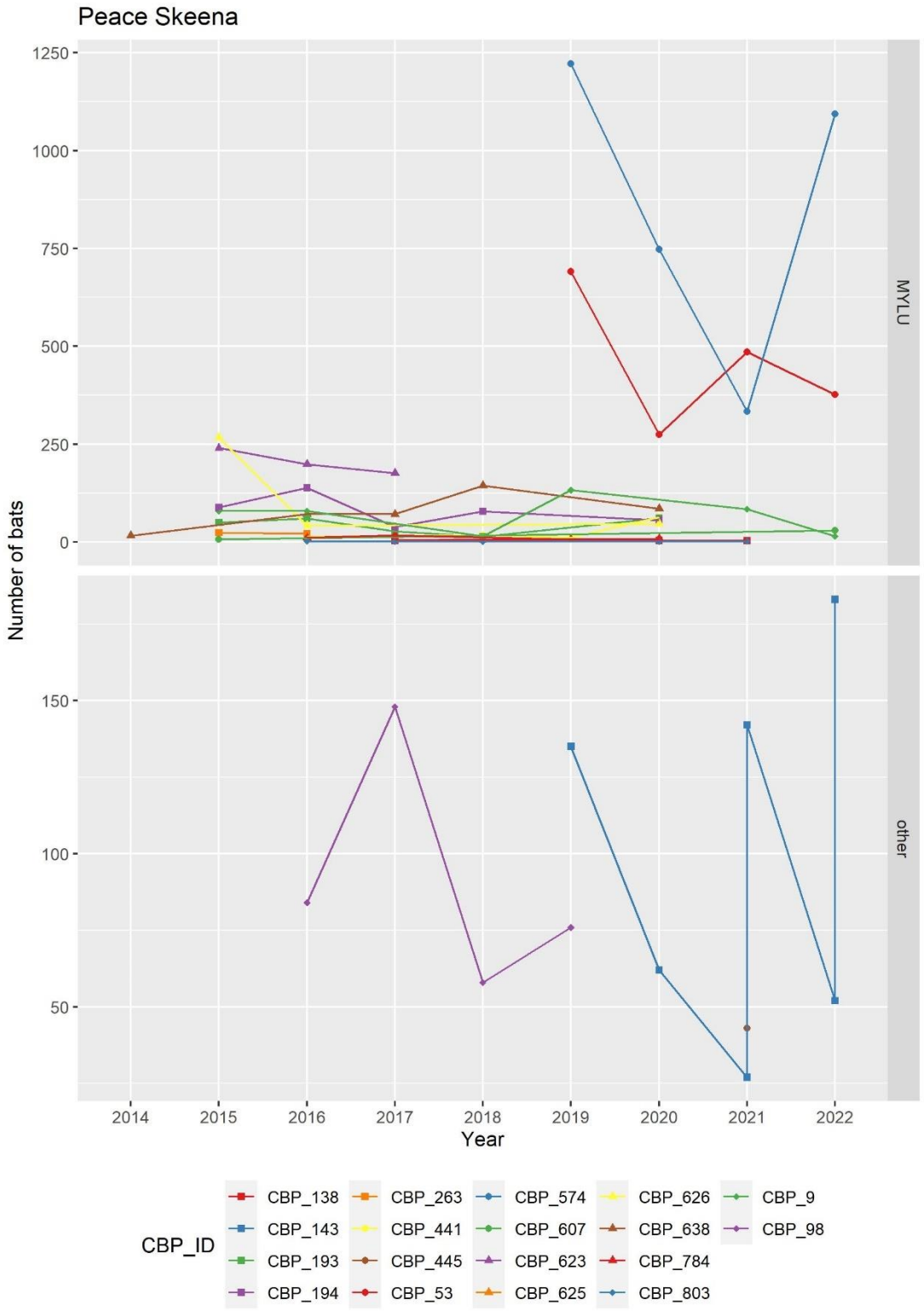


Figure 11. Peace and Skeena Regions yearly maximum pre-pup counts.

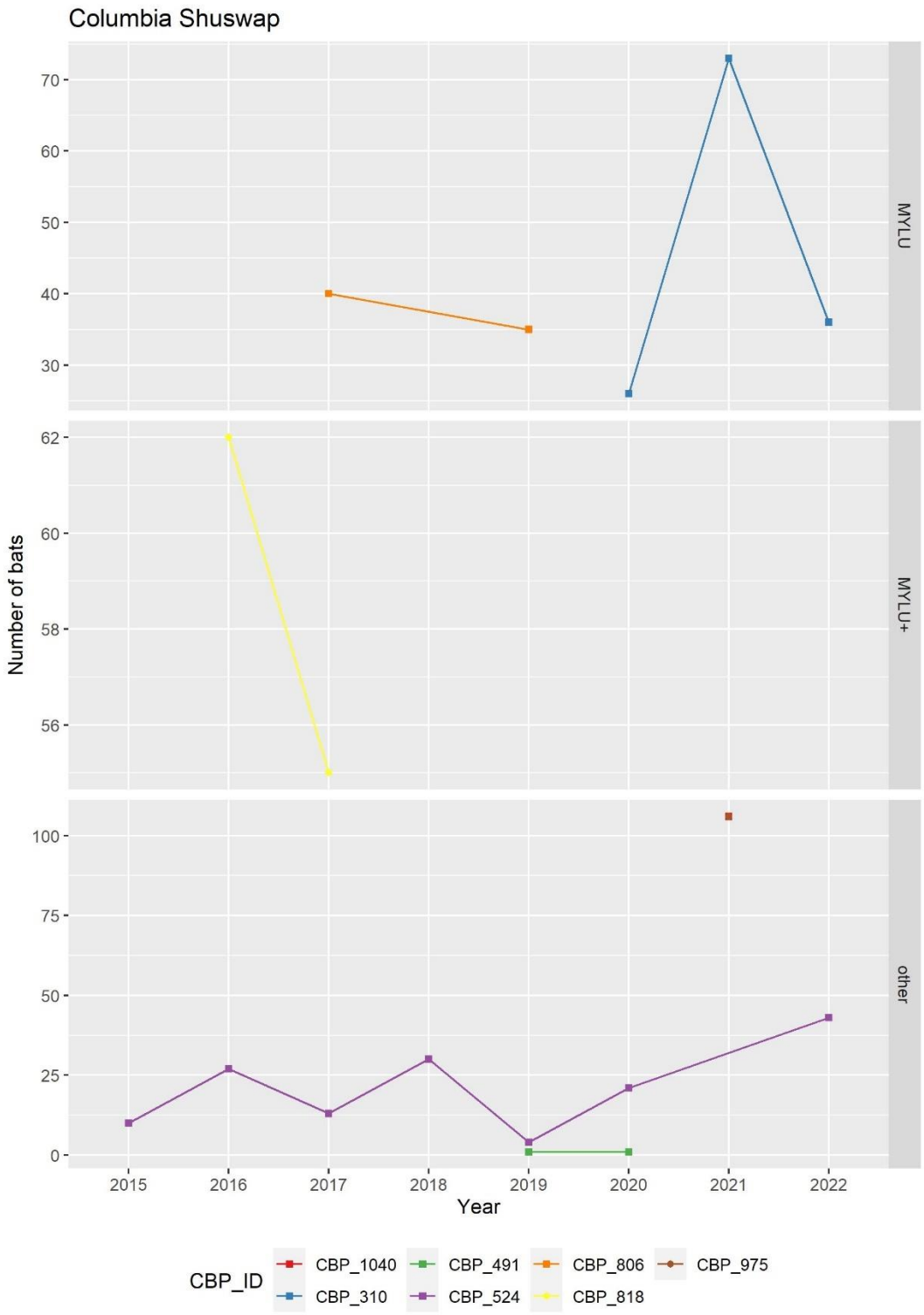


Figure 12. Columbia Shuswap Region yearly maximum pre-pup counts.

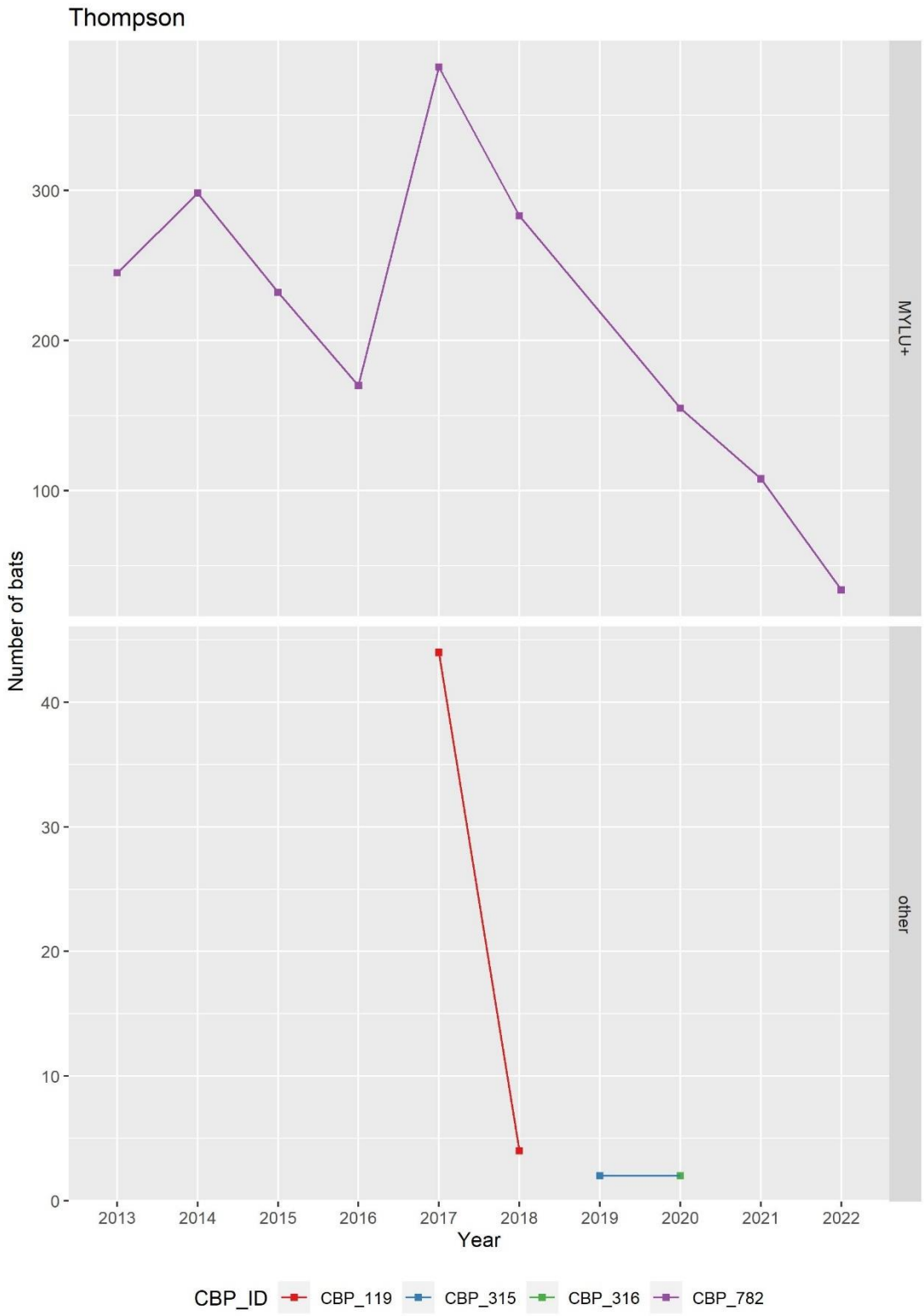


Figure 13. Thompson Region yearly maximum pre-pup counts.

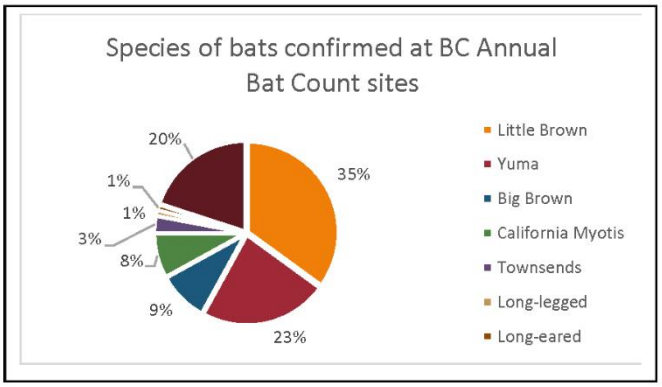
Appendix 2. Sites with declines in 2022.

Table 10. Detail on 16 sites with obvious declines in pre-pup maximum counts in 2022, by region. Grey bands indicate sites with unexplained decreases.

Region	CB_ID	Comment	Summary
Vancouver Island/ Gulf Islands	13	Only 3 years of counts	Normal variation?
	191	First 2 surveys were on cool moist nights in June. First July count abandoned - very little data. Bats returned late July in small numbers	wet June?
	412	Only 1 count in 2022	
	829	Ongoing exclusion	
Lower Mainland	520	Low pre-pup, not sure why- maybe b/c of cold June; post up counts are normal	Post-pup recovery
Sunshine Coast	679	Low pre-pup, not sure why- maybe b/c of cold June; post up counts are normal	Post-pup recovery
Okanagan	551	Okanagan Lak PP. Many roost sites close together – others do not decline. Should look at grouped #s.	Roost complex
	549	Okanagan Lak PP. Many roost sites close together – others do not decline. Should look at grouped #s.	Roost complex
	755	SunOka Provincial Park. Many bat boxes close together – others do not decline. Should look at grouped #s.	Roost complex
	757	SunOka Provincial Park. Many bat boxes close together – others do not decline. Should look at grouped #s.	Roost complex
Kootenay	102	?	
	202	?	
	410	Low pre-pup, not sure why- maybe b/c of cold June; post up counts are normal	Post-pup recovery
	529	Only one count in early June - maybe cold temps impacted?	
Cariboo	183	Low pre-pup, not sure why; post up counts are normal	Post-pup recovery
Cariboo	234	Low pre-pup, not sure why; post up counts are high	Post-pup recovery
Cariboo	795	Only two years of data	Normal variation?
Peace/Skeena	574	Exclusion in progress	Exclusion
Thompson	782	Roost complex in area; other roosts not counted	Roost complex?

Appendix 3. Summary for volunteers

eared Bats, Long-legged Myotis, and Long-eared Myotis. Mixed colonies, with more than one species present, are common. More information about these species can be found on our website or in the Bat-friendly Communities Guide.



There are now **340 sites** where we know the species of bat living there. If you have a roost and do not know what species of bat lives there, you can submit a guano sample following the directions on our Bat Count page, or contact the BC Community Bat Program Coordinator.

Number of species counted: 7

Structures used by bats

Bats roost in many structures, including rocky outcrops and trees with loose bark, cracks, or cavities. The BC Annual Bat Count focuses on bats in human-made structures.

Most monitored roost sites are located in occupied houses (399 sites; 48%) and bat boxes or bat condos (308 sites; 37%). Bat colonies are also monitored in outbuildings/barns, unoccupied houses, and other structures (umbrellas, caves, and bridges).