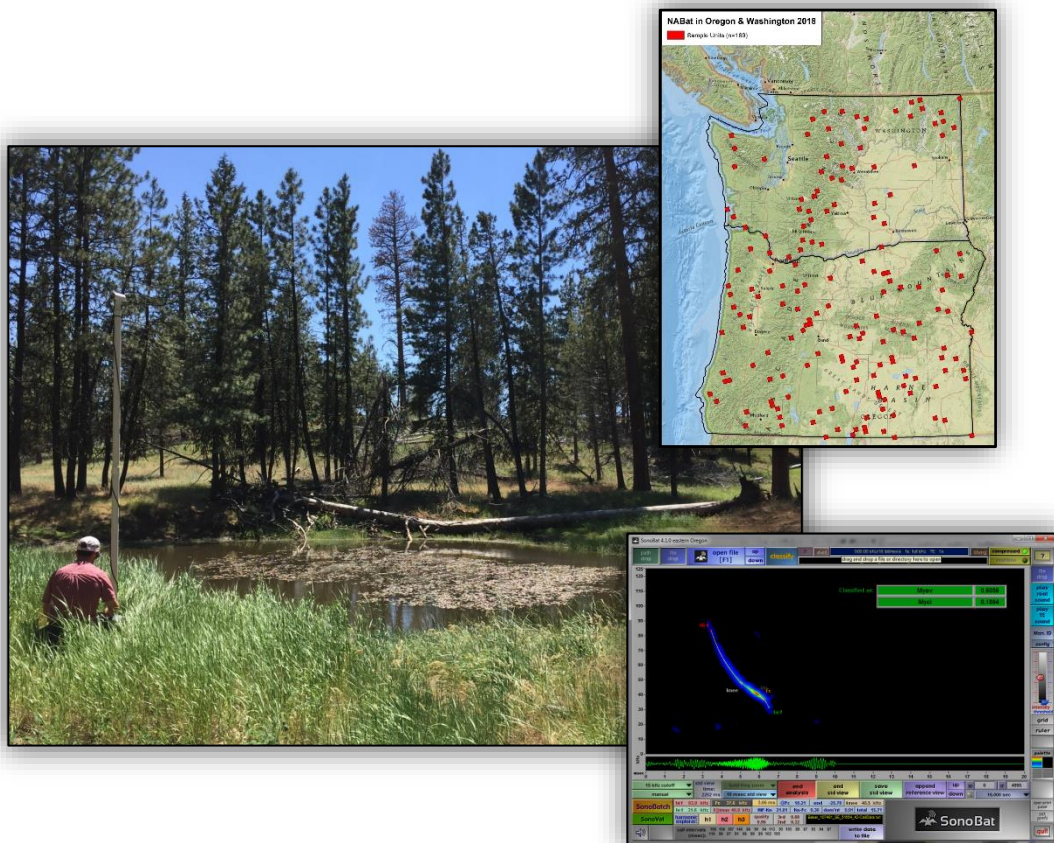

Implementation of the North American Bat Monitoring Program in Oregon and Washington – 2018 Season

ANNUAL PROGRESS REPORT – April 2019



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SUMMARY OF PROJECT ACTIVITIES

Sampling Design & Field Methodology

Building off the successes of the Bat Grid 2.0 pilot effort in 2016 and 2017 in Oregon (Rodriguez 2017), monitoring was continued in 2018 in Oregon with expansion into Washington under the coordination of the Northwestern Hub for Bat Population Research and Monitoring (NW Bat Hub) within the Human and Ecosystem Resiliency and Sustainability (HERS) Lab at Oregon State University-Cascades. The NW Bat Hub was established for highly collaborative and coordinated research and monitoring of bat populations across Oregon, Washington, Northern California, and Idaho. This includes working with interagency partners to spearhead the North American Bat Monitoring Program (NABat) effort in the region. For 2018, the structure of the NW Bat Hub included two co-directors (M. Shinderman and T. Rodhouse), a Hub Coordinator (R. Rodriguez), a GIS Analyst (D. Popp), statistical support (K. Irvine, U.S. Geological Survey [USGS] Northern Rocky Mountain Science Center), and field crew personnel.

For 2018, the NW Bat Hub continued working with agency partners, that is, the Oregon Department of Fish & Wildlife (ODFW), U.S. Forest Service (USFS), U.S. Fish and Wildlife Service (FWS), National Park Service (NPS), and Bureau of Land Management (BLM), to complete surveys in Oregon and initiate surveys in Washington. Within Washington, The Nature Conservancy (TNC) at Moses Coulee Preserve also participated in the effort. Because of the efficiency in obtaining such a robust sample size in 2016 and 2017 and the associated need for testing of statistical analyses, it was agreed among the NW Bat Hub and its partners that the goal for 2018 was to continue surveying within the 103 sample units (SU) previously surveyed in Oregon during the 2017 summer season. Within Washington, the goal was to survey within at least 50 SUs following the NABat GRTS-order list of priority SUs. Due to funding sources and land management needs, the GRTS-order list of SUs surveyed was restricted to lands owned and/or managed by USFS, BLM, FWS, NPS and TNC (Figure 1). To help offset the workload by agency biologists and complete the total number of targeted SUs, with support from agency partners, the NW Bat Hub hired two field crews, that is, one dedicated for Oregon and one for Washington. Each crew consisted of a crew lead and assistant technician.

All monitoring was conducted following the protocol and Standard Operating Procedures (SOPs) outlined in Rodriguez (2017). This protocol and associated SOPs are in the process of being adapted into a larger, comprehensive document that outlines the full details of NABat implementation in the Pacific Northwest (Rodriguez et al. *in process*) and will be formally published in an agency technical publication (e.g., NPS or USGS). The basic protocol is that a single bat detector is deployed at each of four different locations within a single SU to monitor for one full night (15 minutes before sunset to 15 minutes after sunrise) during the period of 1 June through 1 September.

Galvanize Partner Participation

In March 2018, the NW Bat Hub Coordinator reached out to existing agency partners (ODFW, BLM, and USFS) to inquire if they intend to conduct bat monitoring at the same SUs they surveyed at in 2016 and 2017. This correspondence consisted of a draft plan (including the sampling design and field methodology), map of SUs, an Excel file listing details of the SUs, and shapefile of the SUs. Generally, all district biologists who participated in previous years participated in 2018. Seventeen BLM and USFS biologists in both states took on SUs to survey. In other instances, BLM or USFS biologists cooperated with local ODFW District biologists to coordinate monitoring. Jenny Barnett (Inventory & Monitoring Biologist, Mid-Columbia River NWR Complex) coordinated monitoring among FWS biologists on FWS-managed lands. Tara Chestnut (Ecologist, Mount Rainier National Park) coordinated monitoring at national parks within Washington.

In January 2018, Corinna Hanson (Moses Coulee Land Manager, TNC) reached out to T. Rodhouse about the possibility to participating in monitoring. The Bat Hub Coordinator followed up with her and they participated in monitoring in 2018.

In October 2018, Brian Reichert, the National NABat Coordinator provided Mason Scharfe, Natural Resource Specialist with Bonneville Lock and Dam, U.S. Army Corps of Engineers with the contact information for the Bat Hub Coordinator. M. Scharfe was interested in conducting monitoring in the dam area and contributing to the larger effort. The Bat Hub Coordinator discussed possible participation in future (2019) NABat effort in the region. The Coordinator will reach out to him for the 2019 season.

Training of Participants

The Bat Hub Coordinator edited the field manual (which included basics of the sampling design, site selection, detector operation and setup, and the data collection protocol) based on lessons learned during the 2016/2017 pilot study. The Oregon field manual was adapted for use in Washington, which included adding a section on operation and settings for the SM4BAT detector (Wildlife Acoustics, Maynard, MA) since USFS biologists in Washington owned these detectors and wanted to use them. Field manuals were distributed to all participating biologists in May 2018.

Two hands-on training sessions were held for Oregon and Washington participants; one in Washington and one in Oregon. The Washington training was conducted for WA NABat participants at Mount Rainier National Park on May 21, 2019. The Oregon training was held at Oregon State University-Cascades, Bend, OR, on May 24, 2019 for all possible OR NABat participants. Each training session was co-taught by R. Rodriguez (Bat Hub Coordinator), E. Beuttenmuller (Bat Hub OR Crew Lead), and T. Hawkins (Bat Hub WA Crew Lead) and covered basics of the sampling design, site selection, detector operation and setup, and the data collection protocol. Each training session lasted approximately 3 hours and included in-class

instruction and hands-on training (i.e., detector operation and setup) both in- and outdoors. A total of 16 people attended the three sessions (Table 1).

Table 1. Participation in 2018 OR and WA NABat hands-on training sessions.

Agency	Training Location and Date		Total
	Bend, OR May 24, 2018	Mt. Rainier NP, WA May 21, 2018	
BLM	2	0	2
FWS	3	0	3
NPS	0	4	4
ODFW	1	0	1
OSU	2	0	2
Portland State University	1	0	1
TNC	0	1	1
USFS	0	1	1
USGS	0	1	1
Total	9	7	16

Data Collection Protocol

The NW Bat Hub continues to use the NPS Bat Acoustic Database to store all data associated with the Oregon and Washington NABat effort. In the fall 2018, the NW Bat Hub established a partnership with the Computer Science Department at Oregon State University-Cascades to explore converting the NPS Access database into a PostgreSQL web-accessible database. In March 2019, R. Rodriguez and T. Rodhouse traveled to Fort Collins to meet with B. Reichert, the national NABat Coordinator, and NABat information technology support staff to discuss NABat central database improvements and data transfer. Much progress was made to facilitate the sharing of data between the NW Bat Hub and NABat central, this included the future development of a distributed tools, such as a locally-hosted PostgreSQL database and geodatabase that the NW Bat Hub could use to manage field and acoustic data and easily transfer data to NABat central. The NW Bat Hub will continue to work with NABat central to implement these tools in their data management process.

The field datasheet was adapted for 2018 and delivered to all participating biologists in May 2018 before the start of monitoring. During the 2018 season, the NW Bat Hub tested the use of digital data collection technologies, that is, using Survey123, an ESRI ArcGIS product. The standard field datasheet was converted into a Survey123 form (Figure 2) and distributed to NW Bat Hub crews via the Bat Hub Coordinator's ArcGIS Online account and the Survey123 app, which the crews installed on their smart phones. The crews were instructed to complete the Survey123 form while simultaneously completing a paper datasheet as a backup in case of data loss. In general, the use of Survey123 worked seamlessly despite a few lessons learned

like adding the ability to attach photos. The Survey123 form will be updated and distributed to partner agency biologists for use in 2019.

A screenshot of a mobile application window titled 'Survey123 for ArcGIS'. The form is titled 'Bat Acoustic Monitoring Form' and is organized into a 'Location ID' section. It contains several input fields: 'Sample Unit' with a red asterisk and a note '5 or 6 digit Sample Unit ID (otherwise known as CONUS_10KM), e.g., 114143_NW1'; 'Quad' with a red asterisk and a note 'e.g., 114143_NW1'; 'Quad Number' with a red asterisk and a note 'e.g., 114143_NW1'; 'New Site?' with a red asterisk and radio buttons for 'Yes' and 'No'; 'Site Name'; and 'Deployment Date' with a red asterisk. A green checkmark icon is visible at the bottom right of the form.

Figure 2. Screenshot of Survey123 form used to collect field data.

As in 2016 and 2017, the standard data collection protocol was followed. That is, a single datasheet was used for each sample unit and detector (i.e., four datasheets per SU). At the time of detector deployment, the datasheets were filled out and photos were taken of the detector setup. To ensure the recorded acoustic data files were matched to the datasheet of the site, each CompactFlash (CF) memory card was given a unique ID# and the biologist recorded this ID# on the datasheet. Additionally, the detector serial number was recorded on the datasheet. The detector serial number and the date were recorded in the metadata of each recorded audio file (*.wav). This combination of information was used in the quality assurance/quality control (QA/QC) process to ensure audio data were matched to the site at which they were recorded. After monitoring was completed for the specific SU or when the biologist finished monitoring at all targeted SUs, the datasheets were scanned and copied to the memory card from the corresponding detector or emailed directly to the Bat Hub Coordinator. Photo files were either copied to the memory card from the corresponding detector or emailed directly to the Bat Hub Coordinator. The original datasheets were sent to the Bat Hub Coordinator along with the data cards and photos from the completed monitoring session at the individual SU. Before datasheets, photos, and acoustic data were sent, all data was backed up to the local biologist's computer.

Upon receiving the datasheets, field data was entered into the NPS Bats Acoustic Database. Coordinates for new detector locations were converted to NAD83 latitude and longitude decimal degrees and, as a QA/QC step, they were imported into ArcMap to check the accuracy

of these coordinates in reference to site photos and aerial imagery as well as to ensure they fell within the boundaries of the targeted SU.

Issues Encountered

In 2018, detectors at 16 locations did not record any bat calls (i.e., among a total of 583 detector locations). Detectors at 12 of these locations functioned properly but just did not record any actual bat calls, while the other 4 detector locations experienced issues with detector operation. These detector locations were not resurveyed because it is not always possible given the schedule and time commitment of the biologists. Another issue experienced was that one newly selected SU was double-sampled by the OSU OR team and a FS biologist. To remedy this issue for the 2019 season, the Hub Coordinator will work with the FS biologist to determine who will survey this SU.

Analysis of Acoustic Data

Data was initially processed using the Batch File Scrubber function in Sonobat's Data Wizard program (in Sonobat version 4.2.2) to eliminate the most noise files with non-bat sounds while retaining nearly every file containing a bat call. The remaining files were processed with the Attribute Files function in Data Wizard to change the filename to contain the name of the ODFW District (Oregon) or County (Washington), Location ID (Sample Unit number + Quad ID [e.g., NE, NW, SE, SW] + Quad Number [1, 2, 3, etc.]), and the date and time the file was recorded (e.g. Baker_107481_NW-20160621_044400.wav). The NW Bat Hub is in the process of ensuring all data has the consistent file naming convention, that is, all Oregon data will be changed to include the county instead of the ODFW district. Metadata was not added to call files in 2018 given that the central NABat office (USGS, Fort Collins, CO) is formulating a common metadata format. The NW Bat Hub is working with the central NABat office to develop this and incorporate it into the Oregon and Washington data.

Depending on the location of the SU (and the associated species assemblages), call files were either auto-classified with the western Oregon, eastern Oregon, western Washington, or eastern Washington classifiers within Pacific Northwest classifier set in the SonoBatch function of Sonobat. Possible species assemblages per SU were determined by overlaying GIS layers of species distributions with a layer of the SUs. This was specific for Mexican free-tailed bats (range map obtained from the IUCN Redlist of Threatened Species [2016] and included records from Smith and Waldien [1999]), pallid bats, western small-footed myotis, canyon bats, and spotted bats (range maps for these four species were obtained from T. Rodhouse [Rodhouse et al. 2015]). All other species are considered to occur throughout Oregon and Washington. The default settings were used in SonoBatch and species classifications were appended to the filename. The SonoVet function within Sonobat was used to manually review at least 1-2 call files that could be confidently classified to each possible species per detector location and per night. This was the process for most species, but for rarer species (e.g., pallid bat and Mexican free-tailed bat), typically all call files that were classified to these species were reviewed. Files with species classifications for species found outside of their known

range were also reviewed. After reviewing all pertinent files, the vetting table was exported for upload into the NPS Bat Acoustic Database.

Project Dissemination and Outreach

In February 2018, the Bat Hub Coordinator attended the California Bat Working Group Meeting to inform potential California partner agencies of the Bat Hub's role in coordinating NABat in the Pacific Northwest and to discuss possible participation in a California NABat effort. In February 2018, members of the Bat Hub attended the Joint Meeting of the Oregon and Washington Chapters of the Wildlife Society and the Bat Hub Coordinator gave a presentation on updated results of 2017 monitoring and related occupancy modeling results based on analysis of original Bat Grid data and 2016/2017 monitoring. In May 2018, the Bat Hub Partner statisticians, Kathi Irvine (USGS-Northern Rocky Mountain Science Center) and Katie Banner (Montana State University), presented a webinar ("Bats and Stats") on statistical methods and research/development being employed using Oregon NABat data. In May 2018, the Bat Hub Coordinator participated in the Southwest Native American Workshop on Bats hosted by the USGS, US Bureau of Indian Affairs, and the Pueblo of Santa Ana Tribe of the Tamaya Nation by giving a presentation on bat acoustic monitoring techniques and best practices. Because of participating in this workshop, the Bat Hub Coordinator seeks to initiate a similar workshop in the Northwest. In June 2018, the Bat Hub Co-Director and Coordinator attended the White-nose Syndrome National Meeting in Tacoma, Washington and gave presentations on the operation of the Bat Hub as an example of implementing NABat and the occupancy modeling results of the Oregon NABat effort.

In October 2018, T. Rodhouse (Bat Hub Co-Director) presented a webinar for the National Park Service's Connected Conservation Program on the role of the Bat Hub in implementing NABat in the region. On October 12, 2018, the NW Bat Hub hosted the NW Bat Hub Partnership Annual Meeting at the Edith Green Wendall Wyatt Federal Building in Portland, Oregon. This meeting was held to bring together the partners to discuss the vision of the Bat Hub, the current year's accomplishments, and future goals. In attendance were Ray Dodd (ODFW), Josh Chapman (USFS), Kelli Van Norman (BLM), Kevin Kilbride (FWS), Jenny Barnett (FWS), Rita Dixon (Idaho Fish and Game), Brian Reichert (USGS), Alice Chung-MacCoubrey (NPS), Allen Calvert (NPS), Stacey Ostermann-Kelm (NPS), Tara Chestnut (NPS), Bronwyn Hogan (FWS), Scott Osborn (California Department of Fish and Wildlife), Ted Weller (USFS), Linda Angerer (USFS), and from the Bat Hub: Roger Rodriguez (OSU), Tom Rodhouse (NPS), Matt Shinderman (OSU), and Trent Hawkins (OSU). The Bat Hub Coordinator planned to attend the North American Society for Bat Research meeting in October 2018 and present on the Bat Hub and the results of the Oregon NABat effort, but a hurricane caused flight cancellations and prevented attendance. In February 2019, the Bat Hub Coordinator attended the first meeting of the Oregon Bat Working Group (ORBWG). At this meeting, it was discussed how the ORBWG would be structured and how it would function as an informational exchange among members. A Co-Director attended the Oregon Chapter of the Wildlife Society annual meeting and gave a presentation on updated results of the Oregon

and Washington NABat effort based on 2018 monitoring. The Bat Hub Coordinator planned to attend the Washington Chapter of the Wildlife Society annual meeting to present results of the 2018 Oregon and Washington NABat effort and attempt to garner more participation in the Washington NABat effort.

In May 2018, Bat Hub personnel and partners published a manuscript using the Oregon NABat data to explore contingencies in occupancy modeling analyses (“Improving geographically-extensive acoustic survey designs for modeling species occurrence with imperfect detection and misidentification”, *Ecology and Evolution*). Bat Hub personnel and partners published another manuscript using the Oregon NABat data to explore the incorporation of probability (i.e., the NABat GRTS order) and non-probability surveys (i.e., the original Bat Grid selection process) (“Occupancy modeling species-environment relationships with non-ignorable sampling designs”, *Ecological Applications*).

Currently, Bat Hub personnel and partners submitted a manuscript to the *Journal of Applied Ecology* describing comparisons of occupancy modeling results between the original Bat Grid and the current NABat. The manuscript findings will be distributed after acceptance.

ACOUSTIC MONITORING RESULTS

Final Sampling Design

2016 Field Season – A total of 169 SUs were surveyed during the period of June 2018 to September 2018 (Table 2, Figure 2). Of these, 112 SUs were in Oregon, 53 SUs were in Washington, and four SUs occurred along the Oregon and Washington. SUs were categorized as either following the NABat selection method (i.e., GRTS) or the legacy Bat Grid method (i.e., Legacy). Those classified as ‘GRTS-Additional’ were not typically among the first 100 GRTS-ordered cells. Within Washington, the majority of SUs followed GRTS-ordering within USFS managed lands (i.e., GRTS-FS). During the survey of these SUs, 1 SU was unintentionally surveyed while targeting a GRTS-ordered SU (i.e., denoted with ‘Accidental’ below). Either this occurred because of a mistake in locating the boundary of the targeted SU or not identifying suitable bat habitat within the targeted SU. Those denoted as ‘Legacy-Additional’ were SUs not selected following GRTS order but happen to be surveying during the legacy Bat Grid.

Table 2. Number of sample units surveyed during the 2018 NABat effort in Oregon and Washington and surveyed by which agency/organization.

State	Sample Unit Categories	BLM	BLM, ODFW	FWS	NPS	ODFW	OSU	TNC	USFS	Total
OR	GRTS	6	1	1		27	23		3	61
	GRTS-Accidental	1								1
	GRTS-Additional	1		5		2	1		1	10
	Legacy	8				22	4		1	35
	Legacy - Additional	1		2					2	5
OR/WA	GRTS			1		1				2
	GRTS-Additional			2						2
WA	GRTS	2		1	3		5		8	19
	GRTS-Additional			8	2			1	1	12
	GRTS-FS						20		2	22
Total		19	1	20	5	52	53	1	18	169

Acoustic Data

More than 417,000 audio files were recorded. Filtering using the Batch File Scrubber function in Data Wizard (Sonobat) resulted in a total of 122,665 call files potentially containing bat passes. Auto-classifying call files with Sonobat resulted in a total of 27,188 files receiving an identification. A total of 7,519 call files were manually reviewed. All 15 species known to occur in the two states were documented (Table 3). Among species with a statewide distribution, *Lasionycteris noctivagans* appeared most frequently among SUs, followed by *Myotis lucifugus*, *Myotis evotis*, and *Myotis californicus*. Among species with a limited distribution in the state, *Myotis ciliolabrum* appeared most frequently among SUs, followed by *Antrozous pallidus*, *Parastrellus hesperus*, and *Tadarida brasiliensis*.

Table 3. Number of sample units each species was documented in and by state.

Common Name	Species Name	2018 - No. of SUs			
		OR	OR/WA	WA	Total
Pallid bat	<i>Antrozous pallidus</i>	13	0	2	15
Townsend's big-eared bat	<i>Corynorhinus townsendii</i>	4	0	6	10
Big brown bat	<i>Eptesicus fuscus</i>	68	1	34	103
Spotted bat	<i>Euderma maculatum</i>	8	0	3	11
Hoary bat	<i>Lasiurus cinereus</i>	63	1	41	105
Silver-haired bat	<i>Lasionycteris noctivagans</i>	96	3	50	149
California myotis	<i>Myotis californicus</i>	71	1	36	108
Western small-footed myotis	<i>Myotis ciliolabrum</i>	52	0	13	65
Western long-eared myotis	<i>Myotis evotis</i>	77	0	39	116
Little brown bat	<i>Myotis lucifugus</i>	75	3	43	121
Fringed myotis	<i>Myotis thysanodes</i>	24	0	13	37
Long-legged myotis	<i>Myotis volans</i>	43	0	18	61
Yuma myotis	<i>Myotis yumanensis</i>	51	1	30	82
Canyon bat	<i>Parastrellus hesperus</i>	11	0	3	14
Mexican free-tailed bat	<i>Tadarida brasiliensis</i>	5	0	0	5

SPECIES OCCURRENCE SUMMARIES

Antrozous pallidus

Antrozous pallidus was acoustically documented at 26 SUs during 2016 and/or 2017 and at 15 SUs during 2018 (Figure 2). This species was documented at 10 SUs in 2018 that it was previously documented at in 2016 and/or 2017. Occurrences in Oregon and Washington from 2018 fall within the known range of *A. pallidus* which is assumed to encompass all or portions of the Rogue, Applegate, Umpqua, and Willamette Valleys and most regions east of the Cascade Range (Rodhouse et al. 2015).

Corynorhinus townsendii

Corynorhinus townsendii was acoustically documented at 14 SUs during 2016 and/or 2017 and at 10 SUs during 2018 (Figure 3). This species was documented at 2 SUs in 2018 that it was previously documented at in 2016 and/or 2017. Occurrences from 2018 fall within the known range of *C. townsendii* which is assumed to include the entire states of Oregon and Washington (Rodhouse et al. 2015).

Eptesicus fuscus

Eptesicus fuscus was acoustically documented at 82 SUs during 2016 and/or 2017 and at 103 SUs during 2018 (Figure 4). This species was documented at 51 SUs in 2018 that it was

previously documented at in 2016 and/or 2017. Occurrences from 2018 fall within the known range of *E. fuscus* which is assumed to include the entire states of Oregon and Washington (Rodhouse et al. 2015).

Euderma maculatum

Euderma maculatum was acoustically documented at 10 SUs during 2016 and/or 2017 and at 11 SUs during 2018 (Figure 5). This species was documented at 7 SUs in 2018 that it was previously documented at in 2016 and/or 2017. Occurrences from 2018 fall within the known range of *E. maculatum* which is assumed to encompass the portion of Oregon and Washington east of the Cascade Range (Rodhouse et al. 2015). One exception was a new documented record at a SU in Lewis County, Washington that is ~20 kilometers from the edge of the known range. *Euderma maculatum* produce calls that are highly distinguishable from other species in the region (i.e., within a low frequency range [~8-16 kHz] at which no other species produces a consistent search phase call sequence), thus resulting in a high reliable occurrence of this species in this area.

Lasiurus cinereus

Lasiurus cinereus was acoustically documented at 87 SUs during 2016 and/or 2017 and at 105 SUs during 2018 (Figure 6). This species was documented at 51 SUs in 2018 that it was previously documented at in 2016 and/or 2017. Occurrences from 2018 fall within the known range of *L. cinereus* which is assumed to include the entire states of Oregon and Washington (Rodhouse et al. 2015).

Lasionycteris noctivagans

Lasionycteris noctivagans was acoustically documented at 109 SUs during 2016 and/or 2017 and at 149 SUs during 2018 (Figure 7). This species was documented at 82 SUs in 2018 that it was previously documented at in 2016 and/or 2017. Occurrences from 2018 fall within the known range of *L. noctivagans* which is assumed to include the entire states of Oregon and Washington (Rodhouse et al. 2015).

Myotis californicus

Myotis californicus was acoustically documented at 92 SUs during 2016 and/or 2017 and at 108 SUs during 2018 (Figure 8). This species was documented at 58 SUs in 2018 that it was previously documented at in 2016 and/or 2017. Occurrences from both years fall within the known range of *M. californicus* which is assumed to include the entire states of Oregon and Washington (Rodhouse et al. 2015).

Myotis ciliolabrum

Myotis ciliolabrum was acoustically documented at 60 SUs during 2016 and/or 2017 and at 65 SUs during 2018 (Figure 9). This species was documented at 40 SUs in 2018 that it was previously documented at in 2016 and/or 2017. Occurrences from 2018 fall within the known

range of *M. ciliolabrum* which is assumed to encompass the portion of Oregon and Washington east of the Cascade Range (Rodhouse et al. 2015).

Myotis evotis

Myotis evotis was acoustically documented at 85 SUs during 2016 and/or 2017 and at 116 SUs during 2018 (Figure 10). This species was documented at 58 SUs in 2018 that it was previously documented at in 2016 and/or 2017. Occurrences from 2018 fall within the known range of *M. evotis* which is assumed to include the entire states of Oregon and Washington (Rodhouse et al. 2015).

Myotis lucifugus

Myotis lucifugus was acoustically documented at 94 SUs during 2016 and/or 2017 and at 121 SUs during 2018 (Figure 11). This species was documented at 63 SUs in 2018 that it was previously documented at in 2016 and/or 2017. Occurrences from 2018 fall within the known range of *M. lucifugus* which is assumed to include the entire states of Oregon and Washington (Rodhouse et al. 2015).

Myotis thysanodes

Myotis thysanodes was acoustically documented at 37 SUs during 2016 and/or 2017 and at 37 SUs during 2018 (Figure 12). This species was documented at 14 SUs in 2018 that it was previously documented at in 2016 and/or 2017. Occurrences from 2018 fall within the known range of *M. thysanodes* which is assumed to include the entire states of Oregon and Washington (Rodhouse et al. 2015).

Myotis volans

Myotis volans was acoustically documented at 74 SUs during 2016 and/or 2017 and at 61 SUs during 2018 (Figure 13). This species was documented at 30 SUs in 2018 that it was previously documented at in 2016 and/or 2017. Occurrences from 2018 fall within the known range of *M. volans* which is assumed to include the entire states of Oregon and Washington (Rodhouse et al. 2015).

Myotis yumanensis

Myotis yumanensis was acoustically documented at 70 SUs during 2016 and/or 2017 and at 82 SUs during 2018 (Figure 14). This species was documented at 44 SUs in 2018 that it was previously documented at in 2016 and/or 2017. Occurrences from 2018 fall within the known range of *M. yumanensis* which is assumed to include the entire states of Oregon and Washington (Rodhouse et al. 2015).

Parastrellus hesperus

Parastrellus hesperus was acoustically documented at 16 SUs during 2016 and/or 2017 and at 14 SUs during 2018 (Figure 15). This species was documented at 9 SUs in 2018 that it was previously documented at in 2016 and/or 2017. Occurrences from 2018 fall within the known range of *P. hesperus* which is assumed to encompass the portion of Oregon and Washington east of the Cascade Range (Rodhouse et al. 2015).

Tadarida brasiliensis

Tadarida brasiliensis was acoustically documented at 18 SUs during 2016 and/or 2017 and at 5 SUs during 2018 (Figure 16). This species was documented at 2 SUs in 2018 that it was previously documented at in 2016 and/or 2017. Occurrences from 2018 fall within the known range of *T. brasiliensis* which is assumed to encompass the southwestern portion of Oregon (IUCN 2016; Smith and Waldien 1999). The exception is two occurrences documented in 2016 that fall outside of the known range (in the Deschutes District) and may represent vagrant records. The call files that established these occurrences exhibited strong characteristics of the echolocation calls of *T. brasiliensis* (i.e., upswing at beginning of call and downswing at end of the call). No suspect calls at these same SUs were documented in 2017 or 2018. It should be noted that acoustic records should not be solely used to expand the range of a species and rather a capture is required for confirmation of presence.

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- Rodriguez, R.M. 2017. ODFW Bat Monitoring Framework – Bat Grid 2.0 2016 and 2017 Pilot Study. Final Report – December 2017. 71 pp.
- Smith, G.M. and D.L. Waldien. 1999. First records of Brazilian free-tailed bats (*Tadarida brasiliensis*) in the Willamette Valley, Oregon. *Northwestern Naturalist* 80:113-114.

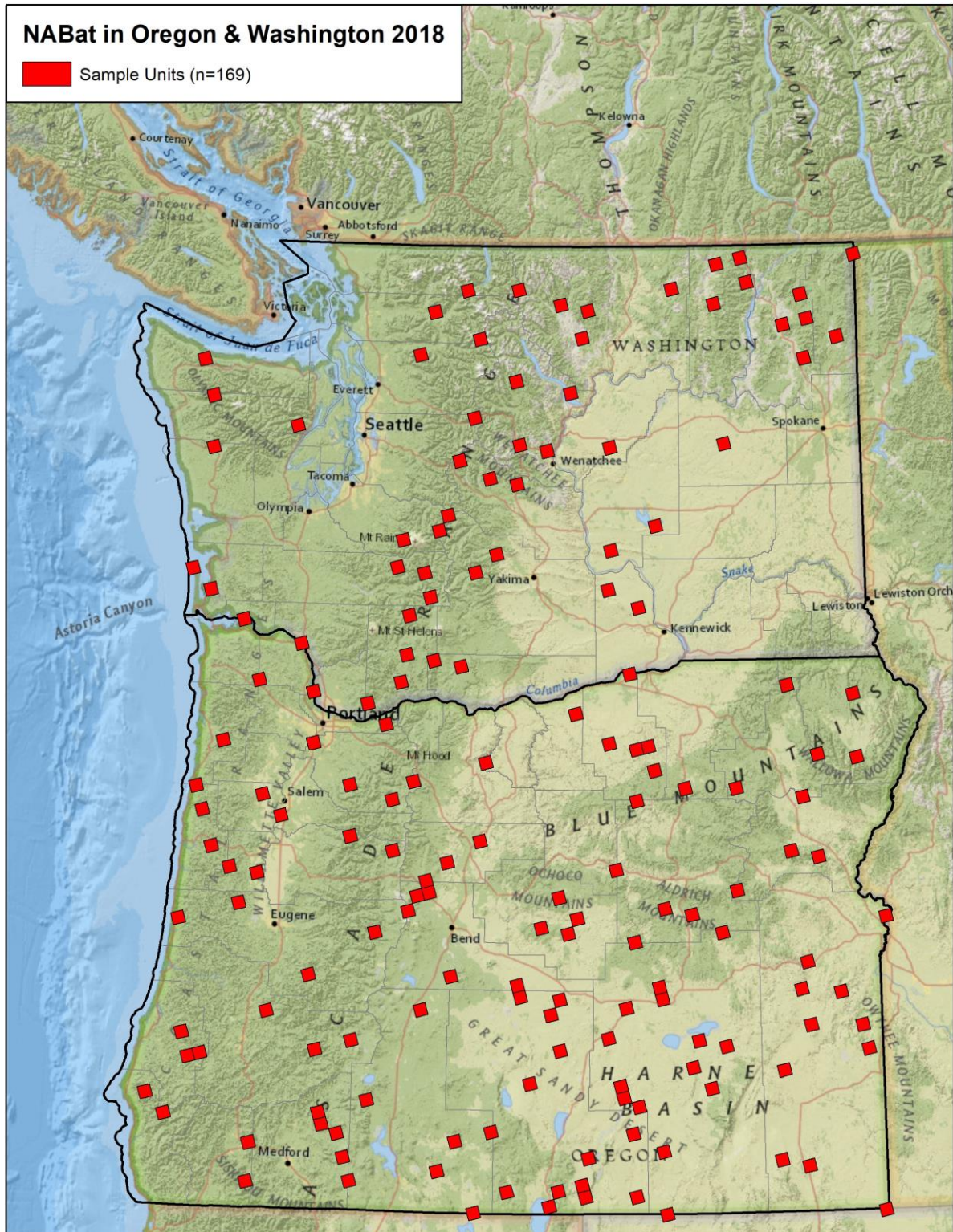


Figure 1. Sample Units (n=169) surveyed during the 2018 NABat effort in Oregon and Washington.

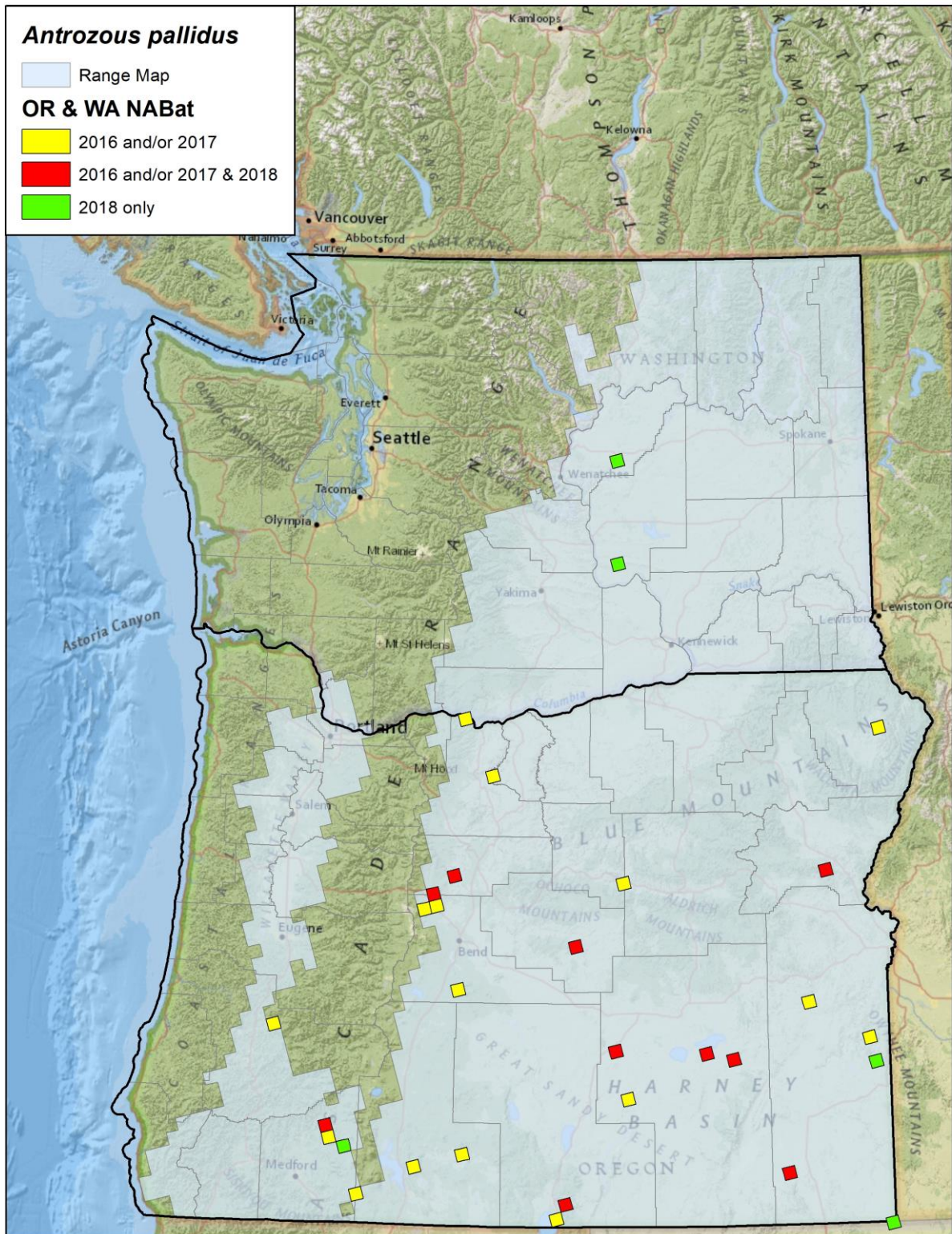


Figure 2. NABat occurrences of *Antrozous pallidus*.

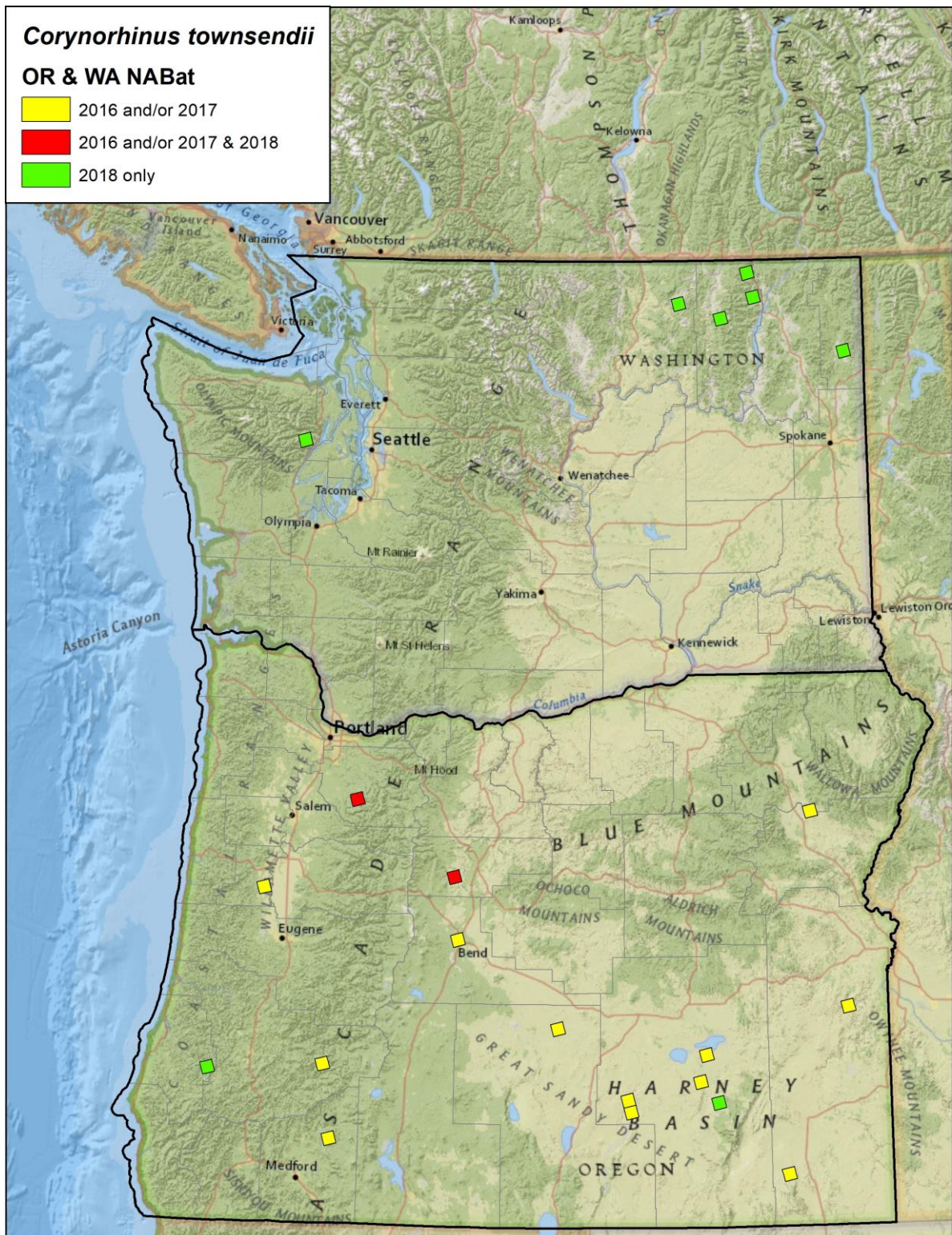


Figure 3. NABat occurrences of *Corynorhinus townsendii*.

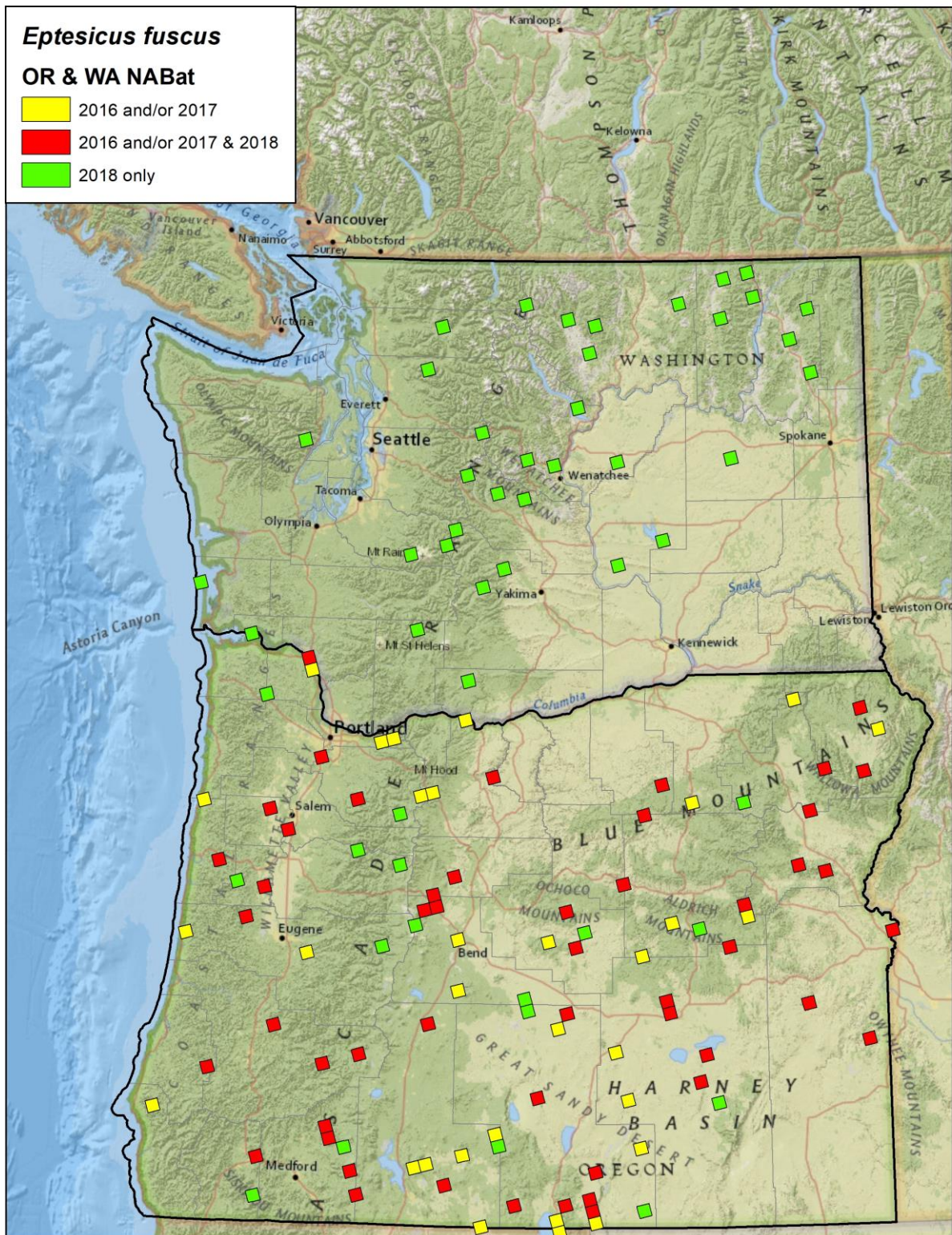


Figure 4. NABat occurrences of *Eptesicus fuscus*.

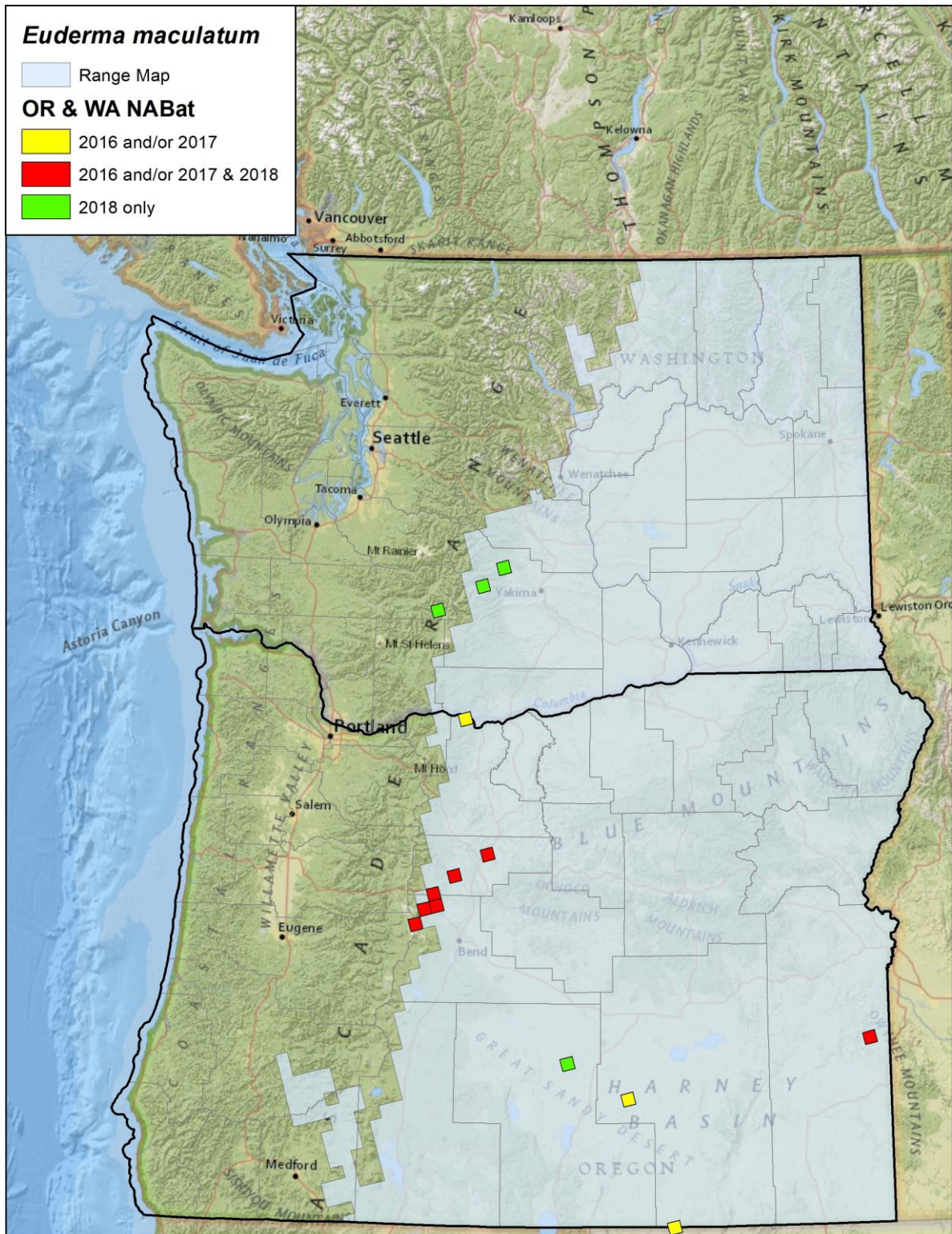


Figure 5. NABat occurrences of *Euderma maculatum*.

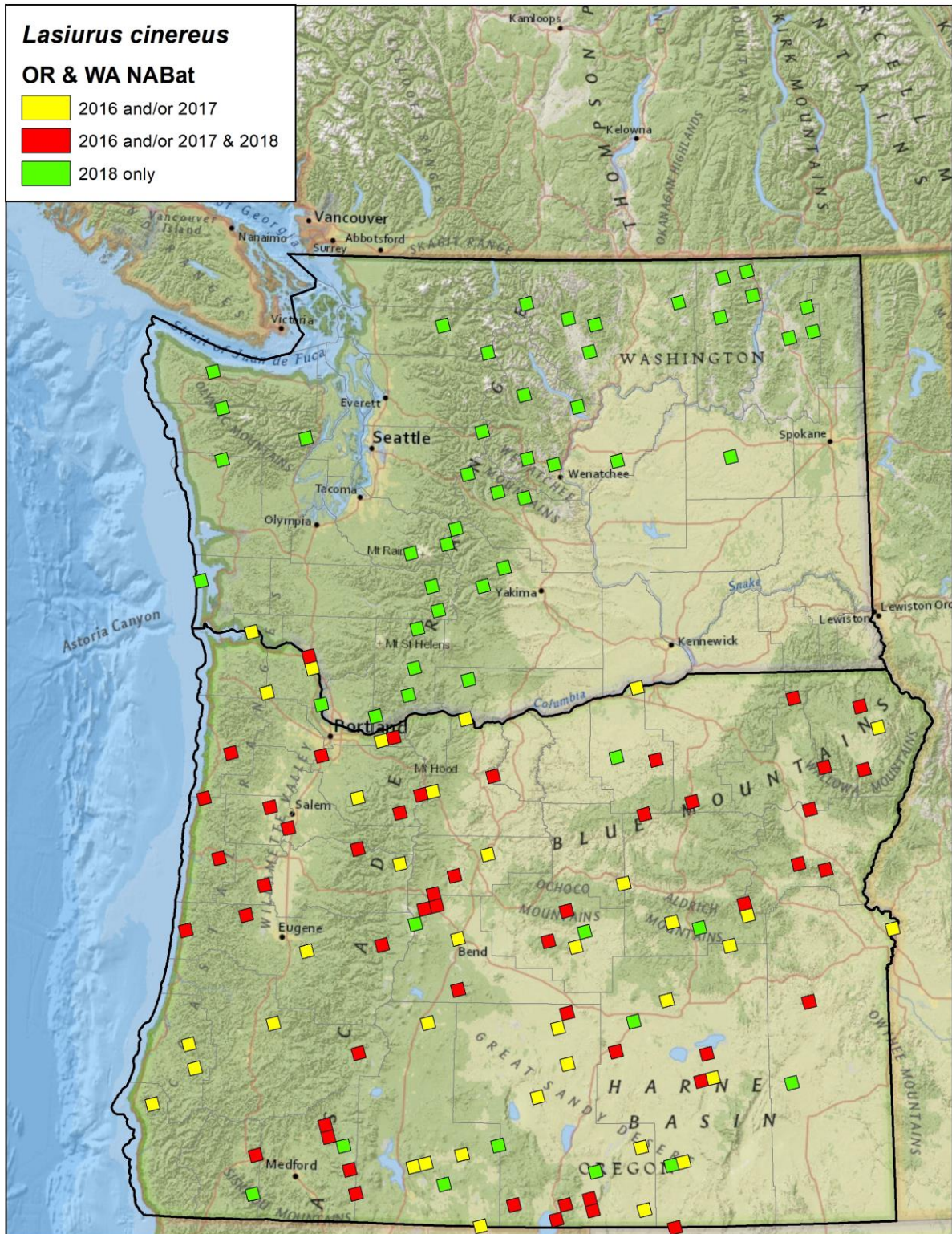


Figure 6. NABat occurrences of *Lasiurus cinereus*.

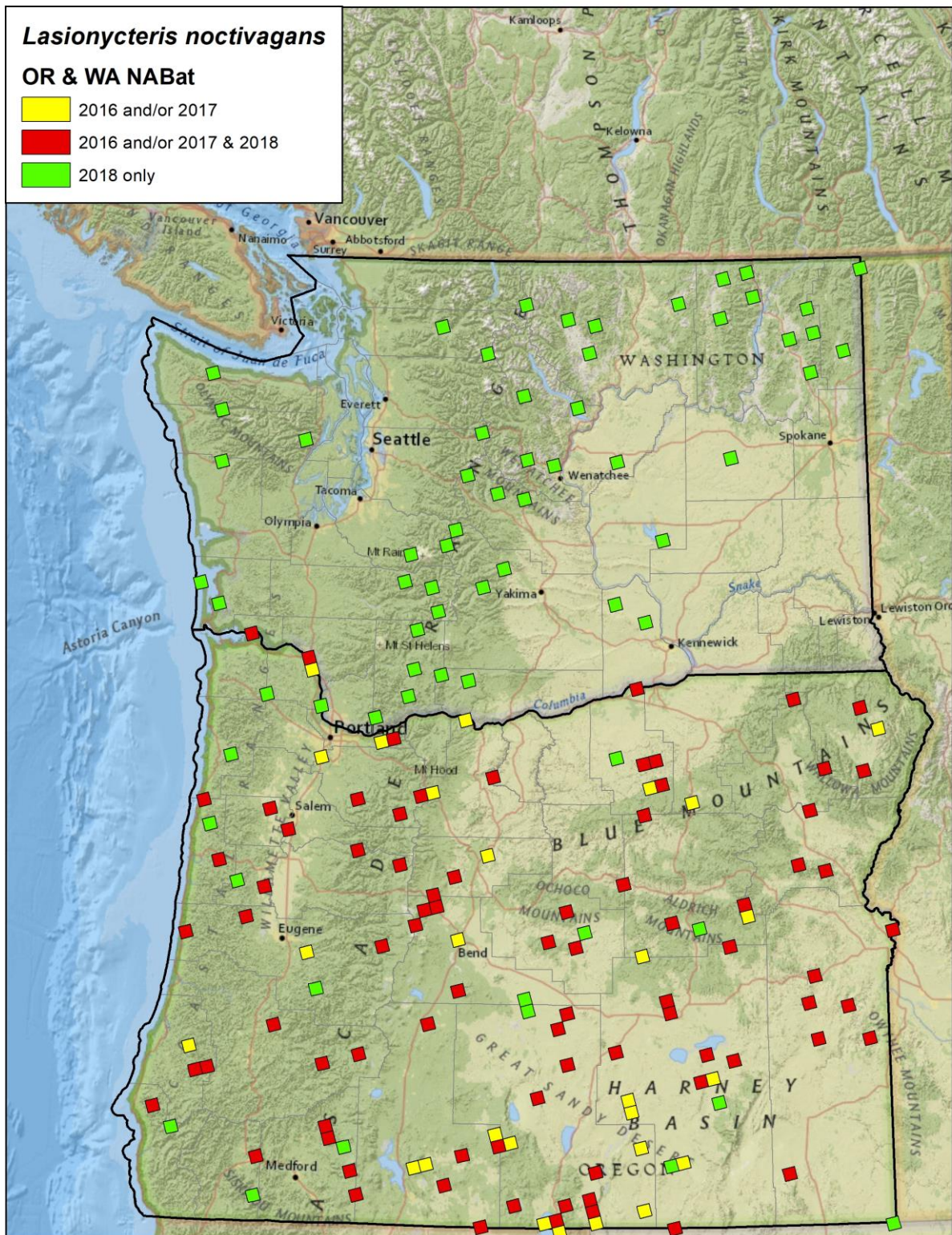


Figure 7. NABat occurrences of *Lasionycteris noctivagans*.

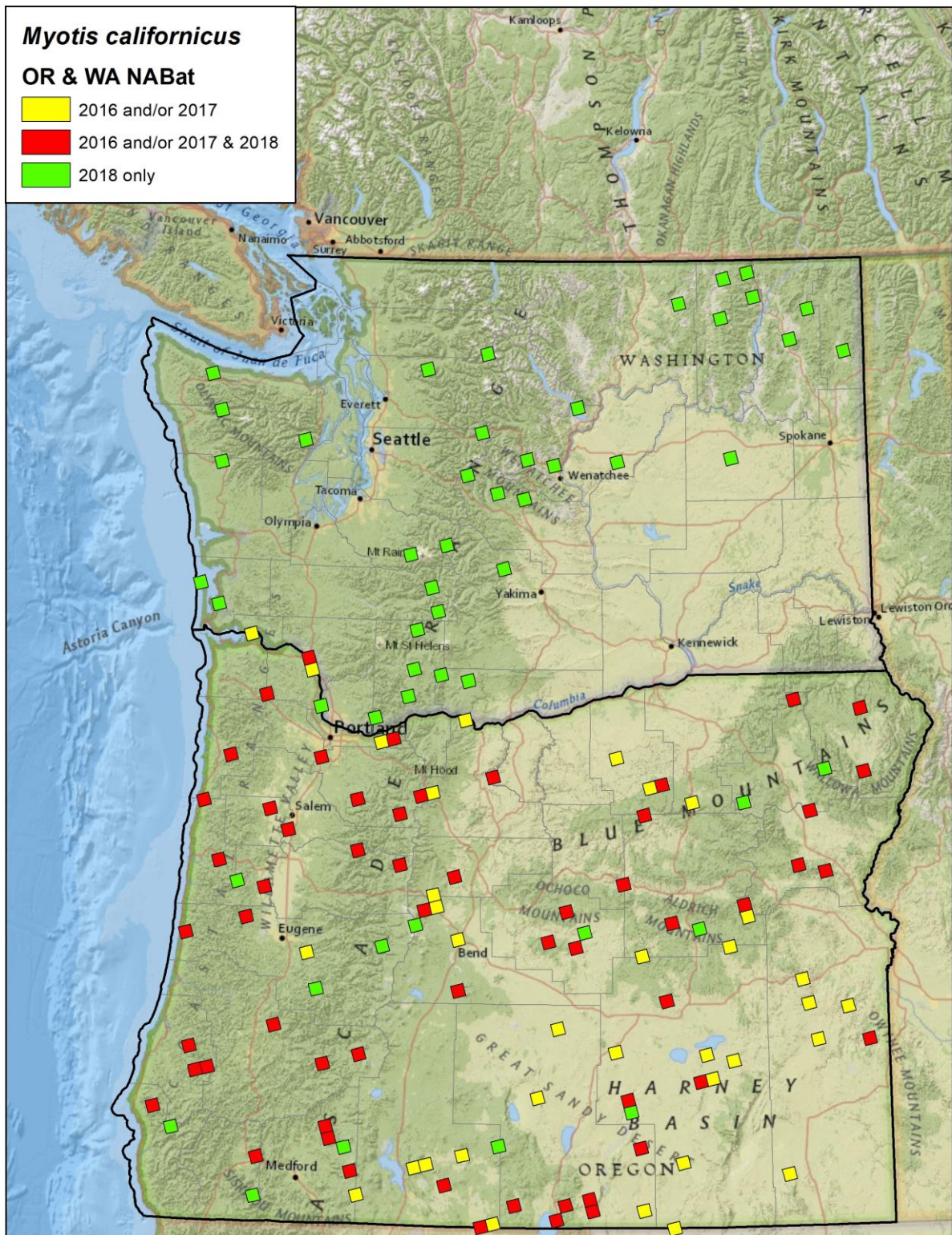


Figure 8. NABat occurrences of *Myotis californicus*.

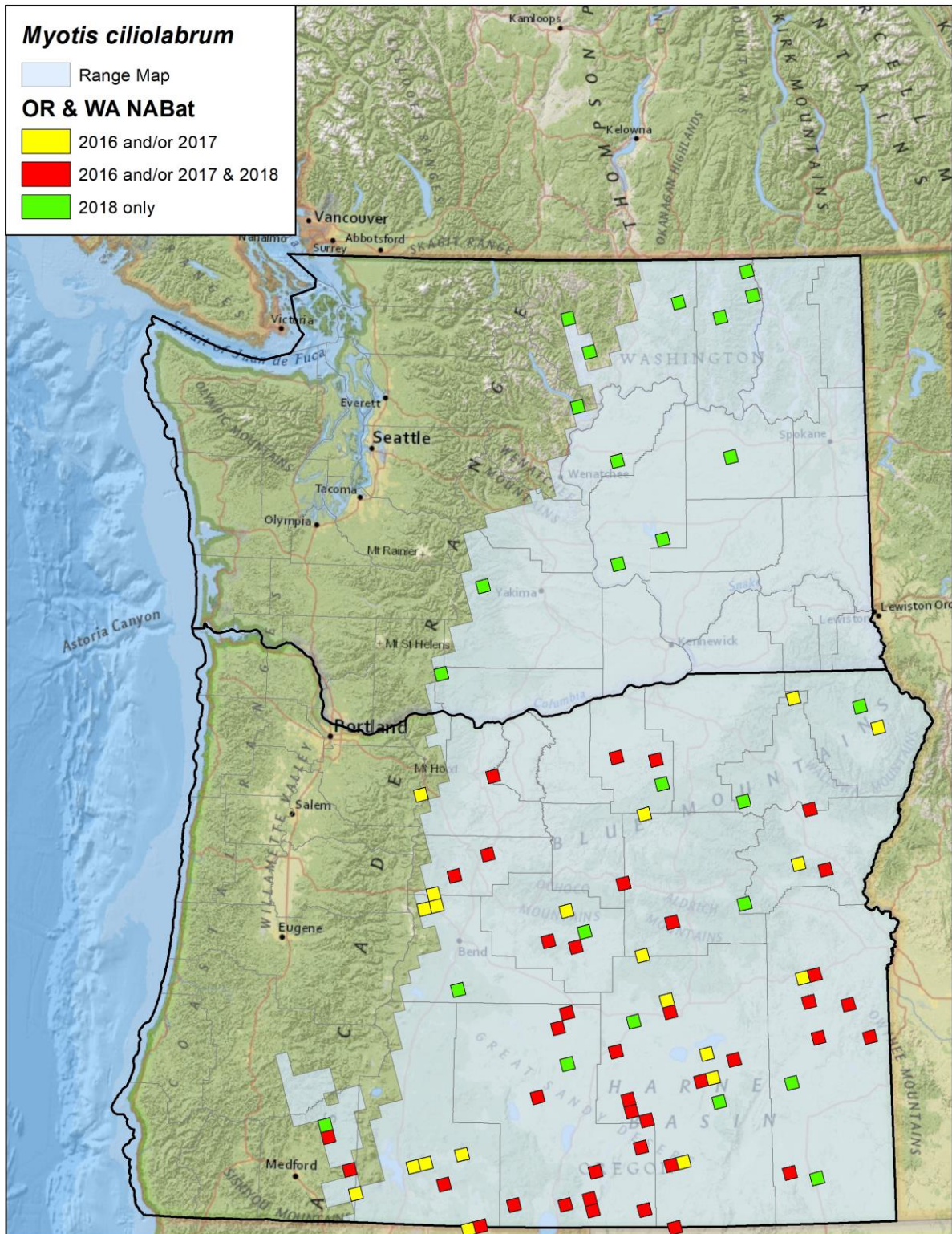


Figure 9. NABat occurrences of *Myotis ciliolabrum*.

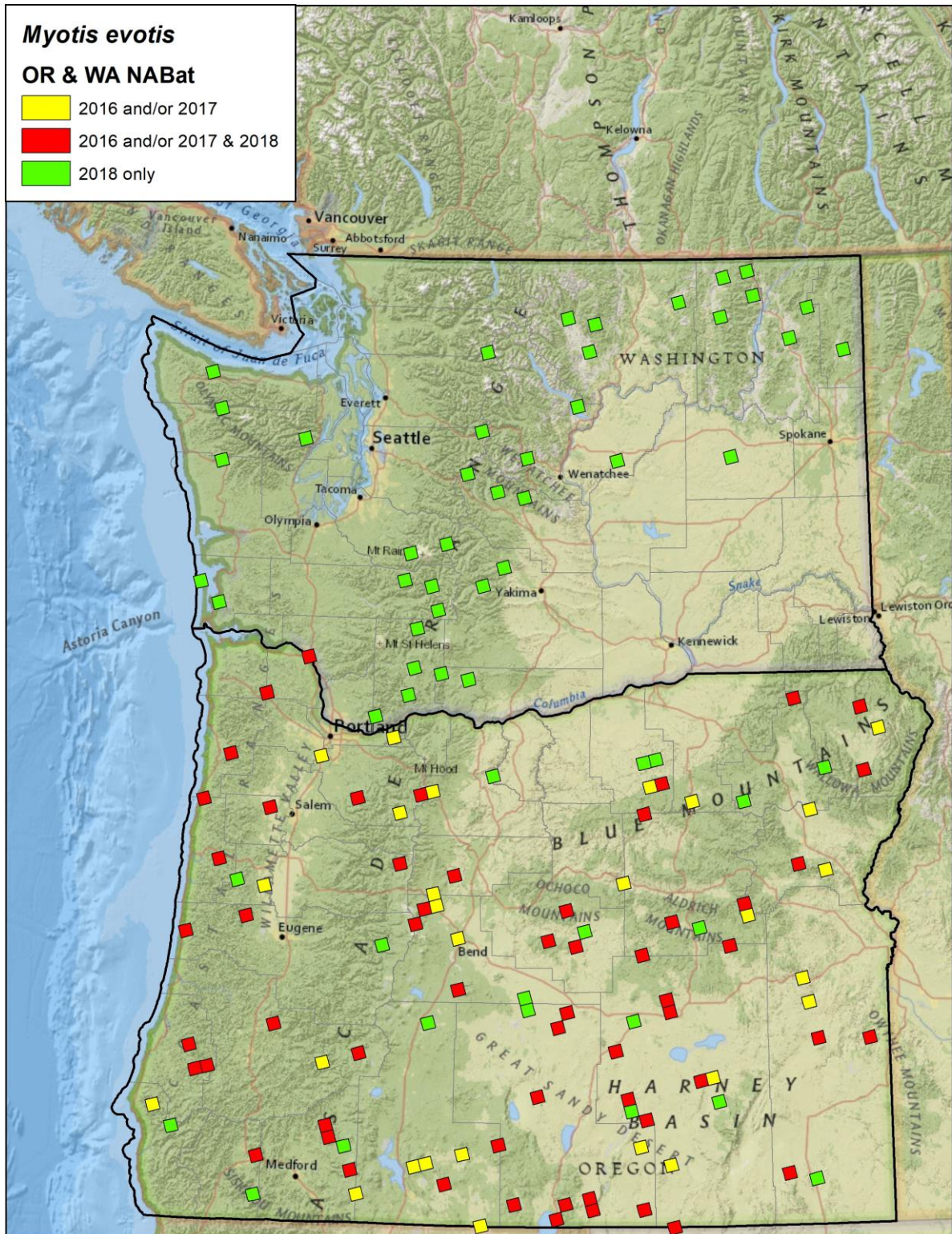


Figure 10. NABat occurrences of *Myotis evotis*.

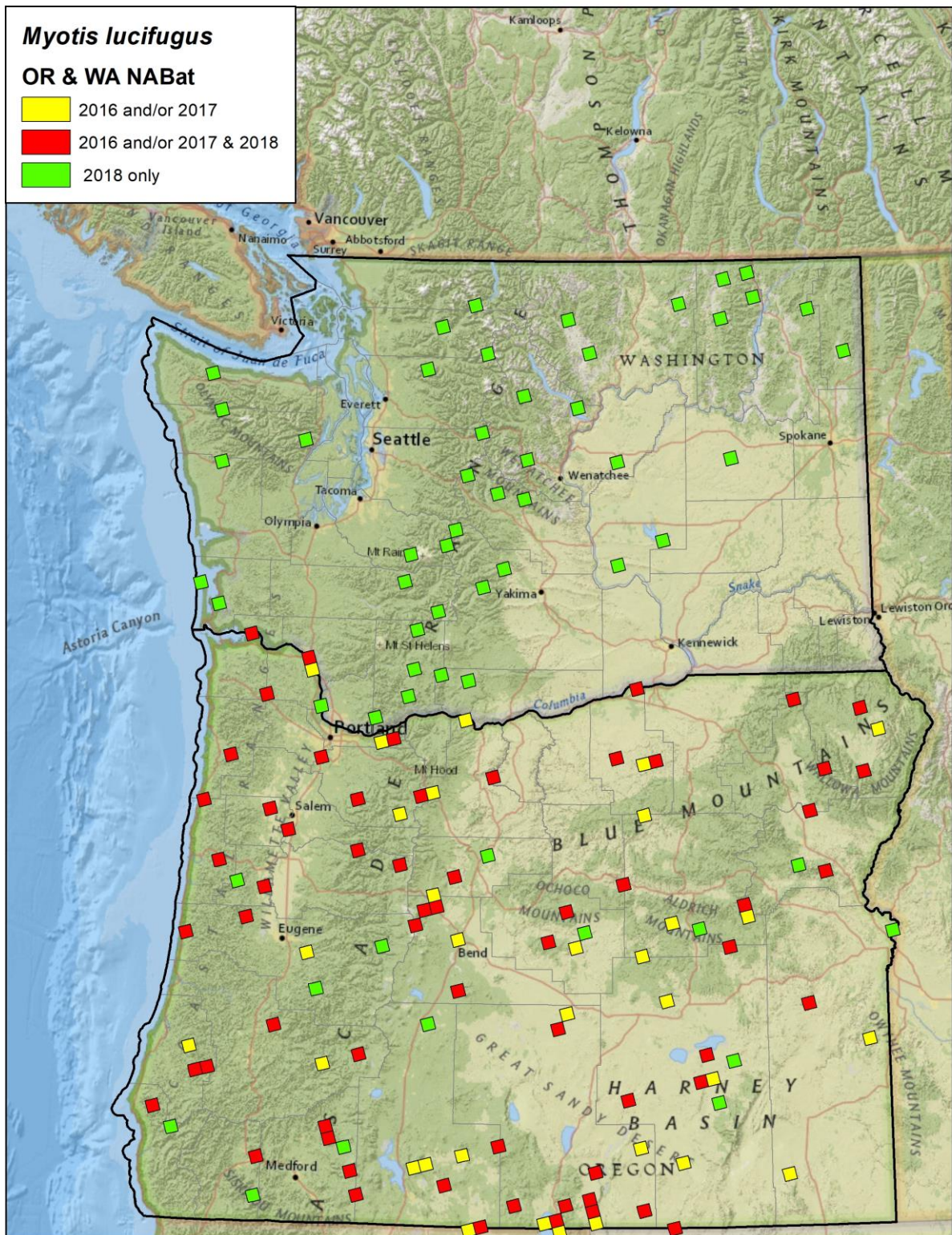


Figure 11. NABat occurrences of *Myotis lucifugus*.

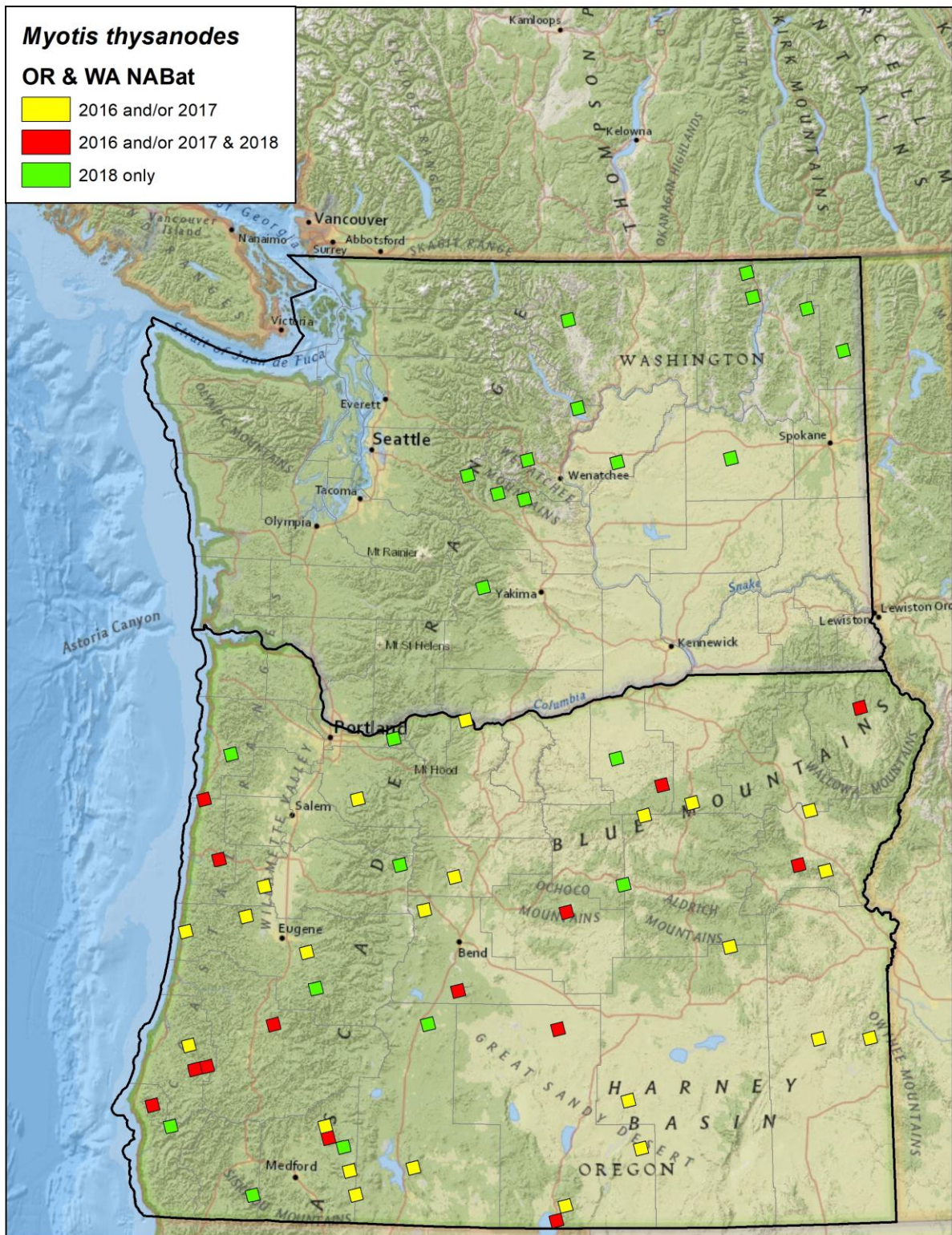


Figure 12. NABat occurrences of *Myotis thysanodes*.

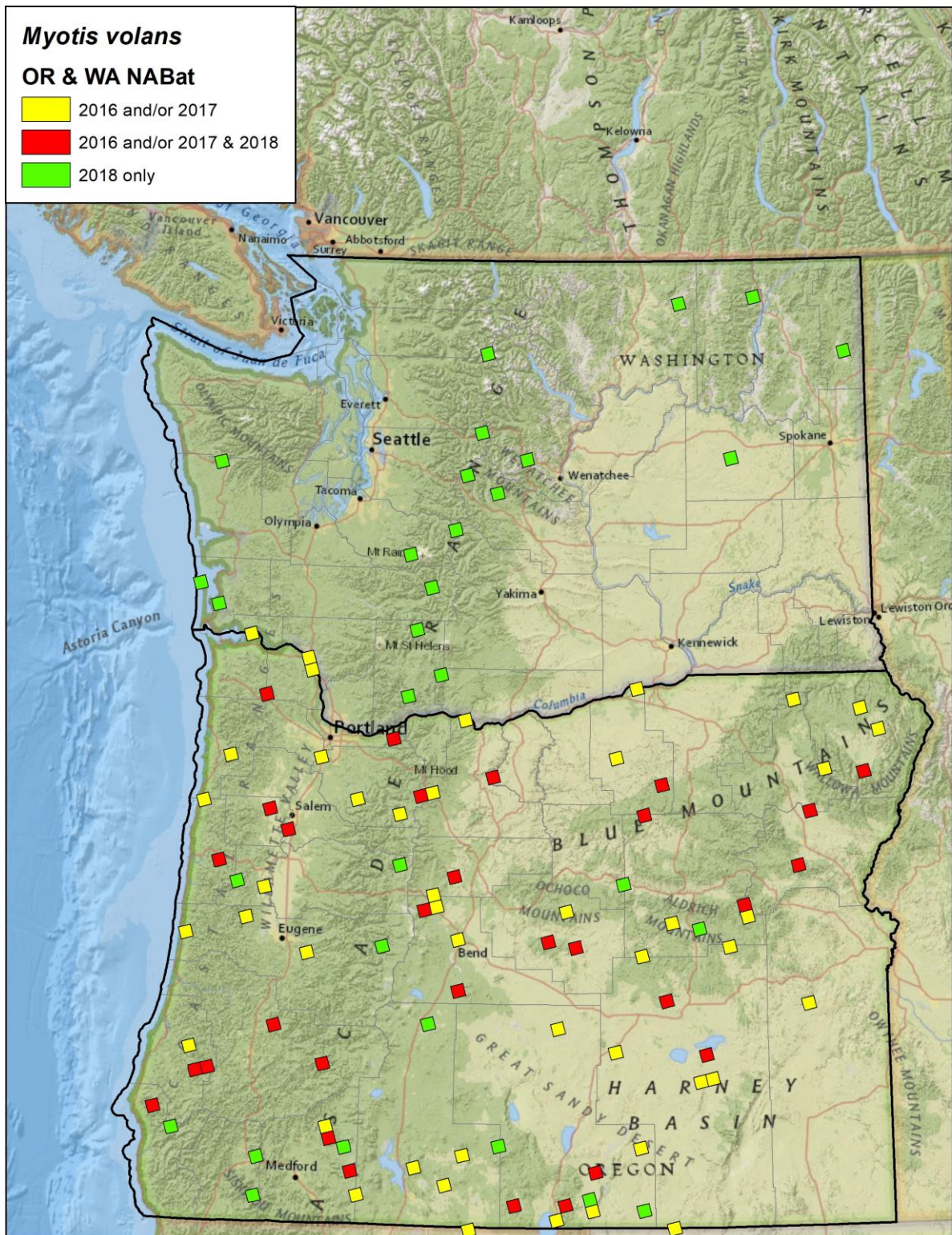


Figure 13. NABat occurrences of *Myotis volans*.

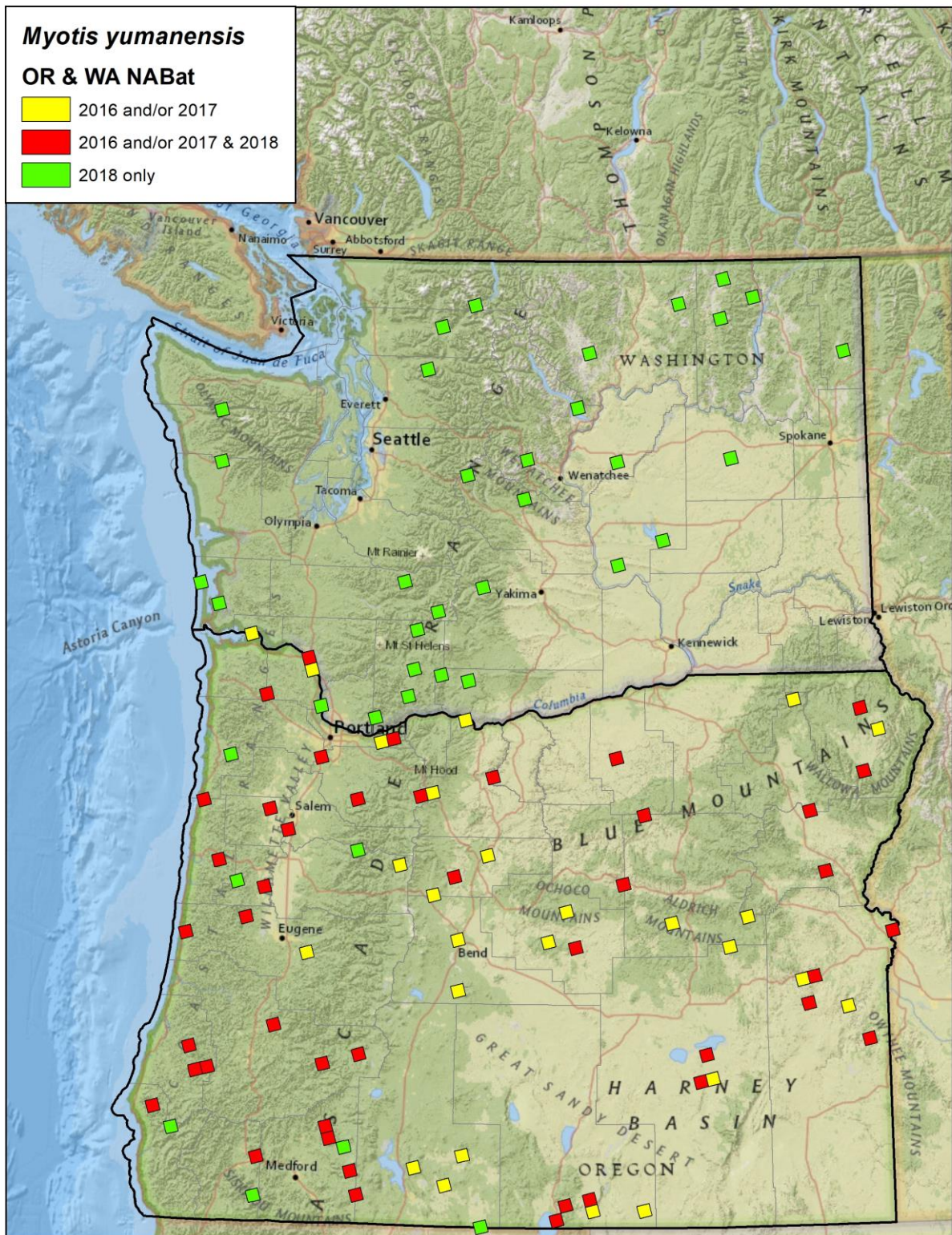


Figure 14. NABat occurrences of *Myotis yumanensis*.

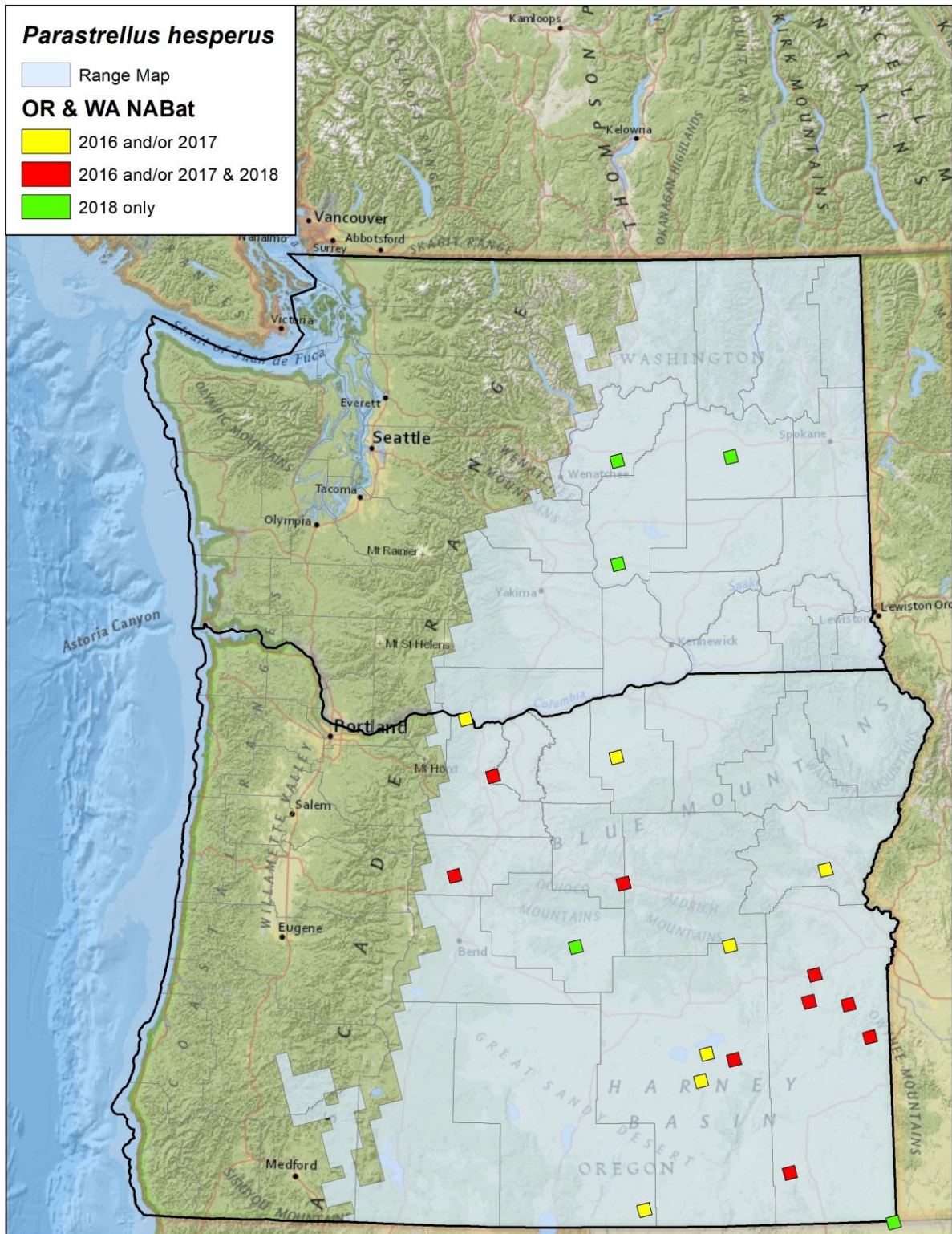


Figure 15. NABat occurrences of *Parastrellus hesperus*.

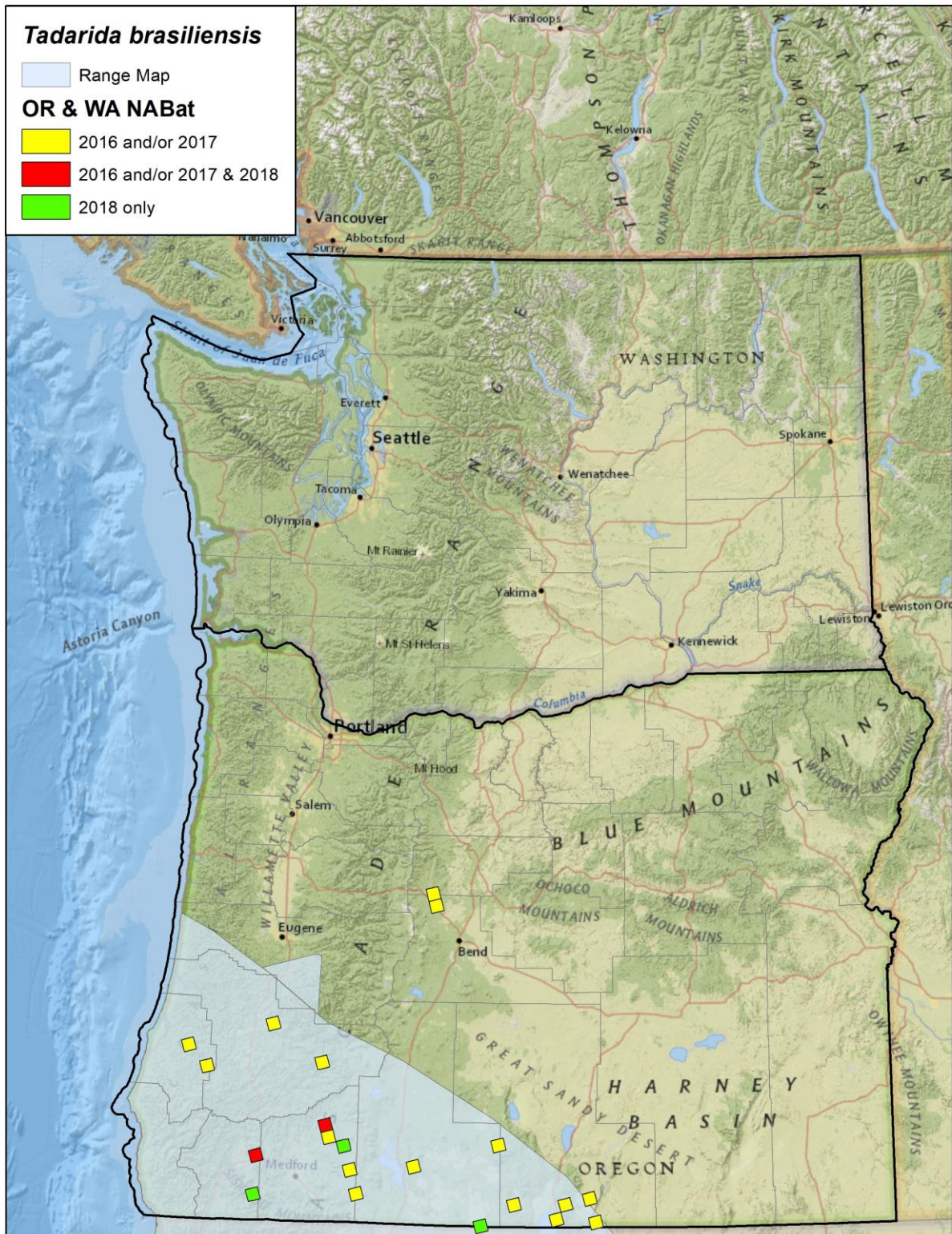


Figure 16. NABat occurrences of *Tadarida brasiliensis*