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ORIGINAL ARTICLE

Continuing increase in the abundance of the Big Brown Bat (*Eptesicus fuscus*) in Maritime Canada in the presence of White-nose Syndrome

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ABSTRACT

Based on public reporting (mainly incidents of bats in homes and bats submitted for rabies testing and health monitoring), the number of reports of the Big Brown Bat (*Eptesicus fuscus*) in New Brunswick (Canada) has increased significantly over the past three decades. Prior to 1990 this species was rarely encountered in the province. From 2000 to 2013 the number of Big Brown Bat reports remained low but regular, including during the emergence of the white-nose syndrome (WNS) epidemic and subsequent endemicity of the disease in New Brunswick. From 2014-2020 numbers of Big Brown Bats reported have risen markedly. The Big Brown Bat is now the bat species most frequently encountered by the public in New Brunswick, although the species remains rare in Nova Scotia and is as yet unrecorded on Prince Edward Island. Establishment and initial increase of the Big Brown Bat in New Brunswick pre-dates the introduction of WNS to North America. Recent increases may be a continuation of a trend related to climate warming that was underway prior to WNS-induced declines in bat species in eastern Canada. However, we cannot discount a role for disease-mediated competitive release in the current surge in reports of the Big Brown Bat in New Brunswick. We also document aspects of the natural history of the Big Brown Bat in the Maritimes, including maternity roosts, autumn swarming behaviour, and first reported over-wintering by multiple Big Brown Bats in underground hibernacula in the region. While the probability of being bitten by a rabid bat in Canada is exceedingly low, the increasing abundance of the Big Brown Bat in New Brunswick and its association with human dwellings throughout the year may warrant increased public education and surveillance for rabies. However, given the continuing persecution of bats, any such educational campaign must be coupled with a strong message emphasizing the importance of bat conservation.

RESUMEN

Según los informes públicos (en especial sobre incidentes con murciélagos en viviendas y murciélagos sometidos a pruebas de detección de la rabia y control sanitario), la cantidad de informes sobre el murciélago pardo grande (*Eptesicus fuscus*) en Nuevo Brunswick (Canadá) aumentó de forma considerable en las tres últimas décadas. Antes de 1990, no era común encontrar esta especie en la provincia. De 2000 a 2013, la cantidad de informes sobre el murciélago pardo grande se mantuvo baja, pero constante, incluso durante la aparición de la epidemia del síndrome de la nariz blanca (white-nose syndrome, WNS) y la posterior presencia endémica de la enfermedad en Nuevo Brunswick. Entre 2014 y 2020, la cantidad de denuncias sobre murciélagos pardos grandes aumentó de forma notable. En la actualidad, el murciélago pardo grande es la especie de murciélago que se encuentra con más frecuencia en Nuevo Brunswick. Sin embargo, la especie es aún poco común en Nueva Escocia y todavía no se ha encontrado en la Isla del Príncipe Eduardo. El establecimiento y aumento inicial del murciélago pardo grande en Nuevo Brunswick es anterior al ingreso del WNS en Norteamérica. Los recientes aumentos podrían ser la continuación de una tendencia relacionada con el calentamiento climático que ya estaba en marcha antes de los descensos que produjo el WNS en las especies de murciélagos del este de Canadá. Sin embargo, no podemos descartar que la difusión competitiva de enfermedades tenga algo que ver con el actual aumento de informes sobre el murciélago pardo grande en Nuevo Brunswick. También documentamos aspectos de

la historia natural del murciélago pardo grande en las Provincias Marítimas, incluidos los nidos de maternidad, el comportamiento de revoloteo en otoño y los primeros informes de hibernación de varios murciélagos pardos grandes en nidos subterráneos de la región. Si bien la probabilidad de que un murciélago rabioso muerda a una persona en Canadá es muy baja, la presencia cada vez mayor del murciélago pardo grande en Nuevo Brunswick y su asociación con las viviendas humanas durante todo el año pueden justificar un aumento de la educación pública y la vigilancia de la rabia. Sin embargo, dada la continua persecución de los murciélagos, toda campaña educativa de este tipo se debe lanzar con un mensaje contundente que enfatice en la importancia de la conservación de los murciélagos.

INTRODUCTION

North American bat species face a variety of conservation challenges throughout their range, including habitat loss and modification, pesticides, and mortality associated with wind-energy development (Mickleburgh et al. 2002, Voigt & Kingston 2016, Frick et al. 2020). Since first documented in New York in 2006 (Blehert et al. 2009), white-nose syndrome (WNS), an epizootic, infectious fungal disease caused by *Pseudogymnoascus destructans* (Pd), has emerged as the most serious threat to cave-dwelling North American bats (Cheng et al. 2021). WNS was first documented in New Brunswick (Canada) in 2011 (Vanderwolf et al. 2012), where it has devastated populations of the Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*), and the Tricoloured Bat (*Perimyotis subflavus*) (Vanderwolf & McAlpine 2021). While Pd has been detected on a few Big Brown Bats from New Brunswick submitted for necropsy (McAlpine et al. 2016), there has been no case of WNS diagnosed in Big Brown Bats since the emergence of the disease in the province, despite submission of specimens during the WNS surveillance season (Canadian Wildlife Health Cooperative unpublished data). Until 2011 the Little Brown Myotis and Northern Myotis were the most abundant and most frequently encountered bat species in eastern Canada (Forbes et al. 2010, Vanderwolf & McAlpine 2021).

The Big Brown Bat (*Eptesicus fuscus*) is a relatively recent addition to the mammalian fauna of Maritime Canada (New Brunswick, Nova Scotia, Prince Edward Island). It was only in 1959 that the species presence in New Brunswick was confirmed (Gorham & Johnson 1962), and where it now reaches its northeastern range limit. There is a single, early autumn, photo-confirmed record of the Big Brown Bat from Nova Scotia (Rankin 2017), an unverifiable hibernaculum sight record (Moseley 2007, but see Discussion), and summer acoustic surveys in which the species has been hypothetically recorded from two sites (Broders et al. 2003), or more often, not reported at all (Phinney 2020). The Big Brown Bat has yet to be reported from Prince Edward Island (Henderson et al. 2009, Curley et al. 2019). Dilworth (1984) mapped only three records for New Brunswick and pronounced the species as “very rare” in the province at that time. Likewise, based on acoustic data collected in 1987-88, Tremblay (1992) reported the Big Brown Bat as “rare” in Fundy National Park, New Brunswick. Verifiable New Brunswick records remained scant through to about 1990, but started to become more frequent through the mid–1990s. By 1999–2000 the species was recorded over-wintering occasionally but regularly in heated buildings in southern and central New Brunswick, and rarely as a breeding species (McAlpine et al. 2002). Whitaker & Gummer (2000) attributed this northward range expansion to the availability of heated buildings suitable for over-wintering in a species that in more temperate regions may rely on tree cavities and rock crevices for winter hibernacula. Several studies have reported on the apparent northward and westward expansion in the range of a variety North American bats species (*Lasionycteris noctivagans, Lasiurus seminolus, Nycticeius humeralis, Perimyotus subflavus, Tadarida brasiliensis*) that may be due to increasing forest cover, climate change, or other factors (Adams et al. 2017, Anderson et al. 2017, McCraken et al. 2018, Perry 2018, McAlpine et al. 2021). Climate warming is also likely playing a role in the northward range expansion of the Big Brown Bat, but disease-mediated competitive release may also be playing a part.

Simonis et al. (2023a) have summarized a large, 30-year dataset for pre and post-WNS captures for the Big Brown Bat in the USA, noting the value in documenting changes in persisting wildlife species for understanding disease impact on populations and ecosystem services. Establishment and initial increase of the Big Brown Bat in New Brunswick pre-dates the first reports of WNS for North America. Although the Big Brown Bat is susceptible to WNS, and some mortality has been observed, the species is considered relatively tolerant/resistant to the disease compared to the Little Brown Myotis (Frank et al. 2014, Moore et al. 2018, Simonis et al. 2023b; the issue remains controversial, see Davey et al. 2018). Nonetheless, McAlpine et al. (2016) reported cases of Pd-positive (but not WNS-positive) Big Brown Bats overwintering in New Brunswick buildings that showed evidence of fungal lesions of unknown etiology. Turner et al. (2011) reported a 41% decrease in Big Brown Bat numbers in northeastern North American hibernacula infected with Pd, while Kurta & Smith (2020) recorded an 11.7% increase in this species associated with WNS in Michigan caves and mines. Cheng et al. (2021) found decreased counts in Big Brown Bats at 73% of northeastern North American sites surveyed.

Here we report on the apparent continuing increase in the abundance of the Big Brown Bat in New Brunswick, in conjunction with declines in other sympatric species of

insectivorous, cave-dwelling bats due to WNS (Balzer et al. 2021, Vanderwolf & McAlpine 2021). We also document Big Brown Bat maternity roosts additional to those reported in McAlpine et al. (2002), autumn swarming behaviour, and first over-wintering by Big Brown Bats in underground hibernacula in New Brunswick, along with the continuing expansion in the geographic range of the species in the region.

MATERIAL & METHODS

Study area

From 2009–2015 we surveyed over-wintering bats in 10–15 caves and mines across southern New Brunswick by tracking number of individuals and species present. Very little of New Brunswick provides the bedrock geology suitable for the formation of natural solution caves (McAlpine 1983). Details on survey methodology can be found in Vanderwolf et al. (2012) and Vanderwolf & McAlpine (2021). No Big Brown Bats were observed over-wintering in caves or mines in New Brunswick during this period, or during earlier, less systematic surveys conducted during the 1970s and early 1980s (McAlpine 1983). We also surveyed occurrence records for bats available for the adjacent Maritime Provinces of Nova Scotia and Prince Edward Island (Fig. 1). Together the three provinces make up most of the Atlantic Maritime Ecozone, an area in eastern Canada of diverse geology, regional climate and vegetation characterized by hills and coastal plains. It is the third most forested ecozone in Canada. Although extant forest is largely mixed stands of conifers and deciduous species, this forest is mostly secondary or tertiary growth on old clearcuts and abandoned farms (McAlpine & Smith 2010).

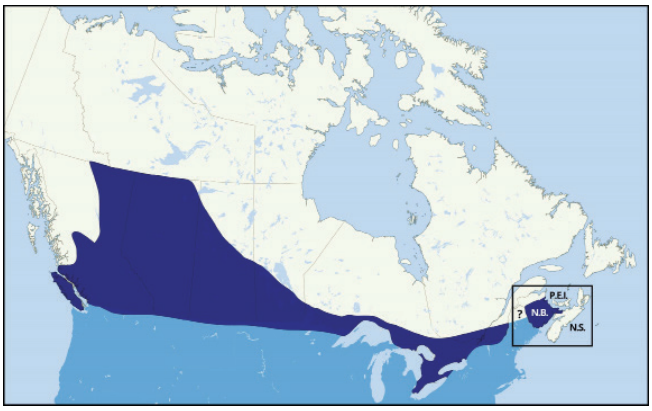

Fig. 1 - The Canadian range (dark blue) of the Big Brown Bat (*Eptesicus fuscus*). Northern USA range is shown in light blue. The species reaches its northern range limit in Canada. The study area, incorporating the Canadian Maritime Provinces of New Brunswick (NB), Prince Edward Island (PEI), and Nova Scotia (NS), is enclosed by the rectangle. Shading is modified from van Zyll de Jong (1985), Kurta & Baker (1990) and Lausen et al. (2022) and includes new range data presented below.

Data collection

We compiled Canadian Maritime records (N= 220) from 2000–2020 of Big Brown Bats using two primary sources: bats reported to the New Brunswick Museum (NBM) by the general public, mainly from residential buildings in the province, and bats submitted from all three Maritime provinces to government agencies during bat health surveillance programs. Separately we compiled Maritime records of maternity roosts (N=9) for the species up to 2021. When there was high probability of bat contact with humans or domestic animals, bats reported by the general public were humanely euthanized and submitted to the Canadian Food Inspection Agency (CFIA, Ottawa) for rabies testing. We assembled Maritime Big Brown Bat records from these submissions, as well as bats submitted to the Canadian Wildlife Health Cooperative (CWHC, Atlantic Region, University of Prince Edward Island, Charlottetown) as part of their ongoing bat health surveillance program. We recognize that these records present a biased sample, in that they represent bat species most frequently associated with anthropogenic structures and probably include a high percentage of bats that have health problems, including traumatic injuries, even if they are rabies negative. Some of the bat specimens submitted to CFIA or CWHC were subsequently deposited in the NBM mammal collection, and some observational reports housed in the NBM are also represented by bat specimens that were euthanized and submitted for health surveillance purposes. There is therefore some overlap in observational and specimen records maintained by the NBM and submissions to CFIA and CWHC. NBM reports included here are restricted to those where Big Brown Bats were photographed to confirm species identification and were then released, or were euthanized and deposited directly in the NBM, in either case without submission to CFIA or CWHC. This approach avoided double-counting of records. Where multiple Big Brown Bats were reported/submitted from a single locality on the same date this was recorded as a single observation. Despite the biases noted above, we believe that together these sources of data can provide an index of relative changes in Big Brown Bat abundance in the region.

Data analysis

We prepared a map showing changes in county-level distribution over time. We also conducted a hot spot analysis in ArcMap 10.8.2 (ESRI 2021) to determine spatial clustering. We ran the Hot Spot Analysis (Getis-Ord Gi*) with a fixed-distance band of 5 km, which is the estimated maximum foraging distance for the Big Brown Bat (Menzell et al. 2001). The Getis-Ord Gi* statistic calculated z scores and p-values, revealing statically significant clusters of Big Brown Bat records between 2000–2020 in Maritime Canada. We then interpolated a raster surface by using the Hot Spot Analysis point data and an inverse distance weighted (IDW) technique with a fixed radius of 5 km and a minimum number of 3 nearest points. Finally, we used a Mann-Kendall test in R (McLeod 2022) to assess the significance of the trend line describing changes in Big Brown Bat annual abundance from 2000–2012.

RESULTS

Reports of Big Brown Bat occurrences in New Brunswick have continued to increase since 2000, with this increase underway several decades prior to the first reports of WNS in the region in 2011. Post-WNS epidemic (>2013) there also appears to have been an expansion northward in the species geographic range in New Brunswick and perhaps eastward to Nova Scotia (Fig. 2A), although occurrences continue to be concentrated in the lower Saint John River Valley of New Brunswick. Although there was a drop in submissions/reports of Big Brown Bats for the two years following the winter when WNS first became prevalent in New Brunswick, whether Pd infection led to any mortality in over-wintering Big Brown Bats in New Brunswick is unknown. No cases of WNS-positive Big Brown Bats have been diagnosed from New Brunswick in the CWHC Atlantic Region's targeted WNS surveillance program since its inception in 2007–08.

Our hot spot analysis determined one statistically significant hot spot for Big Brown Bat occurrences - the Fredericton region (z=5.53, p <0.001) in the lower Saint John River Valley - with smaller but noticeable concentrations in St. Stephen and Sussex and widely scattered individual occurrences elsewhere in New Brunswick (Fig. 3).

Figure 4 combines data on NBM Big Brown Bat observations/specimens and Big Brown Bat health surveillance submissions for the period 2000–2020 for the Maritimes. During 2000–2012 the number of Big Brown Bat reports remained low but regular. Although there was a noticeable drop in reports in 2011–12, immediately following the 2011 onset of the WNS epidemic in New Brunswick, the pattern from 2000–2012, although weakly negative, shows no significant linear trend (Mann-Kendall, tau= - 0.39, 2 sided, p= 0.0826). However, from 2013–2020 the number of Big Brown Bats reported has risen steadily, and even markedly (tau= 0.786, 2 sided, p= 0.0094) (Fig. 4).

Our only observation of the Big Brown Bat engaging in swarming behaviour in the Maritimes occurred 15 August 2019, during night-time harp trapping operations. A 19.7 g adult female Big Brown Bat and a 17.5 g juvenile male were captured by KJV entering and exiting Sayre Mine, Albert County, New Brunswick.

The first confirmation of Big Brown Bats overwintering in underground hibernacula in New Brunswick occurred on

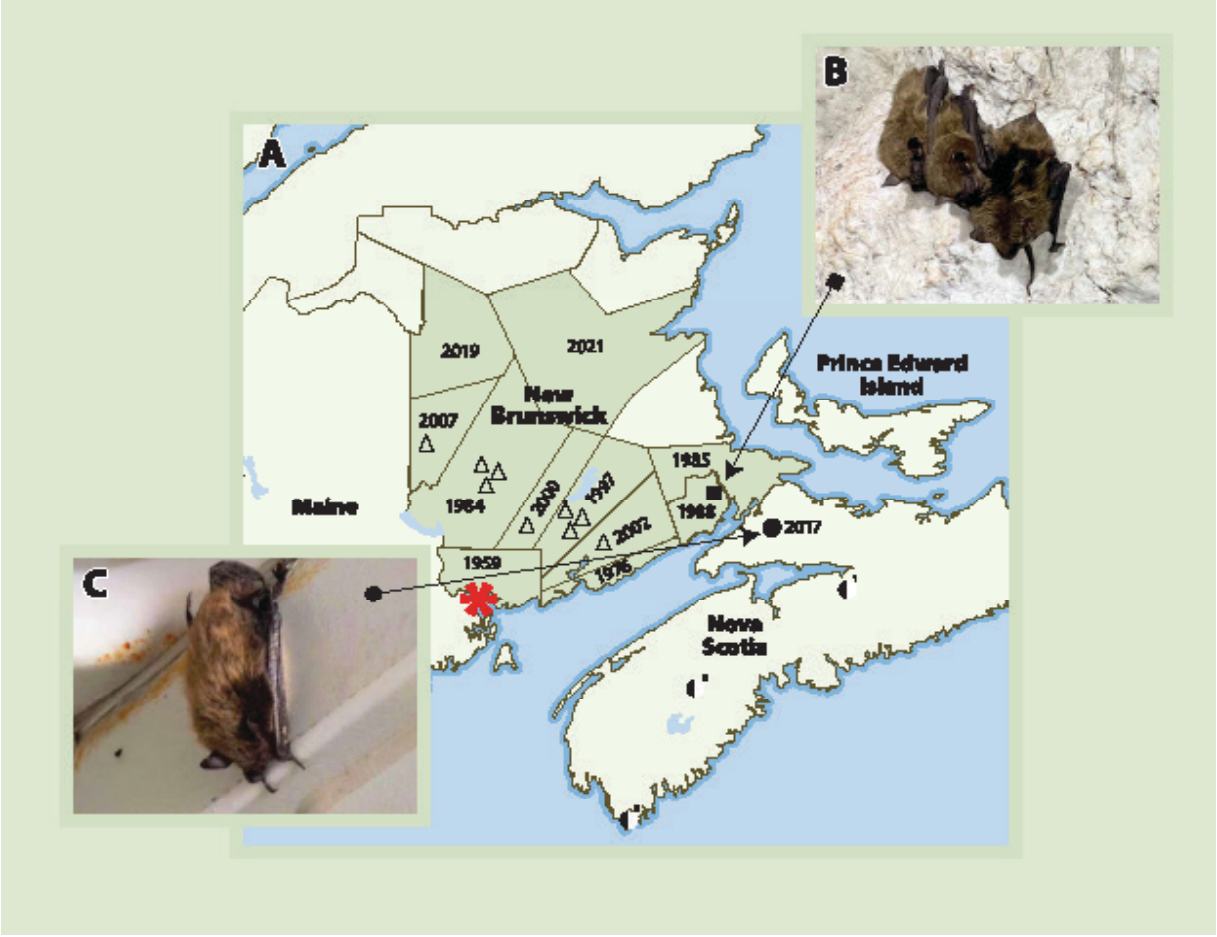

Fig. 2 - A). Distribution of the Big Brown Bat in Maritime Canada 1959-2020. The asterisk marks the first confirmed report (1959). Shaded counties are those from which Big Brown Bats have been recorded based on specimens or photographs, with the year of first reported occurrence noted. Triangles mark the location of maternity colonies. Closed square marks underground hibernacula. Closed circle marks the single confirmed Nova Scotia occurrence, while half-closed circles mark an unconfirmed sighting[1] and hypothetical reports from acoustic surveys[2]. **B)**. A cluster of three Big Brown Bats (*Eptesicus fuscus*) over-wintering in Sayre Mine, Albert County, New Brunswick, on 6 April 2022. (Image: D. F. McAlpine). **C)**. The single verified record of the Big Brown Bat (*Eptesicus fuscus*) for Nova Scotia to date is a September 2017 image from Oxford reported in the media. (Image: Barry Bowman).

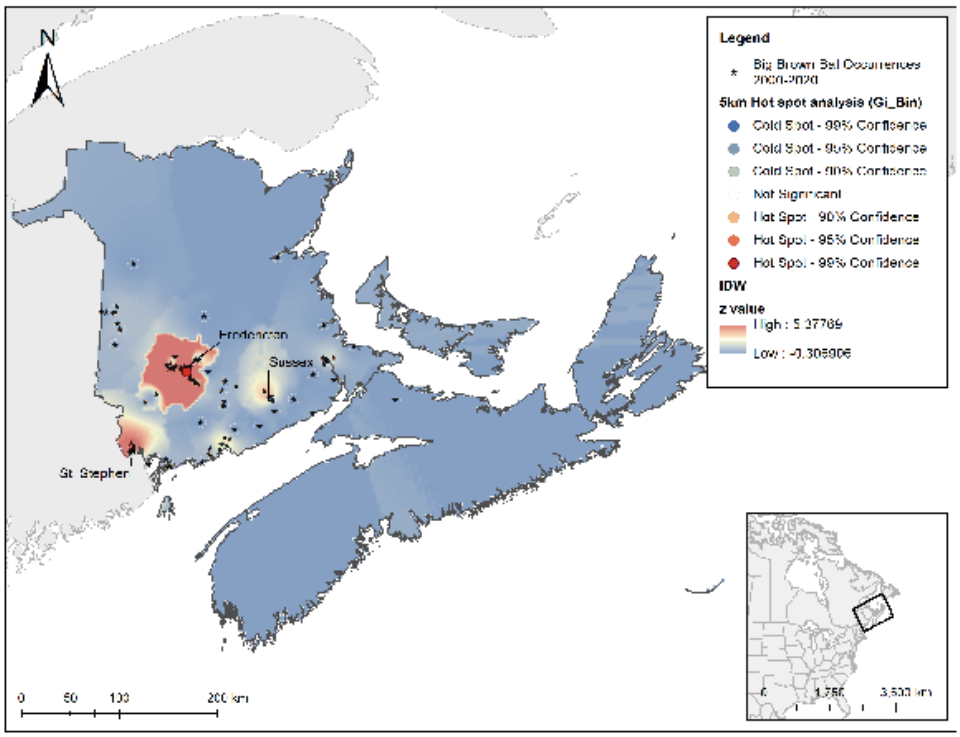

Fig. 3 - Hot spot map showing one statistically significant cluster (Fredericton - lower Saint John River Valley) and other concentrations of Big Brown Bat (*Eptesicus fuscus*) occurrences in Maritime Canada. Each star represents a single site from which one or more Big Brown Bats was confirmed 2000-2020.

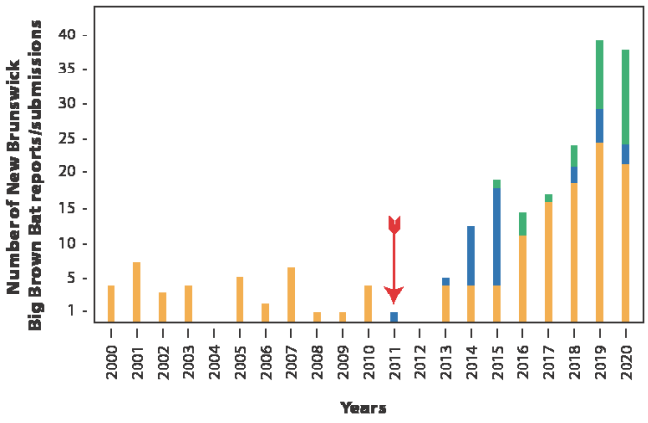

Fig. 4 - Bar graph showing numbers of Big Brown Bats (*Eptesicus fuscus*) reported/submitted annually in New Brunswick 2000-2020. Orange= Canadian Food Inspection Agency rabies submissions, Blue= Canadian Wildlife Health Cooperative Bat Health Surveillance Program, Green= New Brunswick Museum specimens/reports. Red arrow marks onset of white-nose syndrome epidemic in New Brunswick.

28 April 2021. DFM visited Sayre Mine following a report from the public of "larger" bats in the abandoned gypsum mine. Two Big Brown Bats were present, along with 121 Myotis spp. On 6 April 2022 DFM and KJV visited Sayre Mine and counted 12 Big Brown Bats, roosting both singly and in groups of 2-3 (Fig. 2B), and 255 *Myotis* spp. On the same day at New South Mine, 1.5 km south of Sayre Mine, we recorded three Big Brown Bats and two *Myotis* spp. overwintering. The few maternity roosts documented to date are all in anthropogenic structures and restricted to the middle and lower Saint John River valley, New Brunswick (Fig. 2A, Table 1). Such roosts are undoubtedly more widespread in the province.

The single photo-confirmed record for the Big Brown Bat in Nova Scotia was observed inside a stationary trailer in the New Brunswick-Nova Scotia border region on 4 September 2017 (Fig. 2C) and reported in the on-line media. An earlier

Table 1 - Records of maternity roosts for the Big Brown Bat (Eptesicus fuscus) in New Brunswick, Canada.

Date	Location	Remarks
24 July 1997	Lower Hampstead, Queens County	Under metal roof, see McAlpine et al. (2002)
22 June 1999	Fredericton, York County	Non-volant young; see McAlpine et al. (2002)
29 June 2016	Marysville, York County	Residential attic; non-volant young (NBM-OBS-MA-2521)
4 July 2016	Douglas, York County	Under roof; non-volant young (NBM-OBS-MA-253)
3 July 2019	Bath, Carleton County	Residential attic; 21 lactating, 5 pregnant, 1 pup (NBM-OBS-MA-254)
9 July 2020	Jemseg, Queens County	Barn; maternity colony (NBM-OBS-MA-255)
7 August 2020	Upham, Kings County	Roof peak louvers; maternity colony (NBM-OBS-MA-256)
19 July 2021	Lincoln, Sunbury County	Residential attic; non-volant young (NBM- OBS-MA-257)
17 June 2021	Gagetown, Queens County	Residential attic; non-volant young (NBM-OBS-MA-258)

[1]New Brunswick Museum (NBM) mammal observational files

Nova Scotia record from Hayes Cave, near South Maitland, in 1996 is unconfirmed, although more recent acoustic surveys in the province (Broders et al. 2003) have tentatively identified the species (Fig. 2A).

DISCUSSION

All previous reports of over-wintering Big Brown Bats in New Brunswick have involved bats in heated buildings (McAlpine et al. 2002). Although in some regions Big Brown Bats regularly over-winter in caves and abandoned mines, the species is flexible in its selection of winter hibernacula (Perea et al. 2023b). Hibernation in tree cavities, rock crevices, bat boxes, buildings, culverts and bridges have all been documented (Agosta 2002, Neubaum et al. 2006, Kurta 2017). Nagorsen (1980) suggested that underground hibernacula lacking Big Brown Bats in northern Ontario (about 4 degrees latitude farther north than New Brunswick hibernacula) might be unsuitable for them due to high humidity. Air in dark zones in New Brunswick underground hibernacula appears to be near saturation most of the time (Vanderwolf et al. 2012, Vanderwolf & McAlpine 2021). Nonetheless, some sites in the Maritimes are clearly suitable for overwintering Big Brown Bats. Klüg-Baerwald & Brigham (2017) demonstrated that Big Brown Bats are capable of hibernating across a wide range of humidity conditions. The recent use of underground sites in New Brunswick is perhaps a reflection of an expanding population still in the establishment phase. Based on reports to the NBM, the Big Brown Bat now appears to be the bat species most frequently encountered by the public in New Brunswick. Prior to WNS detection the Little Brown Myotis was by far the most common and most frequently encountered species of bat in the region (Forbes et al. 2010).

While available data suggests Big Brown Bats may be widespread in Nova Scotia, the species remains extremely rare in that province. Taylor (1997) reported three Big Brown Bats observed overwintering in Hayes Cave, Nova Scotia, noting the individuals were too high for vouchers to be collected. Based on this observation, Scott & Hebda (2004) recorded the species as "very tentatively identified in [Nova Scotia], but not yet confirmed". Moseley (2007) corrected the observation, reporting that only two Big Brown Bats were observed. Both Taylor (1997) and Moseley (2007) report the date of observation as 12 November 1996, but this is incorrect. A bat survey of Hayes Cave was carried out in November, but Big Brown Bats were only observed on a previous non-count visit on 28 February 1996 (A. Hebda, pers. comm. to DFM, Oct 2023). Taylor (1997) seems to have conflated the two visits. Although unconfirmed, we believe the observation to be reliable. Hebda was very familiar with the species, having maintained a captive colony, and notes that the bats were significantly larger than adjacent roosting *Myotis* spp. (pers. comm. to DFM, October 2023). On the strength of his certainty of identification, combined with tentative acoustic records (Broders et al. 2003), Hebda included the Big Brown Bat on his list of Nova Scotia mammals (Hebda 2014). Nonetheless, extensive acoustic monitoring for bats in Nova Scotia since then has not recorded the species (Phinney 2020), nor has it been reported during wide-ranging surveys of swarming sites in the province, including Hayes Cave (Randall 2011, Randall & Broders 2014).

The Big Brown Bat is noted for its association with human-occupied dwellings (Agosta 2002, Lausen & Barclay 2006, Lausen et al. 2022). Previous studies reported on causes of mortality in bats submitted for health surveillance purposes in Canada and found cat depredation and blunt force trauma accounted for the majority of identified submissions, but also acknowledged the biased nature of the sampling (Segers et al. 2021, Beattie et al. 2022). Although there has been significant media attention given to WNS and bat declines in eastern Canada since 2011, we are not aware of any procedural or policy changes that would have led to the marked increase in Big Brown Bat reports/submissions in the region since 2013. If human presence alone were responsible for increased reporting, we would expect the most frequent occurrences for Big Brown Bats to be in Saint John and Moncton, the two largest cities in New Brunswick. Several studies have found forested areas interspersed with edges and open areas particularly attractive for foraging by the Big Brown Bat (Bender et al. 2015, Gallager et al. 2021, Kunberger & Long 2022, Perea et al. 2023a). It is therefore noteworthy that the Fredericton region is well stocked with late 19th and early 20th century homes accessible to bats that are situated in urban areas well-supplied with green space and mature trees. This is further supported by the clusters forming in the smaller communities of St. Stephen and Sussex, which have urban landscape compositions similar to those found in Fredericton. Fredericton, St. Stephen, and Sussex may be particularly attractive to Big Brown Bats as they provide ready access to over-wintering sites, adequate concentrations of buildings for maternity roosts, as well as adjacent open forested habitat suitable for foraging. This may be especially important for this relatively sedentary species, which is not believed to travel long distances between areas of summer and winter occupancy (Mills et al. 1975, Neubaum et al. 2006).

Morningstar et al. (2019) suggested that disease-mediated competitive release (DMCR), following WNS-induced bat declines, appeared to be responsible for an increase in Big Brown Bat activity in southern Ontario. Certainly, there is now widespread documentation of changes in species composition and relative abundance in North American bat communities post-WNS. Pettit & O'Keefe (2017), Thalken et al. (2018), Deeley et al. (2021), and Johnson et al. (2021) have all reported post-WNS increases in Big Brown Bat abundance associated with decreases in the Little Brown Myotis. However, Bombaci et al. (2021) found limited support for the hypothesis that DMCR was responsible for increased activity by bats resistant to WNS. Bombaci et al. (2021) also note, given the low reproductive rate and recruitment typical of bats, that it may take years following a decline for bat populations resistant to WNS to respond to DMCR. This would be especially the case if populations are low, as Big Brown Bats numbers in New Brunswick have been. While we cannot discount a role for DMCR in the current surge of reports of the Big Brown Bat in New Brunswick, the increase in Big Brown Bat abundance in the province is a continuation of a trend that began more than a decade before the appearance of Pd in North America (McAlpine et al. 2002). Regardless of the cause, we predict that this species' increasing abundance in New Brunswick

will eventually extend across Maritime Canada.

This increasing abundance of the Big Brown Bat in New Brunswick may warrant increased public education and health surveillance. This is supported by the species' year-round association with occupied anthropogenic structures, coupled with regular incidents of rabies cases for the species across Canada (Segers et al. 2021, Wilson et al. 2022). While the probability of being bitten by a rabid bat in Canada is exceedingly low (Fenton et al. 2020), the persecution of bats remains a conservation concern. WNS has decimated over-wintering bat populations in Maritime Canada with estimated reductions of 99% (Vanderwolf & McAlpine 2021). Any public education surrounding increased rabies risks must therefore to be coupled with a strong conservation message that supports the expansion of Big Brown Bat populations in the region.

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