INTRODUCTION

Four species of long-eared myotis bats are recognized in British Columbia: Keen’s Myotis (Myotis keenii), Northern Myotis (M. septentrionalis), Long-eared Myotis (M. evotis), and Fringed Myotis (M. thysanodes). Accurate species description is essential given the ‘vulnerable/sensitive’ conservation status listing of three long-eared myotis species versus the ‘secure’ listing of M. evotis. Due to extreme morphological similarity, the taxonomic status of M. keenii versus M. evotis where the 2 species’ ranges overlap has been questioned (van Zyll de Jong and Nagorsen 1994, Dewey 2006). Here, genetic species is defined as a group of interbreeding populations that are genetically isolated from other such population groups (Baker and Bradley 2006). We ask: Do Myotis keenii and M. evotis interbreed?

METHODS

Wing tissue (2 mm biopsy) was obtained from the 4 long-eared species (n = 257) and 1 outgroup (M. lucifugus; n = 24) from sites in BC, Alaska, Washington, Montana, and Alberta (Figure 1).

We genotyped all samples at 14 microsatellite loci and analyzed population genetic relationships (breeding patterns) in Genetix (Belkhir 1999) and STRUCTURE (Pritchard et al. 2000).

We sequenced 750 base pairs of the mtDNA cytchrome b gene for 86 representative individuals from all putative species to examine gene flow patterns and assigned species identifications using Genbank.

We examined isolation by distance and morphological patterns using regression analysis of microsatellites and forearm lengths, respectively. We included measurements of 2 other widespread bats in BC and Alaska: M. californicus and M. lucifugus.

RESULTS

Genetix clearly delineated distinct clusters representing 4 species: M. septentrionalis, M. thysanodes, M. lucifugus and a mixed cluster of samples that were field identified as M. keenii or M. evotis (Figure 2). This highly mixed cluster provides clear evidence that these individuals represent a single genetics species (Figure 2b). STRUCTURE results (not presented) produced the same conclusions.

The cyt-b sequences did not align well with field identifications, with all 6 morphologically distinct M. thysanodes being identified as M. keenii or M. evotis when compared to known sequences in Genbank.

All long-eared samples west of the Coast Mountains were of one mtDNA haplotype complex suggesting limited female movement over these mountains. We found no evidence of limited gene flow across the Rocky Mountains.

Forearm lengths of coastal M. keenii/evotis are smaller than inland M. keenii/evotis in B.C. (t-test, p < 0.001). This same significant pattern was seen in M. californicus, another wide-ranging gleaning species of bat, but not in M. lucifugus.

DISCUSSION

Do Myotis keenii and M. evotis interbreed?

Based on microsatellite data (breeding patterns), M. septentrionalis, and M. thysanodes separate out from each other and from the M. keenii/M. evotis species group, but M. keenii/M. evotis were not distinguishable from each other.

Based on microsatellite data, M. lucifugus (easily distinguished from the long-eared myotis group by morphology) is also a genetic species, distinct from the long-eared myotis group.

Nuclear gene flow across the study area is clear based on microsatellite results. Our mtDNA data suggest partial restriction of female-mediated gene flow by the Coast Mountain range. No such limitation of gene flow by the Rocky Mountains was detected.

Taxonomic Definition and morphology – Myotis keenii was defined as a species, separate from other long-eared bats, based on smaller body size (van Zyll de Jong and Nagorsen 1994). We found smaller forearm lengths in coastal long-eared myotis. Geographic gaps in sampling across the range of species during taxonomic examination may have prevented observation of this cline. We propose that smaller size may be indicative of ecological pressures on gleaning bat species in coastal B.C. and Alaska. We found that this smaller coastal forearm pattern also exists in the other widespread gleaning bat, M. californicus.

CONCLUSION

Based on our analyses, M. keenii and M. evotis are fully interbreeding. We conclude that M. keenii and M. evotis are conspecific. The appropriate species name is Myotis evotis (Long-eared Myotis), and because M. evotis keenii was named prior to M. e. pacificus, we propose M. e. keenii be retained and M. e. pacificus be dropped.