Update on the Biology and Conservation of Keen's Long-eared Bat (*Myotis keenii*)

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Extended Abstract: First described from specimens collected in Massett, Haida Gwaii (Queen Charlotte Islands), British Columbia (B.C.) in 1893, Keen's long-eared bat (*Myotis keenii*) was subsequently grouped together with a similar species, *Myotis septentrionalis*, as two allopatric subspecies: *M. keenii keenii* found only along the Pacific coast, and *M. keenii septentrionalis* in central-eastern North America. *M. keenii* is also morphologically very similar to *M. evotis*, and, in fact, all three species are virtually impossible to separate in the field. Multivariate analyses of cranial, dental, and pelage characters have demonstrated, however, that the three species are physically discrete and should be viewed as separate species. A recent mtDNA (cytochrome b gene) study identified a distant relationship between *M. keenii* and *M. septentrionalis* (sequence divergence > 10%) but a close relationship between *M. keenii* and *M. evotis* (sequence divergence 0.8–3.3%). Three relatively distinct lineages were identified in the latter group—a clade corresponding to the present range of *M. keenii*, an *evotis* clade found in southern British Columbia, Washington, and Oregon, and an *evotis* clade found primarily in Alberta through to South Dakota. The clades are largely allopatric, except two clades are present in the Skeena Mountains in northwestern B.C., and all three clades are present in the Skagit valley in southern B.C.

Keen's long-eared bat has one of the most restricted distributions of any bat in North America, being limited to western Washington, western British Columbia, and southeastern Alaska. It has been recorded at 25 locations in Canada, 9 locations in Washington, and 4 locations in southeast Alaska.

The species' short, broad wings and long ears, and high frequency, low intensity echolocation call suggest that it is a relatively slow, agile flier capable of foraging within the coastal old-growth environment where it has been captured. It has also been captured in estuaries, riparian habitats, and urban environments. Keen's long-eared bat is known to roost in rock crevices and under boulders, in trees and buildings, and under bridges.

Only one maternity colony has been studied in detail. At Gandl K'in Gwaayaay (Hotspring Island), Haida Gwaii, British Columbia, approximately 40 females returned in early June 1998

[1]NatureServe Explorer (version 4.0, July 2004) lists *Myotis keenii* as Keen's myotis.

and 1999 to roost in crevices and under boulders heated by hydrothermal activity. Parturition occurred in early July, and young were volant by early August. This colony has remained viable for at least the last 40 years even though numerous collections were made during the 1960s. The number of bats using the colony also remained stable between 1991 and 2000. A second maternity colony was located in a low-elevation pine (*Pinus contorta*) snag in a southwest-facing cliff near Tahsis, Vancouver Island, British Columbia. The only known hibernacula for this species are in caves found near Tahsis. No estimates of population size or trend are available for this species.

At Gandl K'in Gwaayaay, Keen's long-eared bat feeds primarily on Lepidoptera and spiders (Arachnida: Araneae). The prevalence of spiders in its diet suggests that Keen's long-eared bat is capable of foraging by gleaning as well as by aerial hawking.

Keen's long-eared bat is currently protected as a species of Special Concern under the *Species at Risk Act*, and the maternity colony at Gandl K'in Gwaayaay is protected by the *Canada National Parks Act*. In British Columbia, the species is protected under the provincial *Wildlife Act*, and is the only bat species listed as an Identified Wildlife Species under the B.C. *Forest and Range Practices Act*. To date, one Wildlife Habitat Area has been designated to protect a maternity site near Tahsis, British Columbia. Weymer Cave and White Ridge Provincial Parks protect caves that serve as hibernacula.

Disturbance at hibernacula is one of the most important threats to Keen's long-eared bat. Hibernating bats are particularly vulnerable to winter arousal, which exhausts fat reserves. All known hibernacula currently remain open to recreational cavers, and thus to the possibility of being disturbed.

Although Keen's long-eared bat forages in coastal old-growth forests, it is not known if such sites provide critical habitat for the species. These forests continue to be logged; consequently, old-growth forest is becoming scarce. Keen's long-eared bat is also vulnerable to predation by cats and possibly other mammals such as raccoons, squirrels, and rats.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) first assessed the status of Keen's long-eared bat in 1988. At that time, the species was designated as Vulnerable (equivalent now to a species of Special Concern) because of its restricted distribution and apparent rarity. In November 2003, a status review concluded that there was not enough information to assess the species, and COSEWIC designated it as Data Deficient. Keen's long-eared bat is red-listed in British Columbia, and ranked as possibly extirpated in both Alaska and Washington States. There are, however, recent records of this bat in both states.

We identified a number of data gaps that must be addressed before a complete status assessment of Keen's long-eared bat can be made:

1. What is the taxonomic relationship between *M. keenii* and *M. evotis*?

Sequence divergences identified for these two species fall within the range of intraspecific divergence for most bat species. *M. evotis* and *M. keenii* may, therefore, be conspecific with *M.*

keenii being a coastal subspecies. What is not yet known is whether the three clades remain reproductively isolated in areas where they are sympatric. We recommend that until a broad systematic study integrating molecular and morphological data is carried out, *M. keenii* should be treated as a distinct taxonomic unit.

2. Is this bat truly rare, or is it just difficult to capture?

In a 1991 survey carried out specifically to look for Keen's long-eared bat, long-eared bats were captured at 5 of 51 sites, but Keen's long-eared bat could only be confirmed at one site. In a 1997 survey of Haida Gwaii and the north coast of British Columbia, 67 long-eared bats were captured at 13 of 46 sites sampled. Keen's long-eared bat could be confirmed at only a few sites, however, because of the problem of identifying the species. We recommend that in future studies, tissue samples be collected for DNA analysis to confirm species identity.

3. Where does Keen's long-eared bat hibernate?

Hibernation is a critical period for bats and any disturbance during this time could potentially be fatal. All caves and mines within the Keen's long-eared bat's range should be investigated and hibernacula identified. Winter caving activities are likely to disturb hibernating bats and should be restricted.

4. What habitats are vital for foraging and summer roosting?

Keen's long-eared bat forages in old-growth forests, but the extent to which it depends on this habitat is unknown. Radiotelemetry studies are required to determine where it most frequently forages and roosts. Investigation of the feasibility of identifying *Myotis* species using time expansion recordings of echolocation calls may result in a more efficient way of monitoring for Keen's long-eared bat presence and habitat use.

A final question has arisen out of the species' new designation—What are the consequences of being listed as Data Deficient? One consequence is that the species will be taken out of Schedule 3 of the *Species at Risk Act*, thereby removing any protection the Act provides. Also, although the designation implies that more research is necessary in order to better evaluate the species' status, there is no longer a formal obligation under the Act for any jurisdiction to fill existing data gaps. We recommend that the *Species at Risk Act* be amended to include a requirement that within one year after COSEWIC designates a taxon as Data Deficient, funds should be made available to address existing data gaps.