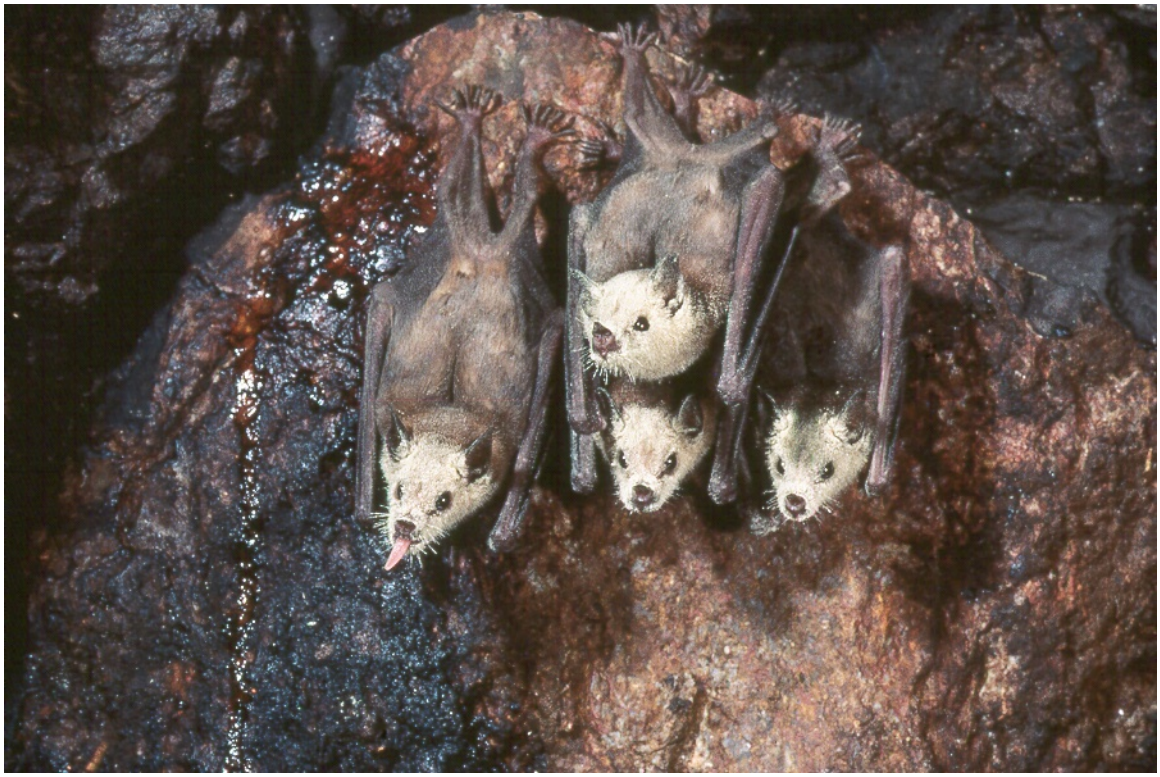
# 5-Year Review:
# Summary and Evaluation



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U.S. Fish and Wildlife Service
Phoenix, Arizona

# 5-Year Review

**Species reviewed:** Lesser Long-nosed Bat / *Leptonycteris curasoae yerbabuenae*

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# 5-YEAR REVIEW

## GENERAL INFORMATION

| | |
|---|---|
| Species Reviewed: | Lesser Long-nosed Bat / *Leptonycteris curasoae yerbabuenae* |
| FR Notice of Review: | Vol. 70, No. 21; Wednesday, February 2, 2005; 5460 – 5463 |
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## BACKGROUND AND METHODOLOGY

### Methodology

In addition to the general solicitation of public comments published in the Federal Register (70 FR 5460), we sent a specific request for new information related to conservation and natural history of the lesser long-nosed bat (LLNB) to a number of individuals with experience working on LLNB research and conservation (see REFERENCES section).

We reviewed pertinent scientific literature, public comments, the Final Rule listing the species as endangered (53 FR 78456), and the recovery plan. Interviews with individuals were conducted as needed to clarify or obtain specific information. We prepared a preliminary draft review. That draft was reviewed by the FWS Arizona Ecological Services Office, the FWS New Mexico Ecological Services Office, and the Arizona Game and Fish Department. The 5-year review document and recommendation were then provided to the FWS Region 2 Regional Office, Division of Threatened and Endangered Species, for review and finalization. Concurrent

with Regional Office review, the LLNB 5-year Review was submitted for peer review to four qualified peer reviewers (See References section)

## Background

**Current Recovery Priority Number for the LLNB:** 8

The recovery priority number for the LLNB was determined based on its classification as a species. The species was listed as *Leptonycteris sanborni*. The LLNB has since been reclassified as *Leptonycteris curasoae yerbabuenae* (Arita and Humphrey 1988), but is more recently considered *Leptonycteris yerbabuenae* by Cole and Wilson (2006) in their Mammalian Species account. Because the LLNB is a colonial roosting species known to occur at only three maternity roosts in the U.S., and approximately 40 total roosts across its range in Arizona, New Mexico, and Mexico, impacts at only one or two roost locations could have a significant effect on the population. Roosts in Mexico receive varying degrees of protection. However, because approximately 12 of the 20 + roost locations in the U.S. are found on federally protected lands such as National Park Service, National Forest Service, and National Wildlife Refuges, the degree of threat is considered to be moderate. The primary recovery actions are to monitor and protect known roost sites and foraging habitats. Because both of these actions could be accomplished through management within identifiable areas, the recovery potential for the LLNB is believed to be high.

**Species Status (per the 2002 Biennial Recovery Report to Congress):**

Species Status: Increasing

Recovery Achieved (% of Recovery Objectives achieved): 1 (0 – 25%)

**Listing History**

Original Listing

FR Notice: FR Vol. 53, No. 190, 38456 – 38460
Date Listed: September 30, 1988
Entity Listed: Species
Classification: Endangered

Revised Listing

None

**Associated Actions**

None

**Review History**

Subsequent to the original listing process and finalization of the recovery plan, the status of the LLNB has been reviewed during the development of biological opinions as part of the section 7 consultation process. Recently, we completed a programmatic consultation with the U.S. Forest Service regarding the continued implementation of their land and resource management plans for 11 National Forests and National Grasslands in the southwestern region. The biological opinion prepared for this consultation is the most extensive recent review of the status of the LLNB. This was a non-jeopardy biological opinion that anticipated take of the LLNB in the form of harm or harassment due to impacts to foraging resources, cyanide leaching, and disturbance of roost sites. The final biological opinion for this consultation was completed on June 10, 2005 and is available for review at:
www.fws.gov/southwest/es/arizona/Documents/Biol_Opin/FS%20LRMP%20BO%20FINAL%206-10-50.pdf

**Recovery Plan or Outline**

| | |
|---|---|
| Name of Plan: | Lesser Long-nosed Bat (*Leptonycteris curasoae yerbabuenae*) Recovery Plan |
| | Prepared by: Dr. Theodore H. Fleming, Dept. of Biology, University of Florida, Coral Gables, Florida |
| Prepared For: | U.S. Fish and Wildlife Service, Region 2, Albuquerque, NM |
| Date Issued: | March 4, 1997 |
| Dates of Previous Revisions: | None, this recovery plan has not been revised since it was finalized in 1997. |

Since the listing of the LLNB in 1988, a number of groups and agencies have provided funding for a variety of LLNB research projects. Independent research has also occurred. The LLNB recovery plan has been used as a general guide to direct this research and, while much remains to be done, the recovery plan has guided research in the areas of roost surveys and monitoring, forage availability and management, impacts to roosts, migration patterns, and LLNB natural history.

In 2002, a *Leptonycteris curasoae* Recovery Cooperative (LcRC) was formed. Members include representatives of the Arizona Game and Fish Department, FWS, Bat Conservation International, the Arizona Sonora Desert Museum, land management agencies, and members of the research community in Arizona, New Mexico, and Mexico to encourage implementation of the 1997 recovery plan. This group has met or coordinated as needed to review recovery progress, discuss research proposals, collaborate on simultaneous roost count efforts, and develop a standardized roost count protocol.

LLNB research is ongoing in Mexico. This research is accomplishing some of the recovery actions outlined in the recovery plan, primarily those related to roost monitoring and education. A greater effort needs to be made to coordinate and accomplish recovery actions in Mexico, where the majority of this species' range is located.

During the public comment period for review of the draft LLNB recovery plan, a number of comments were submitted indicating that the recovery plan lacked specific recovery objectives and did not outline specific activities needed to achieve recovery. The recovery objectives and actions outlined in the LLNB recovery plan are general in nature. In addition, neither the recovery plan, nor the administrative record, states why downlisting, rather than delisting, is the recovery goal of the plan. Given the current state of our knowledge related to LLNBs (better population information, identification of new threats, etc.) a revision of the recovery plan is warranted. Specifically, detailed recovery objectives, criteria, and actions should be developed based on current population status, threats, information gaps, and recovery needs.

## REVIEW ANALYSIS

### Application of the 1996 Distinct Population Segment (DPS) policy

Not applicable; the listed entity is not a DPS and there is no new information for this species regarding the application of the DPS policy.

### Recovery Criteria

The 1997 LLNB recovery plan objective is to downlist the species to threatened (USFWS 1997). The recovery plan does not explain why delisting was not considered as the objective for the recovery plan. The recovery criteria for downlisting the LLNB (see below) adequately address all of the major issues pertinent to the recovery of this species. However, the criteria are very general and two of the four criteria (Recovery Criteria 3 and 4) lack quantifiable benchmarks for evaluating whether the criteria have been met. Considerable information has been gathered since this recovery plan was finalized, and the existing recovery criteria do not reflect the current state of our knowledge with regard to population structure, numbers, and dynamics; forage availability and use; and threats to the species and its habitat. Current information suggests that it may be appropriate to develop recovery criteria to address the management of the two potential population demes that have been identified (see discussion in the Population Dynamics section of this review); migration patterns; the movement of LLNBs among available roost sites; the focus on landscape-level forage availability, rather than local effects to forage plants; management of the new and increasing threats of illegal border activities; and the conversion and loss of important habitats due to exotic, invasive plants species and urban development.

The existing recovery plan does not explicitly tie the recovery criteria to the five listing factors or contain explicit discussion of the five listing factors. In addition, the reasons for listing discussed in the recovery plan do not actually correspond with the five listing factors outlined in section 4(a)(1) of the Endangered Species Act (Act). Rather the recovery plan cites the five reasons for listing the LLNB as: 1) a long-term decline in its populations; 2) recent reports of its absence from previously occupied sites; 3) a decline in the pollination of certain agaves; 4) the

results of the status survey conducted by Wilson; and 5) concern for the death of an ecosystem (USFWS 1997). Regardless of the lack of specific discussion regarding the five listing factors in the recovery plan, some of the recovery criteria do address the relevant listing factors identified in the final listing rule for the LLNB (53 FR 38456) as follows:

- *Factor A - Present or threatened destruction, modification, or curtailment of its habitat or range:*
  Recovery Criterion 1 – Monitor major roosts for five years
  Recovery Criterion 3 – Protect roosts and foraging resources
  Recovery Criterion 4 – No new threats to roosts and foraging resources

- *Factor C - Disease or predation:*
  Recovery Criterion 1 – Monitor major roosts for five years
  Recovery Criterion 2 – Roost numbers stable or increasing

- *Factor E – Other natural or manmade factors affecting its continued existence:*
  Recovery Criterion 1 – Monitor major roosts for five years
  Recovery Criterion 2 – Roost numbers stable or increasing

*Recovery Criterion 1 (Monitor major roosts for five years)* – Significant efforts have been made to implement a regular schedule of monitoring at the known roost sites in Arizona. The formation of the LcRC has led to the implementation of annual simultaneous maternity and late-summer-roost surveys. Efforts have been made to improve monitoring protocols and the consistency of monitoring. All of the roost sites identified in the recovery plan have had some degree of monitoring over the past five years. In the U.S., all of the six roosts identified in the recovery plan for monitoring (Copper Mountain, Bluebird, Old Mammon, Patagonia Bat Cave, State of Texas, and Hilltop) have been monitored since 2001. This recovery criterion has been satisfied for roosts in Arizona. None of the New Mexico roosts were identified for monitoring in the recovery plan, but they have been monitored over the past three years. As indicated in comments provided by Dr. Rodrigo Medellín, 13 LLNB roosts, of the approximately 17 identified in Mexico, have been monitored over the past six years (Medellín 2003 and 2005). However, because all roosts in Mexico are not monitored every year or have not been monitored for five years, this criterion has only partially been satisfied for roosts in Mexico. Efforts to accomplish this recovery criterion are ongoing throughout the range of the LLNB.

*Recovery Criterion 2 (Roost numbers stable or increasing)* – Nearly all of the LLNB experts and researchers who provided input to this 5-year review indicated that they felt that the number of LLNBs at most of the roost sites in both the United States and Mexico are stable or increasing. Specifically, Dr. Medellín indicated that the roosts they are monitoring in Mexico show stable or increasing numbers, but he provided no specific numbers for these roosts (Medellín 2005). Two of the 12 individuals providing input to this 5-year review expressed concern about roost numbers (Howell 2005, McCasland 2005). Their concerns were related to ongoing threats and to the fact that increases at certain roosts may not indicate overall population increases.

The following is a comparison of LLNB numbers at Arizona roosts identified in the recovery plan:

| Roost | Recovery Plan Numbers[1] | Current Numbers[2] | |
|---|---|---|---|
| Copper Mountain | ~ 20,000 | ~ 35,000 | (+ 75%) |
| Bluebird | ~ 3,000 | ~ 4,500 | (+ 50 %) [3] |
| Old Mammon | ~ 3,600 | ~ 6,300 | (+ 75 %) |
| Patagonia Bat Cave | ~ 50,000 | ~ 41,500 | (- 17 %) |
| State of Texas | ~ 20,000 | ~ 21,000 | (+ 5 %) |
| Hilltop | ~ 300 | ~ 200 | (- 30%) |

[1] Highest number in recovery plan
[2] Highest numbers 2001 – 2005
[3] Bluebird was abandoned in 2002, 2003, and 2005 due to illegal border activities.

Numbers from the recovery plan were derived primarily from exit counts or a visual census. A number of different individuals conducted the counts, and there is likely some inconsistency in the methods used. Current numbers were derived from exit counts conducted simultaneously. Simultaneous counts were conducted in June for maternity roosts and in August for late-summer roosts. Live counts by experienced bat surveyors were conducted at roost sites in most years, but an effort has been made in recent years to record the exits with infrared video equipment in order to reduce bias and improve the consistency of the counts. Methodology has been relatively consistent over the past five years. Despite some differences in methodology and consistency of the counts in the recovery plan and recent counts, because the counts are really only an index rather than an actual count, the numbers presented are relatively comparable.

The numbers above must be interpreted with some caution. These counts do not represent the total number of LLNBs in Arizona because counts include a combination of maternity roosts and late summer roosts. Bats found in maternity roosts early in the year could occupy late summer roosts, resulting in double counting of some individuals. The number of LLNBs at any given roost fluctuates considerably each year and among years. For consistency and to set a baseline for detecting increases, only the highest count at each roost was used. However, multiple counts at each roost each year are not conducted so this does not necessarily give an accurate picture of LLNB use at these roosts throughout the year or among years, but does give us a snapshot in time for general comparison.

In addition, researchers indicate increasing and stable populations at roost sites not identified for monitoring in the recovery plan. Of particular note are roost sites on Fort Huachuca in the Huachuca Mountains of Arizona. Monitoring over the past ten years indicates steady increases in the numbers of LLNBs at these roosts. One roost site that had been abandoned on the Fort has been reoccupied (Sidner 1990 – 2005).

Additionally, at least four new roost sites at various locations in Arizona have been discovered within the past five years. One small night roost and a large day roost have also been recently documented in New Mexico. Additional monitoring at these sites is needed to determine if they are long-term roosts newly discovered, or if they truly are new roosts, possibly suggesting population expansion or occupancy due to the loss of other roosts.

LLNB roost-monitoring experience indicates that developing a definitive population estimate for this species is difficult. Many factors must be considered when interpreting roost-monitoring data, including time of year, forage availability, climatic conditions, roost availability, etc.; therefore, this recovery criterion is difficult to assess. While most agency and research personnel feel LLNB roost numbers are stable or increasing, the available data are inconclusive at the scale of the individual roost. The available data do not necessarily indicate if there has been a $\pm$ 10% change in the numbers at certain roosts, the threshold that was set in the recovery plan to indicate stability (USFWS 1997). Increases documented at some roosts may indicate population increases or may be the result of roost switching or roost abandonment in other parts of the range. Until we have a more robust monitoring protocol throughout the range of the LLNB, population trends are difficult to assess. Current information suggests that this recovery criterion has been partially completed (annual monitoring of roost counts in Arizona and some in Mexico; some roosts may have met the stability criterion; and surveys for new roosts are ongoing), but some roosts still need continued monitoring and many historical roosts need to be located and checked.

*Recovery Criterion 3 (Protect roost and forage plant habitats)* – More LLNB roost locations are currently known, and are being more consistently monitored, than at the time of listing. In related efforts, a number of studies have been completed that provide us with better information related to the forage requirements of the LLNB when compared to the time of listing and recovery plan completion. Because of improved information, informed agencies are doing a better job protecting LLNB roost sites and foraging areas. Currently, of the 17 major roosts known in Arizona, 12 occur on Federal lands. Section 7 consultations consider the effects to LLNBs resulting from agency actions. For example, in 2006, we processed 96 section 7 consultations and technical assistance requests that addressed LLNBs.

To date, some efforts to protect roosts have been implemented. In some cases, roosts on Federal lands benefit from monitoring by agency personnel and a law enforcement presence. These roosts are probably exposed to fewer potential impacts than they otherwise would be. However, resource and personnel limitations, as well as safety concerns related to border issues, can sometimes limit these efforts and their effectiveness. Two projects to physically protect roosts through the use of gates or barriers have been implemented (Bluebird and State of Texas mines). The experimental fence at the Bluebird Mine worked initially, but was subsequently damaged, an act that coincided with roost abandonment. Gating at the State of Texas mine has had some success. LLNBs continue to use the mine, but the extent of the use is affected by the gate configuration and moon phase. The LLNBs use the gated entrance less during a full or nearly full moon, potentially due to an increased risk of predation (Bucci et al. 2003). An existing cable net over the main entrance to the State of Texas mine has resulted in some LLNB mortality resulting from collisions and entanglement.

It is still unclear how LLNBs generally respond to gates and fences, especially at roosts containing the largest numbers of bats. The size and flight pattern of LLNBs is hypothesized to affect their ability to negotiate gates during exit flights. An experimental gate constructed of PVC pipe appeared to have no effect on LLNB use at Cave of the Bells when tested by the USFS. However, when the PVC gate was replaced with a steel gate, LLNBs abandoned this roost. Testing various gate designs at the State of Texas mine revealed that exits were affected when panel design was changed, and that moon phase affected the bats' awareness of the presence of the gate (Bucci et al. 2003). The fencing used at Bluebird Mine was some distance away from the actual mine entrance and did not affect the LLNB's entrance or exit from the mine. This may explain why LLNBs did not appear to be influenced by the presence of the fence. No fences or gates have been tried at roosts containing very large numbers of LLNBs such as Copper Mountain or Pinacate. The response of LLNBs to gates is an issue that needs further research. Due to the immediate threats at some roost sites, using protective fences away from the roost entrance may be short-term solution until we have a better understanding of how to protect roosts from human disturbance.

Two laws provide some measure of protection at cave roosts, subject to enforcement capability. The Federal Cave Protection Act of 1988 prohibits persons from activities that "destroy, disturb, deface, mar, alter, remove, or harm any significant cave or alters free movement of any animal or plant life into or out of any significant cave located on Federal lands, or enters a significant cave with the intent of committing any act described …". Arizona Revised Statute (ARS)13-3702 makes it a class 2 misdemeanor to "deface or damage petroglyphs, pictographs, caves, or caverns." Activities covered under ARS 13-3702 include "kill, harm, or disturb plant or animal life found in any cave or cavern, except for safety reasons." The effectiveness of these laws with regard to protecting LLNB roosts is related to enforcement efforts, which are currently minimal.

A number of studies have been completed that improve our understanding of suitable LLNB foraging habitat, and other studies have made progress in clarifying the role of the LLNB in pollination and seed dispersal (see Forage Relationships section in this document). Grazing consultations with the USFS have addressed the effects of livestock grazing on agaves. Fire consultations with the USFS, NPS, and DoD have looked at the effects of fire on agaves. Consultations look only at specific projects and areas. In a larger context, the issues of the effects of fire and grazing still lack adequate data and need additional research. The acquisition of Coal Mine Springs, through nontraditional section 6 funding, will protect LLNB foraging habitat and a roost site. In general, however, forage resources, in the form of lands that support saguaros and agaves, have not experienced an increase in protection or enhancement beyond that described in the recovery plan or listing documents.

It appears that the disturbance impacts and damage to roost sites from human-related activities such as recreation and caving are probably not as great as originally thought (USFWS 1988 and 1997). We remain cautious because the potential for such impacts will likely increase in the near future due to increasing development, urbanization, and other land-conversion activities, resulting in additional human presence in the areas where LLNB roost sites are located.

Issues such as illegal border activities, drought, catastrophic fire, and other impacts to roost sites and foraging habitat continue as threats to LLNB habitat in both the U.S. and Mexico. This recovery criterion has not been completely satisfied because protection of LLNB roosts and forage-plant habitats has not been implemented throughout the range of this species.

*Recovery Criterion 4 (Status of new and known threats)* – Our current state of knowledge with regard to threats to this species has changed since the development of the recovery plan. Threats to the LLNB from grazing on food plants, the tequila industry, and prescribed fire are likely not as severe as once thought. Some progress has been made toward protecting known roost sites; however, the effectiveness of gates as a protection measure has not been determined for LLNBs. While legitimate tequila producers likely have minimal effects on natural LLNB forage availability, bootleg production often utilizes wild agaves and remains a threat to LLNB forage resources. There is a significant new threat in the form of illegal border activities. These activities, and associated enforcement actions, affect roosts through disturbance and destruction, and foraging habitat through vegetation damage and increased potential for fire. Recently, another new threat has become an issue. A wind farm project has been proposed on Fort Huachuca, Arizona, an area supporting at least five late-summer LLNB roosts and agave foraging areas. The development of wind energy is a recent issue characterized by concern over documented bird and bat mortalities (BCI 2004). No current wind farms occur in areas occupied by LLNBs so we do not know what the impacts to this species will be. However, bat mortality of many different species has been documented at existing wind energy facilities (Johnson et al. 2004, Johnson 2005, USGS 2007). This is a new threat that needs to be evaluated and which may become more of an issue as this form of alternative energy is expanded within the range of the LLNB.

Urban development, and catastrophic fire and a changing fire regime resulting from non-native, invasive plants are other threats that must still be addressed. The colonial roosting behavior of this species exposes a high percentage of the population to impacts from existing threats, especially those threats related to human disturbance of roost sites. LLNB roosts in proximity to the U.S./Mexico border are particularly vulnerable. The realization of these threats at only one or two roost sites can have significant population-level impacts. Despite the reduced incidence of some threats identified at listing and in the recovery plan, this recovery criterion has not been met because new threats have been identified (border issues, wind energy), and roost sites remain vulnerable.

## Current Species Status and New Information

**Improved Analysis –** At the time of listing and during the development of the recovery plan, roost monitoring was done on an irregular basis and monitoring protocols were not consistent. The formation of the LcRC has created a forum for improved availability and analysis of LLNB roost-monitoring data. Specifically, work is underway to create a centralized data repository that will improve the completeness and availability of roost-monitoring data for population analysis. In addition, roost-monitoring protocol has been improved through the use of infrared video monitoring. These tapes can then be reviewed in the lab, under slow motion, to obtain a more accurate count and improved species identification. There is some ongoing debate as to the cost-effectiveness of this method because of the increased hours needed to complete the count and the

need for special equipment. The issue of data comparability has been raised when not all monitoring efforts can employ the use of video cameras. The question has also been raised with regard to needing such an accurate count when, in fact, all counts are an index of abundance rather than a complete count, even when using infrared video technology. Regardless, infrared videography has improved the accuracy of roost exit counts.

Roost monitoring at most sites in the U.S. and Mexico now occurs on a regular basis. Annual counts at select maternity and late-summer roosts have occurred for the past five years using consistent methodology (timing and protocol) so that comparison among roost sites and years can occur. The consistent nature of the timing of monitoring and the protocols used has allowed the comparison among years of these trend indices and informed the current determination that population trends are stable or increasing.

The Arizona Game and Fish Department is currently modeling roost-site variables in Arizona and northern Mexico to allow us to better identify potential roost sites in order to more effectively and efficiently allocate research and monitoring resources. The use of radio telemetry has resulted in the location of a number of new roosts. Telemetry technology is also contributing to our increased understanding of seasonal LLNB movements within Arizona and New Mexico and LLNB foraging behavior.

**Taxonomy –** The LLNB has a complicated taxonomic history (Carstens et al. 2002). The species was originally listed as *Leptoynycteris sanborni* (USFWS 1988). Arita and Humphrey (1988) and Wilkinson and Fleming (1995, 1996) support classification as *Leptonycteris curasoae*. They further define two subspecies, *L. c. curasoae* (found in the southern portion of the range) and *L. c. yerbabuenae* (found in the northern portion of the range). Some researchers support the raising of L. *c. yerbabuenae* to specific status as *Leptonycteris yerbabuenae* (Cole and Wilson 2006). FWS currently classifies the listed entity as *Leptonycteris curasoae yerbabuenae*. However, information gathered during this review indicates additional investigation into the taxonomy of the LLNB is warranted (see Recommendations for Future Actions).

**Biology and Habitat –**

*Abundance* – A number of research and monitoring efforts have been completed or are ongoing related to the abundance of the LLNB in Arizona and New Mexico. Maternity roost counts indicate more LLNBs than at the time of listing. Some late-summer roost-site counts have shown a decrease in numbers. However, subsequent to listing, new late summer roost sites have been documented in both Arizona and New Mexico. The meaningfulness of late-summer roost numbers, as well as maternity roost numbers, may be complicated by climatic conditions, forage availability, or a landscape-level change in roost-use patterns. In general, survey and monitoring data indicate that the LLNB is more abundant in Arizona and New Mexico than indicated in the final listing rule, however, additional investigation is needed to determine if this represents a true population increase.

Fort Huachuca has been monitoring LLNB roosts on the base since 1990 (Sidner 1990a, 1990b, 1991, 1992, 1993, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002a, 2002b, 2004, 2005b). Of particular note, one LLNB roost site that had been abandoned became reoccupied. Numbers of LLNBs in this reoccupied roost have steadily increased from no bats (1990 – 1994) to approximately 9,400 in 2004 (Sidner 2004). It is likely that this increase is due to a combination of increased LLNB numbers and roost switching behavior.

Organ Pipe Cactus National Monument personnel have also conducted annual monitoring at the largest LLNB maternity roost in the United States for 15 years. LLNB numbers have increased from an average of approximately 12,000 from 1989 – 1997, to around 25,000 over the past six years (Billings 2005). Monitoring at nearby Cabeza Prieta National Wildlife Refuge (NWR) of a much smaller maternity roost has shown stable numbers, but has also experienced abandonment in three of the past five years, resulting in the potential loss of the annual reproduction of approximately 4,000 LLNBs depending on timing and the availability of alternate roost sites.

The Arizona Game and Fish Department, in conjunction with the LcRC, has coordinated an annual, simultaneous roost count for selected maternity roosts and late-summer roosts throughout Arizona. The results of these counts are presented below (AGFD 2005):

August Simultaneous Roost Census (2001 – 2004)
Number of Roosts = 11

| | **2001** | **2002** | **2003** | **2004** |
|---|---|---|---|---|
| **Annual Total** | 71,200 | 75,035 | 65,124 | 72,615 |

Maternity Site June Roost Census* (2000 - 2004)
Number of Roosts = 3

| | **2000** | **2001** | **2002** | **2003** | **2004** |
|---|---|---|---|---|---|
| **Annual Total** | 43,505 | 26,990 | 30,382 | 37,838 | 34,615 |

*May not be simultaneous

Less is known about LLNB numbers and roosts in New Mexico. One roost site in the Peloncillo Mountains on the Arizona/New Mexico border is known. Two roosts were documented in the mid-1990s in the Animas Mountains of Hidalgo County, New Mexico (Altenbach 1995). These are a new day roost that, at times, contains several hundred long-nosed bats and an historical night roost where both species of long-nosed bat can be found. One additional roost was found in the Big Hatchet Mountains in 2005 (Bogan 2005). Bogan (2005) reported an August 2005 roost count total of 6,200 – 6,500 LLNBs at multiple roost sites.

*Population Dynamics* – Wilkinson and Fleming (1995, 1996) suggest that there are two migration routes used by LLNBs as they move northward from Mexico: 1) a Pacific coastal route ranging from at least Guerrero in the south to Arizona and 2) a Sierra Madrean inland route, possibly ranging as far south as Chiapas, to Arizona. LLNBs in southwestern Arizona show genetic affinities with bats from Pacific coastal sites. LLNBs roosting in southeastern Arizona

show genetic affinities with Mexican bats from inland sites. Under this hypothesis, LLNBs move north and south along two distinct paths, one to southwestern Arizona, and another to southeastern Arizona and southwestern New Mexico.

Medellín (2005) provides a summary of population dynamics in Mexico. He indicates that this species has a complex life history with two female "demes" where reproduction is temporally and spatially displaced. A more discrete, temporally concentrated birth season occurs in early May in the Sonoran Desert from southern Sonora, Mexico to Arizona. A more diffuse (temporally and spatially) winter birth season occurs primarily throughout the dry tropical forest of Mexico from Sinaloa to Guerrero and on to Chiapas along the west coast, and inland at least into the Balsas Basin. Dr. Medellín and his coworkers have documented maternity colonies in the states of Chiapas, Guerrero, Michoacán, Sinaloa, Jalisco, and Hidalgo, from November through February. He believes that there are many more maternity colonies in the winter, southern birth pulse than in the summer, northern birth pulse. However, it appears that the winter maternity colonies are smaller numerically than the largest summer maternity colony known in the Pinacate in Sonora, which contains approximately 100,000 LLNBs. Most of the winter maternity colonies contain around 20,000 to 30,000 pregnant or lactating females. On a single occasion, in the winter of 2000, they documented a much larger colony, an estimated 120,000 pregnant females, in the southernmost recorded maternity colony in the state of Chiapas. This colony normally numbers between 20,000 and 30,000. Such a fluctuation in numbers at roosts in Mexico would possibly affect numbers seen in northern roosts during those same years and provides further evidence that simultaneous and long-term data are needed to get a true picture of the LLNB population trends.

Ongoing monitoring in Mexico continues to track movements and provide information on seasonal feeding habits and dynamics. Medellín (2005) concurs with published information (Cristobol et al. 2004, Stoner et al. 2003, Rojas-Martinez et al. 1999) suggesting that a certain proportion of the LLNB population remains in central Mexico year-round. The migration pattern of LLNBs is diffuse and opportunistic. In central Mexico, food resources are available year-round, with an important seasonal fluctuation. If sufficient resources are produced in a given year, more bats will remain in Mexico year-round and not migrate. If fewer resources are available during the summer, perhaps more bats will show up in the Sonoran Desert. It is unknown whether the production/availability of resources in a given year is correlated between these two ecosystems (tropical dry deciduous forest and Sonoran Desert) (Fleming 2004). Research in Mexico over the next several years is aimed at understanding this pattern and process. However, until a clearer understanding of LLNB population dynamics exists, we need to be cautious about interpreting roost count numbers in the U.S., as they are likely affected by 1) roost switching behavior; 2) the annual influence of the population segment that remains in Mexico; and 3) a diffuse and opportunistic migration pattern.

A recent study by Cristobal et al. (2004) provides the first documentation of the continuous presence of a substantial female population of LLNBs throughout the year in a single roost in the Mexican tropics. This indicates that some populations of LLNBs in central Mexico complete their lifecycle without having to migrate. Rojas-Martinez et al. (1999) also examined the

existence of migratory and non-migratory portions of the LLNB population. Stoner et al. (2003) emphasized the need to protect roosts that are used year-round by resident LLNBs in Mexico, and not just focus on migratory routes and northern maternity roosts in Sonora and Arizona.

Medellín and Fleming (unpublished data) believe that there is genetic flow between the two described demes (Medellín 2005). How and why this flow happens is unknown. However, it appears that a particular female of this species is likely to reproduce but a single time in a year; in other words, it is highly unlikely that a particular female will reproduce once in the north in the summer and again in the winter in the south. This would provide a certain speciation pressure to make the two demes independent species, except that all bats of this species seem to coexist during the winter in central-western Mexico, where at least some genetic flow occurs, thus preventing speciation (Medellín 2005).

As an alternative to the above hypothesis, a more circular pattern of migration has been suggested (Krebbs 2005a, 2005b). Under this hypothesis, LLNBs move north in the spring to southwestern Arizona to give birth in maternity roosts. During this season, columnar cacti are the primary food sources. Following birth, and after the young are volant, the coincidental decline of food resources around maternity roosts and the increase of available food in the form of blooming agaves results in LLNBs moving north and east to late summer roosts. Here, LLNBs feed on agaves until they migrate south, back to Mexico, in October and November. The Arizona-Sonora Desert Museum has undertaken a two-year study to determine if LLNBs at maternity roosts in southwestern Arizona migrate north and east to southeastern Arizona in response to the end of the maternity season and changing availability of food resources. Krebbs et al. (2004) and Krebbs (2005b) used a number of different marking techniques, including microchips and telemetry, to monitor LLNBs when they left their maternity roosts. One bat in 2004 and one bat in 2005, each fitted with a radio transmitter, were located in southeastern Arizona after being marked in a maternity roost in southwestern Arizona. This study provides evidence that at least some LLNBs move north and east to forage on agaves before moving south back to Mexico in late fall.

*Forage Relationships* – One of the primary issues related to listing and discussed in the recovery plan involves the mutualistic relationship between LLNBs and their forage species, columnar cacti and agaves. It has been suggested that a decline in the LLNB or a decline in the forage species could result in a subsequent decline of the other member of the mutualistic pair. There is no question that LLNBs have specific adaptations that allow them to exploit nectar, pollen, and fruits as food resources and that certain plants have adaptations that attract and reward LLNBs for their visits (Howell and Roth 1981, Howell 1974, Howell and Hodgkin 1976, Valiente-Banuet et al. 1996). However, the effect of this type of mutualism on plants and plant communities is not a factor that requires evaluation when considering whether a species should be listed under the Act.

A summary of available literature shows that LLNB are probably dependent on agaves as a food source from mid- to late summer (Barnitz 2002). Howell (1979) and Ober et al. (2000) suggest that bats remember the location of foraging areas and plants within a population. LLNB flock or group foraging behavior (multiple bats foraging together in the same area) decreases overall energy costs of feeding by minimizing the time spent searching for food. Group memory

reduces the potential for visiting flowers that have been emptied on previous nights, and increases the potential of visiting flowers having a large amount of nectar from more than one night of accumulation. Ober et al. (2000) reported that LLNBs returned to foraging areas on consecutive nights and observed that changes in core use areas tended to be the result of the conclusion of nectar production in the original area. LLNB visitation rates to individual agave plants increased as the number of flowering umbels per plant increased and was higher at plants where blooming had progressed to the mid-inflorescence and decreased again as blooming moved to the top of plants (more flowers are in the middle umbels). Peak visitation occurred at 2100 hr, which is when nectar production is the highest. Thus, foraging areas that experience regular and ongoing use, based on nectar and pollen production, may be of particular importance to LLNBs. Ober et al. (2000) calculated that a population of 100,000 bats would need an average density of 0.16 flowering plants/ha over a 3,771 $km^2$ foraging area surrounding a roost. However, density over a broad area is probably less of a determinant than arrangement of food plant populations and density of flowering plants within those populations.

Ober et al. (2000) presents evidence that LLNBs select areas with both high resource abundance and evidence of high resource abundance in previous years (old floral stalks), suggesting site fidelity to agave stands. The seasonal dietary specialization of LLNBs implies that a reduction in or further fragmentation of agave populations could have serious effects on bat behavior, forcing them to commute farther, roost in suboptimal roosts, or compete with one another for food at remaining plants. These effects would be especially evident during years of low flower production, when energy expended by bats is appreciably higher.

LLNBs probably employ different feeding strategies according to forage plant and nectar availability. Changes in nectar availability from year to year can have a large impact on energy expenditure. The common theme of foraging areas is the presence of a high concentration of nectar arranged in a way that minimizes time in inefficient flight. The juxtaposition (or lack thereof) of suitable night roost habitat with areas of high nectar availability is important in relation to energy expenditure, and may further define foraging areas (Barnitz 2002). Sahley et al. (1993) discuss the mechanics of traveling and foraging flight in LLNBs and the adaptations of this species to their foraging environment.

Moreno-Valdez et al. (2004) found that the abundance of *Leptonycteris nivalis* (a species closely related to the LLNB) at a major roost in Mexico was correlated with the frequency of blooming agave and ambient air temperature. They suggest that the conservation of this federally protected bat will require the maintenance of relatively large areas of wild agave. Recent research suggests that nectar availability is not likely to be a limiting resource rangewide, but that there may be areas or years where nectar availability affects LLNB numbers and distribution (Billings 2005, Howell 2005, Slauson and Dalton 1998).

Other studies emphasizing the relationship between LLNBs and their forage species include McGregor et al. 1962, Nabhan and Fleming 1993, Fleming and Sosa 1994, Howell 1994, Petit and Pors 1996, Petit 1997, Slauson 1999, Fleming 2000, Godinez-Alvarez and Valiente-Banuet 2000, Slauson 2000, Stoner et al. 2003, Nassar et al. 2003, Molina-Freaner and Eguiarte 2003, Fehmi et al. 2004, Moreno-Valdez et al. 2004, Ober and Steidl 2004, Quesada et al. 2004, and Scott 2004.

**Threats**

*Roost Disturbance* – Much debate surrounds the legitimacy of the 1988 listing of the LLNB, mostly centered around the population numbers and trends recorded from roost-site monitoring. At the time of listing, population numbers and trends used by FWS in determining the endangered status of the LLNB showed low numbers (~ 500 in Arizona) and a declining trend (Wilson 1985). Information gathered since the listing shows higher population numbers and a generally stable-to-increasing trend (Cockrum and Petryszyn 1991, AGFD 2005). Regardless of the total numbers of LLNBs counted at roost sites, the primary threat to this species comes in the form of roost-site disturbance or loss. The colonial roosting behavior of this species, where high percentages of the population can congregate at a limited number of roost sites, increases the risk of significant declines or extinction due to impacts at roost sites. LLNBs remain vulnerable because they are so highly aggregated – it is one of only two cave-roosting species in Mexico that regularly occur in colonies of over 200 individuals (Nabhan and Fleming 1993).

*Border activities* – Some of the most significant threats to known LLNB roost sites are impacts resulting from use and occupancy of these roost sites by individuals involved in illegal border crossings, both from individuals crossing to look for work and the trafficking of illegal substances. Mines and caves which provide roosts for LLNBs also provide shade, protection, and sometimes water, for border crossers. The types of impacts that result from illegal border activities include disturbance from human occupancy, lighting fires, direct mortality, accumulation of trash and other harmful materials, alteration of temperature and humidity, destruction of the roost itself, and the inability to carry out conservation and research activities. These effects can lead to harm, harassment, or, ultimately, roost abandonment.

The number of illegal border crossers has increased dramatically over the past few years. Effects of this increase are already evident at some known LLNB roost locations. The Bluebird roost on Cabeza Prieta NWR has been abandoned three out the past five years due to illegal border activities (McCasland 2005). Monitoring and research at the roost on Organ Pipe Cactus National Monument has been reduced or eliminated because of researcher safety concerns related to border issues (Billings 2005). In addition, illegal border crossers have typically used the valley adjacent to the roost area. In 2005, trails, trash, and other indicators of illegal crossing activities have moved to an area right below the roost site (Billings 2005). This roost is quite visible and it is only a matter of time before there is occupancy or use of the roost site by people crossing the border.

Comments submitted by Curt McCasland, Assistant Refuge Manager at Cabeza Prieta NWR, indicate the gravity of this threat to the limited number of known roost sites. He states, “There is evidence of illegal smuggling activities less than one tenth of a mile from the mine adit. We continue to be concerned that the fence will be damaged and the adit will be utilized by smugglers, possibly forcing the bats to once again abandon the adit (McCasland 2005).” Approximately two months after submitting these comments, the protective fence at this roost site was vandalized by smugglers and the bats were absent from the roost (McCasland pers. comm.).

Mr. McCasland continues, “Furthermore, we are aware of numerous smuggling trails in close proximity to the mine adit used by lesser long-nosed bats on Organ Pipe Cactus National Monument. Given the paucity of maternity colonies in the United States, any loss is significant. In fact, threats may now be more significant than at the time of the initial listing of the lesser long-nosed bat as an endangered species (McCasland 2005).”

Information provided by Organ Pipe Cactus National Monument echoes this concern. “However, in recent years, it appears anthropogenic threats, especially border related activities (e.g., illegal immigration and drug smuggling) appear to be increasing near this colony. These activities, which are at their peak of intensity from January through June, also correspond with the time period that *Leptonycteris* occupy the Copper Mountain roost. We are concerned that illegal immigrants and/or smugglers and/or law enforcement officers may enter Copper Mountain and cause disturbance of the roost during this critical time frame. Such human disturbance could potentially affect approximately 25,000 adult female bats and offspring. This event would have a substantial impact on the status of this species in the southwestern United States (Billings 2005).”

A new late-summer roost was discovered approximately three years ago. During the August 2005 simultaneous roost count, the individual monitoring this roost noted substantial evidence that the roost had been used by illegal border crossers. The landowner of this site confirmed that illegal border traffic had increased recently (Dalton pers. comm. on 8/20/05).

From Coronado National Memorial: “Heavy illegal cross-border traffic of undocumented aliens (UDAs), including immigrants and smugglers, intensifies the need to protect the roost site of the endangered lesser long-nosed bat (LLNB) at Coronado National Memorial. Specifically, UDAs often use mines and caves as hiding spots, yet the LLNB roost on the Memorial is currently protected only by cable nets, which can be (and have been) breached by lifting up the unsecured bottom sections or cutting. Therefore, the probability of disturbance to bats has increased with the rise in UDA traffic coming through the Memorial, and evidence of human presence has been found more frequently near the main roost site and at some potential roost sites in recent years. UDA apprehension on the Memorial rose from only 289 in 1996, to 2,551 in 2000, and to 7,633 in 2003. However, in 2003, the total number of UDAs detected entering the park was 30,626, over four times the number actually apprehended (total entry numbers are calculated from reported sightings by law enforcement personnel, sensor data, and apprehension data),” (Mann 2005).

The threat of disturbance of roost sites by border crossers is not likely to decrease in the near future. Nearly half a million people cross into Arizona illegally each year. It has been estimated that each immigrant leaves behind approximately eight pounds of trash, resulting in nearly 2,000 tons of trash being dumped in the desert each year (USINFO 2005).

Bogan (2007) states that illegal border crossers are not having as much of an impact on day roosts in New Mexico due to the rugged terrain. However, use of the known night roost is ongoing and “we usually find fresh sign of their presence at this site on every visit. An uncontrolled fire could eliminate this night roost that seems to have been used by one or both species of long-nosed bat since at least the 1960s”.

It is important to note that impacts from border activities are not restricted to just the immigrants or smugglers. Management of this problem, including law enforcement and apprehension of illegal immigrants and smugglers can also result in impacts to LLNBs and their habitat. Of particular concern is the creation of new roads for surveillance. Use of helicopters, off-road vehicles, lights, sensors and other enforcement equipment all have the potential for effects to LLNBs and LLNB habitat.

*Recreation* – Caves and mines continue to attract recreational users interested in exploring these features. While no specific incidences of recreation-related disturbance at LLNB roosts have been documented, this threat continues to be an issue. Disturbance from illegal aliens have caused the Bluebird roost on Cabeza Prieta NWR to be abandoned three out of the past five years. Thus, disturbance from recreational users could also cause roost abandonment. At Cave of the Bells (a historical LLNB roost and popular cave used by cavers), the FS issued keys to cavers for recreational use of this cave every week between December 2004 and April 2006 (USFS 2006). Increasing urbanization in proximity to many LLNB roosts in southeastern Arizona will likely result in increased recreational use and an increased threat for disturbance of LLNB roosts. In addition, liability concerns may lead to managers destroying roost sites to prevent human entry (see issue below).

*Vandalism* – The deliberate destruction, damage, or defacing of caves and mines is a threat to LLNB roosts. This does not appear to be as big of a threat in the United States, but vandalism has been identified as perhaps the single most important threat to the LLNB in Mexico (Medellin 2005).

*Roost Deterioration* – One known night roost in the Animas Mountains in New Mexico is an abandoned building. Over the last decade, the roof of this structure has deteriorated. Unless repairs to the roof are made, this structure will become unusable as a LLNB night roost. This may impact their ability to forage in areas near this night roost. The entrance to a mine in Arizona supporting one of the three known LLNB maternity roosts in the state had to be stabilized due to cave-ins and rock sloughing. If repairs had not occurred, the suitability of this important roost site may have been affected. Howell (2007) reported finding a roost where skeletal evidence indicated that hundreds of LLNBs had perished, apparently trapped as a result of a natural event such as a flood or mudslide.

*Fire* – Catastrophic wildfire may result in impacts to roost sites. The fire itself can result in short-term impacts from smoke and heat. More lasting impacts can result if the microclimate of the roost is affected by the impact of the fire (removal of vegetation, change in air currents, alteration of hydrology, etc.). In 2005, the Florida Fire in the Santa Rita Mountains, south of Tucson, burned in areas affecting late summer roost sites for the LLNB. Post-fire monitoring has not occurred, but smoke and suppression efforts (fire retardant and water drops, helicopters, etc.) likely affected these roost sites to some extent (USFS pers. comm.). The ongoing drought and increased invasion by non-native plant species make fire a continuing threat to roost sites.

Fire is an associated threat resulting from the illegal border activities discussed above. In 2002, illegal immigrants are suspected of having caused eight major wildfires. The wildfires destroyed

68,413 acres (about 108 square miles). Escaped campfires start wildfires when border crossers attempt to warm themselves or cook food, especially during the colder months from late fall through spring (USINFO 2005).

*Vampire-Bat Control* – Ongoing educational efforts have improved the identification of bat species in targeted vampire-bat control and improved the understanding of the general public and agricultural operators with regard to methodology. However, some of the general population still views bats with fear and hesitancy. In Mexico, the impact of vampire bats on the livestock industry and perceived threats to humans has resulted in various vampire-bat control and eradication efforts (Medellín 2003). Genuine vampire-bat control is badly needed in some regions of Mexico and Latin America due to economic losses related to diseases, such as rabies, and a reduction in meat and milk production. If control efforts fail to differentiate between bat species, many other species of bats are killed, including LLNBs. The promotion of properly applied, vampire-specific control methods, rather than indiscriminate methods, is still needed.

*Mine closures* – Many public agencies with land-management responsibilities must consider the liability of caves and mines occurring on their lands. Should LLNB roosts in mines or caves be deemed a public safety threat, the agency may take action to permanently close the roost site. This direct effect to a roost site would be significant. Most land-management agencies (FS, BLM, NPS, etc.) have an ongoing program to close old mine sites. Pima County, in southeastern Arizona, has pursued mine closures on lands that they have acquired for conservation purposes. Efforts to at least survey mines prior to closure for the presence of LLNBs would allow implementation of conservation measures at occupied sites. Such efforts have been made in Arizona and New Mexico by both the BLM and FS in certain areas.

*Forage Availability* – Although LLNBs have the ability to forage over long distances to obtain resources when they are scarce, research has shown that when forage resources are adequate and long movements are not necessary, LLNBs forage as close to their roost sites as possible (Horner et al. 1998, Ober and Steidl 2004, Ober et al. 2005). This strategy is energetically efficient and emphasizes the importance of maintaining food resources in proximity to roost sites. However, foraging studies have also shown that LLNBs will fly long distances to forage even when forage resources are available closer to roost sites (Bogan 2007) and is evidence that further investigation into the foraging behavior of this species is needed. Impacts to forage availability include drought, fire, grazing, and urban development.

<u>Fire</u> – In 2005, it became evident that fire is an important factor related to potential forage availability for the LLNB. As a result of ongoing drought, invasion of non-native plants, and years of fire suppression, two catastrophic wildfires (Florida and Cave Creek Complex fires) and a number of smaller ones affected potential foraging habitat for the LLNB. While some studies have examined the effects of fire on agaves and saguaros, the long-term effects of fire on forage availability are not completely understood.

There is little information available on the effects of fire on agaves and bats. Slauson and Dalton (1998) concluded that the short-term effects of fire on flowering agaves were limited. In fact, they found that burned plants produced significantly more nectar and had higher sugar concentrations than unburned plants. Pollen production and seed set were also unaffected by

burning. Bat monitoring did not show a preference for agaves in burned or unburned areas. The short-term effects of fire on flowering agaves appear limited, but this study did not address the long-term impacts on agave survival, reproduction, or distribution.

Some agency monitoring has occurred post-fire for both wildfires and prescribed burns. This monitoring indicates that agave mortality in burned areas is generally less than 10%. Contributing to this is the fact that most fires burn in a mosaic, where portions of the area do not burn. Impacts of fire on agave as a food source for LLNBs may not be a big concern for the following reasons: fire-caused mortality of agaves appears to be low; alternative foraging areas typically occur within the foraging distance from LLNB roosts; and most agave concentrations occur on steep, rocky slopes with low fuel loads (Warren 1996).

However, Howell (1996) indicated that agave reproduction could be substantially affected by fire. While monitoring agaves for five years on Fort Huachuca, she found that most seeds germinate right under or among the dying leaves of the parent plant. Vegetative reproduction also occurs adjacent to parent plants. She found that the dead agave rosettes are very flammable, with the hearts of these old plants burning long and hot, resulting in the death of adjacent young plants.

Slauson and Dalton (1998) indicate that there is still much to learn related to agave/bat/fire relationships. A five-year study by Howell (1996) is the only long-term look at the effect of fire on agaves. Additional research is needed to more clearly define the interrelationships between burning and 1) nectar volume and sugar concentrations; 2) pollinator populations and foraging behavior; 3) agave fruit- and seed set; and 4) long- and short-term effects of various burning frequencies on agave population biology.

Grazing – Cattle and wildlife can preclude flower development in agaves by grazing the emerging flower stalk, ultimately reducing forage abundance for the LLNB. Widmer (2002) found that the number of agave bolts subject to herbivory was greater in areas where livestock grazing occurred during the bolting season (74.9%) versus areas that were not grazed by livestock during that time period (46.1%). Overall, inflorivory occurred on an average of 56% of the flowering plants. Wildlife such as javelina, white-tailed deer, and small mammals also utilized agave flower stalks as a food resource. Howell (1996) found that pronghorn antelope heavily grazed agave flower stalks in certain areas within Fort Huachuca, resulting in local areas of near 100% utilization. The extent of livestock use of agave flower stalks appears to be related to standing biomass and distance from water. Grazing intensity was higher during dryer years when the standing biomass of alternative forage species was decreased. In addition, livestock use of agave flower stalks decreased the further from water the plants were located. Livestock and wildlife will also break off the agave flower stalk to gain access to the flowers. Bowers and McLaughlin (2000) observed that 70.7% of 140 plants that initiated flower stalks were broken and did not flower. The proportion of flower stalks broken did not differ significantly between grazed and ungrazed areas.

Coronado National Memorial has monitored agaves (*Agave palmeri*) in 9 plots (5 grazed, 4 ungrazed) annually in June from 1995 through 2004. Data collected include numbers of agaves in 5 different size classes, numbers of agaves that are flowering, and numbers of current-year

flower stalks that have been eaten (by wildlife and/or cattle). Analyses of data from 1995-2003 show that compared to grazed plots, ungrazed plots have more agaves in all 5 size classes and more agaves that are flowering (Mann 2005). Additional work on the effects of both livestock and wildlife grazing on agaves is needed. The effects of grazing on LLNB forage availability is a more significant issue if environmental conditions (fire, drought, etc.) reduce forage availability.

Non-native invasives – Non-native, invasive plant species such as buffelgrass (*Pennisetum ciliaris*), Lehmann's lovegrass (*Eragrostis lehmanniana*), red brome (*Bromus rubens*), and Sahara mustard (*Brassica tournefortii*) have become established and are increasing in vegetation communities that provide important LLNB foraging habitat. Of primary concern is that the presence of these species significantly changes the fire regime. These non-native species are fire-adapted, and the fuels they provide increase the frequency and intensity of fire within the vegetation community. The Sonoran Desert is not a fire-adapted community, and the columnar cacti upon which the LLNB depends for food resources are not fire-adapted. The occurrence of fire in the Sonoran Desert community results in the loss of these non-fire-adapted species. Microclimates in areas where these non-native plant species occur are not suitable for the germination and establishment of columnar cacti. The issue of non-native, invasive plants is significant in both the United States and Mexico. Bogan (2007) indicates that invasive species are currently not as great of a threat in New Mexico.

In Mexico, millions of acres of Sonoran Desert and thornscrub are being converted to buffelgrass, which represents both a direct and an indirect loss of habitat because of invasion into adjacent areas and increased fire frequency and intensity (Burquez-Montijo et al. 2002). Buffelgrass occurs in areas purposely converted from native vegetation communities to buffelgrass plantations, and it is also invading into and becoming dominant in other areas of native vegetation. Conversion is achieved by first clearing the native vegetation by mechanical means, and then seeding with buffelgrass. The occurrence of buffelgrass is changing the ecology of these areas by increasing the frequency and intensity of fire, which in turn is resulting in the conversion of native vegetation communities into savanna grasslands. The loss of saguaros is primarily a result of fire in the Sonoran Desert (Esque and Schwalbe 2002). The consequent elimination of trees, shrubs, and columnar cacti from these areas is a serious threat to the availability of LLNB forage resources.

In Sonora, Mexico, 1.6 million ha of desert vegetation has been converted to buffelgrass pasture (about 10% of the state's area) (Burquez-Montijo et al. 2002). Up to 1/3 of the state's area has been targeted for conversion to buffelgrass (Navarro 1988 in Williams and Baruch 2000). This acreage is in addition to those areas that have also been cleared or converted for agriculture and urban development. Burquez and Yrizar (1997) state that "Given the government subsidies to establish exotic introduced grasslands, to maintain large cattle herds, and to support marginal cattle ranching, the desert and thornscrub in Sonora will probably be replaced in the near term by ecosystems with significantly lower species diversity and reduced structural complexity, unless control measures are implemented." Such replacement is and will continue to affect LLNB habitat availability.

In Arizona, many of the areas suitable for buffelgrass are managed as FWS wildlife refuges, national monuments and parks, or occur on the Tohono O'odham Nation, where purposeful conversions are unlikely to occur, although non-native grass invasions have occurred. These non-native grasses have increased the frequency and intensity of fires in the Sonoran Desert scrub of Arizona. Efforts are underway in some of these areas to restore areas where non-native plant invasions have occurred. Thus, ecosystem conditions are less likely to be altered in Arizona, at least with regard to the severity of ecological impacts of vegetation community conversion for livestock and agriculture that is occurring in Mexico.

Development - Arizona is the fastest growing state in the country (Tucson Weekly 2007), and much of this growth is projected to occur in the counties and cities that occur within the range of the LLNB. Growth rates in the three counties that support the known LLNB roosts are approximately 10% (Pima – 10.4%; Santa Cruz – 9.4%; Cochise – 10.6%) (DES 2005). Pima County was expected to reach 1,000,000 residents by 2009, but actually reached this milestone in 2006 (AZ Central 2006). Of specific concern is the explosive growth projected for Benson and Sierra Vista in Cochise County. These two towns are currently relatively rural in nature. However, over the next 20 years, this could change significantly. Fort Huachuca is located in Sierra Vista and is expected to grow as other military bases are shut down throughout the country (AZ Daily Star 2005a). In addition, two developers plan to add more than 11,000 homes to Sierra Vista over the next two decades (AZ Daily Star 2004). Benson, a town of currently around 4,900 residents, is expected to reach 20,000 by 2010. This is due largely to several large, master-planned communities that are anticipated in the area. Whetstone Ranch, currently under development, covers approximately 14,000 acres. Sands Ranch, southeast of Benson, covers approximately 1,230 acres and is planned for 4,500 units. The J-6 Ranch, northeast of Benson, is currently planning development on approximately 560 acres. Urban expansion is also an issue in Mexico, where the population has grown from 13.6 million in 1900 to 85.5 million in 1995 (Pineiro 2001).

LLNBs are affected directly by development which removes important foraging habitat, but also indirectly as growing numbers of people increase the potential for roost disturbance. The impacts to LLNB habitat are of great concern because they tend to be permanent, long-term impacts, as opposed to the often temporary, shorter-term impacts from fire, grazing, and agave harvesting. LLNBs are able to reduce the effects of temporary impacts by moving to alternative sites in the short-term. The permanent removal of habitat and long-term increased human presence on the landscape are significant threats to LLNB populations. Urban development and population growth were not identified as threats in the original listing or in the recovery plan. However, this threat is real and is increasing in significance. Large, open landscapes once used for ranching are being converted to urban subdivisions as the human population shifts towards a more urban emphasis. The presence of hummingbird feeders used by foraging LLNBs is a potential effect associated with urban development. Studies are currently underway investigating the potential effects of hummingbird feeders on LLNBs (Wolf and Dalton 2005). The failure of agaves in southern Arizona to flower in 2006 resulted in an increased number of reports of nectar-feeding bats at hummingbird feeders in urban areas such as Tucson, Green Valley, and Sierra Vista. Some of these reports occurred in areas where use of hummingbird feeders by LLNBs had not been previously reported. The AGFD opportunistically captured and placed radio transmitters on two of these LLNBs in Tucson and followed them back to their day roost,

approximately 10 miles and 25 miles from their respective capture areas. Though only two bats, the results were interesting in that these two bats chose to move around the periphery of the urban area, moving through natural open space along wash corridors and within low-density development (typically 1 house/acre or less dense) rather than through or over higher-density urban development. This experience points out the importance of maintaining natural habitat corridors within developed areas to facilitate the movement of LLNBs between roost sites and foraging areas, as well as between foraging areas.

Agave Harvesting – It has been suggested that LLNBs, as important pollinators of agave, are affected by the harvesting of agave for the production of tequila. Arita and Wilson (1987) indicated that this bat-plant relationship is so strong that the disappearance of one would threaten the survival of the other. However, it is more likely that the relationship between agaves and LLNBs is "a loose association of less closely evolved organisms in a multiple-species pollination syndrome where the effects of one species' decline upon the other organism may be more subtle and complex than those of the "storybook" mutualisms that have become cliché (Nabhan and Fleming 1993)." Nonetheless, there is no doubt that the harvest of wild agaves removes significant LLNB food resources. Nabhan estimates that bootleg mescal makers are eliminating between 500,000 and 1,200,000 wild paniculate agaves per year in Sonora alone (Nabhan 1985 and Nabhan et al. 1992 *in* Nabhan and Fleming 1993).

Pressure to harvest wild agaves may be intensified by the reduction of plantation agaves resulting from a 1997 fungus plague (Nabhan and Zapata 2004). The increased worldwide demand for tequila and the competition from African producers (MSNBC 2003) may also increase demands on the harvest of wild agaves in Mexico.

**Conservation Efforts**

- The Bluebird Mine on Cabeza Prieta NWR was fenced in 2004 to protect a known LLNB maternity roost. Bats reoccupied this abandoned roost following the installation of this protective fencing. Unfortunately, the fence was vandalized in 2005, resulting in subsequent abandonment by LLNBs. The fence will be repaired (McCasland 2005).

- Telemetry projects have been implemented to discover new roost locations. One of these roosts is on private land where efforts are being made to promote the conservation of this roost site. Efforts to protect a new roost on BLM land are being coordinated with the local lease holder and the AGFD (Wolf and Dalton 2005).

- The Arizona-Sonora Desert Museum is conducting studies on seasonal movements between LLNB roosts in Arizona, a migratory pollinator study, and roost monitoring in the United States and Mexico; they also conduct educational activities related to bats (Krebbs 2005a).

- A telemetry study in New Mexico has led to the discovery of two new roosts and expanded the known range of the LLNB in the U.S. (Bogan 2005).

- Experimental gate designs are being studied at a late summer LLNB roost at the Coronado National Memorial (Mann 2005).

- Significant efforts are being made on Fort Huachuca to protect and monitor known LLNB roosts (Sidner 2005a). These efforts include:

    - annual roost monitoring
    - road closures
    - roost improvements and closures
    - increased enforcement of closures
    - agave monitoring (Fehmi et al. 2004)
    - LLNB foraging studies

- Investigations have been initiated related to the distribution and use of hummingbird feeders by LLNBs in the Tucson area (Wolf and Dalton 2005).

- Some habitat-restoration work has begun in Mexico (Medellín 2005).

- A mine site on the Tohono O'odham Nation that supports a LLNB maternity colony has been structurally stabilized to maintain roost integrity (Wolf and Dalton 2005).

- Annual long-term monitoring is ongoing at important roost sites such as Copper Mountain, State of Texas, and Old Mammon (Billings 2005, Mann 2005, Wolf and Dalton 2005).

- The exhaust fan was removed from the historical Colossal Cave maternity roost in an effort to get LLNBs to recolonize this roost. So far, no LLNBs have recolonized this cave (AGFD 2005).

- Educational programs are being given at organized events such as SW Wings Birding Festival. Other programs are being given as requested, but efforts are sporadic (AGFD 2005).

- A protective gate was installed at the Cave of the Bells roost site. This site has not been occupied since gating (AGFD 2005). It is not entirely clear if the gating was responsible for abandonment of this roost, but additional research has indicated that gating may be a problem for LLNBs based on size and flight speeds. Bat gates are an excellent conservation tool for bat roosts, but they may not be suitable for LLNBs (Ludlow and Gore 2000). Further research, similar to efforts at Coronado National Memorial, is needed before the effectiveness of this tool can be determined (Bucci et al. 2003).

- The Arizona Bat Conservation Strategic Plan, which identifies priority actions to guide bat conservation activities statewide, was finalized in 2003. Many of the priority actions are related to investigations to better understand the status of the lesser long-nosed bat.

**Synthesis**

*Numbers* – For a colonial species such as the LLNB, the appropriate unit for assessment of threats may not be total population numbers, but rather the number of colonies (roost sites).

The current population numbers of LLNBs exceed the levels known and recorded at the time of listing in 1988. In general, the trend in overall numbers has been stable or increasing in both the United States and Mexico. However, the number of known roost sites has not significantly increased. Only three new late-summer roosts have been discovered in the U.S., and the number of maternity roosts has not changed. The number of known maternity roosts in the U.S. (three) is the same now as when the LLNB was listed in 1988. We are unaware of any new roost discoveries in Mexico. The total number of roosts monitored in the United States is 10-20, depending on resources, and 10-20 in Mexico, again depending on resources. The occurrence or numbers of roost sites in other countries are unknown. Although disjunct, the distribution of this species runs generally from south-central Arizona to northern South America. For such a wide distribution, there are few known roost sites. The roost-switching behavior of LLNBs makes the small number of roosts even more significant to the population. A particular group of bats may move among several roost sites; in fact, they may require multiple roost sites to meet their foraging and reproductive needs (Cole and Wilson 2006, Newton et al. *In Prep.*). This roost-switching behavior to follow food resources or accomplish reproduction makes population estimates very difficult.

The fact that no LLNBs, or very few, are at a particular roost one season or one year does not mean that the roost site is insignificant or that bat numbers have declined. Conversely, the presence of some or many LLNB at a particular roost one season or one year does not necessarily mean a roost is a preferred or significant roost or that bat numbers on the landscape have increased. New roost sites have been located in recent years. However, it is often unknown if these roost sites have a history of occupancy. It is not known whether they have been used for some time, or whether LLNBs are now using this roost because of the destruction or disturbance of other roosts. Going strictly by the numbers, currently documented numbers of LLNBs at roosts in the U.S. and Mexico clearly show that this species is not in imminent danger of extinction. However, because the number of known roosts is limited, the loss of even one or two key roost sites would threaten the population with extinction. Therefore, given the known threats to roost locations, it is likely that, within the foreseeable future, the LLNB is likely to become endangered throughout all or a significant portion of its range.

Increased LLNB numbers and positive trends at most roosts have reduced concerns expressed in the final listing rule with regard to low population numbers and an apparent declining trend. However, threats to roost sites continue and, in fact, have likely increased in recent years. Some Federal agencies have guidelines to protect these sensitive habitats, but these guidelines are only effective when there are adequate personnel and resources to implement them. Escalating border issues present real threats to the LLNB and limit the effectiveness of management and monitoring related to this species. Organ Pipe Cactus National Monument was shut down in early 2007 due to issues related to border activities. The closure not only affected public visitors, but also natural resources staff activities. It is unknown at this point whether LLNB monitoring and research will be conducted in 2007 (Tim Tibbitts, OPCNM biologist, pers. comm. Jan. 12, 2007). In addition, while several regulatory mechanisms protect caves and animal life in caves,

the effectiveness of these laws is also dependent on enforcement capability. Bat gates, one of the most obvious and easily implemented tools for roost protection for some species, may not be effective for LLNBs. Because the number of LLNB roost sites is limited and threats to roost sites have increased and are likely to remain at high levels for the foreseeable future, protection under the Act is warranted.

*Forage Relationships* - Significant information regarding the relationship of LLNBs to their forage resources has been gathered over the past decade. While the demise of LLNBs would not likely result in the complete loss of the ecosystem, there is strong evidence of the dependence of LLNBs on certain plant groups, as well as a reciprocal benefit to the plants provided by LLNBs (Arizaga et al. 2000). Because LLNBs are highly specialized nectar-, pollen-, and fruit-eaters, they are extremely vulnerable to loss of or impacts to forage species. Specialists tend to be more vulnerable to extinction than generalists. Consequently, nectar-feeding bats, such as the LLNB, are particularly sensitive to habitat loss and the concomitant disappearance of the plants from which they obtain food (Arita and Santos-Del-Prado 1999).

Conversely, LLNBs are highly effective at locating food resources and their nomadic nature allows them to adapt to local conditions (Billings 2005). The resiliency of LLNB foraging behavior became evident in 2004, when a widespread failure of saguaro and organ pipe bloom occurred. The failure was first noted in Organ Pipe Cactus National Monument, and such a failure had not been noted in the recorded history of the Monument (Billings 2005). The failure extended from Cabeza Prieta NWR on the west to Tucson on the east, and south into central Sonora, Mexico. It appears LLNBs were able to subsist and raise young in southwestern Arizona in this atypical year. It is likely they did so by feeding more heavily on agaves (evident by agave pollen found on captured LLNBs [Billings 2005]) than they typically do. The agave species utilized (*Agave deserti*) is not the agave species LLNBs typically feed on in Arizona, which is *Agave palmeri*, but is an important alternate food source when saguaro blooms are declining or absent. The ability of LLNBs to change their foraging patterns and food sources in response to a unique situation provides evidence that this species is more resourceful and resilient than may have been previously thought. This is particularly noteworthy considering that this type of a situation had not previously occurred within the past 60 – 70 years.

In 2006, further evidence of the ability of LLNBs to adapt to available forage resources was seen as a result of a near complete failure of flowering agaves. As a result, it appears that more LLNBs used hummingbird feeders as a source of nourishment, although it is questionable that LLNBs could be supported long-term by hummingbird feeders as protein and other dietary components would be lacking. It also appears that many of the LLNBs moved south to Mexico much earlier than previous years, as evident by reduced numbers or the lack of LLNBs at major roosts in southeastern Arizona beginning in August (Buecher 2006, Mann 2006, McIntire 2006, Daw 2006, Sidner 2006). LLNBs migrate long distances to fulfill their life history requirements. This migratory nature requires that adequate resources (roosts and forage plants) occur not only in maternity and wintering areas, but also along the migration pathways. We cannot control impacts to or conserve crucial migration pathways and roost sites in Mexico. Therefore, it is imperative that we take adequate measures to conserve these resources within the boundaries of the United States in order to maintain our piece of the complex puzzle of LLNB ecology. Protection under the Act facilitates the interagency coordination and evaluation that is necessary

to accomplish such conservation. Absent such protection, it is unlikely that LLNB conservation would be given the priority or resources needed.

As additional information becomes available regarding LLNB population dynamics and life history, the more evident it becomes that we have much more to learn about this species. New information suggests a complex population structure and dynamics (Medellín 2005). However, many questions still remain regarding migration patterns, reproductive strategies, genetic relationships, and inter-specific interactions. This complex structure does suggest that each part is critical and impacts to, or loss of, any part could have significant implications rangewide. The interactions of each part suggest a metapopulation structure, with each subpopulation within the metapopulation playing a key role. The ability to conduct research to improve our understanding of LLNB ecology is currently threatened by dangerous working conditions resulting from illegal border activities. Agencies and independent researchers have limited LLNB monitoring and other research activities because of personal safety issues. The inability to gather needed information on LLNBs limits our ability to conserve and manage this species and increases the importance of maintaining Federal protection so that Federal law enforcement resources can assist in implementing conservation activities.

*Five-Factor Analysis*

Much of the new information regarding the five listing factors is discussed in more detail above (see the Threats section of Review Analysis).

A. *The present or threatened destruction, modification, or curtailment of its habitat or range:* Some efforts have been undertaken to protect known roost locations. The effects of livestock grazing and prescribed fire are probably not as significant as originally thought. The effects of agave harvesting are probably limited to bootleggers. Plague and other factors may result in an increased harvest of wild agaves. Significant new threats to roosts are occurring in the form of illegal border activities and urban development. Invasive, exotic plant species and catastrophic wildfires are resulting in vegetation community conversion and reducing available LLNB foraging habitat. Urban development and expansion is resulting in permanent loss of LLNB habitat. Wind energy development is a threat that is on the verge of explosive development within the U.S.. A critically important threat is the potential for migration corridors to be truncated or interrupted. Significant gaps in the presence of important roosts and forage species along migration routes would affect the population dynamics of this species. The LLNB bat continues to be faced with loss and modification of its habitat throughout its range.

B. *Overutilization for commercial, recreational, scientific, or educational purposes:* We are not aware of LLNBs being exploited for commercial, recreational, or educational purposes. Researchers often concentrate their work at roost sites because of the availability of study animals. Research methods are often intrusive. Tools such as telemetry and banding attach equipment to LLNBs and need to be done correctly and by qualified researchers to prevent injury or mortality. Oversight exists at the Federal, State, and Land Management levels to reduce the likelihood of excessive disturbance of roost sites. However, unscrupulous researchers or researchers who fail to obtain the required permits can cause the disturbance of important roost sites. Repeated disturbance of an ongoing nature has the potential to significantly affect the

integrity of roost sites. Disturbance of roosts by researchers is probably not significant at the landscape level, but may be locally significant at specific roosts.

C. *Disease or Predation:*
Disease is not known to be a significant threat to LLNBs. There is an anecdotal observation that may indicate a die-off at a specific roost, but there is no current information indicating a threat. However, as a colonial species, a disease outbreak could affect significant numbers of the population. Predation contributes to the mortality of LLNBs at roost sites. Specifically, barn owls have been observed preying on LLNBs at the maternity roost at Organ Pipe Cactus National Monument for many years. Given current LLNB numbers at this roost, this predation is likely an insignificant impact on the population. However, at small roosts, predation may be a significant factor. Likely predators include snakes, raccoons, skunks, ringtails, bobcats, coyotes, barn owls, great-horned owls, and screech owls.

D. *Inadequacy of existing regulatory mechanisms:*
The current listing of the LLNB on both the United States' and Mexico's endangered species lists provides this species with some level of protection. Implementation of the Endangered Species Act in Mexico provides limited protection for the species. Additional regulatory protection is not established in Mexico. In fact, the lack of regulation related to control of vampire bats in Mexico is continuing to result in the mortality of the LLNB due to the lack of requirements to properly identify the target species. In the United States, State laws and regulations found in the ARS Title 17 provide some additional level of protection, but this protection is for individual animals only, and does not apply to the loss or destruction of habitat.

E. *Other natural or manmade factors affecting its continued existence:*
LLNBs are highly sensitive to disturbance at roost sites. Recreation specifically related to caving, as well as curiosity by recreationists in general, can affect roost sites. Even one occurrence of roost disturbance can result in long-term effects.

Long-term drought can affect LLNB forage availability. The ongoing, long-term drought being experienced in the southwestern U.S. and northwestern Mexico has resulted in nearly complete failure of both the saguaro and agave blooms in recent years. Drought is a natural condition to which LLNBs have had to adapt, and recent observations tend to support the ability of this species to adapt to local and periodic food shortages. However, the ability of LLNBs to adapt is affected by the permanent loss of foraging habitat associated with vegetation community conversion for livestock and agriculture, as well as urban development. The availability of alternative foraging areas is being reduced.

In the past, bats have had a bad reputation. However, significant changes in the public perception of bats are occurring. Educational efforts are beginning to make a difference. In Mexico, in particular, public education in the form of radio and television spots, and educational materials, have been implemented. Agencies now receive calls for assistance in non-lethal solutions to bat issues. Progress is being made, even if it is slow. But until there is a more general public acceptance of bats as an important ecological component, support for bat conservation will continue to be limited. With vulnerable species such as LLNBs, lack of support can significantly affect the conservation and continued existence of the species.

## RESULTS

Information generated since the listing of the LLNB indicates that the LLNB is not in imminent danger of extinction throughout all or a significant portion of its range. "Endangered" status is related to the current level of threat or population status. As explained above, the current "endangered" status of this species is not warranted. However, it would not take an unusual chain of events to bring it to a level where it is threatened with extinction. As defined in the Act, a "threatened" species is likely to become an endangered species (in danger of going extinct) within the foreseeable future throughout all or a significant portion of its range. The LLNB seems to fit this definition well. Threats are real and the LLNB's occurrence at relatively few roost sites makes it vulnerable. Its migratory nature exposes it to threats along its entire migratory pathway. The following factors could result in the species becoming in danger of extinction in the foreseeable future throughout all or a significant portion of its range:

a) increasing disturbance at limited roost sites where LLNB numbers are concentrated

- increasing population numbers in proximity to roosts – this threat is widespread within the range of the LLNB in the U.S. Current areas where this threat is impacting habitat include Tucson, Green Valley, Nogales, Sierra Vista, Vail, and Benson, Arizona.
- escalating illegal border activity and associated interdiction efforts – this threat has already affected roosts on Cabeza Prieta NWR, in the Mustang Mountains, and Coronado National Memorial. Every known roost in the U.S. falls within the border zone where these threats are occurring;

b) inability to gather needed management and conservation information

- safety concerns during agency and researcher activities – these concerns currently affect nearly all ongoing LLNB research. Areas of specific impact are Organ Pipe Cactus National Monument, Cabeza Prieta NWR, Mustang Mountain roost, State of Texas Mine, and the Altar Valley.
- loss of research equipment and interference with research activities – incidents have occurred at Organ Pipe Cactus National Monument and in the Altar Valley. Equipment such as sensors and data loggers that remain at sites long-term is especially vulnerable;

c) inability to maintain protective measures at roost sites

- gating may not be effective for LLNBs due to physiology and behavior – Cave of the Bells is an example.
- breaching of gates and fences at protected roosts in Arizona – Bluebird Mine and State of Texas roosts are examples;

d) landscape-scale effects to forage resources

- invasion of non-native plant species – this is a current threat that affects the LLNB rangewide
- increase in frequency and intensity of large fires – fires within the past three years on Cabeza Prieta NWR, and in the Santa Rita, Catalina, Huachuca, and Chiricahua mountains have impacted large areas of LLNB foraging habitat. This is a landscape-

level impact.

- ongoing, long-term drought – failures in the saguaro and agave food resources have occurred within the past three years. Continued effects of the ongoing, long-term drought are likely.
- urban development – currently affecting LLNB habitat in Tucson, Green Valley, Nogales, Sierra Vista, Benson, Vail, and Sonoita. Arizona is the fastest growing state in the U.S.;

e) roost structural integrity

- many roosts are old mines. Over time, the structure of mines can degrade, resulting in sloughing and collapse. Roost environments may become unsuitable. Night roosts are found in buildings which can also deteriorate or be torn down. It is unlikely that current mining operations will create new roost sites. Effects have already been seen at the Old Mammon mine and a night roost in New Mexico; and

f) 2006 experience

- a number of interesting occurrences in 2006 emphasized that there are many things we do not know or understand related to the life history of LLNBs. The largest maternity roost in the U.S. was abandoned for a short time this year and then reoccupied; we have no idea where the bats went, but there must be a roost or roosts somewhere that are adequate for them to have moved into, at least temporarily. There are obviously roosts of which we are unaware, so their protection status is unknown. There was an apparent increase in use of hummingbird feeders by LLNBs, likely in response to the agave failure. Concurrently, an increased number of LLNB mortalities were reported by residents. If a potential relationship occurs between hummingbird feeder use and increased mortality, this issue is important to the conservation of the LLNB and other nectar-feeding bats.

While LLNB populations do not currently meet the definition of "endangered", the protection afforded by the Act is warranted. Removing the LLNB from the endangered species list is not prudent at this time due to ongoing vulnerabilities of key roost sites which support a high proportion of the known LLNB population. LLNBs continue to be listed on Mexico's list of endangered species. Keeping LLNBs on the U.S. Endangered Species List is consistent with section 4(b)(1)(B)(ii) of the Act which states that the Secretary shall give consideration to species (for protected status under the Act) "identified as in danger of extinction, or likely to become so within the foreseeable future, by any State agency or **by any agency of a foreign nation that is responsible for the conservation of fish or wildlife or plants**" (emphasis added) and would promote consistent and ongoing management efforts across borders.

The LLNB should be proposed for reclassification from endangered to threatened. Concurrently, a special rule as outlined in section 4(d) of the Act should be promulgated exempting the prohibition for take for the following actions on private lands within the range of the LLNB in the U.S.:

1) Livestock Grazing – livestock grazing carried out under an approved and proper grazing system which maintains good to excellent range conditions and properly

functioning riparian systems; and

2) Prescribed Burning – prescribed burns carried out under an approved fire-management plan and consistent with established conservation goals, and which are an appropriate distance from known LLNB roost sites.

The Recovery Priority Number for the LLNB should remain the same: 8 (species has moderate threats and a high recovery potential)

The Reclassification Priority Number for the change from Endangered to Threatened status should be: 4 (an unpetitioned action with moderate management impacts)

**Recommendations for Future Actions**

- The recovery plan should be updated and rewritten to include specific, quantitative criteria to further guide recovery and establish criteria for delisting of this species and reflect the most current information regarding the status and needs of this species.

- The taxonomic status of the LLNB should be clarified.

- Efforts should continue in the utilization of a coordinated and consistent monitoring program with a centralized clearinghouse for the resulting data. Existing programs should be supported and expanded as appropriate to include information and efforts in both the U.S. and Mexico. The reliability and quality of data should be improved for all ongoing and future activities.

- Significant efforts should be made to obtain adequate research funding to increase our understanding of population dynamics, roost vulnerabilities, forage relationships, and the impacts of new threats such as border activities and invasion of non-native species. Specific efforts should be made to fund and coordinate work in Mexico. Research questions should have direct management implications.

- We should increase our effort with regard to educational programs, both in Mexico and in the United States. Educational efforts should target not just the general public, but agencies and groups responsible for land management, agave harvest, vampire bat control, and conservation activities.

- We should work closely with land-management agencies to develop more appropriate guidelines for grazing and prescribed fire. Guidelines should focus more on ecosystem health and the landscape-level availability of forage resources rather than on individual forage species.

- We should work closely with the Department of Homeland Security and the Border Patrol to protect roosts from illegal border activities and the associated law enforcement efforts.

- We should initiate research activities targeting the effects of urbanization on forage resources and behavioral patterns. Issues for research should include the effects of hummingbird feeders on LLNB physiology and timing of migration and dispersal, and development thresholds and land uses that reduce or maintain LLNB foraging activity.

- We should work closely with the National Park Service to implement a research project at State of Texas and Copper Mountain roosts looking at gate design, effectiveness, and potential impacts to LLNBs at large roosts.

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The following is a list of individuals specifically contacted during this 5-year review:

Ms. Barbara Alberti and Ms. Sherry Mann – Coronado National Memorial, NPS
Dr. Scott Altenbach – University of New Mexico
Dr. E. Lendell Cockrum – University of Arizona (retired)
Dr. Yar Petryszyn – University of Arizona, Arizona-Sonora Desert Museum
Mr. Dave Dalton – Independent bat researcher
Dr. Theodore Fleming – University of Miami at Coral Gables
Ms. Karen Krebbs – Arizona-Sonora Desert Museum
Mr. Curtis McCasland – Cabeza Prieta National Wildlife Refuge, FWS
Ms. Angie McIntire and Mr. Tim Snow – Arizona Game and Fish Department
Mr. Andy Moore – Bat Conservation International
Mr. Tom Skinner – Coronado National Forest
Mr. Sheridan Stone – Fort Huachuca Military Base
Mr. Tim Tibbitts – Organ Pipe Cactus National Monument, National Park Service
Ms. Sandy Wolf – Independent bat researcher
Dr. Ronnie Sidner – University of Arizona, independent bat researcher
Dr. Donna Howell – New Mexico Game and Fish, independent bat researcher

As a result of the Federal Register notice and the individual requests for information, we received a total of eleven written comments. Additional interviews were conducted with some commentors to obtain specific clarification or additional information. Comments were provided for consideration during this review by the following individuals:

Mr. Dave Dalton – Independent bat researcher
Dr. Theodore Fleming – University of Miami at Coral Gables
Ms. Karen Krebbs – Arizona-Sonora Desert Museum
Mr. Curtis McCasland – Cabeza Prieta National Wildlife Refuge, FWS
Mr. Duane Shroufe, Ms. Angie McIntire, and Mr. Tim Snow – AGFD
Mr. Andy Moore – Bat Conservation International
Ms. Kathy Billings – Organ Pipe Cactus National Monument, National Park Service
Ms. Sandy Wolf – Independent bat researcher
Dr. Ronnie Sidner – University of Arizona, independent bat researcher
Dr. Rodrigo Medellín – Instituto de Ecologia, UNAM
Ms. Sherry Mann – Coronado National Memorial
Dr. Donna Howell – New Mexico Game and Fish, independent bat researcher

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Dr. Yar Petryszyn – University of Arizona
Dr. Theodore Fleming – University of Miami at Coral Gables
Dr. Donna Howell – Independent bat researcher
Dr. Don Wilson – Smithsonian Institution

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**U.S. FISH AND WILDLIFE SERVICE**
**5-YEAR REVIEW OF THE**
**LESSER LONG-NOSED BAT**

**Current Classification**: Endangered

**Recommendation resulting from the 5-Year Review**:

_xx_ Downlist to Threatened
____ Uplist to Endangered
____ Delist
____ No change needed

**Appropriate Listing/Reclassification Priority Number, if applicable**: 4

**Review Conducted By**: Scott Richardson, AESO, Tucson Suboffice

**FIELD OFFICE APPROVAL**:

**Lead Field Supervisor, Fish and Wildlife Service**
Acting
Approve _____ Date 5-11-2007

**REGIONAL OFFICE APPROVAL**:

Acting **Assistant Regional Director, Fish and Wildlife Service**
Approve Susan Jacobsen Date 8.30.07