

CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA



Twenty-third meeting of the Animals Committee
Geneva, (Switzerland), 19-24 April 2008

Periodic review of animal species included in the CITES Appendices

STATUS OF THE POPULATIONS OF *LYNX RUFUS* IN MEXICO

1. This document has been prepared by Mexico.
2. Decision 13.93 (Rev. CoP14) directs the Animals Committee to include the family Felidae in its Review of the Appendices, and in particular to focus initially on reviewing the *Lynx* species complex, which includes species that are listed because of similarity of appearance, such as *Lynx rufus*. In addition to evaluating the listings of these species against the criteria for inclusion of species in Appendices I and II contained in Resolution Conf. 9.24 (Rev. CoP14), the Animals Committee was to assess the management and enforcement measures available to achieve effective control of trade in these species so as to resolve the continued need for look-alike listings. This assessment should also include a review of trade information to determine whether these species are actually confused in trade or whether the look-alike problem is merely hypothetical. The Animals Committee is expected to provide a progress report at the 15th meeting of the Conference of the Parties.
3. At the 13th and 14th meetings of the Conference of the Parties, the United States of America submitted proposals CoP13 Prop. 5 and CoP14 Prop. 2, both with the aim of deleting the bobcat (*Lynx rufus*) from the Appendices. According to these proposals, the species does not meet the requirements for listing on the CITES Appendices and should be removed, as provided in Article II, paragraph 2 b) and Annex 2 b, Criterion A. The first proposal was withdrawn by the proponent, while the second one was rejected in a vote, based *inter alia* on the lack of information on the status of its wild populations in Mexico, one of the three countries that make up its range.
4. In support of the implementation of Decision 13.93 (Rev. CoP14), particularly the review of the genus *Lynx*, Mexico committed itself to reviewing the status of these populations in its territory. Accordingly, CONABIO, the Scientific Authority of Mexico, with financial aid from the International Association of Fish and Wildlife Agencies of the United States (IAFWA), developed a research project to estimate the population density and diet of *Lynx rufus* in the country. The project is to be carried out by the Institute of Ecology of the National Autonomous University (*Instituto de Ecología de la UNAM*) of Mexico.

General background on the species

5. The bobcat (*Lynx rufus*) is the most widespread native feline of North America. It ranges from north-central British Columbia, in Canada, down to the south of Mexico, in the state of Oaxaca. Literature shows it to exist in about 80 % of Mexico (Hall, 1981; Wilson and Reeder, 2005), with records from 27 of the 32 States (López Wilches and López, 1998). Bobcats thus occupy a great variety of habitats, from arid scrubland and forests of pine, holm oak or mixed species, to pasturelands

(Larivière, 1997). Hall (1981) mentions that six bobcat subspecies can be found in Mexico: *L. r. californicus*, *L. r. peninsulares*, *L. r. baileyi*, *L. r. texensis*, *L. r. esquinalpae* and *L. r. oaxacensis*.

6. The species is considered the most extensively studied North American feline, as its feeding habits, ecology are well documented. However this is mostly the case in the United States, since there is little information on the bobcat in Mexico, at the southern end of its range, and what little exists essentially refers to its feeding habits [Delibes & Hiraldo (1987); Delibes et al. (1997); Romero (1993); Aranda et al. (2002)]. For the same reason, there is no solid literature on the population size of this species.
7. Approximately 35 % of the territory occupied by the bobcat is located in Mexico (Hall, 1981). Therefore, any decision relating to its management/conservation/use must be backed by data at least from Mexico and the United States, as the two countries comprise 85 % of the species' range.
8. The vegetation in some regions of Mexico has undergone drastic changes, which have affected the conservation status of several species. Bobcats are still present (in as yet unknown numbers) in regions where human activities have a great impact, such as the areas located south of the Federal District, 20 km. from Mexico City.
9. The main pressures for conservation of this feline are associated with destruction of its habitat and removal by peasants, who believe the bobcats prey on their livestock. Additionally, the information provided in the study is necessary to complete knowledge of the species's status in its range, thereby helping to assess whether keeping it on CITES Appendix II is entirely justified, and whether CITES has a relevant role to play in the conservation of the species.

General aspects of the methods used to study the species

10. As with other felines, the bobcat is elusive, difficult to monitor, and population estimates are particularly complex (Zelinski and Kucera, 1995). Historically, diverse methods have been used to study carnivores, including radiotelemetry, which is limited by the low number of individuals that can be marked at the same time, the uncertainty as to how many of them have not been marked and, finally, its cost and the effort it takes. Other techniques that have been used for such estimates are paw prints and tracking, but these are apparently imprecise (Karanth, 1995).
11. Trapping with automatic cameras has recently been combined with statistical methods analysing captures and re-captures to estimate feline populations. This technique considers the natural fur patterns of individuals captured in photographs, as in the successful studies of the tiger (*Panthera tigris*) populations by Karanth (1995) and Karanth & Nichols (1998). Using the same technique, Trolle and Kéry (2003) estimated the population size of the ocelot (*Leopardus pardalis*) in the Pantanal region in Brazil. Based on these findings, the technique is considered adequate for making an estimate of the population density of *L. rufus* in Mexico.
12. The photographs of the felines are obtained by installing unmanned cameras that are activated by movement and heat. Individual animals can be identified through a combination of specific characters on their body and tail fur (spots, wounds), and it may even be possible to sex them (Heibrun, et. al., 2003).
13. Density is obtained from the estimated population size (N) in the area estimated by camera-trapping (A). This area is calculated by following the polygon that is formed by connecting the outermost trapping stations in the study area, plus an area of influence of the traps (w) that is calculated by taking half of the longest distance between consecutive captures of the same individual at the trapping sites; this is added to the estimated area of the polygon A (w) in order to estimate the effective sample area. In the end, the estimated density is calculated as: $D = N/A(w)$.
14. As for its feeding habits, the higher vertebrates that are preyed on are determined by means of the hairs and remains such as bones, teeth and nails found in each scat. Furthermore, the presence of invertebrates, parts of plants and other components is noted. These are compared with reference collections of hairs and bones to identify mammal remains.

15. In order to quantify the scat components (remains of bones, hairs, nails and other components), these are expressed en terms of Percentage of Occurrence (% Oc); in other words, the number of samples in which a particular prey species was found in all the samples. This is obtained from: % Oc = $n \times 100/N$, where n = the number of times a particular type of prey appears, and N = number of scats left by the feline each time it comes to the same place.

Research project to estimate the population density and diet of *Lynx rufus* in Mexico

16. The study was initially intended to cover four sites (Sierra Seri, Sonora; Janos, Chihuahua; San Miguel Topilejo, the Federal District; and Sierra Fría, Aguascalientes), but two more have recently been added (Laguna de Cuetla, Sinaloa; and Acatlán de Osorio, Puebla). The project has thus been broadened in the country to include a greater number of ecosystems, and more information on feeding habits.
17. With the data generated, including the two additional sites, a predictive habitat model was designed to use for estimating bobcat densities in other parts of the country with similar characteristics regarding landscape structure (vegetation, land use, topography, human settlements, roads, etc.) as the sample sites. A list of the taxa and their importance in the bobcat's diet will also be generated for each site.
18. For this study, at least three 15-day visits have been planned. On the first visit, prior to sampling, walking tours of the sites seek to identify the presence of the species by means of paw prints and tracks, and situate the paths and routes used by the bobcats. A dog trained to search for bobcat excrement is also used, and these scats are collected to document the feeding habits of each population. In order to verify the dog's correct identification of the scats, 5 % of these are taken at random to be chemically identified by means of the technique of bile acid recovery through thin layer chromatography.
19. On the next two visits, carried out in the dry season (March-May) and in the rainy season (July-September), the photos are obtained to estimate population density. Camera-trap stations are placed (10 to 20) with CamTrakker (CT) cameras in each study area. These cameras use 200 ASA 35-mm film for 36 colour slides. Half of the trapping stations in place are 'double' (i.e. equipped with two cameras) and half 'single' (one camera). The sequence of the camera-trap stations alternates single and double stations. The distance between each trapping station is 500-800 m, thereby covering an area of approximately 10 km². Cameras are fixed at a height of 15-25 cm. For the individual identification of the bobcats obtained through camera-trapping, the aforementioned combination of distinguishable characters is used (Heilbrun *et al.*, 2003).
20. Throughout the study, the scat samples are removed from each transect, and all those found are collected on each visit, attempting to correlate them with other evaluations of abundance from the defecation radius reported in literature, and to document the general feeding habits of each population in dry and rainy seasons. The reference collections used to identify the scat components belong to the Archeo-zoology laboratory of the National Institute of Anthropology and History (*Laboratorio de Arqueozoología del Instituto Nacional de Antropología e Historia*) and to the National Mammal Collection (*Colección Nacional de Mamíferos*) in the UNAM Institute of Biology (*Instituto de Biología de la UNAM*).
21. The preliminary results obtained to date indicate the presence of the species in San Miguel Topilejo, Sierra Seri and Janos, while in Sierra Fría, Aguascalientes, neither photographic records nor bobcat excrement could be obtained. It is worth mentioning, however, that in this site the presence of cougars (*Puma concolor*) has been detected, both in the rainy season and in the dry season (photographs and scats).

22. The first estimates on the bobcat's population density and diet in the three aforementioned sites are presented below (see Table 1).

		San Miguel Topilejo Federal District	Sierra Seri Sonora	Janos Chihuahua
Density	Rainy season	0 – 0.2 ind/km ²	0.3 ind/km ²	0.2 – 0.3 ind/km ²
	Dry season	1 young**	10 ind/1000 trap-days	10 ind/1000 trap-days
Diet	Rainy season	58 % <i>Romerolagus diaza</i> 42 % <i>Microtus mexicanus</i> 29 % <i>Neotoma mexicana</i>	29 % <i>N. albogula</i> 16 % <i>Sylvilagus audubonii</i> 15 % <i>Chaetodipus</i> sp.	55 % <i>S. audubonii</i> 30 % <i>Dipodomys</i> sp. 25 % <i>N. albogula</i>
	Dry season	45 % <i>N. mexicana</i> 36 % <i>M. mexicanus</i> 27 % <i>Sigmodon</i> sp.	22 % <i>S. audubonii</i> 22 % <i>Chaetodipus</i> sp. 19 % <i>Dipodomys</i> sp.	42 % <i>Dipodomys</i> sp. 37 % <i>Sigmodon</i> sp. 34 % <i>N. albogula</i>

Table 1. Preliminary estimates of population density and diet of *Lynx rufus* in three sites in Mexico.

**It is suggested that although not as many records were obtained as in the rainy season, the bobcat is present and breeding in the area.

23. The densities estimated at the different sites monitored in Mexico during the project run from 0.2 to 0.3 bobcats/km² and fall within the range of results reported in the United States, from 0.09 to 1.53 bobcats/km² (see Table 2).

Site	Bobcats/km ²	Methods	References
California	1.27 – 1.53	Telemetry	Lembeck, 1978
South Carolina	0.58	Telemetry	Marshall, 1969
NE California	0.5	Telemetry	Zezulak, 1998
Texas	0.43	Camera-trapping	Heilbrun, <i>et. al.</i> , 2003
Sierra Seri, Sonora	0.3	Camera-trapping	This study
Arizona	0.24 – 0.27	Marking/re-capture	Jones & Smith, 1979
Arizona	0.25	Telemetry	Lawhead, 1984
Janos, Chihuahua	0.2 – 0.3	Camera-trapping	This study
Topilejo, D. F.	0 - 0.2	Camera-trapping	This study
Idaho	0.04	Telemetry	Koehler and Hornocker, 1989
Oklahoma	0.09	?	Rolley, 1985
Sierra Fría, Aguascalientes	0	Camera-trapping	This study

Table 2. Density of bobcats estimated for different sites in the United States and Mexico

24. At present, 66 % of the initial project for the four sites mentioned has been completed. Work on the two additional sites is due to begin in 2008. At the same time, the site of Sierra Fría, Aguascalientes, will be sampled again. This site has favourable characteristics for the presence of the bobcat, such as low anthropogenic pressure and availability of prey. However, the results obtained in previous visits were not those expected, given that cougars were found in abundance of cougars but no bobcats. Other sites in the area will be sampled in order to understand these results.
25. Although the bobcat is considered to be the most abundant of the six feline species that occur in Mexico, data obtained by this project will be useful to draw up conservation and management proposals to maximize the long-term survival of the species.

26. In short, everything seems to suggest that bobcat populations in the areas selected for study are at intermediate levels compared to other populations studied in different regions of the species' range. Information obtained through the project represents the first attempt to collect data on the population status of *Lynx rufus* at a country level, following a systematic approach and using standardized methodology. Although more information needs to be compiled, the species does not seem to be at risk of extinction and its listing in the Endangered Species lists of Mexico is not considered necessary. The additional information that is to be obtained in the new sites will be used to corroborate this statement.

Use of *Lynx rufus* in the period 2005-2007 in Mexico

27. In 2005, the harvest of 63 specimens was authorized in 40 wildlife management units (UMAs, *Unidades de Manejo y Aprovechamiento de Vida Silvestre*). Only 13 of those reported the estimated density of the population. Estimates ranged from 0.00147 to 0.06 individuals per hectare and from 16 to 714 hectares per individual. In 2006, the harvest of 50 specimens was authorized in 36 UMAs, of which only one reported density – 0.018 ind/ha and 55 ha/ind. Finally, in 2007, the harvest of 15 specimens was authorized in 11 UMAs, but no densities were reported. The methods used to obtain such values include scent stations, night transects, direct observation and tracks found in water bodies. In the period between 2005 and 2007, the harvest of 128 bobcats was authorized.

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