Understanding Vocal Patterns in Tigers, *Panthera tigris*, and Application to the Census and Conservation of Endangered and Threatened Species

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Introduction

Majestic, powerful, awe-inspiring, and critically endangered – all of these characteristics describe the remaining subspecies of tiger (*Panthera tigris*) left in the wild. In recent decades tiger populations have plummeted by over 50% throughout their shrunken-down ranges which currently only occupy 7% of their historic lands (IUCN)(Figure 1) (Seidensticker et al. 1999). Not only is the rapid disappearance of this keystone species creating an immeasurable impact on the ecosystems they support but it is also leaving behind many unanswered questions about their biology. One such area is their communication systems.

The aim of the study is to determine if a unique acoustical pattern exists between *P. tigris* individuals in their vocalizations as well as if males can be discriminated from females and females in estrus from females not in estrus.

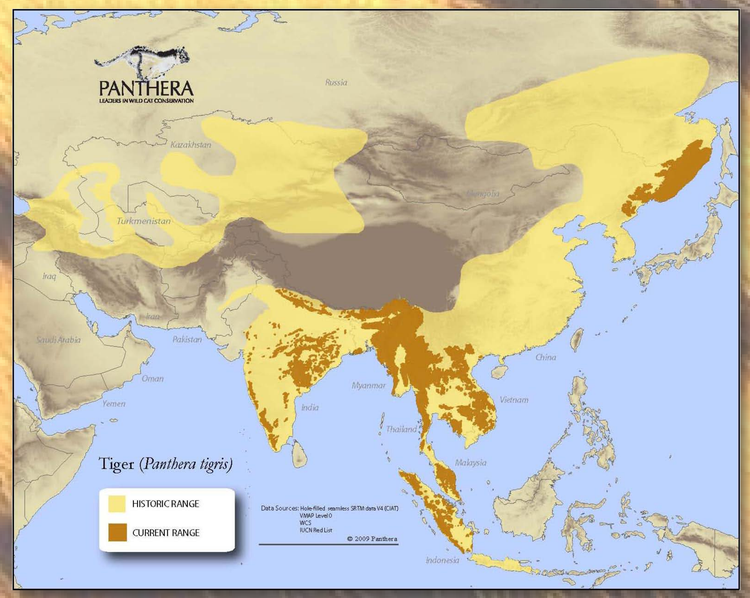

Figure 1 – Current and historical distribution of tiger populations illustrated by Panthera. Total population of this species has plummeted over 50% in just recent decades with a total decline of over 90% since the early 1900s (IUCN).

Why study tiger vocalizations?

Better census of populations is essential for habitat protection and anti-poaching enforcement. The hypothesized complexity of vocalizations will enable a vocal "fingerprint" to be developed for individuals, which, in turn will allow for vocal monitoring as well as censusing when using microphone arrays placed strategically over tiger home ranges. Determination of sex as well as estrus levels also has the potential for representation of breeding populations. Other *Panthera* species could benefit from this project as well as amphibian, avian, and bat species which communicate largely by vocalization.

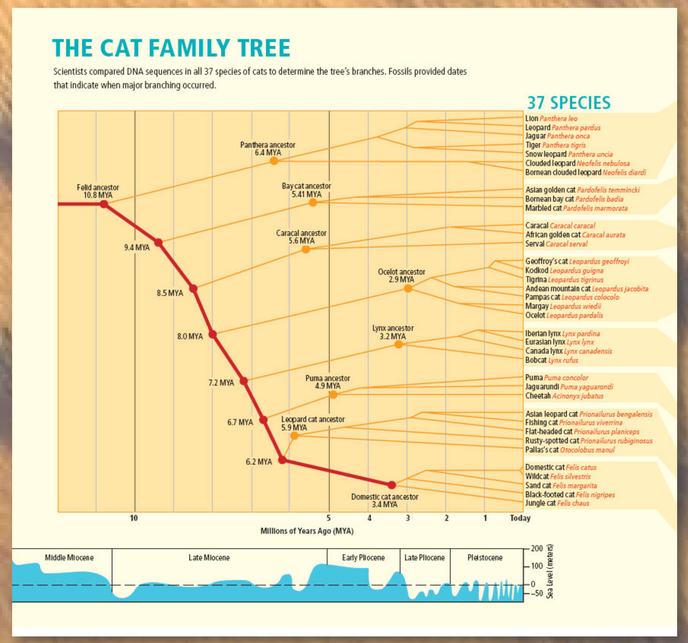

Figure 2 – Phylogenetic tree showing the evolutionary history of the *Panthera tigris* species in relation to other extant wild cat species (Jana Brenning; Photo illustration by James Porto)

Making a Difference

A preliminary study was conducted in the Spring of 2012 with the basis of understanding how great the diversity of tiger vocalizations was. Vocalizations recorded at the National Tiger Sanctuary for this study were used in-part to help lure a rogue tiger out of Lucknow, India who was then placed into a protected tiger reserve with the help of the Wildlife Trust of India and Cee4Life.

Vocalization Collection and Analysis

Recordings for this analysis will be collected at the National Tiger Sanctuary (Saddlebrooke, MO) and Big Cat Rescue (Tampa, FL) over a span of nine months from 28 tigers.

From March to December 2013, *P. tigris* subjects will be observed and recorded at both NTS and BCR. Recording sessions will occur at dawn and dusk as well as overnight using the Songmeter SM2 Platform in 16-bit full-spectrum uncompressed .WAV format (Wildlife Acoustics, Concord, MA, USA). One subject will be the focus of a recording session. Targeted vocalizations include prusten (a.k.a chuffing), subroars , and long-distance calls which range from close-contact vocalization to communication over many miles.

Raven Pro (version 1.4, Cornell University, USA) spectrogram outputs will be utilized to determine characteristics of interest after a vocal category has been determined Characteristics which will be extracted are illustrated in the below figure (Figure 4)(Wilden, et al. 1997).

Figure 3 – Body language changes with differing vocalizations in *Panthera tigris.* The above pictures illustrate the facial expressions when greeting with moans or prusten (right) and long-calls (left). Facial vibrissae are relaxed when greeting and ears are in a non-threatened position with no teeth intentionally exposed. However, when producing an aggressive vocalization, teeth are often exposed with facial vibrissae pointed forward and ears laid back. (Photos by Courtney Dunn)

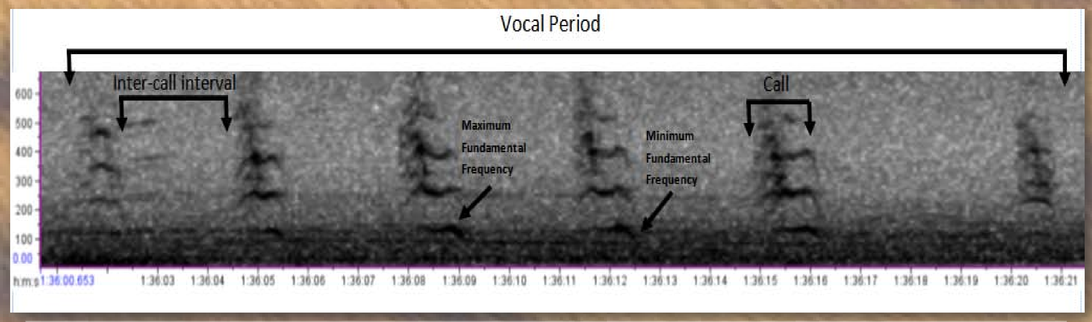

Figure 4 – Spectogram output of a long-distance call by a tiger named "T.J" at Big Cat Rescue. All study measurements of interest are noted. Minimum and maximum fundamental frequencies for a vocal period will be averaged for a single individual across all available calls for a given vocal category. Furthermore, duration of the first, middle, and end call within a period will also be measured. Inter-call intervals and call durations will be averaged for an entire vocal period.

Statistical Analysis

ANOVA will be used to determine if acoustic parameters are different among individuals, sexes, and estrus/non-estrus females as well as to determine differences in minimum and maximum frequency amongst the sexes. In addition, discriminant analysis would be used to assess the reliability of accurately selecting individuals from a collection of group data through reduction of variables (Smith, et al. 1982).

Literature Cited

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