

“Cat Calls : A Study of Bioacoustic Behaviour in Domestic Felines in Satna, India”

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Abstract

Vocalization is a major aspect of primary communication among vast group of mammals. The goal of present study was to analyze the vocal repertoire of domestic cats to decode their complex language through human perception. Interpretations through specialized software such as PRAAT or Audacity, investigation showed that ‘meows’ was the predominant form of feline communication which are scrutinized for pitch, duration, and intensity to reveal distinctive emotional patterns. ‘Purring’ was traditionally associated with contentment which was analysis for frequency and rhythmic nuances, exploring potential therapeutic implications. Defensive vocalizations include, ‘hisses’ which were examined for intensity, duration, and spectral features, offering insights into feline communication during confrontations. ‘Chirps’ and ‘trills’ were less common but unique vocal behaviors which were analyzed as short duration and rapid frequency modulations. The study intends to enhance understanding the acoustic behaviors by facilitating improved interpretations through characterized vocalizations of domestic cats to foster communication and deepen the relation between human and cats.

Key Words: bioacoustics, vocalizations, domestic cats, feline communication

Introduction

The *Felis catus*, a ubiquitous companion animal, has co-evolved with humans for 9,000 year ago, and leading to unique behavioral adaptations, including specialized vocal repertoire which is directed at human interlocutors (Bradshaw, 2013).

Bioacoustics, the interdisciplinary study of animal sound production and perceptions, provides a quantitative lens to dissect these signals, and revealing underlying emotional states and contextual intents (Mathevon et al ., 2023)

The vocalizations of cats serve as a fascinating window into their emotional states, social interactions, and communicative behaviors. Understanding the nuances of cat vocalizations through vocal acoustic analysis provides a valuable avenue for

researchers, veterinarians, and pet owners to decode the language of our feline companions. In this exploration, we will delve into the introductory aspects of vocal acoustic analysis applied to cat sounds, shedding light on the fundamental types of vocalizations and the significance of studying their acoustic characteristics.

Analyzing a cat's vocalizations can provide insights into its emotions and communication. Common vocalizations include meows, purrs, hisses, and chirps. Software tools for acoustic analysis, like Praat or Audacity, can help analyze pitch, intensity, and duration of these sounds. Keep in mind that individual cats may vary, and context plays a crucial role in interpreting their vocalizations.

Analyzing the vocalizations of cats involves delving into various aspects of their sounds, which serve as a means of communication and expression. By employing vocal acoustic analysis techniques, researchers and enthusiasts gain a deeper understanding of feline behavior and emotions.

One of the fundamental components in cat vocalizations is the meow. Meows are versatile and can vary in pitch, duration, and intensity. Analyzing pitch provides insights into a cat's emotional state; higher pitches might indicate excitement or distress, while lower pitches can convey contentment. Duration and intensity help discern the urgency or importance of a message.

Purring, another common feline vocalization is often associated with relaxation or contentment. Acoustic analysis of purrs involves examining the frequency and rhythmic patterns. Some studies suggest that purring frequencies may have therapeutic effects, promoting healing in cats and potentially even humans.

Hisses and growls are defensive vocalizations. Acoustic analysis of these sounds focuses on their intensity, duration, and spectral characteristics. Hisses, for instance, often have a pronounced increase in intensity, signaling a cat's attempt to ward off a perceived threat. Understanding these patterns aids in recognizing signs of aggression or fear in feline communication.

Chirps and trills are unique vocalizations that cats use for various purposes, such as expressing excitement or trying to get attention. Acoustic analysis helps identify the distinct features of these sounds, including rapid frequency modulations and short duration.

To conduct vocal acoustic analysis on cat sounds, researchers utilize specialized software such as Praat or Audacity. These tools enable the visualization and measurement of different acoustic parameters. Pitch analysis reveals the frequency of meows or trills, while intensity analysis highlights the loudness variations within a vocalization. Duration measurements assist in understanding the temporal aspects of a sound.

Method and Material

Study site

The study was conducted in Chitrakoot, Satna M.P. and select different area like Arogayadham, Sphatikshila, Parikrama Marg and Ramghat. We mainly observed road side cat through walking. The site approximately between the latitude 25.17989°N to 80.877°E. The sound recording done by mobile sony ICD-UX560F, Mic, Speaker, Sound level meter, Camera and visible observe done by manually and camera cap (Mobile camera). The study was conducted from August 2023 to July 2024 in Chitrakoot. Chitrakoot is a hilly region, as it is situated in the northern vindhya range in Satna. The

major three season are namely rainy season (between june to august), winter season (September to December), Dry season (between January to march) and Summer season (between april to july).

Site selection

Initially look the mature cat along Arogayadham, Sphatikshila, Parikrama marg and Ramghat (Satna). Mainly observed road side cat through walking. We than selected our 4 roosting site.

Sampling methods

This research observed and survey our roosting site mainly in the morning 5 AM to 8 AM and evening 4 PM to 6 PM. other required roosting measurements are done in the noon time at 12 PM to 2 PM. I can record their sound and capture picture of cat.

Required apparatus

Used camera or smart phone to observe animals (cat), PRAAT application, wired microphone, sony ICD-UX560F, Speaker, Sound level meter, Camera and Visible observe done by manually and camera cap (Mobile camera).

Observation time

This research observed and surveyed our roosting site mainly in the morning 5 AM to 8 AM and evening 4 PM to 6 PM, other required roosting measurements are done in the noon time at 12 PM to 2 PM. Sounds were collected using the wired microphones and smart phones for capturing photographs and videos.

Data Interpretations

The collected data was edited, coded and tabulated. Descriptive statistics and inferential statistics both used to analyze the data. Spectrograms, phonograms and table were used to present the data in simplified and understandable form. PRAAT application was used in extracting and analyzing the data.

Results

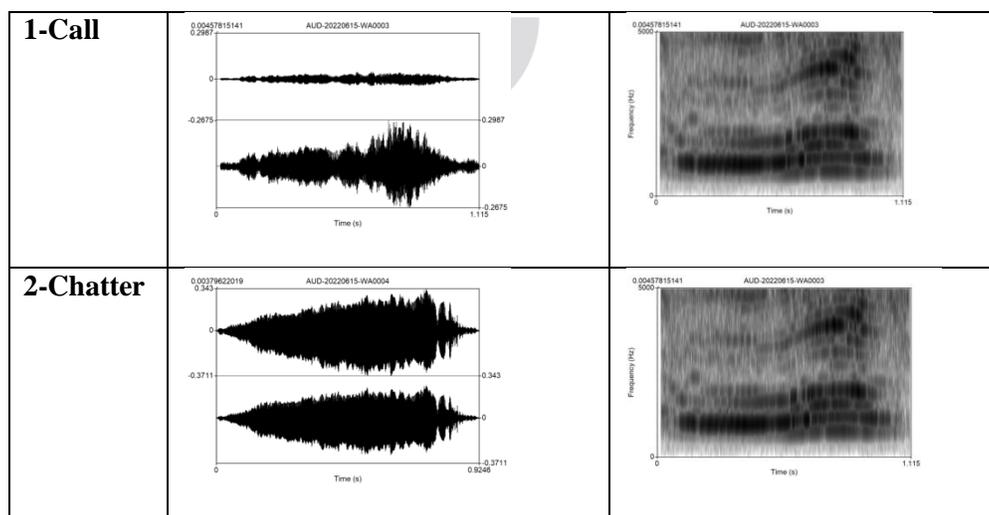
The vocal repertoire of *Felis catus* was found to be diverse, consisting of multiple vocalizations, including calls and vocal displays. Each vocalization exhibited unique characters including:

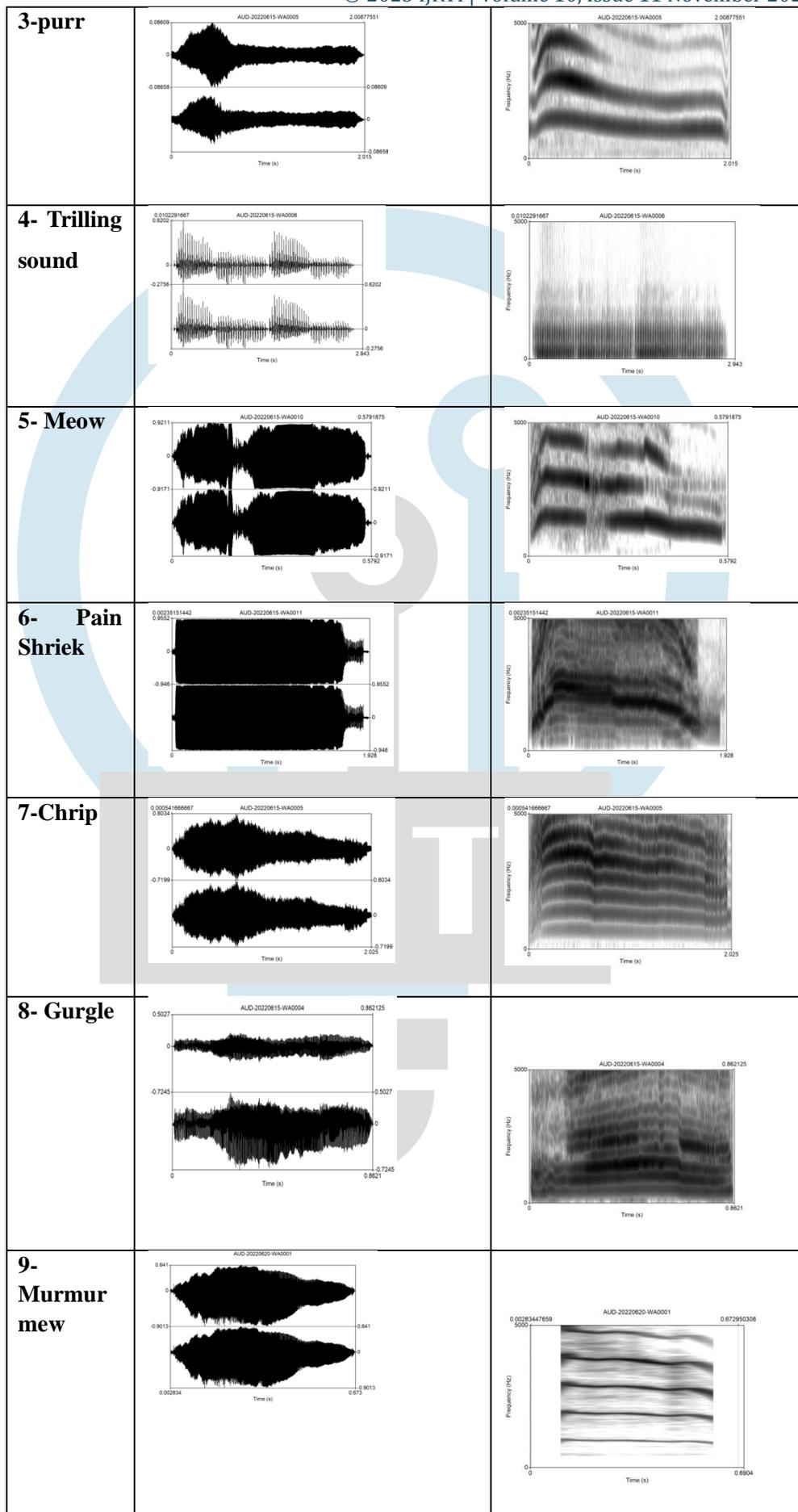
1. **Call** - The sound was recorded during morning. The cat was walking and produces sound. It could refer to a meow as well as other kind of vocalization. Calls can have various functions as it could serve to express a state resulting from general motivation stage.
2. **Chatter**- The chatter vocalization refer to teeth chattering and produced by cat when vicinity of prey. The sound is the result of a quick clicking or stuttering sound with jaw and tensely open mouth. Often produced in sequences. The sound of chatter is often voiceless, meaning that produced without vibration of vocal cords.
3. **Purr**- Purr has considered as a friendly, close-range intra specific communication. The purr appears to be used as “all is well signal” by the kitten while the nurse. It can also produce when cats are content, hungry, stress and pain.
4. **Snoring Sound**- The sound was recorded in the night. When cat is tried and she was sleep and snoring.
5. **Meow**- That vocalization called meow or mew probably due to the regional English. It is unsure if the so called mew corresponds to a unique vocalization type. Large variation intra- and inter- individual in the production. Meow is produced by mouth slowly closed. The mew is common vocalization especially cat to cat interaction and cat colonies.

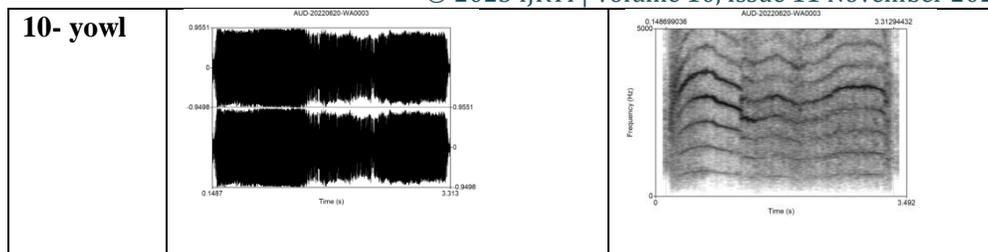
6. **Pain Shriek-** The pain shriek is short and intense cry characterized by tense. The sound is loud, high pitched and short. Vocalization is emitted during fights between cats.
7. **Chirp-** The chirp sound was named as it could be mimicking rodent chirp or bird. This sound produced either single or repeatedly. The chirp sound can vary in intonation and other vocalization is described in the kitten mother interactions
8. **Gurgle-** The sound was recorded evening time, gurgle is a short low sound it is mostly atonal. Gurgle express the friendly intentions of the sender. Its parameters were found intensity Maximum- 79.39dB Minimum- 70.47dB Amplitude: Minimum- 0.724 Pascal Maximum: 0.5027 Pascal Mean 0.002 Pascal Root-mean-square: 0.141 Pascal When she saw human she got excited for playing with them, she was climbing to human.
9. **Murmur mew-** The murmur is a soft, short voiced purr or trill. That sound produced with closed mouth during friendly approach and murmur mew is a long and one of the most common sounds in friendly environment.
10. **Yowl-** the yowl is a loud, long and harsh call. Yowl sound produced with an open mouth that gradually closes. Sound produced in agonistic (threatening situations) or during reproductive situations.

Sr.	Vocalization	Intensity(dB)	Pitch (Hz)
1	Call	66.14	347.592(±2.153)
2	Chatter	74.37	339.371(±4.861)
3	Purr	59.34	396.641(±5.341)
4	Snoring Sound	70.05	82.275 (±4.275)
5	Meow	88.22	430.949 (±4.933)
6	Pain Shriek	90.65	283.095 (±9.133)
7	Chirp	79.50	309.352 (±4.712)
8	Gurgle	76.97	399.968 (±3.647)
9	Murmur mew	80.01	433.740 (±5.727)
10	Yowl	88.48	306.234 (±4.587)

Temporal analysis reveals specific pattern and sequence of vocalization in various







Discussions

Research in this field not only enhances our understanding of cat communication but also has practical applications. For example, it can contribute to the development of devices or applications that help pet owners interpret their cats' needs and emotions more accurately.

In conclusion, vocal acoustic analysis of cats involves a comprehensive exploration of meows, purrs, hisses, chirps, and trills. By dissecting the acoustic features of these sounds, researchers gain valuable insights into feline emotions and communication, ultimately fostering a deeper connection between humans and their feline companions.

Conclusion

The study of *Felis catus* Vocalizations revealed that domestic cats possess a highly diverse vocal repertoire with each vocalization serving distinct communicative purposes. Calls, meows, purrs, and murmurs generally reflect neutral states, whereas vocalizations such as pain shrieks, yowls, and chatters are linked to specific contexts such as aggression, reproduction, or hunting behavior. Intermediate vocalizations, including chirps and calls, appear to fulfill versatile roles across intra and interspecific interactions. Further research employing quantitative acoustic analyses and cross situational comparisons is warranted to refine the categorization of vocal types and to elucidate their evolutionary and adaptive significance.

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