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ECOLOGICAL ASPECTS OF ACOUSTIC COMMUNICATION OF MAMMALS IN THE SOUTHERN ARAL SEA REGION

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ABSTRACT

This article examines the ecological aspects of acoustic communication of mammals in the southern Aral Sea region under arid climate conditions and anthropogenic ecosystem transformation. The focus is on the bioacoustic characteristics of the Bukhara deer (Cervus elaphus bactrianus) and the golden jackal (Canis aureus). It has been established that acoustic signals play an important role in maintaining intraspecific contacts, territorial behavior, and reproductive communication. The Bukhara deer's peak vocal activity is observed during the rutting season, while the jackal's primary forms of acoustic communication are howling, barking, and contact calls. It has been shown that the nature of vocalizations depends on environmental conditions and the behavioral characteristics of the species. The obtained results confirm the potential of bioacoustic monitoring for studying the spatial activity, population status, and conservation of mammals in the Southern Aral Sea region.

KEY WORDS: *Bioacoustics, Acoustic Communication, Mammals, Southern Aral Sea Region, Bukhara Deer, Jackal, Environmental Monitoring.*

INTRODUCTION

Acoustic communication is an important mechanism for mammalian interaction, allowing information to be transmitted over distances without visual contact. Sound signals are used to find mates, defend territory, maintain social bonds, coordinate movements, and warn of danger. Their importance is particularly heightened in conditions of limited visibility, typical of tugai forests, reed beds, and other habitats in the southern Aral Sea region.

The southern Aral Sea region is a region experiencing a high degree of ecological transformation associated with the drying up of the Aral Sea, changing hydrological regimes, and the degradation of natural ecosystems. Under these conditions, mammals develop various adaptive strategies, one of which is changing the nature of their acoustic activity depending on the season, time of day, and habitat characteristics. Of particular interest are the bioacoustic characteristics of the Bukhara deer (Cervus elaphus bactrianus) and the golden jackal (Canis aureus). In the Bukhara deer, acoustic communication plays an important role during the rutting season, attracting females and enabling interaction between males. Golden jackals use acoustic signals for territorial marking, maintaining contact between individuals, and coordinating activities. Studying the acoustic communication of these species allows us to assess their ecological adaptations and the potential for bioacoustic monitoring in conservation.

The aim of the study is to examine the ecological aspects of acoustic communication in mammals of the Southern Aral Sea region using the example of the Bukhara deer and the common jackal, and to determine the role of sound signals in their behavior and adaptation to changing environmental conditions.

MATERIALS AND METHODS

The study was conducted during 2023–2025 in the Southern Aral Sea region, including the Lower Amu Darya State Biosphere Reserve and adjacent ecosystems, which represent the main habitats of the Bactrian deer (Cervus elaphus bactrianus) and the golden jackal (Canis aureus). Observations were carried out in different seasons, taking into account periods of peak vocal activity of the animals. To investigate acoustic communication, visual observations, camera traps, and autonomous acoustic recorders were used. Recording devices were installed at animal concentration sites, along movement trails, near watering points, and feeding areas. Acoustic signals were recorded continuously throughout the day and night, followed by subsequent processing and analysis of the recordings. The analysis considered the duration, frequency characteristics, intensity, and frequency of calls, as well as their diurnal and seasonal variability. For the Bukhara deer, the roars of males during the rutting season were studied, while for the jackal, the howls, barks, and contact calls were analyzed. Acoustic data were processed and analyzed using Raven Pro software. The resulting data was compared with visual observations and photo monitoring to determine the behavioral context of the recorded calls.

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RESULTS AND DISCUSSION

The study's results showed that the acoustic communication of mammals in the southern Aral Sea region is strongly influenced by environmental factors and depends on the species' biological characteristics, habitat structure, season, and social activity. Bukhara deer exhibited the highest vocal activity during the rutting season, which in the southern Aral Sea region typically lasts from late August to mid-November. During this period, males produced powerful roars, which served reproductive and competitive functions. The greatest number of calls was recorded in the morning and evening hours, which is associated with increased activity during cooler times of the day and reduced heat load. Male roars served as a means of attracting females, demonstrating physical condition, and warning other males of their occupancy of a territory or the presence of a harem.

An analysis of the frequency characteristics revealed that the bulk of the Bukhara deer's roars was concentrated in the low- and mid-frequency range, which ensures better sound propagation in riparian forests and reed beds. Adult males typically produced longer, lower-frequency calls, while those of young individuals were less stable and less expressive. This suggests that the acoustic parameters of roars may reflect the age, physical condition, and social status of males. During the peak rutting season, roars were accompanied by movements, display behavior, guarding of females, and conflicts between males.

In the golden jackal (Canis aureus), acoustic communication served different ecological functions. The main types of vocal signals included howls, barks, short contact calls, and group vocalizations. The highest vocal activity was recorded during the evening and nighttime hours, corresponding to the species' crepuscular and nocturnal lifestyle. Jackal howling was most frequently observed along territory boundaries, near feeding sites, water sources, and areas adjacent to human settlements. These vocalizations played important roles in territorial marking, maintaining contact between individuals, coordinating movements, and responding to the presence of conspecifics, other animals, or humans.

A peculiarity of the acoustic behavior of the jackal in the Southern Aral Sea region is its connection with synanthropy and opportunistic feeding. In areas with anthropogenic food sources, sound activity often increased in the evening, when animals began to move towards food items. Group vocalizations could indicate temporary association of several individuals in areas with high food availability. At the same time, the permanent complex social structure is poorly expressed, but situational acoustic coordination plays an important role in the use of resources and the reduction of intraspecific competition.

A comparison of the acoustic activity of the Bukhara deer and the jackal revealed that vocal communication serves different ecological functions in these species. In the Bukhara deer, vocal communication is most closely linked to reproduction, sexual selection, and the territorial behavior of males. In the jackal, vocal signals have a more universal significance and are used in various behavioral situations: during movement, foraging, territory defense, maintaining contact, and responding to danger. Despite these differences, acoustic communication is an important adaptation mechanism for both species to the challenging conditions of the southern Aral Sea region.

The data obtained confirm that the acoustic communication of mammals in the Southern Aral Sea region is shaped by natural and anthropogenic factors. In the context of habitat fragmentation, declining water resources, and changing vegetation structure, vocal signals become an important means of maintaining spatial and social connections. For animals living in tugai forests and reed beds, acoustic communication is particularly important, as dense vegetation limits visual contact. Low-frequency and long-lasting signals propagate better in such conditions, making them an effective means of transmitting information over long distances. For the Bukhara deer, acoustic communication is a crucial element of reproductive behavior. The roar of males allows females to assess the quality of a potential mate, and males to avoid unnecessary direct confrontations with rivals. Thus, vocal signals serve not only a communicative but also a regulatory function, reducing the risk of injury and energy expenditure during the rutting season. Changes in roar intensity can serve as an indirect indicator of population status, the activity of mature males, and the success of the reproductive season.

The jackal's acoustic communication reflects its high ecological flexibility. In anthropogenically altered landscapes, howls and other vocal signals help individuals coordinate their movements, exploit food resources, and maintain spatial contacts. The association of acoustic activity with human settlements and waste accumulation sites demonstrates that jackal behavior is closely linked to human-induced environmental changes. This has practical significance, as increased synanthropy can increase the likelihood of conflicts with human populations, particularly when attacking poultry and small livestock.

Bioacoustic monitoring can be considered an effective non-invasive method for studying mammals in the Southern Aral Sea region. It allows for recording animal presence, assessing activity periods, identifying areas of concentration, and tracking seasonal behavioral changes without directly disturbing the animals. The use of autonomous recorders in hard-to-reach tugai and reedbed habitats is particularly promising. With long-term data accumulation, acoustic monitoring can be used to assess population status, identify changes in the spatial distribution of animals, and develop conservation measures.

CONCLUSION

Acoustic communication plays an important role in the ecological adaptation of mammals in the Southern Aral Sea region and ensures effective interaction among individuals within transformed ecosystems. In the Bactrian deer (Cervus elaphus bactrianus), vocal signals are of particular importance during the rutting season and are closely associated with reproductive behavior and competition among males. In the golden jackal (Canis aureus), vocalizations perform territorial, contact, and coordination functions, facilitating successful adaptation to a wide range of environmental conditions. The obtained results confirm the potential of bioacoustic monitoring as a non-invasive method for studying mammals. The use of acoustic technologies provides valuable information on animal behavior, activity patterns, and spatial distribution, which is essential for assessing population status and

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conserving regional biodiversity. Further development of bioacoustic research will contribute to improving monitoring programs and conservation strategies for rare and ecologically important mammal species in the Southern Aral Sea region.

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