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UDC 591.5

THE TURKESTAN LYNX IN THE CHATKAL RANGE, WESTERN TIEN SHAN, UZBEKISTAN

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Abstract

This article provides new data on the distribution of the Turkestan lynx, *Lynx lynx isabellinus* — a rare subspecies inhabiting the territory of the Chatkal State Biosphere Nature Reserve in the western Chatkal Range in Uzbekistan. Using camera traps, we managed to confirm the presence of this predator in the Chatkal Range and updated the distribution of this rare subspecies in the Western Tien Shan Mountains. The lynx was recorded in all studied biotopes at altitudes between 1,300 and 3,550 m a. s. l.; however, it occurs most frequently in sparse juniper forests, on steep slopes with rocky outcrops, at altitudes 2,000-2,300 m a. s. l. The article also provides data on the lynx's activity patterns, analyzes the species's potential diet, and studies the distribution and biology of its most probable preys. We propose that the Turkestan lynx in the Chatkal Range feeds basically on the chukar partridge *Alectoris chukar* and various rodents.

Citation: Bykova E. A., Golovtsov D. E., Esipov A. V. 2018. "The Turkestan Lynx in the Chatkal Range, Western Tien Shan, Uzbekistan". Tyumen State University Herald. Natural Resource Use and Ecology, vol. 4, no 2, pp. 92-107.
DOI: 10.21684/2411-7927-2018-4-2-92-107

This study provides a baseline for further research on the ecology and conservation needs of the Turkestan lynx. We show that camera trap method is particularly efficient for the study of rare or elusive species, such as the Turkestan lynx, which is supported by large amounts of new, formerly unavailable information on this subspecies. In addition, camera trapping in the Turkestan lynx's habitat provided information about the occurrence and basic ecological aspects of sympatric species, and we propose it as a key methods of monitoring of wildlife in protected areas in Uzbekistan.

Keywords

Turkestan lynx, Western Tien Shan, Chatkal Range, status assessment, camera traps, photo capture, prey species.

DOI: 10.21684/2411-7927-2018-4-2-92-107

Introduction

Camera traps have been used in the Chatkal State Biosphere Nature Reserve (Chatkal Nature Reserve) to monitor mammal populations and study their biology since August 2013 [4-6] alongside traditional methods, such as seasonal transect survey of animals and registration of key vertebrate species by the reserve's rangers while patrolling the territory. When used for a long time, stationary camera traps provide ample material on fauna, as well as daily and seasonal activity. In addition, camera traps make it possible to obtain data on herd size, reproductive biology, sex and age ratio of the populations of target species. Research into the fauna of vertebrates has been carried out since 1937 in Chatkal Nature Reserve — the oldest reserve in Uzbekistan [23]. However, despite the research's wide temporal and geographic scale, the use of camera traps allowed for discovery of mammals, which had never before been reliably recorded in the territory of the Chatkal Nature Reserve, among which is *Lynx lynx* (Linnaeus, 1758), a rare representative of the family Felidae. Uzbekistan is a home for one of its subspecies — Turkestan Lynx, *Lynx lynx isabellinus* Blyth, 1847.

The Turkestan lynx, also known as Central Asian lynx, is a subspecies representative of Central Asian mountains, including the Tien Shan, Pamirs, Hindu Kush, Tibetan Plateau, and southern spurs of the Himalayas [13]. This predator is included in the Red Data Book of Uzbekistan [17] as a Vulnerable species 2(VU:D). In the IUCN Red List, the *Lynx lynx* was assessed as Least Concern (LC). However, IUCN stresses that the Turkestan lynx is a rare subspecies, whose number is declining in many range states, including Uzbekistan, which is caused by the fragmentation and loss of habitats through the development of cattle breeding and infrastructure, the shrinkage of mountain woods, and killing of the animals. Poaching the lynx for its skin and killing in revenge for attacking livestock are common practices for the local people in Central Asia, which causes serious damage to the small Turkestan lynx populations. In Uzbekistan, the lynx's habitat is limited to the mountainous areas in the Western Tien Shan and Pamir Alai, with the numbers of the animals relatively stable only in the

territories of protected areas (Gissar, Surkhan and Zaamin Reserves, and, according to latest data, the Chatkal Nature Reserve).

The main task of the research was to study the distribution of the Turkestan lynx in Chatkal Range, Western Tien Shan, lynx's seasonal altitudinal migrations and daily activity patterns, as well as to analyze this species' potential diet using camera traps.

Material and methods

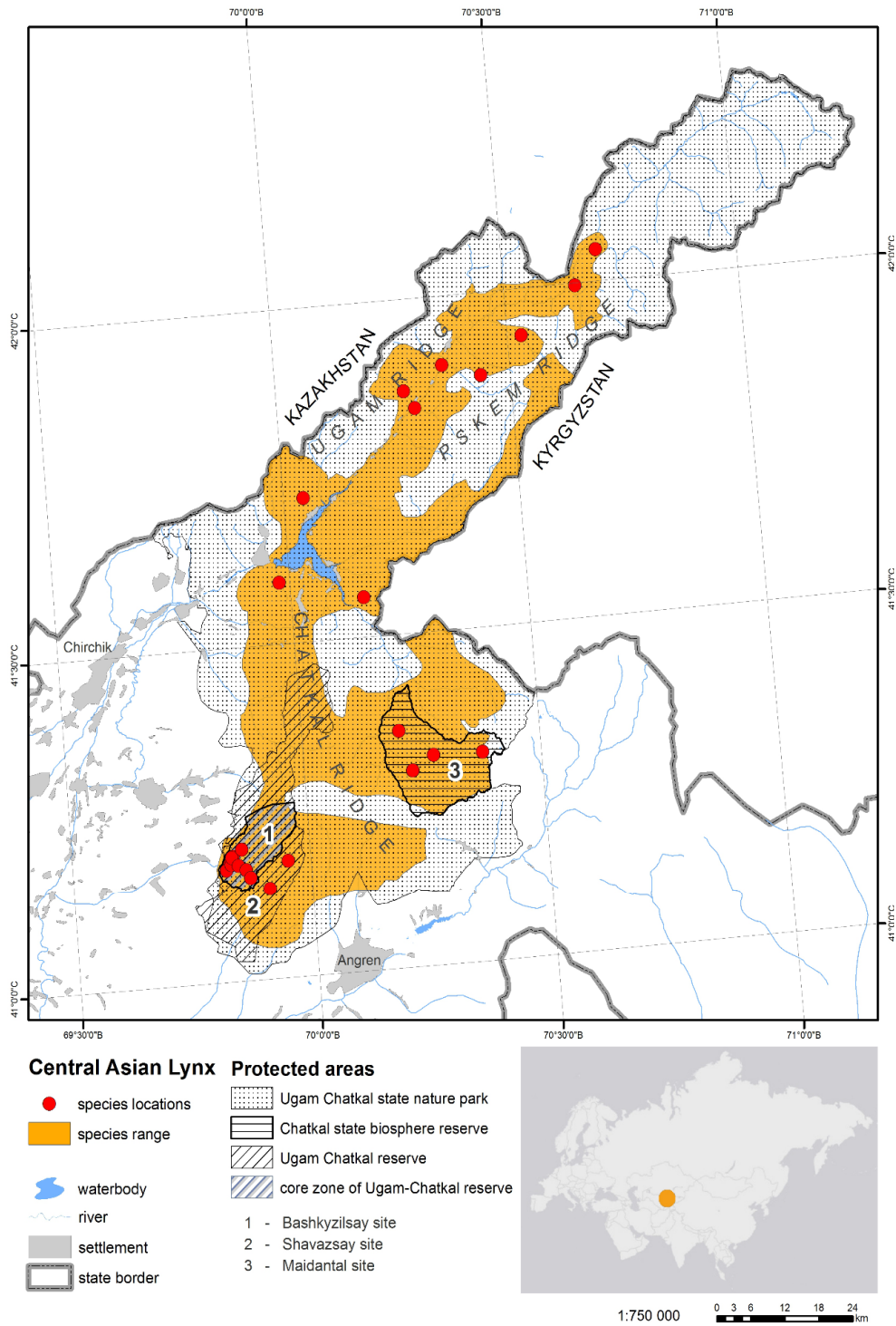
The research was carried out in the South Western Chatkal Range. The data were collected in three sites: Bashkizylsay, Shavazsay, and Maidantal (Fig. 1). We employed 22 camera traps (Covert MP8, Covert MP8 Black, Covert Red 40, Moultrie and Bushnell Trophy Cam). To detect and record wildlife, we used camera traps with a passive infrared sensor (PIR) to detect animal movements.

All camera traps, excluding Cover MP8 Black, had visible flash which may have been detected by wildlife or people. We placed camera traps on a tree 40-120 cm above the ground to record large and medium-sized animals. The cameras were installed for a year at 88 stations in various types of biotopes (dry mountain steppe, deciduous forest and juniper forest, shrub land, alpine meadows and high-altitude barren areas) in the places of the animals' most probable visits (trails, watering points, animal marking places, and places of natural constrictions of relief).

1. Bashkizylsay site (1) is located in the south-western spurs of the Chatkal Range on an area of 11,018 ha. Camera traps were installed at 57 stations in various types of mountain forests (47 spots) and in dry mountain steppe (10 spots) at altitudes 1,100-2,100 m a. s. l. Between August 2013 and October 2017, the camera traps operated for a total of 8,949 camera-days.
2. Shavazsay site (2) is located in the Chatkal Range's southernmost extremity, in the Shavazsay River basin. The section's area is around 11,000 ha. The traps were installed at 19 stations at altitudes between 1,200 m and 2,000 m a. s. l. The landscapes and faunistic composition in this section are identical to those in the Bashkizylsay section adjacent to this territory. Between May and August 2013 the camera traps operated a total of 549 camera-days.

Fig. 1 (on the right). The distribution of the Turkestan lynx in the Western Tien Shan, Uzbekistan by camera traps, questionnaire data (map produced by Anna Ten, 2017). Red spots (species locations) show camera trap locations with photographs of the lynx in Chatkal ridge as well as reliable questionnaire and literature data in Ugam and Pskem ridges

Рис. 1 (справа). Распространение туркестанской рыси в Западном Тянь-Шане (Узбекистан) по данным фотоловушек и анкетных данных (карта Анны Тен, 2017 г.). Красные точки (места находок вида) показывают расположение фотоловушек на Чаткальском хребте, на которые была зарегистрирована рысь, а точки находок рыси на Угамском и Пскемском хребтах — согласно достоверным опросным и литературным данным



3. Maidantal site (3) is located on the north-western slopes of the Chatkal Range, in the basins of the Terekli say River and its tributaries. The section's area is 24,706 ha. The traps were installed at 12 stations at altitudes 1,500-3,550 m a. s. l. The lower altitudinal margin in this section lies in dry mountainous steppe with occasional patches of forest, the higher — in alpine meadows and high-altitude barren areas. Due to higher altitudes and the predominance of north-facing slopes, the landscapes and fauna in this section differ from those in the two previous ones. Between August 2013 and September 2017, the camera traps operated a total of 1,122 camera-days.

We collected photo captures and reported number of animal detections for each species. One capture corresponds with one line in the database and refers to all photographs of one species taken within 30 minutes from the first shot. When an animal stayed in front of the lens for over 30 minutes, it was indicated in the database with two or more lines. The number of individuals in a group is equal to the largest number of animals on one shot or, where a group of animals is moving in one direction, it is calculated by counting all the passing animals. We calculated relative abundance index (RAI) for each species as the number of photo captures per 100 trap nights.

We also questioned a staff of Brichmula forestry farm and Karangitugai weather station (in total, 8 people in 2015) and collected data from literary sources [6, 8, 9, 11, 15, 16] to describe the lynx's range in Western Tien Shan and its possible diet.

Results and discussion

Until very recently, the common opinion was that the Turkestan lynx was very rare in the north-eastern part of Uzbekistan, where it had earlier occurred at high altitudes in the Pskem, Ugam, Chatkal, Kuramin, and Fergana Ranges [8, 9]. This subspecies lives in some other countries, inhabiting areas in the Western Tien Shan adjacent to the territory of Uzbekistan, such as the Pskem, Ugam, Maidantal, and Karjantau Ranges in Kazakhstan [7, 20] and the Chatkal and Chandalash Ranges in Kyrgyzstan [21], yet it is considered a very rare species throughout. The relatively new information, obtained in the course of interviews with local people, demonstrated that there might be occasional encounters with this animal in the Pskem and Maidantal Ranges in north-eastern Uzbekistan ([15] and questionnaire data), while the data obtained with the use of camera traps indicate reliably that the Turkestan lynx inhabits the western slopes of the Chatkal Range, in the Chatkal Nature Reserve, and adjacent mountain valleys (Fig. 1).

Judging from literary sources, the Turkestan lynx's most typical habitats in the Western Tien Shan are juniper forests, mostly those on steep mountain slopes with rocky outcrops and screes [7, 11, 16].

Camera traps recorded 38 captures of Turkestan lynx; relative abundance index (RAI) during the all study period is 0.35 (Table 1).

Table 1

Number of stations, species captures, camera trap nights, and relative abundance index during the camera trapping of Turkestan lynx and its possible prey species (roe deer, tolai hare and chukar) in three sites of Chatkal Nature Reserve in 2013-2017

Таблица 1

Количество станций, фотоотловов, фотоловушка-ночей и индекс относительного обилия животных во время регистрации туркестанской рыси и её возможных видов-жертв (косули, зайца-толая и кеклика) на трёх участках Чаткальского заповедника в 2013-2017 гг.

Species	Site 1				Site 2				Site 3			
	Nst/Npst	Reg	CTNs	RAI	Nst/Npst	Reg	CTNs	RAI	Nst/Npst	Reg	CTNs	RAI
Turkestan lynx	56/9	18	8935	0.20	10/2	2	391	0.51	11/4	18	1282	1.40
Roe deer	56/34	471	8935	5.27	10/7	27	391	6.91	11/0	0	1282	0
Tolai hare	51/2	45	8459	0.53	9/0	0	320	0	11/1	10	988	1.01
Chukar	51/26	739	8459	8.74	9/3	7	320	2.19	11/6	59	988	5.97

Notes: Nst/Npst — general number of stations on the site / number of positive stations where species has been recorded; Reg — registrations; CTNs — number of camera trap nights on the site; RAI — relative abundance index

Примечания: Nst/Npst — общее число станций на участке / число станций, где были зарегистрированы виды; Reg — фотоотлов; CTN — количество фотоловушка-ночей на одной станции; RAI — индекс относительного обилия животных

The analysis of our material shows that the Turkestan lynx inhabits a wide range of altitudes, from 1,300 m to 3,550 m a. s. l. (Fig. 2). Most often, the lynx was captured at altitudes higher than 2,000 m a. s. l., on steep slopes with sparse juniper forests and shrubberies, often with rocky outcrops, and on watersheds covered with steppe-specific vegetation and occasional shrubs. Camera traps, installed on the floodplains of main streams and their major tributaries, did not capture any Turkestan lynx.

In summer, the Turkestan lynx occurs in the subalpine and alpine zones. In winter, when a layer of snow covers the ground, they descend to deciduous forests and mountain steppes with diverse grass species. The largest number of lynxes was captured in summer and autumn at altitudes between 1,400 and 2,600 m a. s. l. (Fig. 2). The lynx is a non-migratory species, and its seasonal altitudinal migrations are conditioned, most probably, by the necessity to find food and excess amounts of snow [7].

The lynx is most active in the morning, evening and night hours, but it can be encountered in the daytime, too (Fig. 3), which was noted by G. I. Ishunin, who referred to observations in Guralash made by O. Nikitin. The lynx may be active in the daytime when breeding or nursing cubs or in case of food shortage, when the animal

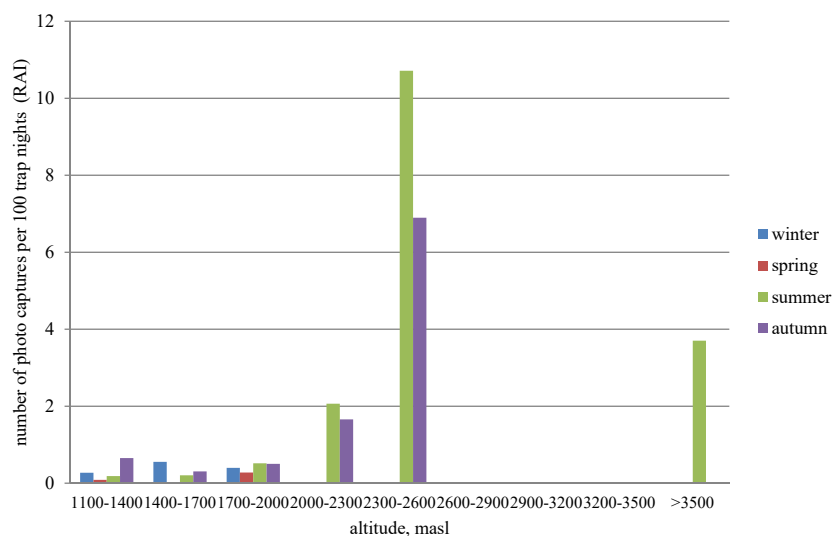


Fig. 2. The altitudinal distribution of the Turkestan lynx in various seasons

Рис. 2. Высотное распределение туркестанской рыси в разные сезоны

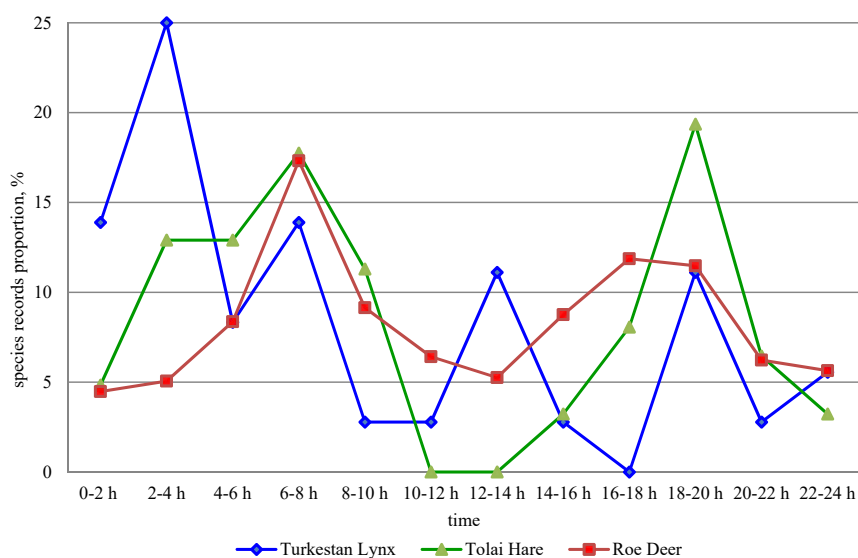


Fig. 3. The comparative daily activity of the Turkestan lynx, Tolai hare, and Siberian roe deer by camera traps in the western spurs of the Chatkal Range

Рис. 3. Сравнительная дневная активность туркестанской рыси, зайца-толая и сибирской косули в Западных отрогах Чаткальского хребта по данным фотоловушек



Fig. 4. A lynx family (a female with two kittens) in Bashkizylsay in September 2016

Рис. 4. Семья рыси (самка с двумя котятами) на Башкизылсае в сентябре 2016 г.

continues to chase its prey at daylight [8]. In our research, the lynx was recorded in the daytime between June and December, which was, probably, caused by the necessity to care about their young. Most of the lynxes were captured in the mentioned period, both during the day and in the night, with only two captures made at other times (January and April), both during the night.

There is very little available data on the Turkestan lynx's breeding in Uzbekistan. Bakhyer Aromov [1] mentions that one litter in the Gissar Range consists of 3-5 kittens. According to literary sources, the size of one litter may vary from 1 to 4 kittens, 5-6 as exceptions, but in most cases — 2-3 cubs [8].

In most cases, our cameras captured single adult individuals; however, there were groups consisting of a female with one or two kittens (Fig. 4). The first young lynxes were captured in early September. At this time, cubs differ considerably in size from their mother: the height of kittens at the forelegs is about $\frac{1}{3}$ of their mother's. Although the cubs, born this year, do not quite reach the size of adult individuals by December, they already become difficult to identify on photographs (particularly if they are single).

The diet of the lynx inhabiting the territory of Uzbekistan has not been studied properly, either. Most data relate to the Pamir-Alai part of the animal's range (Gissar and Turkestan Ranges). There is no available information on this predator's feeding in the Western Tien Shan, which is conditioned by its extremely low occurrence in this part of the range. According to a number of researchers, the Turkestan lynx's main prey is the Tolai hare, rodents, and birds [1, 9, 10, 19]. Sometimes, the lynx

preys on young individuals of the wild boar *Sus scrofa* Linnaeus, 1758, roe deer [14] and Siberian ibex *Capra sibirica* (Pallas, 1776) [1, 19]. The analysis of the lynx's excrements sampled in the Zaamin Reserve (Turkestan Range) revealed that it contained 98.4% of remains of the Tolai hare [18]. The authors also indicate that rodents and birds are the predator's secondary prey, with chukar partridges comprising the majority of eaten birds. B. Aromov [1] also indicates that the chukar and snowcock *Tetraogallus himalayensis* G. R. Gray, 1843 comprise the largest portion of birds the lynx preys upon, while the rodents, most often present in the predator's diet, are the Tien Shan souslik *Spermophilus relictus* (Kaschkarov, 1925), Turkestan rat *Rattus turkestanicus* (Satunin, 1903) and pygmy wood mouse *Sylvaemus uralensis* Pallas, 1811. Tolmaz Aromov [2] points out that the diet of the Turkestan lynx in the Gissar Reserve consists primarily of chukars (39.2%) and hares (29.7%).

Relying on the available information, we attempted to find out which species could be the prey for the lynx inhabiting the Chatkal Range, as this issue remains unsettled up to this day. We based our very careful suggestions about the possible lynx's diet on the analysis of database and the most probable prey species, captured by camera traps. These species include the Siberian roe deer *Capreolus pygargus* Pallas, 1771, chukar partridge *Alectoris chukar* (Gray, 1830), and Tolai hare *Lepus tolai* Pallas, 1778.

According to our survey, Tolai hare has been carried out in the Chatkal Nature Reserve for many years, the altitudinal range of the hare's habitat is very wide, and the animal has been recorded (mostly on the basis of footprints in snow) from the foothills to the alpine zone. However, according to the camera traps, the Tolai hare is highly selective in terms of a habitat, as it may be a common species in one area and absent in adjacent valleys with similar biotopes. During the 9,767 camera trapping-days, the traps recorded 56 registrations of a hare (the camera traps had been set not to capture smaller animals); RAI = 0.57. The hare was recorded only in 3 of the 70 spots the cameras had been installed in, with multiple captures in 2 of the 3 spots. The reasons for such selectiveness are not clear. Generally, hares are not abundant in the Western Tien Shan and cannot be the lynx's main food. That is different from lynx diet in Pamir Alay where hare is numerous species [1]. During the day, the Tolai hare is most active in the morning, between 6 and 8 a. m., and in the evening, between 6 and 8 p. m. (Fig. 3).

In Uzbekistan, the range of the roe deer is limited to the forests in the Western Tien Shan. It occurs primarily in the western spurs of the Chatkal Range and in the Kuramin Range [3]. Some sources mention roe deer found in the Pskem Range [22] and in the areas of the Ugam Range next to the Kazakh border [9, 11].

A typical inhabitant of mountain forests, the roe deer prefers deciduous forests and occurs in valleys with thick woods and shrubberies. In Chatkal Nature Reserve, it is common in the Bashkizylsay site. According to the data from the camera traps, the roe deer lives at altitudes from the lower margin of the research to 1,700 m a. s. l. In the Maydantal section, suitable biotopes are quite limited and located at the lowest altitudes of the reserve. The areas adjacent to the reserve and suitable for the roe deer are used for pasturing, and the roe deer rarely occurs in them. We did not record this

species in the Maidantal section. In total camera traps recorded 509 captures of roe deer, RAI = 4.68.

The Siberian roe deer is most active twice during the day, with the largest number of animals captured at dawn and sunset and smallest at midnight and midday (Fig. 3). The peaks in the lynx's daily activity largely coincide with those in the roe deer's day. The roe deer and Tolai hare are mentioned as the basic food for the lynx in southern Kazakhstan and Kyrgyzstan (Western and Central Tien Shan) [8]. However, the range of the roe deer is somewhat limited. At middle altitudes, it occurs in two sites (Bashkzyzysay and Shavazsai), where the quantity of captured lynxes is lower in comparison with the Maidantal site. This brings us to the conclusion that the roe deer, in most probability, is not the predator's basic food, either.

The chukar partridge is one of the most abundant bird species in the Chatkal Range. Our cameras recorded 895 captures of chukar; RAI = 9.16. The species occupies a relatively wide altitudinal range, between 1,200 and 2,400 m a. s. l., which conforms to the lynx's altitudinal range of seasonal migrations. The chukar partridge occurred in all the areas we observed. We think that the chukar may be the basic component in the diet of the Turkestan lynx in the Chatkal Range. One of our camera traps shot a lynx carrying a chukar 50 minutes after sunrise (6:09 a. m., 8 August 2017).

In addition, the lynx's diet could include murine rodents. There are 14 murine species inhabiting the territory of the Chatkal Nature Reserve, and the Turkestan lynx may prey on them all, except the porcupine. Turkestan rats and pygmy wood mouse are quite numerous in the territory. The Turkestan rat is a typical inhabitant of mountain forests and is quite common in the Chatkal Range. This animal also lives in human settlements, which makes it a typical synanthropic species. We recorded the rodent in nuciferous and almond forests on the floodplains of the Bashkzyzysay and Shavazsai Rivers at altitudes 1,100-1,350 m a. s. l. *Sylvaemus uralensis* was recorded in the Bashkzyzysay, Shavazsai, and Maidantal sections at altitudes between 1,200 and 2,100 m a. s. l.

However, the question of which species are the lynx's main prey at high altitudes above the upper line of the partridge's range, where the predator migrates in the summer, remains unsettled. In this period the lynx, probably, preys on marmots and ground squirrels inhabiting the subalpine and alpine meadows. In the Chatkal Range, these altitudinal zones are inhabited by the Tien Shan souslik and Menzbier's marmot *Marmota menzbieri* (Kashchkarov, 1925). Both species hibernate in winter, but may be the lynx's main prey in summer.

It is also possible that the lynx hunts on young individuals of the wild boar (in the three studied sites, the camera traps made 2,356 captures of boars from all age groups) and Siberian ibex (in the three studied sites, the camera traps made 391 captures of ibexes from all age groups). Both species were shot by the camera traps, but there are no facts confirming they are present in the Turkestan lynx's diet.

Conclusion

Thus, using the camera trapping method, we obtained information on the distribution of the Turkestan lynx, which confirmed its habitation in the Chatkal Range. This allowed for better understanding of the range of this rare subspecies. The lynx occurs at 1,300-3,550 m a. s. l., from dry steppes with diverse grass species and sparse xerophytic forests to barren areas at high altitudes. Most frequently, it was recorded at altitudes 2,000-2,300 m a. s. l., at the upper margin of the mountain forest zone on steep mountain slopes with rocky outcrops. The Turkestan lynx's seasonal altitudinal migrations are conditioned, probably, by the necessity to find food and by thick snow cover.

We also obtained data on the lynx's daily activity and analyzed this species' potential diet. We think that the Turkestan lynx's most probable prey in the Chatkal Range consists of the chukar partridge and rodents. In summer, the animal may prey upon the Tien Shan souslik and Menzbier's marmot. The lynx's diet in the Chatkal Range may also include the roe deer and young individuals of the wild boar and Siberia ibex. Numerous authors have mentioned all these species as the lynx's prey, and our camera traps recorded these species in the same areas where the lynx was captured. The Tolai hare, the Turkestan lynx's basic prey species in the Pamir-Alai, may not be the main component of the predator's diet in the Western Tien Shan due to the small size of the hare's population in this region. However, the Turkestan lynx's diet remains uncertain and requires more research using both camera traps and other methods.

In sum, camera traps rank as the most efficient instrument in the study of the feline, which is supported by our discoveries related to the Turkestan lynx. The use of camera traps made it possible to extend considerably the program of the monitoring of vertebrates in the territory of the Chatkal State Nature Reserve, and we suggest that it should become one of the key monitoring methods in all protected areas across Uzbekistan. However, to make the study of the ecology of the lynx and other rare species more efficient, we need to enhance the scope and volume of research and bring to a new level the methods of collection, systematization, analysis, and storing of data.

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УДК 591.5

ТУРКЕСТАНСКАЯ РЫСЬ НА ЧАТКАЛЬСКОМ ХРЕБТЕ В УЗБЕКИСТАНЕ (ЗАПАДНЫЙ ТЯНЬ-ШАНЬ)

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Аннотация

В данной статье приводятся новые данные по распространению редкого эндемичного подвида — туркестанской рыси *Lynx lynx isabellinus* на территории Чаткальского биосферного заповедника, расположенного в западных отрогах Чаткальского хребта в Узбекистане. Используя метод регистрации с помощью фотоловушек, авторы смогли не только подтвердить присутствие хищника на Чаткальском хребте, но и значительно расширить современное представление о распространении и биотопической приуроченности этого редкого подвида на Западном Тянь-Шане в целом. Рысь обнаружена в различных биотопах в высотном диапазоне от 1 300 до 3 550 м над у. м., но наиболее регулярно она встречается в высотном пределе 2 000-2 300 м над у. м. в зоне арчевого леса и на крутых склонах с выходами скал.

Цитирование: Быкова Е. А. Туркестанская рысь на Чаткальском хребте в Узбекистане (Западный Тянь-Шань) / Е. А. Быкова, Д. Е. Головцов, А. В. Есипов // Вестник Тюменского государственного университета. Экология и природопользование. 2018. Том 4. № 2. С. 92-107. DOI: 10.21684/2411-7927-2018-4-2-92-107

Также в статье приводятся данные по сезонной и суточной активности рыси, проведен анализ возможного пищевого рациона этого вида, распространения и особенностей биологии наиболее вероятных видов-жертв. Делается предположение, что основой рациона туркестанской рыси на Чаткальском хребте, по мнению авторов, являются кеклик *Alectoris chukar* и горные грызуны.

Это исследование является базой для дальнейшего изучения экологии и необходимых природоохранных мер для сохранения туркестанской рыси. В статье подчеркивается, что для кошачьих метод обнаружения с помощью фотоловушек является особенно эффективным, что и подтверждается новыми находками туркестанской рыси, не зарегистрированной ранее с помощью других методов. Применение фотоловушек позволяет существенно расширить программу мониторинга позвоночных животных на территории Чаткальского государственного биосферного заповедника и предлагается в качестве обязательного метода ведения мониторинга на территории ООПТ в Узбекистане.

Ключевые слова

Туркестанская рысь, Западный Тянь-Шань, Чаткальский хребет, оценка состояния, фотоловушки, фотоотлов, виды-жертвы.

DOI: 10.21684/2411-7927-2018-4-2-92-107

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