MOOSE RELATIONS WITH BIOTIC COMMUNITIES AND MAN IN SAMARSKAYA LUKA NATIONAL PARK

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ABSTRACT: During 1985–1990 the density of the moose (*Alces alces*) population in the peninsular territory (Samarskaya Luka National Park and Zhiguliovski Reserve in the middle Volga Region) was studied. It was found that the natural cyclicity of the population differed between regions. The lowest intensity of oscillation in moose density was in the population nucleus, where the wavelength equaled 5 years. In the interflow areas the wavelength was 2–4 years. Oscillatory dependence of the moose density in the nucleus on the density of other trophic level mammals such as the mountain hare (*Lepus timidus*), red fox (*Vulpes vulpes*), wolf (*Canis lupus*), and pine marten (*Martes martes*) was also evident.

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In the forests of the Samarskaya Luka National Park prior to 1985, the moose population was studied only in the Zhiguliovski Reserve (1/7 of the regional area). Information about moose density, number, and mortality in the reserve was scarce (Belanin 1977, 1980, 1981; Korotaev 1983).

STUDY AREA

The study was conducted in Samarskaya Luka National Park. This is a peninsular territory in the mid Volga Region (Fig. 1). It is surrounded by the Volga River and reservoirs. The Zhiguliovski Reserve (Zapovednik) (Fig. 1b, 1e) and Samarskaya Luka National Park lie on the peninsula. The Reserve was established in 1966 and the Park in 1985. The total area is 160,000 ha. The area of the Reserve is 23,000 ha; the area of Park is 128,000 ha.

The geography of the peninsula is quite varied. There are low mountains (Zhiguli) which do not rise above 375m in elevation. These mountains cover an area of 22,152 ha of which 41.3% are in the Reserve (Central Zhiguli, Fig. 1b) and 58.7% are in the National Park (Western, Fig. 1a and Eastern Zhiguli, Fig. 1c). Zhiguli is the mountain forest area.

The area of the forest plateau (Charokayski forest) is 41,069 ha (Fig. 1e, 1d). Only some of this region (13,010 ha) is included in the reserve (Fig. 1e). Other natural areas of the Samarskaya Luka lie only in the park. The area of the Bolshoi Riazanski forest is equal to 2,703 ha (Fig. 1i). The area of the Bolshoi Chuvashski forest is 3,702 ha (Fig. 1j). The well–balanced forest–steppe (46% forested) covers 12,757 ha, including the Bahilovski forest–steppe (Fig. 1f) and Eastern forest–steppe (Fig. 1f, 1g). The Askulskaya forest–steppe, which occupies 51,814 ha (Fig. 1h), is more open (15.5% forested). The mean forest stand size here is 53 ha. The flood plain areas (Fig. 1m) occupy 7,427 ha (65% forested). The Podgorki area (Fig. 1k) is Volga lowland and is not moose habitat. The total area of the National Park forest is 62,499 ha, comprised of lime (29,181 ha), oak (15,443 ha), aspen (10,802 ha), and,

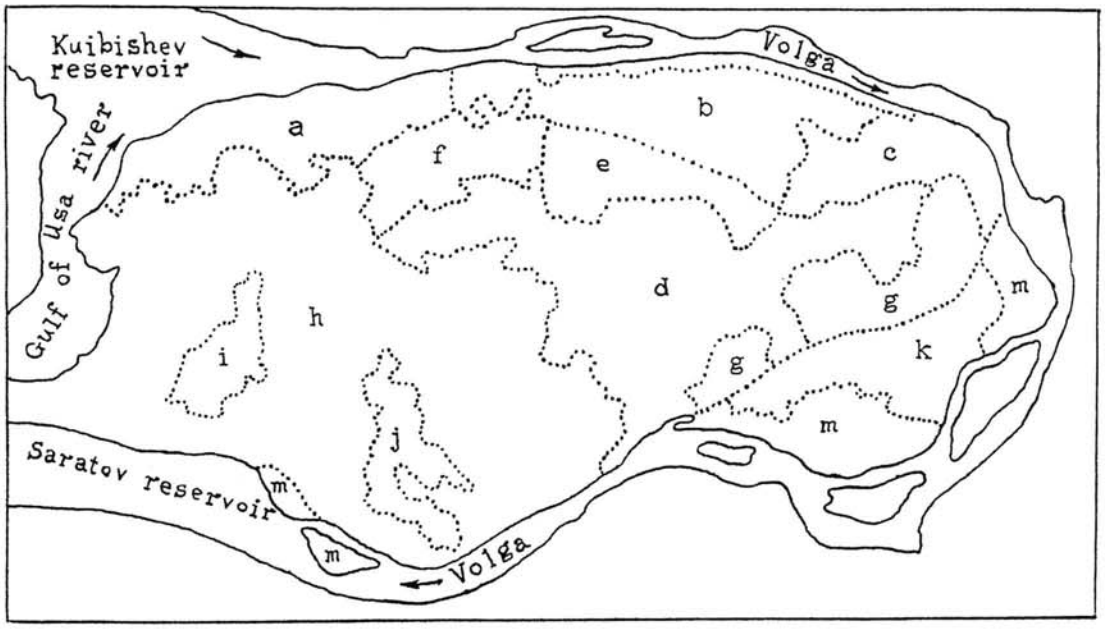

Fig. 1. Boundaries of natural areas in the Samarskaya Luka National Park. Names of areas identified by letters (a–m) are given in the text. Scale 1:400,000.

in the mountains, pine forests (1,243 ha), among other types.

METHODS

The populations of moose and other species were studied during 1985–1990. Aerial (helicopter) surveys of moose and wild boar were conducted in March of 1986, 1987, 1989, and 1990. In 1988 the populations of these 2 species were censused by ground surveys. Ground surveys of other animals were conducted in February of 1986–1990. The length of the ground census transects was 251.5 km each year. Helicopter surveys were conducted with 2 observers and 1 navigator. The width of the aerial census band was 250 m on each side of the aircraft. The length of each aerial census band was at least 1,000 km. Total area of plots of census bands was about 60% of the Park (54,000 ha).

We characterized population cycles by changes in relative density (D_r). By this term we mean: $D_r = D/D_c$, where D_c = maximum density and D = real density.

RESULTS AND DISCUSSION

Moose Density

In 1985 moose hunting was banned. Thus, from 1985 to 1990 the population was changing naturally from one time to another. Moose are distributed very irregularly in the study area, which is explained by the diversity of landscapes and various anthropogenic effects. There are 4 distinct zones which differ in indices of population density (moose/1,000 ha): high (11–13), intermediate (6–8), low (3–5), and very low (0.5–1.5) (Table 1). Of all habitats, the Charokayski forest best meets the ecological demands of moose. The greatest population density was noted here, in the central part of the park. Reasons for this high density are that the strict no–hunting zone occupies half of the Charokayski forest territory and during recent decades (1960–1985) there were intensive timber harvests with an average annual cut of 500–900 ha.

The mean density of this part of the population was 12.6 moose/1,000 ha. In the cutovers moose density increased over 5–

Table 1. Density of the moose population in Zhiguliovski Reserve and Samarskaya Luka National Park during 1986–1990.

Natural areas[1]	Location in Fig.1	Area (ha)	Density (moose/ 1,000 ha)	SE	Variation (%)
Bolshoi Riazanski Forest (p)	i	2,703	0.65	0.38	118
Western Zhiguli (p)	a		1.18	0.16	27
Askulskaya Forest–Steppe (p)	h	51,814	3.06	1.30	85
Banilovskaya Forest–Steppe (p)	f		3.83	1.44	65
Floodland Forest (p)	m	7,427	4.55	0.86	38
Eastern Forest–Steppe (p)	g		6.80	3.36	86
Bolshoi Chuvashski Forest (p)	j	3,702	7.93	1.82	46
Eastern Zhiguli (p)	c		11.34	1.41	25
Central Zhiguli (r)	b	9,149	12.45	4.22	68
Charokayski Forest (p+r)	e,d	41,069	12.62	2.20	35

[1] p = National Park (total area is 128,000 ha) and r = Zhiguliovski Reserve (total area is 23,000 ha).

fold. In the Charokayski forest, the area of forests younger than 10 years in 1985 was 9.5%. The Charokayski part of the population should be considered the nucleus of the population, with 74.5–88.5% of the region's moose population.

Change in the density of the moose population nucleus conforms to 6 year cycles (Fig. 2a). In the interflow areas of the Eastern Zhiguli, we observed a wavelength of 5 years (Fig. 2b). There was a 3–year natural cycle in the Western Zhiguli and Askulskaya forest–steppe (Fig. 2c). The smallest wavelength (2–year cycle) was attained in the large insular forests, occupying areas of 2,703 and 3,702 ha (Fig. 2d). The lowest intensity of oscillation of the moose density thus occurs in the nucleus.

It may well be that the high moose density in the nucleus has a positive effect on the Charokayski forest. The hotbeds of higher moose density were located in very homogeneous phytocoenoses (cutovers). Foraging by moose heavily depresses some tree growth and contributes to the formation of heterogeneous arboreal deciduous

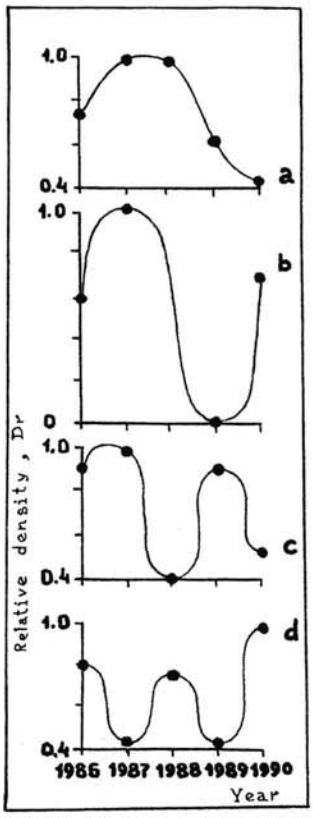

Fig. 2. Dynamics of relative moose density; a – Charokayski forest, b – Eastern Zhiguli, c – Western Zhiguli, and d – Bolshoi Chuvashski forest.

phytocoenoses. These changes were easily observed in the forest. It appears reasonable to assume that under these conditions the moose cause a direct rapid reestablishment of the natural and possibly primary forests without stages of tree species change. However, it is difficult to apply this suggestion to the mountain part of the population because the mountains have no cutovers.

Relation with Other Species of Animals and Man

Before the Park's establishment, populations of moose, wolf, and wild boar were subject to hunting, culling, and poaching. The beginning of population oscillations in these species corresponds with the establishment of the National Park. Since 1985 sport hunting has been banned in the Samarskaya Luka, and the wolf received Park protection in 1986. The Park's scientific laboratory sanctioned the elimination of individual wolves and wild boars, which feed on domestic animals and cultivated plants. From 2 to 6 wolves (15–30% of the population) and 40–60 wild boars (10–20%) are shot each year. Wolves are the greatest source of calf and adult moose mortality in the park. Poaching is also a major cause of mortality. A high correlation was found in the fluctuations of the number of moose and wolves (Fig. 3c). The wolf–moose ratio ranged from 1:120 (1987) to 1:20 (1990).

Lubvina (1982) and Mirkin (1989) stated that the relationships between organisms of different trophic levels frequently may be more important for community structure than competition. This hypothesis is also in accordance with my data. I selected 5 species having different food strategies and studied the interaction of population density between these species and the nucleus of the moose population. Four of the five are indigenous species to the Samarskaya Luka. One of them (wild boar) appeared here for the first time in 1973. The curves of moose density plotted against indigenous–species density are sinusoid (Fig. 3a–3c, 3e) irrespective of food strategy. Of course, these conclusions are only preliminary at this time.

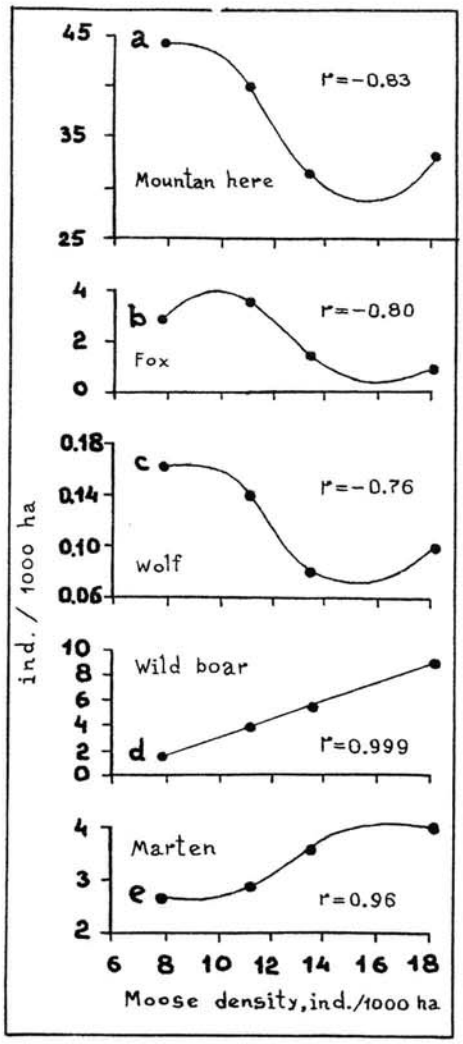

Fig. 3. Relationship between moose density and densities of other mammals in the Charokayski forest; a – mountain hare, b – fox, c – wolf, d – wild boar, and e – marten.

The interaction of moose and the forest in the nucleus is governed by the age of cutovers. It appears reasonable to assume that in the near future the moose density will diminish as the forests mature. These observations provide insight into the mechanisms of relationships between species of

different trophic levels and the formation and oscillations of free populations.

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