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A microregional reindeer herding landscape in Yamal: patterns and dynamics of movements

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Abstract

Human and animal mobility lies at the core of any nomadic pastoralist system. Anthropological studies of migratory patterns of mobile pastoralists' movements have revealed two universal sets of factors—ecological and non-ecological—that influence such movements differently. Our study focuses on the nomadic movement of the Yamal Nenets reindeer herders in the Russian Arctic using a microregional approach to study the indigenous communities on a large scale. The Nenets households of the *Mordyyakha* microregion in the northwest of the Yamal Peninsula have changed winter pasture sites several times over the past 15–20 years, while maintaining a stable summer route. Based on fieldwork among these people, we analyse how environmental and non-environmental factors influence the dynamics of their summer and winter meridional nomadic routes. We argue that long-term changes in their winter mobility are mainly related to the quality of pastures. Changing winter sites is a strategy that relates to ecological factors and still remains relevant for the households migrating via the meridional pastoral corridors of Yamal. In contrast, changing summer areas, as a rule, occurs in response to developing industry and, thus, relates to non-ecological factors.

Keywords Reindeer herding, Arctic, Nenets, Yamal, Nomadic routes, Microregion

Introduction

Pastoralism remains the basis for the livelihood of many communities in different areas across the globe—from arid zones to the Arctic tundra. Depending on the research focus, scholars have defined various key features of both historical and modern pastoralism. These features include nomadic lifestyle, degree of involvement in other productive activities, technological equipment available and used by households, and others (Khazanov 1994; Fratkin 1997; Dolker 2022).

With regard to the reindeer herding of the Nenets people, an indigenous nation living in the Arctic zone of Russia, the concepts of “nomadism” and “nomadic lifestyle”

are still very applicable. According to Golovnev (2016), pastoralism cannot be equated with nomadism, and the Arctic is a space where the nomadic tradition remains stable. Golovnev considers nomadism a type of mobile culture, a concept which may include not only reindeer herders, but also other cultures that are not considered nomadic in the traditional sense (Russian Pomors, or Normans of the Viking Age). F. Stammer emphasized that using the term nomadism in relation to Nenets reindeer herding was essential. The nomadic lifestyle is not only an emic concept of the Nenets people, but also defines the difference between the Soviet “productive nomadism” of large state reindeer herding enterprises and the lifestyle of modern private reindeer herding family farms with their “domestic or everyday nomadism” (Stammer 2005a). This emphasis on the traits of regional economic and cultural practices is an additional argument in favour of the thesis about the futility of formulating a coherent theory of nomadic pastoralism (Dyson-Hudson and Dyson-Hudson 1980).

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One of the common characteristics of pastoral communities is mobility, which can be considered in various contexts: as a form of adaptation, as household practices, or as a special form of natural resource management, etc. (Adriansen 2005). Golovnev, using an aesthetic approach to mobility and nomadism, on many occasions analysed various aspects of mobility in the culture of reindeer herders, primarily the Yamal Nenets (Golovnev et al. 2018). In our work, we do not emphasize a terminological difference between the terms (and their derivatives) “nomad” and “pastoralist”. We consider mobility within a theoretical framework and use concepts developed by K. V. Istomin and his co-authors. They proposed a basis for comparative studies of pastoralism and nomadism in different regions, including certain areas of the Arctic (Dwyer and Istomin 2008; Istomin and Dwyer 2010; Istomin et al. 2017; Istomin and Dwyer 2021). In their studies, an attempt was made to build a refined analytical model of the pastoralists’ movement using the example of several groups of reindeer herders in the Russian Arctic. The movement of various reindeer herding groups, according to Istomin et al., is ultimately determined by local options for establishing the requisite special relations between herders and reindeer, an interaction which they term “herd control”. This control is achieved while deploying a minimum of resources (human/animal efforts) to manipulate the herd. Movement is influenced by ecological factors that determine the behaviour of the animals and the reactions of the people. This process can be understood as a constant learning process for both people and animals, as a dynamic mutual adaptation. Non-ecological factors also affect movement, limiting it in space and time. Furthermore, in nomadic (mobile pastoralists’) movements, the concepts of macro- and micro-mobility should be considered separately (Niamir-Fuller and Turner 1999). The first concerns the movement of people and herds (seasonal, between camps, etc.); the second is related to the movement of animals on specific pastures and is part of the grazing process. The relationship between all these movements is the basis for the “realization of the adaptive function of nomadic mobility” (Dwyer and Istomin 2008).

Below, we present some of the results of our fieldwork on Nenets reindeer pastoralism, within this theoretical framework. Our work offers a new perspective inasmuch as it is based on data on reindeer herding of the people living between the communities where K. V. Istomin and his colleagues conducted their field studies. Their first fieldwork was associated with the Izhma Komi reindeer herders of the Bol’shezemelskaya tundra, migrating to the west of the Urals. The Izhma Komi keep large herds and seasonally move along long linear corridors (450–500 km), while their strategies and decision-making are

determined by their social status. They are employees of large reindeer herding enterprises. The second group is the Taz Nenets. Taz Nenets herders are either employees of reindeer herding enterprises or private households. They live north of the Taz River in the Yamalo-Nenets Autonomous Okrug and employ a grazing system different from that of other Nenets groups. Taz Nenets seasonal pastures are extremely limited in comparison with those of the Izhma Komi, and their movements are confined to relatively short annual migratory routes in the shape of double or triple loops.

Our fieldwork was mainly conducted among the Nenets of the Yamal Peninsula, who, geographically speaking, live between the Taz Nenets and Izhma Komi and constitute a major category of the reindeer herding households of the Yamalo-Nenets Autonomous Okrug (YNAO). They are private herders, self-employed rather than employees, and independently determine their nomadic strategies. Our main aim was to examine how ecological and non-environmental factors influence the dynamics of the summer and winter parts of the meridional nomadic routes in Yamal. We consider these questions using data gathered while doing fieldwork with a local group of Yamal Nenets. We combined a large-scale research perspective with a microregional approach (Terekhina and Volkovitskiy 2020a).

Yamal reindeer herding and study area

The Yamalo-Nenets Autonomous Okrug (YNAO), a federal subject of the Russian Federation located in the Arctic part of Western Siberia, remains an important “field laboratory” for the study of modern pastoralism and nomadic practices. Reindeer herding is the central occupation for many indigenous peoples that maintain a traditional lifestyle in this area. These peoples include the Nenets, Khanty, Selkups, and Komi-Izhma. According to 2020 official statistics, the nomadic population of the YNAO is 17,900 people, most of whom are Nenets (Data on the number of people maintaining the traditional lifestyle in YNAO 2020). The primary distinguishing feature of modern reindeer pastoralism in the YNAO is the preservation of family-centred nomadism. In anthropological literature, scholars (depending on what they want to emphasize) consider Yamal reindeer herders as nomads and/or mobile reindeer pastoralists (Stammler 2005a).

With nearly a third of the world’s (semi-)domestic reindeer population (over 650,000 reindeer), the YNAO, in the post-Soviet era, has become the leader among the reindeer regions of Russia. The highest concentration of reindeer herds in the vast territory of the YNAO (770,000 km²) is associated with tundra (including mountain tundra). Broken down by the YNAO *raion* (district) with the highest reindeer populations, the numbers are as follows:



Fig. 1 Winter camp of Nenets reindeer herders in Yamal (photo by the authors)

the Priuralsky *raion*, 70,000 km² and 90,000 reindeer; the Tazovsky *raion*, 133,800 km² and 254,000 reindeer; and the Yamalsky *raion*, 148,700 km² and 225,000 reindeer¹. The increase in the Yamal reindeer population, against the backdrop of the rapid decrease of the overall reindeer population in Russia's Arctic zone in the 1990s, is a phenomenon that has not yet received a single conceptual explanation. According to some authors, the sustainable development of local, primarily Nenets, reindeer herding households is based solely on their deeply rooted traditions (Golovnev 2017). Other researchers emphasize external factors that manifested differently in reindeer herding regions: local legislation, access to logistics, infrastructure and markets, level of industrial development and disparity in industrial rent (Jernsletten and Klokov 2002; Klokov 2013).

In this article, we focus on the Yamalskiy *raion* of the YNAO, coextensive with the Yamal Peninsula. This region is featured in numerous studies as the area most representative for analysing a wide variety of problems specific to modern reindeer pastoralism: from socio-economic and economic to environmental (Forbes et al. 2009; Degteva and Nellemann 2013; Golovnev et al. 2014). Yamal has become a “model” region for ethnographic research. The region has a special beauty and has acquired a romantic image that includes portrayals of the people of the tundra living in traditional *chums* (mobile tents, Fig. 1), wearing fur clothing, and using *narty*

(traditional sledges) and draft reindeer (Fig. 2) to traverse endless nomadic routes (Golovnev et al. 2018).

Historical data indicate that until the 1930s, independent Yamal Nenets households which owned herds of various sizes (from several dozen to five thousand) migrated between winter pastures located in the taiga on the right bank of the Ob River (the so-called *Khenskaya* side) and summer grazing areas of the Yamal peninsula tundra. Their specific land rights were based on traditional law, and the state did not encroach on this area (Golovnev and Volzanina 2014; Evladov 1992). Later, as a result of Soviet economic transformations, huge state-owned reindeer herding enterprises became the main actors. Enterprises were divided into several *brigades*—units comprised of herders (and their families) who migrated together. Herders received salaries for keeping the state-owned reindeer but had the right to maintain their small private herds—regulated by Soviet officials—which grazed together with the state herd (up to ten herdsman for 3000 to 5000 animals). Brigades moved according to an established schedule along strictly allotted seasonal areas; the reindeer grazing capacity of the pastures was scientifically assessed by the state. At the same time, a significant number of de facto independent households have always remained on the tundra. Despite all the state initiatives aimed at sedentarization and limiting private herds, such families (many of them officially employed as arctic fox hunters) managed to preserve the practices of private reindeer herding and an independent lifestyle.

Since the 1990s, the Soviet model has been modified to respond to new economic conditions. This process is ongoing. The reduction of the state sector in reindeer herding highlighted the importance of private family

¹ There is no validated data on the YNAO reindeer. Various documents contain conflicting statistics. We present data provided to us by the YNAO Agricultural Department in 2020.



Fig. 2 Summer Nenets migration on sledges (photo by the authors)

households. These families included both those who were essentially independent during the Soviet period and new families who had either retired or been let go from state-owned reindeer herding enterprises. The number of reindeer in these private herds has steadily increased, despite the stated government goals seeking to preserve a balance between the number of reindeer and pasture capacity. The share of herds of reindeer that belong to herding enterprises (enterprises formed in the Soviet era) with various forms of ownership is steadily declining in the Yamalskiy *raion*. Presently (as of 2022), only one enterprise—with about 25,000 state-owned reindeer—has survived in the regional centre of Yar-Sale. Many private reindeer herders have become members of *obshchina* (a special co-op-like form of “business” cooperation). Some of these *obshchina* are family-related (the subject is a family, a private household), while others are, for all intents and purposes, associations of households, integrated only at the level of management (Stammler 2005b). Private household income is made up of state financial assistance, profit from the sale of meat and, after the decline of the fur market and the cessation of arctic fox hunting, from trade in *panty* (velvet antlers) (Stammler 2005a; Zuev 2020; Terekhina and Volkovitskiy 2019).

In recent decades the natural gas industry has become the most important factor affecting Yamal reindeer herding, since it is precisely in the YNAO that the largest Russian hydrocarbon production projects are concentrated. The main infrastructural gas facilities are located in the shift workers’ villages of Bovanenkovo, Sabetta, and Kharasavey, as well as in the settlements of Novy Port and Mys Kamenny. Almost half of the territory of the

peninsula has been reserved as licenced areas for natural gas extraction. Industrial facilities are connected by a linear infrastructure (gas pipelines, permanent and seasonal roads), the largest of which is the Obskaya–Bovanenkovo railway. The newly built environment has very seriously impacted the existing Yamal reindeer herding infrastructure. Numerous problems have been analysed: direct exclusion of pastures, blocking access to strategic seasonal pasture areas, the “thickening” of nomadic corridors (the formation of bottlenecks that cause local increases in grazing pressure on pastures), and pollution of the tundra and fishing grounds (Forbes et al. 2009; Kumpula et al. 2012; Degteva and Nellesmann 2013; Golovnev et al. 2014).

Until recently, finding a balance in relations with industry was considered the primary challenge facing Yamal reindeer and their herders. However, crisis events in the 2010s prompted discussion among scholars on the prospects of the local model of reindeer herding and its fundamental rationality in the tundra zone of the YNAO. The crisis events were the reindeer mortality as a result of a series of rain-on-snow events and a sudden outbreak of anthrax (Popova and Kulichenko 2017; Golovnev 2017; Stammler and Ivanova 2020; Volkovitskiy and Terekhina 2020). Rain-on-snow in the beginning of the winters of 2006–2007, 2013–2014, and 2020–2021 caused large-scale icings. The ice blocked the reindeers’ access to forage, resulting in the death of tens of thousands of animals and left many nomadic families without a livelihood (Bartsch et al. 2010; Perevalova 2015; Forbes et al. 2016; Sokolov et al. 2016; Serreze et al. 2021; Volkovickij and Terëchina 2021; Terekhina and Volkovitskiy 2023). In the summer of 2016, there was an anthrax outbreak in Yamal,

the largest in recent decades among Russia's reindeer. The anthrax epizootic resulted in several thousand reindeer deaths—both directly disease-related and due to culling in quarantine.

For some researchers (mainly natural scientists), all these events were a direct consequence of overgrazing—the number of reindeer exceeded the calculated pasture capacity, especially in winter lichen areas (Kryazhimskiy et al. 2011; Golovatin et al. 2012). In their views, epizootics (and implicitly, extreme weather events) turn out to be a kind of natural regulator maintaining the integrity of the tundra ecosystem (Bogdanov and Golovatin 2017). However, some studies directly reject the very possibility of environmentalist approaches to explain the functioning of pastoralist systems (Warren 1993; Behnke and Scoones 1993). In this regard, focus on specific mobility practices of mobile pastoralists is of particular importance. Mobility is not only an essential part of household practices, but also a mechanism for adapting to new environmental and socio-economic conditions.

Methods

Administratively (officially), the Yamalskiy *raion* is divided into several tundras (from south to north): Salemalskaya, Panaevskaya, Yarsalinskaya, Novoportovskaya, Myskamenskaya, and Seyakhinskaya. The names of the tundras are related to the settlements where the nomads from a particular area are registered: Salemal, Panaevsk, Yar-Sale, Novy Port, Mys Kamenny, and Seyakha. The identification of these tundras was established in the Soviet period during the era of socialist reindeer herding enterprises and was only partly based on the historical nomadic routes and divisions in the territory. Often, when speaking about people from another administrative locality, the Nenets use the administrative identity. So, for instance, a person registered in Salemal will talk about people from Panaevsk or Yar-Sale or Seyakha as “Panaevskiy,” “Yarsalinskiy,” and “Seyakhinskiy” (“Panaevskian,” “Yarsalinskian,” and “Seyakhinskian,” respectively). When identifying people within their own administrative locality, they use local and informal identifiers.

We use a microregional approach in our studies of nomadic reindeer pastoralism of the Nenets. We define separate parts (or tundras) of the Yamal Peninsula as microregions. Each has a specific set of numerous features significant for reindeer herding: geographical conditions and access to natural resources, characteristics of local groups of nomads and the history of their development in a particular area, various nomadic routes, economic strategies for reindeer herding and fishing, and constraints and opportunities that have arisen due to infrastructure construction (Terekhina and Volkovitskiy

2020a). These features are, to some extent, rather vague, but this approach helps analyse the daily activities and household practices of the Yamal reindeer herders on a larger scale. Our long-term fieldwork experience has convinced us that viewing the Yamal Nenets as a homogeneous group obscures a wide range of local nuances.

The identification of specific microregions can be somewhat subjective. Although, it is based on the indigenous social and spatial divisions which we observed in the tundra. As a rule, one of the basic criteria for defining a microregion is the common identity of local reindeer herders (or/and fishermen). In the Yarsalinskaya tundra, which is discussed in our article, the local and, thus, microregional identity of reindeer herders is associated with their summer pastures and is often named according to significant bodies of water: Yaratinskiye (people of Lake Yarato), Yuribeiskie (people of the Yuribei River), Kharasaveyskie (people of the Kharasavey River), and so on.

People living in the same microregion constitute a social network of households migrating within one corridor (or in one limited area) and interacting throughout the year or for at least two or three seasons. Most of them are more or less distant relatives of each other. At the same time, their reindeer form another, non-human, network that complements and expands the scope of their human social ties. In Yamal reindeer herding, it is not uncommon for animals to split from their herds and mix with other herds. This prompts the herders to travel to their neighbours' camps to bring back the strays during round-ups and collective lassoing. In any herd, there are at least a few “alien” reindeer. As a rule, these mixings occur among adjacent herds in the microregion, and therefore, the reindeer eventually form multiple breeding ties.

Our study focuses on a microregion, which we call *Mordyyakha*, which is located in a northwestern section of the Yarsalinskaya tundra. Our fieldwork on the Yamal Peninsula is largely related to this particular area. This article is based on longstanding communication and joint nomadic experience with the *Mordyyakha* herders, and we have become very familiar with the dynamics of their movements. In 2015–2016, we conducted a year of fieldwork in a private household, and later we spent several winters with the *Mordyyakha* Nenets (2017, 2018–2019, and 2019–2020), at different sites within the migratory corridor, which they consider as “their own”. We discussed at length with the herders the reasons for the spatial variability of their routes, and we conducted detailed participant mapping of those routes (see Risvoll et al. 2022). As a result of this work, we have compiled a microregional map of the reindeer herding landscape, a space that incorporates a complex of human and

non-human components that characterize local reindeer herding.

Results

The Mordyyakha microregion

It is difficult to define clear and stable territorial boundaries for any reindeer herding microregion because these boundaries are formed by a dynamic environment and mobile people (Fig. 3). However, there is a particular group of Nenets who identify themselves as *Mordy' ter* (people of the Mordy River in Nenets) by their main summer pastures located on the left bank of the eponymous river. The group consists of more than 25 families and can be divided into two subgroups: (1) brigades of the “Yarsalinskoye” reindeer breeding enterprise and (2) private households. Approximately ten families in total are associated with the brigades. The rest of the families are private household herders.

Each brigade herd usually consists of two to four thousand “state” reindeer and reindeer owned by herders-employees (sometimes this private reindeer outnumbers the state ones). Among the private households, there is a wide range of wealth in reindeer: from huge herds (up to 2500 animals) to tiny (50–100). At first glance, the migratory routes of the majority of the *Mordyyakha* families seem to be the classic and well-described meridional linear routes typical for Nenets reindeer herding. However, this is only an external similarity, since only a few of the *Mordyyakha* private households migrate to the winter forest lichen area of the Ob River. In fact, the majority of the families migrate within one or two tundra subzones—depending on what classification of “tundra subzone” is used (see Walker et al. 2005). Thus, while the summer pastures of the *Mordyyakha* Nenets permanently occupy one and the same area, their winter locations may range from the forest zone of the Nadymskiy raion (the so-called *Khenskaya* side) in the south to the mouth of the *Mordyyakha* in the north. This entire rather elongated corridor (up to 600 km) is limited in width (no more than 20–30 km) by neighbouring groups of households. In the bare-ground season, the *Mordyyakha* microregion borders other “northern” Yar-Sale families to the east and north and the Panaevskaya tundra to the west and south.

Another name for the *Mordyyakha* microregion and the closest adjacent areas, common among all the Yamal Nenets, is the *Left North*. The name is used to refer to the northwestern area of the Yarsalinskaya and Panaevskaya tundras, bounded by the Yuribei and Kharasavey rivers. Before Soviet-era “modernization”, the area was used by the Nenets exclusively for summer grazing. Rich green forage resources and access to the coast of Baydaratskaya Bay with its favourable summer conditions for reindeer (cold winds and salt) increased the value of the whole

area and made it one of the most attractive summer pastures of the entire peninsula (Golovnev et al. 2014: 53). During the Soviet period, the *Left North* retained its role as a transit and highly important tundra area where enterprise brigades migrated during the spring and autumn seasons, departing to the *Khenskaya* side for winter. In actual fact, a relatively small group of hunters with small herds lived here all year round. These hunters were, in fact, private herders registered as Arctic fox hunters within the Soviet socialist model.

The infrastructural map of any microregion consists of a network of settlements, trading posts, slaughterhouses, and key seasonal wayposts important to each reindeer herding family. *Mordyyakha* households administratively belong to the Yarsalinskaya tundra and are registered in Yar-Sale, the centre of the Yamalskiy raion. Some herders have apartments in Yar-Sale, and their children study at the local boarding school. In summer, the distance between this village and *Mordyyakha* households reaches 400 km. The herders visit the larger towns (Salekhard, Labytangi, and Nadym) for shopping, medical needs, to visit relatives, or for other needs (Liarskaya 2017). The reindeer herders’ access to infrastructure and the amount of effort expended to ensure mobility determine their energy regimes. These energy regimes depend on many factors: speed and frequency of movement, the need to obtain goods, interactions with official institutions, contacts with village residents, variations in grazing and nomadic practices, and the various means by which reindeer herding products are delivered.

The Obskaya–Bovanenkovo railway is located in the western part of the Yamal Peninsula, which includes the *Mordyyakha* microregion. The railway was built in 2011 and primarily delivers supplies and workers to Bovanenkovo, one of the largest gas fields in the Arctic. By special agreement, indigenous people maintaining a traditional lifestyle have the right to travel free of charge on the railroad, and the railway has become a valuable infrastructure resource for the tundra people (Golovnev et al. 2014). However, the construction and use of the Obskaya–Bovanenkovo railway produced an acrimonious discourse between reindeer herders and scholars concerning industrial facilities that interfere with reindeer pastures and complicate reindeer herding mobility (Kumpula et al. 2012; Yaptik 2021; Povoroznyuk et al. 2022).

With the advent of the opportunity to travel and transport goods along the Obskaya–Bovanenkovo railway, many Nenets families have adopted a cheaper scheme for supplying cheaper goods. The railway increased the frequency of reindeer herder shuttle movements, but a no less important change was a gender shift. Women’s mobility expanded significantly. This had not been a



Fig. 3 Mordyyakha microregion

typical feature of everyday life for the Nenets (Terekhina and Volkovitskiy 2020b).

The railway also often acts as a communication link between nomadic families and their relatives from the villages. The Obskaya–Bovanenkovo railway now functions as a sort of axis along which the most important and most valuable—the most “attractive”—infrastructural points for *Mordyyakha* households: the Bovanenkovo zone, slaughter complex and trading posts on the Yuribei River, and the Lidino trading post near Khralov station.

Summer pastures

When clarifying the boundaries of their collective “possessions”, the reindeer herders themselves outline, first of all, summer pastures: the area around Lake Khalevto and further westward along the left bank of the Mordyyakha River to that part of Baydaratskaya Bay shore located between capes Parne-Sale and Matyuy-Sale (Fig. 3). Nenets herders as a rule consider summer pastures to be their traditional territories, referring to their ancestors’ history and inherited rights (Stammler 2005a: 235; Golovnev et al. 2014: 54). The oldest *Mordyyakha* herders also associate their migratory route with the areas of the brigades of state enterprises, where they worked as herders (or even brigadiers).

Nenets reindeer herding households that migrate separately for most of the year unite their efforts in the summertime. They establish campsites that consist of several *chums* and their herds combined into one to facilitate joint work. This is especially important in July during the peak of insect harassment. In any given year, *Mordyyakha* herders organize both permanent seasonal “unions” and situational associations. By uniting households the herders can both optimize control over their herds and coordinate long-term fishing. Fish becomes an extremely important addition to the diet for reindeer herders in summer, when the Nenets are particularly disinclined to slaughter their reindeer because of their weak condition and bad fur quality. Hence, the presence of a nearby fish lake can be an important factor influencing the choice of a campsite.

The Bovanenkovo industrial zone on the right bank of the Mordyyakha River is an important human-built environment that affects all the local households. The zone includes gas extracting facilities, accommodation complexes for workers, a widespread network of linear infrastructure elements (e.g. pipelines, and roads), an airport, and the Karskaya station, the end point of the railroad. Bovanenkovo has become an important economic and informal trade centre for the households of the *Left North* tundra. Fishermen and reindeer herders who live here have access to the huge informal fish market in

Bovanenkovo. Many have come up with varied schemes of personal and joint activity aimed not only at buying supplies, but also to obtain petrol – a key modern tundra resource (see Arzyutov 2017). Several *Mordyyakha* households have even abandoned migrating entirely and diversified their lifestyle; they have begun to concentrate on fishing, and transferred their reindeer for grazing to relatives.

When we analyse the seasonal dynamics of the movements of the *Mordyyakha* people, we can assess that the summer part of their nomadic route (summer macro-mobility) has, over the years, changed little, if at all. Slight variations may occur within summer pasture boundaries, and these changes, it seems, are usually related to personal relationships. Phrases like “I do not want to live with him [expressing reluctance to share joint efforts on herd control]” succinctly illustrate this motivation to change summer pasture boundaries. The only exceptions we encountered over the last decade were during the difficult years after the icing of 2013–14. The weakness of the draft reindeer prevented some *Mordyyakha* people and their neighbours (the enterprise brigades and many private households) from reaching their summer pastures. In 2014–15 many households were compelled to suspend their migration, stopping in the Yuribei area, some 100–150 km south of their customary summer pasture. Nevertheless, they were later able to resume their traditional movement.

Winter pastures

Unlike the situation with their summer grazing areas, the winter pastures of the *Mordyyakha* Nenets have rotated several times over the last 15 years. We have concentrated our research only on private households that have a degree of freedom when deciding about macro-mobility based on the informal rights concerning tundra territories. This is in stark contrast to the brigades of reindeer herding enterprises which have a rigid spatio-temporal movement regime. This regime is inflexible and changes only in cases of critical weather events or due to herder negligence.

Based on family histories and our field observations, different *Mordyyakha* households have long used winter pastures over the entire length of the meridional corridor from the mouth of the Mordyyakha River to the forest zone of the Nadymskiy raion. In fact, it is possible to identify several “key” frontiers of their winter sites. The northernmost of them is located on tundra lichen pastures in the interlake area between lakes Yambuto and Yasaveito, the “last island of good lichens” in some herders’ opinion. The central grazing area spans the tundra between the Yuribei River and the Khralov station of the Obskaya–Bovanenkovo railroad. Its centre is located in

the vicinity of the 13th railroad siding—jocularly nicknamed by the tundra people “District 13” (after a 2004 French film “Banlieue 13” popular in Russia). The southernmost winter pastures are situated in the forest zone of the Nadymskiy raion, on the Yarudei River and are used by a few large private herds and brigades of the Yarsalinskoye reindeer herding enterprise.

We can estimate the different use densities in *Mordyyakha* winter territories by their migrating neighbours. The northern site is used only for a rather quick transit of northernmost households in the spring and autumn—in fact during times typically considered “snow periods”. In contrast, the central zone (Yuribei–Khralov) is widely exploited by many reindeer herding households for most of the year except winter—by all the enterprise brigades of the western part of the peninsula, as well as by private herders, migrating to Kharasavey in summer. For some herders, this area is just a transit zone before leaving for forest pastures, while others occupy winter pastures on the southern portion of the peninsula. Such a concentration of households and herds is well described by A. V. Golovnev. He likens the cautious but dynamic manoeuvring in such transit zones, fraught with the danger of mixing herds, to a game of chess (Golovnev 2016: 36).

There is a “nuclear core” of *Mordyyakha* herders (approximately half of all the households), which has almost synchronously changed their winter pastures. In the early 2000s, they were spread from the Ports-Yakha trading post area to the Payuta station. Later, between 2007 and 2012, they began to concentrate upstream on the Tanlovayakha River. Several years later, in 2012–2016, they moved northward to District 13. Since 2017, they have made one more “jump” to the north, to the Sebayakha basin, between lakes Yambuto and Yasaveito. The distance from each site to the next more northern site ranges from 50 to 150 km. Over the same period, the rest of the *Mordyyakha* people neither significantly changed their winter route, nor annually migrated beyond the Ob River.

For this nuclear core of herders that changed winter pastures, the close proximity of the household campsites to one another in their northernmost winter pastures forced them to switch to another grazing and herd control model. This new model was, in essence, a compromise solution in which factors such as pasture condition, reindeer concentration and the effect of using modern technology all came into play. The tundra Nenets usually prefer to live separately in winter and control their own herds. But, especially after the 2013 icing event, even in normal weather conditions, *Mordyyakha* and some other groups of households have come to often prefer mixing their reindeer into a single but widely dispersed—so-called *free grazing* (Terekhina and Volkovitskiy 2023). In

District 13, for instance, we once observed a common herd of at least 6 thousand reindeer belonging to nine households. The animals roamed freely between *chums* which stood approximately 5 km from each other. The herders, on snowmobiles, took turns periodically “rolling” (i.e. concentrating) the reindeer, leaving the herd reindeer no chance to split. This grazing practice is considered more “ecological”; it is better for both pastures and reindeer. Free grazing helps prevent the concentrated impact a huge herd might make on lichens and reduces the competition for forage between reindeer. This competition is significantly higher if the herd stays in one spot. At the same time, it requires expensive snowmobiles, access to petrol, and extensive cooperation and coordination on the part of the households—a “harmonization” of the joint efforts of all the households. Another inherent weak point of free grazing is the extra effort required of the herders in the spring. The households have to build a corral for splitting the private herds before migration, and obtaining the construction materials (wood, canvases, etc.) in the tundra demands special skills. For example, the project sometimes requires “risky” actions such as negotiations and informal trade with railroad workers, or even borrowing materials without permission. Another negative consequence, very often claimed by herders commenting on free grazing, is the decrease in the number of draft reindeer even in large herds. This decrease is a function of the fact that their owners do not have time to “train” enough bulls before the movement to summer pastures begins. Nevertheless, this grazing model has now been widely adopted and remains a common response during large-scale icing.

The winter pastures of *Mordyyakha* herders are much more connected with infrastructure facilities than the summer ranges, and this involvement is enhanced by the active use of snowmobiles. Along the nomadic corridor, there is a network of trading posts with stores and bakeries that additionally provide opportunities for informal barter trade—using, for instance, ossified reindeer antlers in exchange for manufactured goods. Stations on the Obskaya–Bovanenkovo railroad have also become points of informal exchange—for example, fish for diesel fuel. At present, the *Mordyyakha* households—typically in “nuclear households”—spend the winter between lakes Yambuto and Yasaveito and continue to exploit Bovanenkovo as a trade and barter hub (fish for goods and petrol). Farther north, the households have established a new, more “attractive” route to the village of Seyakha—three times closer than Yar-Sale—as another centre of supplies.

Analysing the dynamics of the use of winter pastures, it is important to describe some examples of the most radical changes in the routes of the *Mordyyakha* herders. One case concerns a household that, in the 2020–2021 winter,

fearing possible huge icing, stayed within its summer site on the coast of the Baydaratskaya Bay. In the end, this family has reduced their route to a small “roundabout”. This was not only a remarkable example of immediate decision-making by independent herders. The risky choice to stay on the lichenless summer pastures proved successful and provided new empirical data on the adaptational potential of reindeer and the composition of their winter diet. Another example which should be evaluated in terms of strategic decision-making is related to the complete withdrawal from the microregion. This case concerns a family that decided to take part in an experiment on the transition to fenced reindeer herding funded by the YNAO authorities. The herder, who had enjoyed the low density of neighbours on the northern Sebayakha pastures until 2017, became worried when most of his summer neighbours arrived in the same area. In his estimation, over the course of several years, the good lichens in the area would be utterly depleted, and he made a rather extraordinary decision. He decided to switch to year-round grazing in the southern part of the Nadym-skiy *raion* with keeping his reindeer in a huge (440 km²) fence in a snowless season. With this transition, he also changed his identity: now, jokingly, this Nenets calls himself “a former *Mordyyakha* man”, and some tundra people call him “the forest [so-and-so]”.

Discussion

We have focused only on one microregion out of many which can be identified in the Yamal tundra, yet several common elements can be identified that affect all the reindeer herding households of central and southern Yamal: weather and pasture conditions, migratory patterns and timing, the proportion of private households to enterprise brigades, and long but narrow corridors for seasonal movement. We deliberately left aside here the northernmost group of families, living on the Seyakhinskaya tundra. Not only does this area significantly differ from the more southern tundra (subzone C, see Walker et al. 2005), but the migratory patterns of the Seyakha herders also differ from the linear meridional tracks of the Yar-Sale and Panaevsk households (Stammler 2005a; Terekhina and Volkovitskiy 2020a). The Seyakha herders mainly exploit short circular or multi-loop routes, which are somewhat reminiscent of the Taz Nenets movements described by K. V. Istomin and his co-authors. A century ago, most of the local herders also had meridional routes and moved to the forest zone for winter. The transition to shorter routes gradually occurred during the Soviet period. By the 1960s, when more strict administrative borders were put in place between the northern and southern tundras of the Yamal Peninsula, the change had been firmly established (Stammler 2005a).

When using the macro-mobility concept to analyse the movements of *Mordyyakha* households, it should be noted that all the private reindeer herders, as they move along their routes focus on the administrative boundaries of the tundra (on a small or regional scale), and on the informal pastoralist rights (on a large or local scale) (Golovnev et al. 2014: 36). As a rule, primacy in the common use of pasture resources is given to the brigades of reindeer herding enterprises.

Nevertheless, the brigades’ seeming domination does not prevent the majority of private herders from declaring “rights” to a particular territory. That is to say that, though they do not have legislative rights to the land, they allocated, and still allocate, areas that they consider as belonging to a certain group of households. As a rule, this applies specifically to summer pastures that are associated with the local identities of particular families. “Alien” households with their own herds, do not trespass on these summer pastures, at least not without a special, though informal, agreement.

Mordyyakha herders have the right of collective access to grazing resources, and any one of the herders may occupy any particular area. The right is not, however, absolute. It is limited by the privileges of the owners of large herds. If a herder wants to keep his independent status, he must avoid mixing his reindeer with such big herds. If the herds mix, the herder with a smaller herd will have to adhere to the entire macro- and micro-mobility agenda of the richer herder until the time comes for separating herds. Moreover, the concept of “one’s own land” is partly a temporal category. It is quite legal to occupy a particular area before or after the arrival of the “owner”. This approach to conflict prevention requires continuous coordination with one’s neighbours. Such use of pastures and peoples’ interactions can be attributed to a specific variant of open property regime—a concept often applied to variable systems of pastoralism all over the globe (Moritz et al. 2013; Moritz 2016; Behnke 2018; Robinson 2019).

It is also worth mentioning that any tundra is not just an area for reindeer herding activity but also a space with a sophisticated hierarchy of sacred places and cemeteries. This creates additional ties between people and the land. It also plays a role in the determination of the status of a household as “outsider” or “alien” (Stammler 2005a: 236).

Considering the problems of seasonal nomadic route changes, we have divided them into tactical issues and strategic issues. To some extent, these correlate with micro- and macro-mobility, but not precisely. Tactical issues include those that require on-the-spot decisions, usually associated with force majeure situations (e.g. extreme weather conditions). Strategic changes to a route refer to pre-planned modifications involving several

years that are motivated by certain unavoidable factors extended over time. As we see from the example of the *Mordyyakha* microregion, the summer pastures have, with only one exception, remained stable (the exception was when, after large-scale icing, the poor condition of the reindeer prevented some households from reaching their traditional pastures). The experience of the Nenets groups neighbouring the *Mordyyakha* people has been that strategic changes of summer plots were associated with the deployment of industrial facilities that rendered traditional pastures unusable or inaccessible. However, we have never heard from herders any reports on the depredation of summer pastures caused by grazing, which has ever been so extensive as to leave them no options (and thus critically compromising their pasture rotation principal). According to the Nenets, there is “enough” green forage in Yamal.

With regard to winter pastures, we identify two specific strategic trends involving changes to winter routes. The first, more widespread for the *Mordyyakha* households, is a shortening of the route as households winter further and further north, closer to their summer pastures. The other is the opposite, a lengthening of the route and migration to the winter lichens of the forest zone beyond the Ob River. In both scenarios, reindeer herders claim the depredation of tundra winter pastures and the need for better grazing areas for their reindeer as the main reasons for the new routes. The better condition of the northernmost lichen areas on the Sebayakha River has been preserved due to a lower household density. This lower density had been associated with conditions that tended to lead to a lower standard of living. These pastures were the most remote territories, farthest from regional infrastructure. Access to that infrastructure required technical equipment (a snowmobile) and the availability of fuel. Up until the last decade, these requirements made the area less attractive, at least for many households. Another problem is the lack of firewood in this territory: “Good lichens mean no firewood”, as the Nenets put it. Finally, however, the quality of pastures became the main motivation in choosing winter routes. In other words, despite conditions that required greater effort to complete daily activities, and overall, to put it simply, a less comfortable life, the ecological factor turned out to be primary. At the same time, the remoteness from the administrative settlement was partially compensated for by the closer industrial infrastructure of Bovanenkovo and the village of Seyakha. With a significant change in winter pastures and their whole winter lifestyle, the households are adapting to the local infrastructure.

The winter forest lichen pastures of the Nadymskiy *raion* remain a strategic resource for a significant

portion of the households registered in Yar-Sale and Panaevsk—though not for the majority of them. To traverse this several hundred-kilometer route (one way), a household needs a sufficient number of transport reindeer and the ability to perform frequent migrations in a dynamic mode, as is typical for enterprise brigades and skilful private herders. Some Nenets characterize people who stay over the winter on the peninsula as lazy: “They are too lazy to migrate far.” However, such households often express fear regarding the risk of getting caught in icy conditions in early winter or the beginning of spring after a sudden thaw or rain-on-snow right in the moment of long seasonal migration. The response of these households can be paraphrased: “What’s the reason for going southwards? My reindeer may get exhausted in autumn on the way to good lichens, or in the spring, moving to the first green forage. I better stay here.” We admit that this sounds reasonable, at least when it is confirmed by the condition of their herd. Optimal foraging theory may provide an ecological explanation for this dilemma (Pyke 1984). Households prefer to preserve their current energy expenditure condition and avoid extra efforts and energy loss seeking improved energy resources, but this is relevant only to reindeer. As we described above, the human energy expenditure related to staying in harsher conditions (in terms of both physical effort and material costs) may increase.

Another hazard associated with the southern tundra and forest zone is the possibility of summer fires damaging the lichen pastures, so important for reindeer in the snowy season. The extremely slow recovery of lichen pastures (Thomas et al. 1996; Jandt et al. 2008) leads to involuntary regrouping of households on winter ranges with increasing possibility of conflicts not to mention all the risks for reindeer herds in changing conditions. However, the threat of fire is not perceived by herders as acutely as the risks of icing, primarily because of their lower frequency.

Tactical variations of winter migrations can be determined by many temporary events such as mixing with another herd or “traffic” jams caused by human factors or weather conditions. These “on-site” decisions of the Nenets have a significant impact on the temporality of household movement. In addition, one-time, but abrupt, changes in the winter route may be caused by the beginning of an icing event. This, for instance, was the case in 2013 when several households (both private and enterprise brigades) were forced to react quickly to a sudden rain-on-snow event and abandoned their migration to the forest, remaining on the Yamal Peninsula (Golovnev 2017).

The unpredictable influence of abiotic factors limiting access to food refers to the concept of non-equilibrium

grazing systems, widely discussed for the arid and semi-arid areas of Africa (Behnke et al. 1993; Illius and O'Connor 1999; Vetter 2005, etc.). This framework encompasses unstable climatic conditions, which have a more significant impact on the productivity of the system and the dynamics of livestock density than grazing pressure. If in the drylands the abundance of forage depends on the amount of precipitation, then the Northern Asia rangelands (Mongolia, Kazakhstan, Tibet, etc.) are more vulnerable to winter weather events—severe frosts, snowstorms, and icings (Fernandez-Gimenez and Allen-Diaz 1999; Kerven 2004).

Arctic reindeer grazing areas have also been classified as non-equilibrium grazing systems (Caughley and Gunn 1993; Behnke 2000; Dwyer and Istomin 2006; Behnke et al. 2011). However, the question of the influence of winter grazing within this framework has not been fully tested, because, unlike other herbivores' ration, a significant part of the winter reindeer diet are lichens, which recover very slowly after grazing. At the same time, the model of a non-equilibrium system provides additional understanding of the flexible Nenets mobility strategies, specifically in winter.

These examples from the *Mordyyakha* microregion reveal significant principles, relevant at least for this group of Arctic reindeer herders. We have described these principles in a theoretical framework that originated in discussions on the reasons and characteristic features of the pastoralist movement. We determined that long-term changes in winter pastures (actions related to macro-mobility) are always caused by environmental/ecological factors—mainly by the quality of lichen pastures and to some extent by a fear of staying in a territory that is perceived as “risky” (e.g. because of possible icing). Summer routes and summer pastures still remain constant for the *Mordyyakha* people. However, experience from other microregions shows that strategic changes in summer grazing areas (changes of macro-mobility and consequently micro-mobility on the new sites) may be associated with indirect, non-ecological factors, for example, an increase in industrial development with its cascade of impacts. We emphasize that our conclusions do not cover a large historical period in the development of Yamal reindeer herding. We do not consider changes in nomadic movements on all levels, for instance, those caused by external social events, such as Soviet collectivization or the establishment of rigid administrative boundaries between the tundras. We do believe that our analysis way well apply to all households migrating along the extended meridional corridors of the Yamal Peninsula.

Conclusion

Introducing a microregional approach to studies of pastoral mobility broadens the scope of potential research in this area and contributes to a deeper understanding of the dynamics of local reindeer herding. We have shown that strategic winter mobility is usually influenced by environmental factors, but we can also predict that industry may make a greater impact, especially because of the potential that industrial development in the area has to change local winter grazing. Furthermore, strategic changes in summer sites are occurring due to external factors that may completely limit access to pastures.

Reindeer herders living within meridional migratory corridors have much more freedom for *ad hoc* or long-term relocation. Nomadism in an extended latitudinal gradient allows for more efficient responses to critical weather conditions (icing) and gives an opportunity for a more pasture rotation than nomadism within a limited area. On the other hand, reindeer herders living along a linear corridor bear all the risks which may arise at any point (in time or space) along their long seasonal route.

There are three components germane to questions of Nenets motility (mobility potential) in central and southern Yamal. The first component is determined by spatial characteristics—a long migratory corridor with the possibility for households to manoeuvre in and among each other. The second is the size of the herd and the number of draft reindeer required for successful dynamic migrations. The wealth of a household is manifested in the number of reindeer in its herd, and its wealth determines the possibility of obtaining well-functioning snowmobiles for greater efficiency of herd manipulation. Finally, the third component is defined by the labour resources of the household. These resources consist of the skills required to migrate up to 1000 km per year to winter on forest lichen pastures and, importantly, the desire to do so.

Our experience with the Nenets clearly reflects that, depending on the chosen scenario, they modify their migration patterns for various reasons. Sometimes the modification requires no increase in effort on their part; however, they are not averse to taking on additional difficulties. Thus, if a route is shortened, labour efforts might be minimized in the short term, but a less “comfortable” winter site inevitably requires increased human labour. Alternatively, a longer route to the forest zone demands extra efforts, but staying in a forest zone is less trying for the humans involved. Ultimately, it is clear that for the majority of the Nenets, the main principle remains “as long as the reindeer are happy”.

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Authors' contributions

Both authors collected ethnographic material during fieldwork and organized a participant mapping, analysed the data, prepared the manuscript, and edited it.

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Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

All applicable international, national, and/or institutional guidelines for the social and animal studies were followed. The local participants voluntarily provided their information and gave their consent to conduct the studies.

Consent for publication

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Competing interests

The authors declare that they have no competing interests.

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