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ASSESSMENT OF THE RESOURCE POTENTIAL OF THE BITTER - SALTY SULFIDE LAKES OF THE NORTH KAZAKHSTAN REGION FOR THE DEVELOPMENT OF ECOLOGICAL AND BALNEOLOGICAL TOURISM

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Abstract: To consider the resource potential of bitter-salty sulfide lakes for the development of ecological and balneological tourism in the territory of the North Kazakhstan region of the Republic of Kazakhstan. Field studies, a sociological survey were conducted, methods of statistical and mathematical processing were used. The cartographic method made it possible to visualize the studied material. Bitter-salty lakes contain sulfide mud, which is a unique natural resource. Mud can be used in combination with salt water to create the foundations of ecological and health tourism in the North Kazakhstan region. Research has revealed the most promising lakes of the region. The analysis of the obtained field research data and cartographic material made it possible to assess the resource potential of the lakes. These data were confirmed by the results of a sociological survey, which confirms the possibility of developing the tourism industry on the basis of unique local bitter-salty lakes. The cartographic material created in the course of the study visually demonstrates the prospects and possible problems of the development of the health tourism industry in the territory of the studied region. The resources of bitter-salty sulfide lakes have sufficient potential for the development of tourism in the North Kazakhstan region. The bitter-salty lakes of the North Kazakhstan region selected on the basis of a comprehensive score have criteria confirming their resource potential. This assessment shows the possibility of developing health and ecological tourism in the region. The border position of the region makes it possible to develop not only internal, but also external tourism.

Key words: bitter-salty lakes, sulfide mud, ecological and balneological tourism, tourism industry, resource potential, sociological survey

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INTRODUCTION

Today, one of the relevant directions for the development of the tourism industry in Kazakhstan is the study of natural resource potential (Semochkina, 2012; Dmitriyev et al., 2021 b; Mendybayev et al., 2015; Yegemberdiyeva et al., 2020; Atasoy et al., 2022). The natural resource potential includes those necessary environmental qualities that contribute to the creation and development of tourist routes in various regions (Smykova, 2015; Abubakirova et al., 2016; Tiberghien, 2019; Wendt, 2020). The natural resources of the regions of Kazakhstan, as well as artificially created objects of a cultural, environmental nature, serve as a powerful basis for the possible development of tourism (Zhidkoblinova, 2013; Zhakupov et

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al., 2015; Ozgeldinova et al., 2017; Saparov et al., 2017; Bancerova and Kasimova, 2018; Chlachula, 2019, 2020; Dmitriyev et al., 2021 b; Agybetova et al., 2021). The natural resources of the North Kazakhstan region contribute to the formation of a variety of recreational facilities, which in turn give the region a tourism potential. At the moment, tourism and recreation in the study area are at the stage of formation (Wendt and Bógdał-Brzezińska, 2018; Dmitriyev et al., 2022; Agybetova et al., 2023).

The climatic conditions of the region have formed a diverse natural ecosystem throughout the territory, thereby creating an attractive basis for the formation of recreational, health-improving, excursion, and tourist systems. This is of social, environmental and economic importance for the development of the districts of the region (Kantarci, 2007; Syzdykbayeva et al., 2019; Ismagulova et al., 2020; Dmitriyev et al., 2022; Syzdykova et al., 2022 Torres-Pruñonosa et al., 2022).

There are several thousand lakes of various typologies on the territory of the region. Among them, bitter-salty ones are distinguished, having a degree of salinity of more than 50 %. In terms of the development of health and balneological tourism, the most interesting are the bitter-salty sulfide lakes with a layer of mud bottom sediments. These lakes and silt bottom sediments are formed due to the waters and sediments of the miocene-oligocene, as well as interplastic waters of the eocene-oligocene sediments of the geological past of the territory of the period of the chegan formation (Litovskij, 2017). The clays of the chegan formation are bottom sediments of the former sea that covered the territory of the North Kazakhstan region about 40 million years ago. They provide a constant constant of the water-salt balance of lakes and the accumulation of relatively homogeneous clay-silt sediments and concentrated brine waters in them. High evaporation and low precipitation contribute to the formation of salts in lakes and silt deposits, as well as an increase in the concentration of other elements contained. Anaerobic decomposition of organic residues is accompanied by the formation of hydrogen sulfide and increased alkalinity of sludge mixtures. Silt deposits have different levels of power, which are represented by finely dispersed lake mud, they have balneological, health and tourist significance (Vodopyanova, 1985; Beletskaya, 1987; Solodovnikov, 2016; Dunets et al., 2019).

There are carbonate or soda, sulfide (bitter-salty), chloride (salty) lakes (GOST 13273-88, 1988; Miheeva and Trebuhov, 1987). The study of the typology of water bodies suggests the presence of bitter-salty lakes, including sulfide mud, on the territory of the studied region. Materials of research of lakes of the North Kazakhstan region confirm the possibility of practical use of such places of occurrence of therapeutic mud. The composition of sulfide mud includes mineral and organic bottom sediments. Such deposits are mainly characteristic of bitter-salty, sulfide-containing lakes.

Studies have revealed that the black color of such mud is due to the content of hydrogen sulfide and iron compounds. Also, this type of dirt is called inorganic. This is due to the fact that the content of organic substances in them is less than 10%. It should be noted that their composition includes acids, pigment, immunostimulating substances. They are able to penetrate through the epidermis and have a special therapeutic effect. Also in the composition of this therapeutic complex contains lipids, which are the product of blue-green algae. Mud has not only therapeutic, but also adsorbing and bactericidal properties. These properties depend on the features of the mineral composition and the degree of mineralization of the lake. The high degree of mineralization of the reservoir significantly reduces the growth of pathogenic microflora, which is the causative agent of infectious diseases. Sulfide silt mud differs significantly from sapropel mud in thermal properties and surpasses them in the content of iron sulfides and in the degree of mineralization (Solodovnikov, 2016).

There is a high balneological potential of sulfide mud, which is manifested in the prevention and treatment of diseases of the musculoskeletal system, neuromuscular system (Fioravanti et al., 2017). Mud has high rehabilitation properties after injuries and complications. The listed properties make it possible to use mud as a natural balneological resource both in recreational conditions and in medical institutions. Scientists from near and far abroad are studying this issue (Vojnova et al., 2015; Vladimirskij and Fil'cagina, 2018; Cepilov et al., 2018; Yang et al., 2018; Kan et al., 2019).

The study of the tourism and recreational potential of lake ecosystems in Kazakhstan has been extensively developed in the Western and Southern regions of Kazakhstan (Akhmedenov, 2020; Akhmedenov and Idrisova, 2021; Berdenov et al., 2021; Tokpanov et al., 2021). The study of the natural and recreational potential of bitter-salty lakes will contribute to the development of ecological and balneological tourism.

MATERIALS AND METHODS OF RESEARCH

The work carried out field studies including the study of morphometry, observation. A sociological survey was used, methods of statistical processing and mathematical analysis, geoinformation mapping were applied. The sociological survey allowed to give a subjective assessment of the availability of information and awareness of the population of the region on the use of mud of bitter-salty lakes. To assess the natural and recreational potential of bitter-salty sulfide lakes, a complex quality indicator calculated by the weighted average calculation method was used.

In the first stage, a retrospective analysis of the lake database was carried out and field studies were carried out, including morphometric studies and observation of lake sites. At the second stage, a sociological survey was conducted. The sociological survey provided a subjective assessment of the availability of information and awareness of the population of the region on the use of bitter-saline lake mud. Statistical methods and mathematical analysis were used to process the results.

At the third stage, the natural recreational potential of the bitter-saline lakes was assessed, a complex quality indicator calculated by the weighted average calculation method was used.

$$k = \sum k_i \sum a_i \quad (1)$$ Fomin et al., 2020:89

where ki- the indicator of the i-that property of the object, points; ai — the weighting coefficient of the indicators ki, the

fraction of one (∑ai = l). Based on this methodology and the available scientific materials and the results of a sociological survey, the weighting coefficients were calculated, which made it possible to assess the properties of bitter-salty sulfide lakes in order to calculate their potential (Table 1). Using the proposed methods, data characterizing the natural and recreational potential of bitter-salty sulfide lakes were studied. This made it possible to identify the most promising lakes for the development of ecological and health tourism in the territory of the North Kazakhstan region of the Republic of Kazakhstan (Semochkina, 2012; Baryshnikov et al., 2019; Dmitriyev et al., 2022; Niyazova et al., 2022). Geo-information mapping techniques have enabled the visualisation of the location of the region's bitter-salty lakes.

RESULTS AND THEIR DISCUSSION

Conducted field studies have revealed a number of features of natural and recreational resources of lakes. In particular, beaches on such water bodies are mostly undeveloped, devoid of infrastructure. Primary communications and high-quality highways have not been carried out to them. The paths to many lakes are impassable both by car and on foot (Ismagulova et al., 2020; Dmitriyev et al., 2021 a). To get a complete picture of the relevance of the problem, as well as to identify the awareness of the population, a sociological survey was used (Ignatov, 2011). The questionnaire consists of 10 questions, 493 respondents took part in the survey. The survey was conducted on an electronic resource.

The method used revealed that the population of the North Kazakhstan region more often visits foreign countries for health tourism. Respondents are not informed about the location and possibilities of bitter-salty lakes in the territory of the North Kazakhstan region. The results of the questionnaire on public awareness of bitter-salty lakes and mud treatment allowed us to draw a number of conclusions.

1. Respondents are aware of the possibility of using mud for medicinal purposes, mud treatment, which is confirmed by the results of 80% of the respondents positively.
2. At the same time, 41% of respondents do not know about the availability of local sulfide mud resources, which indicates poor awareness of the population.
3. The population knows little about the locations of bitter-salty lakes in the region, this was noted in 25% of respondents.
4. The possibility of using mud resources is confirmed by a high interest in mud treatment, which was revealed in 44% of respondents.

The analysis of the questionnaire allowed us to draw conclusions that many residents of the North Kazakhstan region are absolutely unaware of the balneological properties of mud of local origin. At the same time, it is noted that previous generations actively used the therapeutic mud of sulfide lakes. There are many such lakes in the region, but not all of them are suitable for organizing recreational areas. Nevertheless, reservoirs have been identified that can be used for recreational and balneological purposes. The properties of lakes for the use of their resource potential in the tourism industry are identified and evaluated. Thus, there is a need to inform the population on the dissemination of scientific information about the availability and possibilities of using mud treatment on the bitter-salty lakes of the North Kazakhstan region.

When studying the available information and scientific materials, bitter-salty lakes with an area of more than 100 hectares were identified, representing prospects for the development of recreation. It was found that there are practically no modern studies of the bitter-salty lakes of the North Kazakhstan region. In addition, a number of lakes have undergone morphological regressive changes as a result of natural and anthropogenic transformation. They have lost the necessary natural resource potential and have not been selected for evaluation.

The analysis of the resource potential of the bitter-salty lakes allowed us to identify the most affordable options. The identified lakes, one way or another, are located near settlements. Some of them are visited by the local population and visitors. At the same time, the resource potential of some of the lakes is little studied and unknown even to the local population. Therefore, there is a need for scientific substantiation of the natural and recreational potential of the bitter-salty lakes, work on the creation and implementation of a plan for the improvement of these territories. This is a necessary condition for the development of ecological and health tourism in the region (Dirin et al., 2017; Stoyashcheva, and Golovin, 2020).

There are a large number of bitter-salty lakes on the territory of the region. Based on the research and the conducted sociological survey, the properties and values of their qualitative characteristics were determined, the weighting coefficient of the indicator was revealed (ai). The assessment of the properties characterizing the resource potential of lakes and their ranking depending on the degree of significance was carried out. In order to identify the most promising lakes, criteria have been identified to assess their resource potential. An assessment of the level of natural and recreational potential of each lake was given, based on a modified complex quality indicator obtained by weighted average calculation, according to 8 criteria, according to a 5-point system (Table 1). Recreational properties of bitter-salty lakes are determined by a number of criteria. The criteria are assigned numbers. I – Ecological condition of the area. II – The nature of the landscape. III – The area of the water area. IV - Availability of highways. V - Availability of fresh water sources. VI – Structural features of the lake bottom. VII - The width of the available coastal area. VIII – Level of improvement.

The degree of significance of the properties of the bitter-salty lake is represented by the coefficient of their weight (ai). This allowed us to identify the most significant properties. The presence of fresh water sources – allows you to fulfill a number of conditions for conducting water hygiene procedures, the coefficient is 0.17. The width of the accessible coastal area allows you to place a larger amount of recreational infrastructure on the beach, the coefficient is 0.17. The coefficient is 0.15, belongs to the level of improvement. Landscaping affects the further development of recreational infrastructure in the coastal zone of the lake and in nearby settlements. 0.13 each have two properties.

This is the ecological state of the area, which determines the favorability of the ecological background of the recreational zone and the structural features of the bottom that affect the creation of water recreations. The volume of the resource depends on the width of the shallow water, on the thickness of the mud. Less significant properties that characterize the features and diversity of the landscape, as well as the presence of highways, increasing the level of accessibility and attractiveness. They have coefficients of 0.1 and 0.11, respectively. The area of the water area, as it turned out, has the smallest coefficient of 0.05, that is, it has the minimum value among all obtained.

Table 1. Assessment of the properties of the bitter-salty lake (Source: the authors' own calculations)

The property of the bitter-salty lake	Quantitative characteristic of the parameter of the object property indicator (ki), point					The weighting coefficient of the indicator (ai)
	1	2	3	4	5	
I	Availability of industrial objects	The presence of a network of rural settlements, the presence of dump sites	Large area of agricultural land	The predominance of protected natural areas	A large number of unique protected areas	0.13
II	Insufficient expressiveness of the terrain	Monotonous terrain	Expressive terrain	Picturesque views of the terrain	Unique scenic views of the terrain	0.1
III	25-30 km²	30-35 km²	35-40 km²	40-45 km²	More than 45 km²	0.05
IV	Lack of roads with good coverage	Insufficient development of the transport network	Availability of roads of regional significance	Availability of roads of national significance	Good development of the transport network	0.11
V	Complete absence of unleavened water	Availability of natural sources of unleavened water	Use of local groundwater	Availability of unleavened industrial water sources	Availability of sewer communications	0.17
VI	Gentle shallow water with a width of more than 100 m.	Shallow water turning into a steep slope	Heterogeneous bottom relief, alternation of shallow water and depth	Shallow water gradually turning into depth	Uniform comfortable lowering of the depth	0.13
VII	Absence of a coastal area	The coastal area with heterogeneous soil has significant irregularities. Weeds	The coastal area is less than 25 m. The landscape is heterogeneous and has minor irregularities. Weeds	The coastal area is less than 25 m. The landscape is uniform. Weeds	The coastal area is more than 25 m. The landscape is uniform. It has no weeds.	0.17
VIII	Minor improvements	Beach improvement	Availability of food outlets	Availability of light campsites	Capital structures	0.15

The analysis of Table 1 allows us to conclude that among the main properties characterizing the recreational facilities of the region, much attention is paid to the availability of fresh water sources and the width of the accessible coastal area. The degree of improvement of the water body is also important. The area of the water area according to the results of the study is a secondary property that characterizes the bitter-salty lakes of the studied region.

Based on the information network analysis, the most promising reservoirs are identified on the basis of the administrative-territorial division of the North Kazakhstan region ***. Among them:

Lakes of Zhambyl district – Gor'ko-Solyonoe, Gor'koe Mirnoe, Gor'koe Presnovskoe, Solyonoe.

Lakes of the Kyzylzhar district: Akush, Siverga.

Lakes of Magzhan Zhumabayev district: Kel'tesor, Solyonoe.

Lakes of Mamlyut district: Mengiser, Stanovoe.

Lakes of Timiryazev district: Alpash.

Lakes of Tayynsha district: Zhamantuz (T), Kalibek, Kishkenesor.

Lakes of Ualikhanov district: Zhamantuz (U), Siletyteniz, Teke.

Lakes of Akzhar district: Kishikaroj, Ul'kenkaroj.

Lakes of Yesil district – Zhamankol'.

I would like to note that most of the bitter-salty lakes are located on the territory of Zhambyl district. This is explained by the geological past of the territory of the studied region (Vodopyanova, 1985; Beletskaya, 1987).

The analysis of a comprehensive assessment of the recreational potential of bitter-salty lakes allows us to identify the most significant and promising lakes for further research and use as balneological and recreational resources (Table 2). This analysis, combined with the study of accessible bitter-salty lakes, is necessary for the possible development of ecological and health tourism in the territory of the North Kazakhstan region.

The analysis of Table 2 allows us to conclude that all the bitter-salty lakes of the North Kazakhstan region have recreational potential. Lakes with a coefficient of recreational potential from 1 to 2 predominate. A smaller coefficient - 1, received lakes Siverga (Kyzylzhar district), Solyonoe (Magzhan Zhumabayev district). The highest recreational potential was noted at the lakes: Mengiser and Stanovoe (Mamlyut district) 3.43 and 2.91, respectively. These lakes are widely

known to the population not only of the North Kazakhstan region, but also beyond its borders, including the near abroad. In particular, Lake Mengiser is one of the visiting cards of ecological and balneological tourism of the studied region.

Table 2. Comprehensive assessment of the recreational potential of the bitter-salty lakes of the North Kazakhstan region (Source: the authors' own calculations)

№	Lakes	Administrative regions ***	I	II	III	IV	V	VI	VII	VIII	Result k, with (ai)
1	Gor'ko-Solyonoe	Zhambyl district	1	1	2	2	1	1	2	1	1.33
2	Gor'koe Mirnoe	Zhambyl district	3	1	2	3	2	2	2	2	2.135
3	Gor'koe Presnovskoe	Zhambyl district	4	1	1	3	2	2	2	1	2.06
4	Solyonoe (Z)	Zhambyl district	1	1	1	1	1	2	2	1	1.3
5	Akush	Kyzylzhar district	2	1	1	2	2	1	2	1	1.57
6	Siverga	Kyzylzhar district	1	1	1	1	1	1	1	1	1
7	Kel'tesor	Magzhan Zhumabayev district	2	1	2	2	1	1	1	1	1.285
8	Solyonoe (M)	Magzhan Zhumabayev district	1	1	1	1	1	1	1	1	1
9	Mengiser	Mamlyut district	3	3	3	3	3	5	4	3	3.43
10	Stanovoe	Mamlyut district	3	2	1	3	2	5	4	2	2.91
11	Alpash	Timiryazev district	1	1	2	1	1	1	2	1	1.22
12	Zhamantuz (T)	Tayynsha district	2	2	2	3	2	2	2	1	1.96
13	Kishkenesor	Tayynsha district	2	2	2	3	2	2	2	1	1.96
14	Kalibek	Tayynsha district	2	2	5	3	2	3	2	1	2.24
15	Zhamantuz (U)	Ualikhanov district	2	2	1	3	2	3	3	1	2.21
16	Siletyteniz	Ualikhanov district	1	2	5	2	1	4	2	1	1.97
17	Teke	Ualikhanov district	1	2	4	3	1	3	2	1	1.9
18	Kishikaroj	Akzhar district	2	2	4	3	1	2	2	1	1.895
19	Ul'kenkaroj	Akzhar district	2	2	4	3	1	2	2	1	1.895
20	Zhamankol'	Yesil district	3	2	2	3	1	2	2	1	1.92

A comprehensive assessment of the recreational potential of the bitter-salty lakes of the North Kazakhstan region made it possible to graphically reflect the obtained coefficient and rank the lakes (Figure 1).

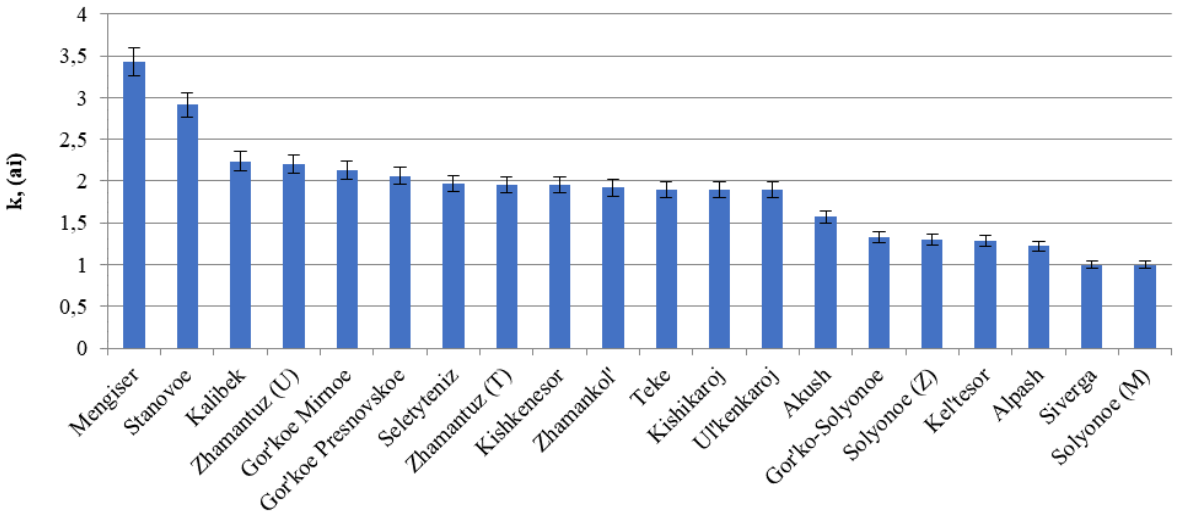


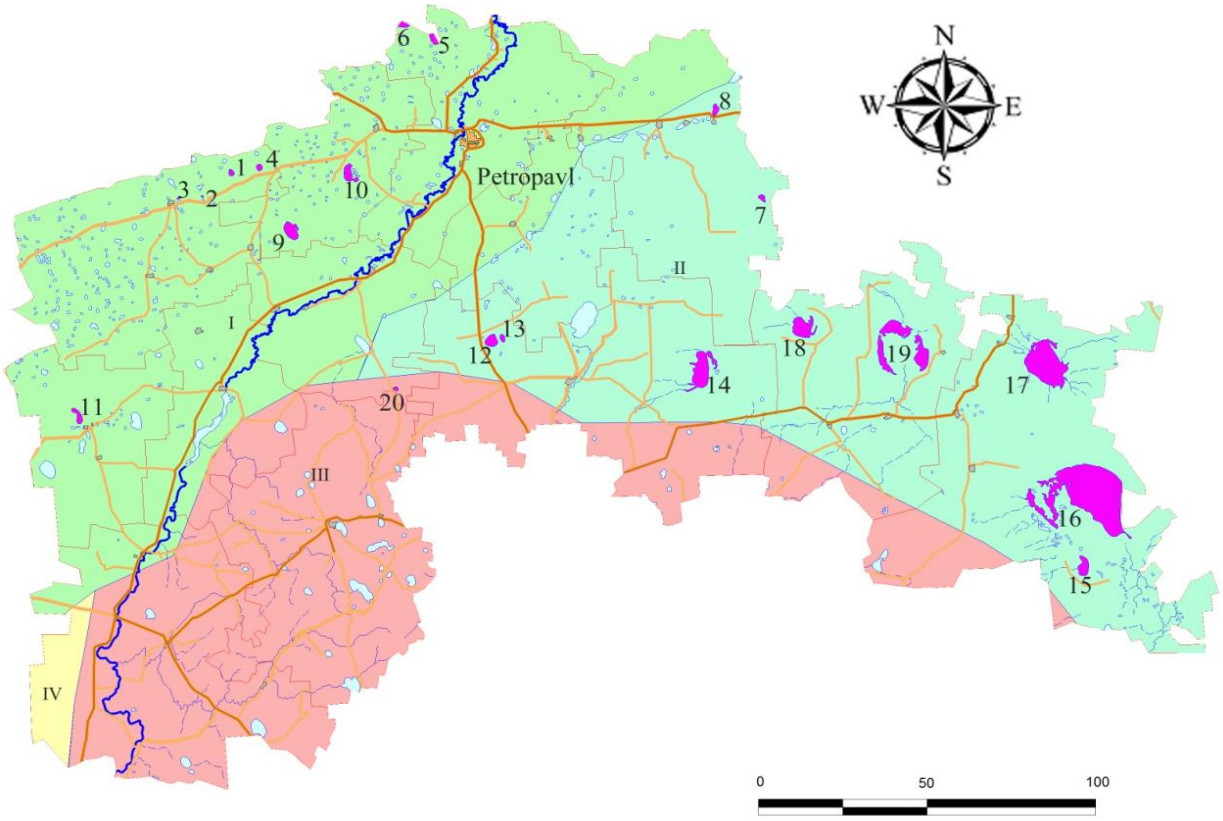
Figure 1. The level of recreational potential of the bitter-salty lakes of the North Kazakhstan region (k), taking into account the margin of error with relative errors (Source: based on the authors' calculations)

Based on the analysis of Figure 1, it can be concluded that the resource potential of most of the bitter-salty lakes of the North Kazakhstan region is quite high. This will significantly accelerate the development of ecological and health tourism. The natural and recreational potential of the lakes will ensure the interest of interested persons and the population, will contribute to the growth of tourist facilities, infrastructure development.

A feature characteristic of almost all lakes is the lack of a sufficiently developed infrastructure. At the same time, the presence of highways is noted, which increases the level of accessibility and attractiveness (Kazakhstan: Roads quality, 2021). In recent years, the quality of roads has been improving, this ensures the traffic flow from neighboring regions and from the regional center, which is a kind of transport hub (Dmitriyev et al., 2021 a). The results of the study made it possible to create a cartographic scheme that visually reflects the spatial placement of bitter-salty lakes. The development of the transport network in the territory of the North Kazakhstan region is one of the factors confirming the resource potential of the lakes, Figure 2. It is noted that the bitter-salty lakes are confined to the steppe zones and plains of Northern Kazakhstan.

The analysis of Figure 2 allows us to conclude that the majority of bitter-salty lakes are located on the territory of Zhambyl, Tayynsha, Ualikhanov districts. Lakes of Mamlut and Kyzylzhar districts have prospects for the development of inbound health tourism. A number of administrative districts of the region on their territory do not have bitter-salty lakes with sufficient recreational potential. These are the districts of Akkayyn, Yesil, Ayyrtau, Shal akyn.

This figure illustrates a well-branched road network, which is one of the main criteria for the development of the tourism industry (Kazakhstan: Roads quality, 2021) The location of most of the identified bitter-salt lakes in the region is confined to the accumulative plains of the Priesil'e, accumulative and stratal denudation plains. This is due to the geological past of the territory of the region under study (Vodopyanova, 1985; Beletskaya, 1987). As a result of the study, the lakes that are most known to the population of the region, with the highest natural and recreational potential, were identified. This indicates their attractiveness and possible prospects for development as objects for ecological, health and balneological tourism. In addition, these lakes will be interesting as a base of practices for the formation of environmental education among students of schools, colleges, universities (Dmitriyev et al., 2021a; Dmitriyev et al., 2021b; Dmitriyev et al., 2022).



Legend

Bitter-salty lakes

1 Gor'ko-Solyonoe, Zhambyl district
2 Gor'koe Mirnoe, Zhambyl district
3 Gor'koe Presnovskoe, Zhambyl district
4 Solyonoe, Zhambyl district
5 Akush, Kyzylzhar district
6 Siverga, Kyzylzhar district
7 Kel'tesor, Magzhan Zhumabayev district
8 Solyonoe, Magzhan Zhumabayev district
9 Mengiser, Mamlyut district
10 Stanovoe, Mamlyut district
11 Alpash, Timiryazev district
12 Zhamantuz (T), Tayynsha district
13 Kishkenesor, Tayynsha district
14 Kalibek, Tayynsha district
15 Zhamantuz (U), Ualikhanov district
16 Siletyteniz, Ualikhanov district
17 Teke, Ualikhanov district
18 Kishikaroj, Akzhar district
19 Ul'kenkaroj, Akzhar district
20 Zhamankol', Yesil district

I Accumulative plains of Priesilla

II Accumulative and reservoir denudation plains

III The basement plains of the Kokshetau upland (small hills, low mountains)

IV Canteens and stepped denudation plateaus

Roads of national significance
Roads of regional significance

Figure 2. Layout of the allocated bitter-salty lakes on the territory of the region (Source: own elaboration)

CONCLUSION

On the territory of the North Kazakhstan region there are a large number of bitter-salty sulfide lakes with a sufficiently high natural and recreational potential. Therapeutic mud of bitter-salty lakes is one of the best natural remedies used for preventive and therapeutic purposes. Mud has high rehabilitation properties. There is a huge range of their applications: treatment of skin diseases, diseases of the nervous and musculoskeletal systems, treatment of respiratory diseases, cardiovascular system, etc. It is possible to use mud as a natural balneological resource directly in recreational conditions, and in medical institutions (Vojnova et al., 2015; Vladimirskij and Fil'cagina, 2018; Cepilov et al., 2018; Akhmedenov, 2020; Tokpanov et al., 2021). The results of a sociological survey of the population confirm the relevance and necessity of conducting comprehensive studies of promising bitter-salty lakes.

The conducted research allowed to identify and evaluate the resource potential of the lakes of the studied region. It was revealed that most of the bitter-salty lakes of the North Kazakhstan region are not landscaped, have not been investigated, and have no infrastructure. In this regard, it is necessary to study the natural and recreational potential, as well as to create conditions for recreation and treatment on the lakes of the North Kazakhstan region. The creation of recreational areas will be an impetus for the development of health and balneological tourism in the region. This will attract investment and increase the number of jobs employed in the tourism industry. Also, it will create interest in the nature management of lakes, which can lead to even more intensive development of recreational areas. The development of the territories of the bitter-salty lakes will contribute to the development of both domestic and international ecological and health tourism.

It was revealed that a number of bitter-salty lakes are characterized by sufficient study, are popular with the population of the city and the region, as well as with tourists. This is due to the unique qualitative and quantitative indicators of mud and waters of bitter-salty lakes, accessibility, development of the road network. The most promising lakes, according to the results of the conducted research, are such lakes as Mengiser and Stanovoe of the Mamlyut district of the North Kazakhstan region. They are unique not only as recreational, balneological objects, but also as objects for educational tourism. The identified bitter-salty lakes will contribute to further scientific substantiation of their use for the development of the tourism industry in the territory of the North Kazakhstan region.

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