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OOLOGICAL PARAMETERS AND NEST-BUILDING CHARACTERISTICS OF THE BLACK-HEADED GULL (LARUS RIDIBUNDUS) IN THE TERRITORY OF THE NORTH KAZAKHSTAN REGION

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Abstract

The article presents the results of a study on the nesting biology of the Black-headed Gull (Larus ridibundus) in the North Kazakhstan region. The research covers the spatial distribution of nests, their structural features and parameters, as well as the oomorphic characteristics of eggs. It was shown that the nesting density decreases from the center of the colony to the periphery, which is due to competition for space and the advantages of collective protection against predators. The average nest diameter, diameter, and depth of the nest cup demonstrated moderate to high variability, reflecting adaptation to the climatic conditions of the region. Comparison of construction parameters and materials used with other parts of the range revealed significant differences caused by the ecological characteristics of the habitat. The oomorphic analysis of eggs showed variability in the length, width, and volume of eggs, which also correlates with regional conditions. Egg coloration ranged from brownish to greenish hues, providing camouflage against predators. The obtained data underscore the significance of ecological factors in shaping the nesting and reproductive characteristics of the Black-headed Gull.

Keywords: Black-headed Gull, oological parameters, shape index, nesting characteristics, color variability, North Kazakhstan, nest location.

СОЛТҮСТІК ҚАЗАҚСТАН ОБЛЫСЫНДАҒЫ ҚАРАБАСЫ (LARUS RIDIBUNDUS) ҚАНАТТЫЛАРДЫҢ ООЛОГИЯЛЫҚ ПАРАМЕТРЛЕРІ МЕН ҰЯ САЛУ СИПАТТАМАЛАРЫ

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Аңдатпа

Мақалада Солтүстік Қазақстан облысындағы көлді шағала (Larus ridibundus) ұясының биологиясына жүргізілген зерттеу жұмыстарының нәтижелері ұсынылған. Зерттеу бойынша ұялардың кеңістікте таралуын, құрылымдық ерекшеліктері мен параметрлерін, сонымен қатар жұмыртқалардың ооморфологиялық сипаттамаларын қамтиды. Ұялардың тығыздығы колонияның ортасынан шетіне қарай азаятыны, орынға деген бәсекелестік және жыртқыштардан ұжымдық қорғаныс артықшылықтарымен түсіндіріледі. Ұяның орташа диаметрі, ұя табағының диаметрі мен тереңдігі орташа және жоғары өзгергіштікті көрсетіп, бұл аймақтың климаттық жағдайына бейімделуін сипаттайды. Ұя құрылымының параметрлері мен пайдаланылған материалдардың басқа бөліктерімен салыстырылуы экологиялық ерекшеліктерге байланысты елеулі айырмашылықтарды анықтады. Жұмыртқалардың ооморфологиялық талдауы олардың ұзындығы, ені мен көлемінің өзгергіштігі аймақтық жағдайлармен байланысты екенің

көруге болады. Жұмыртқалардың түсі қоңырдан жасылға дейін өзгеріп, жыртқыштардан жасыруға мүмкіндік береді. Алынған деректер бойынша көлді шағаланың ұя салу және көбею сипаттамаларын қалыптастыруда экологиялық факторлардың маңыздылығын атап көрсетеді.

Кілт сөздер: Көл шағаласы, оологиялық параметрлер, пішін индексі, ұялық сипаттамалар, түс өзгергіштігі, Солтүстік Қазақстан, ұялардың орналасуы.

ООЛОГИЧЕСКИЕ ПАРАМЕТРЫ И ГНЕЗДОСТРОИТЕЛЬНЫЕ ХАРАКТЕРИСТИКИ ОЗЕРНОЙ ЧАЙКИ (LARUS RIDIBUNDUS) НА ТЕРРИТОРИИ СЕВЕРО-КАЗАХСТАНСКОЙ ОБЛАСТИ

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Аннотация

В статье представлены результаты исследования гнездовой биологии озерной чайки (*Larus ridibundus*) в Северо-Казахстанской области. Исследование охватывает пространственное распределение гнёзд, их конструктивные особенности и параметры, а также ооморфологические характеристики яиц. Показано, что плотность размещения гнёзд уменьшается от центра колонии к периферии, что обусловлено конкуренцией за места и преимуществами коллективной защиты от хищников. Средний диаметр гнезда, диаметр и глубина лотка продемонстрировали умеренную и высокую изменчивость, отражающую адаптацию к климатическим условиям региона. Сравнение строительных параметров и используемых материалов с другими частями ареала выявило значительные различия, обусловленные экологическими особенностями мест обитания. Ооморфологический анализ яиц показал вариабельность длины, ширины и объема яиц, что также коррелирует с региональными условиями. Окраска яиц варьировала в диапазоне от бурых до зеленоватых оттенков, обеспечивая маскировку от хищников. Полученные данные подчеркивают значимость экологических факторов в формировании гнездовых и репродуктивных характеристик озерной чайки.

Ключевые слова: Озёрная чайка, оологические параметры, индекс формы, гнездовые характеристики, изменчивость окраски, Северный Казахстан, расположение гнёзд.

Introduction

The Black-headed Gull (Larus ridibundus) is a common migratory bird that nests across Kazakhstan, except in arid regions. It inhabits a wide range of inland water bodies (freshwater and saline lakes, rivers, ponds) with abundant emergent vegetation. In our country, it appears during the spring snowmelt period (flood season) or shortly before it. The gulls arrive in groups of 5–10 individuals or flocks of up to 50 birds. Some arrive already paired, while others form pairs within and around the colony. During the breeding season, they form colonies, some of which may persist for decades, while others last only one or two seasons. Often, they form joint colonies with other gull species. The stability of the colony depends on the preservation of its habitat. Most adult birds return to the colony annually, though some may relocate to more or less distant areas [1-3]. Although this species is well-studied in Kazakhstan, specific studies on the oology and nesting characteristics in North Kazakhstan have not been conducted [4]. This region is rich in surface waters, which in their structure and hydrological regime characteristics are suitable for the habitat of this species [5]. Therefore, in 2024, we conducted a study to examine the nesting site distribution, nest-building characteristics, and oological parameters of Black-headed Gulls in North Kazakhstan.

Materials and Methods

Information on nest site distribution, nest-building characteristics, and oological parameters was collected from May 10 to May 15, 2024, at a temporary water body located 1 kilometer south of the village of Lugovoe in the Yesil District (Figures 1–2). The colony survey was conducted by walking through the colony area using waders. All nests found (n=26) were measured using a mechanical tape measure with an accuracy of 1 cm. Egg measurements were taken with an electronic caliper with an accuracy of 0.1 mm. Nest-building parameters, nest placement, and oological parameters of the eggs were recorded in a field diary for further organization and calculation. Photographs of the nests were also taken.

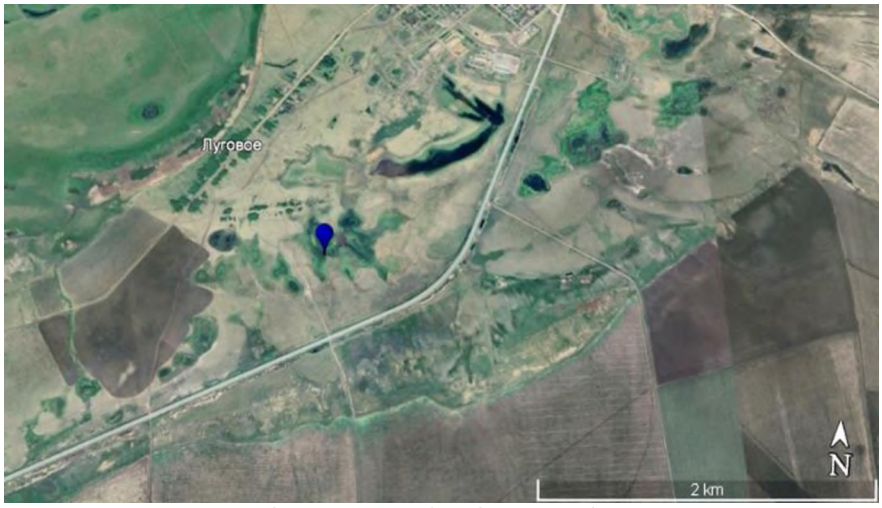

Figure 1. Study Site Location

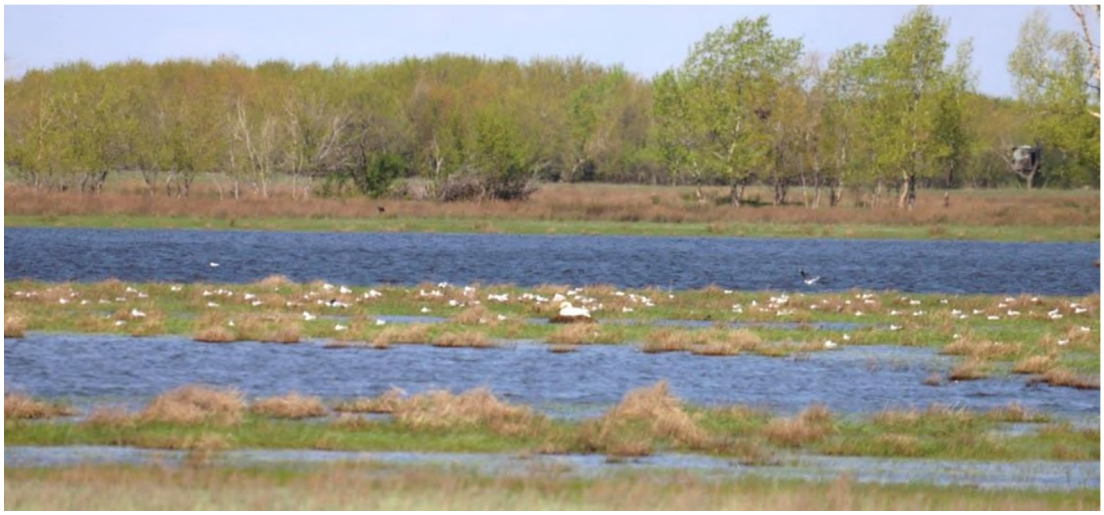

Figure 2. General View of the Black-headed Gull Colony

To work with oological data, the following indicators were used:

Shape Index (I) I=100*B/L

Egg Volume (V) V=0.51*L*B2[6], where L is the length of the egg and B is the width of the egg.

The egg shape index is a measure that defines the shape of the egg and is used in assessing its quality. The index is calculated as the ratio of the egg's transverse diameter to its longitudinal

diameter, expressed as a percentage. An excessively elongated egg has a shape index close to 50%, while a rounder egg approaches 100% [6].

All calculations were performed using Microsoft Excel 2019. Statistical analysis of the variability in nest placement, nest-building characteristics, and oological parameters was conducted using the following methods: calculating and comparing mean parameter values with statistical error, calculating maximum and minimum parameter values, calculating the coefficient of variation, and calculating the shape index.

Results and Discussion

The Black-headed Gull nests in colonies with a high degree of variability in nest density; in some cases, a colony may consist of only a few nests [1]. The distance between nests can vary depending on whether they are located in the center of the colony or at its edge. In the studied colony, one of the main factors influencing nest density was the availability of nesting sites, which, in our case, was provided by remnants of last year's lake reeds (Schoenoplectus lacustris).

Analysis of the data showed that the average distance between nests in the colony was 4.14 meters. Minimum distances were recorded in the central part of the colony, where 10 nests were located between 0.1 and 3 meters apart. Moving towards the periphery, the distance between nests increased: 11 nests (44%) were located between 3 and 6 meters apart. At the edge of the colony, distances were even greater, with five nests (16%) more than 6 meters apart, and the maximum recorded distance was 15.3 meters. Overall, the spatial structure of the colony shows a clear trend characteristic of many colony-nesting birds: nest density decreases from the center to the periphery, indicating a lower degree of spatial competition at the edge compared to the center. The high nest density in the center of the colony can be attributed to the benefits of predator protection. Nests are closer together in the center, which enhances collective defense and communication of danger. These findings align with recent studies that indicate some colony-nesting bird species can directly influence predator visit frequency in these areas, reducing the risk to offspring through the group defense effect [8-9].

Figure 3. Internal Structure of the Black-headed Gull Nest Cup with Lining of Thin Grass and Reed Stems

Figure 4. External View of the Black-headed Gull Nest Using Lake Reed

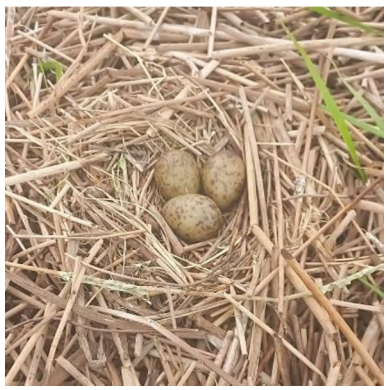

Figure 5. External View of the Black-headed Gull Nest Using Stems of Narrow-leaved Cattail and Lake Reed

All surveyed nests in the colony had a uniform structure. The Black-headed Gulls used remnants of lake reeds as a base, and the nest-building material consisted of stems of rigid emergent vegetation, primarily narrow-leaved cattail (Typha angustifolia) and lake reeds. Finer

stems of the same cattail or reeds, as well as various grasses growing in the coastal zone of the waterbody, were used as lining for the nest cup (Figures 3-5).

Similar nest-building methods and materials have been noted in other regions within the Black-headed Gull's nesting range. According to V. Ryabitsev, in the Ural and Western Siberia regions, the Black-headed Gull nests in various inland water bodies with extensive, hard-to-reach shallow waters overgrown with sedges and reeds. Dry reed bushes here serve as a foundation for nests, which is explained by the availability and durability of these natural materials. Dry reed stems provide reliable support, while grass and leaves offer insulation that helps retain heat and provides effective nest camouflage [12].

For the study of the Black-headed Gull's nest-building characteristics (n=26), parameters such as nest diameter, cup diameter, and cup depth were measured. The obtained data are presented in Table 1.

Table 1. Nest-building Parameters of Black-headed Gull Nests

Parameters	Mean Value (M)	± m, Stat. Error	Min	Max	CV, %
Nest diameter, cm	40,6	9,5	23	70	23,3
Tray diameter, cm	13,3	1,7	9	16	12,9
Tray depth, cm	3,7	0,7	2	5,8	19,0

The results of the statistical analysis indicate that the diameter of the examined nests, with an average value of 40.6 ± 9.5 cm, ranged from 23 to 70 cm, and the coefficient of variation was 23.3%. This indicates high variability in this parameter and may suggest individual preferences of the birds when building their nests. The average cup diameter was 13.3 ± 1.7 cm, with a coefficient of variation of 12.9%, which suggests low variability and reflects strict biological constraints on the size of the cup, ensuring optimal conditions for egg incubation. The cup depth in the examined nests ranged from 2 to 5.8 cm, with an average of 3.7 cm and a coefficient of variation of 19.0%, demonstrating moderate variability in this parameter. This moderate variability may be explained by adaptation to different microclimatic conditions, such as variations in humidity depending on the nest's height above the water surface. Thus, these indicators reflect both the flexibility and stability of the nest's structural characteristics, ensuring a balance between stable conditions for offspring development and adaptation to the external environment. Comparison of the nest parameters of the Black-headed Gull across different parts of its range revealed significant differences. Our data show a range of nest diameters from 23 to 70 cm, which is considerably smaller than those observed at Lake Semiz-Bugu (65–85 cm) [1], but partially overlaps with the results from Chelyabinsk Region (28–61 cm) [10]. The cup diameter in our observations (9–16 cm) is consistent with Ju. Lamekhov's data (12–18 cm), though our lower limit is smaller. V. Gavrin noted a larger cup diameter (17–19 cm), while the data from A. Kydyraiev [11] from mountain lakes in Kyrgyzstan (12.3–13.5 cm) are consistent with our findings. The cup depth in the nests we studied ranged from 2 to 5.8 cm, which is wider than in Chelyabinsk Region (3–5.5 cm), but smaller than at Lake Semiz-Bugu (5–8 cm) and in the mountain lakes of Kyrgyzstan (5.2–6.8 cm).

Thus, comparing our data with results from different regions highlights significant variations in nest sizes and their components. These differences may be explained by the diversity of habitat conditions, availability of building materials, and specific ecological factors in each region.

These differences emphasize the importance of studying the ecological conditions that influence nest construction and parameters of colonial-nesting birds in different parts of their range.

For studying the oomorphological parameters, we used a sample that included 71 eggs. The study examined parameters such as length, width, volume, and shape index (Table 2). The studied clutches of Black-headed Gulls mainly consisted of three eggs (22 clutches), which accounted for 84.6% of the total. However, there were also clutches with one egg (3 clutches, 11.54% of the total) and one clutch with two eggs (3.8% of the total). The average number of eggs per clutch was 2.73 eggs per nest.

Table 2. Oological Parameters

Parameters	Mean Value (M)	± m, Stat. Error	Min	Max	CV, %
Length, mm	49,95	3,08	38,7	54,7	6,17
Width, mm	34,38	3,38	24,70	38,30	9,84
Volume, cm^3	30,64	6,63	12,04	39,96	21,65
Shape Index	68,76	4,76	56,03	77,69	6,93

The research showed that the oomorphological parameters of Black-headed Gull eggs can vary depending on the region, as evidenced by the comparison of data from different colonies. In the studied colony of the North Kazakhstan region, the average egg length was 49.95 mm, width 34.38 mm, and average volume 30.64 cm^3. In comparison, eggs from the mountainous regions of Kyrgyzstan were slightly larger: the average length reached 53.1 mm, width 35.4 mm, resulting in a larger volume of 33.93 cm^3 [11]. More rounded eggs, with an average length of 52.2 mm, width 36.4 mm, and volume of 34.62 cm^3, are characteristic of birds nesting in water bodies in Eastern Europe [13]. Similar measurements were recorded in the Western European population on Texel Island (Netherlands), where the average egg length was 51.6 mm, width 36.72 mm, and egg volume 35.44 cm^3 [14]. One of the important aspects that help protect the clutches from predators is the coloration of the eggs. The coloration of eggs in the clutches we studied varied from dark brown to dirty green and brown with a speckled pattern (Figures 6–7), which matches the coloration described by V. Gavrin from other parts of the range in Kazakhstan [1]. We also observed eggs with a base color ranging from light green (Figure 9) to bluish (Figure 8). This coloration type was previously described by Ryabitsev V.K. [12].

Figure 6. Black-headed Gull eggs with dirty green coloration

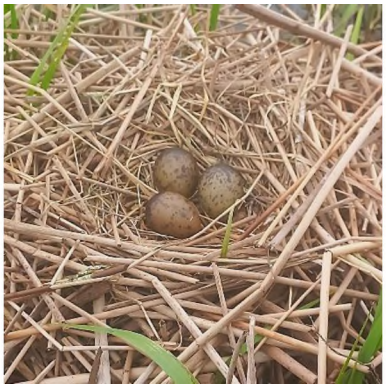

Figure 7. Black-headed Gull eggs with brown coloration

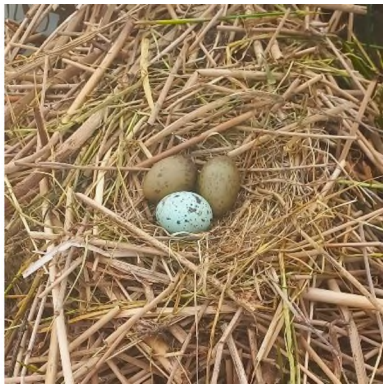

Figure 8. Example of a Black-headed Gull egg with bluish coloration

Figure 9. Black-headed Gull eggs with light green coloration

Conclusion

The results of the study showed that the oological parameters and nesting characteristics of the Black-headed Gull depend on the environmental conditions. The observed differences in egg morphology and nest density align with expected adaptive changes that allow the species to adjust to the specific conditions of the North Kazakhstan region.

The main limitation of the study is its local focus. Since the research was conducted on only one nesting colony, this may limit the generalizability of the results to other areas of North Kazakhstan. Despite this, the data obtained expand our understanding of the regional features of nesting behavior and oological parameters of the Black-headed Gull.

For a better understanding of the adaptation mechanisms of the Black-headed Gull, it is recommended to conduct studies in different regions of the area, including zones with varying ecological conditions. This would allow for a more detailed examination of the universal and specific adaptive traits of the species' nesting biology in the region.

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