



Breeding Ecology and Conservation Needs of the Vulnerable Relict Gull in Western Mongolia

Progress Report to The Rufford Foundation



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Study Site

Ikhes Lake is a saline lake located in Govi-Altai Province, western Mongolia, within the Great Lakes Depression region, at an elevation of 1604 m, with an area of 19.3 km² and an average depth of 0.6m. The lake is situated in an arid-to-semiarid environment dominated by steppe and desert-steppe ecosystems, with saline waters and sulfurous compounds. Its remote location and limited infrastructure have historically resulted in less intensive human pressure than in other wetlands in Mongolia. In contrast, many other key Mongolian wetlands, such as those in the valley of the Great Lakes or in the eastern steppe, are often subject to greater human influence, including fishing, settlement, and agricultural activities.

Several observations of Relict Gulls (*Ichthyaetus relictus*) have been recorded at Ikhes Lake over multiple years. Most of these records come from incidental sightings by ornithologists and birdwatchers during field visits, rather than from systematic surveys or a dedicated monitoring program. During these early observations, Relict Gulls were regularly noted at the lake; however, no active breeding colonies were confirmed.

The first confirmed breeding colony of Relict Gulls at Ikhes Lake was documented on 13 June 2012 by a birdwatcher from Germany. During this observation, an estimated 720 individuals were recorded at the breeding site, providing the first clear evidence that Ikhes Lake functions as an important breeding location for the species. In subsequent years, additional visits have reported the continued presence of Relict Gulls during the breeding season, with moderate numbers observed, although comprehensive systematic surveys remain limited. Direct confirmation of breeding activity in years after 2012 is lacking, and the current population trend at Ikhes Lake remains uncertain. More consistent monitoring is needed to clarify whether Ikhes Lake continues to support significant breeding colonies and to assess any trends in Relict Gull numbers at this site.

Field surveys

Field surveys at Ikhes Lake started on May 29 and lasted for a month. During this period, the team traveled about 4,000 km to conduct field investigations and site assessments (Figure 1). The surveys included lakes where Relict Gull breeding colonies had been previously found, as well as other potential lakes where the species could be present.

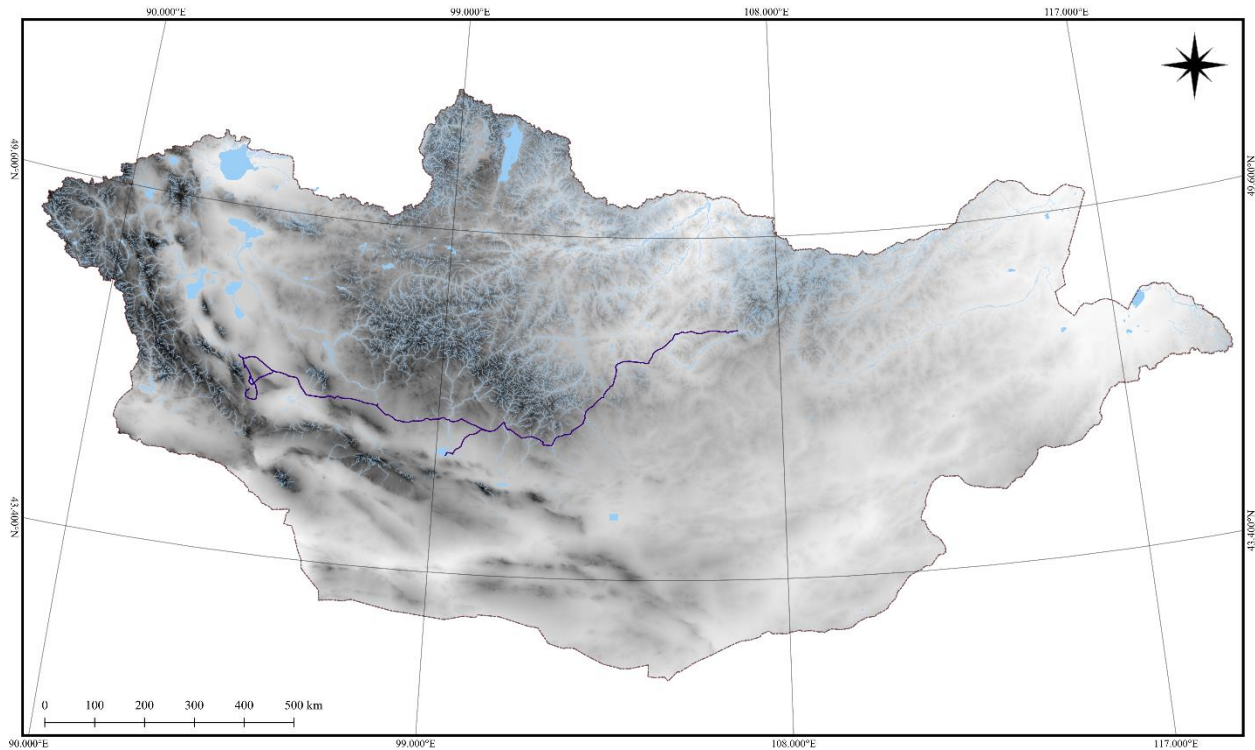


Figure 1. Field survey track

Result

At Ikhes Lake, Relict Gulls begin breeding in mid-May. By June 8, active incubation was confirmed, indicating that the breeding season was well in progress. During the survey period (May 29–June 29), daily air temperatures ranged from 7.8 °C to 34.9 °C, with a mean of 21.4 °C, reflecting warm early-summer conditions typical of the arid to semi-arid steppe ecosystem of western Mongolia. A total of 658 individuals were recorded during colony monitoring. Most were adults in breeding plumage, with only five individuals in non-breeding plumage, suggesting that the site was mainly occupied by actively breeding birds. Colony surveys documented 264 nests containing 585 eggs, confirming the presence of a well-established, spatially concentrated breeding colony. The breeding island is about 1,021.88 m long along its main axis, with an average width of 336.6 m, giving an estimated total area of approximately 2,393,320 m². Despite the large available space, only part of the island was used for nesting. Nest placement was uneven; most nests clustered along the island's edges, while the central area was sparsely used. To measure the active breeding area, a GIS-based Kernel density estimation (KDE) was created using 263 georeferenced nest locations. Spatial analysis showed a highly uneven nesting pattern, with nests forming distinct high-density core zones along the island's margins, as shown in Figure 2.

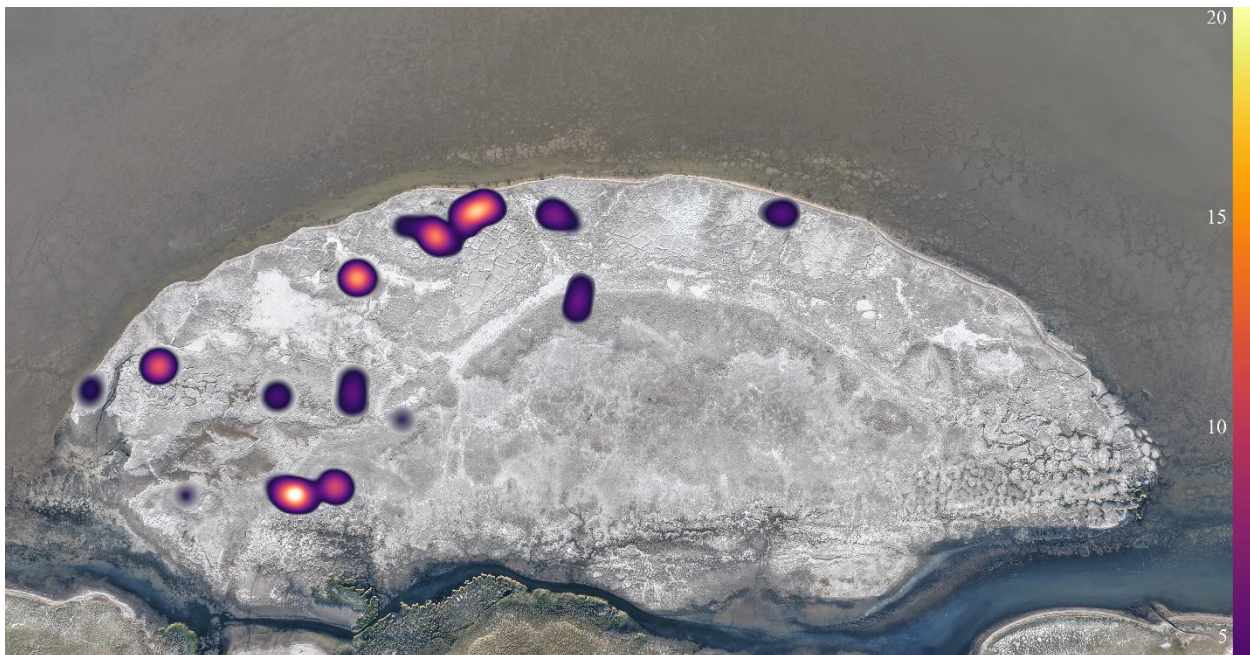


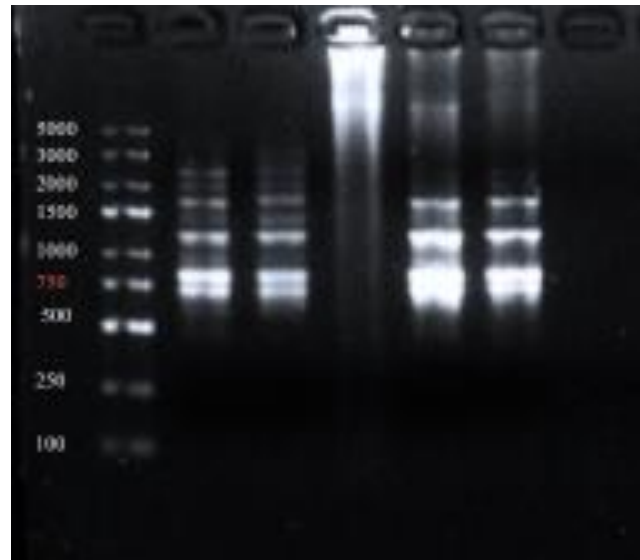
Figure 2. KDE of Relict Gull egg distribution on the breeding island at Ikhes Lake.

The largest nesting cluster was within a 65.3 m² area where 20 eggs were found, corresponding to a density of roughly 0.31 eggs per m². This is much higher than the overall colony average, highlighting the patchy and clustered nature of the breeding colony. Field measurements of a subset of nests ($n = 7$) showed an average outer diameter of 20.2 cm, typical of shallow ground nests made from dry vegetation and saline materials common on hypersaline lake islands.

Overall, these findings show that only a small part of the available island habitat was used for nesting, emphasizing a clear edge-focused breeding strategy. This spatial pattern likely results from the selective use of microhabitats that offer better visibility, lower predation risk, and more stable nesting substrates compared to the island interior (Burger, 1985). It also helps birds access nearby foraging areas during the energy-intensive incubation and early chick-rearing stages. Furthermore, the broad temperature range observed during the breeding season highlights how nest-site choice is crucial for protecting eggs and chicks from both nighttime cooling and extreme daytime heat.

Six Relict Gulls were caught using foot snare traps, and all were fitted with wing tags. Blood samples from five birds were analyzed in the lab for molecular sex determination, revealing four females and leaving the sex of one individual undetermined (Figure 3). The wing tags used in this study measured 6 cm × 4.5 cm, were yellow with black text.

Figure 3. Gel electrophoresis results of molecular sex determination for blood samples collected from tagged Relict Gulls.



Breeding success

The breeding success of the Relict Gull colony was evaluated through systematic monitoring visits conducted at 7 to 10 day intervals throughout the breeding season. The overall breeding success was calculated at 32.8% (Table 1). Notably, chick mortality was highest within the first 14 days post-hatching, as a significant number of dead chicks were detected during the second survey. This period coincided with the hottest part of the season, with peak air temperatures recorded between 10 and 30 June, potentially contributing to decreased chick survival. Additional mortality was observed among other waterbird species, including the Gull-billed Tern and Ruddy Shelduck, on the breeding island. On the northern side of the lake, several birds of various species were found in a weakened state, unable to stand and exhibiting impaired muscular control. Due to extremely muddy and inaccessible conditions, it was not possible to reach these birds or collect samples for laboratory analysis. To determine the cause of these mortalities, future surveys will focus on assessing affected areas and collecting biological samples for disease screening and toxicological assessment. These findings may suggest a broader disease outbreak or poisoning event impacting the wetland bird community, although the specific cause could not be confirmed.

Table 1. Changes in Colony Size and Breeding Progression of Relict Gull (June–July)

	June 14	June 24	July 14
Individuals	658	620	685
Nest	264	182	-
Egg	585	141	-
Chick	-	57	192

Results of Diet Analysis

Diet studies during the breeding season are important for assessing habitat quality and identifying key factors influencing the stability of breeding colonies and chick survival. During this period, food availability and prey composition significantly affect reproductive outcome. This is especially true in arid and saline lake ecosystems, where resources vary greatly across space and time. To evaluate prey use at Ikhes Lake, we combined direct field observations of food provisioning with laboratory analysis of regurgitate samples. These samples were collected from Relict Gulls during wing tagging.

This approach provided a detailed understanding of the diets of both adults and chicks during the breeding period. To minimize disturbance, all observations were conducted from a distance. Only non-invasive materials were collected. Field observations revealed that breeding pairs of Relict Gulls primarily provisioned their chicks with

grasshoppers.

Spontaneous regurgitates analysis confirmed that *Bryodema gebleri* (Figure 4) was the primary prey.

Figure 4. *Bryodema gebleri*

Chloropidae spp. were present only in small amounts (Figure 5). This indicates that grasshoppers are the main food for chicks during early development. Meanwhile, adult Relict Gulls

were observed feeding on both grasshoppers and *Artemia* spp. This demonstrates their ability to exploit terrestrial insects and aquatic prey in the saline lake. Overall,

these findings highlight the importance of grasshopper



Figure 5. *Chloropidae* spp

availability in terrestrial habitats surrounding Ikhes Lake for chick growth, survival, and breeding success.

Conclusion

This study demonstrates that Ikhes Lake serves as a critical breeding site for the Vulnerable Relict Gull in western Mongolia. In the 2025 breeding season, a well-established colony was documented, comprising 658 individuals, 264 nests, and 585 eggs. These findings indicate that the lake continues to support a substantial breeding population.

Although the number of breeding birds and nests was high, overall breeding success remained low at 32.8%. Chick mortality peaked during the first two weeks post-hatching, coinciding with the hottest period of the season. Additionally, weakened and dead individuals from several other waterbird species were observed, suggesting that broader environmental stressors or disease may have influenced breeding performance. However, the precise cause could not be determined.

Dietary observations indicated that grasshoppers, particularly *Bryodema gebleri*, constituted the primary food resource for chicks. Adult gulls utilized both terrestrial insects and aquatic prey, including *Artemia spp.* These results underscore the ecological significance of both the breeding island and adjacent terrestrial foraging habitats in supporting successful reproduction.

In summary, the results indicate that Ikhes Lake possesses high conservation value for the Relict Gull. However, breeding success may be limited by extreme weather conditions and other unidentified mortality factors. Ongoing annual monitoring, disease investigation, and protection of both nesting and foraging habitats are essential to enhance understanding of colony dynamics and to support effective conservation of this globally vulnerable species.