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Navjot S. Sodhi, Department of Veterinary Anatomy, University of Saskatchewan, Saskatoon, Saskatchewan S7N OWO, Canada.

APPENDIX

Prey categories shared by different herons.
Indian Pond-Heron – Little Egret: Naiads of dragonflies, *Crocothemus* sp., *Trithemis* sp., *Ischnura* sp., *Acheta* sp., *Hedotettix* sp., *Cybister* sp., *Erestes* sp., *Hydrophilus* sp., *Mydea* sp., *Sphaerodema* sp., *Ranatra elongata, Lycosa* sp., *Rana* sp., *Barilius* sp., *Nemacheilus* sp.
Little Egret – Cattle Egret: Naiads of dragonflies, *Crocothemus* sp., *Trithemis* sp., *Ischnura* sp., *Acheta* sp., *Mydea* sp., *Laxenera* sp., *Anomala* sp., *Calosoma* sp., *Lycosa* sp., *Rana* sp., Rat.
Indian Pond-Heron – Cattle Egret: *Pheretima* sp., Naiads of dragonflies, *Crocothemus* sp., *Trithemis* sp., *Ischnura* sp., *Gryllotalpa fossor, Tetragonoderus* sp., *Onthophagus* sp., *Episyrphus balteatus, Mydea* sp., Caterpillars, *Athalia proxima, Lycosa* sp., *Rana* sp.
Black-crowned Night-Heron – Indian Pond Heron: *Pheretima* sp., *Barilius* sp., *Nemacheilus* sp., *Ophiocephalus* sp.
Black-crowned Night-Heron – Little Egret: *Palaemonetes* sp., *Barilius* sp., *Nemacheilus* sp., *Barbus* sp., *Labeo* sp., *Lepidocephalus* sp.
Black-crowned Night-Heron – Cattle Egret: *Pheretima* sp.
Intermediate Egret – Indian Pond-Heron: *Sphaerodema* sp., *Acheta* sp., *Cybister* sp.
Intermediate Egret – Little Egret *Sphaerodema* sp., *Acheta* sp., *Cybister* sp., *Barbus* sp.
Intermediate Egret – Cattle Egret: *Acheta* sp.

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Breeding ecology of the Relict Gull *Larus relictus* in Ordos, Inner Mongolia, China

ZHANG YIN-SUN, DING WEN-NING, BU HE and TIAN LU

Details are given of a large breeding population at Taolimiao-Alashan Nur, discovered in spring 1990, including a description of the site; attendance of the birds; breeding ecology, including descriptions of the nests, eggs, incubation period and hatching success; also population density and feeding behaviour. The site is considered to be inherently unstable because of the variable rainfall of the region.

In 1985-1988, during the course of fieldwork on the avifauna of western Inner Mongolia, we found four new sites for the Relict Gull *Larus relictus* in Ordos: at Alashan, Bayandror, and Yeekzhao, and concluded that it might breed in the area (Zhang Yin-sun *et al.* 1991). Then in spring 1990 we discovered the largest known breeding population of the gull at Taolimiao-Alashan Nur, central Ordos. Observations were carried out there in May-June, 1990 as well as some short-term surveys in April, July and August in surrounding areas.

DESCRIPTION OF THE BREEDING SITE

The Taolimiao-Alashan Nur (Nur in Mongolian language means small lake or pond usually with salt water) is located at the junction of the Koobuchi and Mausu deserts in central Ordos, 109°35'E and 39°48'N. The weather there is quite dry with much wind and sandy dust; 130-139 frost-free days a year; 35.8°C the highest and -32.6°C the lowest temperature; plenty of sunshine and the rainfall concentrated in June-August with 325 mm a year on average.

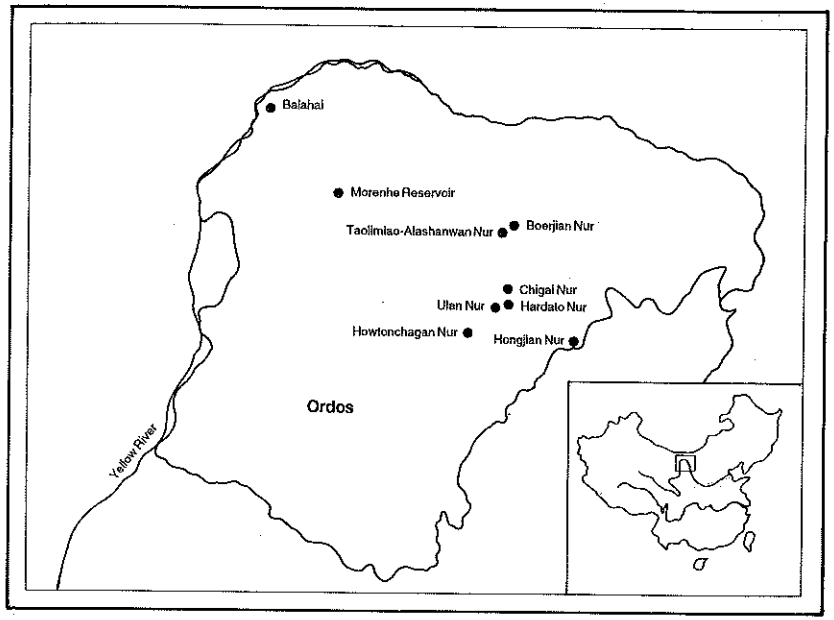
The lake is at an elevation of 1,368 m at the north-west end, rising to 1,392 m at the south-east end. The surroundings are mostly stabilised sand dunes with a poor vegetation of typical eremophytes such as *Nitraria roporowskii, Oxytropis psammocharis, Artemisia ordosica, Achnatherum splendens, Euphorbia kozlowi, Pycnostelma lateriflorum, Carex duriuscula* and the artificial windbreak woods of *Salix cheilophila* and *Caragana korshinskii.*

The lake is about 10 km^2, 6 km long from east to west and 2.5 km the maximum width, and contains hydrophytes such as *Potamogeton filiformis, P. natans, Cladophora, Mougeotia and Ulothrix.*

OCCURRENCE AND DISTRIBUTION AT THE BREEDING SITE

In 1990, the first flock of the Relict Gull arrived at the site on 6 April and all had gone by 28-29 August.

Figure 1. Distribution of the Relict Gull (*Larus relictus*) in Ordos.



During the breeding season we also found some other small flocks and/or pairs at other sites i.e. 12 individuals on 30 April at Morenhe Reservoir, about 20 individuals on 2-3 May at Balahai, two pairs on 18 May at Hardato Nur, 12 birds on 18 May at Chigai Nur, 22 birds on 19 May at Ulan Nur, and one pair on 19 May at Howtonchagan Nur, but there was no indication of breeding at any of these sites.

Although the departure of all the birds from Taolimiao-Alashan Nur in late August coincided with a sudden storm, it seems likely that they were moving elsewhere in Ordos rather than migrating south for the winter since, on 6 November 1989, a flock of more than 100 birds was seen at Hongjian Nur, southern Ordos (Zhang Yin-sun *et al.* 1991).

BREEDING ECOLOGY

The Relict Gull is a gregarious bird, usually gathering in flocks when feeding, roosting and nesting, but keeping apart from other species of gulls. During the breeding season, the gulls usually feed in an area of 2.5-3.0 km radius, roosting initially either on islets or on the lake shore and then, at the commencement of incubation, entirely on the islets.

Our observations of 19-25 May showed that the daily rhythm of the gull flock was as follows: at 04h00 some individuals started calling; 04h20, the

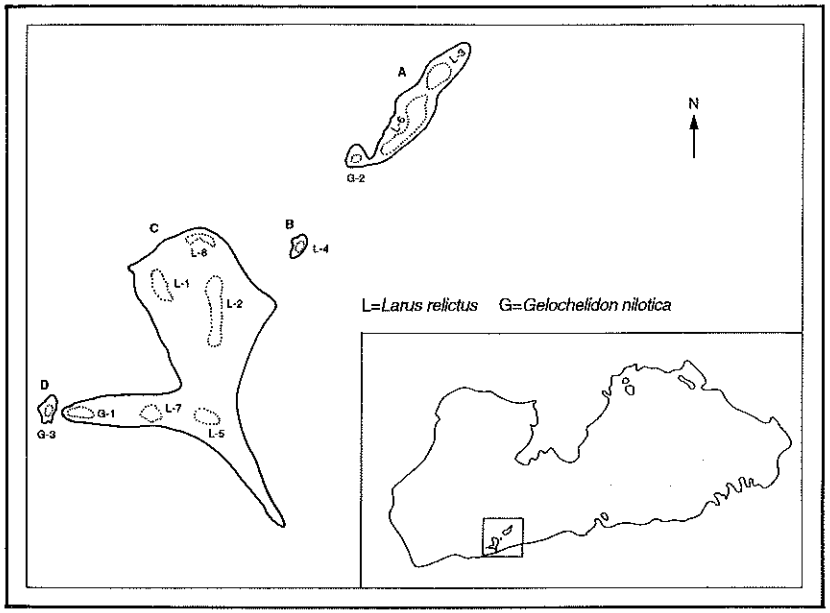
flock called noisily; 04h30 a few birds flew to the southern beach; after 05h40 the birds that were not incubating flew off to feed; during the day, small flocks of 10-30 birds could be seen feeding/resting along the lake shore while 100 or more fed amongst the sand dunes; about 18h30 the gulls returned to the lake and the islets and, after 19h30 most birds actively fed on the water; after dark, calling was heard from the lake and by 21h00 all the birds had returned to the islets.

The breeding season of the gull lasts about two months from early May to early July. During the fieldwork a total of 581 nests was found in eight colonies on the three islets in the lake, The incubation period was 24-26 days. A random examination of 50 nests from different colonies showed that the hatch rate was 100%.

Sexual behaviour occurred only in the region of the nest. The gulls started mating when they were choosing a nest site and continued until the last egg had been laid. Mating occurred through the day but was more concentrated from 19h10 to 19h50. In one couple the shortest interval between two bouts of mating was 9 mins 29 secs.

All the nests were built near the southern beach, on the three islets, which were 1,958 m^2, 183 m^2 and 11,625 m^2 respectively. The distance between the colonies averaged 21.4 (10-40) m while 0.5 m was the shortest distance between nests.

Figure 2. Distribution of nest colonies of the Relict Gull *Larus relictus* and the Gull-billed Tern *Gelochelidon nilotica* on islets.



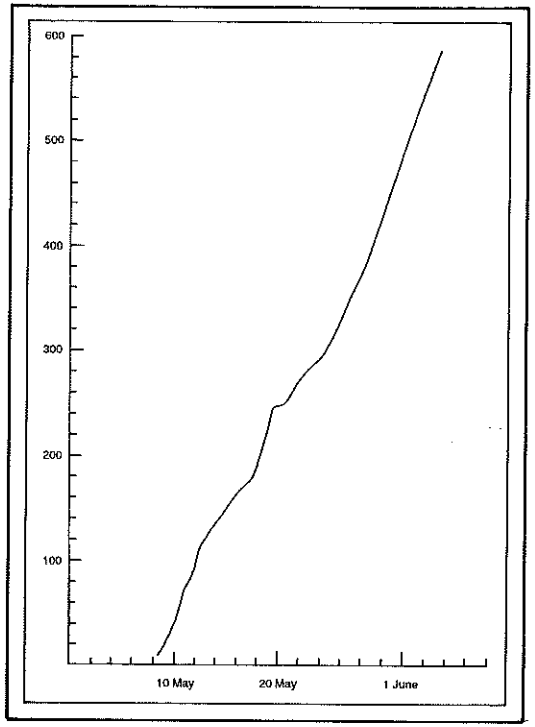


Figure 3. Increase in numbers of nests of the Relict Gull, May-June 1990.

The first colony of six nests appeared on 8 May, and, after 24 May the number of nests increased rapidly until 4 June.

Another main resident on the islets was the Gull-billed Tern *Gelochelidon nilotica*, of which 77 nests were found; also found were a few nests of Black-winged Stilts *Himantopus himantopus* and Pied Avocets *Recurvirostra avosetta*.

The nest of the Relict Gull is simple: the female collects some small stones to shape the base, and then deposits some small branches in it. The light nest materials are dipped in the water first, to lessen the chance of them blowing away in the wind. Some males often stole materials from other nests.

Measurements of 12 nests were 278 (230-320) mm outer diameter, 167 (140-190) mm inner diameter, 45 (30-70) mm high and 40.5 (30-55) mm deep.

The Relict Gull lays an egg every other day; of the 581 nests 20% had one egg only, 41.3% two eggs, 38.6% three eggs, and there was one nest with four eggs. Egg loss was caused either by sudden flights from the nest when eggs were kicked and broken, or by males stamping on eggs after failing to mate.

Most eggs are dark green with irregular black, brown or light chestnut spots, but the colour of some eggs varied remarkably; two pure white ones were the most extreme.

Measurements of 12 eggs were 58.7 (54-66) g in weight and 60.9 (55.6-65.1) x 42.6 (40.3-44.3) mm in size.

In the Relict Gull, the incubation commences when the first egg has been laid and the first young bird noted was on 2 June. Observations during incubation of 12 marked nests throughout one day revealed that the male and female change over on the nest 4-6 times and turn the eggs an average of 17 times. On 4-9 June we checked 50 nests at random in the seven colonies and found a 100% hatching rate.

The newly hatched birds weigh 35-43 g and have light grey down. The back and rump have tiny grey spots; the underparts are almost white; the iris is blackish brown; the bill is black with a silvery nail; the legs are grey with a very light violet tinge and the webs are also grey; the claws are blackish-brown.

The death rate of the young birds is relatively high, mostly due to external injury, cold and starvation. On several occasions males were noted pecking brutally at young birds from other nests.

POPULATION DENSITY

Five censuses were carried out, all at the same time of day (19h30-20h40) when the gulls were most concentrated on the lake or islets. The following numbers were counted : 120 birds on 6 May, 319 on 10 May, 528 on 12 May, 1,034 on 2 June and 1,158 on 4 June, the last more or less according with the 581 nests counted.

There were very few potential predators in the breeding area. Amur Falcons *Falco amurensis* and Black Kites *Milvus migrans* were noted, but they were not seen to attack either the adults or the young birds. Some carnivores,

Table. Nest density of the Relict Gull

Isl.	Colony No.	Range (m^2)	Nest No.	Density (nest/m^2)
A	L-3	330	91	0.276
	L-6	906	197	0.217
B	L-4	86	11	0.128
C	L-1	287	109	0.38
	L-2	644	83	0.129
	L-5	207	25	0.121
	L-7	151	30	0.199
	L-8	64	35	0.547

such as the Kitt Fox *Vulpes corsac,* Yellow Weasel *Mustela sibirica* and Masked Polecat *Mustela eversmanni,* seem likely to be predators because eaten remains of Garganey *Anas querquedula* and Whimbrel *Numenius phaeopus* were found on the beach.

Bad weather conditions may severely affect the species: on 10 April more than 20 adults were killed in a hailstorm.

FEEDING BEHAVIOUR

During the day the gulls fed on the lake shore, sand dunes and between the windbreak woods, whilst in the evening they largely moved to the lake.

In the breeding season, the gulls feed mainly on invertebrates, more than 90% of which are midge larvae, with small numbers of damselfly nymphs and beetles of the families Cicindelidae and Carabidae. Plant food includes algae, the tender leaves of *Nitraria roporowskii* and *Caragana korshinskii.*

DISCUSSION

The Relict Gull is numerically the most important of 50 species of waterbirds occurring at Taolimiao-Alashan Nur in the summer. Other Laridae present were 240 Common Black-headed Gulls Larus ridibundus, 22 White-winged Terns Chlidonias leucopterus, six Common Terns Sterna hirundo, two Little Terns Sterna albifrons and 166 Gull-billed Terns.

There are other similar, large lakes in the Mausu and Koobuchi deserts, such as Barhan Nur, Hardatu Nur, Chigai Nur and Ulan Nur, with apparently suitable islets, but without breeding Relict Gulls. The Taolimiao-Alashan Nur is a desert lake, fed only by rainfall and therefore inherently unstable. If there is too much rain, the islets would not provide enough area for the nest colonies, and, if there is too little rain, the food resources would be quickly depleted. The reproductive success of the Relict Gull in 1990 at Taolimiao-Alashan Nur suggests that the species may well spread to other lakes. Other gulls and terns were not noted to compete with the Relict Gull for food resources, but there is clearly some overlap in colony site selection because the Relict Gull was often noted taking over nests of the Gull-billed Tern.

The Relict Gull arrived at Taolimiao-Alashan Nur over a period of nearly two months from 6 April to 3 June. The birds that arrived early spent several days (or even weeks) before mating, while the birds that arrived later immediately got down to breeding; each colony usually consisted of birds arriving as a flock. It is possible, therefore, that the flocks might come from different wintering sites; however, the wintering places of the species are still uncertain.

We would like particularly to express our gratitude to Mr He Fen-qi of the Institute of Zoology, Academica Sinica and the Endangered Species Scientific Commission (CITES-China) for his kind advice and his translation of the whole paper into English.

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Zhang Yin-sun and Ding Wen-ning, Institute of Zoology, Academica Sinica, 19 Zhongguancun Lu, Haitien, Beijing, China.
Bu He and Tian Lu, The Inner Mongolia Forestry Institute, China.