

A study of the breeding ecology of the Relict Gull *Larus relictus* in Ordos, Inner Mongolia, China

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A large breeding colony of Relict Gulls *Larus relictus*, with 581 nests, was discovered in 1990 at Taolimiao-Alashan Nur (39°48'N 109°35'E) in Ordos, Inner Mongolia. In 1991 the whole area of Maowusu Desert in east and south-east Ordos was explored and 491 nests were counted at Taolimiao-Alashan Nur, and one more breeding site with 624 nests was found at Aubai Nur (38°55'N 108°48'E) in central Maowusu, making the Ordos population the largest in the world for the species.

The fieldwork in 1991 was undertaken from 3 May - 23 June, mainly at Taolimiao-Alashan Nur, while from 17-24 May and 13-20 June a general survey of the 21 lakes in Maowusu Desert was carried out. In August-September, Mr Wu Yong, the local administrative official in charge of wildlife protection and management and our partner in the project, made several short term field observations on the gull at the two above-mentioned breeding sites, as well as at some other lakes.

During May-June 1991 there was another working group subordinated to the Forestry Department of the Inner Mongolia Autonomous Region, also at Taolimiao-Alashan Nur, undertaking field work on the Relict Gull. On 11 June, Mr Bu He and Liang Shuan-zhu from that group erected a metal grid on one islet, isolating a colony of 21 nests from others on the islet. The metal grid was apparently positioned around the colony to facilitate rounding up the unfledged young birds for further observations on their development. The presence of the grid changed the behaviour of almost all the gulls in the area during the latter part of the breeding season. We were very disappointed that, despite much patient persuasion, we were unable to prevent this being carried out.

FIELDWORK AND RESULTS

Breeding habitat comparison

In 1991, the circumstances at and around Taolimiao-Alashan Nur have changed compared with 1990: the water level has dropped slightly and one more islet has emerged some 250 m west of islet D. During the winter 1990-1991, the local people collected small stones from the largest islet (C), for road repairs, allowing grass to cover half the area of the islet and thus affecting

the gulls' nest site selection. Large quantities of fry were released into the lake in early 1991, resulting in more fish-eating birds living on and around the lake throughout the summer and autumn that year.

The newly found breeding site, Aubai Nur, is an isolated lake in the hinterland of Maowusu Desert, 155 km south-west of Taolimiao-Alashan Nur, and is surrounded by mobile/semi-settled sand dunes. The lake is very alkaline (pH 9), covers an area of 5.5 km², and is at an elevation of 1,314-1,321 m, highest at the north-west end and lowest at the south-east end. There is also some water on the low-lying land of the old lake-bed, forming a few small pools. There are four islets in the lake, referred to as A, B, C and D from north to south. Islet A is the largest, with well-developed reeds on it, covering about two-thirds of the area; the other three islets are covered in gravelled desert, thus resembling the islets in Taolimiao-Alashan Nur. The Aubai Nur area has not yet been seriously disturbed by human economic activities.

Residence and dispersion

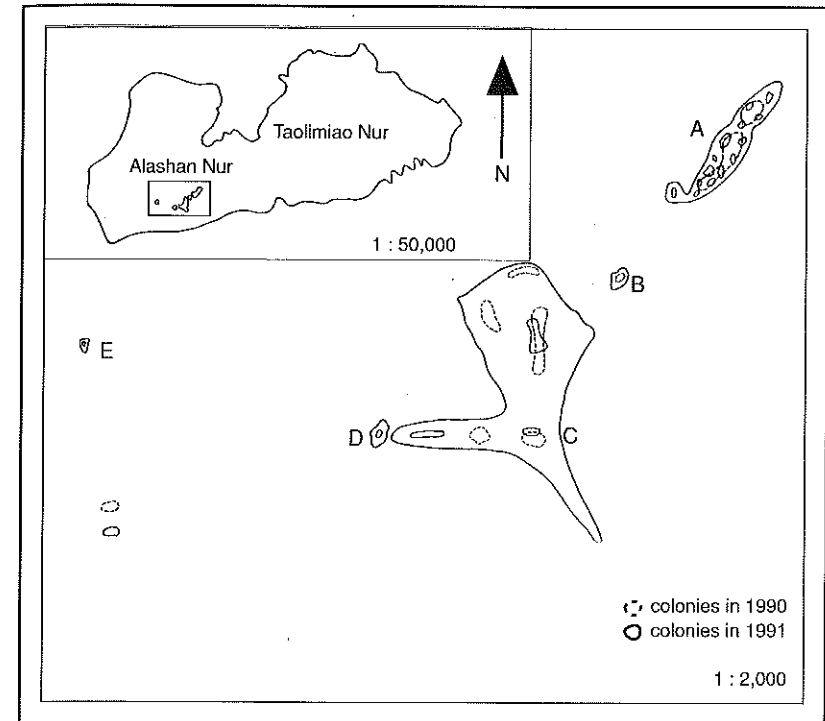
In 1990 and 1991 the Relict Gull stayed at its breeding sites for 140-160 days. In 1990 the first flock arrived at Taolimiao-Alashan Nur on 6 April, and all the birds had left by 29 August (Zhang Yin-sun *et al.* 1992). In 1991, according to the lake watchman, the first flock arrived on 25 March. At Aubai Nur all the birds had left by 26 August. At Taolimiao-Alashan Nur small flocks were noted leaving as early as 17 June; on 20-21 June flocks were noted flying south in the late evening, presumably to roost elsewhere. Some flocks did not return, leaving less than 100 birds there after that date.

The dates of arrival at and departure from the breeding sites are perhaps fairly constant. By the end of August the young gulls are able to fly well and the food resources are no longer able to sustain the whole colony; the birds scatter widely to other lakes in Ordos in early September, prior to migration to winter quarters. Relict Gulls were noted on ten of the 21 lakes in Maowusu Desert, including a non-breeding flock of 426 birds at Hadato Nur on 16 June, and small flocks or individuals at Boerjiang Nur, Hojia Nur, North Hadato Nur, Ulan Nur, Quitz Nur and Haotongchagan Nur. In May 1990 the gull was recorded at Chigai Nur but none was seen there in 1991 (He Fen-qi *et al.* 1992).

Breeding

During May and June 1991 all of the Relict Gulls at Taolimiao-Alashan Nur and Aubai Nur were paired breeding adults, as was the case at the former site in 1990 (Zhang Yin-sun *et al.* 1992). A count on 3 June 1991 revealed 491 nests in 17 colonies at Taolimiao-Alashan Nur, compared with 581 nests in 8 colonies on 4 June 1990. The arrangement of the colonies was somewhat

Figure 1. Colonies of the Relict Gull *Larus relictus* at Taolimiao-Alashan Nur in 1990 and 1991.



different in 1991, mainly because of the spread of grass on islet C. In 1991 the first Relict Gull nests appeared on 7 May (compared with 8 May in 1990), earlier than other species breeding on the islets: Gull-billed Tern *Gelochelidon nilotica* (12 May), Black-necked Grebe *Podiceps nigricollis* (26-28 May), and Common Tern *Sterna hirundo* (26-28 May). The Relict Gulls initially selected nest sites at the centre of islets, subsequent pairs spreading out to the edges; the nests and colonies that were established later on were more densely packed than the earlier ones. In contrast the Gull-billed Tern usually nests on the edge of islets, spreading in towards the centre. At the edge of Islet A, where a colony of Relict Gulls abutted a colony of Gull-billed Terns, one nest of the latter, containing one egg, was taken over by a Relict Gull which laid one of her own eggs and then hatched both of the eggs!

In 1990 and 1991 all of the Relict Gull colonies were discreet, with no other species interspersed, but colony density varied in each year and between colonies: on islet C there was an average of 0.275 nests/m² in 1990 and 0.148 nests/m² in 1991; on islet A the 1990 figure was 0.247, while in 1991 it increased to 2.841 with the closest nests only 7 cm apart.

Measurement of a random selection of 50 nests in 1991 produced the following figures: outer diameter 220 (190-270) mm, inner diameter 122 (110-140) mm, depth 39 (20-55) mm, height 33 (10-80) mm. In all except depth these average measurements were substantially smaller than the corresponding figures for 1990 (Zhang Yin-sun *et al.* 1992). Although there were 90 fewer nests in 1991 than in 1990, average clutch size was slightly higher: 2.52 eggs/nest (total eggs 1,236) compared with 2.19 eggs/nest (total eggs 1,272) in 1990. There was a much larger proportion of nests with three eggs in 1991; of the 491 nests 7.7% had one egg only (20% in 1990), 33.8% two eggs (41.3%), 57.5% three eggs (38.6%) and 1% four eggs (0.17%). In 1991 four white eggs were found in three of the nests examined, one of which contained two white eggs and no normally-colored ones. Measurements of 50 eggs were 48 (43-64) g in weight and 58.9 (52.0-66.3) x 42.9 (39.8-45.2) mm in size.

At Taolimiao-Alashan Nur there were fewer Relict Gull nests in 1991 compared with 1990, but four other species nested in greater numbers:

		A	B	C	D	E
Relict Gull	1991:	446	0	39	6	0
	1990:	288	11	282	0	0
Gull-billed Tern	1991:	15	91	143	16	21
	1990:	28	6	32	11	0
Common Tern <i>Sterna hirundo</i>	1991:	2	4	13	0	0
	1990:	0	0	0	0	0
Black-necked Grebe <i>Podiceps nigricollis</i>	1991:	0	0	49	4	0
	1990:	0	0	0	0	0
Spot-billed Duck <i>Anas poecilorhyncha</i>	1991:	0	0	2	0	0
	1990:	0	0	0	0	0
Pied Avocet <i>Recurvirostra avosetta</i>	1991:	1	0	0	0	0
	1990:	0	0	3	3	0
Black-winged Stilt <i>Himantopus himantopus</i>	1991:	1	0	1	0	0
	1990:	0	0	1	1	0

At Taolimiao-Alashan Nur the hatching rate was much lower in 1991 than in 1990. A check of all the 14 colonies on islet A on 23 June revealed an average hatch rate of 66.7%, but in the colony surrounded by the metal net, only one egg had hatched and the resulting chick was dead, even though that colony had been established for 35-37 days (10 days longer than the incubation period noted in 1990). The barrier appeared to affect all the breeding colonies at Taolimiao-Alashan Nur: the birds were restless, incubation was less intensive, aggressive behaviour towards intruders was reduced, and the young were fed less frequently. As noted above many of the

birds left the area much earlier than they would have done otherwise. Up until 22 June about 250 young birds has been found dead on islet A.

At Aubai Nur, on the other hand, on 17 June a flock of 1,000-1,100 lively young birds had developed. A check of one colony of 122 nests showed that all eggs had hatched and only nine dead young birds were found.

In our opinion the disaster that occurred at Taolimiao-Alashan Nur was due entirely to the erection of the metal grid; a personal note summarising this event was delivered to the Secretary-General of the China Wildlife Conservation Association.

DISCUSSION

Breeding habitat selection

During the breeding season the Relict Gull is restricted, in China, to the semi-desert and desert lakes of the western Mongolian highland, including those in Ordos (38°35'-39°55'N and 108°45'-110°00'E), the Uliangsu Hai (= Nur) (40°46'-41°05'N and 108°40'-109°00'E) and the Suoguo Nur (c. 41°53'N 101°07'E); all of these lakes contain salt water, pH 8.5+, and are at an altitude of 1,000-1,400 m (Zhang Yin-sun *et al.* 1991a and 1991b, He Fen-qi *et al.* 1992). Other extralimital breeding sites, such as Alakul Lake (46°10'N 81°50'E) and the Torey Lakes (50°05'-50°10'N and 115°30'-115°50'E) in Russia and Tatsain Tsagaan Nuur (45°10'N 101°28'E) in the central Gobi of Mongolia, are also situated in desert habitats. Studies in Ordos and elsewhere show that the species nests only on islets in these lakes (Auèzov 1975, Potapov 1971, Fisher 1985). Furthermore, the arrangement of colonies at Aubai Nur suggests that, even in remote situations lacking human disturbance, it is unlikely that the species would attempt to breed except on islets.

The studies in Ordos indicate that a secure, undisturbed nest-site is more important than the need for a concealed nest or the abundance and fluctuations in food supplies. There has been no breeding record of the species at some lakes in Ordos containing islets, for instance Hongjian Nur (39°05'N 109°50'E), due to disturbance from fishing and other activities.

The breeding population of the Relict Gull in Ordos is relatively stable and all the birds present at Taolimiao-Alashan Nur in both 1990 and 1991, and those at Aubai Nur in 1991 were actively breeding. By comparison, the breeding populations of Alakul Lake and the Torey Lakes varied remarkably in numbers: at Alakul the number of pairs ranged from zero to either 800 or 1300 during the period 1969-1974 (Auèzov 1975, Knystautas 1987, Il'ichyev and Zubakin 1988); at the Torey Lakes, apart from scattered individuals and small flocks, the main colony ranged in size from zero to 1,025 pairs during the period 1967-1985 (Potapov 1971, Golovushkin 1977, Il'ichyev and

Zubakin 1988). The numbers of colonies and nests present in each year at these Russian localities are not specified by the above-mentioned authors. In Ordos, a large flock of non-breeding Relict Gulls was found in 1991 at a locality not far from the breeding site, but these non-breeders were involved in extensive movements - during May and June in the years 1990 and 1991 the number at Hadato Nur varied from 4 to 426, and at North Hadato Nur it varied from zero to 48 (He Fen-qi *et al.* 1992).

Although the 1991 study has consolidated our knowledge of breeding habitat selection, the fact that desert lakes have relatively short term lives should be borne in mind.

Niche of the Relict Gull in local and regional bird communities

During May and June 1990 a total of 50 species of wetland birds were recorded at Taolimiao-Alashan Nur, including 27 waterfowl and 23 waders/shorebirds (Zhang Yin-sun *et al.* 1991a). In the same period in 1991 a total of 66 species was found, including 37 waterfowl and 29 waders/shorebirds, of which 15 were evidently breeding at the site.

Number of nests of waterbirds in different habitats at Taolimiao-Alashan Nur in 1991

	water islet surface	lake shoal	sand shore	dune
Little Grebe <i>Tachybaptus ruficollis</i>		+		
Black-necked Grebe <i>Podiceps nigricollis</i>	+++			
Ruddy Shelduck <i>Tadorna ferruginea</i>				+
Common Shelduck <i>T. tadorna</i>				+
Spot-billed Duck <i>Anas poecilorhyncha</i>	+			
Northern Shoveler <i>A. clypeata</i>			+	
Northern Lapwing <i>Vanellus vanellus</i>			++	
Little Ringed Plover <i>Charadrius dubius</i>	+	+		
Kentish Plover <i>C. alexandrinus</i>	+		+	
Common Redshank <i>Tringa totanus</i>				+
Pied Avocet <i>Recurvirostra avosetta</i>	+		+	
Black-winged Stilt <i>Himantopus himantopus</i>	+	+		
Relict Gull <i>Larus relictus</i>		+++++		
Gull-billed Tern <i>Gelochelidon nilotica</i>	++++		+++	
Common tern <i>Sterna hirundo</i>	++			

+++++ more than 400 nests, ++++ 200-300 nests, +++ 50-100 nests, ++ 10-20 nests, + less than 10 nests

During the breeding season at Taolimiao-alashan Nur more than 85% of the local bird community is comprised of Mongolian highland desert birds, of which the Relict Gull is undoubtedly the dominant species, at least numerically.

At Aubai Nur there were only five species of breeding waterbirds in 1991 and, although there were slightly fewer Relict Gull pairs than there were Gull-billed Terns (624: 680), the former was in a dominant position because it occupied the best nest-sites.

Number of nests of waterbirds in different habitats at Aubai Nur in 1991

	islet	lake shoal	sand shore	dune
Ruddy Shelduck <i>Tadorna ferruginea</i>			+	
Common Shelduck <i>T. tadorna</i>				+
Pied Avocet <i>Recurvirostra avosetta</i>		++		
Relict Gull <i>Larus relictus</i>	+++++			
Gull-billed Tern <i>Gelochelidon nilotica</i>	+++		++++	

+++++ more than 600 nests, ++++ 400-500 nests, +++ 200-300 nests, ++ 10-20 nests, + less than 10 nests

The Relict Gull is a typical bird of the Mongolian highland deserts and shows high adaptability to this type of habitat.

Relationship between the Relict Gull and the Gull-billed Tern

The Gull-billed Tern appears to be closely associated with the Relict Gull at the Ordos lakes, both with the breeding colonies and with non-breeding individuals. The tern is more catholic in its choice of nest sites, some pairs nesting on the lake shore or on off-shore shoals. The dominant Relict Gull had a significant effect on the population of the tern. At Taolimiao-Alashan Nur in 1990 the ratio of gulls' nests to terns' nests was 581 to 77 (Zhang Yin-sun *et al.* 1992). In 1991 the ratio was 491 to 286, after the first colony of Relict Gulls on islet B abandoned their nests following disturbance by an Upland Buzzard *Buteo hemilasius*. Soon after this the islet was occupied by Gull-billed Terns and a colony was quickly established. On islet E only two pairs of gulls nested and these eventually abandoned the islet to the terns. At Aubai Nur there were more terns than gulls nesting in total but, on islets, there were three times as many pairs of gulls as there were terns.

The two species do not compete for food resources because the Relict Gull feeds mainly on aquatic insects, whereas the Gull-billed Tern feeds on lizards and small fish.

As already mentioned, the Relict Gull dominates in nest-site selection and the arrangement of colonies of the two species on islets (Figures 3 and 4). The terns allow gulls to nest within their established colonies and benefit both species by their rapid and concerted reaction to predators.

Gull-billed Terns are also found at other breeding, or potential breeding, localities of the Relict Gull: Wuliangsu Hai and Suoguo Nur (Zhang Yin-sun); Lake Alakul, Russia (Knystautas 1987); Tatsain Tsagaan Nuur, Mongolia (Fisher 1985); Orok Nor, Mongolia (Kitson 1980, Vaurie 1964).

We would like to express our gratitude to the Oriental Bird Club for the honourable decision that they made of granting us their *Forktail*-Leica Conservation Award in 1990, which provided us with the opportunity to continue our fieldwork, leading to the results set out in this paper. We particularly appreciate Carol Inskipp for all the kind help she gave us, and the contribution she made towards the implementation of the project.

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Birds of Sariska Tiger Reserve, Rajasthan, India

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Sariska Tiger Reserve (76°17'-76°34'N and 27°5'-27°33'E), situated in the Aravali hill range, is located in the district of Alwar, Rajasthan. Sariska is in the semi-arid part of Rajasthan (Rodgers and Panwar 1988). The tract is mainly hilly and undulating and has numerous narrow valleys, two large plateaus: Kiraska and Kankwari, and two lakes: Manasarovar and Somasagar. Silisad Lake is situated along the north-eastern boundary of the reserve. The total area of the reserve is 800 km², of which 302.2 km² is a buffer zone and 497.8 km² is the core zone.

According to Champion and Seth (1968) the vegetation of Sariska comes under (1) Tropical Dry Deciduous Forest and (2) Tropical Thorn Forest. The dominant vegetation types include *Anogeissus* forest, *Boswellia* forest, *Acacia*-mixed forest, *Butea*-mixed forest, *Ziziphus* woodland, scrub land and riverine forest. The climate of this tract is subtropical, characterised by distinct winter (November to February), summer (March to June), monsoon (July to August) and autumn (September to October). In winter the temperature drops to 0° and in summer it rises as high as 47°. The average annual rainfall is around 600 mm.

Little previous work has been carried out on the avifauna of the reserve. Rodgers (1991) recorded 24 species of birds from Algal spring. KS stayed in Sariska from July 1988 to December 1990 studying the ecology of large herbivores. Birds were identified during this period and also during November 1986, November 1987, May 1988, November 1991 and February 1992. The most interesting finds were Painted Spurfowl *Galloperdix lunulata*, which had not been recorded previously from the arid and semi-arid tracts of Rajasthan, and Indian Cuckoo *Cuculus micropterus*, a rare straggler to the semi-arid tracts. The Aravali race of Red Spurfowl *Galloperdix spadicea caurina*, endemic to the Aravali hill range, is only found in a few localities.

SYSTEMATIC LIST

A total of 211 species was recorded, of which 120 were resident, 73 were migrant visitors and 18 were considered to be vagrants. In the list the following codes are used: