Lake Rezaiyeh: a specialised summer habitat for Shelduck and Flamingos

CHRISTOPHER SAVAGE

Summary

Common Shelduck (*Tadorna tadorna*), to a lesser extent the Ruddy Shelduck (*T. ferruginea*), and the Greater Flamingo (*Phoenicopterus ruber roseus*) are summer visitors to Lake Rezaiyeh, in Iranian Azarbaijan, where they remain throughout the breeding season under conditions of extremely high salinity. In 1960 the Common Shelduck nested successfully in numbers but the Flamingo did not. The Common Shelduck were observed to congregate for their moult. The habitat is described in some detail, in particular the relationship between the lake salinity and the sole sources of food, the brine shrimp *Artemia* and the alga *Enteromorpha intestinalis*.

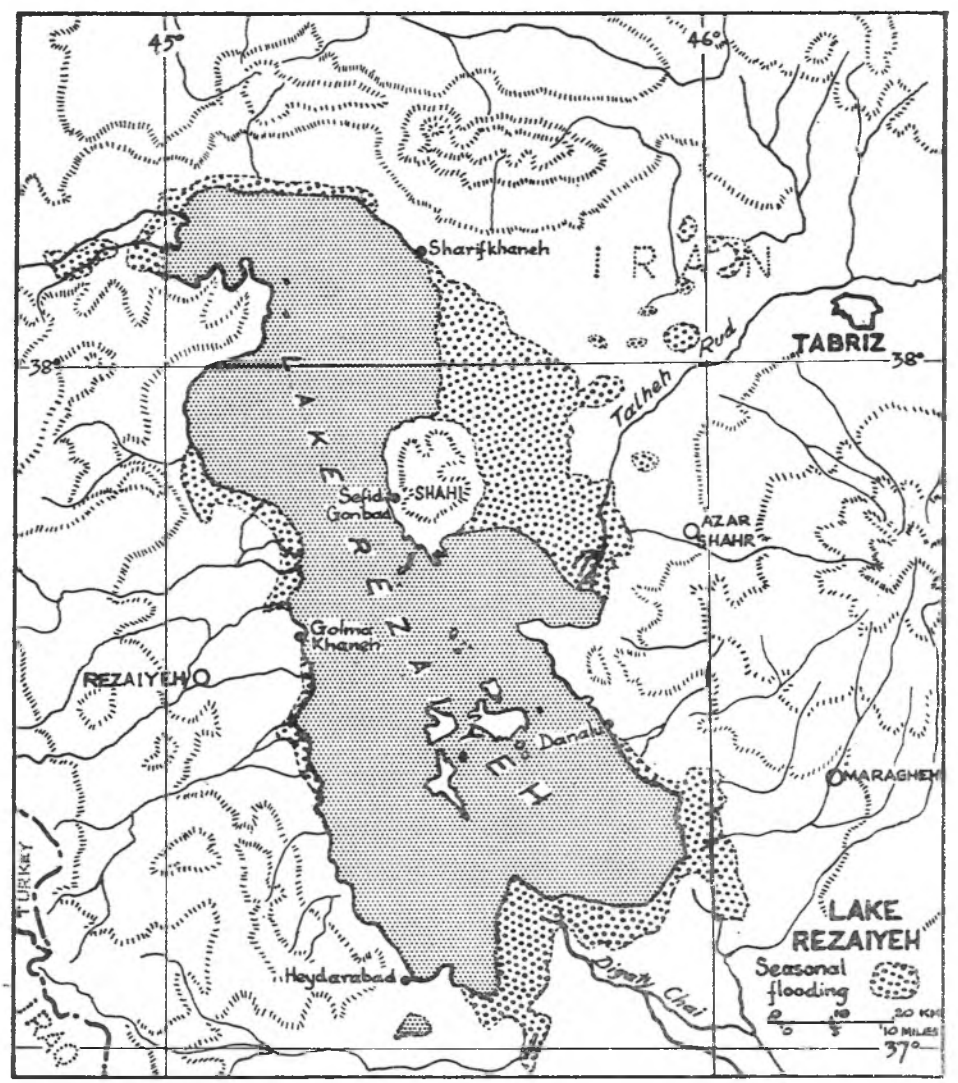

Figure 1. Lake Rezaiyeh and its environs.

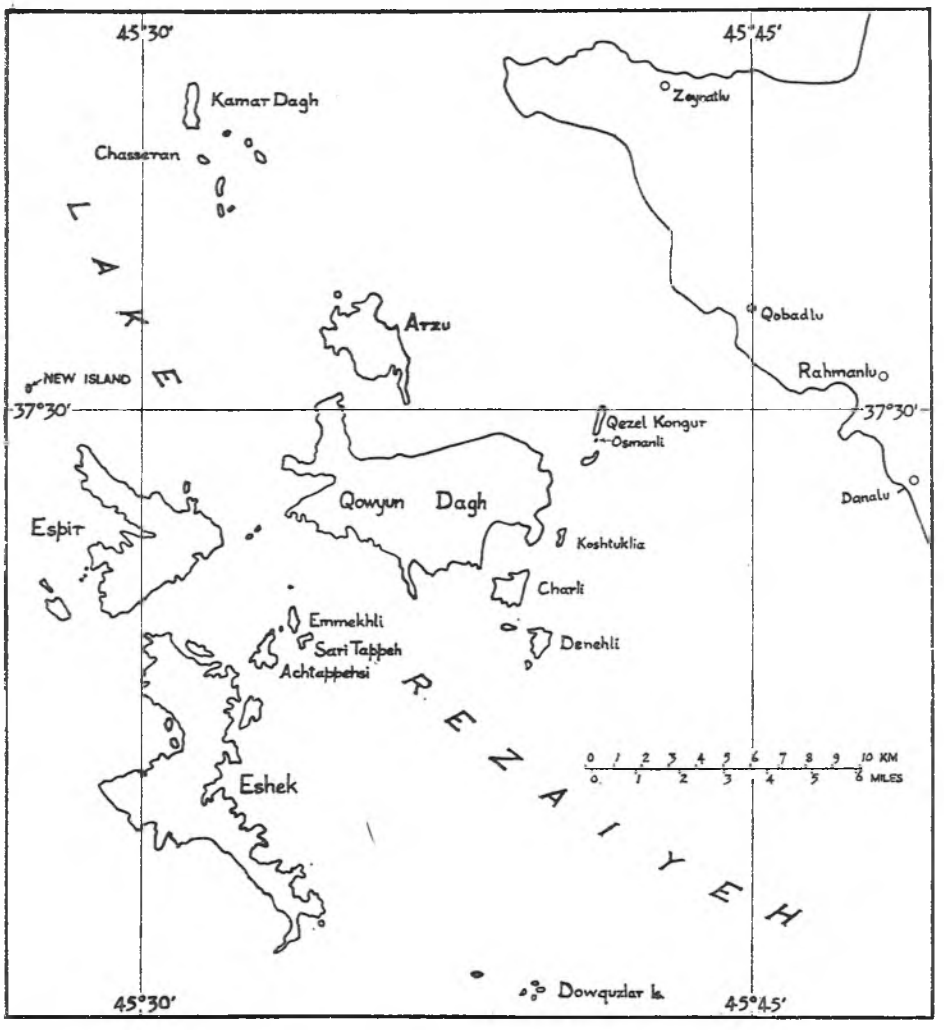

Figure 2. The islands in the southern part of Lake Rezaiyeh.

Lake Rezaiyeh, formerly Lake Urmia, is a great salt lake of nearly two thousand square miles in extent. It is situated in Iranian Azarbaijan, 110 miles south of Mount Ararat and 60 miles west of Tabriz. Although reasonably accessible, it is remarkably little known even locally, except to those who believe in the medicinal properties of the lake-side mud near the town of Rezaiyeh or Sharifkhaneh. There are no fish in the lake and the popular belief is that the lake is 'dead'.

On being posted to Tabriz in the spring of 1960 I was on the lookout for the White-headed Duck (*Oxyura leucocephala* (Scopoli)) and made close enquiries about Lake Rezaiyeh. I soon met Dr. Freidrich Plattner, Professor of Physiology at the University of Tabriz, who had already spent much of his spare time for a number of years canoeing on the lake. I learnt from him that the lake was far from dead, as at certain times of the year there were rich hatches of brine shrimp (*Artemia*), besides a growth of *Enteromorpha intestinalis*, an algal organism belonging to the family Ulvaceae. Moreover these two provided rich food for waterfowl, which seemed well worth looking into. Dr. Plattner's enthusiasm was so infectious that within a few weeks I purchased a second-hand outboard motor boat from Tehran and thenceforward spent every available spare moment exploring the lake.

The lake, its salinity and food resources

Lake Rezaiyeh is shallow throughout, with some fifty-six islands. All these except Shahi, which is now no longer an island, are uninhabited. Besides Shahi, the only island with fresh water is Qowyun Dagh, which has two springs. There are no boats on the lake except for an ancient steam tug which tows a lighter on a weekly service round the lake, mainly for the movement of cattle between the harbours of Sharifkhaneh, Golmakhaneh, Heydarabad, Danalu and Sefid Gonbad for Shahi. My soundings suggested an average depth of 15 feet and no more than 25 feet anywhere in the southern half of the lake. The lake has no outlet so that the seasonal inflow, which is mostly from snow melt, causes the lake to rise in spring up to six feet or more. Evaporation then lowers the level again throughout the summer and autumn. At the same time, the variations in the volume of water cause a range of salt concentration varying from a maximum of more than 28% by weight to as low as 8%. By comparison, the Dead Sea, having a seasonal variation in level of 10 to 15 feet and a mean depth of 1,080 feet, has a range of only 23 to 25% of salts.

The salts of the lake are very similar to those found in the sea, though in greater concentration. Typical analyses are given by Plattner (1955) as follows:

	Abich (*1855*)	*Hitchcock* (*1895*)	*Gunther and Manley* (*1898*)	*Plattner* (*1954*)
Cl'	57·75	58·20	57·33	57·50
SO_4''	5·12	3·75	5·06	4·78
CO_3''	–	–	–	0·08
Na'	34·00	36·40	33·98	34·08
K'	–	–	0·78	0·77
Ca''	0·22	0·24	0·32	0·25
Mg''	2·91	1·41	2·53	2·54
	100·00	100·00	100·00	100·00
Total solids in grams for 100 grams of liquid	22·07	20·55	14·85	20·09

The annual cycle of water levels and salt concentrations is best expressed on the accompanying idealised diagram (Figure 3, after Plattner). The bands for salt concentration and water levels are 'envelopes' for observations taken over a period of nearly ten years. Particularly regular features are the highest water levels in the first half of June and the highest water temperatures in August. The only food resources for waterfowl, *Enteromorpha* and *Artemia*, are closely related to this annual cycle. *Enteromorpha* precedes *Artemia* and disappears earlier, around August.

Enteromorpha grows in dense flat colonies on stony or sandy ground along the shores of the lake and islands wherever the water is shallow. From elevated points the plants can be seen under water as a continuous dark green band. Strong waves and surf will tear it loose, after which it floats at a shallow depth and is distributed by wind and currents over nearly the whole surface of the lake. Plattner (1960) found that whenever there is a year when salt concentrations remain around or below 20% *Enteromorpha* becomes so abundant that the whole lake looks like a vegetable soup. On the basis of random samples, he estimated in these years a production of 200,000 tons wet weight! In years of high salinity, as in 1960 when I made my observations, *Enteromorpha* is relatively scarce.

Artemia begin to appear in April but do not build up in great strength till June. Successive hatches keep numbers up till September when they become noticeably fewer. Dr. Plattner found in the laboratory that they did not hatch out at salt concentrations higher than 11%, from which he deduced that hatching must occur mainly outside the mouths of perennial rivers where salt concentrations are lower. The only rivers of that description are the Tatau Cham and Digati Chai in the south. The Talheh Rud, although an important tributary in winter, dwindles to almost nothing in summer. It is significant that Dr. Plattner also found that salt concentrations sampled in the southern basin always lagged behind those taken simultaneously in the north, at Sharifkhaneh for example.

After hatching *Artemia* appear to be moved northwards and spread over the lake by the winds and currents. In June and July, when there are often storms on the lake with strong winds from the south and south-west it is noticeable that the Flamingos and Shelduck are mostly to be found round the Qowyun Dagh and the neighbouring islands where they can find shelter from the storms yet the winds bring them their food. Conversely, when there is less wind the Shelduck disperse and the Flamingos are to be found more often in the open waters of the southern basin or alongside the southern shore.

Shelduck – their nesting and moult

In early May, 1960, when searching for a suitable beach to make my base of operations, I found a number of pairs of both Common and Ruddy Shelduck (*Tadorna*

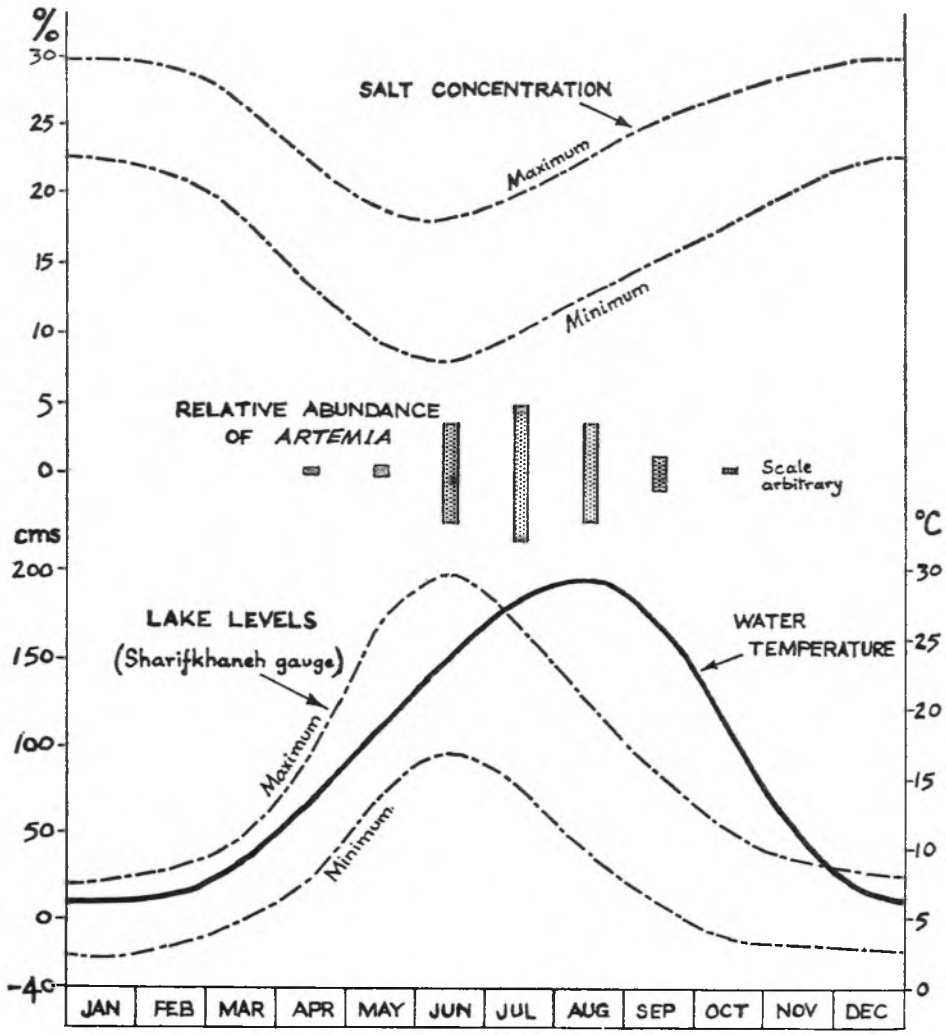

Figure 3. Relationship between relative abundance of *Artemia* (brine shrimp) and the annual cycles of water level, salt concentration and water temperature of Lake Rezaiyeh.

tadorna (L.) and *T. ferruginea* (Pallas)) in the neighbourhood of Rahmanlu. They could often be seen at dawn or dusk visiting some small pools of fresh water near the water's edge. The Ruddy Shelduck spent most of the rest of their time prospecting the gabbro cliffs. I found no signs of nests or young, though the local farmers informed me that they did nest along the tops of the cliffs in some years. This kind of site appears to be popular with *T. ferruginea*, for, about a week earlier, Admiral Furse, who was in the vicinity on a botanical expedition, encountered a pair nesting on a high cliff several miles north of Lake Van. I also heard later that in Azarbaijan these birds are often found several miles from the nearest water.

I saw little more of the Ruddy Shelduck but when I first visited Qowyun Dagh on 26th May there was a number of pairs of Common Shelduck, particularly around the southern side of the island where it has steep limestone cliffs. Three weeks later I found a nest in a crevice some twenty or more feet deep which could only just be crawled into and explored by torchlight. Such nesting sites abound, but are not easily reached, and since the islands are uninhabited they are as safe as a bird could wish.

The following week I made a long circuit of the islands to the south and west of Shahi which I found deserted except for a gullery. On the way back we visited the small island of Kamar Dagh which has

steep cliffs and rocky shores. Numbers of Shelduck were sitting around on the rocks and a little further on, near Chasseran Island, was a brood of twelve very newly hatched ducklings. On moving the boat towards them, the ducklings began diving freely, while the mother put on an impressive performance of the traditional 'broken wing' display. As we left, the mother rejoined them after a short flight round us to make certain all was clear.

At the end of June there were quantities of *Artemia* to be seen and millions of their eggs floated on the surface of the water, often being blown into tight mats several square feet in extent. The Shelduck fed avidly in the open water, on or just below the surface, so it was not possible to say whether they were eating the *Artemia* or their eggs.

At the beginning of July I had my first opportunity of investigating the southern shore of the lake, travelling via Qowyun Dagh to Heydarabad and back via the Dowquzlar Islands. We saw two or three pairs of Shelduck near Denehli but none further south. The only bird-life on the lake was a small party of Flamingos (*Phoenicopterus ruber roseus* (Pallas)) about five miles from land south of Qowyun Dagh. They appeared to have been feeding and seemed reluctant to move as we passed by.

For three weeks in July I was away. On my return on 4th August there were still quantities of *Artemia* but few eggs, and the rising salinity had caused white crusts to have formed on the rocks, sometimes up to eight feet above water level. Near Qezel Kongur (golden rocks) and the fist-like rock of Osman-li we found a flock of nearly three hundred Shelduck. Previously they had taken little notice of a boat till one was within 15 to 20 yards, but this time they swam off quickly; many scuttering over the surface like Steamer Ducks (*Tachyeres* sp.) off Tierra del Fuego. When we approached any individuals too rapidly however, they dived readily, as they do in Bridgwater Bay (King, 1960). Some of the birds were in immature plumage, but the majority were adults in moult. By 18th August the flock had dispersed over a wide area but most were still flightless. By 8th September they had completely dispersed and thereafter I only found small parties around outlying islands.

The Flamingos

The first Flamingo of the season was found in rough water west of Qowyun Dagh on 3rd June. On 5th June there was a party of twenty to thirty in a fjord-like creek on the east of Eshek Island. This particular creek proved to be a favourite haunt of both Flamingo and Shelduck, no doubt because the prevailing winds brought their food supplies from the south and the creek provided still water. It was near here that Dr. Plattner in other years often found the lake 'like vegetable soup'. Numbers soon built up to about a hundred at which they remained throughout the season. They would often be found resting on a sand bank at the southern tip of Arzu or frequenting the numerous little bays and creeks of that island or the neighbouring Qowyun Dagh.

At the beginning of September the lake level had fallen sufficiently to expose a small island about three miles north west of Espir. I had previously heard of the sailors talking of shallows in this area where the Flamingos would often be found. I had also been intrigued by the story that they would sometimes catch young ones in their hands! The place was difficult to find as it was not marked on any map and could only just be discerned from the headland of Espir now that the shallows had become an island. There were nearly thirty Flamingos there as well as a number of Shelduck. On approaching the Flamingos, I found that they were flightless, though some could manage to rise from the water sufficiently to run along the surface to get further away from the boat.

The island itself was almost entirely crystallised in salt but it was interesting to find preserved in the salt the signs of about twenty Flamingo 'nests'. The mounds were unmistakable. It is conceivable therefore that they may have nested there in previous years, though it is possible that the nests may have been only 'dummies' such as described by Brown (1959), and the 'young ones' captured by the boatmen could most likely have been moulting adults.

The same day as we visited the new island we found what were probably the remainder of the flock, numbering about eighty, along the southern shore near Heydarabad. These could all take flight. Some seemed larger than others but I judged them all to have been adults. There were quantities of *Enteromorpha* in the shallow water, where they had been feeding.

At this stage unfortunately I had to cease operations as the salinity was too high for the outboard motor and on more than one occasion I had been almost stranded due to crystallisation in the water circulation system.

Conclusions

It would seem to be no coincidence that the presence of the Shelduck and Flamingos is matched by the abundant seasonal food supply in Lake Rezaiyeh. Judging only from behaviour, it appeared that *Artemia* and

their eggs form the principal item of diet for the Shelduck, and that both *Artemia* and *Enteromorpha* provide the Flamingos with theirs. Both species benefit greatly from lack of human interference. But in spite of these favourable factors how, one may ask, can Shelduck and Flamingos survive in such highly saline conditions? Both species drink the water, with concentrations rising to 28% by weight, and they do not frequent the few fresh springs along the coast or even those on Qowyun Dagh. Brown (1959) describes how Lesser Flamingos living on soda lakes will apparently go to any lengths to drink fresh water, even at near boiling point. Dr. Plattner, being puzzled by this, made some laboratory experiments. A Shelduck which had been brought in winged by one of his staff was fed on *Artemia*, and was provided with lake water to drink. He noticed after a time that it would give a kind of sneeze accompanied by a shake of the head. On collecting the 'sneeze' he found a concentration of salt. This led to his discovery of large lachrymal glands situated above the eyes which are capable of excreting chlorides at a high concentration, thus helping the kidneys, whose capacity for chloride elimination is no higher than average in other animals. Flamingos from Rezaiyeh were found to have similar glands. Although such glands have been found in many marine birds (Schmidt-Nielsen *et al*, 1958) the problem does not appear to have been previously studied in relation to Flamingos.

Final note

No description of Lake Rezaiyeh would be complete without mention of the surprising beauty of the islands in summer. As the concentration of salt increases, the crystals scintillate in the sun as they form on the surface and then drop to the bottom. The water is so clear that one had the feeling of flying high over a vast snow field. The shore lines are encrusted in salt, but in the little pools among the rocks one still finds the *Artemia* which appear golden in the sunlight. From a high point on Qowyun Dagh, as one looks down on the surrounding islands, the colours are unbelievable. Although the only waterfowl on the lake are the Shelduck and Flamingos there are many other sights to delight the eye. I found Avocets nesting in early June on mud flats near Rahmanlu, Red-necked Phalaropes on passage in early September, the Red-billed Chough nesting among the cliffs of Qowyun Dagh, and vast quantities of Rock Doves, many of which made use of a special pigeon tower producing nearly a ton of guano a year for the landlord of Rahmanlu. On Qowyun Dagh there were also wild Moufflon introduced in the time of Mozaferedin Shah during the last century, but this is a story in itself (Savage 1960). Qowyun Dagh was proclaimed a Game Reserve in February, 1960, and in due course may become a National Park, for which it has all the attractions.

Acknowledgements

I most gratefully acknowledge the help of Dr. Freidrich Plattner whose enthusiasm and knowledge have been invaluable in solving some of the mysteries of Lake Rezaiyeh and in overcoming some of the physical difficulties involved.

References

BROWN, L. 1959. *The Mystery of the Flamingos.* Country Life, London.

KING, B. 1960. Diving behaviour of Shelducks. *Wildfowl Trust 11th Annual Report*: 156.

PLATTNER, F. 1955. Über den Salzgehalt des Urmia-Sees. *Petermanns Geographischen Mitteilungen* (4): 276-278.

PLATTNER, F. 1960. Provitamin 'A' in seaweeds of Lake Rezaiyeh. *Acta Medica Iranica* 3 (4): 26-29.

SAVAGE, C. D. W. 1960. Qowyun Dagh. *Shekar o Tabiat* No. 13: 6-11. (in Persian).

SCHMIDT-NEILSEN, K., C. B. JÖRGENSEN and H. OSAKI. 1958. Extrarenal salt excretion in birds. *American J. Physiology*, 193:101-107.