

Saline Lakes

Subjects: Geology

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Saltwater lakes around the world are drying at a rapid rate. These lakes are present in arid and semi-arid regions where evaporation exceeds precipitation. The Aral Sea and Lake Urmia are examples for such rapidly drying lakes. These two lakes have lost up to 90% of their former area in the past 50 years.

Keywords: Drying Saline Lakes ; Aral Sea ; Lake Urmia

1. Lake Urmia Basin

The Lake Urmia Basin (LUB) which encloses Lake Urmia is located in northeast Iran ($37^{\circ}41'59.99''$ N, $45^{\circ}18'60''$ E). The lake basin is shared between the provinces of West Azerbaijan, East Azerbaijan, and Kurdistan as shown in Figure 1. LUB has a total area of $51,331 \text{ km}^2$ of which $4750\text{--}6100 \text{ km}^2$ was occupied by Lake Urmia. Lake Urmia was the twentieth largest lake and second-largest hypersaline lake in the world ^[1]. The total volume of the lake was $25\text{--}27 \text{ km}^3$. It had a maximum depth of 16 m and an average depth of 6 m. It was fed by 60 rivers of which Zarreh Rud and Simineh Rud contribute the highest flow to the lake ^{[2][3][4]}. The lake originally contained 102 islands that used to attract migratory birds. Lake Urmia was declared as a National Park and a UNESCO Biosphere Reserve. There were five Ramsar sites in the basin—Lake Urmia and four satellite wetlands—and nine globally important bird areas. The lake is the main habitat for the endemic Iranian brine shrimp, *Artemia urmiana*, and is a protected aquatic environment ^[5].

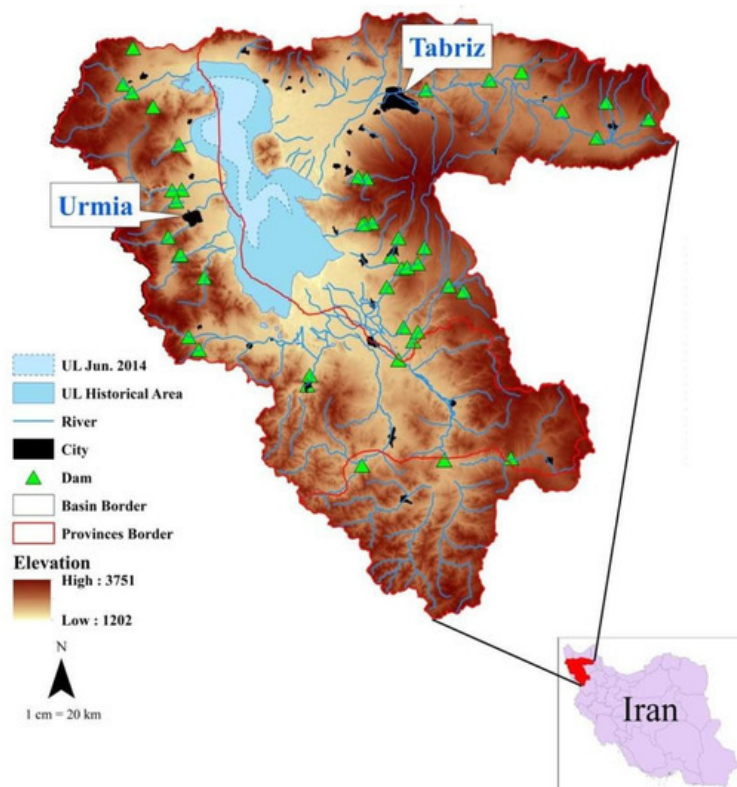


Figure 1. Geographical representation of Lake Urmia Basin ^[6].

2. Aral Sea Basin

The Aral Sea Basin (ASB) which encompasses the Aral Sea, is shared between five countries: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. The ASB is mainly fed by two main tributaries: the Amu Darya from the South and Syr Darya from the East, as shown in Figure 2 [7].

The Aral Sea was once the fourth largest lake in the world and the largest saline endorheic lake in Central Asia. The total area of the Aral Sea in 1960 was 68,478 km² with a water capacity of 1093 km³. Since then it has drastically reduced due to diminishing water inflow [8]. The water level decreased from 53.40 m to 41.02 m during the period 1960–1986 [9]. In 1986, the Kokaral Desert was formed which divided the Aral Sea into two separate lakes; the North Aral Sea (NAS) and South Aral Sea (SAS) [9].

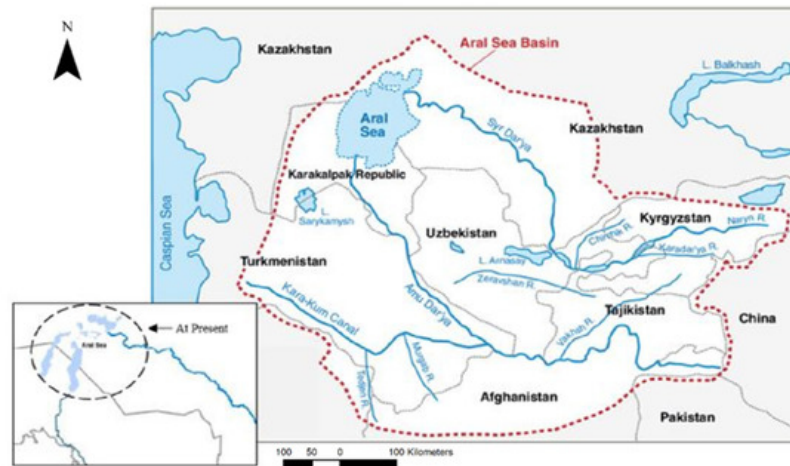


Figure 2. Geographical representation of the Aral Sea Basin. Blue lines indicate tributaries of the Amu Darya and Syr Darya. Red dotted lines indicate the Aral Sea Basin. (Source: modified from [10][11]).

The North Aral Sea belongs to Kazakhstan (46°48' N, 61°40' E) and had a surface area of 5992 km², with a water volume of 80 km³, a maximum depth of 29 m, and an average depth of 13.3 m. It is fed by the Syr Darya river which is the confluence of Naryn and Kara-Darya rivers in the Feraghan Valley. It is the second-longest river in Central Asia and reaches the NAS after travelling 2212 km. Along this course, Syr Darya receives water from seven rivers, namely the Ohangaron and Chirchik in Uzbekistan, and the Arys, Badam, Boroldai, Bungun, and Keles in Kazakhstan [7].

The South Aral Sea belongs to Uzbekistan (45°00' N, 60°00' E) and had a surface area of 60,000 km², with a water volume of 984 km³. The SAS was formerly fed by the Amu Darya tributary, which is the confluence of the Pyanj and Vakhsh rivers. It is the longest river in Central Asia and used to travel 2550 km from its source until it reaches the SAS. Along this course, Amu Darya receives water from four rivers, namely Kunduz (Afghanistan), Kafirnigan (Tajikistan), Sherabad (Uzbekistan), and Surkhandarya (Uzbekistan). The SAS has further split into the East and West Aral Seas with a surface area of 46,466 km² and 13,628 km², respectively. The East Aral Sea was shallow with a maximum depth of 28 m and an average depth of 14.7 m, while the West Aral Sea was deeper with a maximum depth of 69 m and an average depth of 22.2 m [7].

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