Section 2

Water Management Situation in the Aral Sea Basin

2.1. Water Management Situation in the Basins of the Amu Darya and the Syr Darya

Water Resources

In 2018, the total annual flow in the basins of the Amu Darya and the Syr Darya was 97.5 km^3 or 83% of average annual flow.

Amu Darya Basin

The annual flow in the basin, including the Amu Darya and its tributaries, as well as the Zarafshan River, was 62.2 km^3, of which 47.9 km^3 in the Amu Darya (at the nominal Kerki section). The water content of the Amu Darya in the monitoring section upstream of the Garagumdarya was: 55.3% of the norm in the first quarter of the growing season, with the subsequent consequences for water users at the beginning of the season; 80.3% for the growing season as a whole; and, 72.7% in the first half of the non-growing season 2018-2019.

As of 1st of January 2018, the total water accumulation in the Nurek and Tuyamuyun reservoirs was 13.7 km^3.

Syr Darya Basin

The annual flow in the basin, including the rivers Naryn, Karadarya, and Chirchik and small rivers, amounted to 35.3 km^3, of which 22.4 km^3 of inflow to three reservoirs – Toktogul, Andizhan, and Charvak – along the Syr Darya.

As of 1st of January 2018, the total water accumulation by reservoirs in the basin was 25.123 km^3, including 19.881 km^3 in the key reservoirs in the flow formation zone.

Operation of Reservoir Hydrosystems

The annual inflow to the Nurek reservoir was 19.5 km^3, including 16.2 km^3 (83%) - over the growing season. Water releases from the reservoir were in the amount of 19.5 km^3, of which 12.4 km^3 or 63.6% of annual flow was discharged during the growing season.

Because of lower flow along the Panj River, the annual inflow to the Tuyamuyun reservoir was 17.6 km^3. This was 4.1 km^3 lower than the forecast and also 3 km^3 lower for the growing season. Annual water releases from the reservoir were 19.2 km^3 or 85% of the value set in the schedule of the BWO Amu Darya. Water releases amounted to 13.6 km^3 (82%) during the growing season.

Annual inflow to the Toktogul reservoir located on the Naryn River was 13.0 km^3, of which 9.85 km^3 (76%) – during the growing season. Annual water releases from the reservoir were higher than the inflow and amounted to 13.5 km^3 and only 5.0 km^3 (37 %) were discharged from the reservoir during the growing season. By the end of the growing season, the Toktogul reservoir was filled up to 19.3 km^3.

Water Allocation and Water Shortage

Amu Darya Basin

There were some difficulties in provision of users with water in the Amu Darya Basin in 2018 as a whole. ICWC at its meeting decided to reduce water limits by 10% in April-May. In 2018, given the established limit of water withdrawal from the Amu Darya Basin at 54.3 km^3 and the corrected limit of 53.5 km^3, actually 46.5 km^3 were diverted, including 31.9 km^3 during the growing season. 87% of annual water limit was used in total, of which 83% - during the growing season. The following situation was observed by countries:

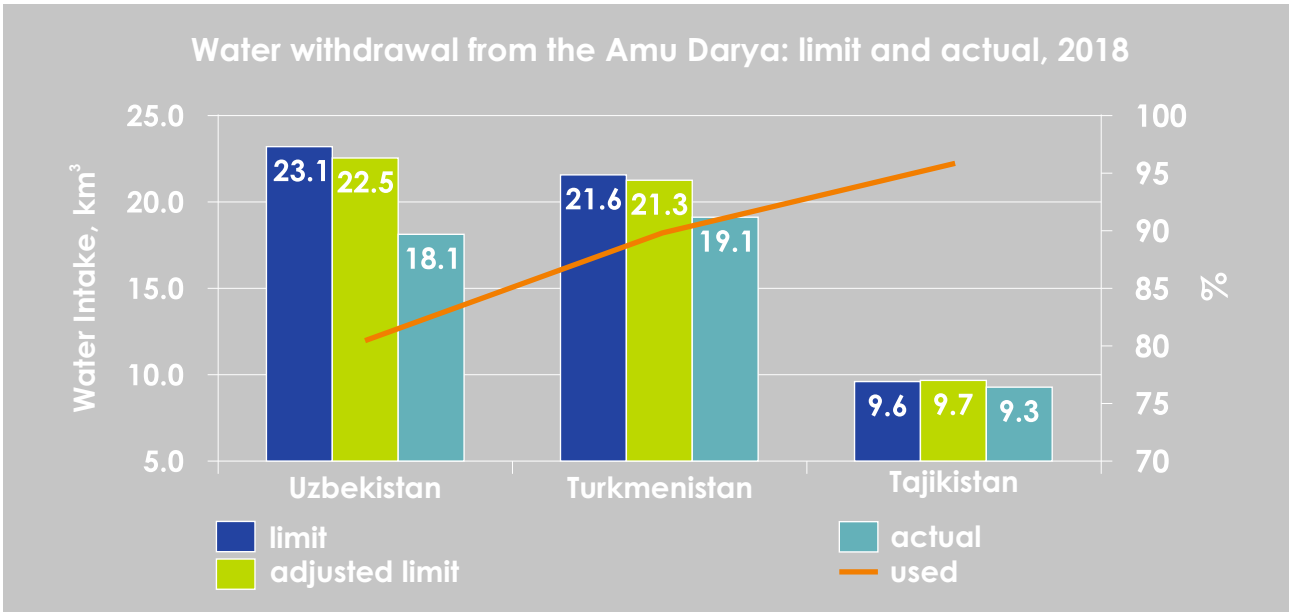
- **Tajikistan** – given the water limit of 9.624 km^3 and the corrected limit of 9.681 km^3, the actual water withdrawal was 9.273 km^3 or 95.8%;
- **Turkmenistan** – given the water limit of 21.582 km^3 and the corrected limit of 21.301 km^3, the actual water withdrawal was 19.127 km^3 or 89.8%;
- **Uzbekistan** – given the water limit of 23.081 km^3 and the corrected limit of 22.536 km^3, the actual water withdrawal was 18.141 km^3 or 80.5%.

During the growing season, water shortage was estimated at 8 % in the reach from the Nurek HPP to the Tuyamuyun reservoir in Tajikistan and 4% and 6% in Turkmenistan and Uzbekistan, respectively. In the reach from the Tuyamuyun

hydrosystem to the Samanbay post, the situation was worse: Turkmenistan and Uzbekistan has received by 34% and 36% less water, respectively, than they required during the growing season.

Syr Darya Basin

The total water withdrawal in the Syr Darya Basin was 13.5 km^3, including 10.7 km^3 or 92% of the established limit on water intake to canals during the growing season. 0.283 km^3 of water was discharged from the Arnasay into the Syr Darya. The water allocation plan of BWO Syr Darya was on average fulfilled by 91%. The water shortage was estimated at 16% in the reach from the Toktogul to the Chardara reservoir in Tajikistan, 20% in Kyrgyzstan, and 13% and 6% in Kazakhstan and Uzbekistan, respectively.



Inflow to Prearalie

In 2018, inflow into the Northern Aral Sea from the Syr Darya was 3.03 km^3, while 3.31 km^3 was discharged from the Northern Sea into the Large Aral Sea (Eastern part).

Based on SIC's estimates, the South Prearalie should receive 8 km^3 of water from the Amu Darya in wet years (in terms of flow) and 3.5 km^3 in dry years. Actually in 2018, 1.32 km^3 or 17% of the required water quantity (for average year) was delivered to the South Prearalie.

Open Channel Losses

The Amu Darya balance calculations indicate to relative lowering of balance discrepancies along the river: 8.06 km^3 during the growing season and 1.29 km^3 during the non-growing season or 9.35 km^3 in total.

Balance discrepancies along the Syr Darya has increased by 50% as compared to 2017 and amounted to 5.17 km^3 a year, including 1.28 km^3 during the growing season and 3.89 km^3 during the non-growing season.

The reasons could be water losses (through evaporation and seepage), inaccurate measurements of water discharge along the rivers, inaccurate accounting of return flow (lateral inflow to river section), unaccounted water diversion, and also mistakes in analysis of daily and ten-day discrepancies in case of changing amount of water in the river channel and floodplain (river training). In 2019, BWO Syr Darya and SIC ICWC has started conducting joint analysis of all elements of channel balance and actual flow discrepancies along the Syr Darya river for more reliable estimations of flow discrepancies and their minimization.

Meeting Demands

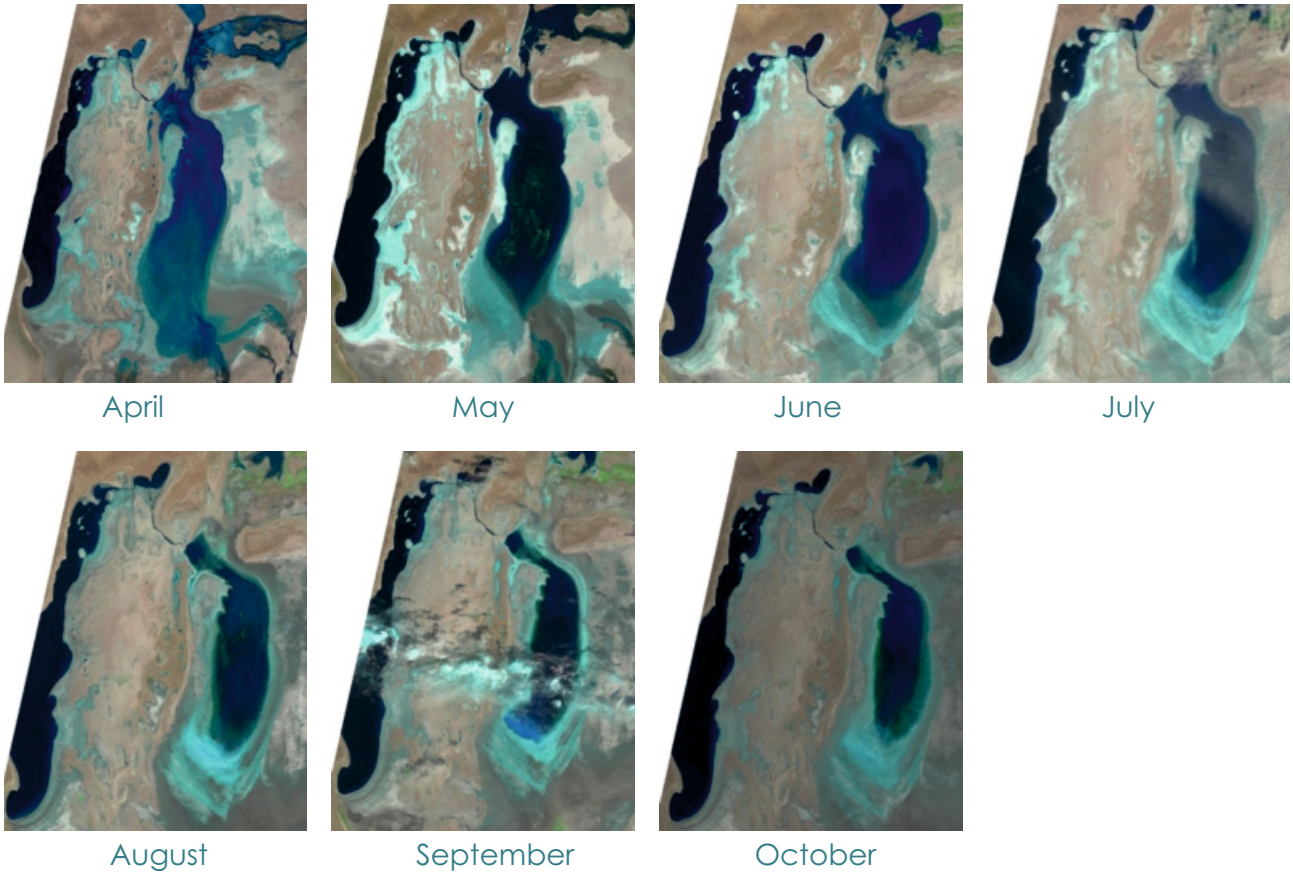
The Table below shows how water demands are met among the CA countries.

CA Countries	Meeting water demands in growing season, %	
	Amu Darya	Syr Darya
Kazakhstan	-	87
Kyrgyzstan	-	79
Tajikistan	92	84
Turkmenistan	87	-
Uzbekistan	76	94

2.2. Monitoring of Changes in the Water Surface Area of the Large Aral Sea and the Amu Darya Delta

In 2018, SIC ICWC continued monitoring of changes in the water surface area of the Eastern and Western parts of the Large Aral Sea, as well as lake systems of the Amu Darya delta through satellite images Landsat 8 OLI (www.cawater-info.net/aral/data/monitoring_amu.htm).

Figure 1. Satellite images of Western and Eastern parts of the Large Aral Sea, *Landsat 8 OLI (2018)*



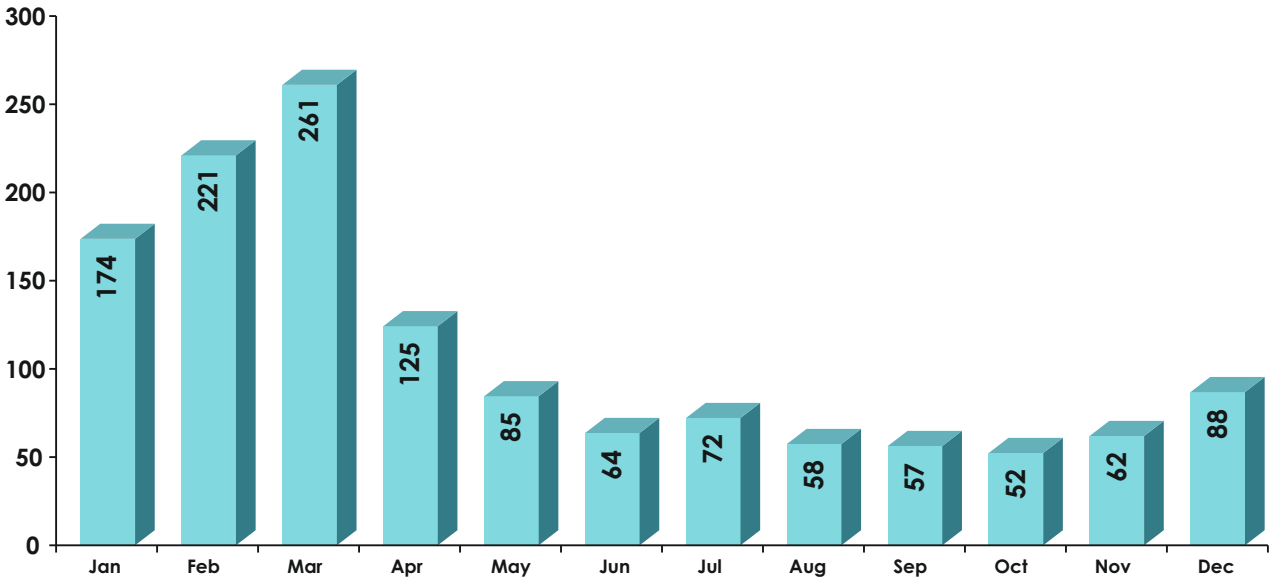
2.2.1. Water Supply to the Aral Sea and the Amu Darya Delta

Water distribution along the Amu Darya

The analysis of water-related situation in the Amu Darya Basin in 2018 shows that the relatively highest water shortage (in % of the water limit) was observed in the lower reaches (36%). As mentioned above, about 3.5 km^3 of water is needed to keep good environmental health of deltaic lake systems in dry years. However, in fact, the lower reaches received 1.32 km^3. Thus, the needed amount of water to the lake systems and the delta was not supplied.

The volumes of water by month are shown in the diagram below.

Monthly water supply to the Aral Sea and the Amu Darya Delta in 2018, including cumulative discharge from the Suenly and Kyzketken canals and the collecting drains, Mm³



Water discharge from the Northern Aral Sea

In the course of 2018, excess water from the Northern Aral Sea (located within the territory of Kazakhstan) was discharged into the Large Aral Sea. The total water discharge amounted to 3.31 km³, of which 3.118 km³ or 94% was discharged from January to April (see Table 1).

Table 1. Water volume in the Northern Aral Sea (NAS) and water discharge into the Large Aral Sea (LAS)

Indicators	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
NAS Level, m	42.09	42.02	42.06	42.05	42.05	42.03	41.97	41.92	41.78	41.56	41.61	41.69	**41.9**
NAS Volume, km³	24.6	24.4	24.4	24.0	23.7	23.2	22.6	22.0	21.7	21.9	22.2	22.8	**23.1**
Discharge into LAS, km³	0.911	0.715	0.740	0.752	0.011	0.009	0.017	0.014	0.013	0.023	0.036	0.069	**3.310**

2.2.2. Dynamics of Changes in the Water Surface and Wetland Area of Eastern and Western Parts of the Large Aral Sea

The water surface area in the Western part of the sea extended by 9,200 ha from April to June and that of the Eastern part enlarged by 66,000 ha from April to May (see Table 2).

This is explained by the discharge of water from the Northern Aral Sea (see Table 1).

Since then, the steady decrease in the water surface area has been observed in the both parts of the Large Aral Sea till November.

As a result, by November, the water surface area has shrunk by 2,600 ha in the Western part and by 282,000 ha in the Eastern part of the Large Aral Sea.

Table 2. The area of wetlands and open water surfaces in the Western and Eastern part of the Large Aral Sea, 2018 *(Landsat 8 OLI)*

Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Western part of the Aral Sea, ha								
Wetland	290,309	282,025	281,047	281,859	286,404	288,274	290,501	292,951
Water surface	271,041	279,324	280,302	279,490	274,945	273,075	270,848	268,399
Eastern part of the Aral Sea, ha								
Wetland	1,152,525	1,071,095	1,138,100	1,220,382	1,279,603	1,290,122	1,323,626	1,353,048
Water surface	344,298	410,244	343,239	260,958	201,736	191,217	157,713	128,291

2.2.3. Lake Systems of the Amu Darya Delta

The lake systems of the Amu Darya delta are represented by small local water bodies of the Southern Prearalie.

As a result of implementation by the Uzbek Government of the project on "Building of small local water bodies in the Amu Darya Delta", Phase I, 180,000 ha were watered, and local water bodies were formed to restore flora and fauna.

Currently, the Phase II of the project is underway to form additional water bodies on an area of 208,690 ha in total.

Meanwhile, the current actual hydrological situation in the South Prearalie is catastrophic due to dry conditions in 2018. In the period from April to November, the open surface area of lake systems in the South Prearalie decreased by 37,600 ha, i.e. 65% of lakes remained with no water (Table 3). Accordingly, the wetland area has increased by 37,600 ha (Table 4). This is proved true by satellite images of local water bodies in the Amu Darya delta *(Landsat 8 OLI, August 2018)*, where only wetlands are seen and many lakes are dried out (Figure 2).

Table 3. The area of open water surface of the lake systems in South Prearalie, ha

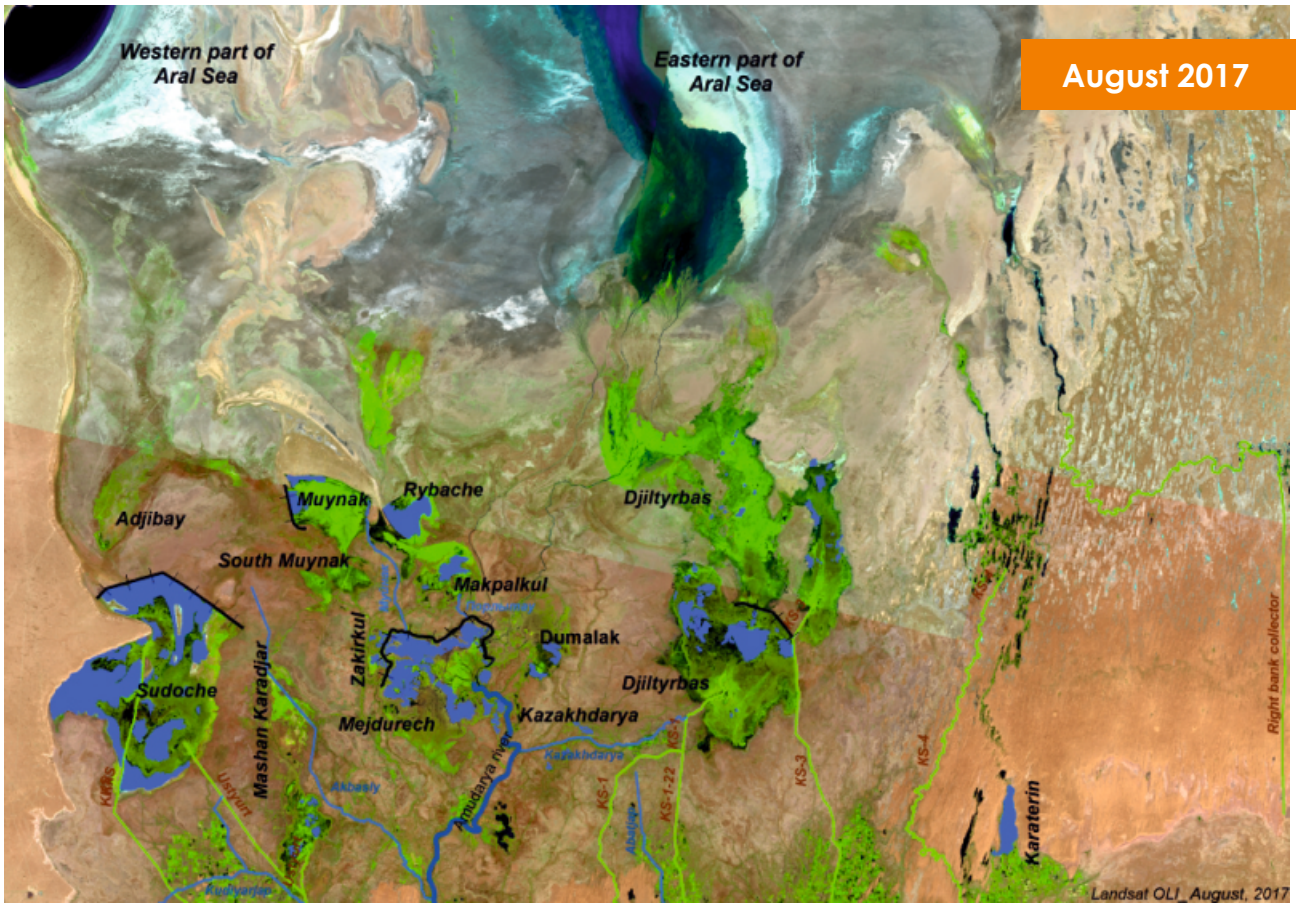
Water body	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Sudoche	25,103	25,823	24,893	20,350	14,144	14,402	11,147	9,860
Mejdureche	7,047.5	4,723.3	2,725.3	1,130.5	402.0	170.8	51.5	625,2
Rybache	4,003.7	3,728.2	3,229.8	3,041.2	2,987.6	3,062.4	3,012.7	2,740.6
Muynak	1,319.2	998.7	786.8	626.5	566.9	907.3	546.0	395.0
Djiltyrbas dam-terminated	6,319.2	5,926.2	5,701.8	5,669.7	5,626.2	6,243.0	5,732.0	5,567.0
Djiltyrbas (together with former right and left streams)	1,778.9	1,552.7	1,131.9	433.5	153.4	84.4	20.0	33.0
Dumalak	270.3	74.8	12.4	0.0	-	-	-	-
Makpalkul	7,440.4	1,100.6	1,039.4	1,039.3	763.2	950.8	512.8	342.9
Mashan Karadjar	3,310.5	3,188.7	1,955.9	848.8	503.5	801.4	502.8	359.5
Water surface southward of Muynak	811.7	371.9	0.0	0.0	-	65.0	40.6	59.8
Water surface along Kazakhdarya river channel	21.2	0.0	0.0	0.0	-	-	-	-
Zakirkol	186.0	107.0	9.9	0.0	-	-	-	-
Total:	**57,584**	**47,595**	**41,486**	**33,140**	**25,147**	**26,687**	**21,565**	**19,923**

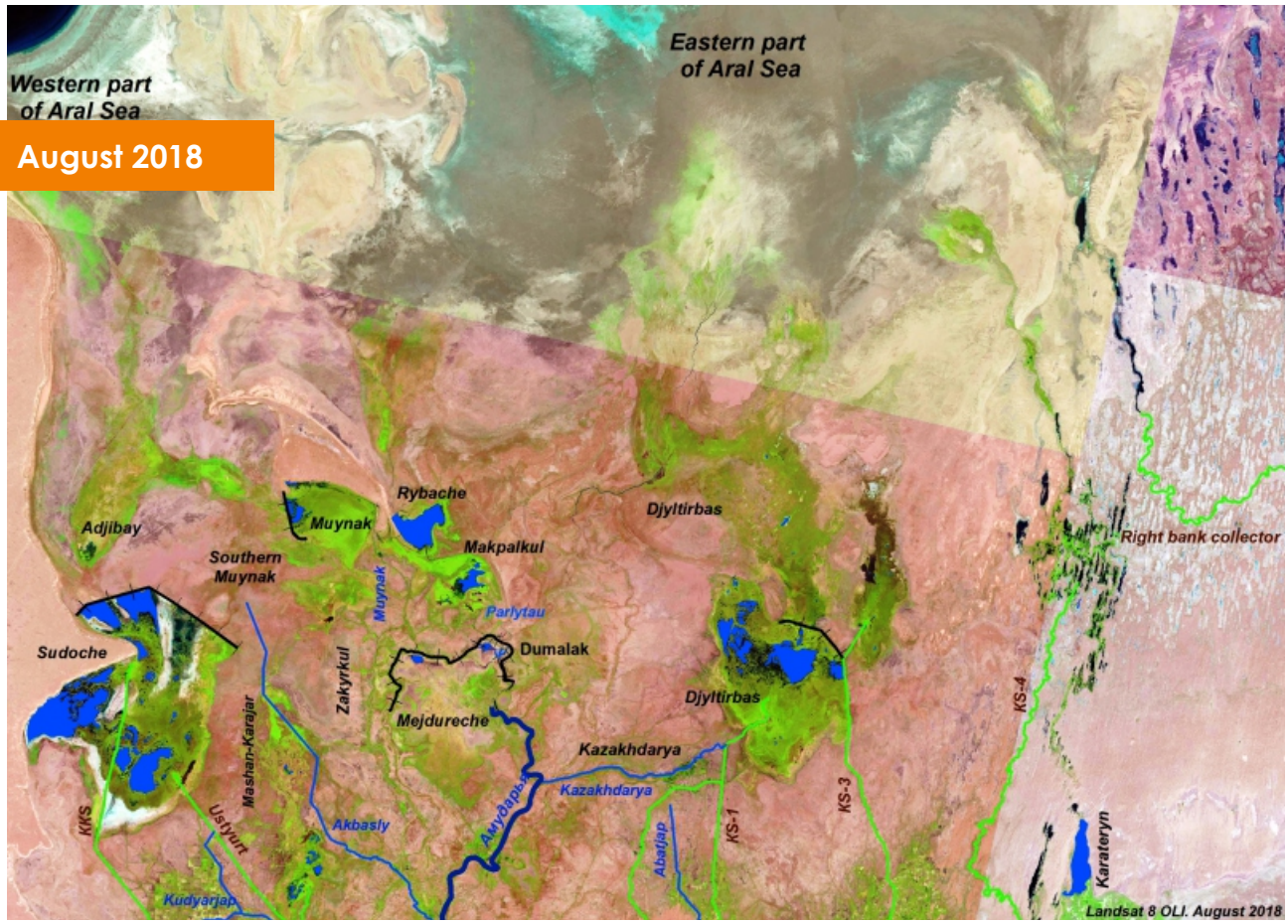
For comparison of the status of lake systems in the Amu Darya, let's compare the data over 2017. That period, 10.721 km^3 flew to the delta and, consequently, the lake systems were filled with water in August. This is proven by satellite images in Figure 2.

Table 4. Wetland areas of lake systems in the Amu Darya delta, ha

Water body	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Sudoche	47,594	46,874	47,804	52,347	58,554	58,296	61,550	62,838
Mejdureche	29,011.9	31,336.0	33,334.1	34,928.9	35,657.4	35,888.7	36,007.9	35,434.0
Rybache	7,523.0	7,798.5	8,296.8	8,485.5	8,539.1	8,464.0	8,514.0	8,786.0
Muynak	14,844.7	15,165.2	15,377.1	15,537.3	15,597.0	15,256.7	15,617.9	15,768.4
Djiltyrbas dam-terminated	41,226.8	41,592.7	41,817.2	41,849.3	41,892.7	41,275.7	41,786.9	41,951.0
Djiltyrbas (together with former right and left streams)	97,249.0	97,475.2	97,895.9	98,594.3	98,874.4	98,943.5	99,007.9	98,994.3
Dumalak	15,780.2	15,975.6	16,038.1	16,050.5	16,050.5	16,050.6	16,050.6	16,050.6
Makpalkul	1,243.7	7,583.5	7,644.7	7,644.8	7,920.8	7,733.4	8,171.0	8,341.2
Mashan Karadjar	23,890.9	24,012.7	25,245.4	26,352.6	26,697.9	26,400.0	26,698.5	26,841.8
Water surface southward of Muynak	8,806.4	9,246.3	9,618.2	9,618.2	9,618.2	9,553.0	9,577.6	9,558.4
Water surface along Kazakhdarya river channel	4,730.2	4,751.5	4,751.5	4,751.5	4,751.1	4,751.5	4,751.5	4,751.5
Zakirkol	2,605.1	2,684.2	2,781.2	2,791.2	2,791.2	2,791.2	2,791.2	2,791.2
Total:	**294,506**	**299,744**	**310,604**	**318,951**	**326,944**	**325,404**	**330,526**	**332,106**

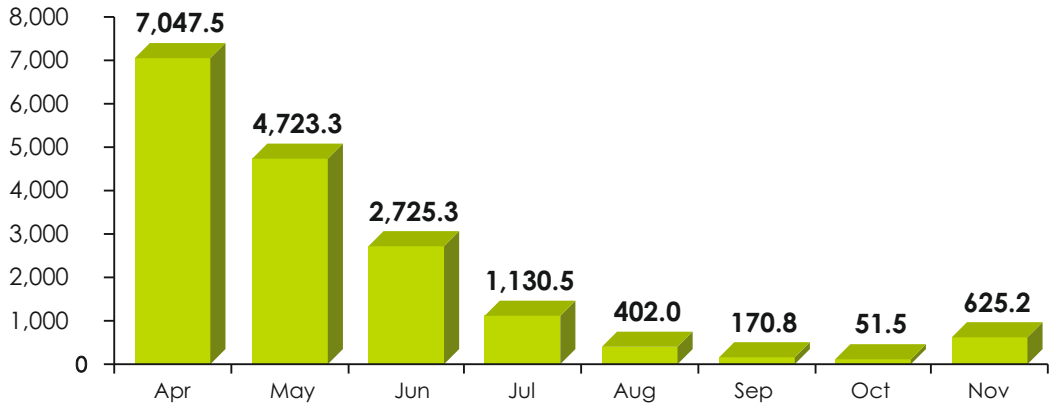
Figure 2. Satellite images of local water bodies in the Amu Darya delta
(Landsat 8 OLI)





Mejdureche reservoir. Almost all water in the Mejdureche reservoir is used up in the mid-season, and the reservoir becomes completely dried by October as shown in the diagram below.

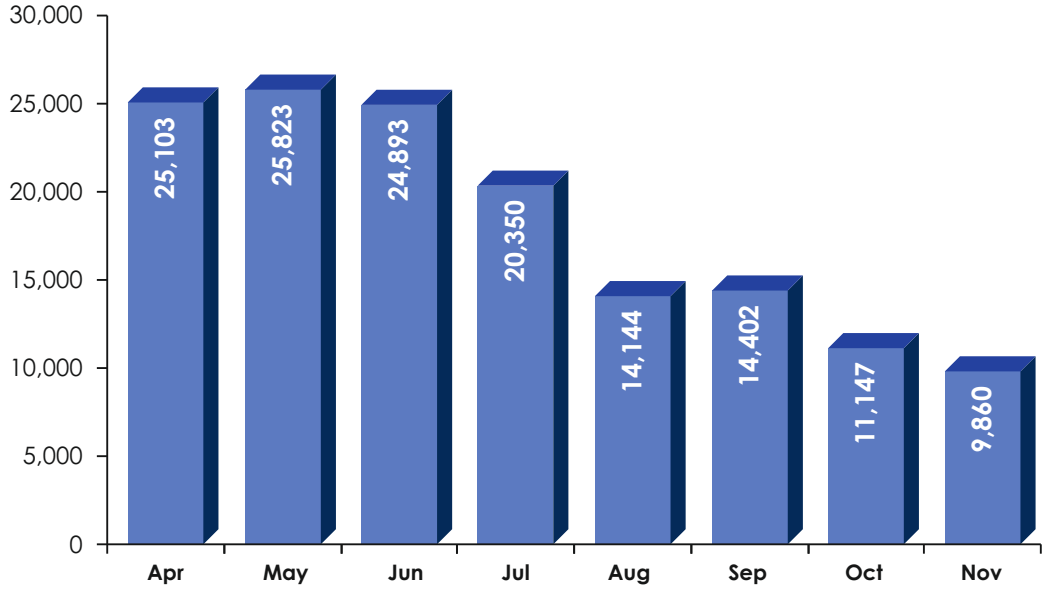
Dynamics of changes in the water surface area of Mejdureche reservoir 2018 (ha)



The Sudoche lake system is a state reservation. This reservation is expected to be included in the List of wetlands of the Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat.

The Sudoche lake system is recharged by drainage water mainly. At the same time, the river water inflow in early 2018 (60% of the annual value) kept the water surface area stable till June. After a decrease in the inflow, the area of lake has shrunk by 61% by November.

Dynamics of changes in the water surface area of the Sudoche Lake system, 2018 (ha)



Similar situation was observed in other lakes: Muynak, Rybache, Djiltyrbas. Moreover, Dumalak and Zakirkol lakes have dried up.

Conclusion

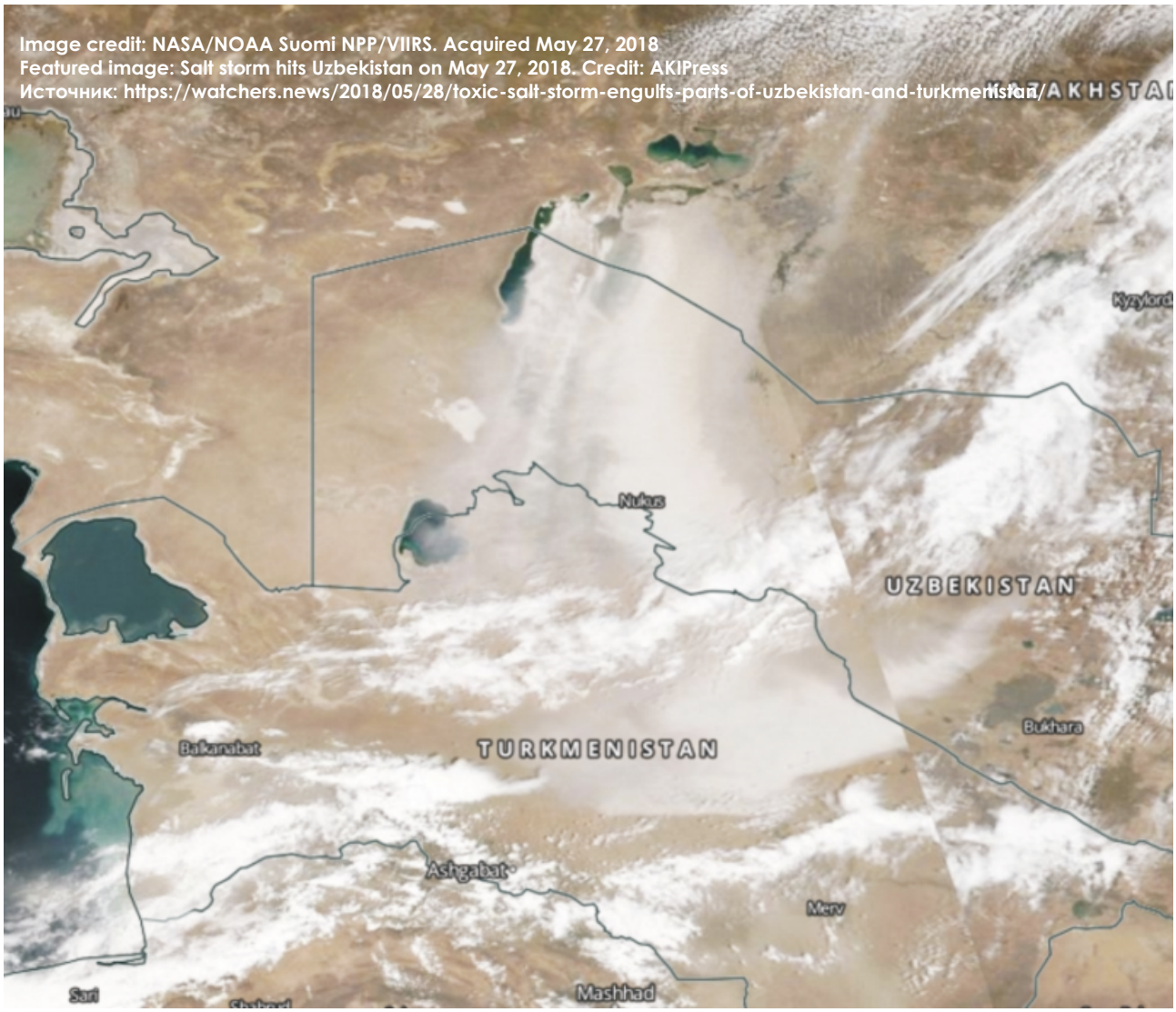
The results of monitoring over changes in water surface area of the Large Aral Sea and wetlands of the South Prearalie in 2018 indicate to continuing desertification. This is caused by dry conditions of the year and ineffective control over water use.

The planned infrastructure in the South Prearalie does not ensure stability of water surface areas for more than half a year. This could lead to the total loss of fish stock. The fish catch amounted to 2 tons in 2010, whereas only 0.4 tons of fish were caught in 2018. In this context, joint and coordinated actions of all riparian countries are needed on water conservation in order to ensure required amount of water (not less than 8 km3 a year) for the nature of the South Prearalie and the Aral Sea itself, including:

- drawing up of a strategy for environmental improvement and better water supply in the South Prearalie;
- development of feasibility study of a set of measures in the South Prearalie – completion of construction of infrastructure in the Amu Darya delta, including the Mejdureche reservoir and lake systems, the system of drainage water transfer from the Ozerniy collector to the Amu Darya;
- development of water governance system in the South Prearalie, including water management rules in the South Prearalie and recommendations for BWO Amu Darya and BISA to improve water efficiency in the lower reaches and ensure stable water supply to lakes and the Aral Sea;
- monitoring.

2.3. Dust and Salt Storm

A strong dust and salt storm hit north-western parts of Uzbekistan (Khorezm, Bukhara, and Navoiy provinces and Karakalpakstan) and northern Turkmenistan in the end of May 2018 and caused serious damage to crops and livestock.



Uzbekistan

The Hydrometeorological Service of Uzbekistan (UzHydromet) has recorded that the maximum permissible level (MPL) of dust in the air of Karakalpakstan and the Khorezm province was exceeded 3-5.9 times after the dust and salt storm. The analysis of samples in observation points showed that the dust level in the air in Nukus was 5.9 times higher than MPL on the 28th of May (data at 13:00).

UzHydromet's comments on the source of the storm (excerpts):

"On 27-28 May the cold air mass intruded from the northwest to the territory of Uzbekistan. High speed of frontal movement and wide temperature contrasts in the front zone contributed to strong northwest and north winds in all regions throughout the Republic. The wind speed reached 17-22 m/s and even 25-27 m/s in some areas. Most unfavorable weather conditions were observed in Karakalpakstan and the Khorezm province.

Dry weather has been observed in this region for a long period of time (last raining was on 25 April there). In May, the air intrusion was not accompanied by precipitation as well. Temperature contrasts in the front zone reached 20 degrees and more. Strong wind, which continued the whole day, has taken a huge amount of dust from the dried ground to

the air. Moreover, prevalent north wind caused transportation of salt from strongly saline ground of the dried bed of the Aral Sea…Dust and salt 'clouds' spread over large distances. Salt precipitated on roads, buildings and plants like a white powder."

Turkmenistan

The dust and salt storm hit the south of Dashoguz and Lebap provinces and reached even Ashkhabad. On 28 May, the citizens of Ashkhabad witnessed the thick 'fog', which turned to be clouds of white dust particles.

Excessive concentration of the dust sharply decreased road visibility, and the city seemed to be enshrouded in white haze from the foothills of the Kopet Dagh.

White dust covered plants and soils, intruded into buildings and lodged on cars. The concentration of dust was decreasing gradually, but even on 30 May the dust was clearly visible in the air of the capital of Turkmenistan.

Aftermath of the Storm

The resident of the Kungrad district, Karakalpakstan, Mr. T.Gayibov told that early vegetables were damaged seriously. Many dwellers tried to flush leaves of cucumbers, tomato and sweet pepper, but crops failed. Moreover, cattle died as the animals ate grass that was poisoned by salt.

According to hydrometeorologists, the MPL of dust in air samples taken in Nukus on the evening of May 27th was exceeded by 50%. At the same time, laboratory analyses showed that solid residues of phosphate, copper and nitrate in the soil did not exceed the MPL.

Allergy specialists observed that bronchial asthma and allergy disease incidences in Karakalpakstan would grow due to the dust and salt storm.

As a result of dust and salt storm in Dashoguz, a layer of salt covered cotton and wheat fields, as well as vegetable and fruit orchards. The thickness of this layer reached 1 cm in some villages. As a correspondent in Dashoguz reported, "the silkworm does not eat leaves of mulberry since those are salt covered. This creates additional complexities. Farmers have to flush the leaves and wipe them dry to feed silkworms…" He added that pastures were also covered with salt: "Small ruminants and cattle do not eat grass. Livestock farms suffer from huge damage…"