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# ANTHROPOGENIC CHANGES IN DRAIN IN LOWERS OF THE SYRDARYA RIVER

**Abstract.** Based on the analysis of information and analytical materials of the Main Administration of the USSR Hydrometeorological Service, RSE «Kazgidromet» and the «Aral-Syrdarya Basin Inspectorate for Regulation of Use and Protection of Water Resources» atthe Committee on Water Resources of the Ministry of Agriculture of the Republic of Kazakhstan has estimated the anthropogenic flow change in the lower reaches of the Syrdarya River on hydrological posts, with the determination of the coefficient of desiccation, characterized by a decrease in the carrying capacity of the river under the influence of not only changes in the hydrological regime of the river in the upper reaches, but also economic activities carried out in the catchments of the river basin.
**Keywords:** river, basin, hydrology, regime, natural, anthropogenic, modern, analysis, assessment, equation.

**Introduction.** Currently, there is a catastrophic water-ecological situation in the Syrdarya river basin, which is explained, first of all, by its transboundary position, as well as by the confinement of the lower part of the basin to arid inland areas where the river receives almost no tributaries. The situation is aggravated by the fact that it is in these areas within Kazakhstan that the Syrdariya river is the main waterway and the source of water supply for the population and various sectors of the economy, the main areas of population as well as industrial and agricultural development to its valley. Irrational economic activity in the catchment area, including the use of water resources, also has a great influence on the ecological status of the basin-river system in the lower reaches of the Syrdarya river [1-8].

**Purpose of the study** based on the analysis of information and analytical materials of the Main Directorate of the Hydrometeorological Service of the USSR, RSE «Kazgidromet» and the «Aral-Syrdarya Basin Inspectorate for Regulation of Use and Protection of Water Resources»at the Committee on Water Resources of the Ministry of Agriculture of the Republic of Kazakhstan in the lower reaches of the Syrdarya river under the influence of economic activity.

**The object of research.** Syrdarya is the second in terms of water content and the first in length along the river of Central Asia. From the sources of Naryn, its length is 3019 km, and the basin area is 219 thousand km$^2$. The sources of the Syrdarya lie in the Central (Inner) Tien Shan. After the confluence of Naryn and Karadarya, the river is called Syrdarya. The power of the river is glacial and snowy, with the latter predominating. For the water regime is characterized by spring-summer flood. The largest stock falls in June. The main flow of the Syrdarya is formed on the territory of the Kyrgyz Republic. Then Syrdarya crosses Uzbekistan and Tajikistan and flows into the Aral Sea on the territory of Kazakhstan. The total length of the channel in the catchment area of the Syrdarya River is 22,212 km and the basin area is 219,000 km$^2$ [4-9].

The reservoir of the Syrdarya river basin has several reservoirs: Toktoguls (19.5 km$^3$, Kyrgyzstan), Kairakkum (4.2 km$^3$, Tajikistan), Lake Aydarkul (41 km$^3$, Uzbekistan) and Shardarins (5.7 km$^3$, Kazakhstan). In order to regulate spring floods and water discharges from the Toktogul hydropower plant, Kazakhstan built the Koksaray reservoir (45 km dam length) in the South Kazakhstan region with a volume of three billion cubic meters, which was first filled in spring 2010 [10].

Syrdarya previously flowed into the Aral Sea, now, due to the catastrophic decline in its level and the collapse of the sea into two parts in 1989, the river flows into the northern part of the sea, (the so-called "Small Sea"). The waters of the Syrdarya are largely dismantled for economic needs; therefore, the current volume of flow in the estuary has decreased by more than 10 times (from 400 to 30 m$^3$/s) as compared with the conditionally natural period (until 1960) [9].

**Materials and research methods.** The study of long-term hydrological data on the hydrological posts of the Syrdarya River, located below the Shardara reservoir, was based on the materials of the Main Directorate of the Hydrometeorological Service of the USSR, RSE «Kazgidromet» and the «Aral-Syrdarya Basin Inspectorate for Regulation of Use and Protection of Water Resources, the Committee on Water Resources of the Ministry of Agriculture» of the Republic of Kazakhstan[10-14].

The hydrological study of the Syrdarya river in the lower reaches is comparatively satisfactory, since the hydrological posts Shardara, Tomenaryk, Kyzylorda and Kazalinsk and the upper reaches of the Naryn river and the Naryn hydrological post from 1911 to 2015 have the longest observations. . At the same time, the hydrological posts «Naryn» and «Shardara» have constant observations from 1911 to the present, which can serve as analogs when restoring the average annual discharge of the river along the hydrological posts «Tomenaryk», «Kyzylorda» and «Kazalinsk», i.e. the hydrological post «Naryn» is located on the zones of formation of the flow of the Syrdarya river, and the hydrological post «Kazalinsk» is located as a closing target in the area of flow drainage (figure 1-6).

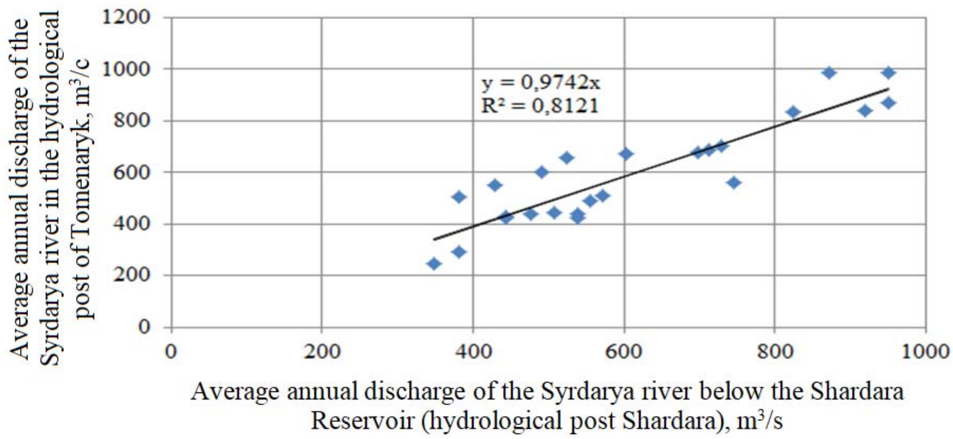


Figure 1 – Dependence of the average annual discharge of the Syrdarya river water in the Tomenaryk hydrological station on the average annual discharge of the Syrdarya river below the Shardara reservoir (hydrological post Shardara) during the natural regime

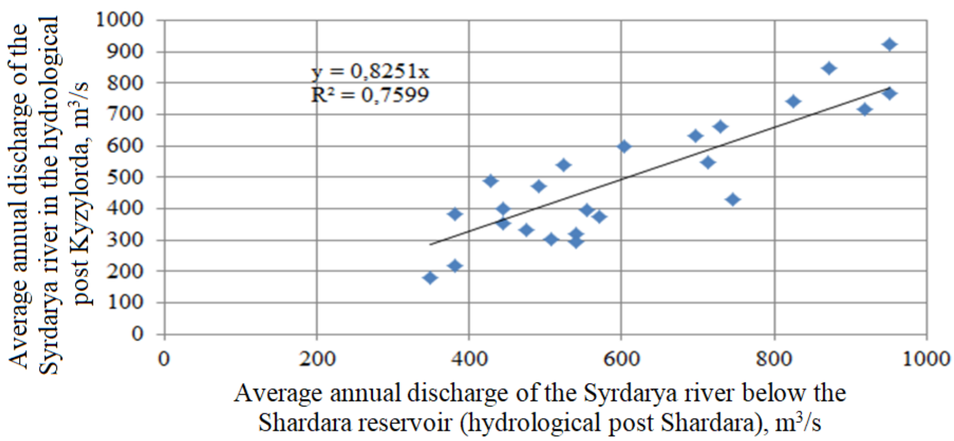


Figure 2 – Dependence of the average annual discharge of the Syrdarya river in the hydrological station Kyzylorda on the average annual discharge of the Syrdarya river below the Shardara reservoir (the hydrological post Shardara) during the natural regime

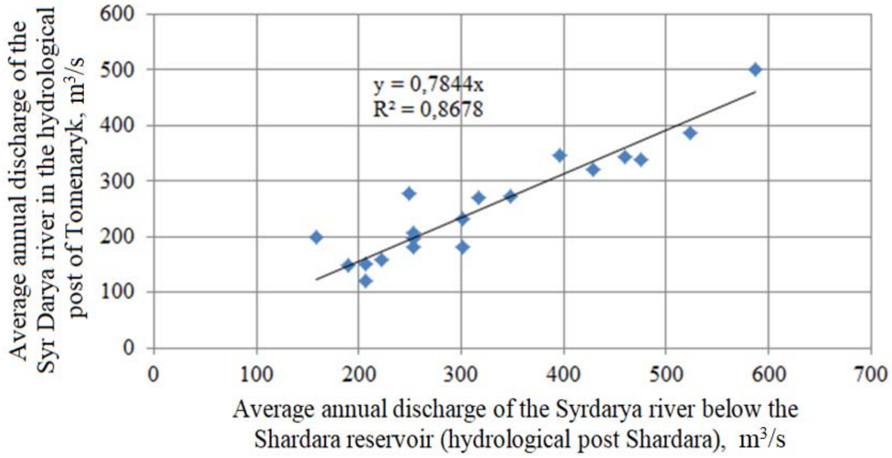


Figure 3 – Dependence of the average annual discharge of the Syrdarya river water in the Tomenaryk hydrological station on the average annual discharge of the Syrdarya river below the Shardara reservoir (hydrological post Shardara) during the anthropogenic regime

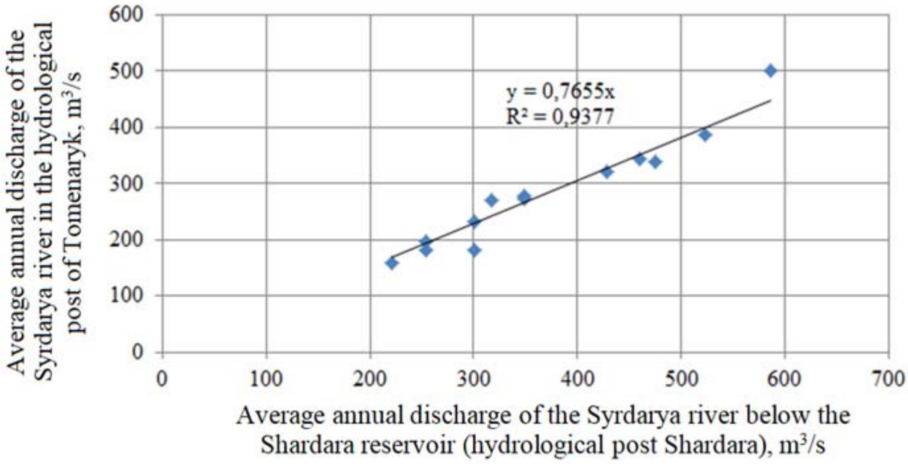


Figure 4 – Dependence of the average annual discharge of the Syrdarya river water in the Tomenaryk hydrological station on the average annual discharge of the Syrdarya river below the Shardara reservoir (the Hydrological post Shardar) during the modern regime

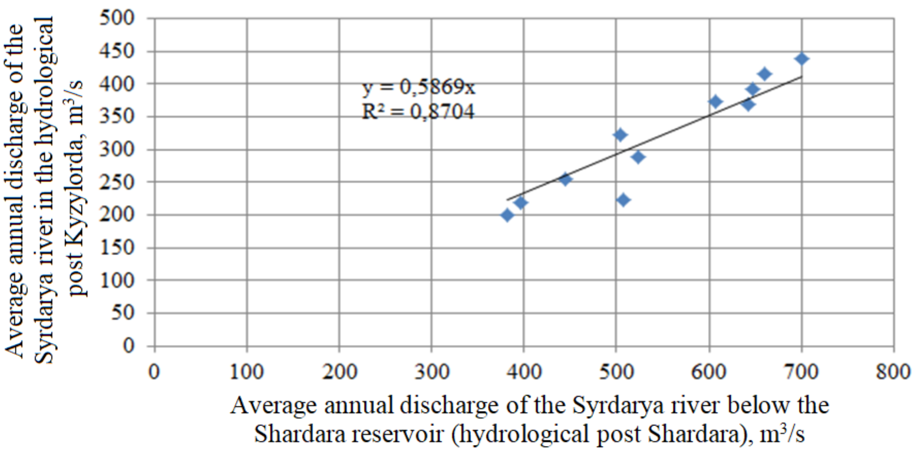


Figure 5 – Dependence of the average annual discharge of the Syrdarya river in the hydrological post Kyzylorda on the average annual discharge of the Syrdarya river below the Shardara reservoir (the hydrological post Shardara) in the period of the modern regime

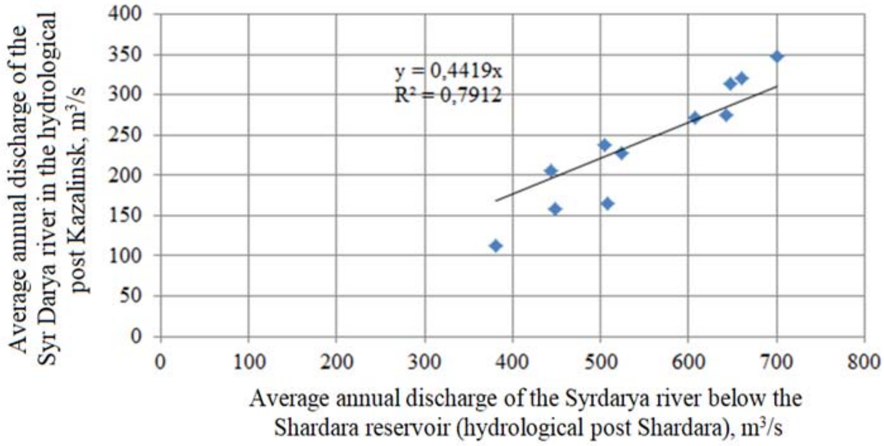


Figure 6 – Dependence of the average annual discharge of the Syrdarya river water
in the Kazalinsk hydrological station on the average annual discharge of the Syrdarya river below the Shardara reservoir
(the hydrological post Shardara) during the modern regime

Thus, as a result of statistical analysis of information and analytical materials of the Main Directorate of the Hydrometeorological Service of the USSR, RSE «Kazgidromet» and the «Aral-Syrdarya Basin Inspectorate for the regulation of the use and protection of water resources» at the Committee on Water Resources of the Ministry of Agriculture of the Republic of Kazakhstan hydrological posts by the method of hydrological analogy obtained regression equation with a high correlation coefficient (table 1).

Table 1 – Information on the reconstruction of the rows of the average annual discharge of the water of the Syrdarya River

| River | River analogues, hydrological post | Regression equation | Correlation coefficient |
|---|---|---|---|
| Natural regime | | | |
| Tomenaryk | Shardara | $У = 0{,}9742 \cdot X$ | $R = 0{,}90$ |
| Kyzylorda | Shardara | $У = 0{,}8251 \cdot X$ | $R = 0{,}87$ |
| Anthropogenic regime | | | |
| Tomenaryk | Shardara | $У = 0{,}7844 \cdot X$ | $R = 0{,}93$ |
| Modern regime | | | |
| Tomenaryk | Shardara | $У = 0{,}7655 \cdot X$ | $R = 0{,}97$ |
| Kyzylorda | Shardara | $У = 0{,}5869 \cdot X$ | $R = 0{,}93$ |
| Kazalinsk | Shardara | $У = 0{,}4419 \cdot X$ | $R = 0{,}89$ |

Assessing the impact of economic activity on the formation of runoff watersheds in the Recmi basin presents great difficulties, since their complexity lies in the fact that the influence of anthropogenic factors has to be estimated against the background of natural fluctuations in runoff and natural flow-forming factors.

**Research results.** Based on the use of the regression equation obtained by the method of hydrological analogs, the average annual discharge of the Syrdarya river water by the «Tomenaryk», «Kyzylorda» and «Kazalinsk» hydro posts in the absence of observation, which allowed us to imagine the long-term average annual discharge in the Syrdarya river sections, that is, the hydrological posts «Naryn», «Shardara», «Tomenaryk», «Kyzylorda» and «Kazalinsk» (figure 7–11).

As can be seen from figure 1–5, the long-term and modern period tends to increase in the hydrological posts of Naryn and Shardara, and the hydrological posts of Tomenaryk, Kyzylorda and Kazalinsk located below the Shardara reservoir, on the contrary, there is a constant decrease in the average annual discharge of the Syrdarya river. It should be noted that in the long-term fluctuations in the average annual water discharge of the hydrological posts of Naryn located above the Toktogul reservoir and the hydrological posts of Shardara located below the Shardara reservoir, there is a weak positive trend during the observation period, which did not particularly affect the general direction of change in the average annual discharge for many years.

Thus, the analysis of observational data on the average annual discharge of water in the lower reaches of the Syrdarya River showed that, beginning in the 1970s, the average annual discharge began to change significantly under the influence of anthropogenic factors and economic activity.

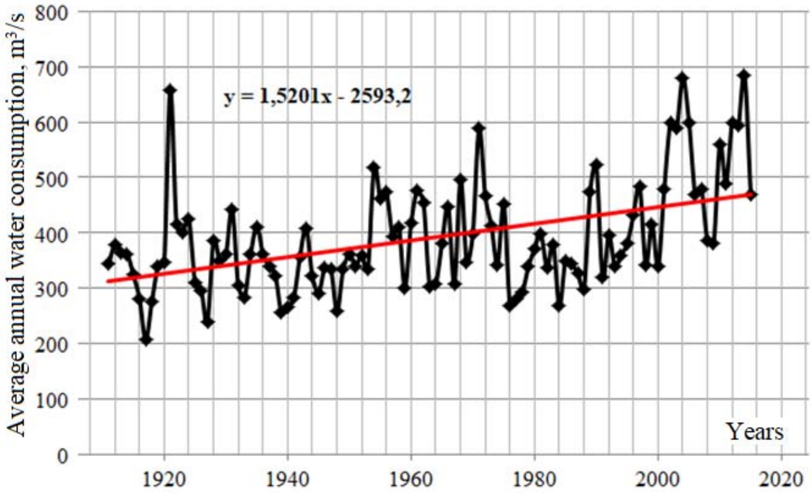


Figure 7 – The long-term course of the average annual water discharge at the hydrological posts of the Naryn River of the Syrdarya

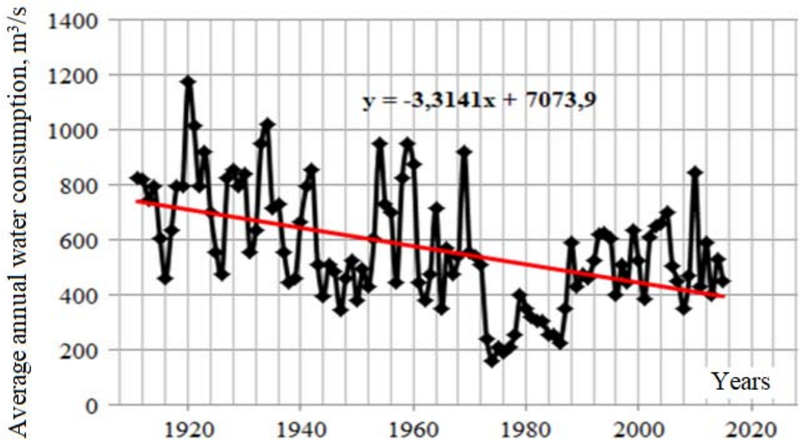


Figure 8 – The long-term course of the average annual discharge of the hydrological posts of Shardara (below the Shardara reservoir) of the Syrdarya river

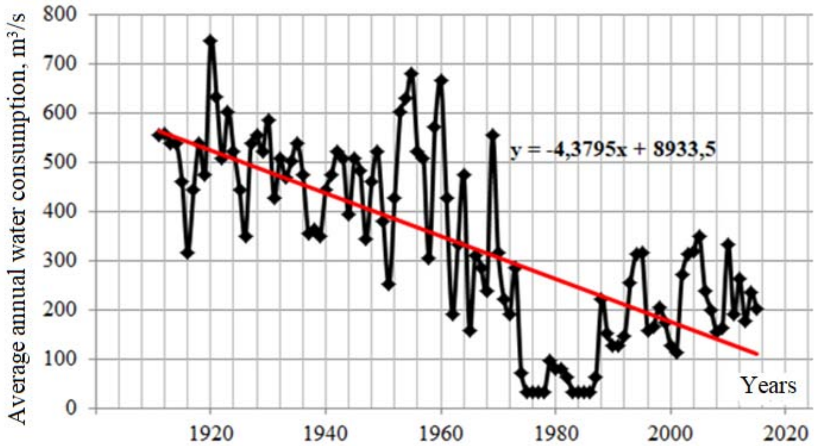


Figure 9 – The long-term course of the average annual water discharge of the hydrological posts of the Tomenaryk of the Syrdarya River

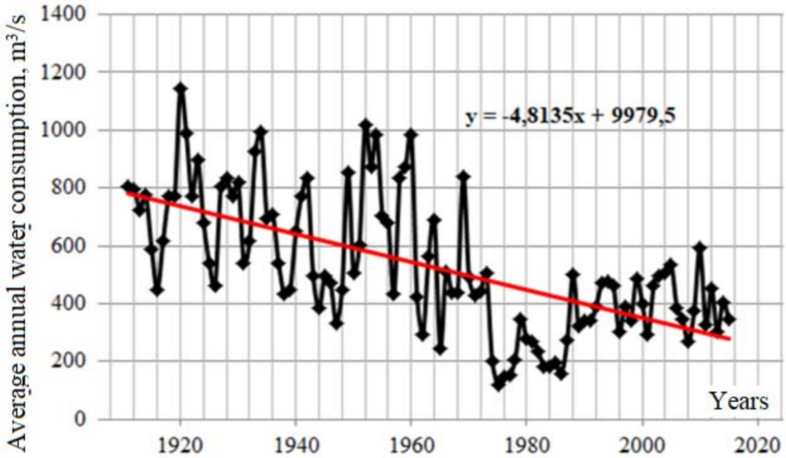


Figure 10 – The long-term course of the average annual water discharge at the Kyzylorda hydrological posts of the Syrdarya River

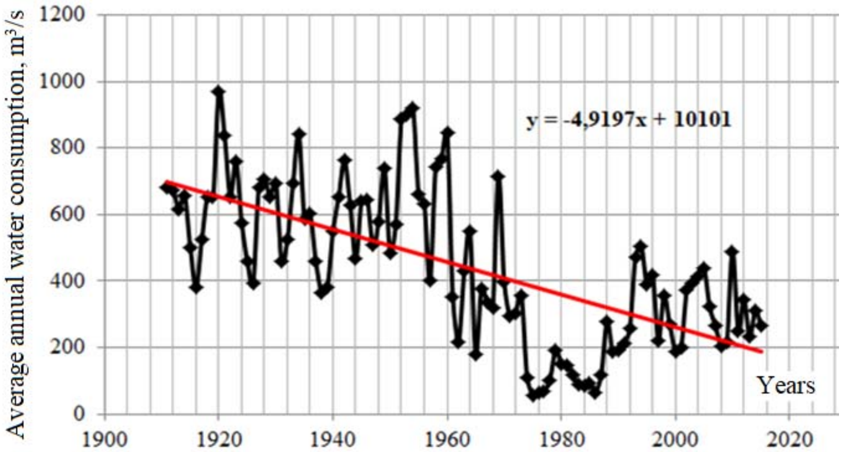


Figure 11 – The long-term course of the average annual water discharge of the hydrological posts of the Kazalinsk,Syrdarya River

Figure 12 shows the difference integral curve for the hydrological posts Naryn, Shardara, Tomenaryk, Kyzylorda and Kazalinsk, as well as the trend line in the area of maximum slope of curve 6 (1970-2015).

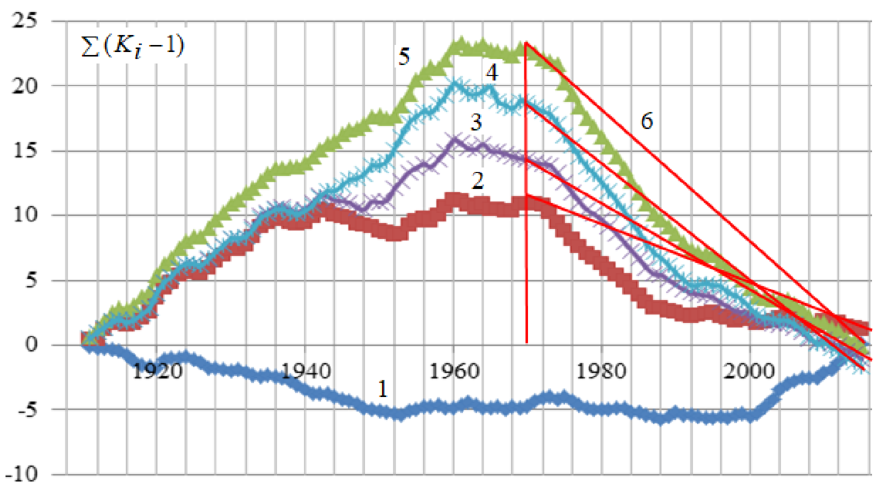


Figure 12 – Integral difference curve in the lower reaches of the Syrdarya river by hydrological posts (1 - Naryn; 2 - below the Shardara reservoir (Shardara); 3 - Tomenaryk; 4 - Kyzylorda; 5 - Kazalinsk)

At the same time, the integral difference curve shows that in the zone of their increase a growth in the average annual water flow is observed, and in the zone of maximum inclination of the trend line there is a decrease in the average annual water flow in the below Shardara reservoir [15].

Based on the maximum slope of the trend line, which characterize the decrease in the average annual discharge of the lower reaches of the Sydarya River, then below the Shardara reservoir, the trend line equation on curve 6 (Figure 6) has the following form:

- for the hydrological station Shardar (below Shardarareservoirs): $У = –0,4796 \cdot X + 955,43$;
- for the hydrological station Tomenaryk: $У = –0,5000 \cdot X + 1010,46$;
- for the hydrological station Kyzylorda: $У = –0,3359 \cdot X + 675,73$;
- for the hydrological station Kazalinsk: $У = –0,4463 \cdot X + 897,62$.

Thus, the representative period was determined by difference integral curves of the average annual water discharge at the hydrological posts located in the catchment area of the Syrdarya river basin, namely in the flow formation zone at the hydrological posts of Naryn and in the store area at the hydrological posts of Shardar, Tomenaryk, Kyzylorda and Kazalinsk located below Shardara reservoir. A multi-year period from 1911 to 2015, which was chosen as the calculation, includes three periods [9]:

- conditionally natural (1911-1970);
- sustainable water consumption - irrigation regime of the Toktogul hydroelectric station (1976-1992):
- sustainable water consumption - energy mode of operation of the Toktogul hydroelectric station (1993-2015).

The division of the period of sustainable water consumption into two is due to the fact that since 1993 the Toktogul reservoir regime has changed, that is, it previously worked in the irrigation mode, where discharges from it were carried out mainly in the autumn-summer period and made up about 75% of the total flow. In the middle of the 90s of the last century, the Toktogul reservoir operation mode changed dramatically, that is, to generate the necessary electricity for Kyrgyzstan, the main water releases were carried out in the winter months, during which about 60% of the total flow volume was triggered, which led to some increase in the lower reaches of the Syrdarya River [9; 15-17].

The current hydrological situation in the lower reaches of the Syrdarya River urgently requires a balanced use of water resources, necessitates an assessment of the impact of anthropogenic factors on the flow and hydrological regime. The issues of assessing the direction and magnitude of changes in river flow under the influence of climate change and human economic activities are of paramount practical and scientific and methodological importance, since their solution allows to take into account the nature and extent of changes in both water resources and the complex environmental conditions of the river basin watershed [9; 18; 19].

Thus, the cited dynamics of changes in expenditures of the lower reaches of the Syrdarya River in the hydrological posts Shardara, Tomenaryk, Kyzylorda and Kazalinsk during the period of observations from 1911 to 2015 showed that as the flow in the upper reaches was regulated by reservoirs from 1955 to 1980, that is, Kairakkum's (1956), Shardara's (1965), Sharvak's (1970), Toktogul's (1975) and Andijan's (1978) with a total usable capacity of 33.1 km3, which was commensurate with the annual flow of the Syr Darya River. Consequently, the felting of such hard anthropogenic activities in the lower reaches of the Syrdarya river began the process of drying out, which radically changed the weight of the hydraulic and geomorphological conditions of water flow, flow and channel indicators.

The dynamics of river drying is expressed by a coefficient that takes into account the ratio of costs left in the river bed to maintain its hydro-ecological balance between adjacent gauging stations [10]:

$$\eta = Q_{пос} / Q_{пр} ,$$

where $\eta$ – river drying coefficient; $Q_{пр}$ – consumption of upper gauging station; $Q_{пос}$ – consumption of lower gauging station.

The change in the coefficient of river desiccation between adjacent hydrological posts below the Shardara reservoir and relative to the hydrological post Shardar is shown in table 2.

Table 2 – Changes in the coefficient of drying in different periods of anthropogenic impacts in the lower Shardara reservoir

| Hydrological post | Indicators | Periods of anthropogenic impacts in the lower Shardara reservoir | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1911-1920 | 1921-1930 | 1931-1940 | 1941-1950 | 1951-1960 | 1961-19700 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Shardara | $Q_{пр}$ , m³/s | 764,2 | 776,9 | 672,8 | 524,5 | 699,3 | 542,2 |
| Tomenaryk | $Q_{пос}$ , m³/s | 744,4 | 756,8 | 655,4 | 559,0 | 798,4 | 493,1 |
| | $\eta$ | 0,97 | 0,97 | 0,97 | 1,07 | 1,14 | 0,91 |
| Kyzylorda | $Q_{пос}$, m³/s | 630,5 | 737,8 | 545,9 | 611,2 | 733,2 | 387,0 |
| | $\eta$ | 0,82 | 0,95 | 0,81 | 1,16 | 1,05 | 0,71 |
| Kazalinsk | $Q_{пос}$, m³/s | 517,2 | 526,4 | 443,5 | 459,4 | 516,7 | 329,1 |
| | $\eta$ | 0,68 | 0,68 | 0,66 | 0,88 | 0,74 | 0,61 |
| Tomenaryk | $Q_{пр}$, m³/s | 744,4 | 756,8 | 655,4 | 559,0 | 798,4 | 493,1 |
| Kyzylorda | $Q_{пос}$,m³/s | 630,5 | 737,8 | 545,9 | 611,2 | 733,2 | 387,0 |
| | $\eta$ | 0,85 | 0,97 | 0,83 | 1,09 | 0,92 | 0,78 |
| Kazalinsk | $Q_{пос}$, m³/s | 517,2 | 526,4 | 443,5 | 459,4 | 516,7 | 329,1 |
| | $\eta$ | 0,69 | 0,70 | 0,68 | 0,82 | 0,65 | 0,67 |
| Kyzylorda | $Q_{пос}$,m³/s | 630,5 | 737,8 | 545,9 | 611,2 | 733,2 | 387,0 |
| Kazalinsk | $Q_{пос}$, m³/s | 517,2 | 526,4 | 443,5 | 459,4 | 516,7 | 329,1 |
| | $\eta$ | 0,82 | 0,71 | 0,81 | 0,75 | 0,70 | 0,85 |

*Continuation of table 2*

| 1 | 2 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|
| Hydrological post | Indicators | Periods of anthropogenic impacts in the lower Shardara reservoir | | | | |
| | | 1971-1980 | 1981-1990 | 1991-2000 | 2001-2010 | 2011-2015 |
| Shardara | $Q_{пр}$,m³/s | 304,4 | 348,8 | 533,4 | 561,7 | 478,8 |
| Tomenaryk | $Q_{пос}$, m³/s | 282,4 | 265,6 | 406,2 | 436,0 | 366,5 |
| | $\eta$ | 0,93 | 0,76 | 0,76 | 0,82 | 0,76 |
| Kyzylorda | $Q_{пос}$, m³/s | 170,1 | 136,6 | 329,2 | 331,7 | 281,0 |
| | $\eta$ | 0,56 | 0,39 | 0,62 | 0,59 | 0,59 |
| Kazalinsk | $Q_{пос}$, m³/s | 107,1 | 83,4 | 198,7 | 245,8 | 213,1 |
| | $\eta$ | 0,35 | 0,24 | 0,37 | 0,44 | 0,44 |
| Tomenaryk | $Q_{пр}$, m³/s | 282,4 | 265,6 | 406,2 | 436,0 | 366,5 |
| Kyzylorda | $Q_{пос}$,m³/s | 170,1 | 136,6 | 329,2 | 331,7 | 281,0 |
| | $\eta$ | 0,60 | 0,51 | 0,81 | 0,76 | 0,77 |
| Kazalinsk | $Q_{пос}$, m³/s | 107,1 | 83,4 | 198,7 | 245,8 | 213,1 |
| | $\eta$ | 0,38 | 0,31 | 0,49 | 0,56 | 0,58 |
| Kyzylorda | $Q_{пос}$,m³/s | 170,1 | 136,6 | 329,2 | 331,7 | 281,0 |
| Kazalinsk | $Q_{пос}$, m³/s | 107,1 | 83,4 | 198,7 | 245,8 | 213,1 |
| | $\eta$ | 0,63 | 0,60 | 0,60 | 0,74 | 0,76 |

Analysis of the coefficient of desiccation of the lower reaches of the Sydarya River below the Shardara's reservoir for the period under review, that is, from 1911 to 2015 at intervals of 10 years showed that between the hydrological posts of Tomenaryk, Kyzylorda and Kazalinsk in unfavourable conditions there were areas below the Kyzylorda hydroelectric complex, where the coefficient of desiccation in the period of anthropogenic activities, that is, sustainable water consumption – the irrigation regime of the Toktogul hydroelectric station (1976-1992) was below 0.56.

Therefore, the long-term analysis of the average annual water discharge and the integral difference curve along the hydrological posts located in the lower Shardara reservoir and based on their obtained trend line equation show that an intensive process occurs in the lower reaches of the Syrdarya River, that is, an intensive process of drying up of the river takes place from the Shardara reservoir to the Small Aral Sea.

**Conclusions.** In order to make an appropriate decision when using the water resources of the Syrdarya river basin, there is a need to change the modern principles in the field of environmental management, and the fundamental change of traditional methods and methodology of natural science to a new one, based on the properties of the natural environment, considered independently of our activities, and on the basis of laws of nature.

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**АНТРОПОГЕННЫЕ ИЗМЕНЕНИЯ СТОКА В НИЗОВЬЯХ РЕКИ СЫРДАРЬИ**

**Аннотация.** На основе анализа информационно-аналитических материалов Главного управления гидрометеорологической службы СССР, РГП «Казгидромет» и «Арало-Сырдарьинской бассейновой инспекции по регулированию использования и охране водных ресурсов» Комитета по водным ресурсам Министерствасельского хозяйства Республики Казахстан произведена оценка антропогенного изменения стока в низовьях реки Сырдарьи по гидрологическим постам, с определением коэффициента усыхания, характеризующегося уменьшение пропускной способности реки под влиянием не только изменения гидрологического режима реки в верховьях, но и хозяйственной деятельности, проведенной в водосборах бассейна реки.

**Ключевые слова:** река, бассейн, гидрология, режим, естественный, антропогенный, современный, анализ, оценка, уравнение.

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**СЫРДАРЬЯ ӨЗЕНІНІҢ ТӨМЕНГІ АЛАБЫНДАҒЫ СУ АҒЫНЫНЫҢ ТЕХНОГЕНДІК ӨЗГЕРУІ**

**Аннотация.** ССРО-ның гидрометеорологиялық қысметінің бас басқармасының, «Қазгидромет» РММ-нің және Қазақстан Республикасының Ауылшаруашылық министерлігіне қарасты Су ресурстар комитетінің «Арал-Сырдарья алабының су ресурстарын пайдалануды реттеу және қорғау инспекциясының» ақпараттық-талдау мәліметтерін жүйлеудің негізінде Сырдарья өзенінің төменгі алқабында орналасқан гидрологиялық бекеттер бойынша құрғау көрстеткішін анықтау арқылы су ағынының өтімінің техногендік өзгеруіне баға берілген, ал ол тек қана өзеннің гидрологиялық режимінің өзгеруінің әсерінен өзеннің су өткізу қабілетінің төмендегенін ғана сипаттап қоймайды және ол өзеннің сужинау алабындағы жүргізілген шараушылық қызметтерге байланысты екендігін көрсетеді.

**Түйін сөздер:** өзен, сужинау алабы, гидрология, режимі, табиғи, техногендік, сқазіргі, талдау, бағалау, теңдеу.

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**REFERENCES**

[1] Ibatullin S.R. Water resources of Central Asia: current state, problems and prospects of use. Almaty, 2013. 144 p.

[2] The water and energy resources of Central Asia: problems of use and development (industry review). 2008. 44 p.

[3] The relationship of water and energy resources in Central Asia. Improving regional cooperation in the Syrdarya basin. 2004. 62 p.

[4] Mustafayeva L.Zh., Seidualiev M.A. Ecological and economic efficiency of water and land resources use (on the example of the Syrdarya river) (Analytical review). Taraz, 2003. 80 p.

[5] Mustafayev Z.S., Pulatov K., Kozykeeva A.T., Mustafayeva L.Zh. Environmental assessment of natural systems in the Aral Sea Basin zones (Analytical review). Taraz, 1997. 80 p.

[6] Mustafayev Z.S., Pulatov K., Kozykeeva A.T., MustafayevaL.Zh. Ways to improve the natural-ecological situation in the Aral Sea Basin (Analytical review). Taraz, 1997. 70 p.

[7] Mustafaev Z.S., Kozykeeva A.T. The Aral Sea Basin: Past, Present and Future. Taraz, 2012. 318 p.

[8] Burlibaev M.Zh., Get it J.D., Tursunov A.A. Aral-Syrdarya basin: hydrological problems, water allocation issues. Almaty: Dauir, 2001. 180 p.

[9] Water resources of Kazakhstan: assessment, forecast, management. Vol. IX. Inland and marginal reservoirs of Kazakhstan (Aral, Balkash, Kspiy). Book 1. Almaty, 2012. 456 p.

[10] Development of a complex of urgent and promising measures to increase the carrying capacity of the Syrdarya river below the Shardara reservoir to the Malaya Aral depression, taking into account the deterioration of the hydrological regime and increased anthropogenic pressures: R & D report (final). Taraz, 2005. 148 p.

[11] Surface water resources of the USSR. Middle Asia. The Syrdarya River Basin. L .: Gidromemoizdat, 1965. Vol. 14, release 1. 256 p.

[12] Surface water resources. Basic hydrological characteristics. Middle Asia. The basin of the river Syrdarya. L.: Gidromemoizdat, 1967. Vol. 14, release 1. 320 p.

[13] State Water Cadastre. Long-term data on the regime and resources of surface land waters. Kazakh SSR. L.: Gidromemoizdat, 1967. Vol. 14, issue 1. 268 p.

[14] Assessment of water resources and channel balance of the Syrdarya River within Kazakhstan. Tashkent-Almaty, 2011. 52 p.

[15] Burlibaev M.Zh., Faschevsky B.V., Opp K., Burlibaeva D.M., Kaydarova R.K., Vagapova A.R. Scientific basis for rationing the ecological flow of rivers of Kazakhstan. Almaty, Kanagat Publishing House, 2014. 408 p.

[16] The relationship of water and energy resources in Central Asia: Improving regional cooperation in the Syr Darya basin. Washington, DC, 2004. 65 p.

[17] Water resources and adaptation interventions in Central and West Asia. 2012. 12 p.

[18] Mustafayev Zh.S., Kozykeyeva A.T., Zhanymkhan Kurmanbek. (2019) Normalization of the ultimate allowable load in the drainage basin of the Karatal river basin // News of the National academy of sciences of the Republic of Kazakhstan. Series of agricultural sciences. 2019. Vol. 3, N 51. P. 37-44. ISSN 2224-526X. https://doi.org/10.32014/2019.2224-526X.33

[19] Mustafaev Zh.S., Kozykeeva A.T., Zhanymkhan K., Aldiyarova A.E., Mosiej Józef. The methods of assessment of maximum allowable impacts ecologically on small rivers // News of the National academy of sciences of the Republic of Kazakhstan.Series of geology and technical sciences, 2019. Vol. 2, N 434. P. 30-38. ISSN 2518-170X (Online), ISSN 2224-5278 (Print). https://doi.org/10.32014/2019.2518-170X.35

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