

## New data on the ecology of the Northern Aral Sea after the construction of the first Kokaral dam on the Berg Strait

Ayzhigit Mambetovich Nurgizarinov, Anipa Seydalevna Tapalova, Essenzhol Assylbekuly Nazarov, Akmaral Zhunisovna Sharipova

Kyzylorda State University named after Korkyt Ata, Ualiev str. 22/88, Kyzylorda, Kazakhstan

**Abstract.** The authors of this article "New data on the ecology of the Northern Aral Sea after the construction of the first dam on the sea Kokaral Berg Strait", devoted to the Northern Aral Sea, which was separated from the large sea Aral recently as "assignee" of itself. Based on my research and observations the authors have collected enough compelling material on the state ecology small Aral, its influence on the formation of biological resources. The authors believe that the small Aral ennobling influence on the environment is undeniable, because there is still performs the second stage of the project RSRNAS. Article was written in a simple form, convincingly.

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### Introduction

The Aral Sea is located in the middle of the desert Turan, has great importance for the development of human culture and wildlife in this lifeless space. Its northern part - the North Aral Sea was created recently at the beginning of the second millennium BC after the turn of the Syrdarya river in North- East [1, 2]. Nowadays, natural and economic significance of the Aral Sea increased dramatically. During the Aral Sea were caught annually 50.0 million tons of fish species. Syrdarya adjacent to the Aral Sea, was grown rich agricultural harvest. All of this was a great potential for the country's economy.

But, during the ecological crisis, which is raised rapidly in the second half of the last century, was destroyed the whole natural complex in the Aral sea region. Due to the reduction of Syrdarya, the Aral Sea supplied to shrinkage of two-thirds in the Kazakhstan part of the Aral Sea and many coastal lake systems. At the same time the danger was not only that the sea lost spread its fish production, but the wind came salt and dust mass removal from the dried seabed. Salt and dust mass was distributed by wind over long distances and settled on agricultural grasslands in the lower reaches of the Syrdarya River, adjacent to the dried Aral Sea area. As a result, fish production has stopped due to the reduction of fields and its productivity of forage lands livestock was suffered, agricultural fields of productivity are decreased. All these problems are seriously affected to the socio-economic situation of the population.

In these difficult circumstances, the international communities of Kazakhstan, Uzbekistan, Kyrgyzstan, Turkmenistan, Tadjikistan whose territories are located in the Aral Sea, were

negotiated to take practical measures to suspend destruction or at least restore the nature of the Aral Sea region. However, most states did not fulfill their promises. Therefore, Kazakhstan made an important decision to keep at least the northern part of the Aral Sea by separating it from the great sea. Thus emerged the idea of conversation, which then turned into reality in the form of the "Regulation of Syrdarya River and saving the Aral Sea" (RSRNAS) which provided as a branch of the Northern Aral Sea (NAS) from the Aral Sea by building large dams on the sea Kokaral Berg Strait (2005) and part of the hydroelectric project "Aklak" on the river Syrdarya (2009)[3]. After completion of the construction "Aklak" station part of the Syrdarya was aimed at restoring the desiccated coastal lakes. The results of these activities have a positive impact on the natural and economic recovery and development of complex socio-economic conditions of the population.

At present, Kazakhstan has embarked on the second stage of project construction. There is a discussion of the issue below.

Aral Sea as a unique inland body of water in the desert Turan lost its integrity as a result of the ecological crisis, which led to the shrinkage of two-thirds in the Kazakhstan part of its territory. At the same time the danger was not only that the sea lost spread its fish production, but the wind came salt and dust mass removal from the dried seabed, an area of 21.4 km<sup>2</sup>. Salt and dust mass was distributed by wind over long distances and settled on agricultural grasslands in the lower reaches of the Syrdarya River, adjacent to the dried Aral Sea area [4].

In these difficult circumstances Kazakhstan made an important decision to keep at least the

northern part of the Aral Sea by separating it from the great sea. Thus emerged the idea of conservation, which then turned into reality in the form of the "Regulation of Syrdarya River and Northern Aral Sea" (RSRNAS). The project has been built the first stage of the dam on the sea Kokaral Berg Strait, which connects the northern part of the Aral Sea with the large. After completion of the construction of the dam the Northern Aral Sea (NAS) almost turned into a man-made geographical object as natural buffer deterrent further destruction by Aral sea environment. Therefore, to restore and preserve the small sea had high hopes.

Kokaral dam was put into usage in 2005 (August) and has a mark of 42 meters, and the level of the Northern Aral Sea (NAS) for 40 yards on Baltik system (BS). After construction of the dam stock between the seas stopped, but it turned out to be temporary. It was assumed that after the cessation of the sea flow to fill the Northern Aral Sea will take several years. Observation showed that from September 2005 to September 2006 in the North Sea received  $8.5 \text{ km}^3$  of river water level of the North Sea and climbed to 41.79 m., when the layers of sea water above 40 meter mark became wash over the top edge of a dam in great sea views. Since then the process continues[5].

Northern Aral Sea (NAS) consists of four parts - the Central, Shevchenko bay, Butakova bay and Sarchaganak bay. Currently its total water mass is  $22 \text{ km}^3$ . This volume of water completely covers the central portion of the bays Shevchenko, Butakova, Sarchaganak and one third (1/3) of the total territory. Therefore fishery value have yet to deep - Central part of Shevchenko bay. To completely fill two shallow bays Butakova and Sarchaganak need to increase the water mass of the North Sea to the line of natural banks in the 50 years of last century, when the great sea level stood at around 53 meters on Baltik system (BS). The total water mass of the North Sea will be at least  $34\text{-}35 \text{ km}^3$ . But the current 42x - meter effective height of the first stage of the dam does not provide Kokaral raise the level of the North Sea to the natural line coasts. It evidenced by the fact that over the last 9 years of the Syrdarya River in its lower reaches received  $64.3 \text{ km}^3$ . Of this amount,  $24.5 \text{ km}^3$  received in the Northern Aral Sea (NAS), and  $39.8 \text{ km}^3$  went to great sea and lost useless for natural- economic complex in the region. 2011 Syrdarya river to the Aral Sea was  $4.6 \text{ km}^3$  of them small Sea received only  $1.2 \text{ km}^3$ . Therefore, the Northern Aral Sea in its present state cannot comply fully with their functions[6,7].

In this regard, a project was launched RSRNAS-2, which provides for the construction of

the second stage Kokaral dam with a height of 48 meters Baltik system (BS). At the moment of the Northern Aral Sea is  $2850 \text{ km}^2$  ( $28500.0$  acres) and the volume of water mass  $20.9 \text{ km}^3$ . In this regard, there are some positive environmental and socio-economic changes in the region. In the seaside village (Karatyup, Zhambyl, Tastyubek, Akespe) before abandoned fishermen returned to their residents. They are engaged in livestock and catch fish using recovered grasslands and rangelands coastal strip.

The results of our studies of the current ecological status of the North Aral Sea have shown that increasing the total mass of sea water through the Syrdarya has led to a decrease in the concentration of salts in sea water with  $23 \text{ g/l}$  to  $17 \text{ g/l}$ . When water ion composition analysis identified a decrease total alkalinity concentration ( $\text{HCO}_3$ ), chlorine (Cl) and sodium (Na), as compared with the same indicators hydrochemical large sea water. This is due to the effect of desalinated water river. Therefore, the Northern Aral Sea water becomes brackish than salt. Researchers note that increasing of the small Aral Sea and Syrdarya led to the reduction of the salinity of lakes, rivers and ground-waters, and are increasing the area of hydromorphic soils, restored delta lakes [8,9]. It is important to emphasize that the lower the salinity of sea water, the better the conditions in the environment for breeding, feeding, increase fish biomass. Now the Northern Aral Sea annual harvests of 4.5 tonnes, which is 10 (ten) times more than in previous years to the construction branch of the dam. Established that the total water area of the CAM at the site 17 % of the area closer to the mouth of the river Syrdarya breed 13 species of fish. Hatcheries "Koszhar" and "Tastak" actively working on recovering sea fish stocks, as well as an increase in the species composition of fish fauna, especially valuable species such as sturgeon and barbel to restore their populations in a small sea.

An important part of the project is hydroelectric station "Aklak" Kokaral on the Syrdarya capacity of 20 megawatts. The plant provides electricity for Aral and Kazaly areas and at the same time allow to regulate the flow of the river. At the same time, part of the river runoff enters the north of the Aral Sea, and the other part goes to the seaside dried lake systems. Building part of the powerhouse ended in 2009 (October), but the plant itself does not give power. Since part of the river runoff enters the dried lakes such as Karachalan, Zhylandy, Kyzylzharma, Domalak, Kartma. In 2013 (June) the total area of irrigated area amounted to more than 15.0 thousand hectares. The process continues. In coming years, the coastal water area of lake systems, commercial fishing importance will increase by an additional 60 hectares. Then the

volume of fish caught in the Aral Sea will reach to 10.0 million tons per year.

With the help of influence of the Northern Aral Sea coastal lakes and restored natural complexes by Aral sea hydromorphic land around the reservoirs become habitat of birds and animals associated with water cyanosis. Virtually ceased wind mass removal of salt and dust with bare areas, improved microclimate. Studies have shown that in the littoral land resources available for use under irrigation. The irrigation of moisture reduces the adverse effects, restores the water free exchange, control sheet of temperature, increases metabolism, processes of growth and outflow assimilators, which increases its quality and harvest [10]. They can grow corn, melons and high-yielding forage crops, conduct landscaping by planting trees and shrubs that are adapted to local conditions, to create artificial hayfields and pastures. When introducing the practice of irrigated agriculture the opportunity to conduct diversified farms (agriculture, livestock, fisheries).

These changes in the favorable direction in the development of natural-economic complex as we consider the Aral model transition to sustainable development in the south of Kazakhstan.

In conclusion we can say that the decision of Kazakhstan on the Conservation of the Northern Aral Sea, separating it from the large Aral Sea, was a bold and decisive step, which completed successfully. As a result of the first project of RSRNAS was created a small geographical man-made object. It is important to emphasize that the creation of man-made sea by separating it from the great sea, Kazakhstan was the first country among CIS. This shows that if you want you can influence to the direction of the natural environment in a particular region.

Currently the Northern Aral Sea with its soft environment influences on the whole natural-economic complex. There has been positive term of development of recovery of biological resources, wildlife in general. However, there still has the second stage of the project, which is designed to address the larger environmental and socio-economic problems.

### Conclusion

1. After completion the first stage of the construction Kokaral dam on the sea Berg Strait from the large Aral Sea was completely separated the Northern Aral Sea (NAS) and its ecological condition began to improve. The results of our studies of the current ecological status of the North Aral Sea have shown that increasing the total mass of sea water through the Syrdarya has led to a decrease in the concentration of salts in sea water with 23 g/l to 17 g/l. This is due to the effect of desalinated water river.

Therefore, the Northern Aral Sea water becomes brackish than salt. It is important to emphasize that the lower the salinity of sea water, the better the conditions in the environment for breeding, feeding, increase fish biomass. Now the Northern Aral Sea annual harvests of 4.0 tones, which is 10 times more than in previous years to the construction branch of the dam.

2. An important part of the project is hydroelectric power station on the river Syrdarya. Building products ended its work in 2009 and since then part of the river runoff enters the dried coastal lakes system. At present, the area of the bottom of lakes, covered with water, is 17.0 thousand hectares. In coming years, the coastal water area of lake systems, commercial fishing importance will increase by an additional 60 hectares. Then the volume of fish caught in the Aral Sea will reach to 10.0 million tons per year.

3. The number of species (birds, animals, and fish fauna) associated with water cyanosis. This is an important factor in restoring biodiversity in the region.

4. Locals can grow corn, melons and high-yielding forage crops, conduct landscaping by planting trees and shrubs that are adapted to local conditions, to create artificial hayfields and pastures. It gives them the ability to create diversified farms (agriculture, livestock, and fisheries).

5. The implementation of environmental project RSRNAS measures enable to improve the environmental situation and develop economic sectors on the basis of biological resources. We consider it as a model of sustainable development of the Aral Sea in southern Kazakhstan.

Materials recommended for publication for the first time.

### Corresponding Author:

Dr.Nurgizarinov Ayzhigit Mambetovich  
Kyzylorda State University named after Korkyt Ata  
Ualieva str. 22/88, Kyzylorda, Kazakhstan

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