International Conference
"Lakes & Reservoirs: Hot Spots and Topics in Limnology"
Mikorzyn, Poland
September 17-20, 2019

ECOLOGICAL DISASTER OF THE ARAL SEA

International Intellectual Solidarity for a Better Future of the Aral Sea and for a Better Future of All Nations in the Catchment Area of the Aral Sea

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Commonwealth of Independent States - Central Asian States
RUSSIA
KAZAKHSTAN
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UZBEKISTAN
KYRGYZSTAN
TAJIKISTAN
AZERBAIJAN
IRAN
AFGHANISTAN
PAKISTAN
INDIA
Caspian Sea
Aral Sea
ARAL SEA BASIN
Catchment area of the Aral Sea is about 1.8 million km²
Scale 1:16,500,000
Lambert Conformal Conic Projection, standard parallels 47°N and 62°N
0 300 Kilometers
0 300 Miles
Boundary representation is not necessarily authoritative.
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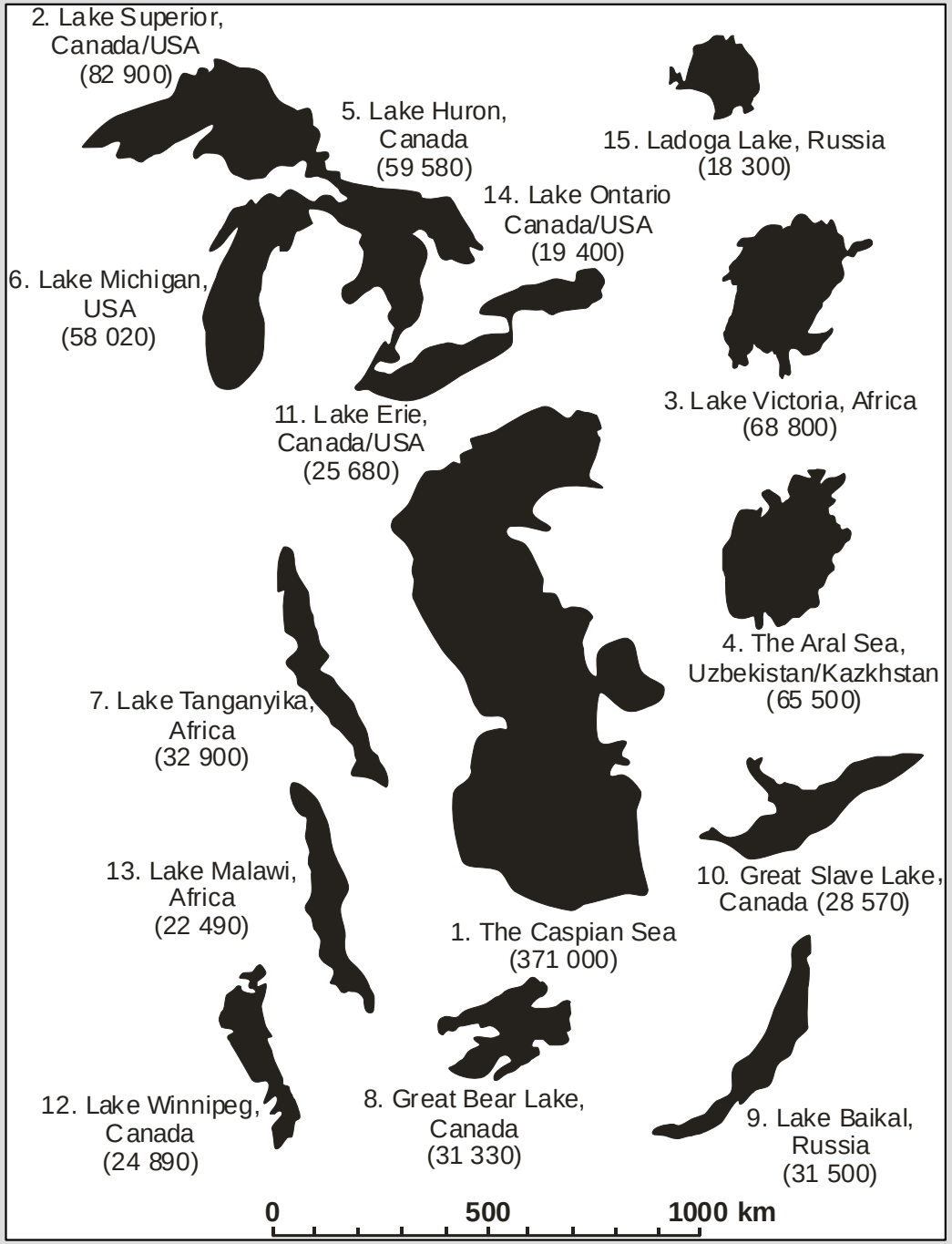
The Aral Sea was the 4th largest lake in the world according to surface in 1960 (comparative areas below in km²)



The Aral Sea map made by A.I. Butakov expedition materials in 1848-1849

IRRIGATION DEVELOPMENT IN ARAL SEA BASIN

MAJOR IRRIGATION COMPLEXES IN THE ARAL SEA BASIN

main irrigation zones in the Aral Sea Basin

proposed Siberia-Aral Sea Canal

1. Kara-Kum Canal
2. Amu Dar'ya Delta
3. Amu-Bukhara Canal
4. Zeravshan Valley
5. Karshi Steppe
6. Middle Amu Dar'ya
7. Surkhandar'ya Valley
8. Golodnaya Steppe
9. Fergana Valley
10. Middle Syr Dar'ya
11. Kzyl-Orda Canal
12. Syr Dar'ya Delta

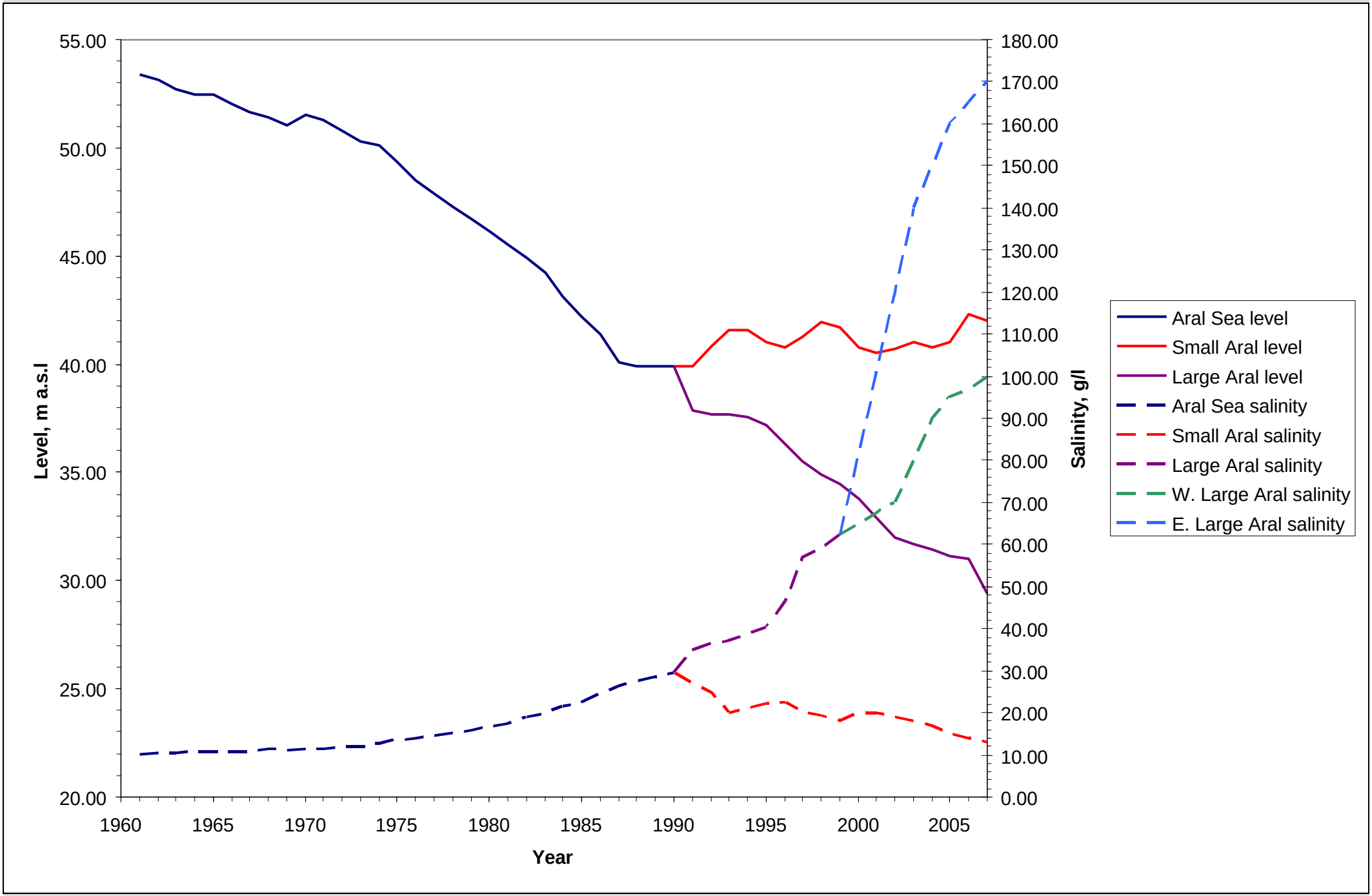
At the end of 1980's, when the level had decreased by about 13 m, reaching about +40 m, the Aral Sea divided into the Large and Small Aral

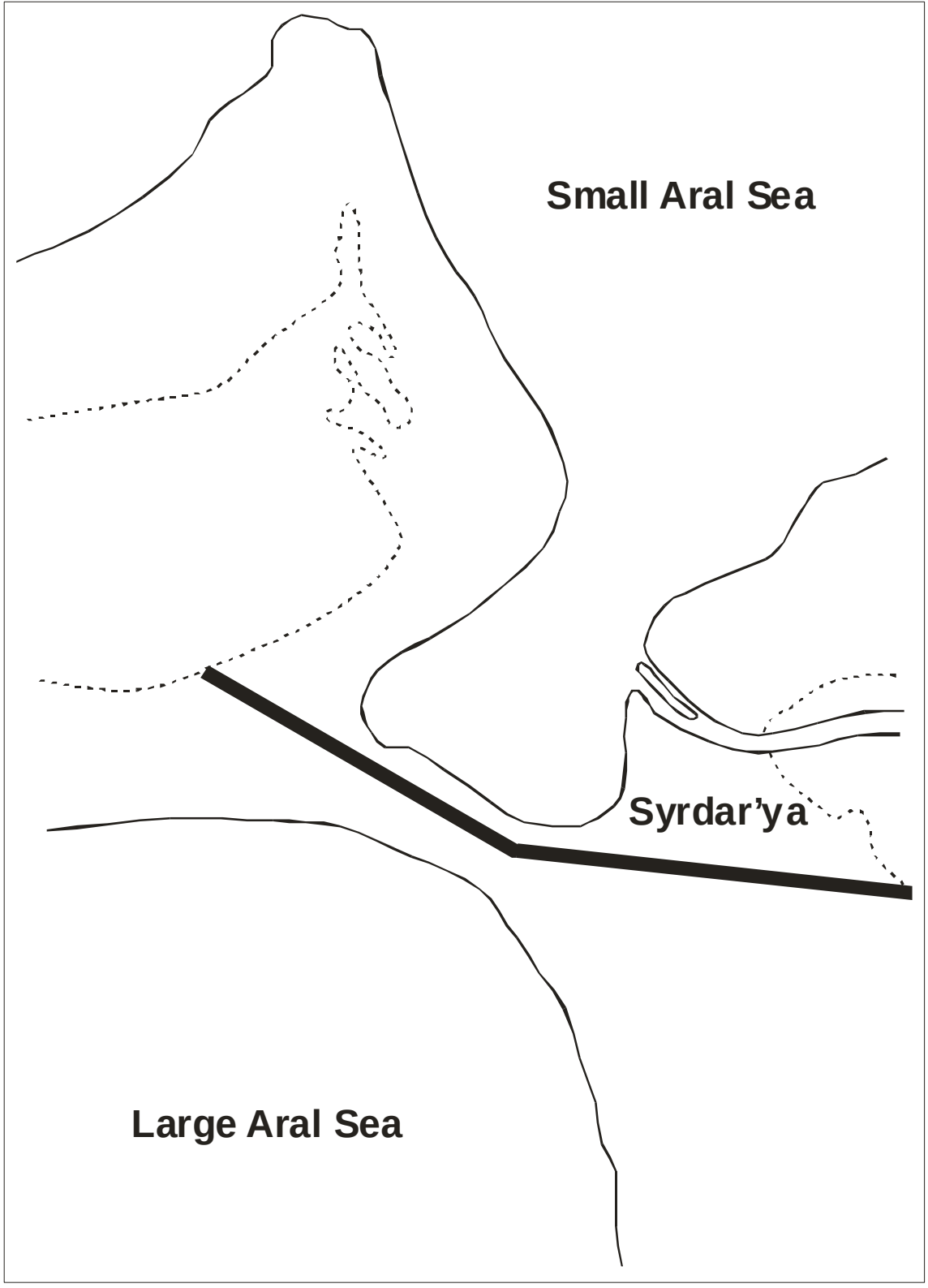
Area 40000 km^2
(60% of 1960 area)

Volume 333 km^3
(33% of 1960 area)

Salinity 30 g/l
(10 g/l in 1960)

The Aral Sea level and salinity

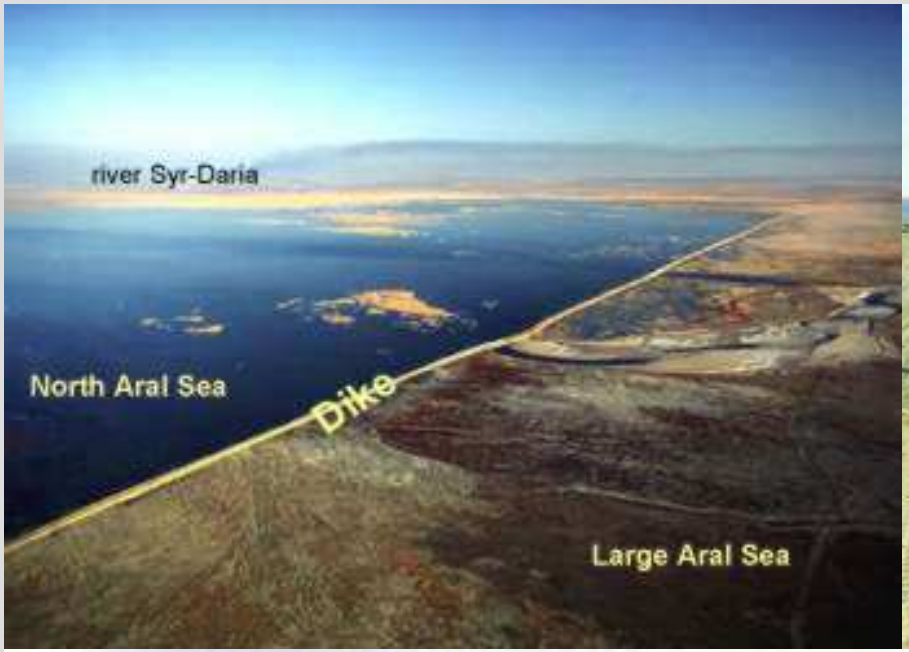




Dike in Berg Strait is preserving Small (Northern) Aral and rehabilitating its biodiversity.

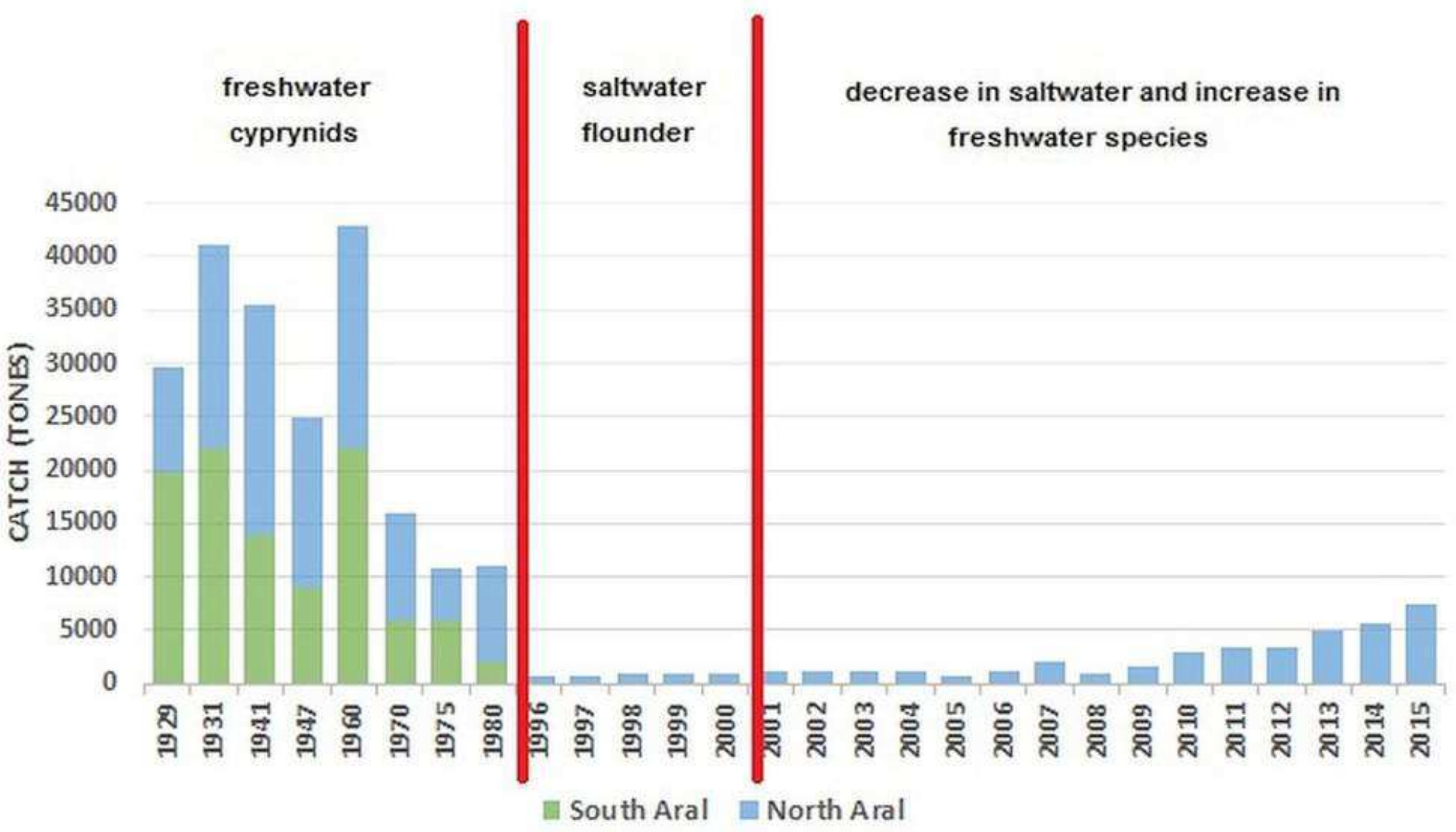
By: Aladin N.V., Plotnikov I.S., Potts W.T.W., 1995. The Aral Sea desiccation and possible ways of rehabilitation and conservation of its North part // Int. J. Environmetrics. Vol. 6: 17-29.

The first dam was built based on our proposal in August 1992.



When the 1992 dike in Berg Strait was built, fishing on the Small Aral recommenced

Dynamics of fish catches in the North and South Aral



Fish processing at the plant in Aralsk

Control structures and dams on the Syr Darya

Kokaral dam

Aklak control structure

Kazaly control structure

Aytek control structure

Karaozek control structure

Kyzylorda control structure

Shardara reservoir

Arnasay dam

By: Bekniyaz et al.

KAMYSHLYBASH AND AKSHATAU LAKE SYSTEMS

1. Restoration of the Kamyshlybash and Akshatau lake systems in the lower reaches of the Syr Darya river produced water and wetland systems with a total area of 40.45 thousand hectares, including:
   - lakes – 33.979 thousand hectares
   - swamps – 6.48 thousand hectares.
2. Improving the socio-economic and sanitary-epidemiological living conditions of the population of the region.

ENLARGEMENT OF GROWTH PONDS IN THE AREA OF TASTACK OF KAMYSHLYBASH FISH HATCHERY IN THE ARALSK DISTRICT

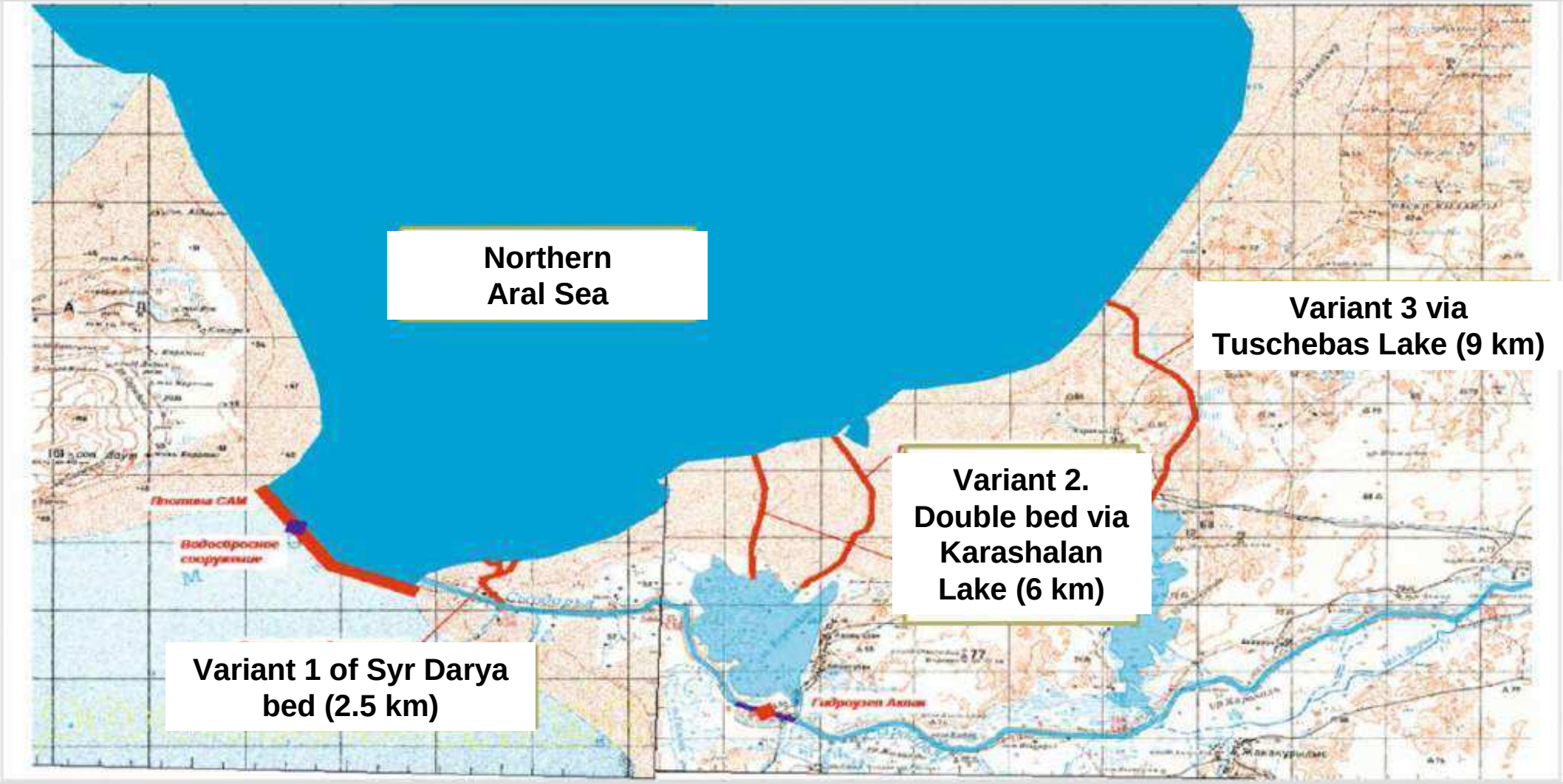
1. Accelerated restoration of fish productivity of the Northern Aral Sea, delta lakes and Syr Darya.
2. Creating conditions for the development of fish farming.
3. Creating new jobs for the local population.

By: Bekniyaz et al.

A new channel of the Syr Darya directed to the Kokaral dam has formed, but this is not desirable.

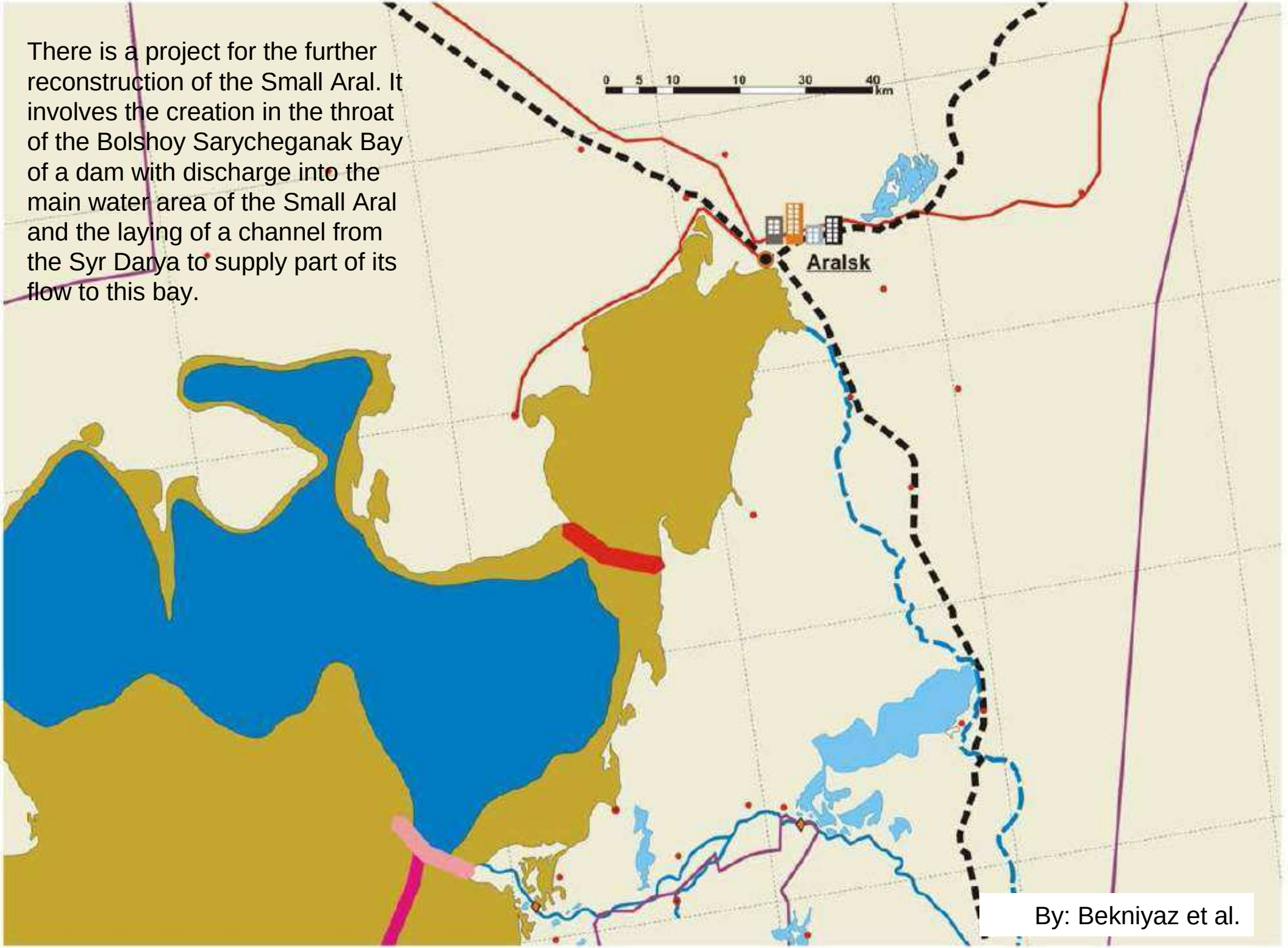
By: Bekniyaz et al.

Proposal made for new artificial channels through which the Syr Darya flow would fall into the Small Aral Sea as far as possible from the dam



By: Bekniyaz et al.

There is a project for the further reconstruction of the Small Aral. It involves the creation in the throat of the Bolshoy Sarycheganak Bay of a dam with discharge into the main water area of the Small Aral and the laying of a channel from the Syr Darya to supply part of its flow to this bay.



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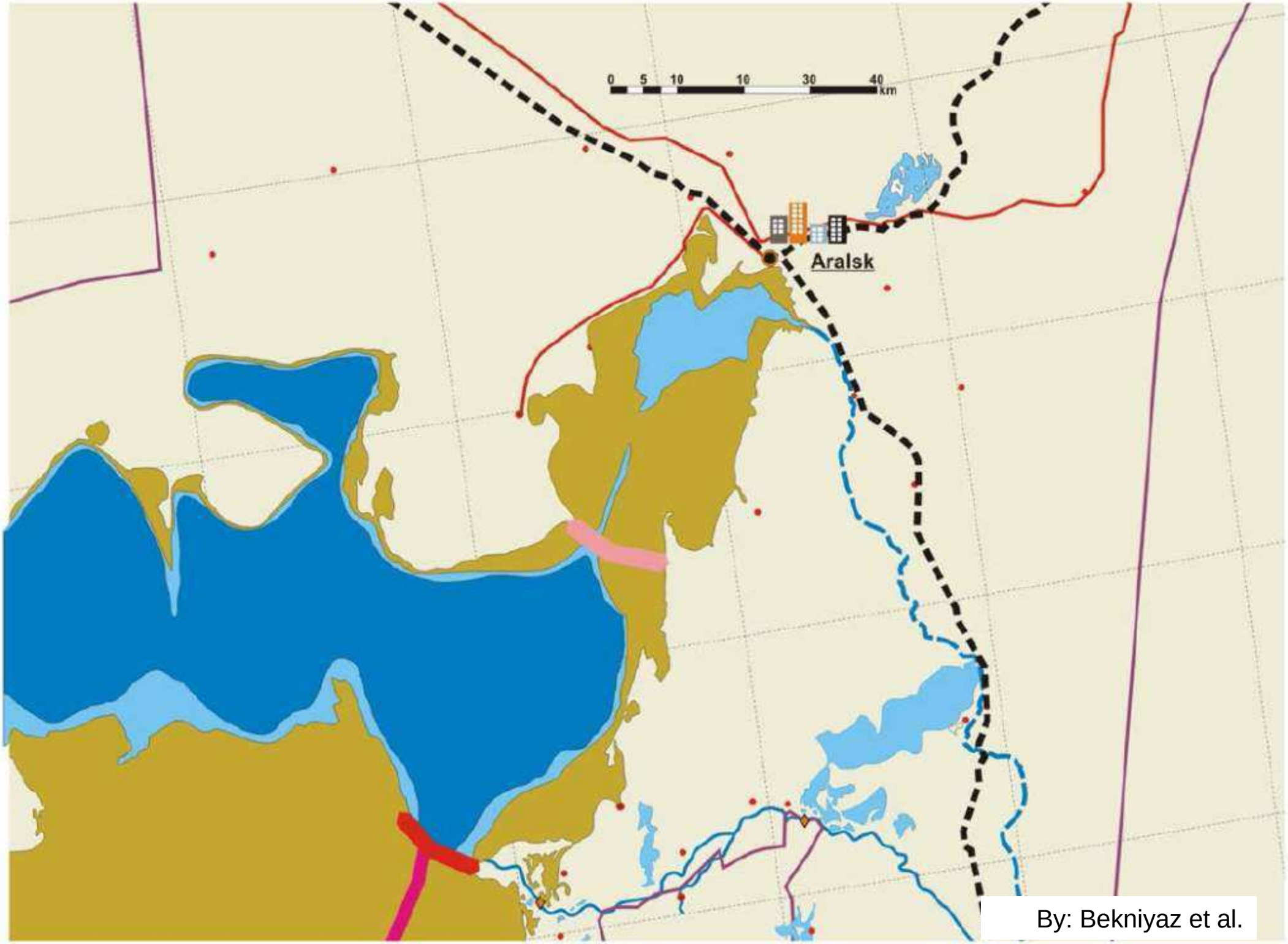
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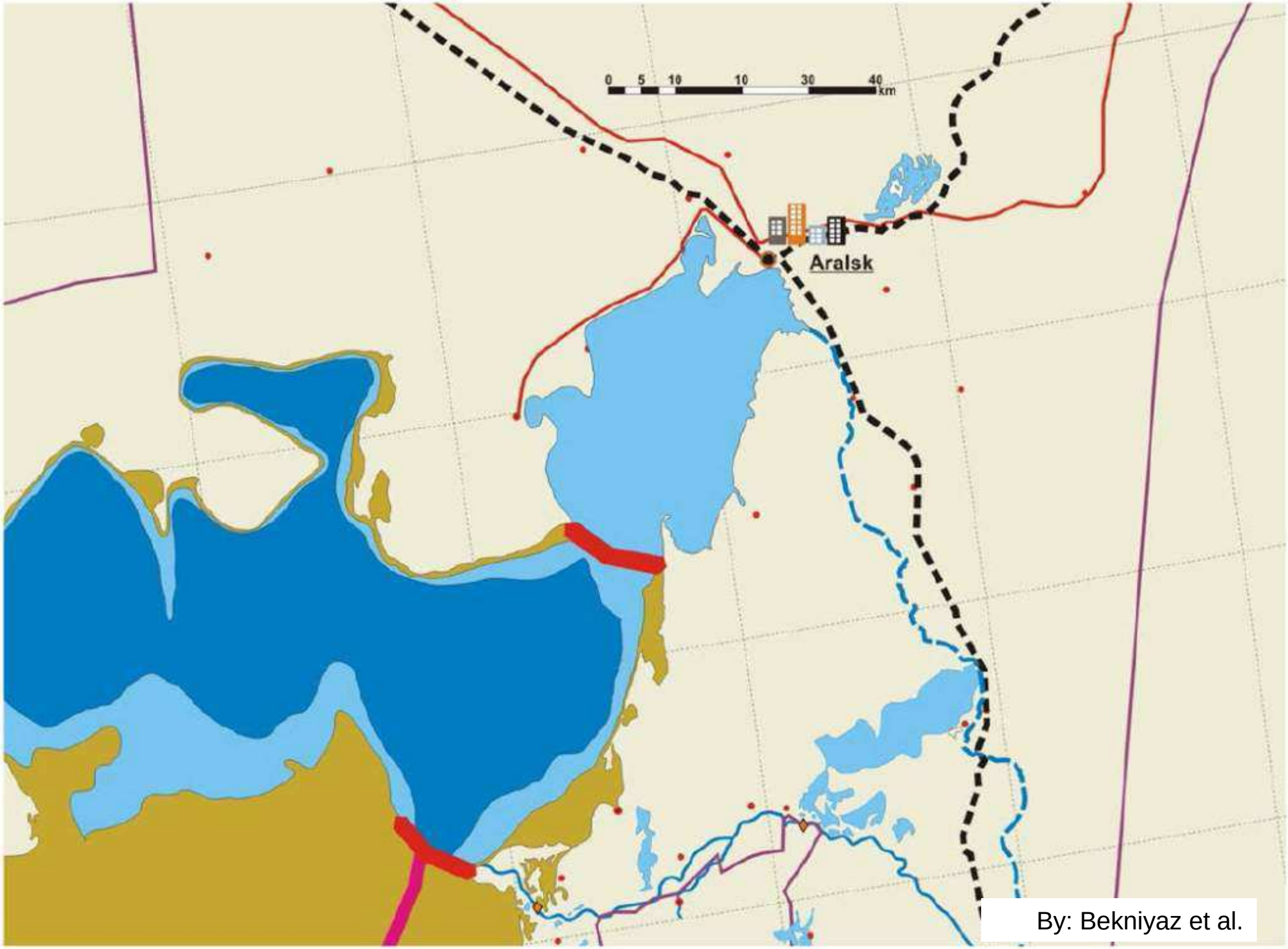
km
Aralsk
By: Bekniyaz et al.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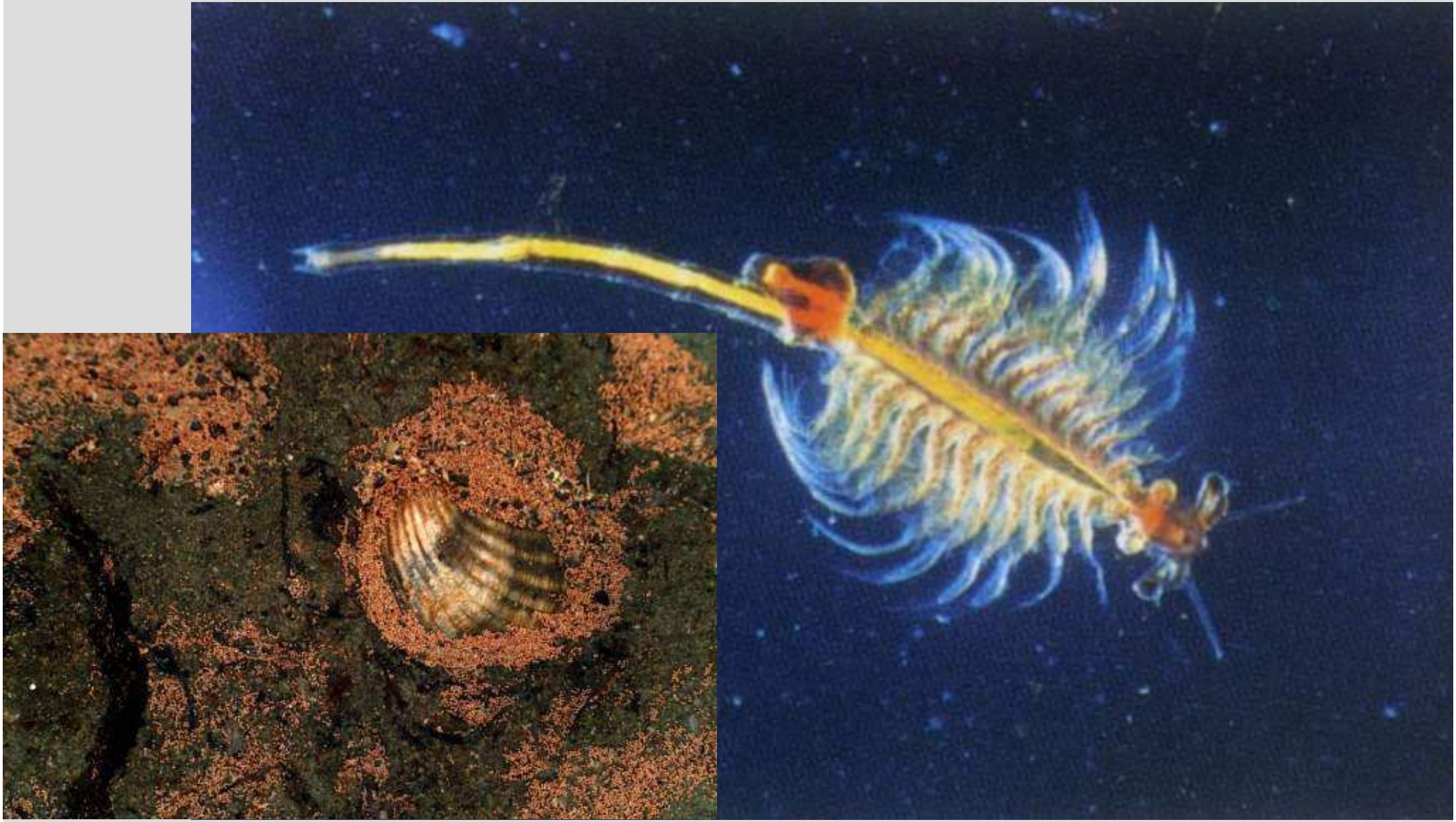
Aralsk
By: Bekniyaz et al.

At the end of 20th century, brine shrimp *Artemia parthenogenetica* appeared in the Large Aral Sea.



The eggs of this crustacean are a valuable biological resource. Eggs of brine shrimp are already being harvested on the Large Aral.

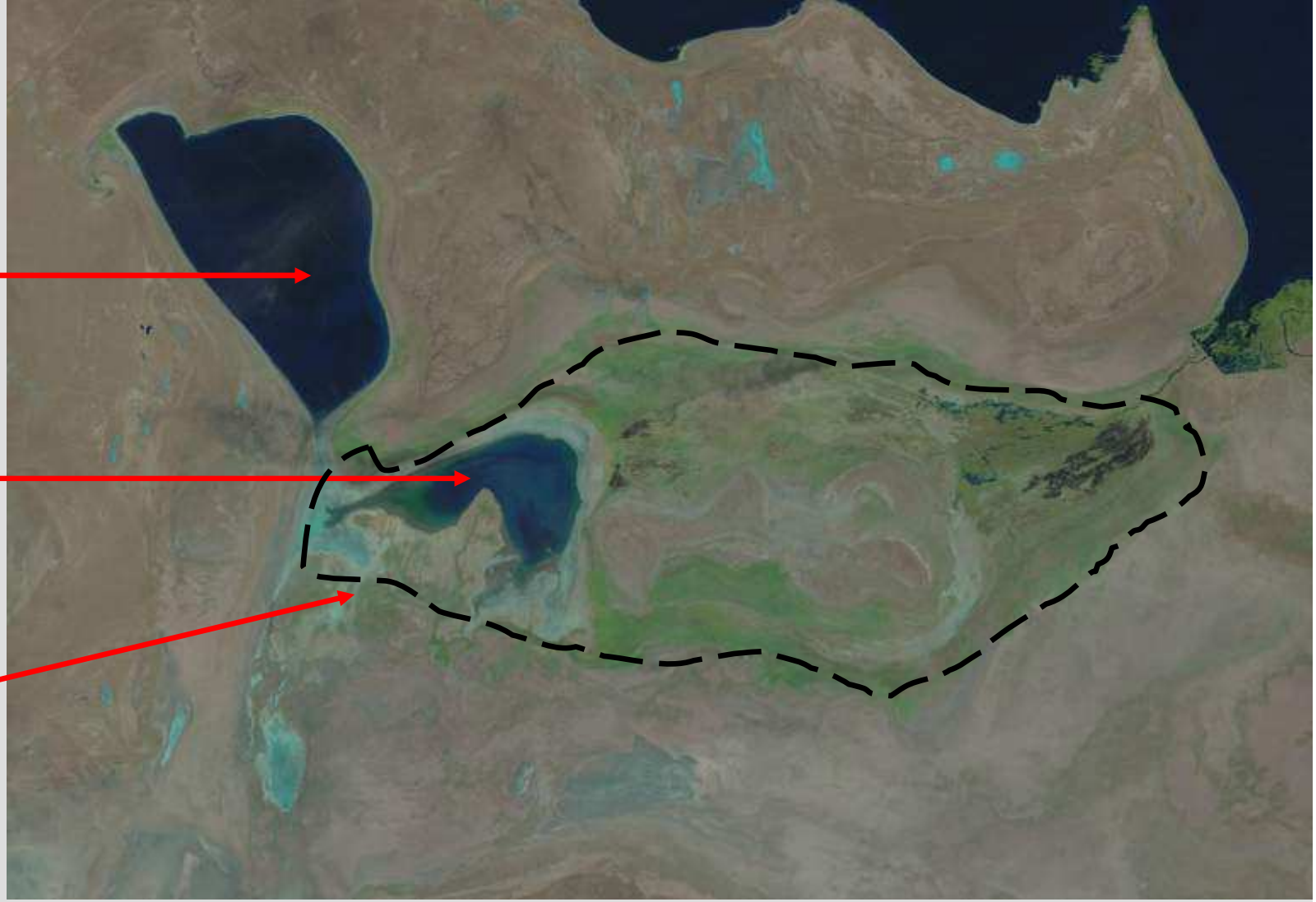
The Aral Sea shape changing

Middle Ages

Middle of the XIX century

Beginning of the XXI century

Paleolimnological data and our studies allow us to hope that preservation and rehabilitation of the Aral Sea will facilitate its revival in XXI century.



Central Aral, 3.10.2015. Light green color - wet soil, shallow water and hydrophytic vegetation. This is the Central Aral at the end of the dry season (July-November), when it receives a little water from the Small Aral Sea. Salinity of Western Lake at the end of this period is probably quite high and perhaps too high for the survival of any fish.

Central Aral, 23.01.2016. Central Aral during the wet season (from December to June), when large volumes of water had discharged into it from the Small Aral Sea due to the large winter water releases through the Toktogul dam on Naryn River in Kyrgyzstan for power generation and from the normal spring flood. Mineralization of the lake at this time was low, so fish could have survived. The lake is covered with ice.

ARAL SEA on August 19, 2014 (MODIS)

1 - Dried Eastern Basin of the Large Aral Sea

2 - Western Basin of the Large Aral Sea

3 - New Central Aral Sea

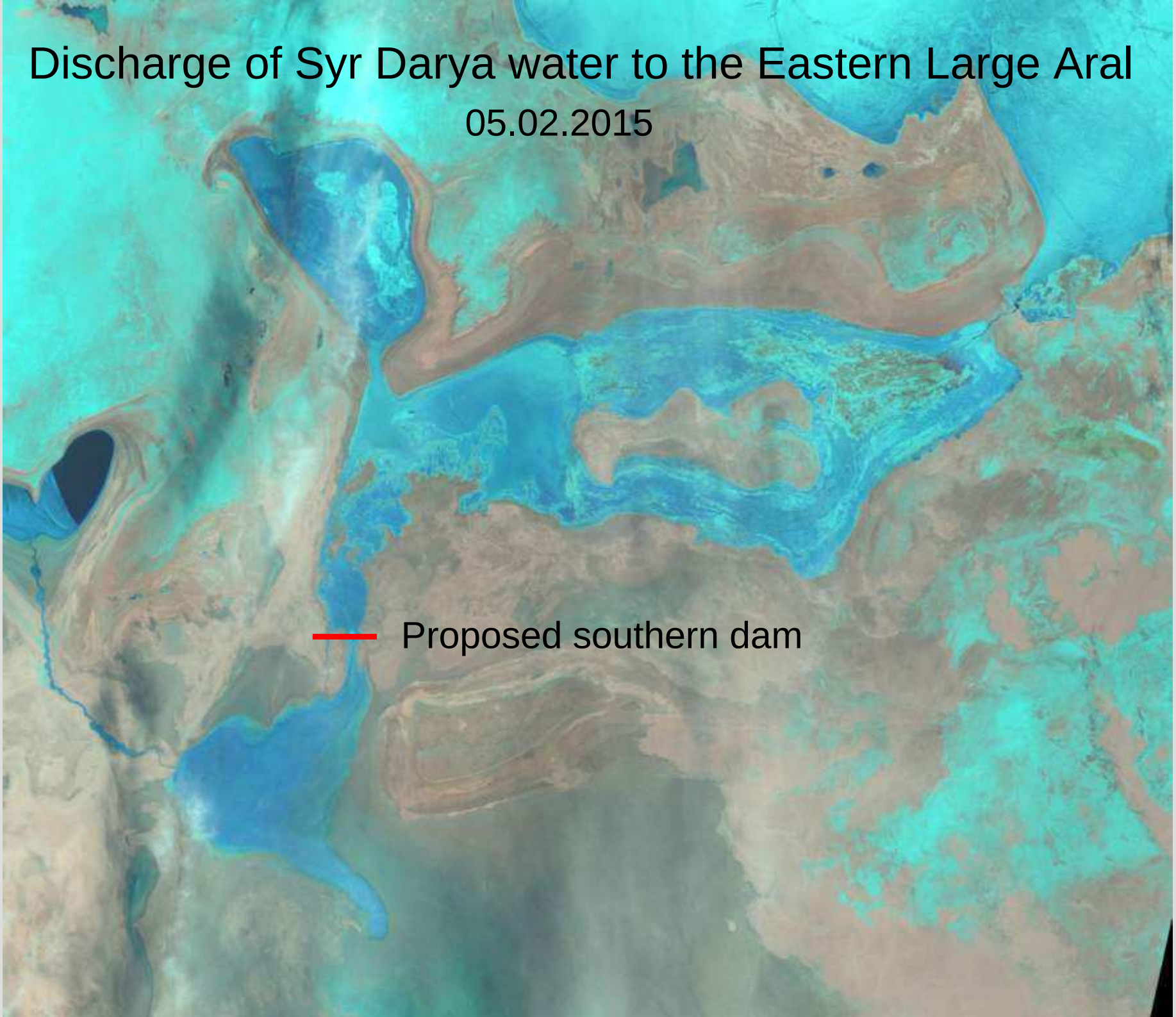
4 - Small Aral Sea

5 - Tsche-Bas Bay

A - Kokaral dam (Central dam)

B – Proposed Northern dam

C – Proposed Southern dam


Discharge of Syr Darya water to the Eastern Large Aral
05.02.2015
Proposed southern dam

Discharge of water together with fish from the Small Aral Sea

Fishes dropping down through the Kokaral Dyke

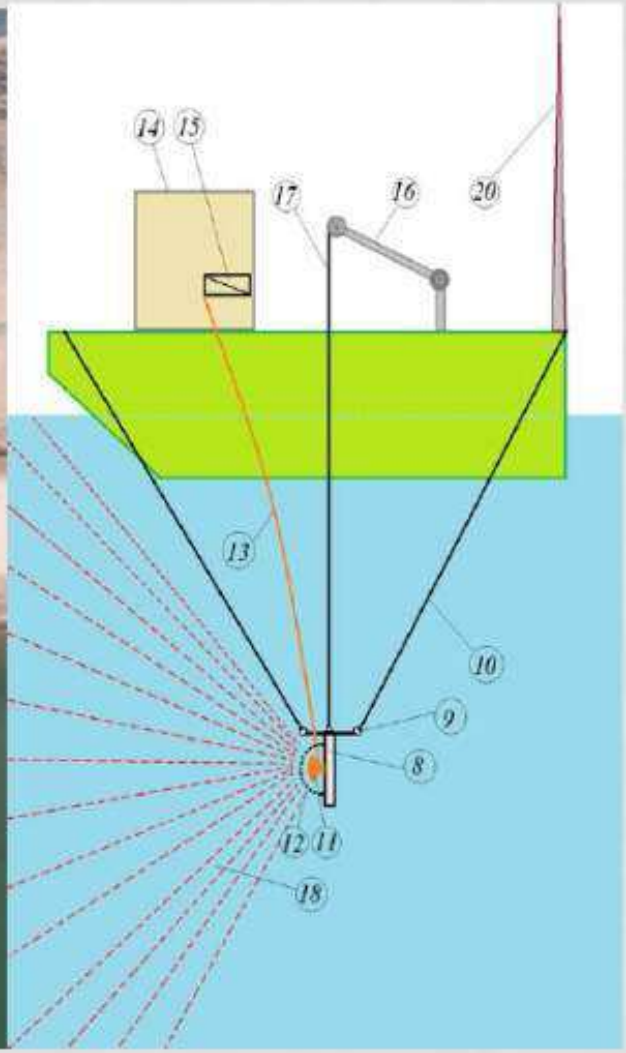
Together with water from the Small Sea, a large number of valuable commercial fish is carried through the Kokaral Dam to the Central Aral.

- December 12, 2018, the Executive Directorate of IFAS in Kazakhstan signed a contract for implementation from December 1, 2018 to December 31, 2019 of a large investment project “Preserving the fish of the Northern Aral”.
- This project will be implemented through grant funds of the German Society for International Cooperation (GIZ).
- The aim of the project is designing a fish protection device on the Kokaral dam to prevent the loss and death of fish during water discharge to downstream from the Northern Aral Sea.

The Executive Directorate of IFAS in Kazakhstan, together with the German Society for International Cooperation (GIZ), is implementing a project to install a hydro-acoustic fish protection device.

POSSIBLE CONCEPT OF FPD, ON THE BASIS OF PATENT #2763, 2018

WIDTH IN PLACE OF INSTALLATION 150 M, DISTANCE FROM WATER DISCHARGE OF DAM 150 M



By: Bekniyaz et al.

- February 27 till March 11, 2019: Prof. Dr. Jumpey Kubota from Japan led a field trip to the Small/Northern Aral Sea
- Members of our laboratory and our colleagues from Japan and Republic of Kazakhstan participated in this cold season expedition.
- Results of this expedition will be published and used for making future plans of conservation and rehabilitation of the remnants of the Aral Sea.


ДИРЕКТОР

WHAT SHOULD BE DONE FOR CONSERVATION OF BIODIVERSITY AND BIOLOGICAL RESOURCES OF THE ARAL SEA?

1. As soon as possible: raise by 2-3 m the dam in Berg Strait.
2. In the next few years: build a dam in the throat of Sarycheganak Bay.
3. Build a simple dam to the south of Kulandy peninsula.
4. Refuse shallow reservoirs in the Amu Darya delta.
5. Redirect the rest of the Amu Darya flow to the Western Large Aral Sea.

Green belt – protection from salt-dust dispersal from the dried bottom of the Aral Sea

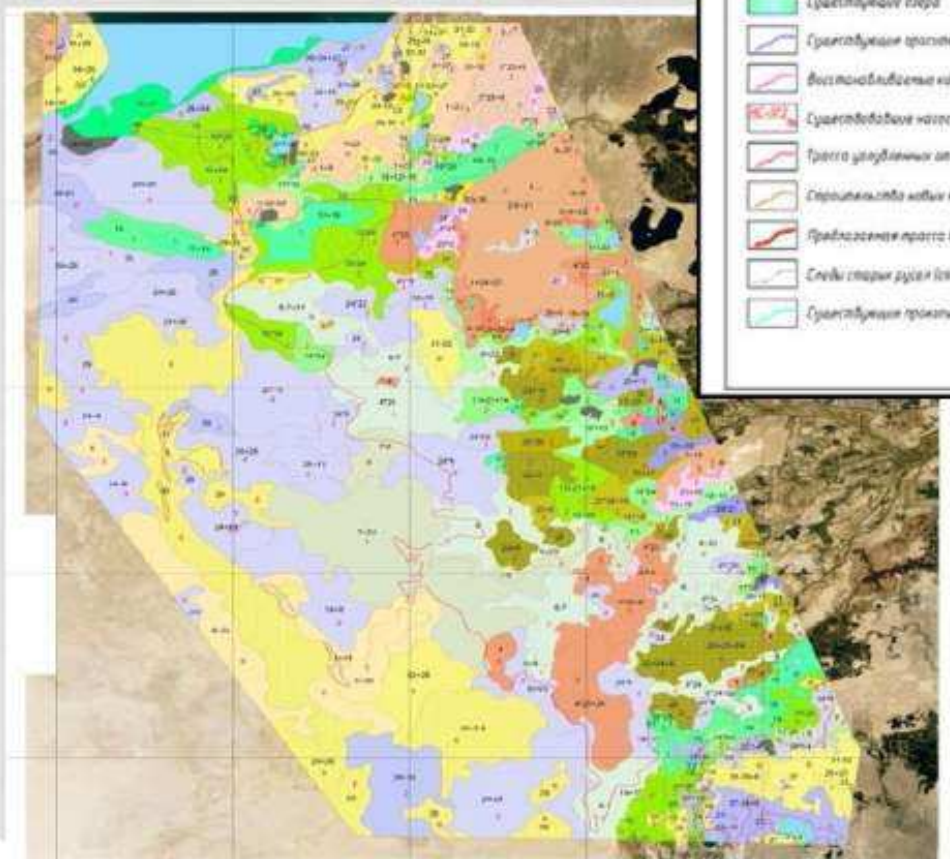
To reduce the direct impact of salt-dust dispersion from the bottom of the dried sea and thereby protect people, settlements, territories of agricultural use, flora and fauna of the Aral Sea region, it is proposed to create a multi-tiered "**Green Belt**".

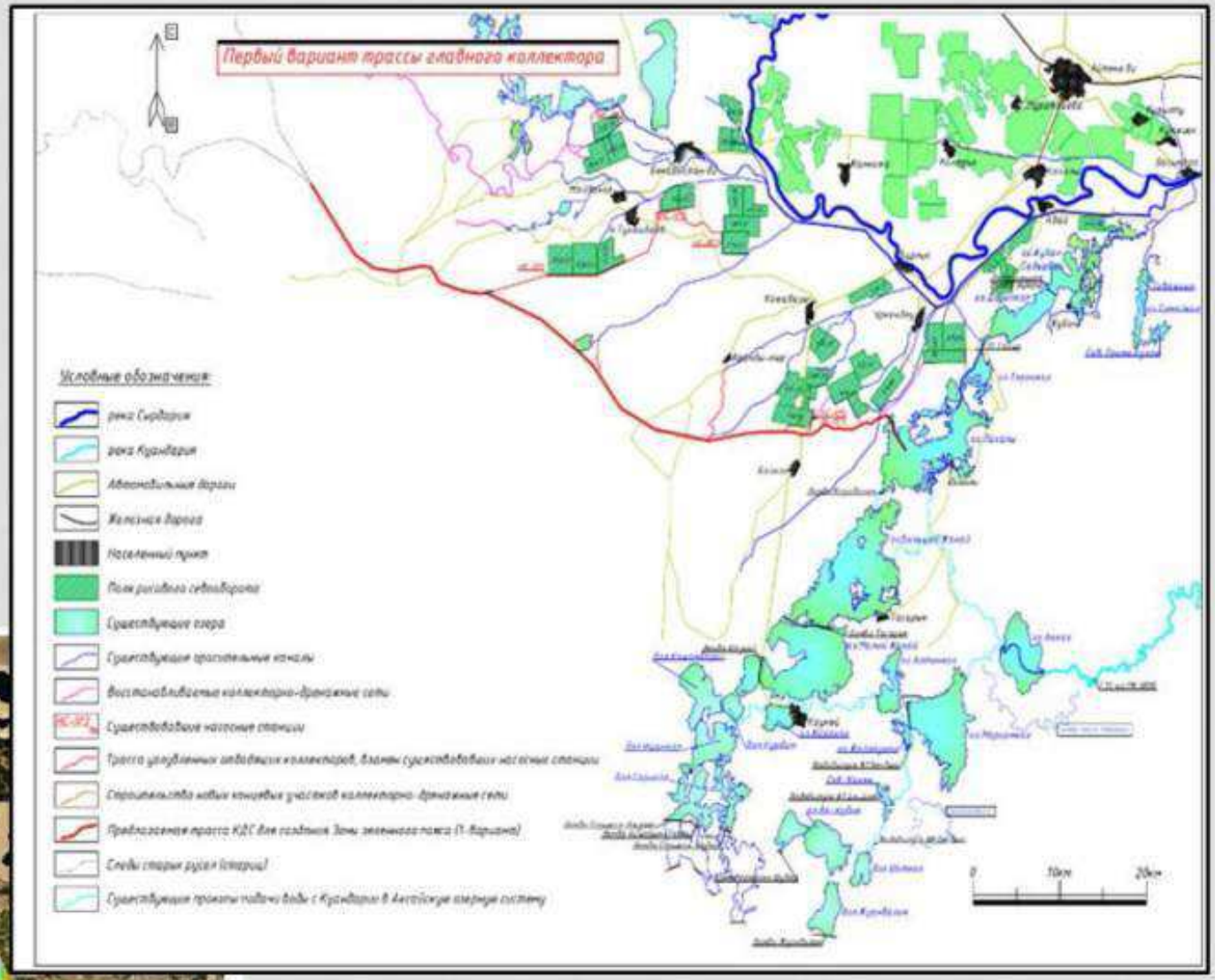
The design length of the belt is about 70 km, width 200-1000 meters.

The belt will serve as a kind of "ecological screen" area.

Plants grown in the belt are planned to be irrigated at the expense of the collector-drainage waters of the Kazaly left bank massif of irrigation, with surplus water of the Aksai and Kuan Darya lakes systems, and by potential discharges from the Syr Darya.

By: Bekniyaz et al.





By: Bekniyaz et al.

Main phytomeliorants

Black Saxaul (*Haloxylon aphyllum*) is a drought- and salt-tolerant desert tree or shrub up to 7 m). It grows on different types of soil from takyr to sandy, but performs best on sandy and loamy soil varieties with relatively close groundwater (from 4 to 10 m). Black saxaul is characterized by average fodder value. It is widely used in crops to create sand-holding strips to protect settlements, roads, oil pipelines from covering with sand. Saxaul forests are also significant for wind protection and for protection of pastures. It has a large calorific value equal to that of brown coal.

Kochia (*Kochia prostrata*) is a drought-resistant and salt-tolerant shrub that is from 10 to 80 cm in height. It grows on saline, stony slopes, cretaceous slopes, in saline and sandy steppes and deserts. It is found in all regions of Kazakhstan and forms several geographic races. It is a good fodder plant, eaten by all kinds of cattle, both as hay and in perennial pastures.

Pamirian winterfat (*Krascheninnikovia ceratoides*) is a xerophilous shrub, 50-100 cm high. Good pasture and haymaking plant, well tolerated by sheep and camels but less so by horses and cattle. Leaves and one-year-old branches are eaten.

Amaranth (*Amaranthus* spp.) is an annual wind-pollinated plant. Two species also grown in Kazakhstan, where they also have a tendency to become invasive and cross-breed with natural populations. As a forage crop, amaranth surpasses traditional crops in terms of yield, drought tolerance, quantity and quality of protein.

By: Bekniyaz et al.

Economically effective phytomeliorants

Almond-tree

Apple-tree renet Simirenko

Persian olive

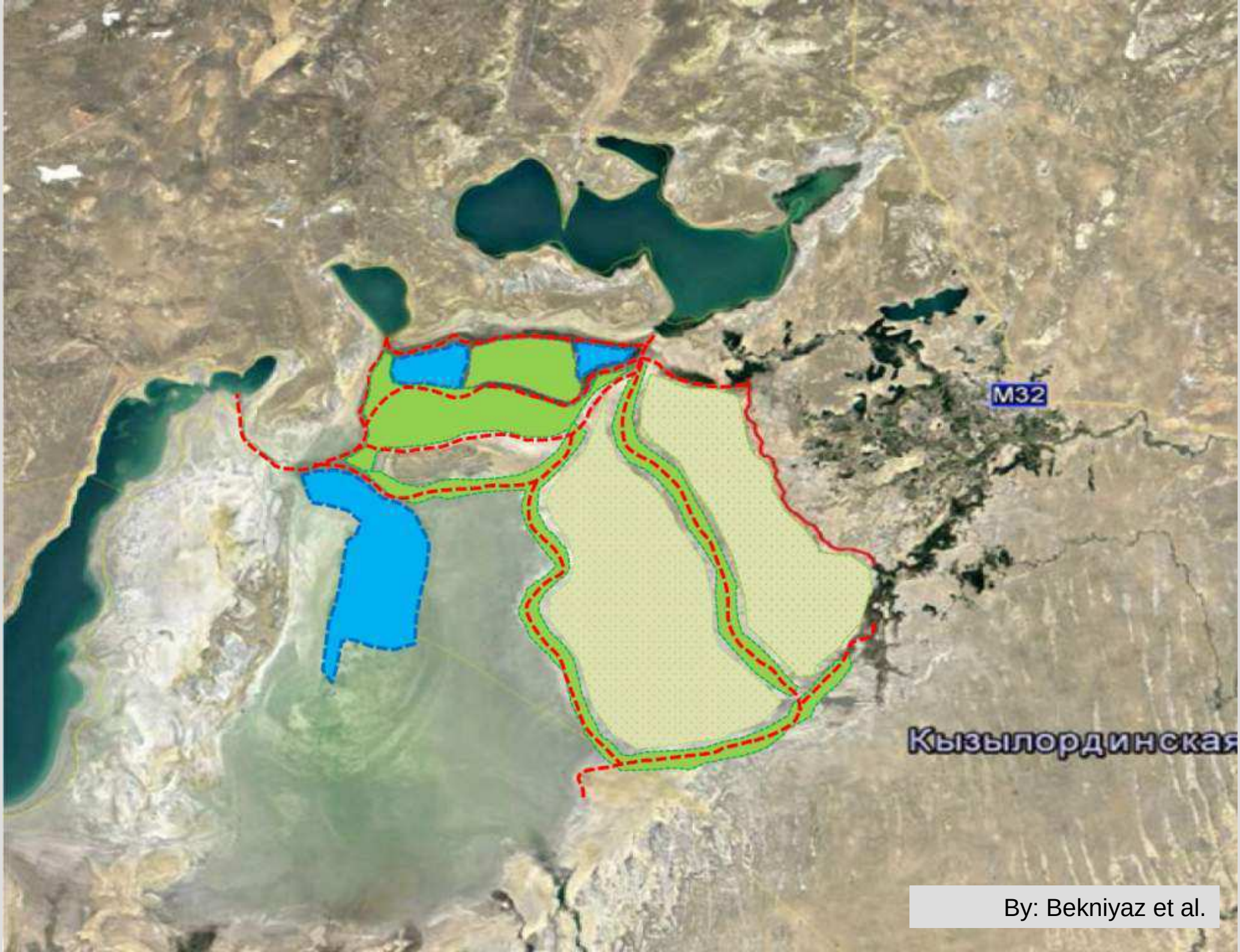
Cherry elaeagnus

By: Bekniyaz et al.

ECOLOGICAL BENEFITS

- Additional volume of water over 300 million cubic meters per year via the Main Collector will be sent to the Large Aral Sea to create wetlands.
- There is a possibility of watering the tree plantations of the "Green Belt".
- A system of polders is being created along the Collector, which will contribute to the improvement of water quality.
- The biodiversity of the region is increasing, conditions are being created for the return of native species of wild ungulates and deltaic vegetation.
- A special ecological screen is being created to protect populated areas, irrigated massifs and pastures from dust and salt removal, and the rate of desertification of the Aral Sea region is decreasing.

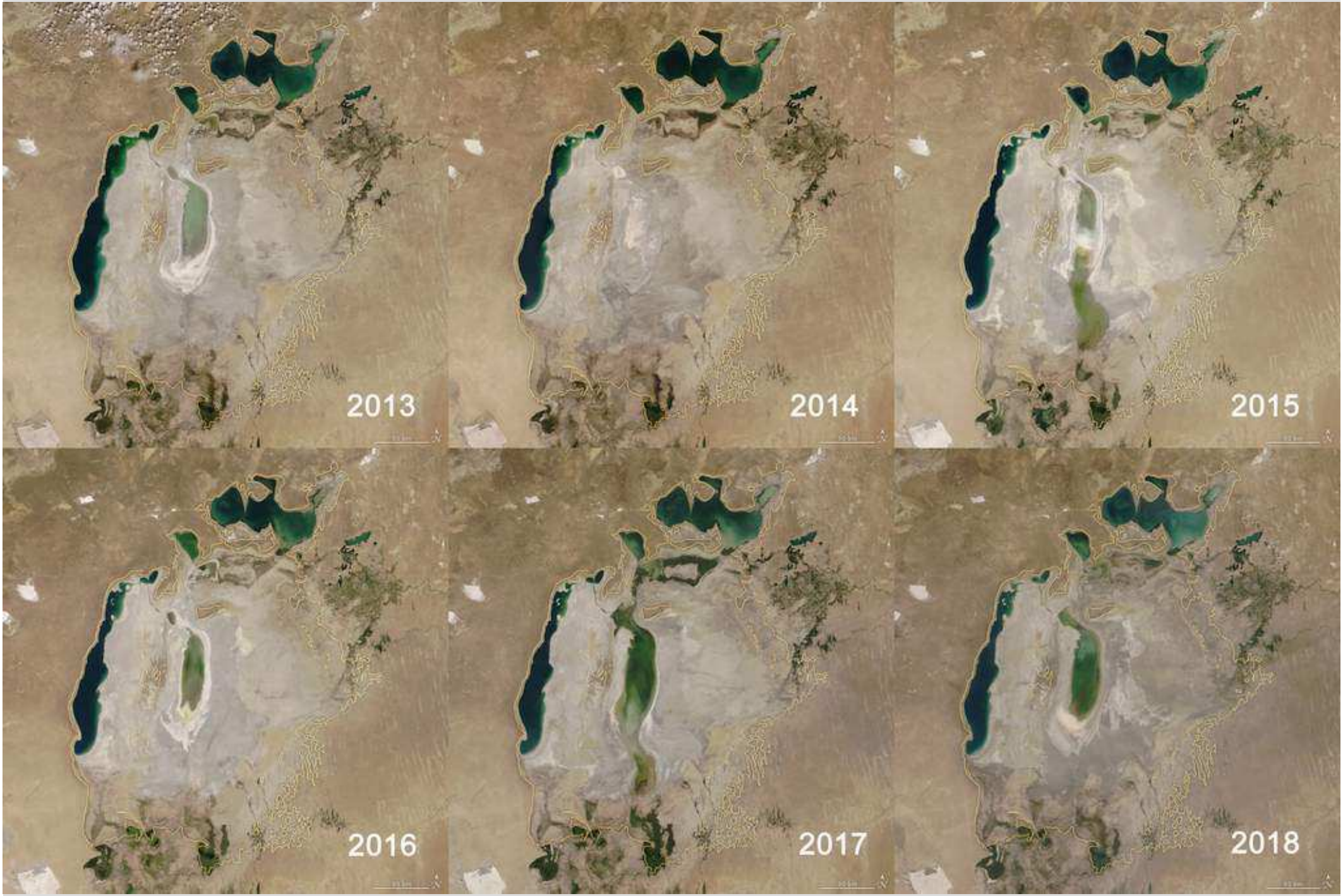
By: Bekniyaz et al.


M32
Кызылординская
By: Bekniyaz et al.

This is what NOVITSKY Zinovy Bogdanovich, Doctor of Agricultural Sciences, Academician of the Uzbek Academy of Sciences wrote on April 11, 2019:

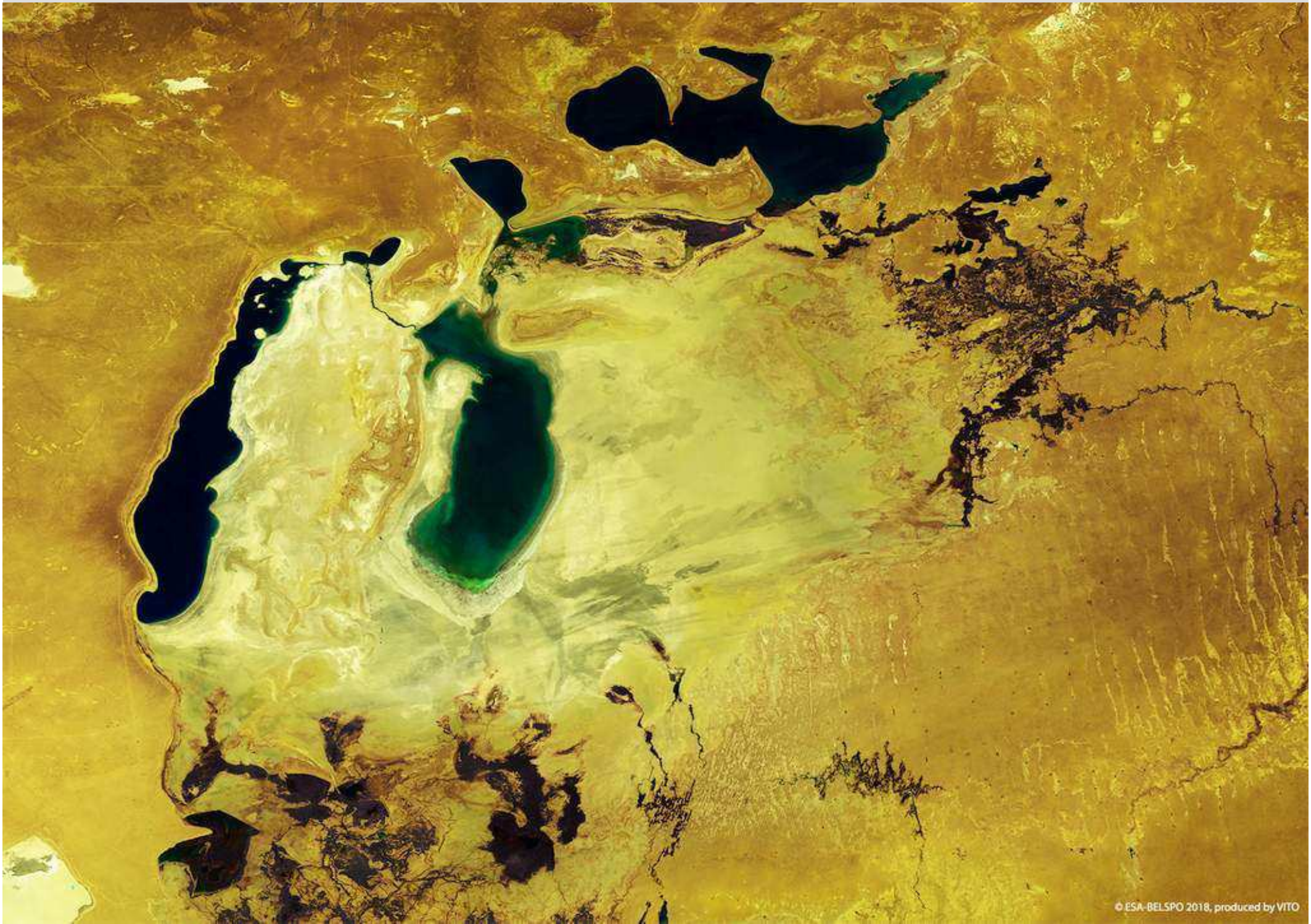
“We have a State program on environmental improvement of the Aral zone, initiated by the president. We started work on December 10th. I was appointed the head of this program and assigned the rank of colonel. So I lead. All the forces of Uzbekistan were involved - 268 tractors and more than 5,000 people. Especially in the city of Muynak, an ecological battalion of 250 soldiers was created. This year we will create 500,000 hectares of plantations. We created a green oasis of fruit. In a word, we carry out revolutionary work”.

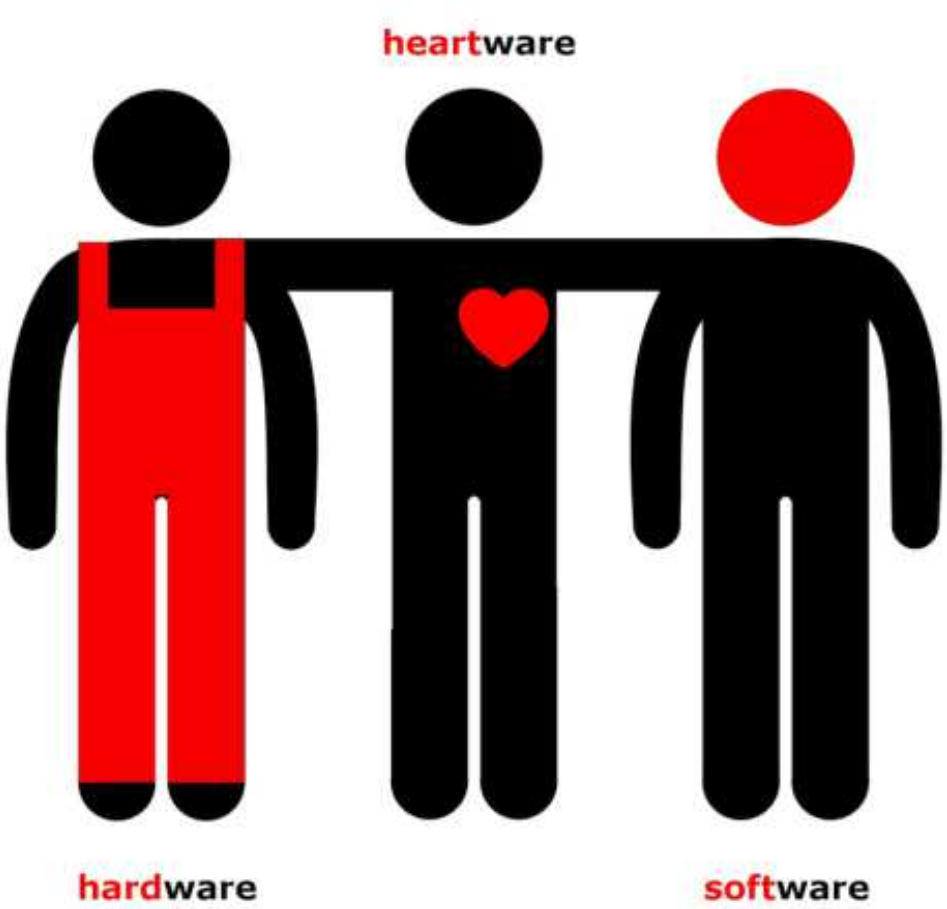
Desiccation of the Aral Sea the last 6 years: 2013-2018

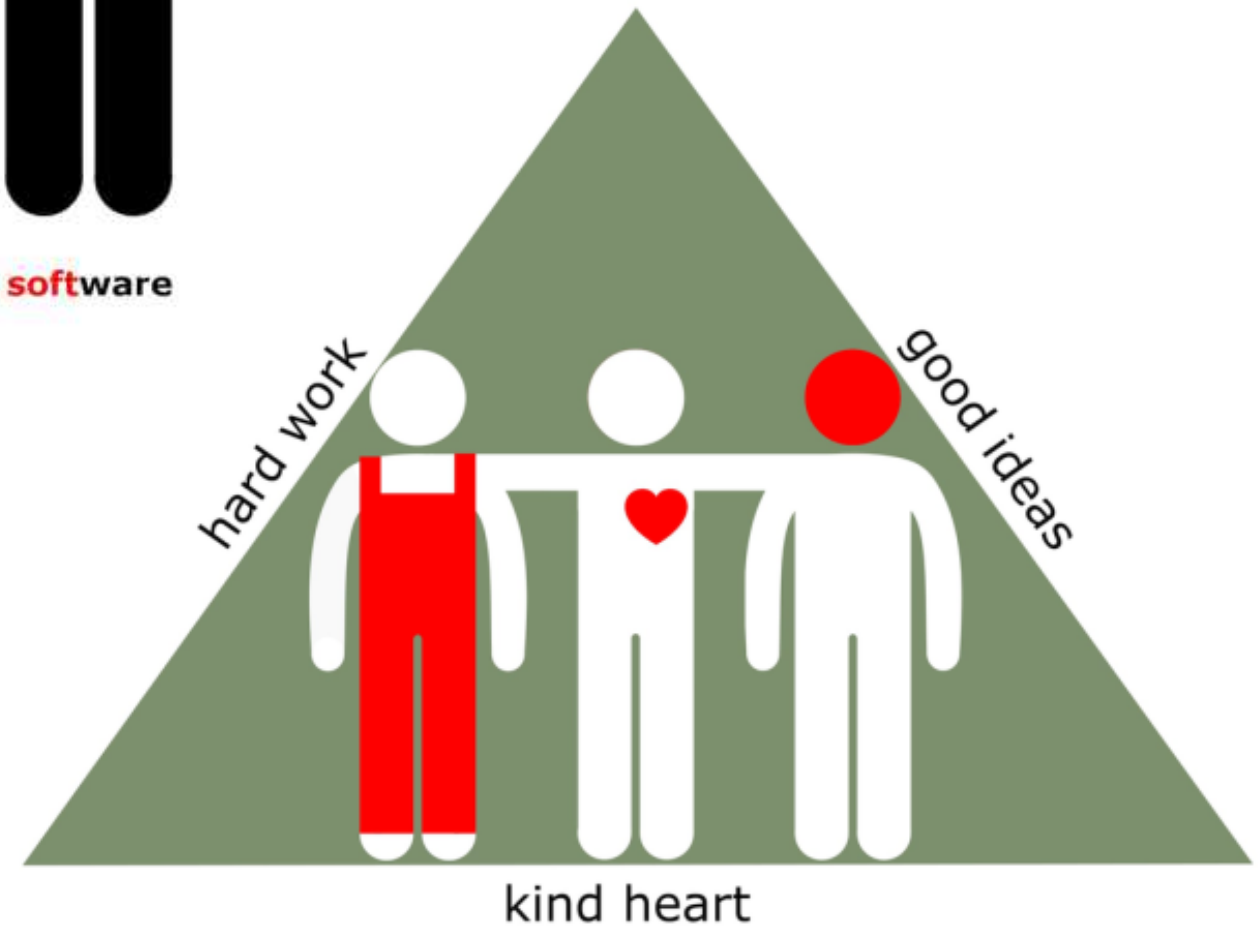


Huge volume of Amu Darya River discharge during the last 4 years: 2015-2018

Aral Sea, June 15, 2018. Space image by Proba V satellite.




heartware
hardware
software


hard work
good ideas
kind heart


August 2005
Rendezvous over Aral


July 20, 2016
Remnants of the Aral Sea
http://www.artemjew.ru/en/2016/07/20/aral16/

Thank you for your attention

The Aral Sea has a future