



Zoological Institute Russian Academy of Sciences
Lecture in Danish Natural History Society

February 07, 2019 at 19.30 hrs.

**Unsolved problems of the Aral Sea,
perhaps the worst environmental
disaster of the 20th – 21st centuries**

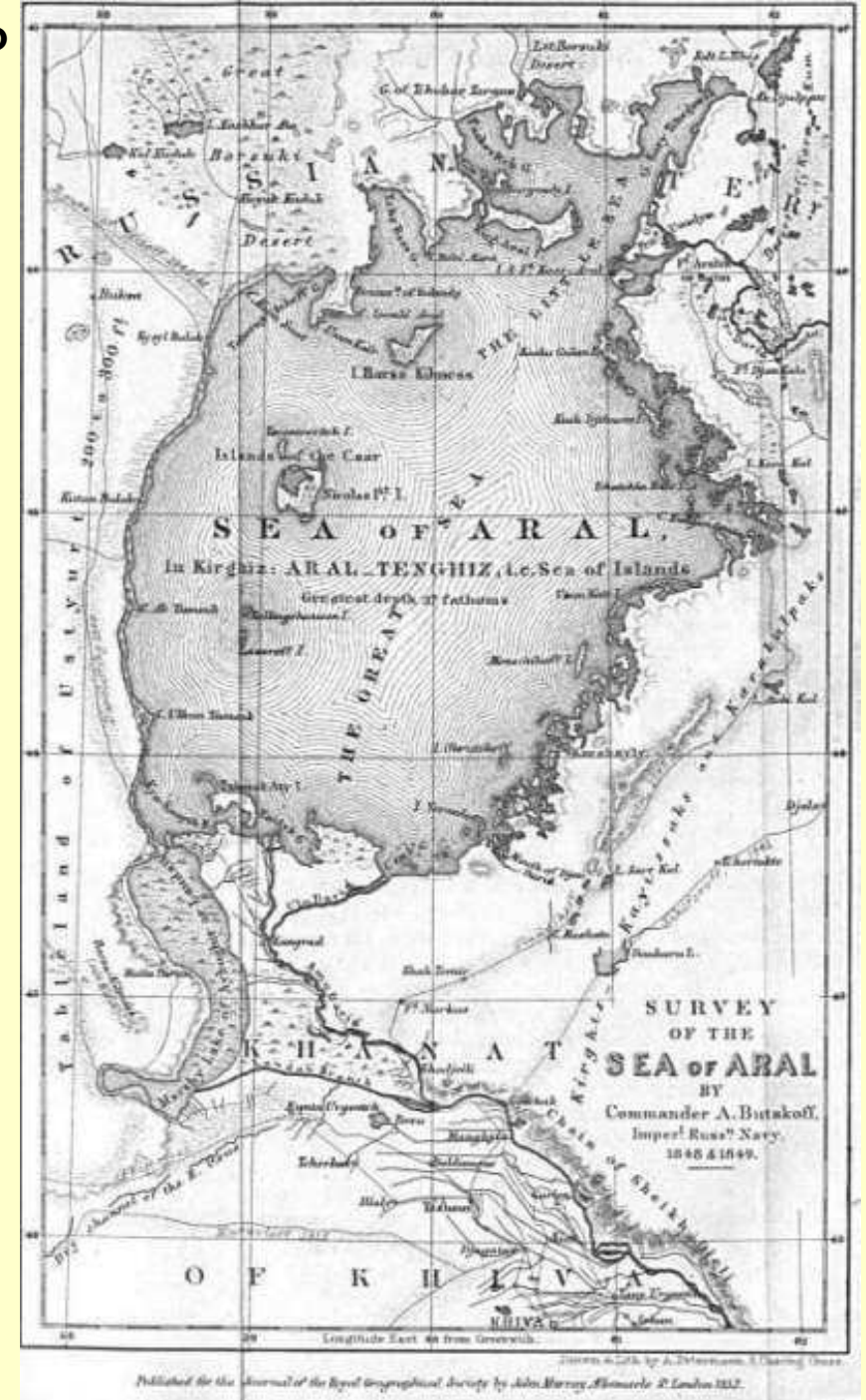
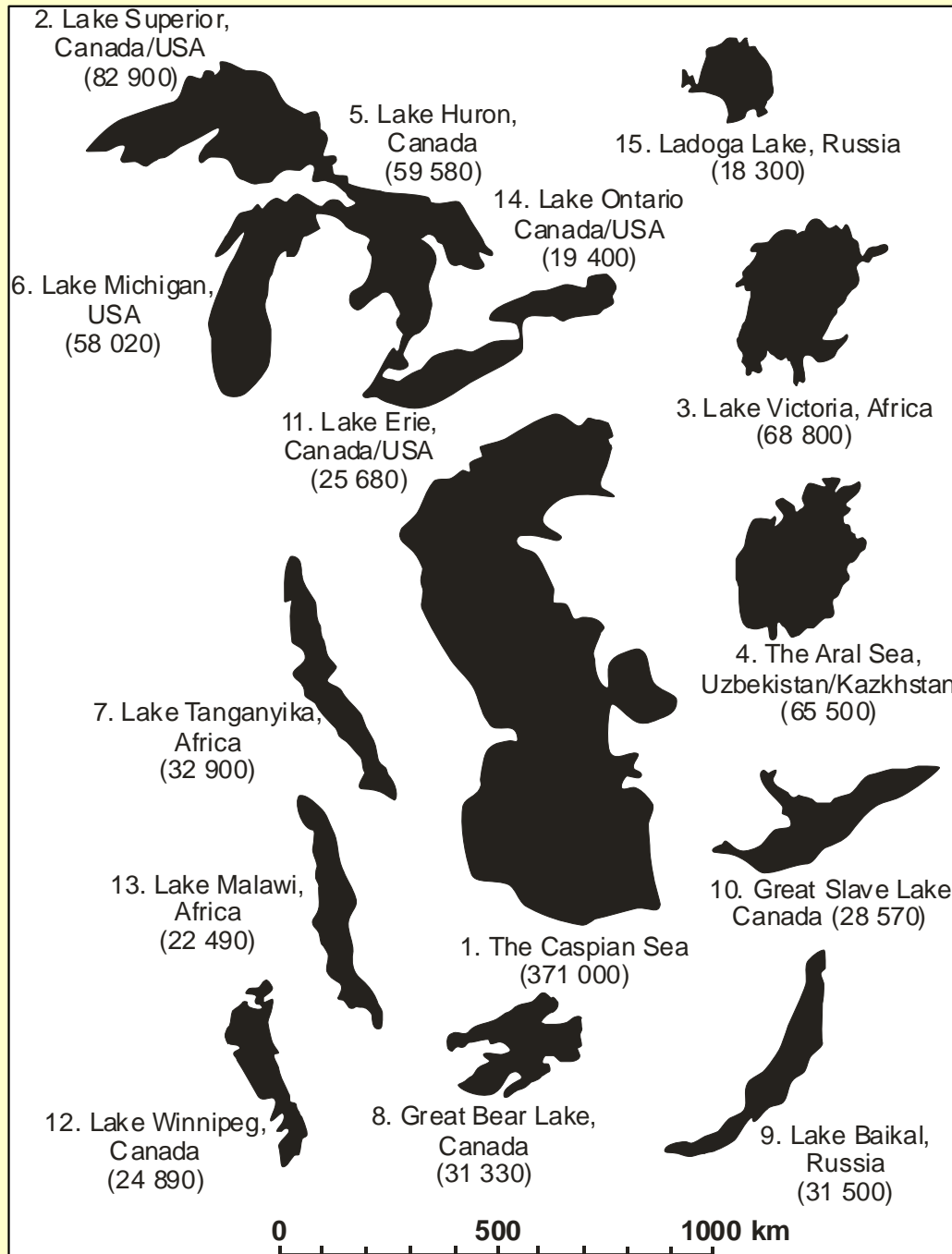
Aladin N.V., Gontar V.I., †Piriulin D.D., Plotnikov I.S., Smurov A.O., Zhakova L.V.
Zoological Institute RAS, St. Petersburg

Commonwealth of Independent States - Central Asian States



**Catchment area of the Aral Sea
is about 1.8 million km²**

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



P. Micklin 2000

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

In the end of 1980's, when the level dropped by about 13 m and reached about +40 m, the Aral Sea divided into the Large and Small Aral

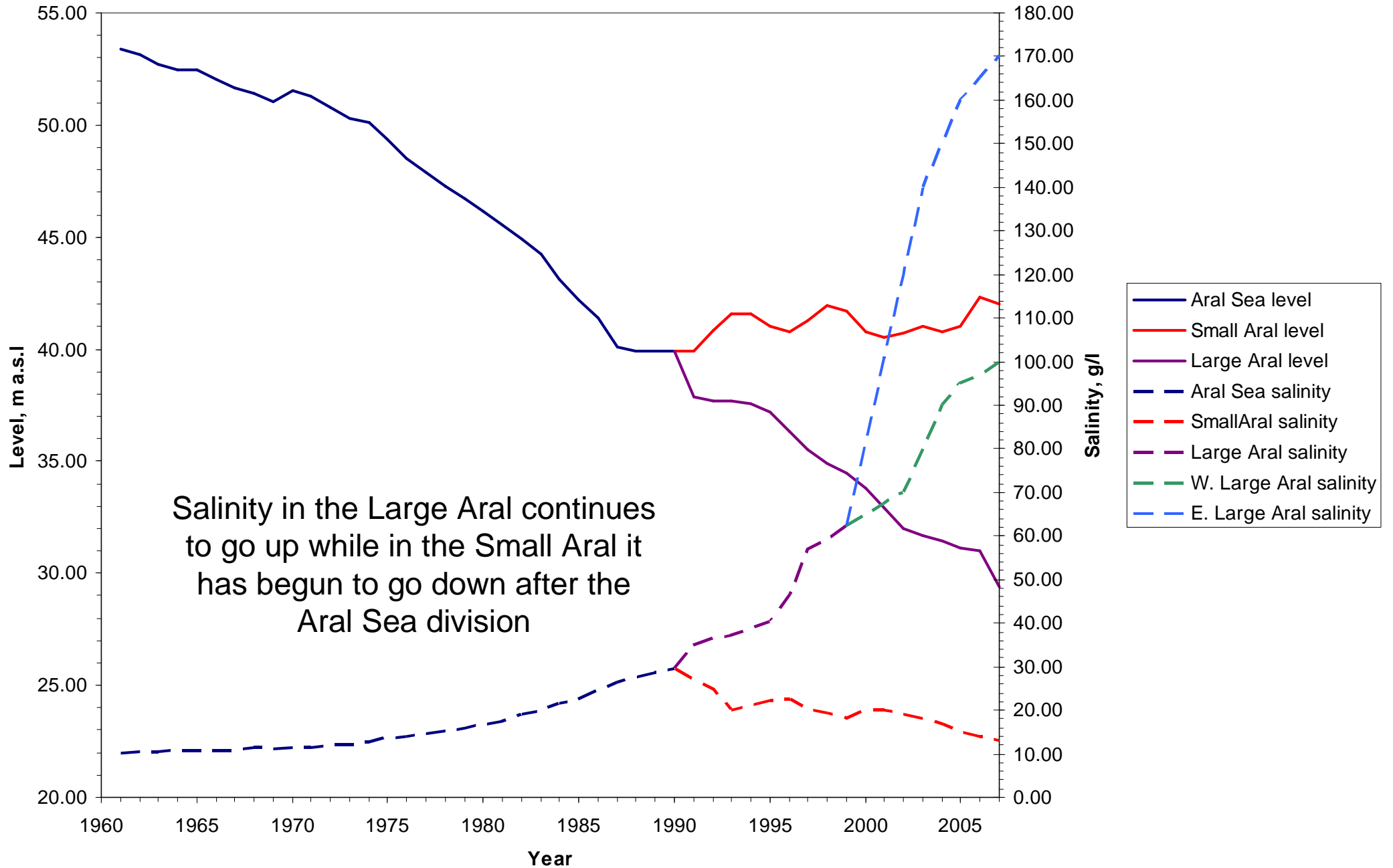


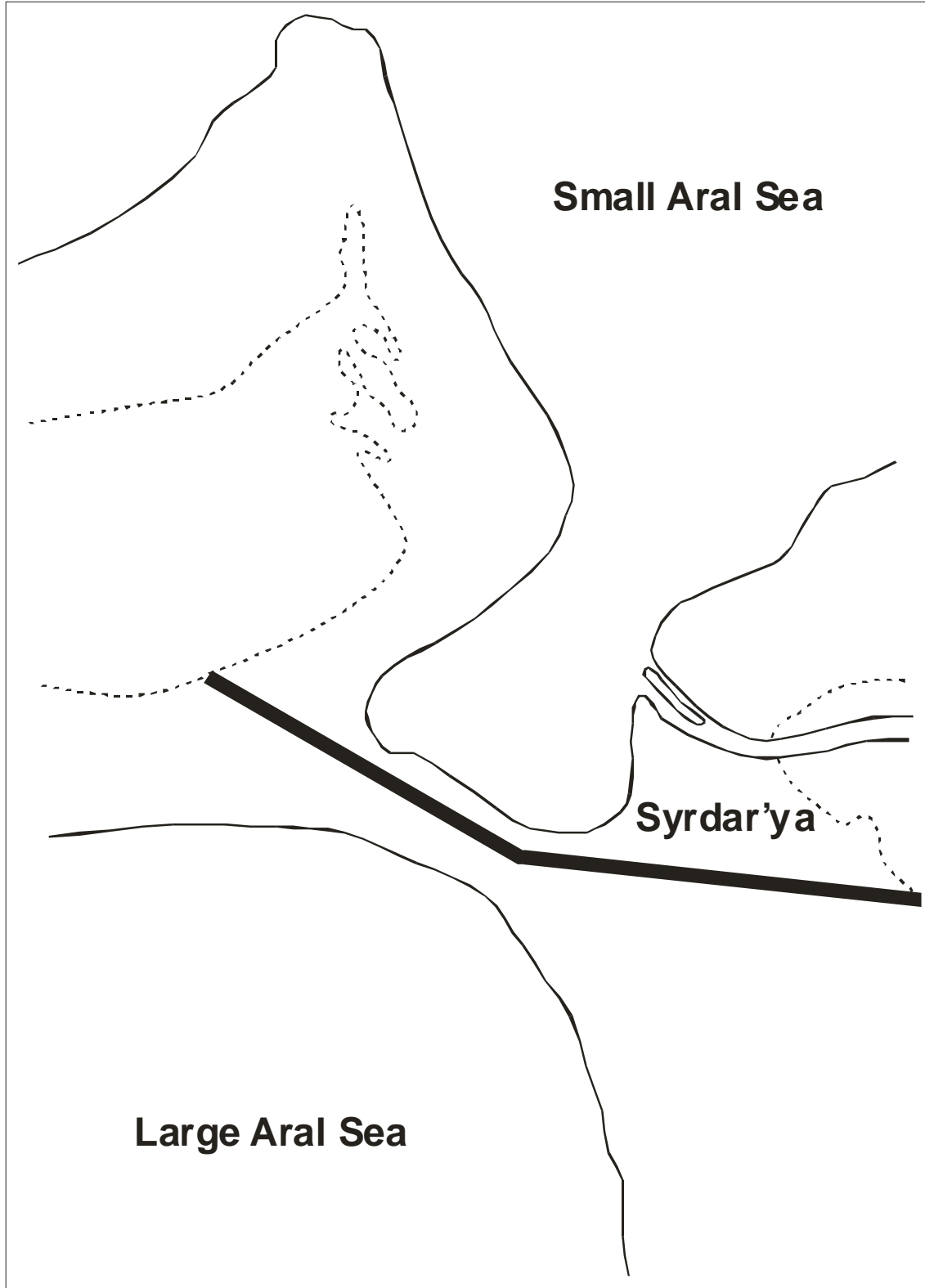
Area 40000 km²
(60% from 1960)

Volume 333 km³
(33% from 1960)

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

The Aral Sea level and salinity

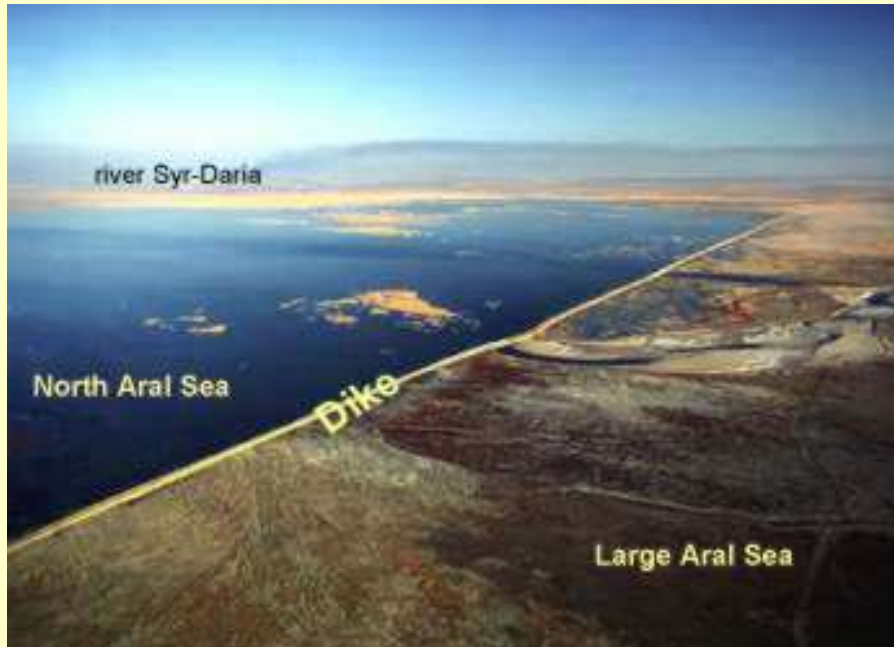




**Dike in Berg strait is
preserving
Small (Northern) Aral
and **rehabilitating its
biodiversity.****

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.

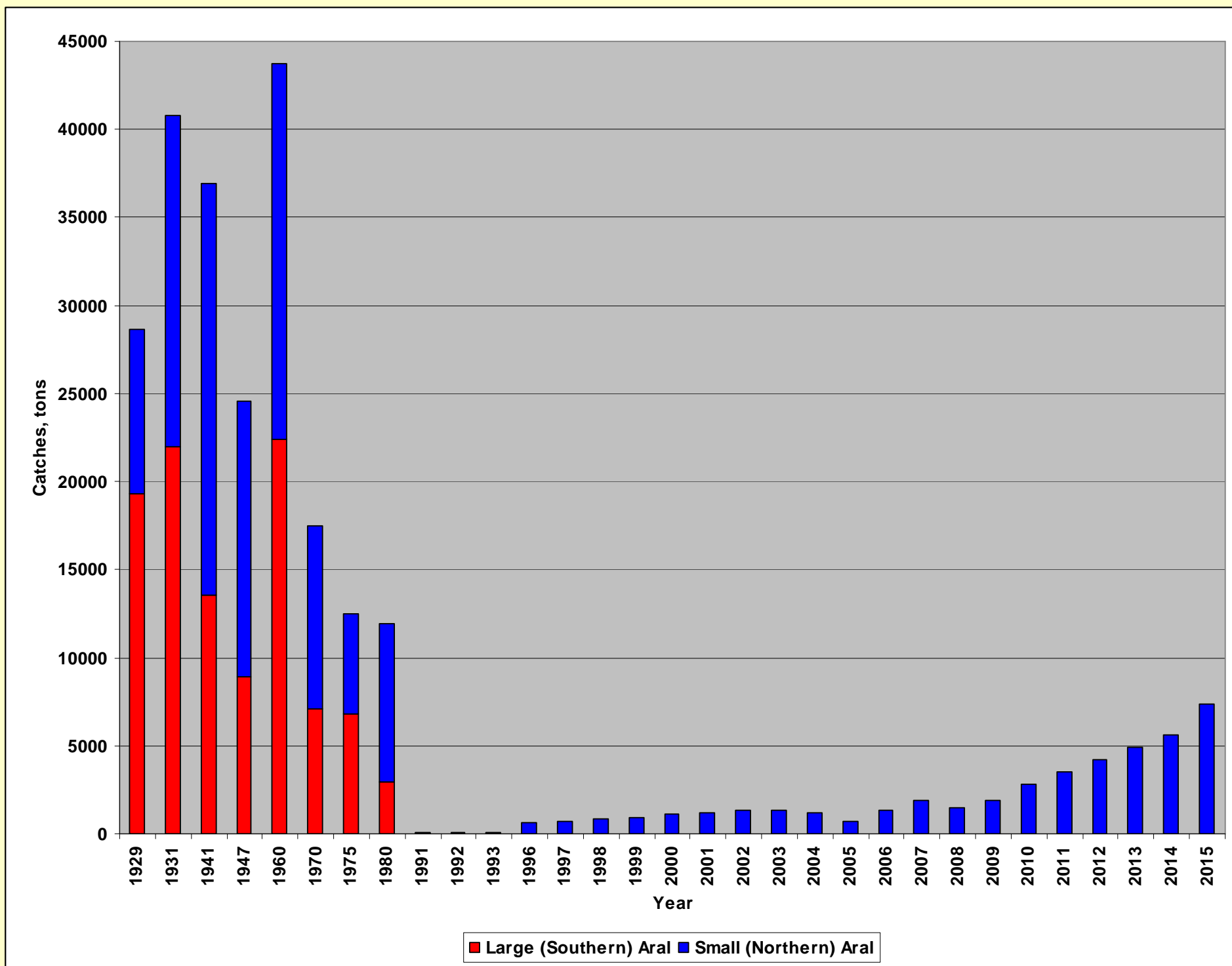
The first dam was built by our proposal in August 1992.



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

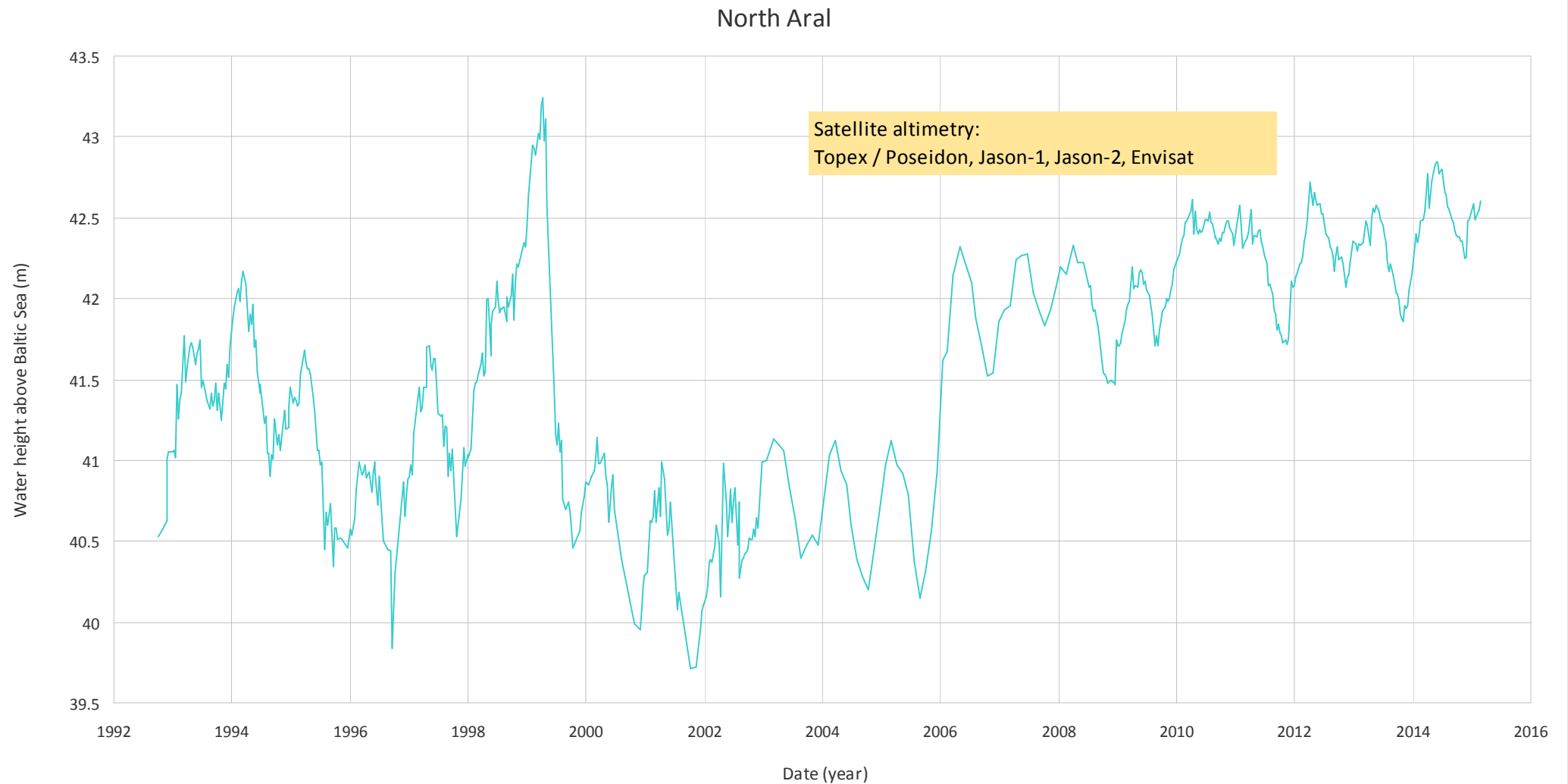


Dynamics of fish catches in the North and South Aral Sea



In April 1999, when the Small Aral Sea level increased more than by 3 m and reached +43.5 m, the dam broke.

(data from satellite altimetry by J.-F. Cretaux)

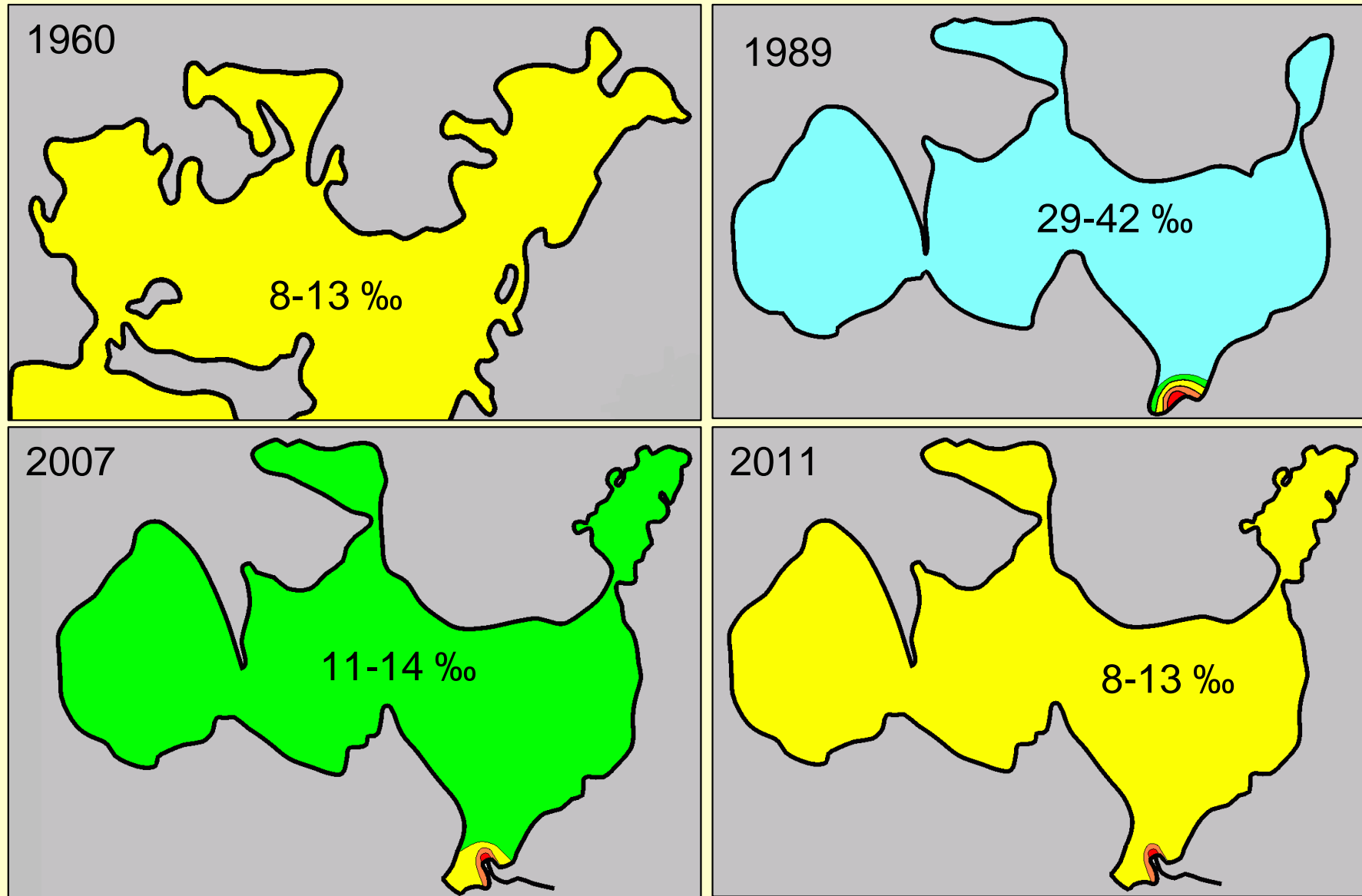


New Kok-Aral dike built by Russian company “ZARUBEZHVODSTROY”



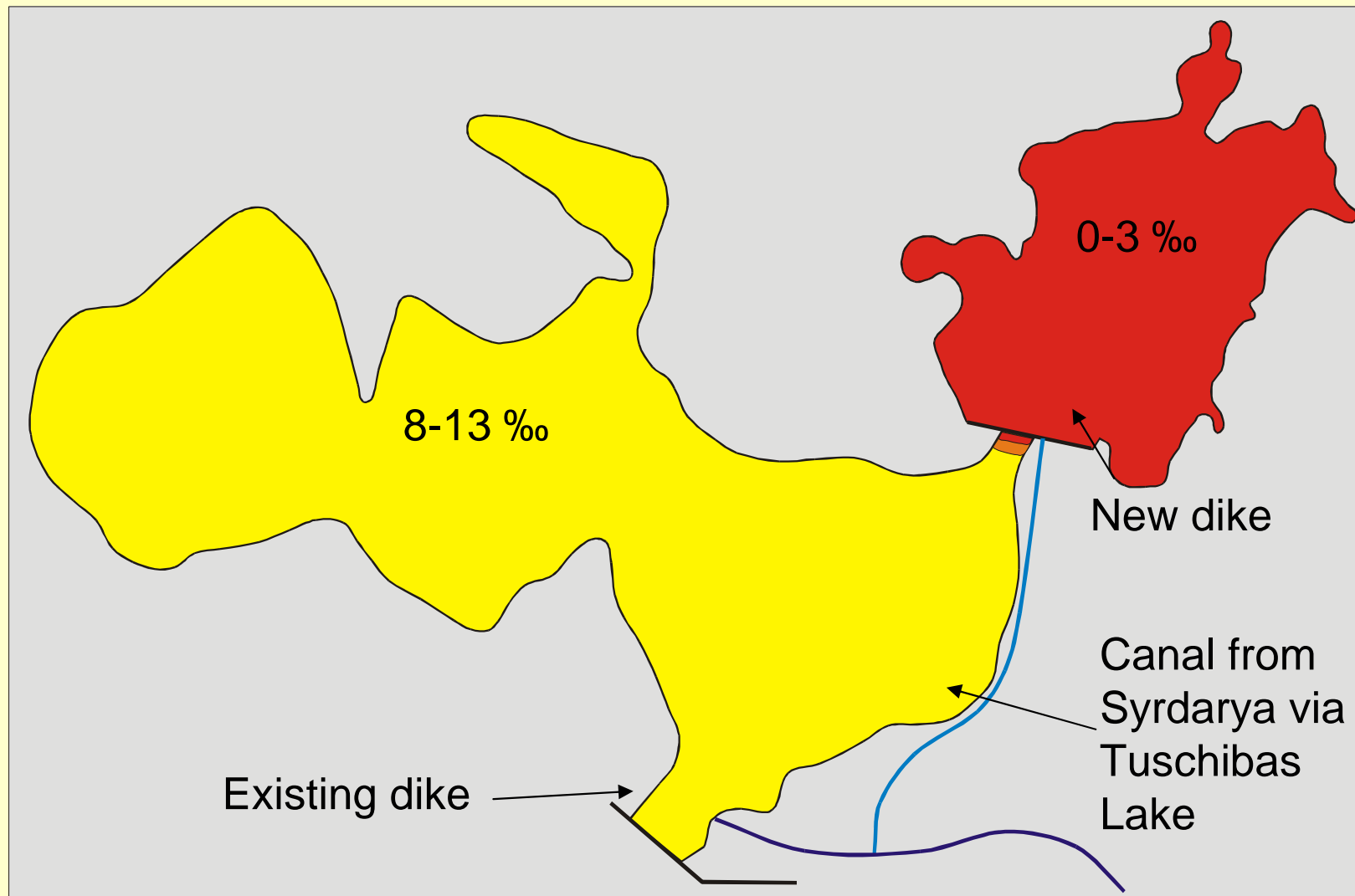
**Kok-Aral
Dam**

Dike in Berg's strait funded by GEF and Kazakhstan government allowed to improve brackish water environment of Small (Northern) Aral Sea



- Dike in Berg's strait allowed increase of level in Small (Northern) Aral Sea to +42 m a.s.l. with "forcing" to 42.5 m.
- Present average salinity in Small (Northern) Aral Sea is about 16-17 g/l. In the nearest future it will reach 8-13 g/l.
- For further improvement of situation there are needed improvements in irrigation efficiency to raise inflow from Syr Dar'ya.
- It is possible to make the present dike a bit higher and raise the level to +45 m a.s.l. This will allow to enlarge the volume and area of Small (Northern) Aral Sea.

Alternative version of the 2nd stage of the project of restoring the Small Aral



- **Alternative 2nd phase of the project would raise level only of Saryshaganak Gulf.**
- **Second phase would allow further improvement of the health of the local people, to decrease unemployment and increase living standards as well as income to the local families.**
- **The local economy also will be improved (fishery, shipping, etc.).**
- **Local microclimate around Small (Northern) Aral Sea will be much better than now.**

Second dike to be built
in the nearest future
Level 46-47 m a.s.l.

Аральск
Аральски
Canal to Aralsk
(≈10 km)

Жаланаш
Canal from Tuschibas Lake to
Sarycheganak Bay (≈50 km)

Платина САМ

Бугунь

Жанакурылмо

Кызылжар

оз. Камыслыбас

оз. Лайкель

оз. Жалаушкыль

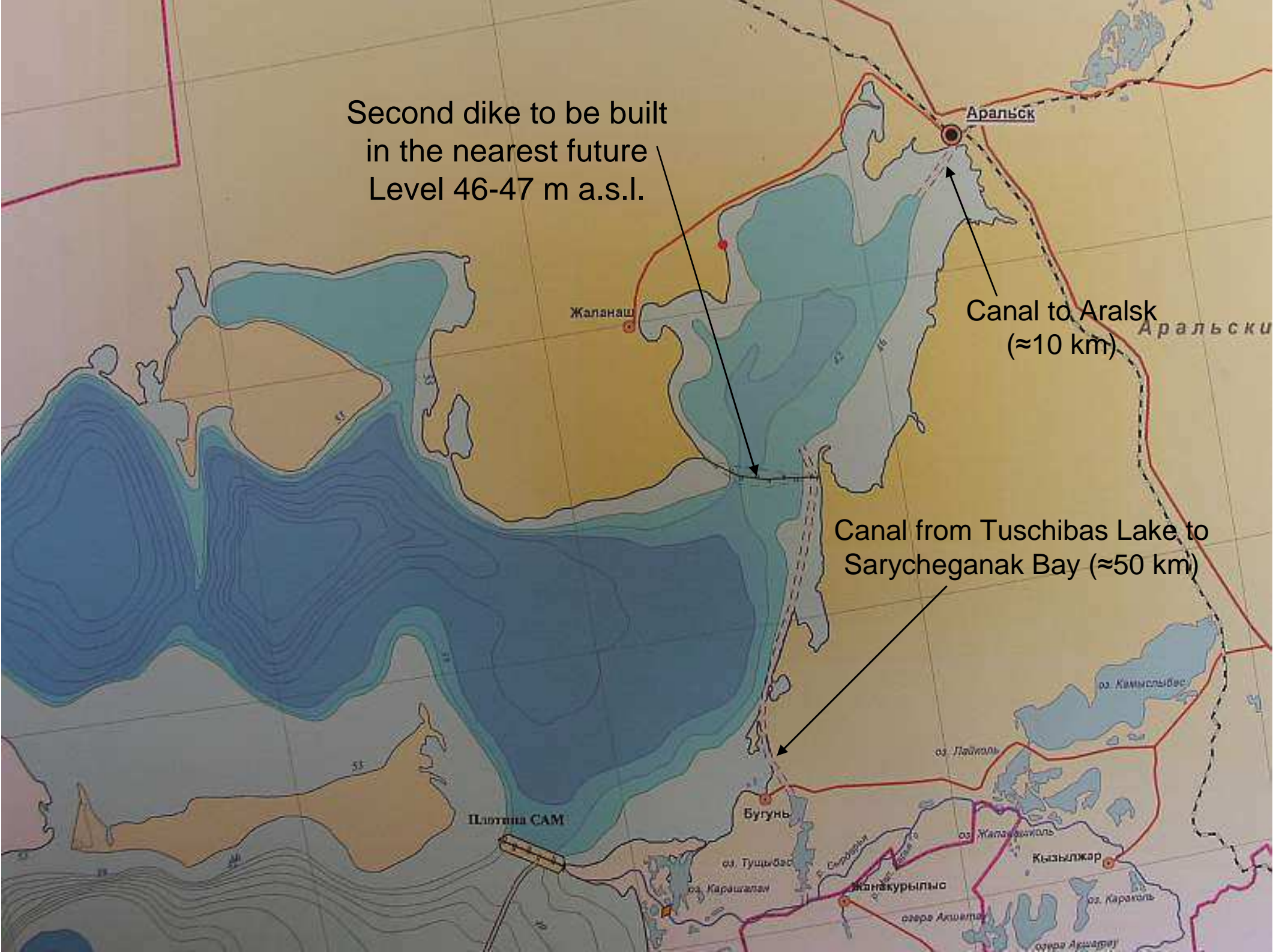
оз. Тушчыбас

оз. Карашалак

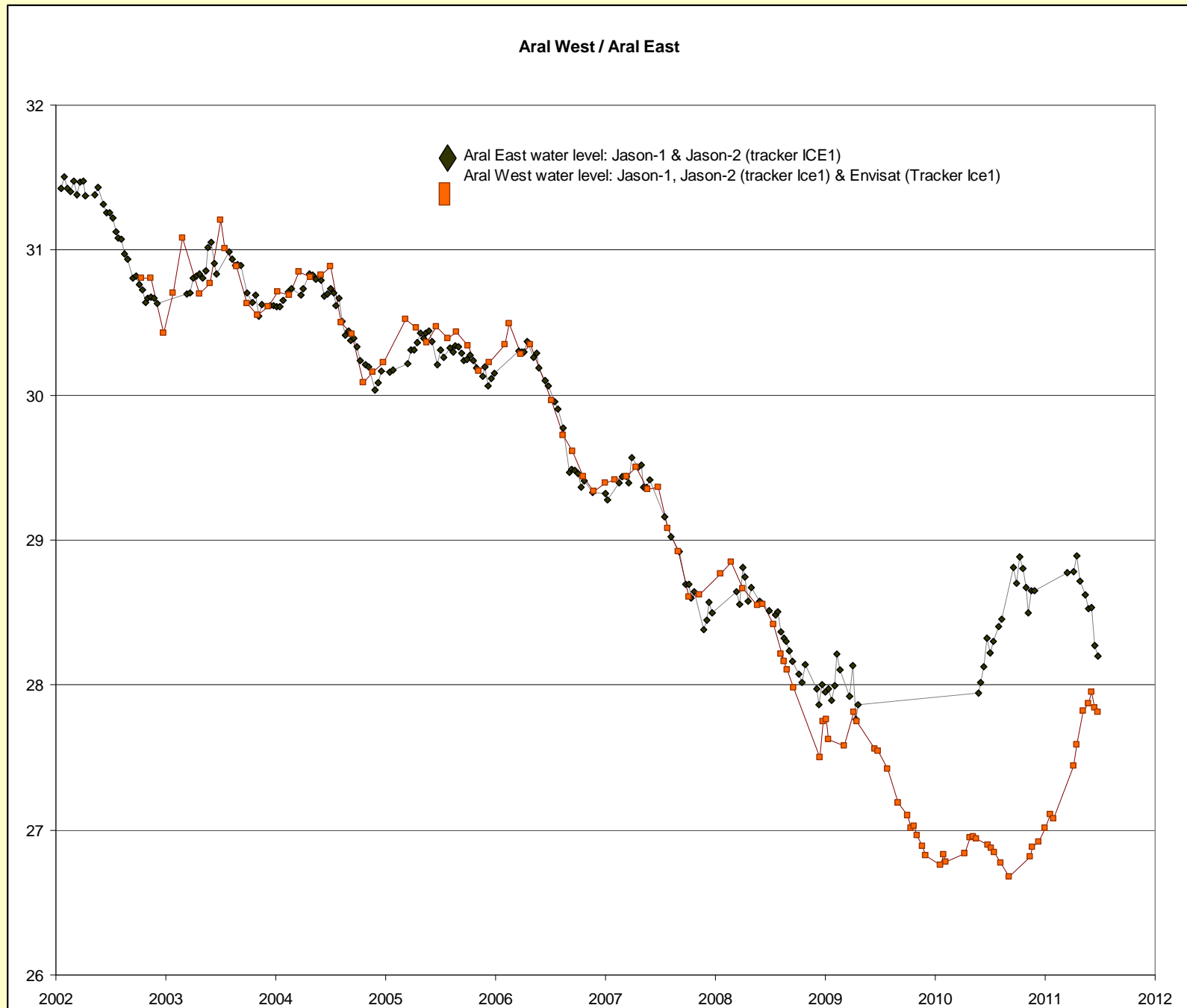
озера Акшатау

оз. Караколь

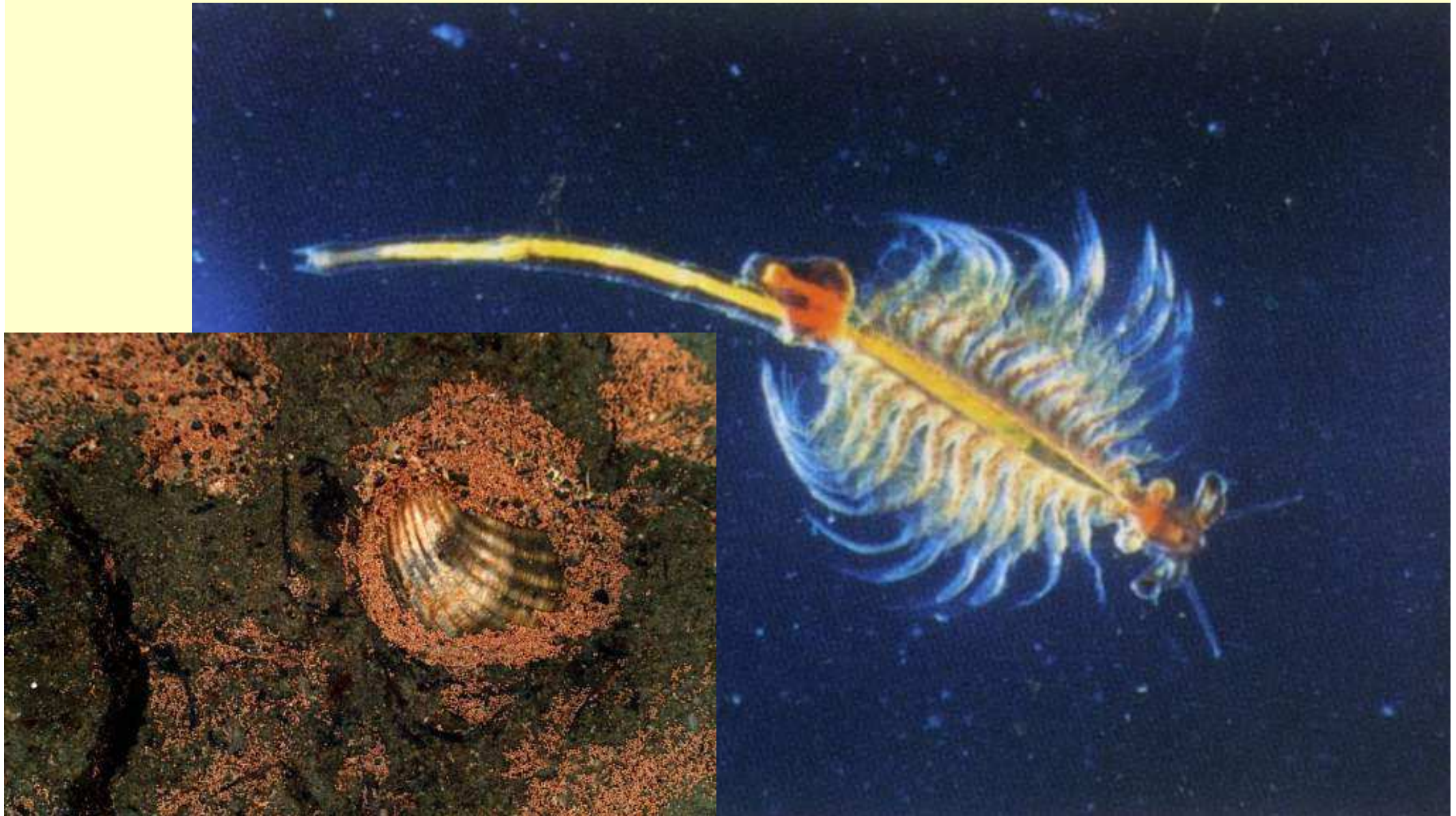
озера Акшатау



Since Aral Sea divided into 2 lakes at the end of 1980s level of Large Aral Sea is declining (data from satellite altimetry, courtesy of Jean-Francois Cretaux)



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



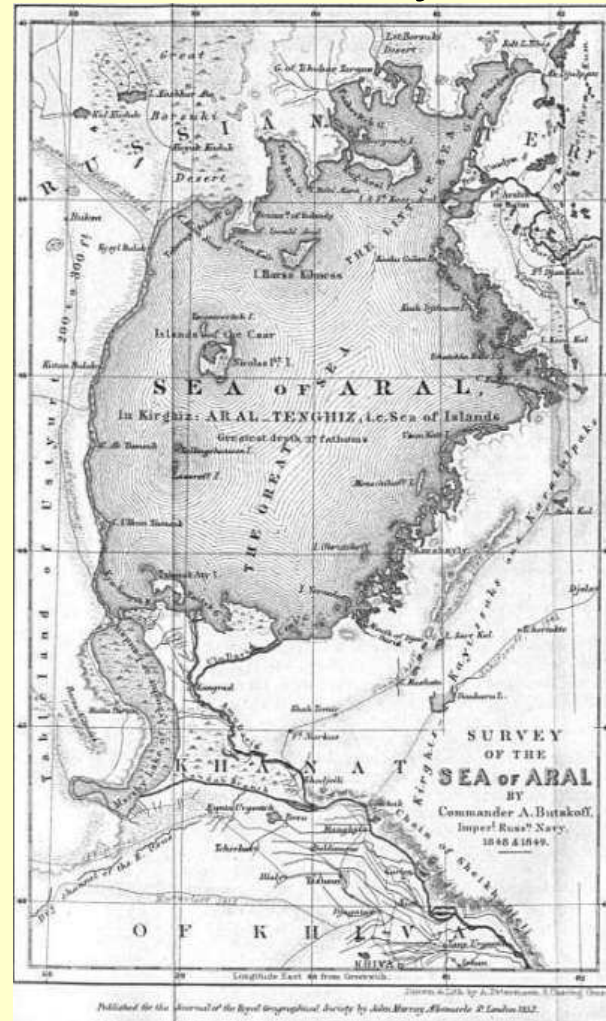
In 2002-2005 under aegis of international company INVE Aquaculture industrial harvesting of cysts was considered but now activities are postponed

The Aral Sea shape changing

Middle Ages



Middle of the XIX century

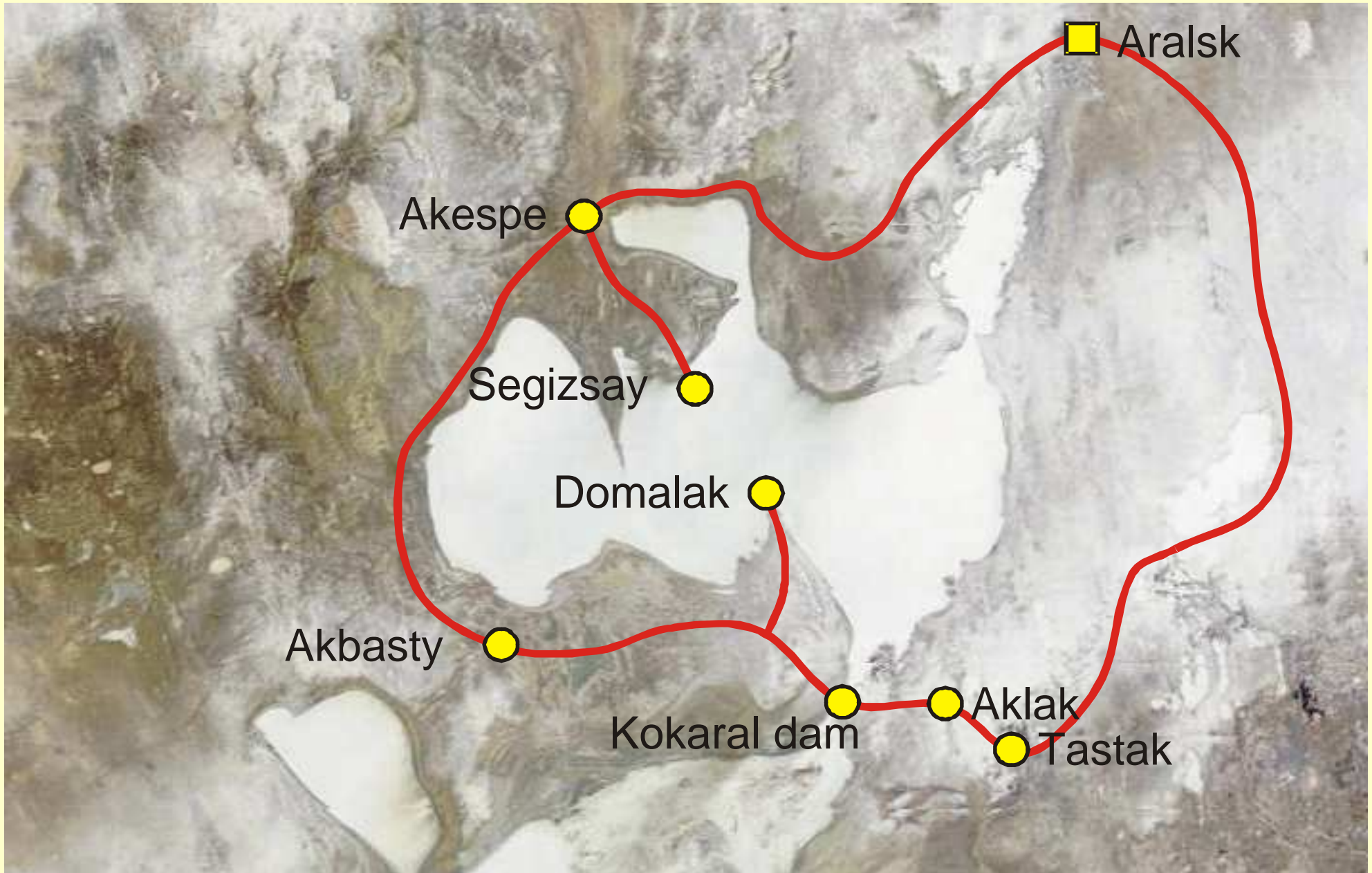


Beginning of the XXI century



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

Expedition to the Small Aral (January-February 2013)



The total length of the expedition route is more than 400 km

Research car of the Aral branch of KazNIIRH on the ice of the Small Aral near
Cape Segizsai

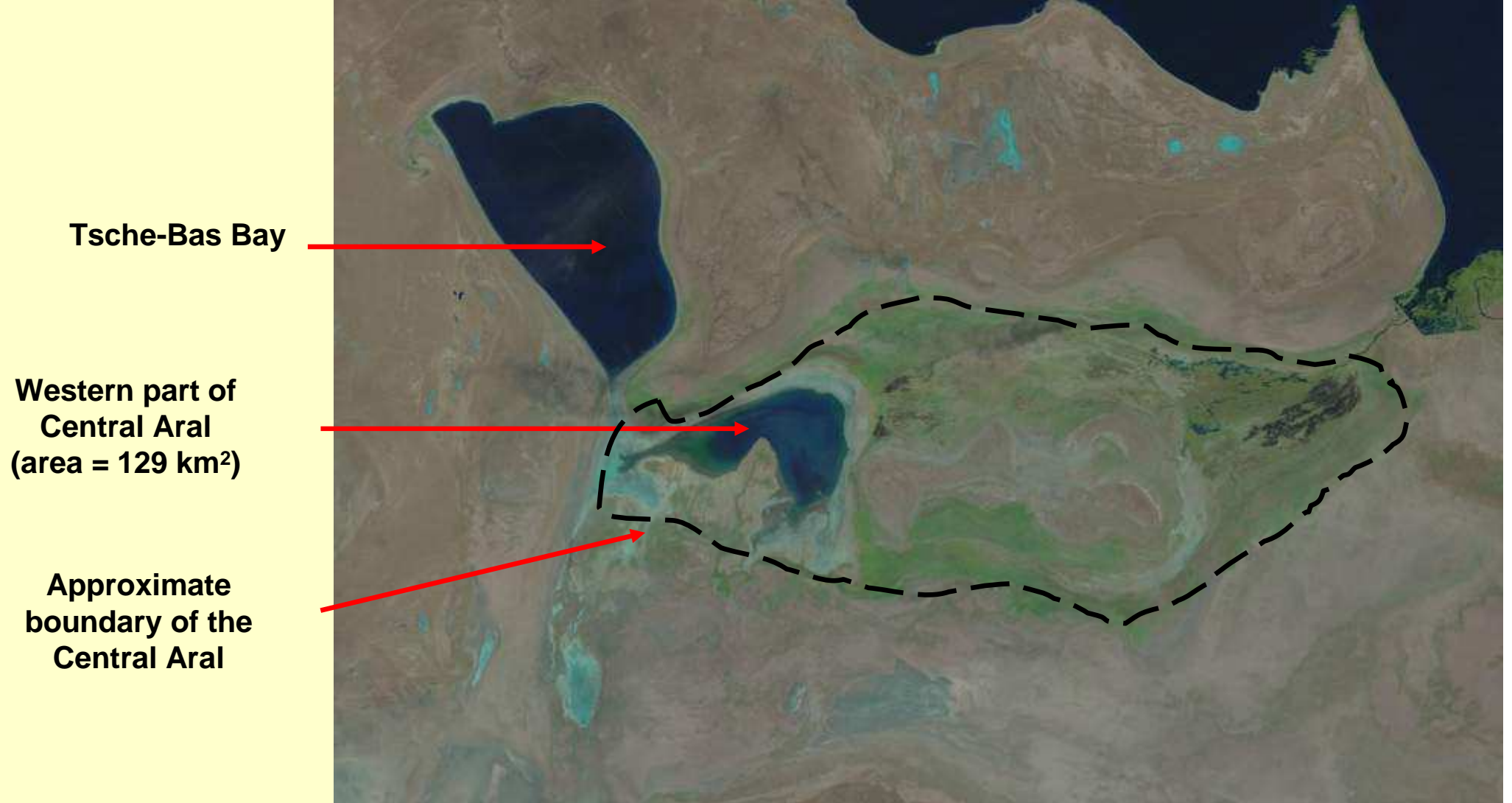




Sampling of winter
zooplankton

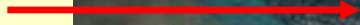
Pulling out of the fishing net on the Aral ice by the scientists of the Aral branch of KazNIIRH



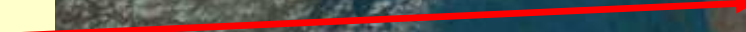


Central Aral, 3.10.2015. Light green color - wet soil, shallow water and hydrophytic vegetation. This is the Central Aral at the end of the dry season (July-November), when it receives a little water from the Small Aral Sea. Salinity of Western Lake at the end of this period is, probably quite high (perhaps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

Tsche-Bas Bay



**Island in the middle of
the Central Aral
(area = 276 km²)**



Central Aral, 23.01.2016. Central Aral during the wet season (from December to June), when large volumes of water discharge 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 normal spring flood. Mineralization of the lake at this time is low (fish can survive). The lake is covered with ice.

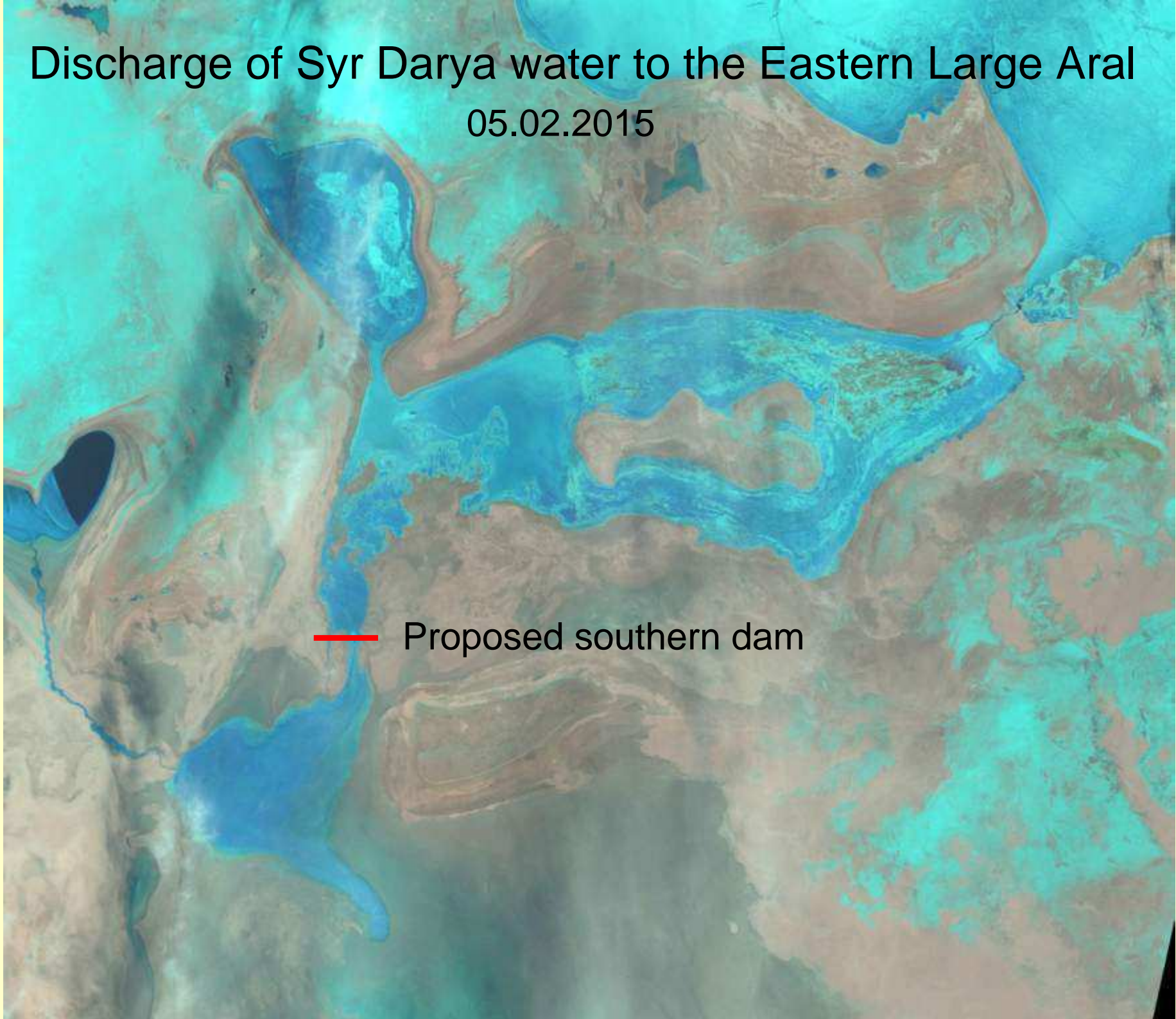


ARAL SEA on August 19, 2014 (MODIS)

- 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 - Tische-Bas Bay
- A - Kokaral dam (Central dam)
- B – Proposed Northern dam
- C – Proposed Southern dam

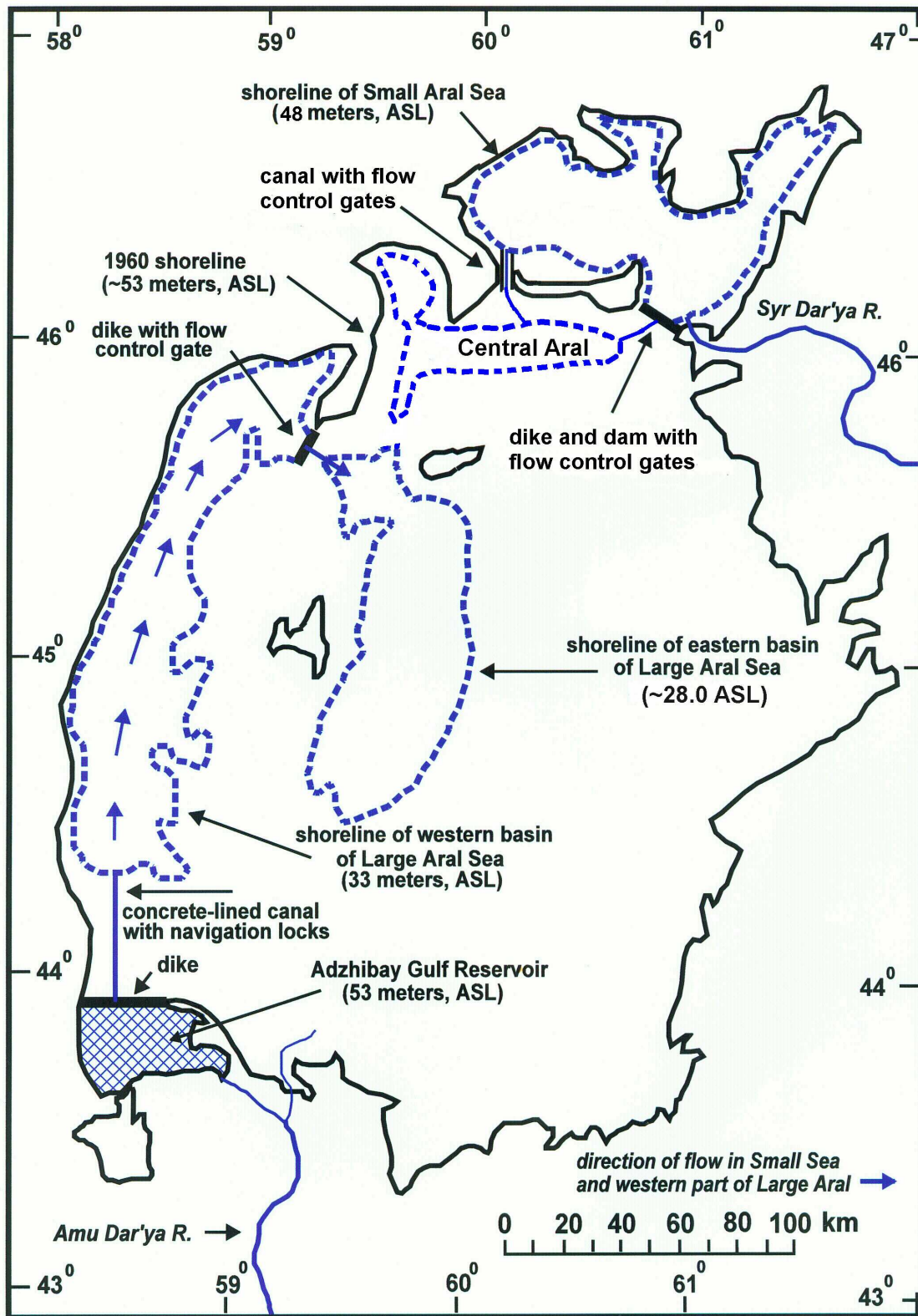
Discharge of Syr Darya water to the Eastern Large Aral

05.02.2015



— Proposed southern dam

Optimistic Scenario of the Future Aral Sea (after 2030)



By: Micklin P. 2016. The future Aral Sea: hope and despair. Environmental Earth Sciences, 75: 844.



2017 Sep. Small Aral Sea Expetion

Day 1 (Sep. 4): Aralsk-Kamstbas-Karateren-Tastak-Karachalan-Koszhal-Aralsk (388km)
Day 2 (Sep. 5): Aralsk-Small Aral Sea-Zhalanash-Akespe (128km)
Day 3 (Sep. 6): Akespe-Akbasty-Small Aral Sea-Akbasty (138km)
Day 4 (Sep. 7): Akbasty-Small Aral Sea-Akbasty (65km)
Day 5 (Sep. 8): Akbasty-Konnyi zavod-Kok-Aral-Tastak (110 km)
Day 6 (Sep. 9): Tastak-Barsakelmes Nature Reserve-Tastak-Amanotkel-Raim-Aralsk (491 km)

Total running distance: 1320 km

100 km



Discharge of water together with the fish from the Small Aral Sea



Fishes dropping down through the Kokaral Dyke



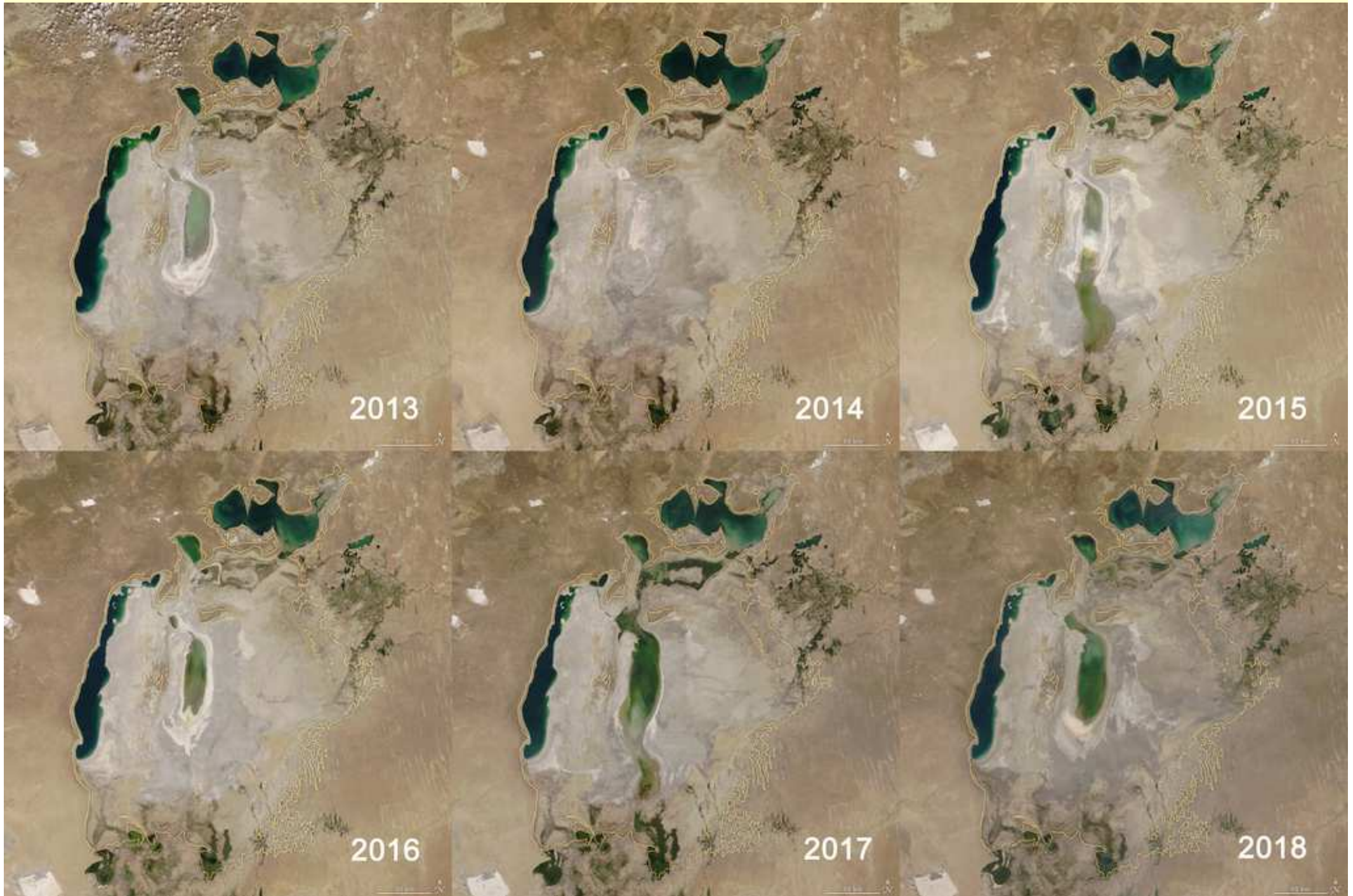
- December 12, 2018, the Executive Directorate of IFAS in Kazakhstan signed a contract for implementation from December 1, 2018 to December 31, 2019 of a large investment project “Preserving the fish of the Northern Aral”.
- This project will be implemented through grant funds of the German Society for 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.

- From February 27 till March 11, 2019 it is planned to make a field trip to the Small/Northern Aral Sea under leadership of Prof. Dr. Jumpey Kubota from Japan.
- Members of our laboratory and our colleagues from Japan and Republic of Kazakhstan will participate 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.

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

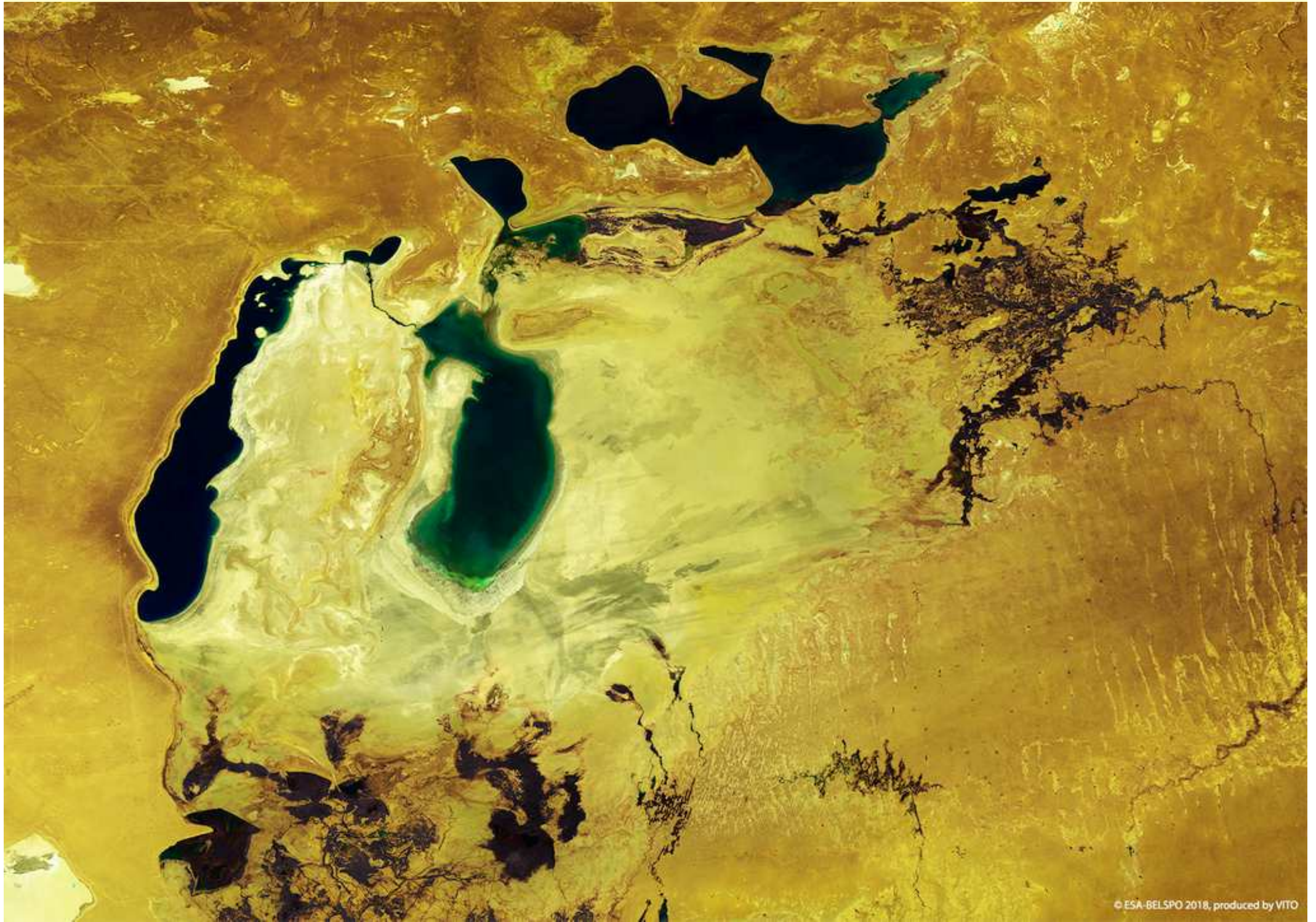
1. As soon as possible to raise by 2-3 m the dam in Berg Strait.
2. In the next few years to build a dam in the throat of Sarycheganak Bay.
3. Build a simple dam to the south of Kulandy peninsula.
4. Refuse shallow reservoirs in Amu Darya delta.
5. To redirect the rest of the Amu Darya flow to the Western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

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

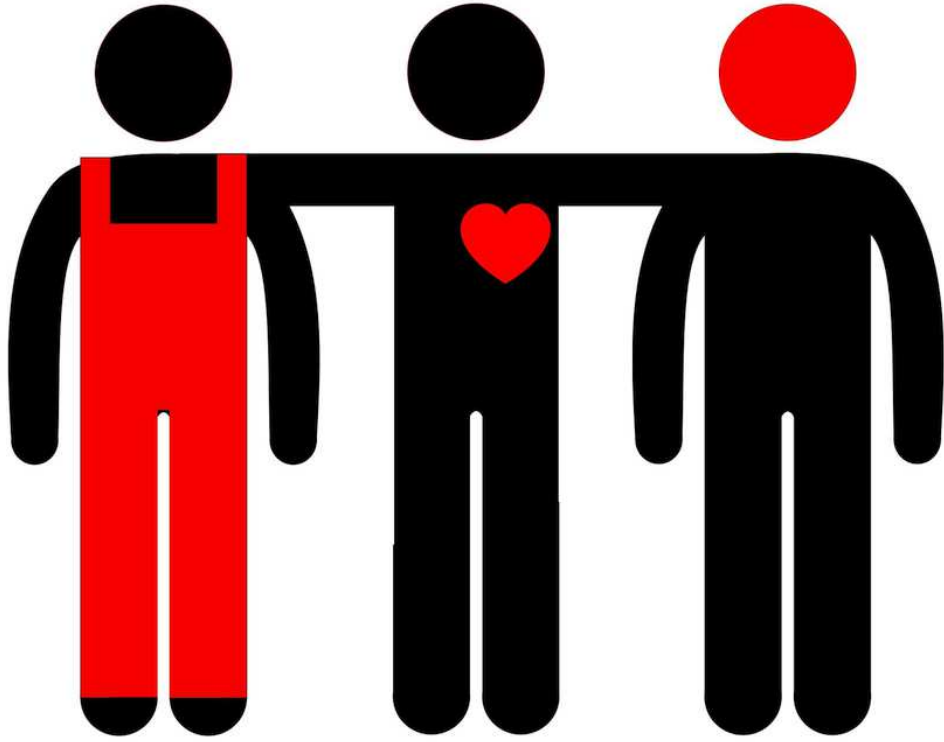


Huge volume of Amu Darya River discharge during the last 4 years: 2015-2018

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



heartware

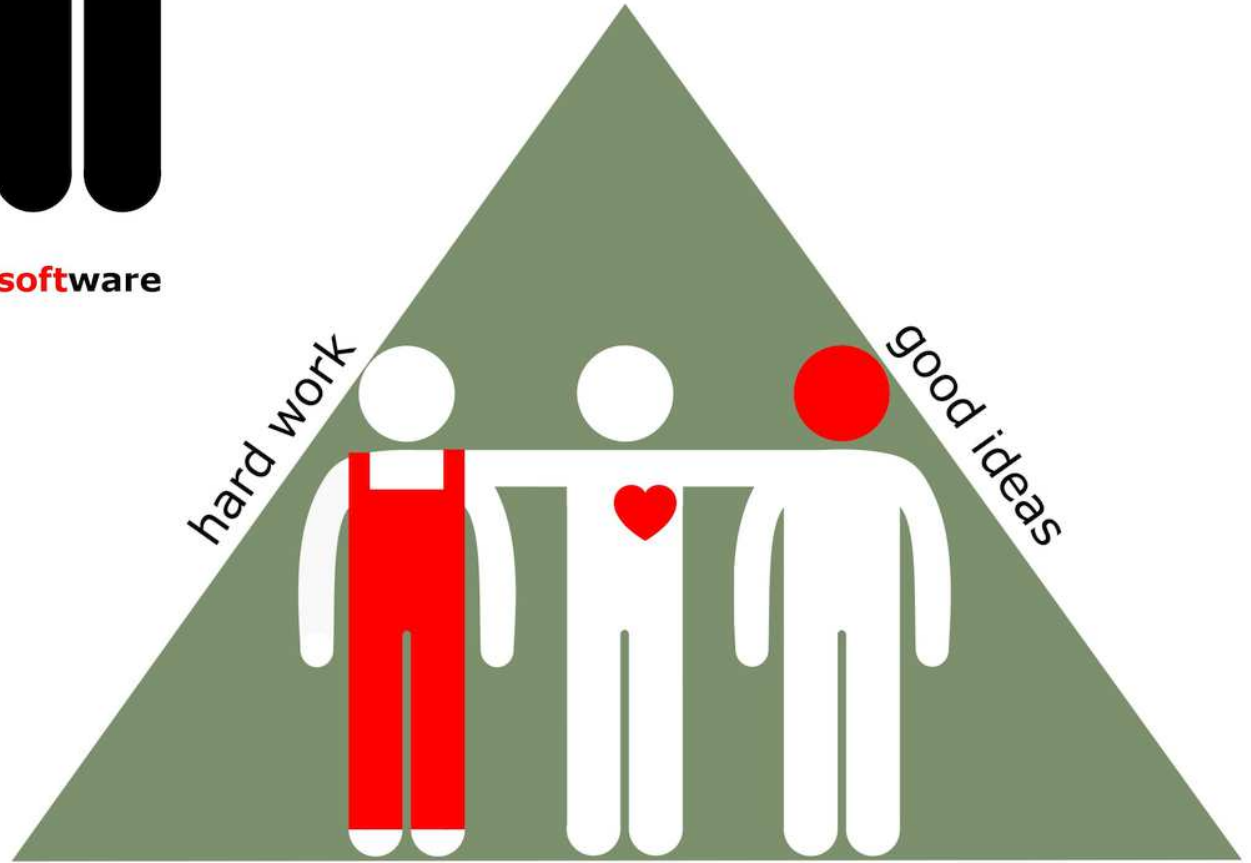


hardware

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 future