Presentation in Sapporo

15:00-16:30, August 1, 2015

The Partial Restoration of the Aral Sea and the Biological, Socio-Economic and Health Conditions in the Region

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in cooperation with
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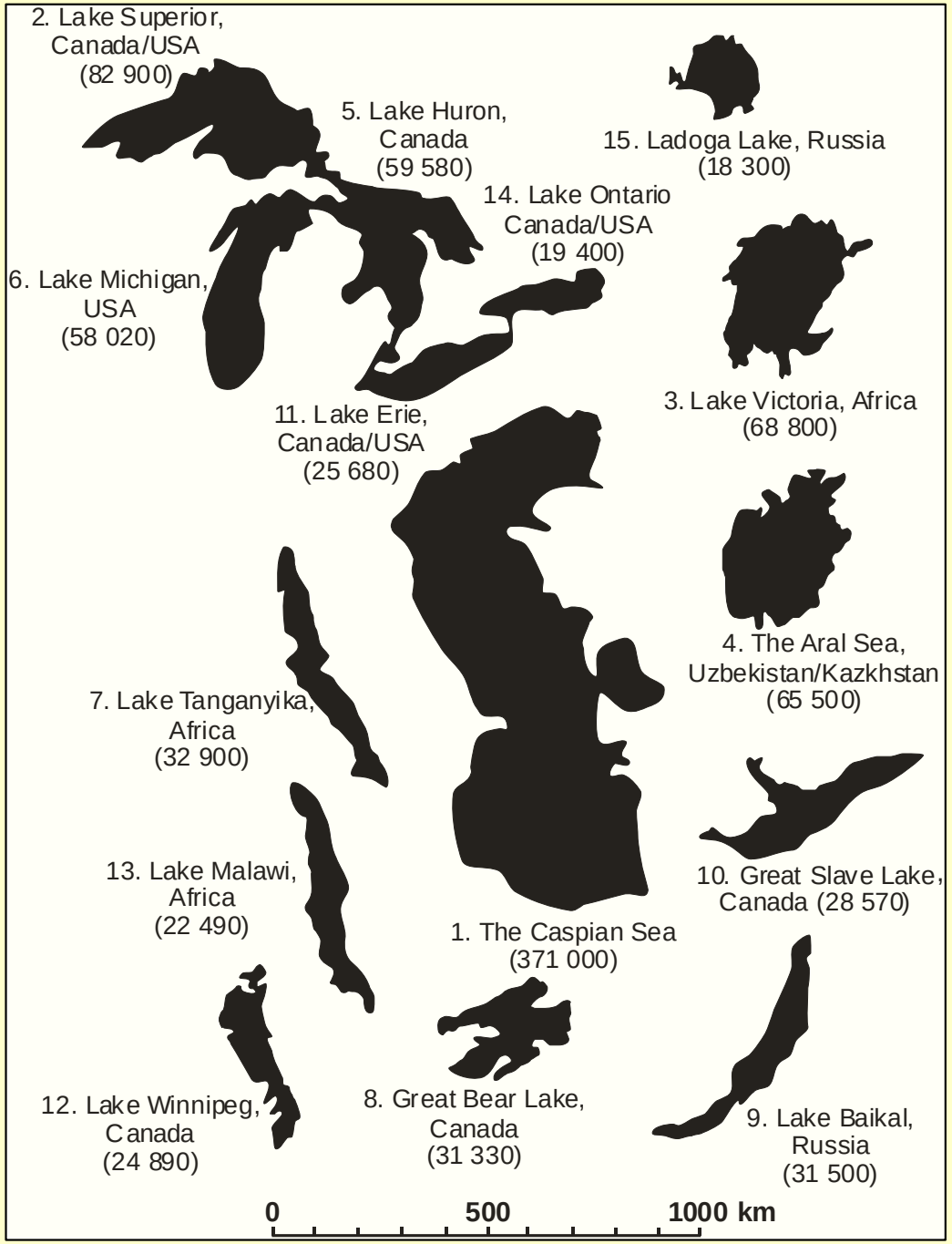
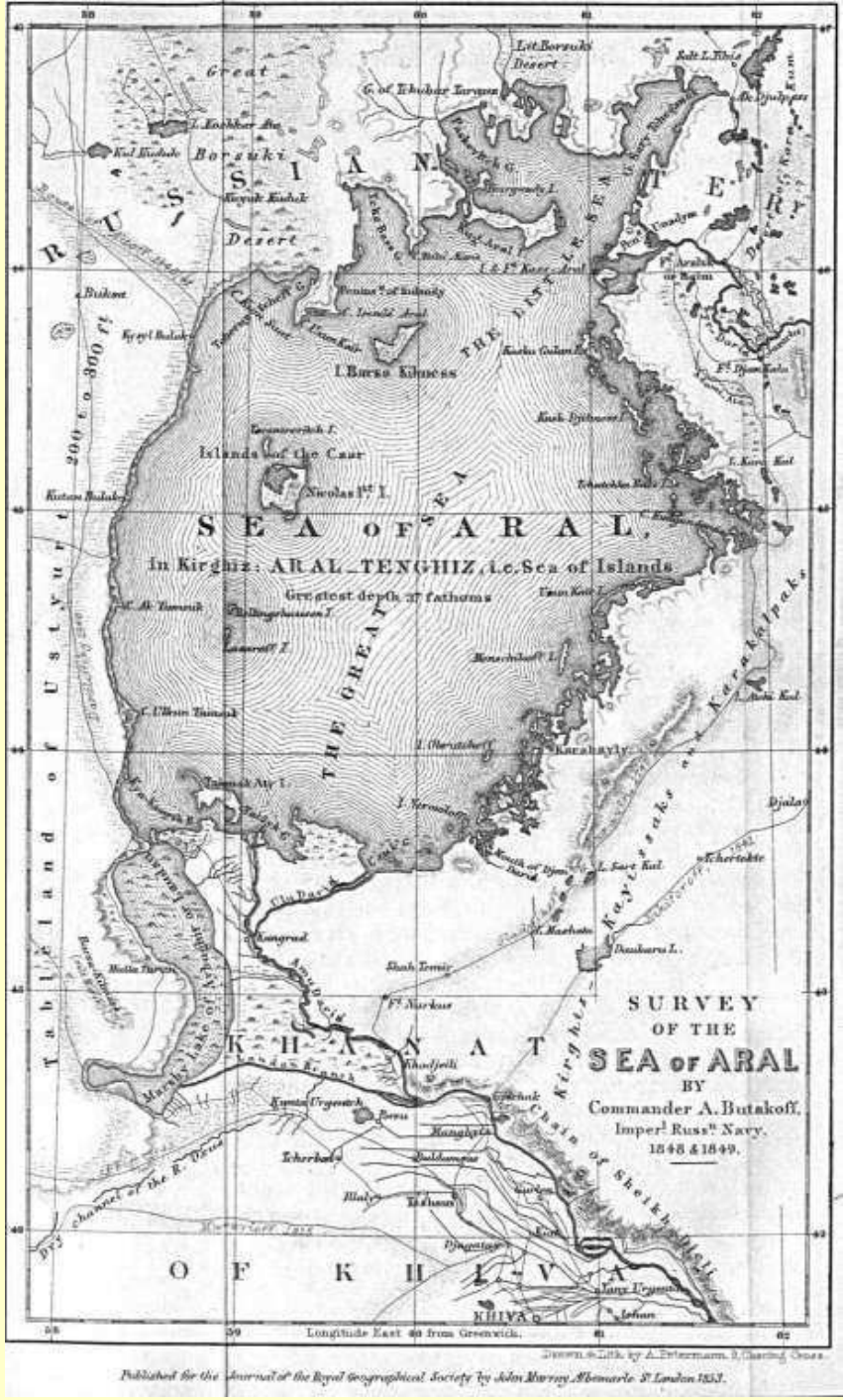
Integrated Lake Basin Management (ILBM)

- ILBM is a way of thinking that assists lake basin managers and stakeholders in achieving sustainable management of lakes and their basins. It takes into account that lakes have a great variety of resource values whose sustainable development and use require special management considerations for their lentic (static) water properties.
- In our studies of Aral Sea we are using IL^{2}BM platform (Integrated Lotic/Lentic Basin Management) (http://www.ilec.or.jp/en/).


Commonwealth of Independent States - Central Asian States
RUSSIA
KAZAKHSTAN
MONGOLIA
CHINA
KYRGYZSTAN
TAJIKISTAN
UZBEKISTAN
TURKMENISTAN
AZERBAIJAN
IRAN
AFGHANISTAN
PAKISTAN
INDIA
Catchment area of the Aral Sea is about 1.8 million km²
ARAL SEA BASIN
Aral Sea
Caspian Sea
Lake Balkhash
Volga-Don Canal
Scale 1:16,500,000
Lambert Conformal Conic Projection, standard parallels 47°N and 62°N
0 300 Kilometers
0 300 Miles
Chinese line of control
Indian claim
Boundary representation is not necessarily authoritative.
802384 (R00030) 5-95

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

Parameters of the Aral Sea in the beginning of 20th century

- Area 67499 km^2
  Large Aral 61381 km^2
  Small Aral 6118 km^2
- Volume 1089 km^3
  Large Aral 1007 km^3
  Small Aral 82 km^3
- Level +53.4 m
- Maximal depth 69 m
- Salinity about 10 g/l
- The Aral Sea was inhabited by about 20 species of fishes and about 200 species of free-living invertebrates

In the Aral Sea there was the following number of aboriginal free-living animals:

Fishes – 20
Coelenterata – 1
Turbellaria – 12
Rotatoria – 58
Oligochaeta – 10
Cladocera – 14
Copepoda – 7
Harpacticoida – 15
Ostracoda – 11
Malacostraca – 1
Hydracarina – 7
Bivalvia – 9
Gastropoda – 3
TOTAL: 160

Protozoa and some other small Metazoa are not included.

Between the middle of the 19th century and 1961 shape and salinity of the Aral Sea practically didn't change. We must note, however, that due to intended and accidental introductions, that started in the 1920s, the number of free-living animals grew substantially.

In the Aral Sea appeared:

Fishes – 17

Mysidacea – 5

Decapoda – 2

Copepoda – 1

Polychaeta – 1

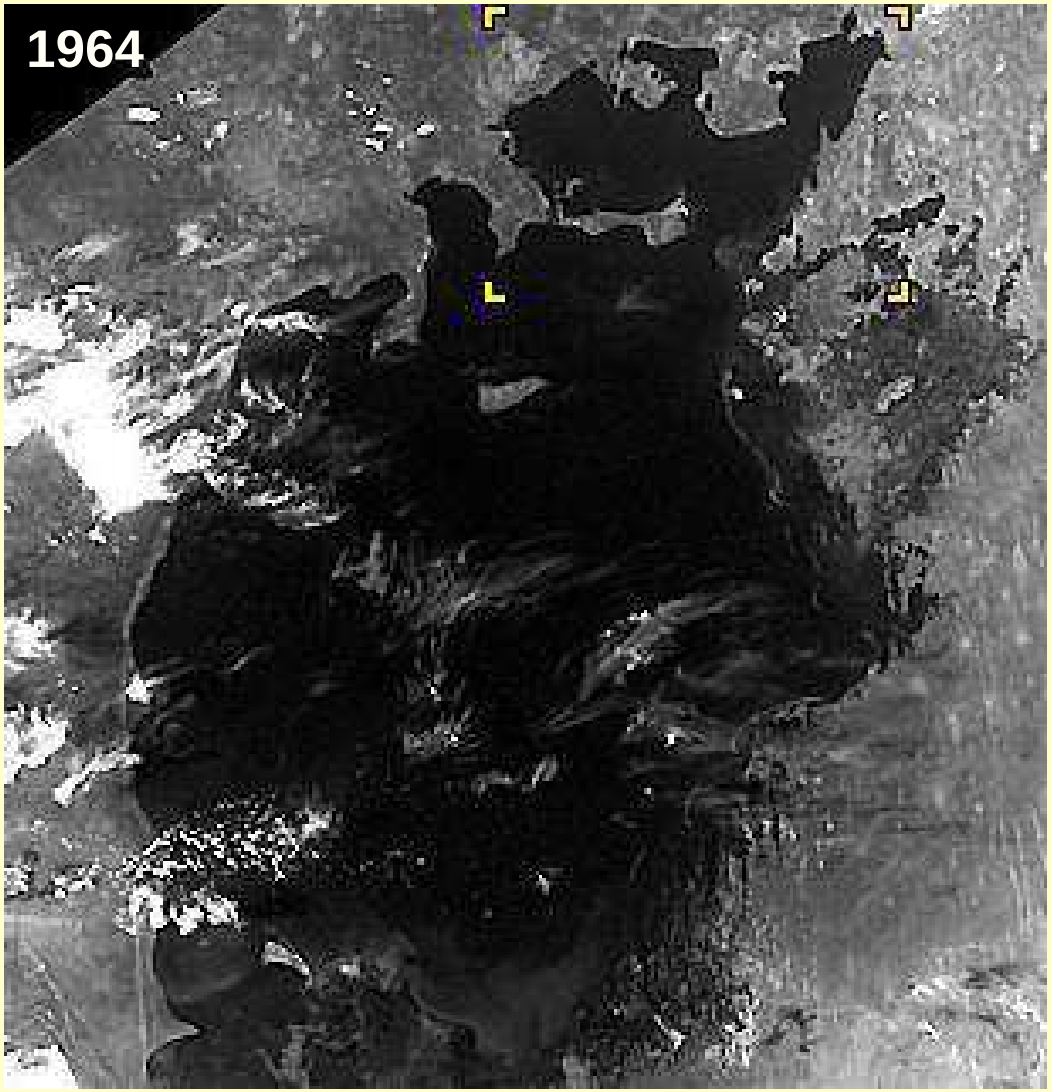
Bivalvia - 1

TOTAL: 27

Abra **and** ***Nereis*** **introduced by man are of great importance for flounder nutrition.**

Crab ***Rithropanopeus*** **was introduced accidentally**

Since 1960 the Aral Sea has steadily shrunk and shallowed owing overwhelmingly to irrigation withdrawals from its influent rivers (Amu Dar'ya and Syr Dar'ya)



September, 2009: Aral area – 8410 km^2 (13%), volume – 85 km^3 (7.5%);
the Large Aral – 4922 km^2 (8%), 58 km^3 (6%), salinity >100 g/l;
the Small Aral – 3487 km^2 (57%), 27 km^3 (33%), salinity 10-14 g/l.

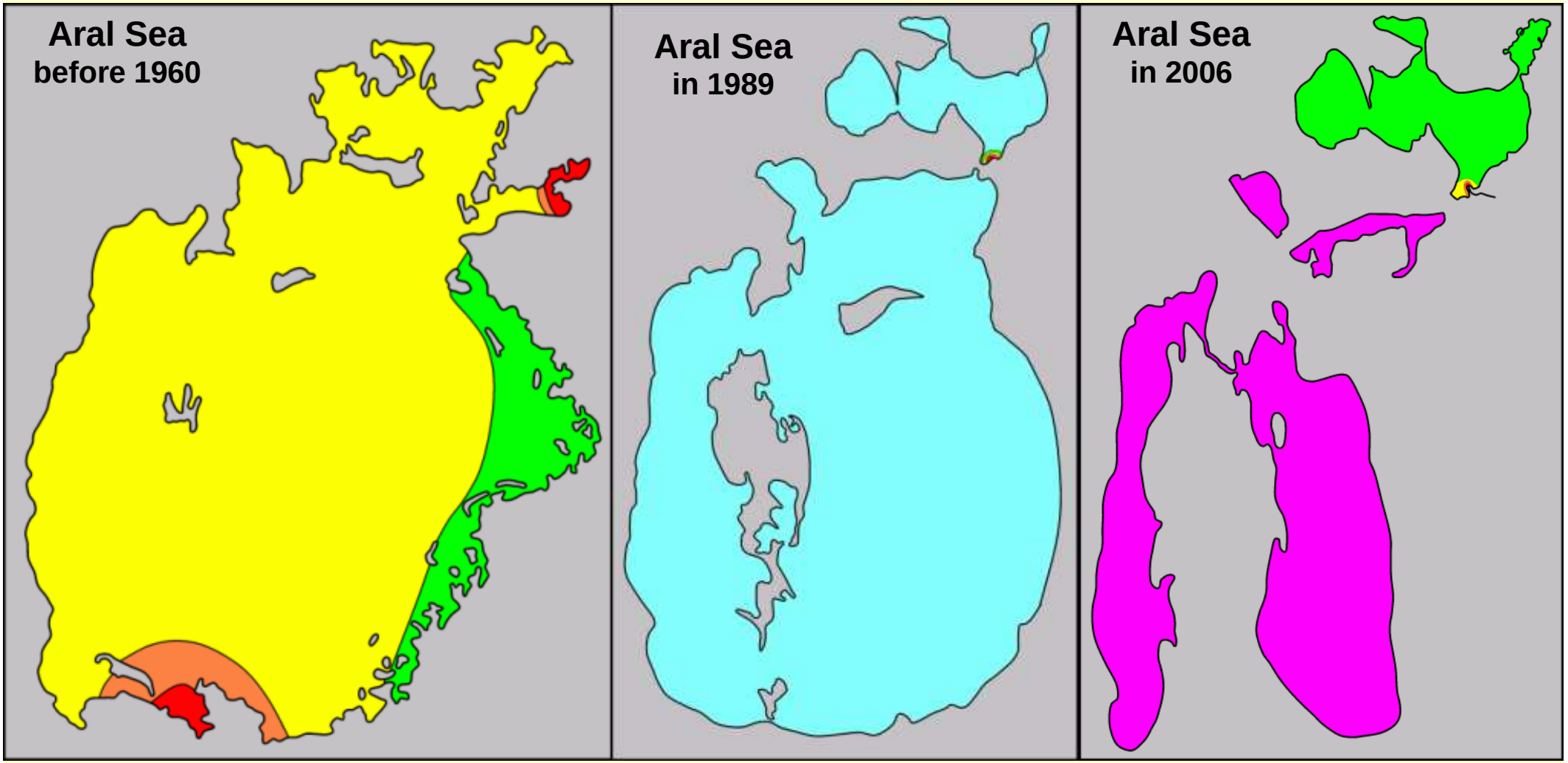
IRRIGATION DEVELOPMENT IN ARAL SEA BASIN

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

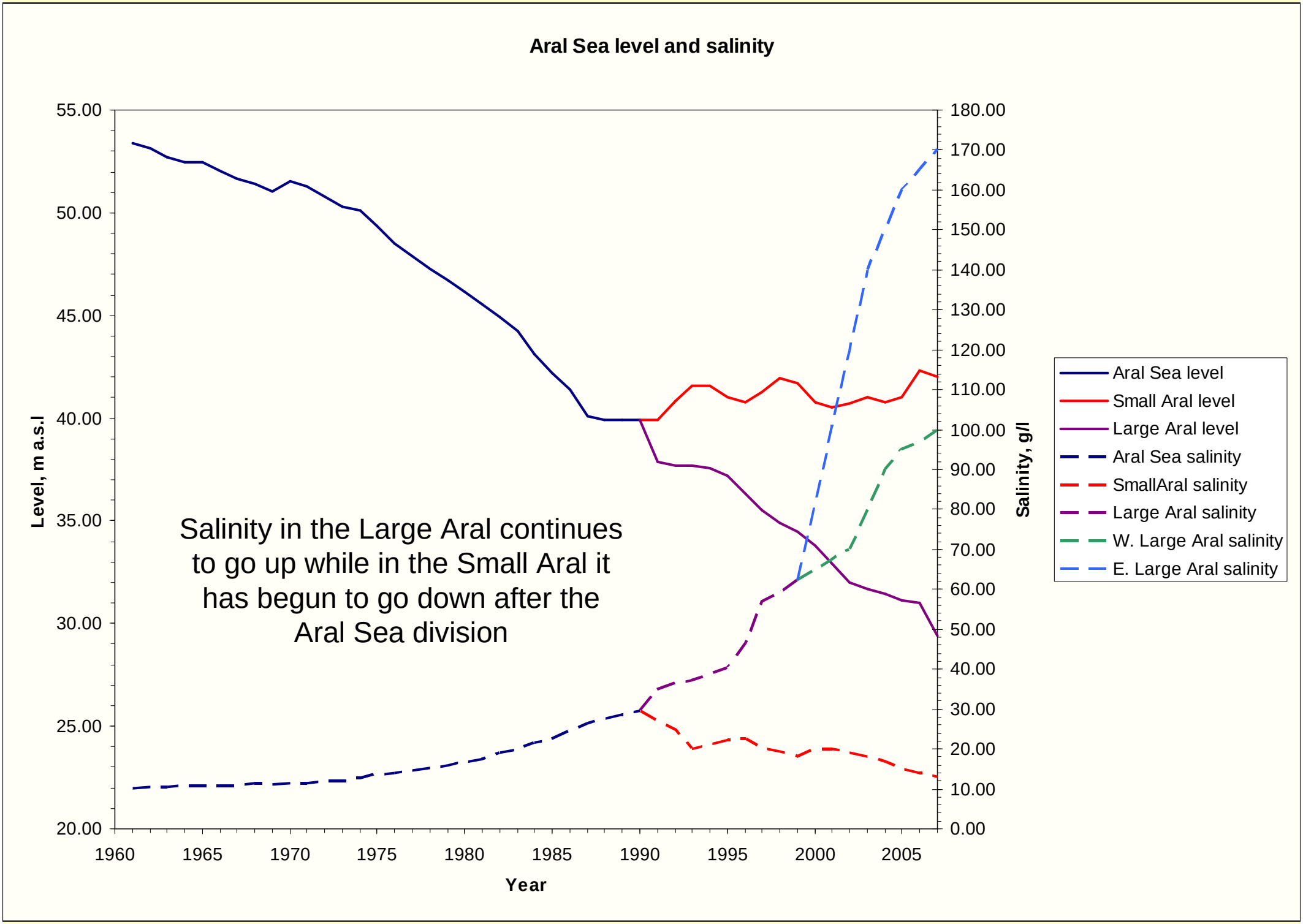


- Freshwater ecosystems
- Transitional freshwater-brackishwater ecosystems
- Brackishwater ecosystems
- Transitional brackishwater-marine ecosystems
- Marine ecosystems
- Hyperhaline ecosystems

At 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 km^2 (60% from 1960)
Volume 333 km^3 (33% from 1960)
Salinity 30 g/l (10 g/l in 1960)

Betweenautumn 1987 – spring 1989 Aral Sea divided into 2 lakes: Small (Northern) Aral and Large (Southern) Aral. In both lakes salinity increased and in each lake practically the same number of free-living animals were able to survive.


Aral Sea level and salinity
Level, m a.s.l
Salinity, g/l
Year
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
180.00
170.00
160.00
150.00
140.00
130.00
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
Salinity in the Large Aral continues to go up while in the Small Aral it has begun to go down after the Aral Sea division
Aral Sea level
Small Aral level
Large Aral level
Aral Sea salinity
SmallAral salinity
Large Aral salinity
W. Large Aral salinity
E. Large Aral salinity

There are 4 main ways of conservation and rehabilitation of Aral Sea and its ecosystems that was first discussed in Geneva (September 1992 - UNEP meeting)

1. **Conservation and rehabilitation of Small Aral**
2. **Conservation and rehabilitation of Large Aral**
3. **Conservation and rehabilitation of delta and deltaic water bodies of Syr Darya**
4. **Conservation and rehabilitation of delta and deltaic water bodies of Amu Darya**

Concept to Partially Preserve Small and Large Aral Seas
(proposed by Lvovich and Tsigelnaya, updated and modified by P. Micklin)

Small Aral Sea

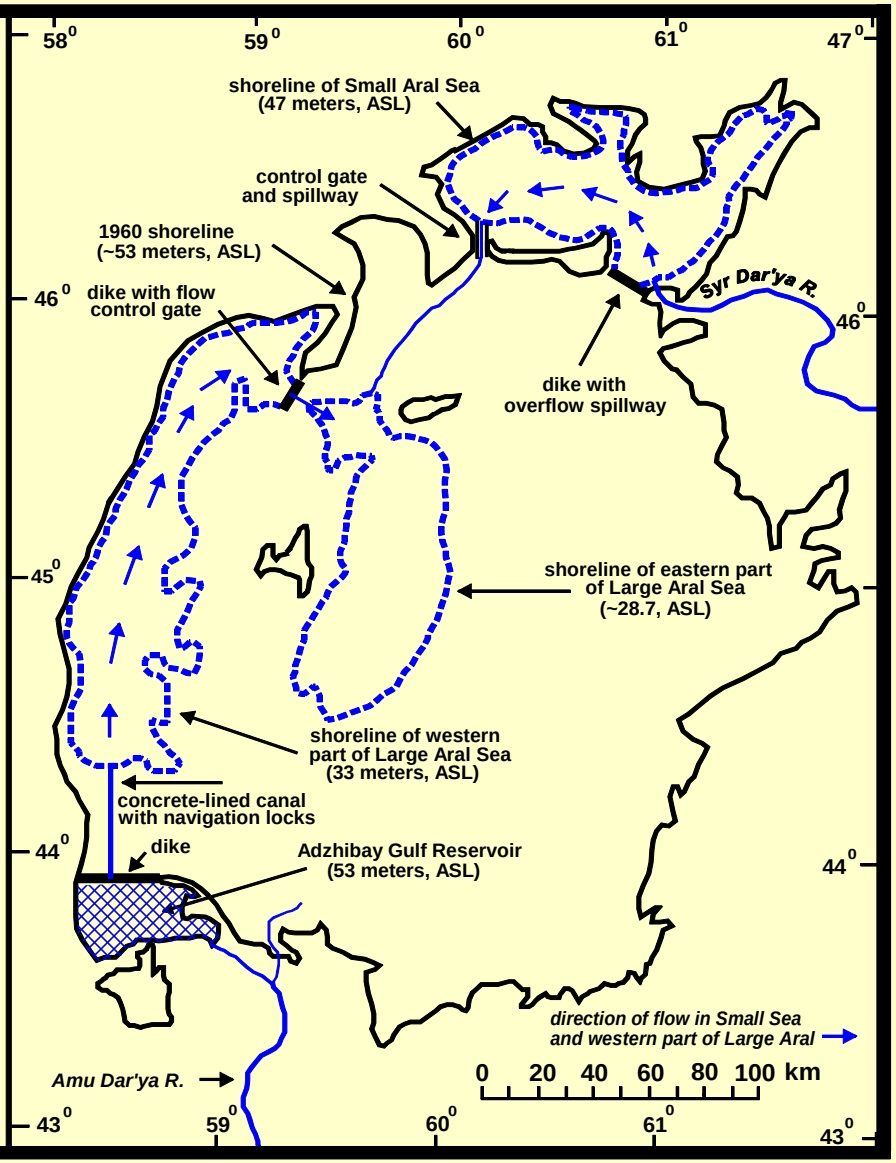
level 47 m, area 4310 km2, vol. 46.5 km3, river inflow 4.5 km3, outflow toward L. Aral 1.4 km3, salinity 7.6 g/l (?), start date for project - 2004

Large Aral Sea

Western Sea: level 33 m, area 6203 km2, vol. 85 km3, river inflow 7.35 km3, outflow to E. Aral 3.05 km3, salinity 45 g/l, (21 g/l by 2050), start date - 2007

Eastern Sea: level 28.7 m, area 5710 km2, vol 21 km3, inflow from W. Aral 2.95 km3, inflow from Small Aral 1.03 km3, salinity 362 g/l (?)

Adzhibay Gulf Reservoir: level 53 m, area 1147 km2, vol. 6.23 km3, inflow from Amu Dar'ya 8.26 km3, outflow to W. Aral 7.35 km3, salinity ~2g/l



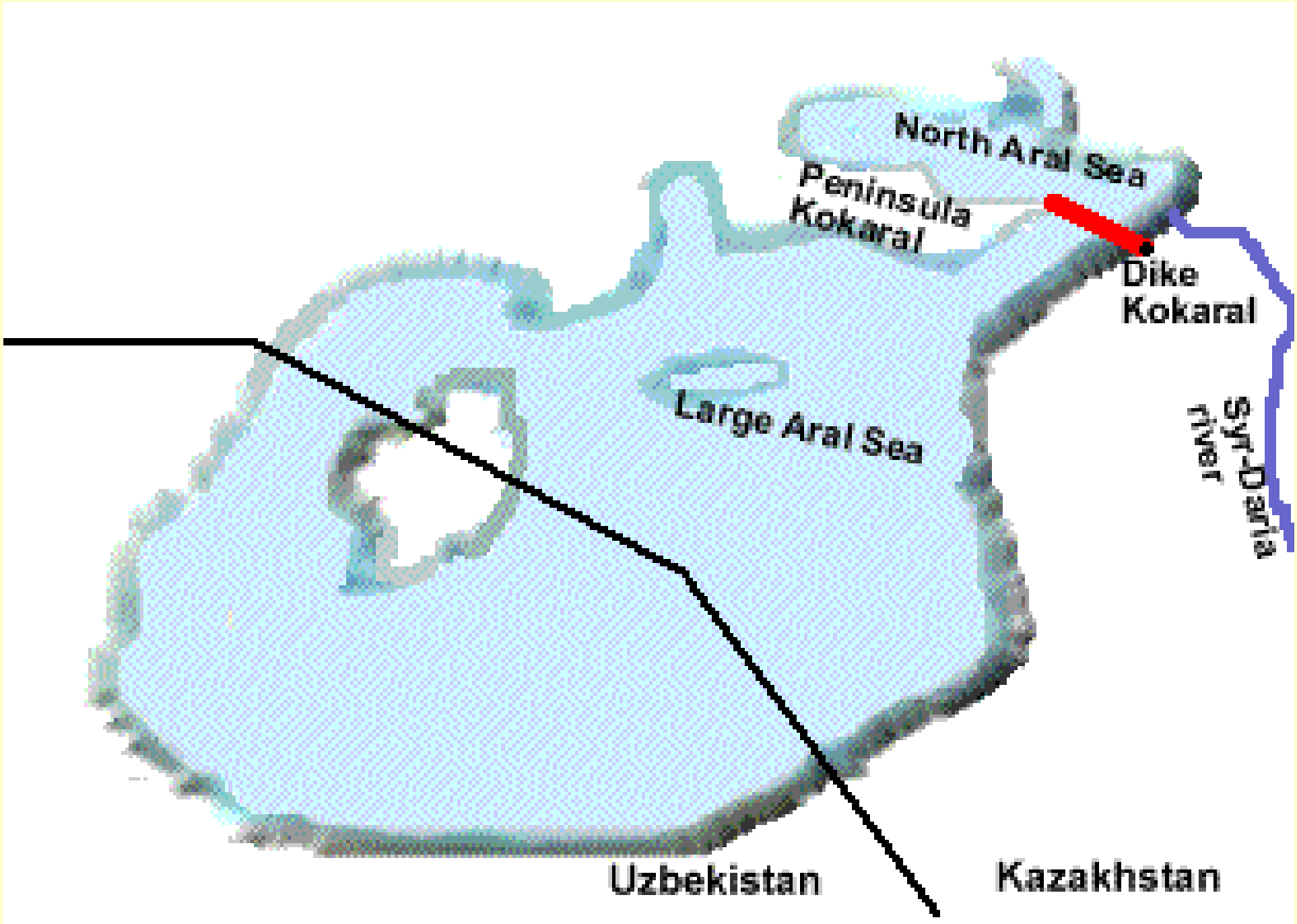
Another option would be to give more water to the Eastern Large Aral from Small Aral via Berg strait and from Amudarya river via Akdarya river bed. Level of Western Large Aral Sea might be maintainable using ground water flow from Amudarya delta and Ustjurt plateau.

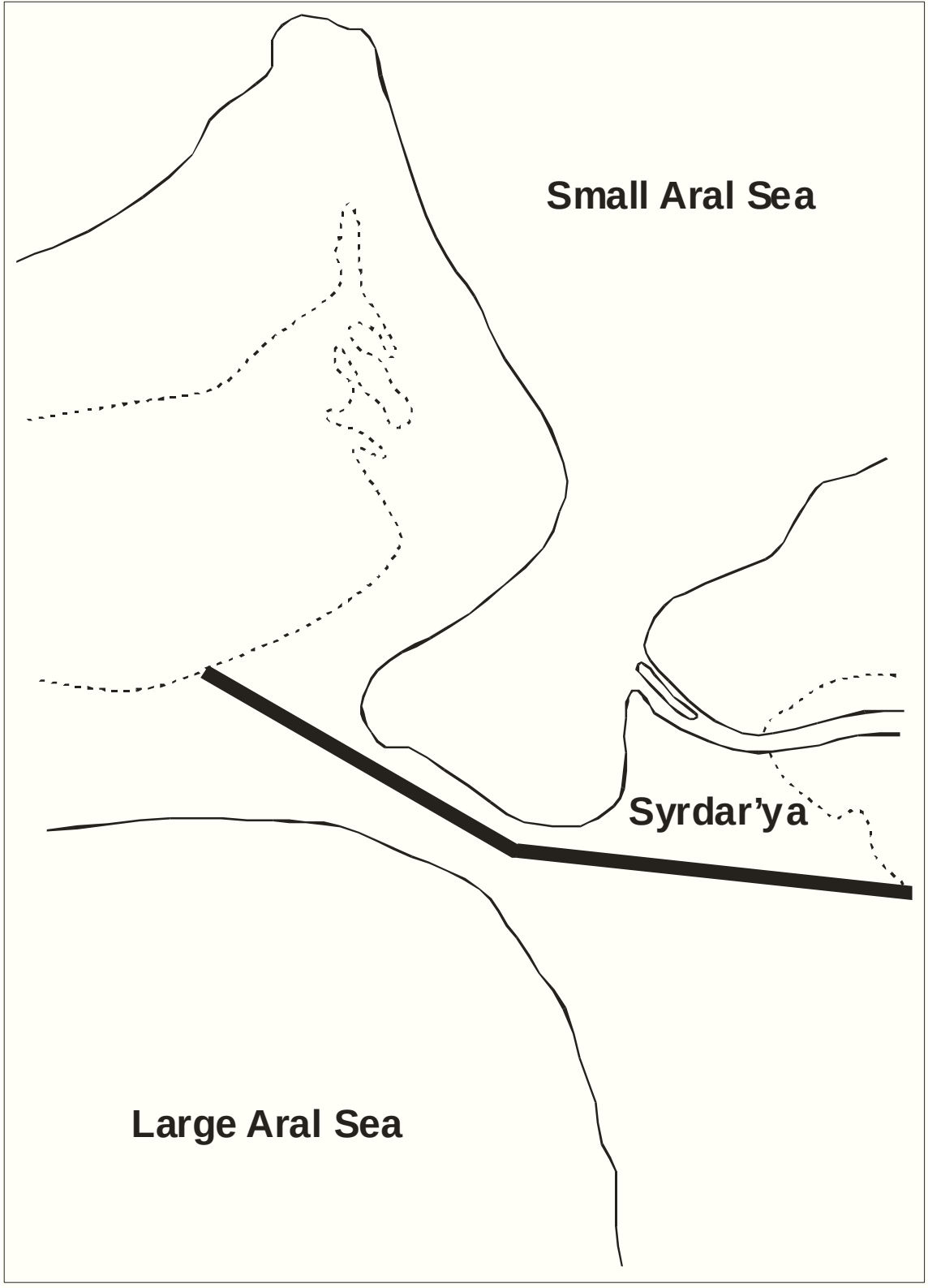
Way 1.
Conservation and rehabilitation of Small Aral and its ecosystems

Discharge of water from Small Aral occurs primarily in Spring-early Summer high flow period on Syr Dar'ya. Since August 2005 outflow is controlled by a discharge structure (gates) in the dike.

SMALL ARAL AND NORTH PART OF LARGE ARAL
(Showing effect of Spring/early summer "high flow" and later Summer "low flow" of Syr Dar'ya)

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

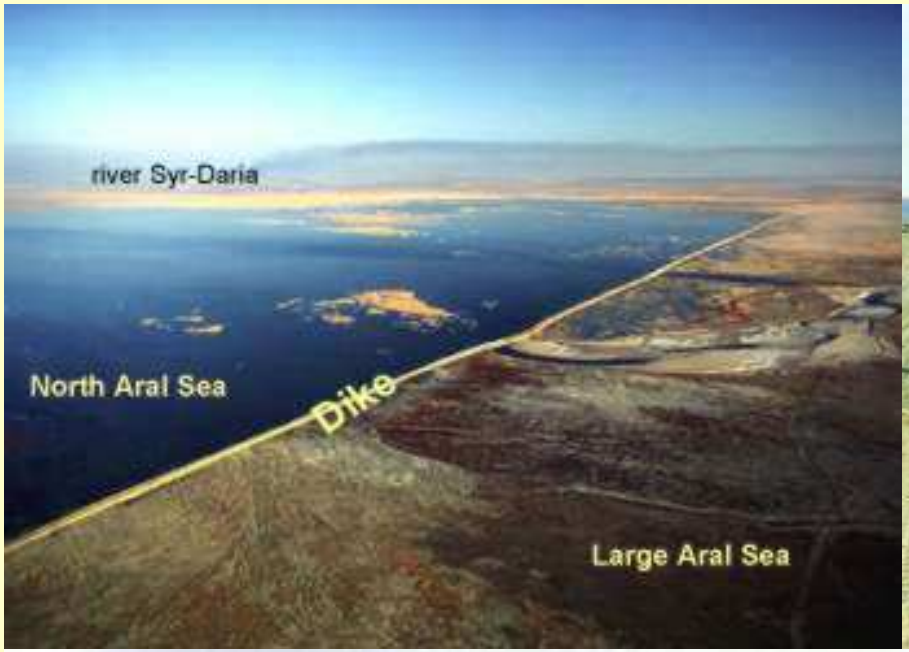




Dike in Berg strait is preserving Small (Northern) Aral and rehabilitating its biodiversity.

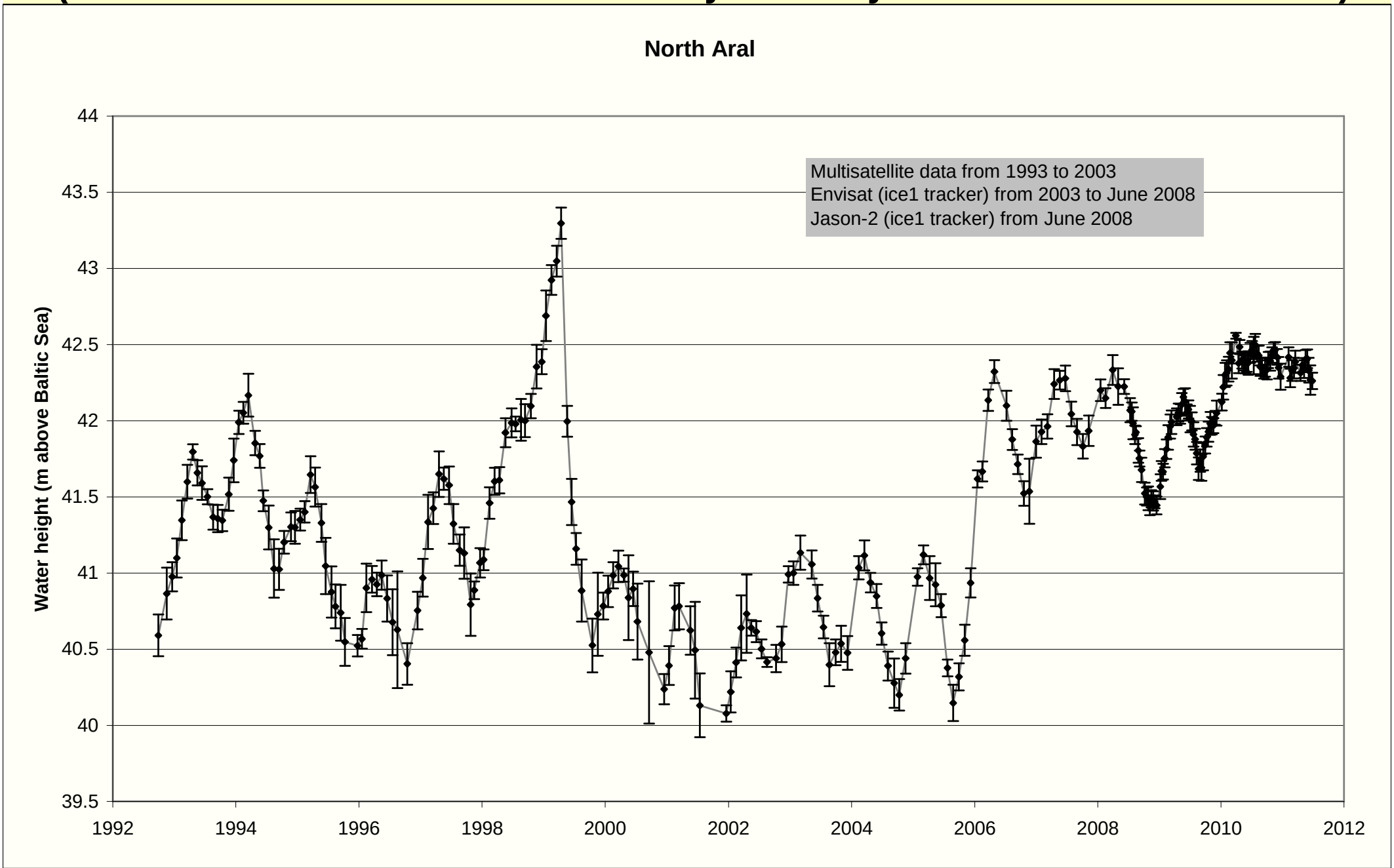
Source: Aladin N.V., Plotnikov I.S., Potts W.T.W., 1995. The Aral Sea desiccation and possible ways of rehabilitation and conservation of its North part // Int. J. Environmetrics. Vol. 6: 17-29.

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



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

(data below are from satellite altimetry courtesy of Jean-Francois Cretaux)



Berg's strait before (left) and (after) the dike collapse

April 14, 1999

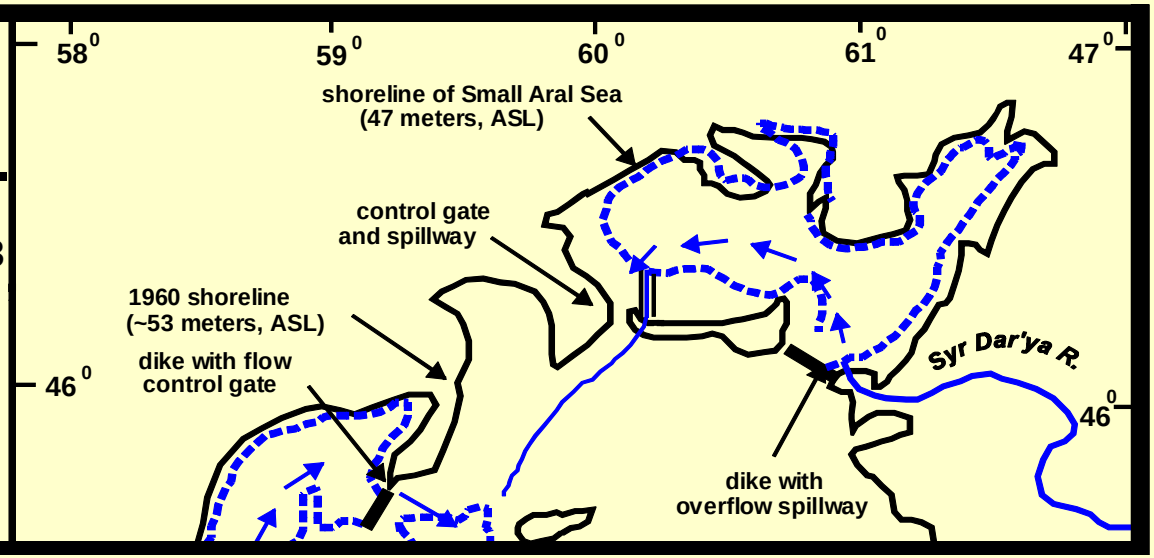
April 30, 1999

Source: USGS Global Visualization Viewer, Landsat 4-5 TM
(http://glovis.usgs.gov/ImgViewer/Java2ImgViewer.html)

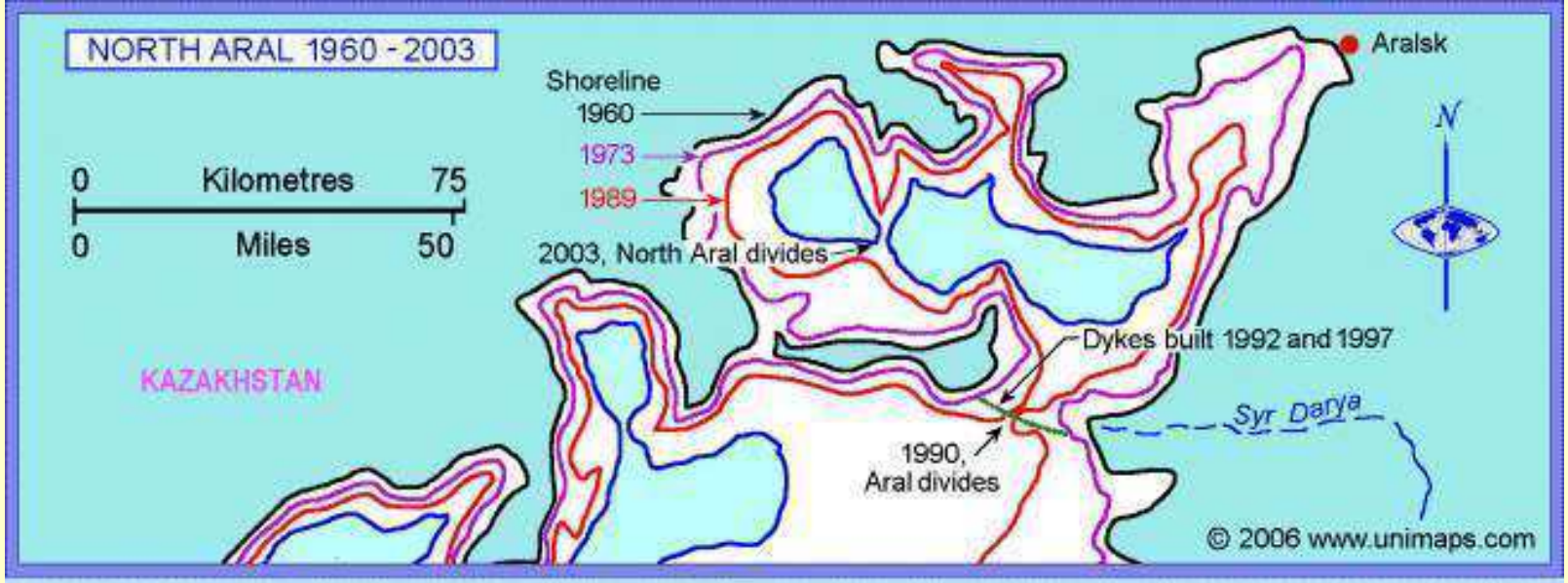
Russian company “Zarubezhvodstroy” made new dike in Berg strait. It was completed in autumn 2005.

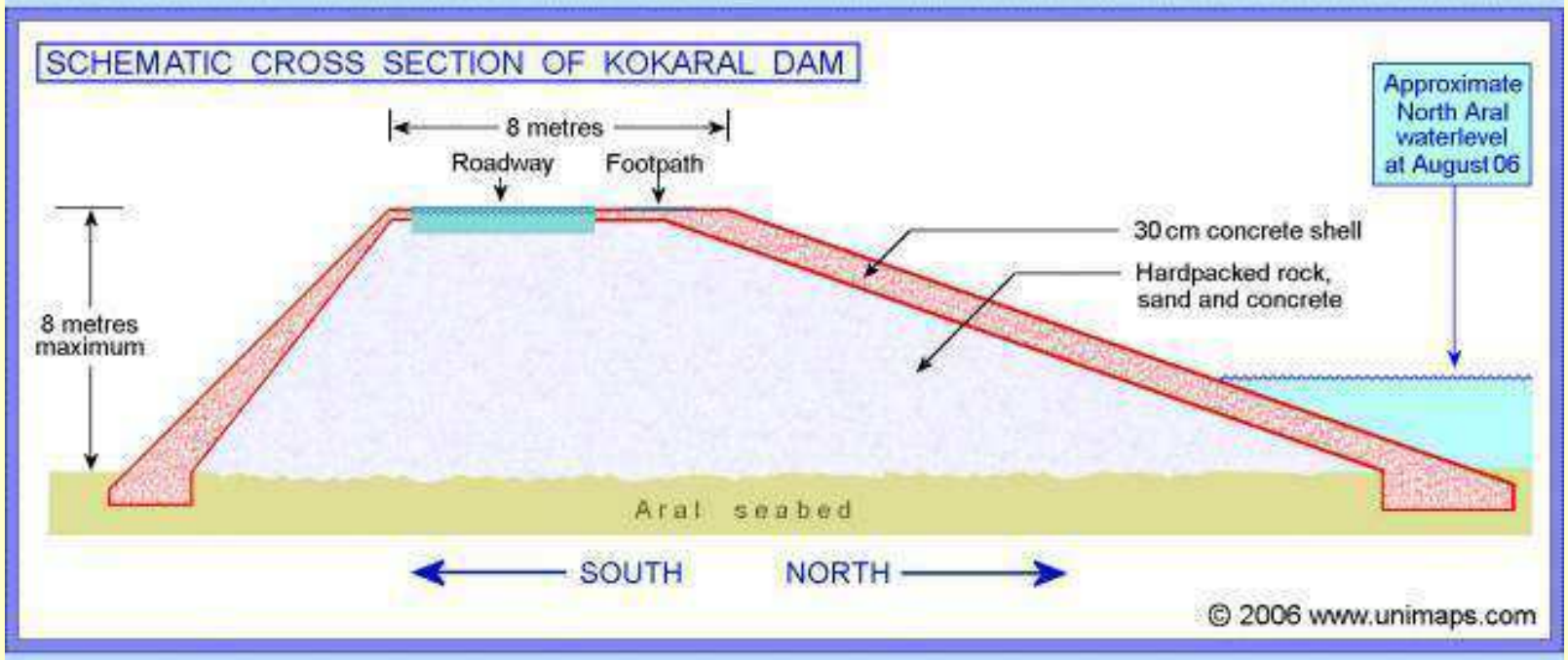
Small Aral Sea

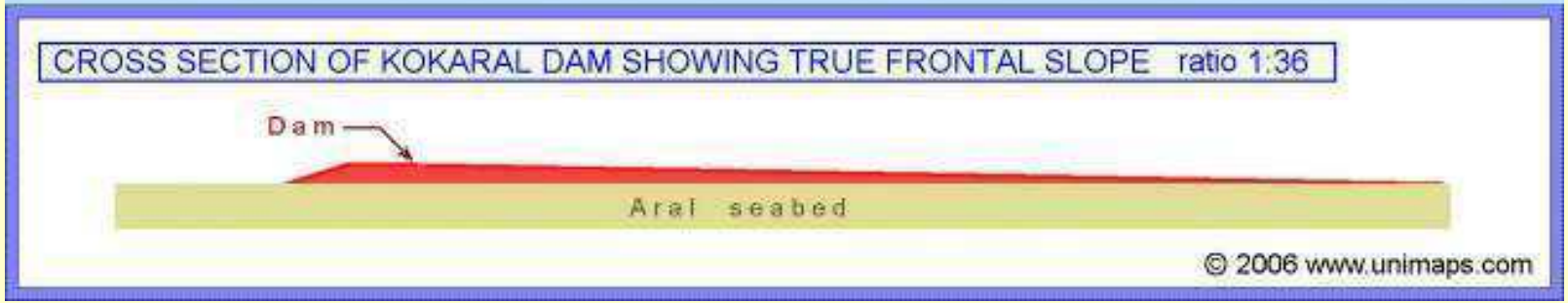
level 47 m, area 4310 km^2, vol. 46.5 km^3, river inflow 4.5 km^3, outflow toward L. Aral 1.4 km^3 salinity 7.6 g/l (?), start date for project - 2004



Unfortunately level of Small Aral reached only +42-43 m but not 47 m as it is shown above. Discharge from Small Aral to Large Aral is not through former Auzy-Kokaral strait, but via former Berg strait. Salinity of Small Aral is 11-14 g/l.


NORTH ARAL 1960 - 2003
Aralsk
Shoreline
1960
1973
1989
2003, North Aral divides
0 Kilometres 75
0 Miles 50
N
KAZAKHSTAN
Dykes built 1992 and 1997
Syr Darya
1990,
Aral divides
© 2006 www.unimaps.com


SCHEMATIC CROSS SECTION OF KOKARAL DAM
8 metres
Roadway
Footpath
Approximate
North Aral
waterlevel
at August 06
30 cm concrete shell
Hardpacked rock,
sand and concrete
8 metres
maximum
Aral seabed
SOUTH
NORTH
© 2006 www.unimaps.com


CROSS SECTION OF KOKARAL DAM SHOWING TRUE FRONTAL SLOPE ratio 1:36
Dam
Aral seabed
© 2006 www.unimaps.com

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

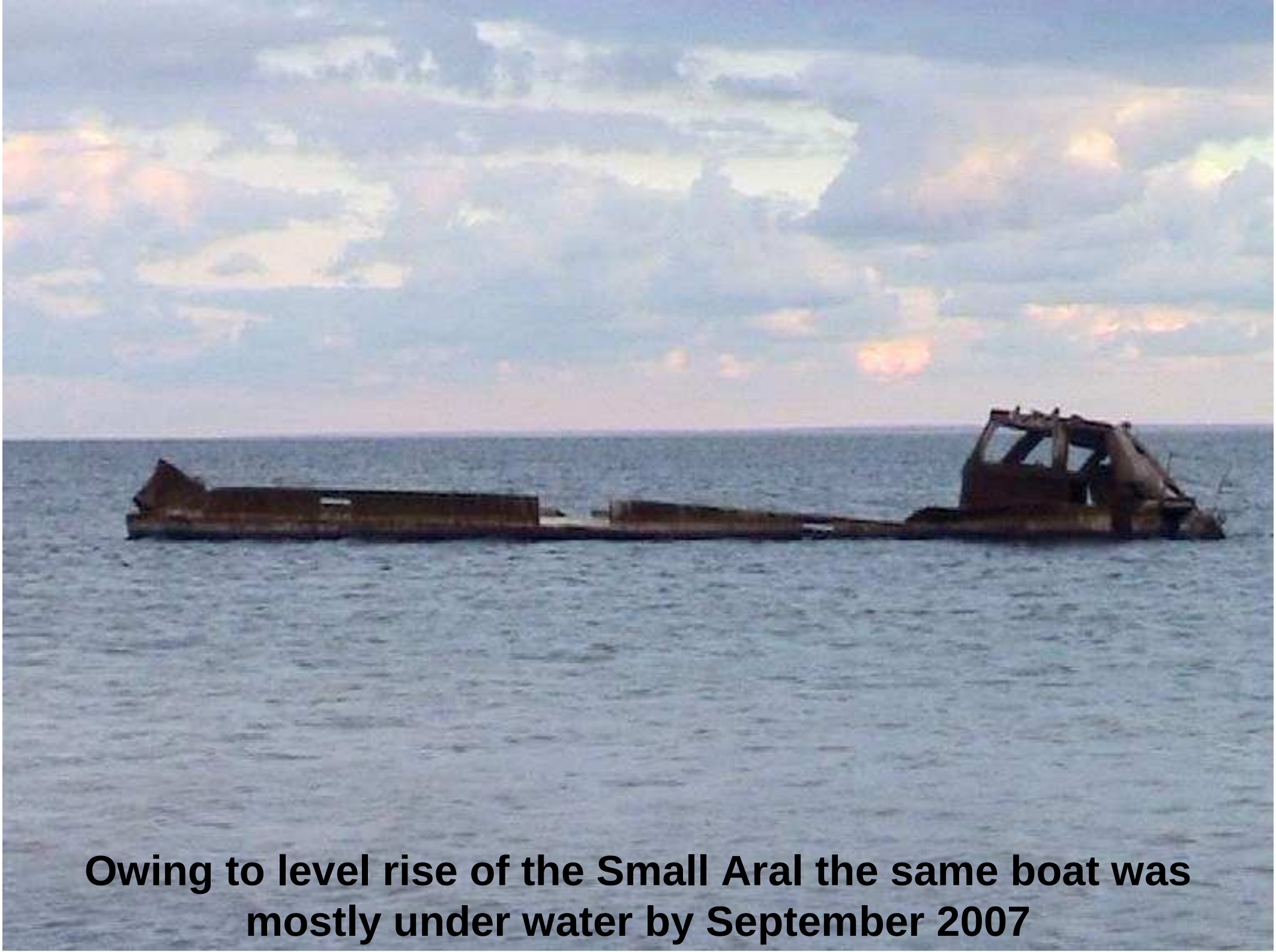
Spillway of new dike in the Berg strait in September 2006 (photo by L.Kuznetsov)

Spillway of new dike in the Berg strait in September 2007

Small Aral sea before new dike construction

This boat was far from the sea in September 2005

Small Aral sea after new dike construction



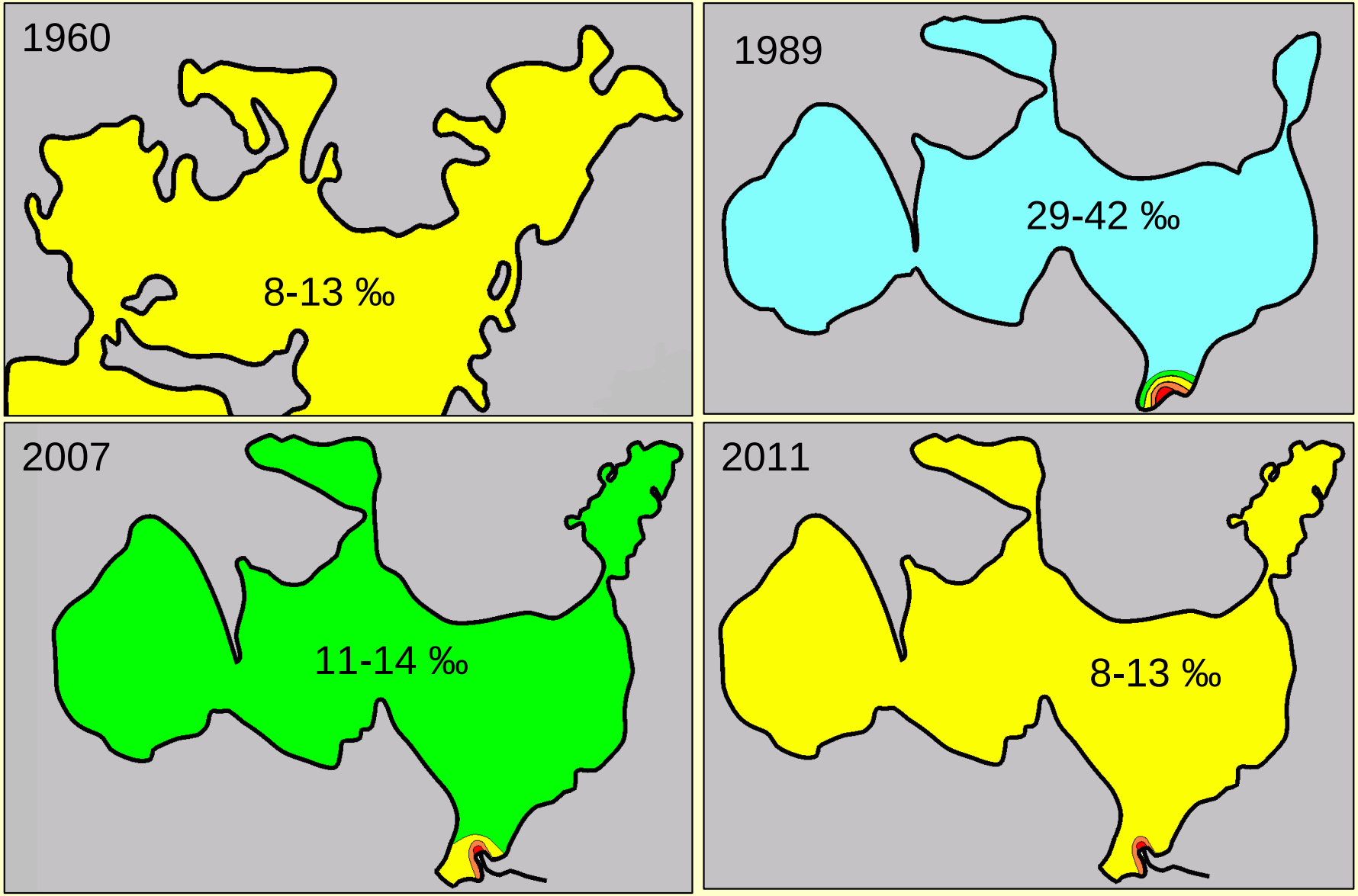
Owing to level rise of the Small Aral the same boat was mostly under water by September 2007

Owing to some level drop of the Small Aral the same boat is standing exactly at the shoreline by September 2011

When water gates are open in Kok-Aral dike all remnant water bodies of the Aral Sea are connected

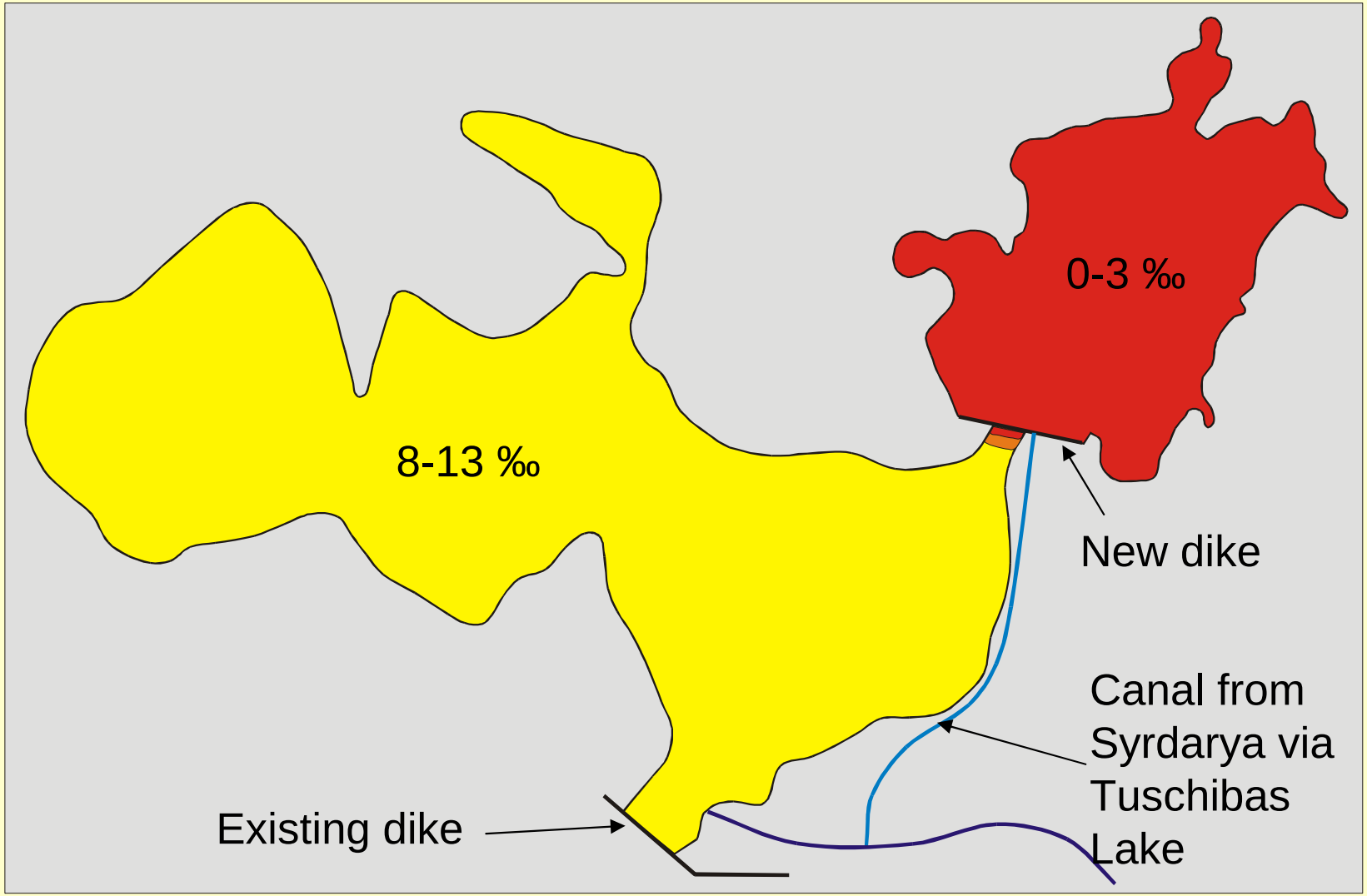

05.02.2015

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

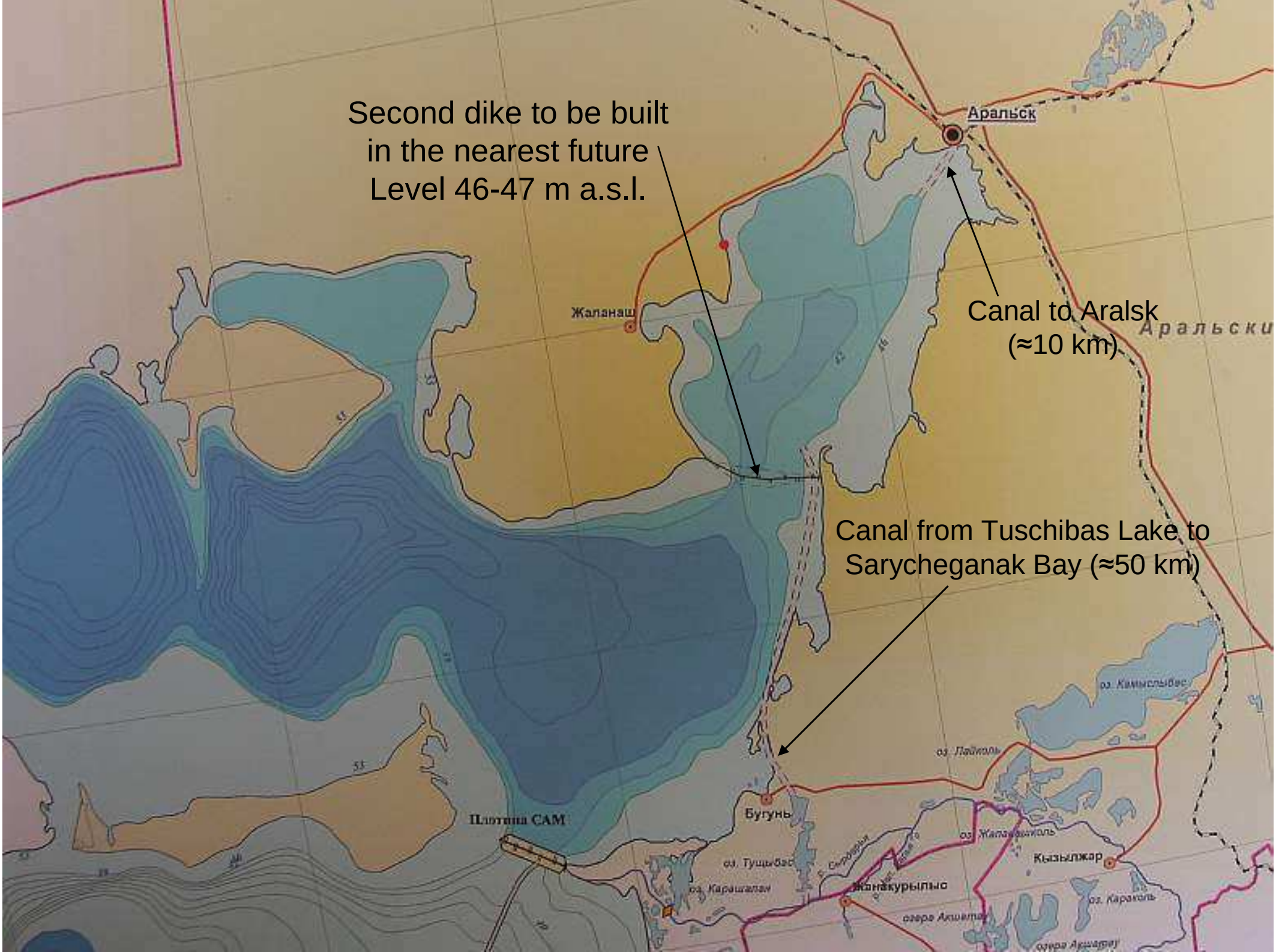


- Dike in Berg's strait allowed increase of level in Small (Northern) Aral Sea to +42 m a.s.l. with "forcing" to 42.5 m.
- Present average salinity in Small (Northern) Aral Sea is about 16-17 g/l. In the nearest future it will reach 8-13 g/l.
- For further improvement of situation there are needed improvements 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 2nd phase of the Small Aral rehabilitation project

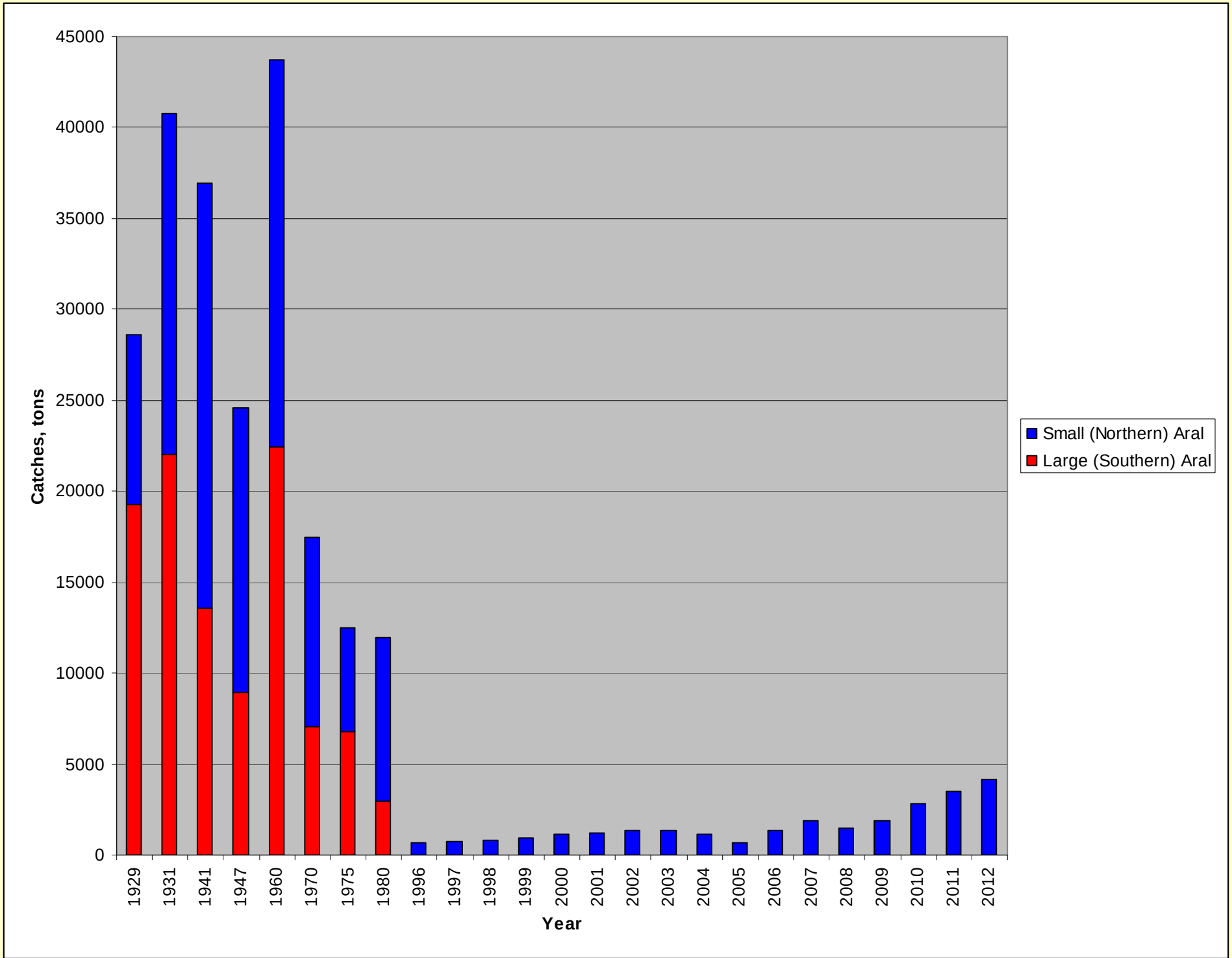


- **Alternative 2nd phase of the project would raise level only of Saryshaganak Gulf.**
- **Second phase would allow further improvement of the health of the local people, to decrease unemployment and increase living standards as well as income to the local families.**
- **The local economy also will 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
Canal to Aralsk
(≈10 km)
Жаланаш
Аральски
Canal from Tuschibas Lake to
Sarycheganak Bay (≈50 km)
Плотина САМ
Бугунь
оз. Тущыбас
оз. Карашалан
Жанакурылыс
Кызылжар
оз. Караколь
оз. Камыслыбас
оз. Пайколь
оз. Жалаулыколь
озера Акшатау

View of Aklak dike

Dynamics of fish catches in the North and South Aral Sea



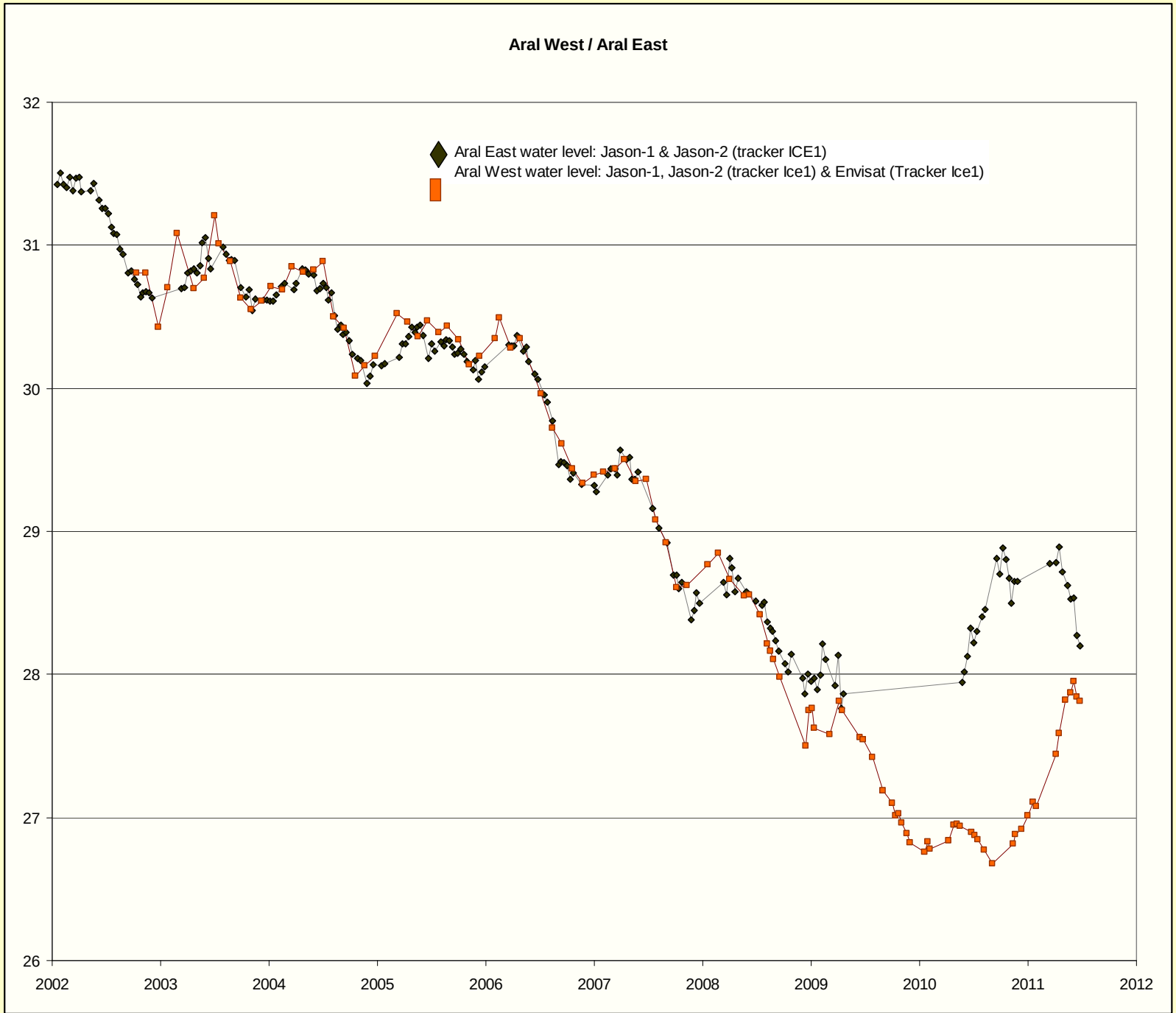
When in 1992 a dike in Berg strait was built, fishing on the Small Aral was recommenced. According to reports of fishermen in 2004 silver carp (*Ctenopharyngodon idella*) reappeared in Small Aral

Flounder (*Platichthys flesus*) totally disappeared from the Large Aral Sea because of rising salinity.

Way 2.
Conservation and rehabilitation of Large Aral and its ecosystems

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)



Since beginning of 2003, when the level in the Large Aral Sea dropped by 22 m and reached about +31 m, the Large Aral Sea is practically divided into the Eastern Large and Western Large Aral

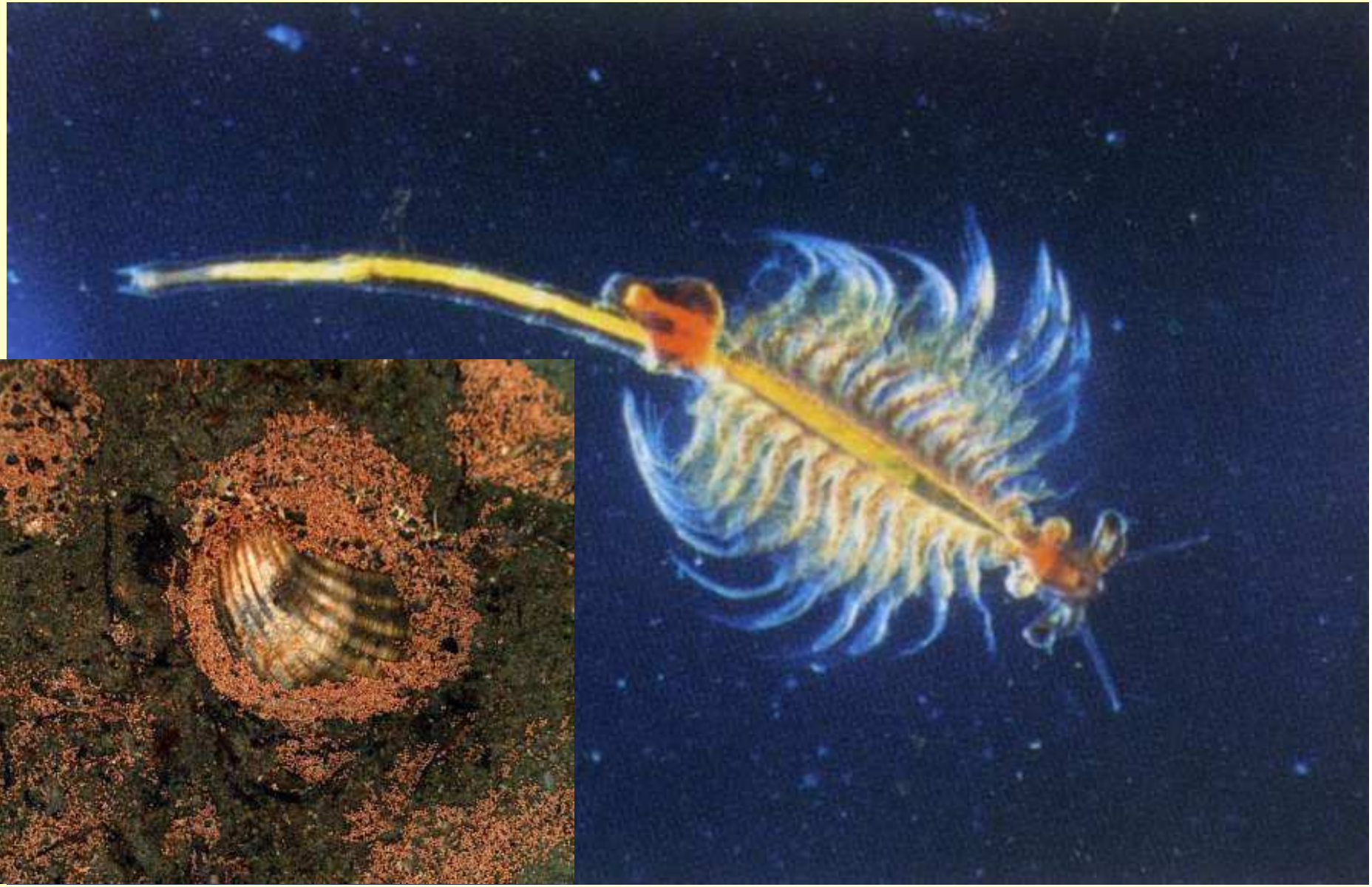
Sept. 6, 2009: Area 4922 km^2 (8% from 1960)
Volume 58 km^3 (6% from 1960)
Salinity: Western part and Tschebas Bay – >100 g/l, Eastern part – >200 g/l)

In both lakes salinity increased so high that all fishes gone and only few free-living invertebrates could survive.

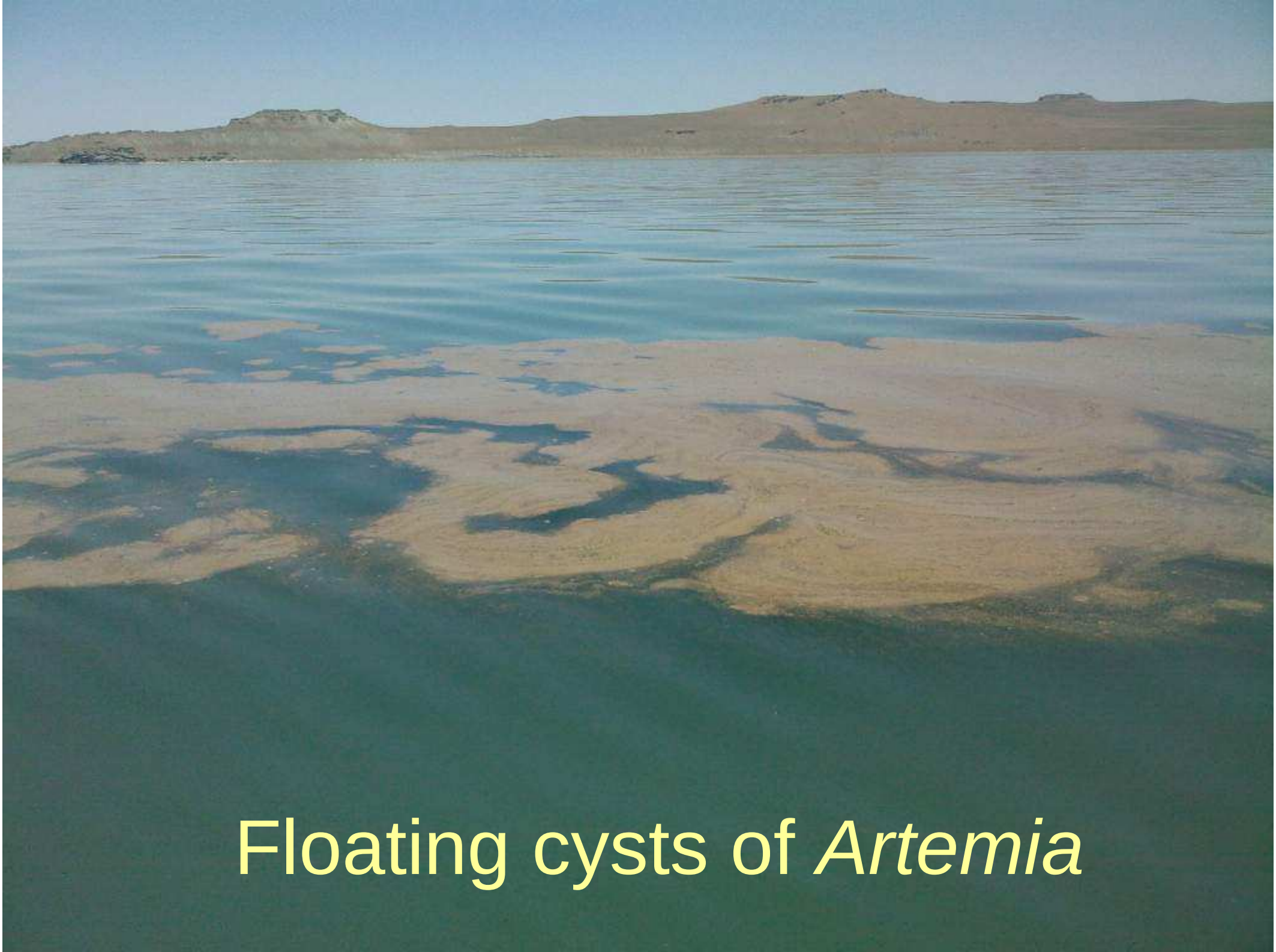
Western part and Tschebas Bay of Large Aral:
Infusoria – 2; Rotatoria – 2; Copepoda – 1; Ostracoda – 2; Branchiopoda – 1; Gastropoda - >2.
TOTAL: >10?

Eastern part of Large Aral :
Branchiopoda – 1.

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



Nowadays industrial harvesting under aegis of international company INVE Aquaculture is being considered, but in 2005 the company postponed activities until salinity increase to levels more favorable for brine shrimp.


Floating cysts of *Artemia*

Former Aral Sea bottom without ground water supply is like this. Karakalpakistan, September 2004 (photo by P.Annin)

Former Aral Sea bottom with ground water supply is rich with reeds. Karakalpakistan, September 2004 (photo by P.Annin)

Special water way and water discharge gates under construction in September 2004 to supply Eastern depression of Large Aral from Mezhdurechensky reservoir via Akdarya river bed. (photo by P.Annin).

Unfortunately completed spillway and water gates failed soon after being put into operation in autumn 2005.

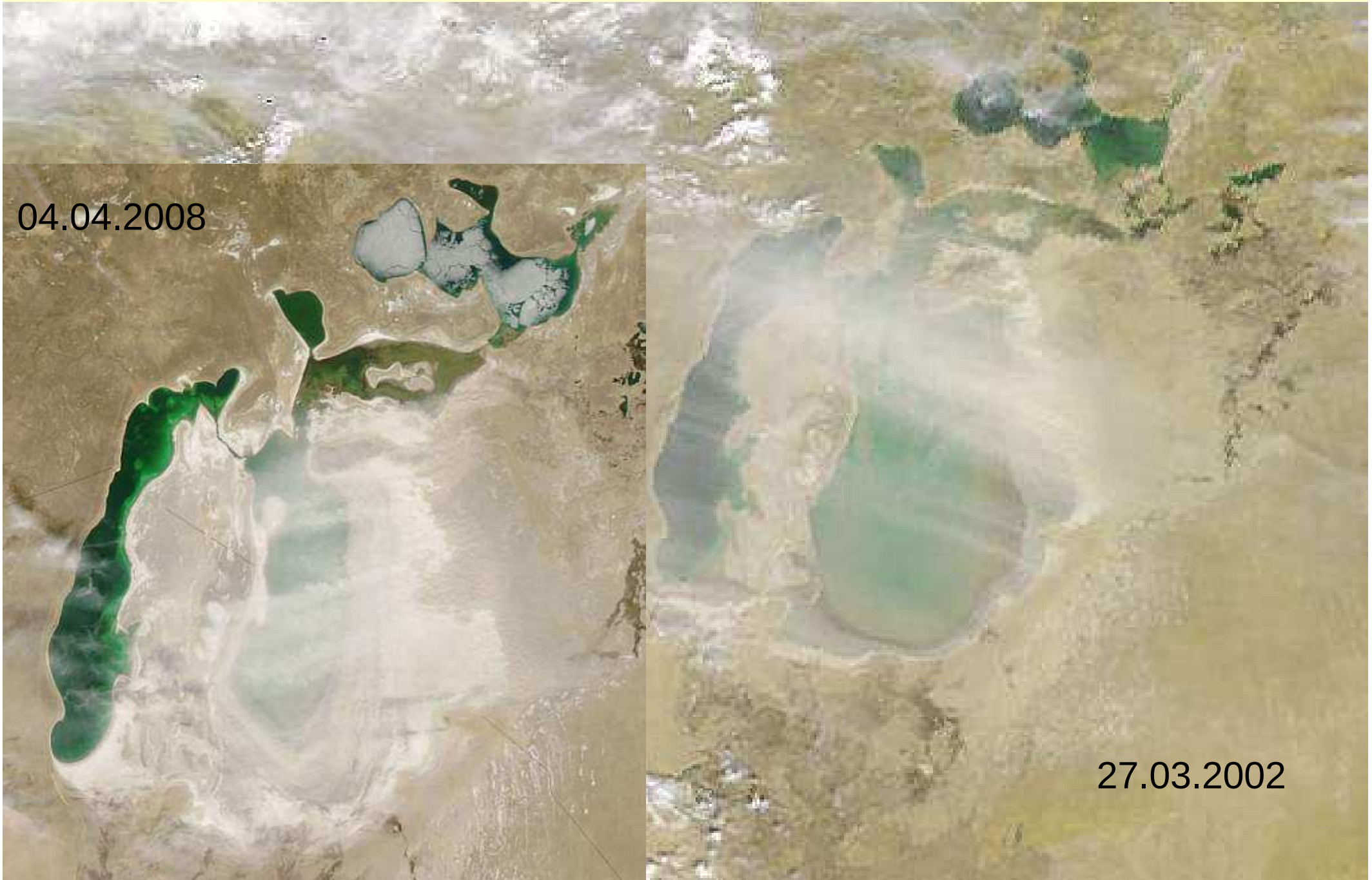
Special water way and water discharge gates just after construction in September 2005. Photo by P. Micklin

It was built to supply Eastern depression of Large Aral from Mezhdurechensky reservoir via Akdarya river bed

Unfortunately completed spillway and water gates failed soon after being put into operation in October 2005. Photo by B. Mukhamadiev.

Health problems of the local people

Salt & Dust blowing from dried bottom of Aral Sea

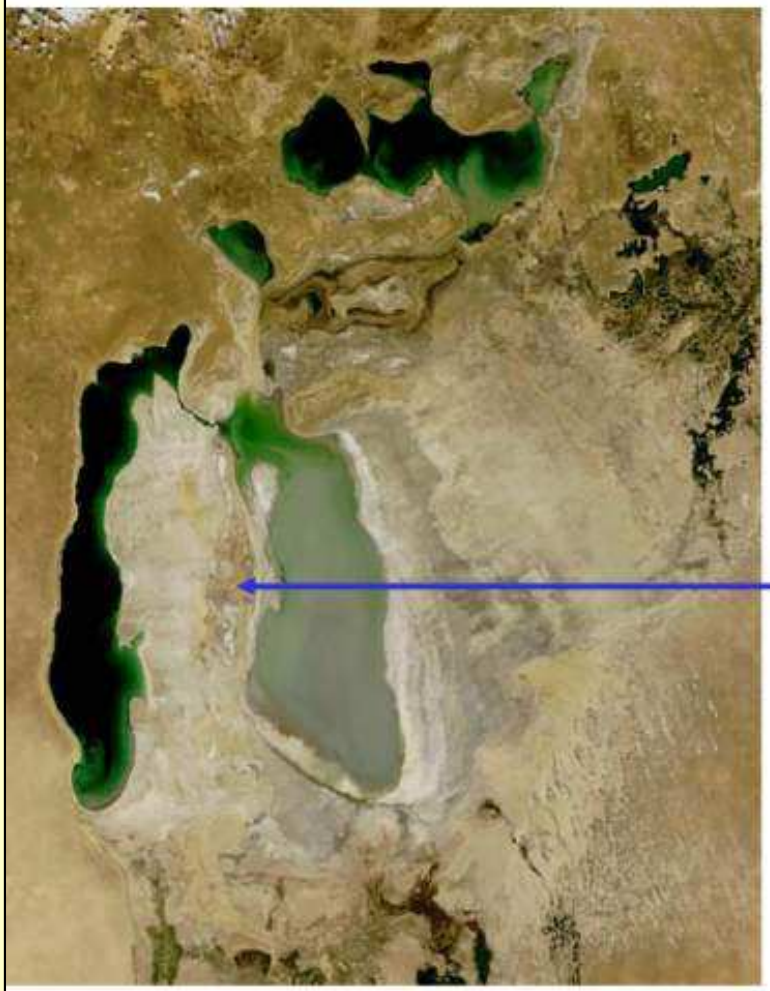


- Salt and sand are being blown from dried Aral Sea bottom and adversely affecting the health of local people.
- Health experts say the local population suffers high levels of:
  1. respiratory illnesses,
  2. throat and esophageal cancer,
  3. digestive disorders,
  4. high blood pressure due to breathing and ingesting salt-laden air and water,
  5. liver and kidney ailments,
  6. eye problems.
- The loss of fish has also greatly reduced dietary variety, worsening malnutrition and anemia, particularly in pregnant women.


Terra/Modis image
October 21, 2002
250 meter resolution
original Vozrozhdeniye
Island bioweapons
test site

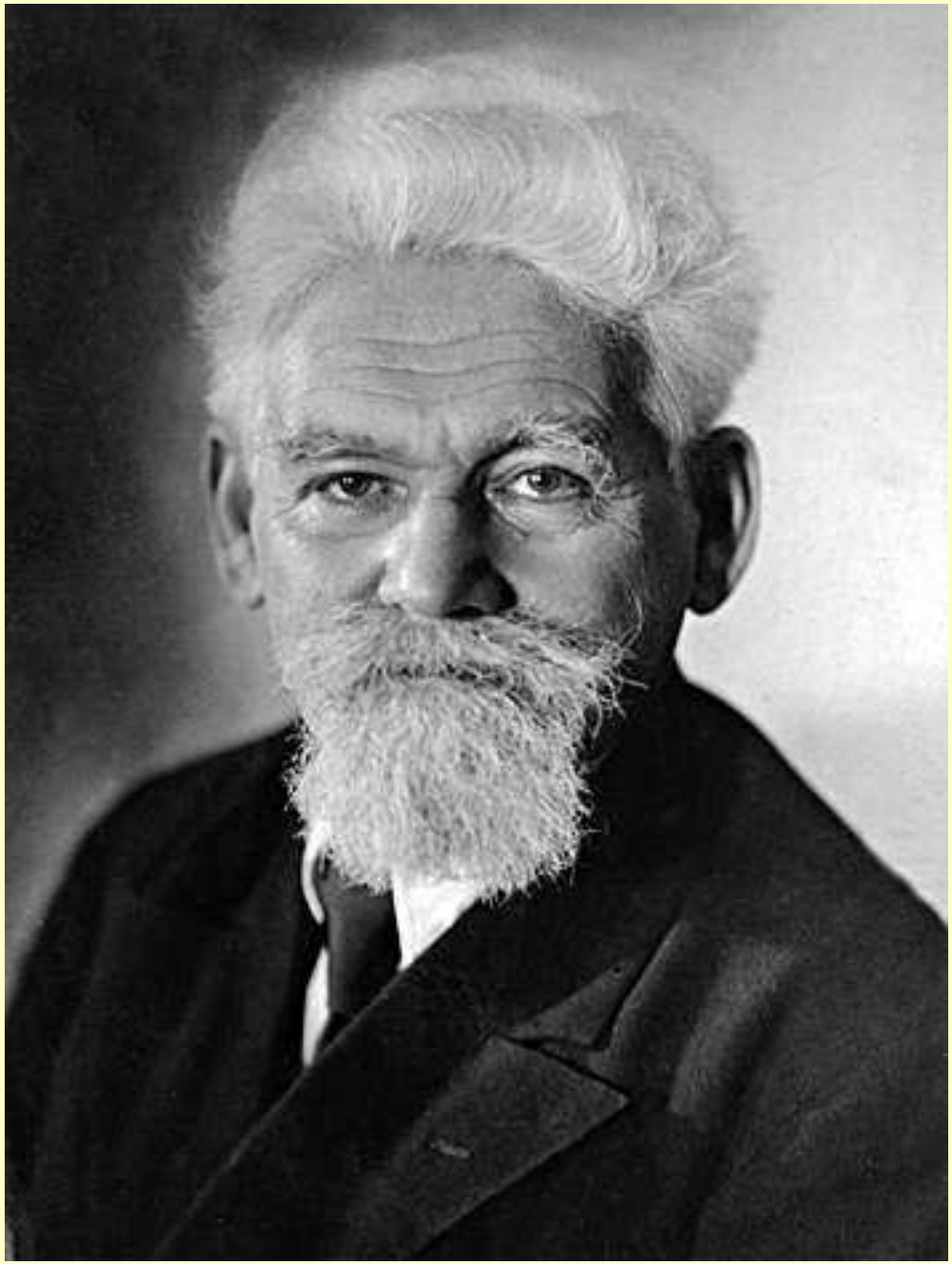
- Vozrozhdeniya (Resurrection) Island also poses a unique problem.
- This Island was once a small, remote outcrop in the middle of the Aral Sea. Beginning in 1952 the Soviet Union used the island as a testing ground for super-secret biological weapons. Genetically modified and weaponized pathogens were tested on horses, monkeys, sheep, donkeys and laboratory animals, including:
  anthrax,
  tularemia,
  brucellosis,
  plague,
  typhus,
  Q fever,
  smallpox,
  botulinum toxin,
  Venezuelan equine encephalitis.
- Fishermen and local residents worried about reports of mass deaths of animals and fish, as well as infectious diseases among people who worked on the island.

Vozrozhdeniya Island bioweapons test site (1957 & late 1990s from Google Earth) right and MODIS (8-11-07) below



- Upon the Soviet Union’s 1991 collapse, the military allegedly decontaminated the island. However, due to receding waters, by 2001 Vozrozhdeniya had united with the mainland to the south. Health experts feared that weaponized organisms such as anthrax survived and could escape to the mainland via fleas on infected rodents, which are numerous on the dried lands, or that terrorists might gain access to the organisms. In 2002 the U.S. sent $6 million and a team of experts to help Uzbekistan destroy any remaining pathogens.

Evidences of medieval desiccation of the Aral Sea

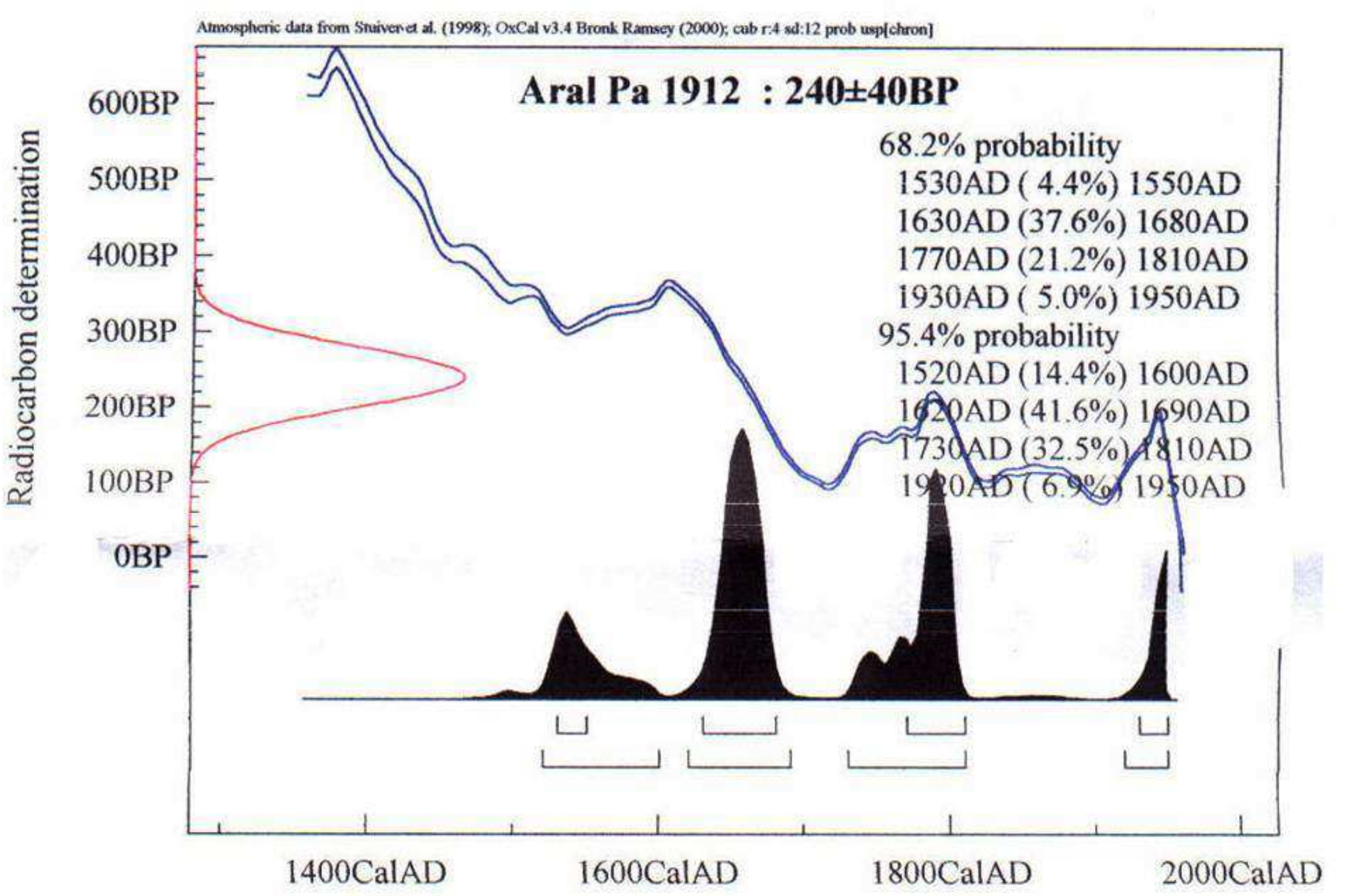


L.S. Berg

V.V. Bartold

Remnants of medieval saxauls on the dried bottom

Remnants of medieval saxauls under water



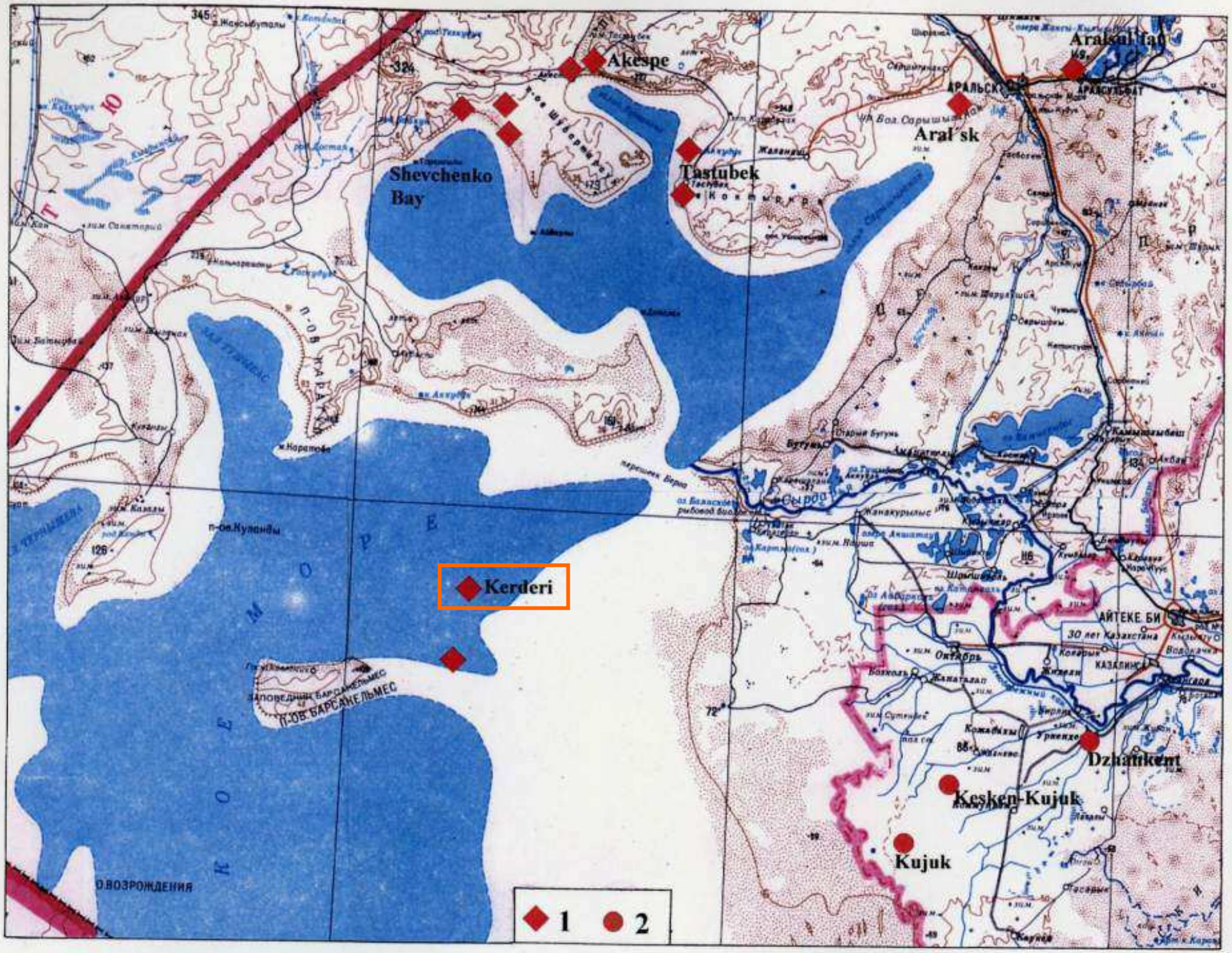
Radiocarbon dating of saxaul stumps

Coring in the Aral Sea. August-September 2002.

Cutting the core with metal plate and splitting into two halves

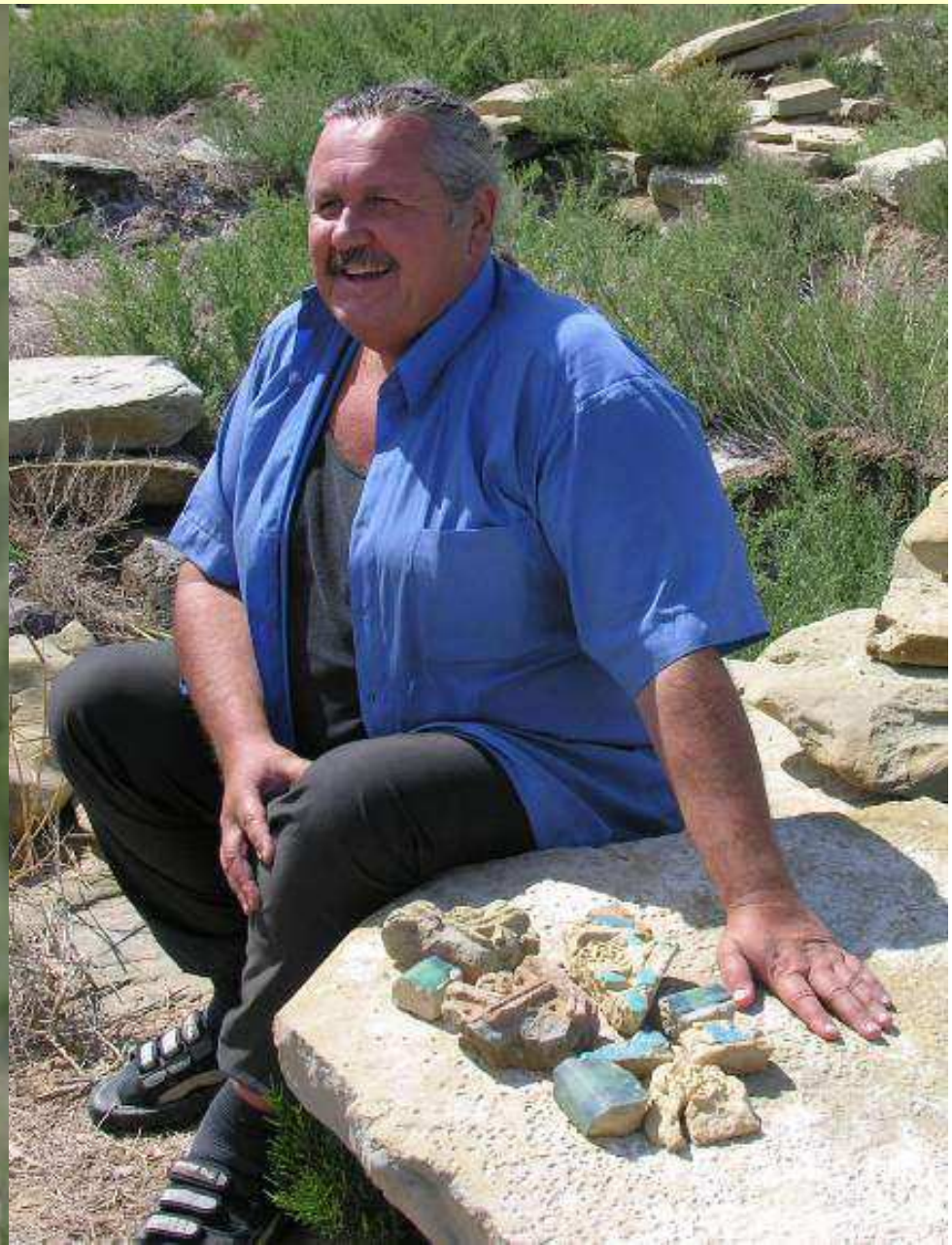
Cut cores

Location of Kerdery Mausoleum



**Ruins of medieval mausoleum (Kerdery) on dried bottom.
In 1960 it was about 20 m below lake level
(photo by N.Boroffka).**

Decorative ceramics from the Mausoleum. (photo by E.Putnam).



Bones of *Homo sapiens* and domestics animals were found near mausoleum (photo by E.Putnam)

Photo by D. Eliseev, member of National Geographic expedition, June 2005

Millstone found on the bottom of the Aral Sea not far from Kerdery mausoleum

Photo by D. Eliseev, member of National Geographic expedition, June 2005

Elements of ceramics and scull of *Homo sapiens* found on the bottom of the Aral Sea not far from Kerdery mausoleum

Photo by I.Plotnikov, member of National Geographic expedition, August 2005

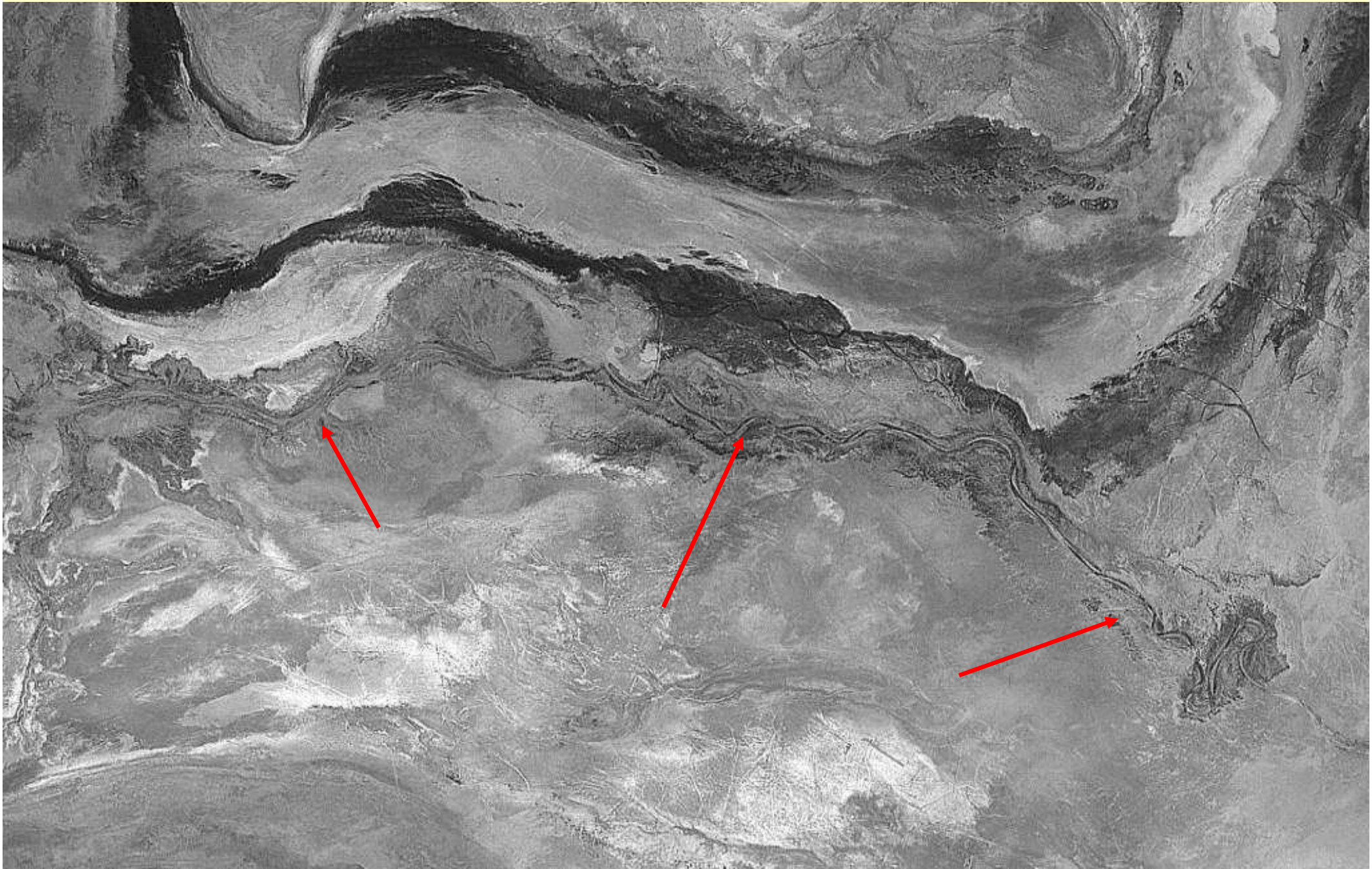
Broken jug found on the bottom of the Aral Sea not far from Kerdery mausoleum

Needle and arrow-head from Kerdery-2

Remnants of Medieval river beds on the former Aral Sea bottom

ANCIENT RIVER BEDS IN THE NORTHEAST FROM BARSAKELNES ISLAND. LANDSAT 5, SEPT. 11, 2007, BAND 1 (BLUE-GREEN), 30 METERS, SHARPENED AND CONTRAST ENHANCED. IN MIDDLE, STRETCHING EAST TO WEST IS OLD RIVER BED (SEE RED ARROWS).

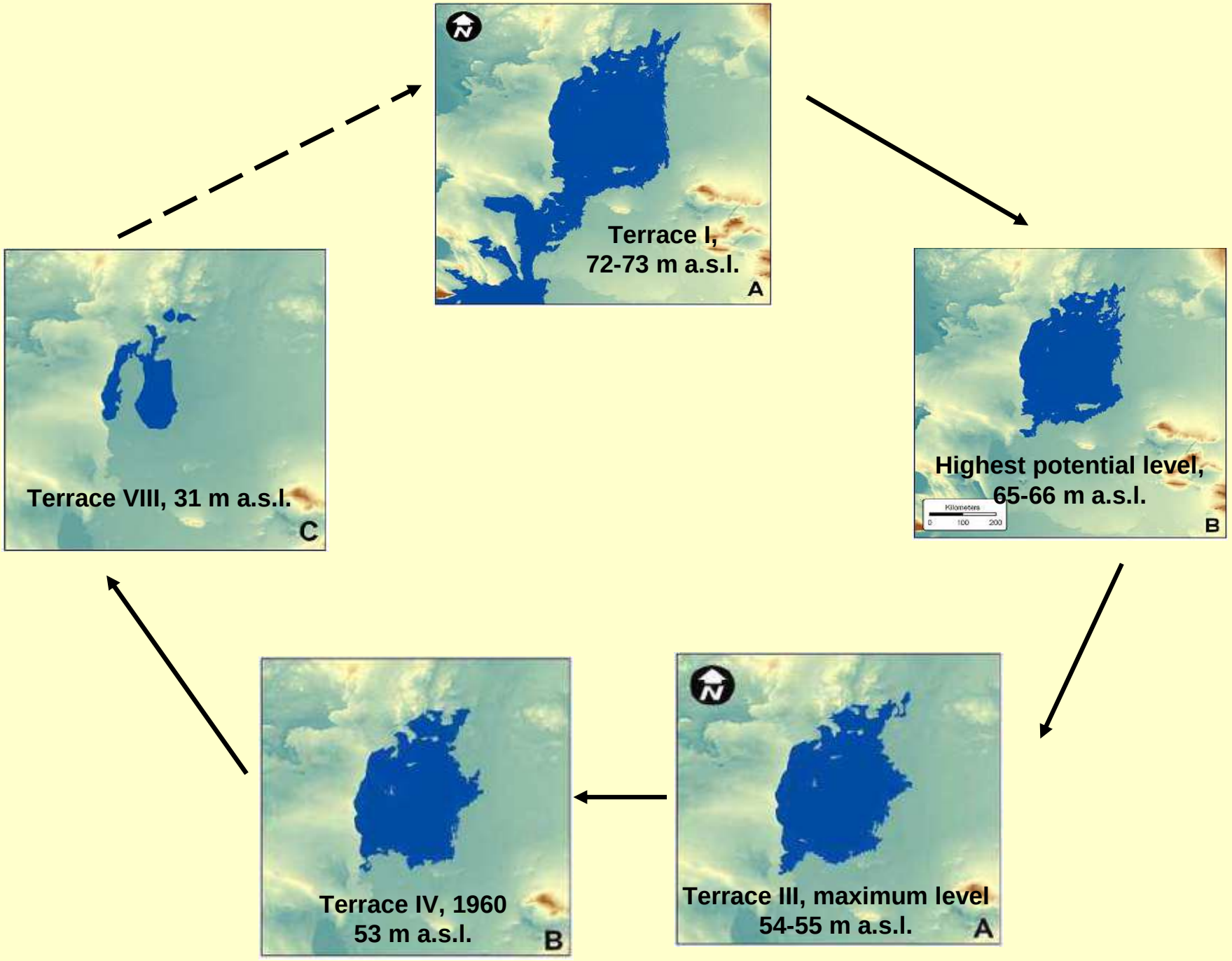
Courtesy by P.Micklin



Fossil (probably Medieval) canal between Western and Eastern Large Aral discovered by Prof. Dr. Rene Letolle and predicted by Dr. David Piriulin

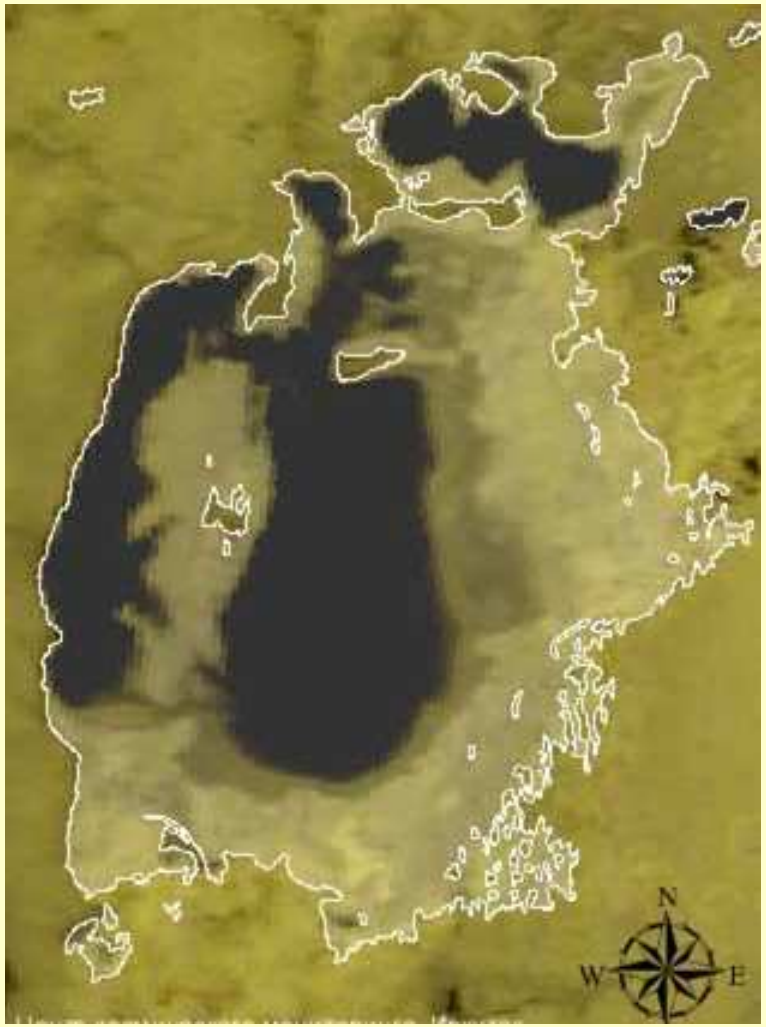
Surface areas of the Aral Sea at different levels

By: Ch. Reinhardt, 2006, 2007



Evolution of the Aral Sea

Middle Ages



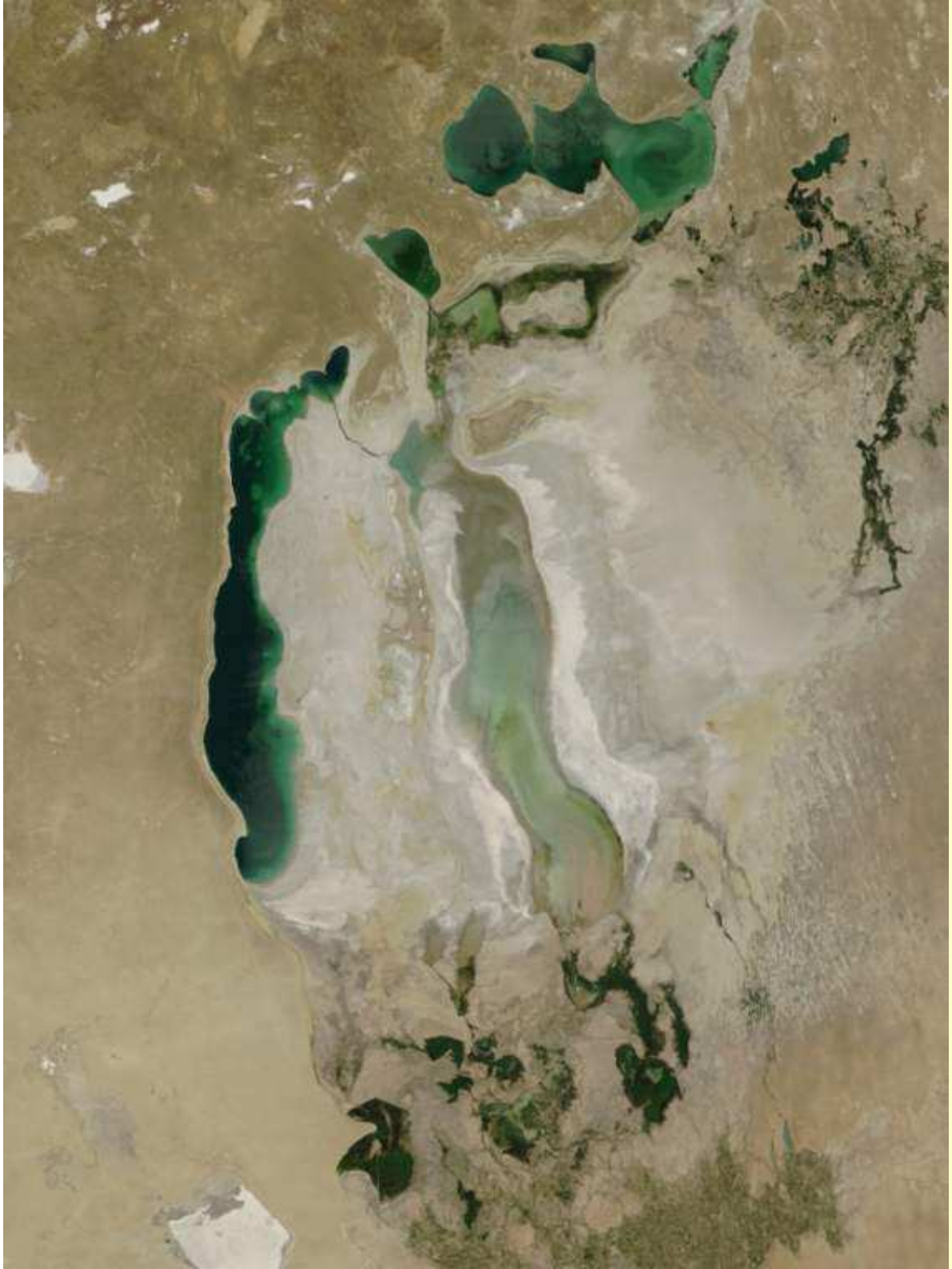
Middle of the XIX century

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 XXII century.

MODIS image of the Aral Sea from September 30, 2009

1. Small (Northern) Aral Sea. Common name – “Kazaral Sea”. Correct scientific name – Northern Aral Sea derived brackish-water regulated reservoir.
2. Western Large (Southern) Aral Sea. Common name – “Western Uzaral”. Correct scientific name – Aral Sea derived Southwest hyperhaline non-regulated lake.
3. Eastern Large (Southern) Aral Sea. Common name – “Eastern Uzaral”. Correct scientific name – Aral Sea derived Southeast hyperhaline non-regulated lake.
4. Former Tschebas Bay. Common name – “Tschebas-Kul”. Correct scientific name – Aral Sea derived Tschebas hyperhaline non-regulated lake.
5. Strait between Eastern and Western Large Aral (common name – “Uzun-Aral”). Correct scientific name – natural Kulandy Channel.
6. Remnants of strait from Small Aral to Large Aral.



MODIS image of the Aral Sea from June 14, 2010

Luckily Eastern Large (Southern) Aral ("Eastern Uzaral") periodically receives inflow from the Amu Darya during high flow years on that river (e.g. 2010). An example of of this is clearly visible on the satellite image on the left. Unfortunately newly reborn Eastern Large Aral is very shallow and dries up soon after water inflow from the Amu Darya ceases. It is unforuntate that this event is occasional and is not repeated annually.

MODIS image of the Aral Sea from November 25, 2014

At present the Aral Sea is divided into a number residual parts (lotic and lentic). The Large Aral Sea currently is the most ecologically devastated part of the lake. In the beginning of the 21st century it was divided into three parts: Western Large Aral Sea, Eastern Large Aral Sea and Tsche-Bas Bay (Micklin, Aladin and Plotnikov, 2014, Chaps. 6&14).

Future of the Aral Sea is connected with oil and gas extraction

Oil and gas drill tower on the former Aral Sea bottom (photo by P.Annin)

Gas condensate plant not far from Muynak.
(photo by P.Annin).

Aral Sea expedition at the strait between
Eastern and Western Large Aral (August-September, 2011)

Aral Sea expedition on the ice of Small Aral Sea (January-February, 2013)

Aral Sea expedition near Tastubek village (September, 2014)

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

Future of the Aral Sea also depends on the prevailing political trends in the countries of the Aral Sea basin

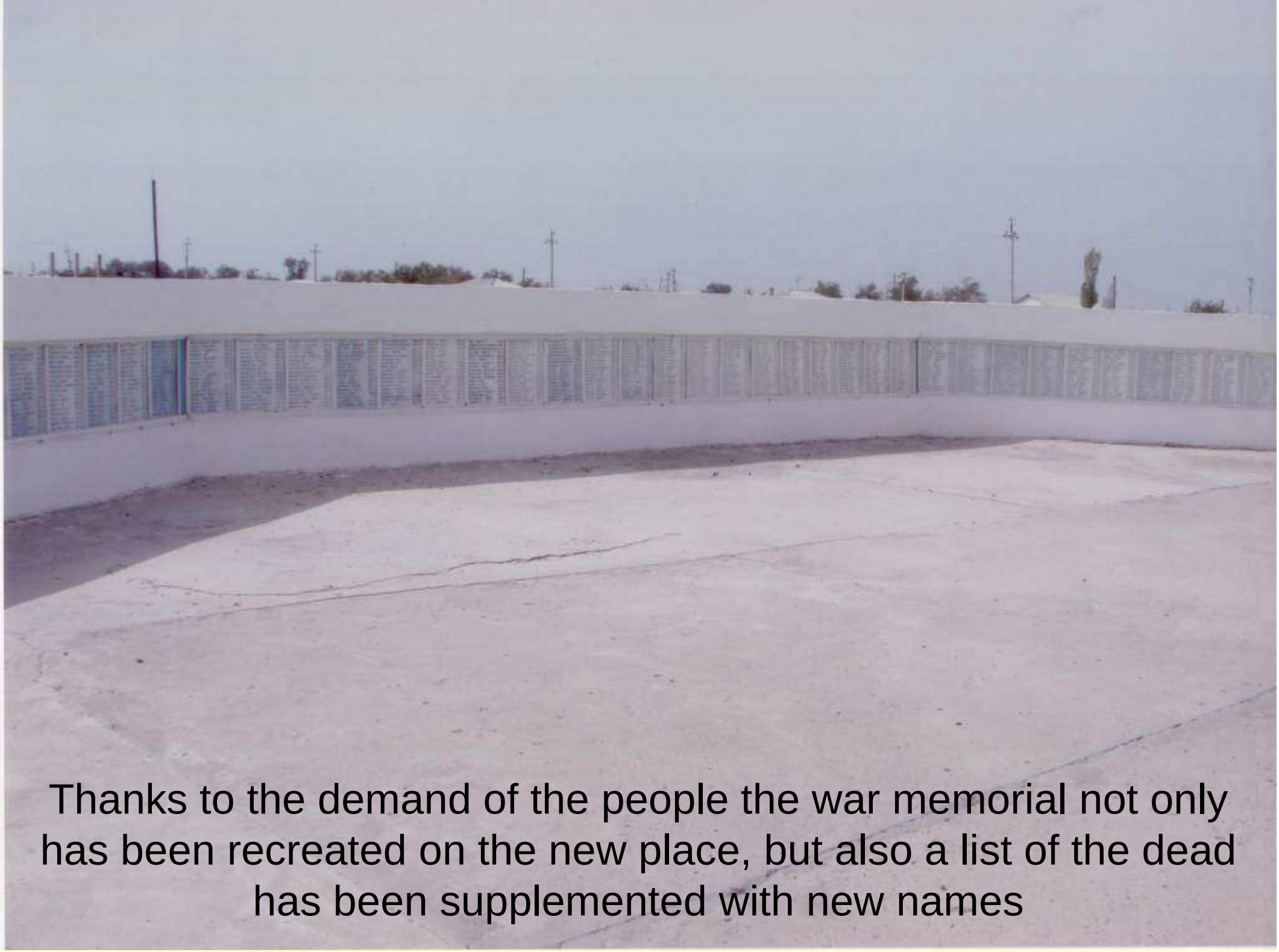
Monument to the soldiers who died in World War II. View in 2003

The same monument in 2004 with text in Uzbek, "Feats of the fathers - the heritage for future generations". On the stele - Uzbek flag.

Opening of converted monument in April 2008. Marble slabs with the names of the dead are removed.
Instead of flags - the image of the Aral Sea.

Now this picture in the Internet is entitled "Observation platform"

In September 2008, in the park of Muynak, district administration has erected a new monument in memory of those who died in the Great Patriotic War



Thanks to the demand of the people the war memorial not only has been recreated on the new place, but also a list of the dead has been supplemented with new names

The main driving force for regional cooperation in the Aral Sea region is International Fund for saving the Aral Sea

The structure of International Fund for saving the Aral Sea

Council of the Heads of states-founders on Aral Sea problem

President of IFAS

Board of IFAS

(Representatives of each founder state at the level of Deputy Prime Minister)

Interstate Commission for Water Coordination of Central Asia (ICWC)

Secretariat

SIC ICWC

BWO "Amudarya"

BWO "Syrdarya"

Coordination Metrological Center

Interstate Commission on Sustainable Development for Central Asia (ICSD)

Secretariat

SIC ICSD

Executive Committee of IFAS

Executive Board of IFAS in Kazakhstan

Kyzylorda Branch

Executive Board of IFAS in Kyrgyzstan

Branch of EC IFAS in Tajikistan

Dashoguz Branch of EC IFAS in Turkmenistan

Agency of IFAS in Uzbekistan

Nukus Branch in Uzbekistan

Regional Center of Hydrology

The next very important organization for regional cooperation in the Aral Sea region is International Lake Environment Committee Foundation (ILEC)

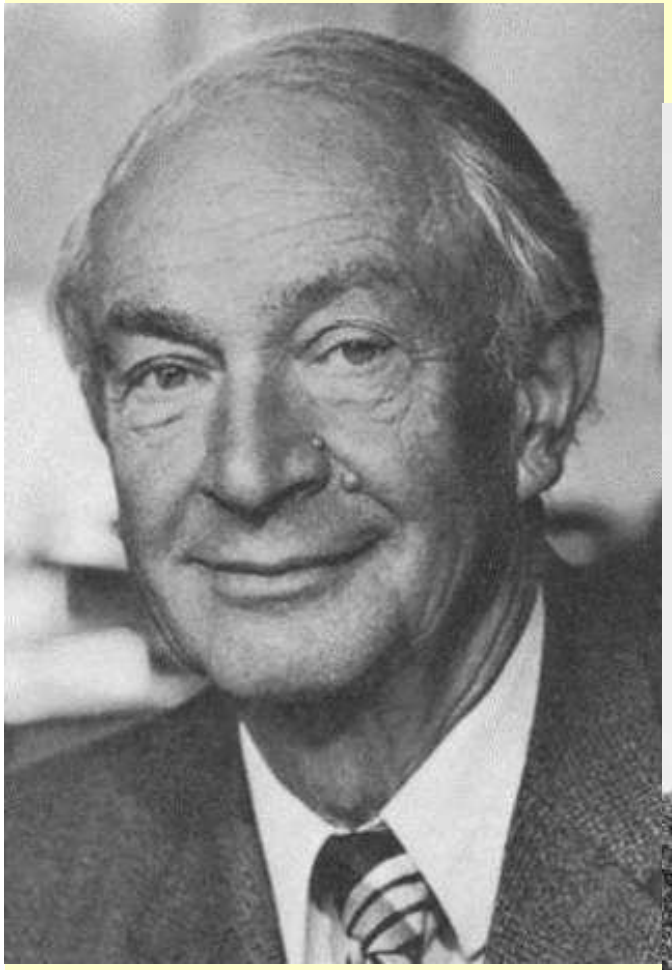
Tatuo Kira
1919 – 2011

Masahisa Nakamura

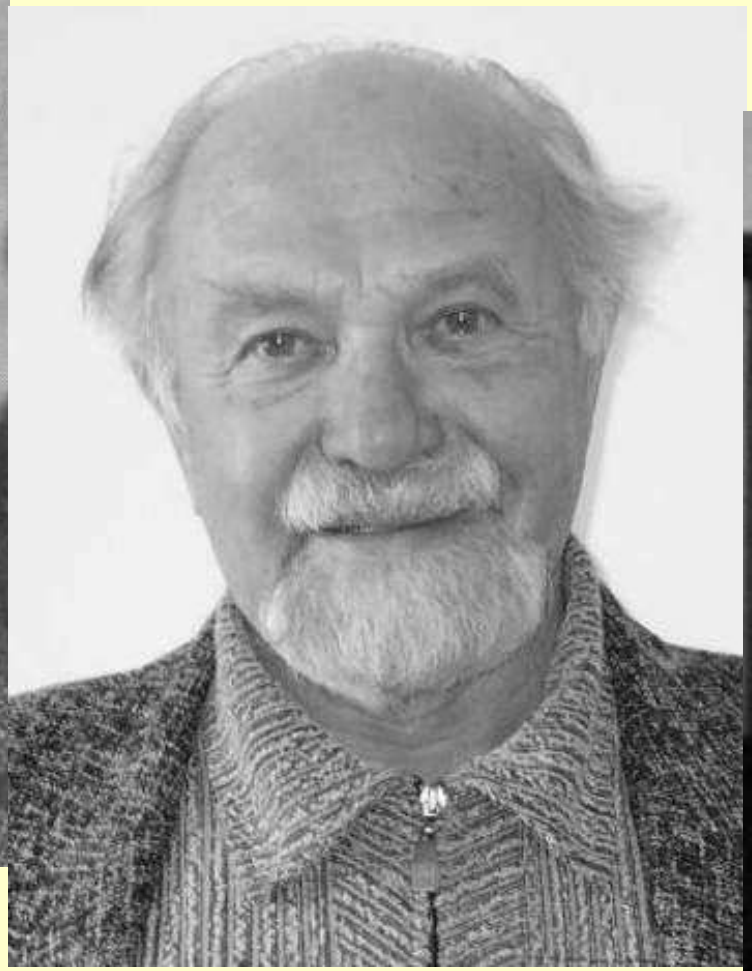
Walter Rast

International scientific cooperation is very important for regional cooperation in the Aral Sea region . Please see below only 2 examples.

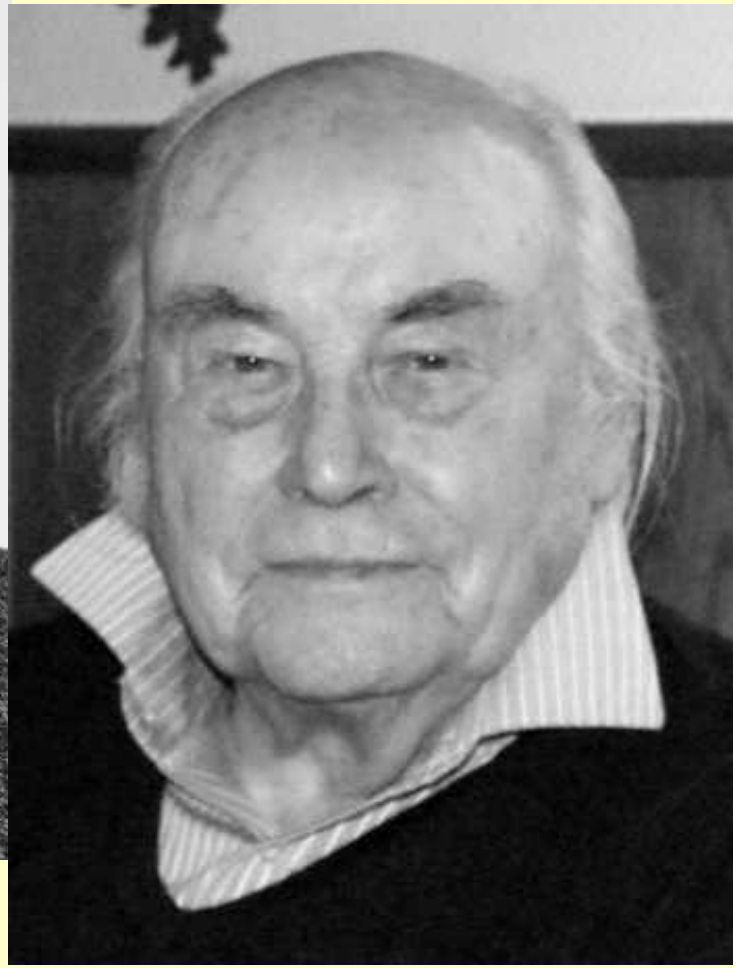
Leading scientists in studying of salinity and osmoregulation



Adolf Renane
1898–1976



Vladislav Khlebovich



Otto Kinne
1923–2015

Leading scientists in studying of physiology and ecology

Nikolai Gerbilskiy
1900 – 1967

Andrey Polenov
1925 – 1996

Lev Kuznetzov
1934-2015

Conclusions

- Prior to the beginning of anthropogenic regression and salinization of the Aral Sea its ecosystem survived consequences of new species introductions that began at the end of the 1920s.
- The main and only cause of modern desiccation and salinization of the Aral Sea is withdrawal of Amu Darya and Syr Darya waters for irrigation.
- It is possible to distinguish 3 main stages of Aral Sea biodiversity decrease process owing to its salinization:
- - in 1971-1976 when salinity has exceeded 12-14 g/l, brackish-water species of freshwater origin have disappeared;
- - in 1986-1989 when salinity has exceeded 23-25 g/l, brackish-water species of Caspian origin have disappeared;
- - in the end of 1990s and beginning of 2000s in the Large Aral Sea when its salinity has exceeded 80-100 g/l, species of marine origin have disappeared.
- In 1989 the Aral Sea because of desiccation has divided into 2 parts: Small Aral in the north and Large Aral in the south. On the place of one lake was formed 2 water bodies.
- After division of Aral Sea in 1989, Small Aral has positive water balance and its salinity began to decrease. After construction of a new dike in Berg's strait there has been a recovery of biodiversity and revival of fishery.
- Large Aral Sea having negative water balance continues to dry up and salinity is increasing; at the end of the 1990s it turned into a hyperhaline water body. Recovery of its biodiversity and fishery is not a real possibility. The only possibility of economic activities on Large Aral is harvesting of brine shrimp.
- To the present, Large Aral has divided into 3 separate water bodies: the Western and Eastern basins connected by channel, and lake Tsche-Bas.
- The significant raising of irrigation efficiency in the basin of Aral Sea could save significant amounts of water, which could replenish the water balance. However it requires comprehensive and very expensive reconstruction of irrigation systems, and also essential changes in the social and economic sphere that are improbable at the present time.
- The volume of underground water reaching the Aral Sea is essentially larger than was assumed earlier.
- Vozrozhdeniya island served as a proving ground for a variety of biological weapons during Soviet times. Once the island linked with the mainland in 2000, there was a definite threat that any pathogenic organisms that had survived Soviet military efforts to kill them could make their way to the mainland via fleas on rodents. The subsequent efforts of Uzbekistan with aid from the U.S. to ensure all pathogens had been killed is reported to have been successful.
- Plans for oil and gas extraction on the dried bottom of the southern Aral Sea can reduce interest of Uzbekistan authorities in taking actions to restore that part of the Aral Sea.


The Aral Sea has future


Thank you for your attention