Freshwater ecology and Biomonitoring

EVALUATION OF THE WATER QUALITY IN THE UPPER WATERSHED REGIONS OF THE ARAL SEA BASIN

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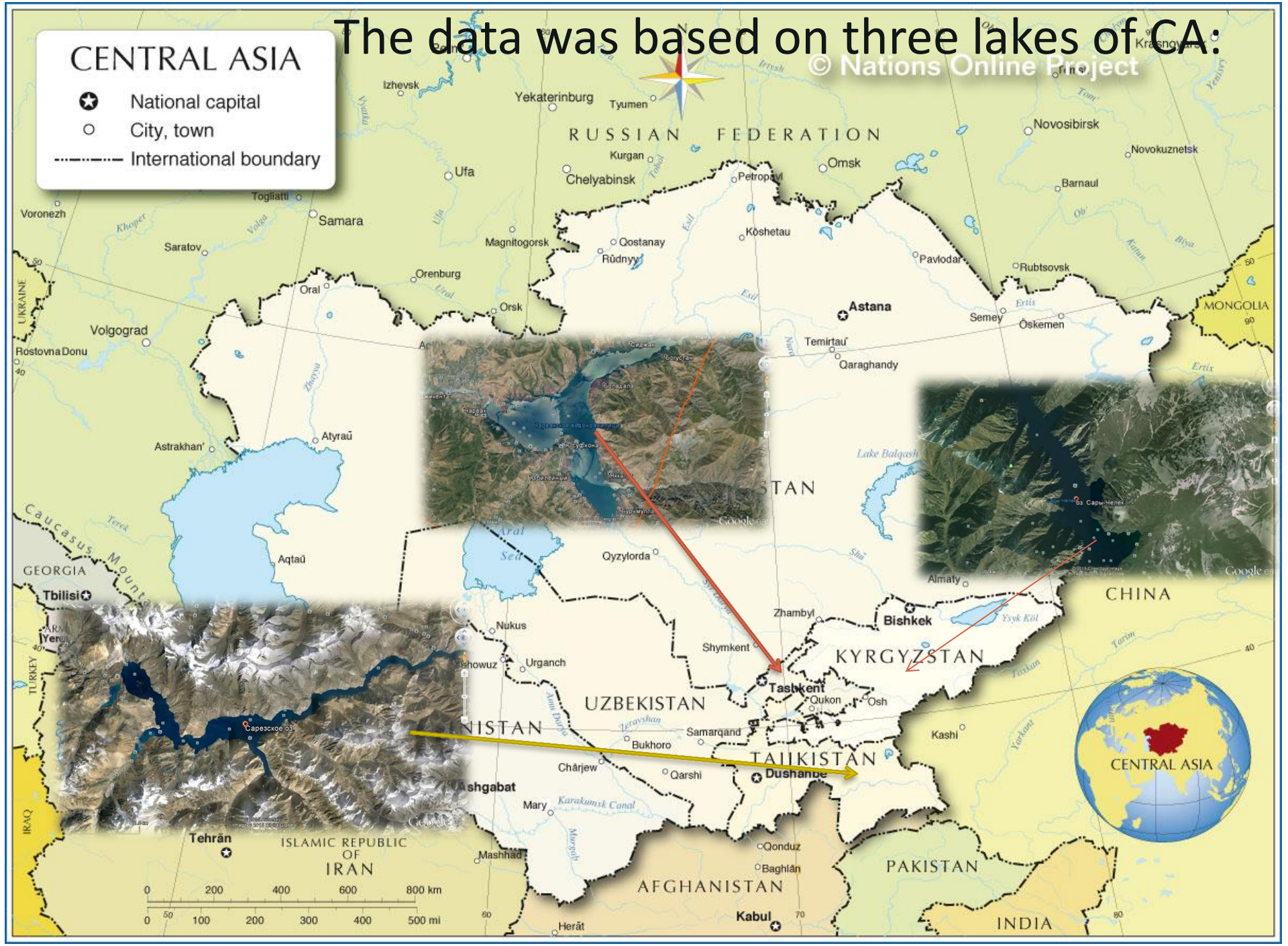
The data was based on three lakes of CA:



Introduction:

- During the Soviet period, a comprehensive network of sampling stations was developed;
- maintenance of these sampling sites is very high costly and has in a recent pruning;
- Hence, the number of sites decreased to a more reasonable size;

The table below demonstrates numbers of sampling sites:

	Uzbekistan	Tajikistan	Kirgizstan	Kazakhstan	Turkmenistan
Total number	**88**	91	32	13	2
Discontinued	**43**	13	20	6	0
functioning	**45**	78	12	7	2

Schematic arrangement of sampling sites Syrdarya river (Uzb.):

Existing water quality standards:

- **Water quality standards for extracted potable water supply:**

- There are 3 classes of requirements:

✓ class 1 - to obtain water corresponding to state standard, disinfection, and filtration are required;

✓ class 2 - to obtain water corresponding to state standard, coagulation, settling, filtration and disinfection are required, when phytoplankton are abundant microfiltration is required;

✓ class 3 - treatment methods determined as a class 2, with using additional steps such as oxidizing and sorption methods, and more effective methods of disinfection;

In general hydrological stations coincides with sampling places:

There are some pictures of hydrological stations taken by me (Uzbekistan),
from bottom to top:
1. Chatkal river, Tashkent region;
2. Pskem river, Tashkent region;
3. Dustlik canal, Syrdarya river, Syrdarya region;

Cont…

- **hazard levels are defined, depending on the ability of the toxin to accumulate in the human body and they are divided into 4 levels:**

✓ Extremely hazardous;

✓ High hazard level;

✓ Hazardous;

✓ Medium hazard;

Comparison of drinking water standards:

	CA republics	WHO
DDT (dikhlofos)	**0.1**	**0.001**
Cd	0.001	0.015
Hg	0.0005	0.001
Benzene	0.5	0.01

Cont…

Comparison of fishery standards:

- Different approaches of standards applied in the CA Republics and EU countries;
- EU standards referring conditions required for fish **survive and breed**, whereas the CA Republics standards, presumably, refer to the requirements for **fish to be eaten**;

Assessment of water quality:

- Data for 1986-1990 (the last period of "complete" data collection in the Soviet period) was collected for all measured parameters of the sampling sites in Uzbekistan;

Assessment of water quality:

- mineralization (total dissolved solids) is low, ranging from 120 - 550 mg/l with a mean of 289;
- Mean COD values are normally below 10 mg/l;
- Mean BOD values are typically below 2.5;
- Ammonia concentrations are below 0.1 mg/l with a mean of 0.06 mg/l;
- Nitrate values are all below 5.5 mg/l, which is well below than international standards (1.27 mg/l);
- Average phosphorus levels are low with a mean of 0.006 g/l;

Water quality classification ..cont..:

- Four bioassessment methods are in operation in Uzbekistan:
  - the water pollution index (WPI);
  - a Saprobic index (SI) - mainly identifies organic pollution;
  - the biotic periphyton index (BPI) - based on algae living on the edge of rivers;
  - a modified biotic index (MBI) - based on bottom living invertebrate species groups;

water pollution index (WPI):

- The WPI was officially recommended for use in the Uzhydromet service in 1988;
- WPI is preferable because it needs less time for calculation;
- Calculation of WPI carried out for only a strictly defined number of ingredients, **for surface water this number is six;**
- Initially the concentrations of all the substances are listed then all concentrations transformed to proportions of the MPC (maximum permitted concentration);
- The 6 highest concentrations as a proportion of the MPC are chosen;
- From these six concentrations the arithmetic mean is calculated - this is the WPI, WPI for surface water =[sum C/ MPC]/6, the table below shows WPI classification:

Water quality classification according to the water pollution index:		
Water quality class:		WPI value:
1	Very clean	<= 0.3
2	Clean	>0.3 to 1
3	Moderately polluted	>1to 2.5
4	Polluted	>2.5 to 4
5	Dirty	>4to 6
6	Very dirty	>6to 10
7	Extremely dirty	>10

Saprobic index (SI):

- Along with other formal evaluations of water quality, the Uzhydromet service recommended using periphyton organisms in the method of saprobic indicator organisms;
- Saprobicity is the ability of organisms to live in water with different contents of organic matter and the products of decay;
- Calculation SI should be done by following formula:
- Saprobic index = sum [S * h]/sum [h];

✓ where h = frequency of occurrence (abundance) of indicator organisms;

✓ s= indicator value (saprobic valency), which must be defined for every kind from edited standard list SEF (1977);

Cont..SI..:

Water quality class is defined according to the table below:

Water class	water state	value of SI
1	Very clean	< 1
2	Clean	1.1-1.5
3	Moderately polluted	1.6-2.5
4	Polluted	2.6-3.5
5	Dirty	3.6-4.0
6	Very dirty	>4.0

Biotic periphyton index (BPI):

- BPI was established in hydro-biological laboratory of Uzhydromet in 1989;
- Periphyton - freshwater organisms clinging to plants and other objects projecting above the bottom sediments;
- On the first stage it was created regional sanitary ecological classification of rivers based on its landscape and ecological ranking;
- then six main groups, corresponding mainly to six water quality classes accepted in Uzhydromet, classified;

Water quality class is defined according to the table hereafter:

Water class	Water state	Value of BPI
1	Very clean	10-9
2	Clean	8-7
3	slightly polluted	6-5
4	Polluted	4
5	Dirty	3-2
6	Very dirty	1-0

Modified biotic index (MBI):

- It is a modification of the Trent biotic index which is widely used for hydro-biological monitoring;
- The modified biotic index of water quality is based on the calculation of the indicator significance of organisms, and different species of these organisms;
- The MBI contains a greater list of organisms than in the BI, particularly organisms which live in the rivers of central Asia;

Water quality class is defined according to the table below (same with BPI):

Water class	Water state	Value of MBI
1	Very clean	10-9
2	Clean	8-7
3	slightly polluted	6-5
4	Polluted	4
5	Dirty	3-2
6	Very dirty	1-0

Results:

- A substantial sampling network exists to follow general trends in water chemistry in the headwaters;
- A significant number of these locations have data runs covering many years;
- A large range of water quality parameters are measured at monthly or two monthly;
- Measurements cover major ions, organic pollution and industrial pollutants;
- The three lakes in the CA headwaters region appear to be oligotrophic but their trapping efficiency for pollutants cannot be predicted with the information available;
- Among water quality standards drinking water and fishery standards are most commonly used;

Results:

- Water quality in the headwater regions is generally very good, although there is evidence of some local pollution;
- Very few chemical parameters show annual or temporal effects;
- Four indices are used to classify rivers in terms of their water quality: water pollution index; Saprobic index; biotic periphyton index and modified biotic index;
- A policy and strategy should be developed to maintain or improve the quality of the water in the headwater regions;
- Drinking water and fisheries standards used by the Republics are based on toxicological effects;

Recommendation:

- Modern computers and peripherals should be supplied to the major water quality data holders in the republics so that they can utilize their records to the best level possible;

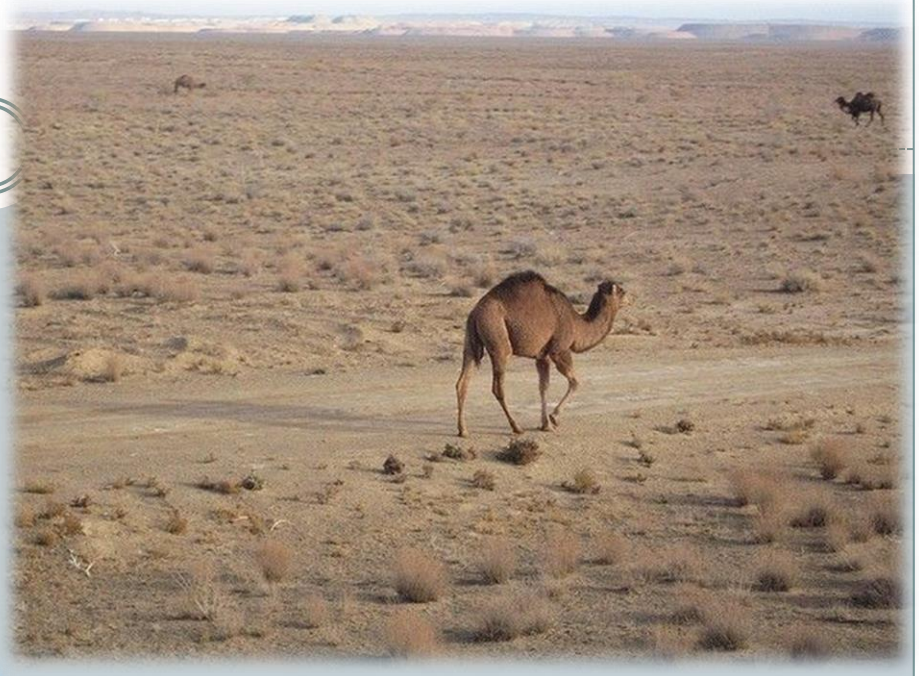
Chatkal mountains

Aydarkul lake

- Water quality across national boundaries, as well as quantity became an issue for Uzbekistan, sampling points at national boundaries should be initiated as soon as possible on all rivers;

Recommendations:

- Consideration should be given to the long term development of a predictive index, similar to the UK RIVPACS system to aid in water quality investment decisions;



Desert (steppe), Navoiy region

Aral sea

- An ecological quality standard should be introduced along with the other standards in order to maintain the ecological integrity of the river systems;
- A systematic forum for the regional transfer of chemical and biological data between the CA republics should be established;

References:

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- http://uznature.uz/?q=uz/yer-suv


Thank you for your
attention!!!