

**Lake Baikal's  
Selenga River Delta:  
Biodiversity, Conservation,  
and Sustainable Development**

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# Briefly about Lake Baikal

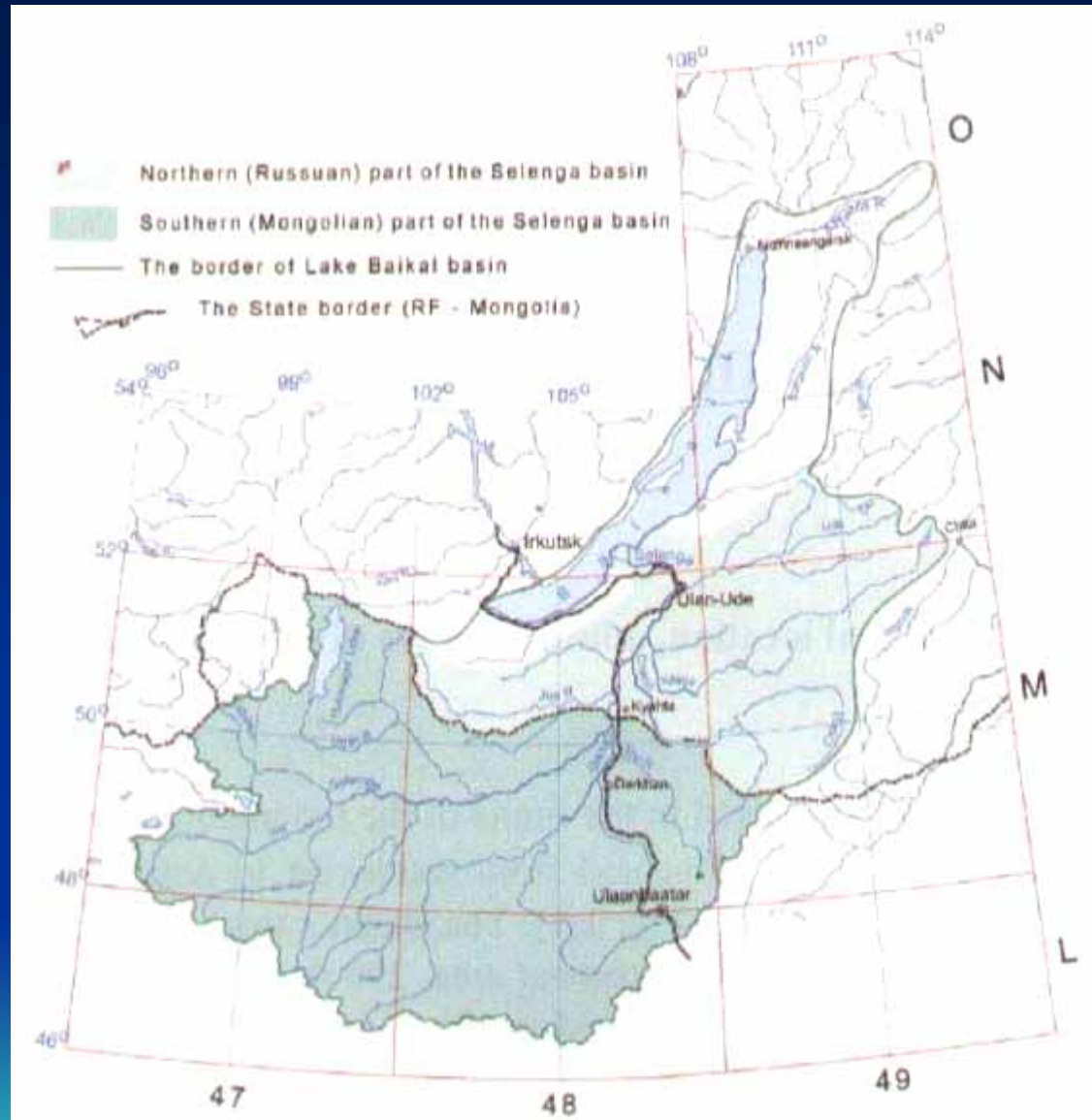
- Lake Baikal is the largest, deepest, and one of the oldest lake in the world
- Baikal contains 23000 km<sup>3</sup> of the clean fresh water (more then total volume of water in the Great Lakes of Northern America)
- This volume is equal about 20 % of the total volume of liquid fresh water of the world
- Depth of Baikal reach 1637 m
- Age of Baikal is about 25 million years





- More than 5000 biological species inhabits Baikal
- About 70 % of them are endemic
- Coastal landscapes of Baikal are incredibly beautiful
- Uniqueness of the Baikal was a reason why it was included into the List of the “World Heritage Site”

- Selenga River is the main inflow of Baikal bringing over 30 km<sup>3</sup> of water and over 3,5 million tons of sediment per year
- The square of basin of Selenga is 447000 km<sup>2</sup> – 82 % of the Baikal's basin square
- The basin is situated within the 3 geographical zones: boreal forest, forest-steppe, steppe.
- Selenga starts in Mongolia and then within Russia inflows to Baikal, so it is related to the “transboundary rivers”



# The main features of the Selenga Delta

## **Some information:**

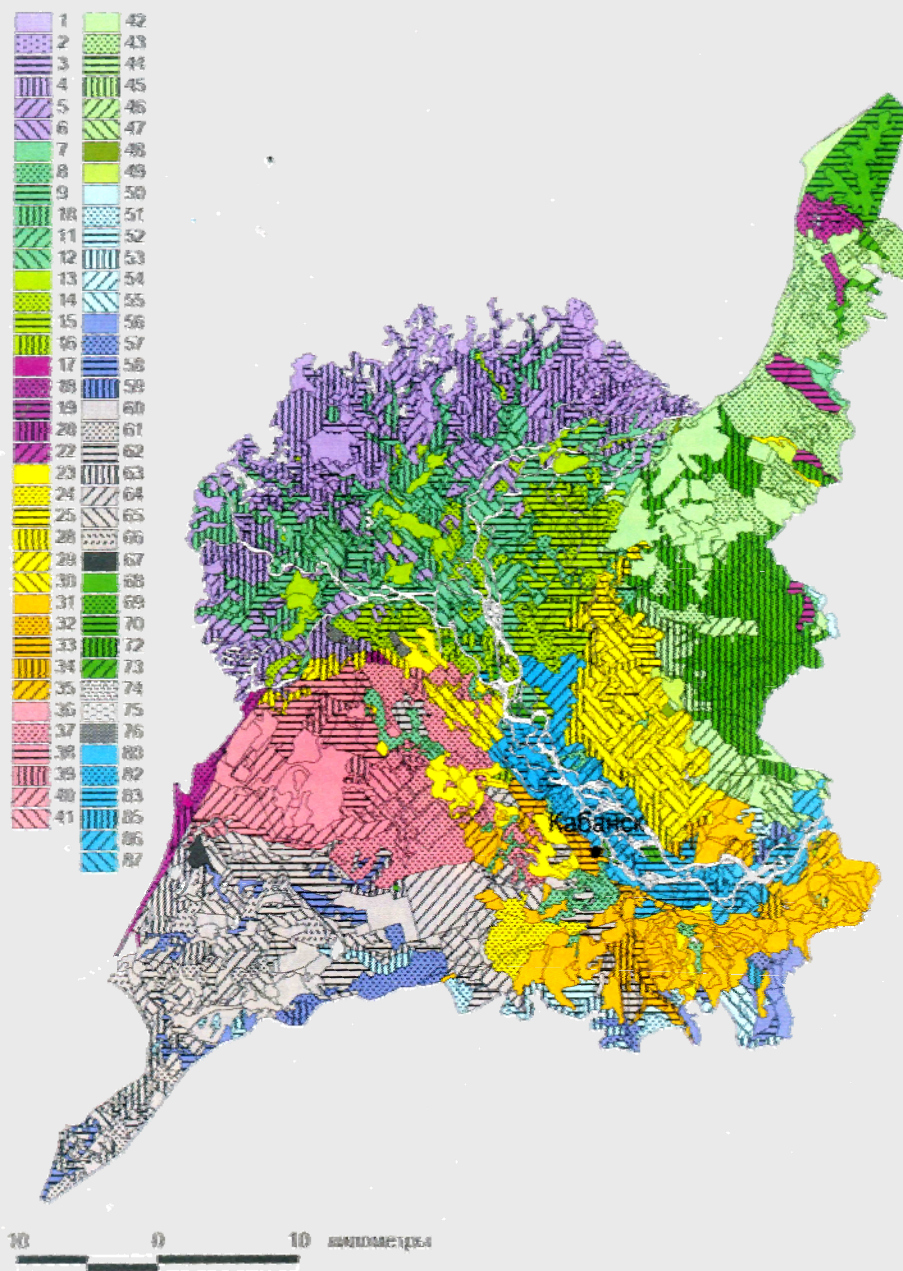
- Morphologically and hydrologically Selenga Delta is related to classical type of deltas
- The square in the geological sense – 1120 km<sup>2</sup>
- Hydrologically bounded square – 600 km<sup>2</sup>
- 85 % of the square – regularly flooded lands
- 8-10 % - river branches
- 5-8 % - lakes

## **Special features:**

- Intercontinental location
- Flowing into a freshwater lake
- The sediments reach a depth of 7-8 km
- The region also has unusually high seismic activity – up to 10 balls
- Selenga river is not dammed anywhere and it's outlet is not regulated by human



- Selenga Delta is included into the International Ramsar Convention as an important point of resting more than 170 seasonally migrating bird species, and area where more than 110 bird species are nesting (the worldwide ornitologically important point)
- The Delta harbors a wide variety of landscapes; this creates a unique environment with a high biological potential
- There are more than 710 plant species (algae – 520, mosses and vascular plants – 190), 110 nesting bird species, and 27 fish species inhabits waters of Delta.



## The Landscape Diversity (Cherhkašin et al., 2002)

87 kinds of geosystems has been distinguished within Selenga Delta

They are related to:

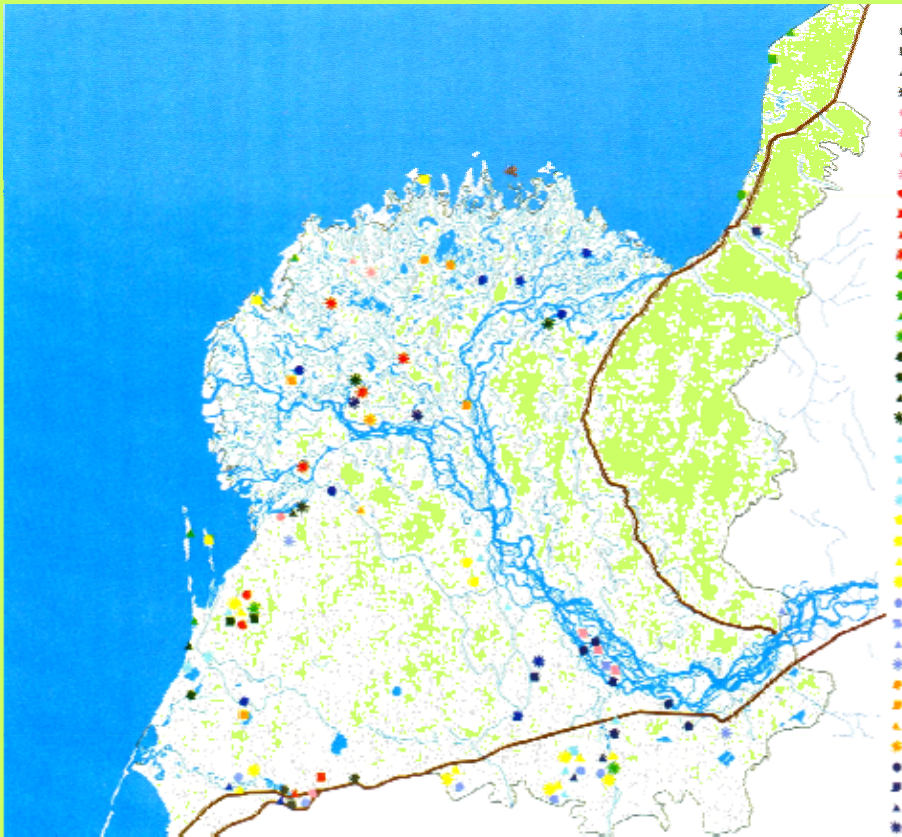
Types:

Arid Daurian, Semi-Arid North Asian, Arcto-Boreal North Asian, Subboreal North Asian, and Subarctic Baikal-Dzhugdzhurian.

Subtypes:

Aquatic, subaquatic, hydromorphic, subhydromorphic, lithomorph, sublithomorph, psammophytic, halophytic, subkryomorph, zonal, intrazonal.

## Distribution of rare and endangered plants



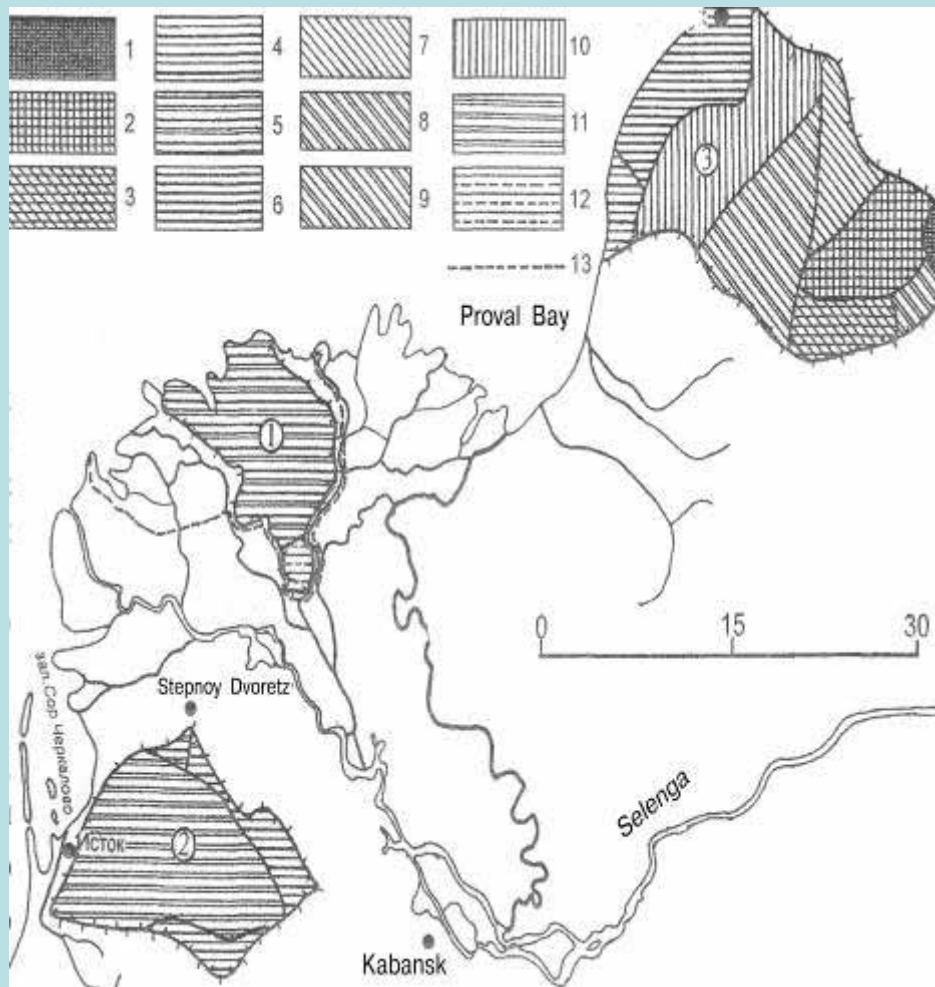
44 rare and endangered plant species, listed in the Red Data Books of Buryatia (2002) and Russian Federation (1988) have been registered in the delta area. 6 of them are endemic of the Baikal Region. (*Craniospermum subvillosum* Lehm., Boraginaceae on the photo).



31 rare and endangered animal species listed in the Red Data Book of Buryatia (2005) inhabits the Delta  
(the White Swan on the photo)



# Nature Reserves in the Delta and adjacent territory (Savenkova, 2003)



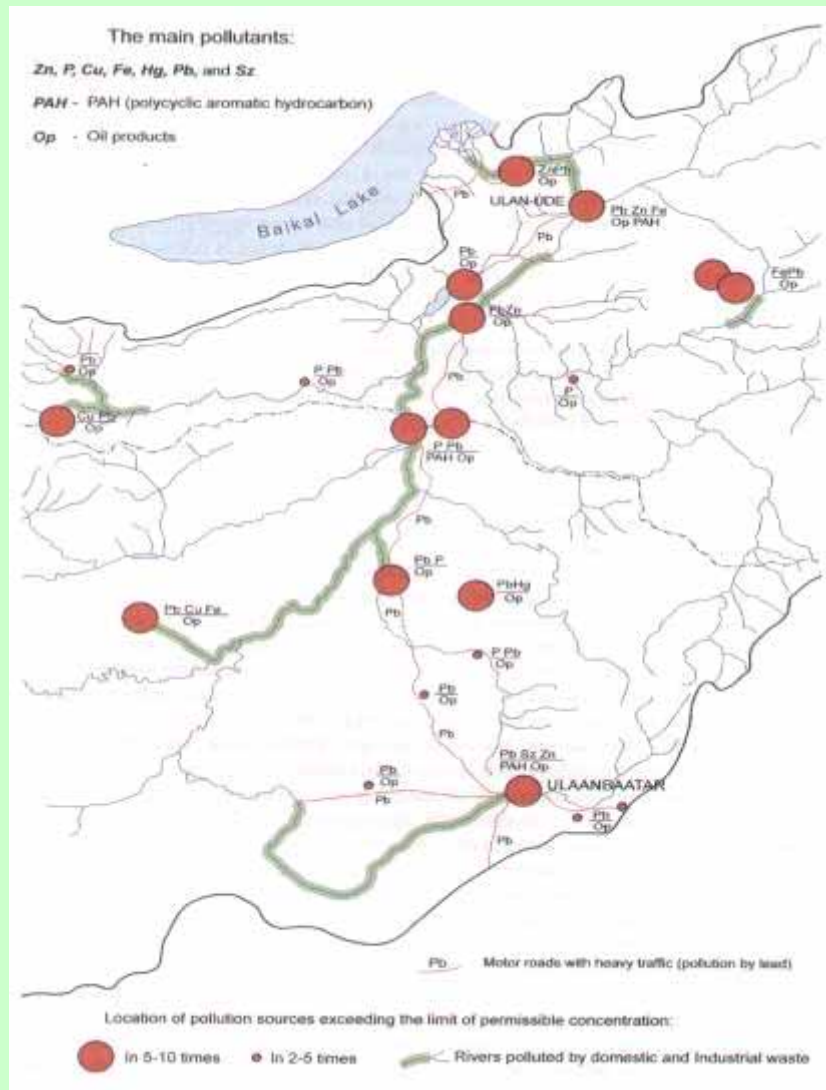
There are 3 reserves, in Russian named “zakaznik”. It means that there are some restrictions for human activity, caused by requirements of the nature conservation.

One of them - Kabanskyi (№ 1 on the Fig.) is located within the Delta. The square – 12100 ha. The main type of ecosystem is wetlands (№ 5 in the Legend). The main topic of activity is conservation of the Delta’s landscapes and protection of ornitofauna.

Legend: 1 – alpine tundra, 2 – mountain cedar forests, 3 – mountain fir tree forests, 4 – larch forests and bogs, 5 – wetlands and grasslands, 6 – grass larch forests, 7 – larch-cedar forests, 8 – moss larch forests, 9-12 – various types of pine forests.

The complex program concerning biodiversity conservation must be elaborated, including changing of status and square of the nature reserves.

# Location of the main pollution sources within the Russian part of the Selenga River basin (Tateishi, Gunin, 2006)



## Main pollutants:

Zn, Pb, Cu,  
Fe, Hg, Pb, Sr, Polycyclic  
Aromatic Carbohydrates  
(PAH), Petroleum, Benzol  
(Op).

## Location of pollution sources exceeding the limit of permissible concentration:

- – in 2-5 times
- – in 5-10 times

The largest pollution sources  
are: Ulan-Ude city,  
Gusinozersk town, and  
Selenginsk town

## Outlet of Elements by water to Baikal throw Selenga Delta (in: "Selenga Delta...", 2008; in press)

Process	Elements					
	Fe	Mn	Pb	Cu	Zn	Cd
Accumulation in the Delta (tons per year)	36180	1060,8	524,4	249,6	157,2	4,9
Incoming to Baikal (tons per year)	24120	707,2	349,6	166,4	104,8	3,3

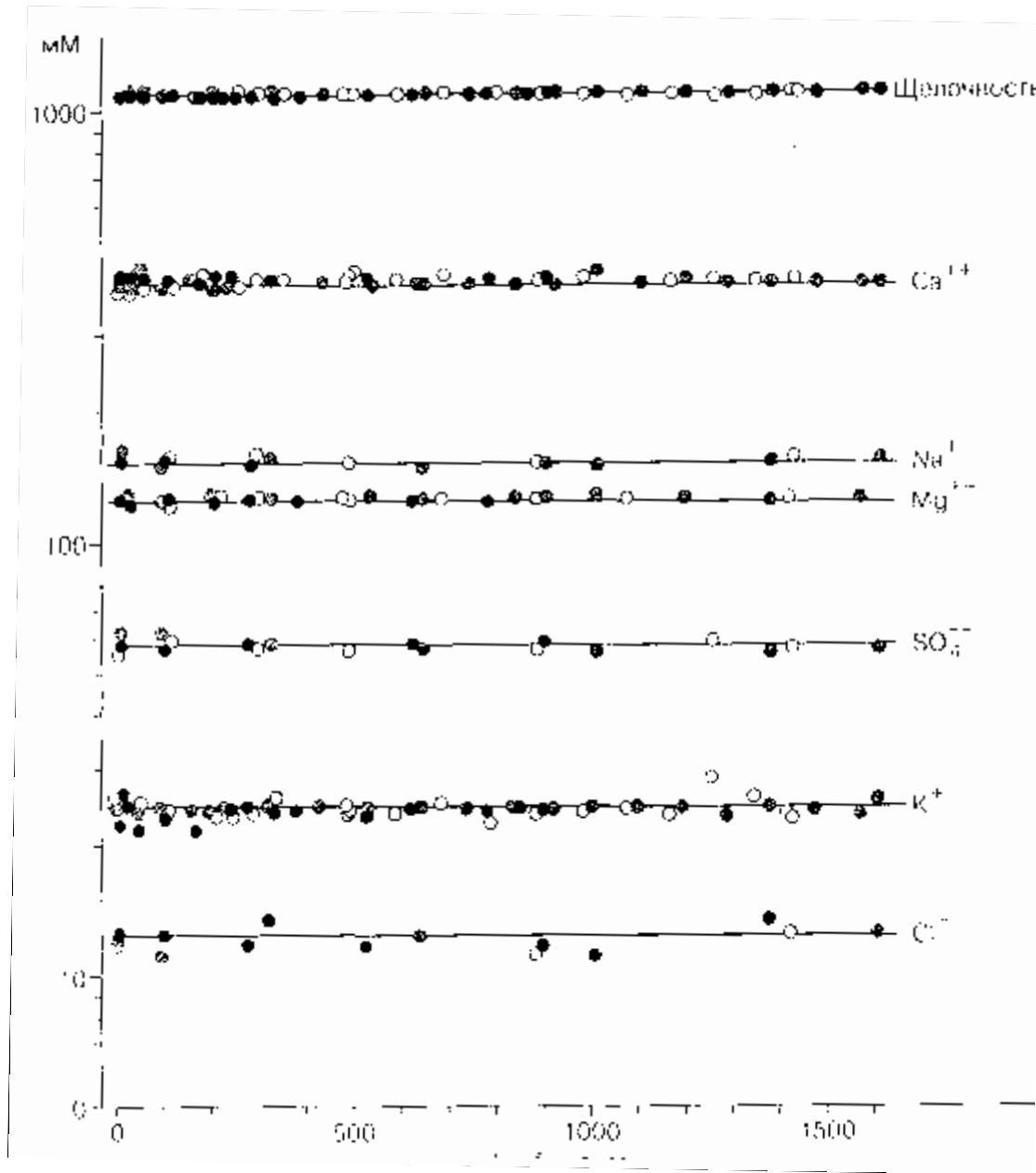
# Content of heavy metals in the fish of the different alimentation types from Selenga to Baikal

(Gomboyeva, Pronin, 2002-2006)

- Biological purifying the water in Delta is connected mostly with microbiological processes. Plants and animals take part as absorbers on the different steps of purifying. Nevertheless, they could be an indicators of pollution of environment.
- Content of 4 metals – Cu, Zn, Cd, Pb, have been studied in the benthophage (rouch), euryphage (perch), predator (pike).
- It was revealed, that contents of all heavy metals is not exceed allowable levels and decrease in all fishes along the row:

*Gusinoe lake → Selenga (near Ulan-Ude city) → Selenga Delta → Shallow waters of Baikal after Selenga Delta → Chivyrkuy Bay in the northern part of Baikal.*

- Chivyrkhuy Bay can be considered as a basic point for further monitoring characterized by the lowest contents of heavy metals in the living beings of Baikal.

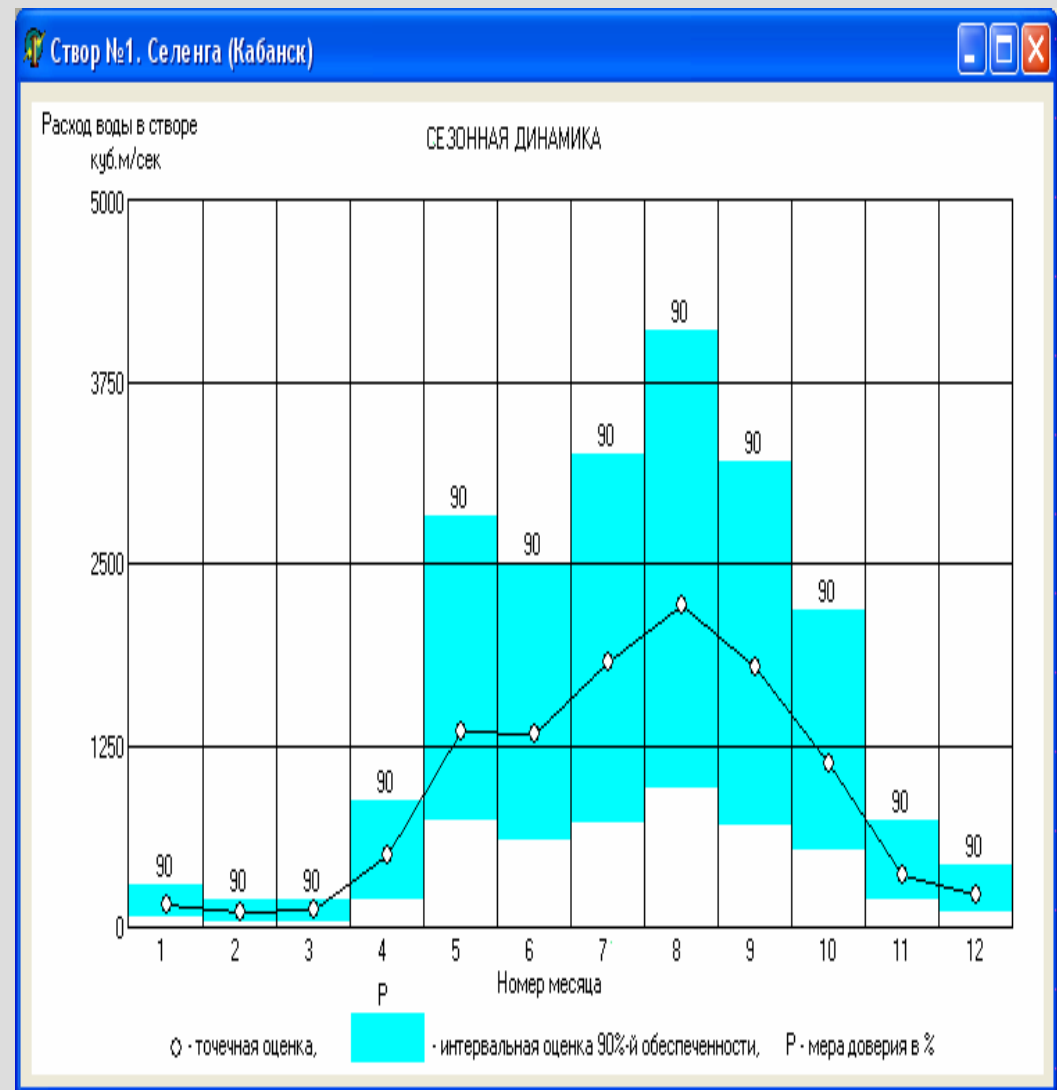


- Variability of concentrations of main ions at the different depth of the Baikal's waters is very low (Falkner et al., 1991; Grachev, 2003). That is why it is possible to conclude that chemically the ecosystem of Baikal is quite stable and is not polluted sufficiently by the industrial air emissions.

# Computer modeling of processes in the Selenga Delta (in: “Selenga Delta...”, 2008; in press)

Still now only 1 computer model is created (Ignatov, 2008, in press). It is devoted to estimating of the hydrological parameters of the Selenga’s outlet within the Delta (local dynamics, current state, prognosis). Creating further models is necessary for substances and energy cycles as well as various biological processes analyzing.

The Fig. shows results of the computer modeling of the seasonal dynamic of the volume of water incoming to the Delta. The curve reflects “exact” predictions, blue columns – 90 % of probability.



## Villages (in red) and agriculture in the area around Selenga delta



- The human population in 26 villages in the area around Delta is about 15000 people



## The Strategy of Nature Management can be outlined by the following general topics:

- Protection of the waters
- Conservation of biodiversity on the different levels: population, species, communities and ecosystems
- Inexhaustible exploitation of the renewable biological resources
- Minimizing of damages of exploitation of other natural resources
- Wide ecological education of the local people
- The creation of policies supporting the federal law “On Protection of Lake Baikal”
- All these topics are a components of the program of Sustainable Development of the Baikal Region including Selenga Delta

Thank you very much for your attention !