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Victoria A. Babicheva[1], Martyna A. Rzętała[2]

[1] Institute of the Earth's Crust SB RAS, 664033, Irkutsk, Lermontov Street, 128, Russia, e-mail: khak@crust.irk.ru

[2] University of Silesia, Faculty of Earth Sciences, ul. Będzińska 60, 41-200 Sosnowiec, e-mail: mrz@wnoz.us.edu.pl

The Angara Reservoir Cascade as a Subject of the Transport and Tourism Concern

Abstract: The article deals with the problems of development of transport and recreation activity in the areas of the Angara man-made reservoirs; here the characteristics of reservoirs and their basic morphometrical parameters are discussed. Creation of reservoirs has provided definite advantages to regional economy, because due to flooding of numerous rapids and bars the Angara-river course has become completely navigable. The rivers of Angara basin are of considerable importance in terms of transport service and the economic development of the territory, as well as for recreation tourism activity. In many cases, however, the interests of navigation do not agree (or even conflict) with those of recreation requirements: the navigation activity and timber rafting produce much of the river water pollution, whereas the recreation objects need high quality fresh water.

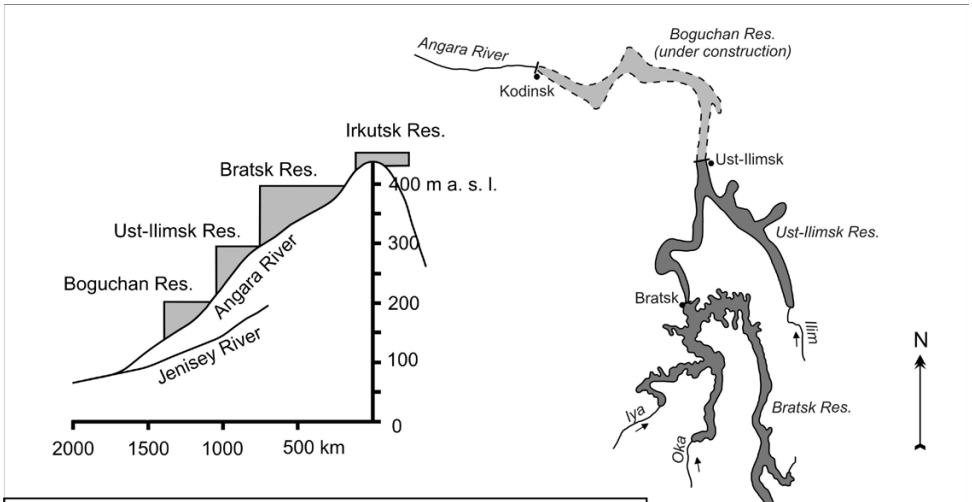
Key words: reservoir cascade, recreation, navigation, rafting

The Angara river that flows from the Lake Baikal and runs west-northwards meets the Enisei river as its tributary. It is 1.800 km long, with the total catchment area (including that of the Lake Baikal) exceeding 1 mln km^2. Toward the end of the 20th century, three large water storage reservoirs (Irkutsk, Bratsk, and Ust-Ilimsk) were created in the Angara river basin; currently, the additional reservoir (Boguchan) is in the process of planning (fig. 1). The cascade of Angara reservoirs extends for 1000 km, with the total water area reaching 7.500 km^2. The Irkutsk reservoir, the smallest among those cited above, contains about 2.1 km^3 water, with 35 m maximum depth, and 276 km shore length. It is located at the cascade head, and extends for 65 km from the Angara river source to the dam of the Irkutsk Hydro, presenting a kind of the man-made bay of Lake Baikal (Bratsk Man-made Reservoir, 1978).

The Angara reservoirs coupled with the Lake Baikal's water body is considered to be the world's largest cascade reservoir system. The Lake Baikal itself covers 31,470 km^2. With 1637 m maximum depth, it contains 23,000 km^3 of water, presenting the world largest fresh water reserve (Ovchinnikov et al. 1999).

The Angara reservoir cascade presents a multiple-purpose project. In addition to its main power-generating function, the reservoirs serve for the flood control, water supply purposes, and provide the adequate conditions for navigation and recreation activities in the coastal areas.

River courses of Angara basin are very important in the context of water transport service, particularly in the region of Lower Priangaria marked by the lack of the overland transport facilities. Actually, the Angara river is an important way of transport communication in the development of the region. In regions of Central and Upper Priangaria with well developed road system, the navigation is exploited side by side with other transport services. In the Angara basin, several rivers such as the Angara river and its man-made reservoir, Taseeva, with lower and middle course of rivers Biryusa and Chuna, and lower course of Ilim, Oka and Iya rivers, are now efficiently used. The length of navigable rivers totals 4,500 km, which is over 4% of all Russian rivers. The main goods transported between Irkutsk and Bratsk are mineral building materials, grain, and petroleum products. From the territory of Enisei petroleum products, coal,



The Angara River Cascade			
Parameters	Irkutsk Reservoir (1956-1962)	Bratsk Reservoir (1961-1967)	Ust-Ilimsk Reservoir (1975-1977)
surface (square kilometers)	154	5 470	1 833
capacity (cubic kilometers)	2.1	169.7	62.7
length (kilometers)	55	570	302
depth (meters)	maximum 35	maximum 150; average 31	maximum 94

Fig. 1. The Angara reservoir cascade scheme, the main parameters
Source: Ovchinnikov et al. 1999

cement, manufactured and provision goods are delivered to the region of Lower Angara. In the Bratsk reservoir, 36 goods-and-passenger piers and 24 raftings are exploited. The yearly handling capacity of the Bratsk river port is up to 1.5 million tons of goods and up to 3.5 million tons of driftwood, the passenger transportation capacity being smaller of about 1 million passengers during the navigation period. Timber rafting as a specific field of economic activity is efficiently practiced in the Angara basin marked by considerable wood resources. Yearly, over 11 million m^3, which presents ¼ of the total lumber amount, are transported in the drift floating and loose floating manner (The General Characteristic of Irkutsk Region 2010) (photo 1).

Photo 1. Timber rafting in the water area of Bratsk reservoir
Photo by V. Babicheva

In 1980s, the environment injuring method of loose timber floating was practiced in left tributaries of the Angara river. At present, this manner of timber floating is practiced only on a few rivers, e.g. the floatwood is directed to Taseeva for rafting, and to Biryusinsk and Cuna, where the logs are conveyed to railroad flat cars to transport them to the wood working enterprises. Currently, only 20% of loose timber floating is temporarily practiced on a few rivers; however, approximately 30-40 years will be required to clear the sweepwood from the rivers. The great bulk of raft floated wood is currently transported by the Angara river and its water storage reservoirs. Though raft floating is considered to be the environment protective method, it does not prevent from the detrimental influence upon the reservoirs' water conditions such as water pollution by noxious matters. Reservoir water is contaminated also by wind-borne woodwastes from woodyards and raft-forming sites. Great amounts, totalling 2-3 million cubic meters, of abandoned logs can still be found in the water space of the Bratsk and Ust-Ilimsk reservoirs.

Water resources in the territory of Angara basin are intensely used for purposes of recreation, sports, health protection, tourism, fishing, hunting, and other activities. The recreational importance of Angara reservoirs is proved by the fact that a half of the urban population of Priangaria dwells in the vicinity of reservoirs, and more than 70% of city dwellers can reach the reservoir coast areas by a 2-hour trip.

In shore areas of the Irkutsk reservoir (the bays of Kurma, Ershi, Burduguz, and Melnichnaya pad), large gardening communities meet for growing foods for domestic consumption. Along the reservoir's right shore, a number of large tourist base camps, hotels, and health resort facilities are located. In the region, both the civilized and "wild" forms of tourism exist. During warm periods, with water temperature reaching 18-24°C, the beach manner of outdoor recreation is rather popular, particularly in the Baikal shore areas. Most attractive are the southern areas of Maloye More – the so called "Baikal Riviera", the sandy beaches of the Olkhon island, and some bays of western shore areas. Also, the sandy beach areas of the Bratsk and Irkutsk reservoirs are very popular for summer recreation purposes. Actually, only two civilized beach recreation areas with adequate hygiene facilities (bio-toilets, refuse collection, regular garbage removal, and lifeboats) exist in Irkutsk city (photo 2a).

In the region of Irkutsk there are numerous not civilized recreation beach areas (fig. 3b), whose conditions do not conform to the sanitary norms, because nobody is responsible for improvement and equipment of those places with modern amenities.

The recreation conditions in beach areas of the Bratsk reservoir are rather badly organized. The problem of improvement is very urgent because the so called "wild" tourism produces considerable harm to the environment as

Photo 2. The beach areas in Irkutsk city: a. The Yakobi beach area (civilized beach recreation area); b. Not civilized beach area near the Irkutsk Hydro dam
Photo by V. Babicheva

Photo 3. The case of "wild" tourism in coastal areas of the Bratsk reservoir (the territory of Rassvet beach)
Photo by V. Babicheva

the beach areas are heavily cluttered up. The southern area of Bratsk reservoir is particularly attractive for tourism, e.g. the territories of Zolotye Peski and Rassvet (photo 3).

Organized tours are practiced only in the area of Irkutsk reservoir, including the trip to the Lake Baikal. At present, the sailing and surf bathing are actually practiced, and the Aquatic Sports Centres exist in the Irkutsk region. The sailing, being rather expensive, complex, and requiring the stationary service base, develops with a definite delay against other sports. Few sail boats appeared first in the Irkutsk reservoir. Later the Sailing Sport Federation was founded to fix the routes for cruiser yacht's regattas in the Lake Baikal. Regularly, five types of yacht boats, including those of the "micro" class and the 12 m long single- and two-mast boats, participate in regatta. At present, wind surfing is actively practiced in Irkutsk. After the first wind surfing schools were set up in 2005, where more than 3000 sportsmen can be trained. Every year, the Regional Cup wind surfing competitions are carried out in the Irkutsk region (The General Characteristic of Irkutsk Region 2010).

Reservoirs of the Priangaria region provide numerous places suitable for those who are fond of fishing and fowling. Traditionally, fishing was the bywork line of business in the Angara region due to the low rate of river productivity. In the Angara river and its tributaries the abundance of valuable fish species such as starlet, sig, grayling, and others was formerly recorded, which were the subject of domestic consumption. The unreasonably intensive fishing out in 1940s and 1950s has considerably exhausted the fish resources, but also the creation of high head hydroelectric stations and water storage reservoirs has contributed much to water pollution and largely damaged the fishing economy in Priangaria. Nevertheless, the residents of the Priangaria can get enough fresh and salt fish (particularly the grayling) for their own needs.

Creation of reservoirs stimulated the development of navigation, tourism and sports, as well as recreation. However, the dams of the Angara hydroelectric complex are not equipped with navigation facilities, which makes the Angara river unsuitable for the through navigation, and stimulates the development of other means of transport services. Low water temperatures in downstream areas of dams make extensive parts of the Angara river, e.g. in Angarsk, Usolie-Sibirskoye, Bratsk, and Ust-Ilimsk, unsuitable for beach recreation. Recreation facilities, navigation, and timber rafting to a large extent contribute to water pollution by petroleum, suspended solids, and garbage (from navigation, tourism and recreation), wood wastes and their toxic substances such as phenols, lignin, resinous matters, acids, etc.

For further development of the regional water transport, a number of vital problems should be solved. One of the urgent tasks is the creation of navigation passage facilities to provide the through traffic from the Lake Baikal

to the Enisei-river to reach the Arctic Ocean and particularly the Arctic Navigation Course. For ecological reasons, loose timber floating in Angara river should be completely stopped, and rafting in Angara reservoirs substantially reduced.

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Babicheva Victoria, Dr. of Geosciences, Researcher in the laboratory of engineering geology and geo-ecology, Institute of the Earth'sCrust, Siberian Branch of RAS.

Field of research: exogenic geological processes in the zones of influence of man-made reservoirs; geo-ecological problems in coastal areas; abrasive-accumulative processes; eolian processes; and erosion processes. Author and co-author of more than 50 publications.

Institute of the Earth's Crust SB RAS, 664033, Irkutsk, Lermontov Street, 128, Russia, e-mail: khak@crust.irk.ru.

Rzętała Martyna, Doctor of Earth Sciences (PhD) in Geography,

Assistant professor in the Department of Physical Geography of the Faculty of Earth Sciences at the University of Silesia in Sosnowiec. Scientific interests: Geomorphology, Environmental Protection, and tourism. The author of several dissertations.

University of Silesia, Faculty of Earth Sciences, ul. Będzińska 60, 41-200 Sosnowiec, e-mail: mrz@wnoz.us.edu.pl.