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Large and small reservoirs of Ukraine

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Abstract: This article is a continuation of the topic of artificial water bodies in Ukraine, which was started in our previous publication in 2020. It was devoted to accounting and monitoring of ponds at the local and national levels. Reservoirs play important role in water supply for various sectors of the economy. For this reason, much more attention is paid to reservoirs by the State Agency of Water Resources of Ukraine (Ukr. Derzhavne ahentstvo vodnykh resursiv Ukrainy), the Ministry of Ecology and Natural Resources of Ukraine (Ukr. Ministerstvo ekolohii ta pryrodnykh resursiv Ukrainy), scientists and specialists. The main tasks of the article are: to establish patterns of territorial distribution of reservoirs in administrative regions and river basins districts; to identify the role of large and small reservoirs in the balance of river runoff regulation. There are 1054 reservoirs in Ukraine, so it can be considered a country rich in reservoirs. The volume of the cascade of six reservoirs on the Dnieper River and the Dniester Reservoir is 85%, other reservoirs – 15% of the total number. At the same time, there are 1047 other reservoirs (middle, small and very small), which provide for regional needs and which have their own patterns of distribution throughout the country. The main trend in their creation was water supply of industrial regions, in particular Kharkiv, Donetsk, Dnipropetrovsk and others. About 28% of reservoirs are leased. These reservoirs also require clear accounting and monitoring at the national level, attention from water management and environmental organizations.

Keywords: the Dnieper Cascade, the Dniester Reservoir, rent, reservoir, river basin district, Ukraine

INTRODUCTION

A reservoir is a water body in the riverbed or in depression, which is artificially created by building a dam or digging a tank (the pit). The reservoirs history dates back several millennia. But the construction of large reservoirs in the world reached its peak in the 1950s–1980s; it was related to the development of hydropower. Monitoring of reservoirs is conducted by the International Commission on Large Dams (ICOLD), taking into account reservoirs, which have a dam height of ≥15 m or 5–15 m and retain more than 3 mln m^3 of water. According to ICOLD, there were 33,105 reservoirs in 2003 in the world, and in 2020 – 57,985 reservoirs, which contain 14,602 km^3 of water [ICOLD 2020]. Such significant changes have occurred not so much due to the construction of new reservoirs, but due to the clarification of information provided by countries to ICOLD. For example, there was a period when information about China's reservoirs was not available.

Global issues related to the reservoirs impact on the environment and society are the focus of scientists [Khilchevskyi *et al.* 2020b; Manatunge *et al.* 2008]. The publications cover various issues: flow regulation and flood protection through a reservoir in Poland [Sojka *et al.* 2016], assessment of water quality and pollution in a reservoir in Algeria [Bahroun, Chaib 2017] etc.

When we talk about reservoirs in Ukraine, the Dnieper Cascade of reservoirs comes to the fore. First of all, because these are the largest reservoirs. Secondly, due to environmental problems associated with them (large areas of shallow water, the development of blue-green algae in summer and degradation

of water quality). But in Ukraine, in addition to the Dnieper Cascade, there are many smaller reservoirs, which are given much less attention by researchers and the environmental community. In recent years, the State Agency of Water Resources of Ukraine (Ukr. Derzhavne ahentstvo vodnykh resursiv Ukrainy), with the involvement of scientists, who engage in hydrology and water resources, has clarified data on the availability of reservoirs in the regions and districts of the country. This article is a continuation of the topic of artificial water bodies, which was initiated in the previous publication [Khilchevskyi *et al.* 2020a; Khilchevskyi, Grebin 2020] and was devoted to Ukrainian ponds.

The purpose of the research is to establish territorial patterns of reservoirs distribution in administrative regions and river basins districts, and to identify the role of large and small reservoirs in the balance of river runoff regulation in Ukraine.

MATERIALS AND METHODS

The study used information about the reservoirs of the State Agency of Water Resources of Ukraine (Ukr. Derzhavne ahentstvo vodnykh resursiv Ukrainy) as of 01.01.2020.

Several general scientific and geographical primary information analysis methods were used in the study. In particular, for processing a significant amount of initial information we used mathematical statistics methods. The number of reservoirs, water table area, volume of water, ownership (property of territorial communities; for rent) were the main characteristics, which were statistically processed.

The geographic-hydrological generalization method was used as one of the main methods for studying the spatial distribution patterns of individual hydrological phenomena and processes. This method was used to analyse the relationship between the distribution of the reservoirs and the degree of regions aridity.

The use of the comparative geographical method consisted in identifying the similarities and differences between the objects under study. We used geographic comparative to display the qualitative and quantitative characteristics of the reservoirs within separate territories. The materials were summarized: 1) by administrative-territorial division – the Autonomous Republic of Crimea (data as of 01.01.2014) and 24 regions; 2) by river basin districts, according to hydrographic zoning of the territory of Ukraine. In general, the research was performed in the following sections: the Dnieper River Cascade of reservoirs; the Dniester Reservoir (on the Dniester River); other reservoirs in different regions of the country.

QGIS software was used to construct schematic maps of the Dnieper River Cascade of reservoirs and the spread of the MSVS-reservoirs across Ukraine.

RESULTS AND DISCUSSION

In Ukraine, a reservoir is an artificial water body with a capacity of more than 1.0 mln m^3, which is built for water supply and runoff regulation [Vodnyi kodeks… 1995]. Until 1950, the total area of reservoirs in Ukraine did not exceed 98 thous. ha, the total volume – 1.4 km^3. Moreover, these were mainly ponds and small reservoirs [Khilchevskyi *et al.* 2020a]. It was possible to regulate no more than 3% of local annual runoff by the reservoirs. During the 1950s and 1980s, there was a significant increase in the number of reservoirs. Their volume exceeded the volume of local river runoff.

Until recently, it was estimated that there were 1160 reservoirs in the country [Palamarchuk, Zakorchevna 2006]. But studies conducted in Ukraine in 2014 [Hrebin *et al.* 2014] and in 2020 allowed to specify this number so, it is 1054 reservoirs. They have a total volume of 55.13 km^3 and a total water table area of 9362 km^2. In Ukraine, the local river runoff is 50.1 $km^3 \cdot y^{-1}$, and together with the transit runoff from Russia, Belarus and Romania – 170.3 $km^3 \cdot y^{-1}$ [FAO undated]. Thus, 32% of the country's total annual runoff is regulated by reservoirs.

Using the Avakyan methodology [Avakyan *et al.* 1987], the classification of 1054 Ukrainian reservoirs by volume of water was performed (Tab. 1). The "very large" ones include the Kremenchuk and Kakhovka reservoirs (on the Dnieper River); to the "large" – Kyiv, Kaniv, Kamianske, Dnieper (on the Dnieper River), Dniester (on the Dniester River). So, seven "very large" and "large" reservoirs account for 0.7%. And the other 1047 reservoirs (99.3%) belong to the middle (M), small (S) and very small (VS) categories. For convenience, we call this group with the abbreviation MSVS-reservoirs. Moreover, in the group of the MSVS-reservoirs the largest share belongs to "very small" reservoirs (89.9%).

Table 1. Classification of reservoirs in Ukraine by volume of water

Category of reservoirs	Volume (km^3)	Number of reservoirs (%)
The largest	>50	0
Very large	10–50	0.2
Large	1.0–10	0.5
Middle	0.1–1.0	1.0
Small	0.01–0.1	8.4
Very small	<0.01	89.9

Source: own study.

If we consider the value of the total volume of reservoirs, it turns out that the six reservoirs of the Dnieper Cascade (43.71 km^3) and the Dniester Reservoir (3.0 km^3) contain 85% of the volume of water of all reservoirs in the country (Fig. 1). The MSVS-reservoirs account for only 15% (8.42 km^3).

The classification of reservoirs by volume is the most general. There are a number of other classifications that take into account the origin of reservoirs, their hydrotechnical, geographical, hydrological, hydrochemical, hydrobiological features and the nature of use. Thus, in Ukraine according to the origin there are 3 types of reservoirs. The river reservoirs – channel and valley, which include 90.8% of the country's reservoirs. The bulk reservoirs – cooling reservoirs of some thermal power station, Chernobyl NPP, which was closed in 2000, eight reservoirs on the route of the North Crimean Canal. The lake-reservoirs – eight Danube lakes. According to the features of the river valley relief, there are plain (98.1% of Ukrainian reservoirs); mountain and

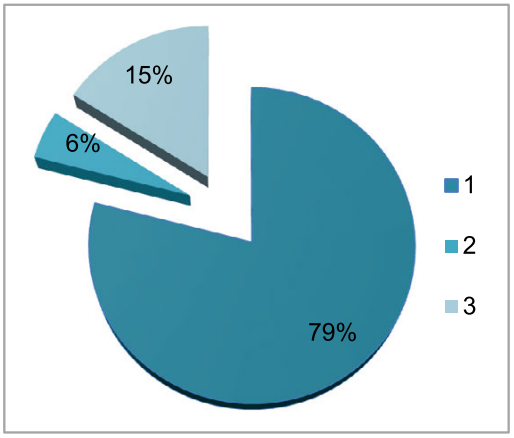

Fig. 1. The share of total volume of water (%) in the Ukrainian reservoirs of the Dnieper Cascade (1), the Dniester Reservoir (2) and the MSVS-reservoirs of (3); source: own study

foothill (mostly small in volume reservoirs of the Carpathian region and the Crimean Mountains). According to the nature of use, there are complex reservoirs (the vast majority of reservoirs) and specialized.

- **The Dnieper River Cascade of reservoirs**

The Dnieper is the fourth longest river in Europe, originates in Russia, flows through Belarus and Ukraine. It flows into the Black Sea (length – 2201 km, catchment area – 504,300 km^2, volume of water runoff – 53.5 km^3 per year). The longest length of the Dnieper is in Ukraine (981 km), where a cascade of six reservoirs has been built, located in three natural zones: mixed forests, forest-steppe and steppe. The main construction of the Dnieper Cascade of reservoirs (from Kyiv to Nova Kakhovka) continued during the 1950s and 1970s (Fig. 2).

The total volume of reservoirs on the Dnieper River is 43.71 km^3 (79% of the volume of all reservoirs in the country), the area of the water table is 6888 km^2 (Tab. 2). The largest volume of

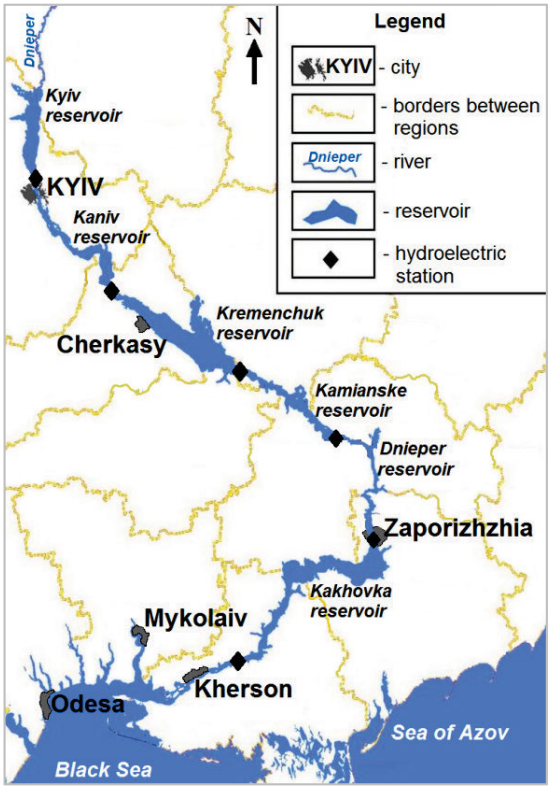

Fig. 2. Map of the Dnieper River Cascade of reservoirs; source: own study

them is contained in the Kakhovka Reservoir (18.18 km^3). Until 2014, its use was limited by the need to maintain high levels during the growing season for self-flowing water supply to the North Crimean Canal. The smallest are Kamianske (2.46 km^3) and Kaniv (2.50 km^3) – included on Figure 3. The main regulator of runoff in the cascade is the Kremenchuk Reservoir, where seasonal and annual runoff regulations are carried out.

Table 2. Characteristics of the Dnieper Cascade of reservoirs

Characteristics	Reservoir					
	Kyiv	Kaniv	Kremenchuk	Kamianske	Dnieper	Kakhovka
Year of reservoir filling	1966	1976	1961	1964	1932	1956
The Dnieper catchment area in HPP cross-section (thous. km^2)	239	336	383	424	463	482
Average volume of runoff in HPP cross-section (km^3)	33.1	43.9	47.8	52.0	52.2	52.2
Total volume of reservoir (km^3)	3.73	2.50	13.52	2.46	3.32	18.18
Useful storage of regulation (km^3)	1.17	0.30	8.97	0.53	0.85	6.78
Water table area (km^2)	922	582	2252	567	410	2155
Average depth (m)	4.0	3.9	6.0	4.3	8.0	8.4
Shallow water area (%)	34	26	18	32	39	5
Average water mineralization (mg·dm^{-3})	285	297	305	282	330	332
Type of runoff regulation	seasonal	daily	annual	weekly, daily	weekly, daily	annual

Source: Denisova *et al.* [1989].

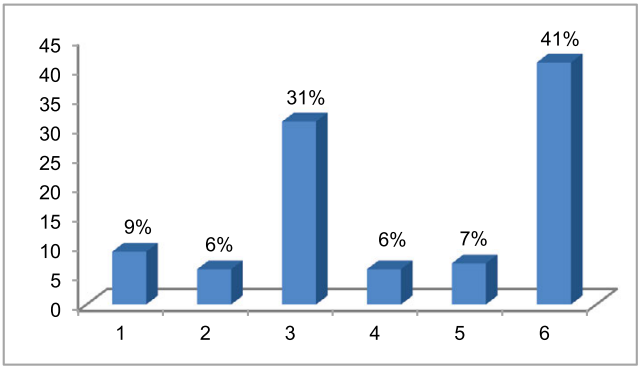

Fig. 3. The share of water volume in the Dnieper Cascade reservoirs from the total volume; the reservoirs; 1 = Kyiv, 2 = Kaniv, 3 = Kremenchuk, 4 = Kamianske, 5 = Dnieper, 6 = Kakhovka; source: own study

Reservoirs are used for hydropower, water supply, irrigation, fisheries, water transport, recreation, flood protection.

The Dnieper Reservoirs have relatively small depths and large areas of shallow water. As a result of the slow water exchange there is a gradual siltation, overgrowing of the water area with higher aquatic vegetation, and mass development of blue-green algae. Water mineralization during the year varies from 120 mg·dm^{-3} (in spring) to 460 mg·dm^{-3} (in winter). Studies of hydrological, hydrochemical and hydrobiological regimes have shown the important role of internal water processes for the existence of these reservoirs [Denisova *et al.* 1989; Dubnyak, Timchenko 2000; Khil'chevskii *et al.* 1999]. Studies of the impact of tributaries on water quality have shown that nitrates and pesticides can enter the reservoirs from agricultural lands [Khil'chevskiy 1994]. Another very important fact that is a certain part of radioactive substances got into the reservoirs of the Dnieper Cascade in 1986, after the Chernobyl disaster.

In the early 2000s, environmental scientists formed two points of view on the Dnieper Cascade problem. Some scientists defend the idea of reservoirs descent and returning the Dnieper Valley to a condition close to natural. They consider that the losses from the current condition of the Dnieper River with a cascade of reservoirs are 10 times larger than profits [Shapar *et al.* 2013]. But most researchers emphasize that the Dnieper Reservoirs help to solve the problem of runoff regulation and water supply. New lake-river ecosystems have stabilized during their development. Therefore, it is necessary to ask the question not about the reservoir's descent, but about the creation of more effective rational use and ecological rehabilitation legislation of the Dnieper Reservoirs [Romanenko 2018].

- **Dniester Reservoir on the Dniester River**

The Dniester is a river in southwestern of Ukraine and in Moldova (length – 1362 km, catchment area – 72 100 km^2). It flows into the Black Sea in Ukraine. The Dniester Reservoir was created on the Dniester River in 1987. The hydroelectric dam is located near the Novodnistrovsk city, Chernivtsi region. Water mineralization of the Dniester River varies from 350 to 420 mg·dm^{-3}.

The total volume of the Dniester Reservoir is 3.0 km^3 (6% of the volume of all reservoirs in the country), the useful storage of regulation is 2.0 km^3, the area of the water table is 142 km^2. It is a complex reservoir which serves for: annual runoff regulation, electricity production, flood protection, water supply and irrigation. The reservoir carries out ecological releases, which are important for water users located below, in Moldova and in Ukraine (Odesa region). Specialists of Ukraine and Moldova deal with the problems of the Dniester [OSCE 2019]. Since the Dubossary Reservoir (volume – 0.49 km^3) is located below the Dniester flow in Moldova, the task is to develop interstate (Ukraine–Moldova) rules for the Dniester Reservoirs operation [Yatsyk, Tomiltseva 2018].

- **Complex reservoirs management**

Complex reservoirs management is based on the regulatory documents: "Rules for the operation of the Dnieper Cascade reservoirs" [Yatayk *et al.* 2003] and "Rules for the operation of the Dniester cascade of HPS and PHES reservoirs" [Pravyla… 2017]. Every month a commission of representatives of various departments and organizations under the State Agency for Water Resources of Ukraine (Ukr. Derzhavne ahentstvo vodnykh resursiv Ukrainy), based on the hydrological forecasts of regional centres for hydrometeorology establishes the operating mode of the reservoirs. This information is provided monthly for mandatory execution to all water users, enterprises and organizations which operate hydraulic structures and water management systems.

- **The MSVS-reservoirs**

The total volume of the 1047 MSVS-reservoirs is 8.42 km^3 (15% of the volume of water from all reservoirs in the country). The area of the water table is 2338.5 km^2 (Tab. 3).

Distribution of the MSVS-reservoirs by administrative regions. The MSVS-reservoirs are distributed unevenly over the territory of Ukraine. The largest number of them is concentrated in the arid central and south-eastern industrial regions of Ukraine (forest-steppe and steppe zones). There is 12% of the total number of the MSVS-reservoirs in the country in Donetsk region (129 reservoirs) and 9% in Dnipropetrovsk region (100 reservoirs). The least amount of the MSVS-reservoirs is in Ivano-Frankivsk region: 0.3% (3 reservoirs) and in Chernivtsi region – 0.4% (4 reservoirs), which are sufficiently supplied with water (Fig. 4).

The first place of terms of the total volume of the MSVS-reservoirs is Odesa region (25% of the volume of the MSVS-reservoirs in the country or 2106.7 mln m^3). This is due to the fact that water management organizations have granted the status of reservoirs to the Danube Lakes (Kytay, Yalpuh, Kuhurlui, Katlabukh, Cahul, Kartal, Safyan) and Lake Sasyk. The hydrological regime of this lakes is regulated by hydraulic structures. Significant volumes of reservoirs are in industrial regions such as Kharkiv – 17% (1447.3 mln m^3), Dnipropetrovsk – 11% (899.5 mln m^3), Donetsk – 10% (859.1 mln m^3).

The smallest volume of the MSVS-reservoirs is in Chernihiv region – 0.5% of the volume of the MSVS-reservoirs in the country (38.9 mln m^3), Volhynia region – 0.5% (39.3 mln m^3), Transcarpathian region – 0.5% (40.6 mln m^3). A number of other regions have less than 1% of the volume of the MSVS-reservoirs in Ukraine such as Ternopil, Rivne, Ivano-Frankivsk, Lviv, Zaporizhzhia.

The total surface area of the MSVS-reservoirs is related to their volumes. In the first place is Odesa region (25% of the area of the MSVS-reservoirs in the country or 58 704 ha) for the reason noted above (granting the reservoirs status to the Danube Lakes). Significant areas of the water surface are occupied by the MSVS-reservoirs in industrial regions: Kharkiv – 10%

Table 3. Availability of the MSVS-reservoirs within the administrative-territorial formations in Ukraine, 2020

AR Crimea, region	Number of reservoirs and their parameters				Rental reservoirs	
	number	area (ha)	total volume (mln m^3)	useful storage (mln m^3)	% of total number	area (ha)
AR of Crimea[1)]	23	4218	398.4	368.1	4	65
Vinnytsia	52	9658	293.0	136.0	8	410
Volhynia	11	2166	39.3	24.8	10	88
Dnipropetrovsk	100	19800	899.5	744.4	34	5182
Donetsk[1)]	129	18100	859.1	615.2	28	3770
Zhytomyr	53	7508	176.8	157.7	21	1134
Transcarpathian	9	1212	40.6	32.7	78	995
Zaporizhzhia	27	2394	73.2	62.5	56	692
Ivano-Frankivsk	3	1631	63.5	15.4	0	0
Kyiv	62	10250	194.0	169.7	34	2573
Kirovograd	62	8949	225.3	177.8	50	3381
Luhan[1)]	73	7403	250.0	192.4	19	1488
Lviv	20	3288	67.6	57.8	0	–
Mykolaiv	39	7042	348.0	212.6	46	1334
Odessa	64	58704	2106.7	934.1	16	1205
Poltava	65	6256	143.6	113.5	43	1996
Rivne	12	2942	47.0	38.2	33	447
Sumy	42	4367	94.5	78.1	14	381
Ternopil	26	3579	79.3	68.8	54	1781
Kharkiv	57	22437	1447.3	1307.0	0	0
Kherson	15	13807	138.3	138.3	7	480
Khmelnytskyi	42	9820	231.5	176.6	45	4470
Cherkasy	39	5827	114.9	84.0	18	2255
Chernivtsi	4	778	47.8	34.9	50	138
Chernihiv	18	1710	38.9	37.5	39	877
In Ukraine	1047	233846	8421.6	5906.0	28	35142

[1)] Data on the 01.01.2014.
Source: own study.

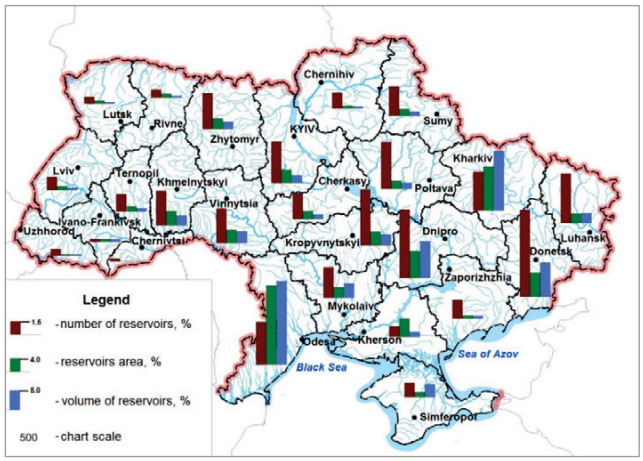

Fig. 4. Map of the availability of the MSVS-reservoirs (number, area and volume) within the administrative regions of Ukraine, % of the total in the country; source: own study

(22,437 ha), Dnipropetrovsk – 8% (1,800 ha), Donetsk – 7.8% (18,100 ha). The smallest is the total water surface area of the MSVS-reservoirs in Chernivtsi region – 0.3% of the area of the MSVS-reservoirs in the country (174 ha), Transcarpathian region – 0.5% (1212 ha), Ivano-Frankivsk region – 0.7% (1631 ha), Chernihiv region – 0.7% (1710 ha), Volhynia region – 0.9% (2166 ha).

Distribution of the MSVS-reservoirs by river basin districts. According to the hydrographic zoning of 2016 there are nine river basin districts (RBDs) in Ukraine: Dnieper RBD; Dniester RBD; Danube RBD; Southern Bug RBD; Don RBD; Vistula RBD; RBD of the Crimea; RBD of the Black Sea coast; RBD of the Sea of Azov coast [Vodnyi kodeks 1995]. Almost all Ukrainian rivers belong to the Black Sea and the Sea of Azov Basins. But Vistula RBD belongs to the Baltic Sea Basin and occupies only 2.5% territory of the country [Khilchevskiy *et al.* 2019].

A significant part of the MSVS-reservoirs is concentrated in the Dnieper River Basin – 45% of the total number of the MSVS-reservoirs in the country (469 reservoirs) – shown in Table 4. The share of the Southern Bug river basin district is 16%, the Don river basin district – 14%. The least of the MSVS-reservoirs is in the Vistula Basin – 1.0% (11 reservoirs), in the river basin of the Crimea – about 2.0% and the Black Sea – about 3.0%.

The share of the total volume of the MSVS-reservoirs in the Dnieper River Basin is 26% of the total number of the MSVS-reservoirs in the country (2163.6 mln m^3). In second place is the Danube river basin district (due to the Danube lakes reservoirs status). The total volume of the MSVS-reservoirs here is about 23% (1975.3 mln m^3). Next are Don river basin district – 23% (1949.1 mln m^3) and Southern Bug river basin district – up to 10%. The lowest is the total volume of the MSVS-reservoirs in the Vistula River Basin – 0.7% (62.4 mln m^3) and the Black Sea Basin – about 2% (168.2 mln m^3).

According to the total water surface area of the MSVS-reservoirs, the ratio between the river basin districts is as follows: the Dnieper River – 31% (72 831 ha); the Danube River – 23% (53 824 ha); the Don River – 14% (33 226 ha); the Southern Bug – 12%. The lowest is the total area of the MSVS-reservoirs in the Vistula basin – 1.4% (3296 ha), in the river basin of the Crimea – 1.8% and the Black Sea Basin – 2.2%.

Rental reservoirs. All water bodies in Ukraine are the water fund of the nation. But, Ukraine has been able to lease water bodies since 1999. Individuals and legal entities can rent lakes, ponds and reservoirs (except for complex reservoirs). The purposes of the lease are fishery, cultural and health, medical, recreational, sports and tourism, research.

As of the 01.01.2020, out of 1047 of the MSVS-reservoirs in Ukraine, 72% were owned and used by territorial communities, and 28% were leased (Tab. 3, 4).

Among the Ukrainian regions, the the highest number of leased MSVS-reservoirs are in Transcarpathian region – 78%. In the Zaporizhzhia region, 56% of the MSVS-reservoirs are leased, in Ternopil region – 54%. There is no lease of the MSVS-reservoirs in Ivano-Frankivsk, Lviv and Kharkiv regions. Low values of the rent were in the Autonomous Republic of Crimea (4%), in Kherson (7%), Vinnytsia (8%) and Volhynia regions (10%). Among the river basin districts, the most in number of the rental MSVS-reservoirs are in Southern Bug river basin district – 35% and in Dnieper river basin district – 32%. The minimum rental number of the MSVS-reservoirs was in the river basin district of the Crimea (4%). There is no lease of the MSVS-reservoirs in the Vistula Basin.

Table 4. Availability of the MSVS-reservoirs within river basin districts in Ukraine, 2020

River basin district (RBD)	Area RBD (km^2)	Number of reservoirs and their parameters				Rental reservoirs	
		number	area (ha)	total volume	useful storage	% of total number	area (ha)
				mln m^3			
Dnieper RBD	296315	469	72831	2163.6	1756.5	32	18370
Dniester RBD	53961	61	11516	335.4	207.3	25	1745
Danube RBD	30625	40	53824	1975	857.9	25	1300
Southern Bug RBD	63700	169	28257	822	483.3	35	7672
Don RBD	55273	148	33226	1949.1	1616	21	3358
Vistula RBD	12892	11	3296	62.4	44.3	0	0
RBD of the Crimea	27218	23	4218	398.4	368.1	4	65
RBD of the Black Sea coast	27179	36	5073	168.2	143.3	22	875.3
RBD of the Sea of Azov coast	36866	90	21604	547.5	429.3	17	1757
In Ukraine	604742[1)]	1047	233846	8421.6	5906	28	35142

[1)] 604 742 km^2 – total area of 9 river basin districts (including coastal waters), 603 628 km^2 – the territory of Ukraine.
Source: own study.

CONCLUSIONS

1. There are 1054 reservoirs in Ukraine. Among them are six large reservoirs of the Dnieper Cascade and the Dniester Reservoir. All other 99.3% (1047 reservoirs) belong to middle, small and very small reservoirs, which are identified as the MSVS-reservoirs in this article.
2. There are two main patterns of territorial distribution of reservoirs. Large reservoirs are located on large rivers (the Dnieper, the Dniester) and are of national importance. The MSVS-reservoirs were created to water supply for industrial regions (e.g., Donetsk, Kharkiv) and have regional or local significance.
3. According to the volume of accumulated water, Ukraine is a country of large reservoirs. In six reservoirs of the Dnieper Cascade is 79% of water, in the Dniester Reservoir – 6%, in the MSVS-reservoirs – 15%.
4. All reservoirs have a total volume of 55.13 km^3. Thus, 32% of the total river runoff of the country, which is 170.3 km^3 per year, is regulated by reservoirs.

5. The volume of the Dnieper Cascade reservoirs is 43.71 km^3, which is 82% of the average long-term runoff of the Dnieper (53.5 km^3 per year).
6. Operation of the Dniester Reservoir (3.0 km^3), which was created on the transboundary River Dniester (Ukraine-Moldova), is carried out taking into account the water management interests of the two countries.
7. The MSVS-reservoirs are unevenly distributed throughout Ukraine. The largest number of them is concentrated in the arid central and south-eastern regions of Ukraine. In the Dnieper River Basin are located 45% of the total number of the MSVS-reservoirs. The Odesa region has the largest total values of the total volume and area of the MSVS-reservoirs due to the Danube lakes.
8. 72% of the MSVS-reservoirs are owned and used by territorial communities in Ukraine, 28% are leased.

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