

Hydrographic monitoring of ponds in Ukraine and their classification by morphometric parameters

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SUMMARY

The purpose of the research was hydrographic monitoring and analysis of territorial patterns of the distribution of ponds in Ukraine, as well as consideration of the territorial patterns of their distribution in the administrative regions and as in the river basin districts as the main hydrographic units of water management. The data were taken from the State Agency for Water Resources of Ukraine. The studies have shown that there were 50 793 ponds in Ukraine in 2019. This figure is 76% more than according to calculations performed in 2006. The classification presented shows that in Ukraine, in terms of the water surface, the vast majority of ponds are small and very small (85%), while medium constitute 12%, and large and very large – 2%. Distribution of the ponds by the volume is the following: small and very small (58%); medium – 29%; large and very large – 13%. The highest number of ponds is in the Vinnytsia region – 10.5% of the total number of ponds in the country. As to the river basin districts, the highest number of ponds is located in the Dnipro River Basin – 48.5% of the total number of ponds in the country. To summarize, Ukraine needs increased attention to comprehensive monitoring of ponds.



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Introduction

Ponds play an important economic and environmental role at the local level. They are used for various purposes, including irrigation, fish and waterfowl farming, recreation, etc. Ponds affect the environment, as well as the microclimate of the surrounding area. In 2009, the European Pond Conservation Network (EPCN) was registered in Geneva, which aims to promote the conservation of ponds and their landscape biodiversity. Studies have found that ponds cover a larger total area on the planet than lakes (Downing, 2006). Ponds constitute a typical landscape element in Ukraine (Khil'chevskiy, 1994). Therefore, interest in their study with the benefit of new methods is growing (Plichko et al., 2020).

Methods of research

The research used original information about the ponds taken from the regional offices of the State Agency of Water Resources of Ukraine for 01.01.2014 and 01.01.2019. The following main characteristics were statistically processed: number of ponds; area of the water table; volume of water; ownership (by territorial communities or rental by public or private entities). The data were summarized: 1) by administrative areas – Crimea (data is given for 01.01.2014) and 24 regions (in temporarily occupied areas of Donetsk and Luhansk regions data is given for 01.01.2014); 2) by 9 river basin districts, which were distinguished during hydrographic zoning of Ukraine in 2016. The aim of the study was hydrographic monitoring and analysis of territorial patterns of pond distribution in the administrative regions of Ukraine, as well as in river basins as the main hydrographic units of water management. According to the Water Code of Ukraine, a pond is an artificially created water body with a volume of not more than 1 million m³.

Results

Until recently, it was believed that the total number of ponds in the country was only 28.8 thousand (Palamarchuk, Zakorchevna, 2006). Later, a new hydrographic monitoring of ponds in Ukraine was carried out. At the first stage of research, carried out in 2014, a new number of ponds were established on the territory of the state – 49444 ponds (Hrebin et al., 2014). This is 72% more than previously mentioned in official sources. In 2019, this figure was clarified - in Ukraine there are 50,793 ponds (2.7% more than according to 2014) – see Table 1.

Table 1 The number of ponds in Ukraine according to the studies of 2006, 2014 and 2019

Year	Number of ponds and their parameters		
	number	area, ha	volume, mln m ³
2006	28800	223260	3344.8
2014	49444	289109	3969.4
2019	50793	292899	3984.5

1. Morphometric characteristics of ponds

Unlike rivers and lakes (Khilchevskiy et al., 2019), little is done in the generalization of the morphometric characteristics of ponds in Ukraine. Using the parameters proposed in the literature (Mishon 2003; Khilchevskiy et al., 2020), we performed the classification of Ukrainian ponds by morphometric parameters. The vast majority of ponds in Ukraine can be classified as “very small” (up to 2 ha) and “small” (from 2 to 10 ha) in terms of water surface area. In certain regions of the country, their total share is from 75.1 to 92.6% of the total number of ponds. The share of “medium” ponds (with an area of 10-25 ha) varies from 6.2 to 16.2% for individual regions. “Large” (with an area of 25-50 ha) and “very large” (more than 50 ha) ponds account for 1.7 to 8.4% of the total number of ponds in individual areas (Table 2).



Table 2 Typology of ponds in Ukraine by water surface

Pond type	Area, ha	Share of ponds,%
Very large	> 50	3
Large	25-50	
Medium	10-25	12
Small	2-10	85
Very small	< 2	

By the volume of accumulated water, the vast majority of ponds in Ukraine are very small (up to 10 thousand m³) and small (from 10 to 50 thousand m³). The total share of these two categories ranges from 41.9-56.1% in the southern regions to 53.1-73.2% in the northern. The share of ponds with average volume (from 50 to 200 thousand m³) in individual regions ranges from 19.1 to 39.2%. The total proportion of large (from 200 to 500 thousand m³) and very large (from 500 thousand m³ to 1.0 million m³) ponds varies from 7.3-11.6% in the northern regions to 12.2-20.2% in the southern regions (Table 3).

Table 3 Typology of ponds in Ukraine by volume of water

Pond type	Volume, thousand m ³	Share of ponds,%
Very large	> 500	13
Large	200-500	
Medium	50-200	29
Small	10-50	58
Very small	< 10	

2. The distribution of ponds by administrative region

The quantitative distribution of ponds throughout Ukraine is uneven (Figure 1). Most of them are concentrated in administrative regions located within central and western Ukraine (forest-steppe zone): Vinnytsia region – 10.5% of the total number of ponds in the country (5341 ponds), Dnipropetrovsk region – 6.5% (3292 ponds), Kyiv region – 6.3% (3215 ponds) and the Lviv region – 6.3% (3192 ponds). The smallest number of ponds from the total amount in the country is located within Luhansk region – 0.7% (362 ponds), Transcarpathian region has 1.3% (645 ponds), Ternopil region has 1.7% (886 ponds) and Odessa region has 2.0% (992 ponds). In terms of the total volume of ponds, Ukraine's leading positions are occupied by Poltava region – 7.0% (279 mln m³), Dnipropetrovsk region – 6.9% (274.8 mln m³) and Donetsk region – 6.5% (258.1 mln m³). Vinnytsia region is only in the fourth place by this indicator – 6.2% (248 mln m³). The lowest total value of the total volume of ponds is in Transcarpathia region – 0.6% (22.6 mln m³, Chernivtsi region – 1.0% (39.5 mln m³) and Ivano-Frankivsk region – 1.1% (44.7 mln m³).

3. The distribution of ponds by river basin districts

The river basin district is the main hydrographic unit for integrated water resources management. In 2016, the Verkhovna Rada of Ukraine approved hydrographic zoning with 9 river basin districts (RBDs): Dnipro (49% of the area of all RBDs); Southern Bug (11%); Don (9%); Dniester (9%); Rivers of the Azov Sea coast (6%); Danube (5%); Rivers of the Crimea (4.5%); Rivers of the Black Sea coast (4.5%); Vistula (2%).

Almost half of Ukraine's ponds are concentrated in the Dnieper river basin – 48.5% (24634) (Figure 2). The part of the Southern Bug River Basin has 19.6% (9954 ponds), the Dniester River Basin has 11.6% (5899 ponds). The least number of ponds is in the Black Sea Basin – 1.2% (656 ponds), in the Azov River Basin there are 2.8% (1417 ponds) and in the Vistula river basin there are 2.9% (1459).



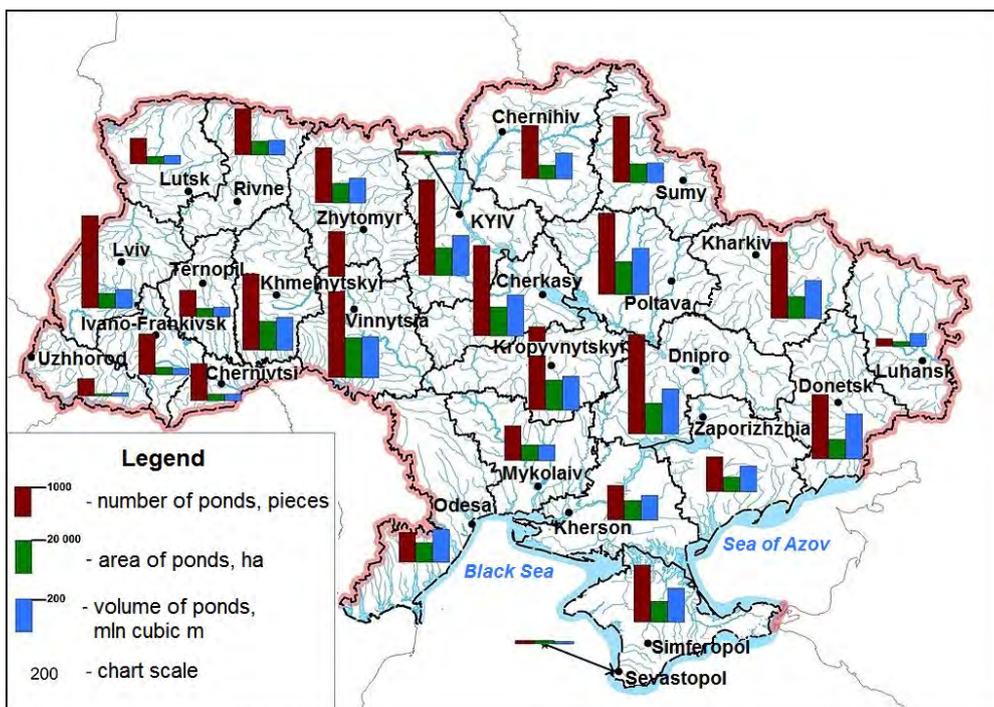


Figure 1 Map of the distribution of ponds (quantity – number of ponds, area - ha; volumes - mln. m³) by the administrative regions of Ukraine

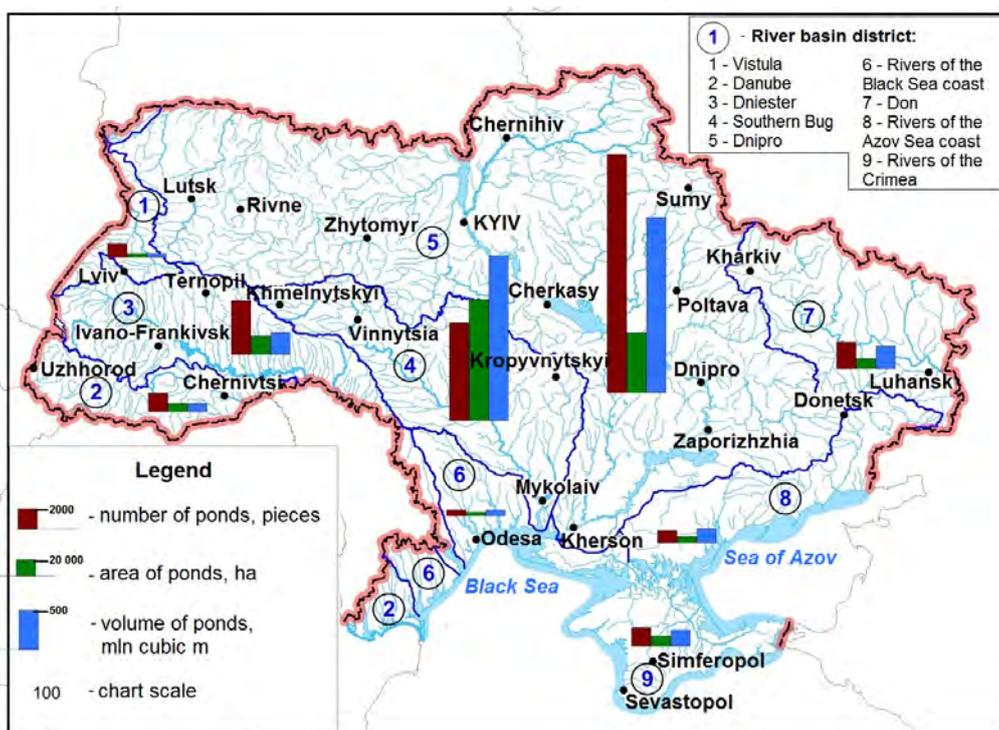


Figure 2 Map of the distribution of ponds (quantity – number of ponds, area - ha; volumes - mln. m³) within the river basin districts of Ukraine. River basin districts: 1 – Vistula; 2 – Danube; 3 – Dniester; 4 – Southern Bug; 5 – Dnipro; 6 – Rivers of the Black Sea coast; 7 – Don; 8 - Rivers of the Azov Sea coast; 9 - Rivers of the Crimea



Half of the total volume of ponds in Ukraine is concentrated in the Dnipro River Basin District – 50.0% (1998.2 mln m³). The share of the Southern Bug River Basin District is 17.3% (691.2 mln m³). The Don and Dniester basin districts have almost the same ponds volume – 7.8% (312.4 mln m³) and 7.3% (290.7 mln m³) respectively. The lowest total volumes of ponds are observed in the Vistula (1.3%, 49.9 mln m³), the Danube (2.8%, 110.1 mln m³) and in the Black Sea (2.9%, 115.2 mln m³) river basin districts.

4. Ponds rental

Ponds can be leased for fishery, cultural, recreational, therapeutic, sports and tourist purposes, and for research activities. On 01.01.2019, 72% (36614) of ponds in Ukraine were controlled by local authorities, and 14179 ponds (28%) were leased. At the same time, the share of leased ponds in 2019 decreased by 8% compared to 2014.

Conclusions

- 1) Researches have shown as of 01.01.2019, in Ukraine there are 50 793 ponds, which is 2.7% more than as of 01.01. 2014 (49 444 ponds).
- 2) The classification performed in the publication shows that in Ukraine the vast majority of ponds are by area: small and very small (85%); mediums - 12%; larges and very larges - 2%. Ponds by volume: small and very small (58%); mediums - 29%; larges and very larges - 13%.
- 3) The highest number of ponds is in the Vinnitsia region - 10.5% of the total number of ponds in the country. The least number of ponds is in the Luhansk region (0.7%).
- 4) As to the river basin districts, the highest number of ponds is located in the Dnipro River Basin - 48.5% of the total number of ponds in the country. The least number is in the region of the Black Sea River Basin (1.2%).

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