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Bathing waters in Poland, 2010–2024 review, including monitoring, water quality characteristics, and risks

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Abstract: This paper provides an overview of the status of bathing waters in Poland in the context of the requirements of Bathing Water Directive (BWD) (Directive 2006/7/EC) on managing water quality for bathing. The source material comes from the reports of the Chief Sanitary Inspectorate. The paper contains characteristics of the state and threats of bathing areas in Poland concerning water quality and their organisation in the period 2010–2024 against the background of the hydro-meteorological situation. BWD-compliant bathing areas have been organised in Poland since 2011, and their number has only positively changed since 2018, following the restriction of the duration of sites occasionally used for bathing to 30 days per calendar year. Bathing areas located at lakes dominate in Poland. The assessment of bathing water quality for 2010–2024 showed that 70% of bathing waters are suitable throughout the bathing season (from June to September). The main reason for temporary bathing bans is blue-green algae blooms, mainly in lakes. There is a tendency for an increase in the proportion of bathing areas with temporary bathing prohibitions, accompanied by an increase in average air temperature in Poland during the summer season (from June to August). The proportion of bathing bans due to *Enterococcus* spp. and *Escherichia coli* exceedances in bathing waters is increasing. The apparent increase in the proportion of bathing areas with temporary bathing prohibitions in Poland does not affect the decrease in the number of sites with excellent water quality, which is stable at around 70% with a slight upward trend.

Keywords: Bathing Water Directive (BWD) (2006/7/EC), classification of bathing areas, climate change, cyanobacterial blooms, microbiological indicators, sites occasionally used for bathing

INTRODUCTION

The most important aspect of bathing facilities is the safety and health of people using the baths. In Poland, the issue of 'people's bathing' has a long tradition and was included in the Ustawa (1919), under the competence of the Ministry of Public Health (Pol.: Ministerstwo Zdrowia Publicznego) concerning the prevention and control of infectious diseases. The implementing acts of the Ustawa (1919) in effect at the time specified requirements for water quality, location and infrastructure for bathing areas organised in open waters (sea, lakes, ponds and rivers). Bathing areas on natural reservoirs functioned as 'bathing establishments', and their commissioning for public use required a permit from the relevant administrative authorities, issued based on a sanitary opinion (Rozporządzenie, 1922; Rozporządzenie, 1936). One hundred years later, in Poland in 2009, there were 1285 bathing areas in the records of the Chief Sanitary Inspectorate (Pol.: Główny Inspektorat Sanitarny), including 1163 inland and 122 sea bathing areas (GIS, 2009–2024).

In 2009, sanitary supervision covered 97.6% of the registered facilities, of which organised bathing areas accounted for about 1/4 of the inspected facilities (GIS, 2009–2024). However, in 2010, legal regulations resulting from the implementation of Directive 2006/7/EC (Directive, 2006) – the so-called Bathing Water Directive, or BWD for short – were amended in Polish legislation as a result of the promulgation on 1 January 2011 of the Ustawa (2010) – the so-colled Water Law. The Directive introducted several changes, including changing the concept of a bathing area, defining the responsibilities of the bathing area organiser, as well as the responsibilities of public administration bodies and the Chief Sanitary Inspectorate (Kaznowska and Wasilewicz, 2019).

In the subsequent years after 2010, the provisions in the water law regarding bathing areas underwent several changes, and their current wording is contained in the amendment to the Water Law (Ustawa, 2017). Since 2011, monitoring the condition of bathing waters in Poland has been subject to the BWD requirements. The main objective of the BWD is to protect the health and well-being of bathers in European Union (EU) waters and to protect the environment. The BWD Directive applies to natural bath waters located in coastal, transitional and inland surface waters. In March 2025, the European Commission's activities completed the first assessment of the BWD, which showed its important role in improving bathing water quality across the EU and protecting public health (EC, 2025).

This paper aims to review the status and risks of bathing areas in Poland regarding water quality and their organisation in 2010–2024 against the background of the hydro-meteorological situation. The work is a continuation of Kaznowska and Wasilewicz (2019) research devoted to an extensive analysis of changes in the organisation and supervision of bathing areas in Poland and their consequences as a result of the implementation of the 2006 BWD directive into Polish legislation.

STUDY MATERIALS AND METHODS

The source material in the study includes the annually reports of the Chief Sanitary Inspectorate (Pol.: Główny Inspektorat Sanitarny – GIS) on the sanitary status of Poland (GIS, 2009–2024), bathing water data published by the Bathing Service (GIS, 2011–2025) and the annual reports of the European Environment Agency (EEA) and the European Commission (EC) on the results of the EU bathing water quality classification.

The study analyses bathing areas, defined as: a separate and marked part of surface waters, designated by a resolution of the municipal council, used by a large number of bathers, as specified in the resolution of the municipal council on the list of bathing areas, provided that a permanent bathing ban has not been issued for this bathing area (Photo 1) (following Article 9 (1)(5a) of the Ustawa (2010) and in the exact wording from Art. 16 – of the Ustawa (2017)).

The bathing season in Poland officially runs from 1 June to 30 September (Art. 37 (1) of the Ustawa (2017)). However, between 2011 and 2017, the announced bathing season was shorter, covering the period between 15 June and 30 September (Art. 34a (1) of the Ustawa (2010)).

During the period 2010–2024, the directions of changes in the number of bathing areas were tracked due to changes in their organisation in the Polish legal order, based on the legal acts published by the Parliament of the Republic of Poland in the Internet System of Legal Acts (Pol.: Internetowy System Aktów Prawnych). These changes resulted from adopting guidelines for organising bathing areas and the parallel introduction into Polish law of the possibility of organising sites used for bathing from 1 January 2011 (Ustawa, 2010). This solution was intended to ensure bathing safety in emergencies, e.g., emergency organisation of competitions, scouting or other camps, or at seasonal resort sites or agritourism farms. A site used for bathing meant a separate and marked part of surface water that is not a bathing area and used for bathing (Art. 9 (1)(5c) Ustawa (2010)). These sites were not subject to the time-consuming and costly procedure in contrast to the creation of bathing areas. Consequently, their organisation significantly impacted the number of bathing areas in Poland (Kaznowska and Wasilewicz, 2019). Since 1 January 2018, following the enactment of the Ustawa (2017), in addition to bathing areas, only sites occasionally used for bathing can function (Photo 2), which, unlike the previous sites used for bathing, can function for no more than 30 days in a calendar year (Art. 39 (1) Ustawa (2017)).

For the analysis of bathing water quality, the results of current bathing water suitability assessments and temporary bathing bans, based on two microbiological indicators (numbers of *Enterococcus* spp. and *Escherichia coli* in 100 cm^3 of water) and visual assessment (cyanobacterial blooms, the proliferation of macroalgae and phytoplankton, and the presence of physical contaminants in the water, were used in each year of the study period (Rozporządzenie, 2019). The study analyses the results of four-year bathing water quality assessments (classifications) in 2014–2024. For the analysis of bathing water classifications in Poland, the study period starts from 2014, which includes the first four bathing seasons (2011–2014), since the introduction of the requirements of the Directive (2006).

The paper presents the variation in the percentage of bathing areas with a temporary bathing ban in the bathing seasons of the studied period 2010–2024 against the background

Photo 1. The Stegna bathing area: a) 21 July 2020, b) 14 July 2020 (phot.: *M. Kaznowska*)

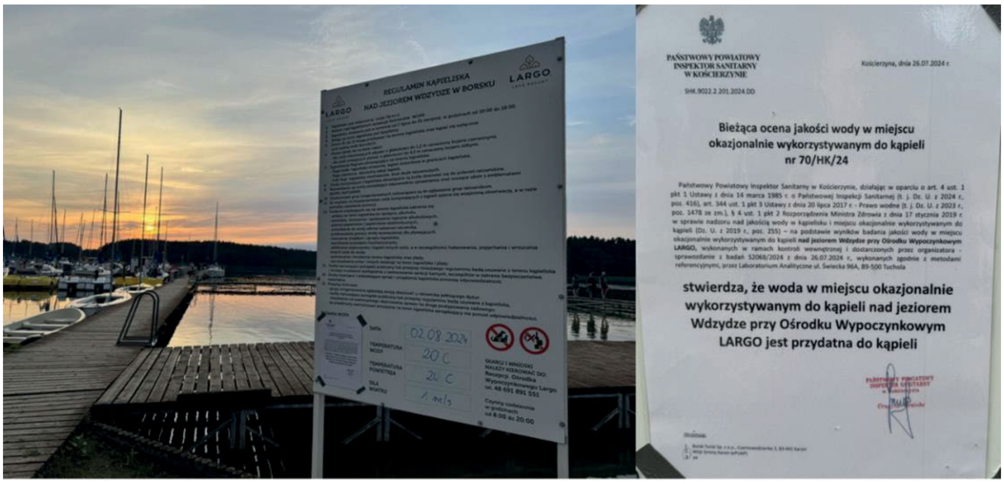

Photo 2. Site occasionally used for bathing at Lake Wdzydze, 2 August 2024 (phot.: *E. Kaznowska*). The regulations for the Wdzydze bathing area are displayed on the board in the middle of the photo. To the right, there is a document from the State Sanitary Inspectorate regarding the current assessment of water quality at site occasionally used for bathing No. 70/HK/24. It states that the water at the site occasionally used for bathing on Lake Wdzydze, near the LARGO holiday resort, is suitable for bathing

of the average monthly air temperatures (June, July, August) and the average air temperature of the summer period in Poland. Also presented is the variation of the average annual air temperature in the calendar years of the 2010–2014 period and the volume of annual river runoff in Poland in hydrological years.

From 2010 to 2014, the following trends were identified against the backdrop of the average summer air temperature in Poland: the percentage share of bathing areas with temporary bans; the number of assessments with temporary bans due to microbiological contamination. Meteorological data are from the IMGW-PIB (2010–2024), while hydrological data are from the IMGW-PIB (2024). A linear relationship was examined between the percentage of bathing sites with a temporary bathing ban and the average summer temperature, based on data organised according to the BWD for the period 2011–2024. The coefficient of determination R^2 was also calculated.

We also evaluated the reasons for temporary bathing bans issued for bathing areas and sites used for bathing/or occasionally used for bathing during the bathing season (GIS, 2015).

The results of Poland's bathing water quality classification were compared with those of other Community countries, as well as conclusions were draw from the first assessment of the Bathing Water Directive (EC, 2025).

RESULTS AND DISCUSSION

THE NUMBER OF BATHING SITES

Poland is one of the EU countries with the most bathing areas. In 2023, over 3% of all EU bathing areas were located in Poland, compared to half of EU countries where the proportion is less than 1%. Only a few countries, such as Italy, France, Germany and Greece, collectively account for 70% of all EU bathing areas (EEA, 2024). In 2010, before implementing the Bathing Water Directive (BWD) (Directive, 2006), the Chief Sanitary Inspectorate recorded 1229 bathing areas, 97.5% (1198) under sanitary supervision (GIS, 2009–2024). The bathing areas at the time, according to Kaznowska and Wasilewicz (2019), should have been subject to water quality monitoring due to the significant number of bathers there. Monitoring obligation was due to the previously applicable definition (Art. 9 (1)(21) of the Ustawa (2001) Act repealed), according to which bathing waters are understood to be flowing or standing waters, or parts thereof, and sea waters in which bathing is expressly permitted or not prohibited and which are traditionally used for bathing. Of the 1198 bathing areas inspected in 2010, 369 were organised bathing areas and 829 were unorganised areas that had traditionally been used by the public for bathing (GIS, 2009–2024).

In 2011, the total number of organised and traditionally used bathing areas in Poland decreased from over 1000 to 220, as defined by the BDW (Directive, 2006) (see Tab. 1 and Fig. 1). This more than fivefold decrease was due to changes in the definition, organisation, classification and water quality monitoring, as detailed in Kaznowska and Wasilewicz's (2019) paper. These changes came into force on 1 January 2011, having been introduced by the amending the Water Law Act (Ustawa, 2010), which was an amendment to the Water Law Act (Ustawa, 2001) (Ustawa, 2005), as amended). As expected by the legislator, the number of bathing areas organised under the rules introduced on 1 January 2011 was expected to increase over time. Their low number in the first bathing season after their introduction was explained by the fact that not all organisers had managed to adapt the bathing waters to the new requirements (GIS, 2009–2024). However, the number of bathing areas in Poland decreased in the following years, reaching 205 in 2017 (see Tab. 1 and Figs. 1 and 2).

In 2017, there were 838 sites used for bathing in Poland (Tab. 1), four times more than bathing areas. The significant range of obligations imposed on organisers of bathing areas and the requirements and financial obligations resulting from the implementation of the BWD (Directive, 2006) led to a significant decrease in the number of bathing areas in Poland in favour of cheaper sites used for bathing (Skotak *et al.*, 2012; NIK, 2014; Kaznowska and Wasilewicz, 2019). This form of recreation was found to be misused as it was intended for exceptional situations but was used to circumvent legal regulations determining requirements for bathing areas (Król, 2019). Due to the high number of sites used for bathing in Poland, the National Sanitary

Table 1. Number of bathing water and sites used for bathing/sites occasionally used for bathing between 2010 and 2024 in Poland

The applicable legal act														
I[1)]	II[2)]							III[3)]						
Years														
2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024[4)]
Number of bathing areas														
1229	220	221	204	201	197	201	205	483	606	602	657	671	683	703
Number of sites used for bathing								Number of sites occasionally used for bathing						
	no data	845	845	897	886	861	838	376	331	189	280	257	239	214

[1)] Rozporządzenie (2002).
[2)] Ustawa (2010), Obwieszczenie (2005), Obwieszczenie (2018).
[3)] Ustawa (2017), Rozporządzenie (2019).
[4)] Raw data from GIS (2011–2025) and GIS (2025).
Source: own study acc. GIS (2009–2024), GIS (2025), Kaznowska and Wasilewicz (2019).

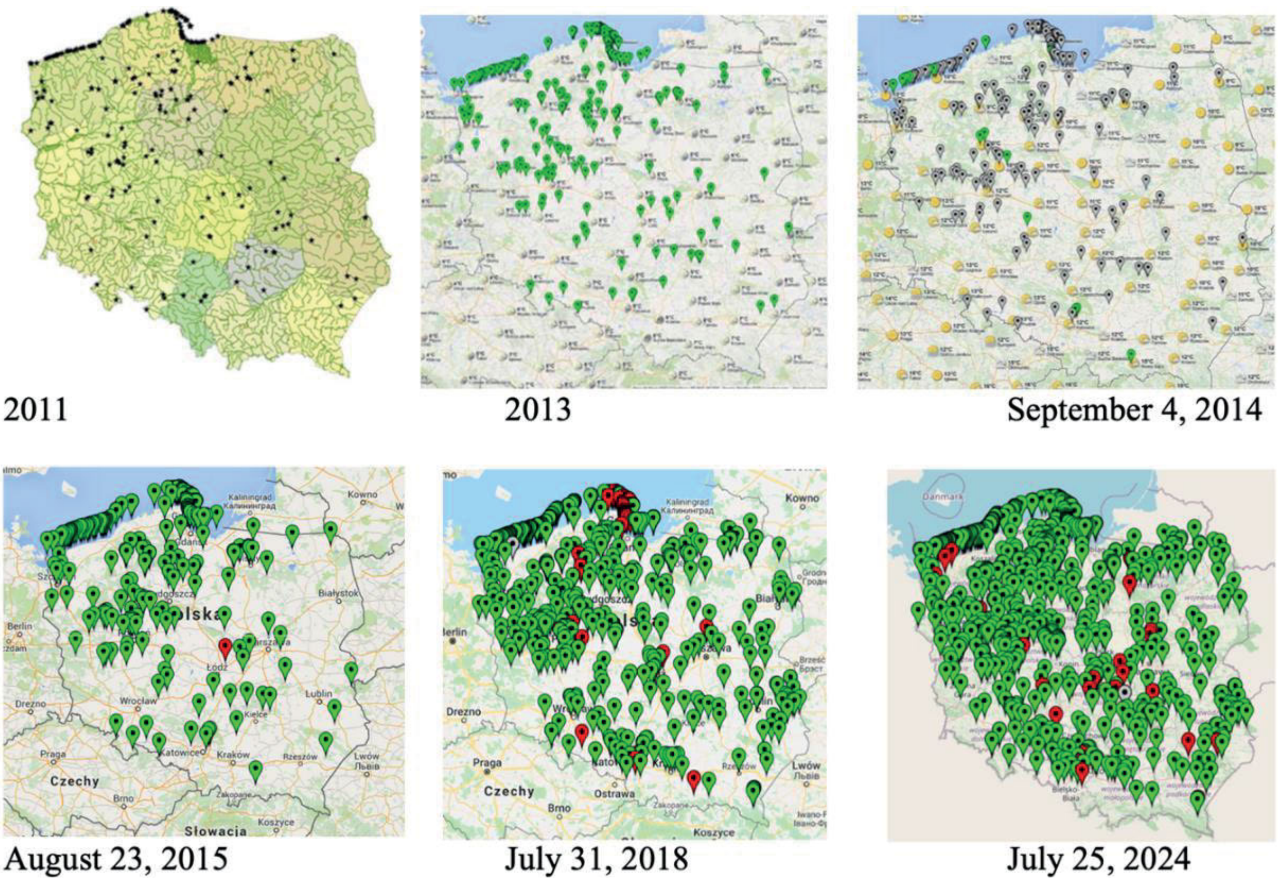

Fig. 1. The bathing waters map for 2011, 2013, 2014, 2015, 2018 and 2024; source: for years 2011 and 2013 GIS (2009–2024), for years 2014, 2015, 2018 and 2024 GIS (2025)

Inspectorate proposed designating some places for occasional bathing only, called sites occasionally used for bathing. According to the Water Law (Ustawa, 2017), sites designated for occasional bathing may operate for no more than 30 days per calendar year, except for designated bathing areas.

The changes introduced were intended to increase the number of designated bathing areas and decrease the number of sites occasionally used for bathing. The bathing season in Poland lasts from 1 June to 30 September; limiting sites occasionally used for bathing to 30 days would disadvantage their organisers and users (Kaznowska and Wasilewicz, 2019). The first positive changes in the number of bathing areas in Poland were recorded in the 2018 bathing season when 483 areas were organised – more than twice the previous year's number (Tab. 1, Fig. 1). During the remainder of the study period (2010–2024), the number of bathing areas increased steadily, reaching 703 in 2024 (Tab. 1, Fig. 1). An exception was in 2020 (Photo 1), when 602 bathing areas were organised during the Covid-19 pandemic – two fewer than in 2019 (Tab. 1). Analysing the number of sites used occasionally for bathing introduced in the Ustawa (2017) instead of bathing areas, a systematic decrease is visible (Tab. 1). During the 2018 bathing season, 376 sites that were occasionally used for bathing were organised, double less than the number in 2017. Between 2018 and 2024, the number of sites occasionally used for bathing decreased from 376 to 214. The change in operation of up to 30 days per calendar year at sites occasionally used for bathing reversed the ratio of bathing areas to this type of facility, changing it from 1:4 in 2017 to 3:1 in 2024 (see Tab. 1).

TYPES OF BATHING SITES

In Poland in 2010, only 10% of bathing areas were located in coastal and transitional waters ('marine bathing waters'), with the remaining 90% situated in inland surface waters ('inland bathing waters') (see Fig. 2). As observed in Kaznowska and Wasilewicz (2019), the ratio of inland to marine bathing waters changed markedly in the first year of the BWD (Directive, 2006), with 60% of all bathing waters being inland and 40% marine (Fig. 1 and 2). In subsequent years, the number of bathing areas in inland waters decreased until 2017 due to the ease and cost-effectiveness of organising sites used for bathing. The only increase was a 10% rise in coastal bathing areas in 2017 compared to 2011. A significant positive change occurred from 2018 onwards due to restrictions on the length of the bathing season for sites occasionally used for bathing (30 days per calendar year). Between 2018 and 2024, marine and inland bathing areas increased steadily, except in 2020, during the COVID-19 pandemic (see Fig. 1 and 2).

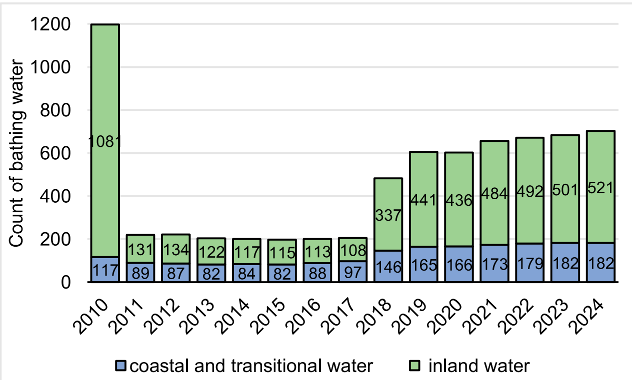

Fig. 2. Number of bathing areas (inland, coastal and transitional waters) supervised by the Chief Sanitary Inspectorate in Poland between 2010 and 2024; own study based on GIS (2009–2024) and GIS (2011–2025)

In 2024, the ratio of marine to inland bathing areas was almost 1:3. Of all bathing areas, 74% were located on inland surface waters, primarily lakes (GIS, 2025). The previous year, in 2023, 60% of all bathing areas were located on lakes, 27% on rivers, and 13% on coastal and transitional waters (GIS, 2009–2024). Comparing the 2023 bathing season with 2018, it is evident that the proportion of marine bathing areas has decreased in favour of inland waters. In 2018, 58% of bathing areas were located on lakes, 12% on rivers, and 30% on coastal and transitional waters (GIS, 2009–2024).

Sites occasionally used for bathing are also overwhelmingly organised on lakes. In 2024, 67% of these sites were located on lakes, 6% on the Baltic Sea, 8% on rivers, and the remainder on lagoons, artificial reservoirs, pits, and ponds (GIS, 2025).

ASSESSMENT OF BATHING WATER QUALITY

We checked the results of bathing water quality assessments in Poland, which are published annually by the Chief Sanitary Inspectorate (GIS). In 2010, decisions on the suitability of bathing water were based on bacteriological indicators such as the number of *Escherichia coli* of the faecal type, the number of faecal streptococci, and the presence of *Salmonella* spp., and enteroviruses if the water deteriorated), as well as physicochemical indices (reaction, colour, odour, mineral oils, surfactants, phenols, transparency and sediment, and total nitrogen, ammoniacal nitrogen, nitrate nitrogen and phosphates if there was a tendency to eutrophication of the water), according to the repealed Regulation of the Minister of Health (Rozporządzenie, 2002). For the 2011–2024 period, however, these were current bathing water assessments or temporary bathing prohibition assessments. These were issued based on the results of two microbiological indicators: the number of *Enterococcus* spp. and *Escherichia coli* in 100 cm^3 of water, as well as a visual assessment of cyanobacterial blooms, macroalgae, phytoplankton proliferation, and physical contaminants in the water. These assessments were made by the Minister of Health's (Rozporządzenie, 2011) and subsequent amendments (Rozporządzenie, 2019).

Over the period 2010–2024, an increase in the proportion of bathing areas with a temporary bathing prohibition is evident (Fig. 3 and 4). However, less than 30% of all organised bathing waters are affected by temporarily impaired water quality. At the remaining 70% of bathing areas, the water is suitable for bathing throughout the bathing season (Fig. 4). The observed increase in the number of bathing areas with temporary bans is accompanied by an increase in mean air temperature in Poland during the summer (June to August), particularly in June (Fig. 4). There has also been an increase in mean annual air temperature (Fig. 5) and decrease in total runoff in Polish rivers (Fig. 5). The coefficient of determination (R^2) for the relationship between the percentage of bathing waters with temporary prohibitions and the mean air temperature during the summers of 2011–2024 was 0.66 (r = 0.81) (Fig. 6), indicating that warmer summers favour the deterioration of bathing water quality. It is also significant that the number of inland bathing areas has increased several fold since 2018 (see Fig. 2), mainly at lakes susceptible to temporary water quality deterioration due to cyanobacterial blooms (Kaznowska and Wasilewicz, 2019; Sołtan, 2025). Also, half of the years of the 2011–2024 period were dry in terms of water abundance (Fig. 5), characterised by one of the lowest river outflows in Poland in the last 74 years (1951–2024). Arid years were 2015, 2019, 2016, 2020, and 2022, among Poland's top ten driest years in total river runoff, from 1951 to 2024 (IMGW-PIB, 2024).

The temporary prohibitions on bathing at organised sites recorded between 2010 and 2024 were due to cyanobacterial blooms occurring in all analysed years, microbiological indicator exceedances occurring in all years except 2013, and the presence of tarry substances and/or solid pollutants endangering bathers' safety in all years except 2010–2015 (GIS, 2010–2024; Sołtan 2025). In 2010, 2018, and 2024, the number of bathing areas with temporary bans was the highest (see Figs. 3 and 4). In 2010, Poland experienced flooding in the second half of May (Kaznowska and Wasilewicz, 2019). In 2010, temporary bathing bans were primarily caused by exceedances of microbiological

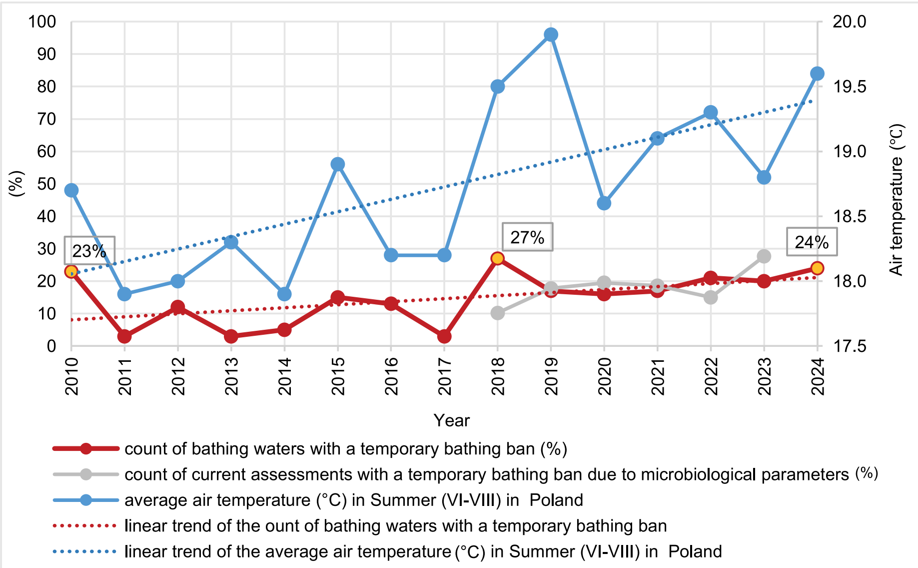

Fig. 3. Change in the percentage of bathing areas with temporary prohibitions on bathing and microbiological contamination assessments from 2010 to 2024 with the mean summer air temperature in Poland; source: own study

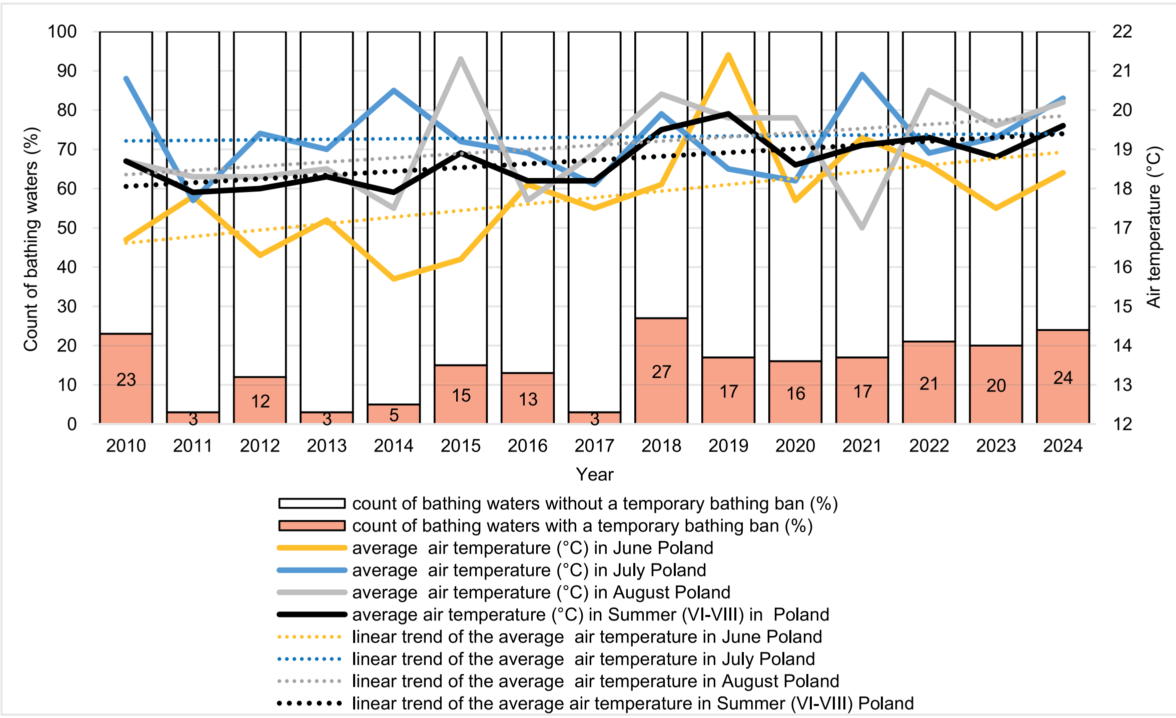

Fig. 4. Percentage ratio of the number of bathing waters with a temporary bathing ban between 2010 and 2024, against the backdrop of the average summer air temperature; source: own study based on GIS (2009–2024), IMGW-PIB (2010–2024) and Sołtan (2025)

and physicochemical indicators rather than cyanobacterial blooms (GIS, 2009–2024). During floods, waters that come into contact with soils from the catchment area, domestic sewage or municipal waste could be a source of pathogenic microorganisms (Prądecka *et al.*, 2019). According to the Chief Sanitary Inspectorate's report on the country's sanitary situation in 2010 (GIS, 2009–2024), inadequate water quality in many bathing waters was mainly due to unregulated sewage management. Pollutants flowed into the bodies of water where the bathing waters were located, making it impossible to improve water quality permanently through uncoordinated, local corrective measures. The recorded temporary bathing prohibitions for bathing areas organised in the period 2010–2024 were due to the occurrence of cyanobacterial blooms in all years analysed; exceedances of microbiological indicators (in all years except 2013); the occurrence of tarry substances and/or solid pollutants endangering bathers' safety (in all years except 2010–2015) (GIS 2009–2024; Sołtan, 2025). Years 2010, 2018 and 2024 were characterised by the highest number of bathing areas with temporary bans (Fig. 3, Fig. 4). In the year 2010 Poland experienced flooding in the second half of May (Kaznowska and Wasilewicz, 2019). In 2010, temporary bathing bans were

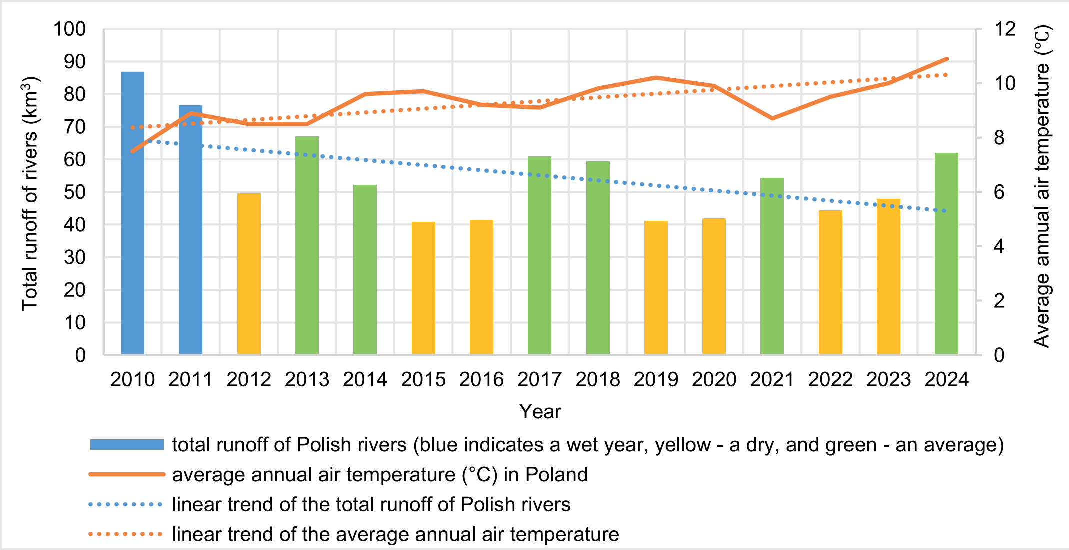

Fig. 5. The total runoff of Polish rivers in hydrological years and the average annual air temperature in calendar years in Poland from 2010 to 2024; source: own study acc. to IMGW-PIB (2024) and IMGW-PIB (2010–2024)

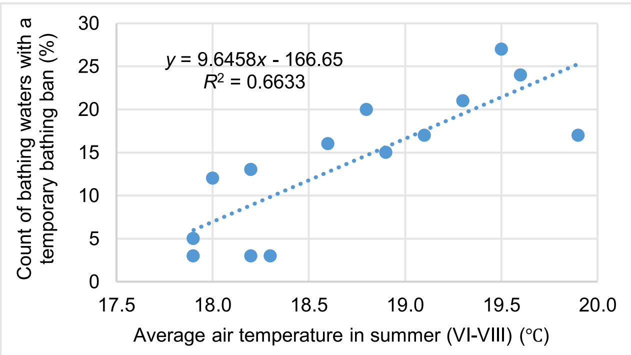

Fig. 6. Correlation between the percentage of bathing waters with a temporary bathing ban and the average air temperature in summer (June–August) in Poland from 2011 to 2024; source: own study based on GIS (2009–2024), the IMGW-PIB (2010–2024) and Sołtan (2025)

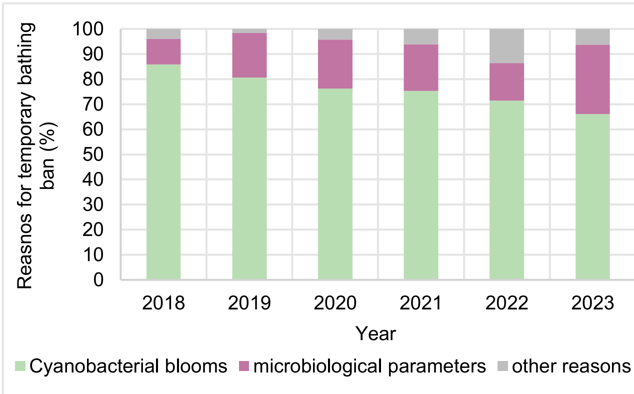

Fig. 7. Reasons for the temporary ban on bathing in bathing waters, based on current water quality assessments issued by the National Sanitary Inspectorate during Poland's 2018–2023 bathing season; source: own study acc. to GIS (2009–2024)

caused primarily by exceedances of microbiological and physico-chemical indicators more often than by cyanobacterial blooms (GIS, 2009–2024). It should be noted that during floods, waters that come into contact with soils from the catchment area, with domestic sewage or municipal waste, could be a source of pathogenic microorganisms (Prądecka *et al.*, 2019). According to the report of the Chief Sanitary Inspectorate (GIS, 2009–2024) on the state of the country's sanitary situation in 2010, the inadequate water quality found in quite a large group of bathing waters was mainly due to unregulated sewage management, with pollutants flowing into the bodies of water in which the bathing waters were located, which made it impossible to permanently improve water quality through uncoordinated and only locally undertaken corrective measures.

By contrast, summers in Poland in 2018 and 2024 were characterised by record warmth, with both July and August seeing exceptionally high mean monthly air temperatures (Fig. 4). As reported Kaznowska and Wasilewicz (2019), the 2018 bathing season saw a significant number of current assessments issued for temporary bathing bans due to excessive cyanobacteria blooms (86%) (Fig. 7). The bans had a particularly severe impact on tourists holidaying on the Baltic Sea, especially in the Gulf of Gdansk.

The percentage of the number of bathing areas where excessive cyanobacterial blooms were found by water category was 61% sea bathing areas, 32% lake bathing areas, and 7% river bathing areas (GIS, 2009–2024). 2024 was also a record year for temporary bathing bans, which were issued for 24% (171) of the bathing areas (703) organised that year (Fig. 3). Cyanobacteria blooms were the reason for 70% (119) of the closures. Blue-green algae blooms were most common in lakes (50%), followed by coastal and transitional waters (31%) and rivers (19%) (Sołtan, 2025). This may be due to the predominance of lakeside organised bathing areas over marine bathing areas observed in 2024 (GIS, 2025), in contrast to 2018, when this difference was less significant. According to research presented by Sołtan (2025) for the 2024 bathing season, cyanobacteria blooms have occurred several times due to excessive eutrophication and other factors. At 13% of sites where cyanobacterial blooms were observed, the phenomenon occurred more than three times during the bathing season, while at more than 50% of sites, it occurred once (Sołtan, 2025). Pac's (2012) research into the conditions under which cyanobacteria appear and reproduce indicates that an increase in nutrient content in the reservoir and a more extended period of warm, sunny weather affect the appearance of cyanobacterial blooms. According to a study by Bańkowska and Wasilewicz (2008), the process of eutrophication in water bodies can be exacerbated by water deficit, which accelerates the mass development of cyanobacteria and necessitates the closure of bathing areas and bathing bans.

The leading cause of current bathing water quality assessments with temporary bathing bans is cyanobacteria blooms. Based on the available data for the period 2018–2023, it can be concluded that, on average, 76% of current assessments with temporary bathing bans are due to cyanobacterial blooms (Fig. 7). However, it is evident that in the period 2018–2023, the proportion of cyanobacterial blooms as a reason for bathing water unsuitability is decreasing year by year in favour of other causes. In 2018, 86% of bathing water unsuitability assessments were due to cyanobacterial blooms, and in 2023 – 66%, i.e. 20% less (Fig. 7). It is also already known that in 2024 the number of assessments of unsuitability for bathing due to cyanobacteria was 63% (Sołtan, 2025). An increase in the proportion of bathing bans due to exceedances of microbiological indicators in bathing waters can be observed based on the available data for the period 2018–2023 (Fig. 3). Specifically, in the 2023 bathing season, the number of assessments with temporary bathing bans due to microbiological indicators was 28%, while in earlier years the proportion was, respectively: in 2018 – 10%; in 2019 – 18%, 2020– 19%, 2021– 19%, 2022–15% (Fig. 7).

This change may be due to increasingly higher air temperature values during the summer (Fig. 4), resulting in more frequent episodes with warmer water temperatures during the bathing season than a decade ago. According to a local study by Budzińska *et al.* (2018) on the sanitary status of the Koronowo Reservoir (located in the lower part of the Brda River), the number of indicator bacteria (*Escherichia coli* and *Enterococcus faecalis*) in the bathing water is determined by water temperature and the number of bathers. In July, when the water temperature and number of bathers were at their highest, the number of microbiological indicators was also at its peak. This figure decreased in August and reached its lowest point in September when the water temperature and number of bathers were at their lowest. Therefore, increasing the number of bathers due to warmer bathing waters may increase the risk of epidemiological hazards. However, *Escherichia coli* and *Enterococcus faecalis* survive longer in water at 4°C than at 20°C (Budzińska *et al.*, 2018).

The progressive increase in average air and water temperatures is confirmed by numerous scientific studies (Graf, 2019; Marszlewski *et al.*, 2022; Kolada, 2024; Tomalski *et al.*, 2025). Kolada (2024) emphasises that, in general, increased water temperatures may favour the spread of diseases, as they increase the likelihood of establishing a wider occurrence of bacterial and viral infections and pathogens with relatively high temperature thresholds. It should also be noted that in Poland, the record warm and extremely warm years 2022, 2023 and 2024 in terms of average air temperature are accompanied by drought phenomena (PSHM Bulletin, 2024). Moreover, the phenomenon of low flows observed during droughts affects the deterioration of water quality. In general, an increase in water temperature enhances the harmful effects of pollutants (Kolada, 2024). Also, intense rainfall observed in Poland in recent years, interrupting long dry periods and causing flash floods (Kaznowska *et al.*, 2024), may contribute to periodic deterioration of water quality.

In Poland, according to the Water Law (Ustawa, 2010) and its amendments (Ustawa, 2005), as amended; Water Law (Ustawa, 2017), sites used for bathing have been established outside bathing areas since 2011. Since 2018, these places have operated for no more than 30 days per calendar year and are called occasional bathing places. The authorities of the Chief Sanitary Inspectorate in Poland carry out water quality monitoring at these sites, and the frequency of water testing from 2018 onwards is the same as that of bathing areas. Analysis of current bathing water suitability assessments from 2016–2023 showed that the vast majority (more than 95%) met the requirements for bathing, and the recorded temporary lack of bathing water suitability was mainly, as in the case of bathing areas, due to cyanobacterial blooms (GIS, 2009–2024).

However, the assessment of bathing water quality based on monitoring two microbiological parameters (*Enterococcus* spp. and *Escherichia coli* bacteria) may not be sufficient to protect human health in the future. According to Oliver *et al.* (2016), bathing water classification provides information about water quality, but does not indicate the health risks and uncertainties associated with contracting diseases from contact with bathing water. According to the evaluation of the BWD completed at the beginning of 2025, the observed changes in climate (increase in air and water temperature, more frequent droughts, heavy rainfall) should be included in the scope of the directive, as should water pollution associated with microplastics or PFAS (Per- and poly-fluoroalkyl substances), in order to provide better protection for the health of bathers. According to the Chief Inspectorate for Environmental Protection (2021), the range of quality parameters tested at the measuring point located in the bathing area should be extended to include biogenic substances – nitrogen and phosphorus compounds, which in excessive quantities contribute to eutrophication of water. This would make it possible to determine the loading of bathing waters with these compounds, allowing the risk of algal and cyanobacterial blooms to be assessed, especially in the case of lakes without outflows. This is important in the case of some lakes (e.g. less than 50 ha), small retention reservoirs, and post-mining water reservoirs that are not monitored under the 2000 Water Framework Directive (Directive, 2000) and do not have ecological and chemical status assessments. The evaluation of the BWD also highlighted the aspect of limiting bathing water quality monitoring to the bathing season only. This restriction is becoming inadequate due to the increase in year-round bathing, such as the Walrus Schools, which have recently become popular.

WATER QUALITY CLASSIFICATION

According to the requirements of Directive (2006), the classification of bathing waters is carried out based on the results of tests on the two microbiological parameters *Escherichia coli* and *Enterococcus* spp. and can be: 'excellent', 'good', 'sufficient' or 'inadequate'. The procedure for classifying bathing waters according to water quality is set out in the Rozporządzenie (2011) and its subsequent amendment (Rozporządzenie, 2019). According to the 2006 guidelines of the BWD, the classification of bathing water is determined based on four-year assessments instead of one-year assessments, as was previously the case

(Directive, 1975). It means that the classification introduced by the 2006 directive is less susceptible to poor weather conditions or one-year events. In order to achieve a water quality classification, a bathing water area must have an adequate set of data (water samples) from four bathing seasons: a minimum of 16 samples or a minimum of 12 water samples for bathing waters with a bathing season of less than eight weeks (GIS, 2009–2024).

In Poland, bathing waters notified for the 2011 bathing season were first subject to a four-year assessment, which was carried out after the 2014 bathing season (Tab. 2). The percentage of each bathing water class with all classified bathing waters was analysed for 2014–2024. Bathing areas that were organised but still too short to be classified were not considered. Based on the results of the 2014–2024 classification period, the percentage of bathing waters with excellent water quality in Poland was found to be stable at around 70% (Tab. 2). So is the percentage of bathing areas with poor water quality, which is a maximum of 4% (Tab. 2). It can be seen in recent years 2021, 2022, 2023 and 2024 that, despite a significant increase in the number of classified bathing areas – more than twofold since 2018 – the percentage of bathing waters with excellent water quality did not decrease, but accounted for 71–73% of all bathing waters, guaranteeing the health safety of bathers (Tab. 2). However, from 2021 a slight but negative shift in the percentage of bathing areas with good water quality to those with sufficient water quality is apparent. In 2021, the percentage of bathing areas with sufficient water quality was 5% and in 2024, 8% (Tab. 2).

QUALITY OF BATHING WATERS IN POLAND COMPARED WITH OTHER EU COUNTRIES

EU countries must report their bathing water quality status annually to the European Commission. This obligation was already enshrined in the first European bathing water legislation in 1976 (Directive, 1975) and was upheld in the provisions of the BWD (Directive, 2006). In contrast, the European Commission is required to publish annual summary reports on bathing water quality in the EU. The first such report was published in 2009 (EC, 2025). Since 2005, Poland has been reporting information on the quality of its bathing waters, marking its first full year of participation in the Community (Poland joined the group of EU countries on 1 May 2004). Since 2011, it has reported on the quality of water in bathing areas organised in accordance with the current Directive (2006). Reports assessing the quality of bathing water in all EU Member States allow the public to make an informed choice about where to go on holiday if it depends on the good results of bathing water quality. Research conducted by Börger *et al.* (2021) in 14 EU Member States (representing around 80% of the Union's population) has already demonstrated that the bathing water classification results introduced by the (Directive, 2006) are an important factor in choosing a holiday destination. Improvements in water quality positively impact the number of visits to a given location, whereas deterioration has the opposite effect. The current BWD changed the classification system by introducing four categories – from 'poor' to 'excellent' – instead of the previous system based on the mandatory and guide ('I' and 'G') values in the Annex of the old BWD.

The European Commission reports (EEA 2019; EEA, 2024) show that the quality of the European Union's bathing waters is steadily improving. It should be noted that the EEA reports also present the results of annual reports from two non-member countries, Albania and Switzerland. Furthermore, 85.4% of bathing water areas were rated 'excellent' in the EU in 2023, and minimum water quality standards were met at 96% of sites. Countries where 95% of bathing areas or more had excellent water quality included Cyprus, Austria, Croatia and Greece. In contrast, 1.5% of all bathing areas in the EU had 'poor' water quality. Between 2009 and 2023, the proportion of excellent

Table 2. Results of the classification of bathing water site quality in Poland and the percentage share of the number of bathing waters with a given water quality classification out of the total number of bathing waters assessed in individual years

Year	Number of bathing water											
	organised	not classified	classified									
			total		excellent		good		sufficient		poor	
			No.	%	No.	%	No.	%	No.	%	No.	%
2014	201	36	165	100	114	69	33	20	17	10	1	1
2015	197	16	181	100	120	66	43	24	16	9	2	1
2016	201	20	182	100	133	73	32	17	16	9	1	1
2017	205	22	182	100	137	75	26	14	14	8	5	3
2018	483	301	182	100	135	74	26	14	18	10	3	2
2019	606	419	187	100	131	70	37	20	17	9	2	1
2020	602	401	201	100	133	66	41	20	19	10	8	4
2021	657	234	423	100	299	71	87	20	21	5	16	4
2022	671	121	550	100	395	72	105	19	33	6	17	3
2023	683	117	566	100	406	72	106	19	33	6	21	3
2024	703	91	612	100	445	73	101	16	46	8	20	3

Source: own study acc. to GIS (2009–2024), Sołtan (2025), Kaznowska and Wasilewicz (2019) quality EU bathing waters ranged from 81–89% for coastal and 60–82% for inland bathing waters. This results from the fact that coastal bathing waters are better quality than inland waters (rivers and lakes) due to more frequent renewal and greater self-purification capacity (EC, 2025).

According to the latest European Commission report (EEA, 2024), in 2023 in Poland, as in Belgium, Estonia and Hungary, less than 70% of bathing waters were of excellent quality (Fig. 8). In the 2023 ranking, Poland is penultimate (ahead of Albania) and last in the EU in terms of the percentage of bathing waters with excellent water quality (Fig. 8), similar to 2018 (EEA, 2019). However, Poland's last place in the EU bathing water quality ranking is due to the adopted methodology for presenting their results, in which unclassified bathing waters are included (Fig. 8). In 2018, more than half of all organised bathing areas in Poland were unclassified and in 2023 at least several percent (Tab. 2). If unclassified bathing areas were not included in the ranking of countries with the highest percentage of bathing areas with excellent water quality, Poland's position would change. In 2018, Poland would be ranked 22nd in the ranking of countries with excellent bathing water quality, and in 2023, it would be 24th, ahead of Romania, Hungary, Estonia, Belgium and Albania (Fig. 8).

Improving water quality in EU bathing areas increases the health and safety of bathers. It directly impacts the economic benefits of areas located on a given body of water. A study examining the recreational value of the Baltic Sea for coastal countries showed that, in the event of improved water quality, the proportional increase in benefits would range from 7 to 18% compared to annual values in individual Baltic Sea countries (Czajkowski *et al.*, 2015). The improved quality of bathing water in EU countries in recent decades is mainly due to numerous investments in sewage treatment plants (Georgiou and Bateman, 2005). However, achieving further improvement in water quality, especially for coastal bathing areas, is proving increasingly difficult in the era of climate change. Therefore, the pilot project launched in September 2025 to support the regeneration of *Zostera marina* seagrass meadows in Puck Bay, Poland, is of interest. Planting seagrass aims to utilise its ability to reduce the amount of nitrogen and phosphorus compounds in the environment and thus limit the process of water eutrophication (Nauka w Polsce, 2025).

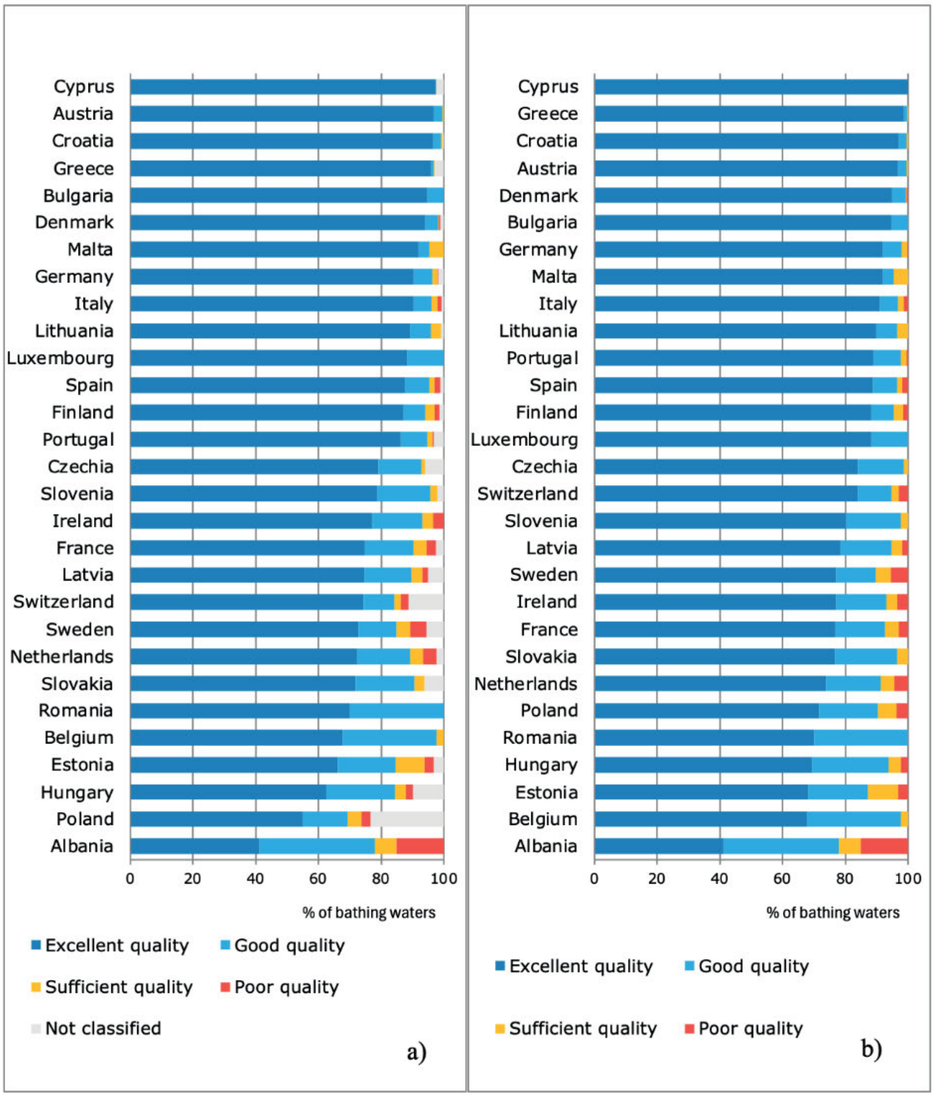

Fig. 8. Classification of European bathing waters in 2023: a) taking into account water quality, b) excluding unclassified bathing waters; source: own study acc. to EEA (2024)

CONCLUSIONS

Since January 1, 2011, Poland has based its system for monitoring and managing bathing water quality on the requirements of Directive 2006/7/EC. Analysis of annual reports from the Chief Sanitary Inspectorate shows how the number and structure of bathing waters defined according to the requirements of the 2006 Bathing Water Directive changed in Poland between 2010 and 2024. In 2010, there were more than 1,000 bathing areas in Poland, and in 2011, only 220 were organised under the 2006 BWD. In the following years, the number of bathing areas in Poland decreased instead of gradually increasing. This situation arose from the introduction of facilities called 'sites used for bathing' into Polish law in 2011, alongside bathing areas. The organisation of sites used for bathing, as opposed to bathing areas, was easier and cheaper but did not provide the same frequency of water quality testing as bathing areas. According to the legislator's intention, these places were intended to ensure the safety of bathers during short summer holidays (e.g. scout camps). In practice, however, the introduced solution has been abused in numerous ways. In 2017, there were only 205 designated bathing areas in Poland, yet as many as four times as many sites were used for bathing. This trend was reversed in 2018, after these facilities were limited to 30 days per calendar year, under the new name of sites occasionally used for bathing. In 2024, 703 bathing areas and 214 occasional-use sites were organised in Poland, about 70% in inland waters, mainly lakes.

The assessment of bathing water quality for 2010–2024 showed that 70% of bathing waters are suitable for bathing throughout the season. However, there is a tendency for an increase in the proportion of bathing areas with temporary bathing bans, accompanied by an increase in average air temperature in Poland during the summer season (from June to August) and a decrease in total runoff in Polish rivers. The observed extremely warm and dry summers are conducive to the deterioration of bathing water quality. From 2010–2024, the main reason for temporary bathing bans was cyanobacterial blooms.

However, the observed increase in the proportion of bathing waters with a temporary bathing prohibition between 2010 and 2024 does not affect the decrease in the number of bathing waters with excellent water quality, which is stable at around 70% with a slight upward trend, respectively: 2021 – 71%; 2024 – 73%. However, from 2021, there has also been a slight but negative shift in the percentage of bathing waters with good water quality to bathing waters with sufficient water quality, which was 5% in 2021 and 8% in 2024.

As of 2018, Poland has the highest number of unclassified bathing waters, and its inclusion in the ranking of EU countries with the highest proportion of bathing waters with excellent water quality affects the ranking position. Thus, excluding non-classified bathing waters, Poland is ranked 24th in the 2023 ranking of countries with excellent bathing water quality, ahead of Romania, Hungary, Estonia, Belgium and Albania.

CONFLICT OF INTERESTS

All authors declare that they have no conflict of interests.

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