DOI: 10.31577/ahs-2023-0024.01.0016

ACTA HYDROLOGICA SLOVACA

Volume 24, No. 1, 2023, 141 – 150

Deterioration of water quality in aquatic system

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The need to reduce anthropogenic pollutants inputs to aquatic ecosystems in order to protect drinking-water supplies and to reduce eutrophication, including the proliferation of harmful algal blooms. Nitrogen (N), needed for protein synthesis, and phosphorus (P), needed for DNA, RNA, and energy transfer, are both required to support aquatic plant growth and are the key limiting nutrients in most aquatic and terrestrial ecosystems. Most researchers have concluded that no single factor is responsible, but rather interactions between two or more factors control the rates.
River aquatic systems that have been heavily loaded with nutrients can display P limitation, N limitation, and colimitation, and what nutrient is most limiting can change both seasonally and spatial. At the transition between fresh and saline water, P can often be the limiting nutrient. P and dissolved silicate are also often limiting during the spring, with N limitation commonly occurring during summer months. Algal production during summer is supported by rapidly recycled P within the water column or released from sediments.

KEY WORDS: surface water, pollution, eutrophication, nutrients

Introduction

Water quality assessment is important for environmental protection. Mechanisms and assessment of water pollution investigated (Rathore et al., 2016; Yang et al., 2008; Hem, 1985; Harper, 1992; David and Gentri, 2000; Gali et al., 2012). Water deterioration has become an environmental problem in recent years, and understanding the mechanisms of water pollutation will help for prevention, remediation of water pollution (Singht and Karla, 1975; Marandi et al., 2013). Recent advances in current status and major mechanisms of water pollution, assessment, evaluation criteria, and the influencing factors were reviewed. The need to reduce anthropogenic nutrient inputs to aquatic systems in order to protect drinking-water supplies and to reduce pollution. Developing the appropriate nutrien management strategy is very important. Nitrogen and phosphorus are the main pollutants and affect the deterioration of the water status (Carpenter et al., 1998; Conley et al., 2009) due to agricultural activities in this region. In small amounts they are necessary. Nitrogen (N), needed for protein synthesis, and phosphorus (P), needed for DNA, RNA and energy transfer, are both required to support aquatic plant growth and are the key limiting nutrients in most aquatic ecosystems.
The inputs included from row crop agriculture, animal production, human consumption of food, and sewage production related net anthropogenic addition. The external supplies of N and P to aquatic systems are derived from a wide variety of sources, including groundwater, fluvial, and atmospheric inputs. The sum of these three sources is the external load. As can be seen the external supplies of nutrients to a water body can originate both as point sources, which are localized and more easily monitored and controlled, and as nonpoint sources, which are diffuse and much more difficult to monitor and regulate (Sokáč and Velísková, 2022; McCleskey et al., 2011; Khan and Ansari, 2005).
Monitoring of surface water quality in Žitný ostrov channel network (Fig. 1) has been provided in terms of requirements Supplement No.1 Directive of Government SR No. 269/2010, Part A (general indicators) and Part E (hydrogiological and micro-biological indicators) in the period of 2000–2022 (Schügerl at al., 2018; Koczka Bara et al., 2014; Makovinská et al., 2015).
Losses of nitrogen (N) and phosphorus (P in land run-off and drainage from agricultural land can impair river water quality and may pose a potential health hazard. Losses of P are up to an order of magnitude smaller than those of N, but may be more significant with respect to freshwater pollution (Withers and Lord, 2002; Jickells, 2005).
Management of the environment requires integrated approaches which include both N and P taking account of differences in their source areas and delivery mechanisms, the vulnerability of land use of safe management options in relation to landscape. For P, the identification of vulnerable zones represents a step

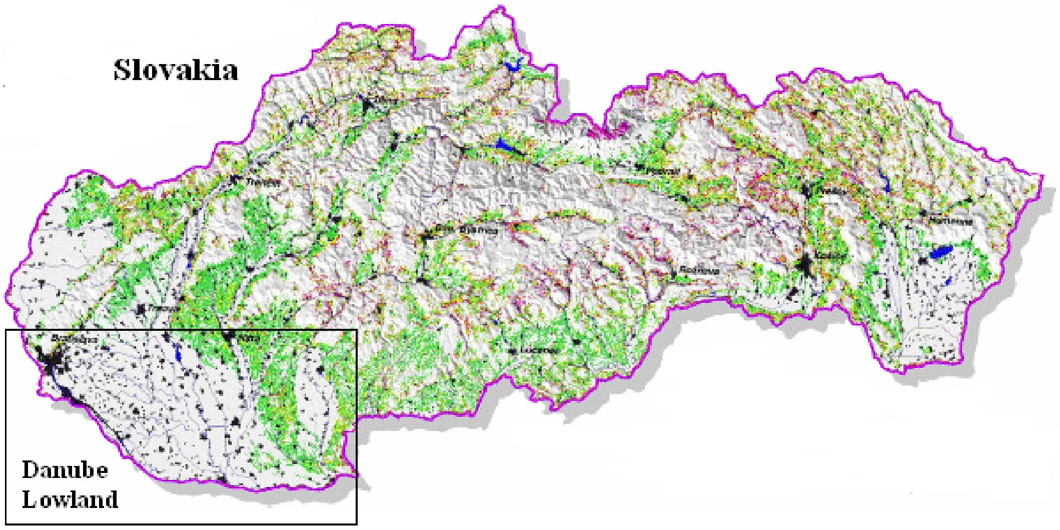

Fig. 1. *Žitný ostrov (Danube Lowland) channel network.*

forward to the management of the river basin in smaller definable units, which can provide a focus for safe management practices (van Niekerk, 2014).

Nutrient emissions from agricultural land are a major cause of elevated nutrient concentrations in ground and surface waters (Smith et al., 1999; Samuel, 2022). The nutrients of main concern are P and N, and an oversupply of either nutrient can cause highly undesirable changes in the structure and function of aquatic systems, although P is probably the more important in rivers impacted by agriculture. (Velísková et al., 2017; Conley et al., 2009).

Reductions in point P loads from sewage treatment works now being implemented to reduce fluvial P inputs in sensitive catchments has focused attention on the role of diffuse P inputs from agriculture. Many surface waters in lowland regions now exceed the EC drinking water limit of 50 mg l^{-1} and nitrate (11.3 mg l^{-1} NO_3-N). for at least a part of the winter. There are a range of situations which might lead to increased rates of nutrient transfer from agricultural land to water.

Whilst landscape characteristics such as climate, topography and soil type govern the inherent risk of nutrient loss within a given locality, current nutrient inputs and land management practices can exacerbate N and P losses from different agricultural land uses. The significance of these factors varies appreciably between the two nutrients, and between different geographic regions and farming systems This paper our knowledge of diffuse nutrient transfer to surface waters and how N and P emissions from agricultural land might be managed to meet future demands.

Estimations of total dissolved solids (TDS) content are commonly based on electrical conductivity (EC) measurements, using a conversion factor f retrieved from in situ monitoring. Chemical and biological processes taking place in the water can significantly affect the pH and conductivity of the water. We found a general upward trend. We observed regularity in the seasonal dynamics. Improvements in the water quality of many freshwater requires reductions in both nitrogen and phosphorus inputs. Although the TDS-EC method is capable of providing very accurate TDS concentrations, the use of a universal conversion factor can result in over- or underestimates. Users of EC meters need to follow certain basic procedures to ensure good representative TDS values, namely, proper calibration and maintenance, correct instrument use and application of the correct TDS-EC conversion factor (van Niekerk et al., 2014; Conley et al., 1999; Devlin et al, 2011; Thirumaliny and Kurian, 2009; Rusydi, 2019).

Additions N and P to the biosphere, largely through the production of fertilizers and increases in fossil fuel emissions. P levels have also significantly increased because of fertilizer use, as well as from municipal and industrial wastewater. The question of whether one or both nutrients should be controlled to reverse the detrimental effects of eutrophication. If N limitation were the only factor governing blooms of N_2-fixing cyanobacteria, then their blooms would be widespread in estuarine.

Estuaries ecosystems, that have been heavily loaded with nutrients can display P limitation, N limitation, and colimitation and what nutrient is most limiting can change both seasonally and spatially. At the transition between fresh and saline water, P can often be the limiting nutrients P and dissolved silicate are also often limiting during the spring, with N limitation commonly, occurring during summer months. Algal production during summer is supported by rapidly recycled P. Nitrogen has clearly been established as the nutrient limiting spring phytoplankton production; it is the sinking spring bloom that sends organic matter to bottom waters, which partly sustains hypoxia. The excess P in the water column leads to summer blooms of cyanobacteria. Controlling only P inputs to freshwaters and ignoring the large anthropogenic inputs of N can reduce algal uptake of N and thus allow more N to be transported downstream where it can exacerbate eutrophication problems in ecosystems.

The external supplies of N and P to aquatic systems are derived from a wide variety of sources, including

groundwater, fluvial, and atmospheric inputs. The environmental consequences of excessive nutrient enrichment are the degradation of water resources by eutrophication and worsening of water quality (David and Gentri, 2000; Hessen, 1999).
Excess of nutrients (mainly nitrogen and phosphorus) in water or soil from sewage outfalls and fertilized farmland. In water, eutrophication accelerates the growth of algae and other vegetation in water (Maistone and Parr, 2002). The degradation of organic material consumes oxygen resulting in oxygen deficiency and, in some cases, fish death. Eutrophication translates the quantity of substances emitted into a common measure expressed as the oxygen required for the degradation of dead biomass (James et al., 2004). In soil, eutrophication favours nitrophilous plant species and modifies the composition of the plant communities (Conley et al., 1999; Devlin et al., 2011; Siosemard et al., 2010).

Material and methods

Factors influencing water pollution

For the evaluation the water quality we went out from the data obtained on Institute of Hydrology SAS.
One of the most important tools for evaluating water quality and character in a catchment is a detailed knowledge of the ranges and trends in salinity pollution of natural water. Žitný ostrov is one of the most productive agricultural areas of Slovakia, situated on the Danube Lowland. Under its surface is the richest water reservoir of Slovakia. For this reason, it is very important to deal with quantity and quality of water resources in this region. The channel network at the Žitný Ostrov area was built up for drainage and also to provide irrigation water (Dulovičová et al., 2022; Velísková et al., 2017; Wang et al., 2001).
There are three main channels of this network: Chotárny channel – is the P1M water body type (partial river-basin Váh, code SKW0029), Gabčíkovo-Topoľníky channel – is the P1M water body type (partial river-basin Váh, code SKW0023), Komárňanský channel – is the P1M water body type (partial river-basin Váh, code SKV0226). We carrying out the measurements in the period 2020–2022. Monitoring and assessment of following indicators were performed-total nitrogen (N_{TOT}), nitrate nitrogen ($N\text{-}NO_3^-$), nitrite nitrogen ($N\text{-}NO_2^-$), ammonia nitrogen ($N\text{-}NH_4^+$), total phosphorus (P_{TOT}), phosphate phosphorus ($P\text{-}PO_4^{3-}$) according the Supplement No.1 Directive of Government SR No. 269/2010, Part A biomas of phytoplankton (CHL_a) according Part E (Makovinská et al., 2015) (Table 1, 2).
Electrical conductivity (EC) and total dissolved solids (TDS) are water quality parameters, which are used to describe salinity level. These two parameters are correlated and usually expressed by a simple equation: TDS = f .EC (in 25°C) by finding the correlation value. TDS concentration can be determined from EC value, which are measured easily and inexpensively in situ by a portable water quality checker (YSI Multiparametric probe). The analysis of TDS is more difficult and expensive as it needs more equipment and time. The relationship between total dissolved solids (TDS) and electrical conductivity (EC) is established in 648 samples collected from Žitný ostrov channels. These data are extremely variable in content, reliability and periodicity of sampling.
Electrical conductivity (EC) and total dissolved solids (TDS) are water quality parameters, which are used previous research (Smith et al. 1999; Schneider and Menzel, 2003) results have found that the correlation between TDS and EC are not always linear. For more precision, TDS concentrations need to be analyzed using the gravimetric method in the laboratory.

Sampling

We take samples once per month in the same day as samples for chosen indicators of water quality assessment from the same sampling sites. By the evaluation of the obtained results we used statistical methods. Water quality was evaluated by the comparison of the characteristic values for individual indicators in all sampling sites calculated and the recommended value for these indicators (Rainwater and Thatcher, 1960; Makovinská et al., 2015).
Three locations were monitored in each main channel, i.e. total of 9 measurements each month in time period 2020–2022. A total of 648 samples were investigated.
Profiles with an assumed higher pollution value were selected by previous observation. For each locality, the quality in selected indicators was separately evaluated through YSI multiparametric probe. In-situ measurements were carried out to evaluate the quality of surface water on Žitný ostrov territory. The samples provide a wide range of EC, TDS and conversion factors. The dry and warm summer climate, evaporation soil, water regime and mineralized groundwater create here convenient conditions for development and spreading of pollutants. These conditions, in addition to the use of high to medium salt-content irrigation water and bad drainage lead to an increased pollutantion in agricultural area (Climate Atlas of Slovakia, 2015).
In-situ measurements were carried out to evaluate the quality of surface water on Žitný ostrov. Profiles with an assumed higher pollution value were selected by previous observation. For each locality, the quality in selected indicators was separately evaluated using the YSI multiparametric probe.
The Okoličná profile on the island was selected as the most polluted. The limit values in it were exceeded in 4 parameters and in the other 2 profiles Komárňanský channel, therefore it was evaluated as the most polluted.
This contribution analysed pollution problem, factors affecting this process, its consequences and possibilities of prevention. Important was to evaluate pollution state of surface water in Žitný ostrov channel network following the assessment physical-chemical and microbiological indicators in monitored period 2020–2022. The sets out the ecological consequences of increased nutrient loading to freshwaters in the context of providing information on the effects of implementing international and national legislative for the ecological

Table 1. Evaluation of surface water status in various polluted waters

Indicator	Symbol	Unit	Value
Ammonia nitrogen	$N\text{-}NH_4^+$	[mg l^{-1}]	1
Nitrite nitrogen	$N\text{-}NO_2^-$	[mg l^{-1}]	0.02
Nitrate nitrogen	$N\text{-}NO_3^-$	[mg l^{-1}]	5
Nitrogen total	N_{TOT}	[mg l^{-1}]	9
Phosphorus total	P_{TOT}	[mg l^{-1}]	0.4
Phytoplankton biomass (chlorophyll-a)	CHL_a	[μg l^{-1}]	50

Table 2. Limited values of surface water according to Supplement No.1 Directive of Government SR No. 269/2010

Place of sampling point: Komárňanský channel | Typ VÚ: P1M | Partial watershed Váh
Profile : Okoličná na Ostrove | Code VÚ: SKV0226 | Monitoring: 2020

Part A – general water quality indicator

Term of indikator	Symbol	Unit	Number statements	Min.	Max.	Average	P90	Value according to NV 269/2010	Meet/Does not meet
Dissolved oxygen	O_2	[mg l^{-1}]	12	8.4	14.0	10.8	9.5	> 6.0	M
Temperature	t	[°C]	12	3	21.6	11.4	20.3	< 27	M
Chemical consump. oxyg	CHSKCr	[mg l^{-1}]	12	5.0	18.0	7.7	10.8	< 25	M
Reaction	pH	–	12	6.39	8.19	7.93	8.16	8.5	M
Conductivity	EC	[μS cm^{-1}]	12	349	543	420	536.1	≤ 700	M
Specific conductivity	SPC	[μS cm^{-1}]	12	370	933	548	857.0	700	N
Total dissolved solids	TDS	[mg l^{-1}]	12	284	630	405	621.0	800	M
Ammonia nitrogen	N-NH4	[mg l^{-1}]	12	0.05	0.9	0.34	0.16	1	M
Nitrate nitrogen	N-NO3	[mg l^{-1}]	12	2.7	5.2	3.68	3.61	5	N
Total nitrogen	Ntot	[mg l^{-1}]	12	2.2	9.4	7.23	3.17	9	N
Phosphate phosphorus	P-PO4	[mg l^{-1}]	12	0.17	0.42	0.30	0.32	0.35	N
Total phosphorus	Ptot	[mg l^{-1}]	12	0.18	0.43	0.35	0.38	0.4	N
Turbidity	T	NTU	12	14	64	42	38	100	M
Phytoplankton biomass (chlorophyll-a	CHLa	[μg l^{-1}]	12	20	46	33.3	16	50	M

status assessment (WHO).

Water eutrophication is mainly caused by excessive loading of nutrients into water bodies like N and P. Excessive nutrients come from both point pollution such as waste water from industry, municipal sewage, and non-point pollution like irrigation water, surface run water containing fertilizer from farmland, etc. Increased nutrient load to water body is now recognized as a major threat of water quality degradation.

At present, excessive total nitrogen (TN) and total phosphorus (TP) in water are considered as the only factors inducing water eutrophication, but nutrient enrichment is only the necessary but not the sufficient condition for algal boom. Eutrophication is not likely to occur if both TN and TP in water are low, but eutrophication may not occur in water high in TN and TP if other conditions such as temperature and current speed are not favorable. The influencing factors of water pollution include: a) nutrient enrichment – excessive TN and TP; b) hydromechanics - slow current velocity; c) adequate temperature and favorable other environmental factors; d) light and Ph; e) microbial activity and biodiversity.

Results and discussion

a) The relationship of nutrient enrichment to water eutrophication and algal bloom: When P concentration in water is low, it may be the limiting factor for inducing water eutrophication and algal bloom. When P concentration in water increases rapidly, other may become a new limiting factor, such as pH, water depth, temperature, light, wave, wind or other biological factors. N and P input and enrichment in water are the most primary factors to induce water pollution. Electrical conductivity (EC) and total dissolved solids (TDS) are frequently used as water quality parameters (Hubert and Wolkersdorfer, 2015; McNeal et al., 1970).

b) Hydrodynamics is not related to disturbing water itself but is influenced indirectly by changing light and nutrient status. In shallow water, increased frequency of disturbance could increased the P release from the sediment, especially at high temperature. Electrical conductivity strongly depends on the sample's temperature because the movement of ions is directly proportional to the temperature.

c) Temperature and salinity are the two important factors to induce alga bloom, which always occurs at temperature between 23°C and 28°C, salinity between 25% and 30%. The variation of temperature and salinity also affect algal bloom, and an important condition for algal bloom is that temperature increases and salinity decreases faster than ever in short time (Smith 1962; McNeil and Cox, 2000; Gali, et al., 2012). Statistical analysis shows that the influence of temperature on algal growth rate is the largest, followed by salinity and their interaction. Change of salinity is also influenced by the concentration of nutrition. Research shows that salinity is negatively related with $N\text{-}NO_3^-$ and $P\text{-}PO_4^3$, but positively related with $N\text{-}NH_4^+$ and however, it is not very related with $N\text{-}NO_2^-$. The change in pH is directly related to the availability and absorption of nutrients from solution. Ionization of electrolytes or the valence numbers of different ion species are influenced by changes in pH. High pH values promote the growth of phytoplankton and result in bloom (Mainstore and Parr, 2002; Velísková et al., 2017; Western, 2001).

d) Light and pH plays an important role in the growth. The direct relationship between phytoplankton and dissolved oxygen content has been observed by a number of researchers. pH is a plant growth limiting factor. The change in pH is directly related to the availability and absorption of nutrients from solution. Ionization of electrolytes or the valence numbers of different ion species are influenced by changes in pH. High pH values promote the growth of phytoplankton and result in bloom. It must be pointed out that many factors influencing pollution are relative and affect each other.

e) Microbial activity is the inducement factor to alga bloom. It can enhance abundant breeding of alga bloom. Nutrient-enhanced microbial production of organic matter, or eutrophication, is frequently accompanied by altered microbial community structure and function. The amount of microbial biomass is positively related to the content of organic matter and the amount of plankton in eutrophicated water. There exists certain intrinsic relationship between the amount of bacteria and the occurrence of eutrophication. The decomposition of organic matter by bacteria activities can produce nutrients and organic substances, which may promote algal bloom breaking out (Mainstore and Parr, 2002; Walton, 1989; Newman et al., 2005). Chemical and biological processes taking place in the water can significantly affect the pH and conductivity of the water. We found a general upward trend. We observed regularity in the seasonal dynamics, too (Pärn et al., 2012).

Monitoring and assessment of following indicators were performed: total nitrogen (N_{TOT}), nitrate nitrogen ($N\text{-}NO_3^-$), nitrite nitrogen ($N\text{-}NO_2^-$), ammonia nitrogen ($N\text{-}NH_4^+$), total phosphorus (P_{TOT}), phosphate phosphorus ($P\text{-}PO_4^{3-}$) according the Supplement No.1 Directive of Government SR No. 269/2010, Part A, biomas of phytoplankton (CHL_a) according Part E and with regards to WHO recommendations (Eq. 1).

Generally, the physical and chemical evaluation parameters were used to assess water eutrophication, mainly nutrient concentration (N and P), algal chlorophyll, water transparency and dissolved oxygen. Although there are many different assessment parameters, the concentrations of total nitrogen and total phosphorus are the two basic ones. (Cheng and Li, 2006) used total nutrient status (TNS) to assess eutrophication status of surface water. The calculation of total nutrient status is as follows (Eq. 1).

$$TNS = \sum W_j TNS_j, W_j = r_{ij}^2 / \sum r_{ij}^2 \qquad (1)$$

where
TNS – the sum of indexes of all nutrient parameters;
TNS_j – the TNS of j parameter;
W_j – the proportion of j parameter in the TNS;
r_{ij} – the relation of chlorophyll a (Chla) to other parameters.

The available parameters concerned include total nitrogen (TN), total phosphorus (TP), Chla, dissolved oxygen (DO), chemical oxygen demand by K_2MnO_4 oxidation method (CODMn), biological oxygen demand (BOD5), etc., and TN, TP and Chla are selected for calculating the TNS (Cheng et al., 2006; Yang et al., 2008).
The results of TNS will be part of the project.
Statistical processing was performed for the entire monitoring period. Water samples were taken along the main Žitný ostrov channels. The dry and warm summer climate, evaporation soil water regime and mineralized groundwater create here convenient conditions for development polluted water. These conditions, in addition to the use of high to medium salt-content irrigation water and bad drainage, lead to an increased risk of pollution in agricultural area (Climate Atlas of Slovakia, 2015).
The need to reduce anthropogenic nutrient inputs to aquatic systems in order to protect drinking-water supplies and to reduce eutrophication. Developing the appropriate nutrient management strategy is very important. Nitrogen (N), needed for protein synthesis and phosphorus (P), needed for DNA, RNA, and energy transfer, are both required to support aquatic plant growth and are the key limiting nutrients in most aquatic ecosystems. (Nedwell et al., 2001).
Mechanisms and assessment of water pollution investigated (Appelo, 2015; Rathore et al., 2016; Yang et al., 2008). Understanding the mechanisms of water pollution will help for prevention and remediation of water pollution. Recent advances in current status and major mechanisms of water pollution, assessment and evaluation criteria, and the influencing factors were reviewed. The need to reduce anthropogenic nutrient inputs to aquatic systems in order to protect drinking-water supplies and to reduce eutrophication. Nitrogen (N), needed for protein synthesis and phosphorus (P), needed for DNA, RNA, and energy transfer, are both required to support aquatic plant growth and are the key limiting nutrients in most aquatic ecosystems. (Conley et al., 2009).
The study was focused on identification of the long-term trends in the surface water quality in channel network at Žitný ostrov region. The paper shows changes in measured values in years 2000–2022. It was shown the channel water quality has been changed significantly during this period, after 1990 is slightly decreased. The nutrient level in surface water has decreased after 1990th in response to decreased discharge of domestic wastes and non-point pollution from agricultural practices and urban development. We observe slight increasing in some profiles of Komárňanský channel, mainly Okoličná na Ostrove and Čalovec (Fig. 2, 3, 4, 5) with major agricultural activities during last few years (2020–2022).
Investigation of surface water and determination surface

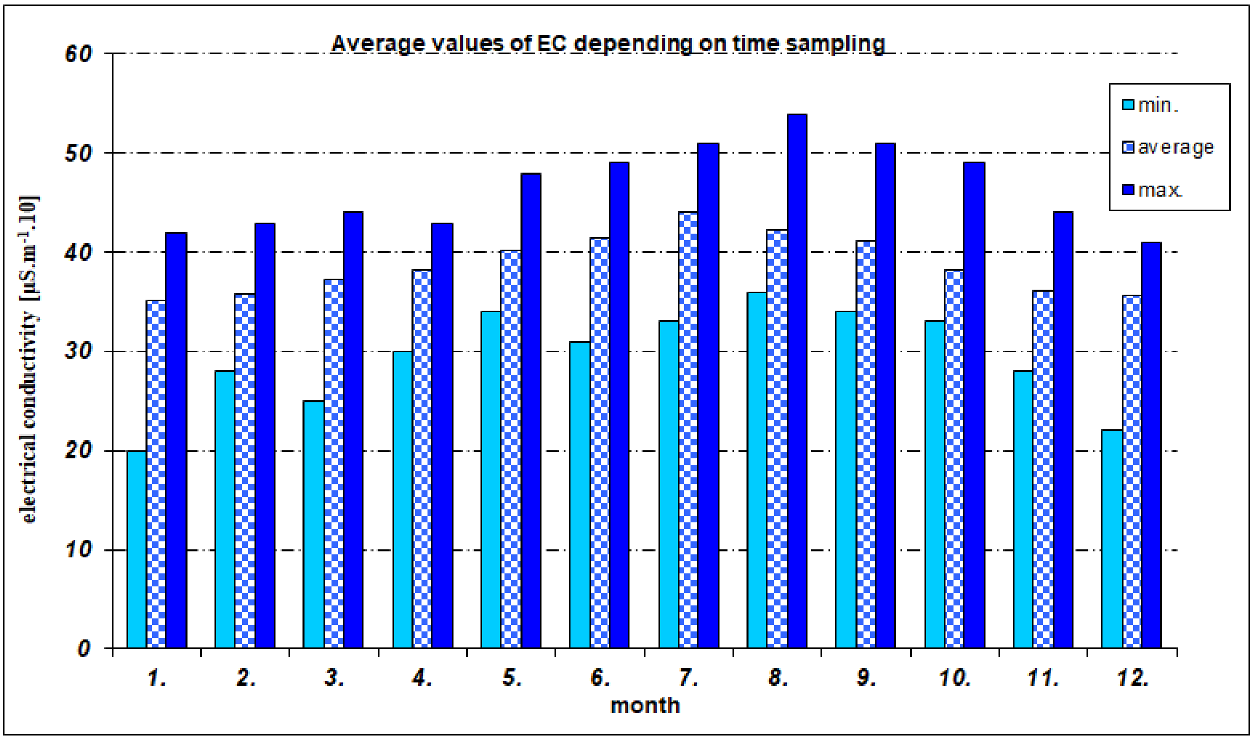

Fig. 2. Average EC values depending on the time sampling (1–12 months in year 2020–2022) Komárňanský channel.

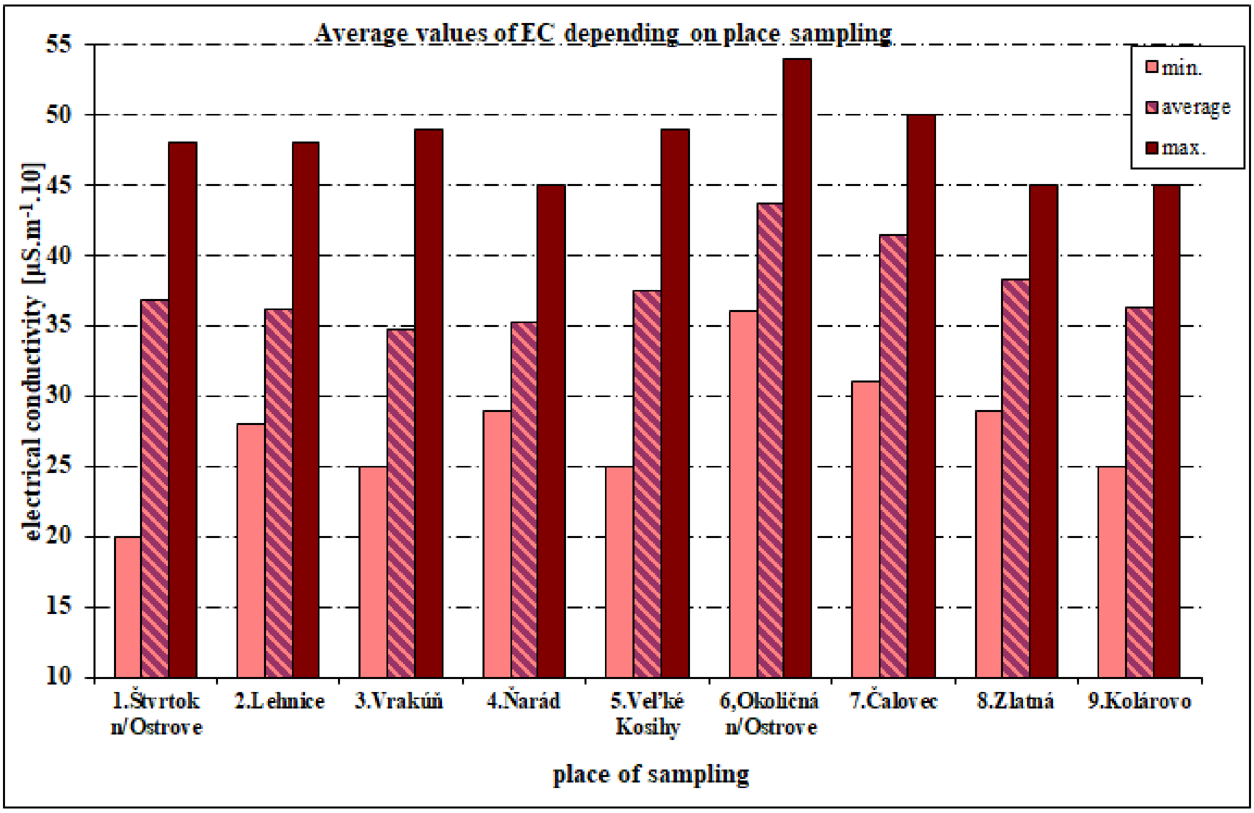

Fig. 3. Average EC values depending on the place sampling (9 places) in year 2020–2022) Komárňanský channel.

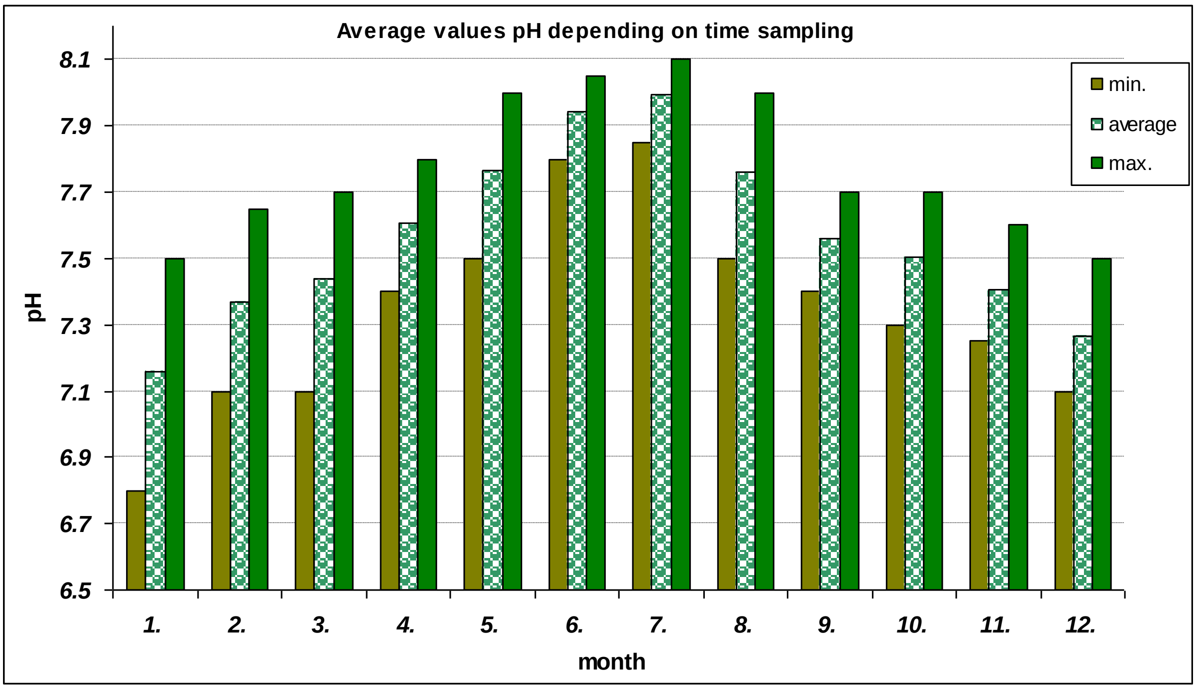

Fig. 4. Average pH values depending on time sampling (1–12 month, 2020–2022), Komárňanský channel.

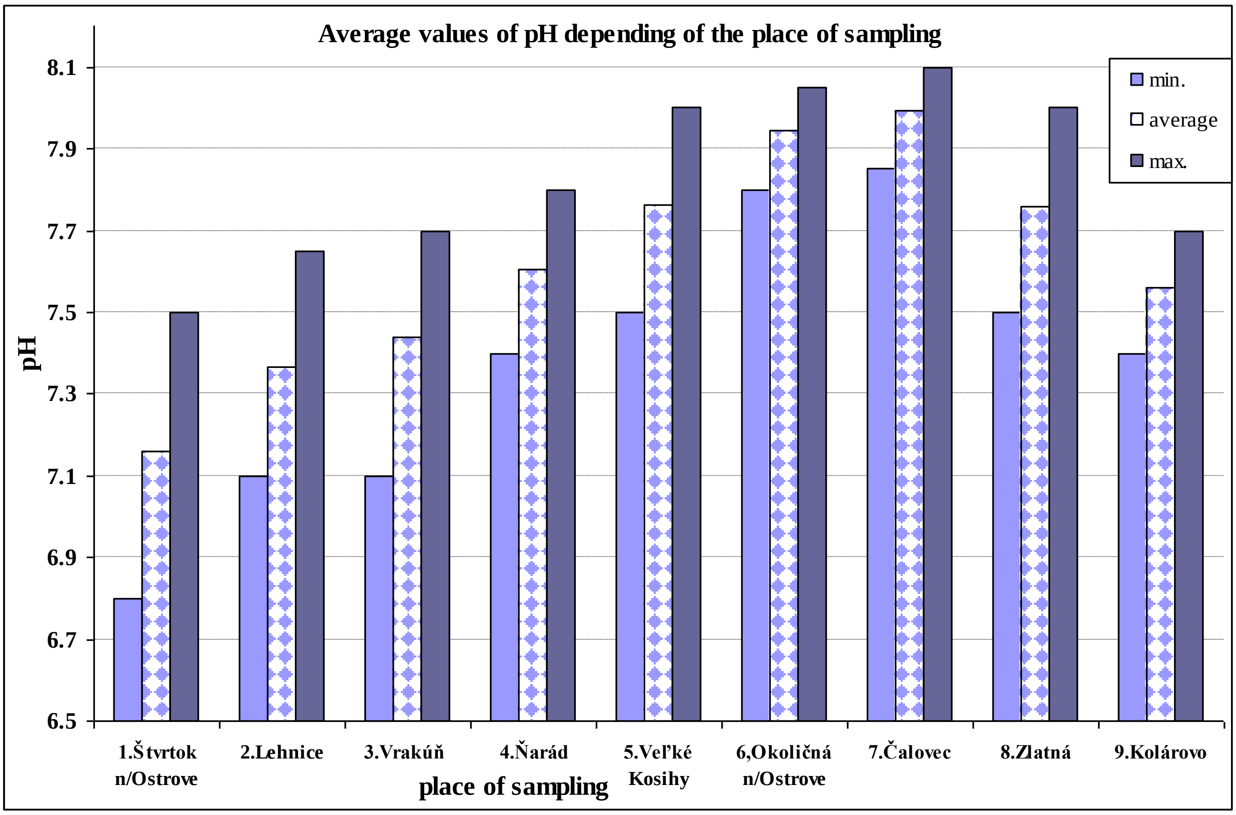

Fig. 5. Average pH values depending on the place sampling (1–12 month, 2020–2022), Komárňanský channel.

water status, measured by water chemistry, biological indicators and briefly review the process, the impacts of pollution in freshwater systems. The present article evaluated the ecological consequences of increased nutrient loading to freshwaters in the context of providing information on the effects of implementing international and national legislative for the ecological status assessment. The limiting factors – namely concentrations of nitrogen (N) and phosphorus (P), temperature, pH, light, dissolved oxygen and CO_2 level are known to affect polluted water bodies.

Conclusion

The present review deals with the studies conducted on the impact of pollutants amount in surface water on the Žitný ostrov channel network. The review covers the definition and concept of indicators for the adverse effects on quality and ecosystem functioning. The contaminations of several water bodies leads to significant changes in the structure and function of the aquatic system. Some profiles in this region have recently been found to be highly polluted. Some of indicators and methods access to biodiversity

Mechanisms and assessment of water pollution investigated many authors. Water pollution has become a environmental problem in recent years. Understanding the mechanisms of water deterioration will help for prevention and remediation of water pollution. The need to reduce anthropogenic nutrient inputs to aquatic systems in order to protect drinking-water supplies and to reduce eutrophication. Developing the appropriate nutrien management strategy is very important. Nitrogen (N), needed for protein synthesis and phosphorus (P), needed for DNA, RNA, and energy transfer, are both required to support aquatic plant growth and are the key limiting nutrients in most aquatic ecosystems.

Electrical conductivity (EC) and total dissolved solids (TDS) are frequently used as water quality parameters. These two parameters are indicators of pollution level, which make them very useful. The value of EC and TDS are correlated. Its ability depends mainly on dissolved ion concentrations, ionic strength, and temperature of measurements. The analysis of TDS concentration from EC value can be used to give an overview of water quality. For more precision, TDS concentrations need to be analyzed using the gravimetric method in the laboratory. EC can be measured easily and inexpensively in situ by a portable water quality checker. This paper provides establishing a conversion factor for EC and TDS parameters using dataset of measurements in Žitný ostrov region (Danube Lowland, Slovakia). Monitored localities was chosen so that they be the most representative area-covering. Measurements shows that just one simple linear conversion factor cannot be suitable throughout the range of waters.

The conversion factors were determined using field and laboratory measurements. The site-specific validation are sed. The limit value in Okoličná na Ostrove has been exceeded (Table 2) for ions nitrate nitrogen $N\text{-}NO_3$, ammonia nitrogen N-NH4, total nitrogen N tot, phosphate phosphorus P-PO4, total phosphorus Ptot. Some profiles in this region have recently been found to be highly polluted. The degradation of water resources by pollution can result in worsening of water quality.

The present review deals with the studies conducted on the impact of pollutants amount on eutrophication in surface water on the Žitný ostrov channel network. Were compared 648 samples, whether it meets the limit values, covers the definition and concept of pollution and the adverse effects on quality ecosystem functioning. The pollution of several water bodies leads to significant changes in the structure and function of the aquatic ecosystem. Some profiles in this region have recently been found to be highly eutrophic. Most of the surface water bodies are surrounded with densely populated human settlement areas and agricultural fields. Frequent sampling is needed to capture intra-event and seasonal fluctuations of pollutants concentrations for accurate load estimations to surface waters; however, processing water samples for multiple nutrients can be expensive and time consuming.

The goal of this study was to investigate electrical conductivity as an inexpensive surrogate for traditional water quality sampling and analysis. This study is being conducted in a heavily tile-drained-agricultural watershed typical of the Žitný ostrov region. This watershed has a unique setup where drained water from flows into a single location, where both surface runoff and drained water from the drainage district can be monitored.

Acknowledgement

This contribution was supported by project VEGA 2/0028/23 Seasonal variations of hydrodynamic and morphological parameters in lowland vegetated rivers.

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