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LAKES RESTORATION: ANALYSIS OF TERMINOLOGY INCORRECTLY USED IN THE SCIENTIFIC LITERATURE

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ABSTRACT

Aim of the study
The analyses of improper use of the term "water restoration" and "restoration of the water reservoir", in order to show the errors that should be avoided in the proper description of the processes carried out in the field of water reservoir protection

Material and methods
The study bases on the literature review for reports and research results in the field of the restoration of surface water and degraded water reservoirs. The author analyzed improper uses the term "water restoration" and suggested a correct form of the new professional term.

Results and conclusions
The results of the analysis of selected articles in the field of water reservoir reclamation clearly indicate that authors mistakenly used the phrase lake restoration in their papers. In the scientific and professional literature, the phrase lake remediation is overused despite the recommendations of world-renowned experts from the Committee on Restoration of Aquatic Ecosystems in USA, who presented in their reports the correct definition of the word water restoration.

Keywords: Lake restoration, water restoration, reclamation, water purification treatment, water pollution

INTRODUCTION

Degradation of water reservoirs remains a global problem, although its intensity in various regions of the world is changeable (Fu et al, 2003; Liu & Diamond, 2005; Goel, 2006; Smol, 2009; Ongley, 2010; Ahuja, 2013). Discharge of improperly treated sewage is one of the main causes of contamination of inland watercourses and water reservoirs (Chmielowski and Ślizowski, 2008; Bugajski et al., 2016 a; Bugajski et al., 2016; Mazur et al., 2016; Młyński et al., 2017).

The Water Framework Directive (WFD) obliges EU member states to eliminate all causes of pollution under the threat of severe financial penalties (Kalli & Butler, 2001; Mostert, 2003; Moss, 2008). Local administration bodies are increasingly looking for and implementing new measures for water reclamation in the area of their administration. The processes of water treatment conducted in order to restore them to the appropriate quality are most often based on the use of selected methods of purification treatment. In the subject literature globally, we find many reports on the purification treatment of water reservoirs (Bernhardt et al., 2005; Loomis, 2006; Palmer et al., 2007). The authors show a positive effect of the methods used, demonstrating the improvement of the tested parameters of polluted

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water. Both the scientists and the experts in the field of water restoration technologies use the expression of "restoration of water reservoirs" or "water restoration". This term is widely used in many aspects of processes aimed at removing selected forms of water pollution. Also in the case of bottom sediment mining, the term "restoration" appears in the scientific literature. In the books devoted to the renewal of surface water quality, the following types of "restoration methods" are mentioned: chemical, biological and mechanical. In the vast majority of cases, the term is used incorrectly. At scientific conferences on the restoration of water reservoirs, research papers are presented, the results of which do not in fact present the effects of such restoration. Also the Water Law in Poland uses the word "restoration" (Polish: "rekultywacja"), the legal interpretation of which is ambiguous. The term "restoration of waters" has become widespread in the literature on the subject, and it has become very popular in both scientific and industry-related activities. The overuse, or abuse, of the term has led to information noise and to its misidentification with water purification processes. It is safe to say that we are dealing with negative transfer within the meaning of the term "water restoration" due to incorrect presentation of the process itself.

What are the reasons for the incorrect application of the aforementioned term? And why do scientists and experts reiterate that same error in scientific studies and expert reports?

The author has attempted to analyse the problem of improper use of the term "water restoration" and "restoration of the water reservoir", in order to show the errors that should be avoided in the proper description of the processes carried out in the field of water reservoir protection.

METHODOLOGY

The following stages can be distinguished in the work on the present paper:

1. Literature review for reports and research results in the field of the restoration of surface water and degraded water reservoirs.
2. Classification of papers due to the terminology used and the misuse of the concept of water restoration.
3. Suggestions for the correct use of terms and correct wording in the scientific and industry literature.

RESULTS AND DISCUSSION

Before we begin to analyse cases of misuse of the term "restoration of watercourses and water reservoirs", definition of this concept should be cited that would cover the full and comprehensive scope of the term. There are many original definitions in the scientific literature; unfortunately, a significant portion of these does not exhaust the broad area to which the term "water restoration" refers.

As recommended by world-class experts from the Committee on Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy Water Science and Technology Board Commission on Geosciences, Environment, and Resources National Research Council, USA and US-EPA, the full definition of "water restoration" or "water reservoir restoration" includes:

Restoring all functions of the aquatic environment to the condition that prevailed in the given reservoir before its disturbance, which concerns physico-chemical parameters and biological water ecosystems (National Research Council, 1992).

Restoration should not be confused with purification, with creation of new forms of water habitats, or with improving water quality. Knowing the condition of the reservoir before the changes introduced by human activity, it may be necessary to carry out additional activities such as the reintroduction of species that had inhabited it previously, and withdrew from the habitat as a result of anthropogenic changes. The use of individual methods to improve selected parameters is usually insufficient for effecting the restoration of such a reservoir (National Research Council, 1992). The restoration process should take into account restoring the full trophic network, including the key species in the changed aquatic ecosystem. Partial actions typically tend to lead to such an ecosystem's continuing to function in a distorted form. The restoration process is aimed at "repairing" environmental damage with regard to restoring the appropriate degree of reproduction of renewable resources that were originally occurring therein (Spencer, 1985). It aims to restore the structure and function of these ecosystems in the aquatic environment (Naiman, 1988). Restoration is therefore holistic in character. Its goal is to achieve a close-to-natural state of the aquatic environment. We understand this state as a self-regulating system, closely integrated with the ecological landscape in which it is located (National Research Council, 1992).

Therefore, the restoration of a close-to-original state for the characteristic resources of renewable water ecosystems requires the application of an appropriate algorithm of operation.

An example of the algorithm of processes aimed at obtaining the proper restoration effect follows:
1. restoring the original hydrological and morphological conditions of the water reservoir,
2. application of chemical, mechanical and/or biological purification methods (for instance, bio-manipulation, or revitalization),
3. reintroduction of native species of aquatic organisms (plant and animal).

Before the restoration process can take place, it is extremely important to determine the initial state (original condition), to which this process should lead. In order to establish the algorithm of activities, a team of experts should be appointed, specialising in the management of water environment, who will correctly determine corrective actions, leading to the ultimate success. Developing a new quality of water environment in water reservoirs, different from their original state, is also *not* a part of the restoration process. If initially such a reservoir was silted and the waters were characterized by an elevated trophic level, or contained, for example, humic compounds, then the ultimate goal (end point) in its reclamation is to obtain an analogous state – rather than desilting the reservoir and reducing the level of trophic waters (Environmental Protection Agency, 1990).

In many cases, it is impossible to restore the original state of the water environment that occurred before the anthropogenic changes. This results from the irreversibility of morphometric changes in the landscape, reservoir morphology, microclimate, progressive industrialization, and so forth. Bearing in mind the above considerations, the process of water restoration should be focused on obtaining similar conditions in the changed area. Nevertheless, it is not possible to reduce restoration to individual measures or selective treatments aimed at improving water quality, unless its improvement will bring about restoration of the close-to-original state, in which case the reservoir can be considered restored (Lineman et al., 2014).

The most problematic issue is calling repair actions on artificial reservoirs (mainly dam reservoirs) a "restoration", because here we are dealing with a new quality and creation of a new water ecosystem dependent on anthropogenic activity. In the USA, a number of campaigns of dam demolitions and restoration of natural conditions of ice-marginal valleys were undertaken. Scientists and experts are still arguing over whether the actions taken can be included in the meaning of the proper process of restoration of selected sections of ice-marginal valleys (American Rivers, 2014, O'Connor et al., 2015, Magilligan et al., 2016).

The author analysed the implemented treatments – as to whether or not they constitute restoration processes – looking at selected examples of fifteen lakes. These reservoirs belonged to various categories of lakes, differentiated due to their size, depth, as well as other hydro-morphological conditions (see: Table 1).

Table 1. Morphometric characteristics and mixing types of selected degraded lakes and water reservoirs subjected to restoration or improvement processes.

No.	Name of the reservoir	Area [ha]	Capacity [hm^3]	Depth [m] mean – maximum	Lake type based on mixing
1	Lake Ełckie	382.4	7.779	15 – 55	dimictic
2	Lake Długie	26.8	1.414	5.3 – 17.3	bradymictic
3	Lake Siekiera	12	0.344	3 – 6	polymictic
4	Cierpisz	2.3	0.022	0.9 – 1.5	polymictic
5	Kamionka	7	0.105	1.5 – 3	polymictic
6	Finjasjön	1100	–	3 – 15	polymictic
7	Lake Wolsztyńskie	124	2.522	4.2 – 3.3	polymictic
8	Lake Jelonek	14.4	0.172	12 – 2.4	polymictic
9	Lake Głęboczek	17.4	–	3.3 – 5	polymictic
10	Round Lake	16.2	–	2.9 – 10.5	dimictic
11	Lake Søga˚rd	26	–	1.6	polymictic
12	Lake Tegel	306	–	7.6 – 16	dimictic
13	Lake Schlachtensee	42	–	4.7 – 9	polymictic
14	Lake Sønderby	8	–	2.8 – 5.7	polymictic
15	Lake Arresø	4000	–	3.1 – 5.9	polymictic

All water reservoirs studied were characterized by significant disturbances in the quality of water and in the functioning of inland ecosystems. In all, corrective measures were taken in order to improve selected qualitative and structural parameters (see: Table 2).

Table 2. Evaluation of the restoration process of the analysed reservoirs in the aspect of the activities carried out, and the final effect in accordance with the restoration criterion.

No.	The origin and nature of reservoir's transformations	Degree of contamination and trophic condition of the water	Undertaken remedial processes	End result of the improvements	Compliance with the restoration process z	Completeness of the studied parameters	Suggested correct title of the paper	References
1	Morphometric parameters close to the original ones, with changes of anthropogenic character.	Hypertrophy of water, and a decrease in water transparency.	Chemical inactivation of phosphorus, oxygenation without de-esterification.	Improvement of transparency, increase of oxygen concentration in oxygen profile, reduction of water trophism.	The reservoir reclamation effect has not been obtained despite the fact that the applied methods are used in the reclamation process.	The monitoring study was based on selective studies that did not provide the opportunity to assess the reclamation effect.	Efekty redegradacji Jeziora Ełckiego metodą sztucznego napowietrzania i chemicznej dezaktywacji fosforu. (Re-degradation effects of the Ełckie Lake by artificial aeration and chemical deactivation of phosphorus)	Bańkowska, A. 2008.
2	It was created as a result of natural processes – significant anthropogenic changes.	Mesotrophic waters.	Chemical inactivation of phosphorus.	Lowered water trophism, increased plankton biodiversity, increased water transparency.	Despite significant changes in terms of lake re-degradation – there is lack of information as to the restoration of the quality of the aquatic environment close to its original state.	Studying the species composition of indicator organisms in order to assess water trophism; lack of detailed information on biogenic nutrient changes.	Ocena zastosowania procesu inaktywacji fosforu na trofię jeziora śródmiejskiego. (Evaluating the application of the phosphorus inactivation process, and its impact on the trophism of a mid-town lake.)	Paturej, 2008.
3	Glacial lake – with visible anthropogenic changes.	Hypertrophy of waters; and hypertrophy of the *Ceratophyllum*	Inactivation of phosphorus in sediments; covering the sediments with a layer of sand; reconstruction of the shoreline; removing macrophyte biomass.	Slight decrease in the ESMI indicator, reduction of water trophism, reduction of organic suspensions.	Treatments had a positive effect on the improvement of water quality and thinning of macrophyte biomass; reduction of water trophism.	Improvement of water quality and modifications of the reservoir's morphology brought about a new, better quality for the reservoir – however, this does not correspond to the principle of restoration.	Rewitalizacja jeziora Siekiera. Zmiany jakości wody i osadów dennych w okresie 2014–2016 r. (Revitalization of lake Siekiera. Changes in the quality of water and bottom sediments in the period 2014–2016.)	Bryl et al., 2017.

4	Artificial – dam-type reservoir.	Hypertrophy of water, and a decrease in water transparency	Mechanical desilting, removal of bottom sediments.	No visible improvement effects.	No information about obtaining the restoration effect (it is not possible to restore/reclaim an artificial reservoir).	Selective monitoring testing of physico-chemical parameters of waters, and biomonitoring based on the use of indicator organisms for the eutrophication process.	Analiza skuteczności odmulania zbiorników wodnych Cierpisz i Kamionka jako efektywnej metody rewitalizacji ekosystemów eutroficznych. (Analysis of desilting effectiveness in Cierpisz and Kamionka water reservoirs as an effective method of revitalising eutrophic ecosystems).	Bartoszek et al., 2017.
5	Artificial – dam-type reservoir.	Mesotrophic waters	Mechanical desilting, removal of bottom sediments.	No visible improvement effects.	No information about obtaining the reclamation effect (it is not possible to reclaim the artificial reservoir).	Selective monitoring of physico-chemical parameters of waters and biomonitoring based on the use of indicator organisms for the eutrophication process.	Analiza skuteczności odmulania zbiorników wodnych Cierpisz i Kamionka jako efektywnej metody rewitalizacji ekosystemów eutroficznych. (Analysis of desilting effectiveness in Cierpisz and Kamionka water reservoirs as an effective method of revitalising eutrophic ecosystems).	Bartoszek et al., 2017.
6	Morpho-metric parameters close to the original ones, with anthropo-genic changes.	Hypertrophy of water, and a decrease in water transparency, significant amount of bottom sediments, disturbances in the food chain.	1st stage – dredging, 2nd stage –biomani-pulation, 3rd stage – construction of a buffer zone: artificial marshland.	Achieved improvement of visibility, reduction of biogenic nutrients- (mainly phosphorus); however, disturbances remain in the structure of trophic networks.	Partial improvement in the physical and chemical parameters of waters. Slight improvement in the biological parameters of the aquatic environment. This does not represent a complete effect of reclamation.	Monitoring tests: physico-chemical and biological.	Multiple techniques for lake reclamation.	Annadotter et al., 1999.

7	Morpho-metric parameters close to the original ones, with anthropo-genic changes.	Hypertrophy of water, and a decrease in water transparency, significant amount of bottom sediments, disturbances in the food chain.	Phosphorus inactivation in the sediments.	Lowering phosphorus content and water trophism, increasing water transparency, reducing chlorophyll concentration.	Partial improvement in water quality parameters. The effect of full reclamation has not been demonstrated.	Selected phosphorus content monitoring tests, selective biomonitoring tests.	The title is correct – in the content we find information about the effects of lake reclamation.	Bryl & Wiśniewski, 2015.
8	Morpho-metric parameters close to the original ones, with anthropo-genic changes.	Hypertrophy of water as well as significant amount of bottom sediments.	Phosphorus inactivation in sediments.	Lowering phosphorus content and water trophism, increasing water transparency, reducing chlorophyll concentration.	Significant improvement in water quality parameters.	Selected phosphorus content and other physic-chemical parameters monitoring tests, extended biomonitoring tests.	The condition and potential methods of reclamation of shallow, urban Lake Jelonek.	Wiśniewski, 2007.
9	Morpho-metric parameters close to the original ones, with anthropo-genic changes.	Hypertrophy of water, and a decrease in water transparency	Missing information	Seasonal variability of microbio-logical parameters in lake water.	There is no information that would indicate the process of reclamation.	Very selective microbiological tests – no other information.	Jakość wód powierzchniowych na przykładzie Jeziora Głęboczek. (Surface water quality as illustrated with the example of lake Głęboczek).	Traczy-kowski, et al. 2009.
10	Morpho-metric parameters close to the original ones, with anthropo-genic changes.	Hypertrophy of water, and a decrease in water transparency	Biomani-pulation.	Significant improvement of physico-chemical parameters, of water transparency; decreased trophism and stabilization of relations in food chains of the lake ecosystem.	Significant improvement of many parameters of the aquatic environment; however, the full effect characteristic of the reclamation of the reservoir has not been achieved.	Monitoring of selected physico-chemical parameters and advanced research into the biological parameters.	Lake reclamation by biomanipulation Round Lake, Minnesota, the first two years.	Wright, 1984.
11	Morphometric parameters close to the original ones, with anthropogenic changes.	Hypertrophy of water, and a decrease in water transparency	Biomani-pulation.	Improvement of transparency, reduction of water trophism, disturbances in the food chain.	Improvement of selected physico-chemical parameters of water has been shown; however, the effect of water reservoir reclamation was not obtained.	Monitoring of selected physico-chemical parameters and biomonitoring of the lake macro-fauna.	Biomanipulating streams: a supplementary tool in lake rehabilitation	Skov et al., 2019.

12	Morphometric parameters close to the original ones, with anthropogenic changes.	Hypertrophy of water, and a decrease in water transparency	Stage 1 – construction of a treatment plant to reduce phosphorus content at the lake's inlet. Stage 2 – aeration and chemical inactivation of phosphorus.	. Significant reduction of phosphorus load in the water and in sediments.	The reduction of phosphorus load was demonstrated, without describing other qualitative parameters of the lake's waters; the obtained effect does not meet the criterion of the reclamation process.	Monitoring of chemical parameters – phosphorus concentration.	Assessment of internal and external lake treatment measures for two Berlin lakes.	Schauser & Chorus, 2007.
13	Morphometric parameters close to the original ones, with anthropogenic changes.	Hypertrophy of water, and a decrease in water transparency	Stage 1: construction of a treatment plant to reduce phosphorus on the impact to the lake. Stage 2: water exchange to lower the phosphorus charge.	Significant reduction of phosphorus load in the water and in sediments.	The reduction of phosphorus load was demonstrated, without describing other qualitative parameters of the lake's waters; the obtained effect does not meet the criterion of the reclamation process.	Monitoring of chemical parameters - phosphorus concentration	Assessment of internal and external lake treatment measures for two Berlin lakes.	Schauser & Chorus, 2007.
14	Morphometric parameters close to the original ones, with anthropogenic changes.	Hypertrophy of water, and a decrease in water transparency	Phosphorus inactivation in sediments.	Significant reduction of phosphorus load in the water.	The reduction of phosphorus load and improved water transparency were demonstrated; the obtained effect does not meet the criterion of the reclamation process.	Physico-chemical monitoring of water and bottom sediments.	Lake reclamation by dosing aluminum relative to mobile phosphorus in the sediment.	Reitzel et al., 2005.
15	Morphometric parameters close to the original ones, with anthropogenic changes.	Hypertrophy of water, and a decrease in water transparency	Biomani-pulation (up to down).	Significant reduction of phosphorus load in the water, improved water transparency.	The reduction of phosphorus load and improved water transparency were demonstrated, as well as decreased degree of eutrophication; the obtained effect does not meet the criterion of the reclamation process.	Monitoring of physico-chemical parameters as well as selected biological parameters.	Reclamation of shallow lakes by nutrient control and biomanipulation - the successful strategy varies with lake size and climate.	Jeppesen et al., 2007.

Original titles of the papers containing the results of monitoring works on the improvement of degraded lakes and reservoirs (from Table 2) are as follows:

1. Efekty rekultywacji Jeziora Ełckiego metodą sztucznego napowietrzania i chemicznej dezaktywacji fosforu. (Lake Ełckie restoration effects with application of artificial aeration and chemical phosphorus deactivation methods)
2. Wpływ Rekultywacji na Trofię Jeziora Śródmiejskiego (The impact of Lake Śródmiejskie restoration processes on the trophy of water)
3. Rekultywacja Jeziora Siekiera. Zmiany jakości wody i osadów dennych w okresie 2014-2016 r. (Lake Siekiera restoration. The changes in water and bottom sediments quality in period of 2014 – 2016)
4. Analiza skuteczności odmulania zbiorników wodnych Cierpisz i Kamionka jako efektywnej metody rekultywacji ekosystemów eutroficznych. (Analysis of the effectiveness of desolation of water reservoirs Cierpisz and Kamionka as an effective method of restoration of eutrophic ecosystems).
5. Analiza skuteczności odmulania zbiorników wodnych Cierpisz i Kamionka jako efektywnej metody rekultywacji ekosystemów eutroficznych. (Analysis of the effectiveness of desolation of water reservoirs Cierpisz and Kamionka as an effective method of restoration of eutrophic ecosystems).
6. Multiple techniques for lake restoration.
7. Efekty inaktywacji fosforu w osadach dennych jeziora Wolsztyńskiego.(The effects of phosphorus inactivation in bottom sediments of Lake Wolsztyńskie)
8. The condition and potential methods of restoration of shallow, urban Lake Jelonek.
9. Jakość wód powierzchniowych po rekultywacji na przykładzie Jeziora Głęboczek. (The quality of surface water after restoration on the example of Lake Głęboczek)
10. Lake restoration by biomanipulation: Round Lake, Minnesota, the first two years.
11. Biomanipulating streams: a supplementary tool in lake restoration.
12. Assessment of internal and external lake restoration measures for two Berlin lakes.
13. Assessment of internal and external lake restoration measures for two Berlin lakes.
14. Lake restoration by dosing aluminum relative to mobile phosphorus in the sediment.
15. Restoration of shallow lakes by nutrient control and biomanipulation—the successful strategy varies with lake size and climate.

In all of the analysed papers, the authors failed to show the complete effect of reclamation, in line with the definition presented by a team of experts (National Research Council, 1992). All articles provide valuable information on the effectiveness of selected methods – which are applicable also in water restoration – having said that, these operations were directed at improving only specific quality parameters and structural parameters of the water bodies. All the water reservoirs described in the examined papers have specific functions – either utility, recreational, retention, drinking water intake, or others (Wright, 1984; Annadotter et al., 1999; Wiśniewski, 2007; Schauser and Chorus, 2007; Paturej, 2007; Bryl et al., 2017). Some of these are dammed reservoirs, created as a result of purposeful human activity, also for utility purposes (Bartoszek et al., 2017). None of the scientific reports provided information on the original state of the reservoir before the occurrence of distortions resulting from anthropogenic stress. The activities carried out were aimed at improving the aesthetic parameters of these reservoirs and restoring adequate water quality (Bańkowska, 2008, Traczykowski et al., 2009, Bryl and Wiśniewski, 2015, Skov et al., 2019). In other papers, including review papers, erroneous phrases suggesting a restoration process are often cited when in fact it did not take place (Funk and Gibbons, 1979; Zhao et al., 2003; Jeppesen et al., 2005; Berleć et al. 2009).

Therefore, one should ask a key question whether improvement actions are possible, which will result in the effect of full restoration of the water reservoir?

In many cases, even at the stage of planning improvement processes in degraded lakes and other water reservoirs, the restoration process should be clearly excluded. This category includes all kinds of artificial reservoirs, and reservoirs adapted to the needs of the local community or tourism in regions with specific, unique natural or cultural values. Improving the proper quality of water and the proper functioning of aquatic ecosystems does not yet lead restoring the original condition. Dam reservoirs constitute a new quality, and the ecosystems formed therein are secondary creations – therefore any restoration would imply necessity to restore the ice-marginal valley to its primary functions and to eliminate the dam, which is impossible. The dam itself stops the continuity of the bed load transport process, and it changes the hydrological and microclimatic conditions of the region in which the reservoir of this type is located (Mazur et al., 2016, Hämmerling et al., 2019). Also, the remaining reservoirs with specific functions made available, in many cases cannot be restored to the original state, due to local, cultural, industrial, or other considerations. At most, it is possible to implement effective purification or purge processes in order to obtain good quality water, or to improve conditions for sailing and other recreational activities.

The word "restoration" has become a fashionable term, whereas projects in the field of water reservoir renewal have become very profitable business for companies who specialise in this area (Bernhardt et al., 2005). These operations can be classified as revitalization, which according to the definition "is a process of reverting the critical condition of degraded areas, conducted in a comprehensive manner, through integrated activities for the benefit of the local community, space, and economy, territorially focused, carried out by stakeholders of revitalization based on the municipal revitalization program." (Journal of Laws, 2015, item 1777). According to this provision, most of the activities carried out in the field of water quality improvement can also be considered parts of the revitalization process. In the Environmental Protection Law you can also find the term "remediation", which according to that same Law "means submitting the soil, ground and groundwater to activities aimed at removing or reducing the amount of substances causing risk, controlling these substances and limiting their spread, so that the contaminated area ceases to pose threat to human health or the natural environment, taking into account the current and, if possible, future use of the area; remediation may involve self-purification if it brings the greatest environmental benefits". (Journal of Laws 2018, item 799). Some of the water treatment activities in reservoirs can also be described as a process of "remediation" or "bioremediation", replacing the inappropriately used term of "restoration" (Polish: "reklamacja").

In the industry-specific jargon, the term "restoration" is commonly used and understood as a synonym for all processes such as purification, water renewal, desilting, creation of new lake utility structures, and so forth.

In the literature of the subject, we also find examples of reservoirs that had been subjected to restoration processes, in which the correct effect of restoring a degraded lake was obtained (Olem and Flock, 1990, National Research Council, 1992). The most common cases of this are found in protected areas, where the reservoir cannot be used for recreational or industrial purposes. In these reservoirs, comprehensive processes are conducted aimed at restoring the original water quality, at restoring the disturbed primary structures of the food chain, and reintroducing species that existed there before these reservoirs' degradation.

In the Water Law in Poland, a new provision was introduced, stating that selected activities within water reservoirs require water permits (Journal of Laws of 2017, item 1566, Filipek et al., 2018). Such activities include the restoration of surface waters or groundwater. Companies and other legal entities wanting to treat the given reservoir must, therefore, obtain the necessary permits. Many companies, in order to shorten the time of waiting for appropriate permits and be able to carry out repair activities in reservoirs, opt for naming their services in another way, for instance, as re-degradation, water renewal or water treatment. Under Polish law, these types of operations do not require additional permits, therefore, in legal interpretation they are not identical to water restoration. Paradoxically, the aforementioned legal provision has contributed to reducing the abuse of the term "restoration" in various remedial actions in water reservoirs, although this was not the main intention behind it.

CONCLUSIONS

1. According to the definition of "water restoration" adopted by world-class experts, this term is reserved for processes aiming at the complete restoration of the water reservoir to its original state, which had been formed during its initial succession.
2. In many scientific articles and industry reports, this term is equated with other, selective corrective actions, designed to improve only some of the

water parameters or the structure of the aquatic environment.
3. The term "water restoration" is undoubtedly misused, abused, or incorrectly applied, to corrective actions carried out in a narrow scope.
4. Water Law in Poland introduced changes that have had a positive impact on reducing the abuse of the term in question.
5. The misuse of words commonplace in industrial jargon causes information noise, and has a negative transfer effect in the wrong understanding of this wording by people who acquire specialized vocabulary (including secondary school and university students).
6. Researchers and experts must pay special attention to the proper naming of water rehabilitation activities.

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REKULTYWACJA JEZIOR: ANALIZA BŁĘDNIE ZASTOSOWANEJ TERMINOLOGII W LITERATURZE FACHOWEJ

ABSTRAKT

Cel badań
Główny celem badań była analiza błędnie zastosowanego sformułowania „rekultywacja wód" oraz „rekultywacja zbiorników wodnych", w odniesieniu do błędów, których należy unikać w opisywaniu procesów związanych z odnową wód powierzchniowych.

Materiał i metody
Jest to praca przeglądowa bazująca na pracach naukowych oraz raportach branżowych w tematyce rekultywacji oraz odnowy wód powierzchniowych i zdegradowanych zbiornikach wodnych. Autor przeprowadził analizę błędnie zastosowanych sformułowań oraz zaproponował poprawną formę nazewnictwa w odniesieniu do opisywanych działań naprawczych.

Wyniki i wnioski
Wyniki analiz wskazują dobitnie, że autorzy wielokrotnie błędnie urzywają sformułowania rekultywacja wód w swoich artykułach. W literaturze naukowej oraz branżowej sformułowanie „rekultywacja wód" jest nadużywane pomimo rekomendacji światowej klasy ekspertów z Committee on Restoration of Aquatic Ecosystems in USA, którzy przedstawili w swoich raportach definicję sformułowania rekutywacja wód.

Słowa kluczowe: rekultywacja wód, rekultywacja zbiorników wodnych, odnowa wód powierzchniowych, zanieczyszczenia wodne