ARTYKUŁY INFORMACYJNE

Reclamation of severely degraded shallow lakes by sediment removal

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S t r e s z c z e n i e. Istotnym problem współczesnej limnologii jest oddziaływanie osadów dennych na stan troficzny jezior. Jedna z metod rekultywacji jezior eutroficznych polega na mechanicznym usuwaniu osadów dennych wzbogaconych w fosfor i materię organiczną. Celem pracy jest ocena skuteczności rekultywacji jezior metodą usuwania ich osadów dennych na podstawie analizy czterech przedsięwzięć zrealizowanych w jeziorach usytuowanych w różnych regionach Eurazji. Skuteczność metody oceniono poprzez porównanie wskaźników fizykochemicznych wód przed i po przeprowadzeniu rekultywacji.
Analiza wykazała, że usuwanie osadów dennych nie gwarantuje trwałej poprawy stanu troficznego jezior, a skuteczność tej metody zależy od spełnienia wielu warunków środowiskowych i technicznych. W części analizowanych jezior odnotowano poprawę jakości wód, natomiast w pozostałych efekty rekultywacji były ograniczone lub nie wystąpiły z powodu utrzymującego się dużego dopływu związków biogennych ze zlewni oraz wtórnego uwalniania fosforu wskutek niepełnego usunięcia zanieczyszczonej warstwy osadów. Wyniki wskazują, że warunkiem skuteczności tej metody jest wcześniejsze ograniczenie zewnętrznego obciążenia biogenami, należyte rozpoznanie właściwości osadów oraz dobór odpowiedniej technologii. Usuwanie osadów dennych nie powinno być traktowane jak uniwersalna metoda rekultywacji jezior eutroficznych. Zastosowanie tej metody wymaga indywidualnej oceny przewidywanych korzyści oraz potencjalnych zagrożeń dla zbiornika wodnego.

Słowa kluczowe: *obciążenie wewnętrzne, substancje biogenne, osady denne, rekultywacja, jezioro*

Anthropogenic activity causes water pollution by introducing various substances, wastes and pathogenic organisms into water bodies (Simpson *et al.,* 2017). The most common types of pollutants are oxygen-demanding organic compounds and toxic inorganic substances (Joniak *et al.,* 2013). The concentration level of biogenic elements is the main indicator of the condition of lake ecosystems.

Eutrophication of water bodies is caused by a combination of external inputs from the catchment area and internal biogenic processes occurring within the water body itself. External inputs include point and diffuse sources of substances. Point sources are associated with the discharge of industrial, municipal and agricultural wastewater into watercourses or directly into the water body. Diffuse inputs are formed as a result of surface runoff from the catchment area, which transports chemical compounds from soils, as well as suspended and dissolved substances washed off by rainfall and snowmelt waters. Eliminating point and non-point pollution sources is often insufficient to return a lake to good ecological status. In many cases, this can only be achieved through reclamation measures (Grochowska *et al.,* 2017).

The condition of some lakes is so critical that, even after the cessation of external pollutant inputs, they continue to be supplied with nutrients stored in the sediments due to internal load (Gawrońska *et al.,* 2003). The potential for internal phosphorus loading depends on the presence of specific phosphorus fractions in sediments and on environmental conditions that promote their release into the water column. The trophic status of a lake is the principal factor controlling phosphorus release from sediments. Anaerobic conditions, which develope in the near-bottom water layer, cause a sharp decline in redox potential, facilitating the release of phosphorus bound to metal compounds, particularly iron oxyhydroxides (Kleeberg *et al.,* 2013).

Shallow lakes are particularly susceptible to eutrophication and vulnerable to internal load because nutrients that accumulated in their sediments exert a much stronger influence on water quality than in deeper lakes (Granéli, 1999; Scheffer, 2004). In shallow, polymictic lakes, rapid short-term changes in oxygen conditions occur, including transient stratification, turbulent mixing, and intensified water exchange (Xie, 2006). Even low wind speeds can substantially resuspend bottom sediments in such lakes (Håkanson, 2004).

To counteract these adverse changes, various reclamation techniques have been developed. These methods aim to reduce the occurrence of anoxic conditions near the bottom, increase the redox potential at the water-sediment interface, and promote the precipitation and immobilization of phosphorus in sediments (Lossow, Gawrońska, 2000).

The selection of an appropriate lake-restoration method must be preceded by a detailed study of the aquatic ecosystem, including both the water column and bottom sediments. Frequently, the most effective outcomes are achieved through the integration of several complementary approaches (Zamparas *et al.,* 2014; Tammeorg *et al.,* 2023).

Sediment removal is a radical yet highly effective restoration technique for shallow, severely degraded reservoirs

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(Ripl, 1976a, b; Zamparas *et al.,* 2014; Grochowska *et al.,* 2021). However, it is used infrequently because of its extremely high cost and substantial technical challenges. The significant financial investment required underscores the need for a thorough assessment of ecosystem responses to sediment extraction in order to understand the recovery processes of the water body and to create the conditions necessary for achieving the desired ecological effect.

MATERIALS AND METHODS

A literature review covering scientific publications from the past 50 years was conducted using search-engine resources and the keywords listed above. For this analysis, only studies containing solid experimental or practical evidence concerning the use of sediment-removal techniques for the restoration of small, severely degraded lakes were included. The aim of this study is to compare the degrees of water-quality improvement achieved through sediment-removal methods and to synthesis existing literature on the feasibility, drivers, prevalence, ecological consequences, and effectiveness of this technical reclamation approach.

LAKE SEDIMENTS

Lake sediments consist of allochthonous and autochthonous material. Allochthonous material originates outside the lake and is transported by rivers, streams, runoff, wind or groundwater. It includes fluvial or aeolian clastic particles, soluble salts, macrofossils, plant detritus, pollen and charcoal. Autochthonous material forms within the lake through biogenic processes and also includes inorganic precipitates forming in the water column (Bradley, 2015). Excessive sediment accumulation reduces lake volume and depth, limiting the suitability of water bodies for various uses. Given the rapid rate of sediment accumulation – especially in small water bodies – periodic sediment removal is required (Maj, Koszelnik, 2016; Mazur *et al.,* 2021).

The rate of sediment-layer growth depends on lake productivity, catchment inputs, and the efficiency of mineralization within the lake ecosystem. Undisturbed lakes in formerly glacial regions displayed the highest productivity and sedimentation rates during the early stages of their evolution (Digerfeldt, 1972; Digerfeldt, Håkansson, 1993). If a lake is polluted by nutrient-rich wastewater, the balance between production and mineralization is disrupted, organic matter accumulates, and sedimentation rates can increase to approximately 10 mm per year. Thus, the ageing rate of a shallow lake may increase several-fold, as the internal nutrient load from accumulated sediments adds to the enhanced external load from the catchment (Björk, 1972). The interactions between bottom sediments and the overlying water are complex and multifaceted, and remain insufficiently understood despite extensive research.

Phosphorus accumulates in lakes in both particulate and dissolved forms. Particulate phosphorus is deposited in sediments, whereas dissolved phosphorus is incorporated into organic matter and later settles to the bottom. Sedimentation occurs through co-precipitation with calcium carbonate, the formation of iron hydroxides, or adsorption onto iron hydroxides. Once deposited, phosphorus participates in biological and chemical processes and is ultimately stored in bottom sediments. It may be released back into the water column via interstitial water fluxes. Suspended phosphorus-rich material that settles to the sediment surface undergoes diagenetic transformations; some of them return phosphorus to the water, while the rest becomes permanently buried. Phosphorus–iron compounds are unstable due to the variable valence of iron (Jansson, 1987; Roden, Edmonds, 1997). Under anaerobic conditions, iron is reduced, causing the release of phosphate into the overlying water. The quantity of phosphorus released depends on temperature, pH, dissolved oxygen, redox conditions, resuspension processes, and sediment structure (Golterman, 2004; Kleeberg *et al.,* 2013).

SEDIMENT-REMOVAL METHODS

Limnological planning of lake restoration must describe in detail the measures required to achieve agreed objectives. Because every ecosystem has its own characteristics, restoration plans must be tailored to the specific lake and ideally developed jointly with the engineering company responsible for implementation. Each plan should provide a detailed description of the technical procedures, cost estimates, and the monitoring program necessary for evaluating restoration effectiveness. It should also include predictions of post-restoration lake development and a long-term monitoring scheme for assessing environmental conditions. Both positive and negative outcomes must be reported (Björk *et al.,* 2010).

Removal of nutrient-rich sediments is considered the most radical and effective restoration method for eutrophic lakes. For several reasons, this approach should be applied only in shallow lakes suffering from substantial sediment accumulation (Björk *et al.,* 2010). Furthermore, due to the potential presence of toxic substances, a rigorous risk assessment is required before sediment disposal or reuse (Jeppesen *et al.,* 2009). Sediment extraction may be conducted using mechanical or hydromechanical methods.

Mechanical Extraction

Mechanical methods involve the use of heavy equipment-bulldozers, excavators and draglines. These machines remove sediment from the lakebed and transfer it to the shore or into designated containers, barges or trucks. Dredging consists of four stages: excavation, lifting, transport and disposal of sediments (Rajan *et al.*, 2014). Mechanical dredging employs buckets mounted on chains for excavation and transport (Jain, Singh, 2003).

Mechanical dredgers remove lake-bottom deposits using buckets or grabs (Airboat and Marsh Excavator Service, 2016). Common types include bucket-ladder dredgers, grab dredgers, and backhoe dredgers. Bucket-ladder dredgers collect sediments using a continuous chain of buckets and add very little water to the removed material. Backhoe dredgers excavate bottom material with a bucket, while grab dredgers operate using a rotating crane mounted on a vessel.

Dredging is widely used to remove nutrient-rich sediments from lakes and other water bodies to reduce internal nutrient recycling (N and P). It is considered an effective method for improving water quality in eutrophic lakes and reducing pollutant concentrations, particularly endogenous nutrients and heavy metals (Reddy *et al.,* 2007; James, Pollman, 2011; Wen *et al.,* 2020). However, Jeppesen *et al.* (2009) and Bormans *et al.* (2016) note that dredging can resuspend sediments and release toxic substances into the overlying water. Extracted sediments may contain toxic compounds and heavy metals and must therefore be transported and stored in a way that prevents environmental contamination.

Hydraulic Extraction

Hydraulic methods remove sediments using suction pumps that extract slurry of water and sediment, which is then transported to the shore via floating pipelines. Hydraulic dredgers include submersible dredgers, cutter-suction dredgers, and trailing suction hopper dredgers (Airboat and Marsh Excavator Service, 2016).

A suction dredger uses a vertical suction pipe to extract and transport sediments through a pipeline. Cutter-suction dredgers are equipped with rotating cutters or teeth that loosen compacted sediments.

Trailing suction hopper dredgers use centrifugal pumps, cutter heads, and water jets to disintegrate and transport sediments as slurry (Western Dredging Association, 2018).

Contractors often emphasize the high pumping capacity of hydraulic dredgers as a competitive advantage. However, this is not a decisive factor; in fact, high capacity is often a disadvantage for this type of restoration. What truly matters is the precision with which a strictly defined sediment layer can be removed. The limnological objective of dredging-based restoration is the selective removal of contaminated sediments responsible for internal nutrient loading (Björk *et al.,* 2010).

In designing a sediment-removal project, the spatial distribution of nutrients, organic pollutants, toxic compounds, and heavy metals must be thoroughly investigated. Knowledge of sediment composition enables identification of the exact sediment layer that must be removed to achieve a measurable ecological improvement. Additionally, the concentration of toxic substances must be known, as sediment excessively enriched with such compounds must be disposed of properly (Grochowska, Augustyniak, 2023).

Various treatment methods may be applied to extracted sediments prior to reuse or disposal, including biosludge processing, composting, chelation, oxidation, incineration and pyrolysis (Reis *et al.,* 2007).

COMPARISON OF THE EFFECTS OF SHALLOW LAKE RESTORATION BY REMOVING BOTTOM SEDIMENTS OUTSIDE THE WATER CATCHMENT AREA

Lake Trummen, Sweden

Lake Trummen was the first demonstration project in which lake restoration was carried out through large-scale sediment removal. A special dredging nozzle was developed specifically for this project to minimize turbidity during the operation.

Lake Trummen (56°51'40"N, 14°49'45"E) is located in the city of Växjö in south-central Sweden. In 1970, its surface area was approximately 1 km^2 and the maximum depth was around 2 m. Until 1957–1958, the lake received municipal wastewater. Between 1941 and 1957, it also received effluent from a flax-processing plant. In 1957, the municipality prohibited all municipal and industrial discharges into the lake. However, despite these measures, the lake was unable to recover naturally in the following years. Even 10 years after the cessation of wastewater inputs, summer water transparency remained only 15–20 cm (Björk *et al.,* 2010).

Studies showed that the sediment accumulation rate in pristine oligotrophic Lake Trummen ranged from 0.2 to 0.4 mm per year. Due to extremely high nutrient loading during the period of wastewater inflow, this rate increased to 8 mm per year (Digerfeldt, 1972). During the 1960s, the sediment column in Lake Trummen exhibited a distinct stratification: a brown, well-consolidated gyttja layer overlain by 20–50 cm of loose black sediment (Björk, Digerfeldt, 1965). The irreversibility of the lake's degradation was attributed to this upper layer, from which nutrients were continuously released (Bengtsson, Fleischer, 1971; Bengtsson *et al.,* 1975). Plankton accumulated within this layer after each growing season, contributing further to internal nutrient loading.

In 1970, approximately 0.5 m of the upper sediment was removed using suction dredging and an additional 0.5 m was removed in 1971 (Björk *et al.,* 2010). The extracted sediments were pumped into simple settling ponds constructed on abandoned agricultural land, where the topsoil had been removed beforehand. Wastewater from the settling ponds – a mixture of lake water and sludge – was treated with aluminum sulfate using a simple precipitation system designed to remove phosphorus and suspended solids. Before restoration, the total phosphorus concentration in lake water was approximately 600 µg/l. After chemical precipitation, the total phosphorus concentration in the discharge from the settling ponds was reduced to about 30 µg/l.

As expected, the changes within the lake were substantial. Concentrations of phosphorus and nitrogen decreased, and water transparency increased significantly (Cronberg, 1982; Fig. 1).

Reclamation induced substantial changes in the ecosystem structure, allowing the lake to return to a functioning state characterized by a renewed balance between production and decomposition (Björk *et al.,* 2010).

The experience accumulated during the sediment-pumping projects of the 1960s and 1970s made it clear to lim-

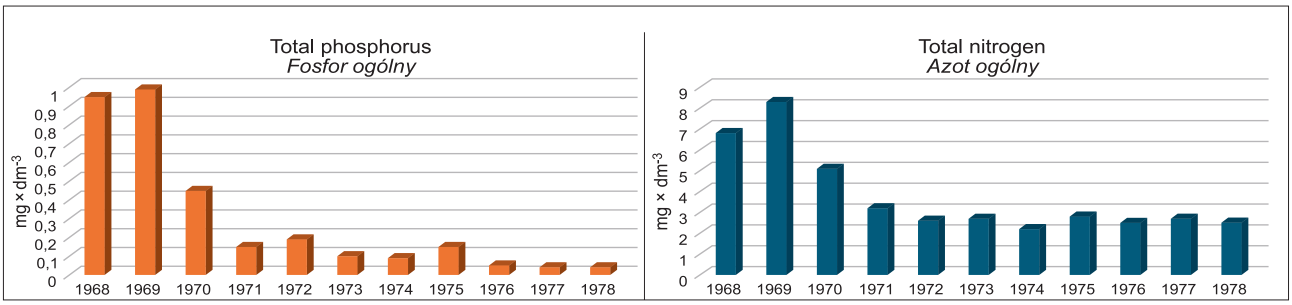

Fig. 1. Maximum concentrations of phosphorus and nitrogen in the water of Lake Trummen, 1968–1978 (Cnorberg, 1982)
Ryc. 1. Maksymalne stężenie fosforu i azotu w wodzie jeziora Trummen w latach 1968–1978 (Cnorberg, 1982)

nologists that the sediment-removal method must satisfy three essential criteria:

– turbidity must not be generated;

– the addition of water to the sediment should not exceed the necessary minimum;

– the sediment–water ratio must remain constant to ensure homogeneous extraction.

In most cases, the nutrient-rich upper sediment layer can be removed without any added water (Björk *et al.,* 2010).

Lake Xuanwu, China

Lake Xuanwu (32°04'13.8"N, 118° 47'32.4"E) is a typical urban shallow lake located in the city of Nanjing, China. The total area of the lake is 5.5 km², of which 3.7 km² is open water. At a water-surface elevation of 10 m, the average water depth is 1.14 m. Since the 1980s, the lake has undergone eutrophication, accompanied by pronounced algal blooms. To prevent further degradation, restoration measures were undertaken that included sediment removal combined with clay flocculation and macrophyte-growth stimulation (Wang, Song, 2025).

The first stage of the project was implemented in 1998, during which approximately 30 cm of sediment was removed from an area of 3.3 km², amounting to a total volume of 87 × 10^4 m³. In 2008–2009, a grab dredger extracted additional 68 × 10^4 m³ of sediment. Subsequent dredging was carried out in the south-eastern part of the lake, with volumes of 3 × 10^4 m³ in 2017, 9.3 × 10^4 m³ in 2018, 9 × 10^4 m³ in 2019, and 14.2 × 10^4 m³ in 2020.

To assess the effects of the restoration measures, a comprehensive monitoring program was conducted before the onset of dredging and throughout all stages of the project. This included routine laboratory analyses of water quality and sediment characteristics in Lake Xuanwu.

The mean annual concentration of total nitrogen (TN) in the water exceeded 4.0 mg/l prior to dredging. It decreased to its lowest level (2.47 mg/l) in 1999 following sediment removal, but increased again to 4.87 mg/l in 2000. The TN concentration in 2000 was higher than in 1997, before dredging and water-diversion efforts. Although the pollutant load entering the lake subsequently decreased and the average TN concentration declined to 1.62 mg/l between 2010 and 2020, it still reached 2.26 mg/l in 2011, exceeding the maximum values observed in 2006–2009.

The mean annual concentration of total phosphorus (TP) was 0.40 mg/l before dredging, decreased to 0.25 mg/l in 1999, and rose again to 0.36 mg/l in 2000 (Fig. 2).

The results of the study showed that bottom sediments were not the main source of pollution in the reservoir, the removal of sediments did not lead to a significant change in the nutrient content of the lake, nor did the heavy metal content in bottom sediments decrease significantly (Wang, Song, 2025).

Lake Mustijärv in Estonia

According to research published in 2020 by Kiani *et al.*, Lake Mustijärv (58°21'55.8"N, 25°32'32.6"E), with a surface area of 1 hectare, became heavily eutrophic in 2015. The free surface area of the lake was only 0.3 hectares, with an average depth of 1.1 m and a maximum depth of 1.6 m. In 2016–2017, the lake was recultivated by removing sediment (on average 1.1 m) to an average depth of 2.2 m and a maximum depth of 3.7 m. In addition, in 2017, the lower part of the lake was expanded by digging a new pit. After the work was completed, the surface area of Lake Mustijärv was 1 hectare, the length was 257 m and the maximum width was 58 m. The removal of approximately 7,500 m^3 of sediment from Lake Mustijärv resulted in the removal of approximately 6,400 kg of total phosphorus from the lake. However, the total phosphorus concentration in the bottom sediments in 2018 was 60% of the 2015 level.

After the technical work was carried out, the total phosphorus concentration and all phosphorus fractions in the sediment of Lake Mustijärv showed significant spatial variation with a downward trend.

In August 2018, the phosphorus concentration in the water was 0.28 mg/l in both the surface layer and the bottom layer of the lake. Some forms of phosphorus in the bottom sediments showed pronounced seasonal fluctuations during 2018. The total phosphorus content in the sediment decreased from June (1,500 mg/kg) to August (1,333 mg/kg), but then increased again from August to October (Kiani *et al.,* 2020; Fig. 3).

In the first years following restoration, substantial anoxia persisted in the surface sediments and in the water layer directly above the lakebed, accompanied by a high phosphorus release via diffusion. After sediment removal, the values of diffusive phosphorus flux remained within the range characteristic of anaerobic release rates in hypertrophic lakes (Nürnberg, 1984; Carter, Dzialowski, 2012). Despite sediment extraction, the lake's trophic status remained high, which was further confirmed by studies of the lake's biotic community. The phosphorus concentration in the surface water layer exceeded 100 µg/l, a threshold commonly used

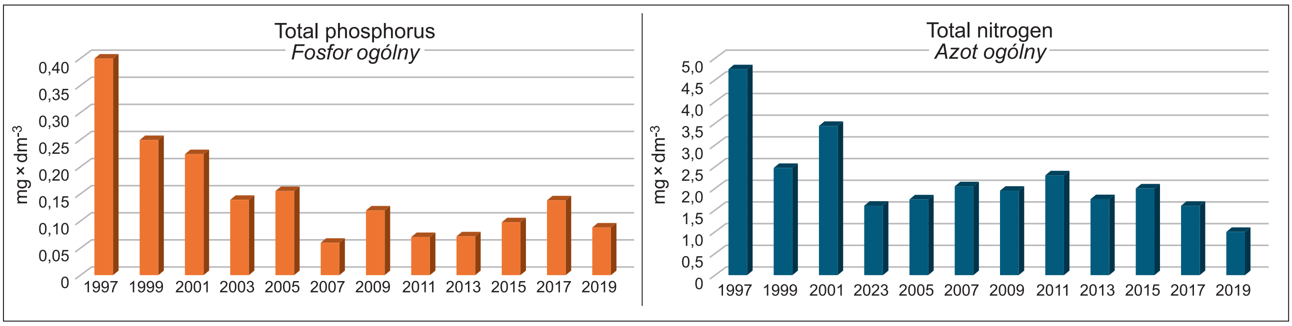

Fig. 2. Total phosphorus and total nitrogen contents in the water of Xuanwu Lake from 1997 to 2020 (Wang, Song, 2025)
Ryc. 2. Stężenie fosforu ogólnego i azotu ogólnego w wodzie jeziora Xuanwu w latach 1997–2020 (Wang, Song, 2025)

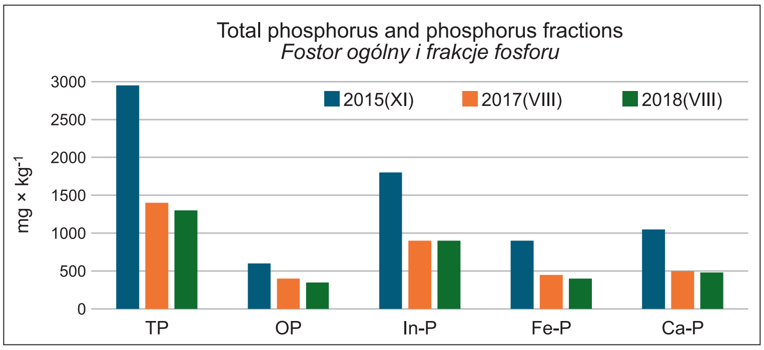

Fig. 3. Concentrations of total phosphorus and phosphorus fractions in the bottom sediments of the central part of Lake Mustijärv in the years 2015–2017 (Kiani *et al.*, 2020)

Ryc. 3. Stężenia fosforu ogólnego oraz frakcji fosforu w osadach dennych centralnej części jeziora Mustijärv w latach 2015–2017 (Kiani i in., 2020)

to distinguish between eutrophic and hypereutrophic lakes (Nürnberg, 1996).

Lake Vajgar, Czech Republic

Lake Vajgar (49°08'38"N, 15°00'41"E) is located in the town of Jindřichův Hradec, Czech Republic. Originally covering an area of 40 ha, it was created for fish production and served as a recreation site for local residents. Beginning in 1795, it also became a recipient of municipal wastewater (Teplý, 1927; Bjork *et al.,* 2010). Until 1965, the fishpond was regularly drained and harvested. Later, due to damage to the main drainage structure and the construction of a small dam separating the Small and Large Vajgar, draining the pond was no longer possible (Björk *et al.,* 2010).

Until 1970, wastewater containing total phosphorus (TP) of 5 mg/l and total nitrogen (TN) of 50 mg/l continued to enter the lake at a rate of 15 l/s. In 1970, a wastewater treatment plant was constructed, treating approximately 10,900 m^3 of water per day to prevent eutrophication. Nevertheless, starting in 1985, dense cyanobacterial blooms developed, accompanied by unpleasant odours from decaying algae. As a result, the pond could no longer be used for recreational purposes, prompting the initiation of restoration measures for Lake Vajgar.

Sediment cores were collected to determine the thickness of the nutrient-enriched layer that required removal. A map of contaminated sediment thickness was then prepared for the entire pond using data from transects spaced 100 m apart and sampling points at 50 m intervals along each transect. Following laboratory analyses of the hydrochemical composition of these samples, the decision was made to remove the upper nutrient-releasing sediment layer.

Sediment pumping began in August 1991. Prior to restoration, the total phosphorus concentration in the water was 333 mg/l. By the end of 1992, approximately 330,000 m^3 of sediment had been removed and transported via pipelines over a distance of about 2.5 km to seven settling ponds, each approximately 1 ha in area and 3–5 m deep (Björk *et al.,* 2010).

In the year following sediment-removal operations, the total phosphorus concentration in the lake initially decreased. However, the capacity of the remaining sediments to bind phosphorus gradually declined starting in 1993. By August 1995, the total phosphorus concentration reached 450 mg/l in the inflow and 495 mg/l in the outflow (Fig. 4). Despite the reduction of internal loading in Lake Vajgar due to sediment removal, external loading remained high. As a result, continuous high inputs of nutrients from the catchment allowed the lake to retain eutrophic characteristics with conditions favourable for extensive cyanobacterial development (Björk *et al.,* 2010).

CONCLUSIONS

The study of four lakes, in which restoration was conducted via sediment removal, made it possible to evaluate the effects of this technical reclamation method on aquatic-ecosystem condition, and to draw several conclusions. To assess the effectiveness of restoration, the trophic-state parameters, measured before and after sediment removal, were compared.

The analysis showed that the application of this method does not always produce the expected outcome. Worsening values of indicators, such as total nitrogen, total phosphorus, and phosphates, demonstrate that sediment extraction may, in some cases, negatively affect water quality.

For successful restoration, several factors must be considered, the most important of which is the initial status of the water body. This method is unsuitable for macrophyte-dominated lakes, where ecological conditions may shift, resulting in substantial deterioration of water quality. Prior to restoration, it is also essential to study the spatial distribution of nutrients and toxic substances within the sediments. Monitoring the spatial distribution of contaminants enables estimation of the thickness of the sediment layers that must be removed to restore the ecosystem.

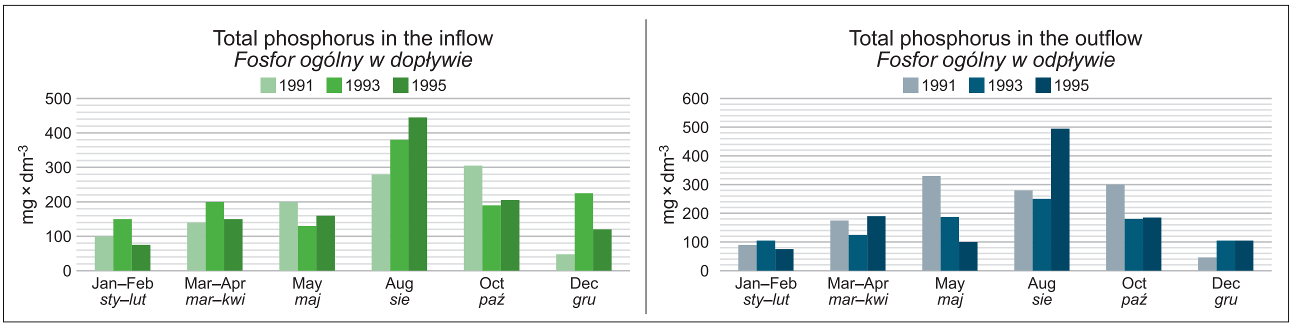

Fig. 4. Seasonal concentration of total phosphorus in the inflow and outflow of Lake Vajgar in 1991, 1993 and 1995 (Björk, 2011)

Ryc. 4. Sezonowe stężenie fosforu ogólnego w dopływie i odpływie jeziora Vajgar w latach 1991, 1993 i 1995 (Björk, 2011)

In some cases – despite reduced internal phosphorus loading achieved through sediment removal – long-term restoration success is hindered by persistently high external nutrient inputs (Björk *et al.,* 2010; Bormans *et al.,* 2016) or insufficient removal of the nutrient-rich surface sediment layer (Liu *et al.,* 2014; Phillips *et al.,* 2015).

A prerequisite for the success of this method is the reduction of external nutrient sources entering the catchment before implementation of the project. According to Björk's findings, the effectiveness of restoration in Sweden's Lake Trummen is attributed to the fact that sediment removal was conducted only after the cessation of wastewater discharge and normalization of external loading. The subsequent ecosystem transformation was driven by changes in geochemical conditions. Reductions in water alkalinity lead to the dissolution of specific rocks and minerals exposed during dredging. The removal of carbonate-rich sediments helps stabilize the macrocomponent composition and facilitates the partial binding and precipitation of humic substances, thereby improving water transparency.

In Mustjärv, Vajgar and Xuanwu, trophic conditions did not improve after sediment extraction because external nutrient loading remained high. Similarly, there are numerous examples worldwide of measures aimed at improving water quality by reducing internal phosphorus loading failing due to excessive external phosphorus inputs (Cooke *et al.,* 2016; Bormans *et al.,* 2016).

An important factor influencing the outcome of reclamation and improving the ecological potential of a water body is also the correct choice of equipment and compliance with the necessary conditions when using hydromechanied technology. This involves preventing water turbidity, removing a certain thickness of bottom sediment layers, and complying with the rules governing the implementation of this technical method. During reclamation, the normal functioning of the lake must not be disrupted.

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