

SEASONAL CHANGES OF SELECTED MORPHOMETRICAL
FEATURES OF EMERGENT MACROPHYTES IN TROPHICALLY
DIFFERENT LAKES

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Abstract. The research was carried out in 1998-1999 in four lakes located in Łęczyńsko-Włodawskie Lakeland: mesotrophic Lake Piaseczno, slightly eutrophic Lake Uściwierz, eutrophic Lake Łukie and hypertrophic Lake Głębokie Uścimowskie. The seasonal changes of selected morphometrical features, biomass and density of 3 species of helophytes (*Typha latifolia*, *Typha angustifolia* and *Schoenoplectus lacustris*) were scrutinized. The investigated features were clearly differentiated in each of these lakes. *Schoenoplectus lacustris* and *Typha latifolia* reached the highest values of examined features in eutrophic Lake Łukie, the lowest in mesotrophic Lake Piaseczno; *Typha angustifolia* – the highest in hypertrophic Lake Głębokie Uścimowskie, the lowest in slightly eutrophic Lake Uściwierz, respectively. In lakes all examined the highest values of features appeared in summer time, the lowest in autumn and early spring.

Key words: helophytes, lake, seasonal changes, morphometry

INTRODUCTION

Macrophytes constitute a crucial element in functioning of all water ecosystems [5, 6, 7]. Some of the lakes of Łęczyńsko-Włodawa Lakeland are subject to recreational activities [1]. Their effect, together with the trophic state of the lake, can sometimes have a significant influence on quantitative and qualitative structure of macrophytes, especially those inhabiting the zone located near the shore. These differences probably are not the same in various seasons of the year.

The aim of this research was to discriminate different morphometrical features, biomass and density of chosen species of helophytes. It also focused on the seasonal changes of examined features in trophically differentiated lakes influ-

enced by recreation. There isn't any information connected with seasonal changes of emergent macrophytes from Łęczyńsko-Włodawskie Lakeland.

INVESTIGATED AREA AND METHODS

The research of emergent macrophytes was carried out in 1998 and 1999 in four trophically different lakes, located in Łęczyńsko-Włodawskie Lakeland. There were mesotrophic Lake Piaseczno, slightly eutrophic Lake Uściwierz, eutrophic Lake Łukie and hypertrophic Lake Głębokie Uścimowskie (Tab.1). Samples were collected in vegetation period from April to October. In each examined lake two sampling sites were chosen. *Typha angustifolia*, *Typha latifolia*, *Schoenoplectus lacustris* inhabited lakes Piaseczno, Uściwierz and Łukie whereas only *Typha angustifolia*, *Typha latifolia* were present in Lake Głębokie Uścimowskie. From each site 30 shoots of helophytes were taken. The density of helophytes was analyzed using a 0.25 m² frame. The biomass and selected morphometrical features such as: length, diameter and presence of a panicle on shoot were scrutinized, using methods applied in other lakes in Poland [11, 4].

In the investigated lakes the type of bottom, where helophytes developed was different. In the mesotrophic Lake Piaseczno helophytes appeared on sandy bottom, in the less eutrophic Lake Uściwierz and the hypertrophic Lake Głębokie Uścimowskie on muddy with sand while in the eutrophic Lake Łukie on muddy one.

Table 1. Limnological characteristics of investigated lakes [2, 8]

| Lake | Area (ha) | | Max. depth (m) | Mixing | Littoral type | Trophy | Restricted type |
|----------------------|-----------|-----------|----------------|------------|----------------------------------------------------------|----------------|--------------------------------------------------|
| | Lake | Catchment | | | | | |
| Piaseczno | 84.7 | 284.8 | 38.8 | dimictic | psammolittoral | mesotrophic | landscape park |
| Uściwierz | 256.3 | 532.3 | 6.6 | dimictic | small lake phytolittoral with elements of psammolittoral | less eutrophic | landscape park, reserve „Uroczysko Uściwierskie” |
| Łukie | 136.7 | 564 | 4 | polimictic | small lake phytolittoral | eutrophic | national park |
| Głębokie Uścimowskie | 20.5 | 173.8 | 7.1 | dimictic | small lake phytolittoral, pond | high eutrophic | landscape park |

RESULTS

Schoenoplectus lacustris occurred in four lakes investigated. The highest length of shoots (2.05 m) appeared in slightly eutrophic Lake Uściwierz and the lowest (1.1 m) in the mesotrophic Lake Piaseczno. The highest values of diameter and weight of *Schoenoplectus lacustris* shoots were reached in eutrophic Lake Łukie, the lowest in mesotrophic Lake Piaseczno. They ranged from 11.6 mm to 3.9 g and from 6.2 mm to 2.25 g, respectively. Most often the panicle on shoot was present in hypertrophic Lake Głębokie Uścimowskie. Up to 80% of *Schoenoplectus lacustris* shoots had panicles developed in this lake. In the rest of investigated lakes only 30% of shoots developed panicles (Fig. 1).

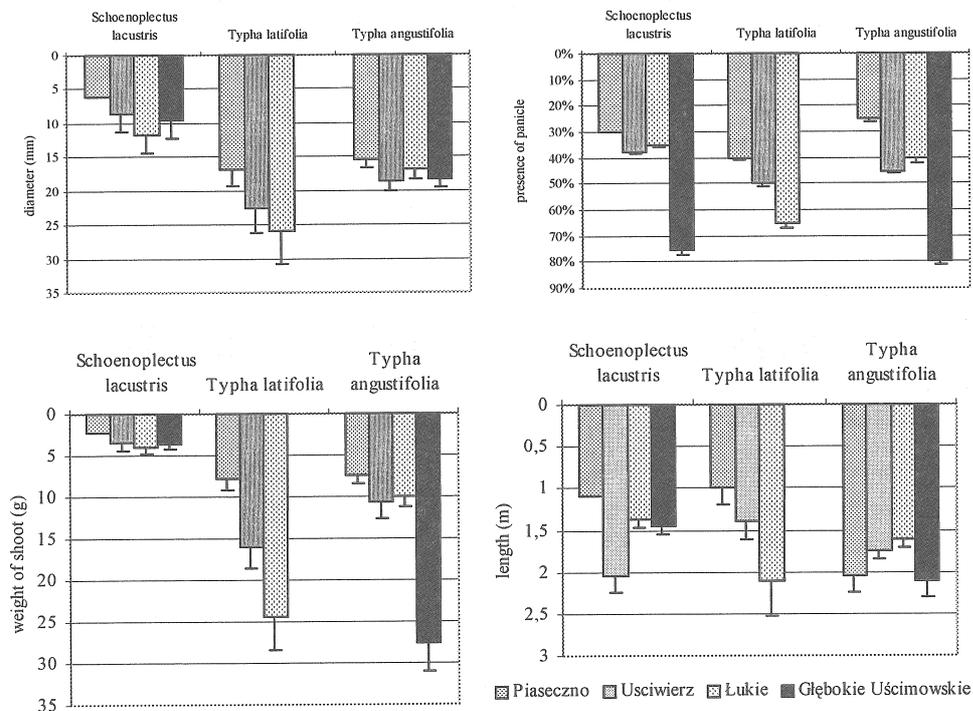


Fig. 1. Selected morphometrical features of three species of helophytes in the lakes Vertical bars mean standard deviations (+SD)

Typha latifolia occurred in three examined lakes: Piaseczno, Uściwierz and Łukie. The highest length, diameter and weight of *Typha latifolia* shoots were observed in eutrophic Lake Łukie. Over 60% of shoots had developed spadix in

this lake. The lowest record of examined features occurred in mesotrophic Lake Piaseczno (Fig. 1).

Typha angustifolia was found in each lake investigated. The length of *Typha angustifolia* shoots ranged from 1.6 m in eutrophic lake Łukie to 2.1 m in hypertrophic Lake Głębokie Uścimowskie. Furthermore, the shoots of *Typha angustifolia* achieved the highest diameter, weight and rate of occurrence of panciple in Lake Głębokie Uścimowskie and the lowest in Lake Piaseczno (Fig. 1).

The greatest density and biomass achieved by *Schoenoplectus lacustris* was in eutrophic Lake Łukie and the lowest in mesotrophic Lake Piaseczno. It ranged from 12 ind. \cdot m⁻² to 26 ind. \cdot m⁻² and from 27 g \cdot m⁻² to 107 g \cdot m⁻².

Moreover, in eutrophic Lake Łukie *Typha latifolia* achieved the highest density – 11 ind. \cdot m⁻² and biomass – 301 g \cdot m⁻². In turn, *Typha angustifolia* achieved the highest density – 27 ind. \cdot m⁻² and biomass – 710 g \cdot m⁻² in hypertrophic Lake Głębokie Uścimowskie, the lowest density – 5.5 ind. \cdot m⁻² in slightly eutrophic Lake Uściwierz and biomass – 48 g \cdot m⁻² in mesotrophic Lake Piaseczno (Fig. 2).

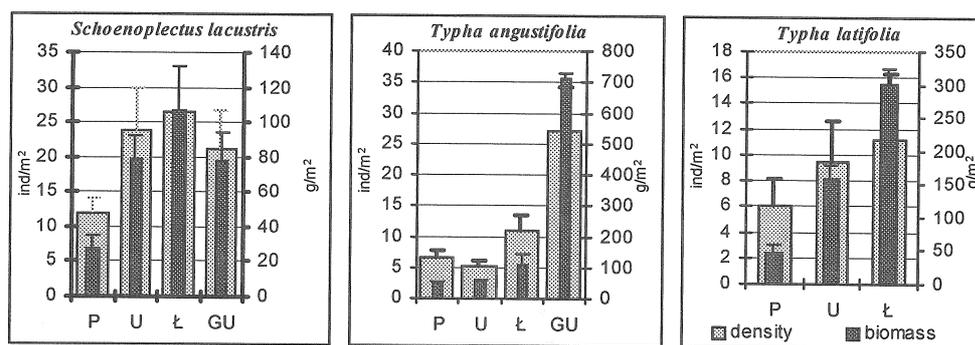


Fig. 2. Density and biomass of some helophytes in investigated lakes (+SD) (explanations: P- lake Piaseczno, U- lake Uściwierz, Ł- lake Łukie, GU- lake Głębokie Uścimowskie).

The greatest values of all investigated characteristics were observed in summer season, the lowest in spring. In autumn the morphometrical features, density and biomass of all investigated helophytes were insignificantly lower than in summer time (Fig. 3).

Selected species of emergent macrophytes were clearly different in investigated lakes. As a rule, the greatest values of examined features, density and biomass were found in slightly eutrophic Lake Uściwierz. This lake is under minimal influence of recreational activities. The lowest values of analyzed features were in the mesotrophic Lake Piaseczno, which is under a significant influence of recrea-

tional activities. Hence, both trophic status of a lake and recreational activities, can probably shape morphometrical features of emergent macrophytes.

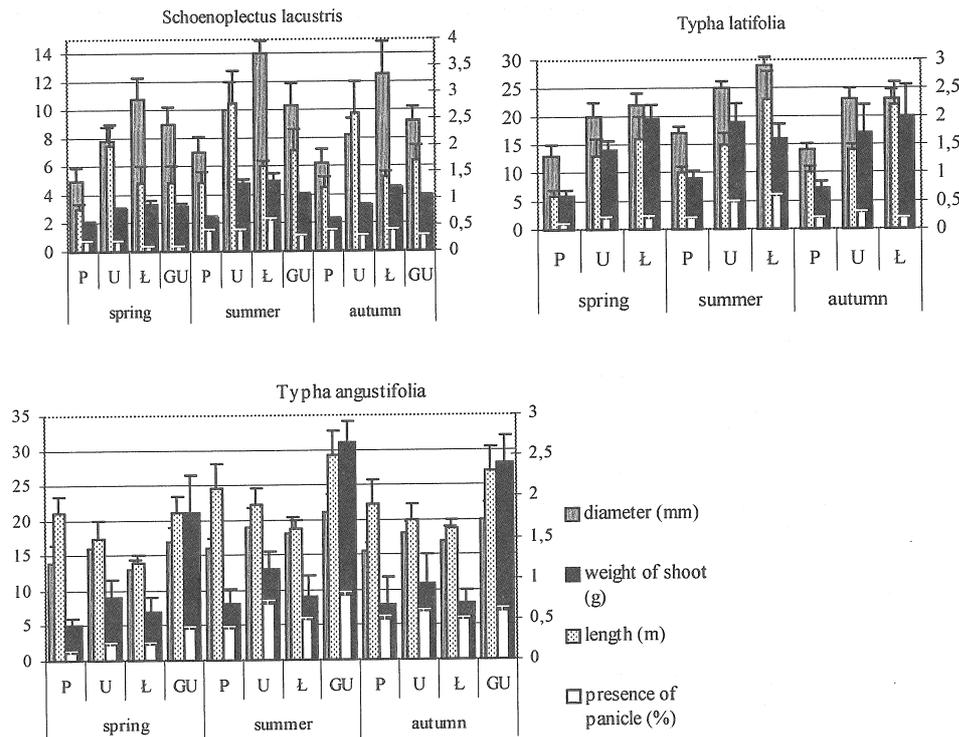


Fig. 3. Seasonal changes of selected morphometrical features in investigated lakes (explanations: P- lake Piaseczno, U- lake Usciwierz, Ł- lake Łukie, GU- lake Głębokie Uścimowskie).

Generally shoots of all helophyte species grew better on muddy bottom than on sandy one. It was also observed for *Phragmites australis* in lakes located in the Mazurian Lakeland [9].

Investigated features, density and biomass were sometimes very different from the ones recorded in Mazurian lakes [9]. This difference was especially clear for *Typha* species. In lakes investigated in Łęczyńsko-Włodawskie Lakeland the values were lower. The length of *Typha* shoots ranged from 1 m to 2.1 m while in Mazurian lakes ranged from 1.46 m to 3.08 m and biomass, 18.1 g·m⁻² and 22.4 g·m⁻², respectively [9].

Typha angustifolia achieved the maximum value of examined features in hypertrophic lake. Quite unusually as, this species is considered one preferring the less eutrophic habitats [3]. But in mesotrophic Lake Piaseczno this species reached the lowest records of analyzed characteristics.

The seasonal changes of selected morphometrical features were like in other Polish lakes [4, 10], achieving the greatest value of examined features in summer time.

CONCLUSIONS

1. The selected morphometrical features, biomass and density of investigated helophytes were clearly differentiated in four lakes in Łęczyńsko-Włodawskie Lakeland.
2. In all lakes the highest values of features appeared in summer, the lowest in autumn and early spring.

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**SEZONOWA ZMIENNOŚĆ WYBRANYCH CECH MORFOMETRYCZNYCH
MAKROFITÓW WYNURZONYCH W JEZIORACH O RÓŻNEJ TROFII***Joanna Sender*

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Streszczenie. Badania prowadzono w latach 1998-1999, w czterech jeziorach Pojezierza Łęczyńsko-Włodawskiego: mezotroficznym jeziorze Piaseczno, lekko eutroficznym jeziorze Uściwierz, eutroficznym jeziorze Łukie oraz hipertroficznym jeziorze Głębokie Uścimowskie. Określano zmienność sezonową wybranych cech morfometrycznych, a także biomasę i zagęszczenie trzech gatunków helofitów: *Schoenoplectus lacustris*, *Typha latifolia* i *Typha angustifolia*. Stwierdzono wyraźne zróżnicowanie badanych cech w poszczególnych jeziorach. *Schoenoplectus lacustris* i *Typha latifolia* najwyższe wartości badanych cech osiągały w eutroficznym jeziorze Łukie, najmniejsze w mezotroficznym jeziorze Piaseczno. *Typha angustifolia* maksymalne wartości badanych cech osiągała w hipertroficznym jeziorze Głębokie Uścimowskie, zaś najniższe w lekko eutroficznym jeziorze Uściwierz. We wszystkich badanych jeziorach maksymalne wartości badanych cech wystąpiły w sezonie letnim, najmniejsze wczesną wiosną i jesienią.

Słowa kluczowe: helofity, jezioro, sezonowe zmiany, cechy morfometryczne

