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Long-term changes of macrophyte vegetation in lakes of the Dovinė river catchment area

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Changes of submerged vegetation over the last 50 years in lakes Dusia, Simnas, Žuvintas and Amalvas, related with re-arrangement of the Dovinė river basin and alteration of the hydrological regime are discussed. The study is based on reference information and data of recent field investigations.

Most significant changes of submerged vegetation were revealed in the shallow Lake Žuvintas. Twenty species of submerged plants became extinct (8 *Charophyta*, 10 *Potamogeton*, 2 *Bryophyta*) in the period from 1961 to 2004. The group of extinct plants includes sparse in the lake and rare in Lithuania species (*Tolypella prolifera, Nitella syncarpa, N. mucronata, Fontinalis hypnoides*). Formerly abundant and dominant species, such as *Chara globularis, C. strigosa, C. hispida, Nitellopsis obtusa*, significantly decreased. The increase of the number of charophytes and their abundance in 1997 has indicated that reduction of inflow of nutrients from the basin can significantly improve the state of submerged vegetation in the lake.

Significant changes took place only in the deepest (8–10 m) zone of the deep Lake Dusia (mean depth 15.7 m). Vegetation of this zone after damming did not recover and communities formed by filamentous algae and mosses became extinct. The zone of vegetation distribution reduced from 9 to 6 m depth limit.

It is possible that in the last 50 years charophytes became extinct in Lake Simnas, whereas in Lake Amalvas pondweeds and possibly charophytes disappeared.

Key words: macrophytes, submerged plants, *Charophyta*, *Potamogeton*, lakes, Lithuania

INTRODUCTION

Five relatively large lakes – Dusia (23.3 km^2), Žuvintas (9.3 km^2), Simnas (2.4 km^2), Giluitis (2.4 km^2) and Amalvas (1.9 km^2), – as well as 13 significantly smaller lakes belong to the Dovinė river catchment area. According to EU Water Framework Directive (WFD), macrophytes are among the most important biological quality elements that are employed for evaluation of ecological status of lakes. A botanical research before reconstruction was performed and still continues (monitoring of lake vegetation) only in lakes Dusia and Žuvintas. Hydrochemical parameters in these lakes are being monitored since 1993. Negative changes in submerged vegetation of Lake Žuvintas were noticed about 10 years after the reconstruction of the Dovinė river basin (Šarkinienė, Trainauskaitė, 1986, 1993) in the period of intensive agriculture.

The aim of the present research was inventory of macrophytes in lakes Dusia, Simnas, Žuvintas and Amalvas and evaluation of changes of submerged vegetation over the last 50 years.

STUDY AREA

The catchment area of the Dovinė river (right inflow of the Šešupė river) is situated in southwest Lithuania (between 54°40' and 54°12' N; 23°25' and 23°45' E). This region is characterized by the most fertile soils. According to the Lithuanian River Cadastre (Gailiušis et al., 2001), the Dovinė river basin includes 41 surface water bodies (lakes, rivers, ditches, fishponds). Different aspects of human activity have disturbed the Dovinė river basin water bodies, especially in the second half of the 20th century. Extensive wetland reclamation has modified heavily the natural net of rivers. The natural hydrological regimen of the Dovinė river and lakes directly related with the river underwent significant changes after 1972, when the lakes Simnas and Dusia were dammed and the course of the Spernia, Bambena and Dovinė rivers was straightened and deepened in some places up to 2 m (Taminskas et al., 2006). Water from the rivulet Spernia was used for the needs of the Simnas fishponds.

Lakes Dusia, Simnas and Žuvintas are the largest in the Dovinė river basin (Table 1). The largest right inflow – the River Amalvė outflows from Lake Amalvas (Fig. 1). Only Lake Dusia is deep, with clear water and thermally stratified. Lake Simnas is shallow, polymictic and clear, whereas Žuvintas and Amalvas are shallow polymictic humic lakes with brown water. All lakes are calcareous, their pH > 8. Lakes Dusia and Simnas are surrounded by mineral shores, whereas lakes Žuvintas and Amalvas are remnant bog lakes.

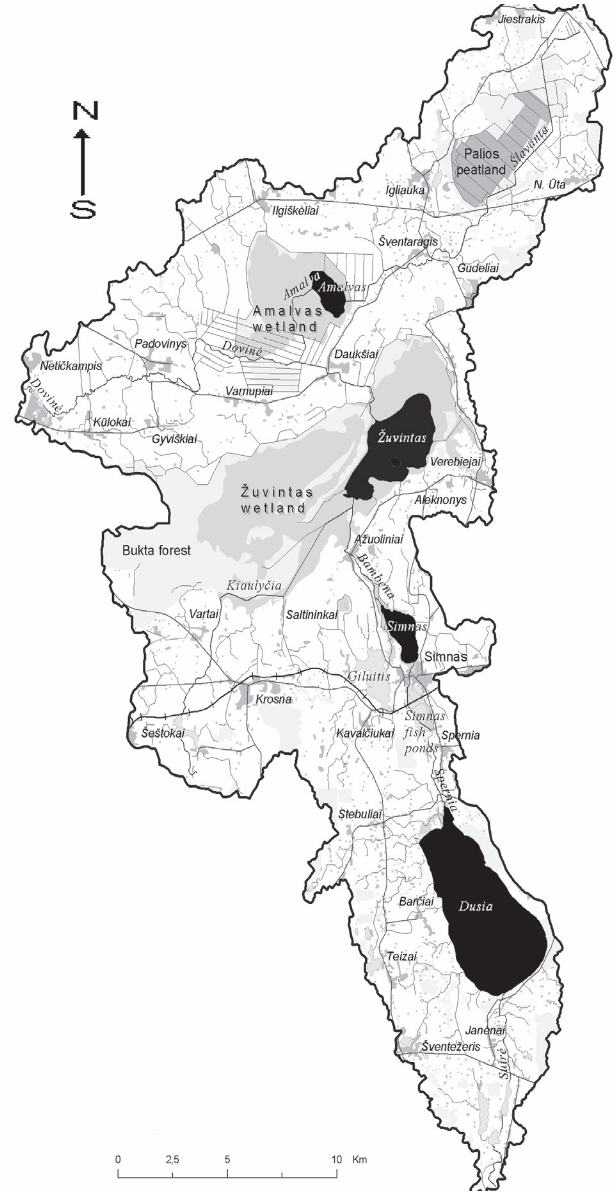

Fig. 1. Lakes investigated in the Dovinė river catchment area

MATERIALS AND METODS

In this research, published data on investigation of macrophytes in Lake Dusia in 1952 and 1968–1973 (Mardosaitė, Minkevičius, 1958, Trainauskaitė et al., 1977) and Lake Žuvintas in 1957–1961, 1963, and 1981–1982 (Šarkinienė, 1968; Šarkinienė, Trainauskaitė, 1986, 1993) were employed. Unpublished data of the author on investigations in lakes Dusia (1994), Žuvintas (1997) and in Dusia, Simnas, Žuvintas, and Amalvas (2004) were also used.

In order to unify data on macrophyte abundance and distribution in lakes provided by different investigators, a 5-grade scale (Melzer, 1999; Stelzer et al., 2005) was applied:

1 – very rare (covers up to 5% of a sampling area)
2 – rare (covers >5–25% of a sampling area)
3 – common (covers >25–50% of a sampling area)
4 – frequent (covers >50–75% of a sampling area)
5 – abundant and dominant (covers >75% of a sampling area).

This scale, with an additional estimation of the coverage, abundance and distribution of macrophytes in lakes of the Dovinė river basin, was also applied in 2004 during inventory of species in transects.

A revision of water plant specimens from lakes of the Dovinė river basin, deposited in herbaria of Vilnius

Table 1. **Morphometric and hydrophysical characteristics of lakes**

Lake	Area, km²	Mean (max.) depth, m	Secchi depth, m	
Dusia	23,3	15.4 (31.7)	8.7–8.9 August 1958	4.0 August 2004
Simnas	2,4	2.8 (4.6)	2,3 July 1961	0.7 August 2004
Žuvintas	9,3	2.6 (1.1)	1,25 August 1960	1.8 August 2004
Amalvas	1,9	0.98 (–)	–	0.6 August 2004

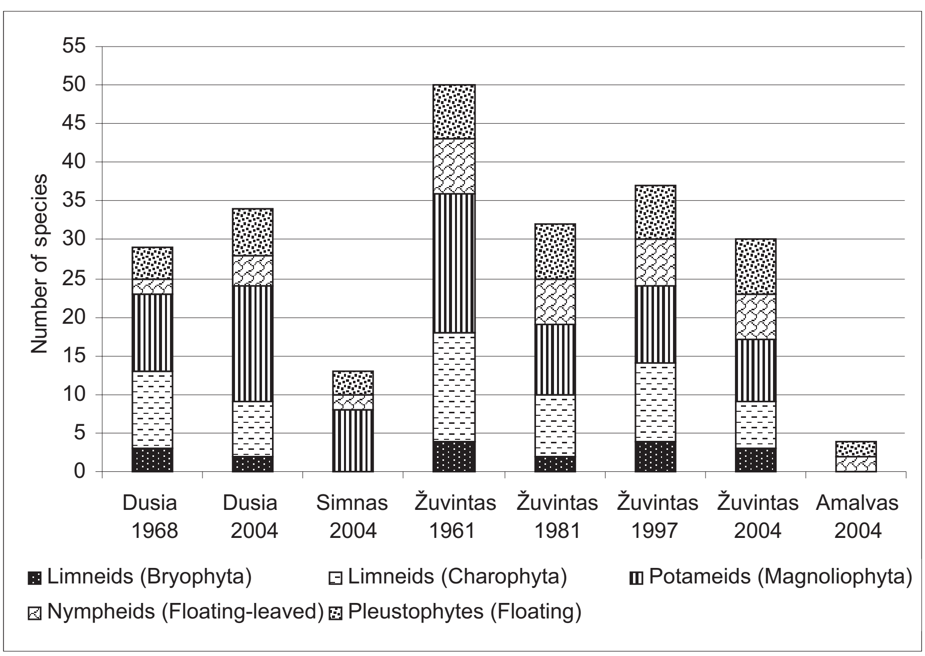

Fig. 2. Species diversity and morph-oecological groups of hydrophytes in different lakes and their changes in Lakes Dusia and Žuvintas

Table 2. **Species composition and abundance of macrophytes in lakes of the Dovine river basin**

University (VI) and Institute of Botany (BILAS), was performed. The identity of some species was corrected, thus data on the number of species in this paper may differ from data provided in the cited references.

RESULTS AND DISCUSSION

Different morphology, hydrochemical and hydrophysical conditions determined the different development of vegetation and diversity of plant species in the surveyed lakes (Table 2). In this investigation, attention was focused on the abundance and distribution of submerged (limneids and potameids), free floating and floating-leaved plants, because these plants are most often used as ecological status indicators of water bodies (Melzer, 1999, Moss et al., 2003). According to the macrophyte-based assessment system proposed for lowland lakes in Germany, all species of the genera *Chara* and *Nitella* and *Nitellopsis obtusa* are indicators of good quality in polymictic lakes, whereas in stratified lakes such indicators are all charophyte species except *Nitella mucronata, Chara contraria* and *Chara globularis* (Stelzer et al., 2005).

Lakes Žuvintas and Dusia differ from other lakes in the diversity of hydrophytes and occurrence of different ecological groups (Table 2). *Charophyta* and *Magnoliophyta* species prevail in submerged vegetation (Fig. 2). The number of species in Lake Simnas is much lower than in Lake Dusia. Only four species of hydrophytes were recorded in Lake Amalvas.

The belt of submerged limneids dominated by *Charophyta* species is best developed in Lake Dusia. The belts of potameids and nympheids are best developed in Lake Simnas. All ecological morphological groups of aquatic plants (limneids, potameids, nympheids, and pleustophytes) are presented in Lake Žuvintas. In Lake Amalvas, only a belt of nympheids is developed (Table 2).

Table 2. **Species composition and abundance of macrophytes in lakes of the Dovine river basin**

Species	Dusia 1952, 1968	Dusia 1994, 2004	Simnas 2004	Žuvintas				Amalvas 2004
				1961–1963	1981–1982	1997	2004	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Submerged plants	23	24	0	36	19	24	21	0
Limneids (*Charophyta*)	10	7	0	14	8	10	6	0
Chara aspera Willd.	4	**4**	–	1	1	1	1	–
Chara contraria A. Braun ex Kütz.	2	**4**	–	1	1	1	1	–
Chara filiformis Hertzsch	2	2	–	1	1	1	1	–
Chara globularis Thuill.	1	1	–	4	1	1	–	–
Chara intermedia A. Braun	–	–	–	1	–	–	–	–
Chara rudis/hispida	2	3	–	3	1	2	1	–
Chara strigosa A. Braun	–	–	–	3	–	1	–	–
Chara tomentosa L.	3	**3**	–	4	1	3	3	–
Chara virgata Kütz.	1	–	–	1	–	–	–	–
Nitella opaca / flexilis	–	–	–	1	–	1	–	–
Nitella mucronata (A.Br.) Miguel	1	–	–	1	1	1	–	–
Nitella syncarpa (Thuill.) Chevall.	1	–	–	1	1	–	–	–
Nitellopsis obtusa (Desv.) J. Groves	3	**3**	–	2	1	3	1	–
Tolypella prolifera (A. Braun) Leonh.	–	–	–	1	–	–	–	–
Depth limits m	0.3–6(8)	0.5–6	–	0,4–2,5(2,8)	–	0,5–1,5	0,1–1(1,5)	–
Limneids (Bryophyta)	3	2	0	4	2	4	3	0
Drepanocladus aduncus (Hedw.) Warnst.	–	–	–	–	–	1	1	–
Drepanocladus sendtneri (Schimp) Warnst.	1	–	–	1	–	2	–	–
Fontinalis antipyretica Hedw.	3	**2**	–	1	1	2	1	–
Fontinalis hypnoides Hartm.	–	–	–	1	–	–	–	–
Riccia fluitans L.	–	–	–	1	–	–	–	
Rhynchostegium riparioides (Hedw.) Cardot	2	1	–	–	–	–	–	–
Scorpidium scorpioides (Hedw.) Limpr.	–	–	–	–	1	2	1	–
Depth limits m	2–9(10)	2–7(9)	–	0,6–1,5	–	0,5–1,8	1,2	–
Potameids (*Magnoliophyta*)	10	15	8	18	9	10	8	0
Alisma gramineum Lej.	–	1	–	1	–	–	–	–
Batrachium circinatum (Sibth.) Spach	2	1	2	2	–	1	1	–
Ceratophyllum demersum L.	1	2	2	–	3	3	2	–
Elodea canadensis Rich.	3	2	–	1	–	1	1	–
Myriophyllum spicatum L.	4	2	3	1	3	2	2	–

Table 2 continued

1	2	3	4	5	6	7	8	9
Myriophyllum verticillatum L.	–	–	–	2	3	3	**3**	–
Potamogeton acutifolius Link.	–	–	–	1	–	–	–	–
Potamogeton berchtoldii Fieber	–	1	–	1	–	–	–	–
Potamogeton compressus L.	3	1	–	1	1	1	–	–
Potamogeton crispus L.	–	1	1	–	–	–	–	–
Potamogeton filiformis Pers.	1	–	–	1	1	1	–	–
Potamogeton friesii Rupr.	1	2	–	1	1	–	–	–
Potamogeton gramineus L.	–	1	–	1	–	–	–	–
Potamogeton lucens L.	2	2	2	1	1	2	3	–
Potamogeton x *nitens* Weber	–	1	–	–	–	–	–	–
Potamogeton obtusifolius Mert. et W.Koch	–	–	–	1	–	–	–	–
Potamogeton pectinatus L.	3	1	2	1	–	1	1	–
Potamogeton perfoliatus L.	3	**3**	2	1	1	2	1	–
Potamogeton praelongus Wulfen	–	–	1	1	1	–	–	–
Potamogeton rutilus Wolfg.	–	–	–	1	–	–	–	–
Potamogeton trichoides Cham. et Schldl.	–	–	–	1	–	–	–	–
Potamogeton x *zizii* Mert. et Koch	–	2	–	–	–	–	–	–
Depth limits (m)	(0,5)1–6(8)	0,3–6(7)	0,5–2,1	0,5–2,0	–	0,5–1,5	0,5–1,9(2)	–
Floating leaved plants (nympheids)	2	4	2	7	6	6	6	2
Nuphar luteum (L.) Sm.	1	1	3	**3**	4	3	3	**3**
Nymphaea alba L.	–	–	–	1	–	–	–	–
Nymphaea candida J. Presl.	–	–	1	3	1	2	2	–
Persicaria amphiba (L.) Gray	–	–		1	1	1	1	–
Potamogeton natans L.	1	1		3	1	2	2	2
Sagittaria sagittifolia L.	–	1		1	1	1	1	–
Sparganium emersum Rehm.	–	1		1	1	1	1	–
Depth limits (m)	–	–	0,5–2	0,5–1,2		0,2–1	0–1,5(2)	0,3–1,2
Floating plants (pleustophytes)	4	6	3	7	7	7	7	2
Hydrocharis morsus-ranae L.	1	1	1	1	1	1	1	1
Lemna minor L.	1	1	1	1	1	1	1	–
Lemna trisulca L.	1	2	–	1	1	2	2	–
Spirodela polyrhiza (L.) Schleid.	–	1	1	2	1	1	1	–
Stratiotes aloides L.	1	1		2	3	3	2	1
Utricularia vulgaris L.	–	1		1	1	1	2	–
Utricularia minor L.	–	–		1	1	1	1	–
Emergent (helophytes)(dominant species only)								
Glyceria maxima (Hartm.) Holmbg.	1	1	1	1	1	1	1	–
Phragmites australis (Cav.) Trin. ex Steud.	2	2	2	3	4	4	4	2
Schoenoplectus lacustris (L.) Palla	2	3	2	1	2	2	2	2
Sparganium erectum L.	1	1	1	1	1	1	1	1
Typha angustifolia L.	1	1	3	3	4	4	4	1
Maximum depth (m)	2(2,5)	2,0	1,1	2,4	–	1,5	1,5	1,2

The number of recorded hydrophyte species in the shallow Lake Žuvintas (by inventory of 1961 and 1997) was higher than in the large Lake Dusia in 2004. However, the number of hydrophyte species in Lake Žuvintas from 1961 to 2004 decreased from 50 to 30. Recently, in Lake Dusia more species have been recorded as compared with previous inventories, however, the number of species increased at the expense of several *Potamogeton* species of hybrid origin. During the last inventory, no *Nitella mucronata*, *Nitella syncarpa* and *Drepanocaladus sendneri* were found.

The emergent plants along lake shores are the most distinguishable part of lake vegetation. The belt of helophytes is more or less developed in all the lakes studied and is characterised by the same prevailing species (*Typha angustifolia, Phragmites australis, Schoenoplectus lacustris*). However, helophytes in Lake Žuvintas occupy about a third of the lake area. They are distributed both at the shores and in the middle of the lake. The discussions about the rapid decrease of specular lake surface (Linkevičienė et al., 2006) are related with a decrease of the lake area caused by emergent and floating-leaved vegetation.

Lake Dusia is the largest and deepest among the study lakes (Table 1). The natural change of vegetation in lakes of this type is slow. Before damming the lake was ascribed to the group of mesotrophic lakes with some features of oligotrophy. It was assigned to the fragmentarily overgrown type (Šarkinienė, 1963). After damming of Lake Dusia in 1972, its depth increased by 0.43 m and surface area by 0.17 km^2 (Taminskas ir kt., 2006). Before damming, well developed submerged and fragmentary emergent vegetation covered ca. 28% of the lake surface area, the limit of massive distribution of submerged magnoliophytes and charophytes reached a depth of 5–6(8) m, whereas bryophytes were distributed down to 9(10) m (Mardosaitė, Minkevičius, 1958, Trainauskaitė et al., 1977).

About 20 years after damming (in 1994), no signs of chaotic re-arrangement or disturbance of submerged communities were observed. It looks like plants shifted towards the flooded banks of lakes and occupied a similar area as before damming. The dominant *Charophyta* species (*Chara aspera C. contraria C. hispida C. tomentosa, Nitellopsis obtusa*) and less abundant flowering plants (*Potamogeton lucens, P. perfoliatus*, *Myriophyllum spicatum*) occupied submerged shores and formed dense sward, as before, at a depth of 1–5 m (maximum 6–7 m). Before damming, at a depth of 8–10 m there was a zone with abundant filamentous algae, charophytes (*Chara, Nitellopsis obtusa*) and mosses (*Fontinalis antipyretica, Rhynchostegium riparioides*), however, later this zone did not recover. *Nitella mucronata* and *Nitella syncarpa*, found in the northern bay of the lake, became extinct probably due to changes in light conditions. At present, the distribution of all submerged macrophytes is almost strictly limited to a depth of 6 m. Only separate plants (*Fontinalis antipyretica, Elodea canadensis, Chara* sp., *Potamogeton friesii*) accidentally can be found deeper. Such changes in distribution are undoubtedly related with changes in water transparency (Secchi depth, m) which decreased from 8.7–8.9 m in August 1958 (Grigelis et al., 1975) up to 4 m in August 2004.

Emergent plants of Lake Dusia (*Phragmites australis, Schoenoplectus lacustris*) after damming relocated to similar habitats up to 2 m deep. First researchers noted that due to a strong surge along the western and eastern shores, reads and bull-rushes formed sparse stands with charophytes. Presently, *Phragmites australis* and *Schoenoplectus lacustris* form a dense stand which screens from waves larger shallow littoral areas. Filamentous green algae became abundant in these enclosed areas during summer, and floating-leaved plants such as *Nuphar luteum*, earlier recorded only in the northern bay, were noted. Lake Dusia for a long time has been in an area of intensive land-use and experiences an intensive pressure of recreation. Therefore, the increased abundance of some nutrient-tolerant species, such as *Ceratophyllum demersum* and *Potamogeton friesii*, in the mouth of the Sutrė stream may indicate the beginning of significant changes in the vegetation structure.

First investigations on macrophytes of Lake Žuvintas were performed in 1961–1963. Though the Dovinė river basin at that time was under extensive land-use, a decrease of the lake area, caused by spreading of emergent macrophytes, was noted as a natural change typical of eutrophic lakes (Garunkštis, 1962). One of the reasons this process was the regimen of a strict nature reserve applied to this territory since 1937. Mowing of lake shore meadows and reeds was prohibited, therefore reeds started to invade the lake. The stand of *Typha angustifolia* and *Phragmites australis* in shallows connected with floating islets formed from reed rhizomes. Lake Žuvintas was formerly characterised by a high diversity of submerged plant species. During the first inventory, 14 species of *Charophyta* and 14 species of the genus *Potamogeton* were recorded (Table 2). Dominant charophytes occupied large areas to a depth of 2(2.8) m (Šarkinienė, 1968).

In 1968, Lake Žuvintas was dammed with the aim to decrease the overgrowth of the lake. Subsequently its water level increased by 0.31 m (Taminskas, Linkevičienė, Žikulinas, 2006). According to the inventory performed in 1981–1982, in Lake Žuvintas 17 species of submerged plants (6 charophytes, 9 flowering plants, 2 bryophytes) became extinct (Fig. 3) (Šarkinienė, Trainauskaitė, 1986, 1993). The list of extinct species included very rare in Lithuania charophyte species (*Tolypella prolifera, Nitella syncarpa, Nitella mucronata*). However, formerly frequent or dominant species, such as *Chara globularis, C. strigosa, C. hispida, Nitellopsis obtusa*, were very sparse. Only *Chara tomentosa* in some parts of the lake was found occurring in small patches. Instead of the extinct *Charophyta* species, widely spread the earlier not recorded species *Ceratophyllum demersum* (Šarkinienė, Trainauskaitė, 1986, 1993) and significantly increased in abundance such species as *Myriophyllum verticillatum, M. spicatum, Stratiotes aloides, Nuphar luteum* (Fig. 4). Charophytes frequently compete with *Potamogeton* species in shallow lakes; however, in Lake Žuvintas no one pond-weed species became dominant and seven not abundant species became extinct.

The period from 1968 to 1981 coincided with large-scale changes in the Dovinė river basin and intensification of agriculture. The low water level in spring and large amounts of nitrogen and phosphorus which exceeded permissible limits (Tamošaitis et al., 1985–1986) were the factors that caused the further development of emerged vegetation and negatively affected submerged vegetation.

The decline of *Charophytes* is noted in many European shallow lakes. This process is mainly caused by poor light conditions (turbidity), toxic effects of phosphorus or a negative impact of fish (Ozimek & Kowalczewski, 1984; Blindow, 1992).

The state of submerged vegetation in Lake Žuvintas significantly improved in 1997; however, the former level was not restored. Charophytes occupied almost a third of lake-bottom area at a depth to 1.5 m and bryophytes to 1–1.8 m. Ten species of *Charophyta* were recorded, however, only *Nitellopsis obtusa* and *Chara tomentosa* were dominant. A significant increase in the abundance of flowering plants, such as *Potamogeton lucens*, was noted, but the dominant species were *Ceratophyllum demersum* and *Myriophyllum verticillatum*. These species frequently

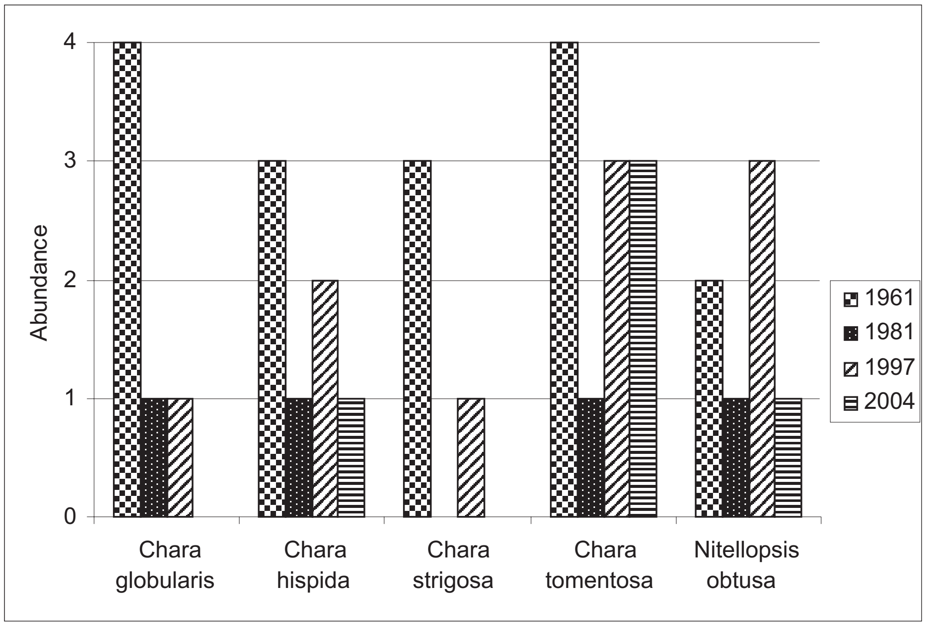

Fig. 3. Changes of dominant *Charophyta* species abundance in Lake Žuvintas

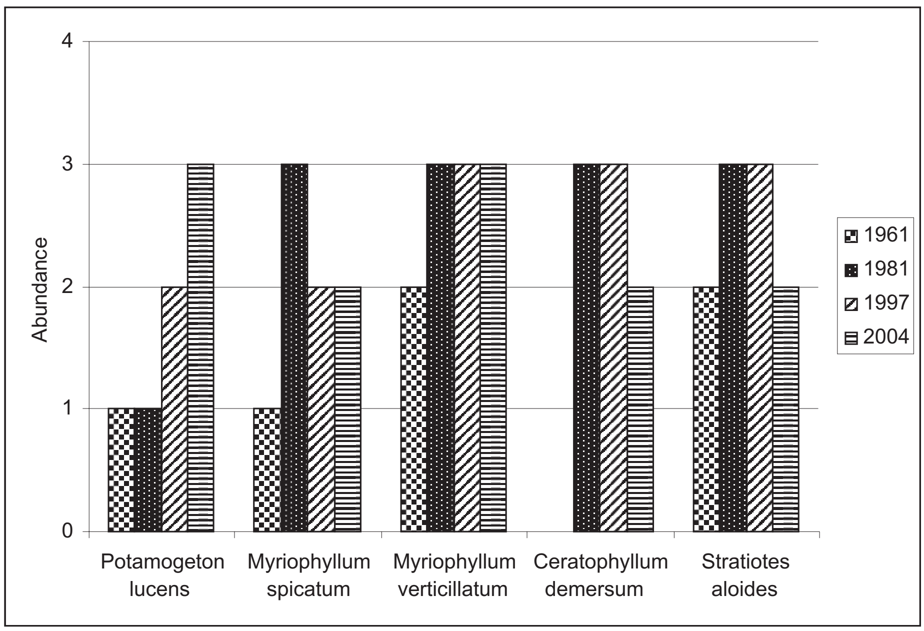

Fig. 4. Changes of dominant *Magnoliophyta* species abundance in Lake Žuvintas

formed mixed communities with *Nuphar luteum* in the northern and southern parts of the lake in semi-closed rings formed by *Typha angustifolia*. This period coincides with changes in land use and a stagnation in agricultural activities.

In 2004, a significant decline of charophytes was observed again. Six species of charophytes were inventoried, but only *Chara tomentosa* was dominant. This species grows to a depth of 1 m, rarely 1.5 m, whereas *Potamogeton lucens*, nympheids and helophytes grow down to 1.5 (2) m. This phenomenon can be explained by accessibility of the light. Potameids easily reach water surface and avoid deficiency of light, whereas charophytes growing close to the bottom disappear (Scheffer, 19980). With increasing transparency, charophytes may come back to deepest locations again (Blindow, 1992). Fluctuations of submerged plant abundance probably take place also in undisturbed lakes, however, in Lake Žuvintas they are closely related with the intensity of human activities, which recently has increased again.

There are very few data on the former macrophytes in lakes Simnas and Amalvas. In the Herbarium of the Institute of Botany, single specimens of *Chara contraria* collected in about 1960, were found, however, there are no data on its abundance, distribution in the lake and accompanying species. As charophytes are found in all neighbouring lakes, they might occur in Lake Simnas also. After damming in 1972, the water level of Lake Simnas increased up to 0.83 m. Such changes of water level and the high turbidity caused by coast erosion might have been disastrous for charophytes. Currently, water transparency (Secchi m) in Lake Simnas is only 0.7 m. In the zone of submerged vegetation down to 2 m, only eight species of flowering plants were registered. In the eastern part of the lake *Myriophyllum spicatum* is dominant, less abundant are *Ceratophyllum demersum, Batrachium circinatum* and species of the genus *Potamogeton*. In the western part of the lake, floating-leaved vegetation with the dominant *Nuphar luteum* is well developed in a zone as deep as 2 m. The belt of helophytes with the dominant *Typha angustifolia* is distributed to a depth of 1 m.

The vegetation in Lake Amalvas is especially poor. In 2004, ten species of macrophytes were recorded in this lake. The dominant species were *Nuphar luteum*, *Potamogeton natans* and *Schoenoplectus lacustris,* occurring at a depth of 0.3–1.2 m. Water transparency in 2004 was 0.6 m. In the Herbarium of Vilnius University, a specimen of *Potamogeton compressus* collected in 1925 is deposited. Thus, it is evident that formerly submerged vegetation in Lake Amalvas was better developed. Before the damming, it was ascribed to the type of lakes with presence of plant species of different ecological groups (Šarkinienė, 1963). The death of submerged vegetation in Lake Amalvas was probably caused by a substantial decrease of water level and the inflow of turbid water from a polder arranged above.

CONCLUSIONS

The alteration and regulation of the water level by sluice-regulators and the inflow of nutrients from agricultural areas were the main reasons for vegetation changes in lakes of the Dovinė river catchment area during the period from 1961 to 2004.

Most significant changes of submerged vegetation were revealed in the shallow Lake Žuvintas. Twenty species of submerged plants became extinct (8 *Charophyta*, 10 *Potamogeton*, 2 *Bryophyta*). The group of extinct plants includes species sparse in the lake and rare in Lithuania (*Tolypella prolifera, Nitella syncarpa, N. mucronata, Fontinalis hypnoides*).

The increase of the number of charophyte species and their abundance in the years of agricultural stagnation (about 1997) in Lake Žuvintas indicate that reduction of inflow of nutrients from the basin significantly improves the state of submerged vegetation in the lake.

It is supposed that charophytes in Lake Simnas and pondweeds and possibly charophytes in Lake Amalvas became extinct.

No significant changes in species composition and abundance were observed in Lake Dusia, the largest and deepest (mean depth 15.7 m) among the lakes studied. The zone of vegetation distribution reduced from the depth limit of 9 m to 6 m, and communities formed by filamentous algae and mosses became extinct.

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POVANDENINĖS AUGALIJOS ILGALAIKIAI POKYČIAI DOVINĖS BASEINO VANDENS TELKINIUOSE

Santrauka

Remiantis literatūros šaltiniais ir pastarųjų metų tyrimų duomenimis aptariami Dusios, Simno, Žuvinto ir Amalvo ežerų povandeninės augalijos pokyčiai apie 50 m. laikotarpyje, susiję su Dovinės baseino vandens telkinių hidrologinio režimo pertvarkymu ir ūkinės veiklos intensyvumu.

Didžiausią antropogeninį poveikį ežerai patyrė XX a. antroje pusėje, kai sausinant šlapžemes ir pertvarkant visą Dovinės baseino hidrografinį tinklą, ežerų vandens lygis pradėtas reguliuoti (Žuvinto ežere nuo 1968 m. pakeltas 0,31 m, Dusios ir Simno ežeruose nuo 1972 m. – 0,43 m ir 0,83 m). Baseine žemdirbystė buvo intensyvi, naudojama daug trąšų ir cheminių medžiagų.

Ženkliausi augalijos pokyčiai nustatyti geriausiai ištirtame sekliame Žuvinto ežere, kuriame 1961–2004 m. išnyko 20 povandeninių augalų rūšių (8 maurabragūnų, 10 plūdžių, 2 samanų). Išnyko ne tik retos Lietuvoje ir negausios ežere rūšys (*Tolypella prolifera, Nitella syncarpa, N. mucronata, Fontinalis hypnoides*), bet ir labai sumažėjo, išskyrus *Chara tomentosa*, vyravusių maurabragūnų rūšių (*Chara globularis, C. strigosa, C. hispida, Nitellopsis obtusa*) užimami plotai. 1997 m. stebėtas maurabragūnų pagausėjimas parodė, kad sumažėjus biogeninių medžiagų prietakai iš ežero baseino, povandeninės augalijos būklė pagerėja.

Dideliame ir giliame Dusios ežere dėl vandens lygio pakėlimo ir žmogaus veiklos vyraujančių rūšių sudėties ir gausumo pokyčių nepastebėta. Didžiausi pokyčiai vyko giluminėje (8–10 m) zonoje, kur po patvenkimo neatsistatė arba dėl sumažėjusio vandens skaidrumo sunyko siūlinių dumblių ir samanų (*Fontinalis antipyretica, Rhynchostegium riparioides*) formuojamos bendrijos. Augalijos išplitimo riba sumažėjo nuo 9 iki 6 m gylio.

Manome, kad per aptariamąjį laikotarpį sekliame Simno ežere dėl vandens lygio pakėlimo ir taršos povandeninėje augalijoje išnyko maurabragūnai, o sekliame Amalvo ežere – plūdės, o galbūt ir maurabragūnai.

Raktažodžiai: makrofitai, povandeninai augalai, *Charophyta*, *Potamogeton*, ežerai, Lietuva