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SMALL WATER BODIES AND LAKES PROTECTED UNDER EU HABITATS DIRECTIVE – RESULTS OF THE PILOT WILDLIFE MONITORING IN THE LUBELSKIE REGION

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Summary. Small water bodies have an important function in preserving biodiversity at the landscape and species level, however, they are subjected to strong pressure resulting in the loss of many of those habitats. One of the useful and promising tools which seems to improve the conservation of this objects is the EU Habitats Directive. This paper presents the results of the pilot program of the conservation status assessment in freshwater habitats: 3150 – Oxbow lakes and natural eutrophic water bodies with communities of Nympheion, Potamion as well as 3160 – natural dystrophic lakes in the Lubelskie Region. 41% of the 12 studied 3160 habitats had characteristics of favourable status (FV), while the remaining 59% were defined as inadequate (U1) or bad (U2). In the type of habitat 3160, 80% of monitoring sites received a rating U1. The assessment of the conservation status of small water bodies habitats in Lubelskie Region against the background of Polish monitoring researches indicating a similar state of preservation of 3150 habitats and significantly worse state of dystrophic lakes (habitat 3160).

Key words: small water bodies, EU Habitat Directive, wildlife monitoring, oxbow lakes, small eutrophic lakes, dystrophic lakes

INTRODUCTION

Small water bodies play an important role in the structure of biodiversity on both landscape and species level [Scheffer *et al.* 2006, Cereghino *et al.* 2008].

However, they are influenced by different anthropogenic stressors, including agriculture, urbanization and negative impacts connected with climate change [Wood *et al.* 2003]. Thus, since last few decades there is an increasing concern on its conservation and management [Biggs *et al.* 2005, De Meester *et al.* 2005]. One of the useful and promising tools which seems to improve the conservation of small water bodies in Europe is The Habitats Directive [Oertli *et al.* 2005]. The Directive (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora) is an European Union (EU) legislation act enacted in 1992 as an EU response to the Berne Convention [1979]. It is one of the EU's two directives in relation to wildlife and nature conservation, the other being the Birds Directive. The main aim of the Directive is to protect about 220 habitat types and 1000 species pointed in the directive's Annexes and which are of European importance [The Habitats Directive 1992]. Articles 11 of the directive requires EU member states to undertake surveillance of the conservation status of these habitats and species. However, article 17 obligates the member states to report the main results of the surveillance every six years [The Habitats Directive 1992].

Freshwater habitats mentioned in the directive cover 19 types from which 10 represent standing waters and nine belong to running waters. From standing freshwater habitats in Poland, which may be formed within the category of small water bodies are: 3150 Oxbow lakes and natural eutrophic lakes with Nympheion and Potamion communities and 3160 Natural dystrophic lakes[1]. In Polish protection system the habitat 3150 has two subtypes: 3510-1 Eutrophic lakes and 3510-2 Eutrophic oxbow lakes and natural small water bodies.

Since 2009 Polish governmental environmental agency started the first pilot program aiming to surveillance the state of protected habitats and species as well as to establish a scheme of common research methods and standards for data sets construction with respect to the needs of the directive. The executive structure of the program was based mainly on scientists and researchers including ecologists, botanists and zoologists in the level of country coordinators and local experts [Mróz 2012].

This paper will focus on the report of the results from the pilot program concerning surveillance the state of protected habitats connected with small water bodies (oxbow lakes, small natural lakes): 3150 Oxbow lakes and natural eutrophic lakes with Nympheion and Potamion communities (both subtypes: 3150-1 and 3510-2) and 3160 Natural dystrophic lakes in Lubelskie Region. We also aimed to compare the results of this first assessment with the results of similar surveys both in Poland and Europe.

[1] Throughout the paper we are using English translation of habitat names from the Polish law system. The original names in EU Habitat Directive are as follows: 3150 Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* — type vegetation; 3160 Natural dystrophic lakes and ponds [The Habitats Directive 1992].

MATERIAL AND METHODS

The selection of monitoring sites in Poland was made thereby to ensure appropriate representation of natural habitats considering their number, geographical distribution and degree of exposure [Mróz 2012]. Therefore the habitats located in Lubelskie Region were also chosen, representing the grouping of natural lakes in which protected habitat had developed.

The design of the monitoring was based on the needs of European Commission recommendations. One of the ideas of the future monitoring of protected habitats is that it should be carry out by environmental staff without very expert knowledge and instrumentation, thus making the assessment economically- and user-friendly. The state of habitat conservation was identified using three parameters: a) the area of the habitat, b) the perspectives of the protection and c) the specific structure and functions. The first parameter was a descriptive measure aimed to describe the actual area of the habitat in the context of the future changes. The perspectives of the protection was used to predict any changes which may influence the state of the habitat and was based on the expert assessment. The main parameter was the specific structure and functions. This measure had particularly to determine the accordance of actual habitat state with adequate species composition, typical for the assessed habitat. This parameter was based on individual indicators proposed for each type of the habitats. The final assessment of the conservation status was constructed on the basis of three (a, b, c) mentioned above parameters [Mróz 2012].

The specific structure and functions in habitat 3150 (Oxbow lakes and natural eutrophic lakes with Nympheion and Potamion communities) was assessed on the basis of the following measures: the combination of plant communities, the occurrence of alien and invasive plant species, water colour, electrolytic conductivity, water transparency, pH, the general structure of phytoplankton and zooplankton communities [Wilk-Woźniak *et al.* 2012 b]. The first five parameters are „the cardinal" ones, that is, they contribute the most to the final general rating of the structure and functions. In the case of habitat 3160 (Natural dystrophic lakes) the assessment was based on the following characteristics: the occurrence of characteristic plant species, the occurrence of expansive species, the occurrence of alien and invasive species, water colour, electrolytic conductivity, water transparency, pH, the total suspended solids concentration, the general structure of phytoplankton and zooplankton communities, and the occurrence of drainage channels [Wilk-Woźniak *et al.* 2012a].

The field studies were carried out in August of 2009, 2010 and 2011 in eight eutrophic lakes (Bikcze, Czarne Uścimowskie, Głębokie Cycowskie, Głębokie Uścimowskie, Koseniec, Płotycze Urszulińskie, Sumin – habitat code 3150-1), four oxbow lakes (Klarów, Orchówek, Wola Uhruska, Zawieprzyce – habitat code: 3150-2) and five dystrophic lakes (Brzeziczno, Łukietek, Orchowe, Płotycze Sobiborskie, Święte – habitat code: 3160). Nine of total 17 studied water bodies are situated in protected areas (Tab. 1).

Plant communities were determined by collection of phytosociological relevés in the 20 m – wide transect starting in the lake shore and ending in the place of maximal range of submersed macrophytes. Water transparency (with a standard Secchi disc), pH, electrolytic conductivity (EC) and total suspended solids (with YSI 556 Multi Probe, MPS) were measured at the end of the transect. Qualitative samples for taxonomic analysis (phytoplankton and zooplankton) were taken in the same place from the surface layer with a planktonic net (mesh size 25 μm). Samples were fixed in Lugol solution and examined under a microscope. Water colour was determined approximately by a subjective description.

Table 1. Water bodies with habitats studied in the assessment and forms of their protection

No.	Lake	Habitat type or subtype	Natura 2000 Area	Natural reserve
1.	Bikcze	3150-1	PLH060009	-
2.	Czarne Uścimowskie	3150-1	-	-
3.	Głębokie Cycowskie	3150-1	-	-
4.	Głębiokie Uścimowskie	3150-1	-	-
5.	Koseniec	3150-1	PLH060043	„Żółwiowe Błota”
6.	Płotycze Urszulińskie	3150-1	-	-
7.	Spólne	3150-1	PLH060043	„Żółwiowe Błota”
8.	Sumin	3150-1	PLH060009	-
9.	Klarów	3150-2	-	-
10.	Orchówek	3150-2	PLB060003	-
11.	Wola Uhruska	3150-2	PLB060003	-
12.	Zawieprzyce	3150-2	-	-
13.	Brzeziczno	3160	PLH060076	„Jezioro Brzeziczno”
14.	Łukietek	3160	-	-
15.	Orchowe	3160	-	„Jezioro Orchowe”
16.	Płotycze Sobiborskie	3160	PLH060043	„Trzy Jeziora”
17.	Święte	3160	-	-

Following the recommendations of the European Commission for habitat monitoring [European Commission 2005] all used measures and parameters as well as the final assessment parameter were assigned to one of the following categories (habitat conservation status): favourable (FV), unfavourable-inadequate (U1) or unfavourable-bad (U2). The ranges of values typical for each state in habitats 3150 and 3160 was proposed by Wilk-Woźniak *et al.* [2012a, b].

RESULTS

Five out of total 12 habitats (41%) of the type 3150 (Oxbow lakes and natural eutrophic lakes with Nympheion and Potamion communities) were assigned to the favourable conservation status FV. The other water bodies were in inadequate (33%) or bad (25%) state (Tab. 2, Fig. 1). The worse rating have got the oxbow

Table 2. The assessment of the conservation status of habitats 3150 Oxbow lakes and eutrophic lakes with Nympheion and Potamion communities in the Lubelskie Region

Lake	Area	*SSF Water colour*	*SSF Plant comm.*	*SSF Plankton*	*SSF EC*	*SSF pH*	*SSF SD*	Specific structure and functions	Conserv. perspect.	**Final assesem.**
Bikcze	FV	*FV*	*FV*	*FV*	*FV*	*FV*	*FV*	FV	FV	**FV**
Czarne Uścimowskie	FV	*FV*	*FV*	*U1*	*FV*	*FV*	*FV*	FV	FV	**FV**
Głębokie Cycowskie	FV	*FV*	*U1*	*U1*	*FV*	*U1*	*FV*	U1	U1	**U1**
Głębokie Uścimowskie	FV	*FV*	*U1*	*U2*	*FV*	*FV*	*U1*	U1	U1	**U1**
Koseniec	U2	*FV*	*U2*	*U1*	*FV*	*FV*	*U2*	U2	U1	**U2**
Płotycze Urszulińskie	FV	*FV*	*FV*	*FV*	*FV*	*FV*	*FV*	FV	FV	**FV**
Spólne	U1	*FV*	*U1*	*U1*	*FV*	*FV*	*U1*	U1	U1	**U1**
Sumin	FV	*FV*	*FV*	*U1*	*FV*	*FV*	*U1*	FV	U1	**FV**
Klarów	U2	*U1*	*U2*	*U1*	*FV*	*FV*	*U2*	U2	U2	**U2**
Orchówek	FV	*FV*	*FV*	*U1*	*FV*	*U1*	*FV*	FV	FV	**FV**
Wola Uhruska	U1	*FV*	*U1*	*U1*	*FV*	*FV*	*U1*	U1	U1	**U1**
Zawieprzyce	U2	*U1*	*U2*	*U2*	*FV*	*FV*	*U2*	U2	U2	**U2**

FV – favourable, U1 – unfavourable-inadequate, U2 – unfavourable-bad; *SSF – Specific structure and functions*; EC – electrolytic conductivity, SD – water transparency. The particular parameters used to estimate SSF are shown in italics

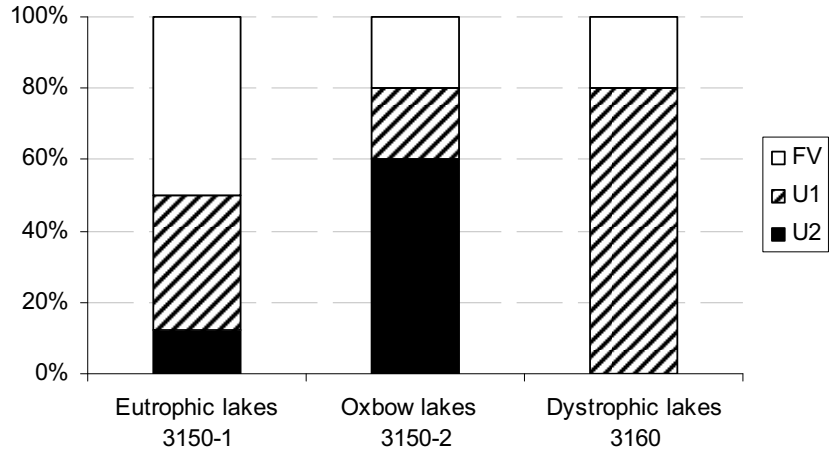

Fig. 1. Percentage of each conservation states in three types of habitats

Table 3. Chemical parameters used in specific structure and functions (SSF) assesement in studied habitats

Habitat	EC, µS · cm^{-1}	pH	SD, m	TDS, mg · dm^{-3}
3150-2 Oxbow lakes	432.5 ±92.6	7.4 ±0.6	1.2 ±0.6	-
3150-1 Eutrophic lakes	316.9 ±132.9	7.6 ±0.4	1.8 ±0.9	-
3160 Dystrophic lakes	50.4 ±14.3	7.0 ±0.4	0.7 ±0.2	33.2 ±9.3

Mean values ± standard deviation; TDS – total dissolved solids; other abbreviations as in Tab. 2

Table 4. The assessment of the conservation status of habitats 3160 Natural dystrophic lakes in Lubelskie Region

Lake	Area	Specific structure and functions	Conservation perspectives	**Final assesement**
Brzeziczno	FV	U1	FV	**U1**
Łukietek	U1	U1	U1	**U1**
Orchowe	FV	U1	U1	**U1**
Płotycze Sobiborskie	FV	FV	FV	**FV**
Święte	FV	FV	U1	**U1**

Abbreviations as in Tab. 2

Table 5. The assessment of SSF (Specific structure and functions) of habitats 3160 Natural dystrophic lakes in Lubelskie Region

Lake	SSF Water colour	SSF Plant comm.	SSF Plankton	SSF Exp. plants	SSF EC	SSF pH	SSF SD	SSF TDS	SSF Drain-agechannles	**SSF general**
Brzeziczno	FV	FV	FV	U1	FV	FV	U1	FV	FV	**U1**
Łukietek	U1	FV	U1	U1	FV	FV	U1	FV	U1	**U1**
Orchowe	U1	FV	U1	U1	FV	FV	U1	FV	FV	**U1**
Płotycze Sob.	FV	FV	FV	U1	FV	FV	FV	FV	FV	**FV**
Święte	FV	FV	FV	FV	FV	FV	U1	FV	FV	**FV**

Exp. plants – expansive plants; other abbreviations as in Tab. 2

lakes (subtype 3150-2) in which only one out of four (25%) was considered as FV. The main two parameters which have contributed to U1 or U2 assessments were the area of the habitat and specific structure and functions. The second one consisted of six measures from which the most important (so called „the cardinal measures") ones were: the combination of plant communities, the occurrence of alien and invasive plant species, water colour, electrolytic conductivity and water transparency. The combination of plant communities were assessed taking into consideration the proper structure of macrophytic ecological groups (elodeids, nympheids and pleustophytes). In some cases, the structure was considered as „extremely reduced", especially in oxbow lakes, where dense *Lemno minoris – Salvinietum natantis* covered almost all the surface of the water body, thus reducing the occurrence of submerged macrophytes. Also the water transparency was the parameter which contributed much to the inadequate /bad ratings because the values of this measure were low (Tab. 3). Rest of „cardinal" parameters have the adequate level, including electrolytic conductivity (Tab. 2 and 5). Plankton structure, which was the „additional" measure was in most cases inadequate (8 cases) or bad (2 cases), even in habitats with general FV status. It was connected mainly with bad zooplankton structure in which there was a lack of filter feeding large cladocerans and the structure was dominated by rotifers or copepods. In some cases the occurrence of filamentous cyanobacteria was the reason that the habitat was assigned to U1 or U2 status.

The second habitat type 3160 (Natural dystrophic lakes) was studied in five water bodies. Out of them only one lake (20%) had FV status, the other (80%) being in inadequate (U1) state (Tab. 4, Fig. 1). In three cases the final U1 status was connected with inadequate specific structure and functions. One lake, although having FV for this parameter, had inadequate perspectives of the protection due to private owner's recreational management (Tab. 4). Particular measures of specific structure and functions are shown in Table 5. All habitats with final U1 assessment have favourable (FV) structure of macrophytes, however they suffer with inadequate status in case of expansive plants cover („cardinal" parameter). It was connected with common reed (*Phragmittes australis*) or narrow leaf cattail (*Typha angustifolia*) expansion, which covered up to 5% of the habitat area. Interestingly, chemical parameters (pH, electrolytic conductivity and total suspended solids) were in all dystrophic lakes on favourable (FV) level (Tab. 3 and 5). Plankton community only in two lakes was inadequate (U1) which was related to zooplankton structure dominated by small rotifers.

DISCUSSION

The assessment program of conservation status concerning habitats 3150 and 3160 in Lubelskie Region was the first trial of evaluation of this type of habitat regarding to needs of The Habitat Directive. Thus, there is a problem of

referring the results to previous studies (conducted with similar methods) to reflect trends of changes over time. However, the results of the assessment can be referred to the results received in whole Poland, as well as in Europe. In the second instance the problem is the lack of actual data from the 2007–2012 period, due to the fact that the deadline for reporting by EU member states was established in 2013, and the synthesis of the results will be announced by the European Commission in 2014–2015. The only accessible data are those from the previous reporting period, ie. 2001–2006, which in most were carried out using published literature and expert assessments, without conducting field researches.

Monitoring of 3150 habitat (Oxbow lakes and natural eutrophic lakes with Nympheion and Potamion communities) in Poland included 270 sites of continental region and it was implemented in 2009–2011 [GIOŚ 2012a]. Against the background of the monitored group of water bodies in Poland, the habitats of Lubelskie Region had more favorable (FV) ratings (43% against 24%) and a smaller number of bad (U2) ratings (25% against 33%). The main component responsible for the assessment of U1/U2 were, both in the Lublin region and whole Poland, the specific structure and functions, among which the worst rated were: the combination of species, the structure of plankton and water transparency. The deterioration of the first parameter was mostly connected with the depletion of macrophyte communities within habitats resulting in the lack of nympheids or elodeids, or, if there were representatives of both groups, in hornwort (*Ceratophyllum demersum*) communities predominated. Low diversity level in plant communities is often linked with overfertlisiation – with high nutrient levels, species richness is expected to be lower because only very competitive species dominate the community [Bornette and Puijalon 2011]. A large number of assessments U1/U2 was also connected with the structure of plankton, which reflected, among the others, with the presence of cyanobacteria and low water transparency [GIOŚ 2012a]. Bad condition of oxbow lakes (subtype 3150-2) in Lubelskie Region is the reflection of the deteriorating quality of these habitats in Poland. For example, among the ten studied Narew oxbow lakes, all received an general rating U1 or U2. Similarly situation occurred in the oxbow lakes of the river Noteć, where such a ratings received 13 out of 17 studied objects. Although there are not enough data to make a generalization, it is possible, that poor status of oxbow lakes is linked to the general deterioration of natural river valleys in Europe [Kruk 2007].

Habitat 3160 (Natural dystrophic lakes) was assessed in Poland in 2011 at 68 sites, among which 70% achieved a general rating FV [GIOŚ 2012b]. Against this background, habitats 3160 in the Lubelskie Region can be considered as definitely poor, where 80% of the studied water bodies received the assessment of U1. What is interesting, received low ratings of this habitat in Lubelskie Region were, among the others, mainly related to the presence of expansive species (*Phragmites australis* or *Typha angustifolia*) what has been found only in a few cases outside of this region. Dystrophic lakes in general, as other

softwater lakes are under strong threat of degradation related to its acidification and eutrophication [Murphy 2002]. Dystrophic lakes are very fragile to changes in catchment hydrology, the deterioration of theirs habitats due to the new drainage systems have been reported in few cases in Poland [Zieliński *et al*. 2011, Pęczuła and Szczurowska 2013].

Available European data for habitat 3150 show that most of the 11 countries of the continental region, which carried out monitoring in 2001–2006, recognize the general condition of the habitat (at the level of the country) as a bad (U2). In the case of continental region dystrophic lakes, out of eight countries which assessed that habitat, U2 rating appeared in six cases [ETC Biological Diversity]. In comparison to the other European countries, it can be assumed that the habitats connected with small water bodies in the Lubelskie Region are in better (habitat 3150) or in the similar (habitat 3160) state.

Detailed monitoring data from all EU member states, which will be available after 2014, will allow for a more comprehensive assessment of the conservation status of small water bodies habitats, both in Poland and in the Lubelskie Region.

CONCLUSIONS

1. The small water bodies forming a habitat 3150 in the Lubelskie Region had more favorable (FV) ratings and a smaller number of bad (U2) ratings as compared with results from the whole Poland.

2. Inadequate conservation status of oxbow lakes (habitat subtype 3150-2) in the Lubelskie Region is the reflection of the unfavourable status of these habitats in Poland.

3. Dystrophic lakes (habitat 3160) in the Lubelskie Region can be considered as definitely poor conservation status, comparing with the results of the national assessment.

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DROBNE ZBIORNIKI WODNE I JEZIORA CHRONIONE W RAMACH DYREKTYWY SIEDLISKOWEJ UE – WYNIKI PILOTAŻOWEGO MONITORINGU PRZYRODNICZEGO W REGIONIE LUBELSKIM

Streszczenie. Drobne zbiorniki wodne, jakkolwiek pełnią ważne funkcje w zachowaniu bioróżnorodności na poziomie krajobrazowym i gatunkowym, podlegają silnej presji, skutkującej zanikiem wielu tego typu siedlisk. Jedną z możliwości ochrony drobnych zbiorników wodnych jest Dyrektywa siedliskowa UE. W pracy przedstawiono wyniki pilotażowego programu oceny stanu zachowania siedlisk słodkowodnych: 3150 – Starorzecza i naturalne eutroficzne zbiorniki wodne ze zbiorowiskami z *Nympheion, Potamion* oraz 3160 – Naturalne dystroficzne zbiorniki wodne w regionie lubelskim. 41% spośród 12 badanych siedlisk 3150 miało cechy stanu zadowalającego (FV), podczas gdy pozostałe 59% określono jako niezadowalający (U1) lub zły (U2). W typie siedliskowym 3160, 80% stanowisk otrzymało ocenę U1. Ocena stanu zachowania siedlisk drobnych zbiorników wodnych regionu lubelskiego na tle badań monitoringowych Polski wskazuje na podobny stan zachowania siedliska 3150 oraz wyraźnie gorszy stan jezior dystroficznych tworzących siedlisko 3160.

Słowa kluczowe: drobne zbiorniki wodne, Dyrektywa siedliskowa UE, monitoring przyrodniczy, starorzecza, jeziora eutroficzne, jeziora dystroficzne