INSPECTION OF ENVIRONMENTAL PROTECTION

# Monitoring of natural habitats

## Methodological guide

## for natural habitat
## 3110 Lobelia lakes - Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*)

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# 3110 Lobelia lakes - Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*)

Photo 1 Obrowo Małe lobelia-lake (© Photo M. Kraska)

## I. INFORMATION CONCERNING THE NATURAL HABITAT

### 1. Phytosociological identifiers

Class: *Littorelletea uniflorae* Br.BI. et R.Tx. 1943

Order: *Littorelletalia uniflorae* Koch 1926

Alliance: *Isoetion lacustris* Nordh. 1936 em. Dierss. 1975

*Isoetetum lacustris* Szankowski et Kłosowski 1996 n.n.

*Isoetetum echinosporae* Koch 1926 em. Dierss. 1975

Alliance: Lobelion (Van Den Bergen 1944) R.Tx. et Dierss. ap. Dierss. 1972

*Lobelietum dortmannae* (Oswald 1923) Tx. ap. Dierss. 1972

*Myriophylletum alterniflori* Lemée 1937 em. Siss. 1943

*Ranunculo-Juncetum bulbosi* Oberd. 1957

Alliance: *Eleocharition acicularis* Pietsch 1966 em. Dierss. 1965

*Luronietum natantis* Szankowski 1988 n.n.

Class: *Fontinalietea antipyreticae* von Hubschmann 1957

Order: *Leptodictyetalia riparii* Philippi 1956

Alliance: *Fontinalion antipyreticaea* W. Koch 1936
Community with *Drepanocladus tenuinervis*

Class: *Utricularietea intermedio-minoris* Den Hartog et Segal 1964 em. Pietsch 1965
Order: *Utricularietalia intermedio-minoris* Pietsch 1965
Alliance: *Sphagno-Utricularion* Th. Müller et Görs 1960
*Sparganietum minimi* Schaaf 1925
*Warnstorfietum exannulatae* Szankowski 1998 n.n.
Community with *Sparganium angustifolium*
Community with *Sphagnum denticulatum*

Class: *Scheuchzerio-Caricetea fuscae* (Nordhagen 1936) R. Tx. 1937
Order: *Scheuchzerietalia palustris* Nordhagen 1936
Alliance: *Caricion lasiocarpae* Vanden Berghen in Lebrun et al. 1949
*Calletum palustris* (Osvald 1923) Vanden Bergen 1952
*Caricetum lasiocarpae* Osvald 1923
*Menyantho-Sphagnetum terestis* Warén 1926
*Sphagno apiculati-Caricetum rostratae* Osvald 1923 em. Steffen 1931

Class: *Charetea* Krausch 1964
Order: *Charetalia fragilis* Sauer 1937
Alliance: *Nitellion flexilis* (Corill. 1957) Dąmbska 1966
*Nitelletum flexilis* Corill. 1957
*Nitelletum capillaris* Corill. 1957

Class: *Potametea* Tx. et Prsg. 1942
Order: *Fotametalia* Koch 1926
Alliance: *Nymphaeion* Oberd. 1957
*Potametum natantis* Soó 1927
*Nymphaeo albae-Nupharetum luteae* Nowiński 1928
*Polygonetum natantis* Soó 1927
*Nymphaeetum candidae* Milian 1958
*Nupharetum pumili* Oberd. 1957
Alliance: *Potamion* Koch 1926 em. Oberd. 1957
*Elodeetum canadensis* (Pign.1953) Pass. 1964
*Ceratophylletum demersi* Hild. 1956

Class: *Phragmitetea australis* (Klika in Klika et Novák 1941) R. Tx. et Prsg. 1942
Order: *Phragmitetalia australis* W. Koch 1926
Alliance: *Phragmition australis* W. Koch 1926
*Phragmitetum australis* (Gams1927) Schmale 1939
*Equisetetum limosi* Steff. 1931
Alliance: *Magnocaricion elatae* W. Koch. 1926
*Caricetum rostratae* Rubel 1912
*Caricetum elatae* W. Koch 1926

## 2. Description of the natural habitat

Soft-water lakes, oligotrophic, mesotrophic or in the early developmental stages of dystrophic lakes, marked by the presence of isoetids grouped in associations: Lobelietum dortmannae,

Isoetetum lacustris, the markedly rarer Isoetetum echinosporae, and also Myriophylletum alterniflorae.

The name Lobelia-type lake pertains to such a lake where characteristic plant species (isoetids) (Photos 2-6) occur together or separately: water lobelia Lobelia dortmanna*,* quillwort Isoëtes lacustris*, thorny quillwort* Isoëtes echinospora*, European shoreweed* Littorella uniflora*, alternate water-milfoil* Myriophyllum alterniflorum*, and – more rarely – floating water-plantain* Luronium natans*.* These plant species develop specific associations and reproduce freely.

The lakes which in the past were classified as lobelia-type lakes, and do not meet the criteria at present, are considered to be historical lobelia lakes or degraded lobelia lakes. The detailed description of the habitat as well as references broadening the knowledge about lobelia lakes can be found in Poradniki ochrony siedlisk i gatunków Natura 2000, vol. 2. Wody słodkie I torfowiska (Kraska 2004).

Photo 2 Quillwort *Isoëtes lacustris* in Wielki Staw lake in the Karkonosze mountains (© Photo R. Knapik)

## 3. Ecological conditions

Lobelia-type lakes (Oligotrophic waters containing very few minerals of sandy plains) are most often inland lakes. Only a few of them have an inflow of water from temporary water courses. Characteristic features of lobelia-type lakes include specific physicochemical properties of their waters and the occurrence of characteristic vegetation – isoetids. The occurrence of isoetids from the Lobelion dortmannae and Isoetion lacustris alliances is possible only in lakes characterised by low mineralisation and low calcium content. The features which are necessary for a lobelia-lake to remain in good condition and guarantee the presence of specific vegetation, are: transparent bluish-coloured water; pH of water from 5.5-7.5; electrolytic conductance lower than 100 µS $cm^{-1}$, trace

quantity of calcium, low concentrations of nitrogen and phosphorus, high transparency of water, characteristic composition of plankton, and no algal blooms.

Based on the physicochemical properties of their waters and the proportion of characteristic plant species, Lobelia-type lakes were divided into four subtypes:

- dystrophic lakes: oligohumic and polyhumic,
- nutrient-balanced lakes,
- eutrophicated lakes,
- degraded lakes.

The acid reaction of water (pH 3.8-5.9) is a distinct feature of dystrophic lobelia lakes. It results from the low quantities of calcium and magnesium and thus lacks the reaction buffering capacity with the inflows of fulvic acids from catchment areas in coniferous forests, acidic Pomeranian beech forests, as well as from coastal vegetation zones – ecotones – whose floristic compositions correspond to the initial stages of bryophyte or high-moor peatbogs. Water in the dystrophic, oligohumic lobelia lakes contain low levels of humic substances, therefore its colour is relatively light, sometimes very light-blue.

On the other hand, the waters of dystrophic polyhumic lobelia lakes contain high levels of humic substances – humins which give them more intensive colour, light-brown or dark-brown. In the polyhumic lakes there are fairly large point concentrations of nitrogen and phosphorus compounds. These elements are permanently bound with humic substances in metaloorganic complexes and therefore are not available to plants.

NOTE: dystrophic lobelia lakes are not the same as dystrophic lakes. Because of the presence of large quantities of humic substances, their waters are brown-coloured, similarly as in dystrophic lakes. However, they can be easily distinguished owing to the presence of plant characteristic of lobelia-type lakes.

Nutrient-balanced lobelia lakes have a neutral water reaction or close to neutral: pH 6.0-7.6, low electrolytic conductance (low quantities of mineral salts), and higher levels of calcium and bicarbonates, compared with dystrophic lobelia lakes.

Eutrophicated lobelia lakes are marked by higher concentrations of nitrogen and phospohorus, calcium, and magnesium. The nitrogen and phosphorus are not bound into permanent complexes and thus they are available to plants. This situation results in the occurrence of undesirable algae or also algal blooms, changes in the physicochemical properties of the water as well as the disappearance of vegetation typical of Lobelia-type lakes and the emergence of vegetation typical of eutrophicated lakes.

Degraded lobelia lakes are those lakes which historically were lobelia lakes but the long-lasting eutrophication process of waters has resulted in the disappearance of vegetation typical of lobelia lakes. In waters of this type of lake, high concentrations of nitrogen and phosphorus compounds, and high values of electrolytic conductance are found.

Because of their small surface areas and often shallowness, lobelia lakes are particularly vulnerable to adverse impacts, especially those resulting from human activities. Changes in hydrological systems through draining peat bogs near the lakes, dumping humic water into the lakes, liming and fish stocking lead to changes in the physicochemical properties of their waters and – as a consequence – to the disappearance of characteristic vegetation. Lobelia lakes are at risk either of eutrophication or of dystrophication. Therefore, this habitat is unstable, susceptible to changes and can rapidly degrade and disappear. The good conservation status of lobelia lakes depends primarily

on maintaining the specificity of landscape in form of natural associations in the catchment areas of the lakes, with its most essential elements such as pine forests, acidic beech forests, Sphagnum bogs and highmoor peatbogs.

Photo 3 *Quillwort* Isoëtes lacustris (left) and water lobelia Lobelia dortmanna (© R. Piotrowicz)

Photo 4 Water lobelia Lobelia dortmanna (© R. Piotrowicz)

Photo 5 European shoreweed *Littorella uniflora* (© R. Piotrowicz)

Photo 6 Kapka lake shore with flowering water lobelia *Lobelia dortmanna* (© R. Piotrowicz)

The following species from Annex II of the Habitats Directive are present in lobelia lakes: *floating water-plantain* Luronium natans, *diving water beetle* Dytiscus latissimus, *water beetle* Graphoderus bilineatus.

## 4. Typical plant species

The plant species that differentiate this habitat from other lakes are *water lobelia* Lobelia dortmanna (Photos 3, 4 and 6), Isoëtes lacustris (Photo 3), *thorny quillwort* Isoëtes echinospora, *European shore-weed* Littorella uniflora (Photo 5), *alternate water-milfoil* Myriophyllum alterniflorum, *floating water-plantain* Luronium natans.

## 5. Distribution in Poland

Lobelia lakes in Poland are situated in the Pomeranian Lake District, Bory Tucholskie forest, Charzykowska plain, and the Kashubian Lake District. The greatest numbers occur near Kartuzy, Sulęczyn, Bytów, Miastko, Bobolice, Czaplinek, Złocieniec, Swornegacie, and Charzykowy localities.

Apart from these areas, there are also three lakes classified as lobelia lakes in the Olsztyn Lake District and Wielki Staw lake in the Karkonosze mountains, where the abundant presence of quillwort Isoëtes lacustris *was found.*

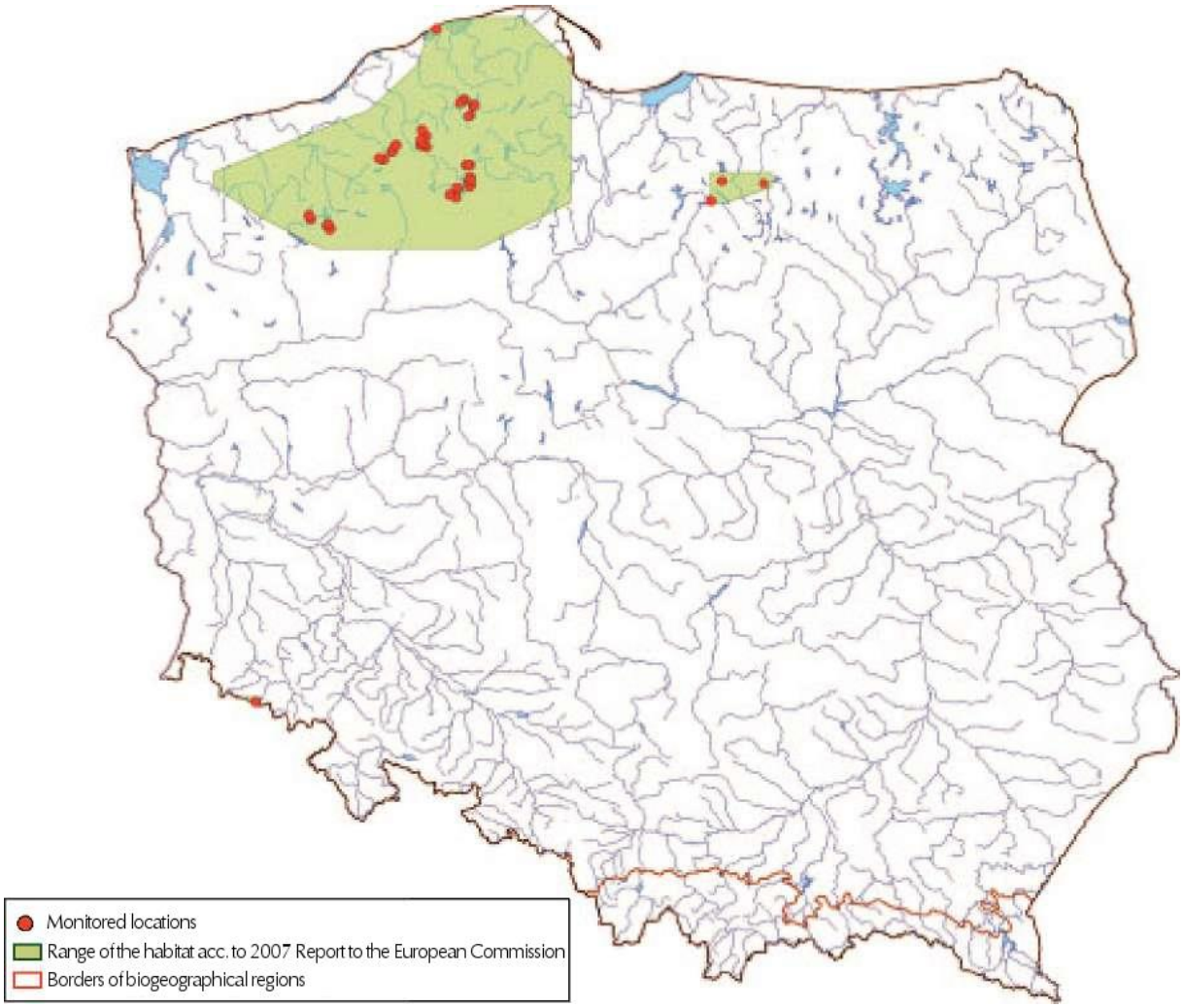


Fig. 1 Distribution of the habitat in Poland and monitored locations

# II. METHODOLOGY

## 1. Methodology of monitoring studies

### Selection of monitoring locations

On account of the great value of the habitat and the possibility of its rapid degradation as well as the resultant possibility of disappearance of plants characteristic of lobelia lakes, monitoring should cover the lakes situated in all regions of their occurrence. The monitoring should cover the lakes within the Olsztyn Lake District and Wielki Staw lake in the Karkonosze mountains. In 2009-2010 the monitoring of lakes was performed in the Pomeranian Province (in the neighbourhoods of Bytów, Miastko, and Charzykowy localities), in the Western Pomeranian province (near Bobolice), Warmia-Masuria, and Lower Silesia provinces (Karkonosze mountains). The monitoring studies encompassed the area of the Bory Tucholskie forest, Charzykowska plain, Olsztyn Lake District, and the Karkonosze

mountains. The monitored locations are representative of lobelia lakes occurring in Poland and covered all the regions where this type of lake was found and described.

Before any detailed field studies are initiated it should be first confirmed that the given lake was correctly classified as a lobelia lake. The monitoring location can cover the entire lake or its clearly distinct part. As a consequence, habitat 3110 may not necessarily cover the whole lake. So, in the case of large lakes, more than one monitoring location can be situated on the given lake. The presence of the characteristic plants should be assessed on a selected transect. The person who carries out the monitoring should have the possibility to sail around the lake or its evidently distinct part. Samples for the determination of physicochemical indices as well as plankton samples should be collected from the deepest location, usually situated centrally on the lake or its evidently distinct part, and not from the littoral zone.

## Method of performing studies

The experience from the monitoring of lobelia lakes indicates that it is a habitat which cannot be properly assessed without cooperation with experts. Additional problems in identifying some characteristic species are associated with the difficulty of finding these species and actually confirming their presence. In this situation the most recommended method of searching for indicator species would be to use divers. This method is, however, very specialised, difficult and costly when used for monitoring. In order to avoid the too easy neglect of the assessment of a habitat, or not to commit an error when assessing the status of a habitat, it would be wise to nevertheless consider this method for monitored locations which meet the criteria required for habitat 3110 and where well-developed communities of species characteristic of lobelia lakes, and where their presence was not confirmed in the field studies.

During the implementation of monitoring activities in the field, the following observations and studies should be performed:

- evaluating overgrowth of lake shores, shallowing, fragmentation of the habitat, and changes which have taken place in the habitat since the time of the previous study;
- taking note of possible damage, littering, sewage dumping, poaching etc.;
- finding the place where the transect was marked at the previous study (GPS data available). If the habitat is examined for the first time, a representative transect should be found and marked;
- determining the characteristic combination of aquatic plant communities in the marked transect;
- determining the dominant species in particular communities;
- determining the occurrence of rare, protected, characteristic species or species alien to the habitat and performing their quantitative assessments (sporadic, very scarce, abundant, massive occurrence);
- in the central part of the lake or in the central selected part of the lake (open water table, not overgrown, pelagial zone), the following elements should be determined: colour of water, transparency (visibility of the Secchi disk), conductance, and reaction of water (pH). The samples should be taken from the surface layer (ca. 0.5-1 m);
- The sample should be collected to analyse the plankton (auxiliary parameter). The samples should be taken from the surface layer (ca. 0.5-1 m) of water and stabilised with Lugol's solution.

If the transect marked in previous studies was moved, the new geographical coordinates should be identified and recorded and the size of the community should be assessed whether it was reduced, expanded, or remained comparable with the size of the previously examined community.

If the lake is not large, and it is technically possible, the lake should be – additionally to the central part – sailed around in order to find the occurrence of vegetation patches or even single individuals of rare, protected, characteristic species or species alien or invasive towards the habitat, situated outside the studied transect. If a marked part of the lake is selected for the studies and meets the criteria for the habitat, it should be sailed around.

The point of collection of samples made to determine plankton should be situated more or less in the central, middle, deepest part of the lake (or in the central, middle, deepest selected part of the lake). The samples are taken with the use of a plankton net (a net with a tiny mesh size, ø 20 µm or less, is recommended because it will allow both phyto- and zooplankton to be identified). After concentrating in the plankton net, the sample should be poured into a plastic container and several drops of Lugol's solution should be added to stabilise it. It should also be well secured against spilling during transportation. A rough analysis of the diversity and percentage proportions of phytoplankton and zooplankton should be done in at least twenty visual fields under a light microscope.

If a plankton net is unavailable, phytoplankton may be assessed in samples with the use of the sedimentation method.

No precise determination of phyto- and zooplankton is required, and if in doubt, consultations with experts are recommended.

## Time and frequency of studies

The monitoring studies of the habitat conservation status in the areas should be conducted once every three years. In cases where the additional indices indicate the evidently bad status of the habitat, a repeated study should be considered after a shorter interval, e.g. after one year.

It is recommended to carry out the studies in summer, in the months of July and August but not earlier than the beginning of July, and not later than mid September.

## Equipment used in studies

**Equipment indispensable for field studies:**

- map, GPS, pencil, notebook,
- vessel suitable for local conditions: dinghy or boat,
- field boots or rubber boots,
- camera,
- probe for measuring conductivity and reaction of water,
- Secchi disk,
- probe measuring the depth of a water body, or any other simple device to measure maximum depth of the examined water body,
- an anchor for pulling submerged vegetation.

**Non-obligatory equipment, required in the case of describing additional indices:**

- plankton net,
- small container for plankton,
- Lugol's solution,
- access and possibility to use a simple light microscope.

## 2. Assessment of the conservation status of the natural habitat as well as indices of specific structure and functions

Table 1 Description of indices of specific structure and function of the natural habitat, as well as "conservation prospects" for natural habitat 3110 Lobelia lakes (Oligotrophic waters containing very few minerals of sandy plains)

| Parameter Index | Description |
|---|---|
| **Specific structure and functions** | |
| Characteristic combination of communities within the transect | This index describes the occurrence of plant communities within the selected transect (typical, representative of the habitat). In the description and assessment, the identified taxa should be listed although without the necessity of listing details of sedge communities. This index evaluates whether the communities typical of a given habitat occur and in what conservation status they are. The presence of indicator species of lobelia lakes should also be found and described, and their quantitative assessment made. The assessment should be performed on the basis of the transect determined and defined (geographical coordinates available) earlier. In the case of moving the studied transect, it is necessary to identify and record the new geographical coordinates. |
| Species indicating habitat deterioration | This index describes the occurrence of species typical of eutrophicated waters, providing the possibility to find the progressive deterioration of the habitat. In the case of lobelia-lakes communities, these are: *yellow water-lily* Ceratophyllum demersum, *spiked water-milfoil* Myriophyllum spicatum, *frogbit* Hydrocharis morsus-ranae, Canadian pond-weed Elodea canadensis. The assessment should be performed on the basis of the transect determined and defined (geographical coordinates available) earlier. In the case of moving the studied transect, it is necessary to identify and record the new geographical coordinates. |
| Water colour | One of the parameters describing water quality. The colour of water is affected by organic waste, humic substances, soil erosion, sewage, and the abundant development of phytoplankton. All the above-listed components have an adverse effect and lead to the deterioration of the habitat's condition. The colour of water is assessed at a point situated more or less in the central, middle, deepest part of the lake (or in the central, middle, deepest selected part of the lake). |
| Water Reaction | The parameter describing the acidity or alkalinity of water. It is an index essential to lobelia lakes because the lowering pH of water will testify to the disappearance of the habitat for plants typical of lobelia lakes and its possible transformation into a dystrophic lake. Conversely, if the pH value is too high it testifies to the disappearance of the habitat and the possible transformation of a lobelia-lake into a eutrophic lake. The pH value is measured using a 1 m long pH probe in the surface layer of water (ca. 0.5-1 m) from the pelagial zone. The measuring point should be situated more or less in the central, middle, deepest part of the lake (or in the central, middle, deepest selected part of the lake). |
| Conductivity (electrolytic conductance) | The value of electrolytic conductivity reflects the level of ion content in the water and is a measure of the water's capability of conducting an electric current. Pollutants in water undergo electrolytic dissociation which also causes higher conductivity. Conductivity is also affected by the quantity of gases absorbed from the air ($CO_2$, $SO_3$ $NO_2$, $NH_3$) and by pollutants of anthropogenic origin (sewage discharges, water run-off from farmlands containing nitrogen and phosphorus fertilisers and the like). The value of conductivity is measured by a conductivity probe in the surface layer of the water (ca. 0.5-1 m) from the pelagial zone. The measuring point should be situated more or less in the central, middle, deepest part of the lake (or in the central, middle, deepest selected part of the lake). |
| Water transparency | Measured as visibility of the Secchi disk. The Secchi disk is a white disk with a diameter measuring 30 cm. It is lowered – on a calibrated line or measuring tape – into the water until the observer loses sight of the disk. The measuring point should be situated more or less in the central, middle, deepest part of the lake (or in the central, middle, deepest selected part of the lake). Poor transparency of water adversely affects the development of the immersed vegetation and can be caused by either the abundant development of phytoplankton, or by the presence of suspended matter in the water. |

| Parameter Index | Description |
|---|---|
| **Auxiliary index** | |
| Plankton[1] | Evaluated on the basis of the analysis of phytoplankton and zooplankton in the examined samples. The three-step assessment of the value of this index is performed as described in Table 2, separately for each of these two groups. If the evaluations of the components differ, the lover value is adopted as a final assessment. Phytoplankton and zooplankton are components which rapidly react to the change of conditions and therefore their response is the fastest. Phytoplankton and zooplankton respond and show changes in a shorter time than higher-level plants. |
| Conservation prospects | A survey should be made to determine the real possibility of preserving the correct status of the habitat or rectifying the incorrect status. The description should include information about potential conservation measures aimed at the preservation or improvement of the status of the habitat. The following should also be evaluated: the condition of the lakes' catchment areas and the land management methods pursued there e.g. whether water and waste-water management measures are implemented, or whether pollutants are dumped in lakes, which pertains to homes and farms as well as recreational facilities; methods of farm and forestry management in close neighbourhoods of the lake and its catchment area; and finally the management of the lobelia lakes themselves should be assessed. In the case of allowing recreational activities on the lakes, the conditions of recreational infrastructure should be also evaluated. |

[1] In lake ecosystems, the blue-green algal blooms are adverse and undesirable phenomena. In the event that such blooms are found in lobelia lakes it means that their trophism is increasing, leading to the deterioration of the conservation status and, ultimately, to the disappearance of habitat 3110. The presence of blue-green algal blooms prompts us to pay particular attention to the status of the ecosystem in which this phenomenon has been observed and to undertake immediate conservation measures.

Table 2. Evaluation of status parameters and indices of specific structure and functions for natural habitat 3110 Lobelia lakes (Oligotrophic waters containing very few minerals of sandy plains)

| **Parameter** | **FV favourable** | **U1** unfavourable inadequate | **U2** unfavourable bad |
|---|---|---|---|
| **Specific structure and functions (including typical species)** | | | |
| Characteristic combination of communities within the transect | Patches of Lobelietum dortmannae, Isoetetum lacustris or Myriophylletum alterniflori *association predominate*. *High diversity of species characteristic of* lobelia lakes, great or massive occurrence of characteristic species. Species characteristic of lobelia lakes: water lobelia, quillwort Isoëtes lacustris, *thorny quillwort* Isoëtes echinospora, *European shore-weed* Littorella uniflora, *alternate water-milfoil* Myriophyllum alterniflorum, *floating water-plantain* Luronium natans. | The vegetation of the Isoeto-Lobelietum asssociation scarcely present, domination of *spiked water-milfoil* Myriophyllum spicatum over *alternate water-milfoil* Myriophyllum alterniflorum. Little diversity among species characteristic of lobelia lakes, few, very few, or sporadic of characteristic species. | At present, species characteristic of lobelia lakes do not occur (but were recorded earlier) or occur as single individuals as accompanying species within the communities of plants typical of eutrophic or dystrophic lakes. |
| Species indicating degeneration of the habitat | Lack of species indicating degeneration of the habitat. | Species indicating degeneration of the habitat occur as single individuals. | Species indicating degeneration of the habitat increase their proportions in the communities. These are the following species: *yellow water-lily* Nuphar lutea, *rigid hornwort* Ceratophyllum demersum, *spiked water-milfoil* Myriophyllum spicatum, *frogbit* Hydrocharis morsus-ranae. |
| Water colour | Transparent, livid-blue or blue | Blue with a green or yellow-green tinge | Brown or visibly green |
| Reaction of water | pH 5.5-7.5 | pH <5.5 to 4.5 or >7.5 to 8.5 | pH <4.5 or >8.5 |
| Conductivity (electrolytic conductance) | <100 µS $cm^{-1}$ | 100-250 µS $cm^{-1}$ | >250 µS $cm^{-1}$ |
| Water transparency | Visibility of Secchi disk >3.5 m | Visibility of Secchi disk 1.5-3.5 m | Visibility of Secchi disk <1.5 m |

| Parameter | FV favourable | U1 unfavourable inadequate | U2 unfavourable bad |
|---|---|---|---|
| **Auxiliary index** | | | |
| Plankton: Phytoplankton | In the dystrophic lakes, many mixotrophic taxa, chrysophytes or tiny green algae and/or chroococcus blue-green algae occur, except those of the Microcystis *and* Woronichinia *genera*. *Also possible is the domination of dinophytes or cryptophytes as well as the occurrence of* Gonyostomum semen (Raphidophyceae). | Co-domination of blue-green and green algae | Domination of filamentous blue-green algae, or those of the Microcystis *and* Woronichinia *genera*, blue-green algal blooms. |
| Zooplankton | Rotatoria and Cladocera *occur often but at low densities*, few *Copepoda*, prevalence of large forms of filtrators/cladocerans (Daphnia!). | *Rotatoria* and small *Cladocera* (Bosmina, Chydorus) *present.* | Domination of *Rotatoria,* particularly Keratella cochlearis f. tecta. |
| Overall structure and functions | All FV ore one U1 | Two or three U1, none U2 | One or more parameters assessed as U2 |
| Conservation prospects | Conservation prospects for the habitat are good or excellent, no significant impact of threatening factors predicted, survival of the habitat in longer time perspective is very probable. | Intermediate combinations | Conservation prospects for the habitat are bad, strong impact of threatening factors is predicted or observed, (draining of the area, bad management of the lakes, bad land management in lake catchment areas and the like), no survival of the habitat can be guaranteed in the long term. |
| Overall assessment | All parameters evaluated as FV | One or more parameters evaluated as U1, no parameters evaluated as U2 | One or more parameters evaluated as U2 |

**Cardinal indices**

- Characteristic combination of communities within the transect
- Species indicating degeneration of the habitat
- Colour of water
- Reaction of water
- Conductivity (electrolytic conductance)
- Water transparency

**Additional indices**

- Plankton

## 3. An example of a filled-in habitat observation sheet for a monitored location

| Habitat observation sheet for the monitored location | |
|---|---|
| **Basic information** | |
| Code and name of the natural habitat | 3110 Lobelia lakes |
| Name of the location | Jezioro Chlewo |
| Type of the location | Research |
| Plant communities | Isoeto-Lobelietum littorelletosum<br>Isoeto-Lobelietum isoetosum (syn. Isoetetosum lacustris*)*<br>*community with Drepanocladus tenuinervis* moss |
| Description of the habitat | Large lobelia-lake (area of 54.9 hectares) distinctly divided into two parts. Shoreline not very varied. Lake shore sandy, on the southern side – steep, currently densely built with recreational huts of holiday centres. The northern side of the closest part of the lake catchment area is overgrown with deciduous forest and – to a lesser extent – coniferous forest. Over the whole of the catchment area, forests cover more than half. The remaining portion is chiefly farmlands, grasslands, and buildings. The vegetation characteristic of lobelia lakes occurs abundantly, particularly in shallow and gently sloped places on the lake bottom. Up to the depth of 100 cm, water lobelia Lobelia dortmanna and *European shore-weed* Littorella uniflora *occupy the largest proportions of the area*. In this lake, quillwort Isoëtes lacustris *occupies the depth interval* from 100 to 300 cm, and the density of quillwort Isoëtes lacustris often exceeds 60%. Up to the depth of 4-4.5 m, Drepanocladus tenuinervis *moss occurs*. Chlewo lake shows symptoms of eutrophication. They are manifested in the form of occurrence of filamentous algae on the underwater vegetation. Thus, the sewage disposal management in the recreational buildings on the lake shores should be assessed. |
| Area of habitat patches | Area with Isoeto-Lobelietum littorelletosum: 150 $m^2$<br>Area with Isoeto-Lobelietum isoetosum: 480 $m^2$<br>Area with *community with* Drepanocladus tenuinervis moss: 270 $m^2$<br>Combined area of habitat patches: 900 $m^2$ |
| Protected areas where the monitored location is situated | PLH320001 Bobolickie Jeziora Lobeliowe |
| Manager of the area | |
| Geographical coordinates | Geographical coordinates of the beginning of the transect: 16° 40'..."E, 53° 56' ..."N |
| Transect dimensions | 30x30 m |
| Elevation a.s.l. | 152.3 m |
| Area | Bobolickie Jeziora Lobeliowe |

| Habitat observation sheet for the monitored location | |
|---|---|
| **Annual report – basic information** | |
| Year | 2009 |
| Monitoring type | Integrated |
| Local experts | Piotr Klimaszyk, Marek Kraska, Ryszard Piotrowicz |
| Threats | Intensive recreational development on the fringes of the lake |
| Other natural values | |
| Is monitoring required? | Yes |
| Justification | Trends towards degradation |
| Conservation measures performed | |
| Proposed conservation measures | Prohibition of stocking with cyprinoid fish as well as with alien fish species, prohibition of fish baiting, bathing outside designated zones, regulated sewage management in recreational facilities |
| Date of inspection | September 2009 |
| Comments | |

| TRANSECT | | | | |
|---|---|---|---|---|
| **Parameters/ Indices** | **Description of index** | **Value of parameter/index** | | **Assessment of index** |
| Surface area of the habitat | | The area has not changed | | FV |
| **Specific structure and functions** | | | | **FV** |
| Characteristic combination of communities within the transect | List the syntaxa occurring in the transect | Isoeto-Lobelietum littorelletosum Isoeto-Lobelietum isoetosum community with Drepanocladus tenuinervis moss | | FV |
| Species indicating deterioration of the habitat | The parameter describes the emergence of species characteristic of eutrophicated waters. The list of such species recorded in the transect should be given. | None | | FV |
| Colour of water | Colour of water is expressed in mg Pt/dm$^3$ | Transparent water of bluish colour. In the epilimnion zone, the colour is 8 mg Pt/dm$^3$. | | FV |
| Reaction of water | The value of reaction is measured with 1 m-long pH probe | The reaction of water in the epilimnion zone is: pH 6.35 | | FV |
| Conductivity (electrolytic conductivity) | Measurement is made in the surface layer by a conductivity probe and expressed in µSm cm$^{-1}$ | The conductivity in the epilimnion zone is 60 µSm cm$^{-1}$ | | FV |
| Water transparency | Visibility of Secchi disk, measurement in cm | Visibility 5.1 m | | FV |
| Phytoplankton | Describe and give the percentage proportion of species groups | No bloom. In terms of total numbers, Chlorophyceae algae occurred in the highest proportion (80% of total numbers of phytoplankton). The second most numerous group were cryptophytes(9% of total numbers). | | FV |
| Zooplankton | Describe and give the percentage proportion of species groups | *Rotifers Rotatoria* definitely dominate in surface layers of open water (domination of Keratella cochlearis *rotifer* ). Copepods *Copepoda* occur in half the number (domination of copepod species *Diaphanosoma brachyurum*) | | U1 |
| **Conservation prospects** | | | | **FV** |
| **Overall assessment** | Proportion of the habitat area representing different conservation status within the monitoring location | FV | 100% | FV |
| | | U1 | - | |
| | | U2 | - | |

| Human activities | | | | |
|---|---|---|---|---|
| **Code** | **Name of the activity** | **Intensity** | **Impact** | **Description** |
| 251 | Plundering the vegetation | B | - | Destruction of lobelia lake vegetation caused by intensive recreational activities. |
| 600 | Sport and recreational infrastructure | C | - | Intensive recreational development on the fringes of the lake. |

## 4. Habitats of similar ecological characteristics

Similar characteristics as the lobelia-type dystrophic lakes are shown by dystrophic lakes, natural habitat code 3160. However, lobelia lakes can be easily distinguished from dystrophic lakes owing to the absence of plants characteristic of lobelia lakes in the latter.

## 5. Conservation of the natural habitat

Eutrophication and dystrophication are the most dangerous threats to lobelia lakes as both can cause the disappearance of the habitat.

In order to avoid the eutrophication of the habitats, the principles of conservation based on conscious actions aimed at preventing adverse phenomena should be adopted. The destructive processes include the processes going on within the lake and along its shores, but also phenomena occurring in its catchment area. For this reason, its is important to protect not only the lakes themselves but also to draw up the principles for the protection of the catchment areas. Sewage management should be regulated in order to stop the dumping of sewage into lakes. This pertains to homes, farmsteads, recreational facilities as well. In order to prevent the introduction of compounds contributing to increased trophism, fertiliser use in farmlands situated in the immediate surroundings of the lake and its catchment area should be regulated.

Lobelia lakes should be excluded from commercial fishing management and free of angling. If the lakes are made available for angling, the absolute ban should be imposed on any baiting of fish. In the case of strong pressure from angling, and applying baits, the trophism of these lakes increases rapidly. Lobelia lakes may not be stocked with cyprinoid fish nor with alien fish species. These procedures result in the destruction of macrophyte vegetation including also that which is subject to conservation. The secondary side effect of this kind of fish stocking is disturbing bottom sediments leading to accelerated eutrophication. There should be special places for anglers (jetties) prepared, outside of which angling is prohibited in order to prevent the trampling and destruction of vegetation. These places should be regularly cleaned.

Whenever the lakes are made available to bathers, designated places should be marked, with the relevant sanitary facilities made available. Bathing should be prohibited outside these places. Walking should also be permitted only on marked routes, again in order to prevent the destruction of vegetation.

Bans should be strictly enforced along with campaigns addressing the general public, to make them aware of the value of nature in the protected areas, and indicate the advantages for local communities resulting from the good conservation status of unique aquatic habitats.

The basis of conservation measures should include the permanent monitoring of lobelia lakes, particularly the status of plant species characteristic of this type of habitat. There should also be the option of reintroducing quillwort *Isoëtes lacustris* and other species typical of lobelia lakes into lakes where the parameters indicate the presence of good lobelia lake-type habitat and where such species occurred in the past but disappeared due to human activities.

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