

# Small river valleys management and nature protection on the basis of amphibians

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## Introduction

The river valley habitats are very important in creating and preserving biodiversity. Among them there are many different types: rivers, riparian habitats, habitats associated with riverbanks, meadows, small water bodies, fens, marshes, forests. All of them are water dependant and that makes water management inside river catchment very crucial for creating the proper conditions for natural habitats and also for many plant and animal species. After December 2000 water management on many different levels became an important task for all EU Member States when “Framework for Community Action in the Field of Water Policy” (called also ‘Water Framework Directive’ – WFD) was established (European Commission 2000). The main objective raised by this document is that all surface waters, artificial and heavily modified waters and ground waters achieve good water status by 2015. It also aims to promote sustainable water use (sufficient provision of drinking water and water for other economic requirements) and to focus on mitigation of the effects of floods and droughts. One of the main goals of water management should be maintaining good ecological status of water ecosystems, which means that only a slight departure from the biological values that may be expected in conditions of minimal anthropogenic impact will be allowed. To achieve the ecological objectives we should consider an integrated approach to three basic components: water quality, water quantity, and physical structure which interact with each other (Logan 2001). The activities arising from management plans may consider wider scale (Moog et al., 2004) but the organization based on catchment areas seem to be of the greatest value for holistic approach to water management and protection of the aquatic environment. It is confirmed by many authors that the regional level of planning and

implementing measures also plays an important role in achieving the directive's regulations (Braukmann and Pinter 1997; Verdonschot 2000; Dorge and Windolf 2005).

The first step for planning management measures for such unit is the analysis of actual situation (condition) of the water body. The next steps should consider the following: definition of main threats, quantitative assessment of deficits, determination of potential measures together with analysis and selection of conservation and/or restoration scenarios. After the implementation of measures the proper monitoring of results should be conducted (Kolisich et al. 2000).

An analysis of water bodies' ecological status should consider animals species and their habitat inventory. Amphibians are among other animals strictly connected with water habitat. Being predators as adults and due to fragile skin, they can serve as a very sensitive indicator of all processes ongoing in water ecosystems. This is also one of most threatened group of animals – the Global Amphibian Assessment consider 427 species as “critically endangered”. While in wider perspective main threats of these animals consist of climate change, emerging diseases, increased ultraviolet-B radiation, or long-distance transmission of chemical contaminants, in local scale the major factors seem to be direct changes of habitat and habitat fragmentation. This rule applies to all organisms connected to water habitats (Barbault and Sastrapradja 1995). Generally, due to their two-staged life cycle, amphibians need two kinds of habitats to fulfill their life requirements: aquatic and terrestrial, so threats to either habitat can affect their populations. The small river catchment with its habitat variety can be a good example of how such dual threats influence this group of animals. The aim of the study was to analyze habitat preferences of amphibians in Zagożdżonka and Zwoleńka catchments and suggest river catchment management proper for conservation of this group of animals.

## Material and Methods

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The research was conducted within two catchments: Zagożdżonka and Zwoleńka rivers located in central Poland (South-Mazovian Lowland) about 100 km south of Warsaw. Both rivers are the left bank inflows of the Vistula river (Figure 9.1).

The length of the Zagożdżonka river is 39,9 km and the size of the whole catchment is 568,5 km<sup>2</sup>. The size of the catchment Plachty Stare is 82,4 km<sup>2</sup>. The absolute relief of the watershed to Plachty Stare gauging point is 37 m (maximum and minimum elevation 185 and 148 m a.s.l. respectively). The mean slopes of the main channels are in the range of 2.0–3.5%. The existing valleys are narrow and shallow. Majority of investigated area is covered by agricultural land with loose rural housing, some parts covered by forest belong to the Kozienicki Landscape Park.

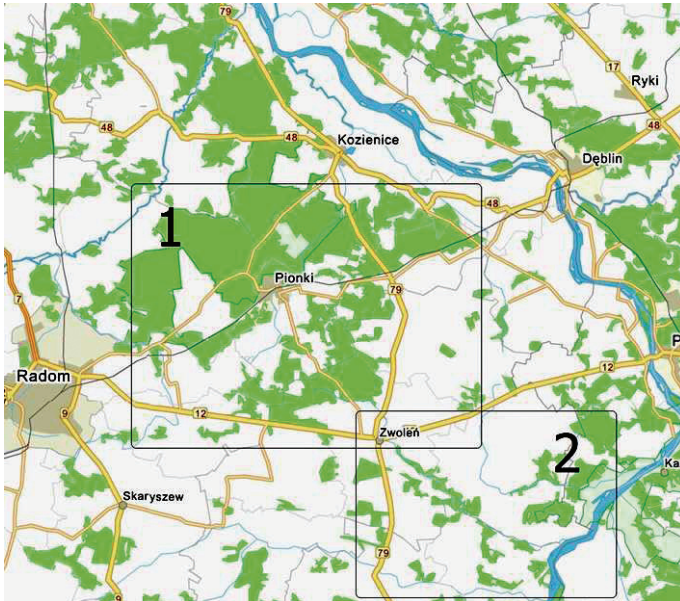


FIGURE 9.1. Location of studied river catchments: 1 – Zagożdżonka, 2 – Zwoleńka

The forest varies from pine stands to rich mix and deciduous forests. River creates habitat for protected animals, like European beaver *Castor fiber* or noble crayfish *Astacus astacus*. The dominant soil types are sandy soil, ranging from almost pure to loamy sands. In depressions areas like river beds, peaty soils can be found. Agricultural land use should be considered as extensive, with small farms and diversity of crop fields, meadows and pastures (Figure 9.2). The 50–70% of watershed is under cultivation. In streams valleys the pasture are dominant. The main crops are rye, wheat-rye and oat together with potato. The forests cover about 40% of catchment to Płachty Stare gauging point.

The Zwoleńka is a natural river, with lots of meanders and abounding biodiversity. The average flow in 2002 was 1,09 m<sup>3</sup>/s. It's length is 34,1 km and the catchment size is 230,2 km<sup>2</sup>. The dominant soils are loamy soils and sand. In the valley there is also peat. The main crops are rye and mixtures of corn and oat. The Zwoleńka valley was designated as Natura 2000 site (PLH140006). There are two nature reserves Borowiec and Ługi Helenowskie in this area. There are about 80 species of birds and 19 species of mammals occurring. According to Annex II of Habitat Directive the most valuable species of vertebrates occurring in this site are: european weatherfish *Misgurnus fossilis*, european pond turtle *Emys orbicularis*, fire bellied toad *Bombina bombina*, marsh harrier *Circus aeruginosus*, corncrake *Crex crex*, black tern *Chlidonias niger*, kingfisher *Alcedo atthis*, european beaver *Castor fiber*. There are also 3 species of invertebrates from Annex II of Habitats Directive:



FIGURE 9.2. Pastures in Zagożdżonka river valley

narrow-mouthed whorl snail *Vertigo angustior*, green snaketail *Ophiogomphus Cecilia*, yellow-spotted whiteface *Leucorrhinia pectoralis*. All those species are strictly connected with wetlands or slowly floating river valleys. The main purpose of establishing Natura 2000 was the preservation of lowland hay meadows (code 6510) covering 20% of site surface, natural eutrophic lakes (code 3150) covering 10% of the surface and alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (code 91E0) covering 8% of the site.

To study habitat preferences of amphibians, water bodies and watercourses with closest surrounding terrestrial habitat within the Zagożdżonka and Zwoleńka river catchments were described and investigated for amphibians occurrence. The species composition has been recorded for different examples of water bodies (river, wetlands, fens) and terrestrial surroundings (forests, meadows, fields, etc.). 16 transect for Zagożdżonka river and 5 sites for Zwoleńka river were designated as representative for different habitats (Figures 9.3 and 9.4). Each transect was 100m long and covered terrestrial habitat next to water. The amphibians occurrence was recorded by the use of direct observations of adults, larvae and eggs, netting and vocal recordings. Each transect or site was visited at least three times (one time at dark). The field observations were carried out from the beginning of April to the end of June 2009 (Zagożdżonka) and the same part of year 2010 for Zwoleńka river, to cover the higher breeding activity of amphibians (Duellman et Trueb 1994).

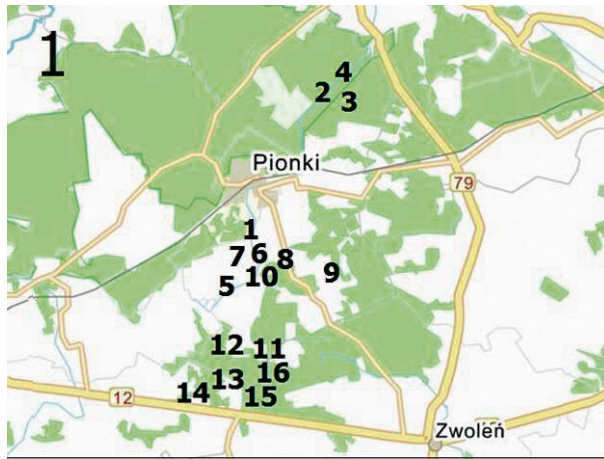


FIGURE 9.3. Transects for amphibian research inside Zagożdżonka catchment (numbers correspond with description in Table 9.1)

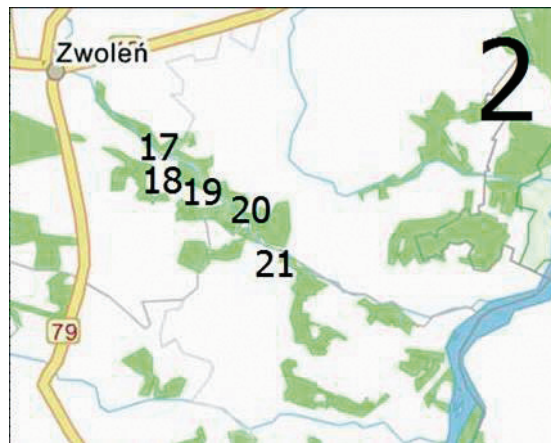


FIGURE 9.4. Transects for amphibian research inside Zwoleńka catchment (numbers correspond with description in Table 9.1)

## Results and discussion

The description of habitats occurring along investigated transect is shown in Table 9.1. Running water (river Zagożdżonka, Mirenka and Zwoleńka) was the base for water habitats of 9 transects (Figure 9.5), while ponds were present at 12 transects (Figure 9.6). The size of the ponds varied from 0,1 ha (transects 6 and 10) up to 25 ha peat bog (transect 15). There were only one transect located close to habitat with high

TABLE 9.1. Habitat description of investigated transects within Zagożdżonka (1–16) and Zwoleńka (17–21) catchments

| Number | Name of transect        | Area of water body | Water habitat   | Surroundings (terrestrial habitat)   |
|--------|-------------------------|--------------------|---|--|
| 1      | Pionki Staw Górny       | 17,5 ha            | water reservoir: 50% of shore is built with concrete. Used for angling. <i>Phragmites australis</i> , <i>Elodea canadensis</i>              | next to Pionki Town, surrounded by gardens, asphalt road, pastures   |
| 2      | Królewskie Źródła taras | –                  | backwater of Zagożdżonka. Shallow water with dense vegetation: <i>Phragmites australis</i> , <i>Typha angustifolia</i> , <i>Lemna minor</i> | <i>Alnus glutinosa</i> forest, mixed pine-deciduous forest   |
| 3      | Królewskie Źródła molo  | –                  | Zagożdżonka river   | <i>Alnus glutinosa</i> forest, mixed pine-deciduous forest, meadows. <i>Phragmites australis</i> , <i>Caltha palustris</i> |
| 4      | Królewskie Źródła rzeka | –                  | Zagożdżonka river   | <i>Alnus glutinosa</i> forest, mixed pine-deciduous forest, meadows. <i>Phragmites australis</i> , <i>Caltha palustris</i> |
| 5      | Czarna jaz              | –                  | Zagożdżonka river   | <i>Salix caprea</i> , <i>Alnus glutinosa</i> , <i>Caltha palustris</i> . Meadows and pastures                              |
| 6      | Płachty oczka wodne     | 0,1 ha             | small ponds, connected with river when high water level occurs. Shadowed by <i>Alnus</i>  | meadows and pastures, farm buildings   |
| 7      | Płachty Mirenka         | –                  | small river Mirenka (tributary of Zagożdżonka). Narrow with sandy bed   | ruderal plants, meadows, bushes  |
| 8      | Mirenka Most            | –                  | small river Mirenka (tributary to Zagożdżonka). Narrow with sandy bed   | ruderal plants, meadows, bushes, asphalt road, <i>Alnus</i> forest   |
| 9      | Mirenka Sławek          | –                  | small river Mirenka (tributary of Zagożdżonka). Narrow with sandy bed.  | agricultural land, meadows, pastures   |
| 10     | Salki                   | 0,1 ha             | small pond inside the village. <i>Lemna minor</i> , <i>Lysimacha nummularia</i>   | some trees, bushes, asphalt road, buildings  |
| 11     | Staw Jagodny            | 13,6 ha            | shallow pond with peatbog   | close to Helenów village, forest and meadows   |
| 12     | Helenów 2               | 0,95 ha            | pond with peatbog <i>Phragmites australis</i> , <i>Typha angustifolia</i> , <i>Lemna minor</i> , <i>Nymphaea alba</i>                       | close to farm buildings, surrounded by forest  |

TABLE 9.1 (continued)

| Number | Name of transect | Area of water body | Water habitat                                     | Surroundings (terrestrial habitat)  |
|--------|------------------|--------------------|---|---|
| 13     | Kuczki           | 0,6 ha             | small pond  | close to Kuczki village, bushes and some trees, ruderal plants  |
| 14     | Czarny Lasek     | 1 ha               | peat bog with variety of water plants             | birch and pine forest   |
| 15     | Ług Tczowski     | 25 ha              | peat bog  | <i>Sphagnopsida</i> , <i>Drosera rotundifolia</i> , <i>Eriophorum</i> , <i>Calla palustris</i> , <i>Sanguisorba officinalis</i> |
| 16     | Ług Tczowski las | 0,7 ha             | shallow pond                                      | mixed pine-deciduous forest   |
| 17     | Podłącze         | 0,5 ha             | shallow pond, peat bog, dense vegetation overgrow | alders, meadows, other peat bogs  |
| 18     | Moskol           | 0,7 ha             | almost completely overgrown shallow pond          | pine forest, meadows, arable fields   |
| 19     | Barycz Stara     | –                  | Zwoleńka river                                    | meadows and deciduous forests (mainly alders)   |
| 20     | Nowa Siekierka   | –                  | Zwoleńka river                                    | meadows, alder forest   |
| 21     | Nowa Siekierka 2 | 2,5 ha             | shallow pond, peat bog, dense vegetation overgrow | mixed forest, meadows, arable fields  |



FIGURE 9.5. Zwoleńka River



Figure 9.6. Ponds (peat-bog) in Zwoleńka river valley

human pressure – Pionki Staw Górny close to Pionki Town. Other transects were situated in more natural habitats like forest areas (transects 2–4 Królewskie Źródła, 11, 15, 16, 21), village neighborhood (transects 6, 10, 11, 12) and extensive agricultural areas (transect 5–9 and 17–20).

During the whole observation period nine amphibian species were recorded: *Rana esculenta complex*, *Rana temporaria*, *Rana arvalis*, *Bufo bufo*, *Hyla arborea*, *Bombina bombina*, *Pelobates fuscus*, *Triturus vulgaris* and *Triturus cristatus* (Table 9.2). The higher number of species (8) was recorded at transect no. 21 – Nowa Siekierka. 6 species occurred in transect 18 – Moskol. At two transect the presence of 5 species was noted – 10 (Sałki) and 17 (Podłęczce). 4 species were found at five transects: Królewskie Źródła taras (transect no 2), Helenów 2 (transect no 14), Ług Tczowski (transect no 15), Barycz Stara (transect no 19), Nowa Siekierka (transect 20). The less suitable habitats for amphibians seem to be present at transect no. 1 – Pionki Staw Górny, transect no 5 – Czarna Jaz and transect no 16 – Ług Tczowski las, where only one species was recorded (*Rana esculenta complex*).

The most common and most numerous species was *R. esculenta complex*, recorded at 19 transects (9 transect – I class, 4 transects – II class, 6 transects – III class). The highest population number (III class) was observed in ponds of different size (ponds with water surface from 0,5 ha – transect 17, to 25 ha – transect n. 15 and also running water in the river). The second most common was *R. temporaria*, found at 16



TABLE 9.2. Occurrence of amphibian species along transects in Zagożdżonka (1–16) and Zwoleńka (17–21) catchments. I – 1–14 individuals, II – 15–49 individuals, III – more than 50 individuals

| Number                                    | Name of transect        | Species                          |                        |                     |                  |                     |                          |                           |                        |                         |                            |
|---|-------------------------|----------------------------------|------------------------|---------------------|------------------|---------------------|--------------------------|---------------------------|------------------------|-------------------------|----------------------------|
|   |                         | <i>Rana esculenta</i><br>complex | <i>Rana temporaria</i> | <i>Rana arvalis</i> | <i>Bufo bufo</i> | <i>Hyla arborea</i> | <i>Triturus vulgaris</i> | <i>Triturus cristatus</i> | <i>Bombina bombina</i> | <i>Pelobates fuscus</i> | Total number of<br>species |
| 1   | Pionki Staw Górny       | I                                |                        |                     |                  |                     |                          |                           |                        |                         | 1                          |
| 2   | Królewskie Źródła taras | I                                | III                    | III                 | I                |                     |                          |                           |                        |                         | 4                          |
| 3   | Królewskie Źródła molo  |                                  | I                      | I                   | I                |                     |                          |                           |                        |                         | 3                          |
| 4   | Królewskie Źródła rzeka |                                  | I                      | I                   | I                |                     |                          |                           |                        |                         | 3                          |
| 5   | Czarna jaz              | I                                |                        |                     |                  |                     |                          |                           |                        |                         | 1                          |
| 6   | Płachty oczka wodne     | I                                | I                      | I                   |                  |                     |                          |                           |                        |                         | 3                          |
| 7   | Płachty Mirenka         | II                               | I                      | I                   |                  |                     |                          |                           |                        |                         | 3                          |
| 8   | Mirenka Most            | I                                | I                      |                     | I                |                     |                          |                           |                        |                         | 3                          |
| 9   | Mirenka Sławek          | I                                | II                     |                     |                  |                     |                          |                           |                        |                         | 2                          |
| 10  | Salki                   | II                               | I                      |                     | I                | I                   |                          | I                         |                        |                         | 5                          |
| 11  | Staw Jagodny            | III                              |                        |                     |                  | I                   |                          |                           |                        |                         | 2                          |
| 12  | Helenów 2               | III                              | I                      |                     |                  | I                   | I                        |                           |                        |                         | 4                          |
| 13  | Kuczki                  | III                              |                        |                     |                  | I                   |                          | I                         |                        |                         | 3                          |
| 14  | Czarny Lasek            | II                               | I                      |                     |                  |                     |                          | I                         |                        |                         | 3                          |
| 15  | Ług Tczowski            | III                              | I                      | I                   |                  |                     |                          | I                         |                        |                         | 4                          |
| 16  | Ług Tczowski las        | II                               |                        |                     |                  |                     |                          |                           |                        |                         | 1                          |
| 17  | Podłącze                | III                              | I                      | I                   | II               |                     | I                        |                           |                        |                         | 5                          |
| 18  | Moskol                  | I                                | II                     |                     | I                | II                  |                          |                           | II                     | I                       | 6                          |
| 19  | Barycz Stara            | I                                | II                     | I                   | II               |                     |                          |                           |                        |                         | 4                          |
| 20  | Nowa Siekierka          | I                                | II                     | I                   | I                |                     |                          |                           |                        |                         | 4                          |
| 21  | Nowa Siekierka 2        | III                              | I                      | I                   | I                | I                   | I                        |                           | I                      | I                       | 8                          |
| Number of transect where species occurred |                         | 19                               | 16                     | 10                  | 10               | 6                   | 3                        | 4                         | 2                      | 2                       | x                          |

transects. *Rana temporaria* and *Bufo bufo* were found in 10 transects, of different size. Other species occurred in less than 7 transects. Only for frogs species (*Rana*) the III number class was observed.

Only 9 species of amphibians were recorded in all 21 transects inside Zagożdżonka and Zwoleńka river catchments. One may expected more out of 12 lowland amphibians species occurring in Poland. Dąbrowski and Strużyński (2006) report two more species from close surrounding in Kozienicki Landscape Park (green toad *Bufo viridis* and

natterjack *Bufo calamita*). The lack of these species at investigated transects is caused by their different habitat requirements. We did not cover ponds surrounded by sandy slopes covered by vegetation and drier territories. The fire bellied toad (*B. bombina*) was expected to live at least in some of investigated transects of Zagożdżonka catchment. The character of water bodies (rather shallow with a lot of water plants) suggests right habitat for this species. Probably more field observations should be done to record this species or population density is very low, which causes difficulties in observations. Also the lack of *Triturus cristatus* should be verified in further studies, while habitat seems to fulfill all species needs. Extensive agricultural land with variety of land use, meadows and forest are the best terrestrial habitats for this newt. Also the character of water bodies suggests the presence of this species. All other recorded species can be considered as common species for central part of Poland (Juszczyk 1987). Green frogs (*Rana esculenta complex*) were recorded at almost every transect (19 out of 21), brown frogs (*R. temporaria* and *R. arvalis*) respectively at 16 and 10 transects and common toad (*Bufo bufo*) was recorded in 10 transects. Green tree frog *Hyla arborea* and great crested newt *Triturus cristatus* were recorded at 4 transects, only inside Zagożdżonka catchment. Common newt (*Triturus vulgaris*) was observed at three investigated transect. The presence of great crested newt (Figure 9.7) at 4 transects shows good habitat conditions for this species. It is very important, because this species is listed in Annex II of Habitat Directive (Council Directive 92/43/EEC on the Conservation of natural habitats and wild fauna and flora) and needs to be protect-

FIGURE 9.7. Great Crested Newt (*Triturus cristatus*)

ed by Special Areas of Conservation within Natura 2000 network. The breeding of this species was recorded in rather small ponds (0,1 ha to 1 ha) and one observation was made in 25 ha pond (transect no 15). Great crested newt requires special terrestrial habitat features: it was observed only at transects close to forest or at least bushes (transects no 10 and 13–15). This species was recorded by the use of eggs observation and netting. The variety of habitats existing in the Zagożdżonka catchment seems to fulfill all the amphibians needs in terms of water and terrestrial habitat (Klimaszewski et al. 2009).

Amphibians seem to use a variety of habitats. For each species stated within the study area the habitats needs were assessed (Table 9.3). During the breeding period, the majority of species prefer water bodies without running water, of different sizes (from small ponds or seasonal pools to high water surface ponds in peat bogs, but usually shallow). In post-breeding period amphibians prefer close surroundings of water bodies, meadows and wastelands and forests. Only few species (*B. bufo*, *R. temporaria*, *R. arvalis*, *P. fuscus*) seem to use arable fields as foraging space. More research concerning the occurrence of amphibians should be done in this area to fully describe the potential influence of humans on this group of animals and to show right management practices for all their habitats. Conservation of these habitats is possible only by responsible, sustainable management of catchment.

TABLE 9.3. Habitat preferences of amphibian species recorded in Zagożdżonka and Zwolenka river catchments (“–” – of no importance for species, “+” – possible to use, “++” – suitable, “+++” – most preferable)

| Habitat \ Species  | <i>Rana esculenta</i><br>complex | <i>Rana temporaria</i> | <i>Rana arvalis</i> | <i>Bufo bufo</i> | <i>Hyla arborea</i> | <i>Triturus vulgaris</i> | <i>Triturus cristatus</i> | <i>Bombina bombina</i> | <i>Pelobates fuscus</i> |
|--|----------------------------------|------------------------|---------------------|------------------|---------------------|--------------------------|---------------------------|------------------------|-------------------------|
| Breeding habitats  |                                  |                        |                     |                  |                     |                          |                           |                        |                         |
| River (with slowly running water)                          | –                                | +                      | +                   | +                | –                   | –                        | –                         | –                      | –                       |
| River valley (meadows with seasonally filled water bodies) | +                                | +++                    | +++                 | +++              | +                   | ++                       | +                         | –                      | +                       |
| Small ponds with dense water vegetation                    | ++                               | ++                     | ++                  | ++               | +++                 | +++                      | +++                       | ++                     | ++                      |
| Big shallow water bodies (in peat bogs)                    | +++                              | ++                     | ++                  | ++               | +++                 | ++                       | +                         | ++                     | +                       |
| Post-breeding habitats                                     |                                  |                        |                     |                  |                     |                          |                           |                        |                         |
| Water bodies and surroundings                              | +++                              | +                      | +                   | +                | +                   | ++                       | +++                       | +++                    | +                       |
| River valleys (meadows)                                    | +                                | +++                    | +++                 | +++              | ++                  | +++                      | ++                        | +                      | ++                      |
| Arable fields  | –                                | +                      | +                   | ++               | –                   | –                        | –                         | –                      | +                       |
| Wastelands with shrub and bushes                           | –                                | ++                     | ++                  | +++              | +                   | ++                       | +++                       | –                      | +++                     |
| Forests  | –                                | +++                    | +++                 | +++              | ++                  | ++                       | ++                        | –                      | +                       |

## Conclusions

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- Zagożdżonka and Zwoleńka river catchments create suitable habitat conditions for the majority of lowland amphibians species occurring in Poland.
- There are suitable habitats for two species listed in Annex II of Habitats Directive that require protection within Natura 2000 ecological network: great crested newt *Triturus cristatus* and fire bellied toad *Bombina orientalis*.
- Management of the catchment should consider preservation of all habitats used by amphibians. The condition of water bodies cannot be changed, and the water flow in the rivers should allow existence of seasonal, small water bodies.
- Amphibians terrestrial habitat is also very crucial – extensive agriculture and forest seem to create the best conditions for these animals.
- Conservation of these habitats is possible only by responsible, sustainable management of catchment concerning all amphibians habitat needs.
- The studies on amphibians' habitat preferences in Zagożdżonka and Zwoleńka catchments should be continued in order to find further relationship between amphibians occurrence and human activities, such as water management, agriculture intensification or house and roads investments.

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