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DRAGONFLIES (ODONATA) OF THE STAW GOŚLICKI POND IN THE FOREST OF PUSZCZA WKRZAŃSKA (NW POLAND)

Abstract

The paper presents results of a study on dragonflies conducted on a pond called Staw Goślicki, situated in the forest of Puszcza Wkrzańska. Five research sites were established over the area of the studied water body, where both adult specimens and larvae were collected. In total, 350 individuals were collected, which belonged to 17 dragonfly species; 297 adult specimens (45 females and 252 males) and 53 larvae were collected. The odonatofauna was mostly composed of eurytopic species. The most frequent species (75–100% frequency) included *Cordulia aenea*, *Coenagrion puella* and *Libellula quarimaculata*. The following species belonged to the second frequency class (50–74%): *Enallagma cyathigerum*, *Erythromma najas*, *Ischnura elegans*, *Pyrrhosoma nymphula*, *Aeshna cyanea* and *Sympetrum sanguineum*. The third frequency class (25–49%) included *Coenagrion pulchellum*, *Coenagrion hastulatum*, *Lestes dyras* and *Lestes sponsa*.

Keywords: Odonata, north-western Poland, Puszcza Wkrzańska, Staw Goślicki, faunistics, Odonata communities

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Introduction

With respect to odonatology, north-western Poland has been rather poorly researched. This was, for instance, reflected by the presence of numerous “white patches” in the Distribution Atlas of Dragonflies (Odonata) in Poland (Bernard et al. 2009).

The forest of Puszcza Wkrzańska constitutes one of such white patches. Situated near the Szczecin Lagoon, it is very diversified both environmentally and with respect to landscape (Białecki, Turek-Kwiatkowska 1991). Puszcza Wkrzańska is a faunistically rich area which is still subject to studies. The research conducted in the area focuses both on its flora (Kutyna et al. 2010) and its fauna (Adamska 2008). The scarce available data on dragonflies inhabiting vast forest areas in that part of the country can be found in the study by Zawal (2003) focusing on the forests of Puszcza Bukowa and Puszcza Baranowska, and in another study by Zawal (2004), examining the Szczecin Landscape Park. In other parts of the country forest areas have been studied by Mielewczyk (1966) and Buczyński (2004). The present work, discussing the results of dragonfly studies conducted on Staw Goślicki is another attempt at filling the odonatological gap on the map of Pomerania.

Research area

The Staw Goślicki pond is situated on the hill of Wielecka Góra. The hill is the highest moraine hill in the mountain range of the Warszawskie Hills (131 m. a. s. l.) (Białecki 1991). Exact geographical location of the pond is the following: 53°29'58 N 14°32'8 E. The pond is 80 m x 20 m large and has the area of ca. 160 m². Its maximum depth is ca. 4 m. The pond is slightly dystrophic with noticeable secondary eutrophication. Four water bodies are situated in close proximity to the Staw Goślicki pond: Czarne Bagno, situated at the distance of 683 m in the westerly direction (53°29'46 N 14°31'37 E), a nameless water body situated at the distance of 724 m in the easterly direction (53°29'55 N 14°32'47 E), another nameless water body situated at the distance of 844 m in the easterly direction (53°29'50 N 14°32'51 E) and yet another water body, also nameless, situated at the distance of 1004 m from the Staw Goślicki pond, in the southeasterly direction (53°29'42 N 14°32'57 E).

The littoral zone of Staw Goślicki is mostly made up of reed beds, composed of i.a. *Typha latifolia* (L.), and *Phragmites australis* (Cav.) Trin. ex Steud.). The zone of floating vegetation is dominated by *Fontinalis antipyretica* (L.) and *Hydrocharis morsus-ranae* (L.) and, to a lesser extent, also by *Nuphar lutea* (Sm.). As for the zone of submergent plants, it is dominated by plants from the genus *Polygonum* (L.). The pond is surrounded by a mixed forest.

Staw Goślicki is a slightly dystrophic water body, as indicated by characteristic parameters shown in Table 2. The pH of the pond is acidic. Humus substances, which are an inevitable element of this type of waters, bind dissolved oxygen, reducing its amount in the water. Ultraviolet radiation reduces the amount of humus substances, thus causing the release of ammonium and phosphate ions. For this reason, the highest values of ammonium, nitrates and phosphates were recorded in the warmest months, i.e. in June (NH₄), July (NO₃), August and September (PO₄).

Table 2. A complete list of the collected material according to years and sites

Species	Locality	2011					2012				
		1	2	3	4	5	1	2	3	4	5
<i>Calopteryx splendens</i>					1						
<i>Coenagrion puella</i>		14	5	8	8	11	38	9	20	10	43
<i>C. pulchellum</i>							8	1	4	1	4
<i>C. hastulatum</i>							2		2	4	
<i>Enallagma cyathigerum</i>		2	1	1							1
<i>Erythromma najas</i>				3	1	1			2		
<i>Ischnura elegans</i>		3	1		1		2				
<i>Lestes dryas</i>		1		2	5						
<i>L. sponsa</i>				1	1						
<i>L. viridis</i>		1									
<i>Pyrrhosoma nymphula</i>		1					4				3
<i>Aeshna cyanea</i>		12	1	3		4					
<i>Cordulia aenea</i>		2	1	8	5	10	4	2	3	7	4
<i>Libellula quadrimaculata</i>		5	2	2	1	1	12	1		1	6
<i>Orthetrum cancellatum</i>		1									
<i>Somatochlora metallica</i>		1									
<i>Sympetrum sanguineum</i>		12		5	2	1					

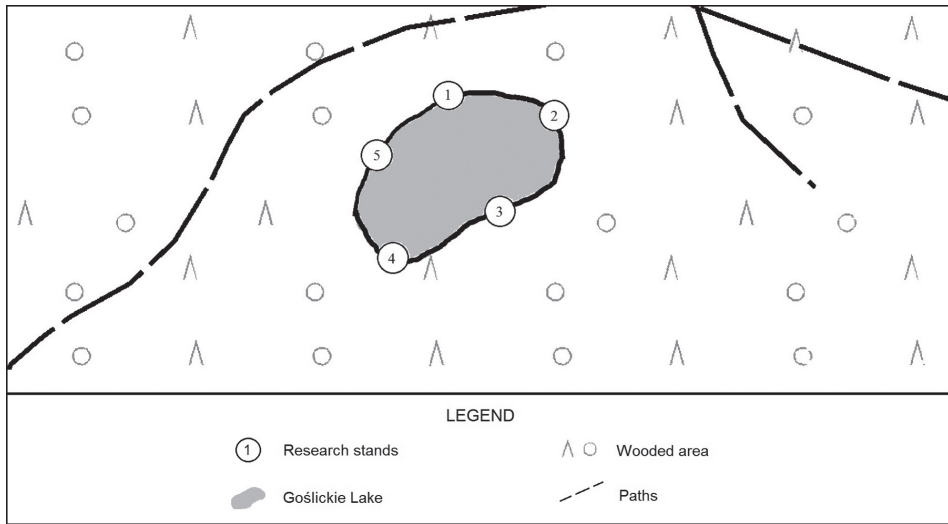


Fig. 1. The map of localities.

The list of research sites

1. A rather muddy bottom with a considerable amount of organic matter. Average depth of the site: ca. 20 cm. The following species dominated at the site: *Typha latifolia*, *Comarum palustre* (L.), *Alnus glutinosa* (L.) and *Hydrocharis morsus-ranae*, *Juncus effusus* (L.). *Polygonum* sp. was also present. A sunlit site.
2. A muddy bottom with a considerable amount of organic matter. Average depth of the site: ca. 50 cm. Characterized by the presence of *Nuphar lutea* adjoining to a patch of *Typha latifolia*. High abundance of *Ilyocoris cimicoides* was recorded at the site. Most of the day the site was shaded.
3. A muddy bottom. Average depth of the site: ca. 40–50 cm. Characterized by very complex phytolittoral composed of *Carex acutiformis* (L.), *Carex stenophylla* (L.), and *Glyceria* sp. (R.Br.). Dominant species included *Spirogyra* and *Calla palustris* (L.). Most of the day the site was sunlit.
4. A very muddy bottom with a considerable amount of organic matter. Average depth of the site: ca. 30 cm. Dominated by *Fontinalis antipyretica*. A shaded site.

5. A muddy bottom with a considerable amount of organic matter. Average depth of the site: ca. 40–50 cm. Characterized by the presence of a band of the common sweet flag (*Acorus calamus* (L.)). A shaded site.

Material and Methods

The research was conducted in the years 2011 (July, August, September, October and November) and 2012 (May and June). Dragonflies were collected once a month. The collected material included both larvae and adult specimens. Collected larvae and imagines were preserved in 70% ethyl alcohol and labeled in the laboratory.

Adult specimens were caught into a sweep net with a 50 cm diameter. The larvae were caught with the aid of a triangular hydrobiological sweep net. They were collected from the surface of the bottom (ca. 1.0 m²), with 20 sweeps. The collected material included the total number of 350 individuals (297 imagines, 53 larvae), belonging to 17 species.

In order to specify frequencies of the studied fauna, the classification of Korniejew (1989) was adopted, i.e. the taxa were divided into dominants (over 20%), subdominants (5–20%) and adominants (below 5%). Furthermore, the division into four classes was adopted: 100–75%, 74–50%, 49–25% and below 24% (Tab. 1).

A list of the collected material featuring respective years and sites indicating when and where particular specimens were collected is given in Table 2.

The water of the pond was also subject to study with respect to the content of particular chemical compounds, i.e. ammonium (NH₄), nitrates (NO₃), and phosphates (PO₄). In addition, such parameters as temperature, pH, oxygen content and BZT₅ were also measured (Tab. 3).

Table 1. Frequencies and shares of particular species in the collected material

Species	Imagines		Larvae	Total	%	Frequency %
	♂♂	♀♀				
1. Calopteryx splendens (Harr.)	1	–	–	1	0.28	16.66
2. Coenagrion puella (L.)	139	25	2	166	47.42	83.33
3. Coenagrion pulchellum (Vander L.)	12	5	1	18	5.14	33.33
4. Coenagrion hastulatum (Charp.)	4	4	–	8	2.28	33.33
5. Enallagma cyathigerum (Charp.)	4	–	1	5	1.42	50.00
6. Erythromma najas (Hansem.)	3	–	4	7	2.00	66.66
7. Ischnura elegans (Vander L.)	7	–	–	7	2.00	50.00
8. Lestes dryas (Krib.)	7	1	–	8	2.28	33.33
9. Lestes sponsa (Hansem.)	2	–	–	2	0.57	33.33
10. Lestes viridis (Charp.)	1	–	–	1	0.28	16.66
11. Pyrrhosoma nymphula (Sulz.)	7	–	1	8	2.28	50.00
12. Aeshna cyanea (O. F. Müll.)	15	3	2	20	5.71	50.00
13. Cordulia aenea (L.)	14	1	31	46	13.14	100.00
14. Libellula quadrimaculata (L.)	20	–	11	31	8.85	83.33
15. Orthetrum cancellatum (L.)	1	–	–	1	0.28	16.66
16. Somatochlora metallica (Vander L.)	1	–	–	1	0.28	16.66
17. Sympetrum sanguineum (O. F. Müll.)	14	6	–	20	5.71	66.66
Total	252	45	53	350	100.00	

Table 3. Hydrochemistry of the Staw Goślicki pond

Date of sample	Temperature [C°]	pH	Oxygen[mg/l]	BZT5 [mg/l]	NH4 [mg/l]	NO3 [mg/l]	PO4 [mg/l]
07.07.2011	22.1	7.20	7.50	6.2	0.080	1.76	> 0.01
06.08.2011	21.3	7.10	7.70	5.4	0.500	1.90	0.46
11.09.2011	17.9	6.17	5.60	2.9	0.800	2.10	1.00
09.10.2011	14.6	6.80	3.20	2.6	0.700	> 0.50	0.80
01.05.2012	17.7	5.60	5.80	7.3	> 0.100	> 0.50	> 0.10
09.06.2012	20.5	6.86	2.11	2.8	0.900	> 0.50	> 0.10

Results

In the collected material only one species had the dominant status, namely *Coenagrion puella*. The group of subdominants included: *Coenagrion pulchellum*, *Aeshna cyanea*, *Cordulia aenea*, *Libellula quadrimaculata*, and *Sympetrum sanguineum*. Adominants were the most numerous group, which included all of the remaining species (Tab. 1). The most frequent species (75–100% frequency) included *Cordulia aenea*, *C. puella* and *Libellula quadrimaculata*. As for the second class according to the adopted classification (i.e. 50–74%), it comprised the following species: *Enallagma cyathigerum*, *Erythromma najas*, *Ischnura elegans*, *Pyrrhosoma nymphula*, *Aeshna cyanea* oraz *Sympetrum sanguineum*. The third class (25–49%) included: *Coenagrion pulchellum*, *Coenagrion hastulatum*, *Lestes dryas* and *Lestes sponsa*. The remaining species (below 24%) belonged to the fourth class (Tab. 1).

Discussion

It can be concluded that the fauna of the studied area was not rich, since it was composed of 17 species, constituting only 23% of the native fauna composed of the total number of 73 species (Bernard et al. 2009). The research was conducted in the area of a rather small water body, i.e. the Goślicki Pond and its surroundings, within the boundaries of the forest of Puszcza Wkrzańska. Thus, the obtained results were unsurprising considering the small area of the studied water body and the low habitat diversification entailed by its size. The species of dragonflies collected in the form of larvae were certainly a permanent faunistic feature of the studied area, which could not be said about the species occurring in the form of imagoes: for instance, one of the species collected in that form (*Calopteryx splendens*) was associated with running water (Askew 1988), so it should rather be assumed that the adult specimens had migrated from other areas.

The dragonfly fauna of the studied water body was composed mainly of eurytopic species characterized by broad ecological valence. An absolutely dominating and also the most abundant species was *Coenagrion puella*, a species with very wide ecological preferences. It was puzzling that only one representative of the Zygoptera, i.e. *C. pulchellum* was present in the group of subdominants, and as many as four representatives of the Anisoptera (*A. cyanea*, *C. aenea*,

L. quadrimaculata, *S. sanguineum*) were present. *C. pulchellum* usually inhabits ponds and oxbow lakes with lush vegetation (Bellmann 2010). The species is distributed over a broad habitat spectrum, inhabiting stagnant and slow-flowing waters (Askew 1988). *Libellula quadrimaculata* prefers water bodies situated in the midst of mires, water bodies overgrown with halophilous plants (Bellmann 2010) as well as ponds and streams surrounded by vegetation. It is especially frequent in mesotrophic and oligotrophic waters. The larvae of *L. quadrimaculata* were among those that were the most frequently encountered during the research conducted on Staw Goślicki. The highest abundances of larval specimens were recorded in sites 1 and 2, both characterized by muddy bottoms. According to Mielewczyk (1969), the larvae inhabit mainly shallow parts of water bodies, where the bottom is peaty and muddy, but they are less frequently encountered among *Sphagnum*. The species is characterized by a broad habitat spectrum. Due to the fact that the pond was surrounded by rich vegetation, the species was provided with very favourable living conditions. In the case of *Cordulia aenea* more larval specimens than adult ones were collected. The highest numbers of larvae were encountered in sites 3, 4 and 5. Imagines were the most abundant in sites 3 and 5. The species prefers ponds and lakes, with the reed bed composed of helophytes in the littoral zones. Its larvae develop in lakes, ponds and peat pits, avoiding water bodies with sandy or clayey bottoms (Mielewczyk 1969). The species is considered as eurytopic and tyrphoxenic (Mielewczyk 1969). A comparatively high abundance of *Sympetrum sanguineum* was the result of its association with the unshaded band of helophytes along the bank (Heidemann, Seidenbusch 1993), frequently encountered in mires (Mielewczyk, 1970, 1972).

The pattern of domination was very untypical: only two species of the Zygoptera were present in the group of dominants and eudominants, accompanied by as many as four species of the Anisoptera. A possible explanation might be the fact that the abundance of the Zygoptera was reduced because they were smaller and thus more prone to fall prey to predators than the Anisoptera. Although fish were present in the studied water body, their pressure on the macrobenthos did not seem to be any higher than in other water bodies. However, large numbers of predatory hemipteran insects and water beetles were encountered in Staw Goślicki and were probably responsible for the reduction of the larvae abundance. The abundance of anisopteran larvae probably had some effect, too.

The fauna of dragonflies inhabiting the Staw Goślicki pond could be divided into species preferring large and small water bodies. The latter group inclu-

ded the following: *Aeshna cyanea*, *Coenagrion puella*, *Libellula quadrimaculata* and *Sympetrum sanguineum* (Mielewczyk 1978). As for the species that preferred large water bodies, according to Mielewczyk (1978) they included: *Coenagrion pulchellum*, *Enallagma cyathigerum*, *Erythromma najas* and *Ischnura elegans*.

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WAŻKI (ODONATA) STAWU GOŚLIŃSKIEGO W PUSZCZY WKRZAŃSKIEJ (PŁN.–ZACH. POLSKA)

Streszczenie

W artykule zaprezentowano wyniki badań ważek przeprowadzonych na Stawie Goślickim położonym w Puszczy Wkrzańskiej. Na obszarze zbiornika wyznaczono pięć stanowisk, na których dokonywano odłowu zarówno osobników dorosłych, jak i larw. Łącznie zebrano 350 osobniki, należące do 17 gatunków ważek, przy czym odnotowano 297 osobników dorosłych (45 samic i 252 samców) i 53 larwy. Odonatofaunę w przeważającej mierze tworzą gatunki eurytopowe. Najczęściej występującymi gatunkami (75–100% frekwencji) były *Cordulia aenea*, *Coenagrion puella* i *Libellula quarimaculata*. W drugim (50–74%) przyjętym przedziale znalazły się *Enallagma cyathigerum*, *Erythromma najas*, *Ischnura elegans*, *Pyrrhosoma nymphula*, *Aeshna cyanea* oraz *Sympetrum sanguineum*. W trzecim przedziale (25–49%) znajdują się *Coenagrion pulchellum*, *Coenagrion hastulatum*, *Lestes dyras* oraz *Lestes sponsa*.

Słowa kluczowe: ważki, Polska północno-zachodnia, Puszcza Wkrzańska, Staw Goślicki, faunistyka, zgrupowania ważek

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