ACTA HYDROBIOL.	19	4	439—449	KRAKÓW 1977

EUGENIUSZ BIESIADKA

Materiały do poznania *Heteroptera, Coleoptera* i *Hydracarina* drobnych zbiorników położonych w odkrywkowej kopalni węgla brunatnego koło Konina

Materials for a study on *Heteroptera, Coleoptera* and *Hydracarina* of small water bodies situated in the lignite opencats mine near Konin

Wpłynęło 25 października 1976 r.

A b s t r a c t — The aim of this paper was to determine the species composition of *Heteroptera, Coleoptera,* and *Hydracarina* of small water bodies situated in the lignite opencast mine at Gosławice. A large number of southern species associated with waters of increased mineralization is a characteristic feature of these water bodies. A comparative analysis of the fauna of the investigated water body and of the warmed Konin Lakes was carried out. The problem of the origin of the fauna of these water bodies and the trends of its further activity are discussed.

Artificial water bodies, not exploited economically, though gradually beginning to play an ever more important role in the hydrographical system of Poland, have infrequently been the subject of hydrobiological investigations. No wonder, then, that their fauna has not yet been properly recognized. Among such water bodies, small ones formed on the bottom of lignite opencast mines are interesting. So far no investigations on their fauna have been carried out in Poland.

The aim of the present paper is to present the investigation results on *Heteroptera, Coleoptera,* and *Hydracarina* of the water bodies situated in the lignite opencast mine at Gosławice (about 8 km northward from Konin). Since the neighbouring warmed up Konin Lakes have already been faunistically elaborated in detail, it was possible to make a compar-

ison between the faunistic structure of the lakes and the investigated water bodies, and on this basis to determine the faunistic relations between these types of waters.

Description of the investigation territory and stations

The mine "Gosławice", on whose territory the investigated water bodies were situated, is one of the oldest opencasts of the Konin region. Its exploitation was begun in 1954 and ended in 1973.

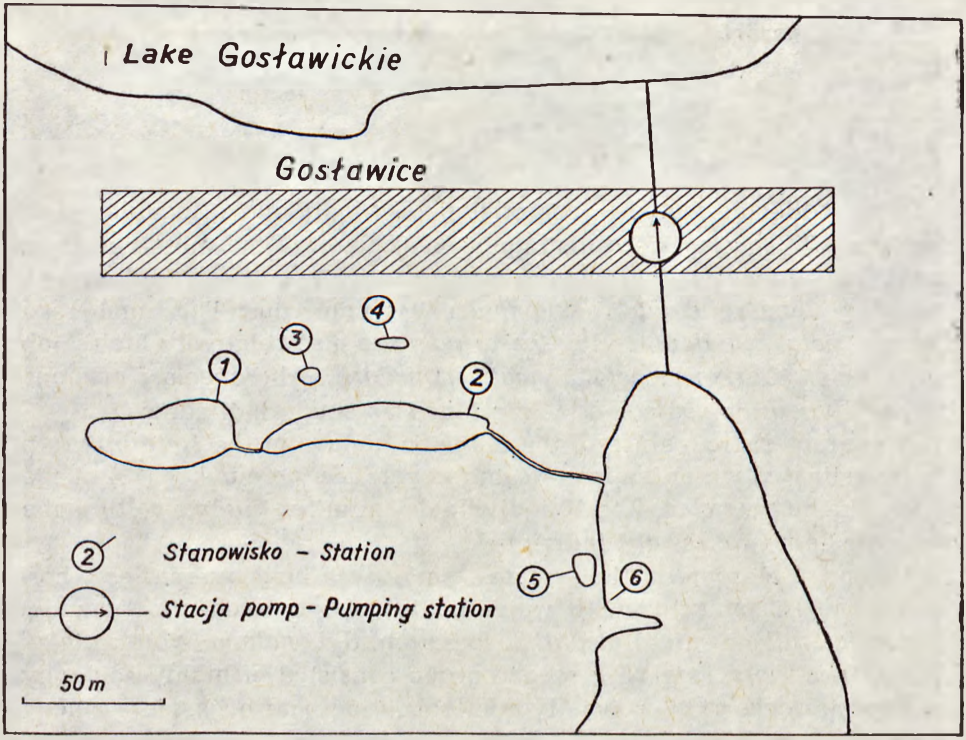
In the period of faunistic investigations the bottom of the mine was about 20 m below the water level of the Konin Lakes. The water submerging the mine was pumped out into Lake Gosławickie. In consequence of a permanent water inflow a number of water bodies were formed at various levels in the opencast. Apart from those supplied with water filtered from Lake Gosławickie, there were also numerous small ephemeric ones supplied with rain-water.

The age of the investigated water bodies varied greatly. Apart from quite recent ones there were also some which were several years old. In consequence of shifts of the earth mass the outlines of these water bodies also changed. The investigated water bodies differed from one another significantly in size of the area they covered, depth, and degree of overgrowth. Two basic types can, however, be distinguished: those situated on a coaly bottom and those on a clayey bottom. Water bodies with a coaly bottom prevailed in lower parts of the mine whereas those with clayey one occurred mainly in its upper parts among the heaps of muck.

The investigations were concentrated in the northern part of the mine, near the village of Gosławice (fig. 1). They were carried out on 6 water bodies. Samples, exclusively qualitative, were collected from May till November 1972, at monthly intervals. For sampling only a sampler was used. Altogether 48 samples were collected. A short station characteristic is given below.

1. Water body size: 50 × 30 m. Bottom clayey, in places coaly, not overgrown, only in the eastern part of the pool a small clump of *Potamogeton filiformis* P e r s. The banks very steep. Maximum water depth about 2 m, at sampling places to 50 cm.

2. Water body situated 1 m below the preceding one, greatly elongated, size 70 × 20 m. The bottom clayey, in the eastern part a narrow belt of *Typha latifolia* L. The southern bank very steep, the northern fairly flat. Maximum depth about 2 m, at the sampling place to 80 cm.



Ryc. 1. Szkic sytuacyjny badanego terenu

Fig. 1. Situation sketch of the investigated territory

3. Water body situated 3 m above the preceding one, size: 5 × 5 m. Bottom clayey, banks flat. The whole pool overgrown with *Typha latifolia* L. Maximum depth about 1 m, at the sampling place to 50 cm.

4. A shallow transient puddle filled only with rain-water, situated about 3 m above the preceding water body. Size 2 × 8 m. Bottom clayey, not overgrown. Depth to 30 cm.

5. Water body 8 × 20 m in size, situated about 2 m below station 2. Bottom coaly, in places overgrown with *Chara* sp. Banks flat. Depth to 50 cm.

6. A large water body. Size 80 × 300 m, situated at the bottom of the mine. Bottom coaly, not overgrown. Maximum depth about 2 m. At the sampling place to 30 cm. Banks flat.

Characteristic of the chosen groups of macrofauna

Heteroptera

In the collected material, comprising 1500 individuals (including 1181 imagines), 29 species were distinguished (Table I). The most numerous was unquestionably *Sigara lateralis*, two other species, *S. nigrolineata* and *Microvelia reticulata*, being much less numerous. The numbers of *Sigara striata*, *S. falleni*, and *S. fossarum* were also relatively high. Only four species (*Corixa moesta*, *Cymatia bonsdorffi*, *Micronecta meridionalis*, and *Ilyocornis cimicoides*) were found as single individuals.

A characteristic feature of the faunistic picture of the *Heteroptera* of the investigated water bodies was, moreover, a large number (13) of species in the number class 2 to 10 individuals and a relatively small number (4) in the number class of 1 individual.

Among *Heteroptera* the greatest share was held by species whose occurrence is connected with water bodies of increased mineralization (*Sigara lateralis*, *S. nigrolineata*, *S. fossarum*, *S. concinna*, *Notonecta viridis*, *Gerris thoracicus*). The second group consisted of highly acidophylous species occurring especially numerously on peat bogs. Here belong: *Corixa linnaei*, *C. sahlbergi*, *C. moesta*, and *Cymatia bonsdorffi*. The third group included species of great eurytophy and associated with eutrophic waters. The most numerous among them were: *Microvelia reticulata*, *Sigara striata*, and *S. falleni*. The dominance structure of *Heteroptera* of the investigated group of water bodies and of each pool separately shows a distinct difference from that in natural water bodies; this results from a specific mixing in them of ecological elements which in natural water body conditions with stabilized ecological relations are, as a rule, quite clearly separated. The large number of *Sigara lateralis* suggests some similarity with groups characteristic of village ponds (Wróblewski 1939, Biesiadka 1969, et al.), but the numerous concomitant occurrence of other species proves that the investigated water bodies have an individual character.

Most of the stations were characterized by a rich fauna of *Heteroptera*. The fewest species were caught in the smallest (station 4) and in the largest water body (station 6). The main feature distinguishing the investigated pools — and also of great importance for *Heteroptera* — was the kind of the bottom and degree of differentiation of aquatic plants. *Heteroptera*, especially *Corixinae*, occured most frequently in the water bodies with a coaly bottom. In places where aquatic plants occured additionally the number of *Heteroptera* still increased. *Gerridae* and *Ranatra linearis* occurred only in water bodies with emergent plants (sta-

tions 2 and 3). The species most closely connected with a clayey bottom was *Sigara nigrolineata*.

A comparison of the *Heteroptera* from the mine water bodies with those from the nearby Konin Lakes investigated by Mielewczyk (1977) and Wróblewski (1977) is interesting. According to these authors, the fauna of *Heteroptera* of the complex of 5 Konin Lakes is relatively poor. During several years of investigations the occurrence of there only 29 species was found; among them 8 (*Nepa cinerea* L., *Mesovelia furcata* Muls. et Rey, *Gerris paludum* (Fabr.), *Hydrometra gracilenta* Horv., *Hebrus pusillus* (Fall.), *H. ruficeps* Thoms., *Micronecta minutissima* (L.), and *M. griseola* Horv.) were not noted in the present investigation. Of the above-mentioned species, it might be possible, with more exact investigations to find in the investigated water bodies only *Nepa cinerea* and *Mesovelia furcata*. The absence of other species characterized by completely different ecological requirements is quite comprehensible. Of the species found in the investigated mine water bodies 8 *(Corixa punctata, C. dentipes, C. sahlbergi, C. moesta, Sigara nigrolineata, Cymatia bonsdorffi, Notonecta maculata,* and *N. viridis)* were not reported from the Konin Lakes.

Much more essential are the difference in the number system of *Heteroptera* between the investigated water bodies and the Konin Lakes. In the latter the dominants were *Sigara falleni, S. striata, Plea leachi, Micronecta meridionalis,* and *M. minutissima*. Of these species only *Sigara falleni* and *S. striata* occurred fairly numerously in the mine water bodies. *S. lateralis,* which dominated decisively in the investigated water bodies and in the Konin Lakes was one of least numerous species. In the investigated water bodies the percentage of *Sigara fossarum, S. distincta, Ranatra linearis, Microvelia reticulata, Gerris thoracicus,* and *G. lacustris* was also higher.

Of the 5 Konin Lakes Lake Gosławickie was undoubtedly qualitatively the richest, 26 species of *Heteroptera* being found there. In the other lakes the number of species did not exceed 20. The neighbourhood of small mine water bodies and hence the migration of some species towards the lake must be regarded as the main cause of the higher number of species in Lake Gosławickie. Certainly some of the species occurring in the small water bodies in the mine originate from Lake Gosławickie. Among the species occurring in Lake Gosławickie and certainly originating from the mentioned small mine water bodies are *Sigara concinna, S. distincta, S. fossarum, S. lateralis,* and *Gerris thoracicus*. It is characteristic that these species either occur only in Lake Gosławickie or are represented there most numerously. From the Konin Lakes, mainly from Lake Gosławickie, certainly originate such elements of the mine water bodies as: *Sigara striata, S. falleni, Cymatia coeloptrata, Plea leachi, Ranatra linearis,* and *Gerris orgentatus. Micronecta meridionalis* most pro-

bably originates from the fairly distant Lake Licheńskie in which a very numerous population of this species is maintained. Other species must come in from neighbouring small water bodies, most of them, surely, from the peat bog water body complex 0.5 to 2 km away.

Coleoptera

In the collected material, comprising 1122 individuals, 35 species were distinguished (Table I). Clearly the dominating species was *Scarodytes halensis*. The smallest numbers were shown by *Gyrinus marinus*, *Bidessus geminus*, and *Laccophilus minutus*. As many as 14 species were represented by single individuals, whereas in 12 species there were 2 to 10 individuals. The faunistic picture of *Heteroptera* thus basically differs from *Heteroptera* where species with the lowest number of one individual had a small percentage share in the whole material.

Among *Heteroptera* two great ecological groups can be distinguished: species connocted with waters of increased mineralization, which include *Haliplus immaculatus*, *Coelambus confluens*, *C. flaviventris*, *Potamonectes canaliculatus*, *Scarodytes halensis*, and *Bidessus geminus*, and small water body species of high eurytophy to which all the others belong.

In comparison with *Heteroptera*, the absence of the group of peat bog species is noticeable. It seems that this can be explained by a poorer migratory ability of *Coleoptera*, especially of the peat bog ones. A characteristic feature of *Coleoptera* of the investigated water bodies in the large number of species associated with more mineralized waters and small number of small water body species.

The dominance structure of *Coleoptera* of the investigated water bodies shows a certain similarity with the communities of small water bodies formed in gravel pits after exploitation. In such water bodies situated at Łowicz, a large number of *Scarodytes halensis* (Tranda 1959) constantly occurred. A decisive dominant at these stations was, however, *Potamonectes canaliculatus*, a species which is here among the rarest.

Similarly as in the case of *Heteroptera*, the smallest number of species was collected at stations 4 and 6, and the largest at stations 2 and 1. The greatest number of *Coleoptera occurred* among the plants, whatever the kind of bottom.

A large number of *Coleoptera* was usually accompanied by a small number of *Heteroptera;* when the number of *Coleoptera* was small that of *Heteroptera* was relatively higher.

The occurrence in a shallow transient puddle (water body 4) of *Coelambus flaviventris*, a species considered to be very rare in Poland (Galewski 1971), is worthy of note.

Tabela I. Ilościowe zestawienie Heteroptera, Coleoptera i Hydracarina i ich występowanie w zbiornikach

Table I. Quantitative comparison of Heteroptera, Coleoptera and Hydracarina and their occurrence in water bodies

Taksony - Taxons	Liczba - Number of			Dominacja Dominance	Zbiorniki - Water bodies					
	osobników specimens	stanowisk stations	prób samples	w in %	1	2	3	4	5	6
Heteroptera										
Corixa punctata (Ill.)	28	4	8	2.37	4	-	12	1	11	-
- dentipes (Thoms.)	3	2	2	0.25	1	2	-	-	-	-
- sahlbergi (Fieb.)	21	3	3	1.77	15	-	1	-	5	-
- linnaei (Fieb.)	20	3	3	1.69	3	1	-	-	16	-
- moesta (Fieb.)	1	1	1	0.08	-	-	-	-	1	-
Sigara praeusta (Fieb.)	3	1	2	0.25	-	-	-	-	3	-
- concinna (Fieb.)	3	2	2	0.25	2	-	-	-	1	-
- striata (L.)	79	3	8	6.63	1	1	-	-	77	-
- distincta (Fieb.)	15	3	6	1.27	2	-	1	-	12	-
- falleni (Fieb.)	79	4	11	6.69	9	1	-	-	67	2
- fossarum (Leach)	69	3	7	5.84	3	-	-	-	65	1
- semistriata (Fieb.)	2	1	1	0.16	-	-	2	-	-	-
- nigrolineata (Fieb.)	148	5	13	12.54	6	1	6	79	56	-
- lateralis (Leach)	496	5	13	42.03	14	-	1	45	426	10
Cymatia bonsdorffi (Sahlb.)	1	1	1	0.08	1	-	-	-	-	-
- coleoptrata (Fabr.)	4	3	4	0.33	-	1	-	-	2	1
Corixinae larwy - larvae	271	5	11	-	5	-	8	36	191	31
Micronecta meridionalis (Costa)	1	1	1	0.08	1	-	-	-	-	-
Notonecta glauca L.	10	3	7	0.84	2	2	6	-	-	-
- maculata Fabr.	2	1	1	0.16	-	-	-	-	2	-
- viridis Delc.	16	2	4	1.35	6	10	-	-	-	-
Notonecta sp. larwy - larvae	3	1	1	-	-	-	3	-	-	-
Plea leachi Mac Greg. et Kirk.	11	2	4	0.93	-	2	9	-	-	-
Ilyocoris cimicoides (L.)	1	1	1	0.08	1	-	-	-	-	-
Ranatra linearis (L.)	8	2	4	0.67	-	1	7	-	-	-
Microvelia reticulata (Burm.)	130	2	5	11.01	-	2	128	-	-	-
Limnoporus rufoscutellatus (Latr.)	2	2	2	0.16	-	1	1	-	-	-
Gerris argentatus Schumm.	3	1	1	0.25	-	-	3	-	-	-
- lacustris (L.)	10	1	1	0.84	-	-	10	-	-	-
- odontogaster (Zett.)	6	1	2	0.50	-	-	6	-	-	-
- thoracicus Schumm.	15	1	3	1.27	-	-	15	-	-	-
Gerris sp. larwy - larvae	39	1	2	-	-	-	39	-	-	-
Razem - Totally	1500	-	-	100.00	76	25	258	161	935	45
Coleoptera										
Peltodytes caesus Duft	3	2	3	0.27	1	2	-	-	-	-
Haliplus ruficollis Deg.	1	1	1	0.09	-	1	-	-	-	-
- immaculatus Gerh.	9	2	3	0.81	7	2	-	-	-	-
Hydroporus palustris (L.)	17	2	5	1.54	3	14	-	-	-	-
Graptodytes granularis (L.)	1	1	1	0.09	-	1	-	-	-	-
Porhydrus lineatus (Fabr.)	9	3	5	0.81	3	5	1	-	-	-
Coelambus impressopunctatus (Schall.)	5	2	2	0.45	4	1	-	-	-	-
- confluens (Fabr.)	2	1	1	0.18	-	-	1	-	-	-
- flaviventris (Motsch.)	3	1	1	0.27	-	-	-	3	-	-
Hygrotus inaequalis (Fabr.)	9	3	6	0.81	2	4	-	-	3	-
- versicolor (Schall.)	2	2	2	0.18	1	1	-	-	-	-
Potamonectes canaliculatus (Lac.)	1	1	1	0.09	-	1	-	-	-	-
Scarodytes halensis (Fabr.)	498	5	24	45.25	116	108	209	-	62	3
Bidessus geminus (Fabr.)	161	6	20	14.63	24	11	47	30	49	2
Hyphydrus ovatus (L.)	29	2	7	2.63	9	20	-	-	-	-
Laccophilus minutus (L.)	106	5	14	9.63	77	14	12	1	2	-
- variegatus (Germ.)	1	1	1	0.09	1	-	-	-	-	-
Agabus sturmi (Gyll.)	1	1	1	0.09	-	-	-	-	1	-
Ilybius fenestratus (Fabr.)	1	1	1	0.09	1	-	-	-	-	-
- fuliginosus (Fabr.)	3	1	2	0.27	-	3	-	-	-	-
Rhantus pulverosus (Steph.)	1	1	1	0.09	1	-	-	-	-	-
Acilius sulcatus (L.)	1	1	1	0.09	1	-	-	-	-	-
Gyrinus minutus Fabr.	3	1	2	0.27	3	-	-	-	-	-
- marinus Gyll.	189	3	7	17.18	146	29	14	-	-	-
- suffriani Scriba	1	1	1	0.09	-	1	-	-	-	-
- natator (L.)	3	2	3	0.27	1	2	-	-	-	-
- mergus Ahr.	1	1	1	0.09	-	1	-	-	-	-
- paykulli Oche	1	1	1	0.09	1	-	-	-	-	-
Limnebius aluta Bedel	2	1	2	0.18	-	-	2	-	-	-
Laccobius bipunctatus F.	20	2	2	1.81	-	2	18	-	-	-
- minutus L.	18	2	3	1.63	-	1	17	-	-	-
- sinuatus Motsch.	17	1	1	1.54	-	-	17	-	-	-
Hydrochara caraboides L.	1	1	11	0.09	-	-	1	-	-	-
Berosus luridus L.	1	1	1	0.09	-	1	-	-	-	-
Helochares lividus Forst.	1	1	1	0.09	-	-	1	-	-	-
Razem - Totally	1122	-	-	100.00	402	225	340	34	117	5
Hydracarina										
Hydrachna cruenta Müll.	23	3	4	17.29	14	1	-	-	8	-
- schneideri Koen.	54	3	3	40.60	3	-	-	-	48	3
Eylais undulosa Koen.	1	1	1	0.75	-	-	1	-	-	-
Hydrodroma despiciens (Müll.)	26	4	5	19.54	16	6	3	-	-	1
Limnesia maculata (Müll.)	2	2	2	1.50	-	1	1	-	-	-
- fulgida Koch	9	3	3	6.76	2	3	6	-	-	-
Piona alpicola (Neum.)	9	1	1	6.76	-	-	-	-	9	-
- carnea (Koch)	1	1	1	0.75	-	-	-	-	1	-
- stjordalensis (Thor)	1	1	1	0.75	-	1	-	-	-	-
- variabilis (Koch)	1	1	1	0.75	-	1	-	-	-	-
Arrenurus crassicaudatus Kram.	5	2	2	3.75	4	1	-	-	-	-
- globator tubulator (Müll.)	1	1	1	0.75	-	-	1	-	-	-
Razem - Totally	133	-	-	100.00	39	14	12	-	66	4

Similarly as *Heteroptera, Coleoptera* of the Konin Lakes, in whose vicinity the investigated water bodies were situated (Biesiadka 1977 a) were also elaborated. The fauna of *Coleoptera* of the Konin Lakes is very rich. 97 species were reported, i.e. almost three times more than in the investigated mine water bodies. Among the species occurring in the Konin Lakes as many as 66 did not occur in the mine water bodies, whereas of those found in the small water bodies in the mine 4 (*Coelambus confluens, C. flaviventris, Potamonectes canaliculatus, Ilybius fenestratus*) did not appear in the lakes. The differences between the fauna of *Coleoptera* of the Konin Lakes and the investigated water bodies are thus much greater than in the case of *Heteroptera*.

The differences in the structure of dominance were also greater. Species dominating in the Konin Lakes — *Noterus crassicornis* and *N. clavicornis* — do not occur in the fauna of the mine water bodies. Among these more numerous in the lakes only *Laccobius minutus, L. bipunctatus, Bidessus geminus* occurred in the investigated water bodies; the number of these species is here also quite large.

The faunistic relations of *Coleoptera* of the Konin Lakes and the investigated water bodies are certainly more limited than those of *Heteroptera. Scarodytes halensis,* dominating in the investigated mine water bodies, are among the rarest *Coleoptera* in the Konin Lakes. *Bidessus geminus,* also unquestionably originating from the mine water bodies, is more numerous in the Konin Lakes. This results from a greater migratory ability, which is clearly demonstrated by a more numerous occurrence in transient pools (station 4). Still less intense is the penetration of lake fauna into the mine water bodies. Of the reported species only *Laccophilus variegatus* certainly originated from the lake, all the rest probably coming from the neighbouring small water bodies.

Hydracarina

The collected material included 133 imagines and nymphs, and nearly 2000 larvae using *Corixinae* as host. 12 species were distinguished in it, among which the most numerous were *Hydrachna schneideri* followed by *Hydrodroma despiciens* and *Hydrachna cruenta* (Table I). 5 species were represented by single individuals.

The species occurring in the investigated water bodies can be divided into three ecological groups. Those connected with water bodies of increased mineralization include the dominating *Hydrachna schneideri.* Among the acidophilous species connected with peat bog water bodies were *Limnesia fulgida, Piona alpicola,* and *P. carnea.* The remaining species are characterized by high eurytrophy and can be determined as small water body species.

Larvae of *Hydracarina* belonging to two species (*Hydrachna cruenta* and *H. schneideri*) were found from May till November, with a distinct fall in number in August and September. They occurred in all water bodies and on almost all species of *Corixinae*, but mainly on *Sigara lateralis* and *S. nigrolineata*.

The species collected in the mine water bodies certainly have the highest migratory ability in the regional fauna of *Hydracarina;* this results from their larvae being hosted by flying insects. They are mainly carried over by *Heteroptera* and *Chironomidae*.

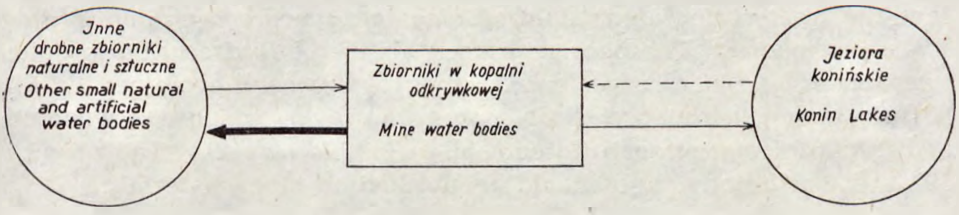
The relations between the fauna of *Hydracarina* of the mine water bodies and those from the Konin Lakes elaborated previously (B i e s i a d k a 1977 b) are very limited. In the Konin Lakes 96 species of *Hydracarina* were found, i.e. almost 8 times as many as in the investigated mine water bodies. The species *Limnesia undulata, Hygrobates trigonicus* K o e n., and *Brachypoda versicolor* (M ü l l.), which dominated in the lakes, were not reported from the investigated water bodies. Although of the 12 species recorded from the latter 9 occurred simultaneously in the lakes, it seems more probable that they came there from the neighbouring small water bodies and not from the Konin Lakes. Two of them, *Piona alpicola* and *P. carnea*, are very numerous in the nearby peat bog water bodies. The third species, *Hydrachna schneideri*, which was most numerous in the mine water bodies, was not found by the author in the nearby ones. This species is regarded in Poland as very rare; the author found it at a few stations in the vicinity ot Poznań (unpublished data). These were small clay pits and transient waters in gravel pits, resembling in character the investigated mine water bodies. This environment thus seems typical for *H. schneideri*. This species mainly uses as host *Sigara nigrolineata* and *S. lateralis* which, as is clearly seen from the discussion on *Heteroptera*, do not migrate into the lakes or, if so, only to a small extent. This explains the non-occurrence of *Hydrachna schneideri* in the Konin Lakes.

In the structure of *Hydracarina* the small number of imagines and nymphs in comparison with the large number of larvae is striking. This is worth noting, since *Hydracarina* do not have many natural enemies. It seems that in the conditions of high density od rapacious species (especially *Heteroptera* and *Coleoptera*) *Hydracarina* too are eaten in masses by these insects. Most of the *Hydracarina* imagines found in the author's samples were individuals just transformed which had not reached their definite size and proper hardening of the chitinous parts of the body characteristic of this species.

Final remarks

The presented analysis of the selected faunistic group distribution in small mine water bodies permits conclusions to be drawn as to the origin of the fauna, showing the migration trends of the aquatic fauna and the migratory ability of particular groups and species.

The probable scheme of the formation of the fauna of the small water bodies situated in the mine is presented in fig. 2. Most of the species



Ryc. 2. Przypuszczalny schemat migracji elementów faunistycznych między badanymi zbiornikami kopalnianymi, okolicznymi zbiornikami drobnymi i podgrzanymi jeziorami konińskimi

Fig. 2. Probable scheme of the migration of the faunistic elements between the investigated mine water bodies, the neighbouring small water bodies, and the warmed Konin Lakes

originate from small water bodies situated in the close vicinity (small post glacial water bodies, artificial water bodies in gravel pits, peat bog water bodies). The fauna of the peat bog waters played an important role in the formation of the fauna of *Heteroptera* of the investigated mine water bodies. Species migrating from the Konin Lakes also have a certain share in their fauna. This was most pronounced in *Heteroptera*.

The faunistic structure of the investigated mine water bodies was determined by the species of greatest migration, whereas in the dominance structure the greatest share was taken by southern species associated with small, intensely warming waters of increased mineralization. The specific structure of dominance cannot result from the greater migratory ability of southern species, which in natural water bodies play a negligible role. It should rather be assumed that it is the effect of the influence of specific environmental conditions on the confused and somewhat fortuitous faunistic material present in these water bodies in consequence of migration.

Intensive development of the fauna leads to excessive density in the water and creates favourable conditions for the migration of the small mine water body fauna in its changed structure of dominance to the neighbouring water bodies, including the Konin Lakes and especially

Lake Gosławickie, situated closest. From a comparison of corresponding faunistic structures it may be supposed that, although migration from the mine waters towards the lakes is not very intensive, it as more clearly detectable than that in the opposite direction. The natural ecological barrier between the lakes and the investigated water bodies seems to be stricter on the side of the lake than on that of the small water bodies, which may perhaps be explained only by differences in the fauna density.

There remains to be discussed the problem of migration of particular groups. From a comparison of the number of species in the investigated water bodies and in the surrounding fauna it appears that *Heteroptera* have the greatest migratory ability, *Coleoptera* much poorer, and *Hydracarina* the poorest. The poor migratory ability of *Hydracarina* is quite comprehensible since it results from their biology and ecology. The relatively poor performance of *Coleoptera*, however, which are regarded as a group of exceptionally great ability in this respect (Galewski 1971), is worth noting and should be checked on other materials.

Summary

In the investigated mine water bodies 29 species of *Heteroptera*, 35 of *Coleoptera*, and 12 of *Hydracarina* were found. *Heteroptera* and *Coleoptera* were most numerous. The number of *Hydracarina* in the imago stage was very low.

The species composition, and especially the system of species number, show a great differentiation in relation to the fauna of natural water bodies. In the collected material three ecological groups can be distinguished: species associated with waters of increased mineralization, acidophylous species associated with peat bog waters, and small water body species. The largest quantitative share was taken by the species preferring waters of greater mineralization (above all *Sigara lateralis*, *S. nigrolineata*, *Scarodytes halensis*, *Bidessus geminus*, and *Hydrachna schneideri*). In the Polish fauna these species are a southern element.

In the formation of the fauna of the water bodies situated in the mine migration from the small water bodies nearby is of the greatest importance, of a lesser importance being that of the fauna from the Konin Lakes in the vicinity of the investigated water bodies.

STRESZCZENIE

Badania nad *Heteroptera, Coleoptera* i *Hydracarina* drobnych zbiorników, położonych w odkrywkowej kopalni węgla brunatnego w Gosławicach, prowadzone były w roku 1972. Badaniami objęto 6 zbiorników różniących się powierzchnią, rodzajem dna i stopniem wykształcenia roślinności wodnej. Zebrany materiał obejmuje 2755 osobników, wśród których wyróżniono 76 gatunków (29 *Heteroptera*, 35 *Coleoptera* i 12 *Hydracarina*).

Wśród *Heteroptera* największy był udział ilościowy *Sigara lateralis, S. nigrolineata* i *Microvelia reticulata*. Wśród *Coleoptera* największe znaczenie ilościowe miały: *Scarodytes halensis, Gyrinus marinus, Bidessus geminus* i *Laccophilus minutus*. Wśród *Hydracarina* największą liczebność miały: *Hydrachna schneideri, H. cruenta* i *Hydrodroma descipiens*. W zebranym materiale faunistycznym można wyróżnić trzy grupy ekologiczne — gatunki związane z wodami o podwyższonej mineralizacji, gatunki acidofilne, związane z wodami torfowiskowymi i gatunki drobnozbiornikowe. Najliczniejsze były gatunki charakterystyczne dla wod silniej zmineralizowanych, które jednocześnie stanowią w naszej faunie element południowy.

Przeprowadzona analiza porównawcza fauny badanych zbiorników kopalnianych i położonych w pobliskim sąsiedztwie, podgrzewanych jezior konińskich wskazuje na bardzo ograniczone kontakty faunistyczne między tymi dwoma grupami zbiorników, przy czym większa jest migracja w kierunku do jezior niż odwrotnie.

Kształtowanie się fauny zbiorników kopalnianych wiąże się zapewne głównie z osiedleniem migrujących elementów drobnozbiornikowych, co przyczyniło się do wytworzenia charakterystycznej struktury dominacji.

REFERENCES

Biesiadka E., 1969. Pluskwiaki wodne *(Heteroptera)* okolic Międzychodu i Sierakowa. Pol. Pismo ent., 39, 385—400.

Biesiadka E., 1977a. *Coleoptera*. (w — in: Bottom fauna of the heated Konin lakes.) Monogr. Fauny Polski, 7, 257—278.

Biesiadka E., 1977b. *Hydracarina*. (w — in: Bottom fauna of the heated Konin lakes). Monogr. Fauny Polski, 7, 279—346.

Galewski K., 1971. Pływakowate — *Dytiscidae*. Klucze do Ozn. Owad. Pol., 19, 7.

Mielewczyk S., 1977. *Heteroptera* (w — in: Bottom fauna of the heated Konin lakes). Monogr. Fauny Polski, 7, 232—255.

Tranda E., 1959. Przyczynek do poznania makrofauny nowo powstałych stawków. Pol. Arch. Hydrobiol., 5, 91—100.

Wróblewski A., 1939. Pluskwiaki różnoskrzydłe wodne *(Hemiptera — Heteroptera aquatilia)* okolic Poznania. Fragm. faun. Mus. zool. Pol., 4, 107—142.

Wróblewski A., 1977. *Micronectinae* (w — in: Bottom of the heated Konin lakes). Monogr. Fauny Polski, 7, 224—230.

Adres autora — Author's address

dr Eugeniusz Biesiadka

Zakład Biologii Rolnej, Instytut Ekologii, Polska Akademia Nauk, ul. Świerczewskiego 19, 60-809 Poznań