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THE 14th POLISH MALACOLOGICAL SEMINAR

The 14th Polish Malacological Seminar took place in April 1998 in Wólka Milanowska near Kielce. Its main organizer was Dr. JADWIGA BARGA-WIĘCŁAWSKA, with assistance of her colleagues from the Pedagogical High School in Kielce. Presenting and discussing our malacological research was accompanied by social events, such as banquet, campfire and trip to the mountain Święty Krzyż. The 1998 Seminar was exceptional in that the number of participants exceeded that of all our previous meetings: including also those who arrived later or left earlier and as a result attended only a part of the meeting, there were 71 of us, most being members of the Association of Polish Malacologists. Not all the participants presented their results, but the number of presentations was also high: there were 44 lectures and posters. Their scope ranged from taxonomy, both fossil and recent, through terrestrial and aquatic ecology, conservancy, to parasitology, genetics and physiology. One–page summaries were published in a Special Volume, regretfully in Polish. The very brief abstracts presented below have been abbreviated and translated, based on the Special Volume, by the author of this report. All the addresses of the authors are given in Polish, as in the Special Volume.

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ABSTRACTS FROM THE 14th POLISH MALACOLOGICAL SEMINAR

THE SYSTEMATIC POSITION AND DISTRIBUTION OF THE AGRIOLIMACIDAE (GASTROPODA: PULMONATA)

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A total of 131 agriolimacid species are known at present, further species being constantly described. They are the closest related to the Limacidae; they include the genera *Deroceras* (120 species), *Furcopenis, Lytopelte, Megalopelte, Krynickillus* and *Mesolimax* (1–4 species each). Their most important diagnostic characters are those of the alimentary tract and genitalia. *Deroceras* inhabits almost whole Holarctic and a fragment of the Ethiopian Region, *Furcopenis* – the northern part of the Iberian Peninsula, *Lytopelte* – Middle Asia, *Krynickillus* – Turkey and Bulgaria, *Mesolimax* – Turkey and the Rhodos Island. The range and number of species of *Deroceras* are due to its ability to reproduce uniparentally. The genus originated probably somewhere in the western Palaearctic (possibly Mediterranean) and spread from there. The other genera have remained in their respective places of origin.

THE GENUS *TRICHIA* (GASTROPODA: PULMONATA: HELICIDAE) IN POLAND

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The genus *Trichia* in Poland includes 6 species. *T. bakowskii* (Poliński), *T. bielzi* (A. Schmidt), *T. lubomirskii* (Ślósarski), *T. villosula* (Rossmässler) and *T. unidentata* (Drap.) are mountain species, distributed mainly in the Sudetes and Carpathians. *T. hispida* (L.) inhabits entire Poland except the Carpathians. Based on the analysis of conchological and anatomical characters (over 2,500 specimens from 29 localities), diagnoses and descriptions of each species, considering the individual and age-related variability, have been provided, as well as identification key and shell and reproductive system illustrations.

MORPHOMETRIC COMPARISON OF *VESTIA ELATA* (ROSSM.) (GASTROPODA: PULMONATA: CLAUSILIIDAE) FROM THE ŚWIĘTOKRZYSKIE MTS AND THE CARPATHIANS

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The distribution range of *Vestia elata* (Rossm.) extends from the eastern part of the Western Carpathians, through the Eastern Carpathians, Transylvanian Upland, to the Southern Carpathians, its isolated localities being known from the Świętokrzyskie Mts. The latter population is clearly separated from the Bieszczady and S Carpathian populations, and displays the smallest intra-population variability. Specimens from the Świętokrzyskie Mts are distinctly smaller than the Carpathian ones, the probable size-limiting factor being the calcium-poor substratum.

SHELL COLOUR AND BANDING POLYMORPHISM IN *CEPAEA NEMORALIS (L.)* (GASTROPODA: PULMONATA: HELICIDAE) FROM MID POMERANIA

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Among *Cepaea nemoralis* (L.) from Mid Pomerania (NE fringes of the species distribution range), yellow and pink shells occurred with almost equal frequency, 51.5% and 48.5%, respectively. No brown shells were found. Frequency of unbanded morphs was low (10.0%) and they were more frequent among the pink (7.4%) than among the yellow shells (2.6%). Five-banded pattern was the most frequent, its mean frequency being 33.5% (9.7–78.5%). Shells with fused bands (three- and five-banded) constituted 19.5% of all shells. The studied colonies differed considerably in the frequency of particular phenotypes.

COURTSHIP AND COPULATION OF *HELIX LUTESCENS* ROSSM. (GASTROPODA: PULMONATA: HELICIDAE)

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The maximum of reproductive activity of *Helix lutescens* Rossm. in Poland falls on May and June. The courtship and copulation proceed according to the typical helicid pattern and last up to over 3 hrs depending on temperature.

THE EFFECT OF LIVING CONDITIONS ON THE SHELL VARIABILITY IN *HELICELLA OBVIA* HARTM. (GASTROPODA: PULMONATA: HELICIDAE)

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Ca. 100 shells of *Helicella obvia* Hartm. collected at three sites, all located within the Kozubowski Landscape Park, but of different habitat conditions, were morphometrically analysed with respect to four characters. The results did not confirm the hypothesis that in an optimum habitat the shell parameters should reach their highest values.

LOCALITIES AND ABUNDANCE DYNAMICS OF *ARION LUSITANICUS* MAB. (GASTROPODA: PULMONATA: ARIONIDAE)

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Arion lusitanicus Mab., an introduced species in Poland, is a serious pest of many cultivated plants. Studies on its spreading in Rzeszów voyvodeship revealed significant differences in its abundance, depending on the location of the field and kind of neighbouring cultivations. Its maximum abundance is observed in the fall, when first juveniles hatch. Most slugs hatch in the spring from overwintering eggs. At that time only few adults are found, hatched in the fall of the previous year. At the beginning of May the abundance increases to attain its first peak at the end of that month. The slugs reach sexual maturity at half of July. After copulation, at the end of July, they start egg-laying. The high abundance is maintained till the end of October. Single individuals can be found in winter, during warmer periods.

LIFE CYCLE OF *DISCUS ROTUNDATUS* (O. F. MÜLL.) (GASTROPODA: PULMONATA: ENDODONTIDAE)

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Life cycle of *Discus rotundatus* (O. F. Müll.) was reconstructed based on the laboratory culture and quantitative samples taken monthly in SW Poland. Juveniles (shells of 1.9–2.1 whorls) hatch from June till October, with a maximum in July and August. Shells of wintering juveniles have usually 2.6–3.5 whorls, less often 4 whorls (the earliest hatched individuals). The mean growth rate is 0.5 whorl per month. In June–July of the next year the snails attain 5 whorls. Some start to reproduce, the remaining ones reach sexual maturity in their third year. Adult individuals continue growing. The number of eggs per clutch is 2–11 (most often 3–4); the number of eggs per individual per season varies from 2 to 21. Freshly laid eggs are calcified, white, slightly flattened, ca. 1 mm in diameter. Incubation period lasts 14–30 days.

PRELIMINARY DATA ON THE BIOLOGY AND ECOLOGY OF *HELICODONTA OBVOLUTA* (O. F. MÜLL.) (GASTROPODA: PULMONATA: HELICIDAE)

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Life cycle of *Helicodonta obvoluta* (O. F. Müll.), a Central European species, was studied in the laboratory and in the nature reserve Muszkowicki Las Bukowy (SW Poland). The reproductive season falls on the end of April, May and June. Eggs, 13–27 per clutch (mean 16), are laid under bark or in rotting wood. *H. obvoluta* lays one clutch per year. The eggs are elongated (2.1–2.9 x 2.0–2.6 mm), white, calcified. Newly hatched young, with shells of 1 whorl, stay near the clutch during the first 2–4 days and consume the egg enve-

lopes. Egg canibalism has been observed. Growth to adulthood takes ca. 10 months.

MALACOCENOSES OF ISOLATED MIDFIELD COPSES

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Twenty six midfield copses examined in SW Poland (120 – 20,000 m^2) harbour 4 to 14 land snail species (mean 8), making a total of 36 species in all the sites. As many as 21 are sporadic (constancy below 20%), 9 are infrequent (20–40%), 3 moderately frequent (40–60%), only *Vitrina pellucida* (O. F. Müll.), *Cochlicopa lubrica* (O. F. Müll.) and *Nesovitrea hammonis* (Ström) being frequent (>80%). The number of species is not correlated with the copse size. Most species (12) are euryoecious, 8 are woodland species, 6 – species of open habitats, 5 – higrophilous and 4 – clearly synanthropic. European species are the most numerous (9), followed by Holarctic (8), Palaearctic, Eurosiberian and Western and Central European species (3 in each group), other groups constituting a negligible proportion.

MALACOCENOSES OF CALCAREOUS AND SILICACEOUS DUMPS IN THE ŚWIĘTOKRZYSKIE MTS, ON THE BACKGROUND OF SOIL AND VEGETATION CONDITIONS

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Malacocenoses of calcareous versus silicaceous substrata differ in their species composition. The rate of snail succession on the dumps depends on the availability of calcium and humidity conditions, and on the plant succession; the succession on calcareous dumps being ca. 30 years in advance compared to that on silicaceous dumps.

NEED FOR PROTECTION OF MALACOFAUNA IN SELECTED ANTHROPOGENIC AREAS OF THE ŚWIĘTOKRZYSKIE MTS

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Areas whose soil and bedrock have been transformed as a result of human activities, especially the oldest (Stone Age) sites of flintstone exploitation, iron ore mines and limestone quarries, are a peculiarity of the Świętokrzyskie Mts. In some of these sites the soils and habitats have become richer and provide favourable conditions for preserving the local malacofauna; they harbour some species that are rare in the area: *Truncatellina cylindrica* (Fér.), *Vertigo pygmaea* (Drap.), *Nesovitrea petronella* (L. Pfeiffer), *Semilimax kotulai* (Wstld.), *Cepaea hortensis* (O. F. Müll.) and *Helix lutescens* Rossm. Of 14 species with northern distribution borders in the Świętokrzyskie Mts, 8 live in such habitats; of 11 species with insular localities in these mountains, 5 live on quarry dumps.

IS OVOVIVIPARITY RIGHTLY ADVERTISED?

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Most pre-adult mortality in land snails involves eggs. Being easily attainable (no anatomical changes required), ovoviviparity should be selected for even at earliest stages of its evolution. Selection pressures thought to promote ovoviviparity are: irreguar onset of wet season, advantage of earlier copulation and progeny production, food competition between juveniles. Ovoviviparity should be common among land snails and especially so in habitats unstable/unpredictable with respect to food and humidity, which it is not. Possible factors preventing ovoviviparity from being common are: limited fertility and thus necessity to extend the reproductive period, relative mortality of eggs, juveniles and adults, mechanical constraints, other forms of parental care, longevity and limited outbreeding.

THE PUPILLOIDEA (GASTROPODA: PULMONATA) OF THE POLISH MIOCENE

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The Miocene pupilloids in Poland are known from localities in Opole, Bełchatów and vicinity of Chmielnik. The genera represented are: *Vallonia, Acanthinula, Argna, Strobilops, Negulus, Gastrocopta, Vertigo* and *Microstele*. Because of the time span involved (8 myr), Bełchatów is by far the richest as regards the number of genera and species. Based on the snail species composition and plant remnants it was possible to reconstruct climatic and vegetational conditions: warm and humid, subtropical (18–19 myr ago); spreading of Cupressaceae marshy forests and mixed forests with pine in drier places (16–17 myr ago), and dominance of communities composed of Arctic–Tertiary and Quaternary woodland elements.

SHELL THANATOCENOSES AS AN OBJECT OF MALACOLOGICAL STUDIES

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The composition of mollusc shell accumulations formed in various deposition environments depends on the character of the malacocenosis, erosion, denudation, transport processes and sedimentation conditions. Subfossil Quaternary malacofauna, well preserved in calcium–abundant conditions, is of significance when estimating the age of the deposit and environmental changes. Studies on shell thanatocenoses require methods used in analysis of Quaternary deposits, numerical methods, observations on sedimentology, hydrology, geomorphology and geology. Little is known on the relation between the thanatocenoses and the living malacocenoses. The studies on shell outwash of several rivers and lakes pertain to the distance of transport and conditions of deposition of the material, quantitative relations, segregation of shells according to their size and species composition.

MALACOFAUNA OF CALCAREOUS TUFAS IN TRZEBIENICE NEAR WOLBROM

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The material of 106 samples from 9 profiles of a valley of a small brook in Trzebienice near Wolbrom included 90 snail and bivalve species. The two richest profiles contained 74 and 69 species, respectively. The first comprised two intervals of different species composition: woodland species and then their disappearance with an increase in the number of meadow and higrophilous species, testifying to a forest disappearance (Subatlantic Phase). In the second profile, first shade-loving forms dominated, later becoming less numerous which indicates open habitats (Subboreal and Subatlantic Phase).

MOLLUSC ASSEMBLAGES AS INDICATORS OF HOLOCENE LAKE LEVEL CHANGES

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Mollusc assemblages of the Kórnik–Zaniemyśl trough lake deposits differ in their species composition, abundance, and structure. They correspond to different development stages and bathymetric zones of the lakes. The most abundant fauna occurs in shallow water calcareous deposits; deposits of the deepest lake parts contain few or no molluscs. Two main sequences characterizing palaeohydrological conditions can be distinguished: regression sequence (decreasing water level) and transgression sequence (increasing water level), each characterized by its own mollusc assemblage.

SHORELINE CHANGES OF THE ŁEBSKO LAKE IN THE LIGHT OF LITHOLOGICAL CHARACTERS AND MALACOLOGICAL ANALYSIS

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Three phases of lake development were distinguished based on lithological and malacological analysis of the deposits of the Łebsko lake. The oldest phase is associated with marine environment, as indicated by euhalobic and oligohalobic species. The second phase includes an oligohalobic assemblage, the third phase being similar to the present shape and ecological conditions of the lake.

WŁADYSŁAW POLIŃSKI AND THE DISCOVERY OF THE ENDEMIC, RELICT FAUNA OF THE OCHRID LAKE

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Snails are the most diverse animal taxon in the Ochrid Lake. A Polish malacologist WŁADYSŁAW POLIŃSKI (1885–1930) was its discoverer, albeit based on materials collected by SINISA STANKOVIČ. POLIŃSKI (1929, and posthumously 1932) listed 26 (24 endemic) snail species from the lake, 16 species, 7 subgenera and genera being new to the science. He did not live to complete a more detailed analysis of the material. Further studies on the malacofauna of the lake started as late as the 1950s.

SHELL ANOMALIES IN THE LYMNAEIDS (GASTROPODA: PULMONATA: LYMNAEIDAE)

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Atypical lymnaeid shells are known mainly in *Lymnaea (Radix) peregra* (O. F. Müll.), *L. (R.) auricularia* (L.) and *L. (Lymnaea) stagnalis* (L.). A frequent anomaly is deformation of the body whorl (greatly increased size, wrinkled surface, atypical shape, larger aperture), shells with two apertures or wholly scalaric spire are very rare. Possible reasons for the anomalies are disturbed ontogeny and mechanical damage followed by regeneration.

BOTTOM MALACOFAUNA OF THE RESERVOIR SIEMANÓWKA ON THE UPPER NAREW RIVER

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Samples were taken at 15 localities in the reservoir and in the river below the dam. A total of 19 mollusc species were found, plus empty shells of further 7 species. Shore, shallow parts of the reservoir were the richest in molluscs; their distribution was mosaic. *Gyraulus albus* (O. F. Müll.) and *Planorbis planorbis* (L.) were the most frequent. The mean biomass was low (>1 g/m^2), except the parts inhabited by *Anodonta* (24 g/m^2).

MALACOFAUNA OF SELECTED RESERVOIRS OF THE OSÓWKA STREAM

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The malacofauna of the Osówka stream, studied in 1997, included 17 snail species and 5 bivalve species, *Potamopyrgus antipodarum* (Gray) being a clear dominant (40%). Two mollusc communities could be distinguished: one in the lake Głębokie (8 species, 5 of them limited to that lake), the other in the stream and ponds (12 species, 6 limited to these reservoirs). Two of the species found: *Musculium lacustre* (O. F. Müll.) and *Valvata pulchella* Studer, are threatened with extinction.

GASTROPOD FAUNA OF SINK-HOLE RESERVOIRS IN CZUŁÓW

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Gastropods of 7 reservoirs that originated as a result of coal exploitation in Czułów were studied in 1995 on the background of vegetation and bottom sediments. The dominant plant communities are Glycerietum maximae and Typhetum latifoliae, quartz being the main component of the bottom sediments. The gastropod fauna varies quantitatively and qualitatively with respect to the occurrence of *Aplexa hypnorum* (L.), *Viviparus contectus* (Millet), *Bathyomphalus contortus* (L.) and *Potamopyrgus antipodarum* (Gray).

Physella acuta Drap. and *Hippeutis complanatus* (L.) are rare in Upper Silesia.

GASTROPODS OF AQUATIC HABITATS OF WYSOCZYZNA CIECHANOWSKA

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Gastropod fauna, plant communities, chemical properties of water and bottom sediments were studied in 4 rivers, a dam reservoir and 9 clay pits in the area of Wysoczyzna Ciechanowska. The vegetation includes mainly Typhetum latifoliae and Phragmitetum. The water is within the third class quality. Twenty four gastropod species were found: 4 prosobranchs and 20 pulmonates. A permanent population of *Ferrissia wautieri* (Mirolli) was found in one of the clay pits, on submerged parts of *Typha latifolia* (L.).

OCCURRENCE OF *DREISSENA POLYMORPHA* (PALL.) (BIVALVIA: DREISSENIDAE) IN A LAKE OF COMPLICATED SHAPE

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The lake Inulec in the Mazurian Lakeland is eutrophic, of 163 ha surface area and a shape complicated by the presence of several bays and peninsulas, four islands and several reed patches. The shape and wind exposure affect the distribution of *Dreissena polymorpha* (Pall.). In most sites the density is several hundred individuals per m^2, in some it exceeds 1,000/m^2. The preferred depth is 2–3 m. The eastern part of the lake, exposed to strong westerly winds, is the densest populated.

FACTORS AFFECTING THE DISTRIBUTION OF *ANODONTA CYGNEA* L. (BIVALVIA: UNIONIDAE) IN THE NIDA RIVER VALLEY

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Out of 18 localities in the Nida River Valley, *Anodonta cygnea* L. was found at 6, and empty shells at 4. The species is associated with small eutrophic reservoirs, oxbows and slow river sections of muddy bottom. In the studied area, water bodies inhabited by *Anodonta* were characterized by a low conductivity, higher concentration of magnesium ions and low concentration of cadmium ions; the species avoids high concentrations of calcium.

CONCHOLOGICAL AND GENETIC VARIATION OF *ANODONTA* (BIVALVIA: UNIONIDAE) IN THE KONIN LAKES

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Fourteen specimens of the genus *Anodonta* were examined conchologically and electrophoretically. Morphologically they were divided in 3 groups (1, 2, 3), one being identified as *A. woodiana* (Lea). With respect to habitat, 2 groups were distinguished: A – specimens from the Licheńskie lake (summer water temperature 29–30°C) and B – from the canals (35°C). Of 18 loci (12 enzymes) 14 were polymorphic, and groups 1, 2 and 3, as well as A and B differed genetically and morphologically. The studies, aimed at identification of *Anodonta* inhabiting the lakes (distinct species or forms of *A. woodiana*), are still in progress.

HETEROPLASMY OF THE LENGTH OF MITOCHONDRIAL DNA AND VARIATION IN THE POPULATION OF *MYTILUS TROSSULUS* (BIVALVIA: MYTILIDAE) FROM THE POLISH COAST

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Mitochondrial DNA in *Mytilus trossulus* is inherited from both parents; the frequency of heteroplasmatic individuals is high. Eleven samples of ca. 40 specimens each were examined. Twenty four composite haplotypes were identified, with a significant spatial diversity in the bays Zatoka Pucka and Zatoka Gdańska, and the open coast. Homo- and heteroplasmic individuals contain 14 size variants of mtDNA. The variants undergo probably a double uniparental mechanism of heredity.

HISTOLOGICAL ANALYSIS OF GONADS OF FEMALE *ANODNTA ANATINA* (L.) (BIVALVIA: UNIONIDAE) FROM MARCH TILL OCTOBER

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Gonads of 40 adult female *Anodonta anatina* (L.) collected in 1994–97 from March till October in the Klępnicko Lake (W Pomerania) were histologically analysed. The gonad activity increases in the spring (1 and 2 phase oocytes), the first occytes 3 appearing in May; in June the gonad mass still constitutes over 20% body mass. In July the gonad, filled with mature or nearly mature oocytes, consitutes over 30% body mass. On the turn of July numerous mature eggs are expelled. In August gonial cells and oocytes 1 appear in the gonads, starting a new cycle; in Septemebr and October the gonads are almost devoid of mature eggs, and gills of the females are filled with incubated glochidia.

LITTORAL MALACOFAUNA OF THE WIGRY LAKE

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The Wigry National Park is the only Polish national park established in order to protect waters. Studies on its aquatic malacofauna, started in 1997, revealed a paucity of the epiphytic and bottom species and a spatial diversity of species composition and abundance. The most abundant species were: *Dreissena polymorpha* (Pall.), *Potamopyrgus antipodarum* (Gray), less often *Lymnaea (Radix)* sp., *Bithynia tentaculata* (L.), *Gyraulus albus* (O. F. Müll.) and *Armiger crista* (L.) The abundance of *P. antipodarum* may be associated with its present expansion.

ZONATION OF GASTROPOD DISTRIBUTION IN THE DAM RESERVOIR RYBNIK

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The dam reservoir of the power plant Rybnik receives a high load of biogenic substances and heated water (summer water temperature increased by 7°C). Four thermal zones have been distinguished: discharge zone, mixing zone, cooling zone, pseudonatural zone. Each has its specific fauna: *Physella acuta* Drap. is the only species in the discharge zone; the pseudonatural zone has a quantitatively rich but qualitatively poor mollusc community. Except the mixing zone, introduced species dominate.

THE EFFECT OF ANTHROPOGENIC CHANGES OF THE POGORIA STREAM (CZARNA PRZEMSZA RIVER BASIN) ON THE DIVERSITY OF ITS MOLLUSC FAUNA

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The Pogoria stream was divided in two sections according to the degree of anthropogenic changes: natural above the Pogoria reservoir and regulated, below the reservoir. Analysis of the mollusc fauna revealed existence of two malacocenoses: one characteristic of unregulated section (*Physella acuta* Drap., *Radix peregra* (O. F. Müll.) and *Potamopyrgus antipodarum* (Gray) being common), another of regulated section, with commonly occurring *Dreissena polymorpha* (Pall.). A consequence of anthropogenic changes is formation of poor malacocenoses often dominated by introduced species.

HEAVY METALS IN THE SHELLS OF MOLLUSCS FROM THE CYBINA RIVER IN POZNAŃ

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The concentration of Cu, Zn, Pb and Cd in the water, mollusc shells (*Lymnaea (Lymnaea) stagnalis* (L.), *Lymnaea (Radix) peregra* (O. F. Müller), *Planorbis planorbis* (L.), *Planorbarius corneus* (L.), *Anodonta cygnea* (L.) and *Sphaerium corneum* (L.)) and bottom sediments were studied in the Cybina River and its artificial lakes. The heavy metal content in the water was low, in the bottom deposits high (2543 x more Cu, 986 x more Zn, 763 x more Pb and 493 x more Cd than water). Comparing the metal content in the sediments and shells it was found that *L. stagnalis* accumulated the highest quantities of Cu, *P. planorbis* and *P. corneus* – Zn, *A. cygnea* – Pb and *L. stagnalis* and *P. corneus* – Cd.

CONCENTRATIONS OF HEAVY METALS IN MOLLUSCS FROM THE ZEGRZYŃSKI RESERVOIR

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Analysis of Zn, Cu, Cd, Pb, Mn and Fe concentration in molluscs (*Viviparus viviparus* (L.), *Dreissena polymorpha* (Pall.), *Anodonta anatina* (L.)), water and bottom sediments from 9 sites in the Zegrzyński Reservoir revealed differences in the concentrations of heavy metals in soft parts and shells, depending on the metal and mollusc species. Low variation in Zn and Cu concentration in soft tissues may result from regulation of their level by the molluscs. Most studied metals showed lower concentrations in soft parts and shells than in the bottom sediments; only *V. viviparus* accumulated in its soft parts more C and Zn than in the sediments.

EXTANT MONOPLACOPHORANS (MONOPLACOPHORA: TRYBLIDIIDA)

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Twenty six species (22 described and named) of extant monoplacophorans are known. They were mostly found in the eastern Pacific, but several species are known from single localities in different part of world ocean which renders zoogeographic analysis difficult. Ten species are known from depths of 2,700–6,500 m, other species were found between 200 and 2,200 m. Detailed examination of the best known species (*Laevipilina antarctica* Warén et Hain, *Micropilina arntzi* Warén et Hain) revealed new characters, some indicating a high degree of specialization.

FROG SHELLS (GASTROPODA: CAENOGASTROPODA: BURSIDAE) IN MY COLLECTION

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The Bursidae include ca. 60 extant species of 8 genera and subgenera. They are widespread in tropical and subtropical seas, most (ca. 45) living in the Indo-Pacific. Most species are represented in the author's collection.

BEHAVIOUR IN A HOST–PARASITE ASSOCIATION, BASED ON SNAILS INFESTED WITH FLUKES

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Parasite adaptations involve inducing changes in the host's behaviour, the changes increasing probability of finding the next host. Partenites of the fluke *Gynaecotyle adunca* disturb orientation of the host, *Ilyanassa obsoleta*, which then migrates towards the shore where the cercariae are emitted next to isopods, their next intermediate hosts. Studies on geotaxy of *Lymnaea stagnalis* (L.) revealed no significant behavioural differences between infected and uninfected snails.

PRELIMINARY STUDIES ON INFESTATION OF *LYMNAEA STAGNALIS* (L.) BY LARVAE OF DIGENETIC FLUKES IN WATER BODIES OF THE KUJAWSKO-POMORSKI REGION AND IŁAWSKIE LAKELAND

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Almost 2,000 specimens of *Lymnaea stagnalis* (L.) from 21 water bodies near Toruń and in Iławsko-Ostródzkie Lakeland were examined for the intensity and extensity of trematode infection. The parasites were found mainly in the digestive gland, the extensity of invasion was higher in shallow stagnant waters; it changed seasonally from low in the spring to the highest in summer and autumn. The larvae observed were: Echinocercariae, Xiphidocercariae, Furcocercariae and Cercariae.

DEFENSIVE BEHAVIOUR OF SNAILS ATTACKED BY LEECHES

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Glossiphonia complanata (L.) is the most "snail-eating" of the Polish leeches. Behaviour of *Theodoxus fluviatilis* (L.) (Prosobranchia) and *Physa fontinalis* (L.) (Pulmonata) under the effect of chemical information about the predator or a direct attack by the leech was studied. Chemical information increases the mobility of *P. fontinalis*. The two snails differ in their reaction to a direct attack: *T. fluviatilis* closes its shell with operculum; *P. fontinalis* shakes its shell, detaching its foot from the subtrate, which results in shaking off the predator.

SEROMUCOID CONCENTRATION AND MORPHOMETRY OF HAEMOLYMPH CELLS IN SELECTED SNAIL SPECIES

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The species studied were: *Helix pomatia* L., *H. aspersa* O. F. Müll., *Achatina fulica* Bowdich and *Ampullaria cuprina* (O. F. Müll.). The total protein and seromucoid content are statistically significantly higher in terrestrial species, the relative content of seromucoid fraction varying between species. The higher seromucoid content in terrestrial species may be associated with their higher mucus production. Haemolymph of *H. pomatia* contains 4, and of *A. cuprina* 3 types of haemocytes; haemolymph cells belong to two functional categories: phagocyting and responsible for wound healing.

TISSUE DISTRIBUTION OF THE ACTIVITY OF INORGANIC PYROPHOSPHATASE IN *HELIX POMATIA* L., *H. ASPERSA* O. F. MÜLL. (GASTROPODA: PULMONATA: HELICIDAE) AND *AMPULLARIA CUPRINA* (O. F. MÜLL.) (GASTROPODA: PROSOBRANCHIA: AMPULLARIIDAE)

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The study was aimed at estimating participation of inorganic pyrophosphatase in the metabolism of aquatic (*Ampullaria cuprina* (O. F. Müll.) and terrestrial (*Helix pomatia* L., *H. aspersa* O. F. Müll.) snails. There were no statistically significant differences in PPase activity in the muscles and reproductive systems of the three species, though the activity varied between the organs (digestive gland, intestine, kidney, albumen gland, central nervous system).

TISSUE DISTRIBUTION OF FRUCTOSE-1,6-BISPHOSPHATASE AND GLUCOSE-6-PHOSPHATASE IN *HELIX POMATIA* L. (GASTROPODA: PULMONATA: HELICIDAE) AND *AMPULLARIA CUPRINA* (O. F. MÜLL.) (GASTROPODA: PROSOBRANCHIA: AMPULLARIIDAE)

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AGNIESZKA ERDT, MAŁGORZATA WOJCIECHOWSKA,
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The activity of fructose-1,6-bisphosphatase and glucose-6-phosphatase is higher in *H. pomatia* L. compared to *A. cuprina* (O. F. Müll.). The highest activity of both enzymes in both species was found in the digestive gland; it was lower in the kidney and the lowest in muscles. Kinetic studies (inhibition by AMP) suggest the presence of one isoenzyme of fructose-1,6-bisphosphatase in *H. pomatia*.

PYRUVATE KINASE – A KEY ENZYME OF GLYCOLYSIS IN THE TISSUES OF SELECTED SNAILS OF POLAND

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Studies on the comparison of PK activity and kinetic properties in foot muscles and hepatopancreas involved *Cepaea nemoralis* (L.), *C. hortensis* (O. F. Müll.), *C. vindobonensis* (Fér.), *Helix pomatia* (L.), *Arianta arbustorum* (L.), *Bradybaena fruticum* (O. F. Müll.), *Deroceras sturanyi* (Simr.) and *Arion rufus* (L.). The enzyme activity varies between species but in all of them it is much higher in the muscles than in the hepatopancreas. Its pH optimum in all the tissues is 6.9.

THE CONCEPT OF AUTAPOMORPHY AND THE RESOLUTION OF TAXONOMY

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According to the principles of phylogenetic systematics only monophyletic taxa are acceptable. Species no doubt is a monophyletic group; consequently it should have at least one autapomorphy. In practice we find identifiable and diagnosable species which differ only in combinations of otherwise plesiomorphic characters. An autapomorphy may remain unrecognized because of difficulties in polarization of "soft" characters (size, shape, colour). Alternatively, an ancestral species may be contemporary with its descendant species, and the former will remain monophyletic though it is defined by a combination of plesiomorphies. Both theoretically and practically, taxonomic procedures are of limited resolution at species level.