



## THE 22ND POLISH MALACOLOGICAL SEMINAR

### SEMINAR REPORT

It was our 22nd Seminar. It took place on April 26th–28th in a small village Huta Szklana (not far from the city of Kielce) at the foot of the Święty Krzyż [=Holy Cross] mountain, which is a part of the main range of the Świętokrzyskie Mts – a mountain chain quite isolated from our other mountains, the Carpathians and the Sudetes. The organisers listed on the cover of the Abstract Book include the Pedagogical Academy of Kielce, the Świętokrzyski National Park, the Association of Polish Malacologists, and the Scientific Society of Kielce. There are always many official organising societies and institutions which are very useful (if only financially, but also helping with conference materials, organising trips etc.), but there are always persons (most often one person only) who are behind all this. Without such persons nothing would have ever got organised. Our person was Dr. JADWIGA ANNA BARGA-WIECŁAWSKA who first organised everything and then looked after everybody till the Seminar was over. Great thanks ANNA!!!

The opening ceremony on the 26th, morning, took place in Kielce and those who had arrived earlier were taken there in a special bus. There were various speeches which is typical of such ceremonies, but there was also very good food (which is not). We all stayed in one hotel called Jodłowy Dwór [=Fir Manor for those who do not speak Polish] which is still being converted from a communist recreation centre into a posh hotel (very posh inside but with lots of building materials and machinery outside). Staying in one hotel provides a lot of opportunity for informal discussions and small parties – the only opportunity always scrupulously seized by most participants. The location – just at the beginning of some nice tourist trails going straight into the mountains – was obviously too tempting to resist, and some participants kept disappearing from the sessions. Another temptation was the fact that the area is one of the very few with huge populations of the rare *Helix lutescens*, and everybody wanted to find a few (empty!) shells. The weather was perfect, though the spring was late this year (the very

first leaves appeared on the last day of the Seminar), but it is always easier to find shells when there is not too much vegetation. The Seminar excursion went to the top of the nearest mountain – Święty Krzyż – where we were told all about the National Park by its Director, and could also visit the monastery; there was no snailing, since the mountain is within the National Park and the Director was looking.

There were 51 presentations (of these, fortunately, about 30% were posters, or we would have been there still) which, of course, has absolutely nothing to do with the number of actual participants. First: there were many multi-author presentations, in some cases the abstract was not much longer than the list of authors, and certainly shorter than the title and authors combined (see below if you don't believe me). Secondly, some prolific people had more than one presentation. Thirdly: not all the authors materialised, and as a result some papers (mostly by our neighbours from across the border) were in the abstract book and are included here, but were not presented at the meeting. Finally, there were some participants who are notorious for not presenting anything, ever. In all, there were about sixty people present – hard to count because quite many arrived after the seminar started and/or departed before it ended. Many new, young faces, many of them doctoral students – will all these nice, bright kids find at least a vaguely malacological employment? Like in the previous years, there were some guests from abroad – this time not only our next door neighbours from Ukraine and Lithuania but also one person from England! Are we getting popular, or what?

To get a better grasp of the scientific aspect of the Seminar, I have attempted what some call a structural analysis, assigning papers to disciplines. Believe me, it is quite difficult to assign some papers to a discipline, say those that deal with both ecology and life history. Also, I had to apply more than one division into categories, to avoid the proverbial classification of trams into those that are red and those that turn left. The

results of the main categorisation are presented in the Table.

The division in the table disregards the kind of animal that was studied (snail or bivalve) or where the animal was caught (land or water); hence my further divisions. These do not merit a table, but the snail:bivalve ratio among the presentations was 2.38:1, and the land:water ratio was 1.13:1. In contrast to many of the previous Seminars, aquatic malacology no longer dominated; in fact I think that the nearly fifty-fifty proportion is ideal. Another very nice fact was that as many as nine presentations dealt with various aspects of life histories – a field that nowadays is often neglected because such studies are time-consuming and will not result in a hundred publications per head per year, but on the other hand are very useful and extremely interesting.

Most oral presentations were quite beautiful and even some people, who during the previous Seminars stoutly refused to use PowerPoint, now use it all right. Most posters were very good, too, though some criticised them mercilessly.

During the first seven (or more?) Seminars there was a tradition of the so-called round table discussions. Their purpose was to keep everybody informed about what other people were doing and/or planning to do, look for help, initiate co-operation etc., and also to introduce new people to the rest. Then somehow they got abandoned. The round table was originally STEFAN ALEXANDROWICZ's idea and he organised such discussions as long as he organised the seminars (for details see *Folia Malacologica* 7 (1999): 275–291: POKRYSZKO B. M., RIEDEL. A. Polish malacology – past, present and future). Now it was decided that we should reinstate the tradition, but I fear it was not a success. The number of participants during the first few seminars was about 20–30, which left time enough for everybody to say what they were doing. Now there were simply too many people and there was barely time enough for them to say what institution they work for. Maybe from now on such discussions should have a somewhat different form?

No.	Discipline	Number of papers/posters
1	Ecology	9
2	Life histories	9
3	Conservation	7
4	Fossil molluscs	5
5	Applied malacology	4
6	Parasitology	3
7	Faunistics	2
8	Methodology	2
9	Physiology	2
10	Structure (histology, cytology, shell)	2
11	Systematics	2
12	Molecular genetics	1
13	Others (general, archaeology)	2

During the banquet, with lots of good food and drink and also a dancing option (you wouldn't believe how some malacologists can dance!), each participant was given a special Seminar Mug, with some *Helix lutescens* and some other helicids on it; the *Helix* came out sinistral, probably because the mug-producers did not appreciate chirality. On the last day, before departure, we were taken to the town of Wąchock, to visit the monastery; we were also given a very good lunch which some consumed in a great hurry, being afraid to miss their trains. There are rumours that the next Seminar will be organised by the malacological team from Siedlce.

Our Abstract Book was in Polish, with *Helix lutescens* on the cover. Brief abstracts in English are presented below; they were in some cases rather brutally abbreviated, and in most cases translated behind the authors' back, by Yours Truly

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## ABSTRACTS OF THE 22ND POLISH MALACOLOGICAL SEMINAR, HUTA SZKLANA 2006

### DYNAMICS OF THE OCCURRENCE OF *DREISSENA POLYMORPHA* (PALLAS, 1771) IN THE SULEJÓW RESERVOIR IN 1997–2005

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First information on the appearance of the zebra mussel in the Sulejów Reservoir dates from 1995. Samples of 1997, taken along three transects in different parts of the reservoir, showed a considerable but varied density of the mussel, the highest recorded value being 31,776 indiv. m<sup>-2</sup> (dam); the density was the lowest on sandy bottom. In 2005 no mussels were found on the dam and associated machinery; the density on the concrete casing of the dam was only 1,484 indiv. m<sup>-2</sup>, and the number of empty shells increased (664 indiv. m<sup>-2</sup>). Filling the reservoir with muddy deposits resulted in a narrowing of the sandy and sandy-muddy zone to a few dozen metres; the zone was attractive to both *Dreissena* and unionids, the latter constituting the main substratum for the zebra mussel in the reservoir's littoral.

### SHELL THANATOCOENOSES ON A COASTAL TERRACE IN LIDO DI OSTIA NEAR ROME

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Abundant accumulations of land snail shells occur on a terrace of the Tyrrhenian Sea near Rome. The terrace is 5–7 m high and 100–200 m wide, with low patchy vegetation on a substratum of sand, clay and – in places – fine gravel. The material accumulates in situ, or is transported by water and wind, resulting in autochthonous and parautochthonous assemblages corresponding to necro- and allocoenoses. The variance among samples from 100 squares (total of 1 m<sup>2</sup>) indicates a clustered distribution of the shells, suggesting a short-distance transport and deposition in local concentrations. The assemblage includes 17 species of terrestrial snails which are common in the Mediterranean; the most abundant are *Cochlicella barbara*, *Xerotracha conspurcata* and *Candidula intersepta*, followed by *Vallonia pulchella*, *Lauria cylindracea*, *Rumina decollata*, *Cochlicella acuta*, *Cerņuella cisalpina* and *Microxeromagna vestita*. Other species (*Eobania vermiculata*, *Theba pisana*, *Punctum pygmaeum*, *Cecilioides acicula*, *Cerņuella virgata*, *Cochlicella conoidea*, *Discus rotundatus*, *Oxychilus draparnaudi*) are accessory components which is reflected in the frequency and dominance structure (the first three species combined

constitute 80%, their Ci-Di indices being 37.5 and 25.3). The diversity index ADI is 0.532 indicating a polymictic assemblage. Species malacospectra allow to distinguish three types of thanatocoenoses. The first is characterised by the dominance of *Cochlicella barbara*, the second has two main components: *Xerotracha conspurcata* and *C. barbara*, the third includes four species in equal proportions: *C. barbara*, *X. conspurcata*, *Candidula intersepta* and *Microxeromagna vestita*. Shell accumulations in shaded places are sometimes different, with a locally higher proportion of larger species (*Eobania vermiculata*, *Theba pisana*, *Rumina decollata*). The differences reflect the habitats and malacocoenoses rather than deposition conditions. More than half of the material corresponds to 4–8 mm fraction, ca. 1/4 – to 2–4 mm fraction which may partly reflect the composition of the malacofauna and partly the dynamics of the transport of the material.

### MOLLUSC ASSEMBLAGES IN LATE GLACIAL AND HOLOCENE LACUSTRINE DEPOSITS IN N. POLAND

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Analysis of mollusc assemblages in many sites with lacustrine carbonate deposits (mainly lacustrine chalk and gytja) provided a basis for reconstruction of development and evolution of mollusc communities in the late glacial and Holocene of N. Poland. The assemblages characterise habitat types and indicate association with climatic phases. Terrestrial habitats that dominated in the lower part of the Late Glacial were inhabited by poor communities of cold-loving species. Dry areas of polar steppe type harboured mainly *Pupilla muscorum loessica* and *Vallonia tenuilabris*, tundra habitats were inhabited by *Columella columella* and *Vertigo parcedentata*. Humid habitats which appeared during Alleröd or at the end of Older Dryas were inhabited by a community with *Vertigo genesii* and *Vertigo geyeri*. At the same time (Alleröd) small, usually well-vegetated water bodies developed, with a specific malacofauna where cold-loving *Pisidium* dominated. Expansion of wetlands in the Younger Dryas resulted in habitats with a characteristic community with *Vertigo genesii* and *Vertigo geyeri*. Periodically disappearing water bodies were characterised by the presence of *Valvata cristata* and *Armiger crista*, the association being often enriched with lymnaeids, planorbids and *Pisidium*.

Well-vegetated water bodies were inhabited by diverse malacocoenoses. Large stagnant water bodies which also appeared at the end of the Late Glacial had rich and diverse aquatic malacocoenoses with a considerable proportion of *Valvata piscinalis*. Early Holocene deposits were characterised by common occurrence of *Bithynia tentaculata*.

#### SPECIFICITY OF MALACOSTRATIGRAPHY OF THE LATE QUATERNARY

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Quaternary stratigraphy is governed by specific laws. Divisions are delineated and defined in a way different from that applied to older geological systems. Several factors contribute to this specificity: the high rate of evolutionary processes, episodes of rapid extinction, spatio-temporal diversity of palaeoenvironments, the possibility of their reconstruction and the duration of the Quaternary. Sequences of mollusc assemblages in Late Quaternary deposits of different origin provide a basis for palaeoenvironmental and stratigraphic conclusions. Attempts were made at constructing malacostatigraphic schemes based on biozones, but the possibility of using such zones is very problematic. Late quaternary malacostatigraphy uses local levels, which are often limited to particular habitats or climatic zones, and are thus nominal zones while actual divisions are rather eco- or climatostratigraphic. The names of zones are usually coined from the most typical species. Despite all the limitations and difficulties application of malacostatigraphic schemes in Quaternary studies is wide. In many cases it is the only method of reconstructing temporal sequences and local or regional chronologies of events.

#### MORPHOLOGY OF GLANDULAR CELLS OF THE FEMALE PART OF SPERMOVIDUCT IN HIBERNATING *HELIX POMATIA* L.

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The reproductive system of *Helix pomatia* includes numerous glands. The female part of the system contains characteristic bottle-shaped cells located below the epithelium lining the oviduct lumen. In summer, in reproductively active snails, the apical parts of these cells are filled with numerous vacuoles containing fine fibrillar material of medium electron density. The material is secreted to the oviduct lumen and probably

represents sugars – components of egg envelopes. Snails collected in September were hibernated for several months in constant conditions (+4°C, 40% relative humidity, in the dark). In April their spermooviducts were examined. Their glandular cells contained Golgi structures, endoplasmic reticulum and numerous vacuoles in their apical parts. The vacuoles contained material of high electron density; no secretion to the oviduct lumen was observed. The results indicate an activity of the cells in spite of long hibernation.

#### PROTECTION OF MALACOFAUNA ON THE 55TH ANNIVERSARY OF THE ŚWIĘTOKRZYSKI NATIONAL PARK

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Seventy two species of terrestrial gastropods and 12 species of aquatic molluscs are known to live in the Świętokrzyski National Park. The proportion of montane species is high (16.5%); some SE-European species are present (5%). Xerothermophilous species inhabit outcrops of Devonian dolomites in three localities in the Łysogóry range. Rich malacocoenoses are found near the monastery on Mt. Łysiec. The Park has been subject to acid emission for over 40 years; the deteriorating edaphic and hydrological conditions limit the occurrence of the malacofauna. The 2003–2005 studies on terrestrial gastropods of nature reserves Zapusty and Skały and in several other sites revealed rich malacocoenoses (36 species in Zapusty, 42 in Skały). The following species were recorded from Łysogóry for the first time: *Vallonia pulchella*, *V. costata*, *Clausilia bidentata*, *Chondrula tridens*, *Cecilioides acicula*, *Helicella obvia*, *Cepaea vindobonensis* and *Helix lutescens*. Some species rare in Łysogóry were found on carbonate outcrops and near buildings: *Carychium minimum*, *C. tridentatum*, *Cecilioides acicula*, *Vallonia enniensis*, *Chondrula tridens*, *Cochlicopa nitens*. Preventing succession on carbonate outcrops is one of the conditions of protection of the malacofauna. Another is preventing trampling the vicinity of monastery buildings on Mt. Łysiec.

#### FOREST SNAIL FAUNAS IN THE KASZUBY UPLANDS: A RICH NORTHERN REFUGE

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Northern and Western Poland appears to have rather poor forest snail faunas, and many species oc-

cur only sporadically. Earlier work by DROZDOWSKI, who used only Oekland frames, suggested that Kaszuby might be an exception. We sampled 14 sites among three localities in the Kaszuby uplands, all river gorges, using standard techniques used by us elsewhere. In total we found 43 snail species, and the richest individual site held 31. Faunas from the various plots resemble each other closely, and the fauna is especially rich in clausiliids (10 species), most of which occur in many samples. Other uncommon species, such as *Vertigo alpestris* and *Helicigona lapicida* were also found. The overall fauna is remarkably similar to that found in the Białowieża forest, and even to that around Lwów. Even the fauna of the Valdai hills in western Russia is more similar than that of the much closer Sudetes. A combination of natural and human-induced changes may have impoverished the western fauna, but a few refugia such as these in the Kaszuby uplands can tell us what the original fauna was like.

#### SUBFOSSIL MOLLUSCS IN HOLOCENE DEPOSITS OF THE ESTUARY SECTION OF THE REGA RIVER VALLEY NEAR MRZEŻYNO

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The malacological analysis was aimed at determining the qualitative and quantitative composition of subfossil mollusc assemblages. Two rather thick cores (11–13 m) from the vicinity of Mrzeżyno were examined. They proved to contain a total of 987 shells representing 19 snail and bivalve species of freshwater (84.30%), brackish (1.82%) and marine (13.88%) habitats. The most abundantly represented taxa were *Bithynia tentaculata* (41.84%), *Valvata pulchella* (19.86%) and *Cardium glaucum* (12.56%). Other taxa recorded were, among others, lymnaeids, sphaeriids, valvatids, *Armiger* and *Acroloxus*. Lithological analysis combined with analysis of the shell material made it possible to distinguish sedimentation environments during late glacial and Holocene. The lower parts of the cores consisted mainly of silty, algal and detritus gyttja, with freshwater fauna with *Bithynia tentaculata*, *Valvata cristata*, *Lymnaea* sp. and *Pisidium* sp. The mid parts contained layers of gyttja and sand, i.e. brackish-marine deposits with *Cardium glaucum*. The top parts contained gyttjas with a high content of organic material with freshwater taxa such as *Bithynia tentaculata* and *Valvata pulchella*.

#### CADMIUM CUMULATION IN *LYMNAEA STAGNALIS* FROM GARDEN PONDS IN PLEŚNA (MAŁOPOLSKA)

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In a situation of changed water regime, small artificial garden ponds often replace natural water bodies, providing habitats for aquatic plants and animals. The ponds are often cleaned using various chemicals; they are often polluted by fertilisers, herbi- and insecticides or by industrial emission. One of the most common inhabitants of such ponds is *Lymnaea stagnalis*. We analysed the content of cadmium, zinc and copper in *L. stagnalis* from ponds in Pleśna. Cadmium was detected in all ten examined specimens; its mean content in dry tissue was 4.68 ppm (2.37–6.46); the corresponding values for zinc and copper were 257 (147–522) and 166 (22–536). The cumulated cadmium resulted in a significant decrease in the content of zinc ( $r=0.83$ ,  $p=0.0027$ ) and copper ( $r=0.87$ ,  $p=0.001$ ). A positive correlation was found between the level of zinc and copper ( $r=0.94$ ,  $p=0.000007$ ). Garden ponds may be polluted with cadmium, resulting in its cumulation in the animal tissues and elimination of zinc and copper ions which are important for physiological processes. *Lymnaea* from such ponds may be an important link introducing cadmium into natural food chains.

#### DO LARGE FEMALES PRODUCE MANY EMBRYOS? REPRODUCTIVE STRATEGY OF A FRESHWATER SNAIL *VIVIPARUS VIVIPARUS* IN THE LITTORAL OF A FLOW RESERVOIR

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Body size is an important component of life history: a large size increases chances for survival and affects reproductive abilities. Is it more profitable to be large or to limit the time of growth? *Viviparus viviparus* is long-lived and iteroparous. The study included snails from selected sites in the littoral of the Zegrzyński Reservoir and estuary sections of its associated rivers. In both habitats fertile females dominated and formed aggregations; females of size classes III (12.1–20.0 × 12.1–25.0 mm) and IV (20.1–25.0 × 25.1–35.0 mm) formed a majority, class II (8.1–12.0 × 8.1–12.0 mm) and I (= 8.0 mm) being less numerous. The mean number of embryos was found to be positively correlated with the shell height and width, dry body mass and dry shell mass; the number of embryos at particular development stages was correlated with

the same parameters. It seems that in *V. viviparus* selection favours long reproductive life rather than early reproduction; the snails tend to mature late, and the reproduction rate increases with body size.

#### GROWTH RATE OF *VIVIPARUS VIVIPARUS* IN THE FIELD AND IN THE LABORATORY

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The objective of the experiment was determination of growth rate depending on age of the snails. The individuals came from an oxbow of the Bug River; the duration of field and laboratory observations was two years. In the laboratory, in the first year the snails exceeded the size limit of size class I (height = 8.0 mm, shell covered in characteristic setae) in the fifth month of life, reaching size of class II (8.1–12.0 × 8.1–12.0 mm) and did not reproduce. In the second year the snails grew at the same rate, reaching size class III (12.1–20.0 × 12.1–25.0 mm). They started to reproduce at the age of 24 months. In the field, at the age of one month, the juveniles reached size class I, and at the end of their first year – class II, and did not reproduce. At the age of 18 months they reached class III and started reproducing. The growth was faster in natural conditions; in both situations the snails reproduced in the second year of life, at size class III. The size did not affect the growth rate.

#### MALACOCOENOSES OF WATER BODIES IN THE BUG RIVER FLOODPLAIN BETWEEN KAMIEŃCZYK AND ŁĘG NURSKI

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Molluscs were sampled in 14 water bodies of different position relative to the river, connection to the river and hydrological dynamics, located between the 118th and 135th km of the river. The samples were taken in late spring and summer of 2005 from 0.5–1 m<sup>2</sup> bottom and from higher aquatic vegetation. Thirty five species were recorded (6 based on empty shells only): 25 snails and 10 bivalves. The malacocoenoses varied in their species richness (1–19 species of live molluscs and 4–27 species, including those based on empty shells only); the number of specimens per sample ranged from 1 to over 300. The most common species (F=50%) were *Lymnaea corvus*, *L. stagnalis*, *Planorbium corneum* and *Anisus vortex*, and – considering empty shells – also *Viviparus contectus*, *Bithynia tentaculata* and *Segmentina nitida*. The dominance

structure varied between the water bodies; most often the dominant was *Bithynia tentaculata*, with a high proportion of *Lymnaea corvus*, *L. stagnalis*, *Sphaerium corneum* and *Segmentina nitida*. The largest water bodies were the richest in species and showed the most complex dominance structure. The studied malacocoenoses in most cases showed little similarity in their species composition and dominance structure, only the largest water bodies and the two temporary water bodies showed a higher similarity.

#### STUDIES OF THE STUDENTS' SCIENTIFIC CLUB OF THE RZESZÓW UNIVERSITY ON PLANTS AS SOURCES OF BIOLOGICAL MOLLUSCICIDES

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For over 10 years slugs have been among the most important pests in the Subcarpathian region. Possible reasons for the increase in their abundance are climatic changes, changes in plant production technology, increased import of plant material. Various preventive and control methods are used in order to limit the slug abundance and the slug-caused losses. Chemical methods are the most popular among agricultural producers, but – since they have disadvantages – numerous institutions conduct studies aimed at devising methods that would employ natural enemies of slugs or biologically active plant substances (alleo-compounds). Members of the Agroecological Section have conducted studies on plants as sources of molluscicides since 2000. Various extracts of 25 medicinal plants have been tested. All the substances were compared to aqueous extract of garlic cloves, adopted as standard. The most effective substance was extract from roots of cowslip. Most of the tested substances disturbed assimilation of the ingested food by slugs.

#### THE EFFECT OF IMPREGNATION OF WINTER WHEAT SEEDS ON FEEDING OF *ARION LUSITANICUS*

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*Arion lusitanicus*, introduced in Poland in the 1990s and today widespread in the Subcarpathian region of the country, is an important pest in gardens, orchards and fields, where it causes losses in crops of winter wheat and winter rape. The only means of control is the use of granulated molluscicides which has many disadvantages. The aim of this study was to test

the efficiency of selected substances as seed impregnators against feeding of *A. lusitanicus*. Eleven active substances, 3 commercial seed impregnators, 3 plant extracts and 2 granulated molluscicides were tested in laboratory conditions. Copper sulphate at all tested doses (0.734, 0.674, 0.664 g dry mass), caffeine (0.692 dry mass) and bis (tributyltin) oxide (0.690 g dry mass) proved to be the most effective. Most other substances tested resulted in a decreased damage by slugs; plants from seeds impregnated with imidaclopride and carbosulphate at the two lowest doses and sodium pentachlorophenolate at the two highest doses were damaged more than untreated plants.

#### DO PREDATORS AFFECT BEHAVIOUR OF *DREISSENA POLYMORPHA*?

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Many animals are known to modify their behaviour in the presence of predator-released kairomones. We tested the behaviour of zebra mussels for their behavioral reaction to three of bivalve-eating predators: roach *Rutilus rutilus*, goby *Neogobius gymnotrachelus* and crayfish *Orconectes limosus*; mussels in aquaria with no predator and with perch *Perca fluviatilis* which feeds on molluscs only exceptionally were used as control. Small mussels (<10 mm) in aquaria with roach migrated upwards less often than control individuals; in the presence of roach and – to a lesser extent – perch, they attached to the substratum stronger. The other predators did not affect the mussel behaviour in any significant way. The strongest reaction of the mussels to the presence of roach is probably associated with the fact that roach is the best adapted to feeding on molluscs which often constitute most of its diet.

#### INVASIVE MOLLUSCS IN WATERS OF NORTH-EASTERN POLAND

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The originally not very diverse freshwater malacofauna of Poland has been enriched with new species since the beginning of the 19th c. Ten such

species have been recorded to date, and some of them may be called invasive: *Dreissena polymorpha*, *Potamopyrgus antipodarum*, and – to some degree – *Lithoglyphus naticoides*. The remaining species are slow to expand or they invade only heated waters. The Mazury and Suwałki lakelands abound with lakes of diverse character. In the Great Mazurian Lakes *D. polymorpha*, in spite of its considerable decline in the 1970s, still maintains high densities in some lakes and is still abundant in Suwałki Lakeland. *P. antipodarum* occurs in masses only in Lake Wigry; in other lakes where it is present at least since 1979 its numbers are low. *L. naticoides* was found in lakes Mikołajskie and Tały where it occurs at low densities. In some lakes as many as three of these species are present which may indicate "incompleteness" of biocoenoses resulting from historical (glaciation) and anthropogenic reasons.

#### CHANGES IN MALACOCOENOSIS STRUCTURE IN AN ASH-ELM FOREST BASED ON TWO-YEAR OBSERVATIONS

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Samples were taken from May 2003 till April 2004 and from July 2004 till June 2005 in a naturally regenerating ash-elm forest in Duszniki near Poznań. The malacocoenosis includes 16 species, with the following dominants: *Nesovitrea hammonis* (24.86%), *Columella edentula* (17.75%), *Vallonia costata* (11.12%) and *Punctum pygmaeum* (10.07%); only four species are sporadic. In the first year the mean density was 192 indiv. m<sup>-2</sup>, in the second year 357 indiv. m<sup>-2</sup>. Differences in abundance of individual species between the years were statistically significant. The mean abundance of snails differed between shaded and open places which reflects the effect of the canopy on the malacofauna.

#### PRELIMINARY DATA ON THE BIOLOGY AND ECOLOGY OF *AEGOPINELLA EPIPEDOSTOMA* (FAGOT)

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*Aegopinella epipedostoma*, a montane species, in Poland occurs in the Sudetes and their foothills, and in the Carpathians except Tatra. It is a forest-dweller, found in humid places in litter and under stones. Ma-

terial for the laboratory culture was collected in Muszkowice (SW. Poland), where also field observations were made. The reproductive season in the studied population includes July, August and September. The earliest hatched juveniles reach a size of 3 whorls in their first season. Individuals wintering for the first time have 2.6–3.5 whorls. The mean growth rate is 0.5 whorl/month. In the second season the snails reach 4 whorls in May–July, and start reproducing. The number of eggs per batch is 4–20 (mean 10), the eggs are white, calcified, 1.3–1.8 (mean 1.6) × 1.0–1.4 (mean 1.3) mm; incubation period is 27–41 (mean 35) days. Hatchlings have shells of 1.1–1.7 (mean 1.3) whorl.

#### PREFERENCES OF SLUGS TO SOME VEGETABLE SPECIES

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Slugs cause losses of vegetable crops through eating all parts of the plants, especially at early development stages, and contaminating them with mucus and faeces. Of slugs occurring in Poland the most dangerous pests are *Deroceras reticulatum* (O. F. Müll.), common in agrocoenoses in the entire country, *Arion rufus* (L.) from the western part of Poland and *A. lusitanicus* Mabille, fairly recently introduced in the Subcarpathian region. Choice tests in the laboratory used young plants of ten vegetable species, separately for each slug species. The three slug species were found to differ in their preferences: all three species caused the greatest damage to beans and parsnips; *A. lusitanicus* and *A. rufus* considerably damaged cucumbers. Vegetables consumed to the least extent were onions, carrots, dill and lettuce.

#### THE EFFECT OF TEMPERATURE ON THE HOST-PARASITE SYSTEM *VIVIPARUS VIVIPARUS* – *LEUCOCHLORIDIOMORPHA CONSTANTINAE*

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*Viviparus viviparus* was collected from the Kaniv Reservoir, Dnieper River and kept in two aquaria: cool (20–22°C) and warm (26–28°C) for 30 days. The body mass of snails, size of their parasites, prevalence and intensity of infection were recorded. The snails in their natural habitat were infected with *Lucochloridiomorpha constantinae* with the prevalence of 7.69% and mean intensity of 1 trematode per snail. No significant changes in the snail body mass were observed. The prevalence of infection in the cool aquarium was 13.04%, in the warm aquarium 31.82%, the respective

values for intensity were 2.67 and 3.14 trematode per snail. The trematodes differed in size: the mean length of cercaria from the cool aquarium was 658.33±216.87 µm, from the warm aquarium – 777.89±225.00 µm, the respective values for the oral sucker diameter were 48.53±9.70 and 53.46±12.90 µm.

#### NATIVE AND ALIEN MALACOFUNA IN THE HEATED LAKE SYSTEM OF KONIN

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Specific conditions in the Konin lakes (increased water temperature, diversity and complexity of habitats, hydrological situation) favour invasion by alien species. Thirty such species have been recorded to date, many of which are snails and bivalves. Native snails in the lakes are species common in Poland, among others *Viviparus viviparus*, *Bithynia tentaculata*, *Lymnaea stagnalis*, *Radix ovata*, *Physa fontinalis*, *Anisus vortex* and *Planorbarius corneus*; native bivalves include several species of sphaeriids (*Pisidium* sp., *Sphaerium* sp.) and unionids (*Unio tumidus*, *U. pictorum*, *Anodonta anatina*, *A. cygnea*). The most abundant of the seven alien species is *Dreissena polymorpha*; *Sinanodonta woodiana* is also numerous. Of snails *Melanoides tuberculata* shows locally a high density. The remaining four species: *Physella acuta*, *Menetus dilatatus*, *Ferrisia wautieri* and *Potamopyrgus antipodarum*, recorded earlier, show low densities.

#### MOLLUSCS FROM HOLOCENE DEPOSITS OF THE VISTULA BAR

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Eleven profiles along the section of the Vistula Bar located between Stegna and Piaski were examined with respect to the presence of mollusc shells. Two assemblages: freshwater and marine, were present. Freshwater fauna was found in four cores and was represented by *Valvata piscinalis* and *Bithynia tentaculata*. Marine fauna, found in most profiles, contained on the one hand species typical of low-salinity, shallow waters and widely distributed in the Baltic (*Hydrobia ulvae*, *H. ventrosa*, *Cerastoderma glaucum*, *Macoma balthica*, *Mytilus edulis*, *Mya arenaria*), on the other species of specific ecological requirements which indicate conditions different from those found today in the S. Baltic (*Retusa truncatula*, *Macoma calcarea*, *Mya truncata*, *Thracia papyracea*). The first group of species





is typical of the boreal climatic zone, the second documents transgression of the *Littorina* sea in the Atlantic period.

#### MALACOFAUNA OF THE SĄSPÓWKA STREAM IN THE OJCÓW NATIONAL PARK. RESULTS OF THE STUDENTS' EXPEDITION, INVERTEBRATE SECTION

ZOFIA KSIĄŻKIEWICZ

Koło Naukowe Przyrodników Uniwersytetu im. Adama Mickiewicza w Poznaniu

Samples were taken in April 30th – May 3rd 2005 from three sites: one near Brama Krakowska on the Prądnik stream, two in the lower section of the Sąspówka stream. The resulting sixty specimens of snails and bivalves represented *Bythinella austriaca* Frauenfeld, 1859, *Ancylus fluviatilis* O.F. Müller, 1774 and *Pisidium personatum* Malm, 1855. Live individuals of *Bythinella austriaca* f. *cylindrica* were found in the two sites in Sąspówka.

#### RARE, THREATENED AND ALIEN SPECIES IN MALACOCOENOSSES OF SINKHOLE PONDS OF INDUSTRIAL AREAS (KATOWICE UPLAND)

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In order to trace the dependence between selected habitat parameters and the occurrence of molluscs, and to evaluate the state of aquatic habitats which provide refuge to some rare or threatened mollusc species, malacofauna of seven sinkhole ponds was studied. In 1993–2005 23 mollusc species were found in the ponds. *Potamopyrgus antipodarum* occurred in masses (up to 2422 indiv. m<sup>-2</sup>). A few rare, threatened or alien species were recorded: *Acroloxus lacustris* (L.), *Hippeutis complanatus* (L.), *Ferrisia clessiniana* (Jickeli), *Anodonta anatina* (L.), *Musculium lacustre* (O. F. Müll.), *Pisidium casertanum* (Poli). The mollusc density was positively correlated with pH; both density and pH were positively correlated with conductivity, dissolved substances, hardness, chlorides, alkalinity and phosphate concentration. The number of species was negatively correlated with conductivity, dissolved substances, chlorides and alkalinity.

#### EFFECTIVENESS OF MARKING *HELIX POMATIA* IN FIELD STUDIES

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*Helix pomatia* was collected from an area of 750 m<sup>2</sup>, confined by buildings and fences and covered in shrubs, and marked in May 2002 and May 2003, then sampled in July and August of 2002 and 2003. The snails were divided in size-based age classes, each class was marked with a different colour of durable wood varnish. On each occasion the sampling lasted 1 hour. The highest recapture rate was that for group >3+, followed by 2+ and 3+; only few individuals of group 1+ were recaptured. The results indicate a sedentary life style of the oldest age classes, and a tendency to migration in the youngest class.

#### A CASE OF HERMAPHRODITISM IN *DREISSENA POLYMORPHA* (PALLAS)

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Cases of hermaphroditism in typically dioecious bivalves are very rare. In our studies on the zebra mussel from Western Pomerania we sampled a site located below the water discharge from the power plant Dolna Odra. The mussels were fixed and their gonads subject to standard paraffin protocol, followed by hematoxylin-eosin staining. Examination of the gonads revealed one hermaphroditic specimen (0.63% total): both oocytes and spermatogenic cells were observed in the slides, as well as few spermatozoa and ovulated oocytes which may indicate synchronous gynandromorphism.

#### DISTRIBUTION, ECOLOGY AND PRELIMINARY DATA ON LIFE HISTORY OF *CHARPENTIERIA ORNATA* (ROSSMÄSSLER, 1836) (GASTROPODA: PULMONATA: CLAUSILIIDAE)

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*Charpentieria ornata* (Rossm.) is an E-Alpine or SE-Alpine species. It is distributed in the NW. part of the Dinaric Mts, in the Kapela and Velebit Mts, in the SE part of Alps; besides it has a few isolated localities in the Czech Republic. In Poland it has a group of closely situated sites (8 abandoned limestone quarries) near Żelazno (district of Kłodzko), which constitutes the northernmost fringe of its range. In each of

these sites it is accompanied by 15–32 species. *Ch. ornata* is a calciphile, preferring rocky, partly wooded, humid but insolated habitats. It spends nights on rock faces and tree trunks, sheltering in rock crevices and moss during daytime. During the last two years one of the sites was monitored, using monthly marking of snails found with visual search within 2 hrs on a rock face and base, ca. 18–20 m<sup>2</sup> in area. The number of collected individuals ranged from 72 to 155, juveniles constituting 23–40% (mean 32.9%). The total number of markings was 1,380 (mean 115 per month). Out of 759 marked snails 317 (42%) were marked once, 187 (25%) – twice, 77 (10%) – three times, 49 (6%) – four times, 18 (2%) – five times, 7 (0.9%) – six times, 3 (0.4%) – seven times and one (0.1%) was marked eight times. Individuals marked in the previous month constituted 51–88% originally marked sample (mean 74.7%). Six age classes were adopted in order to describe the age structure: five immature and one adult. *Ch. ornata* is oviparous. Preliminary data suggest that the two youngest age classes appear from April till the beginning of July and on the turn of August, which would indicate a spring and an early autumn egg-laying. Reaching ultimate size would fall on April and the beginning of September (in these periods subadult individuals were the most numerous). Life history and development of the reproductive system are currently being studied.

LIFE CYCLE OF *BULGARICA CANA* (HELD, 1836)  
IN LABORATORY CONDITIONS (GASTROPODA:  
PULMONATA: CLAUSILIIDAE)

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The laboratory culture of *Bulgarica cana* was started in October 2004; the initial material included 52 adults from natural habitats in Romincka Forest (NE. Poland). During one calendar year (January–December 2005) the snails laid a total of 575 eggs from which 484 juveniles hatched (84%). The mean number of eggs per adult was 13.6; it is likely that some adults laid no eggs at all and thus the number of eggs per individual per year may be greater. At present individuals born in the laboratory are kept in pairs, in order to obtain more precise data on the number of eggs per year and per lifetime. The growth rate in the laboratory was varied. The shortest time from hatching to completion of growth was 18 weeks; most individuals completed their growth in 30 weeks. Some snails, though kept in the same conditions as growing individuals, did not grow. Growth completion is probably not associated with sexual maturity. The shortest time between growth completion and the first eggs was 10 weeks. The minimum generation time (from egg to egg) was 9 months. Considering sta-

ble conditions of the laboratory culture it can be supposed that it is the maximum rate of development. Fourteen adults and 17 juveniles aged 4–6 weeks were hibernated in semi-natural conditions during 4 winter months (November–February). All of them survived, though the temperature dropped below 0°C. It means that severe climatic conditions (such as very long and hard winters) do not affect the abundance of particular age classes in a negative way, but can prolong the generation time in the wild. The laboratory observations are being continued. Besides, some life cycle parameters will be also studied in natural conditions.

MICROCHEMICAL STUDIES ON THE SHELL  
OF *CEPAEA VINDOBONENSIS*

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Microchemical examination of the shell of *Cepaea vindobonensis* with SEM coupled with electronic dispersive spectrometer showed 98% CaCO<sub>3</sub>, mainly as aragonite and marginal quantities of calcite, and 2% of trace elements, among others Fe, Mg, Mn, none of them exceeding 1% shell mass. SEM pictures revealed layers formed by plate-like and needle-like aragonite crystals, 12–20 μm in size. The sutures showed locally the presence of calcite crystals, 3–8 μm in size. The presence of calcite is probably associated with shell microdefects.

YEAST AS SUBSTITUTE FOOD IN LABORATORY  
CULTURE OF *DREISSENA POLYMORPHA*

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Previous studies showed that, out of five substitute diets for captive zebra mussels, lyophilised yeast was the best. This study was aimed at determining the optimum yeast concentration to maintain a stable condition of the mussels, assessed based on their attachment strength. Four concentrations were tested (25, 50, 100, 150 mg l<sup>-1</sup>), starved mussels were used as control; the mussels were examined 5 times at weekly intervals. The lowest concentration proved to be the most favourable, and caused no significant decrease in the attachment strength, compared to the initial condition.



#### MECHANISM OF DEFENCE AGAINST FREE RADICAL DAMAGE IN TERRESTRIAL SNAILS (*HELIX POMATIA*)

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During winter torpor terrestrial snails must often survive periods of anaerobic conditions. Their metabolism is then only 16% control value, resulting in moderate hypoxia of internal organs. Quick oxygen uptake when the snails become active imposes oxidation stress on their tissues, because of increased release of free radicals. Spontaneous activation of snails kept at constant, low temperature in spring suggests a regular increase in the synthesis of natural antioxidants. We found the presence of glutathione in the haemolymph and tissue homogenates of snails during their winter torpor. Glutathione is one of the most frequent endogenous antioxidants. Next studies will be aimed at ascertaining if spring resumption of activity is preceded by an increase in glutathione concentration.

#### DISTRIBUTION AND ROLE OF *CARDIUM GLAUCUM* POITER IN THE POLISH COASTAL ZONE OF THE BALTIC

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Density, wet biomass and frequency of *Cardium glaucum* were determined in the coastal zone of the Baltic (to 3 nautical miles), Bay of Puck and Bay of Gdynia. The frequency was 83.3% in the Bay of Puck and 50% in open coastal waters; the lowest value was noted for the estuary zone of rivers of Middle Pomerania (37.2%). The density ranged from 0 to 304 indiv. m<sup>-2</sup>, the wet mass from 0 to 99.2 g m<sup>-2</sup>. In the Bay of Gdynia the density was 7 times and the wet mass 3.4 times higher than in the open coastal waters; in the Bay of Puck the corresponding values were 4.8 × and 4 ×. The highest density and biomass in the open coastal waters were noted 2 miles from the shore, and in the bays – 30 m from the shore.

#### SHELL CANNIBALISM IN TERRESTRIAL SNAILS IN CONDITIONS OF CALCIUM DEFICIT

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Terrestrial snails commonly use calcium resources contained in shells but usually the phenomenon is restricted to empty shells. In conditions of increasingly common and increasingly stronger acidification of habitats, calcium deficit leads, in some species, to consumption of shells of live snails. In some sites we observed damage to shells of live *Cepaea nemoralis* and *H. pomatia* by *C. nemoralis*. As a result, the prey shell bears irregularly shaped lesions, penetrating mesostracum and hypostracum; sometimes the shell is completely perforated. The soil in this sites showed a very low pH and calcium content.

#### MOLECULAR CHARACTERISTICS OF 3'END OF $\alpha$ SUBUNIT cDNA OF NaK-ATPASE IN *HELIX POMATIA*

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NaK-ATPase (sodium-potassium pump) is an integral part of cell membrane, with two subunits: catalytic alpha, and beta which is necessary for translation, transport, stabilisation and functioning of the alpha subunit. The alpha subunit is conservative (similarity between birds, fishes and mammals close to 90%); the gene encoding it may be phylogenetically useful. Information on this subunit in molluscs is scanty. We characterised a sequence of 3'end of this subunit, of 1,100 nucleotides, in *Helix pomatia*. Computer analysis identified within it an open reading frame coding for a fragment of polypeptide 221 aminoacids long, corresponding to carboxyl end of the protein. The fragment is built of five transmembrane domains (complete alpha subunits have ten domains). At present we are trying to characterise the 5'end.

#### SUSCEPTIBILITY OF ORNAMENTAL PLANTS TO SLUG FEEDING

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Slugs often damage ornamental plants in gardens. In 2001–2002 and 2004–2005, 80 species of ornamental plants were tested for their susceptibility to feeding of slugs of the genus *Arion*. Thirty four species were

not damage throughout the season, further 24 were damaged only to a small extent. These species should be recommended for cultivation in areas with high density of *Arion*.

#### OF OLD AND NEW PUPILLOIDS OF PAKISTAN (TRUNCATELLININAE, VERTIGININAE, GASTROCOPTINAE, PUPILLINAE)

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Based on over 3,500 shells and alcohol-preserved specimens from 77 localities, new records of 12 species (*Truncatellina callicratis* (Scacchi), *T. himalayana* (Benson), *Boysia boysii* (L. Pfeiffer), *Vertigo antivertigo* (Draparnaud), *V. pseudosubstriata* Lozek, *Gastrocopta avanica* (Benson), *G. huttoniana* (Benson), *G. klunzingeri* (Jickeli), *Pupilla muscorum* (Linnaeus), *P. annandalei* Pilsbry, *P. turcmenica* (O. Boettger), *P. signata* (Mousson)) are given; further ten species (*Columella diamiri* n. sp., *Truncatellina ayubiae* n. sp., *T. bituberculata* n. sp., *V. megastriata* n. sp., *V. nangaparabati* n. sp., *Boysidia tamtourica* n. sp., *Pupilla khunjerabana* n. sp., *P. satparana* n. sp., *P. ziaratica* n. sp., *P. pseudoturcmenica* n. sp.) are described. Data on shell variation are provided for most species and data on the reproductive system for nine species. The northern part of the country has the highest diversity of pupilloids belonging to the genera discussed herein. Ten species are currently considered endemic to Pakistan, three are widely distributed, nine are known also from elsewhere in Asia or in the world. At the generic level the fauna displays a high degree of Palearctic/Holarctic influence.

#### SHAPING OF ZEBRA MUSSEL POPULATIONS IN HEATED WATER ECOSYSTEMS (KONIN LAKES)

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Shaping of zebra mussel populations in the heated system of Konin lakes is a resultant of homogenisation (prolonged planktonic phase at higher temperatures) and diversification (different temperatures fa-

vor differences between colonies). The sum of effective temperatures for the growth of zebra mussel in 1993–2005 was twice higher than in natural habitats. In such conditions the mussels do not stop growing in winter, they grow fast, mature early and have a short life span. The strategy in unstable habitat is maximum energy investment in reproduction – K strategy.

#### AN OVERVIEW OF THE DATA ON THE GENUS *ARION* FÉRUSSAC IN LITHUANIA

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The genus *Arion* Férussac, 1819 is problematic in that many of its component taxa may be either complexes of species or distinct, polymorphic species. For example, BACKELJAU and DE BRUYN distinguished two chromosome groups [=subgenera]: *Lochea* and *Prolepis*. Earlier, the complex *A. hortensis* Férussac, 1819 had been divided in three species: *A. distinctus* Mabilie, 1868, *A. owenii* Davies, 1979 and *A. hortensis* Férussac, 1819, and new data on the *A. Subfuscus/fuscus* (Draparnaud, 1805) raised new questions. Seven slugs of the genus *Arion* were recorded from Lithuania. Our molecular data cast doubts on the subdivision into subgenera *Lochea* and *Prolepis*. Genetic variation in the A fragment of *coI* gene in *A. distinctus* (subgenus *Prolepis*) places it closer to *A. fuscus* (subgenus *Lochea*) than to *A. hortensis* (*Prolepis*).

#### DISTRIBUTION AND ECOLOGY OF *BATAVUSIANA* (UNIONIDAE) IN THE UKRAINE

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*Batavusiana* Bourguignat in Locard, 1898 is regarded by some authors as a polymorphic species *Unio crassus* Philipsson, 1788, by others – as several species of the genus *Crassiana* Servain, 1882. We collected unionids in 502 localities in the Ukraine; *Batavusiana* was found in 56 of them, in various river systems, with a frequency of 0.5–6.7% samples, density usually 0.5–2 indiv. m<sup>-2</sup>, biomass 10.7–25.1 g m<sup>-2</sup>. Morphometric analysis revealed several morphs which, however, are difficult to distinguish and require further studies. With respect to their ecological requirements the bivalves are rheophiles, requiring a high oxygen content, pH exceeding 7 and stony or sandy-stony bottom. Water chemistry affects their colour, growth rate, shell thickness and corrosion of the umbones. A parasitic nematode *Aspidogaster conchicola* is in most localities found in 5–13% bivalves, usually 1.5–2 individuals per bivalve; it is located in



pericardium or pericardium and kidney. In the Ukraine *Batavusiana* starts reproducing at the age of 3–4 years and is less fertile than *Unio*.

#### DOUBLE UNIPARENTAL INHERITANCE OF MITOCHONDRIAL DNA IN *ANODONTA WOODIANA* (UNIONIDAE)

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Typically, mitochondrial DNA (mtDNA) is inherited from the mother in an unchanged form. In freshwater and marine bivalves double uniparental inheritance (DUI) is observed: mtDNA of F type is inherited from the mother, of M type from the father. Males have both types of mtDNA. Males receive the M type located in their gonads from their fathers and pass it on only to their sons. Their somatic tissues contain type F of mtDNA which is inherited from the mother. Females have only F type they inherited from their mothers. In freshwater bivalves in phylogenetic analyses F and M types form separate clades which can be independently used in phylogenetic analyses. The fact that DUI was found in phylogenetically remote bivalve families (Mytilidae, Veneridae, Unionidae) suggests that the phenomenon is widespread. Among unionids DUI was found in 12 species. The taxonomic restriction of the phenomenon is difficult to explain. Many authors use somatic tissues as a source of DNA, thus obtaining only F haplotype. Sequential analyses of a fragment of COI gene revealed two haplotypes: F and M, in *Anodonta woodiana*. The fragment showed a high genetic diversity in specimens from Poland and Japan.

#### RESOURCES AND COMMERCIAL EXPLOITATION OF *HELIX POMATIA* L.

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*Helix pomatia* is commercially exploited in entire Poland but its resources vary between regions: 50% or more of the total yield comes from the western part of the country. The populations from these areas are only little or moderately threatened, assuming moderate exploitation. When a certain critical level is exceeded, further exploitation stops being profitable. The mechanism does not work for some populations, since with increasing unemployment many people decide on a time-consuming and low-profit exploitation which may even result in disappearance of some populations. Fifty populations were monitored, the number because of costs was later reduced to thirty. Till

2000 three of them were destroyed as a result of excessive exploitation. In 2003 another two populations ceased to exist. The monitored populations consist mainly of juvenile snails; the second group includes adult snails 78% of which match the size standards. At such population structure catches usually contain only 2% snails below size standards. Removal of 45% or more standard-sized snails from a population disturbs its reproductive structure. Within the last 10 years sporadic data suggest up to 30% snails below standard size in the catches. Before 1990 areas of *Helix* exploitation constituted 60% in Wielkopolska, with the mean annual catch of 30 t. At present the exploitation includes 70% area and the catches amount to 120 t. Rational management should consider only areas where the snails are abundant, with removal of at most 44% standard-sized snails which is at most 110 t. per year. Catches from previous years should not be adopted as bases for prognosing next year catches.

#### FRESHWATER SNAILS OF SAND PITS IN UPPER SILESIA

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Mining resulted in numerous (over 70) post-exploitation reservoirs in Upper Silesia. Most are sand pits; in time they become habitats for aquatic molluscs. The studies included 16 sand pits (9 smaller and 9 larger than 15 ha). Twenty five snail species were recorded: 22 in small and 24 in large reservoirs. *Viviparus contectus* was limited to small ponds, *Aplexa hypnorum*, *Anisus leucostomus* and *Gyraulus rossmaessleri* were found only in large ponds. Fourteen species inhabited more than 50% sites of each group (e.g. *Planorbis planorbis*, *Armiger crista* and *Planorbarius corneus* in small ponds, *Radix peregra* in large ponds). The most common species in the whole material were: *Radix peregra*, *Planorbis planorbis*, *Gyraulus albus* and *Planorbarius corneus*. None of the analysed habitat factors affected the structure of the snail communities in a significant way. The invasive *Potamopyrgus antipodarum* caused decrease in indices of diversity.

*PHYSELLA ACUTA* (DRAPARNAUD, 1805) –  
OVER 30 YEARS EXPANSION IN UPPER SILESIA  
AND ADJACENT AREAS

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*Physella acuta* is alien in Poland; in Upper Silesia it was first recorded in 1974. During the next 30 years it invaded ca 15.000 km<sup>2</sup>; it occurs in rivers (22 localities) and anthropogenic reservoirs of different origin (46 localities). Samples were taken in 1974–2004 from various substrata. Over 5,000 live specimens were collected. The lower intensity of invasion of the species compared to *Potamopyrgus antipodarum* result probably from a smaller ecological tolerance. In heated-water reservoirs it is abundant for a short time after its first appearance, in waters of natural thermal regime the densities are lower. *Ph. acuta* most often inhabits small, slow-flowing rivers and sand pits. In most localities it constituted 1–10% collection. It reached the highest density in sand pits. Its occurrence is limited by concentration of magnesium ions; it does not occur in water exceeding 50 mg Mg<sup>2+</sup> dm<sup>-3</sup>. No effect on the native fauna was found.

SEASONAL CHANGES IN THE STRUCTURE  
OF TWO POPULATIONS OF *VESTIA GULO*  
(E. A. BIELZ)

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In 2005 we started field studies aimed at tracing the age structure of *Vestia gulo* in two sites in Gorce, of different habitat conditions: Kamienica R. valley (650 m a.s.l.) and Dunajec R. valley (425 m a.s.l.). Snails were collected 4 times a year from an area of 2–4 m<sup>2</sup> in each site; following measurements the snails were marked and released. The youngest age class (up to 2 mm shell height) appeared only in July. Till the end of October most snails reached 5 mm in site A and even 7 mm in site B. In site A another group included snails whose shells in June reached 3.1–9 mm, and during consecutive months – 6.1–13 mm. They were probably young of 2004, but the wide range of shell height may indicate their origin from two reproductive seasons. In site B most juveniles from the previous season had shells 7.1–8 mm high in June and 11.1–12 mm high in October. The third juvenile group (11.1–13.0 mm) was distinct in site A only in June (young of 2003?). Probably next month all of them completed growth and built apertural barriers. The fourth group present throughout the study period in-

cluded adults whose size differed between the two sites (mean shell height 15.55 mm in site A and 16.34 mm in site B). The density in site A was 30–56 indiv. m<sup>-2</sup>, in site B 190–390 indiv. m<sup>-2</sup>. The observations suggest a quicker growth in the Dunajec valley which may result from more favourable thermal conditions.

*VIVIPARUS DILUVIANUS* (KUNTH)  
FROM SZYMANOWO IN POLESIE

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The site of lacustrine deposits of Masovian interglacial is located in Szymanowo ca. 17 km SE of Biała Podlaska (E. Poland). The deposits come from the terminal part of the Masovian interglacial optimum, the hornbeam-fir level. 619 specimens of *Viviparus diluvianus* from 9 samples taken at intervals of 10 cm (depth 0.55–1.60 m) were examined with respect to their height, width, body whorl height, aperture height and width and coefficients describing shell proportions. Values of all the metric characters and most coefficients were found to decrease towards the top of the profile: the snails became less slender, with a wider and lower aperture. The most abrupt change was observed at the level corresponding to shallowing of the lake, increasing continentalisation of the climate, and decreasing temperature.

MALACOLOGICAL STUDIES IN ARCHAEOLOGY

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Mollusc remains are among the most frequent invertebrate remains in archaeological sites. They provide information on the past environments (bio-indicators), are useful for radiocarbon dating and – in the case of synanthropic molluscs – provide a particular chronological indicator. Molluscs and their shells have been used by man since Upper Paleolithic (the oldest finds, from Turkey, dated at ca. 43,000–41,000 years BC). Shells were used to produce ornaments, incrustations of wooden objects, tools (spoons, containers, lamps, tools for cutting, polishing etc); two cowrie species (*Cypraea moneta* and *C. annulus*) were used as currency. Shell middens from archaeological sites include consumption (in the case of edible molluscs) or production (purple dye production) refuse. The objective of archaeomalacology is acquiring the greatest possible amount of information, not only on the shells themselves but also on the environment and source and availability of the shells.



### HELICELLA OBVIA MENKE FROM TORUŃ

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Shell parameters (width of embryonic shell, shell increment since hatching, shell height and width, aperture height) were analysed in two populations of *Helicella obvia* from Toruń (20 adult specimens from each). One site was a lawn with a low hedge, the other – abandoned allotment gardens. The two populations differed statistically significantly in the embryonic shell width, shell height and height/width ratio. Comparison with formerly studied populations suggests better environmental conditions, compared to the nature reserve Skowronno (larger size at hatching, quicker growth, larger ultimate size).

### DYNAMICS OF EXPERIMENTAL INFECTION OF *DREISSENA POLYMORPHA* WITH A CILIATE *CONCHOPHTHIRUS ACUMINATUS*

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*Dreissena polymorpha*, a recent invader in the cooling pond of the Khmel'nitska NPP, was found to contain no *Conchophthirus acuminatus*. Uninfected mussels (acceptor group) were placed together with infected individuals (donor group, prevalence 100%, intensity 10–300 ciliates per mussel). Parasitological dissections of acceptor molluscs were carried out at 3 days intervals; the duration of the experiment was 30 days. The first ciliates appeared in the acceptor group after 3 days (prevalence not exceeding 10%, intensity 1 ciliate/mollusc). The prevalence increased at first; the intensity increased at a lower rate. The changes in intensity indicate 1 ciliate division per 2–3 days at 22°C. Till the end of the experiment 70% mussels in the acceptor group were infected, with 1–20 ciliates per mussel.

### HABITAT SELECTION BY *UNIO CRASSUS*

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Behavioural adaptation of *Unio crassus* enabling it to find optimum sites in a changing river environment was tested experimentally. 196 individuals were

placed in a regular network of points on a well-described and mapped bottom in a natural section of the Cedron River. Position and movements of the bivalves were then regularly monitored. The bivalves migrated upstream and downstream, including movements towards the shore, along a rather steep slope. The migration intensity was significantly lower in shallow parts of the river, on stony bottom; in deeper parts of the river the migrations were more intense. The bivalves were found to gather in colonies/beds: in shallower places with fast current they formed beds behind boulders and rocks, in deeper parts they moved towards the shore and buried themselves in the clay substratum. In autumn the migrations showed the same character, but the mobility was lower than in summer because of lower temperatures.

### HOST-PARASITE INTERACTIONS BETWEEN *LYMNAEA STAGNALIS* AND TREMATODES: *PLAGIORCHIS ELEGANS*, *DIPLOSTOMUM PSEUDOSPETHACEUM* AND *ECHINOPARYPHIUM ACONIATUM*

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*Plagiorchis elegans*, *Diplostomum pseudospathaceum* and *Echinoparyphium aconiatum* were found to dominate among parasites of *Lymnaea stagnalis* in central and northern Poland. Their natural invasion was associated with increased shell volume and modified shell shape in the host. In conditions of calcium deficit in the habitat infected specimens had shells of increased calcium content. Larvae of *D. pseudospathaceum* and *E. aconiatum* castrate their hosts, resulting in excess of calcium deposited in their shells. Snails infected with *P. elegans*, capable of reproduction, had shells as delicate as uninfected snails. The hypercalcification hypothesis was thus verified negatively. High leukocytosis in the haemolymph of infected snails guaranteed their good condition. Snails infected with *D. pseudospathaceum*, with haemocyte concentration equal to that in uninfected snails, showed a very high mortality. The highest leukocytosis in snails infected with *E. aconiatum* made it possible to survive even for heavily infected snails. Thermal behaviour was another defence mechanism of infected snails. Hosts of *P. elegans* and *D. pseudospathaceum* chose cooler microhabitats during release of cercariae, thus increasing chances for survival. Hosts of *E. aconiatum* chose, like uninfected snails, warmer microhabitats.