



## THE 18TH POLISH MALACOLOGICAL SEMINAR – WHAT DO WE DO?

### SEMINAR REPORT

This time the Seminar was held on the island of Wolin (April 24th–26th 2002), one of the very few islands on the southern side of the Baltic (when you look at the map and follow the Odra River northward, you will find it just at the estuary), in a village called Lubin. It was organised by Dr. BRYGIDA WAWRZYŃIAK-WYDROWSKA (vivat Brygida!) and the Organising Committee (this included Dr. MARIANNA SOROKA, as many as three Professors: BOGUMIŁA SKOTARCZAK, ANDRZEJ WITKOWSKI and RYSZARD BORÓWKA, and Ms GENOWEFA DANISZEWSKA, M. Sc.) all from the University of Szczecin.

It was a bit difficult to get there, imagine people from all over the country (and not only – see below) taking trains (not so many) or coming in cars (a long drive for most) to get to the island. Luckily, the Organisers took care of the transport from the town of Międzyzdroje (a well-known holiday resort) to the village of Lubin.

The number of participants was about fifty (they were hard to count, some people arrived on the first day and then departed, to be replaced by other malacologists who could not attend on the first day, etc.), with fifty papers and posters. As usual, some people had no poster or paper while some others proved very prolific. Compared to the previous Seminars (those of 1999–2001) the number of visiting neighbours, from Lithuania and Ukraine mainly, has increased (see Abstracts) which is very good. After all, we are active within roughly the same area and study the same molluscs, and the molluscs ignore borders and political divisions.

This time also, like last year and two years before, there were many young malacologists to appear for the first time on the malacological scene, some of them with very good talks/posters. Sounds optimistic,

yes, but will they have to become bank clerks or tram drivers, once they have got their Ph. D.?

It is very difficult to name all the topics presented and discussed, so I will try to name only the extremes: on the one hand *Columella edentula* feeding on



Fig. 1. Cover of the 18th Seminar Abstract Volume

*Impatiens parviflora*, on the other glycoproteins in oocyte membranes of the zebra mussel. With ecology of aquatic molluscs, marine fossil fauna and snail parasites in-between. During the last Seminar (Ojców, see *Folia Malacologica* 9(2): 101) a computer presentation was still a thing unusual, now it appears to be normal. The younger generation of malacologists seems to imagine that only computer presentations exist, and devil take all the slides, transparencies and projectors! You only need to bring a CD with you (but what if you happen to bring a wrong CD, or to sit on your CD in the train and break it?).

A good thing about conferences in small villages is that all the people stay in one hotel and thus can visit each other even late in the night, never bothering about buses, taxis etc. We all lived in a holiday centre of an insurance company, in four small houses with very nice rooms and numerous bathrooms (oh, the nightmarish memories of bathroom queues during our first seminars!).

Malacologists love to have a good time; this is probably why we always have some trips and social events during our Seminars. This time it was a trip to the Baltic cliff, where you could learn a lot about its geology

and also the Baltic fauna. Besides, those who were not afraid of the weather which was not always good could go on a boat trip – the boat of the University of Szczecin – to see the cliffs, or just to get a bit cold, and a bit wet and feel like sailors for a while. The social event was a real fish banquet, with all sorts of fish fried, baked, smoked and marinated, wine galore and a nice fire (though, of course, we made a fire every night but those other fires were unofficial, sort of).

Like last year, this time also an abstract book was published (with a very beautiful cover – see: Fig. 1 – and a fairly good selection of typographic errors), and – as usual – some abstracts were very long, or too long to be called abstracts. I have translated and abbreviated them as best I could (without consulting all the respective authors), believing that it would be good to let the world know what we were doing, but being afraid that the world might find them too long in their original version.

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## ABSTRACTS OF THE 18th POLISH MALACOLOGICAL SEMINAR, LUBIN (WOLIN ISL.)

### HABITAT PREFERENCES OF UNIONID BIVALVES IN THE PILICA RIVER BASIN

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The 1995–1998 studies in the Pilica river basin included the following habitats: sources and upper section of Pilica, mid Pilica, lower Pilica, oxbows, tributaries and the Sulejów reservoir. The material, of over 5,700 individuals, included all the unionid species and two forms recorded from Poland. The mid section of Pilica proved to be the most favourable (moderate anthropopressure, varied microhabitats, low degree of pollution) in terms of density, biomass and condition of the unionids; it was the only section where all the six species were present. The diversity and abundance were found to decrease in the lower section, below the Sulejów reservoir (sedimentation of allochthonous organic matter, pollution). The bivalves varied morphologically depending on the habitat.

### STRUCTURAL SIMILARITY OF SPERMATOZOAN AND OOCYTE MEMBRANES IN THE ZEBRA MUSSEL *DREISSENA POLYMORPHA* BASED ON FLUOROCHROME-MARKED LECTIN STUDIES

JOANNA BIAŁKOWSKA, JAN GŁOGOWSKI

Katedra Ekologii Ewolucyjnej,  
Uniwersytet Warmińsko-Mazurski, Olsztyn

Based on lectin binding with sugar components of spermatozoa and oocyte membranes, sugar components of membrane glycoproteids were studied with a view of acrosomal reaction and the role of mono- and oligosaccharides in the spermatozoon-ovum interaction. The following fluorescein-marked lectins were used: PSA-FITC (*Pisum sativum* agglutinin), PNA-FITC (Peanut *Arachis hypogaea*), concanavalin A-FITC (from *Canavalia ensiformis*). The membrane structure of spermatozoon acrosomal region and oolemma of the zebra mussel was found to be very similar. PSA-FITC bound with the acrosome matrix and oolemma with the same intensity of fluorescence. PNA-FITC showed no specific fluorescence of the external acrosome membrane, which may indicate an absence of galactose as glycoprotein component. Con A-FITC showed no specific binding to acrosome inner membrane or any other structure in spermatozoa, which may result from the fact that no acrosomal reaction was induced in the spermatozoa.



THE ZEBRA MUSSEL *DREISSENA POLYMORPHA*  
(PALLAS, 1771) IN THE LAKE HAŃCZA  
– VERTICAL DIVERSIFICATION OF SIZE  
AND AGE STRUCTURE

BEATA BINEK, ANDRZEJ KOŁODZIEJCZYK

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Uniwersytet Warszawski, Warszawa

The population of *Dreissena polymorpha* in the lake Hańcza was studied from April 2000 till February 2001 (project 6P04 05 17, State Committee for Scientific Research) with respect to its horizontal and vertical distribution, abundance on various substrata and age and size structure. Depending on depth, the age and size structure in the lake Hańcza differ from those observed in most other lakes: medium-sized individuals, aged ca. 1 year, dominate in the littoral, while deeper, on Characeae meadows, smaller and younger individuals prevail, and larvae settle only in this zone. Below the zone of submerged macrophytes, the largest and oldest (up to 4 years old) bivalves occur, the age and size increasing with depth. The age and size distribution may result from the presence of litholittoral, which provides a favourable substratum on which, however, larvae cannot settle. A field experiment revealed migrations of already settled individuals.

CILIARY ACTIVITY OF CILIATED EPITHELIUM  
IN UNIONIDS

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The ciliary activity of ciliated epithelium of gills and foot were studied in vitro in 614 specimens of various unionid genera at temperature 13–18°C and oxygen content 8.6–8.9 mg/l. The activity was found to be similar in *Unio*, *Pseudanodonta* and *Colletopterum*, and higher in *Batavusiana*, which may be associated with living in habitats with a fast current and thus necessity of more efficient filter-feeding.

*HELICOPSIS STRIATA* IN POLAND  
– THE STATE OF KNOWLEDGE AND PLANNED  
INVESTIGATIONS

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*Helicopsis striata* is a Central-East European species, in Poland rare and known from only about a dozen localities. Its two distribution centres are the lower Odra River valley near Słubice and Kostrzyń, and the Nida River valley near Pińczów and Korytnica. Be-

sides, it was recorded from Cierpice near Toruń, but it never forms continuous populations and occupies only small, isolated areas. The species is xerothermophilous, and either too sparse or too lush vegetation is unfavourable; habitats vacated by *H. striata* are often invaded by a more euryoecious *Helicella obvia*. Data on the biology of *H. striata* are scarce. More exact studies will include biometrical analysis of the shell, anatomical structure, valorisation of localities, estimation of population abundance, population dynamics, life cycle, diurnal and seasonal activity and habitat preferences.

ATTEMPTS AT CONTROLLING SLUGS WITH  
THE USE OF A NEMATODE *PHASMARHABDITIS*  
*HERMAPHRODITA* (SCHNEIDER)

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Slugs are pests of ornamental plants and vegetable crops; in case of mass occurrence they cause considerable losses, and there are no completely successful methods of control. Experimental attempts to use *Phasmarhabditis hermaphrodita* (Schneider) to control *Lehmannia valentiana* (Ferussac), *Deroceras reticulatum* (O. F. Müll.) and *D. laeve* (O. F. Müll.) revealed that *D. reticulatum* was the most sensitive to the nematode while *L. valentiana* did not react at all.

HISTOLOGICAL ANALYSIS OF FEMALE GONADS  
OF *DREISSENA POLYMORPHA* (PALLAS, 1771)  
FROM A HEATED CANAL OF THE DOLNA ODRA  
POWER PLANT

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Our previous studies on *Dreissena polymorpha* pertained to females from natural, unheated waters. Samples from a heated canal were taken in 1999–2002, 1–2 times a month, from February till December; the bivalves were fixed in Bouin liquid, and the gonads processed according to standard histological procedures. The water temperature in the canal does not drop below 12°C, the mean of December–January being 12°C, in spring and fall 15–18°C, and in summer ca. 27°C. In February, the male gonads were at stage 3, the most advanced oocytes being at f<sub>3</sub> phase, mean size 34 µm. Starting with March the gonads were mature, at stage 4, and the condition was maintained till October; in Novem-

ber the gonads were at stage 3 again. The size of  $f_4$  oocytes ranged from 40  $\mu\text{m}$  at the beginning to 47  $\mu\text{m}$  at the end of March; in April–October the oldest oocytes, of 40–52  $\mu\text{m}$  size were at  $f_4$  phase. In November and December the most advanced oocytes were  $f_3$ , of a mean size of 30–32  $\mu\text{m}$ . The breeding period seems to last from March till October i.e. 8 months, while in natural waters it is only 4–5 months.

#### ISOLATION OF D-FRUCTOSE-1,6-BISPHOSPHATE 1-PHOSPHOHYDROLASE [EC 3.1.3.11] FROM HEPATOPANCREAS OF *HELIX ASPERSA MAXIMA*

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Glucose is the main monosaccharide in gastropod haemolymph. Its concentration does not undergo any rapid changes; it may be synthesised from non-carbohydrate precursors during gluconeogenesis, or derived from glycogen decomposition. In the presence of bivalent ions ( $\text{Mg}^{2+}$ ,  $\text{Zn}^{2+}$ ), D-fructose-1,6-bisphosphate 1-phosphohydrolase hydrolyses fructose-1,6-bisphosphate to fructose-6-bisphosphate and orthophosphate. FBPase activity in *Helix aspersa maxima* was detected in homogenates of hepatopancreas and kidney and in foot muscle. The procedure used in this study makes it possible to obtain an electrophoretically homogenous FBPase of an activity of 14.6 U/mg. The subunit mass is 37,500 Da, thus being close to values found in vertebrates and higher than values for *Mytilus* mantle. Till now there are no data on FBPase isozymes in invertebrates. Further investigations are needed to answer the question if two isozymes of FBPase are present in *H. aspersa*.

#### KARYOTYPE AS A TAXONOMICALLY IMPORTANT CHARACTER IN FRESHWATER MOLLUSCS

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Karyotypes have been described in a very limited number of molluscs, mostly marine. Systematics of freshwater molluscs is difficult because of the incompatibility between the W European system and the system adopted in Ukraine. Karyotype characters are useful for phylogenetic inferences in various animal taxa. Karyotypes were studied in 16 European lymnaeid and 16 unionid species. Based on karyology, the genus *Lymnaea* could be divided into 4 groups: *Corvusiana* ( $2n=36$ ,  $NF=60$ ), *Lymnaea* s. str. ( $2n=36$ ,  $NF=62$ ),

*Stagnicola* and *Galba* ( $2n=36$ ,  $NF=72$ ), *Radix* and *Peregrina* ( $2n=34$ ,  $NF=68$ ). *Lymnaea vulnerata* and *L. peregra* proved to be highly dissimilar. Unionid chromosomes seem to be conservative ( $n=19$ ,  $2n=38$ ,  $NF=76$ ), but some karyological characters (satellites, centromeres, correlation between the first and second chromosome pairs) point to groups corresponding with superspecies distinguished in the system adopted in Ukraine.

#### EFFECT OF DIGENETIC TREMATODE INFECTION ON SOME BIOMETRICAL CHARACTERS OF *LYMNAEA STAGNALIS*

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Specimens of *Lymnaea stagnalis* were collected in a park pond in Aleksandrów Kujawski, each month from May till October 1998, and subject to biometrical analysis and parasitological section. The intensity and extensity of infection with digenetic trematode larvae were high (mean extensity 74%). Infected individuals were larger and heavier than uninfected ones, the most numerous class of infected snails having shells 50–60 mm high (40–55 mm in uninfected snails), the shells being on an average by ca. 14% higher in the former group. No snails with shell lower than 40 mm were found; the reason for the absence of juvenile snails could be their lower resistance to the parasites. Likewise, the body mass of infected snails was higher (5.35 g compared to 3.59 g in uninfected snails, the difference being ca. 48%), as well as their shell mass (4.4 g compared to 2.89 g in uninfected snails, difference 50%).

#### MALACOFAUNA OF THE Odra ESTUARY – PRELIMINARY RESULTS

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The aquatic malacofauna of the Odra estuary is poorly studied. The studied area includes a mosaic of oxbows, stagnant ponds and water courses connecting the two beds of the Odra River, of different flow speed. The studies were carried out in 2000–2001 at eight sites representing various habitats. Twenty seven species were recorded, including 14 bivalves and 13 snails, some of the species being legally protected.



EFFECT OF LIGHT ON GEOTAXY OF JUVENILE ZEBRA MUSSELS *DREISSENA POLYMORPHA* (PALLAS, 1771)

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It is commonly believed that the main way of dispersal of the zebra mussel is passive transport of planktonic larvae. However, movements of newly settled animals may also be of significance. Preliminary studies indicated that the distribution of zebra mussels in the dam reservoir of Włocławek and in the Vistula River in Toruń could result from gravity and light effect. Aquarium experiments aimed at testing the effect of both these factors revealed a modifying effect of light on the geotactic movements of the bivalves. The behaviour is probably of a high adaptive significance: due to the negative geotaxy, juvenile animals living at great depths can take positions in the upper layers of the colonies, thus avoiding competition, danger of excessive biosedimentation and oxygen deficit. Close to water table, the light has an inhibiting effect on the negative geotaxy, and thus the animals avoid exposure to air and predator attacks.

MECHANISMS OF EFFECT OF COPPER SUBSTRATUM ON THE ADHESION, INTENSITY OF MIGRATION AND MORTALITY OF THE ZEBRA MUSSEL (*DREISSENA POLYMORPHA* (PALLAS, 1771))

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Instytut Biologii Ogólnej i Molekularnej,  
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The experiments were aimed at distinguishing between the effect of copper ions and the properties of surface of copper substratum on adult individuals of the zebra mussel under laboratory conditions. It was found that both copper ions in the water, and the properties of copper surface result in the copper substratum being unsuitable for the zebra mussel: the former factor increased the mussel mortality, the latter decreased the adhesion and induced the mussels to search for a more favourable substratum.

MALACOFUNA OF THE LITTORAL OF THE LAKE HAŃCZA

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Epilithic macrofauna of the littoral of the lake Hańcza was studied within the project 6 P04 055 17, State Committee for Scientific Research. Twenty one mollusc taxa were recorded, including 19 snail species, *Dreissena polymorpha* and members of the genus *Pisidium*. The frequency of most species was low. *Potamopyrgus antipodarum*, not recorded from the lake before, was found in one site. The most widespread species was *D. polymorpha*, which showed a high abundance and dominated in all sites. A high frequency was displayed by *Bithynia tentaculata*, *Marstoniopsis scholtzi* and *Lymnaea glutinosa*. An increase in the abundance of *D. polymorpha* was observed just after disappearance of ice cover. Among 11 snail species, found in neighbouring sheltered and wave-exposed sites, as many as seven occurred in the former type of habitat. The litholittoral macrofauna of the lake Hańcza is uniform and dominated by a single mollusc species – *D. polymorpha*.

SPECIES DIVERSITY OF FRESHWATER BIVALVE FAUNA OF UKRAINE

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Systematics of freshwater bivalves of Ukraine is incompatible with that adopted in other European countries in that more species are recognised in the former system. The bivalve fauna of Ukraine includes 30 valid species: 7 unionids, 21 sphaeriids and 2 dreissenids. Three taxa, commonly regarded as varieties, were treated as species: *Sphaerium nucleus* (Studer), *S. ovale* (Férussac) and *Euglesa globularis* (Clessin). Records of *Euglesa crassa* (Stelfox), *Neopisidium conventus* (Clessin) and *Odhneripisidium tenuilineatum* (Stelfox) are regarded as doubtful. Protection of 10 threatened species is recommended.

#### DAMAGE TO SEEDLINGS OF SELECTED CULTIVATED PLANTS BY VARIOUS SLUGS

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Damage to seedlings of clover, wheat, rape and lettuce by *Arion lusitanicus*, *A. rufus* and *Deroceras reticulatum* was tested. Preferences were marked already after the first day of feeding: *A. lusitanicus* preferred clover and rape, *A. rufus* rape and *D. reticulatum* clover. After five days of feeding, the degree of damage to clover and rape was equal, while lettuce seedlings were much less damaged, the degree of damage becoming equal to that of clover and rape only as late as after nine days. During the whole feeding period, wheat was the least damaged.

#### THE ROLE OF *ANODONTA WOODIANA* (LEA, 1834) IN THE HEATED KONIN LAKES

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The natural range of *Anodonta woodiana* includes the rivers Yangtze and Amur. The bivalve was introduced in Europe as early as half of the 1960s, with herbivorous fishes; in Poland it inhabits only the heated Konin lakes. It plays an important part in biological purification of water, limiting the excessive development of planktonic algae and removing suspension; accumulation of biogenic substances, calcium and heavy metals is also important; pseudofaeces and faeces produced by the bivalve create favourable conditions for bottom and periphytic invertebrates. Its colonies harbour rich biocenoses, among others providing substratum for *Dreissena polymorpha*.

#### MOLLUSCS OF SHORT-LIVED WATER BODIES OF THE FLOODPLAIN OF THE UPPER WARTA RIVER

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Five short-lived reservoirs were studied in 1998 and 2001, the sites being selected because of their duration, quality of bottom deposits, diversity of vascular flora, and depth. Fourteen mollusc species were recorded: 13 gastropods and 1 bivalve. Four snail species (*Planorbis planorbis* (L.), *Anisus vortex* (L.), *Bathyomphalus contortus* (L.) and *Segmentina nitida* (O.

F. Müll.)) were numerous in the studied reservoirs in two seasons. In 1998 *Lymnaea stagnalis* (L.), *Stagnicola corvus* (O. F. Müll.), *Radix peregra* (O. F. Müll.) and *Planorbis corneus* (L.) were less abundant; in 2001 this group of species included only *Stagnicola corvus* (O. F. Müll.) and *Planorbis corneus* (L.). *Lymnaea stagnalis* (L.) was rare but abundant while *Radix peregra* (O. F. Müll.) was accessory, like the remaining six species. During and between the study seasons the studied reservoirs were repeatedly flooded, which resulted in a decrease in mollusc abundance. Reservoirs 2 and 5, being the oldest, showed the highest faunistic similarity.

#### MOLLUSC ASSEMBLAGES IN QUATERNARY DEPOSITS OF FOSSIL LAKES IN THE ICE-MARGINAL VALLEY OF ŁEBA

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Państwowy Instytut Geologiczny, Gdańsk

The aim of the studies was to trace the development of the ice-marginal valley of Łeba on the transition between Pleistocene and Holocene. The lake deposits studied are mainly calcareous (lacustrine chalk and gyttja) accumulated in late Pleistocene and Holocene in depressions remaining after lumps of dead ice. The diversity of mollusc assemblages indicates diverse habitats on the bottom and slopes of the valley, and changing conditions of deposition.

#### NEW LOCALITIES OF *LYMNAEA* (*STAGNICOLA*) *TURRICULA* (HELD, 1836) IN POLAND (GASTROPODA: BASOMMATOPHORA: LYMNAEIDAE)

IGA LEWIN, JOANNA CEBULA

Katedra Ekologii, Zakład Hydrobiologii, Uniwersytet Śląski, Katowice

Eleven lymnaeid species are known to occur in Europe, three of them included in the subgenus *Stagnicola* Leach, 1830. *L. (Stagnicola) turricula* (Held, 1836) was previously found in Germany, the Czech Republic, Hungary, Austria, Bulgaria and Poland – in the latter country in Brzezina Polska near Nysa and in the Bieszczady Mts. In quantitative samples, taken in 2001 from four sites in a drainage ditch in Odrzykoń near Krosno (SE Poland), 172 specimens of *L. turricula* were found, the percentage of the species in the samples ranging from 6.79 to 55.82%.



## MALACOFAUNA OF THE UKRAINIAN DANUBE

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The list of molluscs of the Ukrainian Danube was compiled based on literature data and own results. It includes 107 taxa: 74 snails and 33 bivalves (10 are terrestrial wetland species). The Danube is characterised by a high richness of molluscs (66 taxa). Thirty three species were found in freshwater bays, 38 in brackish gulfs, 30 in vegetation along banks of branches and bays, 38 in wetlands, 33 in the marine part of the delta. The similarity indices suggest a considerable isolation of freshwater and brackish sites, and are high (34–39%) for sites located in the Danube.

## ISOLATION OF FRUCTOSE-1,6-BISPHOSPHATASE [EC 3.1.3.11] FROM THE FOOT MUSCLE OF *HELIX ASPERSA MAXIMA*

MAŁGORZATA ŁOZIŃSKA-GABSKA, DARIA DZIEWULSKA-SZWAJKOWSKA, EWA SZAŁAGAN, ANDRZEJ DŻUGAJ

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Glucose is the main monosaccharide in gastropod haemolymph. Its concentration does not undergo any rapid changes; it may be synthesised from non-carbohydrate precursors during gluconeogenesis, or derived from glycogen decomposition. In the presence of bivalent ions ( $Mg^{2+}$ ,  $Zn^{2+}$ ) D-fructose-1,6-bisphosphate 1-phosphohydrolase hydrolyses fructose-1,6-bisphosphate to fructose-6-phosphate and orthophosphate. FBPase activity in *Helix aspersa maxima* was detected in homogenates of hepatopancreas and kidney and in foot muscle. The activity of the enzyme isolated from the foot muscle at pH was 13.84 U/mg at 25°C and it was 2.8 times higher than that of the enzyme from *Mytilus* mantle. SDS electrophoresis revealed one stripe of ca. 37,500 Da. The result is comparable with those obtained for muscle FBPases of various vertebrates.

## HYDROBIOLOGICAL REGIONALISATION OF UPPER SILESIA. I. SILESIAN LOWLAND

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Based on ILLIES's (1972) hydrobiological regionalisation of Europe, the whole Silesia was included in Central European lowlands. According to KONDRACKI's (1998) regionalisation, Upper Silesia includes

four macroregions partly or wholly. Regions of greater or smaller diversity of gastropods can be distinguished within Upper Silesia, but they do not correspond to KONDRACKI's physico-geographic regions. For example, detailed studies on aquatic snails in Upper Silesian rivers made it possible to distinguish two macroregions in the Silesian Upland macroregion. There is no similar study on anthropogenic reservoirs of Upper Silesia, and the aim of the study is mapping of the distribution of aquatic snails in that region, identifying factors that determine the distribution of species and formation of malacocenoses, and distinguishing hydrobiological regions.

## EFFECT OF SELECTED CHEMICAL AND PHYSICAL FACTORS ON THE ACTIVITY OF *DREISSENA POLYMORPHA* (PALLAS, 1771)

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Because of the possibility to use *Dreissena polymorpha* to control the abundance of phytoplankton, the effect of light and  $FeCl_3$  on the bivalve was studied in the laboratory. The mussels were by 20% more active in the dark. The activity in the water with addition of  $FeCl_3$  was smaller than in pure water, though  $FeCl_3$  did not inhibit filtration completely, the decrease being 55–62%.

## EFFECT OF ACCLIMATION ON THE CONCENTRATION OF KRYOPROTECTING SUBSTANCES IN THE HAEMOLYMPH OF *HELIX POMATIA*

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All gastropods are freezing-sensitive, but their ability to survive low temperatures is higher in winter. The ability is correlated, among other things, with changes in the concentration of kryoprotective substances in the haemolymph. In the Roman snail the concentration of glycerol increases in winter. In order to find out if the winter frost-resistance was only a result of exposure to cold, or if it depended on internal clock, glucose and glycerol concentration was measured in the haemolymph of snails acclimated in 5°C during summer. The concentration of glycerol showed no statistically significant difference between the experimental and control groups; the glucose concentration was somewhat lower in the experimen-



tal group. The results suggest that the temperature is not the only factor responsible for the increase in the concentration of kryoprotective substances.

VERTICAL RANGE AND ABUNDANCE  
OF *PISIDIUM* C. PFEIFFER (BIVALVIA:  
HETERODONTA) IN THE LAKE OSTROWITE,  
BORY Tucholskie NATIONAL PARK

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Thirteen species and one form of *Pisidium* were found in the mesotrophic lake Ostrowite, including such rare species as *P. crassum* Stelf., *P. lilljeborgi* Jen., *P. conventus* Cless. and *P. tenuilineatum* Stelf. Nine species occurred in shallow psammolittoral, at a density of 10–290 indiv./m<sup>2</sup>. The most frequent were *P. henslowanum*, *P. nitidum*, *P. casertanum*, *P. lilljeborgi* and *P. subtruncatum*, the most abundant species being *P. henslowanum* and *P. nitidum*. In the deep littoral three species were present, among others a rare *P. tenuilineatum*. The abundance did not exceed 300 indiv./m<sup>2</sup>. The only species found in the profundal was *P. conventus* (424 indiv./m<sup>2</sup>). Pill clams and other representatives of macrofauna were absent from the deep profundal, probably because of high H<sub>2</sub>S content and oxygen deficit.

CHARACTERISTICS OF *MYTILUS EDULIS*  
IN THE POLISH COASTAL ZONE  
OF THE MIDDLE BALTIC COAST

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Distribution of *Mytilus edulis* was studied in 1996–2001 in the coastal zone of the Baltic in the region of estuaries of the rivers Wieprza, Słupia, Łupawa and Łeba. The frequency ranged from 0 to 50%, the density was varied and ranged from 0 to 9,376 indiv./m<sup>2</sup>, the mean densities being 432 indiv./m<sup>2</sup> in the region of the Wieprza mouth, 1,705 indiv./m<sup>2</sup> in Łupawa, 6 indiv./m<sup>2</sup> in Łeba, and the bivalve was absent from the region of Słupia. Individuals aged 1+ dominated in the population.

EUROPEAN SPECIES OF THE GENUS *VERTIGO*  
– AUTECOLOGY, THREATS AND PROTECTION

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The list of European *Vertigo* includes 15 species: 8 are N-European or, like *V. alpestris*, more common in the north of Europe, 7 have their ranges located more to the centre or south of the continent. Out of 15 species, 7 (or even 8) occur also outside Europe. Within the seemingly continuous distribution ranges, sites of most species are few and often reflect distribution of malacologists rather than that of snails. Distribution data on rare and endangered species are usually not updated. European species of *Vertigo* inhabit mountains (5 species), lowlands (3) or both kinds of areas (7). They may live in one type of habitat (e.g. only wetlands) or several kinds; the latter group comprises species living in various kind of habitats in the same or different parts of their ranges, which is of significance for e.g. protection of genetic diversity. Out of 15 species, 6 live in one and 9 in more than one habitat type; 4 prefer woodlands, 9 wetlands, 1 open areas of varied humidity, and 1 is extremely catholic. Preferences with respect to acidity, calcium content, humidity and plant communities, as well as life histories and structure of *Vertigo*-bearing malacocenoses, are little known. Two species of *Vertigo* are threatened globally, 5 locally, 3 may be threatened by random events; only 5 seem not to be endangered. The main reasons for threat are: physical destruction of habitats, grazing, mowing and trampling, eutrophication and succession. Only three species can penetrate anthropogenic habitats. Though in many European countries from 1 to 4 species are red-listed and/or legally protected, except Britain no active protection measures are taken.

THE GENUS *ANDREFRANCIA* SOLEM  
(GASTROPODA: PULMONATA: CHAROPIDAE)  
AND ITS ANATOMICAL PECULIARITIES

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The endemic genus *Andrefrancia* Solem, 1960 is the most speciose and the least known among New Caledonian charopids; it includes 23 nominal species none of which had been anatomically examined previously. Though a preliminary cladistic analysis, based on characters of male and female genitalia, revealed no synapomorphy that would justify the existence of the genus in its original sense, it made it possible to distinguish a monophyletic group of over ten species.





The group is defined by a unique character, found in no other snails. In all these species the epiphallus and/or vas deferens are coiled tightly and regularly around the penial retractor muscle, making from one to more than ten coils. The character seems to have a functional significance; three hypotheses are equally plausible: (1) regulation of patency of vas deferens; (2) participation in spermatophore transfer; (3) injecting spermatozoa into the spermatophore.

#### SNAILS – UNIQUE INCLUSIONS IN BALTIC AMBER

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Snail inclusions in amber are very rare, which results from the snail's way of life, habitat preferences and mode of dispersal. The history of studies on snail inclusions is short: most known taxa were described by KLEBS in 1886; several specimens not described previously were recently examined by us. Nearly all amber snails known to date are pulmonates, the most numerous and best preserved being pupilloids. The age of the inclusions corresponds to that of Baltic amber – ca. 40 mln years.

#### THE SHELL VARIABILITY AND POPULATION SIZE STRUCTURE IN TWO SPECIES OF *DREISSENA* IN THE DNIEPER RIVER

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Samples were collected from the lower part of the Kiev reservoir, the river Dnieper and the upper part of Kanev reservoir. In all sites *D. polymorpha* (Pall.) co-occurred with *D. bugensis* (Andr.), their densities being 212–15,300 and 5,137–156,300 indiv./m<sup>2</sup>, respectively. The species differed in their population structure, individuals of larger size classes being more numerous in *D. bugensis*. Differences were also found in the shell morphometrics of *D. polymorpha* and *D. bugensis*.

#### SEASONAL CHANGES OF PURINE MARKERS OF ENERGY METABOLISM IN *HELIX ASPERSA MAXIMA*

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Changes in energy metabolism in the foot muscle of active and hibernating *Helix aspersa maxima* were estimated on the basis of the content of purine derivatives. The following nucleotides, nucleosides and products of their metabolism were determined with the use of liquid chromatography (HPLC): ATP, ADP, AMP, Ado, GTP, GDP, GMP, Guo, Hyp, IMP, Ino, Xan, Urd, UA, NAD<sup>+</sup>, NADP<sup>+</sup>. Adenylate energy charge (AEC) and the total content of adenine nucleotides were calculated. In feeding individuals AMP constituted 25.5% purines and was the main adenylate; in hibernating snails AMP constituted 36% studied compounds; in hibernating snails the mean content of ATP, Ado, IMP, Ino and NAD, as well as the AEC value decreased; the content of adenyle nucleotides (TAN) showed a decrease tendency, while that of the other purine derivatives did not change significantly. The decrease in AEC indicates an inhibition of phosphorylation of ADP to ATP.

#### MITOCHONDRIAL DNA SEQUENCE IN PHYLOGENETIC STUDIES ON LYMNAEID SNAILS

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The history of studies on lymnaeid classification is long and controversial. About 1,800 species and 34 genera were described in the past. The 20th c. studies demonstrated that only anatomical characters could serve to identify species, and the number of species decreased to ca. 40 in a few genera. According to the present knowledge, 9 lymnaeid species occur in Poland, classified in a few subgenera. Three (*palustris*, *turricula* and *occulta*) are included in *Stagnicola*, two (*corvus* and *stagnalis*) in *Lymnaea* s. str. Their taxonomic position seemed well established on the basis of reproductive system structure, but in 1992 the status of *turricula*, *occulta*, *corvus* and also *vulnerata* was questioned. Studies on *palustris*, *turricula*, *occulta* and *corvus* with the use of mitochondrial DNA will allow a verification of their specific status.

## SEX RATIO IN THE ZEBRA MUSSEL POPULATION FROM THE KONIN LAKE SYSTEM

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The sex ratio in *D. polymorpha* may undergo changes under the effect of environmental factors. It was studied in 2002 at seven localities in the heated Konin lake system and in one unheated site. The proportion of mature mussels was 22–77% and increased with temperature. In the heated waters females dominated (ca. 70%), males and hermaphrodites being 4–6 times less numerous. Outside the heated system females constituted 61%, hermaphrodites 39% and males only 2.2%. The proportion of females and hermaphrodites increased with temperature.

## GENETIC DIVERSITY IN FRESHWATER BIVALVES ON THE BASIS OF MITOCHONDRIAL DNA SEQUENCES

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Genetic diversity of various species of freshwater bivalves was determined on the basis of sequences of a fragment of mitochondrial gene COI (subunit I of cytochrome oxidase), 629–663 base pairs being analysed, depending on the species. The species examined were members of *Anodonta* (including the introduced *A. woodiana*), *Pseudanodonta*, *Dreissena* (including both *D. polymorpha* and *D. bugensis*) and *Unio*. Specimens of *A. cygnea* from remote localities did not differ, *A. woodiana* from Poland were identical but differed from Japanese specimens. Individuals of *U. pictorum* and *U. tumidus* showed no differentiation, each having a sequence characteristic of the species. *D. polymorpha* from various sites in Poland had identical sequences, but its Polish populations differed from the Ukrainian ones; *D. bugensis* was less differentiated than *D. polymorpha*.

## GENETIC METHODS IN CLASSIFICATION OF SLUGS OF THE GENUS *ARION* FÉRUSAC, 1819

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The existing classification of the genus *Arion* is based on morphological and anatomical characters, and more recently chromosomal characters, enzyme polymorphism and RAPD-PCR results. During studies

aimed at finding universal species markers we found specimens which were difficult to classify. Sequencing of a fragment of mitochondrial gene COI (650 base pairs) showed that the problematic specimens were identical with *A. subfuscus*. The sequences for *A. distinctus*, *A. circumscriptus* and *A. fasciatus* differed from that of *A. subfuscus* and were species-specific.

## ON THE POSSIBILITY TO USE MOLLUSCS IN RADIOECOLOGICAL MONITORING OF FRESHWATER ECOSYSTEMS

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The 1986 failure of the atomic power plant in Chernobyl resulted in considerable quantities of radioactive substances getting to surface waters. Molluscs, being various level consumers in trophic webs, and being able to accumulate radioactive isotopes in their bodies, play a role in circulation, sedimentation and accumulation of these isotopes and thus can be used as indicators in radioecological monitoring. The content of <sup>137</sup>Cs was determined in the bottom sediments, aquatic plants and bodies of molluscs of the genera *Lymnaea*, *Unio*, *Batavusiana*, *Anodonta* and *Colletopterum* from variously polluted rivers of Ukraine. The bottom sediments turned out to be the most polluted, aquatic plants and unionids proved to accumulate the isotopes the most intensely, and the content of radioactive substances was much higher in stagnant than in running waters.

## THE EFFECT OF HABITAT FACTORS ON THE OCCURRENCE OF SNAILS IN THE UPPER WARTA RIVER

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The effect of quality of bottom deposits, flow speed and diversity of vascular flora on snails, as well as habitat preferences of particular species, were studied in the upper section of the Warta River. Fourteen snail species were recorded, only *Bithynia tentaculata*, *Lymnaea stagnalis*, *Radix peregra* and *Stagnicola palustris* being abundant, though rare; their abundance depended on the quality of bottom deposits. The remaining species were rare and not abundant, and their presence depended on specific microhabitats. The abundance and number of species decreased with the flow speed, while *Elodea canadensis* favoured diversity and abundance of gastropods.



## ECOLOGY OF UNIONIDS IN THE LAKE MIEDWIE

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The studies on distribution, abundance, biomass and population growth of unionids in the lake Miedwie started in 1996. Till now ca. 5,000 unionid individuals have been collected, representing all the native unionid species of the genera *Anodonta*, *Pseudanodonta* and *Unio*. The distribution was limited mainly to the depth between 0.25 and 6 m, the maximum depth being 30 m; the highest density was 45 indiv./m<sup>2</sup>, biomass – 1.3 kg/m<sup>2</sup>. The mean density was 0.61 indiv./m<sup>2</sup> and showed an increasing tendency. The dominant unionid was *Anodonta anatina* (72.2%), *A. cygnea* constituting 13.6% and *Unio pictorum* 9%. *U. crassus*, *U. tumidus* and *Pseudanodonta complanata* constituted only 5.2%. The estimated total number of unionid individuals in the lake is 18.8 mln, biomass 752.5 t, which, together with colonies of *Driessena* growing on unionids, contributes considerably to water purification.

## COLUMELLA EDENTULA DRAPARNAUD ON IMPATIENS PARVIFLORA D. C.

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*Impatiens parviflora* was introduced in Europe from E and C Asia. It has idioblasts containing calcium oxalate crystals, such cells being especially numerous on edges of leaves. *Columella edentula* was found to climb leaves of *I. parviflora* and feed on them. Observations were carried out in *Galio silvatici-Carpinetum* and in the laboratory. *C. edentula* was observed to sit on the underside of leaves, along the main vein. Traces of feeding were observed on considerable areas of leaf blades, but the margins of leaves as well as areas adjacent to the main vein were avoided – these are the places where the concentration of calcium oxalate-containing idioblasts is high.

## AVERAGE DAILY FOOD CONSUMPTION OF LYMNAEID SNAILS

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Lymnaeids use almost all food resources. *Lymnaea stagnalis* was studied with respect to average consumption of various kinds of food (*Nymphaea* stems, poplar leaves), by healthy and trematode-infected individ-

uals. Parasite-infected individuals were found to consume 1.5–2.5 times more food compared to the parasite-free snails. The behaviour may be a compensation for the effect of parasite.

## MOLLUSC FAUNA OF THE LITTORAL OF THE LAKE MORZYCKO, WITH SPECIAL REFERENCE TO SNAILS

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The lake Morzycko is located near Moryń, in the north-western part of Szczecin voyvodeship. Samples were taken in 1996–2000 in various months during the vegetation season, from shallow littoral of 0–1 m depth. Seventeen snail species were recorded. The dominant species were *Galba palustris*, *Bithynia tentaculata* and *Succinea putris*. *Radix limosa*, *Theodoxus fluviatilis* and *Planorbis planorbis* were less abundant. Biocenotic indices were found to vary between months.

## MALACOFAUNA OF HOLOCENE DEPOSITS OF THE GULF OF POMERANIA

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The aim of the study was to present stratigraphic and spatial differentiation of the malacofauna of the Holocene deposits of the Gulf of Pomerania. A total of 4,120 specimens representing 8 species were found; they were associated with freshwater, brackish and marine habitats. The malacological assemblages were compatible with lithological borders, forming malacostratigraphical strata. Two main series of deposits could be distinguished: a marshy-limnic series and a brackish-marine series. In the former freshwater snails (*Theodoxus fluviatilis*, *Valvata* sp.) were present, in the latter marine bivalves were found, such as *Cerastoderma glaucum*, *Mytilus edulis*, *Macoma baltica*, as well as brackish-water snails: *Hydrobia ulvae* and *H. ventrosa*. The results indicate that till the early Atlantic period the area was covered by lakes; the transgression of the *Littorina* sea was gradual and characterised by co-occurrence of freshwater and marine fauna. Biometrical analysis shows that *C. glaucum* had larger shells compared to recent specimens, thus testifying to a salinity higher than that observed at present.



## SLUGS OF PAKISTAN

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Pakistan, located at the edge of Palaearctic, is unexplored with regard to slug fauna. In 1990–1992 KURT AUFFENBERG (Florida Museum of Natural History) collected 223 slug specimens from 33 sites in that, mainly desert, country. At least three slug species have managed to colonise Pakistan: one widely distributed in Holarctic (*Deroceras*), one known from Central Asia (*Candaharia*) and one from the southern slopes of Himalaya (*Anadenus*). The specific character of the Pakistan fauna is presented on the background of the world's fauna (see pp. 9–15, this volume).

## MOLLUSCS OF THE SWARZĘDZKIE LAKE

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The Swarzędzkie lake is a natural lake of 93.7 ha surface area, located in the town of Swarzędz near Poznań; its fauna was studied in 1993–1997. A total of 1,319 live specimens of 15 snail species were collected, bivalves being represented only by empty shells. The number of species and the mollusc density varied between years. The dominant species were: in 1993 *Gyraulus albus*, in 1994 *Bithynia tentaculata* and *Physa fontinalis*, in 1995 and 1996 *Bithynia tentaculata*, in 1997 *Physa fontinalis*.

## HELICELLA OBVIA (MENKE) FROM BUSKO ZDRÓJ AND ADJACENT AREAS

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Snail shells were collected from three localities, two (I and II) within and one (III) outside the town; they differed in vegetation and the degree of shading. Twenty adult specimens were collected from each site; embryonic whorl width, shell increment from hatching, total shell width and height as well as aperture width were measured. The results were compared with measurements of earlier studied populations (Skowronno near Pińczów). The shell parameters in-

dicating that snails from site I had the most favourable living conditions; the differences between snails from two parts of locality I which in the past constituted a single population indicate a quick reaction to habitat changes.

## STRATIGRAPHIC DIFFERENTIATION OF MARINE MALACOFUNA IN THE ŚWINA GLACIER SNOUT

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Molluscs of three habitats were found in the studied deposits: marine represented by *Cardium*, *Macoma baltica*, *Mytilus edulis* and *Littorina littorea*, brackish (*Hydrobia ventrosa*, *H. ulvae*) and freshwater (*Theodoxus fluviatilis*). The mollusc assemblages corresponded to lithological borders and represented malacostratigraphical levels. Several series of deposits could be distinguished on this basis: fluvio-glacial, fluvial, marshy-limnic, brackish-marine and dune-beach series. The richest were brackish-marine deposits. The time of sedimentation was estimated as Atlantic period (*Littorina* transgression).

## SOME RELATIONS BETWEEN PARASITE COMMUNITIES OF *DREISSENA POLYMORPHA* AND *D. BUGENSIS*

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Parasite communities of *D. polymorpha* and *D. bugensis* were investigated at a population (host population and all populations of parasites) and individual (host individual and all individuals of parasites) levels in the upper part of the Kanev reservoir (Dnieper River). Thirteen parasite taxa were recorded, the maximum number of parasite taxa per population being 10 for *D. polymorpha* and 4 for *D. bugensis*; the respective numbers at individual level were 4 and 3. Ciliates were found to be more common in *D. polymorpha*, echinostomatid metacercariae in *D. bugensis*.



## BIVALVES OF THE RIVER NIDA

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The 1999–2000 studies in the Nida River (C Poland) included a 30-km section of the river from Pinczów to Nowy Korczyn. Seventeen bivalve species were recorded: 12 sphaeriids and 5 unionids. The most abundant species was *Pisidium moitessierianum*; *Sphaerium rivicola*, *S. corneum*, *P. supinum*, *P. henslowanum* and *P. nitidum* were also represented by numerous specimens. Six out of 17 species recorded, including *Unio crassus* and *Pseudanodonta complanata*, are on the Red List of the animals of Poland.

THERMAL BEHAVIOUR OF *LYMNAEA STAGNALIS* (L.) INFECTED WITH LARVAE OF *TRICHOBILHARZIA SZIDATI* (NEUHAUS, 1952)

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Behaviour of parasite-free and parasite infected individuals of *Lymnaea stagnalis* was studied in a thermal gradient where the snails could select microhabitats of temperatures ranging from 4 to 38°C. The results indicate that the snail behaviour with respect to temperature selection may be controlled by the parasite.