

## THE 34TH POLISH MALACOLOGICAL SEMINAR

### SEMINAR REPORT

This time nothing prevented me from attending the Seminar (I only missed two: the one in Wieliczka and the EuroMal in Kraków). Rather unusually, this one was held in a city (most Seminars were held in the countryside or in some nice holiday resort) – Toruń, from September 13th to September 15th 2018.

The Seminar was hosted by the Association of Polish Malacologists and the Faculty of Biology and Environment Conservation, Mikołaj Kopernik University in Toruń. The Organising Committee

included ELŻBIETA ŻBIKOWSKA, JAROSŁAW KOBAK, ANNA CICHY, ANNA MARSZEWSKA, ANNA DZIERŻYŃSKA-BIAŁOŃCZYK, ŁUKASZ JERMACZ (all from Mikołaj Kopernik University) and TOMASZ K. MALTZ (Museum of Natural History, Wrocław University). The Book of Abstracts was edited by TOMASZ K. MALTZ, JAROSŁAW KOBAK and TOMASZ KAŁUSKI, and published by our faithful publisher JAREK BOGUCKI (Bogucki Wydawnictwo Naukowe). The sponsors were Olympus, Poland Ltd., Noldus



Fig. 1. Participants in front of the hotel

Information Technology, Regional Directorate of State Forests, Toruń, Forest Inspectorate in Cierpiszewo and the Eger restaurant in Toruń. Great thanks to all of you!

The venue was a very nice hotel called Przystanek Toruń [Stop Toruń], and indeed it looked a bit like an old-fashioned station building of red brick (Fig. 1); it was situated just next to the tracks. We all stayed there and the sessions were held in the hotel conference room. By the way, just next to the hotel we found a very good population of *Cepaea nemoralis* and *C. vindobonensis* and we scored them. Some (not *Cepaea* of course, but participants) complained a bit about the noise made by the trains in the night, but they were no doubt those few who did not participate in the nightly consumption of sleep-inducing liquids. The hotel was not far from the very nice and very historic Old Town. The Torunians (or the Toruneers, I honestly don't know what to call them) have a very beautiful city square with clean old houses of different colours, and a multitude of good restaurants and pubs. As the city centre is not very large, everything worth seeing is within walking distance. The weather was clement, for it rained only during the night.

Despite the moderate cost the attendance was not very good. The list of participants included 45 malacologists (very few, if any, failed to appear, but, mind you, usually there are between 50 and 60 of

us). I know of two people who preferred to go to another conference which was held more or less at the same time: GOSIA OŹGO and MARYSIA URBAŃSKA (bad girls!). The accompanying persons were one non-malacological wife, three children and one dog. The children got on splendidly, so that only one parent (three were available) at a time had to supervise them. The dog was very well-behaved. Only one foreign participant was present but, being a faithful member of the Association, he no longer counts as foreign.

The programme contained 33 oral presentations and 9 posters, making a total of 42 contributions (thus the poster:presentation ratio was ca. 1:3, much smaller than during any of our local seminars: 0.9:1, and even more so, compared to the Euromal: 3.7:1). I have noticed that the poster to presentation ratio (though I can not support this with any statistical results) seems roughly positively correlated with the number of participants, namely the more numerous the participants the higher the ratio. The reason is probably that often the organisers, seeing the number of proposed presentations is too high to fit into the programme, persuade some participants to convert their presentation into posters (the methods of persuasion remain unknown to me). The contributions were distributed among six sessions (Fig. 2) without any particular topical division, plus poster



Fig. 2. One of the sessions from behind

session, though one could see that the Organisers made an effort to arrange them in some vague order. The chair persons (listed in the same order as in the Programme) were: ANDRZEJ LESICKI, KRZYSZTOF LEWANDOWSKI, EWA STWORZEWICZ, BEATA M. POKRYSZKO, ANNA SULIKOWSKA-DROZD and JOANNA PIEŃKOWSKA. Three presentations were memorials for those recently departed (MARIA JACKIEWICZ, ANDRZEJ SAMEK; for obituaries see *Folia Malacologica* 2018), or long departed and somehow forgotten (LESZEK BERGER) malacologists. Two presentations were surprising: one was by WITEK ALEXANDROWICZ (this is normal, but it was about... the origin of malacologists – anthropogenesis), another by HENRYK DUSZYŃSKI-KARABASZ, a linguist, about vernacular names of molluscs in Polish. The prize for the best student presentation went to ANNA DZIERŻYŃSKA-BIAŁOŃCZYK which does not mean that the other student presentations (or the old stagers' presentations for that matter) were bad. I especially liked those about phylogeny and evolution, and about life histories, but my opinion may not be objective.

The handouts included various things, the most important of them being The Book of Abstracts and a very beautiful and ingeniously designed seminar mug (Fig. 3). The cover of the Book shows a colony of *Dreissena*, as well as *Lymnaea* and its parasites (both specialties of the Toruń team). On the mug there is a

snail (design TOMASZ K. MALTZ) with the shell representing planets and their orbits – no doubt to remind us that Toruń was the place where the famous astronomer Mikołaj Kopernik lived and worked.

In the Table 1 have tried to do what I often do when writing a report, namely to compare the proportion of contributions to various disciplines in Poland and worldwide, but here I have taken a slightly different approach. The division into disciplines is the same as that adopted in the previous seminar reports. Columns 3–5 show the numbers and percentages of contributions to the various disciplines from the 34th Seminar (column 5), compared to the earlier Seminars (column 3) and the general trends at the Euromal 2017, column 4). The aim of the comparison is to see if the worldwide trends have had any effect on the topical structure of malacology as practiced in our country. In other words: are there some people thinking 'well, phylogeography is now fashionable, shall I write a phylogeographic paper?'

Except for Ecology & Conservation and Miscellaneous, there are great differences (no doubt statistically significant, though not "officially" supported by any statistics) within the disciplines between all three or two of the categories shown in columns 3 to 5. The lack of obvious differences in Ecology & Conservation is easily explainable (the discipline has been popular for a long time and still



Fig. 3. The Main Organiser (in the middle) and two participants, all apparently satisfied

Table 1. Topical structure of the Polish Malacological Seminars 2007–2016, the EuroMal according to the criteria adopted in the seminar reports, and the 2018 Seminar

No.	Discipline	2007–2016	Euromal	2018
1	Ecology & Conservation	187 (31.6%)	64 (25.5%)	9 (22%)
2	Applied Malacology & Parasitology	77 (13.0%)	17 (18.1%)	4 (9.8%)
3	Miscellaneous: general, behaviour, archaeology, collections, history, education, methodology	67 (11.3%)	10 (13.0%)	5 (12.2%)
4	Systematics/Phylogeny (including molecular)	39 (6.6%)	33 (45.8%)	9 (22%)
5	Biogeography & Faunistics	53 (9.0%)	18 (25.4%)	2 (4.9%)
6	Life Histories	60 (10.2%)	6 (9.1%)	9 (22%)
7	Fossil Molluscs	45 (7.6%)	15 (25.0%)	5 (12.2%)
8	Structure (histology, cytology, shell) & Variation	33 (5.1%)	6 (15.4%)	5 (12.2%)
9	Physiology	30 (5.1%)	4 (11.8%)	1 (2.4%)

is), as is that in Miscellaneous (a collection of topics addressed with varying frequency, but not regularly, at malacological conferences). Do the disciplines with frequencies varying among the categories show any trend(s)? Applied Malacology & Parasitology (probably as a result of pest and parasite species of medical and economic importance being rather few in Poland, this in turn being a consequence of our geography and climate, and despite the large number of very active “applied” people in Poznań and Toruń) are more popular worldwide than they are in Poland. The same is true of Systematics/Phylogeny (though the proportion of such papers seems to have increased in Poland, probably mainly as a result of increasing

availability of molecular methods and the activities of the strong team from Jagiellonian University), Biogeography & Faunistics (this is surprising, but maybe less so in view of the fact that nowadays biogeography uses molecular methods, while faunistics usually has conservational aspects), Fossil Molluscs (not very many malaco-palaeontologists in Poland, many presenting their results elsewhere), Structure & Variation (the proportion of such papers published by our authors seems to have increased compared to such proportion in 2007–2016; is it the effect of the EuroMal or the advent of new techniques such as computer microtomography?), and Physiology (only few people in the country deal with mollusc



Fig. 4. In the dungeons of the old fort



physiology and those mainly present their results at non-malacological fora). It is obvious from the Table that one discipline is our pride and joy: Life Histories. This is reflected in both the proportion and in the absolute numbers (of the papers and of the authors: now we have more than ten active students of mollusc life cycles!). On the whole, for a variety of reasons, we follow the trends of our own rather than the global ones.

The snail:bivalve ratio was 2:1 (there was also one cephalopod taxon: squids) (the mean ratio for the Seminars since 2010 was 2.7:1, at the EuroMal 1.3:1), the land:water ratio was 0.9:1 (Seminar mean 1.5:1, EuroMal 0.5:1). The ratio of one-author contributions to contributions with two or more authors was 1:2.5 (Seminar mean 0.9:1, EuroMal 1:4), and

the numbers of papers/posters presented by girls versus boys were: girls 12, boys 5, mixed teams 24.

The social events included a very good barbecue in an old fort (instead of the traditional banquet) (Fig. 4), a visit to a pub with an enormous variety of beers, some of them local and impossible to get anywhere else, and a trip to Dobrzyń-Golub where we visited the old castle and had coffee in a good restaurant.

The abstracts below include all the abstracts from the Abstract Book, most of them translated and some tweaked a bit by the author of this report.

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## ABSTRACTS OF THE 34TH POLISH MALACOLOGICAL SEMINAR

### MALACOFAUNA OF LATE HOLOCENE DEPOSITS OF THE FALSZTYŃSKI STREAM IN EASTERN PODHALE

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Alluvial deposits on a low terrace along the Falsztyński Stream in eastern Podhale were analysed with respect to their malacofauna. The deposits are fine- and medium-grained gravels and sandy silts. The alluvial series rests on much calcified sandstones. Its thickness varies along the stream and the maximum is 2 m. Field observations revealed five levels of gravels and five levels of silty-sandy deposits; the latter contained a rich malacofauna and plant remains. The stream was originally a right-bank tributary to the Dunajec; now, after the dam in Niedzica has been constructed, it falls in Lake Czorsztyńskie. The valley has a relatively wide, flat floodplain and a V-shaped cross-section only in its highest part. At the end of the 20<sup>th</sup> c. its slopes and bottom were deforested and turned into agricultural land. During recent years the agricultural activity has become much limited, resulting in forest expansion. Nine profiles were examined (one in the lowest part of the valley, now flooded by the artificial lake), with 100 samples (54 contained identifiable mollusc remains). Gravel samples were devoid of mollusc shells or contained only unidentifiable fragments. The silts contained a rich and well preserved malacofauna, with 61 terrestrial taxa, two

aquatic snails and vestigial slug shells. The number of taxa per sample ranged from nine to 44, that of specimens from 100 to 593, the total number of identified specimens being close to 13,000. The species represented all the main ecological groups. Shade-loving species (mainly typical of closed-canopy forests) were the most abundant. The shade-loving species were the most abundant in the lower parts of the profiles and less so in the top parts. Four species were characteristic of open habitats and were very abundant in the top parts of the profiles where they dominated. Euryoecious (mesophile) species occurred in all samples but constituted only a minor part of the fauna. Hygrophilous species (group H) appeared rarely, while aquatic molluscs formed a negligible component of the assemblage. The faunal analysis, lithological data and determination of the deposits' age made it possible to reconstruct the environmental changes from the end of the middle Holocene till present. The mollusc assemblages indicate a dominance of shaded habitats nearly throughout the deposition period. Originally, they were mixed forests, and the proportion of conifers increased with deteriorating conditions of vegetation in the Subboreal phase. The change brought about a decrease in species richness of snail assemblages, especially disappearance of stenoecious taxa. The rapid change in habitats during the Middle Ages was associated with the warm period of the Mediaeval Climate Optimum, when large human groups appeared in Podhale. The necessity to gain arable land and pastures led to extensive deforestation, mainly in areas with mild relief and wide river valleys, among them the valley of the

Falsztyński Stream. These processes are reflected in the disappearance of the rich assemblages dominated by shade-loving species and their replacement by poor communities composed mainly of open-country taxa. The presence of gravel intercalations and strata which maintain their continuity over long stretches of the valley makes it possible to correlate phases of intensive fluvial activity with humid climate periods in the Polish Carpathians. Five gravel strata could be distinguished in the Falsztyński Stream valley. Radio-carbon dating shows that the phases fall on the end of Atlantic phase and the oldest part of Subboreal phase, middle part of Subboreal phase, boundary of Subboreal and Subatlantic phases, younger part of Subatlantic phase and the last 200 years. Their chronology correlates well with similar schemes based on other Carpathian river valleys, phases of increased mass movements, periods of glacier advance in the Alps and Scandinavian Peninsula and with phases of high water level in lakes of the European Lowland and the Alps' foreland. Some departures from these patterns can be probably explained by the effect of local factors resulting from the valley's specificity and particular morphological and climatic conditions of the whole Podhale basin.

#### THE POLISH *CEPAEA NEMORALIS* SURVEY: PRELIMINARY RESULTS

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The shell colour and banding polymorphism of the land snail *Cepaea nemoralis* (L.) has attracted attention for more than a century. Local and regional surveys, including the whole of its range, have revealed patterns of habitat- and climate-related variation that reflect the operation of natural selection. They have also, however, revealed patterns associated with genetic drift and founder effects, and the strength of these patterns varies with location and the history of the populations concerned. As an easily-studied example of microevolution, this polymorphism was made the subject of a large-scale public participation project, the Evolution MegaLab (Silvertown, J. et al., 2011. Citizen Science Reveals Unexpected Continental-Scale Evolutionary Change in a Model Organism. PLoS One, 6(4): e18927. doi:10.1371/journal.pone.0018927). The MegaLab included in its analyses some data from Poland. However, there have been many later surveys within the country, greatly increasing the volume of data available. Małgorzata Ożgo therefore initiated a survey within Poland, tak-

ing both the results of published local surveys and inviting the submission of new records following a defined protocol. This programme of submission ran through 2014 to 2017. Altogether, there are 1,048 populations that are accurately located and contain more than 20 shells scoreable for the polymorphism. The total number of shells examined is 118,128 and the mean number of shells per sample is 113. About two thirds of the samples are taken from published accounts from 1984 onwards; the remainder are unpublished records sent in by contributors who will be included as authors in the published outcome, as will Michal Horsák from Brno, Czechia, who has done most of the statistical analyses. The samples are not evenly distributed in geographical terms; most come from the western or northern parts. Nevertheless, there are a number of trends that can be detected across the country. While brown shells are uncommon overall (c. 6% of all shells) they are significantly more frequent in the north, and this correlates well with lower mean annual temperatures and small seasonal variation in rainfall. Less evidently, midbanded shells are less frequent in the south-west than elsewhere, and there is a big change in the direction of the linkage disequilibrium between colour and banding from north (unbanded commoner in pink than in yellow shells) to south (the reverse). There are effects of habitat, but these are not found in all parts of the country. In the north and east, brown shells are significantly higher in frequency in shaded habitats than in the open, while the reverse is true for yellow shells that appear unbanded from above; there is no trace of this relationship in the south west (Wrocław). Most populations are very polymorphic. There are few large scale geographical patterns, and the regional contribution to overall variance, measured by  $F_{st}$  is low (c. 18%). Using Moran's I as an indication of distance decay in genetic similarity among populations reveals a sharp decline in similarity over a distance of about 50 km. Given that *C. nemoralis* is an introduced species in most of Poland, it would appear that a combination of selection and both long- and short-distance dispersal events accounts for many of the patterns seen. We are carrying out further analyses. In the meantime, we are archiving the data, and arranging that they will be publicly accessible. It will also be possible to add data from more populations. In this way, we hope that it will be possible to track changes over time, a robust way of investigating the factors that account for variation within and among populations.



## DIFFERENTIATION OF THE MALACOFAUNA OF EPILITHIC HABITATS IN THE PIENINY MTS IN RELATION TO SELECTED ECOLOGICAL FACTORS

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Around 106 species of terrestrial gastropods occur in the Pieniny; they represent various ecological and zoogeographical groups. The communities include gastropods of open and forest habitats, thermophilous and montane components. Compared to other Carpathian mountain ranges in Poland, the Pieniny malacofauna is distinct in the presence of calciphilous and thermophilous forms which inhabit rock faces. Because of the increasing anthropopressure in the Dunajec valley and the climatic changes associated with the construction of the Czorsztyn Reservoir, the epilithic ecosystems and their typical fauna are threatened by unfavourable changes. In order to ascertain which ecological factors determined the diversity and structure of snail communities of rock outcrops we performed biocoenotic analysis of seven localities in the Pieniny National Park. In each site samples were taken from eight 50x50 cm quadrats. Besides, larger snails were collected by eye in the nearest neighbourhood. For each sample we measured the slope and exposition of the rocks, shadiness, and noted the presence of crevices and plant cover. The material included 2,971 specimens (2,783 of them in quantitative samples), representing 39 species (35 in quantitative samples). The mean number of species per site was 16.9 (maximum 22 in Macelowy), and per 0.25 m<sup>2</sup> 4.93 (maximum 6.5). The density ranged from 87.5 individuals/m<sup>2</sup> in Ociemny E to 368 individuals/m<sup>2</sup> in Macelowy. Species of the greatest frequency and abundance were regarded as characteristic of the epilithic habitats of the PNP: *Truncatellina cylindrica* and *Pyramidula pusilla*. The mean density of their populations was 68.86 individuals/m<sup>2</sup> and 29.29 individuals/m<sup>2</sup>, the maximum values being 177 and 110 individuals/m<sup>2</sup>. Multidimensional analysis showed that the composition and structure of the epilithic fauna was mainly determined by the slope and presence of vegetation (CCA: axis I; 43% of variation) as well as shadiness (CCA: axis II; 34.7% of variation). The Pieniny National Park has a protection policy aimed at preserving the diversity of non-forest habitats which increases the chances of preserving the unique epilithic habitats with their petrophile malacofauna.

## SINGLE OR MULTIPLE BROODS? COMPARISON OF REPRODUCTIVE STRATEGIES OF EUROPEAN UNIONIDS

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Freshwater bivalves are important components of aquatic ecosystems; they provide ecosystem services, food source and materials (shells, pearls) and are often called ecosystem engineers. At the same time they are among the most endangered animal groups worldwide. The dramatic drop in their abundance may be associated with their complicated life cycle involving parasitic larvae (glochidia) which need fish hosts to metamorphose. Though a single female can release hundreds of thousands of glochidia during one reproductive season, the probability of their survival till metamorphosis is very small, ca. 0.000001%. Unionid species differ in their reproductive strategy. On the whole, members of *Anodonta* lay eggs in summer or autumn, their glochidia are retained in marsupia till the next spring and then released through the exhalant siphon (e.g. *Anodonta anatina*, *A. cygnea*). Species of *Unio* can produce one to five broods each year, usually in spring and summer months (e.g. *Unio crassus*). The aim of our study was to compare two unionid reproductive strategies: single brood strategy (SBS) and multiple brood strategy (MBS) with simulation using a mathematical model considering stochastic environmental conditions. The simulation was done for 100 consecutive reproductive seasons. In each season an event precluding reproduction (e.g. lack of hosts, flood) could occur with probability  $P_1$ ; an event facilitating reproduction (stocking with host species) could occur with probability  $P_2$ , while  $P_3$  was the probability of no events that would affect reproduction. Three scenarios were considered: (A) "good", where  $P_1 < P_2$ ,  $P_1 = P_3$ , (B) "neutral", where  $P_1 = P_2 = P_3$  and (C) "bad", where  $P_1 > P_2$ ,  $P_2 = P_3$ . The SBS and MBS strategies were compared based on the results of 1,000 simulations for each of the scenarios. We compared differences in the mean and median number of individuals, variation coefficients and probability of extinction between SBS and MBS populations. For scenarios (A) and (B) the SBS strategy was more profitable. In scenario C the MBS strategy was better, and the probability of extinction during 100 simulated reproductive seasons decreased with the increasing number of broods in the season.

## POLISH NAMES OF SNAILS AND BIVALVES

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Names of animals, plants and fungi are an interesting object of studies for linguists. They study the linguistic picture of nature, names of animals and – less often – plants, names of plant varieties, as well as vernacular names of components of fauna and flora. My presentation deals with names of selected mollusc species found in Polish malacological publications. Both parts of the animal's name were subject to linguistic analysis: generic name and specific name. Semantic motivation for snail and bivalve names was presented. The analysis was aimed at showing which of the motives for mollusc names (morphological characters, geographical origin, behaviour, scientist's name and others) were the most and the least frequent. For comparative purposes Latin nomenclature was also used.

## HABITAT PREFERENCES OF THE ZEBRA MUSSEL IN RELATION TO VARIOUS SPECIES OF UNIONIDS

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The zebra mussel (*Dreissena polymorpha*) is an invasive sedentary bivalve and may pose a considerable threat to the native fauna, especially to the Unionidae whose shells are used as a substratum. Our objective was to check, both in the field and in the laboratory, which unionid species were preferred by the zebra mussel and how its presence affected the weight of the studied individuals. Our field study during which we collected *Anodonta anatina*, *A. cygnea*, *Unio pictorum*, *U. tumidus* and the alien *Sinanodonta woodiana* from sandy and muddy substrata showed that *A. anatina* and *S. woodiana* were the most overgrown by the zebra mussel while *A. cygnea* and *U. tumidus* were the least affected. The percentage of mussels attached directly to the host's shell (in relation to the attached conspecifics) was in negative proportion to the total biomass of the mussels on the host. Besides, considering the differences in the mussel biomass, on the sandy substratum the index was smaller in *Unio* spp. than in *A. anatina* and *S. woodiana*, and on the muddy substratum – smaller in *A. cygnea* than in the

remaining species. Mussel-covered individuals of *S. woodiana*, collected from the muddy substratum, had a smaller biomass than the remaining species. The field experiment in which unionids were exposed to settling of zebra mussel larvae in plastic baskets suspended in the water (no substratum) showed that *A. anatina* and *S. woodiana* were more overgrown than the two species of *Unio*, thus confirming the above result. In the laboratory experiment, with multiple choice and with or without the possibility to bury in the substratum, the most avoided species was *U. pictorum* and also *S. woodiana* (the latter only in the variant with the possibility of burying). No unionid was preferred to stone substrata of similar shape and size. The zebra mussel preferred some unionid species which was associated not only with the degree to which their shells were exposed above the sediment but also, as shown by the experimental studies, with active selection of substratum. Besides, the zebra mussel preferred unionid shells to those of conspecifics, but unionid shells were not preferred to other available materials, for example stones. Since unionids constitute a significant source of hard substratum for the settling zebra mussel larvae in many water bodies, their species composition may be important for the success of *D. polymorpha* in invading such waters.

## MELANOPSIDAE – ANOTHER CASE OF MORPHOSTATIC EVOLUTION

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The recent Melanopsidae are estimated to include 25–50 species, though more than a thousand species have been described. They inhabit freshwaters of southern and south-eastern Europe, northern Africa and Near East, as well as New Zealand and some Pacific islands. Their massive, thick-walled shells are smooth or have more or less pronounced ribs and/or spiral sculpture. The morphology and anatomy of soft parts are simplified, for example there is no penis since it is spermatophore that is transferred; as a result the melanopsid systematics is based exclusively on shell. Some authors demonstrated and emphasised the continuity of variation in sculpture and proportions, suggesting that only one species occurred in the Mediterranean Sea: *Melanopsis praemorsa*, described by Linnaeus. Other authors distinguished a few species, including the widely distributed *M.*



*buccinoidea* with smooth shell, and a ribbed *M. costata*; even in fossil material they pointed to narrow hybrid zones, with specimens of poorly developed ribs. We sequenced DNA in four loci (COI, 18S, 24S, H3), in the Melanopsidae from the islands of the Aegean Sea, Peloponnesus, Israel, Iraq, Croatia, Romania and Austria. Though the *terra typica* stated by Linnaeus for *M. praemorsa* was southern Europe, we assumed that Linnaeus had access to materials from France or Spain rather than to the hardly accessible sites in the Ottoman Empire, which, combined with the disjunct range (no *Melanopsis* in Libya and Egypt, as well as between the south of France and Peloponnesus) excludes the presence of the species in the east. *M. buccinoidea* was described from "Chios and other islands of the Aegean Sea, Crete and Levant". Our studies showed species distinctness of individuals from Chios and Lesbos, and according to the priority rule *M. buccinoidea* occurs only there, while snails recorded under the same name from the other islands and the Near East and not conspecific with them. We demonstrated the occurrence of a distinct species in the islands of Naxos and Samos, and another – widely distributed – in the Peloponnesus, Rhodes and a single specimen from Israel. The shells of all three taxa are similar, not to be distinguished, and always smooth. In Israel we found two species which, besides smooth shells, included shells with more or less pronounced ribs. Yet another time the morphology failed to reflect phylogenetic relationships. We demonstrated the distinctness and relationships of Central European *Microcolpia*, *Esperia* and *Holandriana*, excluding the occurrence of *Melanopsis* in that area. Dating with molecular clock showed that the main evolutionary lineages separated during the Miocene as a result of consecutive invasions from the sea to freshwaters which was confirmed by the fossil record. The morphological variation in some species – while there is no such variation in other species – is not combined with molecular differentiation which has not led to any morphological changes; this is yet another example of morphostatic evolution in Caenogastropoda.

#### SNAILS OF THE GENUS *LITHOGLYPHUS* IN QUATERNARY DEPOSITS OF EUROPE

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Snails of the genus *Lithoglyphus* are fluviatile or fluviatile-lacustrine species. These small snails appeared in Europe in the Neogene. Their extant representatives prefer muddy and sandy bottom, they also attach to rocks or aquatic plants. Shells of fossil species are mainly found in silts, gyttias, clay and sands.

Quaternary deposits of Europe yielded eight species of the genus *Lithoglyphus*. Six of them are still extant (*L. naticoides*, *L. krasnenkovi*, *L. prasinus*, *L. apertus*, *L. pygmaeus* and *L. fuscus*), and their range is mainly limited to Central and Eastern Europe. Two species which became extinct at the end of the Mazovian Interglacial (MIS 11), *L. jahni* and *L. pyramidatus*, have a stratigraphic significance – they delimit the upper boundary of the age of the deposits in which their shells are found. Their names are often regarded as synonyms, while the distinctness of the two species is still debateable and requires further studies. Except *L. naticoides*, the information on habitat preferences of the members of *Lithoglyphus*, biological and behavioural data, are very limited. Their spread is not monitored. Observations of the extant species would certainly contribute to the interpretation of their habitats and those of their fossil counterparts.

#### INTROGRESSION OF MITOCHONDRIAL DNA IN THE GENERA *HAUFFENIA* AND *KERKIA* (CAENOCASTROPODA: HYDROBIIDAE)

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The reconstruction of evolutionary history of organisms should be based on the association between the morphological differentiation and genetic variation. It can be difficult for many reasons, for example occurrence of cryptic species, erroneous taxonomy, often based exclusively on morphological data, or introgression, including introgression of mitochondrial DNA (mtDNA). Snails of the family Hydrobiidae Troschel, 1857 include more than 400 genera, and there are no molecular data on many of them. Our phylogenetic analysis of the members of the genus *Kerkia* Radoman, 1978, included six populations in Slovenia and Croatia. We sequenced a fragment of mtDNA, and three nuclear markers. The analyses confirmed the genetic distinctness of four species of *Kerkia* and showed the presence of two more distinct clades. Besides the snails of the genus *Kerkia*, we analysed three populations of *Hauffenia* Pollonera, 1899, which also proved to be genetically distinct. Genetic comparison with the use of reference sequences showed that the two genera were not sister groups. Moreover, we discovered introgression of mtDNA of "Hauffenia" type from the middle-Slovenian popula-

tion to the members of two clades *Kerkia* from central and southern Croatia. The introduced type of mtDNA was the most similar to the DNA of *Hauffenia erythropomatia* (0.8% difference). Probably the introgression is a relic of the past hybridisation of the two genera. Study financed by K/ZDZ/007345.

#### LONG-TERM CHANGES IN THE MALACOFAUNA OF A SMALL LOWLAND RIVER IN AN AGRICULTURAL AREA IN EASTERN POLAND

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The Muchawka river is the largest tributary to the Liwiec, the main river of the Siedlce Upland. It flows through agricultural areas and is not much polluted with communal or industrial waste. The knowledge of its fauna is limited to inventories and annual assessments of water quality. This encouraged us to undertake detailed studies on the mollusc fauna of the river. In 1999–2000 we recorded 12 mollusc species: 7 snails and 5 bivalves in the Muchawka. In the two years of studies the dominant was *Pisidium amnicum* (O. F. Müller). Co-dominants were *Sphaerium rivicola* (Lamarck), *Lymnaea stagnalis* (Linnaeus) and *Bithynia tentaculata* (Linnaeus). In four sites in the upper and middle section of the river we found *Unio pictorum* (Linnaeus). Less frequent were *Anodonta anatina* (Linnaeus) and the protected *A. cygnea* (Linnaeus). Studies in the same sites in 2016–17 showed the occurrence of 19 species: 11 snails and 8 bivalves. The dominant was *Pisidium casertanum* (Poli). A large proportion was formed by two sphaeriids – *P. subtruncatum* Malm and *Sphaerium corneum* (Linnaeus). Sphaeriid bivalves constituted more than 80% of all molluscs. Among snails the most abundant were *Bithynia tentaculata* and *Bathymphalus contortus* (Linnaeus). The presence of the protected *Unio crassus* Philipsson is noteworthy; it was not recorded in the earlier study. Only seven species were recorded in both periods of studies. The greater species richness of the malacofauna in the last period may indicate good environmental conditions which is confirmed by the physico-chemical parameters of the water.

#### DAMAGE TO PLANTS OF THE FAMILY POACEAE BY *DEROCERAS RETICULATUM* (O. F. MÜLLER) AND *ARION VULGARIS* MOQUIN-TANDON

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Grasses (Poaceae Barnh.) are damaged by many species of agrophages, including slugs of the genera *Deroceras* and *Arion*. They feed on seeds and green plant matter near the soil surface; they show distinct preferences for particular species, varieties or forms. To date there was little information on food preferences of slugs feeding on grasses. In laboratory experiments we exposed five species of meadow grasses as well as wheat to feeding by *Deroceras reticulatum* and *Arion vulgaris*. We observed considerable differences in the degree of damage, depending on the species of plant and slug. *Poa pratensis* and *Festuca rubra* showed a higher susceptibility to damage. Our studies provide data on the damage to *F. rubra*, *Festulolium* sp., *Bromus catharticus*, *Poa pratensis* and *Lolium multiflorum*, compared to winter wheat (*Poa aestivum*) by slugs.

#### COMPARATIVE ANALYSIS OF MOLLUSC DIVERSITY IN VARIOUS WATER HABITATS IN THE LIWIEC CATCHMENT AREA

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Malacocoenoses of five types of water habitats in the Liwiec catchment area were sampled: the main channel of the Liwiec, side channels of the river, six tributaries, as well as natural water bodies and ditches on the floodplain. Species richness, diversity, density, species composition and structure of the malacocoenoses of the habitats were compared in order to estimate their significance for the diversity of the malacofauna. Spatial structure of mollusc diversity was also analysed based on the Jaccard coefficient and the proportion of alpha and beta diversity on various spatial scales. Fifty four mollusc species were recorded during five years, including three from the IUCN red list or Annexes II and IV of the UE Habitats Directive: *Unio crassus*, *Sphaerium rivicola*, *Anisus vorticulus*. The number of species, diversity (Shannon index) and density in most cases showed no statistically significant differences between the habitats, only the mollusc density in the main channel of the Liwiec was significantly smaller compared to the oth-



er habitats. The malacofauna of still water habitats was slightly poorer compared to the rivers, but such habitats proved important for populations of many species inhabiting small water bodies. Ditches, the only anthropogenic habitats, had a rich malacofauna, including the relatively rare *Gyraulus laevis* and a few extinction-threatened species of small water bodies. The composition of the malacofauna varied widely in all kinds of habitats; the similarity in species composition was the smallest among the small water bodies and ditches. The similarity among the five kinds of habitats was rather high, indicating their connectedness. The species richness of molluscs in the Liwiec catchment area to the largest extent depended on the between-habitat diversity which was the greatest in the main channel. The greatest intra-habitat diversity (alpha diversity) was observed in the side channels of the Liwiec.

#### ELECTROPHYSIOLOGICAL ANALYSIS OF THE EFFECT OF CANNABINODIOL ON THE SOLE EPITHELIUM OF *ACHATINA FULICA*

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Cannabinoids are active substances which are responsible for most of the known properties of marijuana. The most important compounds of this group are tetrahydrocannabinol (THC) and cannabiodiol (CBD). Two specific cannabinoid receptors are known: CB1 and CB2, of different affinity and localisation. The mechanism of their effect consists most of all in inhibition of adenylate cyclase, calcium channels, inducing genes of fast transcription. As opposed to THC, cannabiodiol shows no psychoactive effect, since it does not bind to cannabinoid receptors in significant quantities. However, it affects other structures, i.e. ionic channels, receptors and enzymes, and has an anti-inflammatory, pain-killer and anti-epileptic effect; it inhibits cell proliferation and prevents disturbances in blood supply. The objective of our study was electrophysiological analysis of the effect of cannabiodiol on the sole epithelial tissue of *Achatina fulica*. The material included 8 fragments from 8 individuals of *A. fulica* (from our own culture). We isolated foot epithelium with the thinnest possible muscular layer. We used modified Ussing's method. The experiments consisted in rinsing the surface of the tissue, and the delicate flow of liquid was the stimulus. We used two kinds of stimuli: me-

chanical (control) using physiological fluid, and mechanical-chemical (experimental), with physiological fluid with addition of cannabiodiol (10 micromole). The experimental design included a series of 60 second stimulations, with ca. 5 minute interval (control stimulation – experimental stimulation – control stimulation). The results were statistically analysed using Statistica12. Changes in differences of transepithelial electric potential (dPD) and the amplitude of the potential during stimulation were subject to detailed analysis. The experiments showed that cannabiodiol increased the amplitude of the difference in transepithelial electric potential during stimulation ( $p < 0.001$ ), but it had no effect on dPD, i.e. changes in the differences in potential. Control stimulations "before", and "after" did not differ, showing that cannabiodiol acted only during the stimulation. The problem requires further research, since the observed changes in the amplitude present a new phenomenon, previously not observed.

#### DO AMPHIBIANS RENDER TRANSPORT SERVICES TO SNAILS?

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Phoresis consists in transporting an organism by another organism to a new habitat. It is a common phenomenon among animals of limited mobility. Till now there are no literature data on such interactions between snails and amphibians. During field observations we found for the first time evidence of phoretic interactions between snails and amphibians. Five such cases were observed in south-western Poland. Two pertained to tree frogs (*Hyla arborea*) found in a disused swimming pool in Wrocław. Each bore a juvenile helioid snail on its body. The other observations involved toads (*Bufo bufo*) migrating to their mating grounds in the village of Domaszczyn near Wrocław. On the back of one male we found *Arianta arbustorum*, and a couple in amplexus bore a clausiliid each. The fifth case was the observation of snail eggs with developing embryos attached to a toad. All the cases were photographed and described in detail.

FROM A MALACOLOGIST TO THE FROG KING –  
ABOUT PROF. DR HAB. LESZEK BERGER

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Prof. dr hab. Leszek Berger passed away on July 8th 2012 in Jaskółki near Ostrów Wielkopolski. He was a world-famous specialist on green frogs and the pioneer of herpetological studies on southern Wielkopolska. Professor Berger was born on February 10<sup>th</sup> 1925 in Pabianice. He spent his childhood and youth in Lewkowiec on the river Ołobok. In 1947 he finished Boys' Comprehensive School in Ostrów Wielkopolski. Inspired by the richness of local nature he continued his education at the Faculty of Mathematics and Natural Sciences (biological section), Poznań University. His master's and doctoral theses were "Mięczaki Pojezierza Mazurskiego" [Molluscs of the Masurian Lakeland] and "Mięczaki pogranicza Wielkopolski, Śląska and Jury Krakowsko-Wieluńskiej" [Molluscs of the boundary of Wielkopolska, Silesia and Cracow-Wieluń Jura], respectively. While at the university, he started studies on the origin and agricultural significance of alluvial soils; the studies were to comprise the whole of Poland; the herpetofauna of the Wielkopolski National Park was to be included. Later, for reasons beyond his control, Prof. Berger had to resign his malacological studies and focused on amphibians. During 50 years he maintained a culture of green frogs first in Poznań, and then in Jaskółki near Ostrów Wielkopolski. His studies showed that the commonest frog in Europe, *Pelophylax esculentus*, was not a species but a natural hybrid between *P. lessonae* and *P. ridibundus*, which arose through hybridogenesis. In 1981 he became extraordinary professor and in 1990 ordinary professor. During all his professional life he was employed at the Department of Agricultural Environment and Forestry Studies, Polish Academy of Sciences in Poznań. In 1989 Prof. Berger organised a meeting of herpetologists in Turew. Thanks to this initiative the Polish Herpetological Conferences are regularly held in Kraków till today. He was author of more than 120 publications and more than 40 contributions to national and international conferences. He was actively involved in natural history education in southern Wielkopolska. Prof. Berger was the initiator and scientific supervisor of the project of the south-Wielkopolska group of Bird Protection Society "Płazy i gady Południowej Wielkopolski" [Amphibians and reptiles of southern Wielkopolska]. For his achievements he was awarded the first degree award of the Polish Academy of Sciences. His activities in the region were recognised and he got an award of the President of the City of

Ostrów Wielkopolski. Professor Berger was a very open, outgoing and magnanimous person. In spite of his great achievements he was a very modest man. He left us suddenly and unexpectedly, having spent his last moments with his family. His resting place is on the boundary of the nature reserve "Żurawiniec" in Poznań, where he started his adventure with amphibians.

LIFE STRATEGY OF THE THERMOPHILOUS  
BIVALVE *RANGIA CUNEATA* (MACTRIDAE)  
WHILE COLONISING SOUTHERN BALTIC –  
A DEAD END OR A ROAD TO SUCCESS?

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*Rangia cuneata* comes from subtropical estuaries of the Atlantic coast of America. It is a typical r-strategist, with high reproductive rate (iteroparous), small size, wide tolerance to changing environmental factors, short life cycle and low sensitivity to stress. These characters facilitate invasion of unstable ecosystems and potentially – of new territories. In the Polish territorial waters it has been present since the 2010s and has formed prosperous populations in the delta of Vistula (Wisła Śmiała and Wisła Martwa), and in the Gulf of Vistula. It is also sporadically found in the Puck Bay and Pomeranian Bay, as well as in the Kamieński Reservoir. In the Vistula delta and in the Gulf of Vistula the species reaches densities of the order of 1,000 individuals/m<sup>2</sup>, thus exceeding several times the values reported from its native range. Its population in the Vistula delta is stable and undergoes no significant year-to-year changes. The one in the Gulf of Vistula shows very great fluctuations, with declines in 2013, 2015 and 2017. Preliminary data on the sex ratio of the populations suggest that males predominate and show a better condition. Non-specific histopathological changes in the alimentary tract were observed which may suggest extensive inflammatory changes. Attempts at explaining the phenomena raise the following questions: 1. What are the reasons for the great abundance fluctuations of *R. cuneata* in the Gulf of Vistula (as opposed to the stable population of the Vistula delta) and how do they affect the population structure of the species? 2. Do long-lasting winters deplete the energy reserves of the bivalves, resulting in decreased condition, increased stress level, immunosuppression (secondary infections), exhaustion



and mass mortality? 3. Is the evolutionary strategy (energy investment in fast growth and shell building in native conditions), associated with anti-predator defence, too costly for the bivalve's energy budget? 4. Do energy expenses for osmoregulation and reproduction affect the growth rate and reproductive success in waters of different salinity: Vistula delta and Gulf of Vistula? 5. Can the evolutionarily fixed life history of a species serve as predictor for colonisation of new areas in the present conditions, also in the future, as a result of microevolutionary changes (adaptations) and in view of the progressing global warming? We have at least partial answers to some of these questions, the others provide a basis to formulate hypotheses to be falsified in future studies.

#### REPRODUCTION AND GROWTH OF *XEROLENTA OBVIA* IN LABORATORY CONDITIONS

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*Xerolenta obvia* (Menke, 1828) is an expansive, Ponto-Caspian species which is expanding its range in Europe, migrating along rivers and railway embankments. It mainly occurs in open, well insolated habitats with short vegetation on calcium-rich substratum. Our aim was to ascertain selected parameters of biology and growth rate of *X. obvia* in laboratory conditions. The material (eggs and individuals of various age) was collected in October 2015, June 2016, May and October 2017 in a xerothermic habitat in Piotrkowiczki (Lower Silesia). The snails were kept in Petri dishes and in containers in an environmental chamber under constant temperature, humidity and photoperiod, and in a terrarium in a room where the temperature and humidity depended on the season. From early juvenile stages the snails were kept singly, in pairs and in groups of a few specimens. The eggs of *X. obvia* were oval or nearly spherical (1.2–1.6 × 1.2–1.8 mm) milky white, calcified, mostly laid in batches (15–65) but also singly. They were deposited in hollows dug in gravel or on damp tissue paper. The egg-laying lasted from October till April. Juveniles hatched in 11–28 days; their shells had 1.5–2.0 whorls; hatching within the batch was asynchronous. The hatching success of individuals kept in groups or pairs was 30.62%. No uniparental reproduction was observed. There were no cases of cannibalistic behaviour. The snails attained sexual maturity (first egg laid) when their shells had 5.0–5.3 whorls. The mean growth rate was 0.01 to 0.59 whorl/month. Minimum and maximum growth

rate was observed at different stages of growth in different individuals. The difference in growth rate between the snails kept singly and in groups was small. The growth till ultimate size took ca. 20 months. In the laboratory the life span was 2–3 years.

#### GROWTH RATE OF *XEROLENTA OBVIA* IN NATURAL CONDITIONS OF DIFFERENT CLIMATE

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*Xerolenta obvia* (Menke, 1828) is a medium-sized snail (shell 6–8 × 12–17 mm) of Pontic origin. Its range extends from Asia Minor through the Mediterranean, the Balkans, the Carpathians, along the Baltic coast, to France. In Poland it inhabits dry open habitats, including railway embankments and verges. The observations were conducted from May 2015 to May 2017, in parallel in two populations in Poland: south-western in Piotrkowiczki (Lower Silesia) and north-eastern in Żytkiejmy near Suwałki. The two sites differ considerably in their climate conditions. The north-east is one of the coldest regions, with a short vegetation season, the south-west is the warmest part of Poland. In the sites we selected sampling plots of ca. 25 m<sup>2</sup>; snails were collected monthly during one hour. Live individuals were marked with nail varnish (each month a different colour) in such a way that the increment could be read on recapture. On each recapture the snail was marked again. The snails were released in the place of capture. The two populations of *X. obvia* differ morphologically. The shells of the south-western population are larger. At the same number of whorls they are by 1–2 mm wider than those from the north-eastern population; the shell height is the same in both populations. The maximum observed shell width in the Piotrkowiczki population was 16.12 mm, in the Żytkiejmy population 14.08 mm; the respective maximum height was 7.85 and 7.91 mm. Three types of shell colouration were distinguished: white, banded with distinct dark bands and banded with very light and poorly visible bands. Banded shells with distinct dark bands predominated in the south-western population (89%), while the north-eastern population was dominated by white shells (60%). The growth rate (in terms of whorl increment) depended on the initial size of the shells. The smaller the snail, the larger its monthly increment ( $r = -0.6$ ;  $p < 0.0001$ ). The snails from Piotrkowiczki grew faster; their

mean monthly increment was 0.6 whorl, compared to 0.3 whorl in Żytkiejmy. The mean cumulative increment during the vegetation season (5–6 months) in the south-western population was 1.3 whorl, in the north-eastern population it was 0.9 whorl.

SPATIAL AND TEMPORAL CHANGES IN ABUNDANCE AND DISTRIBUTION IN A POPULATION OF *VERTIGO MOULINSIANA* (DUPUY, 1849)

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Life history parameters may explain intra-seasonal patterns of snail population dynamics, but there are still no satisfactory answers to the questions of stability of populations between seasons, dependence between spatio-temporal population intra-seasonal dynamics and implications of such patterns for nature conservation. We studied *Vertigo moulinsiana* (Dupuy, 1849), a rare species (IUCN Red List; Annex II to Habitats Directive), in the inland delta of the Nida, from May to October in 2008–2010. On each monthly control we noted the number of individuals with precise mapping of each snail on the vegetation map. The results showed a non-uniform distribution: there was a distinct gradient of abundance correlated with the habitat gradient: a much higher abundance was observed in a place with increased level of groundwater, mainly covered with *Glyceria maxima*. The abundance dropped with the decrease in groundwater level. We observed this phenomenon on a seasonal scale during the three years. During the season the population abundance increased which was reflected in the population's spatial expansion. The greatest abundance was recorded in August and from then it decreased, along with the spatial range. Furthermore, in the first part of the season the population spread from the places covered with *G. maxima* to drier areas, overgrown by *Carex elata*, and from August it was distinctly limited to wetter areas with *G. maxima*. Considering the species' distribution in the whole study area and the distribution of the vegetation patches, there is a metapopulation with two distinct centres in two big patches with *G. maxima*, which are separated by an area with *C. elata*. Local floods which occur after massive rainfall provide favourable microclimate conditions for the snails; resulting in a greatly increased abundance. The barrier of unfavourable habitat disappears temporarily and migration of individuals between the metapopulation centres is possible.

ASSESSMENT OF INVASIVE CHARACTER OF ALIEN BIVALVE SPECIES

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The list of alien bivalve species in Poland is continually increasing. Since the mid 1980s consecutive localities of *Sinanodonta woodiana* (Lea, 1834) have been recorded, and since 2003 and 2004 – *Corbicula fluminea* (O. F. Müller, 1774) and *C. fluminalis* (O. F. Müller, 1774), respectively. Next to the well established *Dreissena polymorpha* Pallas, 1771, in 2014 *D. rostriformis bugensis* Andrusov, 1897 was first observed in the Gulf of Szczecin. Since 2010 *Rangia cuneata* (G. B. Sowerby I, 1832) has been known to occur in the Gulf of Vistula, and *Mytilopsis leucophaea* (Conrad, 1831) in the Gulf of Gdańsk; both originate from the Gulf of Mexico. The species spread mainly due to human activities. The “List of alien plant and animal species which, when released into natural habitats, may threaten native species or habitats” of the 9<sup>th</sup> September 2011 includes *S. woodiana*, *C. fluminea*, *C. fluminalis*, and – though not recorded from Poland to date – *Crassostrea gigas* (Thunberg, 1793). In 2017, on commission from the General Directorate of Environment Protection (GDOŚ) a group of experts devised a procedure to assess the risk of negative effect of invasive or potentially invasive alien species whose introduction or presence may actually or potentially endanger native species, cause economic losses and affect human health. *S. woodiana*, *C. fluminea*, *C. fluminalis* and *C. gigas* were subject to such assessment. *S. woodiana* and *C. fluminea* are widespread in Poland, with a small degree of invasiveness and low risk (*S. woodiana*) or medium invasiveness and high risk (*C. fluminea*). *C. fluminalis* has a limited distribution and was assessed as a non-invasive alien species of low risk. The eastern distribution boundary of *C. gigas* in Europe is at present the Danish straits. The species' invasiveness in Poland was estimated as small, and the species is low risk for Poland and the Baltic.

REPRODUCTIVE ACTIVITY OF *SINANODONTA WOODIANA* (BIVALVIA: UNIONIDAE)ANNA MARIA ŁABĘCKA<sup>1</sup>, JÓZEF DOMAGAŁA<sup>2</sup><sup>1</sup>Instytut Nauk o Środowisku, Uniwersytet Jagielloński, Kraków<sup>2</sup>Katedra Zoologii Ogólnej, Uniwersytet Szczeciński

*Sinanodonta woodiana* (Lea, 1834) is an Asian species whose natural main means of dispersal is its larva (glochidium) which parasitises fishes. Human activity contributes to its inter-continental spread. In Poland the first area of its occurrence included the system of the heated Konin lakes. At present there are numerous records of the species in more than 50 water bodies; they include inland waters of natural thermal regime. In the canal of cooling waters of the Dolna Odra Power Plant (W. Pomerania) *S. woodiana* has been recorded since 2002. In 2004–2006 each month we caught *S. woodiana* in the canal in order to study its reproductive cycle. Using histological and stereological methods we examined the gonad structure, and traced the changes in the gonads during oogenesis and spermatogenesis; we also ascertained incubation periods of the larvae. The water in the canal of the Dolna Odra Power Plant does not freeze in winter, and its mean annual temperature is 18.4°C. The sex ratio in the reservoir was: 34.66% males to 63% females, with 2.34% of hermaphroditic individuals. The sex ratio differed significantly from the expected value of 1:1 ( $\chi^2 = 25.70$ ,  $df = 1$ ,  $P < 0.0001$ ). Previtellogenic and vitellogenic oocytes were connected with the wall of ovarian follicle, and mature, ovulated oocytes were present in the lumen of the follicles. The females incubated glochidia in their ctenidia and presented multiple tachytictic incubation periods. Two spermatogenesis pathways were observed in males. Individuals with mature gonads were present during all the study months. The gamete production was continuous, but the highest reproductive activity was observed in spring and summer. Because of the connection of the canal of the Dolna Odra Power Plant with the Eastern Odra there is a real danger of *S. woodiana* spreading outside the cooling waters, including the Landscape Park of the Lower Odra Valley in Poland and the National Park Unteres Odertal in Germany. Study financed by the Ministry of Science and Higher Education (grant NN303 068 32/2367 to Anna Maria Łabęcka).

## POLISH BOOK OF ANIMALS. PROTECTED SPECIES. IS IT ACCEPTABLE TO PREPARE AND PUBLISH POPULAR-SCIENTIFIC BOOKS IN THE FORM OF PART PLAGIARISM AND PARTLY INFORMATION FROM UNCERTAIN SOURCES?

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The "Polish Book of Animals. Endangered species" appeared in the spring of 2018. Its authors were four entomologists from Silesian University: A. Tazakowski, D. Chłond, M. Kanturski and Ł. Depa (scientific editor). The book was published by Dragon from Bielsko-Biała. The scientific consultation was done by Prof. A. Herczek. It is intended as a popular-scientific publication addressed to a wide range of readers: pupils, students and people not associated with biology but interested in nature, who could thus get familiar with the problem of endangered animal species in our country. We analysed thoroughly the parts devoted to molluscs (29 species: 23 snails and 6 bivalves). We decided to share our impressions with the Seminar participants since in our opinion the published data are partly plagiarised (including our own data, as well as those of others, apparently reported as results obtained by the book's authors, since no references are given) or are, colloquially speaking, "taken from the ceiling". The question is: do the authors have a right to such behaviour and to what extent the book is popular and/or scientific?

## SIMILARITIES AND DIFFERENCES IN THE STRUCTURE OF THE REPRODUCTIVE SYSTEM OF REPRESENTATIVES OF DIFFERENT SUBFAMILIES OF THE CLAUSILIIDAE (GASTROPODA: PULMONATA)

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Previous histological studies on the clausiliid reproductive system showed that the system was semi-triaulic. The spermoviduct is composed of three partly open ducts: oviduct, spermiduct (autospermiduct) and allospermiduct. After separation of the free vas deferens, the oviduct and allospermiduct, also partly connected, form the free oviduct. The allospermiduct disappears just before the outlet of bursa

copulatrix into the oviduct. The analysed clausiliid species represent three subfamilies: Aloiinae (*Cochlodina laminata*), Clausiliinae (*Macrogastra ventricosa* and *Ruthenica filograna*) and Baleinae (*Alinda biplicata*, *Laciniaria plicata*, *Vestia gulo* and *V. turgida*). Irrespective of the reproductive strategy (oviparity, egg retention, lecithotrophic viviparity) the reproductive systems were morphologically and histologically very similar. However, the serous cells of the allospermiduct in the free oviduct differed in their ultrastructure and secretion in the egg-retaining/viviparous and oviparous snails. Oviparous snails retained their embryos mainly in the free oviduct (egg channel). In egg-retainers/viviparous species the oviduct was much longer compared to oviparous snails. Histological studies on other clausiliid species provided further information on the reproductive system structure. We analysed histological structure of the spermooviduct and free oviduct in eight species of Phaesusinae: *Reinia variegata*, *Oospira vanbuensis*, *Phaedusa paviei*, *Stereophaedusa horikawai*, *S. japonica*, *Formosana swinhoei*, *F. formosensis* and *Neniophaedusa nesiiothauma*, of different reproductive strategy (oviparity, egg retention, viviparity) and in the viviparous *Idyla bicristata* (Mentissoideinae). We observed differences in the allospermiduct structure – from its typical form (partly open duct with a layer of epithelial cells and a layer of subepithelial secretory cells) to the autospermiduct fragment with distinct presence of subepithelial cells, i.e. a much reduced form or the lack of the described organ. We found that the free oviduct was much shortened, often devoid of allospermiduct, and the eggs were retained in the spermooviduct. At present we are studying the ultrastructure of spermooviduct and free oviduct. Study within NCN project no. 2016/21/B/NZ8/03086.

#### TRICHOBILHARZIA SPP. – A DANGEROUS MINORITY OF DIGENEA TRANSMITTED BY THE LYMNAEIDAE

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Bird schistosomes of the genus *Trichobilharzia* are the ethiological factor of the swimmer's itch. Their main sources are lymnaeid snails. In an infected snail a single miracidium forms sporocysts which produce thousands of invasive furcocercariae. Attacking human skin results probably from disturbed chemoreception of the cercariae, but may also indicate an adaptive tendency of the bird parasites. In view of the increasing incidence of swimmer's itch we studied the prevalence of bird schistosomes in lymnaeid pop-

ulations. The objectives were not only to recognise the distribution, seasonal fluctuations or host preferences of the parasites, but also to compare those parameters with invasions of Digenea which occur in the Lymnaeidae. Samples were taken monthly from May to September in selected water bodies of the Polish Lowland in 2016–2017. The material included 2,325 specimens of *Lymnaea stagnalis*, 890 *Radix* sp. and 240 *Stagnicola palustris*. Bird schistosomes were recorded in 1.24% of *L. stagnalis* and 0.44% of *Radix* sp. The prevalence of infection with various fluke species was the greatest among *L. stagnalis*. In the summer, during intensive water recreation, the prevalence of bird schistosomes and other flukes in the populations of *L. stagnalis* was the highest. The parasites were most often found in the largest snails which probably serves their intensive propagation due to greater energy reserves and greater space for larval development. It is likely that the high invasion intensity combined with increased resistance of larger-sized hosts, as well as the highest prevalence in summer, are the main reasons for the increasing number of the swimmer's itch cases. Study financed from individual grant WBiOŚ UMK in Toruń no. 2832-B, 2572-B.

#### BIVALVES AS SUBSTRATUM FOR *DREISSENA POLYMORPHA* (PALLAS, 1771) IN THERMALLY POLLUTED LAKES

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Unionid bivalves are among the most endangered invertebrate groups worldwide. The native species are especially threatened by invasions of other filter-feeding molluscs. An especially disturbing situation of native unionids is observed in thermally polluted aquatic ecosystems in Poland. Such water bodies provide favourable conditions for invasions of alien mollusc species, including *Sinanodonta woodiana* (I. Lea, 1834) or *Corbicula fluminea* (O. F. Müller, 1774). Their shells, like those of native species, are potentially favourable for settling of *Dreissena polymorpha* (Pallas, 1771) – a species which threatens the native unionids. The aim of our study was to check if *D. polymorpha* could affect the spread of alien species in thermally polluted waters. Samples were taken monthly from May till August 2016, in three lakes within the cooling system of the power plants Konin and Pałnów. The material included 458 specimens of native Unionidae, 164 of *S. woodiana*, and 347 of *C. fluminea*. In total, 1,468 specimens of *D. polymorpha* were obtained from the shells of all



those bivalves. Significant differences were observed in the frequency of forming zebra mussel colonies, depending on the bivalve species. *Anodonta anatina* (Linnaeus, 1758) and *Unio tumidus* (Philipsson, 1788) were the most often overgrown by the zebra mussel, while *S. woodiana* and *C. fluminea* were the least frequently used as substrata. Besides, the results show that with increasing mean water temperature the frequency of settling on the shells by *D. polymorpha* significantly decreased. It can be supposed that *D. polymorpha* does not pose a significant threat to the invasive bivalves in the heated Konin lakes.

#### THE FIRST REPORT ON THE OCCURRENCE OF ENDOSYMBIOTIC BACTERIA WHICH CAUSE CYTOPLASMIC INCOMPATIBILITY IN THE ENDANGERED FRESHWATER *UNIO CRASSUS* (PHILIPSSON, 1788): MICROBIOME METAGENOMICS

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The knowledge of the occurrence of bacterial endosymbionts in various taxa is increasing. Such intracellular endosymbiosis has been shown to be more common than previously believed. Previous failures to identify bacterial endosymbionts in Bivalvia are explained by non-specific primers which were devised to identify endosymbionts in arthropods. However, there are still hypotheses on the possibility of occurrence of various bacterial endosymbionts in freshwater bivalves (there are abundant data on the occurrence of chemoautotrophic endosymbionts in marine bivalves and single records of *Wolbachia* in that group of animals). We performed metagenomic sequencing (including V3–V4 fragment of 16S rRNA) of the microbiome of *U. crassus*, which rendered possible identification of bacterial endosymbionts. The analysis of sample composition for particular taxa, based on homology with the data bases, made it possible to classify the 344,815 obtained sequences. We made a pioneer discovery of the endosymbiotic bacterium *Candidatus cardinium* (1,082 sequences). An additional confirmation of its presence in the new host was the positive amplification of its fragment of 16S rRNA, using specific primers. We also found numerous bacterial sequences classified in the order Rickettsiales (2,553 sequences). For specific identification of the bacteria we tested the presence of *Wolbachia* using an array of primers – we obtained sequences of the endosymbiont which is

also a new discovery. The identified endosymbiotic bacteria are vertically and horizontally transmitted to the offspring by infected females. The effects include among other things disturbance of sex ratio, *hitchhiking* genes, disturbance of DNA barcoding and decrease in the level of genetic variation in the population. The bacteria may cause cytoplasmic incompatibility (CI) or trigger speciation (in the case of allopatric populations infected with different strains causing CI). One of the effects of infection with endosymbionts *Wolbachia* and *Candidatus cardinium* is affecting, through CI, the possibility of crossing between the specimens. Thus the observed unbalanced sex ratio and the small genetic diversity of *U. crassus* may result from the presence of various strains of endosymbionts or bacterial infection of some of the evolutionary lineages. We also detected an array of other bacteria, for example protecting cells from oxidation stress (*Desulfobacterales* – 2,218 sequences). Further studies should provide the knowledge of the hitherto unknown mechanisms of symbiotic interactions between bivalves and their endosymbiotic bacteria. It should be possible to analyse host-endosymbiont coevolution, effect of various endosymbionts on the host's biology and genetic variation, and on the disturbance of sex ratio and population dynamics.

#### GENETIC VARIATION IN THE GENUS *BRADYBAENA* IN CENTRAL EUROPE

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The development of modern molecular techniques and methods of phylogenetic analysis makes it possible to verify traditional taxonomies based mainly on variation of morphological characters, and to study relationships between phenotypic variation and genetic structure of populations. This is especially useful in the case of terrestrial snails which, because of their small mobility, are often characterised by great interpopulation differences. *Bradybaena* (Beck, 1937) is a group of terrestrial pulmonates inhabiting eastern and southern Asia and Europe. The objective of our studies was to estimate the genetic variation between the populations of the genus from Central Europe. For this purpose we acquired specimens from more than 30 localities in Poland, Ukraine, the Czech Republic, Slovakia and Romania.

In phylogenetic analyses we used sequences of six genetic markers, from both mitochondrial (COI and 16S rRNA) and nuclear (ITS-1, 18S rRNA, 28S rRNA and H3) DNA. Financed by DS-3253/ZAZ.

MONACHA FITZINGER, 1833 (EUPULMONATA: HYGROMIIDAE) IN EUROPE

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*Monacha* is the most speciose genus among the Hygromiidae. Conchologically, it is very uniform, and species are mainly distinguished based on the structure of their reproductive system. It is included in the Monachinae, and is distinct in that the dart sac has been transformed into a single, hollow appendiculum of the vagina, and in that the right omatophore retractor is usually located to the left of vagina and penis. The genus is traditionally divided in three subgenera: *Monacha* s. str. (single appendiculum and no penial retractor), *Paratheba* Hesse, 1914 (appendiculum and retractor present) and *Metatheba* Hesse, 1914 (retractor present, appendiculum absent). Besides the debate on the status of some other subgenera (i.e. *Platytheba* Pilsbry, 1894 and *Eutheba* Nordsieck, 1993), recently the use of molecular characters (nucleotide sequences of several mitochondrial and nuclear genes) has made it possible to distinguish four new subgenera: *Pontotheba* Neiber et Hausdorf, 2016, *Aegaeotheba* Neiber et Hausdorf, 2016, *Trichotheba* Neiber et Hausdorf, 2016 and *Rhytidotheba* Neiber et Hausdorf, 2016. It is assumed that the region of differentiation of *Monacha* is Anatolia, especially the Pontic region along the Black Sea coast. From there the expansion routes led on the one hand through the Mediterranean to Central and Western Europe, on the other to the Balkan Peninsula. Other routes of spread ran eastward and southward, to the Arab Peninsula, the Caucasus and Iran, and to northern Africa. NEIBER & HAUSDORF (2016) have recently distinguished 9

regions associated with the main evolutionary lineages of the genus. Except three species, most members of *Monacha* have rather small distribution ranges. The three more widely distributed are *Monacha cartusiana* (O. F. Müller, 1774), *M. cantiana* (Montagu, 1803) and *M. claustralis* (Rossmässler, 1834). *M. cartusiana*, the type species of the genus, occurs in nearly all of Europe (except Scandinavia, Russia, Baltic countries, Belarus and northern Ukraine). It is also known to occur in Poland, though in few localities. Our studies with the use of nucleotide sequences of fragments of mitochondrial genes (COI and 16SrDNA) and nuclear genes (histone H3 and ITS2 fragment of the gene of ribosomal RNA) confirmed the close relationship of specimens from Spain, France, Italy, Germany, Poland, the Czech Republic, Slovakia, Hungary, Croatia, Serbia, Bosnia-Herzegovina, Kosovo and Greece. *M. cantiana* occurs on the one hand in southern and central Britain (to southern Scotland), northern France, Germany and Benelux, on the other in northern Spain, southern France, Italy and several islands of the Tyrrhenian Sea (Corsica, Sardinia, Elba) with a distinct gap in central France, Germany and farther west. Our molecular studies showed a close relationship of the British and Spanish populations with those from the region of Latium around Rome (thus confirming the hypothesis of Roman introduction to Britain and Spain), and a taxonomic distinctness between a few populations from the Apuan Alps, northern Italy and Austria and *M. cantiana* s. str. We demonstrated the species distinctness of *M. cemenolea* Risso, 1826 which was earlier regarded as a form or subspecies of *M. cantiana*.

MOLLUSC ASSEMBLAGES FROM DEPOSITS OF THE MILL POND IN THE VALLEY OF JAROSŁAWIANKA (SŁAWA PLAIN) AND THEIR PALAEOCLIMATOLOGICAL INTERPRETATION

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We analysed mollusc assemblages of the mill pond deposits in the valley of Jarosławianka (Sława Plain, NW. Poland). Our aim was to reconstruct the history of changes in the pond's environment from its origin in 1351 till the end of its functioning in 1960. Thirty seven taxa occurred in the pond during its existence: 22 taxa of aquatic snails, 11 bivalves and 4 terrestrial snails. The fauna includes four assemblages of different ecological structure and diversity: species-rich and abundant planorbid assemblage (Pla), characteristic of the initial stage of the pond's existence, assemblage with *Pisidium nitidum*



(Pni), indicating changes in the pond's hydrodynamics and increased flow in the river, an oligomictic assemblage with opercula of *Bithynia tentaculata* (Bto) and an assemblage with Lymnaeidae (Lym), from the final stage of the pond's functioning. The spatial and stratigraphic variation of the mollusc fauna in the profiles indicates variable hydrodynamic conditions and facial differentiation of bathymetric zones of the former mill pond. The variation made it possible to distinguish four phases of the pond's development: phase I (1351 till ca. 1640 AD) with very favourable habitat conditions, high species richness and abundance, as well as uniform ecological structure of the malacocoenosis, phase II (ca. 1640–1720 AD), with deterioration of living conditions, decrease in richness and abundance as a result of hydrological changes in the pond and increased flow of the Jarosławianka, phase III (1720 till ca. 1850 AD), with another improvement of habitat conditions and appearance of species which had inhabited the pond in its initial stage and phase IV (ca. 1850–1960 AD), associated with cessation of the pond's functioning as a result of another increase in the river's flow and accumulation of sandy series of extra-channel and slope deposits. The phases are associated with hydrological factors resulting from climate changes. The unfavourable conditions during phase II may reflect the Little Ice Age, whose culmination fell onto the Maunder minimum (1645–1715 AD). In such a situation phase I, preceding the Little Ice Age, and phase III following it would correspond to warmer periods, in 1350–1630 and 1720–1800 AD.

MARIA JACKIEWICZ (1920–2018)

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Professor Maria Jackiewicz passed away on February 21st 2018. She was born in 1920 in Włocławek, went to elementary school in Sokółka near Białystok, and then to a grammar school in Kalisz till 1939. The Second World War interrupted her schooling. After the War she passed her school-leaving exams in 1946 in Kalisz. Maria Jackiewicz studied biology at the Faculty of Mathematics and Natural Sciences, Poznań University, and got her master's degree in 1950. During the studies, she became student-assistant at the Department of Zoology, Adam Mickiewicz University in Poznań; in 1951–1955 she was promoted to assistant (1951), senior assistant (1952) and lecturer (1955); Maria Jackiewicz got her doctoral degree in 1959, under Prof. J. Urbański's

supervision. Since 1960 she started to cooperate with Prof. Jan Rafalski in his Department of Animal Morphology, and habilitated in 1967 to be nominated senior lecturer in 1987. She became head of the newly created Department of Animal Taxonomy and Ecology, and was nominated professor in 1990. Maria Jackiewicz retired in 1991 but for a long time continued her research and teaching. She was much appreciated as an excellent academic teacher. Prof. Jackiewicz published 58 papers, mainly on freshwater and terrestrial snails. Her main achievements were the cycle of publications on the Lymnaeidae, with a penetrative analysis of anatomical features, and on the Aciculidae. She described a few new species of lymnaeids and *Acicula*. Initially (communist times!) she published in Polish journals. As soon as the communism broke down, she became recognised and sought after as the most experienced lymnaeid expert and she started publishing papers in co-authorship with foreign malacologists. Prof. Jackiewicz was an active participant of our Seminars, as well as international conferences and congresses, and member of *Unitas Malacologica* and the Association of Polish Malacologists. For scientific and teaching work she was awarded numerous distinctions. In 1997 she became honorary member of the Association of Polish Malacologists. One of the authors (BMP) met Prof. Jackiewicz early on. Thanks to this it was also possible to tell some nice and sometimes funny stories about her.

PHENOTYPIC PLASTICITY OF *TROCHULUS HISPIDUS* (LINNAEUS, 1758) AND ITS EVOLUTIONARY SIGNIFICANCE

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In short-lived organisms, the limited duration of vegetation period should have a strong effect on the general growth strategy and ultimate body size. *Trochulus hispidus* may undergo such rules. It is widespread in Europe and within its populations the shells vary in size and shape. It is euryoecious, with usually annual life cycle. These characters make it a good model of studies on short-term phenotypic variation. Morphometric analysis showed a wide intra-population variation in shell size; the phenotypic variation depended on habitat conditions which

changed through time. The shell shape did not undergo significant changes. A transplantation experiment showed a great plasticity of *T. hispidus*. The offspring of snails, which in the laboratory changed their shell size and shape (to larger and more elevated, with narrow umbilicus), when transferred to natural habitat, returned to smaller size and “typical” shell shape (flatter, with wider umbilicus). On the whole, seasonal weather changes cause a seasonal phenotypic variation. The high plasticity may increase the likelihood of population’s survival. Our studies provide further evidence for plasticity being favoured when the habitat is temporally heterogeneous. Besides, we have shown that two morphological forms: *T. hispidus* and *T. sericeus*, do not represent distinct species, since they hybridise producing fertile offspring, and their morphological variation has no genetic background. Their habitat selection is determined by light, forest cover, rainfall and temperature. *T. sericeus* prefers damp, shaded places, mainly forests, while *T. hispidus* selects drier, more insolated, open areas. The durability of hairs is also associated with the habitat preferences. Most often *T. hispidus* is devoid of them, while they are mostly present in *T. sericeus*. In the light of our results these forms should be regarded as ecophenotypes. The observed phenotypic plasticity corresponds to the plasticity of food preferences and the life history which has become adjusted to variable habitat conditions (bet-hedging strategy). It was probably the large variation in the ecophenotypic and genetic structure between populations that made it possible for *T. hispidus* to survive the difficult climate of glacial steppe. The analyses were done within NCN grant 2016/21/B/NZ8/03022.

#### DISTINGUISHING SPECIES OF THE GENUS *BYTHINELLA* IN THE BALKANS AND CENTRAL EUROPE

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In spite of the decades of studies, first morphological (shell and soft parts), then allozymes and later DNA sequences, criteria for distinguishing species within *Bythinella* remain uncertain. For years the studies were limited to morphology which was often insufficient even to identify the genus; moreover, the morphology was usually described and illustrated in a cursory way, and mainly shell characters were considered at the species level. Detailed studies of morphological characters, combined with the use of molecular markers, in some cases make it possible to demonstrate the distinctness of earlier synonymised

or overlooked species, and in other cases to synonymise an array of “endemic” species. The objective of the project was the analysis of genetic structure of metapopulations of *Bythinella*. Using selected molecular markers, such as ITS1, ITS2, Histone H3 as well as COI, yielded sequences of fragments of mitochondrial and nuclear DNA. Furthermore, shell morphometrics was analysed (principle component analysis) as well as soft part morphology and anatomy. Molecular studies combined with analysis of morphological variation provided better criteria for distinguishing species. The studies included the Balkans – the diversity centre of these snails, as well as Poland and Slovakia which are on the northern distribution border of *Bythinella*, thus making it possible to compare populations from the distribution centre with the marginal ones. The material came from 49 localities in the Balkans and in Central Europe: 22 in Slovakia, 8 in Slovenia and 8 in Poland, 6 in Bosnia-Herzegovina, 2 in the Czech Republic, and one in Romania, Albania and Serbia each.

#### MALACOFAUNA OF SMALL KARST FORMS IN CISOWA SKAŁA (EASTERN PODHALE)

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Small karst forms hold deposits with faunal remains, usually mollusc shells and vertebrate bones. The composition and structure of such subfossil assemblages make it possible to reconstruct palaeoenvironment on both regional and (what is especially interesting) local scale. The study included late Glacial and Holocene deposits of small karst forms within an isolated limestone outcrop. Cisowa Skała is located in the eastern part of the Podhale basin in the Carpathians. The basin is bisected by a series of Mesozoic limestones. The rock forms an isolated, partly rocky hill of relative altitude of 55 m. Its northern slope is covered by coniferous forest with a high proportion of *Picea*, while the southern, eastern and western slopes are devoid of forest and covered with swards, often xerothermic, and shrubs. The malacological analysis was based on 35 samples from 10 profiles. Fifty seven species of terrestrial snails were identified; they were represented by 14,000 specimens. Besides, there were some bones and teeth of small vertebrates representing seven taxa. The snails were classified into nine ecological groups. Five faunal assemblages were distinguished which represented different habitat types and were associated with different climatic phases of the late Glacial and Holocene. Based on the assemblages it was possible



to characterise the environmental changes within the last 12,000 years, and to point to the specificity of Cisowa Skała. The assemblages representing the late Glacial and Early and Middle Holocene indicate that Cisowa Skała was then forest-covered; the forest was initially coniferous and then – with progressing climate warming – mixed and deciduous. Climate changes in the Late Holocene led to a strong differentiation of conditions within the rock. Forests were preserved on its relatively damp northern slopes. On slopes of other exposition forests disappeared to be replaced by dry-loving sward and shrub formations. The evolution of environment of Cisowa Skała differed from that in the adjacent areas. The differences were the most distinct in the late Glacial and Late Holocene. In the former period the region of Podhale was dominated by tundra or steppe-tundra while Cisowa Skała was forest-covered. The second period witnessed development of forests in Podhale and their disappearance in Cisowa Skała. The main reason for such differences is the specific geological structure and relief of Cisowa Skała.

“YOU SHOULD ALWAYS HAVE SOMETHING TO DO. THEN YOU REALLY LIVE” – ABOUT PROFESSOR ANDRZEJ SAMEK

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The title is a quotation which concluded a 2014 interview for “Dziennik Polski” on the 90th birthday of Prof. Andrzej Samek. He stayed true to these words till the end of his days, when he was working on his last book, this time about cephalopods; sadly he failed to produce the last chapter. Prof. dr hab. Andrzej Samek passed away on January 14th 2018. By education he was a specialist in machine technology and automatics, but later bionics became the focus of his interest. He is regarded as the founder of the Kraków school of bionics. Since 1956 he was employed at Kraków Polytechnics; having retired in 1994 for a long time he remained associated with it. In 2003–2014 Prof. Samek worked at the Faculty of Mechanical Engineering and Robotics of the Academy of Mining and Metallurgy. His scientific production includes 240 publications in national and international journals, 23 books and 8 monographs. He supervised 9 doctoral theses, refereed 12 such theses and 3 applications for professorship. Many of his 23 books reflect Prof. Samek’s non-professional interests. These interests were wide-ranging, though

it seems that marine molluscs were his greatest passion. It was to them that he devoted as many as six books; the last of them, still unfinished, is a challenge to us, Polish malacologists, because we need to bring it to publication. Regrettably, the planned eight chapter of the book, “Głównogi jako wzorce techniczne” [Cephalopods as technical templates] will remain in the Author’s thoughts only. Not all the books were illustrated with shell photographs – the “Atlas muszli ślimaków morskich” [Atlas of marine snail shells] is a collection of nearly 500 excellent shell pictures painted by the Author with gouache with such precision that not only species but specimens are recognisable. Those shell portraits were even exhibited on two occasions in art galleries in Kraków and Zakopane. Professor Samek was a shell collector, mainly collecting marine shells which, kept in several cabinets, occupied a considerable part of his home. He said that he had got his first shell from his mother, bought not on the seaside but in the Kraków city square. According to his motto “you should always have something to do” Prof. Samek was interested not only in molluscs. In the 1950s and 1960s he was fascinated with model making, resulting in co-operation with the journal “Mały Modelarz” [Small Modeller], for which he prepared designs of more than 100 models, mainly ships, but also airplanes and vehicles. He used his knowledge to write historic books about the fleet of the Hapsburg Empire, or the origin and development of Austro-Hungarian aviation. He shared his extensive knowledge also with readers of such journals as *Morze* [Sea], *Wszczęświat* [Universe], *Przekrój* [Cross-section] and others in which he published several dozen articles. He is even author of a kids’ book “Przygody jeżyka” [Little Hedgehog’s Adventures] published in 2015; the stories in the book were written in the 1970s, upon request of his daughter who was then small. Professor Andrzej Samek attended many of the Polish Malacological Seminars since 1985; there he presented results of his current malacological activities, often associated with bionics. He was member of the Association of Polish Malacologists and since 2007 its Honorary Member.

OVIPAROUS CLAUSILIIDS OF THE SUBFAMILY PHAEDUSINAE – WHAT DETERMINES THE EGG SIZE AND SHAPE?

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Phaedusinae are a speciose subfamily of the Clausiliidae; they occur in Asia. Its members repre-

sent a variety of reproductive strategies: oviparity, egg retention and viviparity. Based on data from laboratory culture of 17 species from Georgia, Vietnam, Taiwan and Japan we compared the egg size with the parents' shell size. The adult shell height ranged from 9.8 to 42.4 mm (in *Zaptyx kikaiensis* and *Megalophaedusa martensi*, respectively), the number of whorls from 9.0 to 17.5 (in *Pravispira semilamellata* and *Tyrannophaedusa mikado*, respectively). The egg size (major × minor diameter) varied from 1.4 × 1.1 mm to 7.4 × 4.3 mm (in *Zaptyx kikaiensis* and *Megalophaedusa martensi*, respectively). The egg shape ranged from nearly spherical to much elongated; the shape index (major to minor diameter ratio) reached extreme values in *Formosana swinhoei* (1.1), *Tyrannophaedusa mikado* (1.8) and *Pontophaedusa funiculum* (2.0). Three groups of oviparous Phaedusinae could be distinguished based on the distribution of calcium crystals in the egg envelope. The results indicate that the egg size is correlated with the parent size, but the correlation differs among the phylogenetic lineages within the subfamily. Studies financed within NCN grant 2016/21/B/NZ8/03086.

#### MALACOLOGICAL ANALYSIS AS APPLIED IN GEOARCHAEOLOGICAL STUDIES

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The use of malacological analysis in geoarchaeological studies is important in research of Quaternary deposits; subfossil mollusc assemblages are among the principal (besides vertebrates and palynological analysis) sources of information on climate-environmental conditions of deposition in archaeological strata. Malacological analysis also helps to ascertain stratigraphy of cultural levels. These problems are presented based on a few sites of middle and upper Palaeolithic age as well as historic times. The oldest localities include an archaeological complex in the environs of Katta Sai (western Tian-Shan) in Uzbekistan. The mollusc fauna accompanying archaeological finds (the same as the present-day fauna of mountain chains of Central Asia) indicates that the climate-environmental conditions during the Palaeolithic were close to the recent ones. The presence of species characteristic of dry, cold climate, such as *Vallonia asiatica* (Nevill, 1878) or *Laevozebrinus eremita* (Reeve, 1849) above the cultural level may indicate development of glacial conditions which, based on the thermoluminescence dating (TL) correlate with the Last Glacial Maximum (~26 thousand years; MIS 2). However, the position of the cultural levels and uranium-thorium dates from snail shells suggest an older age (> 38 thousand years; MIS 3?). Analysis of terrestrial snail assemblages from cave deposits in the Kraków-

Częstochowa Jura made it possible to reconstruct the environment in which man lived in the younger part of the last glacial and the Holocene: it varied from dry and cool open habitats of the end of Pleistocene, through taiga of the Early Holocene, deciduous and mixed forests, and effects of oceanic climate during the climatic optimum, to decreasing density of forests in the Late Holocene and historic times. The studies confirmed the long-postulated methodological discrepancies in the archaeological and malacological analysis. Samples processed on sieves with too great mesh size (2 mm), which are standard in archaeological studies, were distinctly impoverished in small snail species which are sometimes crucial for palaeoenvironmental interpretation. Besides, the risk of redeposition in cave environment also affects archaeological conclusions. These phenomena became apparent during correlation of loess strata of caves and rock shelters of the Kraków-Częstochowa Jura, where (probably as a result of activities of burrowing animals) typically loess species were accompanied by those characteristic of deciduous forests. Freshwater molluscs are also used in geoarchaeological research. Malacological, geological and palynological analyses of lacustrine-fluviatile sediments uncovered in the courtyard of the Archaeological-Historic Museum in Elbląg made it possible to reconstruct sedimentation conditions and palaeoenvironmental changes considering human activity in the area, especially construction of the wooden fortress, dendrochronologically dated as 1245–1302 AD; its remains were found above the lake deposits. Three phases of lake development were distinguished based on malacological analysis correlated with historic data. The lake evolved from a deeper water body (probably ca. 2.1 thousand years ago, in the "Roman period"), through a shallowing flow lake, to a shallow, overgrowing lake dated as Early Middle Ages. Uncovering of the lake's shore zone made it possible to build an oak-wood structure and then the stone castle in Elbląg. At that time open landscape with predominance of fields and pastures occupied most of the area, as indicated by the high proportion of herbaceous plants, cultivated plants and weeds in the pollen spectra.

#### SPATIAL AND TEMPORAL VARIATION OF BIVALVE DISTRIBUTION IN THE POLISH BALTIC IN RELATION TO THE MAIN ENVIRONMENTAL FACTORS

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Because of the relative stability of their communities, long-lived bivalves are regarded as good in-



dicators of the changes of environmental conditions in the Baltic. At the same time they are important components of the diet of bottom-dwelling and demersal fishes as well as wintering aquatic birds. Polish studies of the Baltic bivalves have been conducted since the 1920s. Initially they were only qualitative and limited to the Gulf of Gdańsk. The first quantitative studies in the area corresponding to the present Territorial Waters of Poland fell on 1948–1952. Later research, which is still continued, revealed changes in species composition and structure of bivalve communities, as well as in distribution, abundance and biomass. The deep-water *Macoma calcarea* has become completely extinct; the same is true of the shallow-water *Parvicardium hauniense*. A new dreissenid has appeared – *Mytilopsis leucophaeata*. Genetic analyses have shown the occurrence of *Mytilus trossulus*. The greatest long-term changes in the bivalve distribution, abundance and biomass have been observed in the Bornholm, Gdańsk and Gotland deeps, where below the depth of 60–80 m there was an almost complete disappearance of bivalves. The changes are associated with oxygen deficits caused by the lack of inflow from the North Sea, and eutrophication. A considerable reduction in the abundance and biomass, as well as size structure changes in *Limecola balthica* were noted in the early 20<sup>th</sup> c., also in the shallow zone, on the muddy bottom of the outer Puck Bay. Because of the observed deterioration of fish condition and decrease in fish biomass, there is discussion on the potential effect of changes in the bivalve communities on the availability of food to fishes and wintering water birds.

#### FRESHWATER MOLLUSCS *D. POLYMORPHA*, *A. ANATINA* AND *L. STAGNALIS* AS INDICATORS OF DOSAGE OF PROBIOTIC SUBSTANCE

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We tested the effect of a liquid probiotic substance in various concentrations on common mollusc species: bivalves *Anodonta anatina* (Unionidae) and *Dreissena polymorpha*, (Dreissenidae), and a snail *Lymnaea stagnalis*. The tests were run on sediments and water from ecologically different lakes: oligotrophic, eutrophic and degraded. In each experiment, at constant intervals, we measured temperature (T), pH, electric conductivity (C), percent content of oxygen and dissolved oxygen. No acute toxicity of the probiotic was observed in any experiment (no lethal effect after transfer of molluscs to the culture with probiot-

ic substance). The large density of filtrators *A. anatina* and *D. polymorpha* combined with increased probiotic concentration brought about mainly an increase in conductivity, decrease in oxygen content and pH. The changes in these parameters were greater in the case of *A. anatina*. When using probiotic substance for recultivation purposes it is necessary to determine the maximum dose which is safe for the ecosystem. At high density of bivalves on the bottom an excessive concentration of probiotic substance may lead to oxygen deficit and thus to the bivalves' death, resulting in an excess of dead biomass instead of the expected reduction in biogenic substances. Based on the reaction of young *D. polymorpha* and *L. stagnalis* (growth rate and survivorship) we devised a test to optimise the concentration of probiotic substance in the planned recultivation work. The test should be based on water from the water body which is to be recultivated. The biotest makes it possible to adjust the dose to a level which prevents unfavourable changes in the ecosystem. The test was registered at Patent Office in 2017. Study within project NCBiR „GEKON” no. 267948.

#### SQUID FEEDING IN THE FALKLAND-PATAGONIAN SHELF

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The squids (Theutida) are an order of Cephalopoda with slightly over 300 species; they reach the size of 1 cm to ca. 20 m. Most of them are much valued as sea food and are caught worldwide. Some squid species occur in such numbers and densities that they are objects of industrial catches. One of the most productive regions of such catches is the south-western part of the Atlantic: Falkland and Patagonian shelf. The distinct dominant in the catches, especially near the Falklands, is *Illex argentinus*. It is followed by *Loligo gahi* and, periodically, *Martialia hyadesi*. The Polish fishing fleet, after an adequate modification of its fishing equipment, started exploiting squids in those areas in the late 1970s; in 1982–1984 the catches were ca. 110 thousand tonnes per year. In 1984–1992, in south-western Atlantic, the fleets of all countries caught on average 500 thousand tonnes per year. Assuming that it could constitute ca. 50% of the total biological production of the cephalopods, such huge masses of fast-growing squids required a huge food basis. Contrary to the then common view on squid food, it could not be fish since at high latitudes of the Southern Hemisphere there are few small-sized fishes, especially clupeids. All the shelf bottom off the south coast of South America and the

extensive shelf around the Falklands are inhabited by great numbers of decapods of the family Galatheididae (*Munida gregaria* and *M. subrugosa*). *Munida* species form more than 50% of the bottom macrofauna within their distribution range. Their larvae hatch in August. After metamorphosis in December great masses of their postlarval stages remain planktonic till the end of autumn (June) forming extensive dense schools, coming to the surface, especially at night, as red “clouds”. This is the so called lobster krill. Already preliminary observations showed that they formed the main component of the squid diet. In 1985 I started a study on the feeding habits of the local squids. I analysed their stomach contents. Fresh food was distinguished from digested food and undigested remains. The food of *Illex* and *Martialia*, during their intensive growth and maturation (II–V), was clearly dominated by postlarval forms of *Munida*, which constituted 80–95% of their stomach contents. Other species of crustacean macroplankton, as well as fish and squid, were accessory food items. The main inhabitants of the region, *Illex* squid, displayed a feeding peak during the day. In the second half of night most individuals had empty stomachs, or containing only undigested remains. Invasive, deep-water squid *Martialia*, which temporarily appeared on the Falkland shelf, fed intensively during the 24 hrs. There was a definite change in the kind of food and intensity of feeding by *Illex argentinus* at the end of May and in June; having reached maturity the squid migrated northward, even to the region of middle Argentina and there they gathered near the bottom on the shelf’s slope, at the depths of 500–1000 m, to spawn. At the decreased intensity of feeding which is characteristic of the reproductive season, their main prey was bathypelagic fishes of the family Myctophidae. Squid and deep-water shrimps supplemented the diet. In such areas and at such depths the lobster krill did not occur. According to other authors *Loligo gahi*, commercially caught on the southern fringe of the Falkland shelf near the island of Beauchene, were outside the southern boundary of the lobster krill. They mainly fed on other species of large planktonic crustaceans (Euphausiidae and Amphipoda). *Loligo gahi* fed three times more intensively in the day than in the night.

A COMPREHENSIVE PHYLOGEOGRAPHIC STUDY OF *ARION VULGARIS* MOQUIN-TANDON, 1855 (GASTROPODA: PULMONATA: ARIONIDAE) IN EUROPE

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*Arion vulgaris* Moquin-Tandon, 1855 is regarded as one of the 100 most invasive species in Europe. Its native distribution range is uncertain, but for many years the Iberian Peninsula has been considered as the area of origin. However, recent studies indicate that *A. vulgaris* probably originated from France. We investigated the genetic structure of 33 newly founded European populations (Poland, Norway, Germany, France, Denmark, Switzerland) of this pest slug, based on two molecular markers, mitochondrial cytochrome c oxidase subunit I (COI, mtDNA) and nuclear zinc finger (ZF, nDNA). Our research included published data from two contradictory studies, giving a total of 95 populations of *A. vulgaris* from 26 countries. The results of this analysis suggest that there is no clear geographic structure within *A. vulgaris*. Haplotypes were largely mixed and only a limited pattern of haplotype distribution could be found in most parts of Europe. This situation might be explained by high dispersal abilities, high adaptability to new habitat conditions, as well as by rapid passive dispersal caused mostly by human activity. The haplotype patterns in our results confirm that *A. vulgaris* probably originated in France.



## THERMAL PREFERENCES OF SNAILS INFECTED WITH BIRD SCHISTOSOMES AND THE RISK OF SWIMMER'S ITCH

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Cercariae of bird schistosomes worldwide are known to cause swimmer's itch. Host snails are the source of cercariae; for months they release thousands of invasive larvae. The crucial role of snails – intermediate hosts of the schistosomes – in the transmission of swimmer's itch results from a good adjustment of partners which is manifest in the fact that the host's reproduction is completely inhibited during the patency period while the host channels

all its energy reserves into the parasite's needs. The ambient temperature can thus be expected to have a significant effect on the biology of both ectothermic partners of the interaction. We studied thermal preferences of *Lymnaea stagnalis* infected with *Trichobilharzia szidati* and *Planorbarius corneus* infected with *Bilharziella polonica*, using an experimental set with longitudinal thermal gradient. The infected hosts of the larvae of both the schistosome species preferred significantly lower temperatures compared to the temperature selected by non-infected snails. The host's survivorship and the number of released cercariae depended on the temperature. The results indicate that the thermal preferences of the infected intermediate hosts increased their chance of survival, and thus affected the period of cercariae release, increasing the swimmer's itch threat in the environment.