5th Benelux Congress of Zoology

Phylogeny and Biodiversity

November 6-7, 1998

University of Gent, Belgium

ABSTRACT BOOK

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CONGRESS PROGRAMME

With the financial support of the FWO-Vlaanderen

FRIDAY NOVEMBER 6

08.30 HIKW, peristilium
registration, mounting of posters

Friday morning sessions

Auditorium 4

09.55 Welcome by the president of the KBVD

10.00 Plenary lecture 1 - CHAIRPERSON: A. COOMANS
Van de Peer, Y. (UIA, Antwerp)
Molecular evolution and the construction of phylogenetic trees

Auditorium 3

Phylogeny and evolutionary biology - CHAIRPERSON: J. VANFLETEREN

10.40 *Jenner, R.A. & Schram, F.R.*
Reconstructing the phylogeny of the animal phyla

11.00 *Schön, I., Verheyen, E. & Martens, K.*
Biodiversity and molecular phylogeny - ostracods from ancient lakes

11.20 *Termonia, A., Pasteels, J.M. & Milinkovitch, M.*
Larval chemical defence and evolution of host shifts in *Chrysomela* leaf beetles

11.40 Coffee break

12.00 B* *Van Borm, S., Wenseleers, T. & Billen, J.*
The selfish cytoplasmic micro-organism *Wolbachia*: widespread occurrence in ants

12.20 *Vandekerckhove, T.T.M., Willems, A., De Caesemaeker, J., Van De Weghe, A. & Gillis, M.*
First case of *Wolbachia*-infection in the primitive hexapod order Collembola: possible effect and phylogenetic analysis

Auditorium 4

Ecological diversity: terrestrial systems - CHAIRPERSON: A. COOMANS

10.40 *De Bakker, D., De Vos, B., Maelfait, J.-P. & De Bruyn, L.*
Variation of soil quality parameters and spider community composition in Flemish forest habitats

11.00 *Desender, K., Ervynck, A. & Tack, G.*
Beetle diversity and historical ecology of woodlands in Flanders

11.20 *Ervynck, A.*
Possibilities and limitations of the use of archaeozoological data in faunal analysis: Flanders as a case-study

11.40 Coffee break

* B: competing for the best graduate student oral presentation award (Belgian award)

12.00 *Jacobs,W., De Bruyn, L., Thys, S., De Bakker, D., Maelfait, J.-P. & Verhagen, R.*
The value of plantation forestry for conservation of biodiversity - a case study with soil dwelling Collembola

12.20 *Bonte, D. & Hoffmann, M.*
Characterisation of the breeding habitat of bird species in the Flemish coastal dunes

12.40 *Matthysen, E., Adriaensen, F. & Dhondt, A.A.*
Study plot size and isolation affect dispersal of Great and Blue Tits: 40 years of Belgian nestbox data

Auditorium 5

Behaviour and behavioural ecology - CHAIRPERSON: J. MEES

10.40 *De Bruyn, L., Vandenbussche, D., Scheirs, J. & Verhagen, R.*
Offspring sex allocation in solitary parasitic wasps attacking the same host

11.00 *Stoks, R.*
Autotomy shapes the trade-off between seeking cover and foraging in a larval damselfly

11.20 *De Ridder, E., Mees, V., Pinxten, R. & Eens, M.*
Changes in testosterone levels during the breeding season and the effects of testosterone implantation on paternal care in wild European starlings

11.40 Coffee break

12.00 *Beerlage, B.F.M.*
Red colobus co-operative reactions to playbacks of conspecifics within their range

12.20 B *Obbens, D.P.M.E.*
The social relationships of female Thomas's langurs (*Presbytis thomasi*)

12.40 B *Quick, K. & Van Damme, R.*
Chemoreceptive predator recognition in three Lacertid species

13.00-14.00 LUNCH BREAK

Friday afternoon sessions

Auditorium 4

14.00 Plenary lecture 2 - CHAIRPERSON: E. MATTHYSEN
Seehausen, O. (University of Leiden, The Netherlands)
Speciation and species richness in African cichlids - the role of sexual selection through mate choice

Auditorium 4

Biodiversity and nature conservation - CHAIRPERSON:

14.40 *Pollet, M.*
The use of red data books in nature conservation: the case study of Dolichopodidae (Diptera)

15.00 *Rappé, G. & Vander Velde, A.*
Biodiversity Resources in Belgium: the database BIODIV

15.20 Coffee break

Auditorium 5

Behaviour and behavioural ecology (continued) - CHAIRPERSON: E. MATTHYSEN

14.40 Scheirs, J. & De Bruyn, L.
A test of the C_3 - C_4 hypothesis with two grass miners (Diptera, Agromyzidae)
15.00 Wenseleers, T., Foster, K., Ratnieks, F. & Billen, J.
Spite: an important evolutionary phenomenon
15.20 Gobin, B.
Reproductive division of labour in a polygynous ponerine ant

15.40 Coffee Break

16.00-17.00 *Poster session 1: even-numbered posters*

Auditorium 4

Population genetics - CHAIRPERSON: K. DESENDER

17.00 B Geenen, S., Jordaens, K., Stoks, R. & De Bruyn, L.
Population genetic and morphometric study of the damselfly *Lestes viridis* (Ordo Zygoptera)
17.20 Jordaens, K., Reise, H., Van Riel, P., Verhagen, R. & Backeljau, T.
The evolution of self-fertilization in a pulmonate land gastropod (Mollusca, Pulmonata)
17.40 Maelfait, J.-P. & Neirynck, B.
Intra- and interpopulation allozyme variation in arthropods occurring in Flemish habitat fragments
18.00 Van Riel, P., Verhagen, R., Jordaens, K., Brito, C., Frias Martins, A.M. & Backeljau, T.
Relationships between Azorean and Madeiran Leptaxinae (Mollusca, Pulmonata: Hygromiidae)

Auditorium 5

Functional morphology - CHAIRPERSON: D. ADRIAENS

17.00 D'Août, K. & Aerts, P.
The mechanism of voluntary steady swimming of hatchling and adult axolotls (*Ambystoma mexicanum*)
17.20 B Nauwelaerts, S. & Aerts, P.
'Speed control' in animal locomotion: how does the European green frog increase its swimming velocity?
17.40 Herrel, A. & De Vree, F.
A revision of the cervical musculature in lizards: a tribute to Seiho Nishi
18.00 Menten, L., Cubo, J., Casinos, A.
Curvature in long bones of birds

SATURDAY NOVEMBER 7

Saturday morning sessions

Auditorium 4

9.00 Plenary lecture 3 - CHAIRPERSON: M. VINCX
Gooday, A. (Southampton Oceanography Centre, UK)
Deep-sea foraminiferal diversity: patterns and scales

Auditorium 3

Ecological diversity: marine studies - CHAIRPERSON: M. VINCX

9.40 B *Bonne, W., De Troch, M., Fiers, F. & Vincx, M.*
Harpacticoid copepods associated with the seagrass *Halodule wrightii* ASCHERSON: spatial and taxonomic-hierarchical aspects of biodiversity

10.00 B *Gurdebeke, S., De Troch, M., Fiers, F. & Vincx, M.*
Community structure of meiobenthos in an intertidal seagrass bed (Gazi Bay, Kenya): effect of habitat complexity on diversity

10.20 *Cattrijsse, A. & Vincx, M.*
The benthic biodiversity of the Belgian inshore and offshore waters

10.40 *Wakwabi, E.O. & Mees, J.*
Diversity of the ichthyofauna of a tropical mangrove bay (Gazi Bay, Kenya)

11.00 Coffee break

Auditorium 4

Ecotoxicology & physiology - CHAIRPERSON: L. BRENDONCK

9.40 *Dembélé, K. & Haubruge, E.*
Recovery of brain acetylcholinesterase activity in common carp *Cyprinus carpio* L. exposed to insecticides

10.00 *Hendrickx, F., Maelfait, J.-P., Vernaillen, P., Tack, F., Verloo, M. & Mertens, J.*
Spatial and temporal patterns of heavy metal accumulation and associated population ecological effects in the spider *Pirata piraticus* (Lycosidae, Araneae)

10.20 *Bervoets, L. & Blust, R.*
Do midge larvae reflect metal concentrations in the aquatic environment ?

10.40 B *Smets, H., De Wachter, B. & Blust, R.*
The physiological condition of mussels from three locations on the Western Scheldt, determined with survival in air and condition-index

11.00 Coffee break

Auditorium 5

Morphology - CHAIRPERSON: P. DEVOS

9.40 *Billen, J.*
Exocrine glands in the legs of ants

10.00 *Schoeters, E. & Billen, J.*
Formic acid producing systems in invertebrates: structural aspects

10.20 *Parmentier, E., Castillo, G., Chardon, M. & Vandewalle, P.*
Morphological and behavioural diversity in the Carapini (Carapidae, Pisces) : phylogenetic analysis

10.40 Coffee break

11.20-12.20 *Poster session 2: odd-numbered posters*

Auditorium 3

Ecological diversity: marine studies (continued) - CHAIRPERSON: M. VINCX

12.20 *Kone, T., Teugels, G.G. & Ollevier, F.*
Reproduction strategy of an estuarine tilapia, landlocked in a West African man-made lake

12.40 *Moens, T. & Vincx, M.*
Temperature, salinity and food thresholds in two estuarine bacterivorous nematode species: What is setting the limits?

Auditorium 4

Ecotoxicology & physiology (continued) - CHAIRPERSON: S. DE CLERCK

12.20 B *Erkens, R. & Duchateau, M.-J.*
Ambient temperature and thermoregulation in the bumble bee *Bombus terrestris*

12.40 B *Vercammen, T.*
Paralysing endotoxins in *Musca domestica* L.

Auditorium 5

Morphology (continued) - CHAIRPERSON: P. DEVOS

12.20 *Artois, T. & Schockaert, E.*
On the phylogeny of the Duplacrorhynchinae within the Polycystididae (Plathelminthes, Kalyptorhynchia)

12.40 *De Vocht, A.J.P. & Schockaert, E. R.*
The anatomy and ultrastructure of the proboscis in the genus *Zonorhynchus* and the implications for the phylogenetic relationships within the Eukalyptorhynchia Meixner, 1928 (Platyhelminthes, Rabdocoela)

13.00-14.00 LUNCH BREAK & JUNIOR ZOOLOGISTS' MEETING

Saturday afternoon sessions

Auditorium 4

14.00 Plenary lecture 4 - CHAIRPERSON: C. DE RIDDER
Molgo, J. (CNRS, Gif-sur-Yvette, France)
Biodiversity and bioactivity of ciguatoxins isolated from *Gambierdiscus toxicus* dinoflagellates and poisonous fish

14.40 Flammang, P.
Adhesion in marine invertebrates: Diversity within a universal phenomenon

Auditorium 3

Ecological diversity: freshwater studies - CHAIRPERSON: P. ROOS

15.10 Baribwegure, D. & Dumont, H.J.
The use of integumental pore signature in the recognition of species within the genus *Thermocyclops*: Case of *Thermocyclops eminii* (Mrázek, 1895)

15.30 Brendonck, L.
On eggs and seeds: botany for the zoologist

15.50 B Van Damme, K.
Cladoceran communities of the dune pans in the Lençóis Maranhenses (NE-Brazil)

Auditorium 4

Physiology (continued) - CHAIRPERSON: C. DE RIDDER

15.10 B Dewael, Y., De Bremaeker, N. , Baguet, F. & Mallefet, J.
Control mechanism of *Amphipholis squamata* (Echinodermata) luminescence: implication of seconds messengers and ionic movements

15.30 B Dupont, S. & Mallefet, J.
Luminescence in *Amphipholis squamata* (Echinodermata: Ophiuroidea): a suitable model for studying microevolution

15.50 Castilla, A. M. & De Ridder, F.
The effect of lizard gut-passage on germination performance in the Solanaceae plant *Withania frutescens*

Auditorium 5

Morphology and development - CHAIRPERSON: J. HULSELMANS

15.10 Van der heyden, C., Van Oostveldt, P. & Huysseune, A.
The use of confocal laser scanning microscopy (CLSM) in the study of the dynamics of tooth replacement in the zebrafish (*Danio rerio*) (Teleostei, Cyprinidae)

15.30 Kronnie, G. te, Stroband, H.W.J., Schipper, H. & Samallo, J.
Teleost yolk cell function on blastoderm differentiation and morphogenesis

16.30 Closing session

ABSTRACTS OF THE PLENARY LECTURES

Deep-sea foraminiferal diversity: patterns and scales

GOODAY, A.J.

Southampton Oceanography Centre, Southampton, UK

Numerically, foraminifera are typically a major component of the deep-sea meiofauna and macrofauna. These faunas are also highly diverse, at least at local scales, but since much of this diversity is in the form of poorly-known soft-shelled species, it remains largely overlooked. Single core samples from well-oxygenated sites typically contain well over 100 'live' species and display a high degree of evenness. In organically enriched/oxygen depleted settings, however, species richness and diversity diminsh substantially while dominance increases so that the most abundant species may constitute 70% or more of the total live fauna. Foraminiferal diversity trends may also exist across bathymetric gradients (Buzas & Gibson) and latitudinally (Thomas & Gooday). All of these pattern (in relation to organic enrichment, bathymetric and latitudinal gradients) have more or less well documented counterparts among deep-sea macrofaunal and meiofaunal metazoans. Recent molecular evidence (Pawlowski *et al.*) suggests that foraminifera had an early origin, probably diverging near the centre of the eukaryotic tree before the seperation of the main eukaryotic groups. The similar population responses of foraminifera and metazoans suggests that phylogeny has little influence on population responses to food and oxygen availability.

The patterns described so far are based on changes in local diversity. What is not clear is how local diversity translates into diversity at larger scales. However, it appears that many foraminiferal species have wide, perhaps cosmopolitan distributions. To take one of many possible examples, a soft-walled saccamminid of the genus *Psammophaga* sp. from the Black Sea appears identical to a species described from Monterey Bay, California. Cosmopolitan distributions may be more prevailent at abyssal depths. Thus, global deep-sea foraminiferal diversity may not be as high as local diversity would suggest, or match the very high levels of global diversity claimed for metazoan taxa in the deep sea. A similar conclusion has been reached for smaller protozoans such as ciliates.

Biodiversity and bioactivity of ciguatoxins isolated from *Gambierdiscus toxicus* dinoflagellates and poisonous fish

MOLGO, J., BENOIT, E., MATTEL, C. & LEGRAND, A.-M.[1]

Laboratoire de Neurobiologie Cellulaire et Moléculaire, U.P.R. 9040, Centre National de la Recherche Scientifique, 1 Avenue de la Terrasse, Bâtiment 32-33, 91198-Gif sur Yvette cedex, France and [1] Institut Territorial de Recherches Médicales Louis Malardé, Papeete, Tahiti, French Polynesia

Ciguatoxins are a family of polyether toxins responsible for ciguatera, a complex and widespread form of fish poisoning associated with consumption of many species of tropical and subtropical fishes of the Indo-Pacific Oceans and Caribbean sea. Ciguatera fish poisoning has been linked to the toxic benthic dinoflagellate *Gambierdiscus toxicus* since its discovery in the Gambier Islands. The dinoflagellate is believed to elaborate the toxins which are transmitted to fish through the marine food chain and ultimately to man. Approximately 400 species of marine fish may be poisonous to humans after ingestion. Most of these species, but by no means all, are found in coral reefs. Usually their distribution is spotty, in a particular part of the ocean or around a given island. This presentation is intended to review the progress that has been made during the last decade in the isolation and determination of the chemical structure and bioactivity of the ciguatoxins. These toxins target voltage-dependent Na+ channels with high affinity causing their persistent activation, increase neuronal excitability and neurotransmitter release, impair synaptic vesicle recycling and modify Na+-dependent mechanisms in in most excitable cells and also non excitable cells.

Speciation and species richness in African cichlids - the role of sexual selection through mate choice

SEEHAUSEN, O.

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Cichlids have in Africa radiated in several large lakes but their diversity varies a lot between lakes and between lineages. I studied the most explosively radiated lineage, the haplochromines, of which several hundred species have evolved in Lake Victoria within only 12000 years. My aim was, by studying ecological and microevolutionary processes, to identify possible mechanisms of speciation that do not require geographical isolation. Existence of such would greatly facilitate the understanding of explosive radiation.

Surveying the system, I found correlations between interspecific colour variation and extent of geographical overlap suggestive of sympatric diversification of colour pattern and speciation. These yielded three predictions: (1) Variation in coloration affects intraspecific mate choice such that colour polymorphism is associated with mate preference polymorphism, and leads to geneflow interruption. (2) Coloration is important in interspecific mate choice among closely related species. (3) Closely related species are reproductively isolated only by mate choice. A series of field and laboratory studies on colour morphs, sibling species and communities supported the three predictions, and showed that constraints on colour vision constrain the speciation process. A study of phylogenetic pattern, furthermore, showed that nuptial coloration has likely arisen under sexual selection and is in clades with a polygynous mating system evolving quickly in frequent association with speciation events.

I conclude that mate choice behaviour and its genetical basis and the genetics of coloration in haplochromine cichlids allow rapid speciation via mate preference polymorphisms in sympatry as well as in all other geographical settings. I argue that the origin of this variation in coloration and preference is a stochastic process that can dissolve the sexual coherence of populations where the visual conditions allow variation in the two traits to get linked up and evolve to the extremes. This model explains a large part but not all of the variation in species richness among cichlid fish. It explains why the most diverse lineages are lineages with polygynous mating system, and why these lineages are only in clear water lakes particularly species rich. The model does not explain why not all all polygynous lineages became species rich in clear water lakes.

Molecular evolution and the construction of phylogenetic trees

VAN DE PEER, Y.

Department of Biochemistry, University of Antwerp (UIA), Belgium

Recent years have seen an explosive growth in biological data due to the ongoing advances in biotechnology and sequencing techniques. In particular, numerous new applications of the Polymerase Chain Reaction method and the use of automatic sequencing now quickly provide us with a huge amount of sequence data that can be used to study evolutionary history. However, beside the development of rapid sequencing techniques, advances in computer technologies in particular have been responsible for the breakthrough of molecular evolution. These advances were extremely important for molecular phylogeny to become established since there was a great need for new hardware and software tools that could cope with the exponential growth of sequence data. Furthermore, network facilities and services such as electronic mail, newsgroups, remote logins, gophers, file transfer, and the World Wide Web (WWW) have made life much easier for the molecular biologists and evolutionists. In particular the WWW has caused a revolution in the use of internet over the past three years.

Because of the advances in computer technologies and the progress in computer hardware and software, one should expect that the construction of phylogenetic trees has become much easier lately. This is only partly true. Although fast and user-friendly programs are available now, the number of different methods to infer tree topologies has increased rapidly, and at the moment molecular systematists and evolutionists may choose among several dozens of tree construction methods. As a result, people are often bewildered by the vast range of computer algorithms that can be applied to sequence data. Furthermore, literature on phylogenetic construction is extensive and the pros and cons of different methods are frequently debated. Although there is no such thing as the ultimate tree construction method - all of the current methods have their strengths and weaknesses - the powers and pitfalls of the different algorithms are becoming more and more understood. Lately, much effort goes to the study of specific models that explain the evolutionary change of the molecules. If the 'true' evolutionary process could be described accurately by a certain model of substitution, trees inferred on the basis of that model would suffer less from systematic errors.

ABSTRACTS OF THE LECTURES

On the phylogeny of the Duplacrorhynchinae within the Polycystididae (Plathelminthes, Kalyptorhynchia)

ARTOIS, T. & SCHOCKAERT, E.

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The major distinctive character of the Duplacrorhynchinae SCHOCKAERT & KARLING, 1970 is the copulatory organ of the duplex-type, however clearly a plesiomorphy (prostate vesicle comes after the seminal vesicle as in most Plathelminthes, while in the other Polycystididae the prostate vesicle is next to the ejaculatory duct). Consequently, the taxa within this subfamily may perhaps not have a monophyletic origin.

Two new species belonging to the genus *Duplacrorhynchus* (*D. megalophallus* n.sp. and *D. heyleni* n.sp.) and the new taxon *Jarreella aprostatica* n. gen. n. sp. are described and all other polycystidids with a copulatory organ of the conjuncta-type have been reconsidered. It appears that in all these taxa (exc. *Jarreella*) the retractor system of the proboscis consists of three pairs of retractors and two pairs of integument retractors, while in the vast majority of the Polycystididae and in the other families of Eukalyptorhynchia there are four pairs of retractors and a single pair of integument retractors. A retractor system of 3+2 might be an apomorphy making the Duplacrorhynchinae a monophyletic taxon. Within this taxon some monophyletic subgroups can be distinguished as well. The position of *Jarreella* remains problematic, however.

The use of integumental pore signature in the characterisation of species of the genus *Thermocyclops* KIEFER, 1927: the case of *Thermocyclops emini* (MRÁZEK, 1895)

BARIBWEGURE, D. & DUMONT, H.J.

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The study of the integumental pore signature as a tool leading in the identification of Copepods is explored. We explore the reliability of this pattern in the recognition of the species within Cyclopoids. In female specimens of *Thermocyclops emini* (MRÁZEK, 1895), integumental pores are bilaterally symmetrical and occupy constant positions. Pores on Rostrum, Cephalosome, Metasome and Urosome occupy geometrical positions. On the Metasome, the pore pattern changes from one segment to another, and on the Urosome, it differs in ventral and dorsal position. The total number of pores varies between 181 and 189 pores. They are amply illustrated together with "classical" characters.

Red colobus co-operative reactions to playbacks of conspecifics within their range

BEERLAGE, B.F.M.

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Amongst colobines, apes and new world monkeys, female philopatry is not a standard pattern as in Cercopithecines. If females can be allopatric then males are liberated to become philopatric. Strong bonds can develop between males, especially when between group competition is high. These bonds in turn can facilitate co-operative defence against neighbouring groups, against predators, protection against infanticidal males, and ensuring copulations with females. I examined co-operation against conspecific groups by using playback experiments. These playbacks are carried out in the core area and on the border of ten red colobus groups in the Tai National Park, Ivory Coast. The spacing of red colobus groups, their territorial behavior and individual involvement during intergroup encounters (playbacks) may answer the question whether the philopatric red colobus males co-operatively defend a range for females to forage in (resource defense polygeny) or defend a group of females directly (female defense polygeny).

Do midge larvae reflect metal concentrations in the aquatic environment ?

BERVOETS, L. & BLUST, R.

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The uptake and accumulation of metals by chironomid larvae strongly depend on the chemical behaviour of the metals, the exposure routes, and the physiological condition of the organism. When exposed to a sediment-water system, metal accumulation is function of : (1) the bioavailability of the metal in the different compartments (*i.e.* overlying water, pore water, food and sediment); (2) the metabolic activity, feeding rate and growth rate.

The results of several laboratorium experiments and field studies are presented. Two types of laboratorium experiments were conducted. In a first set of experiments larvae of *Chironomus riparius* were exposed to metals via the water : the effect of changing environmental factors such as salinity, temperature and pH were evaluated. In a second set of experiments metal accumulation by chironomids from sediment was studied by artificially contaminating reference sediments (spiking). The effect of sediment characteristics on metal accumulation was assessed.

In the field studies the relationships between metal concentrations in larvae and sediment was studied on samples from several watercourses. The effect of some sediment characteristics (organic matter, particle size, ..) on these relationships was studied.

From these studies it was clear that under controlled laboratorium conditions, an important percentage of the variation in metal uptake or accumulation in larvae could be explained. In the field studies however, the explained variation was less. However, when we increase our knowledge on the factors affecting metal uptake and accumulation under laboratorium conditions, models that explain metal levels in larvae under field conditions will improve.

Exocrine glands in the legs of ants

BILLEN, J.

Laboratory of Entomology, K.U.Leuven, Belgium

The exocrine system of ants is formed by an impressive variety of glands, the function of which is often related with their social organization. Although the vaste majority of the exocrine glands have been studied in the head, thorax and abdomen, it became clear from recent research that also the legs of ants may contain a variety of exocrine glands.

Some of the leg glands are a common character for all ants, others are restricted to a particular genus or species. Some are found in the six legs, while others only occur in the front- or hindlegs. Recent discoveries of hitherto unknown leg glands are e.g. the conspicuous clusters of secretory cells in the third tarsomere of the hindleg tarsi of both queens and workers of the living fossil ant *Nothomyrmecia macrops*, and the epithelial basicoxal gland in many Ponerinae. Presently, the number of different glands known in the legs of ants is 14. Although their structural organization is more or less well understood, the function for several of these still remains unknown.

Harpacticoid copepods associated with the seagrass *Halodule wrightii* ASCHERSON: spatial and taxonomic-hierarchical aspects of biodiversity

***BONNE, W.[1], DE TROCH, M.[1], FIERS, F.[2] & VINCX, M.[1]**

[1] University of Gent, Department of Biology, Marine Biology Section, K.L. Ledeganckstraat 35, 9000 Gent, Belgium
[2] Royal Belgian Institute of Natural Sciences, Invertebrate Section, Vautierstraat 29, 1000 Brussel, Belgium

Meiofauna (metazoa between 38 μm and 1 mm), especially harpacticoid copepods, are abundant and important in seagrass ecosystems. Standardized samples of meiofauna were taken in five different quadrants in Quintana Roo, Mexico. Four quadrants were situated in the Sian Ka'an Biosphere Reserve, the fifth quadrant was located near Isla Holbox (in the north of Quintana Roo).

The meiofaunal density varied from 1405 ind./10cm^2 to 3563 ind./10cm^2. The dominant taxa were nematodes, copepods, nauplii and polychaetes. 24 families of harpacticoid copepods were encountered. Diosaccidae, Ectinosomatidae, Thalestridae, Harpacticidae, Laophontidae and Ameiridae were the most abundant families. Further, the species composition of the family Thalestridae and the genus *Stenhelia* (Diosaccidae) was analyzed. The spatial patterns in the meiofauna and copepod communities were investigated with multivariate statistical techniques. The first community was found in an undisturbed habitat. This community was characterized by the highest diversity on higher-taxon level. The lowest diversity on each taxon level was recorded for the second community in a disturbed area. The quadrant in Holbox, the third community, was characterized by the largest diversity on family level. The composition on family level is of great importance when making a distinction between the different communities. This also counts for the diversity of the genus *Stenhelia*, contrary to the diversity of Thalestridae. The diversity of meiofauna taxa only possesses enough discriminating power in empoverished communities.

* competing for the best graduate student oral presentation award (Belgian award)

Characterisation of the breeding habitat of bird species in the Flemish coastal dunes

BONTE, D.[1] & HOFFMANN, M.[1,2]

[1] Departement of Biology, University Ghent, Belgium
[2] Institute of Nature Conservation, Brussels, Belgium

The area of coastal dunes in Belgium decreased from approximately 6400 to 3000 ha during the last century. The present dune area's are characterised by heavy recreational pressure, water capturing and an overall shrub encroachment.

A total of seven breeding bird communities were characterised by digital superposition of the overall territory map and a grid-map (Geographical Information System). They were ordinated along two main axes which could be explained as the gradient from open sandy dunes to forests and the presence of buildings or blockhouses (see poster).

By computing the habitat composition via overlays with detailed vegetation maps, the differentiating vegetation items within the breeding habitat could be detected. In the group of the mosaic shrub inhabiting species, the amount of short grazed vegetation and Birch-Willow shrub is responsible for the major habitat segregation between the species. Intergeneric habitat characteristics of the Sylviid and Phylloscopiid warblers were detected in the same way and illustrate the reduction of competition by habitat segregation.

At the landscape level, a significant positive relationship between the number of species and the surface of the shrub or moss vegetation could be revealed. An inverted relationship exists between the surface and the total breeding bird density.

On eggs and seeds: botany for the zoologist

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Several theories predicting the effect of annual plant seed banks on the ecological and evolutionary dynamics of populations and communities, and the trade-offs between seed characters and life history characteristics are applicable to animals that persist in unstable habitats by means of dormant propagules. We empirically tested several of these predictions in the freshwater anostracan *Branchipodopsis wolfi* inhabiting desert rock pools in south-eastern Botswana. Egg bank sizes varied according to pool and season/year between about 1,000 and 220,000 eggs per m2. These resting eggs are relatively 'unassisted' (lacking wings etc.) and are dispersed to some extent by wind over short distances. The lack of abundant long-range dispersal was confirmed indirectly by the geographic pattern of genetic variation in this species. As in seeds with mixed dispersal strategies, a trade-off between dispersibility and hatching fraction occurred in resting eggs of *B. wolfi*; floating (dispersal-prone) eggs hatched significantly better than equally viable sinking eggs. Conform predictions from annual plant theories, only part of the *B. wolfi* egg bank hatches at each hydration event, with the hatching fraction corresponding with the chances for successful recruitment as estimated from long-term rainfall data. Dormant eggs also responded to environmental variables transmitting relevant information about any future recruitment, as such maximising their long-term fitness. Some mechanisms were revealed that made use of the thermal, osmotic and light environment of the eggs. In nature management practices, persistent egg banks may be used for re-establishment of lost populations or species, a common procedure in plant restoration ecology.

The effect of lizard gut-passage on germination performance in the Solanaceae plant *Withania frutescens*

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The plant *Withania frutescens* is very rare and has a restricted and sparse distribution along the Mediterranean. However, it is abundant in small islets of the archipelago of Cabrera (Balearics, Spain) where the endemic lizard *Podarcis lilfordi* is the most abundant vertebrate. This lizard consumes the fruits of this plant and defecates sound seeds. Three months after sowing, ingested and uningested seeds germinated successfully. The rate of germination was significantly improved by lizards gut passage. We also demonstrated that the magnitude of daily temperature fluctuations has a significant effect on both parameters of germination performance of this plant. Daily temperature fluctuations of 6.7±0.2 °C improved the rate and the final percentage of germination in ingested (54 %) and uningested (38 %) seeds, in relation to lower fluctuations of 3.7±0.1 °C (ingested = 38 %, uningested = 28 %). Germination percentage in natural soil was significantly reduced (15 %). Results of this study also indicates that fruit pulp inhibits germination and thus, the plant may needs mediators to separate the seeds from the pulp. The lizard *P. lilfordi* defecates depulped seeds and improves germination performance. Therefore, our results clearly show that *P. lilfordi* is a legitimate and effective disperser of this plant. Also, because this lizard is the most abundant terrestrial vertebrate and very few potential dispersers are present in the islands, we suggest that *P. lilfordi* may probably be the most important disperser of this plant in Cabrera Islands.

The benthic biodiversity of the Belgian inshore and offshore waters

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The benthos of the Belgian coastal and offshore waters has been intensively studied over the past twenty years. The knowledge gathered by many research teams remains mostly unaccessible. This review tries to look at general patterns in the structural biodiversity of the benthos using not only the sparse widely available publications but also the many unpublished administrative reports and student theses.

For this purpose the Belgian continental shelf was *a priori* divided into 9 different regions. For each of these regions data on species number and species diversity were collected for the meiofauna, the macrofauna, the epifauna and the hyperfauna.

Although methods differ between the studies, a general trend of increasing species richness and species diversity was clear for the infauna and the hyperbenthos between inshore and offshore areas. A similar trend of increase in species richness and diversity existed between the eastern and the western parts of the near coastal waters. Within one region depth also seemed to play an important role in determining the structural diversity of the marine benthos.

The mechanism of voluntary steady swimming of hatchling and adult axolotls (*Ambystoma mexicanum*)

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Axolotls swim throughout post-hatching ontogeny, thus dealing with an approximately twentyfold range in total body length (TBL). Using high-speed video (500 fields s^{-1}), we analysed the kinematics and mechanical efficiency of swimming hatchlings (approximately 1 cm TBL, stage '1') and 8 cm TBL animals (stage '2'), and compared the data with adults (14-23 cm TBL, stage '3').

All stages swim by passing waves of lateral curvature down the body. The kinematics, described by the characteristics of this wave (speed, frequency, length, amplitude) are largely comparable in all three stages: swimming speed is increased by increasing the wave frequency only. Mechanical swimming efficiency, estimated by means of Lighthill's elongated-body theory, is about 5% lower in hatchlings than in adults.

The most striking result is that -despite the big TBL range- animals of all stages swim at approximately the same absolute speed. Possible explanations are ecological and/or hydrodynamical. First, predator escape success likely depends on absolute, rather than relative swimming speed, thus favouring high absolute speeds, as are observed. Second, a high absolute swimming speed contributes to an increase in Reynolds number (Re), thus minimising swimming in the unfavourable viscous flow regime.

Variation of soil quality parameters and spider community composition in Flemish forest habitats

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A project aiming at the development of a practical bio-indication system for evaluating forest soil quality was recently started up. The project is funded by the Flemish Forestry Administration responsible for the Flemish forests and is coordinated by the Institute for Forestry and Game Management. In the project the arthropod fauna of fifty forest stands distributed all over the region was sampled by traps active from spring 1997 till spring 1998. All these plots were also investigated for what concerns the chemical properties of their mineral soil and forest floor.

An analysis of the variation of the composition of the spider communities of these plots reveals the important role of physicochemical parameters linked to soil fertility as differentiating variables. On a local scale hydrological regime and tree cover are the more important environmental features. Spider species of which the occurrence co-varies with these major environmental factors are candidates to indicate and to monitor forest soil quality.

Offspring sex allocation in solitary parasitic wasps attacking the same host

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Hymenoptera possess a haplo-diploid reproductive system that enables the ovipositing females to control the sex ratio of their offspring. In the present study we test the host size model (HSM) for sex allocation and assess the possible impact of local mate competition (LMC) with two solitary hymenopterous parasitoids of the leafminer *Agromyza phragmitidis* (Diptera, Agromyzidae); viz. *Opius rex* and *O. polyzonius* (Hymenoptera: Braconidae). Host pupae were collected in four field populations and reared in the laboratory. Host pupal and adult parasitoid sizes were measured. *O. rex* had a 1:1 sex ratio while the sex ratio of *O. polyzonius* was strongly female biassed (1:3,25). Larger host pupae produced larger male and female parasitoids but for neither of the two species the size of the host influenced the sex of the emerging parasitoids (contradicts HSM). Measurements of the thorax and abdomen showed that there was no size difference between males and females of both species. Females of *O. rex* however had significantly larger wings. Analogous to other Hymenopteran parasitoids we therefore can assume that these females have a greater dispersal ability. This results in more females mating outside the oviposition patch. In turns this gives rise to a random mating system. *O. polyzonius* has a female biassed sex ratio as predicted by the assumptions of LMC.

Changes in testosterone levels during the breeding season and the effects of testosterone implantation on paternal care in wild European starlings

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Most studies carried out on birds have shown that plasma levels of testosterone show a marked seasonal variation. These fluctuations usually follow predictable patterns that can be related to changes in sexual, social and paternal behaviour. A first objective of this study was to examine seasonal changes in testosterone concentrations in wild European starlings (*Sturnus vulgaris*). We found that plasma levels of testosterone were highest during incubation. This peak was followed by a strong decrease towards baseline levels during the feeding period. These results seem to contradict the general pattern that plasma levels of testosterone peak during nest-building but may be explained by the fact that starlings are frequently polygynous. The second objective of this study was to investigate the effects of an experimentally elevated testosterone concentration on incubation and feeding behaviour. It has been suggested that testosterone plays an important role in regulating the balance between mating and parental effort. By implanting some males it is possible to sustain testosterone at peak physiological levels for the entire breeding season and to investigate which are the consequences on parental behaviour. Our results indicate that the proportion of time spent incubating by males treated with testosterone implants was lower than that by control males. Testosterone-treated males also fed their nestlings less frequently than control males. During the incubation period, implanted males sang more than control males. These results suggest that males with a high level of testosterone provide less parental care and continue to display after they have acquired their first mate.

The anatomy and ultrastructure of the proboscis in the genus *Zonorhynchus* and the implications for the phylogenetic relationships within the Eukalyptorhynchia MEIXNER, 1928 (Platyhelminthes, Rabdocoela)

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The ultrastructural morphology of the proboscis in the genus *Zonorhynchus* is investigated. The diversity in ultrastructural data on the proboscis is used to elucidate the phylogenetic relationships within the Cicerinidae and Eukalyptorhynchia. A bipartite cone epithelium as found in *Zonorhynchus* is a common feature for all Eukalyptorhynch species investigated. A syncytial proximal belt of the sheath epithelium and intra-epithelial nucle(i)us in the apical cone epithelium form apomorphic features for the genus *Zonorhynchus*. A syncytial basal cone epithelium is an apomorphic character for all species except *Tola* and *Nannorhynchides*. The absence of multiciliary receptors is regarded the plesiomorphic state and distinguishes *Zonorhynchus*, *Tola* and *Nannorhynchides* from other Eukalyptorhynchia investigated. Genera of the *Cicerina*-group and *Psammorhynchus* and *Cytocystis* possess a double set of proboscis retractors. A nucleo-glandular girdle fully enclosed by a layer of ECM forms a common feature for *Cicerina*, *Paracicerina* and *Ptyalorhynchus*. The longitudinal musculature of the proboscis bulb in *Zonorhynchus* is devided in a central cylinder and eight peripheral blocks. The presence of four epithelial belts as is in *Cicerina*, *Psammorhynchus* and *Cytocystis* is considered a joined plesiomorphic state within the Eukalyptorhynchia and the presence of a third belt in the sheath epithelium forms a synapomorhic character for Koinocystididae, Cystiplanidae and Polycystididae.

Recovery of brain acetylcholinesterase activity in common carp *Cyprinus carpio* L. exposed to insecticides

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Organophosphates and carbamates replaced the use of organochlorine pesticides because of their rapid breakdown in water and their low environmental persistence. However these insecticides used in intensive agricultural production can reach aquatic environments either via seepage of chemicals from the soil or directly due to the spraying against pests. These compounds may become concentrated in organs of aquatic organism, especially those at the top of the food chain. The main mechanism of action of these organophosphates and cabamate insecticides involves the inhibition of acetylcholinesterase (AChE). However if exposure to the inhibitor is discontinued, AChE activity could recover the normal level by the dephosphorylation of inhibited site in addition to synthesis of new AChE.

After 96 hours exposure of 6-8 cm lenght carp to chlorfenvinphos (0,24 ppb) and carbofuran (3 ppb), the AChE activity decrease respectively to 30% and 91% compared to control group. The recovery of AChE activity in brain carp exposed to carbofuran occured more rapidly than in carp exposed to chlorvenfinphos. For chlorfenvinphos, a 15 days-period without insecticide exposure is necessary to recover the AChE activity similar to that of control group.

Beetle diversity and historical ecology of woodlands in Flanders

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Woodlands in Flanders nowadays are extremely fragmented and/or reduced in size or are known to have been highly influenced in other ways by humans during at least the past millennium. Within the framework of several projects, including a long-term insect monitoring study, we have recently accumulated data on the carabid beetle fauna occurring in many of these woodlands. In addition, abundant archaeological carabid remains of a post-Roman forest at Velzeke (Eastern Flanders) have revealed a unique example of the faunal composition around 500 AD. Finally, a study on the historical ecology of woodlands in Flanders has been undertaken. The latter includes aspects of fragmentation and site history, such as changes in area and de- or reforestation. Integration of all data on 13 woods reveals that most have been impoverished to a high extent with respect to their stenotopic woodland beetle fauna. Paradoxically, total carabid species diversity is higher in several small and relatively recent woodlands as compared to larger ancient forests. This seems primarily due to the presence, in forest fragments, of many species from surrounding open habitats. Typical woodland beetles show a reduced dispersal power (constant brachyptery) and appear to be powerful indicators for larger ancient woods. Population genetic studies are now conducted on selected woodland beetles in order to evaluate the role of historical and present-day ecology and population characteristics in the observed genetic differentiation and diversity. Such studies may throw light on the mechanisms responsible for the loss of typical species during woodland fragmentation and suggest remedies for future woodland rehabilitation.

Control mechanism of *Amphipholis squamata* (Echinodermata) luminescence: implication of seconds messengers and ionic movements

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Amphipholis squamata is a small polychromatic brittlestar known to be luminescent; light production is under nervous cholinergic control and appears to be calcium dependent. If extrinsic control mechanisms begin to be understood, nothing is known about intrinsic control mechanisms *i.e.* the different steps between receptor activation and photogenesis. In this work, potassium and sodium movements and importance of second messengers (cAMP, cGMP, IP3) were pharmacologically studied on isolated arms and dissociated luminous cells from two varieties of *Amphipholis*. Sodium channels blockers had no effect on acetylcholine-induced luminescence in clear specimens whereas this treatment enhanced photogenesis of the black one. On the contrary, sodium channels activators inhibited light production in both varieties. Potassium channels blockers triggered light emission and enhanced acetylcholine-induced luminescence in clear and black specimens whereas channels activators did not modify light production. Intracellular increase of cAMP level triggered light emission on isolated arms and dissociated cells of clear specimens; this treatment potentiated the acetylcholine-induced luminescence in specimens of both colours. Our results do not support any role of cGMP in the transduction mechanisms leading to luminescence while IP3 seems to be implicated in the intracellular control of photogenesis. Potassium movement at the membrane level and intracellular production of cAMP and IP3 are part of the control mechanism in *Amphipholis squamata* luminescence.

Luminescence in *Amphipholis squamata* (Echinodermata: Ophiuroidea): a suitable model for studying microevolution

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Amphipholis squamata (DELLE CHIAJE, 1828) is a small polychromatic hermaphrodite ophiuroid distributed worldwide except in polar regions. The species is luminescent and important inter- and intrapopulational variations were observed for luminous capabilities. These variations could have 2 origins: (1) variability linked to polychromatism, *i.e.* of genetical origin, and (2) variability linked to brooding state, age and seasonal variations of abiotic parameters (temperature and photoperiod) attributed to phenotypic plasticity. Luminescence have adaptative functions in *A. squamata* with positive and/or negative consequences on individuals fitness: (i) production of light have negative impact on the *A. squamata* survival rate since predation is more intense when the ophiuroid produced more light; (ii) some observations suggest that bioluminescence could have several other functions (intraspecific signal for reproduction, lure/sacrifice strategy, etc.) with positive adaptative effects. Therefore, intrapopulational variations in luminous capabilities implicate that population is composed by individuals with variable chances to survive and these variations should be screened by natural selection. In order to identify selective pressures acting on ophiuroid luminescence and evolution direction, 2 populations were compared: (a) the isolated population of Tindari (Mediteranea, Sicily) characterized by a low predation rate, and (b) the intertidal population of Langrune-sur-mer (English channel, Normandy) where important predation by crustaceans occur.

Ambient temperature and thermoregulation in the bumble bee *Bombus terrestris*

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Bumble bees live in temperate climates, and are capable of thermoregulation within their nests. Under greenhouse conditions, where colonies pollinate, temperatures might be well above the temperatures bumble bees naturally experience.

We studied the ability of bumble bees to maintain nest temperature within its natural range. Artificial colonies, composed of 10 numbered workers, 10 pupae, and with or without 10 additional larvae, were exposed to 20° or 32 °C. We measured brood temperature, CO_2 concentration, and the consumption of pollen and sugar water. Also the frequency of thermoregulatory behaviours was determined. Furthermore, thoracic and abdominal temperatures were measured by means of thermography.

At 20 °C ambient temperature the colony maintains the nest temperature at about 28 °C, by much incubation and presence on the brood. In contrast, at an ambient temperature of 32 °C the bumble bees perform more fanning behaviour and they are minimally present on the brood. In this way they keep the brood at 33 °C. The higher consumption of sugar water and the increased production of CO2 at 20 °C reflects a greater energy investment of the bumble bees at this temperature, compared to 32 °C. The presence of larvae had only little impact. The thermographic measurements show that the bumble bees actively regulate nest temperature. Bumble bees are much better in heating than in cooling the nest in relation to ambient temperature.

Possibilities and limitations of the use of archaeozoological data in faunal analysis: Flanders as a case-study

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Archaeozoology studies the interaction between man and animal through time, by the analysis of animal remains and traces found during archaeological excavations. Gradually, it is also recognised by the 'mainstream' zoological world that archaeozoological data can provide insight in the evolution or regional variation of the late-Pleistocene and Holocene faunas of the Low Countries, just as palaeontological research does for older periods.

However, often not fully recognised is the wide scope covered by recent archaeozoological research, not only in terms of taxonomic diversity, but also considering the detail of information gathered. The paper will discuss examples of these interpretation possibilities that are relevant for Flanders, but will at the same time outline the limitations of our archaeozoological dataset. These limitations are linked with the characteristics of the sites investigated, *i.e.* their preservation conditions, formation processes, cultural framework, or the taphonomy of the contexts that are part of them. Secondly, the dataset is biased by archaeological methodology, especially considering the sampling and recovery of organic remains. Finally, the information gathered strongly differs between taxa, according to their taphonomic status in different human cultures, the possible fossilisation chances of their remains, and eventual identification problems.

When the limiting factors described are not known or not understood, there is an inherent danger in the use of archaeozoological finds in faunal reconstructions.

Adhesion in marine invertebrates: Diversity within an universal phenomenon

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Adhesion (attachment with adhesive substances) is a way of life in the sea. Indeed, representatives of bacteria, all lower plants from unicellular algae to macroalgae, and all animal phyla living in the sea attach to surfaces, including other organisms. The fact that marine organisms produce adhesives that act in the presence of water has raised a growing scientific interest because such bioadhesives may find applications in underwater construction or in the medical and dental fields. In the marine environment, adhesion is particularly developed and diversified in invertebrates. It is involved in various functions such as the attachment of the larvae and/or the adults to the substratum, the taking of food, or the building of tubes or burrows. Three broad types of adhesion may be distinguished: (1) permanent adhesion involving the secretion of a cement (*e.g.* the attachment of barnacles on rocks); (2) transitory adhesion permitting simultaneous adhesion and movement along the substratum (*e.g.* the foot secretions of gastropod molluscs); and (3) temporary adhesion allowing an organism to attach strongly but momentarily to the substratum (*e.g.* the adhesion of echinoderm tube feet). Tenacities (adhesive forces per unit area) of organisms using permanent adhesion are usually higher than those of organisms using non-permanent adhesion (temporary or transitory). In the three types of adhesion, however, the adhesive secretions always seem to involve proteins. The recent revolution in molecular biology has instilled the hope that these adhesive proteins could be easily characterised and imitated. So far, however, not one of the adhesive mechanisms developed by marine invertebrates has been fully deciphered. The reason for this is that bioadhesion is generally mediated by post-translationally modified proteins, and is under the influence of many factors, endogenous as well as exogenous. Multidisciplinary studies, involving morphology, biochemistry, physiology, and biomechanics, thus will be necessary to unlock the secrets of nature's functionally formulated glues.

Population genetic and morphometric study of the damselfly *Lestes viridis* (Ordo Zygoptera)

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The ecology and behavior of damselflies are well known. Yet, data on their population structure are scarce. We studied the population genetic structure of the larvae of *Lestes viridis* in nine Belgian ponds by means of allozyme electrophoresis. F-statistics were used to examine genetic population differentiation. Before electrophoresis, each larvae was sexed and seven morphological characteristics were measured. Principal Component Analysis and Canonical Discriminant Analysis were used to examine population and sex differences in morphology. Additionally, a capture-mark-recapture study (CMR) at three nearby ponds was performed to follow adult dispersal. We found a large genetic population differentiation and a very low gene flow between the nine ponds (Nm = 0.458). Our data were not explained by the 'isolation by distance' model but suggest a strong influence of genetic drift confirming that populations of this species are highly isolated. The strong isolation of *L. viridis* populations was confirmed by the results of the CMR-study since none of the 402 marked individuals dispersed. This is in contrast with the general believe that damselflies are good flyers. We also found large morphological differences between the larvae of different populations and between males and females. Female larvae were larger, heavier and had larger lamellae than male larvae.

Reproductive division of labour in a polygynous ponerine ant

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In many species of the subfamily Ponerinae, workers have retained a spermatheca and can mate. This means that workers are able to replace the queen and become reproductives themselves (we call mated egg-laying workers gamergates to distinguish them from queens). Aggressive interactions among workers determine which becomes the new gamergate. In *Gnamptogenys menadensis*, aggressively dominant individuals are indeed the only ones that lay eggs and become sexually attractive to males. However, once they become gamergates, they do not need aggression to inhibit egg laying in their nestmates. A specific signal related to the high degree of ovary development serves as a cue to virgin workers to actively inhibit each other's oogenesis. This phenomenon is similar to worker policing in honeybees. Our results show that two distinct behavioural mechanisms regulate the establishment and the maintenance of the reproductive division of labour in this species.

Community structure of meiobenthos in an intertidal seagrass bed (Gazi Bay, Kenya): effect of habitat complexity on diversity

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The meiobenthic composition and diversity near five seagrasses *Halodule wrightii* ASCHERSON, *Halophila ovalis* (BRAUN) HOOKER, *Thalassia hemprichii* (EHRENBERG) ASCHERSON, *Syringodium isoetifolium* (ASCHERSON) DANDY and *Halophila stipulacea* (FORSSKÅL) ASCHERSON was investigated. Sediment samples were taken in two quadrants of each seagrass species to a depth of 10 cm using a plastic hand core and were divided into six depth layers. Relevant abiotic factors such as sediment characteristics and organic matter content were also quantified.

Four communities were distinguished, based on meiofaunal composition and prevailing abiotic factors. The first community occurred near *Halodule wrightii* and *Halophila ovalis*, two pioneers in the eulittoral zone. The three other communities were found in the sublittoral zone. One was associated with the climax-vegetation *Thalassia hemprichii*, another with *Syringodium isoetifolium* and a last one with *Halophila stipulacea*, a coloniser of the sublittoral. The vertical pattern of meiobenthos in these four communities showed a decrease in abundances with increasing depth. The meiofauna found in the upper 2 cm was the most diverse and was clearly distinct from that of the underlying sediment.

The spatial variation of meiofaunal taxa between pioneer and climax species was also found on a smaller scale for harpacticoid families between two morphologically similar seagrasses. A high degree of seagrass habitat complexity is translated in a higher diversity on the higher taxon level as well as on the family level (copepods).

Spatial and temporal patterns of heavy metal accumulation and associated population ecological effects in the spider *Pirata piraticus* (Lycosidae, Araneae)

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A year round monthly sampling of several *Pirata piraticus* populations contaminated with heavy metals showed a pronounced temporal variation in the body content of Cu, Zn, Cd and Pb. Especially reproducing females contained very high concentrations of these heavy metals.

The mechanisms responsible for that temporal variation were analysed under laboratory conditions by means of a three level food chain experiment (food source of prey, prey, spider). It appeared that the intensive feeding activity of the female just before egg deposition is responsible for the dramatic increase in heavy metal content.

The population ecological effects of heavy metal pollution in wild populations were assessed by comparing reproductive effort, growth and fluctuating asymmetry between two uncontaminated populations and a highly contaminated one.

It is concluded that understanding temporal variation patterns in body concentrations of indicator species is needed to be able to develop a better monitoring system for heavy metal contamination.

A revision of the cervical musculature in lizards: a tribute to Seiho Nishi

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The evolution of an independantly moveable craniocervical system is a key feature in the evolution of amniote organisms. The cervical system does not only play a crucial role during the orientation of the head towards external stimuli (*eg.* visual, auditive stimuli), but is also of major importance during the inertial components of feeding in amniotes. Although the cervical system and its musculature is generally well studied in mammals, archosaurs (birds and crocodiles) and turtles, very little is known about the cervical system in some of the most primitive amniotes (lepidosaurians). In a first step to elucidate the evolution of the cervical system, the neck musculature is examined in lizards from five different lizard families. In general the bauplan of the cervical musculous system appears stable within closely related phylogenetic groups. Still, the evolutionary shift from a lingual based to a predominantly inertial feeding system within lizards clearly coincides with an increase in the complexity of mainly the epaxial components of the cervical musculature. The use of neck muculature as a systematic character seems to be justified on the condition that the true complexity of the system is appreciated. A "new" nomenclature of lizard neck muscles (based on the work of Nishi) is proposed, and should enable future workers to interprete the neck musculature in an evolutionary context.

The value of plantation forestry for conservation of biodiversity - a case study with soil dwelling Collembola

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The value of plantation forestry for the conservation of biodiversity is a highly controversial and contested issue. However, almost no research on this subject has been carried out yet. Our aim was to compare the soil dwelling Collembola of plantation forests with their semi-natural counterparts.

Therefore, we studied the community of soil dwelling Collembola in the three most common plantation forestry types (*i.e.*, poplar, pine and beach plantations) in Flanders (Belgium). We also studied the respective semi-natural counterparts of each plantation type (*i.e.*, ash, mixed oak-birch and mixed oak-beach with hornbeam forests). The soil dwelling Collembola were collected with pitfall traps in spring. The Collembola were sorted and identified to species level. We compared the species composition, richness and diversity of the different communities.

Reconstructing the phylogeny of the animal phyla

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Comparison of published cladistic analyses of animal morphology indicates that no general consensus about the phylogeny of the animal phyla is possible at this time. Nonetheless, different authors frequently argue that the results of their respective analyses are well-supported! We show that the various cladistic studies published to date exhibit significant differences with regard to methods of character selection, character coding, scoring and weighting, groundpattern reconstructions, and taxon selection. These differences are never dealt with explicitly by authors and thus hinder the comparison of the studies. In order to judge the relative merit of these studies, these methodological issues must be assessed for their effect. Until this is done, we can have little hope to reach a morphological reference framework for effective comparison and combination with molecular and developmental genetic studies.

The evolution of self-fertilization in a pulmonate land gastropod (Mollusca, Pulmonata)

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We studied the evolution of the breeding system of three morphologically highly similar land slugs of the subgenus Carinarion: *Arion (Carinarion) fasciatus*, *A. (C.) circumscriptus* and *A. (C.) silvaticus* throughout the species' main range in Europe. Allozyme studies suggest that in NW-Europe, the three species mainly reproduce uniparentally, most probably by self-fertilization and that each species consists of a number of homozygous multilocus genotypes. In many populations several strains co-occur but we could not detect any ecological differentiation between these strains. In east and SE-Europe, outcrossing seems not infrequent. This is to our knowledge the first report of geographic self-fertilization in a pulmonate gastropod. Further, the results indicate that *A. fasciatus* and *A. silvaticus* possibly may hybridize. A parallel morphometric study supported the close relationship of *A. fasciatus* and *A. silvaticus* and the somewhat distinct position of *A. circumscriptus*. In view of this, we suggest that *Carinarion* may very well represent a single species which originated in SE-Europe and from which, analogous to partenogenetic species, after the last glacial periods, fixed multilocus genotypes invaded the rest of Europe.

Reproduction strategy of an estuarine tilapia, landlocked in a West African man-made lake

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Reproduction of brackish water tilapia *Sarotherodon melanotheron* has been studied for the first time in freshwater conditions in man-made lake Ayame (Côte d'Ivoire). The sex-ratio shows seasonal variations with an average rate of 1: 2.3 in favour of females. Sizes at first sexual maturity both in males (129 mm) and in females (140 mm) are lower than those found in the natural environment of the species. Fecundity, varying from 132 to 430 oocytes is significantly related to body weight, standard length and gonad weight ($p < 0.05$). The small number of oocytes produced in Lake Ayame is compensated by an increase in oocyte diameter. Mean condition factor of *S. melanotheron* populations in the Lake, is situated between values recorded for populations living in brackish water; this indicates a good adaptation of the species to the freshwater conditions of the Lake, where it constitutes more than 50 % of the total fish catches.

Teleost yolk cell function on blastoderm differentiation and morphogenesis

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Next to a prominent nutritional role during larval growth the teleost yolk cell may function during early developmental processes as a source of inducing signals.

In *Xenopus* mesoderm-inducing signals reside in the vegetal cells of the blastula and exert their function on the more animal located cells in the margin. Because of its position reminiscent of the vegetal cells in *Xenopus*, the yolk cell with the yolk syncytial layer of teleost fishes may have a similar inductive capacity. Removal of the blastoderm from the YC offers an experimental approach to study to what extends blastoderm differentiation and morphogenesis depend on inductive interaction with the YC. Expression of marker genes for dorsal-ventral and anterior/posterior determination such as no tail, *gooscoid* and *caudal* was examined in the blastoderm explants which were incubated until sibling controls reached the tail bud stage.

Blastoderms removed at 3 h of development expressed rudimentary dorsal-ventral polarity. Apparently signals leading to this expression had reached the margin of 3 h blastoderms. Blastoderms removed at 4 h showed in addition to dorsal-ventral polarity notochord-like structures and also expression patterns of *gooscoid* and *caudal* suggested that gastrulation movements had occurred.

Intra- and interpopulation allozyme variation in arthropods occurring in Flemish habitat fragments

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Natural and semi-natural habitats in Flanders are usually small remnants distributed in a nature unfriendly matrix. We tried to assess the population genetic consequences of that fragmentation on arthropod populations occurring in two very different habitat types: brackish and freshwater marshes along rivers (highly disturbed) and in forests (more stable habitats). This was done by observing allozyme variation made visible by means of cellulose acetate gel electrophoresis. For the first habitat type the intra- and interpopulion variation in allozymes was determined for two sister species of terrestrial amphipods, *Orchestia gammarellus* and *O. cavimana* (Talitridae, Amphipoda). For forests, allozyme variation in the spider *Coelotes terrestris* (Agelenidae, Araneae) was investigated. In both cases we find indications for genetic isolation and erosion which can be fitted in population genetic theory. The obtained results, however, also illustrate the limitations of the method we used to analyse the population genetic effects of habitat fragmentation.

Study plot size and isolation affect dispersal of Great and Blue Tits: 40 years of Belgian nestbox data

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In a patchy habitat, the proportion of individuals breeding inside the natal patch is one of the key factors affecting the genetic structure and demography of the population. Differential immigration rates may reflect accessibility of patches as well as their quality. Here we report on local recruitment rates in Great and Blue Tit populations that have been studied in a standardized way in the last 40 years in Gent and Antwerp. Local recruitment – *i.e.* the proportion of first-year breeding birds ringed as nestlings in the same study plot - increased with both patch size and breeding density, which supports the idea that dispersal scales with "social distance" (number of individuals or territories) rather than physical distance. Within the heterogeneous Gent study area, local recruitment was higher in patches of higher quality, measured by mean reproductive output. Local recruitment was lower in patches within a larger forest (Peerdsbos) than in isolated forest fragments. However, the degree of isolation of fragments had at most a weak effect.

Curvature in long bones of birds

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Maximum sagittal curvature of long bones (humerus, ulna, radius, femur, tibiotarsus and tarsometatarsus) of 36 species of birds was measured by means of photographs and scanner. This direct measurement of the curvature was regressed to body mass. The curvature of these bones was also regressed to the ratio sagittal diameter/transverse diameter in the same material, in order to test current hypotheses on curvature and cross-sectional asymmetry of long bones as alternative systems of load predictibility. Globally, curvature scaled in hind limb bones faster than in forelimb bones; tarsometatarsus had the highest exponent. Only in two cases (humerus and ulna) did curvature scale in a geometrically similar way. Humerus and radius displayed relatively low correlation coefficients, with a dispersion of values that may be related with particular flying strategies. Given the results, it is very difficult to be sure about the mechanical significance of long bone curvature, at least in birds. The fact that the curvature of appendicular bones is a plesiomorphic character for all the tetrapods should be considered when mechanical explanations are adduced.

Temperature, salinity and food thresholds in two estuarine bacterivorous nematode species: What is setting the limits?

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Respiration and food assimilation of two estuarine bacterivorous nematodes, *Pellioditis marina* and *Diplolaimelloides meyli*, with partly overlapping microhabitat preferences, were measured at different temperatures, salinities, and food densities. Our aim was to identify the fundamental niche of both species in their natural habitat, and to investigate the relative importance of food and abiotic factors for nematodes in the dynamic estuarine tidal environment. Salinity least impacted *P. marina* and *D. meyli*. Temperature heavily affected both species, but Q_{10} values in *D. meyli* were considerably higher than in *P. marina*, suggesting the former species to be particularly well adapted to fine-tuning its energy expenditure as a function of temperature. Scope for production was 0 at 5 °C and increased to a maximum at 25 °C in both nematodes. Food assimilation in both nematodes was significant at bacterial densities above 10^8 cells.ml^{-1} only. Assimilation rate was maximal at 5.10^8 cells.ml^{-1} in *D. meyli*, and remained constant at higher densities. *P. marina* had a well defined peak assimilation at a food density of $2.5 * 10^9$ cells.ml^{-1}. Respiration of *P. marina* at bacterial densities below the assimilation threshold of 5.10^8 cells.ml-1 was threefold lower than at this threshold.. A combination of the present data with life history and field observations indicates that *P. marina* is adapted to colonise palatable organic matter during early decay, with food level as a major determining factor, whereas *D. meyli* exploits a broad range of more refractory detrital substrates, temperature being a major determinant of its success.

'Speed control' in animal locomotion: how does the European green frog increase its swimming velocity?

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In terrestrial locomotion, speed is increased by augmenting the stride frequency (number of strides per unit time) and/or stride length (distance travelled during an entire locomotor cycle). In an aquatic medium the situation becomes more complex because of the interaction between the different gait variables. Swimming cycles in frogs can be divided into three different stages: the propulsion (a powerful extension of the hind limbs), the glide (the frog's body stays fully extended) and the recovery (hind limbs are flexed to the initial position). Each stage has its own duration and amplitude. This gives a total of six variables that can be adjusted to increase the swimming speed. From the point of view of the neural control, it is not obvious to regulate all these components together because this implies a complex feedback system. We found a significant amount of variation in all the variables with the overall swimming speed. This means that, using the conventional way of describing a speed control system, we were not able to reach unequivocal conclusions. Yet, by introducing new variables namely the instantaneous speed at the start of each period, we found well established relationships between these variables and the average swimming velocity. Thus, the latter seems to be modulated on the basis of the instantaneous fluctuations of speed throughout the locomotion cycle.

The social relationships of female Thomas's langurs *(Presbytis thomasi)*

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The social relationships of adult females are of central importance for understanding the adaptive significance of primate social systems in general. In gregarious primates, there is considerable variation in female social relationships. An important factor affecting social relationships in a primate group is the amount of attraction between individuals. Understanding the basis of such attraction, and the ways in which it is expressed, is an important part in explaining the social structure of primate groups. Female Thomas's langurs (*Presbytis thomasi*) disperse, do not form coalitions and have no stable rank orders. These factors are social correlates of a low level of within and between group contest competition. It is interesting to what extent social relationships are important in this species. In the present study, it was determined if female Thomas's langurs have preferences for certain group members, and on which factors these preferences depend. The effect of female transfer on the social relationships of females was also determined. Data were gathered on wild Thomas's langurs in Ketambe Research Station, Indonesia. The social relationships of female Thomas's langurs were studied by collecting data on proximity, allogrooming and aggression. The results from this study indicate that relationships between females of this species and their preferences for certain group members are mostly individualistic. Female preferences tend to be directed to other females rather than to males and there is no clear effect of kin, sex nor age of social partners on female-female social relationships. Familiarity however, does influence female social relationships.

Morphological and behavioural diversity in the Carapini (Carapidae, Pisces) : phylogenetic analysis

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The fishes of the *Carapus* and *Enchelliophis* genera (Carapidae, Ophidiiformes) have the ability to enter and stay in Holothuroids. The comparative study of their cephalic morphology with their stomach contents has shown a carnivorous diet. However some fishes have a large mouth opening, robust jaws and a developed musculature which could be in relation with a diet compound of tough preys (fishes, crustaceans). Theses fishes could have a commensal way of life and they could use their host principally as a shelter. Other fishes, considered as parasites, have on the other hand a limited mouth opening, a less developed denture and a diet compound of soft prey (holothurian tissues). In the current phylogenetic arrangement, the fishes of the *Carapus* genus are commensal when those of the *Enchelliophis* genus regroup parasitic and commensal species. We realised a phylogenetic study based on 61 characters (morphology, diet, ethology). She has shown that three species of the *Enchelliophis* genus (*E. Boraborensis*, *E. homei* and *E. dubius*) should be replaced in the *Carapus* genus. In this way, the latter could regroup the commensal species whereas the *Enchelliophis* genus could have specialise in a parasitic way of life and their cephalic structures should have adapt to this new ecological niche.

The use of Red Data Books in nature conservation: the case study of Dolichopodidae (Diptera) of Flanders

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Very recently, the misuse of Red Data Books (RDB) and RDB as such have been severely critized as if it directs nature conservation towards single species protection rather than the conservation of entire communities or biodiversity as a whole. RDB as a concept, however, stands firm as it is the only way to achieve reliable estimates of the rarity and vulnerability of biota. In fact, the assignment of individual species to RDB categories is only the final visible result of elaborate data collecting and processing. A proper documentation on the ecology of the rarest and most vulnerable species is another important aspect.

In the frame of an IN-project, during 1997-1998 a RDB of Dolichopodidae (Diptera) of Flanders was compiled on the basis of all distribution and ecological records on this dipteran family collected in Belgium since 1850. Of the 295 species ever discovered in Belgium, about 88% (n=260) has been recorded from Flanders. Since 1981, 22 species have become extinct while another 40 are considered vulnerable to critically endangered. Almost 68% of saltmarsh dolichopodid faunas can be called threatened which makes this habitat the most vulnerable in Flanders. Other valuable habitats are reedmarshes and marshlands in general, riparian habitats and to a lesser extend, coastal dunes and humid woodlands and heathlands.

Especially in site quality assessment, RDB prove to be an indispensable data source. By using an index that both incorporates species richness, diversity, rarity and vulnerability, entire dolichopodid and other invertebrate communities are easily compared in respect of their conservation value.

Chemoreceptive predator recognition in three Lacertid species

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Lacertids are higly chemoreceptive lizards. They use chemoreception for a wide rande of behaviours, including predator recognition. We studied the chemoreceptive predator recognition in three species, *Podarcis sicula*, *Podarcis tiliguerta* and *Lacerta bedriagae*. Two of these species, namely *P. sicula* and *P. tiliguerta*, are syntopic with *Coluber viridiflavus*; *L. bedriagae* is allotopic with this snake. *C. viridiflavus* is a predator of lizards. We also used chemicals of a non saurophagous snake, *Natrix maura* as a control scent. First, we tested the ability of the lizards to identify the scent of *C. viridiflavus* as that of a predator. Our results show that all three species of lizards identify this scent (higher tongue-flick rate) as being dangerous. They also show that while *P. sicula* and *P. tiliguerta* can distinguish between the scent of *C. viridiflavus* and of *N. maura*, *L. bedriagae* apparently does not have this ability. In a second part we also investigated the effect of the scent of *C. viridiflavus* on the lizards' microhabitatchoice and foraging behaviour. The results of these tests show that the species have different preferences concerning microhabitats, that this preferences change when confronted with the scent of *C. viridiflavus* and that they actively avoid substrates labeled with this scent. In the presence of snake chemicals, lizards curtailed the duration of several components of their foraging behaviour.

Biodiversity resources in Belgium: the database BIODIV

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Belgium, like many other countries, has ratified the Convention on Biological Diversity (Rio de Janeiro, 1992). As part of its obligations it is making an inventory of the expertise in biological diversity present in Belgium. The database BIODIV is an interactive website on the Internet (http://www.br.fgov.be/BIODIV).

BIODIV contains an extensive list of biodiversity research items done by Belgian researchers or in Belgium. It also offers an overview of biological collections and databases conserved or kept in Belgium. Events related to biodiversity, such as symposia, congresses, important press releases,... in Belgium and its surroundings are announced. A bibliography of Belgian standard literature on biodiversity is offered.

BIODIV contains information on biodiversity research and conservation, ranging from the genome to infraspecific diversity, species diversity, populations, biocoenoses and the biome level.

It is also a guide to Belgian biological university labs, research institutions, zoos, botanic gardens, museums, nature education centres, associations, journals, independent experts,... and their eventual websites.

To select research items and collections three different search keys are accessible - taxonomy, geography and miscellaneous - separately or in combination. Databases present on the Internet can be consulted on-line from BIODIV.

Belgian users have standard forms at their disposal on the web to add or modify any information on themselves or on their biodiversity related activities. At this point the database contains information on some 120 institutions and 500 subdivisions, 700 people and 1000 research lines.

A test of the C_3 - C_4 hypothesis with two grass miners (Diptera, Agromyzidae)

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Caswell *et al.* (1973) hypothesized that plants possessing the C_4-dicarboxylic acid pathway of carbon fixation are a poorer food source for herbivores than those possessing only the C_3-Calvin cycle pathway, and that this difference is reflected in a tendency for herbivores to avoid feeding on C_4 species. We tested host preference and larval performance of two oligophagous grass miners, *Chromatomyia milii* and *C. nigra*, on C_3 versus C_4 grasses. Choice experiments showed a clear preference: both species oviposit and feed almost exclusively on C_3 grasses. The feeding quality of C_3 and C_4 grasses was also analyzed to test wether C_4 grasses are a poorer food resource compared to C_3 grasses. We only found significant differences between C_3 and C_4 grasses for the soluble sugar content. Protein, free amino acid and water content did not differ significantly. However, because the preference tests were very strongly in favour of C_3 grasses and because females of both species still refused to lay eggs when only C_4 grasses were offered we do not think the small differences in feeding quality account for the differences in host preference. We will demonstrate that morphological constraints, e.g. the width of the ovipositor and interveinal distance, determine the preference for C_3 grasses. We conclude that the C_3 - C_4 hypothesis is only partially supported in case of our study species. Both *C. milii* and *C. nigra* avoid to lay eggs or to feed on C_4 grasses, but morphological constraints rather than differences in feeding quality explain this pattern.

Formic acid producing systems in invertebrates: structural aspects

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The formic acid producing glands of three different invertebrate groups have been studied: formicine ants (Hymenoptera, Formicinae), anthinine beetles (Coleoptera, Carabidae) and vinegaroons or whip-scorpions (Arachnida, Uropygi). In ants, the apparatus involved consists of a sac for acid storage and an elliptical, flattened cushion with relatively few secretory cells, the latter apparently involved in secretion of lipophilic minor compounds of the secretion. In anthinine beetles, such as *Anthia*, the glands are huge and form a complex, consisting of a 6-8 mm long bean shaped main reservoir (yellowish and translucent). Attached to this is a similar but smaller greyish coloured chamber (2-3 mm). From the reservoir originates a very long (sometimes 20 cm) transparent free coiled tubule, that connects the secretory acini. The reservoirs are very thick and muscular. In whip-scorpions the reservoir has a striated aspect, due to both muscular and glandular parts. A free secretory tubule is less obvious. Characteristics shared by all systems investigated are the presence of some glandular parts, of an extremely long – mostly non-secretory – tubule, a large muscular reservoir for storage, a muscular closing apparatus and finally special devices for directional trajectory manipulation of the acid spray (the latter very obviously present in vinegaroons and in ants). Our results may lead to a better understanding of the contribution of each compartment in achieving the final concentrated mixture.

Biodiversity and molecular phylogeny - ostracods from ancient lakes

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Ostracods, small, bivalved crustacean, represent an important part of the benthic fauna in ancient lakes. In Lake Baikal, the oldest lake of the world with an age of c. 20 Myr, up to 90% of the ostracod fauna is endemic. We have investigated the most extensive, Baikalian ostracod radiation, the *Cytherissa* flock, with more than 50 (sub-) species. A combined, methodological approach, applying molecular techniques (PCR and automatic sequencing) as well as morphological analysis, is used to study diversity of the flock, to reconstruct phylogenies and to link these data with evolutionary processes and the lake's extensive history.

Molecular phylogenies, based on sequence data from the mitochondrial Cytochrome I oxidase gene, indicate a multiple origin of the flock. Preliminary age estimates suggest that the *Cytherissa* flock is a rather young part of the Baikalian fauna and might have originated after a drastic, climatic change in the Miocene (3 Myr ago), which lead to the formation of a stable, oxygenated abyss in the lake.

The physiological condition of mussels from three locations on the Western Scheldt, determined with survival in air and condition-index

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Specimens of the marine bivalve *Mytilus edulis*, the blue mussel, were sampled at three sites in the Western Scheldt estuary (Westkapelle, Ellewoutsdijk and Hansweert). At Westkapelle we collected mussels from three different heights. In the Western Scheldt an upstream cadmium gradient and a salinity gradient in the opposite direction exists wich creates different conditions of environmental stress.

The physiological condition was determined by assessing the stress tolerance towards cadmium exposure and survival in air. We developed a condition index, to express the condition of the mussel in five values (5: perfect condition - 0: dead) in the cadmium exposure experiments.

The mussels from different heights in the tidal zone did not differ significantly in survival times although significant differences were found for cadmium tolerance. Mussels from the heighest position had lower condition indices during the entire experiment.

The mean survival time in air and the condition index was significantly different among the three sites. This correlates with both decreased salinity and increased cadmium concentration at the sampling site.

Mussels collected at locations with higher stress are more sensitive to added stress. They have lower condition indices and lower survival times.

Autotomy shapes the trade-off between seeking cover and foraging in a larval damselfly

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Animals commonly choose between microhabitats that differ in foraging return and mortality hazard. I studied the influence of autotomy on the way larvae of the damselfly *Lestes sponsa* deal with the trade-off between foraging or seeking cover. Survival of the *Lestes* larvae when confronted with the odonate predator *Aeshna cyanea* was higher in a complex than in a simple microhabitat indicating that this more complex microhabitat was safer. Within the simple microhabitat lamellaeless larvae were more vulnerable than larvae with lamellae, showing a long term cost of autotomy. When varying the foraging value (food present or absent) and predation risk (encaged predator or no predator) at the simple microhabitat lamellaeless larvae and larvae with lamellae responded differentially to the imposed trade-off. All larvae spent more time in the simple microhabitat when food was present than food was absent. Lamellaeless larvae however only sporadically left the safe microhabitat, and this irrespective of the presence of the predator. In contrast, the shift towards the risky microhabitat in larvae with lamellae was more frequent than in lamellaeless larvae, moreover it was higher in the absence than in the presence of the predator. These decisions affected the foraging rates of the animals. The different microhabitat preferences for larvae with and without lamellae are consistent with their different vulnerability to predation and show the importance of intrinsic factors in making trade-offs.

Larval chemical defence and evolution of host shifts in *Chrysomela* leaf beetles

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Larvae of *Chrysomela* leaf beetles release for defence volatile compounds belonging to various chemical families. This study focuses on the defensive strategy based on the esterification of isobutyric acid and 2-methylbutyric acid with a wide variety of alcohols taken up from the host plant. To date, only two species are known to produce these repellents: *C. interrupta*, which is associated with Betulaceae and *C. lapponica* which occurs either on Betulaceae or Salicaceae.

In order to know if other species have developed this chemical defence and how the food plant influences the secretion of these toxins, we targeted by mass spectrometry the presence of iso- and 2-methylbutyric acids and esters of them in the defensive secretions of *Chrysomela* larvae exclusively associated with Betulaceae or Salicaceae.

Screening analyses reveal that the synthesis of these compounds is a common character restricted to all the members belonging to the *C. interrupta* group sensu Brown (1956) regardless of the host-plant family. These chemical data suggest that the biochemical mechanism leading to the synthesis of these compounds could be considered as a synapomorphy meaning that the group is probably monophyletic. The phylogenenetic analyses of the *interrupta* group of species based on mitochondrial DNA sequences supports this hypothesis.

Defensive secretions are quantitatively assayed revealing a chemical plasticity developed by *Chrysomela* species associated with Salicaceae. The amounts of iso- and 2-methylbutyric acids derivatives and of salicylaldehyde in their larval secretions depend on the food plant and on its content in phenolglucosides.

The selfish cytoplasmic micro-organism *Wolbachia*: widespread occurrence in ants

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A weakness of the current theories on reproductive conflicts in hymenopteran societies is that only the interest of autosomal genes are properly accounted for. Recently, several authors have stressed the importance of selfish maternally transmitted elements that manipulate the reproduction of their host to their own advantage, thereby opposing the interests of the autosomal genes. The rickettsial bacterium *Wolbachia* is a typical example of such a maternally transmitted 'selfish cytoplasmic element'. Apart from strains inducing feminisation and asexual (thelytokous) reproduction, a very common strain is known to induce reproductive incompatibility among host strains. The latter 'cytoplasmic incompatibility' type reduces the fitness of uninfected females by rendering them incompatible with an infected male's sperm, resulting in infertility (in diploids) or in exclusively male progeny (in haplodiploids). Using a PCR based on specific primer pairs amplifying sequences of the ftsZ cell cycle gene of A and B strain *Wolbachia*, 43,9 % of 132 worldwide collected ant species were shown to be infected. A comparison of infection patterns in a monogynous vs. a polygynous population of the wood ant *Formica truncorum* supports a reproductive incompatibility effect of *Wolbachia* in ants. Assuming the induction of cytoplasmic incompatibility to be *Wolbachia*'s selfish strategy in ants, colony-level selection, population structure and host modifiers are discussed among other factors as an explanation for a possible facilitated invasion and maintenance of *Wolbachia* infections in eusocial hymenopteran societies.

Cladoceran communities of the dune pans in the Lençóis Maranhenses (NE-Brazil)

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The Lençóis Maranhenses is a sand desert, mainly consisting of moving barcani dunes, situated along the northeastern coast of Brazil. This region, the size of Belgium, is a unique ecosystem because it is a desert with a rainfall regime similar to that of the Amazon Basin.

During the rain season the Lençóis are consequentely covered with thousands of interdunal temporary pools.

This highly vulnerable ecosystem, although being proclaimed a national natural reserve, is under increasing treath of human encroachment (mainly tourism and sporting activities such as dune buggy races)

The invertebrate fauna of the dune pools was sampled for the first time in 1997. Subsequently the taxonomy, genetics and ethology of the cladocerans, in correlation with a large number of ablotic factors, were studied.

While cladoceran communities from the different continents are increasingly and rapidly becoming mixed due to antropochorous dispersion, the communities of the Lençóis Maranhenses, in contrast, showed a extremely high degree of authenticity, being virtually composed of south american species only. This indicates the low anthropogenic influence in this region and hence its great value for zoogeographical studies.

The use of confocal laser scanning microscopy (CLSM) in the study of the dynamics of tooth replacement in the zebrafish (*Danio rerio*) (Teleostei, Cyprinidae)

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The present study aims at the description of the dynamics of tooth replacement in the zebrafish (*Danio rerio*) *i.e.*, the order in which teeth are replaced, the length of the replacement cycle and rate of matrix mineralisation. These data should provide basic information for the study of tooth formation and its molecular control in this model fish. Our present working hypothesis states that the length of the replacement cycle will differ during ontogeny and according to tooth position. Fish from 28 days post-fertilisation (dPF) up to 119 dPF were injected with two fluorochromes (resp. calceine and alizarine red S) with different time intervals, varying from one up to five weeks. Several techniques, each with its own drawbacks (loss of material upon sectioning, difficulties to identify individual teeth,...), were used in order to study the fluorescent incremental lines. The use of confocal laser scanning microscopy (CLSM) appeared to be the most appropriate technique for observing the dentition *in toto*. When the laser is properly adjusted, scanning is rapid, PIC-images of the optical sections can be saved, and 3-D reconstructions can be made and saved. This method has the advantage of providing ready-to-use images which are readily available for use in measuring morphological characteristics of the teeth and for measuring distances between the two fluorescent markers. Preliminary results obtained by CLSM, which appear to be in accordance with our working hypothesis, will be presented.

Relationships between Azorean and Madeiran Leptaxinae (Mollusca, Pulmonata: Hygromiidae)

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The Leptaxinae are a subfamily of hermaphroditic land snails, endemic for the Macaronesian archipelagoes (Azores, Madeira, Canary & Cape Verde Islands) where they are represented by three recent genera.

The Leptaxinae are poorly known and their taxonomy is almost exclusively based on shell features, supplemented by very limited anatomical data. The biogeographic relationships between the representatives from the different archipelagoes have also received very little attention. The inclusion of Madeiran taxa in this study is a first step towards the understanding of the biogeographic relationships between the taxa of the different archipelagoes, but it also allows for a better interpretation of previous results. Extensive morphometric and protein electrophoretic analyses revealed quit complex patterns of differentiation between genera, species and populations. In order to uncover the phylogenetic and phylogeographic relationships within the Leptaxinae, we now also started to analyse sequences using various primers for nuclear as well as mitochondrial DNA.

First case of *Wolbachia*-infection in the primitive hexapod order Collembola: possible effect and phylogenetic analysis

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To intracellular, maternally (transovarially, vertically) transmitted bacteria, only the female sex matters for microbial propagation. Therefore, cytoplasmic microbes may manipulate their hosts' sex, as is exemplified by the α-Proteobacteria member *Wolbachia pipientis*. The latter can feminize genetic males, and induce parthenogenesis and cytoplasmic incompatibility in invertebrates. We focus on the *Wolbachia* endosymbiont of a novel host, the isotomid springtail (Collembola) *Folsomia candida* (FC). Transmission electron microscopy and DAPI (4',6-diamidino-2-phenylindol) fluorescence microscopy revealed the tiny microorganisms (average diameter < 0.5μm) in connective cells and to a greater extent in ovaries and mature eggs, confirming transovarial transmission. Hitherto, parthenogenesis bacteria have been found in quite a few Hymenoptera genera composed of haplodiploid species (*i.e.* where males develop from haploid, unfertilized eggs whereas diploid, inseminated eggs give rise to females). During the first stages of male embryonic development, *Wolbachia* restores diploidy through gamete duplication, resulting in 100% homozygous diploid (thus female) offspring. Our FC strain reproduces by thelytokous (mother-to-daughter) parthenogenesis, probably *Wolbachia*-directed in much the same way as in parasitic wasps. However, unlike the wasps, FC is diplodiploid, hence uninfected haploid eggs from virgin females turn out to abort instead of yielding male progeny. To assess the relationship of the FC bacteria to other *Wolbachiae*, we PCR-amplified and sequenced part of the bacterial 16S rRNA gene, enabling us to include it in the *Wolbachia*l phylogenetic dendrogram. The FC strain indeed shows a high 16S rDNA homology to certain parthenogenesis bacteria present in Hymenoptera, which will be discussed.

Paralysing endotoxins in *Musca domestica* L.

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Acid methanolic extracts of wandering stage larvae of the housefly (*Musca domestica* LINNAEUS) contain substances that cause immediate paralysis, followed by death when injected into adult grey fleshflies (*Neobellieria bullata* PARKER). These highly toxic endogenous substances were designated as paralysins, refering to their immediate paralytic effect upon injection.

The isolation of the paralysins present in the acid methanolic extracts of housefly larvae by means of high performance liquid chromatography was difficult and laborious. Thus, only a partial purification of these hydrophilic compounds was achieved. Preliminary analysis by mass spectrometry indicated that the newly discovered paralysins of *Musca domestica* have a low molecular weight (probably lower than 225 dalton).

During extractions an interesting observation was made. It appeared that the amount of extractable paralysins in the housefly fluctuated with developmental stage. Indeed, paralytic activity was high in late instar larvae, subsequently decreased in the pupal stage and reached a new maximum just before eclosion of the adult fly. This temporal distribution of paralysins during development suggests that these compounds might be involved in some aspects of metamorphosis.

However, purification to homogeneity and identification of these compounds has to be performed before scientists can clarify the physiological importance of paralysins during development.

Diversity of the ichthyofauna of a tropical mangrove bay (Gazi Bay, Kenya)

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Gazi bay is a shallow coastal system located at about 4°25'S and 39°30'E on the Kenyan coast (Western Indian Ocean). The bay is about 1.75-3.5 km wide and 3.25 km long and is characterised by a variety of habitats: it is bordered by extensive mangrove swamps on the landward side and fringed with a coral reef on the seaward side. The mangroves are intersected by large creeks, one of which is a seasonal estuary. Well-developed seagrass and macro-algal beds are present at both intertidal and subtidal levels, as well as unvegetated sandy areas.

The fish communities of the bay have been intensively studied by several research groups between 1991 and 1996. The different studies deployed different sampling strategies and methodologies. Fyke nets, beach seines and several types of beam trawls were used in different habitats and in different seasons and time of day. For this paper, an in-depth assessment and comparison of the different studies on the ichthyofauna of Gazi bay is presented. The paper focuses on the emerging diversity patterns in relation to the differences in sampling strategies.

To date, a total of 333 teleost species in 72 families has been identified from the bay. For each study conducted in the area, less than 10 species constituted about 90% of the total catch. Only 9 species were common to all studies, while 150 species and 18 families were recorded only once. Most of these species were rare. The families Anguillidae, Aploactinidae, Aulostomidae, Balistidae, Congridae, Dasyatidae, Echeneidae, Nemipteridae, Ophidiidae, Percophidae, Rhynobatidae, Sparidae, Tetrarogidae, Torpedonidae, and Triodontidae were each represented by a single species, while Apogonidae, Gobiidae, and Labridae were the most speciose families, each represented by more than 20 species

Spite: an important evolutionary phenomenon

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The evolution of spite, defined as social actions that lower the direct fitness of the recipient at no direct benefit to the actor, has received a mixed and often contradictory treatment. Hamilton showed that spite is selectable when the two interacting parties are negatively related, but thought it to be of minor importance in the evolution of social actions, an opinion widely shared. By consideration of a passive benefiting third party it is shown that the scope for the evolution of spite is greatly extended. Additionally, direct perception of the recipients' phenotypic label (a 'green beard') is a commonly observed strategy that facilitates discrimination involving negative relatedness and hence selection for spiteful actions. We will present a general model for the evolution of spite that successfully unites apparently disparate phenomena such as the sacrificial sting of the honey bee, actions of the immune system, worker policing, *Wolbachia* dynamics, and the bacterial 'altruism' of *Escherichia coli*. Just like altruism, spite is a common phenomenon that is associated particularly with situations where individuals have a low potential for direct reproduction.

ABSTRACTS OF THE POSTERS

On how ontogeny can reveal possible changes in efficiency of feeding strategies in the African catfish *Clarias gariepinus*

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During ontogeny, larval fish have to deal with increasing nutritional and respiratory demands. As ontogeny is characterised by an increase in complexity of structural elements composing the skull, some constraints will have to be met with when developing mechanisms, which enable feeding and respiration, arise at a certain developmental stage. In this paper, special attention is paid to the presumed ontogenetic shift in feeding strategies in *Clarias gariepinus*, based on morphological data. During ontogeny, a total of five different mouth opening mechanisms are formed, which may enable mouth opening, starting shortly after hatching. Presumably, the efficiency of mouth opening improves as the different mechanisms are formed and become protagonists.

By modelling the hyoid and opercular four bar system [according to Aerts & Verraes (1984)], as well as the coupling of hyoid depression to mandibular depression [according to De Visser & Barel (1996)], some suggestions can be made concerning the ontogenetic changes in feeding strategies. It appears that the output velocity (*i.e.* the efficiency in which a four-bar system converts input speed to output speed) of the opercular four-bar system is substantially higher than that of the hyoid system in early larval stages, whereas the difference becomes smaller in juvenile stages. Additionally, maximal output velocity is reached at larger gape angles in juvenile stages, compared to early stages. Based on calculations of hyoid abduction angles, it can be suggested that suction actions are more efficient in early stages, whereas once exogenous feeding starts, suction actions may become less efficient.

The genetic history of the African catfish (*Clarias gariepinus*)

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Very few African fishes are distributed on a pancontinental scale ; the African catfish *Clarias gariepinus* is a notable exception. Such wide geographic distribution integrates two counteracting forces. At one side *Clarias gariepinus* is a geographical generalist due to a high potential for gene flow ; it is capable to breathe air, it has a catholic diet and reasonable potential for swimming. At the other side its wide distribution creates many opportunities for genetic isolation, especially since the history of the African continent during the Tertiary and Quaternary is one of reorganisation of drainage basins due to geotectonic movements.

We have studied the cytoplasmic genome of twelve populations collected all over Africa. The cytochrome b locus was sequenced while the RFLP pattern of the D-loop was screened. Genetic analysis reveals the presence of numerous haplotypes clustering geographically. The haplotypes of the Congo River Basin seem to be at the basis of the other haplotypes, namely a eastern African grouping, a southern African grouping and a Nilo-Sudanic-Asia Minor grouping. The highest diversity of haplotypes is found in Central Africa. We suggest that the haplotypes found in the Congo basin represent an ancestral type and that progressive colonisation of the African continent has happened during at least three indepent events.

Toxic effects of CH_3HgCl and $PbCl_2$ on carp sperm motility and viability *in vitro*

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During this research we investigated the *in vitro* toxic effects of CH_3HgCl and $PbCl_2$ on the motility and the viability of sperm of the common carp, *Cyprinus carpio*. The effects of the pollutants were examined immediately after their addition and after 24 hours of incubation. The motility was analysed using a Computer Aided Sperm Analysis system: the Hobson Sperm Tracker. Concerning the motility no significant effects were observed immediately after exposure to CH_3HgCl at the different concentrations tested (1 ppm – 0,0001 ppb Hg^{2+}). After 24 hours incubation with 1 ppm CH_3HgCl a significant effect ($p<0,05$) was observed, namely complete immotility.

Neither immediately after exposure of sperm to $PbCl_2$, nor after 24 hours incubation, an effect was observed at the different examined concentrations (10 ppm – 0,001 ppb Pb^{+}). Based on this results we can decide that within these tests CH_3HgCl is more toxic than $PbCl_2$ concerning the motility of carp sperm.

In the viability studies CH_3HgCl didn't exert any effect on the viability of carp sperm immediately after exposure. After 24 hours incubation the number of intact cells decreased drastically at a concentration of 1 ppm CH_3HgCl. $PbCl_2$ had no significant effect on the viability of carp sperm, neither after 0 hours, nor after 24 hours of exposure.

Effects of population density on insecticide resistance and life history traits in *Tribolium castaneum*

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Insecticide resistance involves the evolution of the tolerance to insecticide and, also, of life history traits. Both of them may proceed at different rates in some environmental conditions. Differences in the biological parameters affecting the net reproductive rate and the innate capacity to insect populations increase are of particular interest to insecticide resistance management. In various environmental conditions, resistant insects differ also in properties other than their adaptation to insecticide and their esterase activities. Hence, we assessed the effect of population density on egg weight and hatchability, development time, nymphae weight.

† competing for the best graduate student poster presentation award (Belgian award)

The effects of habitat fragmentation on the loss of genetic variation

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Due to human activities such as intensive use of agricultural landscapes, (sub)urbanisation, industrial expansion and intensive recreation, many natural habitats in Flanders have become extensively fragmented into smaller, isolated patches. Habitat fragmentation is a significant threat to the maintenance of biodiversity in many terrestrial ecosystems because it can result in the loss of genetic variation which can be one of the reasons why small populations become extinct. It is believed that movement of animals between fragments is crucial for the long-term sustainability of fragmented populations. Corridors existing between fragments help to increase the connectivity between fragments and thereby assist in maintaining genetic diversity.

It is clear that organisms with their species-specific characteristics (home range, dispersal capacities, specialization in habitat use, reproduction strategies) will differ in the way they react on the effects of habitat fragmentation and in the way they use corridors.

In this study we investigate the genetic consequences of habitat fragmentation on animal species from different taxa (red fox, roe deer, wood mouse, common shrew). The aim of our work is to examine the influence of species-specific characteristics on the effects of habitat fragmentation and the efficiency of corridors. Genetic variation will be assayed using microsatellites.

The results of this study will be used to better understand the potential impacts of habitat fragmentation on biodiversity and to make predictions on the size of natural reserves and the efficiency of corridors in maintaining genetic variation.

Seven nematode species belonging to the order of the Tylenchida new to the Belgian nematofauna

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As Belgium has a long 'nematological tradition', the Belgian nematofauna has been relatively well investigated and described. Within the terrestrial nematodes, especially the species of the order Tylenchida were profoundly examined, for most of the economically important plant parasitic nematodes belong to this group. However, recently, greater attention was paid to more natural habitats or non- conventional crops such as orchards. As a result, some species and genera were found that were not yet recorded for the Belgian fauna. In a wet habitat (clay soil with high peat content) situated in the nature reserve Bourgoyen-Ossemeersen (near Gent) *Coslenchus polonicus* and *Hirschmanniella loofi* were found. Sandy soil along the river Moervaart (Eksaarde, Lokeren) contained *Helicotylenchus varicaudatus*, *Paratylenchus similis* and *Gracilacus acicula*. In the sandy loam soil of an apple orchard (Vliermaal) *Tylenchus arcuatus* and *Cephalenchus leptus* have been found. Moreover it was the first time the genera *Hirschmanniella*, *Gracilacus*, *Tylenchus* and *Cephalenchus* were recorded from Belgium.

The study of the female reproductive system to refine relationships within the Tylenchoidea

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In order to study thoroughly the female genital structure, gonads were first extruded, then stained with acetic orcein or acid fuchsin. Several genera belonging to different families (Tylenchidae, Anguinidae, Belonolaimidae, Pratylenchidae, Hoplolaimidae, Heteroderidae) belonging to the suborder Tylenchina were investigated and compared. One can clearly state the female genital structure is a good indication for the phylogenetic relationships. In general our observations can cohfirm the descriptions from the authors who made comprehensive studies in this field. However, this study reveals a higher variation in the Tylenchoidea female reproductive type. This variation is distinct in the family Belonolaimidae. The investigation of more species must lead to a better knowledge of the relationships within the Tylenchoidea.

Epibenthic and hyperbenthic crustaceans of sandy beaches: spatial and temporal patterns

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The epi- and hyperbenthic fauna of Belgian sandy beaches were sampled intensively from April 1996 through June 1997. In order to assess spatial patterns, 12 stations were sampled along the coast in spring. Temporal patterns were investigated by a year of monthly sampling in two stations. The epibenthos was sampled with a 2 m beam trawl (mesh size 5*5 mm in the cod-end); the hyperbenthos with a hand-pulled sledge equipped with two 20 cm high nets placed one above the other. The nets were 3 m long with a mesh size of 1*1 mm, and sampled the water layer from 5 to 45 cm above the bottom. Trawling in the surfzone was always done around ebb tide, over a distance of 450 m. After sampling, temperature, salinity, oxygen content, nutrients and pigments of the water and grain size distribution of the sediment were measured. All crustaceans were identified to species level. For each species, spatial and temporal distribution patterns are described and density and biomass are estimated. Multivariate techniques are used to identify communities and to analyse correlations with the environmental variables measured in the field.

A total of 9 and 52 crustacean species were recorded from the epibenthos and hyperbenthos, respectively. High densities were found for both compartments. The brown shrimp *Crangon crangon* dominated the epibenthic catches throughout the year, while the hyperbenthos was dominated by the mysids *Mesopodopsis slabberi*, *Schistomysis spiritus*, and *S. kervillei*. Other - locally or seasonally important - hyperbenthic species included representatives of the Amphipoda (20 species), Isopoda, Cumacea, Copepoda, Brachyura and Anomura. Euphausiacea and Cirripedia were rare.

An archeozoological study of animal remains found in the Late Medieval village Walraversyde (15th century)

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This study deals with the archeozoological analysis of animal remains found in the Late Medieval fishermen's village, 'Walraversyde'. Both hand-collected material and sieve samples have been examined. An attempt was made to identify all finds to species level. Where possible, bones were measured by a standard method, height at the withers was calculated and the sex was determined. An estimation of the age at dead has been carried out by studying tooth eruption dates, tooth wear and the epiphyseal fusion of the long bones. Taphonomical analysis reveals that the material mainly consists of consumption refuse. The three domestic meat-suppliers, *I.e.*, sheep, cattle and pig, together with poultry constitute the major component of this consumption refuse. Mussels, oysters and common whelks were also brought to the site for human consumption. Undoubtedly, fish was one of the most important ingredients of the diet. Other taphonomical groups are poorly represented. The consumption refuse illustrates social and economical aspects of daily life in medieval Walraversyde. Three categories of food supply can be distinguished, *I.e.*, the food products coming from the sea such as molluscs, crustaceans and fish, the group of domesticated animals that lived on the site and finally the remains of hunting. Based on the species composition and on their ecological characteristics, we attempted to reconstruct the environment around the site. Our study gives a first, general impression of the fauna present at the site and illustrates former human activities.

Characterisation of the breeding habitat of bird species in the Flemish coastal dunes

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The area of coastal dunes in Belgium decreased from approximately 6400 to 3000 ha during the last century. The present dune area's are characterised by heavy recreational pressure, water capturing and an overall shrub encroachment.

A total of seven breeding bird communities were characterised by digital superposition of the overall territory map and a grid-map (Geographical Information System). They were ordinated along two main axes which could be explained as the gradient from open sandy dunes to forests and the presence of buildings or blockhouses (see poster).

By computing the habitat composition via overlays with detailed vegetation maps, the differentiating vegetation items within the breeding habitat could be detected. In the group of the mosaic shrub inhabiting species, the amount of short grazed vegetation and Birch-Willow shrub is responsible for the major habitat segregation between the species. Intergeneric habitat characteristics of the Sylviid and Phylloscopiid warblers were detected in the same way and illustrate the reduction of competition by habitat segregation.

At the landscape level, a significant positive relationship between the number of species and the surface of the shrub or moss vegetation could be revealed. An inverted relationship exists between the surface and the total breeding bird density.

The importance of systematics and phylogeny in biodiversity conservation

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The global concern over the rapid loss of biodiversity has enraptured the discussion on where and how to conserve our biota. We stress here some important aspects that should be considered when biodiversity conservation strategies are designed. We illustrate our line of thought with some specific examples for the protection of the amphibian fauna from the Western Ghats in South-India. Conservation of such scarcely documented zoological groups is *a priori* dependent on some basic biological parameters. First, a correct taxonomy according to the International Code of Zoological Nomenclature, is essential in order to promote nomenclatural universality and stability. Secondly, the existing diversity must be explained through correct systematics. It is emphasised here that correct naming and decisions on synonymies can *a posteriori* bias the understanding of the group of interest and thus negatively influence conservation strategies. Thirdly, phylogenetic studies provide additional insight into the structure and importance of the taxa of interest. As the resolution of phylogenetic patterns however, is strongly influenced by prior decisions about species limits, we suggest a concept for measuring genetic differentiation from extensive random sampling without prior species demarcation, which provides a more objective basis for discovering biodiversity.

We finally suggest a phylogenetic perspective on endemism, a central term in discussions on conservation strategies.

Control of bacterioplankton and phytoplankton by *Daphnia magna* (Crustacea) in a waste stabilisation pond

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The impact of zooplankton on waste stabilisation pond (WSP) performances has been poorly studied until now. Zooplankton grazing activity is however worth considering as it can control severely the bacterioplankton and phytoplankton which are the cornerstone organisms of the WSP treatment technology. The aim of this study was to determine if the grazing activity of the dominant zooplankter, *Daphnia magna*, can severely control phytoplankton and bacterioplankton in a WSP located at Differdange (Grand-duchy of Luxembourg). The biomass of phytoplankton (B_{phyto}), bacterioplankton (B_{bact}) and *Daphnia magna* ($B_{Daphnia}$) were estimated twice a month from January to July 1998. At four key moments of this period, the ingestion rate of phytoplankton (IR_{phyto}) and bacterioplankton (IR_{bact}) by *D. magna* were moreover determined and compared to B_{phyto} and the primary production (P_{prim}), and to B_{bact} and the bacterial production (P_{bact}), respectively. From May to the beginning of July, B_{phyto}, $B_{Daphnia}$ and IR_{phyto} increased in a similar way. In May and June, IR_{phyto} varied between 65 and 92 % of $B_{phyto}.day^{-1}$ and 16 and 92 % of P_{prim}. In July, the grazing impact on phytoplankton increased and reached 171 % of B_{phyto} and 310 % of P_{prim} causing a significant drop in B_{phyto}. The grazing impact of *D. magna* on bacterioplankton varied between 0.1 and 18 % of $B_{bact}.day^{-1}$ and between 0.8 and 226 % of P_{bact}. When higher than 100% of P_{bact}, the grazing impact however did not lead to decrease of B_{bact} because of a significant input of allochtonous bacterial biomass through the influent.

‡ competing for the best PhD student poster presentation award (Netherlands award)

Low temperature gigantism: polar gigantism or tropical nanism?

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The size spectrum of benthic Gammarid species has been established for 7 marine ecosystems: Madagascar, the Mediterranean Sea, the Black Sea, the British Islands, the Barents Sea, the Subantarctic and Antarctica. The comparison of these spectra reveals clearly an increase of the size of the biggest species when temperature decreases, while modal the size and the size of the smallest species remain constant. A threshold size, separating the 90% smallest species from the 10% biggest (TS90/10), has thus been chosen to estimate the skewedness of each curve.

Similar analyses were carried out for the Caspian Sea (69 spp) and Lake Baikal (230 spp), both lower salinity environments. It shows that the Baikal species are bigger than their Antarctic relatives, although living in a warmer water.

The TS90/10 has then been correlated to the dissolved oxygen availability of each ecosystem, and displays a significant linear relationship. Two other factors have been hypothesised as limiting the "Maximum Potential Size" when temperature and salinity increase : 1. The hemolymph carrying capacity 2. The inverse relationship between temperature and metabolic rate.

New and additional anatomical data on Camaenidae of Papua New Guinea

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The Camaenidae is a helicoid family defined by the absence of a dart sac and associated glands on the female genitalia. The are no characters unique to the family. Within the Camaenidae a large diversity and a large degree of apparently intra specific shell polymorphisms is observed. However little is known about camaenid taxonomy and relationships. It is for example possible that the Camaenidae is not monophyletic. In this context we started a systematic study of selected camaenids of Papua New Guinea and adjacent islands. We have at our disposal Camaenidae samples in the collection of the RBINS collected in the period 1976-1991 and new samples collected in April 1998. The spirit samples were determined, dissected and compared with literature data. Here we present the very first anatomical data on *Forcartia buehleri*, a species described on shell features only. Structure of the genital apparatus and the radula is discussed and compared with those of *Megalacron phaeostoma*. Anatomical data of the viviparous *M. klaarwateri* and *M. novaegeorgensis* are presented too.

Macroinvertebrate community structure in 14 inter-connected ponds in relation to abiotic and biotic factors

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"De Maten" is a nature reserve in Genk that consists of a complex of ponds. Although the ponds are interconnected by a system of overflows and rivulets, there are differences in local biological communities and abiotic factors. The aim of our research was to characterize the structure of the macroinvertebrate community in each pond and to associate it with other components of the ecosystem, such as fish predation, vegetation and abiotic factors. Our results show that the community structure and the species composition of the macroinvertebrates in the ponds is determined mainly by biotic factors. Of major importance are the presence of vertebrate predators, the presence of a well-developed littoral zone and aquatic macrofytes. No relation between abiotic factors and community structure were found, suggesting that the abiotic values measured in the ponds did not exceed the tolerance limits of the macroinvertebrates.

Feeding and oviposition preference of *Prostephanus truncatus* on maize previously infested by *Sitophilus zeamais*

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The aim of this study was to investigate the feeding and the oviposition behaviour of the larger grain borer, *Prostephanus truncatus* (HORN) (Col., Bostrychidae), in competition with the maize weevil, *Sitophilus zeamais* MOSTCH. (Col., Curculionidae). For *P. truncatus*, deterrence was associated with *Sitophilus* adult and larval activities in the host and not with the presence of *Sitophilus* egg. Both chemical and physical stimuli appear to be involved in grain recognition. Our first results show that the maize infested or only conditionned by *S. zeamais* has a deterrent effect on the larger grain borer. The presence of chemicals produced by *Sitophilus* adults on maize grains influence the oviposition behaviour of *P. truncatus*. These chemical substances are more soluble in hexane, diethyl ether and methanol than in water. The second results indicate also that this egg-laying behaviour is influenced the larval activity of *S. zeamais* . Freezing egg-laden grains at -18°C failed to remove inhibiting oviposition factors.

An "Antarctic Marine Biodiversity Reference Centre" devoted to amphipod crustaceans

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An "Antarctic Marine Biodiversity Reference Centre" is being developed at the Royal Belgian Institute of Natural Sciences in Brussels, Belgium under the framework of the SCAR programme "Ecology of the Antarctic Sea-Ice Zone"(EASIZ), and the world biodiversity programmes "Diversitas" and "Systematics Agenda 2000, Charting the Biosphere". The focus of the reference center is on peracarid crustaceans (in particular amphipoda) which are by far the most speciose animal group in the Southern Ocean, and probably the most ecologically diverse.

This reference centre will be comprised of specialised databases that will record and organise the widely scattered information on taxonomy, geographic and bathymetric distribution, ecological and biological characteristics, and bibliography. It will contain extensive and validated reference collections and will assist a network of contributing specialists (the "Antarctic Amphipodologists Network") who are involved in the taxonomical revision of the Antarctic amphipod fauna, the synthesis of their geographical and bathymetrical distribution and of their bio-ecological traits. Finally, the reference center will contribute to the development of highly needed, new, conventional and computer-assisted identification tools ("Synopses of the Antarctic Benthos": multimedia electronic monograph).

A Glow-worm survey for Belgium: some preliminary data

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Recently from all over Europe there are warnings about the decline of glow-worm populations. Although no thorough study has been performed yet, many people claim that glow-worms were much more abundant in the past. To be sure if the glow-worm is really declining, we should first know where the remaining populations occur and if these populations decline in size and number. The distribution of the three Belgian glow-worm species (*Lampyris noctiluca, Phosphaenus hemipterus, Lamprohiza splendidula*) is also to poorly known to evaluate the actual situation. Therefore a glow-worm survey project has been started in both the Benelux and Great Britain.

To gain new data we asked all known entomological, nature and environmental societies to put an advertisement about the glow-worm survey in their journal, magazine, etc. Interested people were provided with information about the species (species key, habitat preferences, life history) and survey forms, and were asked to help distributing these and return completed ones. We also asked them to report if no glow-worms occur in their region. The first (preliminary) results for Belgium (1997-1998) are presented here and discussed in relation to a previous distribution study (Magis, 1977).

The effect of abiotic factors on the induction of summer diapause of the parasitoid *Aphidius rhopalosiphi* (Hymenoptera: Aphidiidae)

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The late summer corresponds to a critical period for cereal aphid parasitoids in Belgium. Indeed, it represents the transition period between two successive wheat cultures and is caracterized by a general crash of aphid populations in adjacent crops. Aphid parasitoids probably have developped physiological adaptations in response to this lack of hosts.

The aim of this study was to clear up the existence of a summer diapause of the parasitoid *Aphidius rhopalosiphi* in Belgium. Diapause induction was tested on two successive parasitoid generations at 16 °C and 30 °C, under different decreasing long daylengths.

Diapause was well observed but its percentage never exceeded 5 %. At 30 °C, for any daylength conditions, mortality came up to at least 50 % during the first generation, and the number of parasitoids in the second generation was very slight.

The tested conditions, as well as the effect of high temperature on mortality and egg laying are discussed.

The effect of diet composition on growth of *Neomysis integer* (Crustacea: Mysidacea)

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The effects of food quantity and quality on growth parameters of the brackish water mysid *Neomysis integer* were studied in the laboratory. Juveniles were reared individually for one month and their growth was assessed through the daily collection and measurement of moults. The animals were fed different concentrations of *Artemia salina* nauplii and a variety of food sources that are thought to be important in their diet in the maximum turbidity zone of estuaries (calanoid copepods and macrophyte detritus). Average growth rates, intermoult periods and growth factors were calculated and compared between treatments.

Food was found to be limiting when *Artemia* concentrations dropped below 200 nauplii per individual per day (0.48 g dry weight). Growth rates and factors were significantly higher and intermoult periods were significantly shorter for mysids cultured on diets of *Artemia salina* nauplii and adult copepods *Eurytemora affinis* as compared to those cultured on macrophyte detritus. Still, the mysids were able to survive and grow on a diet of *Scirpus maritimus* detritus, while *Spartina anglica* detritus proved to be toxic.

The effect of temperature on the spermatogenesis in the bumble bee *Bombus terrestris*

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In temperate regions bumble bees are important pollinators, and therefore, colonies are reared commercially for being used in greenhouses. European bumble bee colonies are transported and used worldwide. For that reason there is an economic interest in the impact of breeding conditions.

Twice we noticed that several adults, apparently normale males did not transfer any sperm at mating. This could have been related to high ambient temperature during its development. Also during transport of colonies, as well as in very crowded colonies, the temperature inside the nest can rise above the optimal 28-32 °C.

Spermatogenesis takes place during the pupal stage. Therefore male pupae, 2 or 5 days old, were exposed to one out of several temperatures (20 °C, 30 °C, 35 °C, 38 °C or 40 °C) in combination with an exposure time (1, 3, 6, 12, 24 or 48 hours). Subsequently, at the mating age of the adult, the number of the spermatozoa in the assessory testes were counted. The number of spermatozoa produced was profoundly effected by temperatures deviating from normal nest temperature and by exposure time. Males treated when 5 day old pupae were more effected than those 2 days old. Furthermore, temperature in combination with exposure time was correlated with survival.

These results show that especially high temperatures in the nest may lead to male sterility.

The feeding ecology of juvenile Percidae and Cyprinidae in a hypertrophic lake: Lake Blankaart (West-Vlaanderen)

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In Lake Blankaart our research group investigates the potential of biomanipulation as a means to reestablish the clear water state in this hypertrophic lake. An important aspect in this study is the strong predation pressure of planktivorous juvenile fish on large zooplankton. The present study focuses on the feeding ecology of the 0+ year class of the dominant fish in Lake Blankaart.

From April till August 1997, fish juveniles and zooplankton were sampled weekly. We analysed the stomachs of the fish and food selectivity was determined. 0+ Percidae and 0+ Cyprinidae > 36 mm show a strong preference for large zooplankton species (*Daphnia* sp.) and a negative selection for small zooplankton species (rotifers, nauplii and *Bosmina longirostris*). The 0+ Cyprinidae < 36 mm do not have a selective feeding behaviour. This nutritional segregation between small Percidae (< 30 mm) and small Cyprinidae (< 36 mm) possibly reduces interspecific competition in the early life of these fish. As the fish grow, they become more efficient hunters. Whereas all juvenile Percidae select for larger (*Daphnia* sp.) and more evasive (*Cyclops* sp.) prey, only relatively larger juvenile Cyprinidae (> 36 mm) become selective.

Our results suggest that fish juveniles can have an important impact on the size structure of the zooplankton population. This is also illustrated by comparing the selectivity for *Daphnia* taxa. We obtained evidence for the strong positive selection for *D. galeata* compared with *D. galeata x cucullata*, also confirming the temporal hybrid superiority hypothesis.

Impact of fish predation on a *Daphnia* species complex: an experimental evaluation of the temporal hybrid superiority hypothesis

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Shortly after the introduction of fish in enclosures, relative densities of *Daphnia galeata* dropped when compared to the hybrid *D. galeata x cucullata*. Conversely, *D. galeata* tended to dominate in enclosures without fish. These results are in accordance with the 'temporal hybrid superiority hypothesis'. During the second half of the experiment, however, there was no further relative decrease of *D. galeata* in the fish treatments. Although our results show that *D. galeata* is especially vulnerable to fish predation shortly after exposure to the predator, the species seems to be able to persist and coexist with hybrids on a longer term. This is explained by the ability of *D. galeata* to show adequate body size responses to the presence of fish. In addition, *D. galeata* may also profit from the higher food ability and the increased turbidity induced by fish.

Contests over food between female hamadryas baboons : winning is not enough for everyone!

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Dominance relationships among female primates are associated with competition for food. These relationships are thought to be despotic as a result of contest competition when food is clumped, while they should be egalitarian as a result of scramble competition when food is dispersed. In our studygroup of hamadryas baboons (*Papio hamadryas hamadryas*) at the Antwerp Zoo, food is mainly offered clumped in space and time. Since studies during the last 7 years indicated a linear hierarchy among the females, we investigated if this hierarchy could be associated with contest competition for food. Individual feeding-success was measured by means of time-parameters in an experimental food condition with one pile of food.

Our study revealed that there is indeed contest competition for preferred food among females. However this competition is reduced between females of different harems due to the spatial separation between these harems, controlled by their leaders. In addition only the most dominant female within a harem benefits from her dominance status. For lower-ranking females other factors, such as friendship with the dominant female, can possibly mask the influence of rank in competition for preferred food.

Morphology, function and systematic distribution of a carpenter plane-like tool in the mandibles of termite workers (Insecta Isoptera)

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The workers' mandibles are commonly used for the systematic description of termite species and for the study of their phylogenetic relationships. They also show morphological adaptations to the species' diet. Despite the mandibles' systematic interest and functional importance, only the external outline of their upper side is generally described and represented.

Through a more complete study of workers mandibles we have discovered that all 60 observed genera of termites exhibit a "premolar tooth", which had so far only been described in the soldierless genera of Apicotermitinae (Sands, 1972).

In the most ancient families (Mastotermitidae, Kalotermitidae, Termopsidae, Hodotermitidae, Rhinotermitidae), whose diet mainly consists in wood, this premolar tooth takes the form of a sharp blade, at the underside of the left mandible. While chewing, the worker progressively crosses its mandibles. The left mandible slides over the right one and bits of ingested wood are held tight between the two mandibles. Due to its position, the premolar blade can thus cut a superficial slide of this food as the chisel of a carpenter plane cuts shavings out a piece of wood.

In higher termites (Termitidae), the xylophagous genera have retained such a "premolar plane", while in most genera with a supposed humivorous diet the premolar tooth takes a different position (along the internal side of the mandible), a more rounded form and a different function.

First evidence for progenesis in *Triturus*

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Paedomorphosis is defined as the retention of subadult morphology in reproductive adults. Two main processes can produce this heterochronic pattern : neoteny and progenesis, but progenesis has not been yet demonstrated in newts. Distinction between them can be obtained from the determination of age at first reproduction using the squelettochronological method. In this study, we sampled more than 300 *Triturus alpestris* newts in two populations : one in a French lake and the other in an Italian pond. Results show that paedomorphs from the Italian pond are mature earlier and at a smaller size than metamorphs (Progenesis) whereas paedomorphic and metamorphic newts from the French population do not differ in size and age (Neoteny). Adaptative significance of Paedomorphosis is discussed in relation to the stability of the aquatic habitat.

A genetic comparison of Atlantic and Mediterranean populations of a saltmarsh beetle

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Enzyme and dispersal polymorphism of the saltmarsh carabid beetle *Pogonus chalceus* MARSHAM were compared between 30 Atlantic and 9 Mediterranean European populations. Allozyme results show that beetles from the Mediterranean (France, Spain) are genetically distinct from Atlantic populations. All Mediterranean beetles so far screened show complete fixation in one enzyme (IDH1), which in Atlantic populations varies nearly always, whereas some unique Mediterranean alleles are observed for another locus (MPI). Genetic differentiation (allozymes) between Mediterranean populations, although highly significant, appears to be much lower (Fst=0.098) than between Atlantic populations (Fst=0.178). Beetles from the Mediterranean moreover show a remarkably high dispersal power in all populations studied so far, whereas Atlantic populations show wing polymorphism and reduced dispersal power to much more varying degrees. These results, along with relatively lower levels of *Pogonus chalceus* abundance in many Mediterranean saltmarshes, strongly suggest increased levels of extinction/recolonization as compared to most Atlantic saltmarshes.

The spring and summer hyperbenthos of the Frisian Front area

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The hyperbenthos of the Frisian Front (North Sea) and surrounding waters was sampled along two transects from south to north in September 1994 (10 stations) and April 1996 (12 stations). Samples were taken with a hyperbenthic sledge: a heavy metal frame equipped with two pairs of nets (mesh sizes of 0.5 mm on the right side and 1 mm on the left side) that sample the hyperbenthal from 0 to 50 cm and from 50 to 100 cm above the bottom, respectively. All sampling was done during daytime, when hyperbenthic animals are known to concentrate near the bottom. In the laboratory, all animals were sorted out, identified to species level and counted. Density and biomass were calculated for each species, and both datamatrices were subjected to multivariate statistical techniques for the identification and characterisation of hyperbenthic communities.

Peracarid and decapod crustaceans were well represented in the hyperbenthic layer: 36 amphipod species, 9 mysid species, 6 cumacean species and 24 larval decapod species were found. Other taxa belonging to the hyperbenthos were early post-larval teleost fish, calanoid copepods, isopods, nebaliaceans and euphausiids. During summer, mysids and amphipods together accounted for nearly 40% of the total density, *Schistomysis ornata* (Mysidacea) and *Scopelocheirus hopei* (Amphipoda Gammaridea) being the dominant species. Larval decapod stages prior to the adaptation to a more benthic life style were also found in large numbers, particularly postlarval Caridea of the genera *Processa*, *Crangon* and *Philocheras*. Seasonal patterns were obvious: density and biomass were higher during summer and species composition was altered. A distinct respons of the hyperbenthic community to the presence of the front was observed in summer: much higher densities were recorded for mysids, amphipods, cumaceans and copepods. In spring though, the hyperbenthos of the frontal area was comparable to that of surrounding waters.

Morphofunctional and comparative analysis of the suspensorium in catfish

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Tactile and gustatory barbels of catfish are usually considered as an adaptation to life in dark or muddy waters. The maxillary barbels are the most movable ones; they are borne by the rod-shaped maxillary bones themselves articulating on the autopalatines. Such mobility rests on an original feature: the independency of the palatines from the rest of the suspensorium, from which they develop separately. One unwanted result is that the rear part of the suspensorium is hanging down by only one articulation from the neurocranium. Different solutions are observed among Siluriforms. A functional explanation is hypothesized and evolutive levels of improvement of the system are recognised. The main means of consolidation are fusion of skeletal components, development of ligaments and intraligamentous bones and formation of a new anterior joint with the skull. In the same time the palatine becomes completely free to support the movements of the maxillary barbel. Controversies about homologies in the catfish suspensorium are brought to an end by focusing on functional anatomy and comparing with suspensoria in trichomycterids and in outgroups (gymnotids and characids). It is clear that the metapterygoid is fused with the hyomandibular and the symplectic with the quadrate. The so-called (toothed) metapterygoid is the endopterygoid or endo-ecto-pterygoid. The so-called endo or ecto-pterygoids are sesamoid bones in the ligaments.

Biodiversity of macroinvertebrates in the rhithron of the north part of Luxembourg: an attempt to associate biodiversity and water quality

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In a 4 year study, the biodiversity of macroinvertebrates was assessed at 142 sampling stations distributed in the rhithral part of streams from Luxembourg. Here, the results of the basins situated in the north part of the country (91 stations) are presented. This area is a homogeneous schistous hercynian massif characterised by relatively low anthropogenic disturbances. The identification at the "species level" of all the macroinvertebrates enables to obtain realistic measures of species richness and diversity indices. Among these indices, the widely used Shannon diversity index and the Hurlbert's eveness index were calculated. The aquatic macroinvertebrate diversity is proving particularly high in some pristine streams. A total number of 645 taxa were identified from which about 300 are new for the fauna of Luxembourg. The average species richness per station is 65 with a maximum of 106 taxa. The Diptera are, by far, the more diverse group with an average of 20 and a maximum of 40 species per station. They are followed by Trichoptera (13, resp. 24 species), Ephemeroptera (10, resp. 20 species) and Coleoptera (6, resp. 13 species). The maximum Shannon diversity index amounts to 3,9 and the average to 3,1. Richness measures (number of taxa, number of Ephemeroptera, Plecoptera, Trichoptera,...) and community indices (Shannon's and Hurlbert's index) are relativvely well correlated with physico-chemical variables often associated with organic pollution (especially conductivity, total phophorus, nitrites and BOD5). Nevertheless, these measures and indices are less suited to correctly interpret the oligotrophic sites of the Our basin on one hand, and sites of highest altitude of the Woltz and Sûre basins, on the other hand, than biotic indices like IBGN or ASPT.

Reproductive behaviour and daily rhythms of activity in the small-spotted dogfish *Scyliorhinus canicula* L.

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Few behavioural studies have been devoted to sharks species. This paper describes the reproductive behaviour and the daily rhythms of activity of the small-spotted dogfish *Scyliorhinus canicula* reared under controlled conditions. Mature fish were individually tagged. They were maintained in 1000 to 5000 liters aquaria at a constant 14°C temperature and were successively maintained under 8L/16D, 12L/12D and 16L/8D photoperiods. They were fed every two days with fish crustacean or mollusc. Behaviours were recorded with a camera video system. The spawning behaviour and mating sequences we have observed included the following, the seizing and the nosing previously described in literature. Spawning acts were detailed as well as the frequency of sexual behaviours and the color patterns. The dogfish exhibited a night activity rhythm which extended to daylight during spawning periods. Moreover we described the activity level in the three studied photopériods. This study adds new data on the biology of the dogfish which is still unknown.

Proprioceptors in serranids pectoral fins?

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Teleosts finely control shape, surface and orientation of their pectoral fins by large extrinsic and thin intrinsic muscles, moving lepidotrichia, in locomotion and manoeuvrability. Such control would rest on sensitive organs recording dynamic pressure and flow on the fin surface. In a preliminary study on *Serranus scriba*, sensory organs or nerves ending in the skin were in no way found on the fin. Nerves passing the distal end of lepidotrichia muscles were followed running at the inner side of the hemitrichia. It was impossible to detect on serial cuts any nerve branch reaching the skin. But TEM cuts revealed an unknown longitudinal arrangement of nerve fibres in somewhat reminding of Pacinian corpuscle with a coiled structure. Our provisional hypothesis is that coiled structures are pressure sensitive and register the passive curvature of the elastic distal part of the lepidotrichia in response to their active and passive deformation when swimming and turning. Such deformations are a measure of the active effort of the fin or water current power. The coiled organs could be original proprioceptor.

Contribution to the trophic ecology of *Eptesicus serotinus* (SCHREBER, 1774) (Mammalia : Chiroptera : Verspertilionidae)

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The diet of a colony of serotines (*Eptesicus serotinus*) living in Aspelt (Grand Duchy of Luxembourg) has been studied by identifying fragments of insects found in their fecal pellets. This search clearly revealed their opportunism and polyphagy. Yet, because of the characteristics of their sonar, they only capture insects of 10 to 25 mm size.

From the end of their hibernation until July, serotines mainly feed on univoltin Coleoptera Melolonthidae (*Amphimallon* sp. and *Melolontha* sp.) and Diptera Tipulidae (probably *Tipula* spp.). In summer when Melolonthidae disappear, they prefer *Pentatoma* sp. (Heteroptera : Pentatomidae) and Lepidoptera (probably species of the families Noctuidae, Arctiidae and Lasiocampidae). In the beginning of autumn, they then prefer some species of *Aphodius* (Coleoptera Scarabeidae). *Ophion* spp. (Hymenoptera : Ichneumonidae) and *Harpalus* spp. (Coleoptera : Carabidae) are consumed during the entire activity period of the serotines.

From this particular diet that was studied, it might be concluded that serotines capture crepuscular prey only during their flight and hunt in an ecotone such as meadows bordering deciduous and resinuous forests. These hypothesises have been confirmed by field observations of mammalogists and are very important as part of the conservation biology of the serotine.

New method for extracting soil Microarthropods

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Since the beginning of the century, few extracting methods for endogeous Microarthropods have been described. Active methods, like Berlese's, are known not to be effective for compact substrates. Flotation in aqueous salt solutions was studied. Duration of flotation of *Brachychthonius* (Acari : Oribatida) in KBr saturated solution was only a few minutes. Carbon tetrachloride extraction can't be applied on soils containing charged colloids like clay minerals. Heptane extraction needs a lot of manipulations, suspected to cause loss of small Microarthropods. A new flotation method was developed by testing several organic molecules. A mixture of 1,2-dibromoethane and methanol was retained. A comparison with the Berlese's method was made. The new method extracts in average five times more Microarthropods than Berlese's. It allows to collect immobile forms like Acarian prelarval stages. The method is restricted to substrates containing few organic matters, for it doesn't allow to separate animals from other organic materials.

Predatory behaviour of the Barn Owl (*Tyto alba*) at Mayotte (Comoro Islands)

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The Belgian Royal Museum for Central Africa (co-ordinator: M. Louette) monitors a research project at the island of Mayotte, evaluating the potential role of the Barn Owl (*Tyto alba*) as a biological agent against the damage caused by introduced rodent pests, especially black rats (*Rattus rattus*). It is thought that through the promotion of the proliferation of the Barn Owl population the rat pop ulation, which has no other predators on the island, can be kept under control. At present, the population dynamics of the predator, and its feeding behaviour are studied. Results from the latter research will be presented here.

As a first approach, the predatory behaviour of Mayotte's Barn Owl population is evaluated by the analysis of pellets collected at 26 nesting localities. The pellets are disintegrated and the prey remains are identified, following the methodology common in archaeozoological analysis. By this, it is proven that more than 90% of the prey items taken by Barn owl were black rats. It could further be demonstrated that a clear selection has acted upon the prey population, favouring individuals of middle age. The near absence of very old rats will be the result of the low frequency of these age classes, but, whether the absence of young animals is caused by low availability of this prey category or by a form of optimal feeding behaviour of the predator, remains to be investigated. In addition, it is shown that the handling of the prey differs according to its age.

Laboratory studies on the growth and development of the brackish water mysid *Neomysis integer* (Crustacea: Mysidacea)

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The life history traits of a species depend to a certain extent on the characteristics of its habitat. For estuarine species, the combined effects of temperature, salinity and the quality and quantity of available food are likely to influence growth and development. The aim of this study was to determine the influence of a broad range of these variables on growth parameters, moulting frequency and age/size at maturity of the brackish-water mysid *Neomysis integer*.

N. integer were cultered in the laboratory and the offspring were kept individually at several constant temperature-salinity conditions (8, 15, 20 and 25°C; 5, 15 and 30 psu). Individuals were followed from the first day after emergence from the marsupium until they reached asymptotic length after about 4 months. They were fed freshly hatched *Artemia* nauplii ad libidum. Growth was studied by collecting and measuring the successive moults. Growth functions were fitted to the data and growth rates, growth factors and intermoult periods were compared between the different treatments. In short-term experiments performed at 15°C and 5 psu, the effects of food quantity and quality on the growth parameters of *N. integer* were studied. A range of *Artemia* nauplii concentrations (0-5700 per litre) were offered daily to individual *N. integer* of 3-5 mm standard length. Other feeding experiments were performed with brackish-water copepods, macrophytal detritus, laboratory-made estuarine flocs, and combinations thereof. Individuals were followed until they had moulted at least 4 times (approximately 25 days) and growth rates, growth factors and intermoult periods were again compared between the different treatments.

Laboratory-made estuarine flocs: colonisation by micro-organisms

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At the freshwater-seawater interface of estuaries, suspended sediments and detrital organic matter are accumulated by flocculation resulting in a zone of increased turbidity (the maximum turbidity zone or MTZ). The biotic characteristics of these flocs, e.g. the colonisation by bacteria, possible attraction pool for micro-zooplankton, potential food items for higher trophic levels (copepods, mysids, larval fish,...), are difficult to study *in situ* since they are extremely fragile and thus hard to sample intact. In this study, a method described to study marine snow (Shanks and Edmondson 1989) was adapted to simulate the estuarine flocculation process under laboratory conditions. Cylinders containing estuarine water originating from the maximum turbidity zone of the Westerschelde (4 stations between 0.3 and 9.7 psu) were slowly rotated on a roller table. After 3 hours, macroflocs were formed. The density and size-distribution of the flocs were determined by image analysis of photographs. The flocs were then allowed to settle for about 5 minutes after which they where separated from the surrounding water by decantation. For both fractions, organic matter, pigments (HPLC), total carbon and nitrogen (C/N analyser) were determined. Techniques for counting bacteria, ciliates and flagellates on the flocs and in the surrounding water were optimised and applied to 3 replicates per station. Preleminary results showed that up to 35% of the bacteria, 12% of the flagellates and 25% of the ciliates in the water column are associated with the flocs. The numbers of micro-organisms per volume unit floc were found to be 10 (flagellates and ciliates) to 100 (bacteria) higher than those in the surrounding water. These concentrations are comparable to those recorded from the sediments in the corresponding estuarine zones. The high concentrations of micro-organisms associated with the floccular suspended matter can make the flocs an attractive food item for the mesozooplankton and hyperbenthos living in and around the maximum turbidity zone of estuaries.

In vitro effects of $HgCl_2$ and $CuCl_2$ on sperm motility and viability in the common carp, *Cyprinus carpio* L.

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The last decennia pollution by heavy metals, like Hg and Cu, are an important threat to fish reproduction. Fish sperm quality (motility, viability,...) can be affected by pollutants in two ways: firstly by bioaccumulation of chemicals in fish tissue; secondly when the sperm comes into contact with chemicals in the water after spawning. The *in vitro* effects of $HgCl_2$ and $CuCl_2$ on the motility and viability of sperm of the common carp, *Cyprinus carpio*, were investigated immediately after addition and after 24h of incubation (mimicking a longer exposure through the seminal plasma). The motility was analysed using a CASA-system while the viability was determined after staining with trypan blue. Concerning motility, $HgCl_2$ exerted an immediate and complete immobilisation of the spermatozoa after addition at a concentration of 10ppm Hg^{2+}. After 24h incubation the same effect occured at 1ppm Hg^{2+}. $CuCl_2$ showed no significant immediate effect at the concentrations tested (1ppm-0,0001ppm Cu^{2+}). After 24h incubation, Cu^{2+} completely inhibits the motility at a concentration of 1ppm. An immediate effect on the viability was present after exposure to 1ppm Hg^{2+} and almost no viable cells were found in the 10ppm condition. After 24h only very few spermatozoa were still alive in 1ppm Hg^{2+}. After 24h exposure to Cu^{2+} a significant decrease was observed at the concentration of 1ppm, where immediately after addition no significant effect was noticed. The developed methodology may provide an objective way to screen pollution effects on sperm quality.

A single tooth replacement pattern generates diversity in the dentition in cichlids of the tribe Eretmodini endemic to Lake Tanganyika (Teleostei: Cichlidae)

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Cichlids from the tribe Eretmodini endemic to Lake Tanganyika provide a unique example of differences in dentition within a single lineage, that are correlated with dietary differences. To prepare a new study that will focus on the mechanisms responsible for ontogenetic and phylogenetic divergence of tooth shape in this taxon, we examined the tooth pattern and sequence of tooth replacement in representative eretmodine taxa. New teeth are formed in alternate positions labial to older ones in waves that sweep from mesial to distal. Only a minor shift, involving different spacing of newly developing germs, is necessary to produce the different dental arcades observed in eretmodine cichlids. The position and state of development of the replacement teeth as well as localized growth and resorption of the jaw bone adds histological evidence that supports the replacement pattern described for the four taxa studied here.

Seasonal succession of 3 trophic levels (microbial loop, phytoplankton and zooplankton) in the Esch-sur-Sûre reservoir (Luxembourg)

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Planktonic protozoans constitute an intermediate trophic level for the bacterial biomass transfer toward higher trophic levels. This study completed in Esch-sur-Sûre reservoir aims at a better understanding of trophic relationships amongst the microbial loop and its interactions with the other planktonic groups. Weekly samples were taken in the epilimnion during spring and summer 1998. Bacterial and heterotrophic nanoflagellates (HNF) were of small size (<1 μm and <5 μm respectively). Oligotrichs (*Strobilidium* sp. and *Strombidium* sp.), Prostomatids (*Urotricha* sp.) and Scuticociliates (*Cyclidium* sp. and *Uronema* sp.) were the dominant taxa of the ciliate community (between 12 and 35 μm). A peak of bacteria (7.6 10^9 cell.l^{-1}) developed in April, immediately followed by ciliates (16.8 10^3 cell.l^{-1}) and HNF (156.3 10^6 cell.l^{-1}) confirming a strong dependence between these groups. The decrease in protozoans (ciliates) abundance in May was concurrent with meta-zooplankton development (*Bosmina* spp. and especially cyclopoid copepods which reached 81 ind.l^{-1} at this period) suggesting a top-down control by these organisms. Cyclopoid copepods are indeed known as main predators of protozoans. The same pattern reproduced at the beginning of summer. However, the meta-zooplankton response was less pronounced. During this period, the community was mainly represented by *Diaphanosoma brachyurum*.

The relative importance of competition and top-down control (e.g. size selective predation) for the succession of planktonic groups will be examined and the role of the microbial web in the reservoir will be discussed.

Some technical problems of feeding rate measurements with *Bosmina longirostris*: the gut passage time and the sensitivity to the "taste" of food particles

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The cladoceran *Bosmina longirostris* is an abundant species in the River Meuse, especially during summer. The gut passage time of this species was measured by using fluorescently labelled algae (FLA). It was comprised between 10 and 12.5 minutes. So measurements of feeding rates involving labelled algae in this species should be performed with incubations shorter than 10 minutes. Nevertheless, it was observed that the proportion of individuals with their gut still empty or already completely full after incubation times comprised between 4 and 10 minutes were not negligible (ca 20%) due to a poor synchronism of the feeding behavior of this species. This variability of the gut passage time might lead to underestimations when ingestion rate is measured with the radiotracer technique (e.g. algae labelled with ^{14}C). An alternative method is the use of FLA as tracer cells. Since *Bosmina longirostris* has been stated by some authors to be able to select "good tasting" particles, tests were performed to check that the feeding behavior of this species was unchanged with stained algae. The algae used was the small unicellular green algae *Dictyosphaerium ehrenbergianum* (3-4 μm in diameter); it was stained with 5-(4,6-dichlorotriazin-2-yl) aminofluorescein (DTAF). Ingestion rates measured with fluorescently labelled algae were about half of the ingestion rates measured with unlabelled algae. These results give evidence that *Bosmina longirostris* is very sensitive to the "taste" of food items; moreover they emphasise the need for preliminary tests prior to the use of FLA in grazing experiments with this species or other "taste sensitive" species.

An experimental approach to the taxonomy of two anostracan species *Branchipus schaefferi* and *Tanymastigites perrieri*

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Based on a preliminary comparative morphological study of the male antennae and limb setulation, the allocation of *Branchipus schaefferi* and *Tanymastigites perrieri* to different genera can be questioned.

As an alternative approach to study the relation between the two taxa, reciprocal crosses were carried out between naturally sympatric populations of the two, originating from the arid area Jbilet in Morocco. The crosses result in infertile cysts, which are morphologically different from the typical cysts of those two species. This offers a biological argument to decide that the two species are congeneric.

Egg laying behaviour and flight capacities of cereal aphid parasitoids at low temperatures

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Parasitoids seem to play an important role in preventing aphid outbreaks. To fill in this part, parasitoids have to be active not only during summer, but also during winter and early spring under difficult conditions. In this context, we tested the reproductive behaviour and flight capacities of *Aphidius rhopalosiphi*, *Aphidius ervi*, *Praon volucre* and *Praon gallicum* at low temperatures.
Egg laying was tested at 2, 4, 6, 8, 10, 15 and 20 °C. During 23 hours, ± 70 *Sitobion avenae* were provided to pairs of parasitoids under the different temperature conditions. Each condition was repeated 8 times.

Egg laying activity was very low between 2 and 6 °C. At 10 °C, percentage parasitism varied between species. *A. rhopalosiphi* seemed the first to be active at low temperatures, *P. gallicum* being the less efficient. These results were confirmed by field observations.

Flight behaviour were tested at 8, 10, 12 and 14 °C during two hour. At 8, 10 and 12 °C, the parasitoids of the genus *Aphidius* showed better flight capacities than the parasitoids of the genus *Praon*.

The results are discussed within the scope of integrated pest management.

Sperm displacement and genital morphology in the damselfly *Lestes sponsa* (Zygoptera: Lestidae)

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Sperm displacement is widespread in Odonata. The amount of sperm a male can displace (P2-value) is important in understanding sexual selection pressures. These P2-values are however mainly determined in highly evolved families where they are very high (>90%). There is only one study reporting the P2-value of a representative of a primitive family. The new world lestid *Lestes vigilax* has a P2-value of ca. 65%, suggesting inefficient sperm displacement in more ancient odonate groups. To check the generality of this finding we calculated the P2-value in the old world lestid *L. sponsa* by determining sperm volumes within the female during different stages of the copulation. Comparing stored sperm volumes before, during and after copulation allowed us to calculate the P2-value. To interpret our findings in a functional morphological way, we also examined the penis morphology using SEM. Despite the presence of clear spines on the penis top, its structure lacks specialised appendages present in the members of the more evolved Odonata. Because a co-evolution between the penis morphology and the female sperm storage organs is assumed, we also dissected these. The spermatheca is barely separated from the bursa copulatrix, which is a primitive situation. Our data confirm the lower sperm displacement capacity in more primitive Odonata and show that this is linked with their more primitive genital morphology.

More evidence for the development of a killer-mentality in captive hamadryas baboons (*Papio hamadryas hamadryas*)

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At least since 1993 the hamadryas baboon (*Papio hamadryas hamadryas*) colony at the Antwerp Zoo suffered from a high degree of infant mortality. Possible causes of death were hypothesised, varying from decreased infant viability, due to inbreeding, to infanticides by groupmembers. All possible killers and their motives -in respect to sociobiological hypotheses- were postulated. Four directly witnessed and some video-recorded cases of infanticide together with similarities to other cases of infant mortality indicate one of the haremleaders as the most important cause of infant death. This is in agreement with earlier findings in other groups in captivity. Although directly observed incidents of infant killing in other hamadryas groups are limited, infanticide seems to be a common problem. It has been suggested that uncertainty of the leader position can lead to infanticides by the male. None of the observed infanticides in our study occurred during periods of staggering leadership, but the infanticidal male was one of the three males who competed in 1991 to establish a harem. This led to a period of social instability, coinciding with infant abuse and infanticides. It can be argued that a behaviour which can be adaptive in such circumstances has evolved to a killer mentality, without apparent advantage.

The coexistence of three net-spinning Philopotamidae (Trichoptera) in a second order stream in Luxembourg

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In central Europe, the genus *Philopotamus* is represented by three species: *P. ludificatus*, *P. montanus* and *P. variegatus*. The larvae of these three species were found to coexist in the 'Breschterbaach', a tributary of the river Attert (Luxembourg). The habitat of all three species is rhithral, mainly epirhithral and they are considered to have almost the same ecological tolerances. Their larvae form an important element in the benthic fauna of most unpolluted, fast running streams. With Hydropsychidae, the Philopotamidae family is an important component of filter-feeding Trichoptera.

The principal objective of this study was to understand the coexistence of the three *Philopotamus* species in the 'Breschterbaach'. To achieve this goal, microhabitat distributions, life histories and feeding habitats of the three philopotamids were compared.

In a year-round study 1820 larvae and 39 adults were captured at 5 study sites.

The larvae of all species constructed their nets beneath rocks within riffles. No significant relationship between rock surface, rock texture, current velocity and microdistributions of the three species were found.

All three species had a univoltin life cycle but differed in emergency pattern. Philopotamid larvae spin capture nets that have the smallest mesh opening sizes recorded among trichopterans. Microscopic analyses showed differences in structure and mesh opening sizes among the three species.

The classical filter technique by CUMMINS and HPLC analyses were used to study the philopotamids' feeding habitats. Diatoms, chlorophyta and cyanobacteria were found to be the dominant prey items. Horn-Index showed that *P. ludificatus* and *P. montanus* had a significant dietary overlap.

Impact of mass rearing on the searching capacities and the genetical polymorphism of *Aphidius rhopalosiphi*

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The mass rearing of an antagonist should not alter too much it's performances. Our aim was to compare the impact of two different rearing environments on the parasitoid's searching capacities and on it's genetical polymorphism. One environment was totally constant, and the other was variable. The parasitoid's searching capacities were studied in 2,5 square meters cages. This experiment has shown that after 15 generations, the searching capacities (analysed in terms of parasitism rate) and the offspring sex-ratio were not significantly different for the two rearing methods, and stayed high. This allows us to affirm that *Aphidius rhopalosiphi* can be raised in a constant environment, during at least 15 generations, without risking the loss of an important part of it's searching capacities. In order to detect genetical variations due to the rearing conditions, changes in the genetical polymorphism for the two rearing conditions were compared by RAPD-PCR method and put into relationship with the searching capacities results.

The angiotensin-I converting enzyme homologue in *Locusta migratoria*: gene cloning and tissue distribution

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Anti-ACE antibodies allow the immunocytochemical tracing of an ACE-like compound in neurosecretory cells of the brain, in the testes and in cells of the intestinal tract of the grasshopper *Locusta migratoria*. In specific neurosecretory cells ACE-like immunoreactivity is co-localized with FXPRLamide immunoreactivity suggesting a role of the ACE equivalent in the processing of these peptides from their precursor. Starting with mRNA extracted from adult testes and by using degenerated PCR primers corresponding to evolutionary conserved ACE domains, we obtained a 400 bp PCR fragment. This cDNA fragment shows over 60% of sequence conservation when compared to known vertebrate and invertebrate ACE genes. Accordingly this *Locusta* sequence was named Lom-ACE. Northern analysis, using the Lom-ACE sequence as a probe, demonstrated the presence of abundant ACE transcript in midgut and less abundant in testis. Northern did not allow the detection of ACE transcript in the brain. On the contrary RT-PCR with Lom-Ace specific primers showed the presence of ACE mRNA not only in the brain, but as well in fat body cells and hemocytes. Initial competitive PCR experiments, in which we use a truncated cDNA fragment as a co-amplified internal standard, confirm the presence of double the amount of Lom-ACE transcript in midgut compared to fat body whereas the amounts detected in total brain RNA are almost 10 times lower. Transcription of this Lom-ACE gene seems not to be restricted to adult tissues since its transcripts remains detectable throughout all developmental stages in tested samples of midgut, brain and fat body.

Impact of the tributaries on zooplankton populations of the Bütgenbach Lake (Belgium)

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Between March and July 1998, we carried out a study to assess the impact of the main tributaries on the zooplankton populations of the Bütgenbach Lake. The main physical and chemical parameters (temperature, pH, dissolved oxygen concentrations, nutrient concentrations) were measured in six tributaries and in three stations along the lake. Zooplankton was sampled and determined at the same sampling points. The input of nitrogen and phosphorous from the tributaries was estimated using discharge measurements. During this study (4 months), nitrogen and phosphorous compounds were mainly introduced into the lake of Bütgenbach by the rivers Warche (28,8 Tons N; 0,70 Tons P), Holzwarche (15,3 Tons N; 0,34 Tons P) and Herresbach (10,5 Tons N; 0,19 Tons P). Using the rotifers as bioindicators following the classification of Sladecek (1983), the impact of the different tributaries on the lake zooplankton was assessed showing a global improvement of the lake water quality from upstream to downstream. The dominant species were the same at the different stations but the relative proportions were different and the densities reached usually higher values at the central sampling station of the lake. The BBI (Belgian Biotic Index) based on macroinvertebrates presence or absence was evaluated in the tributaries. These results were in good accordance with the tendencies shown by rotifers used as bioindicators.

Phylogenetic relationships of phylum Rotifera with emphasis on the families of Bdelloidea

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We investigated phylogenetic relationships of phylum Rotifera using cladistic analysis to uncover all most-parsimonious trees from a data set comprising 60 morphological characters of nine taxa: one Acanthocephala, six Rotifera, and two outgroups (Turbellaria, Gnathostomulida). Analysis of our matrix yielded a single most-parsimonious tree. From our analysis we conclude the following: (1) Class Digononta is paraphyletic; (2) it is still premature to reject rotiferan monophyly; (3) the classification hierarchy that best conforms to this morphologically-based, cladistic analysis is similar to several traditional schemes. In spite of these results, it is significant that this analysis yielded a tree that is incongruent with those trees developed from molecular data or by using the principles of evolutionary taxonomy.

Spatial components of *Mastomys natalensis* population dynamics

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Many African countries are confronted with significant rodent problems, which necessitate the implementation of, preferen-tially scientifically-based, rodent control measures.

It is in this context that this Ph.D. study aims to investigate the spatial dynamics of *Mastomys natalensis*, the multimammate rat (Rodentia, Muridae), which can be considered as one of the major pest species in East-African agriculture.

More specifically, it is the intention to describe and analyse the population dynamics of *M. natalensis* populations in fallow land, monocultures and mosaic structures (small fields embedded in a matrix of fallow land).

The study implies a comparison of the demographic properties of the populations in these three different biotopes. Therefore, a long-term capture-mark-release study, with monthly three-night capture sessions, has been set up on selected fields in Morogoro (Tanzania).

Moreover, it is intended to use the obtained estimates of survival, maturation, sex-ratio and recolonisation (obtained from a recolonisation experiment) to optimise an existing population dynamic model for *M. natalensis* populations in fallow land and to create similar models for populations in mosaic structures and monocultures. As small-scale farming is still relatively abundant in East-Africa, the model for *M. natalensis* populations will be stressed. It will be aimed to generalise the model for the mosaic population by incorporating data of the other population dynamic models and data of the recolonisation experiment.

The constructed models will be used for simulating the effects of manipulative actions on the population dynamics, thereby allowing the evaluation of several control measures. Moreover, the models will act as an early-warning system for rodent outbreaks in monocultures and in small-scale mosaic systems.

Sediment quality assessment employing an *in situ* bioassay and deformities in Chironomids

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An *in situ* bioassay using mouthpart deformation response in *Chironomus riparius* was developed. Second instar larvae and a given amount of food were inserted in specific cages. These enclosures were suspended in the examined rivers on the sediment surface until the larvae reached the fourth instar stage, which was used for the analysis and quantification of mouthpart deformities. AMINAL provided a detailed physico-chemical characterisation of the major xenobiotics present in the sediments. In this way, mouthpart deformities of caged and field larvae (if present) were related to the overall toxic burden of the sediments.

Summing toxicant concentrations and taking into account bioavailability, a significant relationship between toxicity and deformities was revealed. The main advantage of this *in situ* technique is the possibility to assess the incidence of deformities at sites where *Chironomus riparius* is not naturally occurring.

The genetic diversity in a metapopulation of cyclical parthenogenetic zooplankton

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Using allozyme electrophoresis, we studied genetic diversity in different local populations of *Daphnia ambigua*, in a metapopulation consisting of 35 interconnected ponds. The ponds differ widely in ecological characteristics, including fish predation pressure, the development of the littoral zone and water transparency. Even though dispersal among ponds is possible through both diapauzing eggs and parthenogenetic females, and dispersal rates are expected to be very high, we observed significant among-populational differences in genotype frequencies among neighboring ponds, suggesting a strong impact of diversifying selection. Our research aims at quantifying the effect of a metapopulation structure on genetic diversity on a local and on a regional scale, and to quantify the relative contribution of gene flow and natural selection in shaping the genetic structure of local zooplankton populations in a metapopulation setting.

Tidal and diurnal patterns in the hyperbenthos of the Belgian coast

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The hyperbenthos of a subtidal station on the Belgian east-coast was sampled hourly with a sledge during a 26 h period. 39 species in 10 higher taxa were recorded. Mysidacea were the dominant taxon, both in terms of density (N) and biomass (B). Subdominant taxa were gammaridean amphipods, larval decapods and early postlarval teleost fish. The most abundant species was the mysid *Schistomysis kervillei* (59% N, 63.5% B). The amphipod *Gammarus crinicornis* (14% N), postlarval shrimp *Crangon crangon* (12% N) and postlarval gobies *Pomatoschistus* species (5% N, 19% B) were also well represented.

Hill's diversity numbers revealed a tidal pattern, diversities being highest around ebb and lowest around flood tide. This pattern was mainly due to the presence or absence of mysid species. Density patterns of the hyperbenthic species were found to be either diurnal or tidal. Species with a tidal rhythm could be divided into two categories: (1) species with highest densities around low water and (2) species with maximal densities around both low and high water. The former group included the mysids *Schistomysis kervillei*, *S. spiritus*, *Gastrosaccus spinifer* and *Mesopodopsis slabberi*, the cumacean *Diastylis bradyi* and megalopa larvae of the shore crab *Carcinus maenas*. The latter group included zoea larvae and postlarvae of *Crangon crangon*, the cumacean *D. rathkei*, the amphipod *Atylus swammerdami* and megalopa larvae and juveniles of the swimming crab *Liocarcinus holsatus*. Species with a diurnal rhythm could be divided into three groups: highest densities were reached either (1) at night, (2) during daytime or (3) around dawn and dusk. The first group was quite diverse and mainly included gammaridean amphipod species; the second and third categories only consisted of the isopod *Idotea linearis* and postlarval gobies and clupeoids, respectively.

Seasonal variation of distribution and new records of benthic amphipods (Crustacea) from Admiralty Bay, King George Island, West Antarctic

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In Southern Ocean benthic communities, the amphipod crustaceans constitute a very speciose and often abundant group, showing high "ecological" diversity, at least in terms of habitat, life styles, trophic types and size spectra.

In 1993, rich materials of benthic invertebrates were collected from the upper sublittoral to lower sublittoral zones of Admiralty Bay, King George Island. Samples were taken at various times during the year at depths ranging from 15 to 150m using trawls and baited traps.

An analysis of the seasonal variation in relative abundance and bathymetrical distribution was made for the most common benthic amphipod species of the bay.

Bathymetrical migration probably occurs in relation to ice formation and food availability depending on the season. Some of these seasonal variations as well as new records for the bay are reported here.

Cephalic morphology in two commensal fishes of Bivalves : *Encheliophis dubius* and *Onuxodon fowleri* (Carapidae, Ophidiiformes)

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Onuxodon fowleri and *Encheliophis dubius* are two Carapidae fishes that both shelter below the mantle of bivalve hosts. The cephalic muscular and skeletal organisation of the two species shows many similarities. However, the major morphological differences are in the buccal skeleton and the branchial musculature. The *O. fowleri* premaxillaries do not have an ascending process. They are firmly attached to a ossified unpaired rostral that turn around a concave mesethmoid ended by a bump and they possess a ligament that fixes on the anterior process of the palatine. These differences could explain the absence of protraction in *O. fowleri*. In these two fishes, the cephalic morphology (considerable denture, strong adductor mandibulae, etc.) attest the carnivorous diet. However, the presence of large teeth on the dentaries and the premaxillaries, and a thinner branchial musculature in *O. fowleri* could be in relation with the presence of cut preys in their stomach contents. The morphologic diversities could relate the manner of seizing and handling preys but do not explain the behaviour of both fishes toward a bivalve host.

Phylogeny and general biogeography of *Meliturgula* FRIESE, 1903 species

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Meliturgula FRIESE, 1903 are small Panurgine bees close related to *Melitturga* LATREILLE, 1809. These species are mainly distributed in South-Africa but tehy are also present in Iran and Arabia. Warncke (1987) grouped them with *Flavomeliturgula* in a single genus, recent revision of this genus by Patiny (1998b) show that these two genus must be distinguished and that *Meliturgula* have to be subdivided into three separate subgenus: *Meliturgula*, *Poecilomelitta* (FRIESE, 1913) and *Popovia* PATINY, 1998. We propose a biogeographic approach of the group evolution, based on knowledge of both biogeography and phylogeny of the group.

Electroreception in catfish: dc-dipole discrimination

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A catfish, *Ictalurus melas*, was trained in a two-alternatives forced-choice conditioning paradigm to discriminate between two direct-current dipoles, spaced 12 cm apart, with the dipole axes parallel to the swimming path of the fish. The dipole span could be varied between 0.5 and 10 cm. The dipole current was 5 microamp. When dipoles with differents spans were presented simultaneously, the subject's electrodiscrimination performance exceeded the 85% correct choices level if dipoles of 1 cm span were tested against dipoles with a span of 1.5 cm or more. The average stimulus strength at 1 cm distance from the dipole axis was 4.2 ± 1.7 mV/cm. The average swimming speed of the subjects was 7.4 ± 3 cm/s. The potential swing over the skin caused by the subject passing the dipole, covers the frequency band of the ampullary electroreceptor organs. We consider this feat support for the view that motion with respect to a stationary direct current stimulus source provides a biologically adequate stimulus to the passive electric sensory system in catfish.

Effects of testosterone on dominance rank, song development and mate attraction behaviour in captive juvenile male European starlings

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Previous studies have shown that testosterone has many effects on the behaviour and physiology of adult male starlings. Here we have studied the effects of testosterone on juvenile males. Half of the eighteen captive males were treated with testosterone-implants. Their behaviour and some physiological parameters were compared to controls. First, in autumn, we investigated the effect of testosterone on dominance rank. According to the literature, testosterone has a major effect only in the establishment of a hierarchy. Our study revealed that even after the establishment of a hierarchy, testosterone had an important effect on the dominance rank of juvenile males. Secondly, we observed the effects of testosterone on song development. Although testosterone initially accelerated the onset of song, in the long-term it had negative effects on the song activity, and presumably also on the repertoire size. Thirdly, we found that the experimental increase of testosterone not only stimulated juvenile males to start singing earlier than controls, but that they also started occupying a nestbox and collecting nesting material much earlier. Male starlings normally show this attraction behaviour only for the first time at the beginning of the breeding season when being several months older. Finally, we found that testosterone delayed the onset of moult, coloured the bill yellow and increased the cloacal swelling.

Trophic structure of a benthic amphipod taxocoenosis of the eastern Weddell Sea (Antarctica)

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In an attempt to characterize the ecological roles of the amphipod taxocoenosis of the shelf community of the eastern Weddell Sea, the preferential or exclusive trophic types of the 40 most common amphipod species have been determined. Benthic amphipods have been classified in different trophic types by analysing gut contents, by feeding experiments and observations on feeding ethology of living animals and by studying functional morphology of feeding appendages. A first synthesis shows that, in the eastern Weddell Sea, the amphipod fauna is dominated by macrophagous predators (36 to 47% of total amphipod community). Deposit feeders and suspension feeders together represent 29 to 46% of the whole amphipod fauna, showing that benthic amphipods are very depending, during the summer, on planctonic organic rain. Predatory grazers feeding on sessile benthos like bryozoa or cnidaria represent 9 to 14% and scavengers feeding on crustaceans, fishes or other carrions constitute 10 to 20% of the amphipod taxocoenosis.

Semi-quantitative analysis of gut contents show that amphipods take: 32% of their food in the Crustacea group; 40% in the particulate organic matter flux; 8% in the Polychaeta group and 7% in the Bryozoa group.

The male of *Lecane bulla* (GOSSE, 1851): new support for the synonymy of *Lecane* NITZSCH, *Monostyla* EHRENBERG and *Hemimonostyla* Bartoš

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Because sexual reproduction occurs rarely in monogonont Rotifera, the males of only few species are known. The hitherto unknown male of *Lecane bulla* (GOSSE, 1851) is described and figured, and compared to the few known males of congeners. The male of *Lecane bulla* is unique by having two completely separated and mobile toes, in contrast to the female which has a single toe. This intraspecific difference offers an additional argument questioning the separation of genus-group taxa within *Lecane*, based on the degree of fusion of the toes.

The dispersal dynamics of the wood mouse *Apodemus sylvaticus*: a comparison of direct and indirect methods

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Dispersal in rodents has already been subject of many studies, although conclusions are often conflicting. In this study, we examined the dispersal pattern of a peninsular population of woodmice, *Apodemus sylvaticus*. The study area was a forest, situated on the roofs of two buildings, one completely surrounded by water ('the island') and the other on firm ground ('the mainland'). Both were connected by a small bridge that served as a corridor. As woodmice seldom swim, we assumed that this bridge was indeed the only possible way to disperse. Because there is no best method to study dispersal, we combined thee methods, *i.e.* capture-recapture data, PIT-tagging plus recording on the bridge and the use of microsatellite DNA.

Both capture-recapture data and PIT-tag records did not give a clear picture of dispersal. On the other hand, genetic markers proved to be adequate to identify animals that dispersed.

Presence of a local renin-angiotensin system in bovine adrenal medullary cells

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The renin-angiotensin system (RAS) exerts a wide variety of actions on the cardiovascular, renal, endocrine, and nervous systems. These actions are mediated by angiotensin II (AngII) and other shorter angiotensin fragments. Angiotensins have been traditionally regarded as circulating hormones, since the earlier data suggested that the precursor molecule angiotensinogen was secreted by the liver and converted to angiotensin I in the circulation by active renin derived from the kidney. However, there is now considerable evidence that AngII and its active shorter fragments are also produced in and act locally on a number of its target organs. A number of studies indicate that the adrenal medulla may also possess an intrinsic RAS.

In this study the expression of angiotensinogen mRNA, as well as the localization of renin and AngII were investigated in bovine adrenal medullary cells in primary culture. By light microscopy, readily detectable angiotensinogen mRNA expression as well as AngII and renin immunoreactivity were demonstrated. The distribution of AngII and renin immunoreactivity in the sucrose gradient suggested that a predominant part of AII and at least part of renin are present in secretory granules, a conclusion supported by immuno-electron microscopy. These results provide the first direct evidence that adrenal medullary cells are not only target cells for angiotensin, but should also be considered as local angiotensin-generating and -storing cells. This cellular RAS may be a significant autocrine and/or paracrine modulator of adrenal functions, including regulation of local blood flow and catecholamine secretion.

Territorial defence in the comma butterfly, *Polygonia c-album* (Rhopalocera: Nymphalidae)

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Diversity of life is conspicuous in each field of biology and ethology does not fail to this, regardless of the investigated level. Territorial behaviour, for instance, may be associated with home range, exploitation of resources or mating behaviour. Moreover, territoriality as mating behaviour strategy varies between orders, families, species, populations and individuals.

Several studies have already reported behavioural descriptions of territoriality in butterflies, presenting simple and typical interaction behaviours performed by males aiming to chase out intruders. Studying males *Polygonia c-album* (Lepidoptera: Nymphalidae), we show here that territorial defence can be more complex in butterflies, comprising conventional displays and escalated contest. We present seven different patterns performed during territorial interactions, pointing out that some of them are ritualised while others are not. Ritualisation indicates here that territoriality has an evolutionary history. We also present many indications of the great energy cost of the territorial behaviour for *Polygonia c-album* males.

Those elements, together with other specific life history-traits -the equal number of possible copulation for male and female and the supply of nutriments by male to female during copulation- draw an uncommon situation in the study of mating behaviours.

Characterization of the clonal structure of *Daphnia magna* populations

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By following the number of clones and clonal diversity throughout the year we tried to characterize the clonal structure of three *Daphnia magna* populations from three nearby ponds (Oude Meren, Heverlee, Belgium). Clonal genotypes were constructed using the genotypes at four allozyme loci, which were screened for genetic variation by means of cellulose acetate gel electrophoresis. The first population has a permanent character, with a strong impact of clonal selection and a low clonal diversity. There is, however, a temporal addition of clones during the growing season, probably due to hatching of individuals from resting eggs. The second population shows a semi-permanent character, with hatching from resting eggs, followed by clonal erosion, probably due to clonal selection. The third population exhibits characteristics of a true intermittent population, with a high number of clones and a high clonal diversity, probably due to a stronger impact of hatching from resting eggs than in the two other populations. These results can be compared with the results from the *Daphnia magna* population of the Driehoeksvijver (Gent, Belgium). This *Daphnia magna* population has also a semi-permanent character and shows some resemblance with the second population of the Oude Meren.

The influence of predator species and prey age on the efficacy of an antipredator behaviour: lamellae autotomy in a damselfly

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The antipredator efficacy of antipredator behaviours may depend on both intrinsic and extrinsic factors. We experimentally studied the effects of predator species and prey age on the immediate survival value of lamellae autotomy in larval damselflies. Four predators: the notonectid, *Notonecta viridis*, the dragonfly larva *Aeshna cyanea*), and two fishes (*Gasterosteus aculeatus* and *Lepomis gibbosus*) were tested with all combinations of two instars of the damselfly *Lestes sponsa* (F-0 and F-2). The number of escapes by swimming away were lower when larvae were attacked by the two fishes than by the two invertebrates. Both instars did not differ in the number of escapes by swimming, but F-0 instars were more caught at the lamellae than F-2 instars. This is caused by a lower swimming performance of the latter. All larvae that survived a capture where caught at the lamellae and the majority (91.2%) did so by autotomy. The ontogenetic increase in the immediate survival value of this antipredator behaviour was shaped by the predator species. It was highest in captures by the *Notonecta* (40%), and lower when larvae were caught by the *Aeshna* or *Gasterosteus* (ca. 17%). This was because the relative magnitude of the speed difference between damselfly instars depends upon the predator's attack performance. We discuss the consequences of this interaction for the multicomponent antipredator behaviours prey may use.

Functional characterization of pharyngeal glands in *Heterodera schachtii*

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H. schachtii, a cyst nematode, is an obligate plant parasite, which after root penetration induces syncytium formation in the central cylinder. The nematode feeds on this syncytium until maturation. According to the current hypothesis, syncytium induction is probably caused by secretions originating in the pharyngeal glands. By DIC- and transmission electron microscopy, we investigated pharyngeal gland activities during the onset of parasitism. In the preparasitic stage, the two ventrosublateral pharyngeal glands had a very large cell body and contained numerous secretion granules. In contrast, the dorsal pharyngeal gland was rather small, and only a limited number of secretion granules was present in the cytoplasm. Four days after inoculation on the roots, the two ventrosublateral glands were decreased in size, and only very few small secretion granules could be detected in the cell extension. However, the dorsal gland had strongly increased in size, and secretion granules were continously synthesized. As syncytium induction is known to occur approximately two days after the nematodes are inoculated on the roots, our observations indicate that the ventrosublateral pharyngeal gland secretions are involved in migration of the nematodes in the roots or in the syncytium induction. The dorsal gland secretions could be necessary for maintenance of the syncytium or have a function in withdrawal of nutrients out of the syncytium. To characterize the pharyngeal gland secretions, cDNA-AFLP is currently being performed.

The mating system of the dragonfly *Sympetrum striolatum* (Odonata)

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There have been more studies of lifetime mating success in dragonflies (Odonata) than in any other insect orders. Within this order there is however a large bias towards representants of the suborder Zygoptera. Therefore we studied sexual selection in the small Anisopteran dragonfly *Sympetrum striolatum*. An essential condition to understand the process of sexual selection of a species is to study its population ecology. Here we present data on its population structure. Adult *S. striolatum* were marked and recaptured daily throughout a one month period (August 1997). The animals were marked with an individual number written on the forewing using a permanent marker. Each dragonfly was weighed, sexed and photographed to analyse morphological parameters. A large part of the male population was only seen once (transients). The number of visits at the pond was higher for males than for females. Females only visited the pond to copulate. Mated males are on average smaller than unmated. They also visited the pond more frequently and have a higher mating efficiency. This suggest respectively a lower energy expenditure and a higher mobility for smaller animals.

Research of a chemical communication in *Euroglyphus maynei* (Acari: Pyroglyphidae)

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Euroglyphus maynei along with *Dermatophagoides pteronyssinus* are the most abundant mite species in house dust from coastal areas. Both species are potent causes of asthma and rhinitis in human beings.

It is well known that a thorough understanding of a pest's biology is necessary for good management. Unfortunately, there is little information about *E. maynei*.

In this study we investigated the behavior and chemical communication of *E. maynei*. The presence of an alarm, an aggregation and a sexual pheromone were investigated. No alarm pheromone was found but it appears that two different aggregation pheromones are present in a mite culture: a first one emitted by the mites themselves and a second one present in the culture medium with a long range effect.

A guarding behavior, induced by an arrestant pheromone is emitted by quiescent female tritonymphs.

Phylogenetic reconstruction of a neural network underlying theory of mind in primates

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The concept of Theory of Mind (ToM) stands for the ability to have insight into one's own intentions as well as those of others. It has been operationalized by a number of tests which have been applied to humans and other primates. Thusfar data show that humans do and great apes may possess ToM, with lesser apes doubtfully so and monkeys lacking ToM. As yet the interpretation of tests is too problematic to lead to unequivocal conclusions on the evolution of ToM in primates. Starting (1) from the observation that in humans ToM depends on the integrity of a neural network consisting (at least) of the orbitofrontal cortex, amygdala and (parts of the) temporal cortex and (2) from the assumptions (a) that if the presence of ToM per se is shared between species it is shared because of the presence of this neural network per se and (b) that differences in aspects of this neural network are indicative of differences in aspects of ToM, we decided to make a formal phylogenetic reconstruction of this neural network in primates. Existing neuroanatomical data of this network were reworked upon such that characters and character states could be defined, which were subsequently subjected to standard phylogenetic analytical methods. A phylogenetic reconstruction of this neural network in primates will be shown.

Estimating isolation and genetic differentiation in two Belgian populations of moorhens *Gallinula chloropus*

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Isolation of a population can result in an increased homo-zygosity or a decreased genetic variation as a consequence of inbreeding and random genetic drift. This effect is even reinforced if the population is small. The Zoo, which is located at the centre of the city of Antwerp, contains a small, possibly isolated population of free-living moorhens. We compared the genetic image of moorhens at the Zoo with that of moorhens in Planckendael, a large, non-isolated population at a distance of approximately 30 km from the Zoo. Two different methods were used to test the hypothesis that the Zoo population is isolated, being multi-locus DNA-fingerprinting and PCR-analysis. Both analyses indicated that the population in the Zoo is not isolated. First, mean band sharing coefficients within breeding pairs, calculated from the DNA-fingerprints, did not differ between the two areas. Second, PCR-analysis showed the same level of homozygosity in the Zoo as in Planckendael. However we found a significant genetic differentiation between the populations as estimated by a θ-value of 0.082. Nm equaled 2.71, which means that this differentiation is maintained when two to three individuals migrate between the study areas each generation. Comparison of some morphological measurements pointed out that moorhens in the Zoo tended to be smaller than moorhens in Planckendael. This difference could be a result of the genetic differentiation we found.

The use of outdoor insectaries as a technique to solve life history problems in damselflies

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As became clear the last decades, damselflies are extremely suitable to examine a variety of biological questions. One of their peculiar advantages is the possibility to collect enormous numbers of data on a relative short time span. Upon now, most research was carried out under field conditions. Nevertheless, several questions remain difficult to test because of the high number of uncontrolled conditions that coincide with these studies. A solution to avoid these uncertainties is to study populations in semi-natural outdoor insectaries where population parameters can be controlled (*e.g.* population size, sex ratio, ...). We assessed the suitability of the insectaries by comparing behaviour, survival and dayrithm between our study method and previous findings in the literature for the species *Ischnura elegans*. Our results show that the damselflies behave naturally under the experimental conditions. Therefore the outdoor insectaries are ideal tools to elucidate several of the remaining questions concerning life history traits in general.

Increasing densities and bad condition of roe deer (*Capreolus capreolus*) in Flanders

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Roe deer numbers have increased rapidly in Flanders over the last 20 years, going from 2000 counts in the early seventies to 14000 in 1998. Apart from an increase in numbers, there has been an increase in range: where roe deer used to live in big forest complexes, they now also inhabit small fragmented woodland all over Flanders. The effects of this behaviour-ecological change on body condition was studied by means of hunting data. Sample areas were grouped with respect to management: in big forests roe deer hunting is often prohibited in parts of the forest; therefore we considered roe deer populations of big forests as badly-managed, and fragmented populations as better-managed. Eviscerated weights of roe deer shot all over Flanders were compared to each other. All categories of animals (fawns, bucks and does) were found to be high-significantly heavier in fragmented than in big forests. The cause of this difference is unclear: the species composition of the diet of roe deer (a typical browser) might be different, new immigrants and their off-spring in fragmented woodland might be of better condition (hypothesis of only the best roe deer are able to migrate), wildlife diseases might have a different impact, or roe deer densities might have different effects in fragmented and big forests. A combination of all these factors is likely and topic of further research.

Regulation of reproduction in the ant *Odontomachus simillimus*

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In most ant species workers refrain from reproduction in presence of the queen even though they have functional ovaries and are able to produce males from unfertilized eggs. In the ant *Odontomachus simillimus* worker egg laying was rarely observed in queenright colonies and most workers had weakly or undeveloped ovaries. However, when orphaned, a portion of the workers, particularly young ones, achieved well developed ovaries and started to produce males. To explain the absence of worker reproduction in queen presence two major mechanisms have been proposed, namely 'queen policing' and 'worker policing'. Queen policing is not likely to be of any significance in this species since queens were not observed to physically dominate the workers. The hypothesis of worker policing, where workers try to prevent each other's reproduction, was tested by a manipulation experiment in which workers were temporary separated from the queenright colony so that a part of them would become reproductive. Then they were reintroduced into the queenright colony in order to investigate whether egg layers were recognized and differentially treated. Finally all workers were dissected to determine their reproductive status. In two colonies the egg layers were clearly recognized by the queenright workers and were held by their legs, abdomen or antennae and dragged around the nest. Hereby they were stung and bitten and something even killed. In two other colonies the results were rather unclear because all the transferred workers were assaulted. Worker laid eggs which were brought over to the queenright colonies were eaten.

Differential gene expression in BmNPV-infected *Bombyx mori*

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In search of *Bombyx mori* genes that are upregulated during the early phase of a baculoviral infection, two different ways are being followed: DDRT-PCR is used to compare the mRNA-population of Bm-5 cells, 4 hours p.i. with *Bombyx mori* Nuclear Polyhedrosis Virus (BmNPV) with these of mock-infected Bm-5 cells. 53 primer combinations within this technique are tested and about 21 fragments appeared to be differentially expressed. Some of them were false positives and some others appeared to be viral fragments, with this last feature proving the reliability of the used technique. Further investigation by means of sequencing and Northern blotting has to prove the real character of the remaining fragments.

In a second approach PCR-select cDNA subtraction is used to generate a library of cDNA of genes that are expressed in infected, but not or at least far less, in uninfected Bm-5 cells. Of the resulting 350 fragments, 77 were further analysed by sequencing and/or Northern blotting experiments: 33 appeared to be false positives while one was of viral origin. 43 fragments gave no result in a Northern blot. The remaining fragments are now being analysed by sequencing and Northern blotting experiments to prove their differential character.

Subtle genetic structuring of populations of the cyclical parthenogen *Daphnia magna*: an experimental study on the timing of hatching of the resting eggs

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We incubated resting eggs, collected from natural *Daphnia magna* populations, under three temperature-photoperiod conditions which correspond with the conditions during early spring, late spring and summer in the region of sampling. In each treatment the resting eggs hatched over two periods in time (rapid versus late), indicating that genotypes use a risk spreading strategy to cope with both the competition with other clones (rapid hatchers) and the risk of abortive hatching (late hatchers). Using allozyme markers, we screened the groups of individuals that hatched under different conditions for genetic variation. We found important interaction effects of the time of hatching (rapid versus late) and the seasonal conditions (spring or summer) on the allozyme frequencies of the analysed loci, suggesting the presence in the analysed populations of genetically isolated (or at least partially isolated) subgroups of individuals which are characterised by a different hatching behaviour.

Identification and characterization of neuropeptides in insects

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The first neuropeptide identified in insects was proctolin (Brown and Starrat, 1975). It stimulates the motility of the proctodeum of the cockroach *Periplaneta americana*. From then on peptide identification started to boom at a tremendously fast rate (in *Locusta migratoria* more than 60 peptides have been isolated and identified) and this because of major improvements in high performance liquid chromatography (HPLC), in peptide sequencing and molecular biological methods. Most neuropeptides are isolated from huge brain extracts (up to 10000 insect brains) which are purified by HPLC. After each purification step fractions are screened by reliable bioassays. Different bioassays are used to screen the chromatographically purified fractions: myotropic, juvenile hormone biosynthesis, adipokinetic hormone release, trypsin inhibition,... The purity of a specific fraction is checked by mass spectrometry and by amino acid analysis. Finally its sequence is determined by Edman degradation. We synthesize the peptide and compare its activity and retention time with the purified one. Although many neuropeptides have been isolated from insects almost nothing is known about their receptors. We are cloning insect neuropeptide receptors and receptor binding studies are performed. The synthetic peptides are used in additional physiological activity studies. Polyclonal antibodies are raized against the new identified peptides to develop RIAs and to immunolocalize the peptides in the central nervous system and in peripheric organs. By cloning the preprohormones we obtain the essential information about the biosynthetic peptide precursors.

The distribution of the Asiatic chipmunk (*Eutamias sibiricus* LAXMANN 1769) in De Panne (Belgium)

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The Asiatic chipmunk is being imported in Belgium as a pet since the beginning of the sixties. Now there are four free-living populations in Belgium, one of them in the Calmeynbos in De Panne. About 20 years ago, 17 animals were released here by the amusement park Meli and now the population is roughly estimated at 100 to 200 animals.

In their original distribution area these animals can, at high densities, cause a lot of damage to agricultural fields. In the Zonlënwoud a negative influence on some ground breeding birds is indicated. Because of the danger of negative consequences on the ecological system due to increasing population pressure, preventive measures are suggested. There is a need for a more specific study on the interaction of the chipmunks with the forestal ecological system. At first step taken in this direction is the following study, conducted in September and October 1998 in De Panne.

The aim of this project is to estimate chipmunk numbers and distribution and to look at their behaviour (especially feeding habits). The study includes three parts : (1) an estimation of the population density based on the transect method in the whole study area, (2) a more accurate estimation of the population density based on capture-mark-recapture data in part of the study area and (3) observations of the chipmunk behaviour. Results are presented in this poster.

Hierarchical population genetic analysis reveals metapopulation structure in a phytophagous Galápagos beetle

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The Galápagos Archipelago, situated 1000 km west of Ecuador in the Pacific Ocean, since long has been considered a living laboratory for the study of evolution. Due to geographic isolation and speciation many endemic groups have radiated. Although the vertebrate fauna of these islands (e.g. giant tortoises, Darwin's finches) has been studied in great detail, little is known about invertebrates and especially insects. Results are given on the population genetics of the phytophagous beetle *Nesaecrepida darwini*. This small Alticine beetle is present on all major islands but shows a discontinuous population distribution. In order to get population genetic information we used cellulose acetate gel electrophoresis to study allozyme variation in 6 populations of 3 islands. 12 presumptive loci, including 9 polymorphic ones, were analysed. The results show low heterozygosity values, with the lowest genetic diversity on the youngest island. F-statistics (mean FST = 0.431) indicate a large amount of differentiation . A hierarchical analysis indicates little inter-island gene flow but also considerable genetic variation between populations occurring on the same island. These results strongly suggest a metapopulation structure with recurrent extinctions and recolonisations of populations within an island. Recent field observations support these findings.

Possible causes for the increase of hibernating bats in Flanders

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For more than 20 years hibernating bats are counted in Flanders by volunteers of the bat-group. Regularly found species are *Myotis daubentoni, M. mystacinus/brandtii, M. nattereri, M. dasycneme, M. emarginatus, Pipistrellus pipistrellus* and *Plecotus* sp., 5 other species are rare (*M. myotis, M. bechsteinii, Nyctalus noctula, Eptesicus serotinus* and *Barbastella barbastellus*). The other indigenous species are not found in hibernacula. Since 1975 the numbers of most species are increasing. This increase is most pronounced for *M. daubentoni, M. mystacinus/brandtii* and *M. nattereri*.

To protect bats a lot of hibernacula are protected as nature-reserve. The management includes: (1) the installation of doors to minimize disturbance and to increase temperature and humidity (2) create shelters for bats such as cracks and hollow bricks. To evaluate the effect of this management we investigated the effect of humidity, disturbance and wall structure on the number of hibernating bats in the different types of hibernacula. In small objects humidity has a significant effect (Anova, $F=22.8$; $df=567$; $p<0.001$) while the degree of disturbance has no effect. In forts and limestone caves both humidity and disturbance have a significant effect (Anova, $F=14.9$; $p<0.001$ and $F=28.1$; $p<0.001$). The structure of the wall could only be investigated in the small objects. More bats were found in hibernacula with many cracks or rough brick walls compared to hibernacula with smooth walls but this was not significant (Anova, $F=0.09$; $df=718$; $p=0.9$).

Progesterone receptors in canine placenta decidual cells

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The presence of the progesterone receptor (PR) was determined immunohistochemically in the pregnant uteri of 6 dogs, in order to better understand changes occurring in uterine tissue during pregnancy. The placenta of the dog is a deciduate and endotheliochorial placenta of the zonary type. The mean duration of pregnancy in the dog is 64 days and superficial implantation takes place on the 16th day after ovulation. From day 23 to 41 of pregnancy, *i.e.* the period investigated, no changes were seen in immunohistochemical staining for PR in uterine tissue. Furthermore, endometrium of the implantation and non-implantation site had a similar PR distribution, thus close contact with placental and/or fetal tissue had no influence on the PR content of uterine tissue. Positive staining for PR was seen with low intensity in the cell nuclei of the endometrial glands and surface epithelium, and with high intensity in stroma cells and in myometrial smooth muscle cells of both the implantation and non-implantation site. PR were also found in decidual cells of the placental labyrinth. Decidual cells are of maternal origin, are located around maternal blood vessels and in many areas constitute a discontinuous part of the placenta membrane. Inspite of their location they are difficult to identify lightmicroscopically when using common staining techniques in paraffin sections. In the present study, nuclei of the decidual cells stained intensely positive for PR and were easy to recognize. The fetal part of the canine placenta showed no evidence of containing PR.

Echinococcus multilocularis in Belgium? An update

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Echinococcus multilocularis is a small endoparasitic tapeworm belonging to the class Cestoda, subclass Eucestoda, order Cyclophyllidea and family Taeniidae. The metacestode stage of this parasite can cause alveolar echinococcosis (AE), an often fatal zoonosis. In the Northern hemisphere where this cestode is endemic, the human population in close proximity to infested red foxes (*Vulpes vulpes*) are at risk of infection with AE. In order to define the geographical distribution of this tapeworm in Belgium, three surveys were conducted to examine the prevalence of *E. multilocularis* in the red fox population in Belgium, by examining the small intestines at necropsy for the presence of this tapeworm.

The first survey in Belgium was carried out in 1992, where Brochier investigated 85 foxes of the province of Luxembourg (southern Belgium) and revealed the presence of the parasite in13 foxes (15%) (Brochier *et al.*, 1992). In 1996 145 foxes, recolted in the province of Luxembourg, were analysed by Losson, and 74 of them (51%) were found infected (Losson *et al.*, 1997). In 1998 a survey was conducted to examine the presence of *E. multilocularis* in Flanders (northern Belgium). Hereby Vervaeke analysed 147 foxes from various provinces in Flanders and revealed 3 positive foxes infested with the tapeworm (2%) (Vervaeke *et al.*, 1998).

This poster presents an overview of the research on *E. multilocularis*, conducted in Belgium between 1992 and1998, and discusses the geographical distribution of this tapeworm and its evolution in Belgium.

Gait characteristics of level- and vertical running in *Eublepharis macularius*

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Specialisations for climbing most likely put constraints on the locomotor apparatus of animals. Theoretically, this should be reflected in a specialised limb movement pattern. It is well known that most geckoes are specialist climbers. However, some species are never observed climbing, and are strictly ground dwelling. If induced to climb, these level-runners should adjust their limb movements to the substrate they are running on in order to move efficiently. To shed a light on how the locomotor substrate affects the kinematics of limb movements, the primitive ground-dwelling gecko *Eublepharis macularius* was selected. This species was videotaped (in both lateral and dorsal view) by means of a high-speed video system (500fps) while running horizontally and vertically. Next, the gait characteristics (stride- and step length, frequency and duty factor) were determined, and compared over a range of running speeds. *Eublepharis* increases its speed by increasing the frequency in both situations. Only during level-running the duty factor decreases slightly. The other parameters (step length and the stride length) remain constant within the range of speeds considered. In contrast to horizontal running, climbing *Eublepharis* keep their feet in contact with the substrate as long as possible (higher duty factor), and move their limbs, with respect to the substrate, over as short a distance as possible (smaller stride length). Still, the distance travelled by the centre of mass while the foot is on the ground is similar during climbing and running (comparable step length).

Research on *Anguillicola crassus*, a parasitic nematode of the European eel, *Anguilla anguilla*, L.

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Anguicolla crassus is a dracunculoid nematode parasitic in the swim bladder of the European eel (*Anguilla anguilla* L.). Since its introduction in Belgium in 1985, it has rapidly spread through the drainage basins and caused high infection levels. Ten years later questions arose about the latest distribution, infection levels and the evolution of the host-parasite interaction. A sampling of selected river basins in Antwerp, Vlaams Brabant, Limburg, East-Flanders and West-Flanders was carried out to compare the results with those of a survey by the K.U.Leuven in 1986-1987. Although in 1986-'87 non-infected sampling sites still existed, all of them seemed infected in 1997. The reasons for this considerable expansion could be attributed to the successful colonising capacities of *A. crassus*. We may conclude that the overall prevalence increased, but the mean intensity seemed to level off. This observation and the lack of infection-induced thickening of the swim bladder wall, could indicate an evolution to a host-parasite equilibrium.

One of the many features that are responsible for the expansion of this parasite is the high survival capacity of the free living stage (L2). Experiments on the survival of L2 of *A. crassus* have been carried out in function of the hardness of water. Rather than the amount of calcium, the level of disturbance and high water temperatures (similar to those in natural conditions) seemed to influence the survival of the L2. Half of the larvae could survive up to 21 days in water with a range of 33 mg/l up to 433 mg/l calcium. Since the amount of calcium in the Flemish rivers varies within this range, we assume that the dispersion of the parasite is probably not affected by the local calcium concentrations.

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