ZOOLOGY 2014

ZOOLOGY 2014

21st Benelux Congress of Zoology

Liege, Belgium

12 &13 December 2014

Organised by the

Royal Belgian Zoological Society (RBZS)

http://rbzs.myspecies.info

Royal Dutch Zoological Society (RDZS)

http://kndv.science.ru.nl

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Edited by Gilles LEPOINT, Loïc MICHEL, Joseph SCHNITZLER and Nicolas STURARO

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Special thanks to…

Extra information at the end of the book

WELCOME

Mister Chairmans of the Belgium and Dutch societies of zoology, Dear colleagues, Dear students

As dean of the faculty of sciences of the University of Liège, this is a great pleasure for me to welcome your participation at this two thousand fourtheen edition of the meeting of the Benelux congress of zoology.

You are indeed welcome within this prestigious Institute, named after Edouard Van Beneden who was the first to describe the meiosis and whose statue you passed when you entered the building entrance, just next to this of Théodore Schwan, the father of the cellular theory.

This meeting is certainly a very good occasion for gathering people interested in animal diversity and more generally in biodiversity, if I refer to the topics of the meeting that overview most fields of zoological approaches, from genetic to environment.

You are at the rendez-vous and about 300 of you answered positively to the invitation of the organizers. This is already a success and I would like to congratulate the organizing committee.

This meeting is also mainly an opportunity for young scientists, probably the first one, to present the results of their master thesis as a scientific communication, in an international conference.

Indeed, in a close future, some of them will travel the world to communicate their research. Some will become renowned scientists, but all of them will always remind their first public presentation and the first contacts they established during this Benelux Congress of Zoology.

I wish you an excellent stay, both scientifically and socially. This Institute is housing a Museum of Zoology that reflects the evolution of species but also the Aquarium Marcel Dubuisson. In fact I hope you will feel in your element, or as we say in French « as a fish in water » during your stay.

Prof. Dr. Pascal Poncin

Dean of the Sciences Faculty

University of Liège

WELCOME

The Royal Zoological Society of Belgium and the University of Liège are happy to welcome you to the 21st Benelux Congress of Zoology, which will be held at the Institute of Zoology, in the historic centre of Liège.

Since more than 150 years, these two institutions have a long scientific tradition devoted to the promotion of zoology and to the publication of research in zoology.

The Royal Zoological Society of Belgium connects zoology researchers throughout Belgium and abroad, providing a network for both, junior and senior members, who benefit through contacts and collaboration. This society also publishes the Belgian Journal of Zoology, which is distributed in various institutions in more than 50 countries in the world. This journal gives the opportunity to publish high quality studies in a large area of scientific scopes.

Moreover, since 21 years, the Royal Belgian and Dutch Zoological Societies co-organised congresses of zoology and it is a great pleasure that this year, it will be organised in the walls of the University of Liège.

The University of Liège houses 3300 professors and researchers working in more than 470 research units. Concerning Zoology, the University developed this field of research since its creation in 1817. During these last two centuries, thousands of researches were developed in a large number of topics, including marine and terrestrial zoology. One of the most renowned researches is probably the discovery of the meiosis and mitosis processes by Edouard Van Beneden, in 1883. He's also at the origin of the construction of the Institute of Zoology where the congress will take place this year.

But the city of Liège is also highly renowned for its warm and kind hospitality, its historic centre and many good Walloon specialities.

In the name of the Royal Zoological Society of Belgium, it is a great pleasure and honour to welcome you in Liège where we hope that you will appreciate the proposed topics and talks as well as the legendary hospitality of the people from Liège.

Dr. Johan Michaux

President of the Royal Zoological

Society of Belgium

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ORGANISING & SCIENTIFIC COMMITTEE

Organising committee

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Dr. Loïc MICHEL	University of Liège, BE
Dr. Joseph SCHNITZLER	University of Liège, BE
Dr. Nicolas STURARO	University of Liège, BE

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Prof. Dr. Eddy A. VAN DER ZEE	University of Groningen
Annemarieke SPITZEN, M.Sc.	Reptile, Amphibian and Fish Conservation

GENERAL INFORMATION

Scan QR code

Venue

Zoology 2014 will take place at University of Liège's Zoology Institute. The Zoology Institute is nicely located on the banks of the River Meuse, in the center of the town. Practical info on how to reach it can be found at

www.zoology2014.ulg.ac.be/travel-accommodation/how-to-get-there

The Zoology Institute was opened in the end of the 19th century, and over the years, it has been the home of world-renowned zoologists such as Edouard Van Beneden, who discovered meiosis, and Marcel Dubuisson. It provides a perfect setting to accomodate an animal biology conference. Moreover, it also hosts the Liège Aquarium and Zoology Museum. All registered attendees of Zoology 2014 will benefit from free access to the exhibits of the Aquarium and the Museum for the duration of the conference.

Registration desk

Friday, December 12	8.00-12.45
Saturday, December 13	8.00-12.30

Contact information

Zoology2014@ulg.ac.be

Internet wifi

Username: f019838
Password: oVgw5287

Emergencies

General	112
Ambulance	100
Police	101
Internal alert	4444

Regular sessions

Zoology 2014 will welcome oral presentations and posters from researchers from all fields of Animal Sciences (ethology, ecology, oceanology and hydrobiology, taxonomy, morphology, evolutionary biology, paleontology, physiology, cellular and molecular biology, biochemistry, genetics, etc.).

Zoology 2014 is aimed at researchers at all stages of their scientific career, from master students to confirmed, tenured scientists. Students will have the possibility to enter a contest for the award for the best presentation. Young (i.e. non-tenured) postdoctoral researchers will have the opportunity to apply for a double presentation slot, giving them ample time to present their research.

Special sessions: Techniques

The first technical session will be chaired by Prof. Ellen DECAESTECKER (KULeuven). It will focus on techniques currently widely applied in molecular genetics. It will feature talks by Dr. Gipsi LIMA-MENDEZ on metagenomics of microbiomes, by Dr. Jeroen VAN HOUDT (KULeuven) on second & third generation sequencing techniques, and by Prof. Frederick HENDRICKX (UGent) on RAD sequencing.

The second technical session will be chaired by Dr. Gilles LEPOINT (ULg) and sponsored by Elementar. It will be centered on methods to study trophic interactions and food web structure. Topics will include stable isotope ratios of light biogenic elements (C, H, O, N, S ; Dr. Gilles LEPOINT, ULg), use of fatty acids as trophic markers (Dr. Marleen DE TROCH, UGent), examination of gut contents, and compared pros and cons of each method (Dr. Yves CHEREL, CEBC, CNRS & University of La Rochelle).

Social event

Zoology 2014's social event will take place on the evening of **Friday 12 December**, at the same time as the poster session. We hope it will help poster presenters to communicate in more laid-back conditions, and will fuel abundant scientific discussions.

The social event will be centered around degustation of local products. You will have the opportunity to taste apple juice, beers, and wine produced close to Liège. There will be also bread, delicatessen (the renowned "boudins de Liège") and various cheeses made in the area. For dessert, you'll enjoy "bouquettes" (buckwheat pancakes typical of the Liège area) and the world-famous Liège waffles. More detailed info about food and drink manufacturers is available via our "sponsors" page.

Musical animation will be ensured by "Les Anchoises". This female duo (clarinet & barytone sax) is a kind of living juke-box that revisits well-known pop, rock, world music, classical and jazz hits…

Awards

Like in previous Benelux Congresses of Zoology, the Royal Belgian and Dutch Zoological Societies will jointly offer awards for the best student presentations. Two categories of students are considered: master students (or freshly graduated students presenting results from their master thesis) and PhD students.

During the two days of Zoology 2014, a jury of experts will evaluate talks and posters in order to select:

- The best master student oral presentation
- The best master student poster
- The best PhD student oral presentation
- The best PhD student poster

Students willing to take part in the contest for these awards can indicate so during registration. Winners will be announced during the conference closing session, on **Saturday 13 December** 2014. All contestants are expected to attend this closing session, as awards and certificates will be handed over in person.

In addition to those prizes, University of Liège's Applied and Fundamental Fish Research Center (**AFFISH-RC**) will give an award to the best communication presented during Zoology 2014 and dealing with fish biology.

Research at the University of Liège on fish and the aquatic environment date from the middle of the 19th century, creating the public Aquarium at the beginning of the 1960s followed by establishing the STARESO Marine Research Station (Corsica) and Aquaculture Research and Training Center served to launch fundamental and applied research in many domains belonging to ichthyology and marine biology : eco-ethology, morphology, biochemistry, physiology, embryology, eco-toxicology, virology as well as genetic.

In an attempt to increasingly federate their expertise around the internationally recognized Tihange research and educational station and one of the most representative showcases – the Zoology Institute's Aquarium-Museum – fish laboratories have joined in a single official operational structure. Within this perspective, in its December 2012 session, the University of Liège's board of governors ratified the creation of a fundamental and applied research thematic entity on fish, AFFISH-RC.

Website: www.affish.ulg.ac.be

DETAILED PROGRAMME

Friday 12 December 2014

8:00-12:45 Registration desk open (Welcome hall)

9:00- 9:15 Welcome by Prof. Pascal Poncin (Dean of the Sciences Faculty, University of Liège and by Dr. Johan Michaux (President of RBZS, FNRS, University of Liège) (Auditorium)

9:15-10:15 Keynote 1 - Open access publishing (Auditorium)

1. Open Access: Dream or reality for scholars? The ULg experience by Paul Thirion
2. Open access at no or little cost - the example of the Belgian Journal of Zoology by Isa Schön
3. “The European Journal of Taxonomy” by Isabelle Gérard

10:15-10:45 Coffee break

Session 1- PHYSIOLOGY & ECOTOXICOLOGY

Auditorium, ground floor

Chair: Richir Jonathan

10:45-11:15 Ecology of 22 trace elements in *Mytilus galloprovincialis*
Richir Jonathan, Lepoint Gilles, Lejeune Pierre and Gobert Sylvie

11:15-11:30 The effects of metal pollution under field and laboratory conditions on the development and physiology of zebrafish embryos
**Michiels Ellen DG, Hagenaars An, Vergauwen Lucia, Knapen Dries and Bervoets Lieven

11:30-11:45 Impaired swim bladder inflation in zebrafish following acute and chronic MBT exposure
**Stinckens Evelyn, Vergauwen Lucia, Hagenaars An, Schroeder Anthony L., Blust Ronny, Villeneuve Daniel L., Ankley Gerald T. and Knapen Dries

11:45-12:00 POPs in free-ranging pilot whales and sperm whales from the Mediterranean Sea: influence of ecological factors
*Pinzone Marianna, Tasciotti Aurélie, Ody Denis, Lepoint Gilles, Scholl George, Thomé Jean-Pierre, Budzinski Hélène, Tapie Nathalie, Eppe Gauthier and Das Krishna

12:00-12:15 Of sneaky males that grow smaller: otolith studies of the bearded goby from the Benguela upwelling ecosystem
Christiansen Henrik, Ekau Werner, Sveiåg Maria Larsen, Folkvord Arild and Gro Vea Salvanes Anne

12:15-12:30 Stressed out reptiles: a case study of *Anolis carolinensis*
**Borgmans Glenn and Raoul Van Damme

12:30-12:45 The extraembryonic serosa protects the insect egg against dehydration and infection
**Jacobs Chris GC and van der Zee Maurijn

* MSc award competitor; ** PhD award competitor

Session 2- PHYLOGEOGRAPHY & BIODIVERSITY

Charles Jeuniaux room, 1st floor

Chair: Havermans Charlotte

10:45-11:15 Phylogeography of Southern Ocean amphipods shows evidence for circumpolar, eurybathic, bipolar and (pseudo)cryptic species
Havermans Charlotte

11:15-11:30 Species and speciation in *Tropheus*: an endemic cichlid radiation from Lake Tanganyika
Van Steenberge Maarten and Snoeks Jos

11:30-11:45 Taxonomic problems in the ichthyofauna of the north-eastern tributaries of the Congo basin: some case studies
**Decru Eva, Vreven Emmanuel and Snoeks Jos

11:45-12:00 Linking relatedness and past environment to current phenotype
**Thuillier Virginie and Schtickzelle Nicolas

12:00-12:15 Connectivity of the Skunk Clown Fish using a combination of mitochondrial and nuclear genetic markers
**Huyghe Filip and Kochzius Marc

12:15-12:30 Inferring allele networks using the parsimony criterion for phylogeographic studies
*Branders Vincent and Mardulyn Patrick

12:30-12:45 Artificial hard substrata favouring non-indigenous species in the Southern North Sea
Kerckhof Francis, De Mesel Ilse, Rumes Bob and Degraer Steven

Session 3- EVOLUTION 1 & ECOLOGY 1

Practical work room, 1st floor

Chair: Lebigre Christophe

10:45-11:15 Age-specific effect on sexual traits and sexual selection

Lebigre Christophe, Kervinen Matti and Soulsbury Carl

11:15-11:30 Can natal habitat learning drive assortative mating by spatial sorting?

**De Wolf Katrien, Van Belleghem M. Steven and Hendrickx Frederik

11:30-11:45 Colonization of a new habitat by copepods: An *in situ* experiment

**Mascart Thibaud, Lepoint Gilles, Biondo Renzo, Remy François, Agusto Laura and De Troch Marleen

11:45-12:00 Trophic linkages of deep-sea fishes across a depth gradient assessed by stable isotope analyses

**Vieira Rui Pedro, ChungMing-Tsung, Johnston Graham, O'Hea Brendan, NeatFrancis and Trueman Clive

12:00-12:15 Symbiosis between the coral gall crab *Hapalocarcinus marsupialis* (Decapoda: Cryptochiridae) and the stony coral *Seriatopora hystrix* (Hexacorallia: Scleractinia) within the Great Reef of Toliara, Madagascar

*Terrana Lucas, Caulier Guillaume, Lepoint Gilles, Todinanahary Gildas, Eeckhaut Igor

12:15-12:30 Seasonal variation of carbon fluxes induced by dominant hard and soft corals in a northern Red Sea coral reef

**van Hoytema Nanne, Bednarz Vanessa, Cardini Ulisse, Rix Laura, Naumann Malik S, Al-Horani Fuad and Wild Christian

12:30-12:45 Mediterranean coastal fish are more diversified and abundant in *Cystoseira* forests than in structurally less complex subtidal rocky habitats: finding the drivers behind this pattern

Thiriet Pierre, Cheminée Adrien, Garnier Thibault, Lepoint Gilles, Guidetti Paolo, Di Franco Antonio, Mangialajo Luisa and Francour Patrice

12:45-14:00 Lunch (not provided)

14:00-15:00 Key note 2 - Ecological interactions

"Stable isotopes document the food and feeding ecology of marine predators from the Southern Ocean" by Yves CHEREL

15:00-15:30 Coffee break (Welcome hall)

Session 4- ECOLOGY 2

Auditorium, ground floor

Chair: Herrel Anthony

15:30-16:00 You are what you eat. Analyses of morphology, physiology, and microbial diversity after a recent dietary switch in a lizard

Herrel Anthony, Vigliotti Chloé, Taverne Maxime, Fabre Anne-Claire, Boistel Renaud, Cornette Raphael, Habib Michel, Tadić Zoran, Wehrle Bec, German Donovan, Lopez Philippe and Bapteste Eric

16:00-16:15 Between the jaws of the leptocephalus larva: biomechanically approaching a rarely observed organism

**Bouilliart Mathias, Tomkiewicz Jonna, Lauesen Peter, Okamura Akihiro and Adriaens Dominique

16:15-16:30 Seasonal sampling and mixing model use to delineate seagrass phytodetritus macrofauna trophic ecology: baseline variation or actual diet change?

**Remy François, Mascart Thibaud, Dauby Patrick, Gobert Sylvie and Lepoint Gilles

16:30-16:45 When foraging requirements go beyond foraging habitats: what does Next Generation Sequencing tell us about it?

**Arrizabalaga-Escudero Aitor, Garcia Juan Luis, Alberdi Antton, Garin Inazio, Aihartza Joxerra, Goiti Urtzi

16:45-17:00 Flexibility of the movement patterns of two rheophilic cyprinids according to river characteristics

***Benitez Jean-Philippe* and Ovidio Michaël**

17:00-17:30 The influence of urbanization on non-marine ostracod diversity

Quinzin Maud C., Patel Tasnim, Higuti Janet, Schön Isa and Martens Koen

17:30-17:45 Elemental changes along an urbanization gradient and its impact on *Daphnia*-parasite interactions

**Reyserhove Lien

17:45-18:00 Urban heat island effect and temperature-related developmental plasticity: do cities shape butterflies differently?

**Kaiser Aurélien, Merckx Thomas and Van Dyck Hans

Session 5- EVOLUTION 2

Charles Jeuniaux room, 1st floor

Chair: Flot Jean-François

15:30-16:00 Turning garbage into gold: heterozygosity as the key to species delimitation

Flot Jean-François

16:00-16:15 Origin of androgenesis in the freshwater clams, *Corbicula* spp

**Etoundi Emilie, Virgo Julie, Heude-Berthelin Clothilde and Van Doninck Karine

16:15-16:30 Cophylogeny of marine mammals and digeneans of the family Brachycladiidae Odhner, 1905: incongruent phylogenies

**Fraija-Fernández Natalia, Raga Juan Antonio, Aznar Francisco Javier and Fernández Mercedes

16:30-16:45 New tricks for old dogs: Ancient pheromone blend as an alternative for copulation in advanced salamanders

**Maex Margo, Van Bocxlaer Ines, Treer Dag, Vandebergh Wim, Janssenswillen Sunita, Stegen Gwij, Philippe Kok, Willaert Bert, Matthijs Severine, Martens Erik, Mortier Anneleen, de Greve Henri, Proost Paul and Bossuyt Franky

16:45-17:00 Parent-offspring co-adaptation within families in a wild bird population

Korsten Peter and Komdeur Jan

17:00-17:15 Gateway to genetic exchange? DNA double-strand breaks in the bdelloid rotifer *Adineta vaga* submitted to desiccation

**Hespeels Boris, Li Xiang, Knapen Manon, Hanot-Mambres Delphine, Heuskin Anne-Catherine, Pineux Florent, LucasStéphane, Flot Jean François, Koszul Romain and Van Doninck Karine

17:15-17:30 Connectivity of coral reefs and mangroves: differences between the Coral Triangle and Western Indian Ocean

Kochzius

17:30-18:00 Reliability of phylogenomic inference: vertebrates as a case study

Baurain Denis, Roure Béatrice, Brinkmann Henner, Delsuc Frédéric and Philippe Hervé

Session 6- MORPHOLOGY

Practical work room, 1st floor

Chair: Van Wassenbergh Sam

15:30-16:00 Suction power output and the inertial cost of rotating the neurocranium to generate suction in fish

Van Wassenbergh Sam, HighamTimothy E. and Day Steven W.

16:00-16:15 Numerical simulation of hydrodynamic constraints associated with different underwater prey capture strategies in the Dice snake, *Natrix tessellate*

**Segall M., Herrel A., Arfaoui A. and Polidori G.

16:15-16:30 The cerato-mandibular ligament: an innovation for sound production and feeding in damselfishes (Pomacentridae)

**Olivier Damien, Frédérich Bruno, Spanopoulos-Zarco Milton, Balart F. Eduardo and Parmentier Eric

16:30-16:45 The mechanism of sound production in *Haemulon flavolineatum* (Haemulidae): an example of exaptation

Bertucci Frédéric, Ruppé Laëtitia, Van Wassenbergh Sam, Compère Philippe and Parmentier Eric

16:45-17:00 Kinematics and kinetics of locomotion in Przewalski's horse (*Equus f. przewalski*) and Grévy's zebra (*E. grevyi*)

*Claes Raf, MacLaren Jamie and Nauwelaerts Sandra

17:00-17:15 Comparative morphology of cephalic cartilage and statocysts of Mediterranean cephalopods using magnetic resonance imaging (MRI)

*Gillet Amandine, Solé Marta, Jauniaux Thierry and André Michel

17:15-17:30 Searching the onset of head shape bimodality in European eels (*Anguilla anguilla)*

**De Meyer Jens, Ide Céline, Belpaire Claude, Goemans Geert and Adriaens Dominique

17:30-17:45 Does bite force provide a competitive advantage in shrews? The case of the greater white-toothed shrew

Cornette Raphaël, Tresset Anne, Houssin Céline, Pascal Michel and Herrel Anthony

17:45-18:00 Discrimination of haploid and diploid males of bumblebees based on wing shape

**Gérard Maxence, De Meulemeester Thibaut, Debat Vincent and Michez Denis

18:00-22:00 Social event and poster session evening

Saturday, 13 December 2014

8:00-12:30	Registration desk open (Welcome hall)
9:00-10:00	Keynote 3 - Evolution
	Eight evolutionary myths: The closing of the Darwinian mind?" by Simon CONWAY-MORRIS (Auditorium)
10:00-10:30	Kets award presentation
	The evolution of a male dimorphism in a dwarf spider: unravelling the genomic basis and the importance of female choice by Emily VELTJEN
10:30-11:00	*Coffee break*
11:00-12:30	Technical session 1 - molecular genetics (Practical work room, 1st floor) - Chair: Prof. Ellen DECAESTECKER - Dr. Gipsi LIMA-MENDEZ on metagenomics of microbiomes, Dr. Jeroen VAN HOUDT (KULeuven) on second & third generation sequencing techniques, and Prof. Frederick HENDRICKX (UGent) on RAD sequencing.
11:00-12:30	Technical session 1 - trophic interactions and food web structure (Charles Jeuniaux Room, first 1st floor) - Chair: Dr. Gilles LEPOINT - Dr Gilles LEPOINT on stable isotope ratios of light biogenic elements), Dr. Marleen DE TROCH on the use of fatty acids as trophic, Dr. Yves CHEREL on markers examination of gut contents, and compared pros and cons of each method.
12:30-13:30	*Lunch (not provided)*

Session 7- CONSERVATION BIOLOGY

Auditorium, ground floor

Chair: Mouton Alice

13:30-14:00 Phylogenetic and morphometrics assessment of the evolutionary history of the hazel dormouse: *Muscardinus avellanarius*

Mouton Alice, Mortelliti Alessio, Grill Andrea, Sara Maurizio, Kryštufek Boris, Juškaitis Rimvydas, Latinne Alice, Amori Giovanni, Randi Ettore, Büchner Sven, Schulz Bjorn, Ehlers Sina,Lang Johannes,Adamik Peter,Verbeylen Goedele, Dorenbosch Martijn, Trout Roger, Elmeros Morten, Aloise Gaetano, Mazzoti Stefano, Matur Ferat, Poitevin Françoise, Borkenhagen Peter, Renaud Sabrina, Michaux Johan

14:00-14:15 Wildlife conservation practitioners' skills, between official goals and real practices

Denayer Dorothée, Mougenot Catherine, Arpin Isabelle and Collard Damien

14:15-14:30 Genetic evidence for introgression between domestic pigs and wild boars (*Sus scrofa*) in Belgium and Luxembourg - a comparative approach with multiple marker systems

Frantz Alain C., Zachos Frank E., Kirschning Julia, Cellina Sandra, Bertouille Sabine, Mamuris Zissis, Koutsogiannouli Evagelia A., Burke Terry

14:30-14:45 Population genetics of the European otter in Western France: which contribution for its conservation?

Pigneur Lise-Marie, Caublot Gaëlle, Fournier-Chambrillon Christine, Fournier Pascal, Girralda-Carrera Gloria, Marc Daniel, Simonnet Franck, Sourp Eric, Steinmetz Julien, Urra-Maya Fermin and Michaux Johan

14:45-15:00 What genome sequences tell us about demographic history and selection in pigs

**Bosse Mirte, Megens Hendrik-Jan, Madsen Ole and Groenen Martien

15:00-15:15 New technologies in conservation: monitoring African wildlife with Unmanned Aerial Systems

**Linchant Julie, Semeki Jean, Lejeune Philippe and Vermeulen Cédric

15:15-15:30 Management and eradication of the North American beaver *Castor canadensis* in Western Europe

Schley Laurent, Dalbeck Lutz, Denné Rasmund, Manet Benoît, Schwoerer Marie-Laure, Venske Stefanie and Herr Jan

Session 8- EVOLUTION 3 - BEHAVIOUR

Charles Jeuniaux room, 1st floor

Chair: Raeymaekers Joost

13:30-14:00 Does ecological complexity enhance or constrain the evolution of Darwin's finches?

Raeymaekers Joost A.M., De León Luis F., Chaves Jaime A., Sharpe Diana M. T., Huber Sarah, Herrel Anthony, Vanhooydonck Bieke, Koop Jennifer A.H., Knutie Sarah A., Le Bohec Celine, Clayton Dale H., Grant B. Rosemary, Grant Peter R., Podos Jeff and Hendry Andrew P.

14:00-14:15 The impact of an alien fish on alternative newt phenotypes: invader personality matters in a feeding context

**Winandy Laurane and Denoël Mathieu

14:15-14:30 Comparison of the behavioral patterns of a symbiotic and a predatory crab chemically detecting diseased Holothuroids

**Caulier Guillaume, Flammang Patrick, Gerbaux Pascal and Eeckhaut Igor

14:30-14:45 The evolution of reproductive decisions in a social environment

**Fokkema Rienk W., Ubels R. and Tinbergen Joost M.

14:45-15:00 Predatory behavior in *Podarcis muralis* (Lacertidae, Squamata): a model species for determining Linear Optical Trajectory?

**Maillard Aurélie, PlacideMarie-Ange, Ortiz Katia, Malvot Florian and Bels Vincent

15:00-15:15 Tool making and use by captive bonobos: functional & behavioral strategies

**Bardo Ameline, Borel Antony and Pouydebat Emmanuelle

15:15-15:30 Eco-behavioral adjustments of Balinese commensal macaques (*Macaca fascicularis*) to anthropogenic influences

**Brotcorne Fany, Fuentes Agustin, Wandia I Nengah, Beudels-Jamar Roseline and Huynen Marie-Claude

Session 9- ECOLOGY 3

Practical work room, 1st floor

Chair: Vanderplanck Maryse

13:30-14:00 *Aconitum* and *Bombus* interactions: is floral rewards chemistry driving pollen-mixing behaviour in generalist bumblebees?
Vanderplanck Maryse, Glauser Gaétan, Michez Denis and Praz Christophe

14:00-14:15 *Tuta absoluta* (Lepidoptera: Gelechiidae) ability to localize and develop on wild and cultivated solanaceous plant species
**Bawin Thomas, Dujeu David, Fagan Maud, De Backer Lara, Caparros Megido Rudy, Francis Frédéric, Verheggen François

14:15-14:30 Exploiting tritrophic interactions to control the tomato leafminer *Tuta absoluta* Meyrick [Lepidoptera: Gelechiidae]
**De Backer Lara, Caparros Megido Rudy, Fauconnier Marie-Laure, Brosteaux Yves, Francis Frédéric and Verheggen François J.

14:30-14:45 Unraveling the ecology of the dune aphid *Schizaphis rufula* (Hemiptera: Aphidoidea): ecological preferences and parasitoids (Hymenoptera)
*Van Moorleghem Charlotte and de la Peña Eduardo

14:45-15:00 Arboreal ant mosaics meltdown along an elevation gradient in Papua New Guinea
Leponce Maurice and Klimes Petr

15:00-15:15 Belowground chemical ecology: the case of wireworms
**Barsics Fanny, Delory Benjamin M., Delaplace Pierre, Fauconnier Marie-Laure, Haubruge Éric, Francis Frédéric, Verheggen François J.

15:15-15:30 Short effects of tillage practices and crop residue exportation on earthworm communities and soil physico-chemical properties in silt loam arable soil (Belgium)
**Lemtiri Aboulkacem, Colinet Gilles, Alabi Taofic Bodson, Bernard, Cluzeau Daniel, Olivier Claire, Brostaux Yves, Pierreux Jérome, Haubruge Eric, Francis Frédéric

15:30-16:00 Coffee break

16:00-17:00 Key note 4 - Conservation Biology - Species concepts, taxonomic inflation and conservation by Frank ZACHOS

17:00-17:15 Awards announced by Prof. Jean-Christophe PLUMIER and congress closure

KEYNOTE LECTURES

Ecological interactions keynote

Stable isotopes document the food and feeding ecology of marine predators from the Southern Ocean

Cherel Yves

The stable isotope method has increasingly been used in ecology over the last 15 years. Since the Southern Ocean is marked by latitudinal and inshore/offshore isotopic gradients (isoscapes), the method allowed depicting foraging strategies and resource partitioning of its top marine predators at various spatio-temporal scales and at the individual, sexual, specific and intra-guild levels. This keynote aims at giving how δ13C and δ15N values of both metabolically active (*e.g.* blood) and inactive (*e.g.* feathers, whiskers) tissues shed new light on the feeding ecology of various species of Antarctic and subantarctic seabirds and pinnipeds.

Yves is Senior Researcher at the CNRS. He first studied the fasting adaptations of penguins by wintering at the Crozet Islands (1982) and during his subsequent PhD (1985). He then shifted from physiology to ecology, and since 1993 he works on trophic interactions and feeding strategies of seabirds and marine mammals from the French Antarctic Territories. He specialized in the direct method of prey determination and in the use of stable isotopes. He published more than 200 scientific articles and is member of the editorial board of the international journals Marine Ecology Progress Series, Marine Biology and Antarctic Science.

Animal evolution keynote

Eight evolutionary myths: The closing of the Darwinian mind?

Conway Morris Simon

Evolution is true and Darwin got it right, but that doesn't mean that aren't areas of received wisdom that are long over-due for re-examination, or if you prefer a really good kicking. Mass extinctions? Of course they happen, but do they radically re-direct the course of evolution? Hardly; paradoxically mass extinctions are creative agencies accelerating the inevitable. Evolution is a random process without either direction or predictability? Forget it; evolutionary convergence shows the number of available solutions is severely restricted. Extra-solar planets by the billion and intelligences springing all over the Milky Way? Unfortunately Fermi was correct; there aren't any extraterrestrials which might be just as well given our propensity for violence. And then the big one: consciousness. Watch our materialist colleagues run in ever-diminishing circles…

Simon is a professor of evolutionary biology in the University of Cambridge and is best known for his work on the Burgess Shale (summarized in The Crucible of Creation) and evolutionary convergence (reviewed in Life's Solution; as well as our website Map of Life), while his next book The Runes of Evolution is in press. He was elected to the Royal Society in 1990, and has won various medals, etc. He is also active in outreach, including developing a new website on evolution as well as frequent television and radio appearances. When undisturbed he can be found with a glass of wine (or something stronger) closer to hand, reading something by the Inklings.

Open access publishing keynote

Open Access: Dream or reality for scholars? The ULg experience

Thirion Paul

Since the « serial price crisis », no institution in the world has been able anymore to provide to scholars with the scientific literature they need. Although it was the first reason why the scientific community developed Open Access initiatives, it's absolutely not the only one. Nowadays, the awareness has become so large that many research players have put OA on the agenda (NIH, WHO, H2020, Wellcome Trust, FRS-FNRS…). The two main existing complementary ways will be described (Green and Gold) and Fools' Gold will be denounced (unfair gold, hybrid journals, predatory journals). The University of Liege is one of the world leaders in OA with Green and Gold initiatives. What benefits can scholars expect from OA as authors and as readers on the basis of that experience?

Paul works in university libraries since 1985. He is currently Head librarian of University of Liège and since 2010, chairman of the "Bibliothèque interuniversitaire de la Communauté française de Belgique" (BICfB), the consortia of the Belgian French speaking universities for collections sharing and electronic content licensing. His main concerns are Information literacy and Open Access. He is responsible for several Open Access initiatives at the University of Liege as PoPuPS, a portal for publication of scientific serials in Open Access and ORBi, the institutional repository of University of Liège.

Open access at no or little cost – the example of the Belgian Journal of Zoology

Schön Isa

The Belgian Journal of Zoology exists for more than 150 years and publishes original papers, reviews and notes in Zoology focusing on “Biodiversity and adaptations”. All published contributions of the BJZ are open-access.

Isa lives near Ghent in Belgium and is a permanent scientific staff member of the Royal Belgian Institute of Natural Sciences, Operational Directorate “Natural Environment”. She has a Ph.D. from the Philipps-University Marburg and studies the phylogeny, molecular ecology, genomics and evolution of Ostracoda (Crustacea) and other aquatic invertebrates. She is also Editor-in-Chief of the Belgian Journal of Zoology, author of more than 160 scientific publications, founder and board member of BeWiSe (Belgian Women in Science) and coordinator for polar research at the RBINS.

The European Journal of Taxonomy

Gérard Isabelle

The European Journal of Taxonomy is a peer-reviewed international journal in descriptive taxonomy, covering the eukaryotic world. Its content is fully electronic and Open Access. It is published and funded by a consortium of European natural history institutions.

Isabelle has been the head of the Publications Service at the Royal Museum for Central Africa (Tervuren) since 2005. She is a member of the active core of scientific publishers from European public institutions in the natural sciences, as well as of the founding consortium of the full open access European Journal of Taxonomy (2011). She is a consultant for the Bibliometrics working group of the Royal Academy for Overseas Sciences (Brussels), and is also involved in the ‘Open access’, ‘Dissemination of scientific publications’, and ‘Institutional repository’ working groups of the Belgian Federal Science Policy Office.

Conservation biology keynote

Species concepts, taxonomic inflation and conservation

Zachos Frank

It is probably fair to say that every biologist has a certain notion of what a species is. Nonetheless, this question is the most vexed in the whole of biology. Apart from theoretical issues related to what a species is (or is not), there are a number of practical corollaries of species delineation, species lumping and species splitting. Conservation biology is one of the disciplines for which the designation and rejection of species status are of paramount importance, a fact that has increasingly become clear in the wake of a paradigmatic shift from the biological to the phylogenetic species concept(s). This keynote aims at giving an introduction on recent developments in species concepts and their (often negative) impacts on conservation issues.

Frank studied biology (with a major in zoology) and philosophy in Kiel and Jena, Germany. In 2005 he got his PhD from Kiel University with a dissertation on genetic and morphological variability and fluctuating asymmetry in roe deer. He then worked as a postdoc researcher at Kiel University where he got his *Habilitation* for zoology and evolutionary biology in 2009. Since 2011 he has been head of the Mammal Collection at the Natural History Museum in Vienna, Austria, and since 2007 he has been the chief editor of the journal *Mammalian Biology*. He is an evolutionary zoologist working mainly on mammals (and birds), focusing on population genetics, biogeography and conservation. He also has a keen interest in theoretical issues of evolutionary biology and systematics/phylogenetics, particularly in species concepts and their bearing on taxonomy and conservation.

KETS AWARD LECTURE

The Royal Zoological Society of Antwerp and the Royal Belgian Zoological Society annually award a scientific distinction for the best Belgian master thesis in Zoology. The Jacque Kets award laureate for 2014 is miss Emily VELTJEN (Ugent). She will have the opportunity to present her work as an invited speaker at Zoology 2014.

The evolution of a male dimorphism in a dwarf spider: unravelling the genomic basis and the importance of female choice

Veltjen Emily

Male dimorphisms are a form of discrete intrasexual variation which has intrigued, and still intrigues many researches. The coexistence of the morphs is often associated with an evolutionary paradox: even though there is an inferior morph, it is apparently able to coexist with high quality males in the population. This has drawn the research focus towards alternative reproductive male tactics (ART's) and male-male competition, but other interesting evolutionary information linked to male dimorphisms is often neglected: the evolution of the genetic mechanisms giving rise to the discrete male variation and the role of intersexual interactions.

Emily Veltjen has just finished her master of science in biology at the Ghent University this year. Her main interest is evolution in all its forms, but sexual selection and conservation of the current biodiversity has drawn her attention the most. Her bachelor thesis was focused on the biological species concept of marine nematodes, while her master thesis revolves around male dimorphisms in dwarf spiders. Recently, she started a PhD on the biodiversity and conservation of Magnolia trees in the Caribbean.

LECTURE ABSTRACTS

When foraging requirements go beyond foraging habitats: what does Next Generation Sequencing tell us about it?

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Bat-prey interactions are usually described as static images limited to a given space and time. However, these interactions may change seasonally and ontogenetically. Ontogenetic habitat switches are common in holometabolous insects, the main prey of most European bat species. The source habitats of larval stages could considerably vary from the sink habitats of imaginal stages. Consequently, the availability of prey for predators may not only depend on the suitability of habitats where they and adult insects forage, but also in the source habitats needed by insect larvae to develop the first ontogenetic stages.

We evaluated the link between the source habitats of the moths consumed by the moth specialist *Rhinolophus euryale* and those used by this bat to forage to assess to what extent do they match. We analysed the diet composition of 19 adult *R. euryale* within each pre-breeding, breeding and post-breeding periods using DNA barcoding and Next Generation Sequencing technologies. Then, we checked the ontogenetic habitat switch of prey larvae by searching for larval feeding guilds in the literature.

From pre-breeding to post-breeding periods, there was a decrease in the number of bats preying on woody-plant specialist moths from hedgerows and broadleaved woodlands (broadleaved specialist: 84.2%; 63.2%; 31.6%, shrub specialist: 52.6%; 42.1%; 5.3%, respectively), whereas the importance of herbaceous specialist moths originated in meadows and pastures was relevant and remained constant through all the seasons (94.7%; 89.5%; 100%, respectively).

These results show that a considerable proportion of moths consumed by *R. euryale* depend in their first ontogenetic stages on habitats other than hedgerows or forest edges, the main foraging habitat of *R. euryale*, highlighting the importance of a diverse heterogeneous landscape playing as prey source for the Nearly Threatened *R. euryale*. We suggest that prey source habitats should be taken into account when proposing conservation guidelines for bats.

Tool making and use by captive bonobos: functional & behavioral strategies

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Primates have highly developed capacities for gripping and manipulating that differ between species. In this context, the human hand is considered as unique based on its functional characteristics. However, the real dynamic manual abilities of primates remain poorly known.

The aim of the present study was to quantify the behavioral strategies (tool selectivity and modification) and functional strategies (manual postures and in-hand movements) used by 8 captive adult bonobos (*Pan paniscus*) during two tool use tasks: food extraction and a new, more complex task consisting of recovering food in a wooden maze placed outside the cage.

We found that 1) bonobos were able to plan, chose and modify their tools according to the task; 2) that each individual presented his own manipulation techniques with more variability for the maze task than extractive food tasks; 3) more in-hand movements for the maze task than extractive food task; 4) a difference between males and females with a greater variability in manual postures for males for both tasks, and more in-hand movements for females. Bonobos had individual specificities that could reflect the specialization of their manipulation strategies, especially for the more complex task. They were able of in-hand movements similar to humans and chimpanzees. The observed sex effect could reflect an effect of the hierarchy with females taking more their time to perform a task.

These preliminary results show the necessity to pursue the quantification of object manipulation in different species for new tasks and with new methods to better understand the manual specificities of each species.

Belowground chemical ecology: the case of wireworms

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Plants interact with their environment using semiochemicals, chemical organic molecules that may act intra-specifically, allowing plant-plant communication, or interspecifically, e.g. allowing the attraction of pollinators. That plants produce airborne volatile organic chemicals that attract insect herbivores is well documented. Here, we demonstrate the ability of the belowground pests *Agriotes sordidus* Illiger (Coleoptera, Elateridae) to be guided towards their host using odorant cues released in the rhizosphere of barley (*Hordeum distichon* L.). Our work consisted in: 1) developing a bioassay suitable to observe orientation of wireworms exposed to blends of root-emitted volatile organic compounds (VOC), 2) profiling these VOC blends, and 3) testing the effect of identified compounds on the foraging behaviour of *Agriotes* larvae.

Wireworms tested individually were attracted towards roots, either healthy after 7 and 38 days of growth, roots infected with a phytopathogenic fungus (*Cochliobolus sativus*), or chopped roots. The VOC blends were analysed by GC-MS (Gas Chromatography – Mass Spectrometry) using two sampling methods: Solid Phase Micro Extraction (SPME) on fresh roots, and Dynamic Headspace Sampling (DHS) on ground roots. Altogether, 42 VOC were identified in various growing conditions. We selected 2-pentylfuran (abundant in SPME samples), and hexanal, (*E*)-hex-2-enal, (*E*)-non-2-enal, and (2*E*,6*Z*)-nona-2,6-dienal (highlighted with DHS), to perform olfactometric assays. 2-pentylfuran was attractant, and an experimental blend of the four aldehydes was distinctively attractant or repellent according to tested concentrations.

Wireworms perceive and use other cues than carbon dioxide, previously considered as the only important cue for them. We are now able to test signature blends of different plant species or other soil organisms, in their diverse physiological stages. Our method improves research against wireworms, as it unveils mechanisms underpinning their foraging behaviour. This, and further data it will generate, could be implementable in agro-ecological strategies in agricultural zones regularly threatened by these pests.

Reliability of phylogenomic inference: vertebrates as a case study

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Phylogenetic inference, hence classification, has long been plagued by stochastic errors due to the limited amount of available information (e.g., morphological characters or single-gene alignments). The use of genome scale data has the promise to largely overcome this major limitation. However, data and systematic errors may drastically affect phylogenomics and produce highly supported, but erroneous results. Data errors are due to culture or library contaminations, sequencing errors or incorrect orthology assessment. They are much more frequent in phylogenomics than in traditional molecular phylogenetics because many of the extensive quality checks that were carried out manually have not yet been replaced by adequate automated software. Systematic errors are due to the failure of the reconstruction method to fully account for the properties of the data. They are naturally expected to gain in importance in phylogenomics owing to the large size of the datasets. As a result of these two kinds of errors, incongruences remain widespread in phylogenomics (e.g., see the controversy about the position of Ctenophora). Here, we will use the case of vertebrates to propose methods aimed at reducing data and systematic errors in genome-scale phylogenetic inference.

Tuta absoluta (Lepidoptera: Gelechiidae) ability to localize and develop on wild and cultivated solanaceous plant species

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The tomato leafminer, *Tuta absoluta* (Lepidoptera: Gelechiidae), is a widespread invasive species damaging economically important cultivated solanaceous crop plants, including tomatoes and potatoes. Little is known about the ability of this microlepidoptera to encounter and develop on alternative wild and agricultural plant species. These plants could provide refuges and have to be identified for more efficient integrated management strategies.

In the present study, we assessed the ability of *T. absoluta* to develop on wild (*Solanum nigrum, Atropa belladonna, Datura stramonium*) and cultivated (*Solanum tuberosum*) solanaceous plant species under laboratory conditions. Fitness tests were performed in Petri dishes by isolating single individuals with excised leaf from one of the host plants.

We found that *Solanum* species allowed higher larval survivability and shorter development time (from egg to adult emergency) compared to the other plants. Two choice behavioral assays performed in flying tunnels (*S. tuberosum* versus another plant) revealed that adult distribution and female oviposition did not differ between *Solanum* species, which were preferred to the other tested plants. These results appeared to be consistent with survival rates and development times. Because larval survivability depends on the female's oviposition choice, the hypothesis that host plant choice is influenced by plant volatile organic compounds has to be tested.

It can be concluded that *Solanum* species remain the more suitable hosts for *T. absoluta* development among the tested plants. Other plant species could be opportunistically colonized with little incidence but care should be taken in these results as genetic variability in insects and plants, as well as plant physiological state, might have an impact on the pest survivabilty.

Flexibility of the movement patterns of two rheophilic cyprinids according to river characteristics

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In fragmented rivers, fish-passes are installed to increase the longitudinal continuity and improve fish movements between functional habitats. Continuous and multiannual monitoring of such devices allows to evaluate their effectiveness (biodiversity, biomass) but it can be also a scientific tool to better understand the fish mobility in rivers thanks to multispecific quantitative data's.

As fish are supposed to adapt their behaviour in relation with their habitats, we test if the movement characteristics (biometry, periodicity or environmental determinants) of two rheophilic cyprinids, the barbel (*Barbus barbus*) and the chub (*Squalius cephalus*) are flexible and adaptive depending on the river typology (flow, T°, anthropization, altitude).

We used the capture data of three modern multispecies fish-passes that were monitored continuously during 3 consecutive years (2010 to 2012) in three different rivers: the Meuse (altitude: 52m ; average annual discharge: 400 $m^3.s^{-1}$), the Ourthe (70m ; 67.4 $m^3.s^{-1}$), a Meuse tributary and the Amblève (190m ; 19.3$m^3.s^{-1}$), an Ourthe tributary.

We observed different functional movements at different life stages (spawning migration, refuge or juvenile dispersion) for both species with specific periodicity and influence of environmental factors between each location. The spawning migration in spring of mature barbel was observed earlier (Q_{50}: 120^{th} day of the year) and to lower temperature (Q_{50}: 14.5°C) in the lower rivers (Meuse and Ourthe) relative to the upper portion (Amblève) (Q_{50}:140^{th} day of the year and 18°C). Moreover, we observed only in river Meuse, a second annual peak of capture in early fall. In contrast, the spawning migration of mature chub took place at the same temperature (Q_{50}: 16°C) but at different times between the three different locations (Meuse>Ourthe>Amblève).

This study demonstrates that individuals of the same species are able to develop behavioural tactics allowing to optimize their space and time use depending on their environment.

The mechanism of sound production in *Haemulon flavolineatum* (Haemulidae): an example of exaptation

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Numerous fishes produce sounds during aggression, courtship or in distress situation by means of a large diversity of mechanisms. Members of the family Haemulidae are commonly called “grunts” due to their ability to produce grating sounds when they are hand held. Their sound production would involve the pharyngeal jaws apparatus but the mechanism is not described.

After the characterization of acoustic signals in the French grunt *Haemulon flavolineatum*, the present study investigates their sound production mechanism by means of high-speed X-ray videos and scanning electron microscopy of the pharyngeal jaw apparatus.

Vocalizations consisted of a series of stridulatory sounds lasting *ca* 47 ms with a mean period of 155 ms and a dominant frequency of *ca* 700 Hz. High-speed X-ray videos revealed that sounds result from the rubbing of teeth located on pharyngeal jaws. Moreover, traces of erosion found on the teeth of the fourth branchial arch suggest they are probably also involved in sound production. This mechanism, involving the upper and lower pharyngeal jaws, appears to be similar to the food processing motor pattern which highlights calling may be an exaptation of the food processing mechanism.

Stressed out reptiles: a case study of *Anolis carolinensis*

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Stress is known to affect the endocrinology, physiology and behaviour of a wide variety of animals. These responses may confound the results of scientific experiments or observations on captive study animals. Numerous studies have investigated stress and how to avoid it in model species such as small mammals (rats, mice, rabbits), birds and even fish. Although many reptilian and amphibian species are used as model species in various branches of biology, little is known on how they react to the stress induced by housing conditions or experimental treatments. One of the reasons for this neglect could be that it is difficult to assess stress levels in reptiles and amphibians in an objective manner.

In this study, we evaluated several methods of assessing stress in green anoles (*Anolis carolinensis*) and investigate how captive conditions influence these levels. Stress levels were gauged by a number of behavioural and physiological measurements. Individual behaviour was scored via direct observations and time budgets were calculated. Physiological measurements included assessments of faecal corticosterone level, condition indexes, reflectance of the skin using photospectrometry and neutrophil/lymphocyte ratio in the blood.

We examined changes in response to three potential stressors: manipulation frequency, level of environmental enrichment and cage size. We hypothesize that a higher manipulation frequency, a lower level of enrichment and a smaller cage size will all lead to increased stress levels and concordant changes in behavioural and physiological indices.

What genome sequences tell us about demographic history and selection in pigs

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Pigs originated around 5 million years ago in South-East Asia, and spread over the entire Eurasian continent from there. Because of its wide geographical range and because European and Asian wild boars diverged ~1.2 million years ago, the Eurasian wild boar is an excellent model species to study the effects of demography on genomic variation.

Using the latest genomic tools, we show that past glaciations had a strong effect on the effective population size and diversification in many wild boar populations worldwide. We also detect signs of recent inbreeding and demonstrate how genomics-based measures of inbreeding can outperform classic pedigree-based breeding programs in maintaining variation in a population. Pig domestication occurred independently in Europe and Asia about 10.000 years ago, leading to genetically and phenotypically highly distinct domesticated clades. It is well documented that Asian pigs have been imported into Europe in the early nineteenth century and were crossed with European pigs to improve the performance of local breeds.

By re-sequencing 70 pigs and wild boars, we demonstrate the genome-wide nature of these introgression and selection patterns in domesticated European pigs. Our results reveal selection on Asian haplotypes in the genome of European commercial pigs and significant effects of the Asian variants on multiple traits of commercial interest. The identified Asian introgressed haplotypes are associated with regions harboring genes involved in meat quality, development and fertility. On top of that, we show that nucleotide diversity in the genome of European domesticated pigs is increased when Asian haplotypes are introduced, supporting the fundamental genetics theory behind outcrossing.

These findings demonstrate that a single genome contains information on the demographic history of a population, from ancient bottlenecks till recent inbreeding, hybridization and selection.

Between the jaws of the leptocephalus larva: biomechanically approaching a rarely observed organism

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Being part of the Elopomorph group of fishes, Anguillidae species have a leptocephalus larval stage. Unfortunately, due to (mostly) unknown deep-water marine birthplaces, a catadromous lifestyle, and a transparent body morphology, these *Anguilla* larvae are rarely encountered in nature. Therefore, information regarding the early development of these larvae, including the exogenous feeding strategy and feeding performance, is rather scarce.

To get some insight into these early ontogenetic changes and their influence on the functionality of the developing feeding apparatus, an ontogenetic series is put together from two artificially bred Anguillids. Throughout this series, graphical three-dimensional reconstructions (based on histological sections) of the musculoskeletal system of European (*Anguilla anguilla*) and Japanese eel (*Anguilla japonica*) larvae provide detailed descriptions of the changing feeding apparatus. Subsequently, theoretical bite forces are calculated for every reconstructed phase, using 3D data of joints, levers, and muscles derived from these reconstructions.

Although the expected increase in bite force is observed with progressing age of the larvae, the obtained forces remain rather small (several µN). As a result, leptocephalus larvae are hypothesized to be anatomically constrained to feed only on soft and/or small food particles, which is in line with the current observations of small and/or gelatinous prey items (Hydrozoa, Thaliacea, Ctenophora, Polycystenia) in the guts of these larvae.

Inferring allele networks using the parsimony criterion for phylogeographic studies

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Allele network graphs are often used in the scientific literature to display DNA sequence variation at the intraspecific level. Such a graph can be built from a set of aligned sequences using a computer program like Network (Median-Joining algorithm) or TCS (statistical parsimony). An alternative strategy is to infer all most parsimonious (MP) trees from the alignment, and combine those, as a second step, into a network. However, each approach has the ability to find MP connections that the other does not. It was recently suggested that the MP inference approach could be improved by including all MP reconstructions of ancestral states for each inferred MP tree, before combining those into a single graph.

Here, we explore this possibility by investigating whether, and to what extent, doing so allows the finding of additional MP connections and increases the complexity of the final network.

Eco-behavioral adjustments of Balinese commensal macaques (*Macaca fascicularis*) to anthropogenic influences

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In Bali, Indonesia, humans and long-tailed macaques (*Macaca fascicularis*) already have a long history of sympatry and coexistence. The forest-agricultural matrix landscape of the island and the numerous religious temples provide habitat patches for macaques, sometimes living in very close proximity to humans. However, little is known about the ways anthropic factors impact the behavioral ecology of this species.

Between 2009 and 2012, using an ethological protocol including three macaque populations made of ten social groups, we documented variations in the activity, dietary and ranging patterns by systematically investigating the anthropogenic influences (i.e. human food provisioning degree and habitat anthropization level) on those variations. Furthermore, we questioned the biological significance of the responses in terms of costs and benefits.

We found a remarkable eco-behavioral diversity between study populations. Human food was a central component of their ecology, macaques preferentially exploiting this resource when available while still consuming a significant proportion of natural resources. The inclination for human food was optimal for macaques as it maximized their energy intake while minimizing the time spent for food acquisition. Therefore, they adjusted their activity budget according to the proportions of human food consumed. The free time available from relaxed foraging constraints was invested into resting and social activities. Macaques were versatile in their movements making them successful in exploiting natural forest areas as well as highly anthropogenic habitats. However, increased social tension was a cost that stemmed from high-density situations induced by excessive anthropization of their habitat.

Overall, this study contributed to our understanding of how commensal primates cope with human-induced environmental pressure.

Comparison of the behavioral patterns of a symbiotic and a predatory crab chemically detecting diseased Holothuroids

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Skin Ulceration Disease (SUD) is a bacterial infection that induces serious lesions on the body wall of cultivated holothuroids (sea cucumbers). It is highly contagious and can cause the death of 95% of reared individuals. Healthy sea cucumbers *Bohadschia vitiensis* usually host the common symbiotic Harlequin crab *Lissocarcinus orbicularis* while *Thalamita crenata* is a predatory crab that usually feeds on holothuroids. Using host choices experiments in a Davenport olfactometer, we recently demonstrated that the symbiotic crabs are attracted by triterpenoid saponins that enable them to specifically recognize their hosts by means of chemical sensing.

In this study, we observed that individuals of *B. vitiensis* presenting SUD were no longer attractive to *L. orbicularis*. Moreover, when given the choice between two sea cucumbers, Harlequin crabs were able to distinguish healthy individuals from diseased ones, with a significant preference for sea cucumbers that were not infected by skin ulceration disease. On the contrary, the predatory crabs *Thalamita crenata*, which were not attracted by holothuroid saponins, did recognize sick preys and preferred them to healthy ones.

Using MALDI mass spectrometer, we measured similar concentrations of saponins in the extracts realized from the water conditioned by a healthy or SUD *B. vitiensis*. Both predatory and symbiotic crabs were not repelled by the bacteria cultured from the wounds of a diseased holothuroid. Genetic analyses revealed that these bacteria belong to the genus *Vibrio*.

We finally highlighted that an artificially skin ulcerated individual had a repellent effect on symbionts but an attractive effect on predators. Both symbionts and predators are then able to discriminate if their hosts/preys are ill or not by sniffing surrounding water.

Of sneaky males that grow smaller: otolith studies of the bearded goby from the Benguela upwelling ecosystem

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Despite being less common than in mammals, parental care is known in many teleosts, where usually males guard eggs or offspring. In order to maximize their reproductive output, members of one species can adopt different alternative reproductive tactics (ART). Since behaviours such as territory defence, nest building, and guarding and fanning of eggs are energetically costly, they may be more likely to be expressed by large individuals and consequently the adoption of ARTs has been linked to growth. In fish sagittal otoliths (earbones) are commonly used for age readings. This study employed otolith analyses to examine growth differences between males of the bearded goby (*Sufflogobius bibarbatus*), that express different ARTs. The bearded goby is an ecologically important species endemic to the northern Benguela upwelling ecosystem, where it has replaced sardines at least partly as prey for top predators in the light of a regime shift over the last decades. Sneaker and territorial males were identified using gonado-somatic indices, growth has been modelled with von Bertalanffy functions, and various otolith shape characteristics have been investigated using linear models and principal component analyses (PCA). While territorial males grew larger (141.4 ± 13.55 mm; modelled L_∞ ± SE), sneakers stayed considerably smaller (92.2 ± 7.78 mm). Analyses of otolith increments, however, revealed that the sneakers possibly grow faster during early life history. The relations between otolith measurements and fish length validated age readings, yet no differentiation of the groups by PCA was possible. The latter could be explained by similar environmental conditions encountered by both sneakers and territorials. Next to its remarkable physiological adaptations, the apparent flexibility in investment in growth and reproduction may contribute to the success of the bearded goby in the Benguela ecosystem.

Kinematics and kinetics of locomotion in Przewalski's horse (*Equus f. przewalski*) and Grévy's zebra (*E. grevyi*)

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In order to test hypotheses on the evolution of the extremities of equids, we started comparative research among the extant species of *Equus* (horses, zebras and asses), *Tapirus* and Rhinocerotidae.

This thesis was a pilot study initiating this large scale investigation. The aim of this study was to compare the locomotor characteristics of the trot in two species of equids: the Przewalski's horse (*Equus f. przewalski*) and the Grévy's zebra (*E. grevyi*).

Kinematic and kinetic characteristics were determined and compared using force plates and high-speed camera recordings, which were converted into time normalised diagrams.

Even though both species naturally occur in environments with a similar substrate, Grévy's zebras live in savannah/shrubland. A faster response to concealed predators might cause differences in locomotor performance. Results support the second hypothesis, as significant differences in angle profiles and timing of the fore-aft forces were found between the two species. The scapula of Grévy's zebra adopts a more vertical position during the total stride. Also, the inclination angle of the short pastern+coffin bone in Grévy's zebras was greater at the beginning and middle of the stance phase than corresponding angles for the Przewalski's horses. The least variation between the species was found for the swing phase. Variation in kinematics and kinetics between Przewalski's horse and Grévy's zebra suggest locomotor differences between caballine and non-caballine equids.

Evidence from this study will be invaluable when reconstructing the kinematics and kinetics of fossil equids.

Does bite force provide a competitive advantage in shrews? The case of the greater white-toothed shrew

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Competition for resources has long been considered a major driver of evolution by natural selection. Thus, the ability to gain access to resources not available to other individuals and species should be under strong selection.

Here, we focus on the potential role of biting in a shrew (*Crocidura russula*) as this trait may confer two advantages: 1) a broadening of the dietary niche, and 2) providing direct superiority in interspecific interactions.

The model chosen is the greater white-toothed shrew which is considered invasive in northern Europe and which is known to displace native species of shrew in this area. Moreover, its distribution appears to constrain the distributional ranges of other species of shrew in the Maghreb. We use geometric morphometrics and a simple biomechanical model to describe shape variation and to evaluate the mechanical potential of the mandible of ten species of white-toothed shrews with a special emphasis on *C. russula* and *C. suaveolens*. We found that *C. russula* possesses the highest mechanical potential linked with an intermediate level of shape variability.

Our results suggest that the higher mechanical potential may explain the observed pattern of colonisation of the Atlantic islands by *C. russula* at the expense of *C. suaveolens*. Finally, our results suggest that the ability to bite hard may be under strong selection in shrews.

Exploiting tritrophic interactions to control the tomato leafminer *Tuta absoluta* Meyrick (Lepidoptera: Gelechiidae)

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Tuta absoluta (Lepidoptera, Gelechiidae) is one of the most damaging pests of tomato crops in South America, and in Europe since its accidental introduction. Current control methods are not efficient to keep the tomato leafminer under the economic threshold, leading to the development of new strategies based on natural enemies. In this research, we investigated the tomato plant volatiles induced under infestation by *T. absoluta* (Herbivore induced plant volatiles - HIPVs) potential to attract *Macrolophus pygmaeus* (Heteroptera, Miridae), a natural enemy of *T. absoluta.*

First, we evaluated the ability of *M. pygmaeus* to discriminate *T. absoluta*-infested plants versus non–infested tomato plants and, subsequently, we have collected volatile organic chemicals released by tomato plants under different level of infestation and identified the associated HIPVs. Behavioral assays were conducted in double choice olfactometer and flying tunnel, to investigate the ability of *M. pygmaeus* to discriminate healthy and *T. absoluta*-infested plants with two infestation levels.

In both systems, *M. pygmaeus* was significantly attracted toward infested plants. Because distance attraction is likely to be mediated, at least partially, by volatile organic compounds, HIPVs were collected from healthy and infested plants using a dynamic volatile collection system. The volatiles compounds were identified and quantified by gas chromatography. Volatile compound profiles vary with the infestation level: twice as much chemicals were identified under infestation by 20 *T. absoluta* larvae, compared to healthy plants. A total of 35 compounds were identified, with β-phellandrene, 2 carene, β-caryophyllene, α-pinene and α-phellandrene representing 76% to 86% of the total blend. Out of the 35 compounds, 19 significantly increased with the infestation level, mainly belonging to monoterpenes. This is the first evidence of *M. pygmaeus* preference for *T. absoluta*-infested plants.

This study offers a background to further researches investigating the role of isolated volatiles on the attraction of *T. absoluta* predator.

Taxonomic problems in the ichthyofauna of the north-eastern tributaries of the Congo basin: some case studies

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Despite the fact that the Congo is the second largest river basin in the world and harbours one of the most species rich, highly endemic (about 75%) fish faunas, large parts of the Congo basin remain unexplored and/or poorly studied. This study focusses on the poorly known ichthyofauna of the Itimbiri, Aruwimi-Ituri and Lindi-Tshopo, the major north-eastern tributaries of the Congo basin downstream of Kisangani.

To date, fish specimens from five large recent expeditions have been identified, and all available material from the RMCA has been checked when necessary. This has led to a detailed inventory of the area. However, during the identification process, many taxonomic problems were encountered, some of which have been examined in detail.

One of these concerns the problematic *Labeobarbus/Varicorhinus* complex (Cyprinidae) of the Epulu River that includes *Labeobarbus mawambiensis*, *Varicorhinus longidorsalis* and specimens that appear to be hybrids between the two species.

A DNA-barcoding study resulted in a fairly low identification success of the species from the region and indicated the occurrence of possible cryptic species, synonymies and taxonomic problems in higher taxa. Major differences in DNA barcodes and morphology were found between various populations of *Brycinus imberi* pointing towards the presence of a new species *Brycinus sp.* "epuluensis" in the region.

A detailed DNA-barcoding study on '*Barbus'* species from the region and other parts of the Congo revealed an unexpected high number of cryptic species within the genus. Where at first only four taxa were distinguished, the barcoding study resulted in 23 different genetic groups. A thorough morphological examination of the specimens confirmed differences between most of these groups. Extrapolation of these results to the whole Congo basin would mean an enormous increase of species within the genus.

Searching the onset of head shape bimodality in European eels (*Anguilla anguilla)*

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The life cycle of the European eel (*Anguilla anguilla)* remained a mystery until the 20th century, when Schmidt discovered that the Sargasso Sea was its spawning area. However, many aspects of the eel's life cycle remain poorly understood. Among these is the bimodal distribution in head shape, with broad- and narrow headed phenotypes reported in the yellow eel stage. Although this has been linked to dietary preferences of the yellow eels, very little is known about why, how and when this dimorphism arises during their ontogeny.

To find out whether this dimorphism indeed appears in relation to trophic niche segregation, we examined head shape variation at an earlier ontogenetic stage, the glass eel stage, as at this stage, eels are considered to be non-feeding.

Head shape was studied in glass eels captured from the Yser river mouth (N=275), the Leopold Canal (N=112; Belgium) and from the rivers Severn, Trent and Parret (N=153; U.K.) by both taking measurements (head width/head length) and using an outline analysis.

Our results show that there's already considerable variation in broadness and bluntness of the head at the glass eel stage, but no unambiguous support for head shape dimorphism was found. However, as variation in head width/head length ratios in non-feeding glass eels shows a similar range as in feeding yellow eels, head shape in European eel might be at least partially determined through other mechanisms than trophic segregation.

Wildlife conservation practitioners' skills, between official goals and real practices

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Wildlife conservation projects mobilize players with primarily scientific and technical backgrounds. These practitioners, who operate far from laboratories and the academic world, deploy a very diverse range of skills to cope with the challenges of field work. A debate has emerged over the past few years in the scientific literature about "skills for conservation." How should conservation practitioners be prepared for their work? How should they be trained better? And, farther upstream, how should their tasks be redefined to be able to meet the challenges that they actually face in the field more effectively? The notions of skills and competence span several well-identified issues in the social sciences that are not easy to reconcile, although they all participate very concretely in the same reality out in the field.

To fuel this debate, we propose to take an anthropological side trip to study some projects and the skills that are actually deployed by practitioners in their work.

To this end, we interviewed the protagonists of nine projects devoted to the protection of threatened animal species and observed some of them at work. These "first-hand" data were completed by an analysis of documents, some documentaries, and the literature. We then pinpointed four areas of competence and action in which all the players in these individual experiences were engaged. T

his inductive approach to develop generalizations from the specific leads to better knowledge and recognition of the true practices, skills, and competence of these essential players at the interfaces of science, nature, and society.

Can natal habitat learning drive assortative mating by spatial sorting?

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Speciation in the face of gene flow is one of the most debated topics in evolutionary biology. Species with strong dispersal capacities should not only evolve traits that result in a better performance in each habitat, but also a strong preference for their respective habitat. Conversely, gene flow is expected to counteract local adaptation and population divergence by breaking down adaptive combinations of both suits of traits. One mechanism proposes that traits subjected to disruptive selection directly result in differential habitat preference between the diverging populations. This match between phenotype and habitat preference results in spatial sorting and assortative mating between the diverging ecotypes.

Habitat choice and performance experiments were conducted to investigate the evolution of ecotypic divergence in the wing polymorphic salt marsh beetle, *Pogonus chalceus*. This beetle is characterized by extensive divergence in dispersal related traits (wing development, body size) and given the high genetic heritability of these traits, it remains currently unclear how this ecotypic divergence persists under gene flow. We therefore investigated a behavioural trait, i.e. escape behaviour towards inundations.

First, our results indicate that individuals inhabiting seasonally flooded habitats showed higher escape rates upon flooding in contrast to individuals inhabiting tidal habitats. Furthermore, these beetles were capable of entering a hypoxic comatose state to survive short periods of inundation. We argue that these behavioural differences are the consequence of adaptations to the contrasting hydrological regime present in these habitats which leads to spatial sorting. We additionally investigated the effect of natal habitat preference experienced during larval and pupal development and found evidence of transgenerational effects of native environment on the behavioural responses upon inundation.

These results suggest that such natal habitat preference may be the first trigger in local adaptation to prevent gene flow, and subsequently facilitates further adaptive divergence in response to environmental conditions.

Origin of androgenesis in the freshwater clams, *Corbicula* spp

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Androgenesis is the strict paternal inheritance of the nuclear genome, which can be considered as male parthenogenesis. Androgenesis is however rare since it seems to be restricted to only few animal taxa, in which its use is usually rather limited.

The only occurrence of extensive and successful androgenesis has been recorded in the bivalve genus *Corbicula*. *Corbicula* clams are important pest species in American and European freshwater where they have been introduced in the 20's and 80's respectively probably from Asia and Africa. Invasion in the genus is linked to the reproductive mode as, remarkably, only four androgenetic lineages, with highly reduced genetic diversity, have been recorded outside the native range.

Cytological mechanisms of androgenesis in *Corbicula* have been extensively studied and described. Soon after fertilization of an oocyte by androgenetic biflagellate and unreduced sperm, maternal chromosomes are expulsed as to polar bodies. Therefore only the male pronucleus forms and participates into the offspring. Despite this characterization, until now, nothing was known regarding the origin of androgenesis. The good description of androgenesis in *Corbicula* makes nevertheless these clams a relevant model to investigate the evolution of this reproductive mode.

We investigate the evolutionary history of androgenesis in the genus *Corbicula* using cytological approaches combined with molecular markers and determine where and how androgenesis emerge from sexuality in the genus *Corbicula*.

First, androgenesis in *Corbicula* probably originated in the ancient lake Biwa, Japan, from the sexual *C. sandai* or an ancestor. Second, transition from sexuality to androgenesis might be frequent in *Corbicula*. Some sexual individuals indeed produce unreduced spermatozoa similarly to androgenetic individuals, suggesting that a meiosis-defect could be at the origin of androgenesis in *Corbicula.* Given the frequency of unreduced sperm produced by sexuals, the transition to androgenesis should be encoded by a rather simple mutational event.

Turning garbage into gold: heterozygosity as the key to species delimitation

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Although diploidy is the dominant life stage in eukaryotes, biologists commonly turn a blind eye to heterozygosity by discarding loci that display intra-individual heterogeneity, by excluding heterozygotes from their analyses and/or by retaining only one of their allelic sequences. Indeed, the alleles of heterozygotes have long been considered impossible to resolve without cloning since the resulting chromatograms contain double peaks.

However, the forward and reverse chromatograms of length-variant heterozygotes contain different double peaks, and it is actually quite easy to combine the complementary information carried by these two chromatograms and unravel the sequences of the two haplotypes of such individuals using my program Champuru (http://seqphase.mpg.de/champuru/); whereas the haplotypes of non-length-variant heterozygotes can be inferred using my other program SeqPHASE (http://seqphase.mpg.de/seqphase) in conjunction with PHASE. Once all the haplotypes of a collection of individuals have been determined accurately, knowing which alleles co-occur in heterozygotes makes it possible to delineate species boundaries in a very accurate and sensitive fashion using the criterion of mutual allelic exclusivity.

This criterion is best applied graphically by drawing a haplotype tree (haplotree) or a haplotype network (haplonet) then adding connections between alleles found co-occurring in heterozygous individuals, thereby turning the graph into a haplotype web (haploweb).

After introducing the methods and theoretical foundations of this approach, examples of its application to tropical corals, cave amphipods and rotifers will be presented.

The evolution of reproductive decisions in a social environment

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In order to unravel the ultimate causation of reproductive behaviour, quantification of the fitness costs and benefits is essential. Recent experimental work shows that whether or not fitness costs of reproduction are paid is dependent on the social environment. Parental survival costs where only apparent in environments in which competitive pressure was increased. The hypothesis was raised that family size negatively affects parental competitive ability in later life. Depending on the level of local competition this will result in fitness costs for the parent.

We put this hypothesis to the test. During two study years, in a population of nest box breeding great tits (*Parus major*) we manipulated family size, reducing or enlarging families with 2 or 3 nestlings relative to a control group.

Next in the subsequent breeding season we promoted competition among the tits for high quality breeding boxes. We did this by reducing the depth of 80% of the boxes (Great tits have been shown to prefer deep nest boxes). We indeed found that family size negatively affected the chances of parents to obtain a high quality breeding box. This result is important because it proves that optimal clutch size is affected by social mechanisms such as intraspecific competition over resources later in life. Whether or not parents incur a cost of reproduction is thus dependent on the availability and quality of resources as well as the number and the competitive ability of competitors. This implies that the fitness landscape of individual reproductive decisions is shaped by the reproductive strategies of other members of the local population.

Cophylogeny of marine mammals and digeneans of the family Brachycladiidae Odhner, 1905: incongruent phylogenies

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Cophylogenetic studies examine host and parasite phylogenies in order to provide plausible hypotheses about the patterns and processes that have shaped their current associations. Digeneans of the family Brachycladiidae occur worldwide parasitizing hepatic and pancreatic ducts, intestine, lungs and air sinuses of marine mammals. Previous studies have suggested that the origin of the association between brachycladiids and marine mammals occurred by an initial colonization event from digenean of fish. In the case of Brachycladiids, it subsequently diversified among marine mammals. Here, we study the associations between brachycladiids and marine mammals using 9 species, representing 6 out of 10 genera, of the family Brachycladiidae, and 103 mammalian taxa, from which 27 are actually infected by brachycladiids. Host and parasite phylogenies were generated independently through Bayesian methods and tested for evolutionary congruence, using global-fit and event-based methods. ParaFit and PACo were applied to globally test the degree of congruence between host and parasite topologies and to identify the level in which host-parasite associations explained the cophylogenetic structure. The event-based JANE program was used to search for the minimal cost in the phylogenetic topology given a cost regime for different events, i.e. coespeciation, duplication, host switch, loss and lineage sorting. Overall, global-fit methods revealed incongruence between host and parasite phylogenies, indicating that colonization, rather than coespeciation, accounts for most of the associations between brachycladiids and marine mammals. Event-based methods confirmed that duplication and host switches predominantly occurred in the parasite phylogeny. This is the first cophylogenetic study on the association between marine mammals and brachycladiids, which provides information about the evolutionary events that have shaped such relationship.

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Genetic evidence for introgression between domestic pigs and wild boars (*Sus scrofa*) in Belgium and Luxembourg – a comparative approach with multiple marker systems

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Hybridisation between wild species and their domestic relatives can be an important conservation and management problem. Genetic purity of the wild species is desirable *per se* and the phenomenon can have unpredictable evolutionary consequences. Declining European wild boar populations were frequently restocked with farmed wild boars that sometimes had been crossed with domestic pigs.

We used simple PCR-based diagnostic tests to detect the presence of mitochondrial DNA and coat colour alleles of domestic origin in wild boars from Belgium, Luxembourg and western Germany. Microsatellite genotypes were used to test for genetic admixture between the wild boars and domestic pigs.

While almost a third of all Luxembourg wild boars carried Asian mitochondrial DNA haplotypes originating from domestic pigs, microsatellite-based clustering only identified four putatively admixed individuals in Luxembourg. In contrast, clustering identified wild boar x domestic hybrids in most sampling locations in Belgium. We interpret these results as evidence of releases of hybrid captive-reared wild boars. Our results emphasise the need, if working with classical markers, to use different systems to get a more complete understanding of hybridisation between wild and domestic relatives.

Discrimination of haploid and diploid males of bumblebees based on wing shape

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Being efficient pollinators of many flowering plants, bumblebees are an important group for temperate ecosystems services. Over the last decades they experience a strong decline in Europe because of different primary factors such as habitat fragmentation. These primary factors lead to genetic stresses that can reinforce the decline. This is particularly problematic in haplodiploid species, such as bumblebees, where diploids heterozygous at a single locus sex determination (sl-CSD) are females and haploids are males. Inbreeding can therefore lead to diploids homozygous at the sl-CSD which develop into functionally sterile males, which in turn leads to inbred strain having much lower fitness than outbred colonies. This is known as the "diploid male extinction vortex". The monitoring of diploid males in wild population is therefore of primary importance for conservation management. Until now, diploid males cannot be morphologically discriminated from haploid males.

The present study aims to discriminate diploid males from haploid using wing shape and geometric morphometric methods.

Diploid males of *Bombus terrestris* were produced from sister/brother mating in different colonies, and ploidy was checked by flow-cytometry. Our total dataset contains 702 wing pictures of 166 haploid males, 91 diploid males, 83 workers, and 11 queens.

Based on wing shape, diploid males are accurately discriminated from haploid males using between-group PCA and LDA (hit ratio of 98% for males correctly attributed). Wing shapes of the other castes were also diagnostic (e.g. hit ratio of 100% for queens).

Conservation issues and potential applications are discussed. The morphometric identifiers can be turned into an automated or semi-automated identification tools suitable for field or museum studies. Morphology-based analysis will also facilitate future citizen-science bee monitoring schemes, e.g. involving smartphone or tablet-based image analysis.

Comparative morphology of cephalic cartilage and statocysts of Mediterranean cephalopods using magnetic resonance imaging (MRI)

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Organs responsible for equilibrium of cephalopods, the statocysts, possess numerous similarities with the vestibular systems of vertebrates. The statocysts are embedded in the cephalic cartilage protecting the brain. Although statocysts have been largely described, few studies focused on the cephalic cartilage and its morphology.

The aim of this study is to describe the morphology of both statocysts and cartilage, to compare them between different species and to determine which are the parameters influencing their morphology.

For species of *Decapodiformes* (*Sepia officinalis, Sepiola rondeletii, Loligo vulgaris* and *Illex coindetii*) and two species of *Octopodiformes* (*Octopus vulgaris* and *Eledone cirrhosa*) have been studied. Cephalic cartilages from these species have been scanned by magnetic resonance imaging (MRI) and volumes and linear measurements have been taken on the 3 dimension reconstructed models of the cartilages and statocysts.

Results show that *Octopodiformes* possess a globular cartilage which surrounds almost totally the brain. On the other hand *Decapodiformes* posses a cartilage with bigger lateral and anterior foramens and then surrounds a smaller part of the brain. The morphology of the statocysts also varies between the two superorders. The statocysts of *Octopodiformes* are divided into two parts: endolymph and perilymph while those of *Decapodiformes* aren't.

These morphological variations between the two groups might be related to their ecology. *Eledone cirrhosa* and *Octopus vulgaris* are typically benthic species and then might receive shocks more often than *Decapodiformes* that possess a more pelagic lifestyle. *Octopodiformes* might then need a better protection for their brain than *Decapodiformes*.

Phylogeography of Southern Ocean amphipods shows evidence for circumpolar, eurybathic, bipolar and (pseudo) cryptic species

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Using an integrative approach based on genes and morphology, Southern Ocean amphipod species' distributions were assessed in view of the paradigms emitted for Antarctic invertebrates: circumpolarity and eurybathy.

In several lysianassoid amphipod species of the genera *Abyssorchomene* and *Pseudorchomene*, a genetic homogeneity was found among specimens from remote sampling sites in the Southern Ocean, indicating a widespread or even a truly circum-Antarctic or eurybathic distribution. In other species, genetically divergent lineages and (pseudo)cryptic taxa were revealed, of which some were restricted to certain geographic and bathymetric zones whilst others were characterized by a widespread distribution. The giant deep-sea lysianassoid *Eurythenes gryllus* appeared to be composed of several overlooked species, one of which being characterized by a bipolar distribution. This represents the first molecular evidence for a bipolar distribution in a macro-benthic organism. Moreover, within the Southern Ocean, three distinct species of *Eurythenes gryllus sensu lato* coexisted, of which two seemed restricted to abyssal waters whilst the bipolar species was found only in the bathyal zone. In this case, a clear genetic break occurred around 3000 m, rejecting the previously assumed eurybathy of *Eurythenes gryllus*. Finally, phylogeographic and population genetic analyses were conducted on the pelagic hyperiid amphipod *Themisto gaudichaudii*, a key species of the Southern Ocean pelagic realm. Three distinct, sympatric lineages were detected in the Atlantic sector of the Southern Ocean, possibly associated with distinct feeding behaviours and morphological divergences.

Hence, species diversity is still largely underestimated for amphipods and undescribed species or additional species-level clades are likely to be uncovered with an increasing sampling effort. Since some regions of the Southern Ocean are more threatened by climate change than elsewhere in the world, studies investigating spatial genetic structure are of particular importance since they may serve as a basis for monitoring and conservational efforts.

You are what you eat. Analyses of morphology, physiology, and microbial diversity after a recent dietary switch in a lizard

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Although evolution is commonly considered a slow process, recent evidence has shown that organisms can show dramatic and measurable phenotypic responses after introductions to novel environments in relatively short time spans.

We have previously shown how lizards (*Podarcis sicula*) have rapidly evolved differences in head morphology, bite strength, and digestive tract structure after experimental introduction onto a small island in the Adriatic Sea. Despite the short time scale (36 years) since this introduction, the introduced lizards became omnivores and evolved cecal valves in the hindgut, a structure rarely observed in lizards. These changes in morphology and performance parallel those typically documented among species and even families of lizards in both the type and extent of their specialization.

Here, we present novel data on 1) the morphology of the cranium and its muscles using µCT scanning and 3D geometric morphometric approaches, 2) the digestive physiology of the two populations, and 3) the diversity of the microbiomes in the hindgut using metagenomic sequencing approaches.

Gateway to genetic exchange? DNA double-strand breaks in the bdelloid rotifer *Adineta vaga* submitted to desiccation

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The bdelloid rotifer lineage *Adineta vaga* inhabits temporary habitats subjected to frequent episodes of drought. The recently published draft sequence of the genome of *A. vaga* revealed a peculiar genomic structure incompatible with meiosis, suggesting that DNA damage induced by desiccation may have reshaped the genomic structure of these organisms. However, the causative link between DNA damage and desiccation had never been proven to date in rotifers.

Using pulsed-field gel electrophoresis to monitor genomic integrity, we followed the occurrence of DSBs in dried bdelloids that accumulate with the time spent in dehydrated state increases and are gradually repaired upon rehydration.

Even when the genome was shattered into small DNA fragments by proton radiation, *A. vaga* individuals were able to efficiently recover from desiccation and repair a large amount of their DSBs. Interestingly, when investigating the influence of UV-A and UV-B exposure on the genomic integrity of desiccated bdelloids we observed that these natural radiations also caused important DNA DSBs, suggesting that the genome is not protected during the desiccated stage but that the repair mechanisms are extremely efficient in these intriguing organisms. DNA double-strand breaks in desiccated *A. vaga* may represent gateways to genetic exchange, as suggested by the unprecedented amount of horizontally transferred genes identified in this organism. In one particularly illustrative example, we will present our discovery of putative trehalose-6-phosphate synthase (tps) genes in the *Adineta* genome and explain why these genes were not detected in previous researches.

Connectivity of the Skunk Clown Fish using a combination of mitochondrial and nuclear genetic markers

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Like many coral reef associated organisms, the Skunk Clown Fish (*Amphiprion akallopisos*) is unable to migrate from one coral reef to another during its adult life. Dispersal between reefs is limited to a two week long pelagic larval stage. Because tracking larvae in the ocean is extremely difficult, population genetics is a useful technique to evaluate gene flow and connectivity between populations of coral reef associated organisms. Insight into connectivity in coral reef inhabitants is vital for a correct spacing of Marine Protected Areas, needed for conservation. *A. akallopisos* has a disjunct distribution, occurring in the Western Indian Ocean (WIO) and the Eastern Indian Ocean (EIO) but not in the Central Indian Ocean (CIO).

We use a combination of mitochondrial (Control Region) and nuclear (microsatellite) genetic markers to measure gene flow between populations in the Indian Ocean.

The first results, based on mitochondrial DNA (337 base pair long sequence, 263 samples from 17 different sites in Indonesia, Kenya, Tanzania, and Madagascar) indicate strong population structure (ϕ_{st}=0.28) and significant differentiation (ϕ_{ct}=0.61) between the EIO and the WIO populations. Both haplotype and nucleotide diversity were one order of magnitude higher in the EIO compared to the WIO. Analysis of historical connectivity will be completed with the use of 16 microsatellite markers, including 77 extra, recently obtained samples from 4 different sites in Mozambique. Furthermore, we plan to measure also ecological connectivity, using the same set of microsatellite markers. Complete populations of *A. akallopisos* will be sampled on carefully selected reefs on the coast of Zanzibar (Tanzania), as well as new recruits during several months. The origin of new recruits, either as descendants from the adult population of the same reef or from elsewhere, will then be determined with parentage analysis, providing information of dispersal on ecologically more relevant timescales.

The extraembryonic serosa protects the insect egg against dehydration and infection

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Insects comprise three quarters of all described animal species and their diversification represents an unparalleled episode in the course of evolution. One important aspects of insect evolution is their ability to live in any terrestrial habitat. Their ability to do so is typically attributed to adult traits, whereas little attention has been paid to adaptation of the egg. An evolutionary novelty of insect eggs is the serosa, an extraembryonic membrane that enfolds the embryo and secretes a cuticle.

To experimentally test the protective functions of the serosa, we exploit an exceptional possibility to eliminate this membrane by *zerknüllt1* RNAi in the beetle *Tribolium castaneum*. To assess the protective value of the serosa in desiccation resistance we analyzed hatching rates of eggs under a range of humidities and find dramatically decreasing hatching rates with decreasing humidities for serosa-less eggs, but not for wild-type eggs.

We show that this decreased hatching rate at dry conditions is due to the lack of the serosal cuticle. Furthermore, we show that when we infect eggs with bacteria, they propagate twice as fast in serosa-less eggs when compared to wild-type eggs. Whereas the wild-type *Tribolium* egg is able to upregulate a full complement of immune genes in response to infection, serosa-less eggs are not able to upregulate immune genes. We confirm the expression of both constitutive and induced immune gene expression in the serosa by in situ hybridization. Together these data indicate an important role for the serosa in desiccation resistance and early immunity.

We propose that the origin of this extraembryonic membrane facilitated the spectacular radiation of insects on land.

Urban heat island effect and temperature-related developmental plasticity: do cities shape butterflies differently?

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Urbanization is currently one of the most important human-induced environmental changes. Cities are typically warmer and dryer than natural habitats with remnants of native vegetation being strongly fragmented. Such conditions represent a challenge for many organisms and may lead to plastic responses.

Using a split-brood design, we assessed the impact of urbanization at two spatial scales on larval survival and functional adult morphology of two closely related satyrine butterflies (*Pararge aegeria* and *Lasiommata megera*).

We compared larval survival between rural, semi-urban and urban environments, and we compared the phenotype of resulting adult butterflies. Larval survival was species-specific: mortality was constant over the urbanization gradient in *P. aegeria* whereas larval survival was highest in urban habitats for *L. megera* even though larvae were forced to develop in suboptimal environments. We suggest that the latter species directly benefits from the higher temperature of urban areas and that its thermophily may well represent a pre-adaptation to urban life. We predicted urban butterflies to be paler and to have a more mobile phenotype in response to increased habitat fragmentation. In line with these predictions, *P. aegeria* individuals were paler in urban settings and urban *L. megera* had significantly higher wing loadings.

Our results therefore suggest the existence of phenotypic plasticity in butterfly flight morphology in response to urbanization, but plastic responses in *P. aegeria* individuals were mostly present in males and were stronger in individuals of agricultural origin compared to forest origin. We argue that the higher average temperature and/or temperature variability of urban environments, rather than differences in host plant quality, triggers these plastic responses.

Artificial hard substrata favouring non-indigenous species in the Southern North Sea

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Coastal communities all over the world have witnessed major changes in the past decades, largely as a result of the rapid and ongoing hardening of the shore with artificial structures. This phenomenon is particularly visible along the coasts of the shallow Southern North Sea, already hardened for centuries.

Recently, artificial hard substrata such as those for renewable energy projects or used by the gas and oil industry are introduced to the offshore environment.

The increased activities of vectors for the introduction of non-indigenous species such as shipping, allows a much faster and more intense transport of certain biota. Because of the increased availability of man-made hard substrata, the migrants now find additional and more suitable habitat to settle and to survive in regions beyond their native range. This enhances the range expansion and strengthens the strategic position of both spreading and introduced species.

Wind turbines for example are often built in sandy environments and these artificial hard structures may therefore act as a stepping stones for non-indigenous fouling organisms. The number of non-indigenous species proved to be particularly high in the intertidal zone on wind turbine foundations. For these obligate intertidal hard substrata species, clear water, offshore habitat did not exist in the Southern North Sea until recently.

It has been argued that the newcomers may augment local biodiversity. However, it becomes more and more evident that these non-native species often impose a burden on native biodiversity: they alter local communities and there are many unwanted ecological and economic impacts. Non-indigenous species introduced by human activities are hence of relevance to various EU strategies.

We illustrate the ongoing changes with examples from the Southern North Sea.

Connectivity of coral reefs and mangroves: differences between the Coral Triangle and Western Indian Ocean

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A fundamental question in marine ecology is the connectivity of populations: are they open or closed? Most marine animals of coral reefs are rather sedentary. Adults are strongly site attached and connectivity among populations can only be facilitated by pelagic early life history stages (eggs and/or larvae). In an open population the majority of the offspring will not recruit to the parental population, but will disperse and recruit to other populations. In the contrary, offspring of a closed population will mainly recruit to the parental population, which is also called self-recruitment. Connectivity of populations is a key element for resilience, which is the ability of ecosystems to absorb shocks, resist phase-shifts, and regenerate after disturbances. Therefore, the degree of connectivity among populations is crucial for re-colonization and knowledge about connectivity is important for the management of marine protected areas. Since the open ocean does not show any obvious barriers for dispersal, it was generally assumed that marine populations are open. However, recent studies have shown restricted connectivity in many different coral reef taxa and a substantial amount of self-recruitment in coral reef fish. Examples of different taxa, such as anemonefish, corals and giant clams show a clear congruent pattern of genetic population structure in the Coral Triangle, which can be attributed to Pleistocene sea level fluctuations separating populations, as well as contemporary current patterns. In contrast, the picture in the Western Indian Ocean is less clear, rather showing a weak genetic structure along the East African coast, e.g. in anemonefish, mangrove crab and mangrove whelk. This might be attributed to its geological history, were sea level fluctuations had less impact and did not separate populations, as well as contemporary currents that rather seem to foster connectivity.

Parent-offspring co-adaptation within families in a wild bird population

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Recent quantitative genetics theory hypothesises offspring demand and parental supply to be co-adapted within families. Two main predictions are that (1) the behavioural reaction norms for parental provisioning and offspring solicitation behaviours are correlated, and that (2) cross-fostering of offspring creates mismatches between parental and offspring behaviours, leading to fitness costs to parents and/or offspring. A high-profile lab study on domesticated canaries (*Serinus canaria*) has provided support for these two predictions (Hinde et al. 2010, Science). However, at present it is unclear how general these results are, because rigorous tests of this theory under natural circumstances in outbred and free-living animals are lacking. Therefore, we carried out a large-scale experimental study in a free-living population of blue tits (*Cyanistes caeruleus*) testing for parent-offspring co-adaptation. To test the parent-offspring mismatch prediction, we cross-fostered 2/3 of the broods, while 1/3 of broods were kept as controls (total n = 184; in 2012 and 2013). For part of these broods, we estimated behavioural reaction norms of parents by measuring provisioning rates as a function of short-term (6h) brood size manipulations, which created experimental variation in offspring demand. We also estimated behavioural reaction norms of offspring by measuring begging intensity as a function of experimental variation in food deprivation (up to 2.5h). First analyses of this large and unique dataset show no evidence of negative fitness effects due to cross-fostering. However, we found evidence for sex-specific changes in parental provisioning behavior in response to the cross-fostering. Furthermore, preliminary results indicate sex-specific correlations of behavioural reaction norms between parents and offspring. Therefore, our results partly support the parent-offspring co-adaptation hypothesis, and indicate that cross-fostering per se may influence parent and/or offspring behaviours. This could have important implications for the quantitative genetics field, where cross-fostering is routinely used to separate genetic and environmental effects.

Age-specific effect on sexual traits and sexual selection

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It is well established that age can simultaneously influences key life history traits underpinning individual fitness and multiple morphological and behavioural traits. Therefore, accounting for age is critical to understand the selection pressure acting on specific traits. In species with strong sexual selection this issue has not yet been thoroughly addressed because of the difficulties quantifying accurately male mating success and linking its variation to changes in the expression of multiple sexually selected traits

We used longitudinal data collected in the black grouse (*Tetrao tetrix*), a lekking species with strong sexual selection to determine whether measures of sexual selection are biased because of age effects. The expression of seven morphological and behavioural traits increased with age but that long-lived males had slower increase and delayed maxima in trait values compared to short-lived males. We found evidence of senescence in all traits, but these patterns were weakened by the increased expression of some traits during the last breeding season (terminal investment). Mating success increased substantially with age and reproductive senescence was weak. Males lekking at age 1 had higher age-specific annual mating success than males that began lekking at age ≥2, but their lifespan was shorter meaning that lifetime mating success was independent of the age at which males began lekking.

When age was accounted for, we found that sexual selection in black grouse operated directly on behavioural traits and indirectly on morphological traits as those can be used to allow females to discriminate against active 1 year old males of uncertain “genetic quality”. The strong condition-dependence of behavioural traits in turn ensures that additive genetic variance can be maintained despite consistent directional selection, and multiple information signalled simultaneously by different male traits can promote the maintenance multiple secondary sexual traits.

Short effects of tillage practices and crop residue exportation on earthworm communities and soil physico-chemical properties in silt loam arable soil (Belgium)

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It is generally acknowledge, that different types of soil tillage can modify the density and community structure of earthworms, depending on their feeding and burrowing behaviour. Therefore, it is important to understand how earthworm communities are impacted by tillage practices and exportation of crop residues. In this study, earthworm and soil samples were collected from wheat cultivated fields in Gembloux, Belgium under different agricultural practices: (1) conventional tillage with crop residues incorporated into the soil (CT/IN); (2) conventional tillage with crop residues exported from the field (CT/OUT); (3) reduced tillage with crop residues incorporated into the soil (RT/IN); and (4) reduced tillage with crop residues exported from the field (RT/OUT). The purpose of this study was to research the influence of agricultural practices on on earthworms and their interactions with soil properties.

The results indicated that agricultural practices affected soil properties and earthworm communities. The penetration resistance measured to a depth of 50 cm increased with increasing soil depth in all treatments. Soil compaction was significantly higher in RT compared with CT. For each depth, measures of soil physico-chemical properties showed significant differences among treatments. Significant differences were not detected between residue incorporation depth treatments on earthworm abundance and biomass. However, a significant difference was observed between IN and OUT treatments, suggesting the exportation of wheat residues will limit earthworm abundance and biomass, and will mask the tillage effect. The endogeic species *Apporectodea caliginosa* strongly dominated the earthworm community (64%), whereas epigeic and anecic species remained < 3% and 5% of all earthworms in all agricultural practices. Findings indicate that endogeic and epi-anecic groups appears to be highly affected by tillage practice and the exportation of crop residues. The obtained results were attributable to earthworm activity and wheat residues, suggesting earthworms contributed to nutrient dynamics, particularly at increased soil depths.

Arboreal ant mosaics meltdown along an elevation gradient in Papua New Guinea

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Mosaics of ant territories resulting from the mutual exclusion of dominant arboreal ants from tree crowns are common in tree plantations and in lowland tropical forests. In temperate zones arboreal-nesting ants, especially territorial ones, are much less abundant probably because of unfavourable climatic conditions. Therefore along a tropical mountain one can expect the decay of ant mosaics with increasing elevation.

We mapped the distribution of numerically dominant ant colonies, often spreading on several neighbour trees, in ¼ ha plots distributed between 200 and 2700m asl along Mt Wilhelm, Papua New Guinea. Ants were captured at tuna/honey baits spread along tree trunks from the ground to the top of canopy trees.

In lowland forests (200-700m) *Crematogaster polita* large carton nests were omnipresent and often formed supercolonies. Other major players were *Oecophylla smaragdina* nesting in leaves and *Anonychomyrma* cf *scrutator* nesting in live plant tissues. At mid-elevation (1200-1700m) dominant ants were *Anonychomyrma* spp. and two species found in myrmecophytes (*Monomorium sp. nov. aff. edentatum* and *Philidris* cf. *cordata*). At 2200m ants found in the canopy (e.g. *Ancyridris*, *Pheidole*) were probably living in suspended soil. No ants were observed at 2700m.

In conclusion, with increasing elevation it seems that there is a progressive filtering of the most abundant arboreal ant species. Typical territorial ants, living in carton or leaf nests are eliminated first. At mid-elevation myrmecophytes allow to maintain high ant populations in trees. At high elevation only species nesting in suspended organic matter remain

New technologies in conservation: monitoring African wildlife with Unmanned Aerial Systems

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In the vast protected areas of Africa, traditional wildlife surveys performed by plane or foot are logistically difficult to implement due to the lack of means and appropriate materials. Moreover, the possibilities of encountering poachers in the field pose a serious risk to the monitoring teams.

Over the last decade, civilian UAS (Unmanned Aerial Systems) boomed in natural resource monitoring. One of the biggest challenges of the UAS is to replace traditional wildlife censuses for the application of wildlife conservation. Parameters have to be approached in a different way than before.

We performed test flights in the open savannah of the Garamba National Park during the wet season using the Falcon Unmanned UAS. Both photos (Sony Nex7, 24Mp) and videos, including thermal infrared videos (Tamarisk 640x480), have been used. Flight altitude ranged from 50 to 200m and pictures showed that animals can be effectively detected at 100m. We spotted elephants, hippopotamus and buffaloes as well as other smaller species such as hartebeests, kobs and warthogs. Thermal videos gave medium quality results during the day due to the heat but performed well during the night. The limited range and endurance of the UAS suggest a rethink of the usual census protocols. We therefore tested new flight plans in a rosette shape to take advantage of the higher points in the park, with transects having the length of the maximal range. Twelve transects of 10km can be covered in half a day with pictures covering a 15.6km² area. Human activities could also be detected. Pictures showed areas burned by poachers and the thermal infrared camera allows the detection of fires from a high altitude.

Future developments need to be investigated such as automatic detection to review the huge amount of data collected and statistical methods must be adapted to those challenging situations.

New tricks for old dogs: Ancient pheromone blend as an alternative for copulation in advanced salamanders

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Males of the advanced salamanders (Salamandroidea) attain internal fertilization without a copulatory organ by depositing a spermatophore on the substrate in the environment, which females subsequently take up with their cloaca. The aquatically reproducing modern Eurasian newts (Salamandridae) have taken this to extremes, since most species do not display close physical contact during courtship, but instead largely rely on females following the male track at spermatophore deposition. Although pheromones have been widely assumed to represent an important aspect of male courtship, molecules able to induce the female following behaviour that is the prelude for successful insemination have not been identified yet. Here we show that uncleaved Sodefrin Precursor-like Factor (SPF) protein pheromones are sufficient to elicit such behaviour in female palmate newts (*Lissotriton helveticus*). Combined transcriptomic and proteomic evidence demonstrates that males simultaneously tail-fan multiple ca. 20 kDa glycosylated SPF proteins during courtship. Notably, molecular dating estimates show that the diversification of these proteins already started in the late Palaeozoic, about 300 million years ago. Our study thus not only extends the use of uncleaved SPF proteins outside terrestrially reproducing plethodontid salamanders, but also reveals one of the oldest vertebrate pheromone systems.

Predatory behavior in *Podarcis muralis* (Lacertidae, Squamata): a model species for determining Linear Optical Trajectory?

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Predation behaviors play a major role in the functioning of communities of organisms. Two major behaviors identified are functions of life history traits of predators: the pursuit and interception. By studying *Squamata* models, we have revealed a third type of approach in diurnal terrestrial reptiles: the LOT (Linear Optical Trajectory): During the LOT, the predator takes into account the angle formed by the movement of the prey to the ground and moves himself to keep this constant angle until it reaches the prey, i.e. the predator has a tendency to move so that the angle formed by the prey during movement permits to build a straight line between the eyes of the predator and the body of the prey along its escaping trajectory. The aim of this study was to extract some general rules on this particular type of behavior, using *Lacertidae* with different morphological, phylogenetic and ecological traits. Predatory behavior of *Podarcis muralis* was based on a quantitative study of variables characterizing the sequences of predation (i.e., speed, initial angle of approach), allowing us to determine the use of the LOT, with lateralization of the approach. Three main phases have been identified in the models: detection, approach and adjustment. The hypothesis of using LOT was tested in a completely different lacertid lizard, *Lacerta bilineata,* through a preliminary study of predatory behavior in two populations in France. This work opens perspectives to a comprehensive study of the relationship between phenotypic traits (morphology, physiology, behavior) of these predators and their genotypic traits (intra-population *vs* inter-individual differences).

Colonization of a new habitat by copepods: An *in situ* experiment

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Colonization of new habitats by a biological community is conspicuous and this dynamic process is one of the architectural forces of the biogeographical distribution we know today. Within the meiofauna (<1mm), copepods (Crustacea) have successfully adapted to nearly every ecosystem and heir colonization power of permanent habitats is therefore well-established. However, few studies tackled the colonization of new naturally occurring provisional habitats, which are of ecological interest since they are rich in organic material, structurally complex and devoted of native fauna.

Hence, the present study investigated the copepod colonization of provisional macrophytodetritus (mainly composed of senescent leaves and drift macroalgae) accumulated on bare sand patches inside a Mediterranean *Posidonia oceanica* seagrass meadow. General motive of colonization such as food and shelter are well-defined. However, little is known regarding the mode of the colonization and source pool of the associated colonists.

Here, an *in situ* experiment was deployed in order to understand the mode of copepod's colonization to fauna deprived macrophytodetritus.

The objectives were: (1) assessing the adjacent colonist's source pool (i.e. sediment, water column or *P. oceanica* canopy), (2) investigating the speed of settlement and (3) quantifying the species composition of the colonizing copepods.

In summary: (1) species from every source pool actively colonized the macrophytodetritus through the water column and through the sediment-macrophytodetritus interface. (2) The initial settlement occurred within the first 24 hours. (3) The species composition showed to be different than the source's composition. After 24h, the composition was similar to 45% of the *P. oceanica*, 28% of the water column and 25% of the sediments. After 96h, the composition was similar to 24% of the *P. oceanica*, 13% of the water column and 10% of the sediments, indicating an evolution towards a macrophytodetritus copepod specific community composed of a mixture of the adjacent habitats first colonizers.

The effects of metal pollution under field and laboratory conditions on the development and physiology of zebrafish embryos

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The amount of chemicals which end up in aquatic ecosystems increases annually. Unfortunately, risk assessment of environmental samples is almost solely based on chemical analyses, physicochemical characteristics and the presence of nutrients and (micro-) organisms. This results in a lack of biological information about the effects of complex mixtures in environmental samples on aquatic organisms. The goal of this study is to assess the biological effects of environmental water samples using the zebrafish embryo as an alternative testing model.

Zebrafish embryos were exposed to samples from 5 different sites of 2 Flemish metal contaminated streams: 'Scheppelijke Nete' (SN) and 'Kneutersloop' (K). The SN1 location was upstream and SN2 was downstream from the pollution source (DITCH). K1 and K2 were 2 polluted sites of the Kneutersloop, which is part of a different tributary of the same drainage basin as SN. Dissolved concentrations of 12 metals were measured using ICP-MS. Nine exceeded the surface water standards at one site at least.

Almost all embryos exposed to water from DITCH died within 3 days, and the SN2 embryos showed a decrease in hatching rate and success. Probably due to delayed hatching, the majority of the SN2 embryos had no inflated swim bladder at 5 days. The larvae of SN2 were also significantly smaller than the control (reconstituted freshwater) and SN1 larvae. All larvae except SN1 showed a reduced swimming activity compared to control larvae. We conclude that the pollution sources in both rivers cause adverse effects in aquatic organisms, but less in K than in SN.

To investigate whether the effects are predominantly caused by the metal mixtures or whether confounding factors and/or other pollutants play an important role in toxicity, we are currently simulating and testing the physicochemical composition of the environmental samples using all metals that exceeded the surface water quality standards.

Phylogenetic and morphometrics assessment of the evolutionary history of the hazel dormouse: *Muscardinus avellanarius*

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The hazel dormouse, *Muscardinus avellanarius* is a hibernating rodent, member of the Gliridae family. At the European level, the hazel dormouse is a strictly protected species listed in Annex IV of the "Fauna-Flora -Habitat Directive" (Directive 92/43/EEC) and Annex II of the Bern Convention. Concrete conservation measures must be implemented to maintain long-term viable populations of this species. To develop appropriate tools for conservation, it is essential to understand the origin and the evolution of this species whose ancestor appeared 17 million years ago. To this aim, it is fundamental to analyze the evolutionary history of the species in both a geographic dimension (spatial) and a temporal scale. Both mitochondrial and nuclear markers revealed a complex phylogeographic pattern for the hazel dormouse with the presence of two highly divergent and allopatric genetic lineages, respectively distributed in South-Western and Central-Eastern Europe. The presence of two highly differentiated phylogenetic lineages might question the taxonomic status of the hazel dormouse.

Our work has highlighted the difficulty of delineating species boundaries and stressed the importance of integrating complementary approaches to achieve further taxonomic work. We used a quantitative analysis of intra- specific phenotypic variation as a complementary tool of the molecular approach by studying the upper first molar (UM1) in hazel dormouse populations. The analysis of phenotypic feature appears as a valuable complement to genetic analyses, providing a complementary insight into evolutionary processes, such as differentiation by vicariance or adaptation to different environments. A geographic structure emerges from the morphometric pattern of differentiation, partially corresponding to the expectations based on the genetic results. The knowledge acquired through this study might add a significant piece of the puzzle for the understanding of the evolutionary history of the common dormouse and might have important implications for its conservation.

The cerato-mandibular ligament: an innovation for sound production and feeding in damselfishes (Pomacentridae)

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The success of a taxonomic group can be promoted by a key character that allows the group to interact with its environment in a different way and to potentially occupy new niches. The Pomacentridae possess a synapomorphic trait, the cerato-mandibular (c-md) ligament, which joins the hyoid bar to the inner part of the lower jaw. It has previously been shown that this ligament is a key trait in communication in damselfishes because it enables them to slam the oral jaws shut causing teeth collision and sound production. This specific behavior of mouth closing could, however, also be used for other tasks, such as feeding. Many territorial damselfishes are referred to as farmers, due to their ability to manage algal crops on which they feed.

This study hypothesizes that the c-md ligament provides an advantage for grazing filamentous algae, and should thus be considered a key trait for farming behavior.

The kinematic patterns associated with sound production and biting filamentous algae or attached animal prey are all based on the same mechanism and are associated with a slam of the oral jaws.

We observed that transection of the c-md ligaments makes the fish unable to perform such actions. This study shows that the c-md ligament is a key trait both for sound production and for grazing activities in damselfishes. The buccal jaw slam enables the fish to perform accurate strikes on small filamentous algae. This kind of bite probably plays a major role in farming activity and allows grazing damselfishes to occupy distinct niches, possibly increasing their competitive evolutionary success.

Population genetics of the European otter in Western France: which contribution for its conservation?

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The European otter (*Lutra lutra*) was critically endangered in France during the last century. However, mainly due to its legal protection, the species has recolonized several French regions since more than twenty years. In order to investigate the colonization dynamics of this elusive species, we conducted a study of the genetic diversity and the genetic differentiation of several otter populations from Western France and Navarre, Spain. Using 14 microsatellite markers, we analyzed the data through several statistical approaches, including clustering methods and F-statistics. The first results suggest that the studied populations present a clear genetic structure, with among others an "Iberic population" centered in the Pyrenees; another one in Western Brittany, and finally a large group associating all remaining individuals from Western France. A finer analysis suggest that within this last group, 3 sub-clusters can be recognized: one situated in the Limousin region, another one in the "Massif Central" region and a last one situated in the Atlantic Coast. The assignment of individuals in these clusters suggest inter-basin colonization ways and a mixing between the distinct genetic lineages. These results and their implication for the conservation of the otter will be discussed in the present communication.

POPs in free-ranging pilot whales and sperm whales from the Mediterranean Sea: influence of ecological factors

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The pilot whale *Globicephala melas* and the sperm whale *Physeter macrocephalus* are large toothed whales, which permanently inhabit the Northwestern Mediterranean Sea, where they feed mainly on cephalopods. Here they are subjected to numerous anthropogenic threats such as exposure to high levels of contaminants.

Selected persistent organic pollutants POPs (31PCBs, 15 organochlorine compounds, 9 PBDEs and 17 PCDD/Fs) were analyzed in blubber biopsies of 49 long-finned pilot whales and 61 sperm whales sampled in NWMS from 2006 to 2013. $\delta^{13}C$, $\delta^{15}N$ values and POPs levels were assessed through IR-MS and GC-MS respectively. To assess the toxic potency of the dioxin-like compounds, the TEQ approach was applied.

$\delta^{15}N$ values were 12.2±1.3‰ for sperm whales and 10.5±0.7‰ for pilot whales, positioning sperm whales at higher trophic levels. $\delta^{13}C$ instead was similar and amounted to −17.3±0.4‰ and −17.8±0.3‰ respectively. Pilot whales presented higher concentrations than sperm whales for ΣPCBs (38666±25731ng.g^{-1} lw and 22849±15566ng.g^{-1} lw respectively), ΣPBDEs (712±412ng.g^{-1} lw and 347±173ng.g^{-1} lw respectively) and ΣDDTs (46081±37506ng.g^{-1} lw and 37647±38518ng.g^{-1} lw respectively). Each species was characterized by large inter-individual variations that could probably be more related to sex than trophic level, with males presenting higher contaminant burden than females. The PCA analysis confirmed how p,p'DDT and p,p'DDE were influential in differentiating the two species, as a consequence of their migratory behavior and distribution.

Pollutant concentrations of our species were significantly higher than both their Southern Hemisphere and North Atlantic counterparts, possibly due to the particular Mediterranean geomorphology, which influences pollutants distribution and recycle. Dioxin-like PCBs accounted for over 80% of the total TEQ. This study demonstrated (1) an important exposure to pollutants of Mediterranean toothed-whales, often surpassing the estimated threshold toxicity value of 17000ng.g^{-1} for blubber in marine mammals[1]; and (2) how the final pollutant burden in these animals is strongly influenced by numerous ecological factors.

The influence of urbanization on non-marine ostracod diversity

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The international SPEEDY (SPatial and environmental determinants of Eco-Evolutionary DYnamics: anthropogenic environments as a model) project aims to obtain integrated insights into eco-evolutionary dynamics over strong gradients of anthropogenic disturbance caused by urbanization for a range of terrestrial and freshwater organisms varying in body size, generation time, reproduction mode and dispersal capacity. The core of this program is a collective, field-based research. Here, we report preliminary results on the influence of urbanization on two species of non-marine ostracods, *Cypridopsis vidua* (asexual) and *Cypria ophthalmica*, (sexual) in Belgium.

We statistically test whether the degree of urbanization has affected the presence of these two ostracod species analyzing the data from the 81 ponds sampled in our 2014 field campaign. We also use DNA sequence data from the mitochondrial COI region to investigate whether cryptic species are present in these two ostracod morpho-species and how their appearance/occurence might be correlated with the degree of urbanization.

First results indicate that, at least in *C. vidua*, some cryptic species may exist.

Does ecological complexity enhance or constrain the evolution of Darwin's finches?

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Biological diversity is constantly pulsed by ecological and evolutionary change in predictable and unpredictable ways. Forecasting biological diversity is therefore often impossible. Long-term studies on insular systems have provided some of the best examples of the evolutionary mechanisms underlying biodiversity. It has been hypothesized that small size and spatial isolation of islands reduces ecological complexity to an extent that evolutionary change becomes predominant. This feature has contributed to the iconic status of the Darwin's finches of the Galápagos archipelago for the study of evolution. Darwin's finches illustrate the concepts of natural selection, sexual selection, character displacement, adaptive intraspecific variation, the formation of new biological species, adaptive species radiation, and the reversibility of evolution. However, the contribution of variation in ecological complexity remains largely unexplored in Darwin's finches. In a comparison of ten years of evolution in three communities of Darwin's ground finches (*Geospiza* sp.) on a neighbouring large and small island, we investigated if ecological complexity enhances or constrains phenotypic evolution. We found that the common (parallel) phenotypic response to regional, climate-driven processes is weak, and that phenotypic change is mostly driven by local factors. Selection could be detected at each location, and was either directional or disruptive. However, only on the small island climate fluctuations resulted in demographic and subsequent phenotypic change. These relationships were weaker or absent on the large island. We conclude that ecological complexity on the large island constrains phenotypic evolution, either through relaxation of selection or by generating conditions that allow for disruptive selection.

Seasonal sampling and mixing model use to delineate seagrass phytodetritus macrofauna trophic ecology: baseline variation or actual diet change?

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In Mediterranean exported seagrass macrophytodetritus accumulations, a diverse (more than 130 species) and abundant (up to 4900 id.m^{-2}) macrofauna assemblage is found alongside meiofauna, microalgae, fungi and bacteria. Macrophytodetritus are mainly composed of poorly digestible yet highly colonized material: the dead leaves of the very productive (300 to 2000 g dry wt m^{-2} yr^{-1}) endemic seagrass *Posidonia oceanica*. A key role may be played by macrofauna, and more particularly by litter vagile macroinvertebrates (invertebrates > 500µm), in the degradation, enrichment and carbon transfer from *P. oceanica* to coastal food webs. Indeed, results of gut content observations of the most abundant species show that even if only a few of these species ingest a large proportion of *P.oceanica* dead leaves fragments, most of the others ingest a small but non-negligible part, suggesting a potential role of the whole community in the mechanical fragmentation of the dead leaves.

Mediterranean exported macrophytodetritus accumulations are very dynamic habitats with very variable food availability, quality, and composition. Such an inconstant habitat may result in drastic modifications of the invertebrate community but also of its trophic structure and ecology.

To test this hypothesis of influence of pulsed availability, quality and composition of food sources on the vagile macrofauna diet, we took seasonal samples in Calvi Bay (Corsica, 8°45'E; 42°35'N), at two sites between August 2011 and May 2012. Gut content observations and C/N/S stable isotope analysis of bulk tissues were conducted on both the macrofauna and their potential food sources.

Significant seasonal and spatial differences of ingestion patterns of the most abundant species were emphasised as were differences of isotopic signatures. "SIAR" Bayesian mixing model and "SIBER" package were used to analyse isotopic data and determine if these differences were due to actual diet modifications or only to baselines isotopic composition variations.

Elemental changes along a urbanization gradient and its impact on *Daphnia*-parasite interactions

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Urbanisation has played a crucial role as a driver of local, regional and global changes in N and P biochemistry of aquatic ecosystems. Moreover, as the rate of N and P-inflow can differ considerably, we expect the aquatic N : P ratio to vary along with the degree of urbanisation. As many aquatic grazers perform best under a fixed N:P ratio, this altered food quantity and quality can impact their life history traits directly (growth, mortality) or indirectly (predation, immune defences). Although often neglected, defences against parasites are important as they regulate host density or susceptibility to predation.

In this study, we monitored changes in phytoplankton N- and P-concentration and ratio of 81 ponds in Flanders along a gradient of urbanisation.

Our results indicate that spatial scale is important when considering patterns of elemental change. On a local scale (within 9 km^2), phytoplankton N-concentration and N : P ratio increased with the percentage of build-up area around the pond. However, on a regional scale (within the region of Flanders), P-concentration tended to increase from rural to urban regions.

We determined how this altered elemental context impacted the interaction of three different zooplankton species (*Daphnia magna, D. pulex and Simocephalus vetulus*) with their parasites.

Ecology of 22 trace elements in *Mytilus galloprovincialis*

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Trace elements (TEs) are considered as non-degradable pollutants. This persistent character can alter their natural biogeochemical balance in contaminated environments. TEs are further toxic for aquatic organisms from threshold levels and are thus likely to cause multiple damages to the population, the community and the ecosystem levels. For these reasons, their environmental occurrence has to be accurately monitored. The main interest of the use of quantitative sentinel organisms to this end, or bioindicator species, is their capacity to give information on the bioavailability of environmental contaminants. Mussels from the genus *Mytilus* are particularly well suited organisms for the monitoring of the coastal contamination. Native wild and cultured *Mytilus galloprovincialis* Lamarck, 1819 have been widely used since around 40 years to this purpose along coasts of the eastern Atlantic and the Mediterranean. But the accurate use of a bioindicator relies on the detailed knowledge of its ecophysiology and the influence of environmental variables on the bioaccumulation processes.

In the framework of the STARECAPMED project, the ecology of 22 TEs in *M. galloprovincialis* is therefore investigated. The mussel morphometry and biology firstly define the TE accumulation processes.

Accumulated TE are internally regulated and redistributed between body compartments; these internal processes notably depend on the essential or non-essential character of TEs. As filter feeder, mussels accumulate soluble and suspended TEs whose environmental levels are determined by the geomorphology, the physico-chemistry and the hydrology of monitored coastal meadows. All these factors are acting together to modulate the TE accumulation processes in mussels. TE bioaccumulated levels further balance quickly when any physiological or environmental changes occur in order to reach a new steady-state with environmental TE loads.

The ecology of TEs in *M. galloprovincialis* is thus complex and very dynamic; these considerations must be taken into account when monitoring the chemical contamination of coastal meadows.

Management and eradication of the North American beaver *Castor canadensis* in Western Europe

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In 2009 we demonstrated that allochtonous North American beavers *Castor canadensis* were present in Rhineland-Palatinate (Germany), in Wallonia (Belgium) and in Luxembourg. This led to a major concern over the conservation of the native Eurasian beaver *Castor fiber* in this region of Europe.

Following this discovery, we produced recommendations on how do deal with this situation. Thereafter, we carried out a trans-boundary research project which involved further genetic analyses over a large area in order to get a better view on the scale of the problem.

North American beavers were also detected in North Rhine-Westphalia (Germany). In all four political units management decisions were taken with a view of eradicating the North American beaver in the greater region. However, the actions taken differed between countries and went from systematic culling to a capture, sterilisation and re-release programme.

Here we present the preliminary results of this ongoing conservation action and also highlight potential problems of such trans-boundary management in relation to its outcome.

Numerical simulation of hydrodynamic constraints associated with different underwater prey capture strategies in the Dice snake, *Natrix tessellata*

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Water is a dense and viscous medium. Although these properties constrain movement, numerous snake species capture prey under water. Consequently, these snakes have to circumvent the hydrodynamic constraints associated with the prey capture while being unable to rely on suction feeding mechanisms because of the extreme reduction of their hyoid apparatus. One potential way to cope with these hydrodynamic constraints is behavioral adaptation. Two main foraging strategies are used by snakes that capture prey under water, i.e. sit-and-wait and pursuit. Moreover, most snakes that capture prey under water perform high acceleration strikes.

Here we propose to evaluate the pattern of fluid flow around the head associated with sit-and-wait and pursuit strategy as well as the pattern associated with different accelerations.

To do so, we use computational fluid dynamics to simulate the unsteady flow associated with prey capture behavior in the dice snake, *Natrix tessellata*, while focusing mainly on the pressure fields and turbulence profiles.

Our results show that both magnitude and duration of the acceleration impact the flow pattern around the head and that short and high acceleration appears to be the more optimal prey capture strategy. This is consistent with what is observed in snakes as sit-and-wait strikes are associated with a higher prey capture success.

Impaired swim bladder inflation in zebrafish following acute and chronic MBT exposure

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Many environmental chemicals can disrupt thyroid hormone (TH) balance, thereby affecting vertebrate development. 2-Mercaptobenzothiazole (MBT), a high production volume chemical, is known to inhibit thyroperoxidase (TPO), a key enzyme for TH synthesis. To investigate the effects of thyroid disruption on swim bladder inflation, which is considered an ecologically relevant adverse effect, zebrafish embryos were exposed to MBT in acute and chronic experiments.

Acute experiments were performed using an adjusted Fish Embryo Acute Toxicity test (OECD TG 236) exposing zebrafish embryos up to 120 hpf (hours post fertilization). Chronic experiments were performed using the Fish Early-life Stage Toxicity test (OECD TG 210), requiring exposures up to 32 dpf (days post fertilization). Survival, hatching, swimming behaviour and morphological defects were recorded, with specific focus on swim bladder inflation.

The swim bladder of zebrafish consists of a posterior and an anterior chamber, which inflate around 96 hpf and 20 dpf respectively. Both chambers regulate buoyancy, and the anterior chamber additionally has a role in hearing. Our results show that acute MBT exposure induces dose-dependent effects, including delayed hatching and abnormal pigmentation. There was no direct impact on posterior chamber inflation. Chronic MBT exposure resulted in impaired anterior chamber inflation, with either absence of inflation, a smaller surface area or an abnormal structure.

Before endogenous T_4 (the thyroid prohormone) production, zebrafish embryos have a maternal T_4 pool. Therefore, TPO activity is possibly not essential for posterior chamber inflation. However, iodothyronine deiodinases (ID) enzymes are crucial to convert T_4 to T_3, the biologically active TH. We hypothesize that ID inhibitors do impair posterior and subsequently anterior chamber inflation, while TPO inhibitors disrupt endogenous T_4 synthesis at later age, resulting in impaired anterior chamber inflation.

In conclusion, thyroid disruptors impact swim bladder inflation, with specific subtypes of TH disrupting compounds probably targeting specific aspects of inflation.

Symbiosis between the coral gall crab *Hapalocarcinus marsupialis* (Decapoda: Cryptochiridae) and the stony coral *Seriatopora hystrix* (Hexacorallia: Scleractinia) within the Great Reef of Toliara, Madagascar

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The parasitic marsupial crab *Hapalocarcinus marsupialis* is found in abundance on the stony coral *Seriatopora hystrix* within the Great Reef of Toliara, Madagascar. The female crabs have a modified abdomen that forms a large pouch located under the cephalothorax and where they can brood more than 500 eggs. Their life cycle is divided into two distinct parts: a free-swimming larval phase and an adult parasitic phase. When a larva settles down on its host, it induces a gall formation that grows in four distinct stages where the first one corresponds to a small bud and the last one represent the gall completely closed and surrounding the crab inside. Presence of the parasite does not affect the coral skeleton or their reproduction, because mature polyps were found.

On the reef, 563 colonies of *S. hystrix* were observed by scuba-diving on different stations: 37.8% of them were infested by these crabs with a total of 763 galls. Galls morphology is representative of the age of the infestation on a site and the maturity of the crab inside. Galls are monopolized by females which have a similar morphology to males at the juvenile stage. They grow simultaneously with the gall and males visit them in order to mate before the gall closure. Females are fertilized by different males and store the sperm into two spermathecae, mating being probably a powerful stimulus that induces a fast growth of their abdomen. In parallel, the gall closes until the crab is stuck inside.

Thanks to the isotopic compositions of carbon and nitrogen, this study shows that the crabs feed mostly on particles carried by the current thanks to the small openings located all around the gall.

Mediterranean coastal fish are more diversified and abundant in *Cystoseira* forests than in structurally less complex subtidal rocky habitats: finding the drivers behind this pattern

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In Mediterranean rocky subtidal, macrophytes belonging to the genus *Cystoseira* (Phaeophyceae) form structurally complex habitats, called forests. Due to the occurrence of multiple anthropogenic stressors, *Cystoseira* forests are regressing in the whole Mediterranean Sea, and are replaced by structurally less complex habitats such as shrub lands, turfs and barren grounds. The consequences of such habitat shifts on fish assemblages are still poorly known.

We aimed at comparing fish assemblage structure between *Cystoseira* forests and structurally less complex habitats, and at investigating if fish distribution patterns are driven by the putative *Cystoseira* spp. ecosystem functions 'habitat-former' and 'basal source of organic material'. To achieve these goals, multiple complementary approaches were used: macrophytes and fish field surveys, habitat-choice and predation experiments in tanks, stable isotopes and stomach contents analyses.

Species richness and densities of both crypto-benthic fish (e.g. Blenniidae, Gobiidae, Scorpaenidae) and necto-benthic fish (e.g. Labridae, Serranidae) were higher in *Cystoseira* forests compared to structurally less complex habitats. This was, at least partially, explained by the function 'habitat former' of *Cystoseira* spp., which induces (1) net immigration of fish into forests due to their preference for the high structural complexity of forests, and (2) reduced mortality of both prey fish and piscivorous fish in forests, due to higher shelter and prey fish availability, respectively. Moreover, the *Cystoseira* forest food web may rely heavily on *Cystoseira* spp. as basal source of organic material. However, this was not clearly demonstrated since carbon and nitrogen isotopic compositions did not enable to distinguish *Cystoseira* spp. from some other possible sources such as particulate organic matter.

The present work highlights the crucial ecosystemic role of *Cystoseira* spp. supporting high fish diversity and density, including socio-economical important fish species such as *Scorpaena* spp. and *Serranus* spp.. This stresses the need to better manage human activities impacting *Cystoseira* spp.

Linking relatedness and past environment to current phenotype

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In the context of global change, the individual has to cope to a fast variation of their environment. It could be achieved by the modification of pattern between life history traits conferring a benefit on their fitness.

This talk aims to present the influence of genetic and geographic signals in the variability of life history traits and their phenotypic plasticity within the *Tetrahymena thermophila* species.

This presentation is divided in two parts. On one hand, several traits and their phenotypic plasticity are measured on 44 genotypes. This aims to characterize the variability of plasticity for different genotypes and traits within the same species.

On another hand, differences between genotypes are studied in order to understand the origin of this variability. These genotypes came for different genetic populations and geographic locations. So, we could estimate if there is influence of genetic signal or geographic position in the observed variability of traits and their phenotypic plasticity.

Seasonal variation of carbon fluxes induced by dominant hard and soft corals in a northern Red Sea coral reef

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Corals play a vital role in the fixation and cycling of carbon (C) in coral reefs. However, studies on C cycling that include both hard and soft corals, and the natural environmental change they experience, are scarce. Therefore, this comprehensive study quantified C fluxes induced by the dominant hard and soft corals of a high latitude fringing reef in the northern Red Sea while they were exposed to typical pronounced seasonal variability in key environmental factors.

Physiological measurements of photosynthesis (PS), respiration (R), calcification (G), and particulate and dissolved organic carbon (POC and DOC, respectively) fluxes were performed in all four seasons. Measurements were supplemented by in situ monitoring of key environmental factors such as temperature, light availability, and inorganic nutrient concentrations.

Findings revealed that PS was significantly increased in spring and summer, coinciding with highest light availability. Hard coral PS was significantly higher than soft coral PS. R, G, and POC were significantly higher in high temperature, low nutrient, summer compared to all other seasons and year-round higher for hard than soft corals. DOC fluxes were highly variable and not significantly different between genera or seasons. Significant positive correlations of PS were found with POC and DOC fluxes. This may be explained by the release of photosynthates as coral mucus entering both the POC and DOC pools of coral-surrounding seawater. Both PS and R correlated significantly and positively with G, confirming G as a light-enhanced and energy-demanding process. All fluxes were lower for soft corals than hard corals.

Globally reported coral reef phase shifts from hard to soft coral dominance would consequently reduce essential processes such as primary production, organic matter recycling, and reef construction through calcification.

Unraveling the ecology of the dune aphid *Schizaphis rufula* (Hemiptera: Aphidoidea): ecological preferences and parasitoids (Hymenoptera)

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Schizaphis rufula Walker (1949) is an aphid species typical of European coastal sand dunes. Although the species can reach abundant numbers in Mediterranean and Atlantic dunes, information regarding its ecology is scarce. *Schizaphis rufula* is usually associated with sand-fixing grasses in primary dunes. Understanding the species' ecology is therefore relevant to understand its role in plant community structure and succession. To characterize the ecological niche of *S. rufula* and to identify the associated parasitoid community an observational study was performed. By means of a green-house experiment we compared the aphid's performance on different dune grasses characteristic of different dune succession stages.

A field survey was conducted in the summer of 2012 at three locations along the Belgian and Dutch coast. Densities of *S. rufula* on its host plant *Ammophila arenaria* were monitored and environmental features near each monitored plant were characterized. The occurrence of *S. rufula* was inversely related to plant species richness and abundance of *Festuca rubra*. These factors are related to the degree of dune fixation in a way that fixated dunes harbor a more species rich plant community with higher abundances of *F. rubra.* Results therefore place the optimal environment for aphid development in mobile dune areas.

Molecular and morphological characterization of parasitoids found during the field survey revealed for the first time that *Aphidius rhopalosiphi* and *A. avenae* (Hymenoptera:Aphidiinae) are associated with *S. rufula* together with at least three hyperparasitoids from the genera *Apoanagyrus* sp., *Dendrocerus* sp. and *Pachyneuron* sp.(Hymenoptera).

The green-house experiment showed that aphid population densities became highest on the dune stabilizing grasses *A. arenaria* and *L. arenarius*. The analysis of plant biomass at harvest also indicated that these two grasses suffer the most from the aphid's presence suggesting a role of this aphid in population dynamics (i.e. establishment and recruitment) of dune-fixing grasses.

Species and speciation in *Tropheus*: an endemic cichlid radiation from Lake Tanganyika

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The Lake Tanganyika cichlid genus *Tropheus* Boulenger 1898 consists of stenotypic rock dwellers and contains over a hundred colour morphs. This makes *Tropheus* an important model for evolutionary research. Yet, the genus' taxonomy is confusing and many populations cannot be assigned to a valid species. Notwithstanding its high chromatic and genetic differentiation, the genus was reported to have remained in morphological stasis. A study of an early-diverged species: *T. duboisi* Marlier 1959, revealed significant intra-population differentiation and refuted the hypothesis of morphological stasis. Different morphological characters, however, showed alternative patterns.

Therefore, a verification of which characters are most suitable for species delineation in *Tropheus* was needed. Lake Tanganyika consists of three subbasins that once formed isolated paleolakes, containing unique cichlid communities. This justified the separate study of the *Tropheus* species from the central and the southern subbasins.

In the central basin, most localities habour two or more sympatric *Tropheus* species. Surprisingly, heterospecific populations from the same shore were more alike in body proportions than conspecifics from opposite shores. Meristic characters did, however, unite conspecifics, regardless of their origin. As periodic changes in water level drastically changed the shoreline of the shallow parts of the lake, shallow shores harbour younger *Tropheus* populations than steeper shores.

By comparing 'old' and 'young' populations from the southern subbasin, we found that meristics appeared more evolutionary stable than measurements. Hence, both case studies show that meristics are more suitable for species delineation than measurements. Using meristics, seven species were recognised. In the northern and the central subbasin, species could be readily identified. In the south, however, populations could only be assigned to a species by analysing average morphometric values. The relatively low species diversity in *Tropheus*, compared to its chromatic differentiation, is remarkable. Yet, it is comparable with the situation of other Lake Tanganyika cichlids.

Suction power output and the inertial cost of rotating the neurocranium to generate suction in fish

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To expand the buccal cavity, many suction-feeding fishes rely on a considerable contribution of a dorsal rotation of the dorsal part of the skull including the brains, eyes, and several bones forming the braincase and skull roof (jointly referred to as the neurocranium). As the neurocranium takes up a large part of the total mass of the head, there may be a considerable inertial cost to rotate the neurocranium. If so, this would imply a significant selective pressure on the kinematics and mass distribution of the neurocranium of suction feeders.

Here, an inverse dynamic model was formulated to calculate the instantaneous power required to rotate the neurocranium approximated by a quarter ellipsoid volume of homogeneous density, as well as to calculate the instantaneous suction power based on intra-oral pressure and head volume quantifications.

Applying this model to the largemouth bass showed that the power required to rotate its neurocranium only accounts for a few per cents of the power delivered to sucking water into the mouth in this species. Furthermore, recovery of kinetic energy from the rotating neurocranium converted into suction work may be possible during the phase of neurocranial deceleration.

Our data thus suggest that only a negligible proportion of the power output of the feeding muscles is lost as inertial costs in the largemouth bass. Consequently, the feeding performance of piscivore suction feeders of generalized morphology comparable to our model species is not limited by the recruitment of neurocranial motion to contribute to head expansion during suction feeding, and is not likely to be a factor of importance in the evolution of cranial shape and size.

Aconitum and *Bombus* interactions: is floral rewards chemistry driving pollen-mixing behaviour in generalist bumblebees?

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Plants synthesise an array of chemicals to defend themselves against herbivorous insects. Some of these defense compounds also occur in nectar and pollen, which constitute resources for pollinators. Such floral chemicals may be beneficial or detrimental to bees: they may protect them against disease and pathogens but also cause toxicity. How these toxins affect pollinator behavior, is not fully understood. Monkshoods (i.e. *Aconitum* species) are typical 'bee-pollinated' plants with large inflorescences and a specific floral morphology that makes their nectar accessible only for long-tongued visitors such as bumblebees. All the investigated species of *Aconitum* contain aconitine-like alkaloids, which are neurotoxic and for insects. *Aconitum* pollen contains particularly large concentrations of alkaloids compared to the leaves or the nectar. Pollen alkaloids may protect the flower from herbivores, or deter generalist pollen-collecting bumblebees, thus favoring nectar-visits over pollen-visits. A recent study suggested that pollen mixing in generalist bees may be considered as a possible strategy to exploit flowers with unfavorable pollen. To elucidate to what degree generalist bumblebees mix pollen in *Aconitum*-*Bombus* interaction system, pollen loads from two generalist species (*Bombus hortorum* and *B. wurflenii*) were collected in several sites with different *Aconitum* species and analyzed microscopically. In addition, chemical analyses were conducted on pure pollen and nectar of the *Aconitum* species, pollen loads from the two generalist bumblebees and from one *Aconitum*-specialist bumblebee (*B. gersteackeri*), as well as tissues of the three bumblebee species. Comparison between the different data allowed us to investigate potential alkaloid sequestration in bumblebees as well as potential dilution mechanisms of *Aconitum* pollen that could lead to alkaloid concentrations too low to affect generalist survival.

The evolution of a male dimorphism in a dwarf spider: unravelling the genomic basis and the importance of female choice

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Male dimorphisms are intriguing as the coexistence of the morphs poses an evolutionary paradox: an inferior morph is able to coexist with high quality males. As most research focuses on the underlying intrasexual ultimate mechanisms, the proximate and intersexual ultimate causes are poorly explored.

To unravel more on both topics, the solitary dwarf spider *Oedothorax gibbosus* was used. It has a genetically fixed male dimorphism with males developing into either a *gibbosus* morph, which has a cephalic region with a profound hunch preceded by a hairy groove, or a *tuberosus* morph, which has a cephalic morphology similar to the females.

Firstly the proximate cause underlying the evolution of the morphs was addressed, aimed to localize the genetic region determining the male head morphology with the use of Restriction-site Associated DNA sequencing (RADseq). The obtained data showed that the male morph determining genetic region is located on an autosomal chromosome. Furthermore there were 14 RAD-loci which were consistently associated with the *gibbosus* morph and no RAD-loci which were consistently associated with the *tuberosus* morph. The complete absence of consistent *tuberosus* RAD-loci points towards a chromosomal deletion on the *tuberosus* chromosomes.

Secondly the ultimate cause that leads to the stable coexistence of the male morphs was tackled. Here the aim was to reveal more on intersexual interactions to complement previous research on intrasexual competition. The importance of females was exemplified by conducting a behavioral observation experiment with varying operational sex-ratios (OSR). The experiment indicated that it's not merely the ratio of *tuberosus* and *gibbosus* males that influences their copulation success, but that the amount of mate availability also alters females choosiness. It was also apparent that the female is dominant in deciding whether or not a copulation occurs, as the average female copulation rate was equal in all OSR settings.

Trophic linkages of deep-sea fishes across a depth gradient assessed by stable isotope analyses

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Continental slopes are highly diverse ecosystems, which are influenced by strong environmental depth-related gradients. Food availability is among the factors responsible for trends in community structure and patterns of biomass, diversity and distribution of assemblages along continental slopes. Deep-sea fishes are supported by food provided by both physical (sinking fluxes) and biological (controlled by vertically migratory organisms) processes. The relative role of these pathways in delivering food, and therefore the sensitivity of deep communities to change, is poorly known.

Stable isotope analysis provides information on trophic level and nutrient sources within ecosystems. In the deep sea, stomach content work is particularly challenging and isotopic data provide a key insight into trophic biology. In this study we report results of an extensive survey of demersal fish communities recovered between 500 and 2000m water depth on the North East Atlantic (Scottish and Irish) continental slope.

The isotopic composition of 48 deep-sea fish species was analyzed in relation to depth along the continental slope. $\delta^{15}N$ and $\delta^{13}C$ values clearly distinguish fish supported by benthic and pelagic nutrient pathways, and indicate increased separation between these pathways (i.e. lower benthic-pelagic coupling) with increasing water depth. At 500m, benthic-pelagic coupling is surprisingly strong, presumably driven by impingement of vertically-migrating fauna on the seafloor. The effect of increasing depth (and decreasing coupling) on isotopic niche space is also explored here.

The impact of an alien fish on alternative newt phenotypes: invader personality matters in a feeding context

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Amphibians are currently declining worldwide for many reasons. A major cause is the introduction of exotic fish in their natural habitat. Specifically, the goldfish (*Carassius auratus*) is the most introduced ornamental fish in Europe. Although it does not prey on adult newts, this fish has been associated with a strong decrease of newt populations. Moreover in the palmate newt (*Lissotriton helveticus*) alternative phenotypes can coexist in a same population: the paedomorphs that retain gills at the adult stage and the metamorphs that have undergone metamorphosis. These two phenotypes are differently affected by goldfish introduction: while metamorphs can persist with fish, the paedomorphs almost always disappear but the reasons of this differential sensibility are still unknown.

In this study we aimed to assess the effect of goldfish on foraging behaviour of both phenotypes in palmate newt. We also evaluated individual fish harassing behaviour towards newts to highlight the presence of fish personality and its impact on newt foraging.

To this end we assessed behavioural patterns of newts and fish in a replicated laboratory design using the focal sampling method. Goldfish were present in direct contact with newts in half of the 24 experimental tanks and the study covered the breeding period of newts.

Results showed that in the presence of fish fewer newts foraged than in the absence of fish. This effect was stronger in paedomorphs than in metamorphs. We also found that all fish did not behave in the same way: some fish revealed a stronger harassing personality than others. In contact with a more harassing fish, fewer newts came to eat.

This study showed the complexity of interactions between native and alien species in which not only the presence but also the particular personality of the invader can have ecological consequences.

POSTER ABSTRACTS

Trophic ethology of common genet *Genetta genetta* (Linné, 1758) surroundings Tonga Lake in north east of Algeria

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The present study was realized surroundings Tonga Lake, located in El Kala National Park in north eastern Algeria. The Lake has a great importance due to its biodiversity. The collect of droppings was monthly. The analyse of 35 droppings of common genet (*Genetta genetta* L., 1758) collected from July 2012 to February 2013 revealed the presence of 1079 items belonging to 119 families. The class of Insecta was the dominant one (RA % = 75.5%), followed by Batrachia (RA % = 7.9%), and Arachnida (RA % = 7.1 %). The dominant species, by relatives abundance, was *Tetramorium biskrens* (RA % = 9.2%) followed by *Discoglossus pictus* (RA % = 7.8 %). The values of Shannon-Weaver index varied between 2.25 and 4.91 bits. 31 of 35 analysed droppings present Shannon-Weaver index values higher than 3 bits which indicates an important diversity of prey. The values of the equitability index swung between 0.67 and 1. We noticed that 91.4% of decorticated droppings presented values of equitability higher than 0.84. Results exploited with relative biomass index yielded the dominance of Aves class (B % = 41.9%) followed by Mammalia (B % = 17.6%) and Batrachia (B % = 15 %). Fragmentation index applied on chitinous fragments of *Rhizotrogus* sp. and on *Discoglossus pictus* and *Apodemus sylvaticus* bones indicates high proportion of fragmentation. In this current study plants detected were not considered.

Impact of fungicide newly introduced in Algeria (VACOMYL - PLUS) on the physiology and biochemistry of animal bio-accumulator / bio-indicator of pollution, the snail *Helix aspersa*

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The massive use of pesticides is not without consequences for our environment. So, faced with this, the study of the effects of pesticides on different ecosystems is paramount. It is in this context that we conducted an eco-toxicological of determining the inhibitory effects and toxic fungicide newly introduced in Algeria (VACOMYL-PLUS) composed of two active ingredients (copper oxychloride 35% Metalaxyl 15%) on the biology and ecology of a species, organic pollution indicator, the gastropod: *Helix aspersa*. So we are interested in the toxicity of xenobiotic on the physiology and biochemistry of the snail *Helix aspersa*. The main results show firstly that the fungicide causes a dose-dependent decrease in body weight of the animals and the hepatopancreas. On the other hand, biochemical assays reveal a very highly significant increase in the rate of total carbohydrates. In parallel treatment with different concentrations of Vacomyl-PLUS generates a cellular stress resulting in reduced glutathione (GSH).

Deltamethrin-induces oxidative stress to the freshwater ciliate model: *Paramecium tetraurelia*

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The problem of environmental contamination by the excessive use of organics cannot be neglected. Extensive application is usually companied with serious problems and health risk. It is established that many chemicals, in common use, can produce some toxic effects on biological systems through their mode of action or by production of free radicals that damage all cell compounds. Deltamethrin, a widely used type II pyrethroid pesticide, is one of the most common contaminants in freshwater aquatic system. In this study, we investigate the effects of deltamethrin exposure on the induction of oxidative stress to the freshwater ciliate *Paramecium tetraurelia*. After the treatment of paramecium cells with increasing concentrations of insecticide, we followed up the growth kinetics, generation time and the percentage response. Also, we studied the variation in biomarkers of stress such as: GSH content, GST, GPX and CAT activities. Our results showed a significant decrease in the proliferation of cells correlated by the decrease in generation number and the increase in generation time. Also, we noted an inhibition in the percentage response. The monitoring of biomarkers revealed depletion in GSH content in a proportional and dose dependent manner accompanied by an increase in the GST activity. In parallel, a strong induction in the CAT and GPX activities was noted specially for the highest dose. In summary, under the current experimental conditions, deltamethrin is highly toxic to the freshwater ciliate *Paramecium tetraurelia*. Exposure to low concentrations showed significant adverse on growth accompanied with the induction of oxidative damage supported by the decrease in GSH content and the intensification of the antioxidant enzymes.

Influence of fine-scale habitat structure on site occupancy and breeding performance: a long-term study on a wild bird

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Most birds show specific habitat requirements for breeding. Vegetation structure, as determinant of habitat quality, surrounding the nesting sites can have large effects on breeding performance. We studied Blue Tit *Cyanistes caeruleus* breeding traits using long-term population data to determine whether characteristics of vegetation structure are linked to site occupancy, laying date and number of eggs laid. Measurements of vegetation structure included density of English Oak *Quercus robur*, European Beech *Fagus sylvatica*, miscellaneous deciduous, coniferous and non-coniferous evergreen trees within a 20-m radius of nest boxes used for breeding. Those trees were further sub-divided into specific classes of trunk circumferences to determine the density in different maturity level. Our results demonstrated that site occupancy rates and number of eggs laid were positively correlated with the proportion of deciduous trees and hence negatively correlated with the density of coniferous trees. Laying date was more advanced when the proportion of deciduous trees (especially English Oak) increased. Furthermore, the density of English Oak trees with higher maturity level was positively correlated with site occupancy and number of eggs laid, and negatively correlated with egg laying onset. Our findings highlight the potential role of deciduous trees, particularly more mature English Oak, as good predictors of habitat quality. We also found that egg laying started earlier and more eggs were laid in nest-boxes with higher occupancy rates, which coincide with the results for the vegetation characteristics. Therefore, we conclude that long-term occupancy rate can predict habitat quality and breeding performance. Consequently, our results have implications for the management and conservation of breeding habitats of insectivorous bird populations.

Biodiversity, reproduction and population structure of Sciuridae (Rodentia, Mammalia) from the Forest Reserves of Yoko , Masako and the locality of Uma (Eastern Province , DR Congo)

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We collected squirrels in the Forest Reserves of Yoko (left bank of the Congo River), Masako (right bank of the Congo River) and in the local community forest Uma (right bank of the Congo River, 96 km Kisangani on the road from Bunia - Kisangani) . In total we caught 107 Scuiridae using traditional traps that were positioned at different heights (1 to 10m) above the ground during a series of field campaigns executed in the period between January and July 2014, each of which lasted 7 consecutive days. The use of external morphometric characters revealed the presence of six species: (1) the *Thomas's* Rope Squirrel *(Funisciurus anerythrus* Thomas, 1890) ; (2) the Fire-footed Rope Squirrel *Funisciurus pyrropus* F. Cuvier, 1833) ; (3) the forest giant squirrel (*Protoxerus stangeri* Thomas, 1890) ; (4) the Boehm's Bush Squirrel **(***Paraxerus boehmi* Reichenow , 1886); (5) the Red-legged Sun Squirrel (*Heliosciurus rufrobrachium* Waterhouse , 1842 ; and (6) an unidentified member of the African bush squirrel genus *Paraxerus* Major, 1893. Our observations indicate that more than 73% of the specimens collected along both banks of the Congo River were reproductively active throughout the study period, that the average number of embryos in all species ranged between 1 and 2, and that except for the Fire-footed Rope Squirrel, the observed sex ratio was higher for males. Finally, in all species, and along both banks of the Congo River, we observed the presence of three age classes (juveniles, sub-adults and adults), which suggests a stable population structure in these six squirrel species.

Effect of two molecules; scopolamine and hyoscyamine of *Datura stramonium* on the larval mortality of *Meloidogyne incognita* (*Tylenchida, Meloidogynidae*)

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In order to seek an alternative mean of manage to chemical control that is part of this work aims to evaluate the nematicidal activity in vitro of two main alkaloids (Hyoscyamine and scopolamine) of thorn-apple weed (*Datura stramonium*) against the larvae of nematodes of the *Meloidogyne incognita*. For this, four different doses were tested for each molecule (1, 5, 10 and 25µl/ml). The results were compared with those of the solvent (dichloromethane). The results showed that the two alkaloids react differently against this nematode. Hyoscyamine presents the greatest percentages of mortality compared with scopolamine for all concentrations tested. The maximum mortality rate is recorded when the dose increase and during the period of the longest exposure. Hyoscyamine to the mortality rate reached 86% after 72 h exposure with a dose of 25µl/ml. By cons for the same exposure time and with the same dose mortality scopolamine is only 10%. The LD50 (median lethal dose) value obtained is 7.89 µl/ml after 72 hours of exposure for hyoscyamine. In addition, scopolamine gave high LD50 in the conditions of our experiment. A high concentration (25µl/ml), the median survival time for mortality of 50% of the population (LT50) is 2 h 54 min for hyoscyamine. For the same mortality and at the same concentration in the experimental conditions, scopolamine requires a much longer time. The latter proves ineffective against the infective larvae of *Meloidogyne incognita*.

Interspecific variation in vomeronasal morphology of lacertid lizards

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Animals communicate via a variety of sensory channels and signals. The effects of the physical environment on various characteristics of the sensory channels have been studied extensively for visual and acoustic communication systems. Much less is known on how the environment affects the evolution of chemical communication. An important aspect in chemical communication is the durability of an infochemical. If the signals do not last for a sufficiently long time in their environment, animals may need to increase their effectiveness to maintain their functionality. Enhancing the overall production or adjusting the chemical composition of infochemicals is a way of coping with environmental challenges that decrease chemical signal durability. Investing in a more efficient signal receiving system could be an alternative strategy. Squamate reptiles (lizards and snakes) rely on their ability to perceive chemical signals from the environment using their vomeronasal organ (VNO), located at the base of the nasal cavity just above the palate. Vomeronasal stimulation is mediated by “tongue-flick” behaviour in which the tongue is used to sample environmental chemicals, and returning them to the mouth for delivery to the VNO. Vomeronasal chemoreception is an essential sensory mode in squamates, mediating overall social behaviour, particularly those related to prey detection, predator avoidance and mate assessment. Species living in habitats with distinct environmental conditions can be subjected to differential natural selection, acting to maximize signal uptake efficiency, and subsequently leading to VNO morphology diversity. In this preliminary study we compare the VNO morphology, using microCT imaging, of approximately 20 lacertid lizard species with distinct habitats in an explicit phylogenetic context.

Osmoregulatory capacities of striped catfish (*Pangasianodon hypophthalmus*) in response to hyperosmotic stress

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Striped catfish (*Pangasianodon hypophthalmus*) aquaculture industry is a major activity of Mekong Delta in Vietnam but is since a few years impacted by both climate change and upstream basin development. Exploited especially for its rapid growth, its omnivorous diet and its high tolerance to low dissolved oxygen concentrations, the species is increasingly exposed to higher salinities in low-Mekong Delta. Based on recent studies, striped catfish appears to be tolerant to salinities of up to 13 ppt without significantly compromising its growth or survival. To better understand the effects of a salinity increase on its physiology, some osmoregulatory variables (plasma osmolality and Na+, K+ ATPase activity from gills and kidney) and various stress indicators (spleen-somatic index, condition factor (K) and red blood cells concentration) were studied. The expression of Heat Shock Proteins -- a large group of proteins induced by stress including salinity and performing a multitude of functions that are essential for cell survival -- was also investigated. Two working methods were considered. On the one hand, fish were collected in rearing ponds from high and low Mekong Delta during dry (March to May 2013) and wet (July to September 2014) seasons. On the other hand some fish were exposed in a laboratory experiment to two increased salinity profiles up to 10 ppt and 20 ppt during a 20-day experiment. Samples were taken on days 0, 10 and 20. Although no fish mortality was observed until 20 ppt, fish autopsy showed fin congestion (100% of the fish) and also barbs and opercular membranes congestion (15% of the fish) when exposed to the highest salinities. First results indicate that the osmoregulatory system of striped catfish cannot totally compensate salinity increase which leads to physiological disturbances and finally can make that sector more vulnerable.

Sexual cycle and spawning period of the spider crab, *Maja squinado*, (Herbst, 1788) (Decapoda: Majidae), in the Gulf of Gabes (Tunisia, Central Mediterranean)

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The reproductive biology of the Mediterranean crab, *Maja squinado* (Herbst, 1788) from the Gulf of Gabes, was investigated monthly between July 2010 and June 2012. This study was motivated by the lack of information on its reproductive parameters in Tunisian waters. Thus, the sexual cycle and spawning period were studied on a total of 770 individuals (292 females and 478 males) caught monthly. The gonadosomatic index (GSI), the hepatosomatic index (HSI) and the condition index (K) were calculated separately for males and females. The overall samples presented a carapace length (CL) ranging between 22.5 and 87 mm. The analysis of monthly changes in the gonadosomatic index showed that the spawning period of *Maja squinado* is marked in December to March. The hepatosomatic index HSI recording his maximum in December. Then it decreased to March. Female *Maja squinado* store lipid reserves at the hepatopancreas for oocyte maturation. For males, this index reached its maximum in November. The hepatopancreas accumulates the lipid reserves to be spent during reproduction. No significant variations were observed for the condition index (K).

Detection of rRNA synthesis sites within reptilian nucleoli

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The nucleolus is the most obvious structure of the nucleus in eukaryotic cells. The main function of the nucleolus is ribogenesis and it is generally assumed that each structural compartment of the nucleolus is associated with a step of this process, demonstrating a strong structure/function relationship in the nucleolus. This process has been mostly conserved during evolution; however two different nucleolar organizations can be observed: most amniotes display a nucleolus with three different compartments while the rest of the eukaryotes present a nucleolus with only two compartments. The first type of nucleolus has been deeply studied while the second remain more enigmatic. To better understand the relationships between structure and function in these two types of nucleoli, we investigated the localization of the rRNA synthesis site within the nucleolus of cultured cells from two reptilian species: a turtle *Trachemys scripta scripta* with a bicompartimentalized nucleolus and a lizard *Gecko gecko* with a tricompartimentalized one. For this purpose, we used the terminal deoxynucleotidyl transferase immunogold method for detecting DNA. For studying the spatial dynamics of RNA within the different nucleolar components, we also used a uridine triphosphate analog, bromouridine triphosphate, which was tranfected into cells then chased for different times before being detected by an immunocytochemical approach and visualized either by confocal microscopy or by transmission electron microscopy. Our results clearly indicate that in the lizard nucleolus the fibrillar center is the site of rRNA gene transcription, confirming previous observations realized on the tricompartimentalized nucleolus of mammalian cells. Furthermore we reveal for the first time that the dense strands of the fibrillar zone correspond to the sites of rRNA synthesis within bicompartimentalized nucleolus.

Dispersal and landscape perception by simulation models: exploring the role of habitat perception and the cost of dispersal in differently fragmented landscapes

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Dispersal, i.e. individual movements away from their native population, is a key process in ecology. Since it allows gene flow among populations, dispersal is of primary importance for meta-population long-term persistence. Dispersing animals make use of different sources of information. They can differ in their abilities to gather this information and in the way they respond to it (i.e. decide to settle or not). For example, our lab has recently shown that Speckled Wood Butterflies (*Pararge aegeria*) from fragmented, agricultural landscapes had significantly wider perceptual ranges than did conspecifics from woodland landscapes [1]. This means that a particular landscape may differ in functional grain, which in turn will affect movement, relative to the organism's landscape of origin. Lower perceptual distance in woodland populations suggests that perceptual ability is costly (either at the sensory system or at the level of information processing). A combination of dispersal traits can be beneficial for the success at the individual level, but detrimental at the (meta-)population level. It could for example increase local connectivity to the detriment of long-distance dispersal. It is then crucial to obtain a more precise understanding about the evolution of dispersal to avoid inadequate management decisions for natural populations. The aim of this PhD-project is to understand how perceptual distance and environmental responsiveness impact connectivity in different landscape configurations. This is addressed by a modelling approach. We present the first results of a spatially explicit individual-based model integrating perception, the associated costs, and responsiveness in order to evaluate the effect on dispersal and functional connectivity in differently fragmented landscapes.

[1] Öckinger E and Van Dyck H (2012) Landscape structure shapes habitat finding ability in a butterfly. PLoS ONE 7(8): e41517

Wood digestion in lower termites: multidisciplinary approaches based on differential feeding

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Termites digestive tract and hindgut especially still holds many secrets despites hundreds of years of research. The complexity of the symbiotic microbial community and the contrast of physio-chemical environments found in lower termites paunch are potentially the key point to explain the efficiency of ligno-cellulose digestion. Contribution of advancing technologies accelerates the progress of our knowledge in this field. Here, we present multiple approaches combining old and recent techniques used to highlight the effect of ligno-cellulosic compounds on termite gut and the role of populations from the symbiotic microbial community. Termites *Reticulitermes flavipes* (Kollar) submitted to various artificial diets showed variations in flagellates populations profile and enzymatic activities. Differential protein expression was investigated using 2D-DIGE MALDI-TOF-TOF and 2D-LC-MS/MS using high resolution orbitrap analyzer. Results from both proteomic experiments tend to support each-other and bring complementary points of view. The gel-free analysis resulted in highly contrasted identification of enzymes involved in ligno-cellulose digestion and metabolism. Finally, differential feeding experiments leaded to *in vivo* selection of different symbiotic communities. These communities were characterized following some metabolism assays and allowed the cultivation of diverse microbial consortia using media closely related to the respective artificial diets. This work provides relevant data on termite and associated microbial community response to alimentary diets.

Study of insect diversity in vegetable crops in Libreville and Owendo (Gabon)

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Gabon is a Central African country rich in diversity of plant and animal species. Vegetable production increases every year, this development causes the proliferation of pests and pathogens. To ensure a sustainable pest control, a study was conducted in 2012 in three market garden areas in Libreville and Owendo. Insects records in yellow traps and weekly visual observations were made in plots of pigweed (*Amaranthus* sp. Amaranthaceae), of red sorrel (*Hibiscus sabdariffa* L, Malavaceae), of tomatoes (*Lycopersicon esculentum* Mill, Solanaceae) and of cabbage (*Brassica oleracea* L., Brassicaceae). A total of 7119 insects were counted and taxonomically classified into 8 separate orders including 81 families. The main pests were represented by 4 families: Aphididae (31.0%), Cecidomyiidae (5.1%), Chrysomelidae (4.0%), Thripidae (2.0%) and 6 families of useful insects (pollinators and predators): Dolichopodidae (5.4%), Andrenidae (2.6%), Coccinellidae (1.7%), Syrphidae (0.6%), Braconidae (0.5%), Hemerobiidae (0.1%). Entomological diversity is discussed according to the local conditions and opportunity to promote biological control.

The effect of urbanization on the phenotype of the Collared Dove (*Streptopelia decaocto*) in northeastern Algeria

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Urbanization has led to a dramatic increase in the areas occupied by the cities and therefore the increase in human population in many parts of North America, Europe, Asia and even Africa, at the same time forcing the animals and plants to adapt to new conditions, including the proximity of humans or disappear, it's the case of the Eurasian Collared Dove (*Streptopelia decaocto*). Indeed, it has an extraordinary hardiness and adaptation abilities. Its rapid expansion in Algeria has not been discussed outside of a few papers, and no indicator is available to assess its abundance, evolution and phenotype in Algeria except Belabed et al. 2012, 2013a, 2013b. This study aims to deepen the phenotypic and biometric knowledge on this species in urban and suburban areas in in the city of Annaba Northeastern Algeria. It was conducted between January 2011 and June 2012, adult doves were captured using different methods. The recorded biometric parameters were: weight, height, width and length the beak, the length of culmen, collar, tarsus, stretched and folded wing, the wingspan and finally the fifth remix. We made our series of measurements on the 50 captured birds before releasing them. Of those 50 specimen, 02 were pre-adults (an urban and a suburban one), and 48 adults (25 in the urban area and 23 in the suburban site). Based on morphometric parameters, comparing averages shows significant differences between the two environments regarding the tarsus, the height and length of the beak in favour of the urban site and 5th remix, wingspan, collar, stretched and folded wing in favour of the suburban site. This gives us two distinct groups, representing the adult urban site on one side, supported by the characteristics of the beak, and, on the other side, the group of the suburban birds, grouped around the other characteristics, especially the wings' ones. The Eurasian Collared dove is part of a group of species that adapts quickly to the colonized habitats. The differences between urban and suburban areas make that populations that colonize the two environments are different. By cons, if the same species colonizes the two environments with two distinct populations, they can develop adaptive strategies whether ethological, physiological or even phenotypic. The speed and success of the colonization of the collared dove apparently seems to be based on the use of selected sites according to the abundance of easily accessible food (small field sites, mixed grazing land and livestock, grain farms and marginal scrubland).

The role of little owl *Athene Noctua* in the limitation of the population of grasshoppers in the center of hunting reserve (Zéralda – Algeria)

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The preferred habitat of the Orthoptera is the grassy area in the garden or meadow, as well as forests as the centre of hunting reserve where we did our study on the diet menu of the little owl. They are thermophilic insects prefer warm environments, they occupy many ecological niches in different regions around the earth, which they adapt easily, in late summer, you can count sometimes twenty to thirty different species. Some are arboreal; others live on the ground or in the ground. The study of the diet of the owl is done by analysing 31 pellets for three seasons between 2012 and 2013 We have recorded 475 prey consumed by the owl, among 369 individuals of insects there 102 individuals belong to the order Orthoptera. This order is devise on 5 families and 17 species represented mainly by the family Acrididae with over 46% of the total. Depending on season, grasshoppers have an abundance of 36.87% during the summer and 24.79% during the autumn. *Calliptamus* sp. is the most consumed species of orthoptera with 6.95% of the total rate of prey eaten by the bird of prey during the entire period.

Study of some biological parameters of the round sardinella *Sardinella aurita* Valencienne 1847: biometry, growth and reproduction

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In This work we present the results of some biological parameters of the gilt sardine *Sardinella aurita* like the Growth reproduction biometrics parameters. The study of biology is based on 894 sardinella, fished in the Bay of Oran for 12 months (from March 2008 to March 2009).The biometric study shows mean spine is about 47.82 for males and 47.73 for females. On the other hand, the average cephalic index is 19.06 for females and 19.49 for males. In addition, the study of size-weight relationships indicates a majorant allometry, so is indicating that the weight is growing more than size. The reproduction study showed a sex ratio in favor of females, with a rate of femininity (61.07%). The laying period is starts in June and finishes in September .This fact was confirmed by histological examination of gonads. The size at first maturity is 14 cm and 14.09 cm respectively for males and females. The study of growth by scalimetric method was doing in the "Laboratoire des Sciences de l'Environnement Marin" France and showed the difficulty of use a scale for the age determination. The Von Bertalanffy growth parameters have been determinate by the study of the structure of length and by using the software FISAT II (version 1.2.0) recommended by FAO. The asymptotic length (L ∞) of *Sardinella* is 34.21 for females and 33.68 for males; the curvature parameter (K) which determines the speed of the fish to get close to the asymptotic length is 0.47 for females and 0.39 for males.

Impact of triclosan on behaviour and neural development of *Cyprinodon variegatus*

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The study focussed on the effects of triclosan (TCS) exposure on mobility and hearing capacities of *Cyprinodon variegatus* larvae. TCS is an omnipresent antimicrobial and contaminant of aquatic ecosystems, which can act as endocrine disruptor, mainly by modifying thyroid functioning. Larval stages are particularly vulnerable to deleterious effects of endocrine disrupters because of potential impairment of fish development and behaviour. Exposure to TCS was conducted at fertilization of eggs at concentrations likely to be found in the environment: 20, 50 and 100 $\mu g.l^{-1}$. The analysis of growth parameters of *C. variegatus* showed no effect of TCS on the fertility of eggs, survival and larval weight. Subsequently, THs concentrations were measured on 15 days post hatching larvae. THs are initially produced as T4 (thyroxine) cells and then converted in the bioactive form of T3 (triiodothyronine) cells. The observed increase of T4 and T3 cells in larvae exposed to 50 and 100 $\mu g.l^{-1}$ suggests an increase in THs synthesis as a consequence of TCS exposure. Auditory thresholds of larvae were determined using ABR (Auditory Brainstem Response) technique, and finally larval mobility was measured. For both parameters no significant differences were observed among the three different treatments. Audiograms showed that the auditory system is not yet completely established at 30 days post hatching. However, these results allowed us to consider *C. variegatus* as an "hearing generalist" because this species have a hearing sensitivity lower than 2000 Hz. Regarding locomotion, our result summarized short time experiences targeting only swimming speed, distance and degree of mobility. It would be interesting to expand the behavioural aspects on other parameters of locomotion and integrate *Cyprinodon* reaction to different stress (light or touch). In conclusion, our results require an extensive long-term study on the full life cycle of *C. variegatus*, in order to evaluate the impact of triclosan on neural function and behaviour through several generations.

Food web structure of two intertidal *Fucus* spp. communities: complexity and temporal variability evidenced by $\delta^{13}C$ and $\delta^{15}N$ approach

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Canopy-forming macroalgae are of major importance for coastal areas and are considered as foundation species. While they exhibit a high level of photosynthesis, storing a large amount of organic carbon, their role as organic matter supplier for the food webs of associated communities remains poorly understood. Moreover, numerous processes in these communities are under seasonal control, potentially leading to modification in the food web structure. Along the rocky coast of Brittany (France), the two mid-intertidal communities dominated by canopy-forming macroalgae *Fucus vesiculosus* (Linnaeus, 1753) and *Fucus serratus* (Linnaeus, 1753), respectively, are abundant. This study aimed to investigate the food web structure of these communities, looking at their temporal evolution and the potential divergences between them. Focusing on the dominant species of macroalgae and macrofauna, their associated food webs were studied in September and December 2013 using a functional and isotopic ($\delta^{13}C$ and $\delta^{15}N$) approach. This survey showed that both communities exhibit nearly the same food web structure with several trophic pathways, and the more abundant algal species, i.e. *Fucus* sp., not acting as the dominant supplier of organic matter for consumers. Temporal variations were also observed for both communities. Almost all consumers of the *F. serratus* community exhibited ^{13}C enrichment in December compared to September. This could be partly explained by a lower dietary activity in winter coupled with a preferential elimination of ^{12}C by the respiration process. Grazers and predators also showed significant ^{15}N enrichment in September compared to December, for both communities that could be a consequence of the grazing of first stages of heterotroph species together with macroalgae and/or epilithon in summer, when their occurrence is maximal. This could have resulted in a ^{15}N enrichment of grazer tissues, contributing then to the enrichment of predators.

Health status and dietary imbalance in a medieval monastic Belgian population

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The medieval Dunes abbey in Koksijde (Belgium), mostly occupied during the 13th and 14th centuries, was one of the most important Cistercian monasteries in Western Europe. We aimed to study the general health status of this population and the effect of social status on health status. The latter was studied macroscopically using different non-specific stress indicators (cribra orbitalia, enamel hypoplasias and stature). The sample constitutes 136 adult males from different social levels. Two social groups have sufficient numbers for statistical comparisons: 77 lay brothers (non-monk religious from peasant origin) and 43 wealthy benefactors. The total sample shows high rates of cribra orbitalia (43%) and enamel hypoplasias (90%), suggesting a number of stresses (nutritional deficiencies or diseases) endured during childhood. However, the high average stature (170 cm ± 6 cm) indicates that living conditions were probably favourable during adolescence (better care and feeding). The individuals with no hypoplasias are significantly taller than the ones with hypoplasias, showing that stresses during childhood have still affected the adult height. Because of their social status, individuals were not affected in the same way. As a matter of fact, nobles from the cloister show significantly lower rates of cribra orbitalia than the lay brothers (27% against 50%). These latter seem to have endured more anemias, probably because of more frequent or stronger nutritional deficiencies or infections.

Is there a differential virus transmission efficiency between aphid strains?

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Aphid species is an important factor in phytovirus transmission efficiency. Aphid strain has also to be considered in the plant-aphid-virus system. To better understand these interactions, different approaches as biological observations and molecular tools were developed. After a period of virus acquisition, the virus transmission rate was assayed by immudetection. A good and bad virus vectors were characterized in different aphid strains - plant - virus models. The variation of aphid proteome and potential involvement in virus interactions were studied. Changes in protein expressions were investigated using a 2D-DIGE approach. Protein spots with significant up- and down expressions were then mechanically picked, trypsin digested and analysed by mass spectrometry. Particular proteins probably interacting with virus were selected. These results were discussed in order to better understand virus-vector relations.

Does the best wine come in old bottles? A sliding semi-landmarks software comparison

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Nowadays, geometric morphometrics is commonly used for quantitative analyses of form. Biological structures such as bones show a high complexity that cannot be described in detail by anatomical landmarks alone, even through 3D approaches. Therefore the use of 3D semi-landmarks to describe curves and surfaces is becoming increasingly used. In this approach, semi-landmarks sliding on curves are used to describe crests and edges whereas semi-landmarks sliding on surfaces are used to asses geometry of areas such as articular surfaces or the diaphysis of bones. These semi-landmarks are allowed to slide with respect to an arbitrary template according to the minimum bending energy criterion. Considering the time-consuming nature of the sliding procedure, we compare for the same sliding task, the ergonomics, repeatability, variability and the time required when using two software packages which are Edgewarp and Morpho, an R software library. To do so we used 3D scans of mustelids (*Mammalia*, *Carnivora*) humeri and a template composed of anatomical landmarks and semi-landmarks sliding on curves and surface. Thus, we were able to compare the different steps of the sliding process and to investigate resulting differences in the output of the two software packages.

First Data on the diet of Reed Warbler *Acrocephalus scirpaceus* around the marsh of Réghaïa (Algeria)

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The diet of the reed warbler *Acrocephalus scirpaceus* has been studied by examining 27 droppings collected near the marsh of Réghaïa between September 2013 and April 2014. We found out that Insecta are the most dominant group which represented 85.71%. They are followed by Arachnida with 7.85%. The other classes are poorly ingested by the bird (1.43% <AR% <2.86%). Within the Insects, Hymenoptera dominate relative abundance (RA% = 36.67%), followed by Coleoptera (AR% = 20.00%), Diptera third (14.17%), Heteroptera (10.83 %), Orthoptera (AR% = 7.50%) and other levels are poorly represented. The values of H' varies between 1 and 3.28 bits. 81.76% of warbler individuals in the trophic regime were between 3 and 7 mm. The other indices used in this study are relative biomass and fragmentation index.

Impact of climate changes on aphid - natural enemies relationships

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While the effects of global atmospheric changes on vegetation and associated insect populations (bottom-up interactions) are increasingly studied, how these gases affect the interactions between insects and their natural enemies (top-down interactions) is less clear. As the efficacy of natural enemies is governed largely by behavioural mechanisms, changes in their prey-seeking behaviour or the behaviour of insect prey defenses can change the dynamics of insect populations. The impact of increases in atmospheric carbon dioxide (CO_2) concentration on aphid population dynamic is well documented. However, nothing about their chemical ecology is reported in the literature. Aphids are using many chemical signals to communicate with each other or with their environment. For example aphids produce an alarm pheromone, with the *E*-β-Farnesene (EBF) as the main active chemical component, to signal the presence of a natural enemy (such as a predator or a parasitoid) in the colony. Moreover, this pheromone is used by natural enemies as a kairomone to locate aphid prey, and is thus at the center of aphid – natural enemies interactions. In this study, the impact of elevated CO_2 concentration on the emission of the alarm pheromone in the aphid *A. pisum* is studied. Using a zNose^{TM} (Gas chromatograph enabling the fast analyse of the chemical composition of a sample), the kinetic of the EBF emission in real-time is set up for a single individual predated by a coccinellid predator *Harmonia axyridis* Pallas. This experimentation is done both for aphids reared under ambient atmospheric conditions and for individuals reared under elevated CO_2 concentrations. We present the differences in terms of emission dynamic and discuss the potential of these results in terms of biological control.

Rapid morphological change of barbels (Cyprinidae) after the dry-up of Sahara

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In the Maghreb, there is a large taxonomic diversity of largely endemic barbels (Cyprinidae). Their ecological niches are also diverse and some species were live in temporary or underground Saharan rivers, (eg Ziz river in Morocco), Guir river (Morocco and Algeria), Abiod river (Algeria). To clarify the barbel systematic of basin of Guir River, a large number of specimens (n = 52) were trapped in the northwest (Bechar) and the southwest (Adrar) of Algerian Sahara. We quantified meristic, morphometric, osteometric characters as well as sequenced two genetic markers for each sampled individual. Significant morphological differences were found between the two populations as 13 out of the 24 analysed variables had a discriminatory power, including the osteometric form and the size of four cephalic bones (premaxilla, maxilla, dentary and pharyngeal bone).In contrast, the sequencing of the mitochondrial markers Cyt b and D-loop, did not reveal any heterogeneity among samples, which all belonged to the same species *Luciobarbus antinorii* (Boulenger, 1911). In contrast, the sequencing of the mitochondrial markers Cyt b and D-loop, did not reveal any heterogeneity among samples, which all belonged to the same species *Luciobarbus antinorii* (Boulenger, 1911). Thus, the morphological divergence observed between these two populations of barbels occurs between populations currently exchanging gene flow or too recently diverged to show genetic divergence, and precedes genetic differentiation. The observed morphological differences could reflect local adaptation to the differing environments of Bechar and Adrar. We suggest that barbels of Adrar have developed new skills to adapt to very restrictive conditions: the females are grow ripe whereas the size is lower than 100 mm. Based on the geographical, morphological and biological differences observed between the two studied populations of barbels, we propose that the barbel of Adrar is distinct at the taxonomic level like subspecies: *L. antinorii pallaryi* (Pellegrin, 1919).

METROPOLE FLANDERS: eco-evolutionary dynamics in zooplankton populations and communities along strong urbanization gradients

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Rapid demographic growth, technical progress, land use change and global warming generate direct and indirect anthropogenic threats to natural systems. These result in a biodiversity crisis at different organizational levels (genetic and taxon diversity, habitat diversity) which threatens ecosystem functions and services. Given that 'human- dominated landscapes' lead to strong and novel environmental conditions, they generate intense selection pressures that may influence genetic structure of populations as well as species composition of communities. The resulting changes in life history, morphological, behavioural and physiological trait characteristics may lead to altered ecosystem functioning and resilience. We are currently examining how populations of the water flea *Daphnia magna* respond to urbanization gradients and urbanization linked stressors, such as nutrient enrichment, temperature elevation, increased concentrations of heavy metals and other environmental pollutants. We focus on a quantitative genetic analysis of trait variation among *D. magna* populations, combined with analysis of the same trait values at the community level in the same set of ponds. Traits of our interest range from life history traits and morphological to physiological traits, such as oxidative stress response, energy budget and stoichiometric composition. The hierarchical sampling design we imposed, enables us to disentangle the local and regional context of urban environments. By combining all data, we hope to explore the relative contribution of ecology and evolution to trait responses and characterize the evolving metacommunity structure of zooplankton in anthropogenic landscapes. This study targets eco-evolutionary dynamics and feedbacks in a landscape setting. It will render novel insights into multi-level responses of zooplankton to anthropogenic stress and the resulting ecosystem functions and services of freshwater systems.

Comparative study of long-term stability cuticular hydrocarbons in queens, workers and males of *Bombus terrestris* and related species (Hymenoptera, Apidae)

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Pollinating insects, like bees, play a major role in maintaining productive natural plant communities. Because they spend most of their adult lives collecting pollen, bees are considered as excellent pollinators. Their apparent decline is of importance for humans and biodiversity. In this context, accurate species identification is a crucial first step to any kind of study. The morphological approach is the earliest, the easiest and the most common method used for species identification. However, identifying closely related species is often hindered by lack of diagnostic morphological characters (i.e. cryptic species and convergent evolution). The DNA-based methods are the main alternative features to traditional morphological characters (i.e. barcoding). Nevertheless, the DNA-based approaches remain expensive and are hard to apply successfully particularly on old collection specimens. In insect taxonomy, one of the most used chemical traits are chemical reproductive traits (ie sexual pheromones). However, this chemical trait need fresh specimens and can only be extracted from a single sex. Other most used chemical traits are the long chains of cuticular hydrocarbons (CHCs).They play an important role in insect communication and beside their primary roles as barrier against desiccation and microorganisms several other functions have been assigned to CHCs, including, nestmate recognition and task specificity. Here we propose a new simple and fast method that can also be used on old collection specimens. Considering these points, we aimed to determine whether cuticular hydrocarbons profile might also present a reliable option inside a model group of bees with a confused taxonomy, the bumblebees.

Consumer acceptance of insect-based meat substitutes

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Meat plays an important role in the consumption pattern of most western consumers. Meat production is responsible for an environmental pressure due to the inefficient conversion of plant protein to meat protein and alternatives sources, such as insects or algae, will be rapidly required. It is known that consumers prefer to eat a hybrid meat product (i.e. a mix of meat and its substitute) rather than a pure meat substitute. Based on this assumption, hedonic tests were realized to assess the acceptability of insect-based burgers in a target population composed of people from 15 to 25 years old, considered as the future insect consumers. Isolated in tasting booths, participants were invited to taste four burger samples containing a ratio of 20 gr of protein by 100 gr of burger. The first burger was prepared with 95% of grounded beef (1), the second with 95% of green lentil (2), the third with 45% of green lentil and 50% of mealworms (*Tenebrio molitor* L.; Coleoptera, Tenebrionidae) and the fourth with 45% of grounded beef and 50% of mealworms. The last 5% of each burger consists of an aromatization portion containing onions, carrots, tomato paste and garlic. Participants were asked to rate each sample on a 9-point hedonic scale, where extreme sides were noted from “extremely dislike” to “extremely like”. Tukey post-hoc comparisons on the appreciation results showed that beef-based products (with or without mealworms) were relatively preferred to lentil-based products (with or without mealworms), probably because hybrid meat burgers seem more familiar to the consumers than vegetable burgers, and that no liking differences were noticed between the two beef-based burgers and between the two insect-based burgers. These results confirm that shape and appearance are key criteria in the acceptation of meat substitute by non-vegetarian consumers and that insects will preferentially be consumed, in the future, if they are presented in an invisible way and associated with familiar flavours.

The Role of The Turkish Straits System on The Population Genetic Structure of *Pachygrapsus marmoratus* in Turkish Coasts

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Population dynamics of marine invertebrates having planktonic larval dispersal is not predictable a priori according to pelagic larval duration and geographic distances. Historical environmental factors regarding habitat, currents, sea level fluctuations together with species-specific traits and current ecological factors result in complex patterns of intraspecific genetic diversity. There is a deficit of studies about the role of the Turkish Straits System (TSS) on the gene flow of marine populations. Because of its two-layer stratification due to density differences between the Mediterranean and Black Sea waters, the TSS can be either a genetic barrier or a corridor for living organisms. According to mtDNA CO1 results of 130 individuals of *Pachygrapsus marmoratus* (Brachyura: Grapsidae) from 16 sites, the gene flow of populations was restricted from the Mediterranean into the Black Sea. The aim of this research is to gain a better resolution of the population genetic structure and to infer biogeographic history of *Pachygrapsus marmoratus* along the coasts of Western Black Sea, the TSS, the Aegean Sea, and the Levantine Sea using six polymorphic microsatellite loci to combine with mtDNA analyses. A total of 384 specimens were collected from the upper littoral zone at a depth range of 0-0.5 m from 31 sites in total. There were seven sites from the Turkish Straits System, nine sites from the Black Sea, 11 sites from the Aegean Sea, and four sites from the Levantine Sea. In this study, we may find local population differentiation due to hydrological effects especially around the TSS rather than at meso- and macro- geographical scales. The questions such as the homogeneity of populations on both sides of the Straits, the genetic transition between the Black Sea and the Mediterranean populations and the role of the TSS on the recent gene flow of *Pachygrapsus marmoratus* populations are tried to be answered.

Extraocular opsin detection in lanternshark (*Etmopterus spinax*) photogenic tissue

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The velvet belly lanternshark (*Etmopterus spinax*) is a small deep-sea shark commonly found in the Eastern Atlantic and the Mediterranean Sea. As other members of the Etmopteridae family, it displays thousands of tiny epidermal light organs called photophores, which are composed of a cluster of photogenic cells (photocytes) enclosed in a pigmented sheath and topped by a shutter-like structure and a lens. These organs produce a blue-green light that is believed to be involved in numerous functions including camouflage by counterillumination, intraspecific communication and aposematism. According to recent pharmacological studies, this functional versatility is partly achieved thanks to a complex photophore control mechanism, which involves hormones and neural agents. Current experimental data suggest (i) photocytes and the shutter to be the main targets of these pharmacological substances, and (ii) the presence of a link between the targets since the shutter appears to open while photocytes are glowing and inversely. Here, we hypothesize extraocular opsins to endowe photophores with their own light perception (as it was recently shown in a bioluminescent squid) and hence to provide the link between shutter opening and photocyte activity. The present work uses various techniques including transcriptome analysis, western blotting, immunohistochemistry to detect the presence of opsins in the shark's photogenic tissue. Results confirm the presence of extraocular opsins associated with the photophores, which likely supports their involvement in the bioluminescence control mechanism.

Ingestion of viscose fibers by macrofauna living in seagrass macro-phytodetritus

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Vagile macroinvertebrates associated with *Posidonia oceanica* exported litter were sampled in August 2011, November 2011 and March 2012 in the Calvi Bay (Corsica), near the STARESO oceanographic station. Contents of digestive tracts were analysed and fibers of various sizes and colours were found. Fibers were found in 27.6% of the digestive tracts in the nine dominant species. No correlation was found between number of fibers and taxonomic or trophic level. There were no seasonal or spatial preferences and thus we hypothesize that the organisms ingest these fibers randomly throughout the year. Analyses performed with a Raman spectroscope showed that these fibers were composed of cellulose associated with a colouring agent following the fiber colour. Red fibers were dyed with the Direct Red 28, blue fibers were dyed with Direct Blue 22. Analyses by a scanning electron microscope (SEM) showed that cellulose fibers had the particular morphology of artificial cellulose fibers called: viscose. Our SEM analyses were compared to literature. This comparison assessed that fibers found in digestive tracts were made of viscose. In a first approach, viscose fibers looked like microplastic fibers because of their colour and shape. However, it appeared that these fibers were made of artificial cellulose which is very different than plastic in terms of impacts and fate in the organisms. This study highlights the importance of physico-chemical analyses such as Raman spectroscopy and SEM to certainly identify the composition of particles ingested by organisms. From an ecological point of view, the red colouring agent is known to be carcinogenic in mammals and fish. Consequently, this pollution could provoke an environmental problem for the *P. oceanica* litter vagile macrofauna.

Unusual mercury concentration and speciation in a population of sea bass, *Dicentrarchus labrax*, from the Black Sea

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Despite the reduction of mercury (Hg) emissions in Europe in the last decades, Hg emissions are increasing worldwide and concentrations found in some marine predators remain high. This raises questions on mercury's biogeochemical cycle at both local and global scale. The present work is part of a wider study conducted in several areas of Europe. Here, we chose to focus our attention on the Black Sea, where the lack of information is particularly pronounced. A set of ten juvenile common sea bass, *Dicentrarchus labrax,* were collected between Sinop and Gerze, the central Black Sea coast of Turkey. Total mercury concentration (T-Hg) was analysed by direct mercury analyser (DMA) and speciation by gas chromatography inductively coupled plasma mass spectrometer (GC-ICP-MS). T-Hg in muscles and livers was quite low ($T\text{-}Hg_{muscle}$=55 ± 2 $ng.g^{-1}$ fw; $T\text{-}Hg_{liver}$=89 ± 12 $ng.g^{-1}$ fw). Our attention was drawn by the particularly high concentrations in brain and kidneys ($T\text{-}Hg_{brain}$=104 ± 8 $ng.g^{-1}$ fw; $T\text{-}Hg_{kidneys}$=327 ± 35 $ng.g^{-1}$ fw). Speciation analysis shows that methylmercury (MeHg) is, as expected, the predominant form of Hg in muscle (83% MeHg on average), but not in liver (only 11% MeHg, which is quite unusual). In kidneys, the value even reached 2% MeHg, much lower than the 30% MeHg measured on other sites. We were able to show a clear relationship between speciation and concentration in the different organs. Besides, it is well known that kidneys mainly accumulate inorganic mercury while muscles accumulate methylmercury. However such a high concentration in kidneys compared to muscles and such a high percentage of inorganic mercury in kidney has never been mentioned previously in wild teleostei. These results suggest that these fish from the Black Sea have been exposed to a source of inorganic mercury and highlight the need of further investigation.

Spatial variation in the concentrations of mercury and persistent organic pollutants in free-ranging bottlenose dolphins (*Tursiops truncatus*) from South Florida

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The bottlenose dolphin (*Tursiops truncatus*) is an abundant apex predator found in nearshore waters of South Florida, especially in the Lower Florida Keys (Key West) and the coastal waters of Everglades National Park (ENP). The objective of this study was to assess variation in contamination levels of total mercury (T-Hg) and persistent organic pollutants (NDL-PCBs, PBDEs, DDT, HCH, HCB, PCDD/Fs and DL-PCBs) in bottlenose dolphins found offshore of the densely populated Key West (n = 27) and from undeveloped ENP (n = 20). T-Hg and POPs were analysed in skin and blubber, respectively, by the mean of Direct Mercury analyser (for T-Hg), GC-ECD (POPs) and GC-HRMS (DLCs). The 7 ICES PCBs were the main compounds found in bottlenose dolphins from Key West (8229 $ng.g^{-1}$ lipids) and the ENP (2289 $ng.g^{-1}$ lipids), while the concentrations of PCDD/Fs remained low (Key West: 104 $pg.g^{-1}$ lipids, ENP: 102 $ng.g^{-1}$ lipids). POP concentrations were higher in individuals from Key West compared to those from the ENP. However, POPs concentrations in Key West dolphins were lower than those from other locations in Florida and around the world. Unlike organic pollutants, T-Hg concentrations were significantly higher in ENP dolphins (Key West: 2941 $ng.g^{-1}$ dw *versus* ENP: 9314 $ng.g^{-1}$ dw) highlighting the specific cycle of Hg in mangrove ecosystems. To conclude, sources of T-Hg and POPs differed between Key West and ENP as reflected by their concentrations in skin and blubber of free-ranging bottlenose dolphins highlighting their role as sentinels of their environment.

Impact of goldfish on terrestrial and aquatic microhabitat use in the palmate newt

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Amphibians are particularly affected by fish introductions and are declining worldwide. Recent works showed that newts can respond behaviourally to fish presence in hiding in aquatic microhabitats. However, whether newts can choose to use terrestrial habitats and then skip reproduction in response to fish presence remains unknown. In this study, we aimed at testing the impact of goldfish (*Carassius auratus*) on the escape behaviour from the aquatic environment to a terrestrial habitat by the palmate newt (*Lissotriton helveticus*) in function of the availability in aquatic micro-habitats (shelter presence). We also studied the consequences on reproductive activities. We used four experimental conditions with six replicates by condition and four newts by tank: no fish and shelter, no fish and no shelter, fish and shelter and fish and no shelter. Each newts was observed 80 times over its reproductive period. Our general hypothesis is an increase in the use of the terrestrial part and a decrease in reproductive activities from the first to the last of these conditions. The results highlight the avoidance of the aquatic environment by newts in the presence of fish and even more when there is no aquatic shelter. In accordance with our hypothesis, there is a gradation in the use of the terrestrial habitat in the four experimental conditions showing the importance of both the aquatic shelter and fish presence. Moreover, in the presence of fish, newts exhibited less sexual encounters and laid fewer eggs than in the absence of fish. This study shows the negative effects of fish, which causes the escape of newts from an aquatic environment to a terrestrial life during the breeding season. This also highlights the importance of taking into account the availability in microhabitats for understanding the patterns of coexistence between fish and amphibians.

Population genetic study of the ameiotic rotifer *Adineta vaga*: worldwide dispersal and local adaptation

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Bdelloid rotifers are freshwater microinvertebrates that have survived and diversified into more than 400 morphospecies in the absence of sex over the past 40 My. Their success has been called an "evolutionary scandal" because theories predict that asexuality is an evolutionary dead end mechanism. Hence, their persistence and diversification as long-term asexuals suggest that bdelloids have developed alternative ways to evolve and diversify. To study bdelloid evolution and adaptation, nuclear markers were developed (the 28S gene along with exon-primed, intron-crossing markers) and used together with the mitochondrial COI marker to investigate genetic diversity within the bdelloid species *Adineta vaga* at a very local scale (several lichens collected from trees within a distance of 300m). To define genetic clusters within this asexual taxon three distinct species delineation methods (GMYC, ABGD and Haplowebs) relying on different criteria were used. Moreover, we compared the *Adineta vaga* individuals collected in lichens from different heights with other *A. vaga* found in soil patches. Interestingly, our results suggest two contrasting patterns of distribution: a global dispersal and local adaptation. The three delineation methods gave similar results, indicating the existence of 6-7 distinct species in our whole local dataset out of 21 *A. vaga* species reported worldwide. Strikingly, two individuals were assigned to different species depending on whether mitochondrial or nuclear markers were considered, which could indicate a form of non-sexual recombination among bdelloids (such as parasexuality or horizontal gene transfer).

Long-term host-parasite coevolutionary dynamics: *Daphnia* and its parasites as a model

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Hosts and parasites are involved in a coevolutionary interaction in which hosts do not evolve as fast as their parasites. Yet, fast adaptive genetic changes occur upon infection, especially if host-parasite interactions are characterized by Red Queen dynamics. Reconstructions in combination with theoretical studies on long-term time shifts between *Daphnia* and its bacterial parasite *Pasteuria* extend current insight into the dynamics of co-evolutionary antagonistic interactions. A coevolution model, incorporating an increase in allelic diversity over time in terms of accumulation of resistance alleles in the host confirmed the infectivity cycles obtained in the experimental results.

Asteraceae paradox for bumblebees

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Through pollen collection, bees act concurrently as effective pollinators and herbivores. Regardless of floral specialization, they display numerous adaptations as well as sensorial capabilities, which allow them to discriminate among plant species and to enhance floral rewards foraging. In response to excessive pollen harvesting, flowers developed complex defense systems through particular morphological and/or chemical traits. In particular, recent findings support that Asteraceae pollen possesses unfavourable or protective properties and suggests that bees need physiological adaptations to successfully utilize it. Although Asteraceae are ubiquitous in most terrestrial habitats and produce considerable amounts of pollen, this pollen plays only a marginal role in the diets of the pollen generalists by striking contrast to specialists. Despite numerous hypotheses, this paradox remains unsolved. To investigate the unfavourable pollen properties of the Asteraceae for generalist bees, chemical analyses of pollen and bumblebee rearing were performed on *Cirsium*-type pollen. The colonies performances were compared to those from other diets known to be suitable to the model *Bombus terrestris* (i.e. willow and clover pollen). Digestibility (i.e. quality of feces) as well as toxicity (i.e. alkaloids) and nutrient content (i.e. total amino acids) of *Cirsium*-type pollen were examined. Results revealed that unsuccessful exploitation of Asteraceae pollen by bumblebees is not necessarily related to amino acid or alkaloid contents. However incomplete digestion of pollen grains seems indicate difficulties in extracting nutrients from the pollen. Other properties are currently investigated to elucidate this Asteraceae paradox.

Taxonomic affinity of bee fossils (Hymenoptera; Anthophila) based on geometric morphometrics analyses of wing shape

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Bees are one of the major groups of pollinators of flowering plants. The understanding of their evolution and diversification is of high importance for their conservation, but requires integrating bee fossil to the current taxa history. Wing shape morphometrics were used to assess taxonomic affinities of fossils with present and extinct. We studied nine bee fossils: four newly described fossils from the Upper Oligocene of Céreste (FR), the Miocene of la Cerdanya (ES), and the Eocene shale of the Green River Formation in Utah (USA); and five fossils from the Eocene Florissant shale of Colorado (USA), the Eocene Baltic amber (EU), the Eocene Oise amber (FR) and the Miocene lacustrine mudstone of the Shanwang Formation (CN). Most of extant and extinct bee tribes were sampled to assemble a reference data: 76 tribes of Anthophila and apoid wasps (sister group), represented by 471 species (more than 1800 female specimens). Predictive discriminant analyses allowed us to recover the taxonomic placement of the four newly described species: the first, *Bombus cerdanyensis* sp. nov., was assigned to bumble bee (Bombini), the second, *Protohabropoda pauli* sp. nov., to digger bee (Anthophorini), the third one, *Euglossopteryx biesmeijeri* sp. nov., to an extinct bee tribe close to Euglossini, while forewing shape of the last one, *Andrena antoinei* sp. nov., is more similar to the Andrenidae. By considering the five already described specimens, predictive discriminant analyses show that one share taxonomic affinities with the subfamily Andreninae (Andrenidae) and the four remaining are similar to the Melittidae (tribe Macropidini). Our results provide new information on the distribution and rate of diversification of particular bee groups, most notably the extension into North America of possible Eocene-Oligocene cooling-induced extinctions.

Stigmergy as a mechanism to produce collective vortex behaviours: a study case in shoveler ducks

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Ant mill, caterpillar circle, bat donut, bacteria vortex, duck swirl and fish torus are different names for rotating circular formations of animals, where individuals turn around a common centre. Even if the ubiquity of this behavioural phenomenon might have suggested common causes or fundamental underlying principles across contexts, a variety of proximate mechanisms can give rise to vortex behaviours. Here, we investigate if stigmergic process (mechanism of self-organisation without direct communication or interaction between individuals) is able to produce different collective behaviours, notably collective vortices. We present an individual-based simulation model for the movement of populations in a resource landscape that allows us to vary the strength of the interactions mentioned above. The key assumption and novelty of our model is that individuals can cause the release of additional nutrients, as well as consuming them. Our model produces clear predictions. For example, we expect more tortuous individual movement paths and higher levels of aggregation in populations occupying homogeneous environments where individual movement makes more nutrients available. We also show how observed movement dynamics could change when local nutrient sources are depleted or when the population density increases. Our predictions are testable and qualitatively reproduce the different feeding behaviours observed in filter-feeding ducks (*Anas clypeata*), for example. We suggest that considering two-way interactions between feeding individuals and resource landscapes could help to explain fine-scale movement dynamics.

Molecular basis of the echinoderm vision

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Life, as we know it on Earth, is dependent on solar electromagnetic radiations. Since life appeared on this planet, light has indeed been one of the most important selective evolutionary forces for living organisms. Most of the organisms respond in some way to light, moving, orienting, flying, or swimming towards or away from it. Despite their absence of eye *sensus stricto,* echinoderms are no exception to the rule. Numerous echinoderm species are indeed light sensitive and sea urchins and brittle stars exhibit a large opsin gene diversity. Opsin light receptors are defined as the primordial actors of visual-like photoreception. Based on multiple transcriptome analyses, we present new findings in echinoderm opsin diversity. The specific case of two ecologically distinct brittle stars is approached including behavioural and molecular results. Even *Amphiura filiformis* do not exhibit escape behaviour upon light; light is known to control its feeding activity. *Ophiopsila aranea* exhibits clear escape behaviour upon light of various wavelengths. A comparative view of opsin gene expression is envisaged. Rhabdomeric opsin is proposed to be involved in the visual-like process of *O. aranea*. Even opsin can be considered as the basis of the light perception, skeleton structures are suspected to be important for the emergence of visual-like behaviour in echinoderms.

Adhesion of sea cucumber Cuvierian tubules: investigations on the protein fraction of the adhesive

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Cuvierian tubules are white caeca used as a defence system by some species of sea cucumbers, all belonging to the family Holothuriidae. When attacked by a predator, these animals expel a few tubules which elongate in seawater and become sticky upon contact with a surface. The adhesive material produced by Cuvierian tubules is predominantly composed of proteins (54% of its dry weight), followed by carbohydrates (36%) and inorganic residues (10%). Moreover, it has been proved that following a proteolytic trypsin treatment, the adhesiveness of the tubules was significantly decreased. We therefore focused our study on the protein fraction of the tubule adhesive. On the one hand, proteins were extracted from the adhesive material produced by tubules and analysed by mass spectrometry with the goal to list all glue components. For unidentified proteins, however, this method allowed only the retrieval of short peptide sequences. On the other hand, mRNAs were extracted from whole tubules and an Illumina transcriptome was generated. This approach yielded longer sequences but for all tubule proteins, without glue specificity. Combining both methods, we obtained a list of long sequences for our adhesive protein candidates. Several abundant glue components were unidentified after a BLAST search in databases. Among them, some possess relevant particularities like domains involved in interaction with other proteins, calcium, or the substratum. Lectin-type domains, responsible for oligosaccharidic structure recognition, were also detected in some proteins. From the list of candidates elaborated, the cellular origin of putative adhesive proteins in the tubules was visualized by *in situ* hybridization. Thirteen transcripts were tested and some of them appeared to be specifically expressed the mesothelium, the adhesive epithelium of the tubule, thereby confirming their adhesive function.

PhD project: Control of predators in microalgal cultures based on ecological principles

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Microalgae are a promising new source of biomass for production of food, feed, fuel or bulk chemicals. Today, microalgae production is moving from lab-scale to full-scale production. One of the major challenges in large-scale systems are grazing predators (e.g. protozoa, rotifers, microcrustaceans), which can infest cultures and decimate microalgal biomass within days. So far, there has barely been research into the identity of these predators, their impact on productivity and how to effectively control them. There is a need for innovative approaches for crop control of microalgae, preferably using ecological methods that avoid the unsustainable use of chemical pesticides. The aim of this PhD study is to control microalgal predators based on ecological principles. The focus will be on ciliate predators, which are poorly known and are difficult to control. In the first phase of the PhD project, potential contamination routes will be investigated. Next, microalgal predators will be isolated and their impact on multiple freshwater and marine microalgal cultures will be assessed. Methods (i.e. flow cytometry) and predictive models will be developed to monitor and forecast predators' impact in these cultures. The project will attempt to control ciliates by a trophic cascade, i.e. by introducing predators that feed on ciliates. Besides this top-down control also a bottom-up control that relies on the principle of ecological stoichiometry will be considered. Ultimately, we will also attempt to control ciliates by means of feeding deterrents that are naturally produced by specific microalgae.

GENBAS: Unravelling the genomic basis of speciation in African cichlids from Lake Tanganyika

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The processes and mechanisms that have led to the tremendous species diversity observed today have intrigued people for centuries. Initially, it was believed that the geographical separation of populations formed the most important barrier for reproduction. It is now clear that processes such as sexual selection or environmental changes also contribute to speciation. Despite these advances, the genetic basis of the speciation process itself remains largely unknown. Here we present the GENBAS project, in which the GENomic BAsis of Speciation will be investigated in the cichlid genus *Ophthalmotilapia*. The genus comprises four species with comparable ecological preferences, and different but partially overlapping distribution ranges in Lake Tanganyika. Their reproductive behaviour, taxonomy and phylogeny are well known, and unidirectional hybridisation between sympatric species pairs has been observed. The males defend a breeding territory, to which females are attracted to spawn. *Ophthalmotilapia* species are maternal mouthbrooders and females provide care for the fry. The GENBAS project aims (1) to characterize the genomic differentiation that drove the speciation process in *Ophthalmotilapia*, and (2) to verify whether/and to what extent the same genomic changes are maintaining the 'integrity' of the gene pools of the resulting sister species. To achieve these goals, we will first experimentally assess courtship behaviour and acoustics in the four species, under con- and heterospecific mating trials. Second, gene expression patterns in the female brain during con- and heterospecific courtship behaviour will be assessed through RNAseq. Third, a genome-wide screening of genetic diversity and differentiation among populations of sister species will reveal which genomic regions are under selection in *Ophthalmotilapia*. Finally, integration of the RNAseq and genome-wide differentiation patterns will indicate whether the genes involved in mate pairing are situated in regions with high or low differentiation which will provide insight in the selective mechanisms driving speciation.

Tracing functional adaptation in African cichlid fishes through morphometric analysis of fossil teeth

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The sedimentary archive of crater Lake Challa in East Africa contains abundant fossil teeth and bones of cichlid fishes throughout at least the last 25,000 years. We use morphometric analyses of oral jaw teeth from the two extant species of *Oreochromis* inhabiting Lake Challa today, in order to explore the feasibility of tracing adaptive modification of the cichlid trophic apparatus in the lake's fossil record. We assessed the comparative performance of semi-landmark analysis (SLM) and elliptic Fourier analysis (EFA) in capturing the full range of morphological variation in oral tooth crowns. Whereas both approaches have merits and yielded similar results, working with SLM data ensured greater consistency with the whole-body landmark (LM) analyses used to discriminate between individuals of both species. SLM of oral tooth crown morphology, supplemented with biometric measurements on the tooth shaft, revealed that *Oreochromis hunteri* (indigenous and endemic to Lake Challa) has generally more slender oral teeth than *Oreochromis korogwe* (introduced in the mid-20th century). Both species have an outer row of bicuspid teeth and multiple inner rows of tricuspid teeth, but in *O. hunteri* the major crown cusp is more clearly taller than the others. These results suggest that *O. korogwe* feeds by scraping algae from rocks, whereas *O. hunteri* gently brushes off loose material from between the algae. Finally, SLM of three samples of fossil teeth showed that the major types of oral teeth present in the modern-day *Oreochromis* of Lake Challa are also represented in the fossil record. The total morphological variation in our (so far limited) collection of fossil teeth is largely restricted to the morphospace occupied by contemporary teeth, suggesting a close functional relationship between the ancient populations and their likely descendant, modern-day *O. hunteri*.

Habitat use by Geoffroy's white-thighed colobus in the Kikélé Sacred Forest: activity budget, feeding ecology, and selection of sleeping trees

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Habitat use by primates is an important aspect of their ecology and knowledge of this is interesting for conservation purposes. This study addresses the activity budget, feeding ecology, and selection of sleeping trees by Geoffroy's white-thighed colobus (*Colobus vellerosus*). A group of 18 monkeys was followed over 72 days in the Kikélé Sacred Forest, in the phytodistrict of Bassila in Benin (West Africa), to understand their pattern of habitat use. Activity budget and diet were determined using scan sampling with a group. In addition, the structure of the habitat and the physical characteristics of sleeping trees were described using plot surveys. Results showed that resting, feeding, moving, social interaction, and other activities account for 56.64%, 26.31%, 13.04%, 3.31%, 0.70% of the activity budget, respectively. The diet was composed of 35 food resources with the parts consumed being leaves, fruits, seeds, buds, bark, flowers, resin, and inflorescences. Only three tree species were used as sleeping trees: *Celtis integrifolia*, *Cola cordifolia*, and *Holoptelea grandis*. Our findings suggest that the monkeys prefer tall (22.53 ± SD 3.76 m) and large (112.07± SD 14.23 cm) sleeping trees. These data on the ecology, food, and quality of habitat are essential in the conservation of *C. vellerosus*.

In vitro sensivity of phytopathogenic *Fusarium sp.* to some fungicides

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Fungal diseases affect multiple hosts such as fruits, vegetables and cereals. These diseases include fusarium head blight, a common disease in cereal plants. It affects yields but also the health quality of the crop and economic losses arising are often very heavy. Chemical control is currently one of the most effective ways to fight against these diseases. In this study, the efficacy of three fungicides (tebuconazole, thiram and fludioxonil - difenoconazole mixture) was tested, *In vitro,* on the plant pathogen *Fusarium sp*. isolated from seeds of wheat. The active ingredients were tested at different concentrations: 0.06, 1.39, 2.79, 5.58 and 11.16mg/l for tebuconazole, 0.035, 0.052, 0.105, 0.21 and 0.42mg/l for thiram and finally, for the mixture fludioxonil- difenoconazole 4 concentrations were tested: 0.05, 0.1, 0.5 and 1mg/l. In our study we demonstrated an efficiency of fludioxonil - tebuconazole mixture whose percentage inhibition varies between 15.52% and 79.41%. For thiram, the percent inhibition at the concentration 0.42mg/l is 81.05% of and for tebuconazole it is of the order of 79.76% at the concentration 11.16mg/l.

Changes in the expression of superoxide dismutase during ontogenesis of female solitary bee – red mason bee (*Osmia rufa*) - preliminary study

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The decrease in a number of pollinating insects is observed all over the world, as is mainly connected to honeybee decline. It should be, however, remembered that the number of other wild pollinators is also decreasing. Protection of insect pollinators is currently an important challenge. An effective antioxidative system determines the state of health of an organism and its sensitivity to environmental stress factors. So we decided to investigate one of the most important element of antioxidant system red mason bees (*Osmia rufa*) – superoxide dismutase (SOD) by determination enzyme activity and its genes expression during ontogenesis of *O. rufa* female. The activity of SOD was measured using a SOD assay kit (Sigma). In the present research we decided to mark determine the expression genes of cytoplasmic Cu/ZnSod and mitochondrial MnSod by real-time PCR method. The activity of SOD was lower in pupae than in larvae, and it remained at a similar level until the imago emerged from cocoons. The highest activity was found in active insects. Following this study observed the presence of both Sod genes in each state of development. High level of transcripts was in larval stage, and then expression declined. An exception was Sod2 gene expression in pupa with dark body and imago in diapause stage. Surprisingly there was a low expression of Sod2 in active bee, as MnSod plays important role as an antioxidant in mitochondria during fly. It was demonstrated that every stage of development *O. rufa* has specific SOD expression profile. The studies on gene expression and SOD activity are important to the recognition of the ability of *O. rufa* to neutralize free radicals.

Benelux “mountains”: summit traps for cold-stenotherm species inhabiting headwater streams in a climate change context

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Headwaters account for a high proportion of total freshwater stream-channel length in a drainage basin and are critical habitats for rare, endangered, and specialized species. In the context of climate warming, increasing water temperatures may be an ultimate threat to cold-adapted species even in temperate ecosystems. Climate change effects on streams may interact with other pressures such as pollution or habitat fragmentation, confounding their real impact on biological communities. Three headwater streams exposed to contrasted shading and land use conditions were sampled over a three-year period in spring and autumn (2010-2012). Five stations distributed along the longitudinal continuum were chosen in the upstream part of each stream. In addition to benthic invertebrate sampling, water temperature was recorded continuously using data loggers. Results showed that the riparian woodland associated with forested land use throughout the catchment clearly moderated winter temperature minima, summer temperature maxima and thermal variability compared to open river channels with narrow or absent riparian tree cover. Although, the variability in macroinvertebrate species distribution was mainly attributed to anthropogenic land use in the catchment, a significant part of the variability was explained by temperature descriptors such as the number of cumulative degree-days in summer and extremes in winter temperature. Trichoptera species preferring headwaters and cold water temperatures were found exclusively in the forested unimpacted stream. Conservation issues for low mountainous areas are discussed in relation to the predicted loss of the potential future distributions of these Trichoptera cold-adapted species.

Taxonomic Sufficiency for soft-bottom macrobenthos long term study - A case study

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Nowadays, the knowledge of the marine ecological quality status of an environment is essential and soft-bottom macrobenthos is one of the indicators used. Studies of soft-bottom macrobenthos are time consuming and need expertise for organisms' identification. Simplifications of these studies are tried and Taxonomic Sufficiency (TS) proposed by [1] is one of research axes. For example, some studies highlight that family level identification could be sufficient to identify perturbed area [e.g. 2, 3, 4]. Nevertheless, identification at species level could be recommended to have more precise information about the existing situation [5] or to complete information from others levels [6]. In Corsican waters where human impacts are less important than in main land waters, we present TS based on STARESO research studies between 2006 and 2012. This work is within the frameworks of the STARE-CAPMED program dedicated to STAtion of Reference and rEsearch on Change of local and global Anthropogenic Pressures on Mediterranean Ecosystem Drifts. After Permanova analysis and Canonical analysis of principal coordinates, eight habitat types have been identified along Corsican coastal water. Their own reference conditions and ecological class boundaries have been evaluated. Those reference conditions and ecological status have been identified for species, genus and family level. A highly significant correlation of calculated values between species and genus levels (R^2=0.93) has been determined and a significant correlation between species and family level (R^2=0.75). Genus and family levels have a significant Spearman correlation with species level ($p<0.05$). An application of these reference conditions on the macrobenthos assemblages sampling on 14 stations in spring 2011 and late summer 2012 in Calvi Bay highlights areas with high, good or moderate ecological status. In conclusion, family level is sufficient to follow spatial and/or temporal ecological status. This study was funding by Agence de l'Eau Rhône Méditerranée Corse and by Collectivité Territoriale de Corse.

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A functional approach to the dewlap in *Anolis sagrei*

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The dewlap of *Anolis* lizards, an extendable flap of skin attached to their throat, presents a classic example of a highly variable and complex signalling device. Even though the dewlap has been suggested to play a role in male-male competition, female mate choice, species recognition and/or predator defense, the exact function and evolutionary flexibility of this structure remain poorly understood. Our study incorporates a functional approach to the anoline dewlap, using *Anolis sagrei* as model species. Specifically, we examined whether certain dewlap components (i.e. size, colour and pattern) have a specific signalling function and if this implies certain costs or benefits. Therefore, a suite of physiological (body condition, immune response, hematocrit), behavioural (predator interactions, male-male and male-female interactions, female mate choice) and performance traits (bite force, clinging capacity, sprinting speed, jumping capacity) were obtained from the same individuals under fully-controlled laboratory conditions, and linked to the individual dewlap components. We focused on both sexes of *Anolis sagrei*, as selective pressures on signalling traits often differ between sexes and previous studies on anoles are strongly biased towards the male dewlap only.

Functional analysis of macrobenthos diversity through their biological traits

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The preservation of the health and biodiversity of benthic ecosystems is a crucial priority in order to achieve the Good Environmental Status (GES) of aquatic systems. The definition of management strategies that would preserve GES in a changing environment require tools able to predict the modifications of environmental conditions and to link these modifications to the status of the benthic system. Coupled biogeochemical-circulation models provide a large amount of information on physical (e.g. currents, salinity, temperature, shear stress) and biochemical conditions (e.g. oxygen, inorganic nutrients, sinking detritus) but cannot provide information on species richness.

The organisms of the macrobenthos, the benthic living communities taller than 1mm, are often considered as bioindicators of environmental changes and play a key-role in the structure and functioning of sedimentary ecosystems. However, their role is generally ignored in coupled benthic- pelagic models and this seriously limits the appreciation of the ecological value of benthic biodiversity. The general aims of my PhD are to assess the effect of environmental conditions on the composition of the macrobenthos and to estimate the role played by the macrobenthos in aquatic ecosystem functioning. Since the ecological functions sustained by a given species are determined by its behavioral, biological and ecological traits, a functional description of the benthos is chosen and a Biological Traits Analysis performed. The methodology proposed combines field data collection, analysis of historical databases, mechanistic and statistical modelling and will be applied to two sites (Black Sea, Scheldt). This approach allows appraising how local conditions determine the functional and taxonomical diversity and provides a mean to evaluate the impact of habitat alteration on the ecological role of benthic assemblages.

Impact of invasive alien species on the foraging behaviour of *Bombus terrestris* (L.) (Hymenoptera, Apidae)

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Being plant-eating pollinating insects, bumblebees collect exclusively pollen and nectar, which respectively constitute their main protein and energetic source. During their floral visits, workers insure the pollen grains' transfer from one flower to another, thus contributing to the reproductive success and sustainability of wild and cultivated flowering plants. However, the interactional balance has been threatened for several decades, due to a biodiversity crisis in the animal and vegetal kingdom. Like the other Apoidea, bumblebees do not escape this tendency and suffer from a worldwide decline of their populations. Several causes are pointed out and most of them are related to the human activity. Among these, invasive alien species potentially constitute a decline factor for some bumblebee species. Indeed, alien plants compete with native plants in numerous biotopes for biotic (i.e. pollination) or abiotic resources (i.e. nutrients, light, space, water). Furthermore, some invasive plants could display attractive floral resources but less suitable for bumblebees. This study aims at measuring the impact of invasive alien exploitation on the behaviour and the diet quality of the polylectic bumblebee *Bombus terrestris*. For this purpose, a comparison between alien (i.e. *Impatiens glandulifera* and *Buddleja davidii*) and native (i.e. *Trifolium pratense*, *Lythrum salicaria* and *Calluna vulgaris*) plants has been made through ethological (i.e. visiting rate, foraging time, foraging efficacy) and nutritional (i.e. nutritional inputs) measures. As a result, the starting premise related to the resources quality of invasive alien species has been nuanced. This study shows indeed that plant species like *I. glandulifera* and *B. davidii* could represent good host-plants for generalist pollinators like the buff-tailed bumblebee. As for native plants, the results confirm the first-rate character of *T. pretense* for *B. terrestris* while *C. vulgaris* and *L. salicaria* are less suitable.

Analyse of fish and macroinvertebrates traits after restoration works on the Petit Bocq river

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In the context of Walphy, a Life European project, it was decided to restore the longitudinal and transversal connectivities of two catchments from the Bocq and Eau Blanche rivers. We will discuss the effect of a restoration action undertaken on the Petit Bocq river, where a new river section and a rock ramp were built to bypass a weir of 3.3 m high. The ecological status of that river was assessed in a precedent study. So we are able to compare pre and post restoration status. Like the European Water Framework Directive advised we followed physical, biological and chemical quality components of the Petit Bocq. The physical aspects of the stream were assessed by TELEOS index, the mapping of the macrohabitats and by the survey of the clogging of spawning substrates. Thanks to these physical surveys we monitored the availability and the quality of the habitats for fish and macroinvertebrates. The functionality of the ecosystem was assessed by the scope of the traits of fish and invertebrates communities. The physical and chemical variables were followed by diverse parameters such as oxygen, conductivity, DOC, total nitrogen and phosphorus. The monitoring of the physical and chemical variables was done to observe the limiting parameters for the targeted organisms. Some encouraging results are, at first, the appearance of more sensitive species like *Ephemera, Rhitrogena, Dugesia, Goera pilosa, Nemoura* and *Sialis* after the restoration and secondly the mount in the number of lamprey (*Lampetra planeris*) a Natura 2000 species. All these surveys were done in the first year after the restoration and this allow us to understand if the restoration actions were beneficial to the Petit Bocq river ecosystem. We can say by the first results that the ecosystem is following a good trend.

Sampling scheme optimization for microsatellite-based population genetic studies

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Genetic studies are more and more used in conservation and landscape ecology contexts. While the costs and time involved in sampling, laboratory work and analyses increase with the number of samples, the gain of accuracy of genetic estimates does not. Optimizing the sampling scheme is therefore important to ensure reliable estimation of genetic parameters at a minimum cost. We conducted a literature review in the Scopus database using "butterfl* AND microsatellit*" as keywords to investigate how sampling scheme of microsatellite-based population genetic analyses was usually done, focusing on three main aspects of the sampled butterflies: their number, the sex ratio and the period of sampling. From the 86 papers returned, 42 matched the required context: genetic diversity estimation and differentiation between populations. The number of butterflies sampled per population varied tremendously, from 1 to 100 (mean ± STD: 22.46 ± 13.89). The sex ratio was explicitly mentioned in only 2 papers, both male biased. The period of sampling during the flight season was never mentioned; furthermore many studies pooled samples collected over several years (generally 2 consecutive years). We sampled *Boloria aquilonaris*, a bog-dwelling butterfly, in Belgium (12 populations, 50 individuals) and used microsatellite markers to estimate genetic parameters (observed heterozygosity, within population heterozygote deficit, genetic differentiation between populations and number of migrants per generation). We then conducted sensitivity analyses on these measures via downsampling of the data. Results confirmed how the sample size affects the estimate of genetic measures, already shown by previous studies; but, more importantly, they indicated that the sex ratio and the period of sampling can profoundly affect them too, potentially leading to different conclusions and consequently impacting conservation measures issued from these genetic studies.

Effect of temperature shift between tributary and Meuse on smoltification of early and late migrants of two allochtonous salmon (*Salmo salar* L.) strains

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Smoltification insures high survival rates at sea entry for migrating salmon juveniles. Some environmental factors controlling that process have been documented but less is reported on the impact of genetic pool or its interaction with environmental conditions. As smoltification is population specific, strain characteristics are of high importance for restocking programs, especially in rivers where fish populations already became extinct like in the river Meuse (Belgium). The present study aimed to compare Loire-Allier (France) and Cong (Ireland) strains under simulated Belgian conditions. Field data shows a 5°C shift in temperature between tributaries and the river Meuse. We therefor simulated the complete downstream route ending with salinity tests mimicking sea-arrival. Hormonal, osmotic and enzymatic indicators were used to monitor the response of the two allochtonous strains. According to hypo-osmoregulatory capacities, smoltification timing varies between the strains but no influence of temperature was noticed. This leads us to presume a greater influence of genetic pool than environmental conditions on the smoltification process. Results are then being compared to field-monitoring of downstream migration. Implications for maximising yield of restocking efforts will thereafter be discussed.

The “Centre de surveillance de Biodiversité” (Biodiversity Monitoring Center), a great opportunity to collaborate with researchers from the University of Kisangani (Democratic Republic of the Congo)

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Created in 2011 at the initiative of the “Consortium Congo 2010", the Center for Monitoring Biodiversity (CBS / UNIKIS) was inaugurated June 14, 2014 in presence of Congolese, Belgian and UNESCO Representative officials in DRC. The building of the CSB (2,300 m²), well equipped, includes offices, collection rooms, laboratories, a conference room, a physical and digital library, an internal telephone network, a permanent connection to the Internet and to Intranet. The CSB, accessible to Congolese and foreign researchers, has good logistics for both work in Kisangani and in the field. The Center has 12 part-time academic staff, 31 scientists and 12 administrative personal. The CSB has an international vocation and is called to collaborate worldwide with research institutions. It is actively involved in several research projects and scientific missions with foreign scientists and institutions since 2011. CSB wishes to take advantage of relationships initiated at an international conference in June 2014 at the University of Kisangani to increase its scientific relations and become visible internationally. Thus, the Center is considering the possibility of opening new sectors related to your specialties in order to participate in the training of its young researchers in your areas of experience, including training courses and further specialized training.

Evolutionary history of the wood mouse (*Apodemus sylvaticus*) in the Palaearctic region, with emphasis on the colonization of the Orkney Islands and Iceland

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To improve our knowledge concerning the hypothesis of northern refugia during the last glaciation for European species, we have focused our study on the evolutionary history of the wood mouse (*Apodemus sylvaticus*) throughout its Palearctic distribution. In addition, we also studied the wood mice populations from Orkney Islands and Iceland in order to understand their ways of colonization in the Atlantic islands. We used different molecular markers (cytb mitochondrial gene and a mitochondrial pseudogene). A geometric morphometric analysis using a morphological marker (mandible) was also used. This work highlights the potential existence of new wood mice lineages in Western Europe. These would be genetically differentiated, probably due to a geographical separation of an ancestral population in different refugia situated in the Iberian Peninsula during the last glacial maximum. Morphological differences also exist between the wood mice lineages. However, the study did not bring any evidence concerning the existence of Nordic refugia for this species. Concerning the insular populations, our results seem to show that populations from Orkney Islands and Iceland are genetically close to the Great Britain populations. They would have been introduced in these islands by Vikings or by earlier human populations. Additional sampling in Western Europe and in the Atlantic islands will clarify the origins of these populations.

Mesozooplankton diversity and Biomass in an upwelling system (Cape Blanc 21°N – Cape Boujdor 26°30'N)

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This study forms part of CCLME program (Canary Current Large Marine Ecosystem) financed by the Global Environment Facility (GEF) in collaboration with INRH of Casablanca (Institut National de Recherche Halieutique). Two surveys were carried out in this area, one in November 2011 and another in July 2012 abroad the Norwegian ship 'Fridjof Nansen'. During cruises, mesozooplankon where collected over 7 transects, from one to five levels along the water column (0 - 200 m). Some environmental parameters were measured in situ using a multiprobe CTD: chlorophyll 'a', temperature, salinity and dissolved oxygen. Counting and identification of mesozooplankton were made under a binocular. This area is well known by a permanent upwelling activity and submitted to the met of both Atlantic Central Waters (NACW and SACW) [1, 2]) which make it the most productive zone of Moroccan shore [3, 4]. Copepods constituted more than 90% in all stations and cosmopolitan species were dominant as *Oncea venusta* and *Acartia clausi*. Vertical profiles of hydrological parameters have shown a cooler temperature and high chlorophyll 'a' concentrations in shallower stations. Copepods diversity is decreasing from Cape Blanc to Cape Boujdour and seems to be higher during summer, mesozooplankton's biomass as well.

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Biomarkers as a tool to evaluate the environmental state of the Moroccan Mediterranean coast

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This study was carried out on the Moroccan Mediterranean coast using wild mussels (*Mytilus galloprovincialis*) as a biological model, sampled from areas characterized by high levels of urban and industrial contamination. The biological response of the mussels was evaluated by the use of a battery of biomarker: general stress biomarker (evaluation of lysosomal membrane stability: the neutral red retention rate (NRRR) method), a genotoxic effects biomarker (determination of micronuclei (MN) frequency), stress oxidant biomarker (MDA) and a neurotoxic effects biomarker (determination of the acetylcholinesterase (AChE) concentration). Compared to the control site, the organisms originating from the studied sites were submitted to a high level of stress principally at harbour sites. The results also showed a positive correlation between biomarkers. This study reflects the interest in such "in situ biomonitoring" assays and the utility of these biomarkers for assessing the effects of pollution in the Moroccan coastal marine environment.

Effects of urbanization on zooplankton community structure: a spatial and environmental analysis along an urbanization gradient in Flanders

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Ever since the existence of mankind, humans have put an enormous pressure on natural systems. Due to our increasing population numbers and higher standard of living, this impact is still growing. Recently, there is increasing interest in the direct and indirect impacts of urbanization on biodiversity and ecosystems, which might act both on a local and regional scale. The main aim of our study is to gain insights into the extent urbanization is impacting meta-community structure of zooplankton, and disentangle at what scale urbanization is driving meta-community processes. We conducted a large field survey of 81 ponds, during summer 2013, across urbanization gradients in Flanders. In addition to physico-chemical variables, the entire food web was characterized and morphometric characteristics of the pond as well as regional variables (number of ponds within 500m, land use in direct vicinity of pond) were quantified. Thanks to the use of a stratified hierarchical design, we were able to differentiate between local and regional effects of urbanization. Based on a GIS analysis of the percentage of built-up area, we defined an urbanizational gradient at both a regional (consisting of 3 by 3 kilometres plots) and local scale (comprising of 200 by 200 meters subplots). This translates into 3 specific urbanization classes (high, medium and low) at each scale. For each class we selected 9 plots at the regional scale (i.e. 27 plots in total), and within each plot 3 ponds were chosen based on the different urbanization classes at subplot level. A first exploratory data analysis was conducted on the resulting dataset, focusing on structure within the environmental data and the relationship between taxon composition of the cladoceran community and both environmental and spatial drivers.

Evaluation of two capture methods in the assessment of species richness of eusocial bees in Gabon

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The eusocial bees, Apini and Meliponini, contribute to the pollination of numerous flowering plants. If honeybees are found in different habitats worldwide, stingless bees occupy tropical and subtropical America, Africa and Asia regions. In Africa, habitat loss constitutes one of the main threats to these bees. The need to assess the impact of human activities or other events which could modify the eusocial bee's habitat is proved true. An evaluation of two methods of capture of eusocial bees was conducted in three localities (Kougouleu, Massengalini and Lékokodiba) in Gabon from October 2013 to March 2014. Kougouleu was the object of deforestation for food crops, the other localities have somewhat degraded forest habitat. A capture with yellow trap filled with a mixture of water and honey and using a handheld vacuum were carried out simultaneously in twenty sites in each locality. *Apis mellifera adansonii, Dactylurina staudingeri, Hypotrigona gribodoi Meliponula bocandei, Meliponula nebulata, Meliponula erythra, Meliponula ferruginea, Meliponula togensis, Meliponula becarii, Meliponula cameroonensis* and *Meliponula lendliana* were captured. Massengalini and Lékokodiba had the greatest species richness with 8 and 11 species caught respectively, compared with Kougouleu with 5 species. *M. erythra, M. ferruginea* and *M. togensis* were captured in Massengalini and Lékokodiba, while *M. becarii, M. cameroonensis* and *M. lendliana* were captured in Lékokodiba. These differences are explained by the fact that forest habitat is most appropriate for Meliponini. The hand vacuum allowed to capture all 11 species, while yellow trap allowed to capture *A. mellifera adansonii*, *H. gribodoi, M. nebulata* and *M. togoensis*. A permutational Anova shows that there is a highly significant difference in richness species according to localities and method of capture. Yellow trap is not the most appropriate tool to determine the species richness of eusocial bees, especially Meliponini in Gabon.

A pheromone-based formulation against phytophagous pests

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Innovative integrated pest management methods are needed to overcome market withdrawal of synthetic pesticides. Therefore, the identification of environment-friendly bio-products carrying direct or indirect biocide activity is one promising alternative option. Our researches focus on the identification of appropriate formulations releasing volatile organic compounds that are attractive for natural enemies of insect pests. However, the elaboration of slow-release devices that ensure stable and controlled release of active volatile compounds is quite challenging. Here, we developed a formulation based on E-β-farnesene and (–)-β-caryophyllene, these two semiochemicals having strong attractive potential on aphid natural enemies including ladybeetles and hoverflies. Both compounds were encapsulated together in alginate gel beads. The blend efficiency is currently being evaluated through laboratory and field assays.

First evidence of a volatile sex pheromone in *Harmonia axyridis* (Pallas) (Coleoptera: Coccinellidae)

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Data about sex pheromones, or any semiochemicals that play a role in Coccinellid mating, remain limited. Since years, various studies and behavioural observations have hypothesized that such molecules are involved in sexual communication of ladybeetles. In this study, we collected volatile organic compounds released by virgin females of the multicolored Asian ladybeetle, *Harmonia axyridis* (Pallas), which were either allowed or not allowed to feed on aphids. In the presence of aphids, virgin females exhibited "calling behaviour", which has been associated with the emission of a sex pheromone in several Coleoptera species. Bioassays showed that these females released a blend of volatile compounds that is involved in the attraction of males. Gas Chromatography-Mass Spectrometry analyses highlighted specific volatile cues emanating from females, whereas males did not produce these compounds. Five components were identified: (–)-β-caryophyllene, β-elemene, methyl-eugenol, α-humulene, and α-bulnesene. All compounds were produced after virgin females were fed aphids, and their quantity increased across the experimental period. The results confirm that female *H. axyridis* produce a volatile sex pheromone. Therefore, this study provides important biological information that could promote the development of efficient pest-control management methods to manipulate the movements of this invasive ladybeetle, and to reduce its negative impacts on biodiversity.

Wildlife acoustic indicators and a soundscape study in Chevetogne, Belgium

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By detecting the presence or absence of vocal species, the study of soundscapes unveils information about ecosystems. The present work is an analysis of sound records collected at the beginning of July 2014 in the rural, publicly owned nature park of Chevetogne, Belgium. A continuous 24-hour window is focused on. The primary microphone is set up in fields adjacent to the edge of a small wood. Colour-composite images (spectrograms) are built from broad acoustic indicators, either mainstream or specific to wildlife. This allows grasping all sound events in the timeframe at a glance. New indicators are proposed that aim to highlight the vocal activity of all twelve bird species identified in selected representative sound samples. The elaborate songs of passerines (e.g. *Turdus merula*, *Alauda avensis*) respond well to Acoustic Complexity Index (ACI) calculations. This is not the case for mammal sounds (e.g. cows) and plainer bird calls (e.g. *Gallus gallus domesticus*, *Streptopelia turtur*). The latter are better put forward using a modified spectral entropy indicator (Hs). Both ACI and entropy measures tame the dominant anthropogenic noises (e.g. cars) which might otherwise mask wildlife sounds on such a 24-hour scale. Finally, sound samples are made available for animal sound archives and further exploitation in species identification algorithms.

Adaptation to a changing world: How wild bees cope with climate change

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The current climate change affects living systems, especially by inducing shifts in species phenology (the time of the year at which a seasonal activity is performed). First fragmented available results strongly suggest that the phenology of wild bees (Hymenoptera : Apoidea) is changing. However, this is still poorly understood since few researches have focused on this phenomenon. According to the key role of wild bees in ecosystem service, the understanding of their phenology changes is thus a biological conservation priority.

In this project, starting in January 2015, we will perform the first comprehensive study of the apoïds (i.e. wild bees) phenological shifts in Europe since the 19th Century. Our main goal is to determine if the phenology shifts are triggered by the meteorological parameters and/or species life history traits by comparative statistical and modelling analyses. In this study, we will also investigate the interpopulational and intergenerational adaptations to climate change in a model species (*Bombus terrestris*) through comparative bioassays. These bioassays will focus on the effect of temperature on diapause termination in this species. It will bring more understanding on how this model species adapts to the changes in climate through adaptation and phenotypic plasticity.

This research is innovative as it focuses on a topic of great ecological importance but still very scarcely studied. Thus, this work will be pioneering and it will bring to light results with significant applications in conservation ecology as well as for the study of ecosystem services and climate change.

Living on the edge: settlement patterns by the barnacle *Xenobalanus globicipitis* on striped dolphins (*Stenella coeruleoalba*)

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Xenobalanus globicipitis is a highly specialized coronulid barnacle that exclusively attaches on cetaceans worldwide, but little is known about the factors that drive patterns of microhabitat selection on hosts. We investigate this issue based on data on occurrence, abundance, distribution, orientation and size of *X. globicipitis* collected from 242 striped dolphins, *Stenella coeruleoalba*, that were stranded along the Mediterranean coast of Spain. Barnacles were found exclusively on the fins, particularly along the trailing edge. Occurrence, abundance, and density of *X. globicipitis* were significantly higher, and barnacles were significantly larger, on the caudal fin than on the flippers and dorsal fin. Barnacles were found more frequently, and in greater numbers, on the dorsal vs. ventral side of the caudal fin, and on the central third on the flukes of both sides. Nearly all individuals examined were attached with the cirral fan oriented opposite to the fluke edge. We suggest that *X. globicipitis* may chemically recognize dolphins as a substratum, but fins, particularly the flukes, are passively selected due to vortex creation that increases contact with skin and early survival of larvae at these sites. Larvae could actively select the trailing edge, and be orientated so that the cirral fan faces the main direction of flow. Attachment on the dorsal side of the flukes is likely associated to assymetrical oscillation of caudal fin, and the main occurrence of the central segment of the flukes could be related to suitable water flow conditions, generated by flukes' performance, for both settlement and filtering function.

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A morphospace for the marine angelfishes (Pomacanthidae): patterns of diversity

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The Pomacanthidae (marine angelfishes) is an iconic reef fish family of about 88 species. They have a circum-global distribution on tropical to warm-temperate reefs. Marine angelfishes occupy a diverse range of trophic niches, ranging from spongivory and algivory to zooplanktivory. Previous morpho-functional analysis of this family mainly focused on the head region and gut morphology in a limited number of species. However a morphological study including a large sample of angelfish representatives is currently lacking. Here, I explore the diversity of body morphology in this reef fish group. I collected x-ray images of 228 museum specimens from 71 species and I used landmark-based geometric morphometrics to quantify the overall body shape variation within this family. In a test for interspecific allometry, the linear regression of shape variables onto size (LogTL; TL = total length) was significant ($P < 0.001$). However, the percentage of explained variance in this model (23%) showed no strong relation between size and body shape. Main shape variation across species was explored using a principal component analysis on shape variables. The two main axes (PC1 and PC2) explained 74% of the total variance of the dataset. *Pomacanthus* spp., which mainly feed on fixed invertebrates (sponges and tunicates), have deep body with high and angular cephalic profile (lowest values along PC1). Conversely, the zooplanktivorous *Genicanthus* spp., those have a more pelagic lifestyle, show a slender body with shorter anal fin (highest values along PC1). The pigmy angelfishes from the genus *Centropyge*, which group different diets (omnivory or algivory), show a more robust and rectangular body shape (high scores along PC2). This work provides the row data for future studies dealing with the mode of phenotypic diversification of Pomacanthidae during evolution.

Ecological diversity of damselfishes (Pomacentridae) at Moorea Island (French Polynesia)

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The Pomacentridae (damselfishes) represents the 3rd most species-rich coral reef fish family, including 394 species spread worldwide. Recent studies suggested that damselfishes iteratively evolve along three main trophic guilds: “the pelagic feeders” feeding mainly on zooplankton, “the benthic feeders” grazing filamentous algae or biting coral polyps, and an “intermediate” group with species feeding on zooplankton, small benthic invertebrates and algae in variable proportions. Comparing the ecological diversity of damselfish communities among various geographical regions could assess such an iterative radiation. Within this context, the present study is a first attempt exploring the trophic diversity of damselfish community at Moorea Island (French Polynesia). The relationship between the trophic guilds, their habitat diversity and their behaviour is evaluated. Habitat and behaviour of 19 damselfish species were described during transects along which different kinds of data were collected. For examples, the location within the reef (e.g. fringing or barrier reef), the depth, the substrate over which fishes are living or the solitary/gregarious habits were recorded. Diet of individuals was investigated by means of stomach content and stable isotopes analyses. Correlations between the dietary preferences and ecological data (habitat and behaviour) are given and the ecological diversity among trophic groups is compared.

Assessing humpback whale (*Megaptera novaeangliae*) reactions to biopsy darting in the Machalilla National Park, Ecuador

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Biopsy darting has recently become a very popular research technique in cetacean research. It represents a cheap and effective non-lethal study approach for genetics, toxicology and ecological tracers. Most published studies report on the whales' reaction to biopsy sampling. The rate of reactions to darting has been shown to be quite low, even in the case of calves. We biopsy sampled 28 humpback whales (27 adults and 1 calf) in the waters around Isla de la Plata, Machalilla National Park, Ecuador, from August 29th to October 4th 2014. All whales were monitored for reactions to both the vessel's approach and to the biopsies themselves, through videos, photographs and data. Data recorded included reaction/no reaction, and in case of reaction: reaction to the vessel, versus reaction to the biopsy. The type of reaction was categorised in 3 classes: minor reaction, change in behaviour, and major reaction. In total, only 4 whales (14.28%) showed a reaction to the biopsy procedure, of which 1 whale (3.57%) reacted to the vessel's approach. Of the reactions to the biopsies, 2 (7.14%) were minor reactions (including the calf), and 1 (3.57%) was a major reaction (peduncle throw). No short- or long-term changes in behaviour were observed. These results are similar to the ones described in the literature, differing only in that most reactions in the literature seem to be due to the vessels' approach, whereas in our study most whales reacted to the biopsy sampling itself. The absence of change in behaviour may be due to the fact that most whales were involved in surface active groups. This study shows that humpback whales sampled in Ecuador during our study showed little reaction to biopsy sampling, and showed no short- or long-term change of behaviour.

Impacts on nectar robbing of a toxic species, *Aconitum napellus* subsp. *lusitanicum*, in bumble bees' behaviour (*Bombus terrestris*)

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Among the main challenges for the future of ecosystem functioning worldwide, the maintenance of pollination networks is crucial. Bees (Apidae, Hymenoptera) are among the more important pollinators in temperate zones in the Northern Hemisphere. Bees present several adaptations to optimize pollen and nectar collection, even in case of plant defenses. One of the efficient plant defenses to limit pollen predation concerns toxicity. Pollen toxicity increases larval mortality in Apidae. One adaptation for the insects could be to focus on nectar collection avoiding toxic pollen collection. We study whether Apidae individuals can learn or prefer nectar collection on toxic plants. We focus on *Aconitum napellus* subsp. *lusitanicum*, a bee pollinated species. This species is highly toxic, due to alkaloids present in the plant (roots, leaves etc.), even in the pollen. Nevertheless, the nectar, the only one nontoxic part of the plant, is abundantly robbed. 3D flowers have be printed and will be used for binary choice tests with one bumble bee species (*Bombus terrestris*) under controlled conditions in flight chamber. These choices include different proportions of aconitin in nectar and pollen, quantity of available nectar (robbing), different floral morphologies (pierced corolla or not, colour). In addition, we study the necessary signals (sight, smell and touch) in learning nectar robbing on naive bumblebees in presence of the trained individuals during the same binary choices with 3D flowers.

Genetic structure of nase, *Chondrostoma nasus*, and common barbel, *Barbus barbus* (Teleostei, Cyprinidae) populations in South Belgium rivers: toward a rational management of conservation restocking

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Nase (*Chondrostoma nasus*) and common barbel (*Barbus barbus*) are two rheophilic cyprinid fish naturally present in the Belgian Meuse and Rhine basins. During the last decades, the construction of dams together with changes in hydrological regimes, modifications of riverbed morphology and water pollution have caused some local dramatic declines in their populations. However, recent improvements in terms of water quality and habitat fragmentation allow considering as realistic a rational restocking plan of locally endangered patrimonial fish species such as nase and common barbel. Restocking operations for a conservation purpose have to be based on the knowledge and the use of wild type genetic strains. Therefore, the aim of this study was to characterize the genetic structure and diversity of nase and common barbel populations in South Belgium rivers. Wild common barbels (n = 313) and nases (n = 271) were sampled by electrofishing in respectively 10 and 6 different tributaries from the Meuse and Rhine rivers. Genotyping was performed on 24 microsatellite markers for each species. Preliminary results showed, for both species, a differential genetic clustering between fish originating from the Meuse basin and those originating from the Rhine basin. Detailed analysis describing the genetic structure and diversity of South Belgium populations will be presented and will serve as a management tool to set up a breeding plan for conservation restocking.

Ecology and biogeography of the endemic scorpion species *Euscorpius carpathicus* (Scorpiones: Euscorpiidae): a multiscale analysis

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This is a first analysis of the ecology and potential distribution of *Euscorpius carpathicus* (Linnaeus), a scorpion species endemic to southern Romania, and the report on the overwintering habitat selection of a species of *Euscorpius*. Using field data, literature review, species distribution modelling, and habitat selection models, we document the distribution and ecology of *E. carpathicus,* as well as habitat selection in the foothills of the Curvature Carpathians involving microhabitat selection of riverine clay banks exclusively. Contrarily to other species of the genus that inhabit cracks in cliffs or walls, the Carpathian Scorpion adapted to cracks in clay. The potential threats on the Carpathian Scorpion due to clay exploitation, as well as by the non-native species, Italian Scorpion are also discussed.

Evaluation of the relationship between the ecology and the morphology of the vertebral column and the fins of different cetaceans: A preliminary study

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Ecomorphology is the study of the relationships between functional design and the environment. One of its aims is to understand how the environmental factors can constraint the performance of an organism or act on its phenotype. Different studies have already showed in different cetaceans that the number and shape of vertebrae can reflect the stiffness of the body and consequently can impact their swimming mode. The aim of this preliminary study is to establish relationships between characteristics of the vertebral column of different cetaceans and their ecology. To this purpose, we have studied meristic and morphometric data on the vertebrae (centrum length, height and width, neural and haemal spine height and the transverse process length) of different species of mysticetes and odontocetes coming from the Aquarium-Museum of Liege and the Royal Institute of Natural Sciences of Brussels. The aspect ratio of the pectoral and caudal fins of these species have also been studied. Preliminary results showed the distinction of three morphotypes: firstly, the active, cruising, fast swimmers with rigid body, secondly, the maneuverers, slow swimmers with flexible body and thirdly, the steady swimmers.

Evidence of a fine-scale genetic structure for the endangered Pyrenean desman (*Galemys pyrenaicus*) in the French Pyrénées

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The Pyrenean desman (*Galemys pyrenaicus*) is a small semi-aquatic mammal endemic to the Pyrenean Mountains and the northern half of the Iberian Peninsula where it lives in mountain streams of cold and well-oxygenated flowing waters [1]. This species is currently considered as vulnerable in the IUCN Red List [2] and has been suffering from habitat loss and fragmentation for decades, inevitably impacting its distribution. The ecology and biology of this species are poorly known, notably because of its elusive behavior and its primarily nocturnal activity [3, 4]. Its distribution area is even not definitively established. Furthermore, a recent genetic study, based on mitochondrial and intronic sequences [5] showed that the genetic variability of the Pyrenean desman is very low in the Pyrenees. In this study we investigated the potential existence of a genetic structure and gene flow at a smaller scale using 24 polymorphic microsatellites loci. As the Pyrenean desman is a very elusive species, we completed our sample collection of tissues with faeces samples coming from the French distribution area of this species. Doing so, we successfully identify 70 individuals out of 355 faeces samples. Bayesian analyses revealed a cryptic genetic structure in our data set. Three clusters were evidenced (one western, one central and one eastern) and gene flow appears to be limited between these clusters (min. Fst value of 0.2).

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BDE-47 effects on the proteome of *Gammarus pulex* males and females: a gel-free proteomic approach

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In the pollutant effects assessment, only few studies have taken into account effects on both male and female organisms, whereas it is well known that gender represents a confounding factor. Investigations in both genders could lead to better evaluate the xenobiotic effects on the population, and thus to better understand ecosystem disturbances. Here, we have investigated protein expression variations in the freshwater amphipod *Gammarus pulex* males and females in unstressed condition and under polybromodiphenyl ethers (PBDE) pressure, emerging pollutants whose effects on invertebrate are very few studied. Protein expression patterns were evaluated by using a gel-free proteomic analysis, the LC-ESI-MS/MS^{E} (Liquid Chromatography–electrospray tandem mass spectrometry, 2D nano Acquity-Synapt G2 HDMS, Waters). Gammarids were exposed for 96h to BDE-47 at 0.1 µg.L^{-1}, and proteomic analyses were carried out on caeca. Proteomic analyses have led to identify 33 unambiguous proteins involved in several biological functions such as chaperone proteins, cell signal or transcription/translation, and revealed gender differences in protein expressions. Indeed, in control condition, all proteins were higher expressed in females as compared to males. Under stress conditions, the 33 proteins were under-expressed in exposed males as compared to controls one, whereas protein expression deregulation was more varied (up- and down-expressed) in exposed females as compared to control females. Results have also highlighted the expression of the α-2HS-glycoprotein only in exposed gammarids. The biological role of the α-2HS-glycoprotein in gammarids was not yet studied, but it could be interesting to investigate this protein, to better understand its involvement in stress response after a BDE-47 exposure. The present study has highlighted gender-biased protein expression patterns in *Gammarus pulex* exposed to BDE-47, suggesting different impacts at long term in males and females. Further studies with both genders appear necessary to evaluate xenobiotic effects at individual level, and crucial to evaluate population consequences.

Functional diversity from bacterial communities along a urbanization gradient

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The intense expansion of urban areas associated with human population growth increases the pressure on natural communities and ecosystems, as well as on the fundamental ecological processes related with them (biogeochemical cycles, food webs). Urban areas have become an important subject for ecological studies determining how species, populations and communities respond to environmental changes. Among the organisms studied, the microbial community appears to exhibit differential responses to disturbance due to the low generation time, high adaptive potential and small body size of microorganisms. One alternative way to address the possible changes in the community, it is by functional processes related to the bacterial community. Here we studied the functional diversity of freshwater bacterioplankton communities in small ponds over a gradient of urbanization along Flanders region. We analysed 64 ponds in a hierarchically designed field survey using as functional traits, the metabolic consumption of bacterial communities in relation to 31 different types of carbon sources (EcologTM). All the plates were incubate for one week at 18°C in dark conditions and the optical density measured as response of catabolic response (>0.5). Using multivariate analysis (nMDS and PCA), our results indicated a higher level of specialization from the bacterial communities related to ponds located in less impacted areas. Further, the functional diversity calculated by Shannon index was lower also for ponds located in natural areas. This can be related to the fact that bacterial communities from impacted areas might catabolize different types of carbon to deal with more changes in the environment through time.

Genetic research at the CRC for the conservation of captive and wild populations

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Within the Centre for Research and Conservation (CRC), molecular genetic and statistical tools are used to study wild and captive populations, to increase conservation success.

Delineating (genetic) differences is of prime interest in conservation. Hence, samples from the wild and musea are analysed (microsatellites, sanger sequencing or NGS) to determine both the taxonomic position (e.g. military macaws, *Ara militaris*) or to understand recent population dynamics (e.g. effect of reintroductions in storks, *Ciconia ciconia*). In terms of captive breeding, most of this work centres around avoidance of hybridisation.

On a “lower” hierarchical level, individual subpopulations are subject of genetic surveys, which are often linked to one of our in-situ research projects. Genetic analysis on non-invasive stool samples of the Cross river gorilla (*Gorilla gorilla diehli*) for instance enable us to get insights in population sizes, social interactions and dispersal rate of this highly elusive and threatened subspecies. These estimates are essential in modeling (eg. probability of extinction) and the management of these wild populations. Within ex-situ breeding populations we study the role of inbreeding depression and how genes affect the expression of traits (e.g. life-history traits in Congo peafowl, *Afropavo congensis*) and whether genetic variability of these traits changes throughout time.

Within captive breeding genetic goal are set and evaluated based on pedigrees, which often include gaps and assume founders to be unrelated. Here (genetic) management of breeding programs can be supported by DNA analyses. As such, samples of eg. captive golden-headed lion tamarins (*Leontopithecus chrysomelas*) are currently analysed to resolve questions on founder relatedness and paternity, often by integrating the molecular data with the available pedigree data and samples from the wild. At the individual level, analyses on Major Histocompatibility Complex genes of Eurasian black vultures aim to optimize pair formation.

3D reconstruction of seahorse swimming: an automated image analysis approach

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Dedicated automated tracking and image analysis software becomes increasingly important in biomechanics research. Especially in swim maneuvers, 3D automatic kinematic analyses are hindered by low contrast, non-uniform lighting, occlusions and refraction. The present paper discusses an in-house developed 3D refraction correction algorithm and image analysis techniques, used to extract 3D body and fin kinematics of seahorses. Seahorses have a broad swimming envelope; from hovering and turning on the spot, to slow, stable swimming. Seahorses propel themselves with an integral propulsion system consisting of 2 pectoral fins, and 1 dorsal fin. We filmed swimming maneuvers of seahorses (*Hippocampus abdominalis*) with 7 synchronized high-speed video cameras to extract detailed 3D kinematics of both body movement, including neck bending and tail deformation, and 3D undulatory fin kinematics. Current kinematic and image analysis techniques used in underwater locomotion research (both laboratory and field research) suffer from experimental inflexibility, image distortion due to refraction, low contrast and manual, labour intensive analyses. We present a 3D refraction correction algorithm, enabling feature tracking from both orthogonally and stereovision placed cameras. In addition, we present a framework of image analysis operations enabling (semi-) automatic kinematic analysis and 3D reconstruction techniques of complex swimming maneuvers under deprived light conditions and occlusions of camera views. Finally, a complete body model reconstruction of a forward swimming seahorse is shown, based only on image data input and without additional anatomical data of the animal under consideration. The methodological and biological insights of this research help to advance automatic analysis of large data sets of swimming kinematics. This, in turn, broadens our understanding of the basic mechanic principles of aquatic underwater maneuvers and helps to generate ideas for the design of bio-inspired underwater robotics dealing with complex and dangerous environments.

Synchrotron radiated X-ray microtomography reveals detailed 3D musculoskeletal dorsal and pectoral fin musculature in seahorses

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Seahorses exhibit a broad swimming repertoire; from hovering and turning on the spot, to slow, stable swimming. They swim with just 2 pectoral fins and 1 dorsal fin, the movements of which can change in frequency, wave number and amplitude. To get insight into the control of these highly adaptive movements, the musculoskeletal architecture was studied. To preserve the general morphology, we used non-invasive synchrotron radiation absorption X-ray imaging, in combination with dedicated muscle staining. This approach revealed the musculoskeletal architecture of fin muscles for two developmental stages (new-born and sub-adult). Although X-ray imaging is regularly used in medical applications, its use for muscle visualization is still in its infancy, especially in fish. We used a combination of Fig/Bouin as fixation and PTA/IKI as muscle staining agents. The use of synchrotron X-ray radiation enabled us to scan muscle tissue volumes of 200 mm^3 in less than 2 minutes with micrometre accuracy. Our 3D reconstruction of the dorsal fin musculature in *Hippocampus abdominalis* shows that it is more complex than previously thought. Several small muscle slips were identified that control the movement of each fin ray. The 3D musculature of the pectoral fins shows a similar pattern with a large number of muscle-fibre bundles acting on each fin ray. This clearly indicates that the fins can be very accurately controlled during subtle swimming behaviours. This research is a first step towards an *in vivo* X-ray tomography muscle functioning experiment of a swimming seahorse. The methodological as well as biological insights of this research help to advance the visualization and understanding of muscle functioning in fish.

Measuring sexual selection in a simultaneous hermaphrodite

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Sexual selection is generally predicted to act more strongly on males than on females, essentially because anisogamy dictates different reproductive strategies. This fundamental difference in gamete size between the sexes also applies to simultaneous hermaphrodites, which have both sexual functions united in one body. Hence, the Darwin-Bateman paradigm predicts that hermaphrodites should also experience stronger sexual selection via the male function. However, measuring the strength of sexual selection is less straightforward in an animal that performs both sexual functions throughout its lifetime. What is more, quantifications of sexual selection are usually performed based on a short time window, while many animals store sperm and are long-lived.

To address this, we performed an experiment using the simultaneously hermaphroditic pond snail, *Lymnaea stagnalis*, in which mating success and reproductive success were recorded over time.

We show that multiple mating is beneficial for offspring development, but that the mating systems is polygynous. The latter is based on the finding that male Bateman gradients are significantly positive, i.e., higher male mating success results in higher male reproductive success. Interestingly, we also find that higher female mating success negatively affect the individual's male mating success, which is explained by the recently-reported negative effect of seminal fluid proteins on sperm transfer. Importantly, this effects becomes clearly visible after eight weeks, which highlights that the experimental time frame is crucial for the quantification and interpretation of sexual selection measures, an insight that clearly applies to any iteroparous mating system.

Compensatory responses to dietary protease inhibitors in the migratory locust, *Locusta migratoria*

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Plants are a major feeding source for most insects. In order to defend themselves against these herbivory attacks, plants have developed diverse defensive mechanisms. One important method of plant defense against herbivorous insects involves the production of protease inhibitors, which can inhibit the proteolytic digestion of the plant material in the insect's gut. But as a result of a co-evolution between plants and insects, most insects are able to respond to protease inhibitors in their diets by adaptation through a number of different mechanisms. This ecological interaction is particularly interesting for the development of new biopesticides. In this study, we analysed the compensatory responses to the dietary uptake of protease inhibitors in the gut of the migratory locust, *Locusta migratoria*. This notorious pest insect has a very robust protease inhibitor induced response and serves as a very appealing model organism for physiological studies in insects. Interestingly, it seems that *L. migratoria* copes with the presence of these anti metabolites by upregulating the expression of certain proteolytic enzymes in its gut. This results in an elevated proteolytic activity by which they can circumvent the inhibitory effects of protease inhibitors. The following step in this research will be the unravelling of the exact regulation of this observed response mechanism.

Effects of methoprene and 4-nonylphenol on survival and chitobiase activity of the freshwater amphipod *Gammarus pulex*

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Nowadays in ecotoxicology, an increasing interest is provided to the endocrine disruptive effects of organic micropollutants (e.g. pesticides, industrial chemicals) because they could have impacts at low concentrations (e.g. $ng.L^{-1}$). However, if effects of endocrine disruptors are well documented on aquatic vertebrates, little information is given on invertebrates, although they constitute an essential component of aquatic ecosystems, as for example amphipod gammarids, commonly used as biological models in ecotoxicology. In amphipods, reproduction is strongly related to molt process which is controlled by hormones (i.e. hydroecdysone). Chitobiase is a chitinolytic enzyme involved in the exoskeleton degradation in arthropods, and plays a crucial role in molting, growth of amphipods, and thus population reproduction. In endocrine disruption assessment, chitobiase activity in gammarids could be used as a biomarker of exposure. This work aimed to study the effects of 4-nonylphenol and methoprene, on the endocrine system of *Gammarus pulex* by measuring chitobiase activity according to gender, pollutant concentrations and time of exposure. In parallel, the acute toxicity of these two emerging pollutants on *G. pulex* was investigated, for both genders, by determining $LC_{50\text{-}96h}$. Result revealed that $LC_{50\text{-}96h}$ for 4-nonylphenol were $>1mg.L^{-1}$ and $0.791mg.L^{-1}$ in males and females respectively, and the $LC_{50\text{-}96h}$ for methoprene in males was $>1mg.L^{-1}$ (not determined in females). However, effects of 4-nonylphenol and methoprene were observed at lower concentrations (e.g. 50 $\mu g.L^{-1}$). Indeed, chitobiase activity had a tendency to be increased in both genders exposed to 4-nonylphenol, whereas methoprene exposure had only increased chitobiase activity in females. The present study revealed that although the $LC_{50\text{-}96h}$ of 4-nonylphenol and methoprene are high, endocrine disruptions could occur in *G. pulex* exposed to low concentrations of these two compounds, by disturbing molting process. Results suggest that, at long term, the *G. pulex* population could be affected, which will cause a dysfunction of ecosystem.

Linking the effects of triclosan on arrestin 3A in zebrafish larvae (*Danio rerio*) with phenotypic responses

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Triclosan (5-chloro-2-[2,4-dichloro-phenoxy] phenol; TCS) is a bactericide widely used in personal care products. It is found at low concentrations in aquatic environments with concentrations ranging from 0,01 µg/L to 8,5 µg/L. A former study has shown that after 7 days of exposure to TCS from 0dpf to 7dpf (50 and 100 µg/L), zebrafish (*Danio rerio*) larvae have different levels of protein expression. This proteomic study highlighted modified expressions of several proteins, including arrestin 3A ($p<0.5$). This protein plays an essential role in the process of phototransduction in zebrafish. The same study also demonstrated a significant increase of glutathione peroxidase (GPx) and a significant decrease of glutathione reductase (GR) activities ($p<0.5$). The aim of the present study was to investigate the consequences of the observed effects of TCS on arrestin 3A. We exposed zebrafish embryos to TCS following the procedure described above. Using western-blot, we investigated the different expressions levels of arr3A. Secondly, we analysed oxidized and reduced forms of glutathione (GSH/GSSG) in 7dpf zebrafish to test whether there is an unbalance between these two compounds after an exposure to TCS. In addition, two behavioural studies were carried out on day 7 larvae and analysed with Ethovision® XT 10 software in collaboration with the University of Liège. We recorded 7dpf larvae 5 X 2min with and without light flash to quantify their mobility and to observe if there might have an alteration in phototransduction process. Altogether, this study templed to anchor the effects of a common pollutant on the expression of arrestin 3A to phenotypic consequences at the behavioural level.

Genetic structure of an European forest species, the edible dormouse (*Glis glis*): consequence of past anthropogenic forest fragmentation?

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The genetic structure of forest species may allow tracking the spatial dynamics of the forests themselves. Two scales are commonly discussed: changes in forest distribution during the Quaternary, due to glacial/interglacial cycles, and current fragmentation related to habitat destruction in modern days. Anthropogenic changes in forest distribution might have started much earlier, causing fragmentation at an intermediate time scale seldom considered. To explore the relative role of these processes, the genetic structure of a forest species with narrow ecological preferences, the edible dormouse (*Glis glis*), was investigated using microsatellites as markers of fine molecular differentiation on a set of samples covering a large part of the Palaearctic distribution area of the species. A strong and complex geographic structure suggests a four-fold process of differentiation: (1) an initial step of differentiation, probably from a single Italian refugium, at the beginning of the Holocene, around 9000 ago; (2) a second phase of differentiation among ancestral populations in the Balkan area, around 6500 years ago; (3) a third phase during the Neolithic period, further splitting the ancestral stock into peripheral isolates (around 5000-4000 years ago); (4) a late period of differentiation, in Medieval times. These phases clearly post-date the last glacial maximum, undermining a classical phylogeographic interpretation, and supporting instead the role of anthropogenic deforestation as a trigger of intra-specific differentiation. This is the first evidence of such an impact on a forest species, and it reveals long-standing pressures related to habitat fragmentation, potentially increasing risks of extinction by lowering genetic diversity in isolated patches.

Ranging patterns in two troops of northern pigtailed macaques (*Macaca leonina*): impact of habitat anthropization on behaviour and ecological role

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We compared the ranging patterns and habitat use of two troops of northern pigtailed macaques, a typical non-territorial primate species, in the Khao Yai National Park, Thailand. The first troop was living close to human settlements and strongly dependent on human food therefore considered as "semi-provisioned". The second troop was a strict forest dweller, never observed to feed on human food. The study of the semi-provisioned troop showed that macaques were efficient seed dispersers, despite their dependence on human food, and their quite small home range. The study of the second, wild feeding, troop, allowed to secondarily picture the impact of anthropization on home range and habitat use. Indeed, the home range, core area and daily path length of the non-provisioned macaque troop were significantly larger than those of the semi-provisioned one. The non-provisioned troop did not recurrently use a particular section of its home range whereas the semi-provisioned troop consistently re-used the same small home range with a defined core area. Thus, the limited space and food concentration of human food may have forced provisioned macaques into a territorial scenario. This has to be examined in terms of the potential alteration of the seed dispersal role of the species, as well as of the influence on their predatory impact on passerine birds populations.

From individual diet determination to food web disentanglement: the use of stable isotopes and fatty acids in the study of ant trophic ecology

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Ants feed on a broad range of food sources and play a variety of trophic functions in tropical forests where their biomass and diversity are high. Due to the difficulty of assessing ant diet by direct observations in the field, biochemical methods such as stable isotope (SI) and fatty acid (FA) analyses appear as a solution to investigate their trophic ecology. SI and FA analyses have only rarely been used in tropical terrestrial environments. We illustrate the use of these techniques at two different levels of resolution: 1/ at the level of a species, with the determination of the trophic position of a rare and cryptic neotropical ant species, *Tatuidris tatusia*, and 2/ at the level of an elevation gradient in Papua New Guinea, by testing whether ants species with a large distribution occupy the same trophic level at each elevation, and whether their food is based on the same primary sources. While feeding experiments on live *T. tatusia* and direct observation in the field did not provide any information on their food preference, the N isotope analysis of its tissues and of a series of other arthropods present in the leaf-litter suggested that *T. tatusia* are top predators in the leaf-litter food web. The study in Papua New Guinea is still ongoing. However, based on preliminary results and on a short review of the state of the art, we will show how SI and FA analyses are complementary to investigate changes in trophic interactions in food webs along elevation gradients.

Phylogenetic relationships in ototretine fireflies (Coleoptera: Lampyridae) and the evolution of bioluminescence

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The Ototretinae is a subfamily of Lampyridae which includes those fireflies whose adults do not use bioluminescence, or their light production is very weak. Although the Lampyridae have been analysed recently, the relationships in the subfamily Ototretinae remain unclear. A phylogenetic analysis of the Ototretinae was conducted here to elucidate the relationships within the group. The data matrix consisted of 55 morphological characters and 31 species representing all genus-group ototretine taxa. Employed characters represent external morphological features (13 characters: shape of head, antennae, maxillary and labial palpi, pronotum, elytra etc.) and particularly detailed characters of male copulathory organs (38 characters). Phylogenetic analyses using maximum parsimony criterion were conducted. The strict consensus tree refuted monophyly of the Ototretinae, although the group was present in majority rule consensus tree. All generic taxa showed 100% support. The placement of *Baolacus*, *Stenocladius* and *Falsophaeopterus* in the Ototretinae was challenged by our phylogenetic analyses. The clade of other Ototretinae was robustly supported (100%), although the true ototretines with a circular pit in posterior pronotal angles formed a crown group (77% support). Enigmatic taxa *Lamellipalpus* and *Lamellipalpodes*, with enlarged terminal palpomeres of maxillary and labial palpi, formed a crown clade presented as a sister group of Hyperstoma. The evolution of adult bioluminescence was evaluated. While our morphological hypothesis suggests single origin of adult bioluminescence in Lampyridae with three reversions, previous DNA sequence hypothesis rejected single origin of adult bioluminescence in fireflies as the most parsimonious reconstruction assumed four origins and four losses of adult bioluminescence in Lampyridae.

Effects of sea water stress on levels of plasma cortisol in freshwater *Tilapia zillii*

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Effects of gradual transfer to sea water (37.0 ppt) on the freshwater *Tilapia zillii*. Plasma cortisol at different levels of salinity were measured. The plasma cortisol levels were significantly different from those measured in control group. These results indicate that cortisol have important role in the adaptive response of freshwater fish (*Tilapia zillii*) to sea water.

Review of the genus *Hypoaspis* Canestrini (Acari: Laelapidae) occurring in the Western Palaearctic Region

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The classification of the mite family Laelapidae is unstable as a result of continued discussion about the definition and status of some of its genera and subgenera. Different generic and subgeneric concepts have been used by authors, for example, Evans and Till (1966), Van Aswegen and Loots (1970), Tenorio (1982) and Karg (1993). Species have been described in up to 10 subgenera of a very loosely-defined genus *Hypoaspis* Canestrini. Recently, authors have attempted to reassess and stabilize the diagnosis and taxonomic rank of several of the subgenera (Beaulieu 2009, Joharchi & Halliday 2011). The nominotypical subgenus, i.e., *Hypoaspis sens. strict*., is most easily recognised by the greatly elongate setae Z4 on the dorsal shield (3–5 times longer than J4) and greatly elongate setae on some of the leg segments (Evans & Till 1966, Karg 1979). It now comprises 15 species of Hypoaspis sens. strict. had been reported from the Western Palaearctic Region: *Hypoaspis alborzensis* Razavi Susan & Joharchi, 2014; H*. campestris* (Berlese, 1887) *sensu* Bregetova, 1977*; H. elegans Joharchi, Ostovan & Babaeian, 2014; H. integer* Berlese, 1911; *H. krameri* (G. & R. Canestrini, 1881); *H. larvicolus* Joharchi & Halliday, 2011; *H. maryamae* Joharchi & Halliday, 2011*; H. melolonthae* Joharchi & Halliday, 2011; *H. neokrameri* Costa, 1971; *H. pentodoni* Costa, 1971; *H. phyllognathi* Costa, 1971; *H. polyphyllae* Khanjani & Ueckermann, 2005, *H. surii* Khanjani *et. al*., 2013, *H. terrestris* (Leonardi, 1899) and *H. zaheri* Fouly & Al-Rehiayani, 2011.

Stereo PIV measurements reveal dorsal fin thrust production mechanisms in seahorses

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Seahorses display relatively slow but precise and stable swimming maneuvers, a necessity for a life in densely vegetated environments. Seahorses propel themselves with 2 pectoral fins, located behind the gills, and 1 dorsal fin. Their dorsal fin is able to change frequency, wave number and amplitude and is considered to be the main thrust generator. Their propulsive system is interesting because seahorses have a rigid upper body on which an undulatory fin in attached, which makes it different from fish propulsion by whole-body movements.

In this study, the near wake patterns generated by the dorsal fin were visualized using a stereo-particle image velocimetry (PIV) setup, which gave the opportunity to compute the lateral (in-plane) and backwards (out-of-plane) velocity components. Two synchronized high-speed cameras recorded, through a dedicated prism, the movement of small particles illuminated by a laser sheet. Another set of two high-speed cameras recorded the accompanying body movements and dorsal fin kinematics. Data was collected extracted from slow- and fast-swimming seahorses (and herewith changing body posture).

The PIV-images showed that multiple vortices were shed on the fin edges with the highest amplitude throughout the length of the fin. High swimming speeds resulted in clear vortex structures; during lower swimming speeds the vortices were less visible. The calculations of the backward velocities showed that the highest backward velocity components were generated by the upper (most anterior) part of the fin. This indicates that the anterior part of the fin functions as the main thrust generator while the posterior part might be mainly involved in steering.

Although the range of maneuvers in seahorses is much broader than fast and slow forward swimming, studying these relative simple maneuvers provides basic knowledge that helps to understand how fish with fins attached to an almost rigid body are able to maneuver in complex environments.

Fin flickering and associated sounds in the cichlid fish *Ophthalmotilapia ventralis:* a preliminary study

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Fin flickering was defined as rapid movements of the fins. The behavioural function of such movements is however not well established. Depending on the species investigated, they were considered as comfort movements (e.g. removal of minor irritations) or alarm for young. In the cichlid *Etroplus maculatus* they allow homogenous repartition of eggs on the substrate.

We studied visual and acoustical behaviour of five *Ophthalmotilapia ventralis* (two males and three females) reared in a 240 l tank.

Pectoral fin flickering associated with sound production was often observed, especially from fish that established a territory. With the exception of the butterflish *Chaetodon mutlicinctus* and gouramis, this aspect of fin flickering is generally overlooked in teleosts. First observations support the fact that sounds (peak frequency and pulse duration: 562±95 Hz and 14±5 ms, respectively) are not emitted during all kinds of fin movements but mainly during some caudo-rostral horizontal fin sweeps.

In-depth studies are however required to better characterize the movements and understand what morphological traits are responsible for the sound production. Further investigations are also needed to determine if fin flickering has a role in *O. ventralis* social interactions.

Structural response of the musculo-skeletal system of birds to different mechanical constraints

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The traits of the organisms are compromise between the phylogenetical (inherited factors) structural factors (properties of the biological material) and functional factors. The functional factors depend on the habits and habitats of the species. The functional demand on the skeleto-muscular system corresponds to the mechanical exchanges between the animal and its physical environment. It will be different depending if the animal moves on the ground or in the water.

Our project is to quantify the impact of contrasted (but natural) functional constraints during the growth, on the structure of the skeleto-muscular system.

We raised pure breed ducks (*Anas platyrhynchos*) during 50 days, under four conditions : 1/limited moving area, 2/normal area (control), 3/large area and stimulation for walking, 4/large area, swimming pool and stimulation for swimming. The areas were filmed all day long in order to quantify the exercise done by the ducks during their life. Five birds of each condition were sampled at 7 stages during the period. All the birds sampled run in special track and filmed to detect the maximum speed. The muscles of the hindlimb will be measured (length +weight +fiber length) and the bone shape and structure will be compared using µctscans. The comparison between the 50 old ducks muscles will be presented here.

Egg parasitoids, processionnary moth *Thaumetopoea pityocampa* (Denis & Schiffermuller, 1775) populations' regulation factors in the cedar forest of Chréa (Blida)

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The study concerns some bioecological features of the procesionnary pine moth eggs parasoids in the Chrea cedar forest (Blida). Results for egg masses measurements and eggs quantification show that the processionnary moth population is reaching its peak. Three species of active parasitoids were observed from the egg masses of the processionnary pine moth, they are: *Baryscapus servadeii, Ooencyrtus pityocampae* and *Trichogramma embryophagum.* The global egg parasitism rate is of 11%. The longevity of these eggs parasitoids varies from one species to another. *Trichogramma embryophagum* life time is relatively limited.

Effect of chlordecone on the expression of vitellogenin and vitellogenin-receptor genes in *Macrobrachium rosenbergii*: an *in-situ* study case

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In the quality environment assessment, the effects of endocrine disruptors have an increased concern, because they could disturb endocrine system of organisms. These systems are mediated by hormones which regulate several physiological processes such as reproduction and juvenile growth, having important role in population dynamics.

In invertebrate, for example crustaceans, vitellogenin (Vtg) is the precursor of yolk proteins (e.g. vitellins) which supply energy reserves available during embryonic and larval development. Due to its role, vitellogenin have been described as exposure biomarker for endocrine disruptors. Indeed, several previous studies have highlighted a modification of Vtg level (e.g. increase or decrease) in organisms exposed to these compounds.

In this *in-situ* study, we investigated the effects of chlordecone, an organochlorinated pesticide, on the endocrine system of a decapod, *Macrobrachium rosenbergii* by measuring relative expression of the vitellogenin gene in hepatopancreas of organisms coming from a control site and a contaminated site. In addition, we evaluated the relative expression of the vitellogenin receptor (VtgR) gene in gonadal tissue.

One month-old prawns of *Macrobrachium rosenbergii* females and males were sampled in a control site and an aquaculture pond supply by a contaminated river (0.33 $\mu g.L^{-1}$ of chlordecone). Hepatopancreas and gonadal tissues were dissected and total RNA was extracted and analyzed by quantitative RT-PCR.

The results revealed an increase of both genes in exposed prawns compared to control one, whatever the gender. This observation suggested that the Vtg and VtgR expressions were influenced by the chlordecone exposure in *M. Rosenbergii* and thus, that the prawns reproduction could be impact by this compound. Endocrine disruption of hormonal system could therefore occur following an exposure to an estrogenic compound. Finally, results of this study allow us to better understand the mechanisms of action of chlordecone which appeared to act as an endocrine disruptor compound.

The effects of Triclosan on the metabolism of developing Sheepshead minnow (*Cyprinodon variegatus*) larvae

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The aquatic environment represents the final sink for many chemicals, including bactericidal agents. Among them Triclosan (TCS) has been shown to affect the thyroid system of teleost. Thyroid hormones are involved in the control of metabolism, so changes in hormone levels induced by triclosan may affect respiratory rates and antioxidant stress in exposed fish.

Couples of three females and two males were placed in breeding chambers designed for this experiment. Eggs were collected and maintained in seawater. Embryos were selected under a dissection microscope, randomly assigned to each of five treatment groups: Control, DMSO control, 20 µg/L TCS, 50 µg/L TCS and 100 µg/L TCS and placed in incubation dishes (50 per dish) at 25°C. On day 6, embryos hatched and larvae were transferred to 1L dishes. The larvae were fed on artemias and on flaked fish food till day 15 and 30 post hatching when the fish were analysed. Respiratory rate measurements were carried out by respirometry and assays of antioxidant enzymes, Glutathionreductase (GR), glutathione peroxidase (GPx) and glutathione-S-transferase (GST) were conducted to determine the presence of oxidative stress.

Respirometry showed that TCS exposed fish exhibited decreased the metabolism at 15 dph, whereas no differences in respiration rate could be observed between control and exposed larvae at 30 dph. At 15 dph no difference was observed for any of the antioxidant enzymes, whereas at 30 dph a sharp increase in the activity of GR was observed between the control and TCS exposed fish. The activity of GST and Gpx remained stable.

Thyroid hormones are major factors controlling the metabolic rate related to respiration and oxidative stress. TCS reduced the metabolism at 15 dph that corresponds to the moment where larvae to juvenile transition of Sheepshead minnows occur. Previous experiments showed that TCS induces an increase in thyroid hormone concentrations and hyperthyroidism induces oxidative stress. So our observed increase of antioxidant protection mechanisms could be a way to compensate oxidative stress. On the other hand, the changes in GR activity observed at 30 dph, may also be related to the reduced metabolism at 15 dph.

Honey bee colony strength: assessing accuracy of the Liebefeld estimation method

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Honey bee colony strength (number of adult bees) is a crucial character in several studies to assess for example demographic variations in colonies or a host-parasite ratio (i.a. involving the mite *Varroa destructor* Anderson & Trueman). In large field studies the method used to measure the strength of colonies must be sufficiently accurate (depending on the study) but should not be too time consuming. Currently the "Liebefeld estimation method" is extensively used while its accuracy remains weakly documented. Our goal was to provide more information on the accuracy of this method.

A set of 100 digital images of frames from 5 Dadant-Blatt hives was used for the estimate. Pictures were taken in early April (before laying of drones). For all pictures all workers were counted manually. Then for the Liebefeld method 3 guest estimators evaluated the percentage of the frame area covered by bees for all frames and data were converted into numbers of bees (with a coefficient of 0.72 bee/cm²). Manual counts were used as a reference, with the assumption that almost no worker was missed during counting.

The results showed that the average of the 3 estimators overestimated the number of workers on a picture by 15.3%±0.2% on average. The colony strength was overestimated by 14.5%±6.3% on average. The results also exposed how the accuracy of this method seems to vary with the number of workers featuring on a picture. Liebefeld estimates were highly correlated to manual counts (0.936, $p<0.001$) suggesting that these estimates could be reliably used to compare the strength of different colonies. The accuracy of the Liebefeld estimates could probably be improved by using another coefficient or a better estimator training. In the future new automated methods will most likely be developed because of constant progress in digital image analysis.

Methods for species delimitation in bumblebees: towards an integrative approach

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Delimitation of closely related species is often hindered by the lack of discrete diagnostic morphological character. The bumblebee taxonomy exemplifies this issue. There were many attempts to clarify bumblebee taxonomy by using alternative features to discrete morphological characters such as geometric morphometric, DNA, or eco-chemical traits. Nevertheless each approach has its own limitations. Recent studies have used a multisource approach to gather different lines of speciation evidence in order to draw a strongly supported taxonomic hypothesis in bumblebees. Yet, the resulting taxonomic status is not independent of selected evidences and of consensus methodology (i.e. unanimous procedure, majority, different weighting of evidence).

In this communication, we compare taxonomic conclusions for taxonomically doubtful species obtained from the commonly used lines of evidence for species delimitation in bumblebees. We ultimately aim to assess the usefulness of these evidence as components of an integrative decision framework to delimitate bumblebee species. This allows setting up an integrative decision framework to establish strongly supported species and subspecies status within bumblebees.

Breeding habitat change of Alpine newts, *Ichthyosaura alpestris*, in the presence of Goldfish, *Carassius auratus*

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As many other amphibian species, the Alpine newt, *Ichthyosaura alpestris*, is locally declining because of fish introductions in its aquatic habitat. The Goldfish, *Carassius auratus*, plays a major role in this decline for a variety of reasons that remain to be explored. Through an experimental approach, we aimed to study the distribution of newts when goldfish is present in a part of the habitat network. We have also estimated the reproductive success of newts living in such habitat networks with and without goldfish. We have used an experimental design constituted by aquariums that were divided into two tanks filled with water and joined by a terrestrial platform. We have analysed the response of eight groups of newts in configurations involving either or not goldfish in one of the two tanks. We found out that the Alpine newt is able to escape fish by changing of aquatic habitat, i.e. tank in our design. Newt populations living in a habitat configuration including goldfish exhibited fewer courtships and laid fewer eggs than newts from populations living in a configuration without goldfish. Our results show that newts living in fishless networks are not attached at a single reproduction area during the breeding season: they make several movements between aquatic areas through land connections, showing the dynamic of a patchy population. In conclusion, our study points out that the Alpine newt is able to use refuge areas, particularly when its habitat is fished and an alternative aquatic habitat is available. Even if these areas are not fully able to compensate the impact of goldfish at the network scale, the construction of refuge ponds could help to maintain newt populations living in fish-stocked areas.

Are southern elephant seals attracted by the bioluminescence of lantern fishes in the deep dark of the southern Ocean?

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Bioluminescence, the emission of visible light by living organism, is mostly found in the deep ocean where it is used to avoid or help predation as well as communication between conspecifics. This work is based on the hypothesis that bioluminescence could also be used by predators, here the southern elephant seals (SES), to locate their prey. It has been shown that SES are endowed with a vision adapted to low light intensity with a peak sensitivity at 479 nm, matching not only the wavelength of natural light at depth but also the bioluminescent spectrum of most mesopelagic organisms. Lantern fishes represent the biggest biomass in the southern ocean and are known to be SES's main prey. In this work, we aimed to reveal that Prey Catch Attempts (PCA) might be related to bioluminescent events.

By stimulating the bioluminescence of lantern fishes trawled during Mycto 3D expedition (MD197) and by analysing diving behaviour of three satellite-tracked females equipped with high sampling rate Time-Depth-Light 3D-accelerometers and magnetometers recorders (MK10-X and DDT) we were able (i) to link the number of Prey Catch Attempts (PCA), assessed from the processing of accelerometer data, with the number of detected bioluminescence events; (ii) to assess if SES modified trajectory and performed PCA in relation to bioluminescence events; (iii) to measure bioluminescence characteristics of several lantern fishes species.

Results revealed that lantern fishes produced a blue luminescence (450nm) and although PCA could take place in absence of bioluminescence events, we found that PCA was positively related to bioluminescence events which provide strong support that bioluminescence represents a key element in predator-prey interactions.

Swimming speed from deep-sea sharks inferred from video footage analysis

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For animals to successfully exploit their niche space, one strategy is to develop efficient locomotion. This is particularly true for sharks, which have evolved a diversity of shapes, thermal physiologies and swimming mechanisms to propel their body in marine and terrestrial waters. In that context, swimming speed appears to be an informative performance measure because it influences predator escape, prey capture and mate finding behaviours. While some swimming speed data are currently available for shallow water species (i.e. species common above 200 m depth), very little information exists for deep-sea sharks, mainly because no systematic video sampling of the deep sea has been achieved so far and also because of the logistical challenge to keep them alive in captivity.

This study obtained 251 video footages from 11 shark species using stereo baited remote underwater video cameras (stereo-BRUV) deployed in deep coastal areas of New Zealand. Footages were analyzed to determine absolute and relative swimming speeds in relation to tail-beat frequency. Statistical analyses were performed in order to (i) investigate the relationship between swimming speed values and morphological features (tail-ratio, body-ratio and tail area) of deep-sea sharks and (ii) determine if deep-sea sharks, which live in a permanently cold (4°C) environment, have comparable swimming speeds than their shallow water counterparts.

Results show that the swimming speed values deep-sea sharks does not appear to be influenced by selected morphological parameters and, on average, are lower than those reported for shallow water sharks.

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Cryptic species, ecomorphs and GFP/GFP-like profiles in the cnidarian *Anemonia viridis*

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GFP-like proteins are responsible for the bright colours that can be found in corals and sea anemones (Cnidaria). These proteins are coded and produced in animal tissues, and their fluorescence allows identifying differentially colour morphs in the field. However, the taxonomical status of these colour morphs remains relatively unexplored. For instance, in *Anemonia viridis*, 5 colour morphs were described. The most pigmented morphs seem to be more frequent in shallow waters which would be consistent with the supposed anti-oxidant role of GFP-like proteins. Moreover, the dominant reproductive mode (sexual or asexual) may change between the morphs.

Although genetic differences have been found locally (allozymes), morphologic similarities between colour morphs are striking. We started a genetic study of *A. viridis* morphs by sampling the most widespread ones (*smaragdina* and *rustica*) at Mediterranean and English Channel sites.

Two types of markers were designed. Microsatellite markers were obtained from an EST library and have already been used to show that the *rustica* morph was mainly clonal. From the same EST library, a list of genes whose expression is modified under temperature and/or UV stress had been obtained. We designed EPIC markers for 10 of these genes by comparison of the *Anemonia* expressed sequences to the published genomes of 2 other cnidarians. These EPIC are being used in a phylogenetic analysis of the morphs. From the first results obtained so far, it seems there is no clear genetic differentiation between the two morphs. However, we still need a full-fledged analysis of the whole dataset (in terms of loci and populations) to confirm this first impression.

With these two types of markers, we will know if *rustica* and *smaragdina* morphs form separated gene pools and, therefore, if the expression profiles of GFP-like proteins could be a diagnostic trait of cryptic species in *Anemonia viridis*.

Heat waves: Stupor in Arctic Bumblebees

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The current worldwide biodiversity undergoes one of the largest species extinction. Biodiversity decline results from numerous interacting factors, especially climate change. One of the main phenomenons related to climate change is the increase of the frequency of extreme event such as heat waves. Since the heat waves dramatically increase the bee mortality, the worldwide key pollinators, there is an urgent need to predict the consequences of heat waves on important organisms for ecosystem services. However these predictions remain difficult without bioassays because of each species have its own thermo-tolerance.

In this study, we develop a comparative bioassay approach in 6 species of widespread, arctic and mountainous bumblebees using a new experimental portable device to determine the heat stress tolerance in order to predict consequences of local heat waves.

Our results show a thermo-tolerance gradient: the thermo-tolerance of Arctic species is lower than the thermo-tolerance of mountainous species which is itself lower than widespread species. This study paves the way to a large scale assessment of heat stress tolerance of insects, a further step in their conservation.

Preliminary data on the biodiversity of Rodents (Rodentia) and shrews (Soricomorpha) in the Hunting Area Rubi - Tele (Province Orientale, Democratic Republic of Congo)

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Small mammals were trapped in open transects with four types of traps: Sherman, Victor, Pitfall and traditional traps of farmers. The first session of sampling was conducted from 17 to 28 August 2013 in the rainy season.

This yielded 106 shrews and 220 rodents, a total of 326. The second session, done during the dry season, provided 26 shrews and 137 rodents, totalising 163 animals. After these two sampling sessions, 5 genres of shrews are present: (*Crocidura*, *Paracrocidura, Scutisorex, Suncus* et *Sylvisorex*) representing at least 10 species (*Crocidura* sp, *C*. cf. *littoralis, C*. cf. *dolichura, C. denti, C*. *ludia, C*. cf. *olivieri*, *Paracrocidura schoutedeni, Scutisorex sommereni (= S. congicus ?)*, *Sylvisorex* cf. *remyi*, et *S*. cf. *johnstoni*). *S*.cf *remyi* and *S.* cf *johnstoni* are reported for the second time in the Kisangani area. *S.* cf *olivier*i, a complex of species, is numerically most abundant in the collection. 11 genera of rodents were trapped: (*Grammomys , Hybomys , Hylomyscus , Lemniscomys, Lophuromys, Malacomys, Nannomys, Oenomys, Praomys, Rattus* and *Stochomys*) and at least 14 species (*G. kuru, Hybomys* cf *lunaris, Hylomyscus stella, Lemniscomys sp., Lophuromys dudui, L. luteogaster M. longipes, N.* cf *grata, O. hypoxanthus, Praomys sp., P.* cf *jacksoni, P. misonnei, Rattus sp* and *S. longicaudatus*). *P.* cf *jacksoni, L. dudui, H.* cf *lunaris* and *H. stella* are numerically most abundant.

Species richness varies according to the 7 types of sampling habitats, depending on the types of traps used and on the seasons.

Sound production in piranhas and relatives: preliminary results

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Acoustic communication plays an important role in the life of many teleost species where it is mainly involved in agonistic and/or courtship behavior. Despite the large number of species in the family Serrasalmidae (92 species), sound production has been described only in some of them, particularly in the genera *Serrasalmus* and *Pygocentrus*.

The aim of this study is to investigate the sound producing abilities of different Serrasalmidae species and to understand the corresponding mechanisms.

Two herbivorous species of Serrasalmidae, *Piaractus brachypomus* and *Metynnis lippincottianus*, produce sounds composed of a single pulse. The mechanism involved in these species is not yet understood. In contrast, the calls emitted by several species of *Serrasalmus* and *Pygocentrus* are harmonic sounds composed of several pulses without inter-pulse interval. Their mechanism results from the forced vibration of the swim bladder following the contraction of sonic muscles that are attached to tendons surrounding ventrally the bladder. Another species, *Pygopristis denticulata*, is able to produce two types of sounds. The first sound consists of several pulses with irregular pulse period and is likely produced by a sonic muscle inserting on the skull and on the rostral part of the swim bladder. The second sound is multi-pulsed and, contrary to all other sounds described here, possesses a high dominant frequency suggesting a mechanism that does not involve the swim bladder and that remains to be determined.

According to these results, Serrasalmidae seems to contain many species able to produce sounds by means of different mechanisms.

The biodiversity monitoring scheme in Luxembourg

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The Centre de Recherche Public - Gabriel Lippmann (CRP-GL) was designated in 2009 to coordinate a biodiversity monitoring scheme in Luxembourg with an emphasis on a set of species of European Community interest (Habitats Directive 92/43/EEC).

A specific sampling procedure was developed to document the conservation status of each surveyed species at the national scale and on a time lapse regular basis (leech, crayfish, butterflies, dragonflies, amphibians, reptiles and mammals). Samplings were randomly stratified, in order to ensure the representativity of the different environmental contexts. In addition, we carried out a butterfly survey along transects (Pollard walk).

This survey aimed to measure richness, diversity and phenology of butterflies in different landscapes over seasons and years. These three parameters were considered as relevant to reflect the impact of environmental changes (climate, land use…) on biodiversity. The results enabled to produce habitat suitability models at a fine resolution (200 m), and provided the basis for the reporting under Article 17 of the Habitat Directive in Luxembourg (2007-2012).

The quantity and quality of monitoring outcomes greatly contributed to reduce the amount of species with unknown conservation status or poor conservation knowledge.

Stable isotope ratios reveal trophic niche partitioning among hermit crabs from tropical polyspecific seagrass meadows

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Polyspecific seagrass meadows are ubiquitous features of tropical coastal zones. These ecosystems are of critical ecological importance, and provide a wide range of socio-economical services to local populations. Meadows however undergo multiple threats linked to human activities (increased nutrient input, overfishing, invertebrate overharvesting, etc.). It is currently hard to assess how seagrass meadows could respond to anthropogenic impacts due to poor knowledge of their functional ecology. In an effort to unravel trophic interactions ruling the food webs associated to seagrass beds of the Toliara Great Reef (SW Madagascar), we studied resource segregation between two common Diogenidae hermit crabs (*Dardanus scutellatus* and *Ciliopagurus tricolor*) using stable isotope ratios.
Interspecific differences were noted in isotopic composition of carbon ($\delta^{13}C$ = -12.22 ± 1.73 ‰ for *D. scutellatus*, $\delta^{13}C$ = -14.55 ± 0.73 ‰ for *C. tricolor*), nitrogen ($\delta^{15}N$ = 4.73 ± 0.53 ‰ for *D. scutellatus*, $\delta^{15}N$ = 5.20 ± 0.61 ‰ for *C. tricolor*) and sulfur ($\delta^{34}S$ = 14.08 ± 2.32 ‰ for *D. scutellatus*, $\delta^{34}S$ = 16.73 ± 1.49 ‰ for *C. tricolor*), suggesting that the two species do not feed on the same items. In addition, SIBER (Stable Isotope Bayesian Ellipses in R) modeling based on C and N data clearly showed that no overlap was present in the core isotopic niches of the two species. It also indicated that the isotopic niche of *D. scutellatus* was greater than the one of *C. tricolor*, implying that the former feeds on a greater number of items than the latter. While hermit crabs are generally considered as omnivorous species, this study highlighted differences in the foraging ecology of *D. scutellatus* and *C. tricolor*. These differences could help to limit competition for food between these two species, and facilitate their coexistence in Malagasy seagrass beds.

Taxonomic background information is essential for bee conservation

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Bees are a monophyletic group of largely pollenivorous species derived from among the predatory apoid wasps. Their extant diversity is estimated to be about 20,000 species worldwide, with ~2,000 species known from Europe. Many European bee species are experiencing a strong decline and several working groups are currently analysing potential drivers of range contraction.

Here we would like to address the importance of clear taxonomic background information to correctly characterize bee decline and to develop a conservation program at global scale.

We present the state of art of species concept in bees and how it can impact on a European red list assessment developed in collaboration with IUCN (International Union for Conservation of Nature).

Light on skin properties of megamouth shark, *Megachasma pelagios* (Lamniforme)

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Despite its 5 meters long, the megamouth shark (*Megachasma pelagios*) is one of the rarest types of sharks known in the world recently discovered in 1983 (only 54 specimens observed and documented so far). This filter shark has been described many times as possessing a luminous mouth used as a lure trap or for social recognition. However, none histological study has been realized to confirm these assumptions so far. Two hypotheses about the light production arose notably from video recording observations: (i) the light may be produced by bioluminescence inside its mouth or on the white band of its upper jaw; (ii) light can be due to the reflection on this white band.

Given the fact that we had the opportunity to analyze mouth tissues from one individual, the aim of the current study is to test these hypotheses by highlighting the presence of light organs (photophores) or specialized light-reflective structures.

Up to now, the study of skin tissues from 11 sites (8 around and inside the mouth, 3 control sites: on the back, the belly and the pectoral fins) performed thanks to several techniques (histological sections, CT-scan, microradiographies, SEM, cryofractures and spectrophotometer) do not indicate the presence of any photophores. However, dermal denticles (calcified structures on shark skin) embedded into the white band are likely involved in reflection of light.

Still, the observation of a living individual and the study of fresh or well-fixed and conserved tissues are essential to determine if this shark is bioluminescent and to confirm if it is able to reflect light.

Study of pollution-breeding report of Algerian Barbel populations *Luciobarbus callencis* of El-Harrach Wadi and its tributaries

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Our work focuses on a comparative bio-ecological study between two populations of fish belonging to the Cyprinid family (The Algerian Barbel) characterizes Wadi El-HARRACH (stream) in central Algiers, one at upstream (Station 01) and another in Downstream the (station 02) as bio-indicator of pollution.

A sample of 381 individuals spread from 02 deferent stations during the spring season (we made seasonal fisheries three months, March, April and May), only the species *Luciobarbus callensis* constituting the population of Wadi studied the only species *Luciobarbus callensis* up the population of Wadi studied.

The numerical study of individuals during the spring showed that the station Upstream (ST01) was 51.7% and the station Downstream (ST02) of 48.3% of the total workforce.

Immature have a large number in our study was 34.64% of the population, but from the two stations, the first ST01 has a low immaturity of 16.75% and the second ST02 a high rate of 53.80% rate.

The overall sex ratio reflects the degree of masculinity or femininity of the population considered; it is defined as the population of male and female individuals in relation to the total workforce and gives an idea about the gender balance in within the population. In our sample: 381 individuals were captured *Luciobarbus callensis* which 203 (53.28%) males and 178 (47.72%) females indicates that both sexes have almost the same abundance with a slight predominance of males.

Molecular phylogeny and taxonomical revision of the tribe Calochromini (Coleoptera: Lycidae)

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The net-winged beetles are a cantharoid lineage related to fireflies and soldier beetles. The tribe Calochromini is widespread in all tropical and temperate regions and altogether more than 300 species have been described. As they are morphologically different and easily recognizable they were the first group of net-winged beetles for which a supergeneric taxon was delimited. The tribal limits have not been questioned, but the generic classification has remained in chaos due to morphological similarity and high level of ambiguity of the actual delimitation of calochomine genera.

We present the five-gene molecular phylogeny of the principal lineages of Calochromini and comparative morphology of the group. The sampling is very dense and about two hundred species have been examined to evaluate morphological variability in the external morphology and male genitalia. Additionally, the study covers the fauna originating from all zoogeographic regions, although the main interest was given to the Oriental and Palaearctic regions where the highest genetic variability was identified.

We confirm monophyly of Calochromini. Further, genera *Falsocalochromus* Pic, 1942 and *Dumbrelia* Lea, 1909 are transferred from Calochromini to Platerodrilini and Platerodini, respectively. Altogether 6 genera remain in Calochromini at present: *Adoceta* Bourgeois, 1882, *Caloptognatha* Green, 1954, *Calochromus* Guérin-Méneville, 1833, *Lucaina* Duges, 1879, *Lygistopterus* Mulsant, 1838 and *Macrolygistopterus* Pic, 1929.

The molecular phylogeny identifies south eastern part of the Asian continent as an ancestral region of Calochromini with dispersal to other areas over a long time span. The genera are redefined using both molecular and morphological characters. Many species have been transferred from *Calochromus* to other genera. *Calochromus* are widespread in South East Asia and reached Papua in the south, *Lygistopterus* occur in the Palaearctic and Nearctic region, *Adoceta* in Southern Asia and Africa, *Lucaina* in the Nearctic region and *Macrolygistopterus* in the Nearctic and Neotropical regions.

State of play of the registered exploitation of game at the Control post AFILONDO (Project Pro-roads) on the RN4 (PK 129, Route Buta , Kisangani, DR Congo)

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The exploitation of forest through the rehabilitation of roads and mining activities results in an increased bush meat trade in the region of Kisangani, with the urban markets and the mining quarries as the main factors that favouring this kind of trade. At the Afilondo checkpoint (PK, 129 Route Buta) we monitored the regional exploitation of bush meat by the assessment of two aspects: the quantitative fluctuations of game on the bush meat market; and the influence of checkpoints along the recently rehabilitated National Highway No. 4 (road Kisangani - Buta) on the bush meat trade. In a six month period (November 2013-April 2014), we counted 6059 carcasses representing 33 species, 14 families and 8 orders with a total biomass of 9.2 tonnes. Our results indicate that three duiker species *Cephalophus dorsalis* (208.35 kg) *Cephalophus* sp (186.43 kg) and *Cephalophus monticola* (135,33Kg) are the species that contribute most to the observed number of carcasses and recorded biomass.

Among the 11 mining sites that we considered along this axis, we recorded the highest demand for game in Panga (35.7%), Makeokeo (22.13%) and Mangi (12.68%), while the amount of game detected for the remaining 8 mines [Yambelo (7.03 %), Benda Nkayi (4.67 %), Zua idea (3.98 %) , Belgika (3.71%), Bomboma (3.42 %) , Bongolo (3.1%), Badambila (1.96 %) and Bana Mayi (1.62 %)] was significantly lower. The implication of the observation that bush meat is consumed in large quantities in these mining sites is that bush meat that is transported along the Route Buta rarely reaches the markets of Kisangani.

Outside of the hunting season (Act No. 82-002 of 28 May 1982), we observed that game is smuggled across the Afilondo control post to maintain the supply of bush meat for the various mining sites or markets. It is clear that there are unfortunate synergistic relationships between the rehabilitation or reopening of roads and various facets of underdevelopment such as food insecurity, poverty, and ecological degradation that contribute to an uncontrolled and increased bush meat trade.

The use of geometric morphometrics in the skulls of Brazilian pterosaurs

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The Araripe Basin has been the source of many pterosaur discoveries. Pterosaurs from the Araripe Basin are highly diverse but their taxonomy and underlying relationships remain, however, controversial. This debate is fuelled by contradicting results of several phylogenetic analyses that are based mainly on discrete characters such as the presence of certain structures. Shape, while a very important taxonomic character, is not often considered in these analyses. In some cases linear measurements have been used but these represent only a limited subset of the shape information available in a fossil.

Here, the potential of geometric morphometrics for incorporating shape in paleontological taxonomy and its consequences were explored. Geometric morphometrics enables the user to compare different shapes in a quantitative and objective way, and is intrinsically more robust than typical subjective observations a paleontologist typically uses.

The results confirm that this method can be used on different taxonomic scales, but the results were most interesting within Ornithocheiridae. As the results revealed a linear change of crest size and shape in time, it indicates that geometric morphometrics can be used in Evolution research as well. This linear pattern is consistent with an evolution of shape and there are several indications that this can be explained by sexual selection. Sexual selection is often associated with sexual dimorphism and we predicted that a sexual dimorphic Ornithocheirid-like pterosaur would appear with a high probability. This prediction appears to be consistent with observations by Wang *et al.,* 2014.

The professional fishery of sea urchin *Paracentrotus lividus* (Lamarck, 1816) in Corsica Island, France

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The purple sea urchin *Paracentrotus lividus* (Echinodermata: Echinoidea) is widely distributed in the Mediterranean Sea and along the North-eastern Atlantic coasts, from Scotland to southern Morocco. It is an important commercial species with a wide market demand for its roe, particularly in the Mediterranean Basin. This fishery is a great resource for many European regions, thus an important decline due to overfishing and pathologies was observed recently in many locations. In Corsica Island the sea urchin fishery is a traditional activity during winter. Over the last years Corsican fishermen have pointed out to an important decline of sea urchin catches around the island. As a consequence, many regulations took place in Corsica like fishing calendar (fishing is opened between December 15th and April 15th), catch quota per fisher and a minimum harvestable size. Currently, no information exists about Corsican sea urchin professional fishery and about its functioning or production.

The present study aimed at acquiring data by surveys before, during and after the fishing season 2013-2014 to estimate the production.

This preliminary study has allowed to identify a total of 32 sea urchin Corsican fishermen as well as acquire information on the practices of the professional fishing, on the catches (102 400 dozen), fishing effort and selling.

Impact of shading on meiofauna in a *Posidonia oceanica* meadow

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Posidonia oceanica meadow is an endemic ecosystem of the Mediterranean coasts. A known threat to this ecosystem is aquaculture. In zones of intensive fish production, *P. oceanica* meadow tends to be less healthy or to disappear .One of the reasons for this is a decrease in the light that reaches the leaves (direct shading, increase of water turbidity or of epiphytic algae density). Unfortunately, when the meadow begins to die, it is often too late to act. So, people are trying to find indicators that react early to this kind of perturbations.

In this framework, this study focuses on the impact of shading (without nutrient enrichment) on the meiofauna living in the surface sediment of a *P. oceanica* meadow.

An *in situ* shading experiment was led from the end of May to the end of August 2009, at a depth of 10 m, in a reference *P. oceanica* meadow. Three shading nets were put in the meadow to reach a light extinction of 50%. A control site was also defined. The first two centimetres of sampled sediment cores were studied.

After three months of shading, the total abundance of meiofauna at the shading site was lower than at the beginning of the experiment, while it stayed around the same level at the control site. This difference is mainly due to a decrease in the total number of foraminiferans, nematods, gnathostomulids, copepods and bivalves. However, no significant difference in diversity was observed.

At the end of this experiment, it appeared that, contrarily to what is mostly said in the literature, the direct organic enrichment that occurs at fish farms is not the only reason to the modification of the meiofauna communities of the ecosystem. The shading by itself has also an effect.

The influence of bioavailable copper and zinc concentrations on metallothionein levels, DNA damage and gene expression in the polychaete *Nereis (Alitta) virens* (M. Sars, 1835)

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Nereis (Alitta) virens is an ecologically and commercially important polychaete of intertidal soft sediment and an ideal species to investigate long term effects of metals. Using a spike approach, worms (1-3 g) were incubated for nine months in sediments spiked at environmentally relevant concentrations of copper, zinc and copper & zinc together: low (copper: 70 mg kg^{-1}, zinc: 200 mg kg^{-1}), medium (copper 120 mg kg^{-1}, zinc: 270 mg kg^{-1}) and high (copper 575 mg kg^{-1}, zinc: 1160 mg kg^{-1}) concentrations. These concentrations were based on an extensive sampling regime of sediment, pore water and worms from seven sites with different levels of contamination across the UK. Worms were fed and maintained under ambient conditions in a flow-through seawater system and sampled at 3, 6 and 9 months. Using BCR sequential extraction, bioavailable metal concentrations in the sediment were assessed in addition to pore water and tissues metal concentrations. The induction of metallothionein (MT) activity, especially at month 6, revealed the detoxification potential of *N. virens* under metal stress conditions. Significant correlations were obtained between copper bioavailable concentrations in the sediment and MT levels at month 3 and between zinc bioavailable concentrations in the sediment and MT levels at month 6. The highest DNA damage was recorded at month 3 for high copper & zinc combined treatment with 36.44%. Significant correlations were obtained between sediment bioavailable metal concentrations and DNA damage. In addition, the study of metal induced gene expression will reveal for the first time metal regulation process in the polychaete *N. virens.* This study showed that (1) not only high copper was toxic to *N. virens* but high copper & zinc combined treatment was the most toxic to the worms and (2) MT and DNA damage were sensitive and reliable endpoints used to evaluate copper and zinc toxicity.

Resolving the military macaw *(Ara militaris)* taxonomy uncertainties through old museum samples

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Military macaws (*A. militaris*) used to range from Mexico all the way down to Argentina. Recently increased levels of habitat loss and illegal bird trade resulted in dramatic decrease in terms of numbers and available habitat. Currently, their patchy distribution range matches three allopatric subspecies (*A. m. militaris*, *A. m. mexicana* and *A. m. boliviana*) which are all listed as vulnerable on the IUCN Red List of Threatened Species. Apart from some early morphological descriptions, little is known about the taxonomy of this species. Resolving these taxonomic uncertainties, would not only be of interest to better understand the phylogeographic structure of the species (and add extra insights in the phylogeograpy of the Central American and Andes region as a whole), but this information will also be crucial in preserving the species on the long-term. Asides conservation actions on the field, breeding programs were created to conserve the species ex-situ. The Royal Zoological Society of Antwerp (RZSA) is European studbook keeper of the Mexican military macaw (*A. m. mexicana*) and, as such, started a project on resolving these taxonomy uncertainties, aiming at developing molecular diagnostic tools to identify pure subspecies. Therefore, the present work aims to evaluate: (i) the genetic differentiation of Military macaws within their former natural range, (ii) the "pureness" of the current captive breeding program (iii) and the availability of potential extra founders currently excluded from the breeding program due to taxonomic uncertainties. As such, we are making use of targeted enrichment strategies to study the complete mitochondrial genome (through NGS platforms) of 150-year old toe pads belonging to historical collections representing all described subspecies and a closely related sister species (*Ara ambigua*). Here we will underline the use (and potential pitfalls) of targeted enrichment strategies when dealing with old degraded starting material.

Evaluation of the impact of Triclosan on the functioning of the thyroid system in *Cyprinodon variegatus* L., 1803

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Triclosan (5-chloro-2-[2, 4-dichlorophenoxy] phenol) is an antimicrobial widely used in various industrial products such as textiles, cosmetics and body care products. It is often detected in aquatic environments. The presence of the main biotransformation product, methyl TCS, indicates that this compound is not only degraded, but also persistent and accumulates in aquatic organisms. In this study, the effects of TCS on the thyroid system during embryonic and larval stages in *Cyprinodon variegatus* were evaluated. In particular, whole body thyroid hormone levels and the activity of deiodinases, enzymes involved in the activation of the thyroid prohormone T4, were measured. Couples of three females and two males were placed in breeding chambers designed for this experiment from which 3832 eggs were obtained by reproduction in the laboratory. Eggs were collected and maintained in seawater. Embryos were selected under a dissection microscope, randomly assigned to each of five treatment groups: Control, DMSO control (vehicle), 20 µg/L TCS, 50 µg/L TCS and 100 µg/L TCS and placed in incubation dishes (50 per dish) at 25°C. On day 6, embryos hatched and larvae were transferred to 1L dishes. The larvae were fed on artemia and on flaked fish food till day 15 post hatching when the fish were analysed. The fertilization and survival rate, as well as the larval dry weight did not vary significantly between individuals exposed to 20, 50 and 100 µg/L TCS. T3 and T4 concentrations increased significantly in larvae exposed to 50 and 100 µg/L TCS. The study of the activity of enzymes involved in the deiodination of thyroid hormones (ORD) represents a new aspect in the study of endocrine disruption in *C. variegatus.* Unfortunately, we were not able to detect a net enzymatic T4 deiodination activity, most likely due to the very small amounts of protein and low specific enzyme activity in brain homogenates, carcass and liver.

Cytoskeletal changes in supporting cells of the auditory organ during development in rodents: the appearance of 15-protofilament microtubules and β5-tubulin isoform

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A feature of the supporting cells of the organ of Corti is the presence of an abundant cytoskeleton which is mainly composed of microtubules. These supporting cells have also been shown to contain a minor mammalian tubulin, the β5-tubulin [1], recently reported to be a biomarker for cancer outcome [2] and cell proliferation [3]. It was shown that a β-tubulin isoform can specify the microtubule architecture, as seen with the expression of the Moth β2 tubulin in the Drosophila testes which imposes the 16-protofilament (16pf) structure on the corresponding subset of Drosophila microtubules, which normally contain 13pf [4]. Moreover, supporting cell microtubules are formed by 15pf instead of the canonical 13, a unique fact among vertebrates [5]. Such a protofilament configuration has been observed in *C. elegans'* neurons which are responsible for the mechanosensory sense of touch [6]. It was also shown that these 15pf microtubules were essential to the proper functioning of these mechanosensory neurons [6]. To determine the role of this particular tubulin in the auditory organ and its possible involvement in the formation of the unusual 15pf microtubules of supporting cells, we studied the spatiotemporal localization of β5-tubulin during development in rats from embryonic day 18 until P25 (25th postnatal day). Then we examined the fine structure of microtubules at the transmission electron microscope level. Our results showed that β5-tubulin, contrary to other β-tubulins, had a unique distribution in the cochlea. This β-tubulin appeared at a postnatal stage, before the opening of the Corti's tunnel and are restricted to supporting cells, especially in pillar and Deiters' cells. Electron microscopy further indicated that pillar and Deiters cells were composed by 13pf microtubules at P2, but by 15pf microtubules at P25. In conclusion, the architecture of microtubules seems to evolve during the development of the organ of Corti. Furthermore, β5-tubulin has the same localization than this structure and could be an interesting target.

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Trace element kinetics in caged *Mytilus galloprovincialis*

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Trace elements (TEs) remain contaminants of concern because of their persistence, ability to concentrate in organisms and toxicity. The Mediterranean mussel *Mytilus galloprovincialis* Lamarck, 1819 is a relevant bioindicator of TE coastal contamination. However, little research has studied the combined influence of environmental condition changes and physiological processes on their kinetics in that species.

Caged *M. galloprovincialis* were thus immerged in 2 contrasted pristine Corsican (France) coastal environments, the semi-enclosed Diane salty pond and the open Calvi Bay, from February to June 2011. Mussels were regularly sampled to study the kinetics of 19 TEs in their flesh; dissolved and particulate TEs were also monitored. The primary production and the water physico-chemical variables were measured, and meteorological data were purchased from Météo-France.

TE kinetics in mussels differed between sites. Mussel spawning, a temperature and saline-induced physiological process that occurred about 10 days later in the Diane pond, was followed by a short time increase of TE levels in the mussel flesh. Mussel contamination also evolved according to changes of their respective environmental TE levels. Raining events temporary led, in the Diane pond, to the water enrichment with TEs, nutrients and detrital material, to peaks of primary production and to the increase of TE concentrations in the mussel flesh. This step by step evolution of TE levels in the environment and mussels was afterwards followed by a rapid return to initial conditions. In the open Calvi Bay, these fast and balanced kinetics were not so obvious, because of the rapid dilution of environmental constrain effects in the Bay.

Mussels are often used as bioindicator in estuaries and coastal enclosed meadows with rapidly changing environmental conditions. In such conditions, the influence of the environment on TE kinetics in mussels must be considered, in addition to physiological processes, when monitoring the TE coastal contamination.

The effect of shift plant host by bumblebees seems to be species related

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Bees are important pollinators for both wild and crop plants. Their massive decline has then a direct impact on the stability of wild and agricultural ecosystems. Different drivers were pointed out to explain this decline: fragmentation and loss of habitat, pesticides and shift in plant communities. This last factor was particularly strong in the second part of the last century as many wild flowers and entomophilous crops were becoming rare while new invasive herbaceous species were spreading. Such changes could directly affect the survival of bee populations, especially by impacting on their physiological state.

To characterize the effects of new pollen resources foraged by bumblebees through the 20th century, we tested the impact of different pollen diets on colony development and immune system of *Bombus terrestris* as well as two wild bumblebee species (i.e. *Bombus hypnorum* and *Bombus pratorum*).

While willow pollen seems really suitable for *B. terrestris*, other pollen species such as rockrose pollen, are more efficient for wild bumblebee colony development. This study highlights that effects of shift in plant communities on bumblebees are species-dependent. Caution has then to be taken given that studies are often limited to *B. terrestris* model, which does not still reflect effect on wild bee species.

Monitoring the host community of ticks in different forest types to investigate risk of Lyme disease

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Lyme disease is caused by the bacterium *Borrelia burgdorferi* sensu lato and transmitted to humans by ticks. In Western Europe, the castor bean tick *Ixodes ricinus* is the most important species for *Borrelia* transmission. The risk at attaining Lyme disease is determined by the abundance of ticks and the *Borrelia*-infection prevalence in the ticks. Research has shown that the abundance of *I. ricinus* is higher in structure-rich oak forests than in structure-poor homogenous pine forests. The infection prevalence, however, has not yet been fully studied in different forest types in Europe.

Ticks become infected with *Borrelia* by sucking blood from an infected host. The host community composition can greatly influence the risk of Lyme disease since host species differ in transmission potential. The Dilution Effect Hypothesis, postulated in North America, states that a high host species diversity can lower the *Borrelia* infection prevalence in ticks as the ticks will suck blood from hosts that easily transmit the bacteria, i.e., good reservoirs such as mice, as well as from poor reservoirs.

In northern Belgium, forest conversion from pine to oak forests is implemented on a large scale. Since the abundance of ticks is higher in the desired well-structured oak forests, forest conversion will cause more human-tick contacts. To quantify the impact of forest conversion on the risk of Lyme disease, the infection prevalence of *Borrelia* in ticks was studied in four different forest types (oak and pine, with or without shrubs). We caught ticks in 22 stands and examined their infection. We tested the Dilution Effect Hypothesis by monitoring host communities via an array of techniques, such as point counts of birds, camera trapping, and mark-recapture of mice.

Analyses of the interactions between day length and temperature on diapause induction and fitness cost in two aphid-parasitoid species

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In aphid parasitoids, diapause is a state of metabolic rest essential for winter survival. However, the factors triggering the entry into diapause are often poorly understood and appear to vary considerably from one species to another. In addition, little is known about energy costs and consequences of diapause in terms of fitness for the generation produced.

In this context, our goal is to analyze the influence of the interaction between day length and temperature on the entry into diapause and the parameters of fitness such as survival and fecundity but also the size of individuals produced, their fresh weight, the water content and fat content. We will test two lengths of days (8L: 16D and 16L: 8D) crossed with three temperatures (4 ° C, 8 ° C and 16 ° C). The species chosen are the parasitoids *Aphidius ervi* and *Praon volucre* (Hymenoptera: Aphidiinea) on cereal aphids *Sitobion avenae* (Homoptera: Aphididae). These conditions will be applied to L2 stages of parasitized aphids until the production of mummies and this for two generations.

Based on data from the literature and our previous results, we predict that the low temperatures and short photoperiod combination should produce a high percentage of diapause, particularly in the second generation. However, the low temperatures should produce individuals of larger sizes according to the temperature-size rule, these should also probably be characterized by reduced fertility. Finally, we believe that the cost of diapause will be also mark in terms of decrease in lipid content compared to non-diapausing individuals. This project is part of the thesis Muhammad Mubashir Saeed.

Insect biodiversity of wild boar corpses (*Sus scrofa*) in East the Algeria (Bordj Bou Arreridj)

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In this study, a corpse of wild boar was used. The first observations were collected to Ain Soltane (Bordj Bou Arreridj) during the summer of 2013. They relate to the necrophagous entomofauna of the wild boar (*Sus scrofa*). Insects were captured by yellow traps. 15 species were identified. On the second day, the first wave was dominated by *Lucilia sericata* (A.R. % = 69.7%). This latter deposited its eggs in great number on the wounds of the biological model. Layings took place on the eyes and the mouth. Other species; *Muscina stabilans*, *Sarcophaga* sp. , *Musca domestica, Piophila* sp. seem to belong to the first wave. On the 3rd and the 4th day after death, *Lucilia sericata* reduced its presence (25.9% and 0.7%). Beetles like Dermestidae (*Dermestes frichii*) and Histeridae (*Gnathoncus* sp.) were observed directly. In addition, two other species of Coleoptera intervene with a small percentage. They belong to Staphylinidae ; *Creophilus maxillosus* and Cleridae ; *Necrobia rufipes*.

Eponyms in honor of the Royals Astrid and Léopold III of Belgium

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The Royal Belgian Institute of Natural Sciences (RBINS) in Brussels and the Royal Museum of Central Africa (RMCA) in Tervuren curate the largest natural history collections in Belgium. Among the estimated 50 billion specimens are hundreds of thousands type specimens which represent the most important pieces in the collections because they form the objective standards of scientific names. Good curation and validation of these types therefore is core business of Belgium's natural history institutions. It is for this reason that the Belgian Science Policy Office funds projects that are axed on the digitization of types and figured specimens.

In this contribution we demonstrate best practice in how to recover types in vast natural history collections and this by recovering eponyms named after Princess/Queen Astrid and Prince/King Léopold III of Belgium. Through our approach we were able to recover near 170 eponyms given to taxa distributed over 16 taxonomic classes, all but one zoological. A large number of the types behind the eponyms have been sampled during explorations in Africa and South-East Asia and this either by the Royals themselves or by the scientists and technical staff that joined them on their expeditions. Mainly European taxonomists have attributed eponyms but, unexpectedly, also by a restricted number of taxonomists from Africa, North and South America. None were given by Asian scientists.

Our results not only have unveiled historical aspects of our collections but have also demonstrated that recovery of types, for subsequent digitization to facilitate taxonomic research, is most efficient by systematic screening of 'in-house' publications of the RBINS and the RMCA linked to searches through the collections. Relying on internet aggregators such as the 'Index to Organism Names' proved quite unreliable in this exercise.

The thyroid gland and thyroid hormones in sheepshead minnow (*Cyprinodon variegatus*) during early development and metamorphosis

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The sheepshead minnow is widely used in ecotoxicological studies that recently, begin to focus on potential disruption of the thyroid axis by xenobiotics and endocrine disrupting compounds. However, reference levels of thyroxin (T4) and 3,5,3'-triiodothyronine (T3) and their developmental patterns are unknown. This study set out to describe the ontogeny and morphology of the thyroid gland in sheepshead minnow, and correlate these with whole body concentrations of thyroid hormones during early development and metamorphosis. Couples of three females and two males were placed in breeding chambers designed for this experiment. More than 1000 eggs were collected and maintained in seawater. Embryos were selected under a dissection microscope and placed in incubation dishes (50 per dish) at 25°C. On day 6, embryos hatched and larvae were transferred to 1L beakers. For one week after hatching, larvae were fed on artemia, and from 8 to 30 days post-hatch they were fed on flaked fish food. Embryos were sampled on day 0, 3, 6 post-fertilization and larvae and juveniles were sampled every three days from day 0 to 28 days post-hatch. The pooled samples were taken from several incubation dishes and divided in three replicate batches of 10-30 individuals. T4 and T3 were extracted from whole fish bodies and an enzyme-linked immunoassay was used to measure whole-body hormone levels. At each sampling point 5 individuals were placed in formalin fixative for histology. Length and body mass were measured. Hatching success, gross morphology, thyroid hormone levels and histology data were recorded. The onset of metamorphosis at 12 days post-hatching coincided with surges in whole body T4 and T3 concentrations. Thyroid follicles were first observed in pre-metamorphic larvae at hatching, and were detected exclusively in the subpharyngeal region, surrounding the ventral aorta. Follicle size and epithelial cell heights varied during the developmental phase, indicating fluctuations in thyroid hormone synthesis activity. The increase in the whole body T3/T4 ratio was indicative of an increase in outer ring deiodination. This study establishes a baseline for thyroid hormones in sheepshead minnows, which will be vital for the understanding of thyroid hormone functions and in future studies of thyroid toxicants in this species.

Combined effects of copper and increased temperature on methylation status of zebrafish (*Danio rerio*)

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Some pollutants are able to alter epigenetic marks such as DNA methylation. In the other hand, early life stages are especially sensitive to these pollutants because of epigenetic reprogramming during embryogenesis. Epigenetic alterations can possibly be conserved until adult stage or even inherited by their unexposed offspring.

The purpose of this study is to evaluate whether copper (Cu), increased temperature or their combined effect impact DNA methylation and gene expression of zebrafish (*Danio rerio*).

The first experiment consisted in the exposure of zebrafish embryos to 0 or 325 µg Cu/l at 26.5°C or 34°C during the remethylation phase of the genome [from fertilization to 4 hours post fertilization (hpf)], followed by incubation within clean water at 26.5 °C to 96 hpf. Exposure to high temperature and/or copper significantly increased larval mortality at 24 hpf and delayed hatching. Developmental anomalies were more frequent when temperature is increased. mRNA expression of the metallotionein-2 (*mt*-2) has been measured by qPCR on 96 hpf larvae and was significantly increased (45 %) after Cu exposure. DNA methylation, thought to be linked to gene expression, was investigated using pyrosequencing.

No significant modification of the DNA methylation status of 7 CpG sites situated in the *mt*-2 promoter region was detected. These CpG positions had low methylation level. Global DNA methylation will also be investigated. A second experiment will include the exposure of adult zebrafish to Cu, high temperature or ethinylestradiol for 14 days. Global and gene specific DNA methylation and gene expression will be investigated in gonads and liver.

Given the possible long-term impact of epigenetic alterations, it is relevant to study the potential effect of environmental pollutants on early life stages but also on adults that could transfer alterations to their unexposed offspring.

Relative habitat restoration is the reason for the improvement of the benthic biodiversity in the Sevastopol Bay (the Black Sea)

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The one hundred years is since the publication of the treatise “To question about study of life of the Black Sea”, by Zernov A.S., which is still relevant today. This scientific work is the starting point for the study of long-term changes in the structure of benthic communities in the Sevastopol Bay.

Five benthic communities recorded in the Bay in the early 20th century, and now only - two. The anthropogenous influence began to have an effect already in 20's – 30's years with a maximum load of 60's - 90's of the last century. The worst state of benthic communities was observed in this period.

Restore biodiversity of benthic communities began to appear in the late 90's on a background of significant reduction in the number of ships and of the volumes of coastal runoff in the Bay. The positive trend in improving of benthic characteristics (increase of biodiversity and biological productivity) persists and now. Reduction of eutrophication and lack of abundant phytoplankton bloom in the summer season in certain years have affected the functioning of the ecosystem of the Bay. Benthic habitat has changed because of these trends - increased area with oxidative conditions in sediments. Rise of the redox-potential of sediment indirectly indicates reduction of eutrophication in the Sevastopol Bay during the last 10-15 years.

Habitats of benthic communities were strongly transformed during long-term period of intense eutrophication of the Bay. The upper boundary of the silt zone is registered from depth of 8-10 m and is located in the seasonal thermocline layer, i.e. shell rock has now completely silted. Significant change in the spatial structure of habitats is an obstacle to the full restoration of the original biodiversity and zoobenthic communities despite the partial improvement of environmental conditions in the Sevastopol Bay.

Genetic structure of fragmented southern populations of African Cape buffalo (*S.c. caffer*) based on microsatellite analysis

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Along with the elephant and the wildbeest, the Cape buffalo is the most dominant species in terms of biomass but also the most widespread herbivore in the savannas and open woodlands of East-Southern Africa. African wildlife experienced a reduction in population size and geographical distribution over the last millennium, particularly since the 19th century as a result of human demographic expansion, overexploitation, habitat degradation and cattle-borne diseases. The last natural parcels are reduced to an ill-assorted mosaic of refuges, generally corresponding to the protected areas. These metapopulations face gene flow restriction and run the risk of genetic diversity erosion.

Therefore, we assessed the genetic health of southern African Cape buffalo populations and investigated the origins of their current genetic structure. The analyses were based on 264 samples from 6 countries (14autosomal and 3Y-chromosomal microsatellites). Three genetic clusters were differentiated, hereafter referred to as Northern (N), Central (C) and Southern (S) clusters.

The results suggest that splitting of the N and C clusters occurred around 6000 to 8400 years ago. Both N and C clusters displayed high genetic diversity, low differentiation, and an absence of inbreeding depression signal. The splitting time of N and C clusters suggests that the current pattern results from human-induced factors and/or from the aridification process that occurred during the Holocene. The third cluster, a tiny population enclosed within an isolated protected area, likely originated from a more recent isolation and experienced genetic drift, probably resulting of processes such as habitat fragmentation and diseases. We also highlighted the impact of translocations on the genetic structure of several populations. Lower differentiation estimates were observed between C and N sampling localities that experienced translocation over the last century. This information is particularly essential within the context of translocation programs currently undertaken to restore genetic diversity in Austral Africa.

Molecular systematics of the genus *Calliptamus* Serville, 1831, (Orthoptera: Acrididae: Calliptaminae)

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The genus *Calliptamus* belongs to the family of Acrididae (Orthoptera, Caelifera) which includes the most important devastating species of Orthoptera. This grasshopper does not possess either phenomena of transformation or gregarious area but it can produce important swarms. The recognition of the taxonomic of this group requires a precise and rigorous identification.

The objective of this study is to contribute to the resolution of the problem of identification by characterizing the species of *Calliptamus.* A novel taxonomic approach is envisaged : the molecular taxonomy which bases on the analysis of the DNA involving a mitochondrial cytochrome gene C oxydase I (COI) — to classify 48 individual grasshoppers belonging to two species, *Calliptamus barbarus* Costa, 1836 and *Calliptamus wattenwylianus* Pantel, 1896 collected at two different ecosystems in the Setif region (northeastern Algeria).

The results of this combined approach by the morphological studies and by the ADNmt revealed that several distinctive differentiate morphological criteria between both species are in reality phenotypic forms which do not reflect their molecular discrimination, the only one which turns out compatible with the barcoding, it is retained as morphotaxonomic character of this genus.

Quantity but also quality: choosing a next-generation sequencing approach to address specific questions in systematics

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The development of next-generation sequencing (NGS) technologies allows high-throughput DNA data production. This offers many new opportunities to study non-model organisms by analysing many more DNA markers than initially possible with traditional Sanger sequencing. However, the added-value of this large amount of data will greatly depend on the experimental design: specimens sampled, DNA markers selected, existence of a reference genome, DNA library preparation, NGS platform, bioinformatic analyses, etc.

Here we illustrate the advantages of applying three different NGS methods to three specific scientific questions. Genotyping by sequencing (GBS) and restriction-site associated DNA tags (RAD) both produce reduced representations of the genome using restriction enzymes. They are used to study the population genetic structure of two species of snails (genus *Bulinus*) that are intermediate hosts of the human blood fluke (genus *Schistosoma*), and the phylogeny of closely related fruitfly species (genus *Ceratitis*), respectively. As a third approach, we use anchored enrichment for targeted high-throughput sequencing of multiple loci in order to investigate the phylogeny of water snakes.

Even if it is tempting to explore all possibilities offered by NGS, technology-driven research projects applied to non-model organisms risk to deliver a large amount of data that cannot be interpreted reliably. Here we chose to minimize the cost and optimize the expected dataset, not only in number of markers and samples but also according to the data already available for the organisms under study.

Gene mapping of 28S and 5S rDNA sites in chromosomes of some species from the family Cobitidae (Pisces; Teleostei)

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Polyploid species may be a useful model system to comparatively investigate the evolutionary process along polyploidization at genome and chromosomal level. Chromosomal location of ribosomal DNA sequences is used for comparative cytogenetic studies because of the relatively fast rate of evolution. Some species from the family Cobitidae are of polyploid origin as *Misgurnus* species. Some others as *Cobitis* species may occur in an exclusively monospecific diploid populations as well as an allopolyploids in mixed, diploid-polyploid populations. The objective of this study was to compare the results of molecular cytogenetics on the spined loach *C. taenia* (2n=48), the danubian loach *C. elongatoides* (2n=50) and the weather fish *M. fossilis* (2n=100) using fluorescence in situ hybridization (FISH) with 28S rDNA and 5S rDNA as probes. The 5S rDNA probe was labelled with biotin-16-dUTP and digoxigenin-11-dUTP using respectively, Biotin-Nick Translation and the DIG-Nick Translation Mix kits (Roche). Variation of 28S rDNA sites was observed; from seven to nine in *C. taenia*, from six to seven in *C. elongatoides* and form four to six in *M. fossilis*. The results with 5S rDNA probe gave an impression of more genomic stability considering all investigated species; 5S rDNA was located on four or six chromosomes. Simultaneous mapping of the two rDNA families on the chromosomes of all species under study revealed that both 28S and 5S rDNA probes were located partially on the same chromosomes in the karyotype of *C. taenia* and *C. elongatoides*, and on different chromosomes of *M. fossilis*. The presented results of species from the family Cobitidae presented here for the first time, give an important insight into the structure of chromosomes of this polyploid and declining species and may be useful in its systematic.

Correlates of melanism in populations of the *Vipera berus* (Reptilia: Viperidae) complex from eastern Romania

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The colouration of animals is considered to be an adaptation to different biotic and abiotic environmental factors. Colouration plays an important role in avoiding predation via crypsis, mimicry or aposematism, inter and intraspecific communication and sexual selection. In ctothermic animals, colouration could also be especially important in thermoregulation. Colour polymorphism (i.e. the presence of two or more phenotypic morphs in the same population) and the mechanisms which maintain it have been the subject of numerous studies, several hypotheses having been suggested. Melanism is one of the commonest and most studied examples of polymorphism in animals and it has been reported in invertebrates as well as in all higher vertebrate groups. In squamate reptiles, melanism has been frequently observed in a large number of taxa and in the majority of the regions of the world.

The ecological advantages and disadvantages of being a darker coloured reptile have benefited from intense studies in the past three decades, especially since a study on Garter snakes (*Thamnophis sirtalis*) had indicated that black specimens receive thermoregulatory advantages.

Here we investigated several correlates (frequency of melanistic individuals, body size, body mass, female reproductive characteristics) of melanism in two populations of the *Vipera berus* complex from eastern Romania in order to test previously proposed hypotheses for explaining the maintenance of colour polymorphism in squamate populations. Melanistic vipers were less frequently encountered in both studied populations than zigzag individuals. There were no significant differences in body size or body mass between the two morphs. No differences were observed regarding reproductive characteristics with the exception that melanistic females gave birth to significantly longer neonates. Our conclusions were that, for our studied populations, the maintenance of colour polymorphism is achieved mostly through non-adaptive processes.

Are amphipods influenced by *Posidonia oceanica* seagrass features?

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In the Mediterranean Sea, the seagrass *Posidonia oceanica* plays an important role as habitat for invertebrates, among which amphipod crustaceans represent a dense and diverse assemblage. Recent studies have observed that amphipod density and biomass vary significantly on small spatial scales. This patchiness may be caused by different factors, such as recruitment, competition, and predation; however, habitat features, resulting in availability of resources such as food or shelter, may also be important in structuring these assemblages. This study examined the relationships between amphipod and habitat features in a *P. oceanica* meadow of the Revellata Bay (Corsica). The sampling was carried out in a continuous meadow colonizing soft substrates at constant depth in August 2008. We quantified the density and biomass of each amphipod species, as well as habitat features, namely shoot density, leaf and epiphyte biomasses, percentage of leaves per shoot having alteration marks and litter biomass. Using multiple regression analyses, few weak significant relationships were identified between amphipod and habitat features. The number of species and the diversity appeared unaffected by the measured habitat features. In contrast, total amphipod density and biomass were generally positively related to the shoot density and epiphyte biomass of *P. oceanica*, respectively. Overall, habitat features accounted for 0-30% of the variation in the densities of the amphipod species. A distance-based linear model explained a total of 25.8% of the variation of the amphipod assemblages (of which 18.6% was explained by litter biomass). Amphipods are therefore influenced by some *P. oceanica* features, but only weakly. Furthermore, some features appeared to influence individual species whereas others functioned at the assemblage level. The main challenge remains in evaluating the scale at which these features act and the way in which they influence the structure of assemblages.

Diflubenzuron activity on the cuticle and hemolympahatic ecdysteroids rate changes of fifth-stage larvae of the desert locust *Schistocerca gregaria* (Forskål, 1775) (Orthoptera: Acrididae)

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Several studies have described the biochemical and biological effects of benzoylphenylureas (BPUs) but not completely elucidated their mechanism of action. The effect of diflubenzuron (DFB), a benzoylphenyl urea, was firstly examined on the cuticle in newly fifth-instar larvae of *S. gregaria*. Treatment was made 24h earlier by ingestion of 30 mg/ml.

DFB significantly affected the levels of the compounds of cuticle compared with controls. In a second series of experiments, the effect of DFB was evaluated on hemolymph ecdysteroid levels in fifth-instar larvae of *S. gregaria*. Results show that DFB significantly reduced ($p < 0.05$) ecdysteroids titres in hemolymph during larval cycle with disruption of molting compared to controls.

The effect of three plant extracts of *Inula viscosa*, *Sinapis arvensis,* and *Artemisia herba halba* against second-stage larvae of *Meloidogyne*

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Agronomic issues due to the different genera of nematodes are globally known in vegetable farming. Species of these genera are highly polyphagous and are a phytosanitary issue of great magnitude. For agricultural, environmental and economic improvement purposes, we tested and evaluated the effect of root parts of three plants: *Inula viscosa*, *Sinapis arvensis* and *Artemisia herba halba* and an alga*: Cystoceira crinita in vitro* on the the second larval instar (L2) of Meloidogyne.*Cystoceira crinita* proved to be more effective with a 100% mortality rate and a low revitalization which is comparable to Oxamyl. On the other hand, the aqueous extract of the roots of the three plants revealed a lower mortality rate which is more reversible than that of the algae.

The results showed that this macroalgae has a nematocid effects relevant to these toxic compounds compared to the plant extracts which showed a nematostatic effect.

Identification of necrophagous Diptera visiting bait traps in Ghardaia, Algeria

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Forensic entomology is the use of insects to aid legal investigations. The main purpose of forensic entomology is to establish the postmortem interval (PMI). In order to estimate the PMI, a forensic entomologist compares the case data with certain reference information relevant to the particular location and time of year. This reference information, including the local distribution of species, are not available in Algeria. Therefore, experiments need to be conducted to provide references for entomological evidence. The objective of this study was to identify the necrophagous fly species which arrive first to carrion using liver baits in Ghardaia.

The study was carried out during the spring season in the palm grove of Beni Isguen, Ghardaia which is well known by its hot arid climate. The experiment site (32°28'0'' N, 3°42'0'' E), is situated at an altitude of about 526 metres above mean sea level. On April the 4th, 2014, a number of three liver baited traps were used; two of them were placed in the shade and the other one was exposed to the sun. Flying insects and larvae were captured and identified.

After few minutes, flies invaded the trap which was exposed to the sun. In contrast, no flies were observed in the other traps. A total number of fourty five (45) adult specimens belonging to three taxa were identified: *Calliphora vicina* (Robineau-Desvoidy, 1830) (*Diptera*, *Calliphoridae*) (51.11%), *Lucilia sericata* (Meigen, 1826) (*Diptera*, *Calliphoridae*) (33.33%) and *Sarcophaga africa* (Wiedemann, 1824) (*Diptera*: *Sarcophagidae*) (15.55%). Six hundred and three (603) maggots belonging to two taxa were identified: *Calliphora vicina* (76.28%) and *Lucilia sericata* (23.71%).

The data obtained from this study provides baseline information regarding the carrion fauna of this area. It will also form a basis for similar studies in different geographical and climatological regions of Algeria.

The effects of transportation on shrink in cattle

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Transportation is a process that affects the animal physiogically and causes shrink naturally. The shrink of cattle transported within the optimum animal welfare condition will be least. Transportation period, supplying water and feed to cattle before and after the transportation, the design of the vehicle used for transportation, temperature of the environment, age and temperament of the animal are the main factors affecting shrink during transportation. As the transportation distance increases; transportation period, temperature of the environment, feed and water support are the most effective factors especially. The transportation shrink may be decreased and profitability of cattle buyers and sellers may be increased by shortening the period of transportation, supplying feed and water, transportation of cattle at a temperature within thermoneutral conditions.

Hydrological modelling of temporary aquatic systems: a tool in ecological research and management

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Temporary aquatic systems are in many (semi) arid areas an important source of surface water for livestock, wild life and men. Additionally they often harbor a unique biological diversity. Temporary water bodies occur in different types, such as wetlands, rock pools, saline and freshwater pans (pools) and all share an important characteristic: the variable presence of water with alternating dry and wet phases. The hydroregime, characterized by the duration, frequency, and predictability of inundations, is one of the most important drivers of local and regional biotic and abiotic processes. Accurate reconstruction of this complex variable requires hydrological modelling based on long-term climatic records.

As a first step in the development of hydrological models for diverse potential applications, we automated and extended a water balance model for rock pools, the simplest type of temporary pools. Next, this model was adapted for clay pans, a more complex system (case study in a Savannah woodland). These daily water balance models are based on precipitation as major source and evaporation as dominant loss factor and need some pool specific variables based on morphometrics and soil composition of the basin.

Such types of models can be used for assessing fundamental ecological questions about the role of habitat stability as a driver of diversity patterns in temporary pool metacommunities and to understand patterns in aquatic species distribution and composition. Furthermore, these models can also be used for wildlife management purposes by simulating and predicting water availability over space and time in wildlife reserves and to understand distribution and migration patterns of game species. Finally, these simulation models can also be used to evaluate the impact of climate change on habitat suitability, aquatic diversity and water availability.

Biodiversity of the understory kelp-associated community (*Laminaria hyperborea*), in natural and exploited conditions

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Kelp forests are major benthic ecosystems in coastal temperate reefs, due to their primary production and the biodiversity inhabiting them. The *Laminaria hyperborea* forests are very heterogeneous and are characterized by several micro-habitats. Scientists study whether the impact of kelp harvesting impact the structure functioning of these systems.

In this study, which took place in Brittany (France), we focused on the biodiversity and the structure of the understory in different experimental conditions of exploitation (unexploited, harvested and experimental clearing).

We found 316 taxa in total, whose 126 taxa of algae, 115 of fixed fauna, 61 species of mollusks and 9 of echinoderms. Similarly to what is found in terrestrial forests, we divided the algae assemblages in three layers or stratum, following their size and their occurrence. On the experimental area, we also found that the understory algae were moderately impacted by harvest, unlike mobile and fixed fauna which showed differences between impacted and pristine locations.

Although further works is necessary because of larges spatio-temporal variations, gastropods and fixed fauna may represent good indicators of exploitation.

Diversity of rodents and shrews in the Yangambi Biosphere Reserve, DR Congo

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The UN-REDD+ strategy aims at protecting and enhancing biosphere carbon stocks, by conserving tropical rainforest systems, as a means to mitigate global climate change. Biodiversity is generally described as a potential 'co-benefit' of forest carbon sequestration, but components of forest biodiversity may overlap to different degrees, trade off with, or be largely independent from those that intervene in carbon storage potential. In general, biodiversity is positively (but rather weakly) associated with ecosystem carbon, but the association is geographically variable, and even reverses in some regions. Understanding the relationship between carbon stock and biodiversity is needed to maximize the UN-REDD+ gains, to better address the risks of UN-REDD+ programs, and to avoid substantial biodiversity loss. Therefore, this study will focus on the local scale relation of carbon stock and biodiversity expressed in multiple diversity parameters over a range of taxa.

We will use data from the first multi-taxon inventory in the central Congo basin conducted in the framework of the COBIMFO project (Congo basin integrated monitoring for forest carbon mitigation and biodiversity). The project started in 2010 and measured carbon as well as the diversity of 9 different taxa (eumycetozoa, lichens, trees, fungi, diptera, ants, termites, birds and mammals) in the Yangambi Biosphere Reserve

In a first step we monitored the diversity of rodents and shrews in the Yangambi Biosphere Reserve. A total of 617 rodents and shrews were captured in several forest types between July 2013 and June 2014. The specimens were determined using DNA Barcoding. Species richness was generally higher in young-regrowth forests compared to old-growth forests.

Terpene biosynthetic pathway in aphid in relation with endosymbiont diversity

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Development of innovative approaches in crop protection requires to more fully explore the aphid biology such as the interactive network linking aphids to the host plant they feed on and endosymbiotic bacteria they harbor. Specific adaptations of aphids toward their host plants were found to be related to the occurrence of some secondary and facultative endosymbiotic bacteria (beside one primary endosymbiont namely *Buchnera aphidicola* being essential in all aphids to stay alive). The terpene biosynthetic pathway and its regulation as well as the location of production and storage are still unknown. In insects, terpenoids form an extensive group of natural products involved in a number of important biological processes. These molecules serve for instance as hormones (e.g. juvenile hormone) and pheromones. In aphids, the most prominent and well-studied interactions among conspecifics are those mediated by alarm pheromone. We investigate the terpene biosynthetic pathway and its putative hormonal regulation using MALDI-imaging and focusing on specific proteins and related metabolites. Our work will highlight the potential contribution of endosymbiotic bacteria to the production of terpenes in aphids by « multi-omics » and micro- injection approaches.

Genetic diversity and connectivity of the stony coral *Acropora tenuis* along the coast of Kenya and Tanzania

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The reefs along East Africa are declining and the ability of coral reefs to adapt to, and recover from, environmental stressors such bleaching events and ocean acidification depends highly on genetic diversity of populations and the connectivity among reefs. Connectivity between coral populations depends on the life history of the coral species, the geographic location of the reefs and oceanographic barriers between populations.
In this study we present research on the genetic diversity and connectivity of the stony coral *Acropora tenuis* along the coastline of Kenya and Tanzania with a particular focus on the possibility of oceanographic barriers limiting dispersal. *Acropora tenuis* is a common Indo-Pacific coral species which reproduces by synchronized mass broadcast spawning events.

Coral fragments were collected at five locations in Kenya and six locations in Tanzania, including three islands (Pemba, Zanzibar and Mafia Island). Multiplex PCR was performed with seven DNA microsatellite markers, followed by fragment length analysis on a capillary sequencer.

All sample locations showed high inbreeding while maintaining high allelic richness. No clear genetic structure was found when comparing all sample sites (F_{st} = 0.061), which indicates high overall connectivity. However, significantly higher differentiation was found among island sites than mainland sites. This indicates that the connectivity between mainland sites is higher than between island sites. High overall connectivity can be explained by the long distance dispersal capacity of *Acropora tenuis* and by the influence of the northbound East African Coastal Current which aids dispersal by effectively spreading larvae along the coast. Strong outbound currents and eddies around the islands, as well as the relatively sheltered island reef sites, could explain the more limited connectivity of the island sites.

Evaluation of sampling intervals to score behavioural states

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In behavioural research studies, the validity of the intervals that are used for instantaneous scan sampling is seldom systematically evaluated. Engel (1997) suggested an elegant method starting from a small continuously scored dataset from which a lot of instantaneous pseudo-protocols are derived, each one with a longer sample interval than its predecessor. The relative frequency of the behaviour pattern under investigation in the continuous protocol and every pseudo-protocol is computed and the dependence between each data point is calculated. The optimum sample interval is graphically derived from on the one hand, the association of pseudo-protocols with different intervals and the continuous protocol (Spearman rank correlation coefficients) and on the other hand, the mean probability of sampling the behaviour statistically independent.

We applied this method on a data set of Konik horses and Scottish Highland cattle in a Belgian coastal dune reserve.

For 127 focals of 900 seconds with continuous scoring, a data entry was made every second on ingestive and locomotory behaviour states, vegetation types of the area and consumed food type. Based on the screening of the plots visualizing the optimal intervals, a compromise was determined to find an optimal interval for different behaviour states.

The results obtained from this analysis were applied on a larger data-set to describe the observed activity budget and habitat use of the grazers.

DNA methylation in the mangrove rivulus and effects of EE2 on its developmental plasticity

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The mangrove rivulus, *Kryptolebias marmoratus*, is one of the two known self-fertilizing hermaphroditic vertebrates, resulting in populations composed of distinct homozygous and isogenic strains. Despite no or low genetic diversity within a strain, this fish displays remarkable levels of phenotypic plasticity.

The present study investigated developmental plasticity induced by a chronic exposure to 17-α-ethynylestradiol (EE2) in rivulus, and the role of DNA methylation in driving this plastic response. Hatchlings from a single isogenic lineage were individually exposed during 28 days post hatching (dph) to solvent control, 4 and 120 ng/L of EE2, and then transferred to clean salt water until 180 dph.

We aim to link global DNA methylation and methylation at specific GpG sites of selected genes to both cellular (proteome) and organismal phenotypes (hormone levels, behaviour, growth, reproductive success) measured during the course of the experiment.

Preliminary results show that at 28 dph, both standard length (SL; 12.6 ± 0.4 vs 13.4 ± 0.4 mm) and mass (31.9 ± 3.4 vs 37.8 ± 3.6 mg) were significantly lower in fish exposed to 120 ng/L compared to control. In the 4 ng/L group, only SL was significantly lower than control (13.0 ± 0.5 vs 13.4 ± 0.4 mm). At 56 dph, only SL of individuals exposed to 120 ng/L treatment differed from control (16.5 ± 0.4 vs 17.0 ± 0.5 mm). A first examination of global DNA methylation showed that the proportion of methylated CpG sites might be lower than what is reported in other fish species.

Consequences of climate and landscape changes on populations of bumblebees (Hymenoptera: Apidae: *Bombus*) in Belgium

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It is widely acknowledged that climate and landscape changes are currently the most pervasive drivers of ecosystem change worldwide and will also play an important role in the future. Therefore, a thorough understanding of the mechanisms involved in the responses of populations and communities to these environmental changes is a pre-requisite to predict and mitigate the long-term effects of these changes on biodiversity. Bumblebees are among the most essential pollinators for their services to both natural ecosystems and agricultural production. However they currently experiment a strong decline fostered by habitat fragmentation and loss (e.g. diminution of open landscapes) and agricultural intensification. Indeed, changes in the structure of rural landscapes increase the fragmentation and isolation of populations leading to loss of genetic diversity. Moreover, agricultural intensification and standardization of production processes eliminate bumblebee food sources such as leguminous. More recently, several studies have implicated changes in climate in the bumblebee decline. Furthermore, climate and landscape changes are assumed to underlie a multitude of environmental pressures that may have a greater joint impact on biodiversity than when operating in isolation.

The aim of this project is therefore to qualify and quantify the relationship between landscape changes, climate change and changes in populations of bumblebees.

We use a comparative approach based on past and present landscape composition and structure, historical climate records and bumblebees data in Belgium. This will provide key elements for understanding the processes responsible for the decline of populations of bumblebees, which will in the longer term allow designing conservation strategies to halt biodiversity loss of these essential pollinators.

Change of pace of life under rapid urbanization: modifications in functional morphology, physiology and behavioural syndromes in Orthoptera

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The recent and rapid process of urbanization provides a unique opportunity to study the mechanisms of rapid changes, which is a major goal of evolutionary ecology. Urbanization is accompanied by several environmental changes (e.g. habitat fragmentation and loss, temperature increase – i.e. urban heat island hypothesis) altering selection pressures. For a vast majority of species, these conditions challenge survival or reproduction. However, some flourish well in anthropogenic environments and developed a successful “urban profile”: individuals are able to live in warmer and more fragmented, small habitat patches through morphological, physiological or behavioural adaptations (including plasticity).

In this Phd-project, we study a selection of morphological, physiological and behavioural variables in natural and urban environmental settings in two species of Orthoptera that differ in ecological profile (*Chorthippus brunneus* and *Pholidoptera griseoaptera*). This is done at two different latitudes (Belgium and France) to study interaction effects with natural and urban thermal conditions. This project adopts an integrative, syndrome approach, i.e. the suite of morphological, physiological and behavioural variables associated with a particular lifestyle in a particular environment.

The project has three central objectives: (1) Study of the dispersal abilities by morphological and physiological analyses. Dispersal is essential for the survival of a species in fragmented habitat such as urban environments; (2) Study of individual behaviours and differences between urban and natural environments according to a personality research approach. Laboratory experiments will score temerity, activity, aggressiveness and exploration behaviour for individuals of both species and both habitat types; (3) Test the hypothesis of the "pace of life syndrome" by comparing resting metabolic rate between individuals of natural and urban populations and explore the relationships between their physiological pace of life and behaviours (personality traits) between the types of population.

Shedding light on two unstudied species of *Lepilemur* of Northwest Madagascar

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Madagascar's extraordinary biological diversity is under increasingly severe threat from anthropogenic degradation of its forest habitats. Genus *Lepilemur* is exemplary of the mammalian fauna of the island. The genus is particularly negatively affected by deforestation and habitat fragmentation, which is reflected by the recent uplisting of many of the 26 *Lepilemur* species into one of the threatened categories of the IUCN Red List. *Lepilemur* have a small distribution range, and fairly small total populations. Their pattern of distribution appears to have been established through vicariant speciation, probably driven by changes in the configuration of the hydrographic system. Such a pattern permits to expect a high level of niche conservatism.

The main goals of this study is to verify the existence and extent of niche conservatism in three closely related species within genus *Lepilemur*, and to draw conclusions on the applicability of conservation protocols to a broader array of *Lepilemur* species. This study focuses on three poorly-known taxa: *L. sahamalazensis*, *L. dorsalis* and *L. mittermeieri*, which have their distribution ranges in northwestern Madagascar.

We will present our global project as well as the results of a field mission conducted from March to June 2014 in order to specifically 1) evaluate *Lepilemur* presence and abundance in forest patches of northwest Madagascar and 2) to investigate their sleeping sites characteristics. Our study is conducted on species that have been described but never studied before.

The use of anesthetics, fixatives and preservatives on invertebrates dedicated to DNA-based molecular analyses: a manual of best practice

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The Royal Museum for Central Africa (RMCA) and the Royal Belgian Institute of Natural Sciences (RBINS) hold the most important zoological collections housed in Belgium. The existing collections served numerous research activities, in particular traditional morphological research. A large part of the collections involve specimens preserved in various ways intended for this type of research, including dried specimens, specimens stored in 75% alcohol at room temperature or in formaldehyde. Some recent accessions are stored in various ways intended for both morphological and molecular research. But for the majority of these collection specimens, the current preservation methods do not optimally inhibit the natural process that will gradually lower the integrity of the genetic material.

Several factors will affect the DNA preservation and have effects on future molecular analysis. The main degrading agents of DNA in most samples are enzymes with DNase activity. These can either be present in the sample, or produced by growing microorganisms when stored improperly and will degrade DNA. All of these enzymes require an aqueous environment to function properly. The goal is therefore to store samples in a water-free environment in order to avoid any DNA degradation. The fragmentation of DNA may also be induced by environment parameters such as pH, salinity, temperature or exposure to some chemicals, such as ethylene glycol, formalin, ethyl acetate or forms of alcohol other than absolute ethanol. Some anesthetic agents, trapping solutions, fixatives or preservatives may be incompatible with good quality DNA. Subsampling for genetic analysis prior to fixation is therefore essential in these cases.

The AGORA MOLCOL project has been funded by the Belgian Science Policy Office to ensure an optimal future use of these zoological collections, by proposing clear outlines and procedures for molecular systematics. It is within the framework of this project that this manual has been written.

Correlations between *in vivo* bite forces and functional properties of the cranial muscles in anoles from the Greater Antillean Islands and Central and South America

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Some of the most spectacular cases of modification by descent concern adaptive radiations. Whereas Caribbean *Anolis* lizards are among the best studied island radiations the mainland *Anolis* radiation has received much less attention. Recent studies have observed that for the same morphologies, anoles on the mainland have higher bite forces than anoles on islands. However, the underlying morphological or functional bases that drive these differences remain unknown.

Here we test whether mainland anoles show larger muscles (i.e. a bigger muscle volume or shorter fibre length) relative to their head size as they show relative higher bite forces compared to islanders.

We first took morphometric measures on each specimen and further analyses were performed taking size into account. In order to calculate the physiological cross-section which represents the strength of the muscle, we dissected the jaw muscles apparatus to isolate each muscle. Doing so, we were able to compare the different characteristics of the muscles that might explain variation in bite force.

We show that muscle characteristics do not explain the observed difference in bite force. In fact, unexpectedly islands anoles have bigger muscles. Our results of the comparison on the morphometric data, on the other hand, show that the difference in bite force may be explained by the biomechanics of the jaw system (lever arms) rather than by muscle characteristics. Thus, selection for high bite force appears to result in a trade-off between size and strength.

Ecological status of Mediterranean coastal ecosystem using quality indexes

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Coastal marine ecosystems are subject to many anthropogenic pressures which affect biodiversity by rapid destruction of habitats and populations. These anthropogenic pressures can be highlighted by a survey and a habitat and population's census, by the assessment of the environmental ecological status using quality indexes. Our study area, which faces the oceanographic research station STARESO (Corsica), is considered as a reference site in the Mediterranean Sea and qualified as little affected (pristine). This study is part of the STARECAPMED (Station of Reference and Research on Change of local and global Anthropogenic Pressures on Mediterranean Ecosystems Drifts) project funded by the Territorial Collectivity of Corsica and by The French Water Agency (PACA-Corsica). During this work, the ecological status of the area has been assessed, in a completely non-destructive way, based on the description and characterization of the ichthyological, malacological and algal settlements, and on the ecological status of the seawater body. The quantitative and qualitative (FAST) inventory of fish fauna and malacofauna reveals a population with high species richness and with a few notable species, with fishing pressures that is felt but not as important as in other parts of Mediterranean sea. As for algal communities in the study area, they are qualified as little affected by human activities and are similar, as shown by the PREI and CARLIT indexes, to a water body with a "high" ecological status. However, a large number of environmental factors, independent from pollution and other anthropogenic impacts, come into play when describing the population of an area. But although some species densities have fluctuated in the last 30 years, the overall final characterization of the communities corresponds to a pristine nature and reference area status, as attributed to the study area since the installation of the oceanographic station in the bay of Calvi on 1972.

Changes in the effector genes mRNA expression in development of honeybee (*Apis mellifera carnica*) in response to infection with *Varroa destructor*

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Phenomenon of mass disappearance of honey bees (CCD-Colony Collapse Disorder) is the result of co-interaction of many factors, but especially large negative part in its essence has mite *Varroa destructor*. This parasite, feeding on hemolymph of larvae, pupae, and imago, deprives bees of valuable nutrients but what's more dangerous is a vector of viruses, bacteria and fungi. Humoral immune response of insect host is connected with the synthesis antimicrobials peptides (AMPs) and the activation of enzymatic cascades that regulate melanin formation and clotting. Pathogens activate Toll signalling cascades, leading to AMPs genes expression by NF-κ B factors.

The aim of the research was the analysis expression of effector genes: *abaecin (GB18323), defensins-1 (GB19392), hymenoptaecin (GB17538), lysozyme-1 (GB10231)* in development of *Apis mellifera carnica* infected with *V. destructor*.

The research material consisted of five developmental stages of worker naturally infected with *V. destructor.* There were: capped stage of the fifth larva (L5), prepupa (PP), two stages of pupae with pink (P3) and with brown eyes and dark trunk (P5) and imago (I) (JAY, 1963). Real-time PCR was carried out using SYBRGreen 2xPCR Master Mix (A&A Biotechnology), in accordance according to the with the manufacturer's instructions. Data were analyzed and normalising with respect to reference gene *rp49* and endogenous control samples (the analogous stages of not infected workers) using the method $2^{-\Delta\Delta Ct}$ (Pfaffl 2001). All the tests were performed in three replications using LightCycler (Applied Biosystems, FAST7500).

In larvae the infection had induced only the increase of expression of *defensin-1* gene (148-times). In the infested: prepupa, pupae and adult specimens noted the reduction expression of all effector AMPs genes was observed.

The reduction of the AMP genes expression in the development of infested honey bees confirms at the molecular level the earlier date about the phenomenon of immune suppression caused by varroatosis.

Biomarkers of exposure in mussels *Mytilus galloprovincialis* to characterize the environmental state of Moroccan Atlantic center coastal areas

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Alterations in a number of biochemical parameters in marine organism represent specific markers of exposure to particular classes of contaminants. They are used as tools for the detection and monitoring of contaminants impact.

In this study, 3 biomarkers, Acetylcholinesterase (AchE), Gluthation-s-transferase (GST) and Malondialdehyde (MDA) were measured in indigenous mussels *Mytilus galloprovincialis* from 6 sites of Moroccan Atlantic center coast, subject to anthropogenic activities, during spring 2013.

The results show a general stress, with 3 sites more contaminant than others, and indicate that the biochemical alterations observed in the mussel digestive gland could be used as suitable biomarkers for evaluating the residual effects of contaminants and can provide early warning information on the impact of organic contaminants on marine environment.

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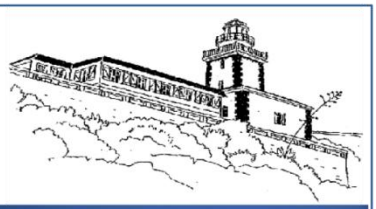

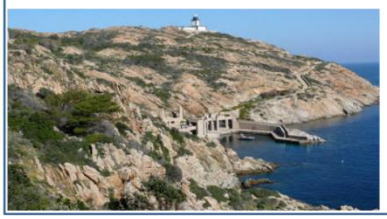

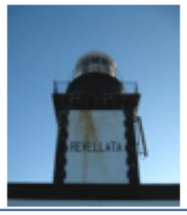

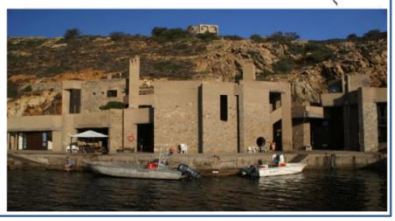

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Société Royale des Sciences de Liège

Nec Temere, Nec Timide

La Société Royale des Sciences de Liège fut fondée en 1835 par un groupe de professeurs d'université et d'érudits liégeois. Sa Majesté le Roi Léopold I daigna lui accorder le titre de Société Royale.

Elle est la deuxième Société pluridisciplinaire de Belgique après l'Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique fondée en 1772 par l'Impératrice Marie-Thérèse d'Autriche.

Elle compte actuellement quelque 220 membres effectifs et correspondants dont plusieurs Prix Nobel et échange ses publications avec plusieurs centaines d'Institutions réparties dans le monde entier.

Les buts de ses fondateurs, auxquels leurs successeurs sont restés fidèles, sont de contribuer au progrès des Sciences et d'en répandre la connaissance en nouant des contacts avec les savants étrangers, de resserrer les liens d'estime et d'affection avec leurs collègues liégeois, de créer dans la Province de Liège un centre auquel puissent se rallier toutes les personnes qui se livrent à des recherches sur les principes scientifiques qui servent de base à leurs activités professionnelles.

Cet esprit d'ouverture vers l'extérieur a inspiré la publication et la diffusion des Mémoires de la Société à partir de 1843 et d'un Bulletin bimestriel à partir de 1931. Des articles originaux d'auteurs belges et étrangers, acceptés par les Comités de lecture, des actes de congrès nationaux et internationaux, des thèses de doctorat, les textes des conférences faites à sa tribune sont ainsi diffusés dans le monde grâce au réseau d'échange et aux membres correspondants.

La Société reçoit chaque année à sa tribune trois conférenciers étrangers de renom qui viennent exposer les résultats de leurs recherches.

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Museum:

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Website: www.aquarium-museum.ulg.ac.be

Les Cercles des Naturalistes et Jeunes Naturalistes de Belgique

Association sans but lucratif créée en 1957 par Léon WOUÉ groupant des jeunes et des adultes intéressés par l'étude de la nature, sa conservation, la protection de l'environnement et le tourisme intégré.

Les Cercles organisent de nombreuses activités très diversifiées de formations, de découvertes ... ouvertes à tous dans les régions francophone et germanophone du pays. Nous rassemblons près de 10.000 membres et éditons à leur intention un périodique trimestriel "**L'ÉRABLE**" qui annonce entre autres toutes les activités.

En collaboration avec l'Entente nationale pour la Protection de la Nature, la société intervient régulièrement en faveur de la défense de la nature et de l'environnement.

Les Cercles gèrent des réserves naturelles en Wallonie et aident à la gestion de réserves naturelles d'associations soeurs, ils organisent des excursions à travers toutes les parties francophone et germanophone du Pays, des voyages d'études (flore, faune, paysages, régions ...), des formations de Guides-nature, des stages et des leçons de nature (pour des adultes en formation continuée, pour les naturalistes et pour les écoles) ... diversifiés et ouverts à tous.

Nos formations apportent aux participants des acquis, des savoir-faire, savoir-être qui vont entraîner des changements dans leurs comportements citoyens par leur combinaison "connaissance théorique "et "apprentissage participatif ". Elles s'adressent à tous les publics et ne nécessitent pas de connaissances préalables.

Site web: www.cercles-naturalistes.be

Natagora asbl une association de protection de la Nature jeune : elle est née en juin 2003. Mais, dès cette date, elle bénéficiait du soutien de plus de 8 000 membres et possédait plus de 50 ans d'expérience dans la protection, l'étude et la sensibilisation à la nature.

Natagora est en effet née du rapprochement entre deux associations : Aves et Réserves Naturelles RNOB. Ensemble, elles ont créé une structure forte pour leur permettre de protéger au mieux les intérêts de la biodiversité: Natagora! Natagora compte à ce jour plus de 17 000 membres affiliés !

Aves a cependant gardé une identité forte en tant que pôle ornithologique de Natagora. Il a pour but d'étudier et de protéger l'avifaune. Les observations d'oiseaux sont récoltées et analysées pour faire l'objet d'exposés et de publications (articles, atlas...). Des études spécialisées sont aussi réalisées par le réseau des ornithologues amateurs et professionnels, notamment afin de mieux connaître l'évolution des populations de nos oiseaux au fil du temps.Natagora a pour but de protéger la nature, plus particulièrement en Wallonie et à Bruxelles. Avec un grand objectif : enrayer la dégradation de la biodiversité et reconstituer un bon état général de la nature, en équilibre avec les activités humaines. Aves

Site web : www.natagora.be

NOTES

See you next year for the

ZOOLOGY 2015

« Dynamic Ecology and Evolution »

Amsterdam

8 & 9 October 2015

Friday, December 12

	Auditorium	Charles Jeuniaux room	Practical work room
9:00	Welcome		
9:15	Keynote: Open access publishing		
10:15	Coffee break (Hall)		
	Physiology & Ecotoxicology	**Phylogeography & Biodiversity**	**Evolution & Ecology**
10:45	RICHIR	HAVERMANS	LEBIGRE
11:15	MICHIELS**	VAN STEENBERGE	DE WOLF**
11:30	STINCKENS**	DECRU**	MASCART**
11:45	PINZONE*	THUILLIER**	VIEIRA**
12:00	CHRISTIANSEN	HUYGHE**	TERRANA*
12:15	BORGMANS**	BRANDERS*	VAN HOYTEMA**
12:30	JACOBS**	KERCKHOF	THIRIET
12:45	Lunch (not provided)		
14:00	Keynote: Ecological interactions		
15:00	Coffee break (Hall)		
	Ecology	**Evolution**	**Morphology**
15:30	HERREL	FLOT	VAN WASSENBERGH
16:00	BOUILLIART**	ETOUNDI**	SEGALL**
16:15	REMY**	FRAIJA-FERNANDEZ**	OLIVIER**
16:30	ARRIZABALAGA-ESCUDERO**	MAEX**	BERTUCCI
16:45	BENITEZ**	KORSTEN	CLAES*
17:00	QUINZIN	HESPEELS**	GILLET*
17:15		KOCKZIUS	DE MEYER**
17:30	REYSERHOVE**	PHILIPPE	CORNETTE
17:45	KAISER**		GERARD**
18:00	Social event - Poster session (Hall & Auditorium)		

Saturday, December 13

	Auditorium	Charles Jeuniaux room	Practical work room
9:00	Keynote: Evolution		
10:00	Kets Award		
10:30	Coffee break (Hall)		
11:00		Technical session: Trophic markers	Technical session: Genetics
12:30	Lunch (not provided)		
	Conservation Biology	**Evolution & Behaviour**	**Ecology**
13:30	MOUTON	RAEYMAEKERS	VANDERPLANCK
14:00	DENAYER	WINANDY**	BAWIN**
14:15	FRANTZ	CAULIER**	DE BACKER**
14:30	PIGNEUR	FOKKEMA**	VAN MOORLEGHEM*
14:45	BOSSE**	MAILLARD**	LEPONCE
15:00	LINCHANT**	BARDO**	BARSICS**
15:15	SCHLEY	BROTCORNE**	LEMTIRI**
15:30	Coffee break (Hall)		
16:00	Keynote: Conservation Biology		
17:00	Closing session - Awards		

* MSc award competitor ** PhD award competitor