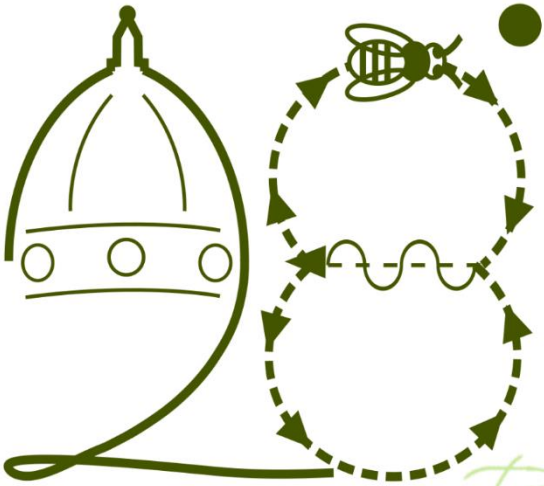
XXVIII Convegno Nazionale della Società Italiana di Etologia



Firenze, **9-12 S**ettembre **2019**

SOCIETA' ITALIANA DI ETOLOGIA

SIE

FLORENTINA STUDIORUM UNIVERSITAS

UNIVERSITÀ
DEGLI STUDI
FIRENZE

XXVIII CONVEGNO NAZIONALE DELLA SOCIETA' ITALIANA DI ETOLOGIA

SIE

Firenze, 9-12 Settembre 2019

Palazzo Nonfinito
Via del Proconsolo, 12

Polo di Novoli
Via delle Pandette, 3

Con il Patrocinio di Università degli Studi di Firenze e il contributo della Società Italiana di Etologia e dell'Università degli Studi di Firenze

Info e contatti:

https://socialinsectitaly2.wixsite.com/sie2019
sie2019firenze@gmail.com

Alessandro Cini - cini.ales@gmail.com
David Baracchi - david.baracchi@unifi.it
Rita Cervo - rita.cervo@unifi.it

UNIVERSITÀ DEGLI STUDI FIRENZE

Comitato scientifico

Presidente
Rita Cervo

Direttivo SIE
Stefano Parmigiani
Maria Cristina Lorenzi
Christian Agrillo
Claudio Carere
Elisabetta Palagi

Comitato locale
Laura Beani
Stefano Cannicci
Rita Cervo
Alessandro Cini
Francesco Dessì-Fulgheri
Sara Fratini
Felicita Scapini
Stefano Turillazzi
Alberto Ugolini
Marco Vannini

Comitato organizzatore

David Baracchi
Rita Cervo
Alessandro Cini
Francesca Romana Dani
Leonardo Dapporto
Filippo Frizzi
Elena Tricarico
Marco Zaccaroni

UNIVERSITÀ
DEGLI STUDI
FIRENZE

INDICE

SOCIETÀ ITALIANA DI ETOLOGIA SIE

UNIVERSITÀ DEGLI STUDI FIRENZE

PROGRAMMA

Lunedì 9 Settembre

11:00-15:00	**Registrazione**
15:00-15.30	**Benvenuto e saluti**
15:30-18:30	**Tavola rotonda – La divulgazione dell'Etologia**
19:00	**Aperitivo di benvenuto**
	Cena libera

Martedì 10 Settembre

9:15-13:00	**Sessione *Neuroscienze e Cognizione***
10:30-11:00	**Coffee break**
13:00-14:30	**Pranzo libero**
14:30-16:30	**Sessione *Orientamento, migrazioni e uso dello spazio***
16:30-17:00	**Coffee break**
17:00-19:00	**Sessione poster**
18:00-19:00	**Assemblea soci**
20:00	**Cena libera**

Mercoledì 11 Settembre

9:15-13:00	**Sessione *Dalla Riproduzione alla Socialità***
10:30-11:00	**Coffee break**
13:00-14:30	**Pranzo libero**
14:30-16:00	**Sessione *Etologia delle simbiosi***
16:00-16:30	**Coffee break**
16:30-18:00	**Sessione *Comunicazione***
18:00-19:00	**Sessione Poster**
20:30	**Cena sociale**

Giovedì 12 Settembre

9:15-13:00	**Sessione *Etologia Applicata***
10:30-11:00	**Coffee break**
13:00	**Chiusura congresso e saluti**

PROGRAMMA DETTAGLIATO

Lunedì 9 Settembre

Sede: Palazzo Nonfinito

11:00-15:00	**Registrazione**
15:00-15:30	**Benvenuto e saluti**
15:30-18:30	**Tavola rotonda – La divulgazione dell'Etologia**

Coordinatrice: **Laura Beani**

(v. programma degli interventi a pag. 15)

19:00	**Aperitivo di benvenuto**
	Cena libera

Martedì 10 Settembre

Sede: Polo di Novoli

9:15 **Sessione *Neuroetologia e Cognizione***

Chairmen: **G. Vallortigara, E. Alleva**

RELAZIONE SU INVITO

- **G. Vallortigara** - How to build a social brain: Basic equipment

CONTRIBUTI ORALI

- **E. Gatto** - Inhibitory control abilities in teleost fish
- **M. De Agrò** - An automated and objective system to train jumping spiders

10:30-11:00 **Coffee break**

- **T. Lucon-Xiccato** - Cognitive flexibility in male and female guppies
- **D. Baracchi** - Aminergic underpinnings of pheromonal modulation of olfactory learning and memory formation in honeybees
- **S. Smargiassi** - Impact of non-Protein Amino Acids (NPAAs) in nectar on honeybee gustatory response, feeding preference and learning and memory
- **E. Prato-Previde** - Breed differences in human-directed gazing: a comparison between Czechoslovakian Wolfdogs, German Shepherds and Labrador Retrievers
- **E. Visalberghi** - Age affects action planning in wild bearded capuchin monkeys (*Sapajus libidinosus*)
- **G. Annicchiarico** - Face-to-face interaction prolongs female homo-sexual contacts in bonobos
- **M. Cangiano** - First evidence of stone handling in geladas: ontogenetic trajectories of a peculiar form of solitary object play

13:00-14:30 **Pranzo libero**

14:30 **Sessione *Orientamento, migrazioni e uso dello spazio***

Chairmen: **L. Fusani, A. Foà**

RELAZIONE SU INVITO

- **L. Fusani** - To stay or to go: the physiology of migratory decisions

CONTRIBUTI ORALI

- **P. Luschi** - Investigating the diving and orientation behaviour of loggerhead sea turtles (*Caretta caretta*) following offshore displacement
- **A. Gagliardo** - Reliance on familiar visual landmarks by anosmic pigeons
- **S. Fratini** - Interference competition as a key determinant for spatial distribution of mangrove crabs
- **E. Mori** - Spatiotemporal behaviour of the endemic Apennine hare *Lepus corsicanus*
- **E. Natoli** - Territorial male wildcats defend female wildcats, lowering the risk of hybridization with the domestic tomcats

16:30-17:00 **Coffee break**

17:00-19:00 **Sessione poster**

18:00-19:00 **Assemblea soci**

Cena libera

Mercoledì 11 Settembre

Sede: Polo di Novoli

9:15 **Sessione *Dalla riproduzione alla Socialità***

Chairman/woman: **D. Rubolini, C. Giacoma**

RELAZIONE SU INVITO

- **D. Rubolini** - Of gulls, crows and swallows: a tribute to Nicola Saino (1961-2019) studies in behavioural ecology

CONTRIBUTI ORALI

- **A. Pilastro** - Dietary stress increases the total opportunity for sexual selection and modifies selection on condition-dependent traits in guppies
- **L. Picchi** - Egg-clutch exchange in a simultaneous hermaphrodite: evidence for conditional reciprocity in a cognitively unsophisticated animal

10:30-11:00 **Coffee break**

- **R. Branconi** - Ecological and social constraints combine to promote social evolution in clownfish
- **F.R. Dani** - Nesting behaviour, intraspefic interactions and defense against nest parasites in the solitary bee *Megachile parietina* (Geoffroy, 1785)
- **C. Grasso** - Can we predict the social hierarchy of a group of giraffes (*Giraffa amelopardalis*) by observing the order of leaving the enclosure? A preliminary study
- **A. Zanoli** - Asking for sex…or for grooming? The role of pre-copulation calls in geladas
- **C. Llamazares-Martin** - Spontaneous yawning in *Otaria flavescens*
- **G. Cordoni** - Play in newborn pigs (*Sus scrofa*): the more variable, the more successful
- **E. Marchi** - Play fighting and facial communication in meerkats (*Suricata suricatta*)

13:00-14:30 **Pranzo libero**

14:30 **Sessione *Etologia delle simbiosi***

Chairwomen: **F. Barbero, M.C. Lorenzi**

RELAZIONE SU INVITO

- **F. Barbero** - Deception strategies in social parasites of ants

CONTRIBUTI ORALI

- **D. A. Grasso** - Ant-plant interactions in temperate areas: from basic to applied behavioural ecology
- **M. Martini** - Effect of *Echinococcus multilocularis* infection on anti-predator behaviour of *Microtus arvalis* intermediate host
- **D. Campobello** - Asymmetrical interspecific communication in avian mixed species colonies

16:00-16.30 **Coffee break**

16:30 **Sessione *Comunicazione***

- **D. Maestripieri** - Evolution and functional significance of female copulation calls in primates
- **E. Demuru** - Are bonobo females' postures influenced by their sexual status?
- **C. Giacoma** - Bubbling, drumming or talking? Underwater communication in *Emys orbicularis ingauna*
- **F. Cappa** - Social context rather than nestmateship or imprinting shapes recognition in a social wasp
- **E. Tommasi** - Intentionality and rapid mimicry during playful interaction in Czechoslovakian wolfdogs
- **I. Norscia** - Possible yawn contagion in the domestic pig, *Sus scrofa*

18:00-19:00 **Sessione Poster**

20:30 **Cena sociale**

Giovedì 12 Settembre

Sede: Polo di Novoli

9:15 Sessione *Etologia Applicata*

Chairwomen: **F. Cirulli, P. Palanza**

RELAZIONE SU INVITO

- **F. Cirulli** - New Frontiers of applied ethology: exploiting the emotional potential of human-animal relationships through Animal Assisted Interventions

CONTRIBUTI ORALI

- **F. Zoratto** - Poor empathy and abnormal aggression in mice as a model for human psychopathology
- **C. Burani** - Comparing problem-solving style in pet and long-term shelter dogs

10:30-11:00 Coffee break

- **E. Tricarico** - How behaviour helps to control invasive alien crayfish
- **G. Mazza** - Pest Risk Assessment of *Trissolcus japonicas* (Hymenoptera: Scelionidae): host-acceptance behavior on *Halyomorpha halys* (Heteroptera: Pentatomidae) and non-target species
- **M. Pusceddu** - From self-medication to social-medication. The use of propolis in Varroa-infested hives
- **D. Carlesso** - Effects of a biopesticide on honeybees' habituation and sucrose responsiveness
- **C. Castracani** - Trophobiosis between ants and mealybugs: ant behaviour as a useful tool for pest monitoring in vineyard IPM
- **S. Cannicci** - Digging behavior in mangrove crabs: quantifying its bioturbation potential in Hong Kong coastal forests
- **C. Carere** - Using a RobotFalcon for chasing away flocks of birds

13:00 Chiusura congresso e saluti

Poster

Alleva E. - Experimental infestation of the nematode parasite *Anisakis pegreffii* induces marked behavioural changes in the European bass (*Dycentrarchus labrax*)

Bandoli F. - What is in it for me? Welfare assessment of a captive colony of African penguins before and after the transfer to a new enclosure

Bertini M. - From infancy to adulthood: consistency and effectiveness of playful facial mimicry in bonobos

Bertoni V. - Are feline semiochemicals "communicative" enrichments for European wildcats?

Bigozzi F. - Beyond the species: dog-horse communication during social play

Branconi R. - Understanding the behavioural integration of social parasites into the host dominance network: a multilevel analytic framework tested in paper wasps

Buglisi M. - Evaluation of stress-induced genomic damage in shelter and home cats

Cancemi L. - The use of environmental enrichments by single-housed crab-eating macaques

Carlesso D. - A new paradigm for studying quantity discrimination ability in invertebrates

Caselli M. - One-male unit composition and time budget of a gelada population in an unprotected area

Cerritelli G. - Effect of weather conditions on spring migration Eurasian teals

Cini A. - Larval nutritional status and adult-larva vibrational communication: playback experiments in the paper wasp *Polistes dominula*

Cordeschi G. - Environmental variability and chronic stress: hair cortisol concentration in red squirrel *Sciurus vulgaris*

Costa E. - Niche overlap between the golden jackal (*Canis aureus*) and the red fox (*Vulpes vulpes*) in a sympatry area in north- eastern Italy (Gorizian karst)

Dapporto L. - Home economics in an oak gall. Behavioural and chemical immune strategies against a fungal pathogen in *Temnothorax* ant nests

De Palma C. - Ethological approach in post-adoption follow-up of shelter cats

Fattoruso V. - Vibrational communication of the greenhouse whitefly *Trialeurodes vaporariorum* (Westwood) (Homoptera: Aleyrodidae)

Ferrari C. - Influence of intrinsic and extrinsic factors on behavior and survival of Alpine marmots (*Marmota marmota*)

Forti V. - Post-conflict conciliatory tendency and third-party interaction in Amiata donkeys

Friggi S. - Interspecific interactions among mesocarnivores in the Northern Apennines

Galli G. - Integration of multisensory information in the ant *Lasius niger*

Gazzola A. - Behavioural plasticity under predation risk in relation to environmental change in an endemic Italian frog

Ghizzoni M. - Behavioral adaptation to urban environment by ant of *Tetramorium caespitum* complex

Giannetti D. - Field survey on ant-gall colonization in Italy: first data on nest architecture and the role of ants as plant defenders

Grasso C. - Human and non-human primates: visitors' perception in a wildlife sanctuary

Lenzi C. - Social responses of zebrafish induced by different visual stimuli: a cyber-ethological study

Loconsole M. - Individual recognition in 4-day-old domestic chicks is not affected by physical contact deprivation

Luminelli D. - A year as a bear: welfare monitoring of a pair of zoo-housed brown bears

Mazza G. - Diet of the American mink *Neovison* vison introduced to Mikri Prespa (northern Greece)

Mori E. - Did Siberian chipmunks colonize areas outside the Sigurtà Garden Park? A summary from Mincio riverbanks

Ottolini G. - Louder together: intra-specific and inter-specific interactions of macaws

Palanza P. - Effects of oxytocin treatment during labor on early mother-infant interactions

Pellitteri-Rosa D. - Lateralization in the Hermann's tortoise (*Testudo hermanni*) in different behavioural contexts

Ramundo G. - Effects of early maternal environment and limbic NPY-1R expression in reproductive behaviour

Regaiolli B. - Greater flamingos at Parco Natura Viva: a "pink" story of success and monogamy

Salerno G. - Observing animal behavior during science lessons at school

Scopa C. - The horse in the mirror: self-recognition in *Equus caballus*

Seganfreddo S. - Behavioural observations from the sky: Unmanned Aerial Vehicles (UAVs) as a tool in the investigation of harbour seals' (*Phoca vitulina vitulina*) behaviour

Tricarico E. - Crayfish track chemical scents in turbulent, unidirectional flows

TAVOLA ROTONDA – La divulgazione dell'Etologia

Introduce **Laura Beani** - Breve filmato di **Danilo Mainardi**

RELATORE SU INVITO

Emanuele Coco

Università di Catania - Dipartimento di Scienze della Formazione

emanuele.coco@unict.it

The theater of Ethology

Ethology has always been a subject of narration. Characters, images and stories are important not only to narrate ethology in society but also in interdisciplinary work among specialists. Let's think, for example, about the "selfish Gene" or the "Red Queen". These two "characters" of modern evolutionary ethology have promoted a theatrical imagery that has stimulated reflection both in the wider public and in scholars. The scientific and philosophical comparison moved by this imaginary attempted to clarify whether these figures with a slightly theatrical tone had an actual correspondence in the natural context. In other words, if the gene must be considered really selfish or if the race of the red queen (the co-evolution between organisms and pathogens) could explain the success of sexual reproduction. During my speech I will try to provide some hypotheses for reflection on three questions that involve the narration of ethology: is the story necessarily simplification? what role do metaphors and narration play in the success of a scientific idea? does narration only constitute an aesthetic transposition of concepts or can it have a heuristic value? In speaking of this I will report some experiences I have followed over the years: the construction of an *Atlas of Ethology* (with Rita Cervo), the recourse to Shakespeare to retrace the biological basis of social behavior (*The selfish, the spiteful and the generous. A natural history of altruism*), the mystery of the synanthropic animals and their barbaric invasion (*Ungrateful Guests*), the theatricalization of the biological becoming told in the show *Practical Tips for disoriented evolutionists* (Genoa Science Festival, with Leo Gullotta and Elio and the Storie Tese). Sometimes, and with unexpected results, ethology meets theater.

Francesco Petretti

Fondazione Bioparco, Roma

okapia.studium@gmail.com

Ethology in TV

Large carnivores get the best response in terms of people interest, as it is assessed through share index (the percentage of people watching a specific tv program in comparison to the total people watching tv). This means that bears, big cats, wolves, are the most favourite subjects of natural history films and this is particularly true for Italian tv public. The Author reports his experience of 20 year activity in the popular afternoon program Geo, broadcasted by RAI 3rd Channel, and in the new series Wild Italy, broadcasted by RAI 5th channel, which has grown in the interest and appreciation of the public dealing with "unpopular" animals like insects, spiders, small birds, reptiles and so on. The reason of this success lies in the particular mix of scientific information, plain commentary, natural sequences really taken in the wild, which represent the essence of the films written and directed by a biologist. The behaviour of common, but often unknown, animals filmed in the wild is able to capture the attention of people who, for the first time, has the opportunity to know intriguing aspects of the life history of Italian animals: the war of ants, the mating system of mantis, the nocturnal hunt of wolf spider, the courtship of newts have been appreciated as the most spectacular performance of large, hairy, flesh eating mammals.

Elisabetta Visalberghi

Istituto di Scienze e Tecnologie della Cognizione - CNR, Roma

elisabetta.visalberghi@gmail.com

Nature documentaries: audience appeal and scientific correctness

Nowadays nature documentaries involve substantial financial investments and returns. The most successful ones have impressive scenarios, high technical equipment, strong emotional impact (that may require intrusion in the animals' life) and captivating narrations. The primary aim of narration is to capture the audience while scientific rigor has less importance. I will illustrate the above points through the analysis of a few video-clips on non-human primate species that inspires high emphatic response in humans. I will also discuss to what extent researchers can contribute to the correctness of a documentary and its ethics by supervising the shooting and the content of the narration from the start to the very end of it.

Giorgio Vallortigara

Università di Trento - CIMeC - Centro Interdipartimentale Mente/Cervello

giorgio.vallortigara@unitn.it

Animals Brains: Pride and Prejudice

Our intuitive conceptions of the relationships between mental capacities and brain features are rich in prejudices and misunderstandings, which are widespread in communication in the media. I will discuss some of these misconceptions, such as that of birds having small brains -in fact the reduced volume and weight of birds brains, which is associated with the needs of the flight, is accompanied by a packing density of the nerve cells that is twice that of non-human primates. By contrast, the celebrated large volume of the brain of mammals like dolphins, may have nothing to do with the cognitive abilities of these animals, since the density of neurons in these large brains is quite modest and likely associated with increase of glial cells for thermoregulation purposes.

Marco Ferrari

Caposervizio Scienza di Focus

marco.pferrari@gmail.com

Ethology journals: from Airone to Focus

The language of natural science communication, in magazines and elsewhere, has changed from the Eighties till present day. Not as much as the language of photography, which underwent a really profound revolution, though in a slightly later time in Italy, compared to other countries. Before the birth of Airone in 1981 (and later Oasis in 1985) animal species were seen as a collection of single individuals unconnected to the other individuals and most of all to the environment. Naturalist friends of the editors and science minded journalists helped the magazines to convey concepts derived from evolution and ecology.

Donato Antonio Grasso

Università di Parma - Dipartimento di Scienze Chimiche, della Vita e della Sostenibilità ambientale

donatoantonio.grasso@unipr.it

Stories from the anthill: how to talk about complexity watching at your feet

Ants are protagonists in many stories in both literature and movies. They are cited in the Divina Commedia, in Poetries and even in the Holy Bible. In some cases, the non-scientist Authors have "caught" important elements of their biological essence, while in others gross mistakes have been made. The popularity of the ants is strictly linked to their ecological and evolutionary success, that make these animals a common and essential element of our "mental landscape" since our childhood. Their social nature inspired humans to look at them as simplified versions of our social systems and as examples to draw moral and civil life lessons. Everyone in the world knows what an ant is. However, what are ants really and what information can we get from them? Here I will talk about my experience in dealing with the ants as fragments of nature in which all the Nature is included. The challenge is to popularize the concepts that ant societies are complex systems that solve complex problems whose study may allow advancement in knowledge, they are source of biomimetic inspiration and study models in several (basic and applied) disciplines even beyond biology, windows open to the study of different levels of biological organization. Last but not the least, an effective "tool" to inspire people toward nature conservation.

Stefano Turillazzi

Università di Firenze - Dipartimento di Biologia

stefano.turillazi@unifi.it

In the midst of social insects

The social insects represent the higher expression of social behavior in multicellular organisms on the planet. Despite their relative rarity, their biomass surpasses that of all the other insects taken together. Outstanding are their presence and importance in terrestrial ecosystems. The so called "superorganisms", where millions of individual ants, bees or termites live together with symbiont microorganisms, represent the ultimate achievement of sociality and are good models for the study of highly intricate biological systems formed by organisms at all level of complexity. Ethology (the natural study of all patterns of animal behaviour), integrates nicely, especially at the group level, the research on animal societies, combining behavioural ecology, gene expression, population genetics and microbiology. In 1975, in the first chapter of Sociobiology (that he defines as the systematic study of the biological bases of all social behaviour), E.O. Wilson prophesized that Ethology would be cannibalized by neurophysiology at one end and sociobiology and behavioural ecology on the other in twenty-thirty years. After a half century of researches, however, it seems to me that the study of behaviour is still fundamental for the comprehension of the infinite interrelationships between living organisms.

Gabriella Salerno

Istituto Tecnico Statale Carlo Cattaneo, San Miniato (PI)

prof.gabriella.salerno@gmail.com

Ethology goes to school: from divulgation to scientific education

Nowadays the teaching of scientific subjects in our secondary schools focuses on lab experiences. Although ethology is only marginal in textbooks, it can give many occasions to organize side activities. Those can be carried out in school labs and also in classrooms using the many scientific divulgation resources offered by internet. I've been focusing on these ideas in latest years and here I present some of these activities which use as models some animals, easily to rear in school labs, observable around the schools, or on online live video. The learning process of such teaching activities allows the students to learn, guided by some key questions given by the teacher, how to observe and carry out a research: it leads them to ask questions, to conduct experiments based on hypothesis and to build interpretative models regarding evolution. Such activities can be chances of collaboration with universities and contribute to encourage students to undertake scientific careers.

Claudia Borgioli

De Agostini Scuola

borgioli68@gmail.com

Drawing animal behavior: ethology for young readers

All children love animals: live, in movies, in books, in whatever way and place they happen to meet them! Taking advantage of this "fatal attraction", animal drawings can be used, whether they are realistic representations, amusing revisitations or simple sketches, to explain to the young readers not only the anatomy but also the behavior of our kingdom companions. Children also love drawing and trying to reproduce their animal heroes, after listening to their exploits, can be a fun and instructive completion of the reading. The variety of animal behavior is almost unknown to children, but it is so rich in unexpected and surprising strategies that it has nothing to envy of the fantastic adventures in which animals in traditional fairy tales are protagonists. Serenades, disguises, deadly traps, fights to the death: nothing is missing to keep small readers in suspense!

Rebecca Branconi

Boston University (USA) - Department of Biology

branconi@bu.edu

Art in Ethology & Art for Ethology: a binomial for the divulgation of science

Both art and science are human attempts to understand and describe the world and the reality around us. In common, art and science have the ambition (and need) to produce new perceptions of reality and to communicate this new vision effectively. In fact, scientists and artists who have nothing novel to reveal are not as successful as those that have something interesting to disclose but fail to communicate their ideas and insights. The relationship between ethology and art has always been important for the cultural development of society (let's think about Mainardi's drawings as an example) and has now become a fundamental element for the expansion of science itself. During my speech I will share some experiences that I have encountered over the years to exemplify the extraordinary artistic traits of studying animal behavior (art in ethology) and how the visual arts are fundamental means to better describe, broadcast and understand the phenomena that we observe (art for ethology).

Laura Beani

Università di Firenze - Dipartimento di Biologia

laura.beani@unifi.it

Ethology enters the novels

The art of storytelling has been defined, in its positive acceptation, as a discursive and empathetic communication: if the topic is animal behaviour, this art may be shared by ethologists and writers. In the pages of Anton Cechov and Thomas Mann the behaviour of dog is described in its physiological and psychological details, as well as in The expression of Emotions in man and animals (Darwin 1872), whereas in other authors animals assume symbolic meanings, "un universo di metafore, una selva di iperboli" (Levi, L'altrui mestiere, 1985): two completely different trajectories that I'd like to compare and discuss.

RELAZIONI SU INVITO

Giorgio Vallortigara

Università di Trento - CIMeC - Centro Interdipartimentale Mente/Cervello

giorgio.vallortigara@unitn.it

How to build a social brain: Basic equipment

To what extent are filial responses the outcome of spontaneous or acquired preferences? The case of domestic chicks (*Gallus gallus*) illustrates the connection between predisposed and learned knowledge in early social responses. In the absence of specific experience, chicks prefer to approach objects that are more similar to natural social partners (e.g. they prefer face-like configurations, biological motion, self-propelled objects and those that move at variable speed). Spontaneous preferences are complemented by filial imprinting, a powerful learning mechanism that enables chicks to quickly learn the features of specific social partners. While neurobiological studies have clarified that the substrates of spontaneous and learned preferences are at least partially distinct in chicks, evidence shows that spontaneous preferences might orient and facilitate imprinting on animate stimuli, such as the mother hen, and that hormones facilitate and strengthen preferences for predisposed stimuli. Subpallial regions of the so-called Social Behaviour Network (including e.g. lateral septum and nucleus teaniae) seem to be involved in spontaneous preferences, whereas pallial regions in learning-plasticity associated with imprinting. Preferences towards animate stimuli are observed in human neonates as well. The remarkable consistency between the perceptual cues attended to by newborn babies and naïve chicks suggests that the attentional biases observed in babies are unlikely to result from very rapid post-natal learning, and confirms that research on precocial species can inform and guide human infant research with regards to both typical and atypical development. This has potentially important biomedical implications, opening new possibilities for the early detection of subjects at risk for autism spectrum disorders. We show how the parallel investigation of predispositions in naïve chicks and human infants, both benefiting from contact with social partners since the beginning of life, has greatly improved our understanding of early responses to social stimuli at the behavioural and neurobiological level.

Leonida Fusani

Università di Ferrara - Dipartimento di Scienze della Vita e Biotecnologie
University of Vienna & Konrad Lorenz Institute of Ethology, University of Veterinary Medicine – Department of Cognitive Biology

leofusani@gmail.com

To stay or to go: the physiology of migratory decisions

Recent technological advances have increased substantially our understanding of animal migratory routes and movement ecology. On the other side, the physiological mechanisms that underlie decision-making in relation to physiological condition, i.e. how the extent of energy reserves modulates the decision of staying at a stopover site or resume migration, are mostly unknown. In this talk I will present a series of studies conducted by our group in the last 15 years aimed at understanding how endogenous factors that depend on energy stores regulate the behavior of migratory passerines at stopover sites, where birds can spend up to 80% of the migratory period. I will discuss how the hormones melatonin and ghrelin affect locomotor and foraging behavior and how the pattern of rest is associated to condition. I will then present an interpretative model of decision-making of migratory birds that summarizes our current knowledge in this field.

Diego Rubolini

Università di Milano - Dipartimento di Scienze e Politiche Ambientali

diego.rubolini@unimi.it

Of gulls, crows and swallows: a tribute to Nicola Saino (1961-2019) studies in behavioural ecology

Nicola Saino, full professor of Ecology at the University of Milano, unexpectedly passed away on April 17, 2019. He was an outstanding scientist and naturalist, who published >300 peer-reviewed articles, receiving >10,000 citations. He was eclectic in his research interests, spanning from fundamental organismal ecology to ecotoxicology and genomics. I will present an overview of his contribution to the advancement of behavioural ecology, one of his preferred research areas. He aimed at unravelling both the proximate and ultimate causes of behavioural variation, using birds as his favourite research system. Through elegant and carefully designed experiments in the wild, he was able to demonstrate the causal links between several aspects of the phenotype – including morphology, sexual ornaments, stress response, immunity, oxidative status – and fitness. His studies initially focused on parent-offspring recognition and ecological niche partitioning in terns and gulls. Later, he addressed the mechanisms maintaining phenotypic divergence in a hybrid zone between carrion and hooded crows, highlighting that behavioural differences between phenotypes may play a key role in speciation. In 1994, he began a long-term study of the barn swallow – still ongoing – aimed at exploring variation in life-history traits, trade-offs, and patterns of natural and sexual selection. He made pioneering empirical contributions to the fields of 1) ecological immunology, demonstrating that immunocompetence is a major driver of survival among both adults and offspring; 2) parent-offspring communication, showing that carotenoid-based signaling of condition by offspring affects parental allocation decisions; and 3) maternal effects, providing experimental evidence that maternal stress affects offspring fitness through the transfer of corticosteroids to the eggs. He established a huge network of collaborations worldwide and mentored several ecologists who are now at different career stages both in Italy and abroad. Their work will propagate his scientific legacy, yet his insight, acumen and dedication will be severely missed.

Francesca Barbero

Università di Torino - Dipartimento di Scienze della Vita e Sistemi Biologici

francesca.barbero@unito.it

Deception strategies in social parasites of ants

Much of the ecological success of ants is due to their social organization, maintained also by a complex communication system. Chemical, acoustic, and visual signals coordinate a large number of individuals in the collective decision-making process and determine the plasticity of the colony in responding rapidly to biotic and abiotic variations. Due to the presence of trophic resources or a stable and protected environment, the nests and the surrounding territory attract many organisms that have evolved strategies to elude the fierce defenses of the colony. The variety of obligatory or facultative associations that other arthropods can establish with ants includes examples of commensalism, mutualism, and parasitism. Among the obligate social parasites, the butterflies of the *Maculinea* genus are textbook models for ethological and ecological studies and permit to evaluate the evolution of mimicry and the host/parasite communication system in different contexts. After oviposition occurs on species-specific food plants, *Maculinea* larvae spend a short phytophagous period accomplishing three molts but growing very little in weight. At IV stage, caterpillars leave the buds and fall to the ground, waiting for a foraging ant of the genus *Myrmica*. Following an adoption ritual, during which behavioral, chemical and acoustic signals are used by the parasite to be perceived as an ant larva, the "deceived" worker carries the parasite into its colony. Once inside the nest, depending on the species, some caterpillars directly prey on the ant brood ("predator" species), whereas others ("cuckoo" species) are integrated in the ant society to such an extent that the parasite larvae are fed by trophallaxis. In the colony, thanks to an improved acoustic and chemical mimicry, the larval development is completed and pupation occurs in the upper chambers of the nest. After 11-23 months (larval polymorphism exists in some populations), the adult butterflies emerge directly from the galleries of the ant nest. The parasite's ability to subvert the host's communication system is a necessary condition for achieving a high social status in the colony hierarchy, as observed in the cuckoo species, so as to fully exploit the resources in all conditions (including stress) of the colony. Results of ethological experiments will be presented to clarify the evolutionary significance of vibroacoustic and chemical signals in the context of multimodal interspecific communication.

Francesca Cirulli

Istituto Superiore di Sanità - Centro di Riferimento per le Scienze comportamentali e la Salute Mentale, Roma

francesca.cirulli@iss.it

New frontiers of applied ethology: exploiting the emotional potential of human-animal relationships through Animal Assisted Interventions

Companion animals, or pets, represent one category of animals that have been assigned a special status by humans. The process of domestication has led to the emergence of selected physical characteristics and cognitive-behavioral traits that have allowed some animals, like dogs, to establish long-lasting social relations with humans. In dogs, the presence of a complex communication system is accompanied by the ability to elicit shared inter-specific emotional states, exploiting the same neurobiological mechanisms that underlie human attachment. Indeed, much like the relationship between the mother and her child, humans and dogs share gazes, which triggers the release of the neuropeptide oxytocin in the brain, resulting in a positive emotional feedback loop that reinforces the relationship. Studies carried out by our group have recently highlighted the importance of neotenic features (baby-schema) in the attitudes and preferences of children and adults towards animals. These characteristics have most likely been selected during the process of domestication, promoting human-animal relationships. The lecture will highlight how these data represent an important theoretical framework for the introduction of domestic animals in complementary rehabilitation practices such as Animal Assisted Interventions.

SESSIONI ORALI

Neuroetologia e Cognizione

Inhibitory control abilities in teleost fish

ELIA GATTO[1], TYRONE LUCON-XICCATO[2], ANGELO BISAZZA[1]

[1] Università di Padova - Dipartimento di Psicologia Generale
[2] Università di Ferrara - Dipartimento Scienze della vita e Biotecnologie

elia.gatto@phd.unipd.it

Inhibitory control is a cognitive process that allows animals to inhibit a certain behaviour when it is not appropriate to the context. Because inhibitory control positively correlates with high cognitive abilities, it is generally considered typical of vertebrates with large and complex nervous system, such as primates, other mammals, and birds. The growing evidence of high cognitive abilities in teleost fish suggests that this group might also possess efficient inhibitory control, in spite of the relatively small brain size. We addressed this point by testing guppies, *Poecilia reticulata*, for their ability to solve two inhibitory control tasks, the cylinder task and the barrier task. In the cylinder task, which is the most used inhibitory control task in birds and mammals, we presented guppies with a horizontal transparent cylinder containing a food reward. To reach the food, guppies had to enter the cylinder from the open lateral ends, and inhibit the tendency to swim directly toward the food. Guppies showed an unexpectedly high performance, with an average of 58% correct responses in which they entered the transparent cylinder sideway, without touching the transparent material. This performance did not substantially differ from the average performance of mammals and birds in the cylinder task. In the barrier task, we used a social reward: guppies had to detour a transparent barrier to reach a group of conspecifics. Guppies showed high efficiency also in avoiding the transparent barrier, which suggested high ability to inhibit the behaviour to swim directly toward the conspecifics. These two experiments indicated that efficient inhibitory control is not a prerogative of mammals and birds with large brain size, but can also be found in small teleost fish.

Keywords*: executive function, fish, inhibitory control,* Poecilia reticulata

An automated and objective system to train jumping spiders

MASSIMO DE AGRÒ[1], ENZO MORETTO[2], LUCIA REGOLIN[1]

[1] Università di Padova - Dipartimento di Psicologia Generale
[2] Museo Vivente degli Insetti di Esapolis, Padova

massimo.deagro@phd.unipd.it

Objectivity is as crucial as often elusive in behavioural studies. Data collection can be affected by unconscious bias of the experimenter, decreasing the confidence in the results or forcing to resort on time consuming procedures like blind scoring. Modern technologies let us overcome this problem, designing automated systems that separate completely scientists from the data acquisition process. Use of Skinnerboxes is already well established in classical model species, like rodents and birds. Unfortunately, not so much for studying tiny animals, such as Arthropods, even though their behaviours can be as complex as that of Vertebrates. We designed a Skinner-box system intended for the training of solitary Arthropods and, validated its functioning in the jumping spider *Phidippus regius*. We employed light-sensitive sensors as actuators. Spider contact with the correct sensor causes a pump to dispense a precise amount of sucrose solution as a reward. The amount can be adjusted for the delivery of quantities as low as 2 µl. We trained spiders in a colour discrimination task. After a habituation phase, subjects were required to walk over a blue sensor in order to obtain the reward. The box also contained an inactive (control) yellow sensor. After 5 days of training, we observed a significant increase in the number of visits to the blue sensor, but not to the yellow one. Our results suggest that this system allows higher objectivity due to its fully automated nature, and it also decreases the time and human resources needed to carry out large scale experiments.

***Keywords**: Jumping spider, learning, cognition, skinnerbox, automation*

Cognitive flexibility in male and female guppies

TYRONE LUCON-XICCATO[1], CRISTIANO BERTOLUCCI[1], ANGELO BISAZZA[2]

[1] Università di Ferrara - Dipartimento di Scienze delle Vita e Biotecnologie
[2] Università di Padova - Dipartimento di Psicologia Generale

tyrone.luconxiccato@unife.it

Studies on various species suggest that males and females may exhibit different cognitive abilities if the two sexes have been selected to perform different behaviours. In a teleost fish, the guppy *Poecilia reticulata*, females exhibit an extremely flexible mate choice behaviour, which plastically varies according to the available mates, the female's mating experience, the mate choices of other females, and a range of ecological factors. Conversely, male guppies persistently court and harass every female that they encounter, with up to one mating attempt per minute. To test whether these different sexual behaviours might be associated to sex differences in cognition, we compared male and female guppies in a battery of cognitive tasks that measure flexibility and persistence. In a reversal-learning task, in which guppies had to switch from choosing a predetermined stimulus to choosing a different, previously unrewarded stimulus, females learned to modify their behaviour twice as fast as males. In a detour task, guppies were exposed to a group of conspecifics placed behind a transparent barrier; females showed a greater capacity to inhibit the tendency to swim directly toward the social group compared to males and rapidly found the way to detour the barrier, whereas males persistently tried to pass through the barrier. This sex difference was confirmed in a third experiment in which guppies were exposed to live prey sealed inside a transparent tube: males persistently tried to attack the prey, whereas females rapidly learned to inhibit the unsuccessful foraging behaviour. Overall, these results support the hypothesis that, in guppies, females show high cognitive flexibility and males high persistence, which is in line with the idea that cognitive sex differences may arise as a consequence of sexual differentiation in behaviour.

Keywords*: cognition, flexibility, inhibitory control, learning, sex differences*

Aminergic underpinnings of pheromonal modulation of olfactory learning and memory formation in honeybees

DAVID BARACCHI[1,2], JEAN-MARC DEVAUD[2], PATRIZIA D'ETTORRE[2,3], MARTIN GIURFA[2]

[1] Università di Firenze - Dipartimento di Biologia
[2] University of Toulouse - Research Centre on Animal Cognition, France
[3] University of Paris 13 - Laboratory of Experimental and Comparative Ethology, France

david.baracchi@unifi.it

Pheromones are chemical messengers allowing the exchange of information between members of the same species. Besides releasing stereotyped behavioural and/or physiological responses, recent reports show that pheromones modulate responsiveness to stimuli commonly used as reward and punishment in learning protocols, thus suggesting that they could modulate learning and memory formation. Here we explored this possibility in the honeybee *Apis mellifera*. We studied the effect of one pheromone signalling valuable resources (geraniol) and two alarm pheromones signalling noxious situations (isopentyl-acetate (IPA) and 2-heptanone (2H)) on an olfactory differential conditioning in which one odour was paired with sucrose and another odour remained unrewarded. Bees were exposed to the pheromones either before or after conditioning to evaluate their impact on acquisition and memory retention, respectively. We found that bees exposed to geraniol before conditioning not only improved their learning performance but had also better memory retention than controls up to 24h. By contrast, 2H strongly inhibited appetitive learning and memory retention up to 72h following conditioning with respect to controls. IPA did neither modulate learning nor memory performance. None of the three pheromones affected memory retention evaluated at 2h, 24h and 72h in bees exposed after conditioning, suggesting that pheromones affect memory formation but not its retrieval. To explore the underlying neural mechanisms of this modulation we used a pharmacological approach to specifically block/activate the octopaminergic and the dopaminergic circuits, which signal appetitive and aversive events in the bee brain respectively. Injections of octopamine (OA), dopamine (DA) and their antagonists were performed into the brain of bees that were exposed to pheromones before conditioning. As OA and DA-antagonist restored learning and memory in 2H-exposed bees, and DA- and OA-antagonists counterbalanced the geraniol effect on learning and memory, we concluded that both aminergic systems underpin the pheromonal modulation of learning and memory in honeybees.

Keywords: Apis mellifera, *chemical communication, cognition, biogenic amines, neuromodulators*

Impact of non-Protein Amino Acids (NPAAs) in nectar on honeybee gustatory response, feeding preference and learning and memory

STEFANIA SMARGIASSI[1,2], GIACOMO BERTELLI[3], LEONARDO VERDELLI[1], DAVID BARACCHI[1]

[1] Università di Firenze - Dipartimento di Biologia
[2] Università di Torino - Dipartimento di Scienze della Vita e Biologica dei Sistemi
[3] Università di Firenze - Dipartimento di Agraria

stefania.smargias@edu.unito.it

Pollinators choose between flower species, and plants, in turn, compete for attracting insect pollinators. However, plants and pollinators' benefits do not always align opening ups potentials for competition and cheating from both sides. Floral nectars are far from being a simple sugary reward. They are extremely rich in secondary metabolites (SMs), such as phenolics, terpenes, alkaloids and non-protein amino acids (NPAAs). Recent works suggested that ecologically relevant concentrations of nectar alkaloids may serve as a form of floral deception, by manipulating the behaviour of pollinators in a way that increases the quantity and quality of pollination services received by the plant. So far, only few nectar alkaloids have been tested for their psychoactive action in insect pollinators and no study investigated NPAAs in this regard. Moreover, whether pollinators can specifically taste SMs is still highly controversial and poorly investigated. The present work thoroughly investigated the gustatory system of the honeybee *Apis mellifera* and its ability to taste (detect) and discriminate ecologically relevant concentrations of five common nectar NAAPs (β-alanine, Citrulline, GABA, Ornithine and Taurine). In doing so, we used a set of experiments (a chemo-tactile conditioning of the proboscis extension response (PER) and a highly controlled behavioural assay for measuring the feeding responses of freely moving, individual worker honeybees) which allowed us to disentangle pre- and post-feeding preference for NPAAs. Finally, using a classical Pavlovian conditioning of the proboscis extension response (PER) of harnessed forager bees we evaluated whether the aversive/appetitive nature of each NPAA affects olfactory appetitive learning and memory, thus facilitating or inhibiting the learning and memorization of the association between neutral odours and NPAA-laced sucrose reward. Our work will contribute to elucidate the biological role of secondary metabolites in nectars and the coevolution between flowering plants and insect pollinators.

Keywords: Apis mellifera, *phytochemicals, foraging, gustation, plant-pollinator interactions*

Breed differences in human-directed gazing: a comparison between Czechoslovakian Wolfdogs, German Shepherds and Labrador Retrievers

VERONICA MAGLIERI[1], EMANUELA PRATO-PREVIDE[2], ERICA TOMMASI[1], ELISABETTA PALAGI[1,3]

[1] Università di Pisa - Dipartimento di Biologia, Unità di Etologia
[2] Università di Milano - Dipartimento di Fisiopatologia Medico-Chirurgica e dei Trapianti
[3] Università di Pisa - Museo di Storia Naturale, Calci

emanuela.pratoprevide@unimi.it

In dog communication, gazing plays a central role in building, facilitating and maintaining relationships and social bonds both at intra- and interspecific level. Human-directed gazing, a keystone in dog-human communication, has been suggested to derive from both domestication and breed selection. However, the influence of genetic similarity to wolves and selective pressures on human-directed gazing is still under debate. In this study we compared Czechoslovakian Wolfdogs (CWDs, a close-to-wolf breed), German Shepherds (GSs) and Labrador Retrievers (LRs) in the classical "impossible task". Differences in life experiences and interspecific social communication were controlled by testing dogs kept for companionship, living in the same household with their owner and without specific training. If artificial selection and dogs' "type of work" affect gazing towards humans, a gradient in the expression of this behavior should emerge in the three breeds, with Czechoslovakian Wolfdogs showing a low level of gazing, Labrador Retriever a high level of gazing and German Shepherd an intermediate one. In the 'solvable trials' all dogs learned to obtain the reward; however, differently from GSs and LRs, CWDs rarely gazed at humans. In the 'unsolvable task' CWDs gazed significantly less towards humans compared to LRs but not to GSs. Although all dogs were similarly motivated to explore the apparatus, CWDs and GSs spent more time in manipulating it compared to LRs. A clear difference emerged in gazing at the experimenter vs owner. CWDs gazed preferentially towards the experimenter (the unfamiliar subject manipulating the food), GSs towards their owners and LRs gazed at humans independently from their level of familiarity. In conclusion, it seems that the artificial selection operated on CWDs has not yet produced a breed showing complete dog-like behavioural features. The next step is to clarify GSs' behaviour and better understand the genetic role of this breed in shaping CWDs' hetero-specific behaviour.

Keywords: *human-directed gazing, unsolvable task, breed differences, Czechoslovakian Wolfdog*

Age affects action planning in wild bearded capuchin monkeys (*Sapajus libidinosus*)

VALENTINA TRUPPA[1], GLORIA SABBATINI[1], PATRICIA IZAR[2], DOROTHY M. FRAGASZY[3], ELISABETTA VISALBERGHI[1]

[1] Consiglio Nazionale delle Ricerche (CNR) - Istituto di Scienze e Tecnologie della Cognizione, Roma
[2] University of São Paulo - Department of Experimental Psychology, Brazil
[3] University of Georgia - Department of Psychology, USA

elisabetta.visalberghi@istc.cnr.it

The study of how animals anticipate future actions is crucial to understand cognitive processes that guide behavior. Action planning involves the abilities to plan how to perform an action and to coordinate effective movements within this plan. Planning is fundamental to the execution of most daily activities, including object manipulation. The *End-State Comfort* (ESC) effect is the capability of grasping an object in a way that enhances hand comfort and object control while performing the next action; ESC demonstrates second-order motor planning in grip selection. In humans, anticipatory planning skills develop slowly over the course of sensory-motor maturation. Age-related differences in ESC effect have not been investigated in other primates so far. We assessed the anticipatory motor planning of infant, juvenile and adult capuchin monkeys (N=15) belonging to a wild group. The study area was located in Fazenda Boa Vista in the North-Eastern Brazilian state of Piauí. We used a modified version of the "elevated spoon task" in which a horizontal stick was supported by two Y-shaped forks; the stick was baited either on its left or right side. Subjects grasped the stick and brought the bait to the mouth. We found that "comfortable" grips significantly increased with age. All age classes performed "comfortable" grips significantly more than expected by chance. However, their planning ability varied as a function of age: adult individuals used them significantly more frequently than infants, whereas juveniles were in-between adults and infants and did not significantly differ from both groups. Thus, we found a positive relation between age and sensitivity to the ESC effect. Our findings in capuchins parallel those reported in humans and indicate that simple grasping tasks allow drawing and comparing developmental trajectories of planning skills in primates, also in natural settings.

Keywords: *action planning, hand use, motor development, grasping behavior, capuchin monkeys*

Face-to-face interaction prolongs female homo-sexual contacts in bonobos

GIULIA ANNICCHIARICO[1], MARTA BERTINI[1], GIADA CORDONI[1], ELISABETTA PALAGI[1,2]

[1] Università di Pisa - Museo di Storia Naturale, Calci
[2] Università di Pisa - Dipartimento di Biologia, Unità di Etologia

giulia.annicchiaric@gmail.com

In bonobos sexual behaviour is often disentangled from the mere reproductive function. Socio-sexual contacts can be found in all age- and sex-combinations. In this species, sex has an important social function such as conflict resolution, anxiety reduction and maintenance of strong bonds. Bonobo females engage in homo-sexual interactions, the so-called ventro-ventral genito-genital rubbing (VVGGR) consisting in embracing each other ventro-ventrally while rubbing their clitorises. During VVGGR the two sexual partners can engage in face-to-face interaction which, due to the close proximity of the faces, leads to an eye-to-eye contact. In humans, eye contact is an innate reflexive predisposition not always under conscious control, which makes it a likely source of emotional contagion. This interaction mostly occurs in affinitive contexts and represents an efficient tool for establishing an emotional connection between interacting subjects. Here, we investigated the possible role of face-to-face interaction during socio-sexual contacts in bonobos by observing eight adult females hosted at the Wilhelma Zoo (Stuttgart, Germany). We video-recorded and analysed about 350 VVGGR events. We found that the distribution of face-to-face interaction was significantly affected by the relationship quality between females (determined by body contact and grooming rates): the more the face-to-face interaction, the stronger the social relationship. Moreover, the duration of VVGGR was higher in the presence of face-to-face interaction compared to the conditions during which none of the two partners looked towards the other or only one of the two females looked at the face of the partner. As a whole, our findings support the view that a reciprocal visual engagement can promote an emotional linkage between partners and concur in increasing the success of socio-sexual contacts in bonobos.

Keywords: Pan paniscus, *socio-sexuality, genito-genital rubbing, emotional engagement, eye-to-eye contact*

First evidence of stone handling in geladas: ontogenetic trajectories of a peculiar form of solitary object play

MARIA CANGIANO[1], ELISABETTA PALAGI[1,2]

[1] Università di Pisa - Museo di Storia Naturale, Calci
[2] Università di Pisa - Dipartimento di Biologia, Unità di Etologia

maria.cangiano@edu.unito.it

Stone Handling (SH) consists of manipulation with stones that can vary from simple exploration to more complex interactions on the object. This phenomenon has been exclusively reported in macaques. To investigate the developmental pathway of this behaviour, we selected the *Theropithecus gelada* as a model for two main reasons. Geladas, showing the highest opposability index among nonhuman primates, possess exceptional manipulative skills. Moreover, the species is particularly playful with a retention of play in adulthood. We video-recorded and analyzed SH (all occurrences sampling method; 426 hours) of 62 geladas hosted at the NaturZoo (Rheine, Germany). Out of the 62 subjects observed, 43 (69.35%) belonging to all age and sex classes engaged in SH. Even though the frequency of the behaviour tended to decrease with age, subadult and adult subjects engaged in longer SH sessions compared to infants. Based on previous ethograms used for macaques, we grouped the SH patterns as a function of their level of complexity thus obtaining five clusters of behaviour. We found that complexity (e.g. *Percussive/Producing sound with stones*) increased along with the age of the players, with black infants (<3months) mainly showing *investigative/explorative actions*. Here, we propose that the significance of SH can change along with ontogeny from exploration to true play. During their investigative/explorative actions, infants acquire information on the environment with the apparent goal to familiarize with a novel object. Therefore, in evolutionary terms, *exploration* is a *receptor activity*, favored by natural selection because of its survival functions. During their percussive/producing sound and complex patterns (e.g., piling up), mature geladas use the stones to create novel and uncertain situations. This is self-rewarding for the subjects that, concurrently, can assess and improve their motor/cognitive abilities. In this sense, SH is an *effector activity* thus acquiring the significance of true play.

Keywords: Theropithecus gelada, *simple play, complex play, age classes*

Orientamento, migrazioni e uso dello spazio

Investigating the diving and orientation behaviour of loggerhead sea turtles (*Caretta caretta*) following offshore displacement

GIULIA CERRITELLI[1], AYFER ŞIRIN[2], DOGAN SÖZBILEN[2], EYUP BAŞKALE[2], YAKUP KASKA[2], RESI MENCACCI[1], PAOLO CASALE[1], PAOLO LUSCHI[1]

[1] Università di Pisa - Dipartimento di Biologia
[2] Pamukkale University - Department of Biology, Turkey

paolo.luschi@unipi.it

Argos satellite telemetry constitutes an efficient way to study sea turtle migrations, but provides little opportunities to collect information on turtle behaviour during these movements. Data loggers could be used to record fine-scale underwater behaviours, but they need to be retrieved to collect the data. One possible way to use loggers is through displacement experiments with breeding females, that are expected to return to their home beach to complete their nesting cycle, thus allowing to recover the logger. In this study, we performed a displacement experiment with nine loggerheads belonging to a large rookery in Turkey, which were released offshore after having been equipped with a satellite transmitter and a logger recording depth and tri-axial magnetism and acceleration. All turtles returned to the vicinity of the nesting beach following generally similar routes, first reaching the coast and then following the coastline. During the open-sea segment of their journey, turtles alternated short shallow dives with prolonged deep ones, mostly performed during the night. In the first hour after release, turtles displayed a poor orientation, heading in variable directions; they then generally adopted a given heading, maintaining it precisely even at night. The directions chosen were similar in different turtles, but were usually not directed towards the home beach. In all cases, turtles changed direction when reaching the coastline, adopting a homeward-directed heading. These results show how combining different technologies and experimental approaches allows to increase our understanding of turtle migrations, revealing poorly known aspects, such as their diving and orientation behaviour.

***Keywords**: displacement experiment, at-sea behaviour, orientation, diving behaviour*

Reliance on familiar visual landmarks by anosmic pigeons

ANNA GAGLIARDO[1], ENRICA POLLONARA[1], MARTIN WIKELSKI[2]

[1] Università di Pisa - Dipartimento di Biologia
[2] Max Planck Institute for Ornithology, Radolfzell, Germany

anna.gagliardo@unipi.it

Anosmic birds are impaired at homing when challenged to navigate over unfamiliar areas. Their unimpaired navigational performances when released within their familiar area, suggest that homing pigeons may rely on visual familiar landmarks for navigation. However, a direct evidence for the reliance on familiar visual landmarks during homing in anosmic birds has never been provided. Pigeons were subjected singly to one training flight from each of three locations. Prior the second release series from the three sites, a subgroup of birds was made anosmic while the other subgroup was not manipulated. The efficiency index of the first and second track from each site were compared. Each track recorded during the second release from each site was divided in three sections corresponding to three distinct behavioural phases: 1) Decision making, 2) En route, 3) Local navigation. In the latter phase also unmanipulated pigeons were expected to rely on familiar visual cues for localising the loft. The percentage of fixes closer than 300 meters to fixes of previous tracks (FF) was computed for each section. The median test was applied to the individual median values of FF for each behavioural phase and to the Individual Total Fidelity Score obtained by summing the ranks assigned to each birds in the "Decision making" and in the "En route" phases. In the second release from each site the anosmic birds displayed unimpaired homing abilities as well as controls. The control birds significantly improved their path efficiency homing from 2 out of 3 release sites, while the anosmic birds did so only from 1 site. The anosmic birds turned out to fly significantly closer to previously over-flown locations compared to the intact birds during the En route phase, while no significant difference emerged in route fidelity in the "Decision making" and the "Local navigation" phases. However, the Individual Total Fidelity Score of the anosmic pigeons was significantly higher compared to the control pigeons. A single experience from each site is sufficient to the anosmic pigeons for release site recognition and unimpaired navigation. Familiar visual landmarks constitute a critical source of navigational information for olfactory deprived birds.

***Keywords**: olfaction, familiar landmarks, homing pigeon*

Interference competition as a key determinant for spatial distribution of mangrove crabs

SARA FRATINI[1], STEFANO CANNICCI[1,2]

[1] Università di Firenze - Dipartimento di Biologia
[2] The University of Hong Kong - The Swire Institute of Marine Science, School of Biological Sciences, HK

sara.fratini@unifi.it

The spatial distribution of mangrove crabs has been commonly associated with tree zonation and abiotic factors such as ground temperature and soil granulometry. Conversely, no studies were designed to investigate the role of competition for resources and predation in shaping crab distribution in mangroves, despite these biotic factors are recognised as key determinants for spatial patterns observed in the communities colonising rocky and sandy intertidal habitats. We studied floral and faunal assemblages in two zones of a Sri Lankan mangrove, a man-made upper intertidal level and a natural eulittoral, mid-shore one. Leaf choice experiments were designed to study both feeding rate and intra and inter-specific interactions for food of sesarmid crabs in the two habitats in order to better understand crab spatial distribution. The two intertidal belts differed in terms of floral composition and crab species abundance. The eulittoral zone was strongly dominated by the sesarmid *Neosarmatium smithi*, while within the elevated littoral fringe four sesarmids (*N. smithi*, *N. asiaticum*, *N. malabaricum* and *Muradium tetragonum*) were more abundant. There was no temporal segregation in feeding activity among the four species either species-specific preferences for food, resulting in a high interference competition for leaves. Regardless of the habitat, a species, namely *N. smithi*, was always successful in winning inter-specific fights. Our results showed that the elevated littoral fringe was more crowded with crabs, but was less favourable in terms of food availability and environmental conditions. The dominance of *N. smithi* in gathering mangrove leaves suggests that this species may segregate the other sesarmids into less favourable habitats. The present data strongly suggest for the first time that interference competition for food can contribute to shape mangrove crab spatial distribution.

Keywords*: aggressive behaviour, distribution patterns, Indo-Pacific mangroves, environmental factors*

Spatiotemporal behaviour of the endemic Apennine hare *Lepus corsicanus*

EMILIANO MORI[1], SANDRO LOVARI[1,2], MARTINA CALOSI[1], MARTA ZANCHI[1], GIORGIA ROMEO[3], FRANCESCO FERRETTI[1], GIANLUCA CARFÌ[3], NICCOLÒ FATTORINI[1]

[1] Università di Siena - Dipartimento di Scienze della Vita
[2] Museo di Storia Naturale della Maremma, Grosseto
[3] Ufficio Territoriale Caccia - Regione Toscana, Grosseto

moriemiliano@tiscali.it

The movements, habitat use and activity of herbivores are influenced by food availability and seasonal variation in predation risk. Information on their spatiotemporal behaviour is basic for conservation purposes, but it is often lacking for cryptic and localised species. We evaluated how sex, seasonality, time of the day and habitat type may influence the spatial behaviour and activity of an herbivorous mammal, the Apennine hare *Lepus corsicanus*, a threatened (*sensu* IUCN) species endemic to Central-Southern Italy. We radio-tracked 12 hares (7 males and 5 females) for at least 12 months each, in an area of Maremma, Southern Tuscany. Sex influenced neither home range size, nor habitat selection. Home range size was larger during the warm months, when hares increased their usage of top habitat types for feeding activities, i.e. cultivations. At both study area and home range spatial scales, habitat selection did not change between the cold and the warm months. At the study area scale, hares avoided woodlands and human settlements. As well, they selected scrubwoods and cultivations. Within home ranges, at night Apennine hares selected open habitats (i.e. cultivations) as feeding grounds, whereas in daylight the scrubwood was used for cover and resting. Throughout the year, Apennine hares were mostly nocturnal and were more active in open than in concealed habitats, with no differences between sexes. Bright nights, i.e. with full moon and clear sky, inhibited activity in open areas but not under cover, possibly to reduce predation risk. Our findings emphasize the role of feeding and antipredatory requirements in shaping the spatiotemporal behaviour of this hare species.

Keywords*: activity rhythms, endemic species, habitat selection, home range size, radiotracking*

Territorial male wildcats defend female wildcats, lowering the risk of hybridization with the domestic male cats

EUGENIA NATOLI[1], BEUGIN MARIE-PAULINE[2], GUILLAUME LEBLANC[3], GUILLAUME QUENEY[4], DOMINIQUE PONTIER[2]

[1] Canile Sovrazonale - Servizio Veterinario, ASL Roma 3, Roma
[2] Université 'Lyon 1', CNRS, UMR - Laboratoire de Biométrie et Biologie Evolutive, Villeurbanne, France
[3] Association LOANA, Lorraine Association Nature, Le Fort, Champougny, France
[4] Animal Genomics Laboratory, ANTAGENE, Lyon, France

enatoli@tiscali.it

Studies in Europe have indicated various degrees of hybridization between the European wild cat (*Felis s. silvestris* Schreber, 1777) and the domestic cat (*Felis s. catus* Linnaeus, 1758), highlighting that this process is not occurring uniformly across different continents and types of habitat. Few studies have provided information directly on the degree of overlap of the distribution areas of the two subspecies. In Scotland and in Hungary, the degree of hybridization is high whereas in Italy, Germany, Iberian Peninsula and France, hybridization is sporadic. Especially in France, the results are surprising because the ranges of the two subspecies overlap completely. In this study, we focus on a local population of European wildcats inhabiting in forests fragmented by agricultural lands in north-eastern France, in order to investigate if the wildcat spacing pattern in this particular type of environment, influences the proportion of hybridization. The spacing pattern and the level of hybridization were investigated by mean of radio-tracking and the use of microsatellite markers, respectively. Out of 42 putative wildcats, only one resulted as a putative hybrid (most likely backcrossed). The spacing pattern found reflects the ancestral model of many polygynous mammals: a larger territory for males which includes the territories of some females. The peculiarity is that most females were concentrated inside the forest while males stood in the periphery or outside the forest; many males and females resulted related. Such a spacing pattern might limit contacts between male domestic cats and female wildcats and this could explain the low level of hybridization in the wildcat population in this environment. These results highlight the importance of the landscape configuration and of the spacing pattern on gene flow between the populations of the two subspecies.

***Keywords**: European wildcats, hybridization, kinship, habitat fragmentation, radio-tracking*

Dalla Riproduzione alla Socialità

Dietary stress increases the total opportunity for sexual selection and modifies selection on condition-dependent traits in guppies

SILVIA CATTELAN[1], JONATHAN P. EVANS[2], FRANCISCO GARCIA GONZALEZ[2,3], ELISA MORBIATO[1,4], ANDREA PILASTRO[1]

[1] Università di Padova - Dipartimento di Biologia
[2] University of Western Australia - Centre for Evolutionary Biology, School of Biological Sciences, Australia
[3] Doñana Biological Station - Spanish Research Council CSIC, Spain
[4] Università di Ferrara - Dipartimento di Scienze della Vita e Biotecnologie

andrea.pilastro@unipd.it

Condition, defined as the pool of acquired resources for allocation to fitness, typically determines an individual's expression of sexually selected traits. When environmental conditions are adverse, the mean expression of condition-dependent traits is reduced, yet the consequences of such environmental instability for the action of sexual selection, in terms of the opportunity for selection and patterns of phenotypic selection, have rarely if ever been explored within a single experimental paradigm. Predictions on the effect of adverse conditions on the opportunity for sexual selection are difficult, because they will depend on the effect of the environment on the pattern of phenotypic variation in male sexual traits, on female sexual behaviour and fecundity, and on their interaction. We explored these questions comprehensively by applying experimental dietary restriction to guppies, *Poecilia reticulata*. We show that dietary stress results in strong reductions in the expression of several sexual traits, and that these effects are accompanied by striking differences in the opportunity for total sexual selection (standardized variance in reproductive success) between diet treatments. Furthermore, our results show that dietary stress modulates the relative importance of pre-copulatory (mating success) and post-copulatory (relative fertilization success) components of sexual selection, and that the form of multivariate selection (linear vs. nonlinear) on these components of sexual selection depends on dietary regime. Overall, our results are consistent with a pattern of heightened directional sexual selection on condition-dependent sexual traits under environmental stress, underscoring the potential importance of sexual selection in shaping adaptation in a changing world.

Keywords*: sexual selection, phenotypic plasticity, condition-dependence, mating effort, sperm competition*

Egg-clutch exchange in a simultaneous hermaphrodite: evidence for conditional reciprocity in a cognitively unsophisticated animal

LAURA PICCHI[1], GUÉNAËL CABANES[2], CLAIRE RICCI-BONOT[1], MARIA CRISTINA LORENZI[1]

[1] Université Paris 13 - Laboratoire d'Ethologie Expérimentale et Comparée (LEEC), France
[2] Université Paris 13 - Laboratoire d'Informatique de Paris-Nord (LIPN), France

picchi@leec.univ-paris13.fr

Reciprocity (i.e., the exchange of cooperative acts between individuals) is often assumed too cognitively demanding to be widespread among animals. Therefore, whether animals are able to conditionally reciprocate cooperative acts and assess their value is hotly debated. For instance, in some simultaneous hermaphrodites with unilateral mating, partners alternate sexual roles with each other, repeatedly exchanging egg-clutches of variable size. This alternation has been interpreted as egg-reciprocation, but it may also emerge from the random alignment of two independent reproductive cycles. Here, we tested the random-alignment hypothesis against the hypothesis that egg release by one individual is conditioned upon egg release by the partner. With this aim, we investigated the egg-laying activity of 39 isolated pairs of the simultaneously hermaphroditic worm *Ophryotrocha diadema*, checking daily for the presence, size, and maternity of new egg-clutches. Our results show that hermaphroditic worms reciprocated eggs conditionally to the partner's behavior, since worms were more likely to lay eggs after receiving them from their partners. Conditionality was further confirmed by an agent-based simulation, which showed that "virtual worms" programmed to lay eggs only according to their own egg-laying rhythm, alternate sexual roles, but do not adjust egg release to the partner's egg-laying activity. Finally, worms adjusted the quality of cooperation according to their partners': worms which have received large egg-clutches, laid large clutches. Overall, our analyses show that the hermaphroditic worms *O. diadema* are able to conditionally reciprocate cooperative acts, assess their value and change their behavior accordingly. On a broader perspective, this study documents that complex forms of conditional reciprocity can emerge in cognitively unsophisticated animals, broadening the criteria to recognize conditional reciprocity among animals.

***Keywords**: cooperation, egg-trading, polychaetes, reproduction, sexual conflict*

Ecological and social constraints combine to promote social evolution in clownfish

REBECCA BRANCONI[1], TINA BARBASCH[1], ROBIN FRANCIS[1], MAYA SRINIVASAN[3,4], GEOFFREY JONES[3,4], PETER BUSTON[1]

[1] Boston University - Department of Biology, Boston, MA, USA
[2] James Cook University -College of Science & Engineering, Cairns, Australia
[3] ARC Centre of Excellence for Coral Reef Studies, Australia

branconi@bu.edu

Individuals that forgo their own reproduction in animal societies represent an evolutionary paradox, because it is not immediately apparent how natural selection can preserve the genes that underlie non-breeding behaviors. Cooperative breeding theory provides a solution to the paradox: on the one hand, non-breeders benefit by helping relatives and/or inheriting territories; on the other hand, non-breeders do not disperse to breed elsewhere because of ecological constraints. It is usually less clear, however, why non-breeders do not contest to breed within the group. Here, we use the clown anemonefish (*Amphiprion percula*), where non-breeders wait peacefully for years to inherit territories, to show that non-breeders will disperse to breed when ecological constraints are experimentally relaxed. In addition, we show that non-breeders will contest to breed when social constraints are experimentally relaxed. Our results show that harsh ecological constraints are not the only reason that individuals forgo their own reproduction and emphasize the role of harsh social constraints in explaining non-breeding behavior also. In doing so, we illustrate the parallels between, and potential for unification of, cooperative breeding theory and economic bargaining theory: individuals will forgo their own reproduction and wait peacefully to inherit territories (engage in cooperative options) when there are harsh ecological constraints (poor outside options) and harsh social constraints (poor inside options).

***Keywords**: cooperative breeding, ecological constraints, social constraints, social evolution, coral reef fish*

Nesting behaviour, intraspefic interactions and defense against nest parasites in the solitary bee *Megachile parietina* (Geoffroy, 1785)

GIULIA CALDERAI[1], ELISA MONTERASTELLI[1,2], ALFONSO ORLOTTI[1], MARINO QUARANTA[3], FRANCESCA ROMANA DANI[1]

[1] Università di Firenze - Dipartimento di Biologia
[2] Università di Firenze - Dipartimento di Scienze e Tecnologie Agrarie, Alimentari, Ambientali e Forestali
[3] Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria - Centro di ricerca Agricoltura e Ambiente, Bologna

francescaromana.dani@unifi.it

Megachile parietina, is a Eurasian species, abundant in Southern Europe, known for building, on stones or walls, hard and waterproof nests by mixing sand and clay with salivary secretion. Despite being strictly solitary like all megachilid species, *M. parietina* can form large aggregations of nests. A very large aggregation found in the Council of Montespertoli (Tuscany) has been observed for three consecutive years with the aim of studying nesting behaviour, female interactions and mechanisms of defence against natural enemies. Old nests cover seamlessly a surface of about 3 m^2. At the beginning of the flight period the nidification entails about 650 females with a density of about 2.5 female/dm^2. Nidification occurs in old cells and foundation of new nests is very rare, possibly because of the high energetic cost required to build a complete nest, which we estimated to require about 3,000 flights. At the beginning of the reproductive season, females compete very actively for cells, fronting each other on the nidification or while flying. Females adopting cells insistently rub their abdomen on the cell ridge, possibly marking with abdominal glands. However, succession of more females on a same cell does occur either at the beginning or over the whole nesting season. Only in a few cases we observed different females provisioning food or building material to the same cell during the same day, meaning that even under high-density conditions, females do not show collaborative nesting behaviours. Sixteen species of natural enemy insects have been identified on the aggregation, the most numerous ones being two cuckoo bees (*Stelis nasuta* and *Coelioxys aurolimbatus*), two chalcid wasps (*Leucospis gigas* and *Monodontomerus aeneus*) and two bombylid flies (*Anthrax anthrax* and *Spongostylum tripunctatum*). Active defense towards these species was very limited and consequently nesting in aggregation has little effect against parasitism.

Keywords*: solitary bees, collaborative behaviours, parasitism, cleptoparasites, parasitoids*

Can we predict the social hierarchy of a group of giraffes (*Giraffa camelopardalis*) by observing the order of leaving the enclosure? A preliminary study

CHIARA GRASSO[1], FEDERICO GUILLÉN-SALAZAR[2], ELISABETTA MACCHI[3], ESTER ORIENT-PÉREZ[2], PAULA MARTÍNEZ-ROS[2], SUSANA ASTIZ[4]

[1] Associazione ETICOSCIENZA, Torino
[2] Universidad CEU Cardenal Herrera (Valencia) - Ethology and Animal Welfare Section, Spain
[3] Università di Torino - Dipartimento di Scienze Veterinarie
[4] INIA (Madrid) - Department of Animal Reproduction, Spain

chiaragrasso.eticoscienza@gmail.com

The population of giraffes (*Giraffa camelopardalis*) in the wild has dramatically decreased over the last 20 years. For this reason, ex situ breeding and management has become necessary for conservation and knowledge of the species. This study was carried out at the Bioparc Valencia (Spain) in March and April 2017, on a group of 6 giraffes (1 male and 5 females). This research aims to deepen the ethological knowledge of giraffes and their captive management, verifying whether the sequence in which animals leave the day-time enclosure to reach the night-time one might reflect their dominance hierarchy, as in the night-time enclosure animals could find more food than in the day-time one. We analysed the group's social structure and hierarchy collecting frequencies of social interactions using a continuous focal animal sampling method. Social relationships between individuals and dominance hierarchy were analysed by SOCPROG and SPSS statistical software focusing on agonistic behaviours. The results showed that the giraffes had a linear dominance hierarchy, in which the male was the dominant individual, followed by the older female. Juvenile individuals were at the bottom of the hierarchy. This order also seemed to be correlated with the height of the subjects. Results showed that the exit sequence from the enclosure actually reflects the dominance hierarchy. This study thus contributed to increase the ethological knowledge of giraffes and suggested a simplification and speeding up of the process to identify captive giraffes' social structure.

***Keywords**: giraffes, social behaviour, hierarchy, dominance, ex situ*

Asking for sex…or for grooming? The role of pre-copulation calls in geladas

ANNA ZANOLI[1], MARTA CASELLI[1], CARLO DAGRADI[1], ALESSANDRO GALLO[1], IVAN NORSCIA[1,2], ELISABETTA PALAGI[2,3]

[1] Università di Torino - Dipartimento di Scienze della Vita e Biologia dei Sistemi
[2] Università di Pisa - Museo di Storia Naturale, Calci
[3] Università di Pisa - Dipartimento di Biologia, Unità di Etologia

anna.zanoli@unito.it

Several studies on primates have focused on the acoustic parameters and the social consequences of the vocalizations emitted during and after copulations. On the other hand, there is a lack of knowledge regarding the vocalizations emitted before the copulation and how these can affect sexual and social contacts following the acoustic pattern. Among non-human primates, geladas (*Theropithecus gelada*) represent an interesting species for studying the role of vocalizations emitted in sexual context due to the complex social structure and the impressive vocal repertoire of the species. To fill the gap, we collected data (January-May, 2019) on 18 alpha males and 81 adult females from a population of 268 geladas living in the Kundi highland (Amhara region, Ethiopia). We recorded a total of 356 copulations. If the role of pre-copulation calls is to communicate the motivation to copulate, we hypothesize that the presence of calls significantly increases the probability for the copulation to occur. Secondarily, we focused on social behaviours that are exhibited after the copulation. If geladas use copulations not only for reproductive purposes but also to increase the quality of social bonds between partners, we hypothesize that the signal can lead to the engagement in social interactions, mainly grooming. We found that the presence of a pre-copulation call increases the likelihood of copulations, while the pre-existence of a social interaction not associated to calls does not. Moreover, grooming tends to increase when preceded by call-and-copulation compared to copulation not associated with calls. To understand whether some characteristics can optimize the quality of the signal and determine the social role of pre-copulation calls, acoustic analyses will be performed by taking into account the sex of the senders and the outcome of the call performance.

Keywords: Theropithecus gelada, *copulation, acoustic cue, social behavior, metacommunication*

Spontaneous yawning in *Otaria flavescens*

CLARA LLAMAZARES-MARTÍN[1], FEDERICO GUILLÉN-SALAZAR[1], ELISABETTA PALAGI[2,3]

[1] University CEU Cardenal Herrera - Ethology and Animal Welfare Section, Valencia, Spain
[2] Università di Pisa - Dipartimento di Biologia, Unità di Etologia
[3] Università di Pisa - Museo di Storia Naturale, Calci

clarallamazares@gmail.com

Spontaneous yawning is a ubiquitous behaviour present in all classes of vertebrates, however, it has not already been the focus of attention of marine mammal research. In this study, we aimed at exploring different potential functions of this behaviour in a captive group of South American sea lions (*Otaria flavescens*). Firstly, we found that spontaneous yawning was equally distributed across the different age and sex classes, supporting the *Dimorphism Hypothesis* postulating that no differences on the performance of yawning are expected in species without sexual dimorphism in canine size. When assessing variability in the performance of yawning between the different contexts, yawning was observed to be context-dependent, being more frequently performed during resting/sleeping (the *Drowsiness Hypothesis* supported). Our results also indicate that yawning and self-scratching are indicators of short-term anxiety in sea lions, since these self-directed behaviours increased immediately after conflicts in both the aggressor and the victim. Yawning was not correlated with individuals' dominance status, showing that long-term anxiety was similarly experienced by both dominant and subordinate individuals. The last two findings can be explained by the high social competition of this species that involves all sex and age classes of individuals, leading to an equivalent behavioural distribution in response to short- and long-term anxiety. Our findings unveil that spontaneous yawning in sea lions share similar functions with other mammals, suggesting the plesiomorphic nature of this behaviour.

Keywords*: Drowsiness Hypothesis, self-directed behaviour, scratching, Social Distress Hypothesis, anxiety*

Play in newborn pigs (*Sus scrofa*): the more variable, the more successful

GIADA CORDONI[1], MARIKA GIOIA[2], MARTA COMIN[2], IVAN NORSCIA[2]

[1] Università di Pisa - Museo di Storia Naturale, Calci
[2] Università di Torino - Dipartimento di Scienze della Vita e Biologia dei Sistemi

giada.cordoni@unipi.it

Animal play behaviour is notable for its versatility, plasticity, and unpredictability. During play, individuals recruits many patterns typical of other "serious" contexts, even though the movements are differently mixed, exaggerated and not in ordinary sequence. In order to quantify the variability and complexity of play, we apply, for the first time, a methodological approach using diversity indices, borrowed from the ecology domain, to characterize the playful sessions (mainly play fighting) in immature subjects of *Sus scrofa*. In particular, we considered the Shannon Index, measuring abundance and richness of play patterns, and the *Pielou index*, also accounting for play pattern evenness (the higher the frequency of a specific playful pattern - "dominant" pattern - the lower the level of the index). We collected video data on 28 pre-weaning piglets hosted at the ethical pig farm Parva Domus (Turin, Italy). By running a LMM preliminary analyses, we found that the *Shannon Index*, accounting for the variability of the playful patterns (number of different patterns per session) and their relative frequency (number of each type of pattern per session), significantly affected the play duration: the higher the *Shannon Index* value, the longer the length of the session. The same trend was found for the *Pielou index*. Newborn pigs are very precocial and perform well-coordinated movements soon after birth, especially during playful interactions. Our preliminary results might advocate that play sessions with higher motor pattern variability may be more successful and, in a long-term view, may concur in increasing the physical and cognitive abilities of pigs and in improving their capacity to cope with unexpected situation.

Keywords*: play variability, diversity indices, unexpected situation,* Sus scrofa

Play fighting and facial communication in meerkats (*Suricata suricatta*)

ELISABETTA PALAGI[1,2], ELENA MARCHI[1], PAOLO CAVICCHIO[3], FRANCESCA BANDOLI[3]

[1] Università di Pisa - Dipartimento di Biologia, Unità di Etologia
[2] Università di Pisa - Museo di Storia Naturale, Calci
[3] Giardino Zoologico di Pistoia

elena-marchi@hotmail.com

The social play is one of the most productive behavioural domains to study visual communication in mammals. The ability to manage play-fighting interactions can favour the development of communicative modules and their correct decoding. For the first time, we studied how slender-tailed meerkats (*Suricata suricatta*) use visual signals during dyadic play fighting. Due to their high levels of social cohesion and cooperation, meerkats are a very good model to test some hypotheses on the role of facial communication in synchronizing playful motor actions. We analysed 797 play sessions of a group of 15 meerkats hosted at Pistoia Zoo (Italy). We found that meerkats use the relaxed open-mouth (ROM), a playful facial expression conveying a positive mood in several social mammals. We also found that meerkats mimic in a very rapid and automatic way the ROM emitted by playmates (Rapid Facial Mimicry, RFM). RFM was positively correlated with the relationship quality shared by subjects, thus suggesting that the mimicry phenomenon is socially modulated. Moreover, the presence of RFM prolonged the playful interaction. Our findings suggest that RFM is involved in playful motivation and positive emotional sharing as it occurs in primates and canids. Through RFM animals can share the emotional mood they are experiencing, and this appears to be particularly adaptive when the relationships are not inhibited by rank rules and when animals build and maintain their bonds through social affiliation. The meerkat society is extremely cohesive and cooperative. Such features could have therefore favoured the evolution of facial mimicry, a phenomenon linked to emotional contagion, one of the most basic forms of empathy.

***Keywords**: facial communication, relaxed open mouth, emotional contagion, social play, meerkats*

Etologia delle simbiosi

Ant-plant interactions in temperate areas: from basic to applied behavioural ecology

DONATO A. GRASSO, DANIELE GIANNETTI, CRISTINA CASTRACANI, FIORENZA A. SPOTTI, ENRICO SCHIFANI, ALESSANDRA MORI

Università di Parma - Dipartimento di Scienze Chimiche, della Vita e della Sostenibilità Ambientale

donato.grasso@unipr.it

The coevolutionary pathway involving ants and plants dates back over 100 million years and has led to the development of many adaptations whose knowledge could be extremely important in many fields of basic and applied biology. In this context, most of the information on ant-plant interactions only deals with tropical species. However, it is worth noting that also many plants at temperate latitudes establish relationships with ants, although fewer data on the biology of these interactions are available. Ants may have direct or indirect effects on the plant fitness and this may have important applicative implications in different fields including agronomy. In fact, the tendency of ants to defend their partner plants or the habit of several species acting as generalist predators may give new insights to develop novel systems of biological control. In this context, our research aims to bridge the gap of knowledge regarding the Italian species, on which virtually no detailed study has been conducted so far. Here we report the results of a series of field and laboratory investigations (e.g. exclusion or augmentative experiments, analysis of predation and involved cues) on different model systems mainly focusing on plants of forestry and agronomic interest (e.g. citrus and pear orchards, oaks, wild cherry, fava beans, potatoes and cucumbers). We showed that ant-plant interactions (including myrmecophilous relationships) are common and may play important roles in the ecological dynamics of agroecosystems. This opens up the possibility to study and discuss new aspects and paradigms of the behavioural biology of animal-plant relationships and at the same time offers the opportunity of using these concepts in an agroecological context.

***Keywords**: ant-plant biology, mutualism, agroecosystems, applied myrmecology, biological control*

Effect of *Echinococcus multilocularis* infection on anti-predator behaviour of *Microtus arvalis* intermediate host

MATILDE MARTINI[1], TEILA CIOLI[1], THOMAS ROMIG[2], ANNA GAGLIARDO[1], ALESSANDRO MASSOLO[1]

[1] Università di Pisa - Dipartimento di Biologia, Unità di Etologia
[2] Hohenheim University - Institute of Zoology, Stuttgart, Germany

alessandro.massolo@unipi.it

Manipulation of host behaviour by parasites to enhance transmission to the next host is a fascinating phenomenon that interested scientist since the '70s. It has been proposed that infection with the cestode *Echinococcus multilocularis* in common voles leads to an impairment in anti-predatory behaviour of the rodent intermediate host, which facilitates transmission of the tapeworm to the final host, a canid. We tested whether the behavioural changes of infected common voles are specific to contexts where they would indeed enhance transmission, thus when the protoscoleces (infectious larval stage) are present. For this reason, 8 and 12 weeks post-infection rodent hosts where selected as the supposed time of protoscoleces production and maturation to test this hypothesis. Therefore, we compared the behaviour between animals that were experimentally infected with *E. multilocularis* eggs and control, through a 24-hour monitoring followed, the next day, by four behavioural trials: an open field test, a barrier test, a platform test and a running wheel test. The animals showed an alteration of the anti-predatory behaviour associated to the infection in the 24-hour monitoring. Specifically, the results showed an increase in frequency of eating and, most relevantly, of time spent above bedding in treated animals. These findings are the first direct evidence in elucidating the role of *E. multilocularis* infection in affecting anti-predatory responses in common voles.

Keywords*: behavioral alteration, trophically-transmitted parasites, cestode, rodent, predator-prey relationship*

Asymmetrical interspecific communication in avian mixed species colonies

DANIELA CAMPOBELLO[1], MAURIZIO SARÀ[1], ALEXANDER J. HARE[2, 3], JAMES F. HARE[2]

[1] Università di Palermo - Dipartimento STEBICEF, Sezione di Biologia Animale
[2] University of Manitoba - Department of Biological Sciences, Canada
[3] University of Guelph - Department of Integrative Biology, Canada

daniela.campobello@unipa.it

Sympatric species derive benefits by attending to information conveyed by heterospecifics. We previously reported reduced vigilance among jackdaws (*Corvus monedula*) and lesser kestrels (*Falco numanni*) residing in mixed species colonies and conducted the present study to test for interspecific communication of threat associated with European magpies (*Pica pica*) as nest predators. After quantifying structural differences in jackdaw and lesser kestrel calls relative to European magpie versus non-predator models, we played back calls of jackdaws and lesser kestrels representative of the different model types to test whether receivers perceive threat-related variation in either conspecific or heterospecific calls. We detected differential behavioural responses to call playbacks, with both jackdaws and lesser kestrels increasing vigilance and alarm calling in response to magpie elicited jackdaw calls, but not to other call types. Taken together, our results suggest that jackdaw, but not lesser kestrel vocalizations, communicate enhanced threat associated with European magpies as possible nest predators. This interspecific alarm communication benefits both jackdaws and lesser kestrels, and at least in part, explains asymmetric responses of jackdaws and lesser kestrels to magpies attending mixed species colonies in nature.

Keywords*: interspecific association, alarm communication, response urgency, group living, public information*

Comunicazione

Evolution and functional significance of female copulation calls in primates

DARIO MAESTRIPIERI

The University of Chicago - Institute for Mind and Biology, USA

dario@uchicago.edu

Female copulation calls are mating-associated vocalizations that occur in some species of Old World monkeys and apes. Females use these calls to advertise mating to other group members. In doing so, they encourage mating attempts by other males, as well as increase mate guarding by the consort male. Female copulation calls have evolved under the selective pressures of risk of infanticide and sperm competition. When male mate guarding is effective, copulation calls allow females to concentrate paternity in dominant males and benefit from their protection against infanticide. When mate guarding is ineffective, copulation calls may bring genetic benefits to females through facilitation of sperm competition. In species with little female promiscuity copulation calls are rare and exhibited only in association with mating with dominant males. In species in which females are highly promiscuous, copulation calls are frequent and unrelated to male dominance rank. In a captive group of Guinea baboons (*Papio papio*), copulation calls occurred in 61% of all copulations. Calls were most frequent after females had mated with a high-quality male and were followed by increased post-copulatory mate guarding. In a group of wild northern pigtail macaques (*Macaca leonina*), copulation calls occurred in 11.5 % of all copulations and were given more frequently when mating with the alpha male. Copulation calls encouraged male ejaculation and mate guarding. In pigtail macaques, the alpha male is able to monopolize mating with fertile females to a greater extent than in Guinea baboons, which explains why the occurrence of copulation calls is lower than in the baboons. In both species, female promiscuity is low and females have little opportunity to choose their mates and/or female mate choice is costly. In these species, copulation calls function to concentrate paternity in the alpha male and presumably benefit from his protection against infanticide.

***Keywords**: sexual selection, mating, female choice, copulation calls, primates*

Are bonobo females' postures influenced by their sexual status?

ELISA DEMURU[1,2], DAN DEDIU[1], FRANÇOIS PELLEGRINO[1], FLORENCE LEVRÉRO[2]

[1] Université Lumière Lyon 2 - Dynamique du Langage, UMR5596, CNRS, Lyon, France
[2] Université Jean Monnet - Equipe Neuro-Ethologie Sensorielle, UMR 9197, CNRS, Saint-Etienne, France

elisa.demuru@cnrs.fr

In many catarrhine species, the anogenital region of adult females undergoes cyclical changes in size, colour and turgidity. These fluctuations are under hormonal control and culminate in the Maximum Swelling Phase (MSP) that usually occurs around the periovulatory period, thus functioning as an honest signal of female fecundity. During the MSP, females show high levels of proceptivity, receptivity and attractiveness and, in many species, the sexual activity is mostly concentrated in this phase. Female bonobos seem not to follow these general rules. In this species, the duration of the MSP can be unusually long and the timing of ovulation in relation to the onset of the MSP is extremely variable. These factors make the maximum sexual swelling in bonobo females a much less reliable indicator of fertility. It has been proposed that the evolution of their prolonged MSP resulted in a reduction of male coercion and aggressiveness and favoured the emergence of female bonding through the use of socio-sexual contacts. This is supported by the evidence that females in MSP are more attractive not only to males, but also to females. Given the social importance of the maximum sexual swelling, it is reasonable to predict that females should "advertise" it whenever possible. Here, we investigated whether the body posture assumed by female bonobos while foraging changed as a function of their sexual status. We analysed about 400h of videos collected in the primate park "*La Vallée des Singes*" (France) in 2012, 2014 and 2018. Our results support our prediction and reveal the effects of other factors, such as energetic and biomechanical costs of the postures considered. Our research questions the biologically irrelevant creation of clear-cut barriers between different behavioural contexts in animals living in stable social groups and provides some interesting insights on the emergence of composite signals.

Keywords: Pan paniscus, *swelling phase, foraging, communication*

Bubbling, drumming or talking? Underwater communication in *Emys orbicularis ingauna*

GABRIELLA POLITO[1,2], OLIVIER FRIARD[1], LIVIO FAVARO[1], DARIO OTTONELLO[2], MASSIMO DELFINO[3], CRISTINA GIACOMA[1]

[1] Università di Torino - Dipartimento di Scienze della Vita e Biologia dei Sistemi
[2] Associazione *Emys* Liguria, Albenga (SV)
[3] Università di Torino - Dipartimento di Scienze della Terra

cristina.giacoma@unito.it

More than 30 species of tortoises are known to vocalize during mating. However, very little is documented on underwater vocal communication in freshwater turtles, since they are considered animals with a poor social life and low communication capabilities. The only published descriptions of underwater sound production are available for *Podocnemis expansa* (Testudines; Pleurodira; Podocnemididae), occurring in the Amazon basin in South America, and for two freshwater turtles occurring in Australia, *Chelodina colliei* (Testudines; Pleurodira; Chelidae), and *Carettochelys insculpta* (Testudines; Cryptodira; Carettochelyidae). The size of the vocal repertoire of these species is comparable to those of cetaceans and primates. In particular, *C. colliei* has a repertoire of at least 17 categories of sounds used in different contexts, *C. insculpta* uses vocalizations during different life stages, and *P. expansa* vocalizes in social contexts. The use of acoustic signals for communication is particularly effective underwater, where visibility is usually lower than in terrestrial environments. In this study, we investigated whether the rarest conservation unit of pond turtles occurring in Europe, *Emys orbicularis ingauna* (Testudines; Cryptodira; Emydidae), utilizes vocal signals to communicate underwater. From April to September 2018, we recorded the soundscape of two outdoor artificial ponds at the *Centro Emys* (Albenga, SV). We recorded 24 hours per day for 124 days with a Song Meter 4 equipped with an HTI-96-MIN hydrophone (recording bandwidth 2Hz to 48kHz). Overall, we collected 5950 audio files (.wav format, 16-bit resolution) that were further analyzed at the "c3s" High Performance Computing Center of the University of Turin. We identified several discrete categories of complex vocalizations emitted only by males or only by females or both. We found that such vocalizations are produced in the social context and particularly during mating. We will discuss how this first description of the complex vocal repertoire of this species might contribute to our understanding of the evolution of vocal communication in Testudines.

***Keywords**: bioacoustics, passive acoustic recording, Testudines, freshwater turtles, vocal repertoire*

Social context rather than nestmateship or imprinting shapes recognition in a social wasp

FEDERICO CAPPA[1], ALESSANDRO CINI[1], LISA SIGNOROTTI[1], RITA CERVO[1]

[1] Università di Firenze - Dipartimento di Biologia

federico.cappa@unifi.it

Prenatal and early olfactory learning trigger significant effects on development in general, and exquisitely on behaviour, in a wide variety of organisms. Early learning has been largely investigated in vertebrates, but the process can occur also in invertebrates. In social insects early learning appears to influence important features of social life, such as nestmate recognition. Social insects can discriminate between nestmates and aliens by comparing the chemical phenotype of an individual with the neural representation of their own colony odor (template). Yet, relatively little is known about the ontogeny of nestmate recognition, and the learning processes that might be involved. Individuals could acquire the information to create their template from their social environment or through self-referent phenotype matching, which requires no learning of environmental kinship cues. The acquisition process might be restricted to an early sensitive period, or the template could be updated during adult life according to social requirements. Here, we present the results of our studies on the ontogeny of nestmate recognition in *Polistes* paper wasps, a model genus for the study of recognition. We performed differential odour experience experiments, in which *Polistes dominula* workers were isolated at emergence and maintained for 96 h in presence of nest-odour cues before being inserted into a novel colony. Our results show that workers develop their nestmate recognition abilities based on their social context rather than through prenatal and early learning or self-matching. Interestingly, our results showed that wasps do not form their referent template during the pupal or early adult phase simply from the nest paper and they are not able to acquire kinship information through self-matching. Our studies suggest that the social context provided by the nest, shapes recognition abilities in *Polistes* wasps, therefore shedding new light on the ontogeny of nestmate recognition in paper wasps and in other social insects.

Keywords*: ontogeny of recognition, nestmate recognition, early learning, paper wasps,* Polistes

Intentionality and rapid mimicry during playful interactions in Czechoslovakian wolfdogs

GIADA CORDONI[1], ERICA TOMMASI[2], VERONICA MAGLIERI[2], ELISABETTA PALAGI[1,2]

[1] Università di Pisa - Museo di Storia Naturale, Calci
[2] Università di Pisa - Dipartimento di Biologia, Unità di Etologia

eri.toma@libero.it

Social play is a multifunctional behaviour, which can recruit many different motor patterns from other functional contexts. For this reason, play requires following changeable rules in order to avoid aggressive escalation. Animals communicate their non-serious intents by using specific playful signals that are produced to influence conspecifics' behaviour (intentional signals, audience-dependent) or to express the internal emotional state of the performer (emotional signals, audience-independent). To investigate this topic, we focused on playful communication in 24 Czechoslovakian wolfdogs (*Canis lupus familiaris*), a breed derived from the cross between German shepherds and Carpathian wolves. Both wolves and dogs retain the propensity to play into adulthood, for this reason the CWD is an excellent model to test hypotheses about play dynamics. We found longer duration and higher frequency of Relaxed Open Mouth (a specific playful signal, ROM) in contact than in locomotor play. Conversely, we did not find any difference in the frequency of play bow (PBOW) between contact and locomotor play. Following the criteria used to define signal intentionality, we found that ROM i) was directed to a unique and recognizable target, ii) was performed when the receiver's attention was achieved by the trigger and iii) was followed by a behavioral response by the receiver. These findings suggest that ROM can be considered as an intentional signal used by CWD to communicate playful motivation and avoid aggressive reaction by the receiver. We confirmed the occurrence of Rapid Mimicry (RM) of both ROM and PBOW during CWD play. RM did not significantly affect the duration of play session. However, we cannot exclude that other factors such as the age of the player and body size, may affect the duration and, consequently, the success of the play interaction.

***Keywords**:* Canis lupus familiaris, *play fighting, meta-communication, intentional signals, emotional signals*

Possible yawn contagion in the domestic pig, *Sus scrofa*

IVAN NORSCIA[1], ELISABETTA COCO[1], EDOARDO COLLARINI[1], GIADA CORDONI[2]

[1] Università di Torino - Dipartimento di Scienze della Vita e Biologia dei Sistemi
[2] Università di Pisa - Museo di Storia Naturale, Calci

ivan.norscia@unito.it

Yawning can be solitary or social. Social yawning occurs when the individuals of a group yawn together (synchrony) whereas contagious yawning occurs when one individual yawns in response to the yawn released by another individual. Yawn contagion is important because it may underlie emotional contagion, as a result of the perception-action mechanism that allows individuals to pre-consciously activate shared motor and emotional representations during the perception of the facial expression of others. Contagious yawning has been investigated in different social mammals, including canids, sea lions, humans and some non-human primates but never in domestic pigs (*Sus scrofa*). Observational data on yawning were collected on 109 semi-free ranging pigs via video-recording (Panasonic HC-V180eg and similar) at the ethical farm *Parva Domus* (Torino, Italy). A GLMM run on a partial dataset included the interaction between the identity of the yawner and the identity of the receiver (the subject seeing the yawn) as random factors. The fixed factors were sex and age (in months) of yawner and potential responder, the distance between the two subjects, and – importantly – visibility. Visibility indicated whether the triggering yawn fell within the visual range of the potential responder or not. This latter case involved the presence of an obstacle between the two subjects preventing sight. Yawns were not vocalised. In the best model the only fixed factor having a significant effect on the presence of a yawning response (dependent variable) was visibility, thus suggesting that yawn contagion and not just yawn synchronicity occurred. These preliminary findings are in line with the moderate emotional contagion observed in pigs in previous studies. However, the presence of yawn contagion in pigs and its possible relation to emotional contagion can be confirmed only when the complete dataset is analysed and other variables (e.g. social bond) are considered.

Keywords*: yawn contagion, facial mimicry, emotional contagion, swine*

Etologia applicata

Poor empathy and abnormal aggression in mice as a model for human psychopathology

FRANCESCA ZORATTO[1], FRANCESCA FRANCHI[1], DIANA CASH[2], JEFFREY C. GLENNON[3], SIMONE MACRI[1], GIOVANNI LAVIOLA[1]

[1] Istituto Superiore di Sanità - Centro di Riferimento per le Scienze comportamentali e la Salute mentale, Roma
[2] King's College London - Department of Neuroimaging, Institute of Psychiatry, Psychology and Neuroscience, UK
[3] Radboud University Medical Centre - Department of Cognitive Neuroscience, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, NL

francesca.zoratto@iss.it

Deficits in empathy, the ability to share an emotion of another individual, constitute a hallmark of several psychopathological conditions, including conduct disorder (CD) and adult psychopathy. CD is also characterised by excess rates of aggression, often associated with shallow or deficient affect, violation of societal norms and callous-unemotional traits. CD symptoms are quantitative rather than qualitative in nature, whereby patients indulge in normal behaviours albeit at abnormal rates. An experimental model of CD shall thus replicate the quantitative nature of CD-specific symptoms. Here, we present a theoretical framework apt to the design of a mouse model of CD, and then describe how it has been used to test the potential therapeutic efficacy of oxytocin and methylphenidate. Resting upon the hypothesis that lack of empathy may constitute a distinctive feature of CD, we tested whether mice exhibiting extremely low levels of empathy also show excess aggression, diminished sociability, punishment-related emotional memory, and physiological stress reactivity, and norm violation. We investigated empathy in the simplest form of emotional contagion: specifically, mice exposed to a painful stimulus display a higher response if in the presence of a familiar individual also experiencing pain, than in isolation. In accordance with our predictions, excess callousness is associated with many of the aforementioned behavioural and physiological abnormalities. High resolution structural imaging revealed subtle differences in regional brain volume and fibre organization in mice selected for high and low empathy-like traits. Affected brain areas comprise circuits that mediate fear behaviour and olfactory processing. We then observed that intranasal oxytocin administration normalised empathy-like behaviour, aggression, and behavioural stereotypies. Conversely, the compensatory effects of methylphenidate on these abnormalities were less pervasive. Ultimately, we offer that empathy may constitute a central node in the identification of a preclinical behavioural syndrome isomorphic to CD.

Keywords*: callous-unemotional traits, conduct disorder, psychopathy, empathy for pain, oxytocin*

Comparing problem-solving style in pet and long-term shelter dogs

CARLOTTA BURANI[1,2], EMANUELA PRATO PREVIDE[3], PAOLA VALSECCHI[2]

[1] Università di Parma - Dipartimento di Medicina e Chirurgia
[2] Università di Parma - Dipartimento di Scienze Chimiche, della Vita e della Sostenibilità Ambientale
[3] Università di Milano - Dipartimento di Fisiopatologia Medico-Chirurgica e dei Trapianti

carlotta.burani@studenti.unipr.it

The unsolvable task has traditionally been used to assess subjects' communicative skills and social reliance towards people. However, recent findings on dogs have shown that differences in animals' behavioural response to this task are also ascribable to their motivation and persistence. We aimed to evaluate effects of life-conditions on dogs' behaviour. The protocol consisted of three consecutive solvable trials in which dogs could obtain food by manipulating a container, followed by an unsolvable trial. Test room was unknow for all dogs. Results revealed differences in problem-solving style between long-term shelter dogs (N=47) and pets (N=46). During the unsolvable trial pets were as persistent as shelter dogs in trying to open the container but they gazed significantly more at people than shelter dogs, in particular towards the researcher who manipulated the food and was unknown to all dogs; this suggests that pets persistently gazed at the researcher probably because they were seeking help in retrieving the treat, whereas shelter dogs did it less often possibly because they are not used to be helped by humans. Moreover, shelter dogs spent significantly more time exploring the testing room than pets: they could be more interested than pets in a new environment given that they spend most of their day alone in a barren kennel. The effects of age and of time of permanence in shelter on problem-solving abilities will be discussed.

***Keywords**: problem-solving, shelter dogs, coping style, social referencing, persistence*

How behaviour helps to control invasive alien crayfish

ELENA TRICARICO[1], LAURA AQUILONI[1], ALBERTO FRANCESCO INGHILESI[1], GIUSEPPE MAZZA[1,2]

[1] Università di Firenze - Dipartimento di Biologia
[2] CREA-DC - Centro di ricerca, difesa e certificazione, Firenze

elena.tricarico@unifi.it

Behaviour can be considered the key factor for improving knowledge on invasive alien species and their interactions with native species, in order to develop effective management methods for controlling them. Introduced crayfish have been the subject of much research to understand their behaviour and their impacts, leading to innovations and to the successful application of new control techniques in conservation actions. The Louisiana red swamp crayfish *Procambarus clarkii*, one of the most widespread introduced species worldwide and highly invasive in European fresh waters, provides a powerful illustration. The numerous studies conducted to assess its sexual selection, mating strategies, aggression, anti-predator and predatory behaviour were crucial for selecting appropriate techniques for the control of its invasive populations. For example, sexual selection was particularly useful in testing and calibrating the Sterile Males Release Technique (SMRT). This requires a polygynous system and few monopolizing dominant males; behavioural studies showed that large males of *P. clarkii* are dominant in intrasexual fights and are selected by females, thus enabling the use of SMRT in the field. Moreover, an integrated management approach (e.g. coupling intensive trapping and SMRT or intensive trapping and native predators) is usually recommended for red swamp crayfish. Again, behavioural studies lie behind this approach as it is known from laboratory and field observations that adult crayfish are more vagile and tend to be trapped, while juveniles are more trap-shy but they are the preferred size preyed on by fish and aquatic birds. Both these examples are outstanding proofs of the need to integrate behaviour and conservation biology in order to find the best management solutions for invasive species and thereby protect native species and ecosystems.

***Keywords**: biological invasions, management, crayfish, sexual selection*

Non-target Pest Risk Assessment of *Trissolcus japonicus* (Hymenoptera: Scelionidae): host-acceptance behavior on *Halyomorpha halys* (Heteroptera: Pentatomidae) and non-target species

GIUSEPPE MAZZA, FRANCESCO PAOLI, LUCA BONCOMPAGNI, LEONARDO MARIANELLI, PIO FEDERICO ROVERSI, GIUSEPPINO SABBATINI PEVERIERI

CREA-DC - Centro di ricerca, difesa e certificazione, Firenze

giuseppe.mazza@crea.gov.it

Halyomorpha halys is currently widespread in Italy and many other countries worldwide. It is an invasive and highly polyphagous species, damaging several plants such as field crops, vegetables, tree fruits and ornamentals. To date, pest control is realized using chemicals, but for a long-term solution, classical biological control appears to be the only sustainable option. *Trissolcus japonicus*, an Asian egg parasitoid wasp, resulted to be an important natural enemy against this pest, demonstrating a high effectiveness in its native range. Host range and risk analysis need to be performed prior to the introduction, but for this species detailed behavioral host-acceptance repertoire of target and non-target species is still missing. The aim of the present contribution was to evaluate the acceptance behavior and reproductive success of *T. japonicus* in no-choice tests with *H. halys* and 11 native non-target stink bug: *Coreus marginatus*, *Carpocoris purpureipennis*, *Carpocoris mediterraneus mediterraneus*, *Dolycoris baccarum*, *Gonocerus juniperi*, *Nezara viridula*, *Piezodorus lituratus*, *Rhaphigaster nebulosa*, *Peribalus strictus*, *Staria lunata* and *Rhynocoris iracundus*. The parasitoid adult females used in the experiment were 3-days old and reared in a climatic chamber in standard condition inside glass tubes provided with honey. The following behaviours i) egg inspection, ii) oviposition and iii) egg marking were scored and analyzed from two-hour videos in which a single potential host egg was exposed to one female. The target species *H. halys* along with *R. nebulosa*, showed high percentages of successful parasitization, with similar behaviours. Eggs from both species of *Carpocoris*, *D. baccarum*, *S. lunata*, *P. lituratus*, *N. viridula* were only partially parasitized with different emergence success, while eggs of *C. marginatus*, *G. juniperi*, *R. iracundus* and *P. strictus* were not accepted. Our results confirm that *T. japonicus* is a good candidate for biological control of *H. halys* displaying an oligophagous trophic behaviour.

***Keywords**: biological control, brown marmorated stink bug, egg parasitoid, host-specificity, natural enemy*

From self-medication to social-medication. The use of propolis in *Varroa*-infested hives

MICHELINA PUSCEDDU[1], DESIDERATO ANNOSCIA[2], IGNAZIO FLORIS[1], DAVIDE FRIZZERA[2], VIRGINIA ZANNI[2], ALBERTO ANGIONI[3], ALBERTOSATTA[1], FRANCESCO NAZZI[2]

[1] Università di Sassari - Dipartimento di Agraria
[2] Università di Udine - Dipartimento di Scienze Agroalimentari, Ambientali e Animali
[3] Università di Cagliari - Dipartimento di Scienze della Vita e dell'Ambiente

m.pusceddu@uniss.it

In the last decade, studies on social insects have extended the concept of self-medication from the individual to the colony level and the term "social medication" has been specifically coined. Recent studies suggest that *Apis mellifera* can adopt this type of medication behaviour against the mite *Varroa destructor*, the most important ectoparasite of honeybees, using plant resin with bioactive properties (propolis). *Varroa*-infested colonies increase the resin foraging rate in comparison to non-infested ones. However, the benefits associated to this behaviour remain still unclear. In this work, we tested the hypothesis that propolis can interfere with *Varroa* reproduction, based on the fact that worker bees prepare brood cells for the oviposition by applying propolis on their inner surface. We also tested the hypothesis that propolis administered with food can be beneficial to adult bees infested during the pupal stage. Our results show that propolis causes an increase in *Varroa* mortality and a decrease in mite fertility in treated brood cells as compared to control cells. We also found a positive effect of propolis on the survival of adult workers parasitized at the pre-imaginal stage. Finally, our results suggest that *Varroa* parasitism drives the choice of the diet towards a food enriched with bioactive substances. In conclusion, our findings seem to confirm the hypothesis that increased resin collection represents an example of social medication to mitigate the detrimental effects of parasitism.

***Keywords**: propolis,* Varroa destructor*, self-medication, medication of kin, social medication*

Effects of a biopesticide on honeybees' habituation and sucrose responsiveness

DANIELE CARLESSO[1,2], FEDERICO CAPPA[2], STEFANIA SMARGIASSI[3], LARA SASSOLI[2], RITA CERVO[2], DAVID BARACCHI[2]

[1] Università di Padova - Dipartimento di Psicologia Generale
[2] Università di Firenze - Dipartimento di Biologia
[3] Università di Torino - Dipartimento di Scienze della Vita e Biologia dei Sistemi

daniele.carlesso.92@gmail.com

Pathogens and pesticides represent two of the main drivers of insect pollinators decline worldwide. As chemical pesticides, such as neonicotinoids, have been proven to be detrimental for pollinators' health and cognition, more eco-friendly strategies such as the use of biopesticides bloomed. The entomopathogenic fungus *Beauveria bassiana*, a biopesticide extensively used in both organic and traditional farming, has been considered safe for pollinators at the point that bees are used as fungus vectors in cultivations. Yet, so far, no studies assessed sub-lethal cognitive effects of *B. bassiana* infection on *Apis mellifera*. We therefore investigated whether bees treated with *B. bassiana* at relevant field doses show cognitive impairments which may undermine individual and colony fitness. We tested this hypothesis by studying two simple processes which are key determinants of the division of labor inside the colony: habituation to antennal sucrose stimulation, which is a non-associative learning process, and the subjective evaluation of sucrose reward, which may be assessed via the innate responsiveness of bees to sucrose solutions of increasing concentration. Both behaviors have been quantified via the proboscis extension response (PER) in harnessed bees. Preliminary results show that while the fungus does not affect the subjective evaluation of sucrose reward, it makes the bees less consistent in their response. Moreover, fungus-treated honeybees habituated less than controls. Overall these results suggest that the fungus might unsettle learning and memory capabilities. Ongoing experiments will clarify whether more complex forms of learning such as associative learning are also affected by this fungus.

***Keywords**:* Beauveria bassiana, Apis mellifera, *cognition, learning, pesticides, pollinators*

Trophobiosis between ants and mealybugs: ant behaviour as a useful tool for pest monitoring in vineyard IPM

CRISTINA CASTRACANI[1], DANIELE GIANNETTI[1], MARTINA GHIZZONI[1], FIORENZA A. SPOTTI[1], MARCO DELAITI[2], FRANCESCO PENNER[2], CLAUDIO IORIATTI[2], ALESSANDRA MORI[1], DONATO A. GRASSO[1]

[1] Università di Parma - Dipartimento di Scienze Chimiche, della Vita e della Sostenibilità Ambientale
[2] Centro di Trasferimento Tecnologico - Fondazione Edmund Mach, San Michele all'Adige

cristina.castracani@unipr.it

The vine mealybug *Planococcus ficus* (Hemiptera: Pseudococcidae) is a worldwide pest of grapevine. It is present in several grape-growing countries, including regions of Middle East, Pakistan, India, South Africa, South America, Mexico, California and of Mediterranean Basin (e.g. Italy, Spain, Turkey). *Planococcus ficus* infestations lead to severe economic losses, both on wine and table grape. Damages on plant range from early defoliation to fruit injuries due to *P. ficus* clustering behaviour on fruits during summer with consistent production of wax, honeydew, sooty-mod fungi, attraction of secondary pests and transmission of leafroll-associated viruses (GLRaVs). The result is a great reduction of table grape market value and reduced crop yield and wine production quality. Several ant species (Hymenoptera: Formicidae) establish mutualistic relationships with mealybugs that can be led back to trophobiosis where honeydew excretion produced by mealybugs is traded for enemy's protection by ants. Consequently, in Integrated Pest Management (IPM) programs for vineyards, ant control is usually recommended to enhance the activity of mealybug natural enemies. However, along our studies on ant-mealybugs interactions, we developed the idea that trophobiotic relationships can be useful also in the monitoring phase of IPM. Our research focused on the vine mealybug *P. ficus* infesting vineyards in Trentino-Alto Adige region (Italy) and on its relationship with some ant species. We found that, although several ant species regularly visit the vineyards, only few establish mutualistic relationships with the mealybugs. In addition, we developed a protocol based on ant behaviour to locate the mealybugs when they are not immediately visible, as in the first part of the season, when they tend to colonize the deeper part of the trunk and only successively move to the leaves where their detection is easier. The early discovery of infestation is a crucial step that can enhance other IPM actions such as pest control through sexual confusion.

***Keywords**: IPM,* Planococcus ficus*, ants, trophobiosis, pest monitoring*

Digging behavior in mangrove crabs: quantifying its bioturbation potential in Hong Kong coastal forests

STEFANO CANNICCI[1,2], LAURA E. AGUSTO[2], SARA FRATINI[1]

[1] Università di Firenze - Dipartimento di Biologia
[2] The University of Hong Kong - The Swire Institute of Marine Science, School of Biological Sciences, HK

stefano.cannicci@unifi.it

Mangrove crabs are known as ecosystem engineers because of their burrowing behaviour, which impacts several important biogeochemical processes. Crab's burrows enhance nutrient and organic matter fluxes and water flow within the mangrove soil by increasing belowground surface area, bacterial communities, and volume. Burrow morphology has been shown to be similar across species within the same family but variable among families. Therefore, the potential ecosystem impact of burrowing crabs depends on their community structure and composition. However, a detailed quantification of the scale to which the different behaviours impact the mangrove ecosystem through such mechanisms has not been done. Here, we quantified the bioturbation potential of five crab species belonging to three families in three Hong Kong mangroves. Using a polyester resin to cast burrows, 3D-scanning and the MeshLab Open-Source Mesh Processing Tool, we obtained the mean species-specific burrow surface area, volume and depth of three ocypodid, one sesarmid (*Parasesarma bidens*) and varunid species (*Metaplax longipes*). Next, we assessed burrow density (openings m-2) and identified their ownership. By combining these data, we found the increase in surface area per unit area of burrow contribution to be substantial. *Parasesarma bidens*, the most abundant sesarmid species in Hong Kong, has complex and large burrows, which can increase the surface area on average by 50–200%, depending on density. The burrows of *M. longipes* increased the surface area by 50%, on average, while the ocypodid species increased surface area by 10-25 % across sites. The created volume due to *P. bidens* burrows showed 6.5 to 13 times larger than *M. longipes* and the ocypodid species, across sites. Our data show that, by incorporating burrow species-specific characteristics, it is possible to accurately quantify their bioturbation potential and demonstrate that previous studies have underestimated the impact of such behaviour on mangrove ecosystem functioning.

***Keywords**: ecosystem engineers, Hong Kong mangroves, ecosystem functioning*

Using a RobotFalcon for chasing away flocks of birds

ROLF STORMS[1], CLAUDIO CARERE[1,2], ROBERT MUSTERS[3], DEBORAH SALLE[1], SIMON VERHULST[4], CHARLOTTE K. HEMELRIJK[1]

[1] University of Groningen - Theoretical Research in Evolutionary Life Sciences, Faculty of Science and Engineering, Groningen Institute for Evolutionary Life Sciences, NL
[2] Università della Tuscia - Dipartimento di Scienze Ecologiche e Biologiche, Viterbo
[3] Roflight, Enschede, NL
[4] University of Groningen - Behavioural and Physiological Ecology, Faculty of Science and Engineering, Groningen Institute for Evolutionary Life Sciences, NL

claudiocarere@unitus.it

Bird flocks constitute a major problem for humans in several circumstances, for instance when colliding with airplanes, residing at a roost in cities and when foraging in farmland. Since the early 60s, ethological, non-invasive and ethically acceptable methods, such as acoustic devices, have been used systematically to remove, relocate or limit the presence of flocks on unwanted locations. However, the effectiveness of these standard methods is limited, since they do not control in what direction the birds flee and birds tend to habituate to them. Here, we present a new approach, first-in-its-kind, by using a robotic falcon to chase away bird flocks. The RobotFalcon closely resembles a peregrine falcon. Based on 50 deterrence actions of flocks of different species (gulls, corvids, and starlings), we show that our method controls the direction of fleeing, and lengthens the time until flocks return for gulls and starlings, but not for corvids. We discuss the unprecedented potential of our method for both driving away flocks and for studying individual responses during collective escape.

Keywords: *flocking, predation, collective behaviour, bird strike, robotFalcon*

SESSIONE POSTER

Experimental infestation of the nematode parasite *Anisakis pegreffii* induces marked behavioural changes in the European bass (*Dycentrarchus labrax*)

FRANCESCA ZORATTO[1], FRANCESCO CIABATTONI[1,2], EDOARDO LEDDA[1], ALESSANDRO CARLINI[2], DANIELA SANTUCCI[1], GIUSEPPE NASCETTI[2], CLAUDIO CARERE[2], ENRICO ALLEVA[1]

[1] Istituto Superiore di Sanità - Centro di Riferimento per le Scienze comportamentali e la Salute mentale, Roma
[2] Università della Tuscia - Centro Ittiogenico Sperimentale Marino del Dipartimento di Scienze Ecologiche e Biologiche, Viterbo

enrico.alleva@iss.it

In off-shore farms, most of the intermediate guests of the nematode parasite *Anisakis pegreffii* (small fish, crustaceans) may come into contact with the farmed species, with an actual risk of infestation. In this study we tested whether an infestation of *A. pegreffii* affects activity, foraging, predator and antipredator response in the European bass (*Dicentrarchus labrax*), one of the most common fish used in aquaculture, as predicted by the host manipulation hypothesis. The experiment involved 32 subjects, housed in 8 tanks, each containing 4 fish. The infestation was performed non-invasively with larvae L3 of the parasite in food pellets. In the three weeks following the infestation, we recorded: spontaneous activity; foraging behaviour, to assess the amount of food ingested; predatory behaviour, using a model of anchovy as bait; antipredatory behaviour, using a model of grey heron. Infected animals ingested more pellets than controls during foraging tests, they were faster in approaching the prey model and spent more time interacting with it in the predation test. As for the antipredator test, infected subjects were faster in entering the area where the predator was positioned and spent more time in it, therefore showing a higher propensity to risk; besides, they showed a decrease in sociability and an increase in activity. Finally, infected fish were faster in both approaching and consuming the food that was thrown in close proximity to the predator model. In conclusion, following the infestation a pronounced trait of boldness emerged: infected fish were either less frightened of the predator or more attracted by food or possibly both. Such trait could constitute a behavioural marker of parasite infestation in farmed seabass. Further investigations should try to disentangle the role of positive (food) and stressful (predator) stimuli as well as to understand the physiological causes of such marked behavioural effects.

Keywords*: parasitism, host behaviour, European bass,* Anisakis *sp., aquaculture*

What is in it for me? Welfare assessment of a captive colony of African penguins before and after the transfer to a new enclosure

FRANCESCA BANDOLI[1], ENEA SILVIO RABAZZI[2], VERONICA CARRETTA[3], MARA GESSINI[2], PAOLO CAVICCHIO[1]

[1] Giardino Zoologico di Pistoia
[2] Università di Firenze – Dipartimento di Biologia
[3] Università di Parma - Dipartimento di Scienze Chimiche, della Vita e della Sostenibilità ambientale

francesca.bandoli@zoodipistoia.it

African penguins (*Spheniscus demersus*) are endangered seabird endemic to Southern Africa and Namibia. Due to their negative population trend, captive breeding programs play a vital role in their conservation. Pistoia zoo is currently hosting a colony of 31 birds, 14 of which were born at the park. This study was aimed to monitor the penguins' behaviour over a 3-year period in order to assess the welfare of the colony before and after the transfer to a new enclosure. Data were firstly collected from July to September 2015 to identify potential welfare issues and to plan the new penguin exhibit. Thereafter, birds were monitored in 2017 before and after the relocation to their new enclosure that took place in June. A final data collection was then carried out from July to September 2018. An average of eleven 30-min observation sessions per day were conducted and 662 hours of video-recording were obtained. Video-analysis was implemented with the software BORIS and data were analysed with non-parametric statistical tests. No abnormal behaviour was detected, nevertheless, in 2015 penguins showed lower percentage of resting and pool use compared to previous studies. Visitor number did not influence their behaviour, whereas background noise level negatively affected nesting and couple behavioural patterns. In 2017, after the transfer, penguins spent significantly more time swimming and, as expected, they dedicated a higher amount of time to vigilance behaviour. In 2018 the birds' time budget was finally found to be similar to those reported for other captive colonies and penguins also showed a richer behavioural repertoire. Moreover, no correlation was found between background noise level and reproductive behaviours. This study provided caregivers with valuable information to create a more suitable environment and emphasized how essential long-term research projects are to promptly tackle any emerging factor that could negatively affect penguin welfare.

***Keywords**: African penguins, ex-situ conservation, welfare*

From infancy to adulthood: consistency and effectiveness of playful facial mimicry in bonobos

MARTA BERTINI[1], GIULIA ANNICCHIARICO[1], TONY CALMETTE[2], GIADA CORDONI[1], ELISABETTA PALAGI[1,3]

[1] Università di Pisa - Museo di Storia Naturale, Calci
[2] Ecole Normale Supérieure de Lyon - Department of Biology, France
[3] Università di Pisa - Dipartimento di Biologia, Unità di Etologia

marta.bertini.13@gmail.com

Social play is a complex activity characterized by extreme plasticity, versatility and unpredictability. Non-human primates show specific playful facial expressions, such as play face and full play face, to convey information on individual motivation and emotional state. The fast and automatic replication of partners' playful expressions, a phenomenon defined as Rapid Facial Mimicry (RFM), indicates that the observer has correctly interpreted the signal and that she/he has shared the same positive mood of the partner (emotionally-driven mechanism). Although play mostly occurs during infancy, in some species such as the playful bonobo, it can also persist in adulthood. Thus, bonobos represent a good model to investigate the phenomenon of RFM across ages. Here, we report data on a bonobo colony housed in the Wilhelma Zoo (Stuttgart, Germany) composed by 16 individuals (11 adults; 5 infants). RFM was present in both immature and adult subjects and its distribution was strongly affected by the relationship quality shared between the playmates: the stronger the relationship, the higher the RFM frequency. This linkage was particularly evident in adult-adult dyads. Our results suggest not only that RFM is a socially modulated phenomenon, but also that it develops from early infancy and remains an affective communicative tool also later in life. Finally, the LMM analysis revealed that RFM was the main factor positively influencing the duration of the playful interactions. In conclusion, RFM seems to be a consistent phenomenon along with the bonobo ontogenetic pathways that contributes to maintain a high playful motivation independently from the age of the players.

***Keywords**: emotional contagion, play face, full play face, ontogeny of rapid facial mimicry,* Pan paniscus

Are feline semiochemicals "communicative" enrichments for European wildcats?

VALENTINA BERTONI[1,2], NORMANDO SIMONA[3], COZZI ALESSANDRO[4], BARBARA REGAIOLLI[1], CATERINA SPIEZIO[1]

[1]Parco Natura Viva, Bussolengo (VR)
[2]Università di Parma - Dipartimento di Bioscienze
[3]Università di Padova - Dipartimento di Biomedicina Comparata e Alimentazione
[4]IRSEA - Research Institute Semiochemistry and Applied Ethology, Quartier Salignan, France

valentinabertoni4@gmail.com

Recently, semiochemicals have been used as sensory enrichment as well as facilitators in some problematic situations (e.g. abnormal behaviours) in zoos. Domestic cats release Fraction 3 of Facial Pheromone (F_3) by rubbing the muzzle presumably to mark some points around their preferred pathways in the territory. This pheromone seems to appease the cats and could help them to distinguish "known" objects from those "unknown". Using pheromone F_3 has been found to decrease the probability of fear behaviours and urine marking and could also induce exploratory behaviours in cats. The aim of this study was to evaluate the effect of semiochemical F_3 as environmental enrichment on the behaviour of five European wildcats (*Felis silvestris silvestris*), hosted at Parco Natura Viva (VR). We focused on the effects of two administration methods of F_3 on wildcats' behaviour by using spray (on rags) and diffuser blocks. The behaviour of the wildcats was observed during five different periods: baseline, placebo rags, F_3 rags, placebo blocks, F_3 diffuser blocks. Each period consisted of five consecutive days. Durations of behaviours were collected using a continuous focal animal sampling method. Per period and per subject, two 20-minute daily sessions were done for a total of 5000 minutes of observation. Non-parametric tests were used to analyse the data with significance level set at $p < 0.05$. Results showed no differences between the two administration methods. Also, the semiochemical F_3 had no significant effects on the wildcats' behaviour. However, during the placebo rags' period, wildcats showed more locomotory and exploratory behaviours than in the baseline period. These findings seem to suggest that objects within the enclosure might be a good enrichment for wildcats regardless of the F_3 presence. However, more studies are necessary to evaluate the effect of semiochemicals on animal welfare.

***Keywords**: zoo felids, sensory communication, animal welfare, environmental enrichment*

Beyond the species: dog-horse communication during social play

VERONICA MAGLIERI[1], FILIPPO BIGOZZI[1], MARCO GERMAIN RICCOBONO[1], ELISABETTA PALAGI[1,2]

[1] Università di Pisa - Dipartimento di Biologia, Unità di Etologia
[2] Università di Pisa - Museo di Storia Naturale, Calci

elisabetta.palagi@unipi.it

Play can be considered as a window on the cognitive and communicative abilities of a species. Inter-specific play is a fertile field to explore the capacity to perceive and interpret signals emitted by subjects of different species in a correct manner. Up to now, most of the studies focused on dog-human play due to the important implications such studies have in understanding the peculiar relationship we establish with our pets. Yet, systematic data on social play involving dogs and other non-human species are missing. Here, we focused on social play between dogs and horses. By using a set of specific keywords (*dog*, *horse*, *play*, *friend*) we selected 20 videos of dog-horse social play (session lasting >30 secs) from open video-sharing website YouTube. We described the behavioural patterns composing each session by defining analogous and species-specific patterns shown by dogs and horses. Self-handicapping and the Relaxed Open Mouth (ROM, a widespread playful facial expression in mammals) were similarly performed by the two interacting subjects. During their free playful interactions, moreover, both dogs and horses showed a stronger and rapid mimicry response (less than 1 s) after perceiving ROM than after perceiving an attempt to bite (a play pattern resembling ROM in motor performance). The rapid facial mimicry is an automatic, fast response in which individuals mimic others' expressions (less than 1 sec) that seems to have a role in positively mediating social interactions. Taken together, our results suggest that, despite the difference in size, the phylogenetic distance, and differences in behavioural repertoire, the animals were able to reciprocally fine-tune their actions thus reducing the probability of misunderstanding and escalating into aggression. One of the future challenges is to explore the role of ontogenetic pathways that shape the ability of animals to finely communicate with individuals belonging to different species.

Keywords*: interspecific play, play signals, rapid facial mimicry, play complexity, self-handicapping*

Understanding the behavioural integration of social parasites into the host dominance network: a multilevel analytic framework tested in paper wasps

REBECCA BRANCONI[1,2], ALESSANDRO CINI[1], THIBAUD MONNIN[3], RITA CERVO[1]

[1] Università di Firenze - Dipartimento di Biologia
[2] Boston University - Department of Biology, Boston, USA
[3] Sorbonne Université, UPMC - Institut d'Écologie et des Sciences de l'Environnement UMR 7618, Paris, France

branconi@bu.edu

Social integration, i.e. the degree of behavioural interaction between group members, is a crucial feature of animal societies. Understanding how social integration takes place and the effects of a new individual on the dynamics occurring at the group level is crucial to understand how animal social groups form, change and are maintained over time. Inquiline social parasites of social insects, i.e. species that enter a host colony and exploit host brood care to rear their own brood, are an outstanding example of high social integration. While the importance of physical strength and sophisticated sensory deception mechanisms on the social integration of inquiline social parasites has been widely recognized and investigated, the effect of social parasite integration into the complex host social network has been often overlooked and poorly analysed. Here, using a paper wasp social parasite-social host model, *Polistes sulcifer-P. dominula*, we propose a simple analytical framework to assess the degree of behavioural integration by the socially parasitic queen. Our multi-layer framework focuses on individual-, meso- and whole-network scales, thus allowing to comprehensively assess behavioural integration at multiple levels. We tested the hypothesis that social parasitic female successfully replaces the host queen in the host social network, by testing predictions regarding network centrality measures, triads distribution and whole network parameters. We generated experimentally parasitized and control colonies and followed the inter-individual dominance interactions over time. We demonstrate that the parasitic queen properly integrates inside the host social network, with integration occurring at the three network scales: similar individual centrality, triads distribution and overall network properties between parasitized and control colonies. In addition to giving new insights into the strategies of integration adopted by inquiline social parasites, the potential of our conceptual and analytical framework is likely to reach far beyond these groups and, therefore, be used to understand social integration in a wide range of animal societies.

***Keywords**: social parasites, behavioural integration, paper wasps, group membership, social network analysis*

Evaluation of stress-induced genomic damage in shelter and home cats

MARTINA BUGLISI, MANUEL SCARFÒ, ALFREDO SANTOVITO

Università di Torino - Dipartimento di Scienze della Vita e Biologia dei Sistemi

martina.buglisi@edu.unito.it

Chronic psychological stress was found to induce, in laboratory mice and rats, alterations in the expression of hepatic and brain genes. In humans, stress and anxiety conditions were associated to modifications in DNA methylation patterns and in the levels of genomic damage and telomeres erosion. No data are present in literature about the possible correlation between stress and genomic damage in felines. For this reason, we decided to evaluate the level of genomic damage in shelter cats (n = 30), by buccal micronucleus assay. As control group, we sampled family cats (n = 30) matched for age and sex but without any experience of shelters. The hypothesis was that stress conditions, like those potentially present in shelter houses, could affect the levels of genomic damage. Moreover, for the first time in literature, the baseline frequencies of buccal micronuclei (MNi) and nuclear buds (NBUDs) were provided for non-human mammals. MNi represent chromosome fragments or whole chromosomes that fail to segregate properly during mitosis, appearing in interphase as small additional nuclei. NBUDs represent elimination processes from cells of amplified DNA and/or excess chromosomes. For both groups, 30.000 cells were analysed. MNi and NBUDs frequencies (%) in shelter cats were 0.210±0.209 and 0.220±0.183, respectively, whereas in family cats were 0.100±0.383 and 0.110±0.092, respectively. Significant differences were found between shelter and family cats in terms of MNi ($P<0.001$) and NBUDs ($P<0.01$) frequencies, whereas sex and age did not influence the level of genomic damage in both groups. Animal behaviour was also assessed: all animals were subjected to Cat Stress Score (CSS), a short test to assess their stress level. This was done to give even more emphasis to the importance of animal welfare and to highlight some maladaptive behaviours that the animal can show, both in home and in shelters. These behaviours could also lead to fewer prospects for adoption and problems in the relationship between man and cat. As general result, we provided evidences of a possible association between stress conditions and highest levels of genomic damage in shelter cats. Our hope is that these results can be a stimulus to improve the hospitality conditions in shelters, in terms of living space and assistance, in order to reduce the stress conditions suffered by housed animals.

***Keywords**: micronuclei, nuclear buds, genomic damage, stress*

The use of environmental enrichments by single-housed crab-eating macaques (*Macaca fascicularis*)

Luigia Cancemi[1], Isabella Marcucci[1], Annarita Lamagna[1], Augusto Vitale[2]

[1] Istituto Superiore di Sanità - Centro per il Benessere animale, Roma
[2] Istituto Superiore di Sanità - Centro di Riferimento per le Scienze comportamentali e Salute mentale, Roma

luigia.cancemi@iss.it

In this poster we present preliminary results on the use of environmental enrichments by single-housed crab-eating macaques (*Macaca fascicularis*). The nine subjects were adult males. We provided three non-food (NFE) (a ball, a mirror and an attached kong toy) and three food enrichments (FE) (a ball with holes, a cardboard box, a moveable puzzle-feeder) in separate sessions, and each subject was observed daily during 15min long sessions. The enrichments were left with the animals during the length of the experiment. In the case of the NFE, we observed inter-individual differences in the interest and manipulation of the three objects. However, some general tendencies were observed. Overall, the ball was preferred over the kong toy, and when the toy was detached from its support, it became interesting too. The mirror was mainly used by one particular subject, who used it to observe what was going on in the room. In the case of the FE, all of the three FE were initially briefly explored, but the ball was preferred over the other two objects. The puzzle-feeder was eventually solved by the subjects, but not immediately. Therefore, movable objects appear to be the preferred ones, but a constant turnover of objects must be applied, in order to avoid habituation and boredom. The use of mirrors seems to be beneficial, but it is advisable to avoid glass and to use metal mirrors instead. In particular for the FE, the easiness of obtain food determined the preferred choice, together with the possibility of taking the enrichment around the cage. However, despite general tendencies, the use of particular enrichments must be tailored to the preference of the single individuals.

Keywords: *Animal welfare, Crab-eating macaques, Environmental enrichments,* Macaca fascicularis*, Non-human primates*

A new paradigm for studying quantity discrimination ability in invertebrates

ELIA GATTO[1], DANIELE CARLESSO[1,2]

[1] Università di Padova - Dipartimento di Psicologia Generale
[2] Università di Firenze - Dipartimento di Biologia

daniele.carlesso.92@gmail.com

Animals often face situation where quantities discrimination ability is essential to make adaptive decision, such as foraging, social interaction, predator avoidance. Recently studies have reported that ants, bees, spiders, and cuttlefish can discriminate among quantities, suggesting that this ability is not a prerogative of vertebrates. Although such evidences of a proto-counting, studies in invertebrates have focused on few contexts and more control experiments are necessary to confirm this ability. Here we propose a new method to investigate quantity discrimination in invertebrates that allows to control for both discrete (e.g., number of objects) and continuous quantities (e.g., size of the objects). We investigated whether the cricket *Acheta domesticus* discriminate among quantities by exploiting its natural shelter-seeking behaviour in a dangerous context. To study discrete quantities discrimination ability, we presented subjects with a dichotomous choice between sets of same-sized geometrical shapes differing in number of items. The majority of crickets show a choice for the larger sets up to 2 *vs* 3 items. In a second experiment aimed at studying the effect of continuous variable (e.g., convex hull and cumulative surface area), we presented the 2 *vs* 3 discrimination by controlling for such attribute. Here, crickets did not show a preference for one set, suggesting the use of both discrete and continuous information when making quantity discrimination decision. In a further experiment, we showed that crickets attended to the width but not to the height of the stimuli to discriminate between shape sizes. This approach may be a useful system for a numerical cognition's comparison by adopting the same paradigm for different species.

Keywords*: numerical cognition, invertebrates,* Acheta domesticus*, spontaneous preference*

One-male unit composition and time budget of a gelada population in an unprotected area (Ethiopia, Kundi plateau, N9° 40.402', E39° 45.060')

MARTA CASELLI[1], ANNA ZANOLI[1], ALESSANDRO GALLO[1], CARLO DAGRADI[1], ELISABETTA PALAGI[2,3], IVAN NORSCIA[1,3]

[1] Università di Torino - Dipartimento di Scienze della Vita e Biologia dei Sistemi
[2] Università di Pisa - Dipartimento di Biologia, Unità di Etologia
[3] Università di Pisa - Museo di Storia Naturale, Calci

marta.caselli@unito.it

Theropithecus gelada, a species endemic to Ethiopia, lives in multi-level societies whose basic elements are one-male units (OMU). An OMU includes one adult male, several females and offspring. Composition of OMUs and time budget are only available for the population living in the Simien Mountains National Park and Menz Guassa area. Nothing is known with respect to composition, numerosity and time budget of geladas living in the unprotected areas. To fill the gap, we collected data (January-May, 2019) on a population of geladas living in the Kundi highland (Amhara region). We counted two all-male groups and 18 OMUs for a total of 268 subjects. Each OMU was composed by a mean of 1.22 adult males, 4.39 adult females, 3.28 subadults, 1.89 juveniles and 2.83 infants. To calculate the time-budget as a function of the season (dry *vs* early-rainy season), we employed the scan sampling (10-min interval). During each scan, we recorded the number of adults and immatures and their activity (foraging, moving, social behaviour, play). Randomization tests revealed that, in adults, the time spent in foraging and social behaviour did not differ between the two seasons; on the other hand, the time spent in moving was significantly less during the rainy season. The analysis on immatures gave similar results. The time spent in foraging, social interactions and play was comparable between the two seasons; while moving seemed to be higher during the dry compared to rainy season. In conclusion, it seems that seasonality has little influence on the time budget of the study groups, especially on the investment in social and playful activity, which has an important role in the cohesion of the gelada society. The low seasonality could be due to the data collection period, because it does not include the full-rainy season, when the climatic differences become stronger.

***Keywords**:* Theropithecus gelada, *playful activity, social activity, seasonality, adults, immatures*

Larval nutritional status and adult-larva vibrational communication: playback experiments in the paper wasp *Polistes dominula*

IRENE PEPICIELLO[1]*, ALESSANDRO CINI[1], RACHELE NIERI[2§], BIANCA MARTINELLI CONSUMI[1], VALERIO MAZZONI[2], RITA CERVO[1]

[1] Università di Firenze - Dipartimento di Biologia
[2] Fondazione Edmund Mach, San Michele all'Adige
* Affiliazione attuale: Entomon s.a.s.; Firenze
§ Affiliazione attuale: Oregon State University - North Willamette Research and Extension Center, USA

cini.ales@gmail.com

Communication through substrate-borne vibrations is widespread among social insects and regulates fundamental aspects of social life. In the paper wasp *Polistes dominula*, adult females produce vibrations by performing an abdominal oscillatory behaviour, known as abdominal wagging (AbW). Since AbW is strongly linked to the presence of larvae in the nest and is performed predominantly during the distribution of food to larvae, it has been hypothesized that the AbW may be involved in adult-offspring communication in the nutritional context. That is, the wasps that return to the nest after foraging could use the AbW to warn the larvae that food is being distributed and the latter will respond to the AbW by increasing the body's movements to signal their state of hunger. In this way the adult females could quickly recognize the larvae to be fed, saving energy and resources. The hypothesis that AbW plays a role in adult-larva communication in the nutritional context recently received support from playback experiments, which demonstrated that the vibrations produced by AbW are perceived by larvae, which react by increasing body movements and, through this, increasing the likelihood of receiving food from adult. Under this hypothesis, we can also predict that that larval response to AbW will depend on the larval nutritional status. Specifically, we predict that larvae with higher hunger levels will respond more to AbW compared to satiated larvae. To test this, we experimentally modified the nutritional status of larvae belonging to 41 solitary pre-emergence colonies and evaluated their behavioural response to the AbW signal. The larvae were divided into two different groups: (i) larvae fed by the experimenter until they were satiated (n = 83) and (ii) larvae not fed by the experimenter (n = 85). The larvae of the two groups were subjected to three different playbacks lasting two minutes: (i) vibrations equal to those generated by an AbW, (ii) a non-specific vibration and (iii) a silent track. We video recorded the behaviour of the larvae and measured the duration of their body movements during the playback. The results show a different response of the larvae to the AbW based on their nutritional status: when subjected to AbW the non-fed larvae moved more than the nourished larvae, a difference that did not emerge when larvae were subjected to non-specific vibration and to the silent track. This study demonstrates that the response to AbW depends on the larval hunger level, thus strongly supporting that AbW represents a signal involved in adult-offspring communication in the nutritional context and that the larvae respond to the AbW signaling their hunger status.

***Keywords**: social wasps, hungry signals, larval behaviour, substrate-borne vibrations, abdominal wagging*

Environmental variability and chronic stress: hair cortisol concentration in red squirrel *Sciurus vulgaris*

GIULIA CORDESCHI[1], TANJA PERIC[2], GIULIO CURONE[3], FEDERICA PIRRONE[3], FRANCESCA ZORATTO[1], EMILIANO MORI[4], ENRICO ALLEVA[1]

[1] Istituto Superiore di Sanità - Centro di Riferimento per le Scienze comportamentali e la Salute mentale, Roma
[2] Università di Udine - Dipartimento di Scienze agroalimentari, ambientali e animali
[3] Università di Milano - Dipartimento di Medicina veterinaria
[4] Università di Siena - Dipartimento di Scienze della Vita

cordeschi.1332058@studenti.uniroma1.it

The analysis of physiological parameters in wildlife is decisive for their conservation and management, not only to establish cause and effect, obtaining a set of raw data, but also to monitor the effectiveness of management strategies. We studied Hair Cortisol Concentration (HCC) in red squirrels (*Sciurus vulgaris*) in four study areas: Villa Ada (Rome), Ansedonia (Grosseto), Poggi di Prata (Grosseto) and Giardino Sigurtà (Verona). Sampling was performed with hair tubes installed from December 2017 to May 2018. The areas differ for vegetation type, degree of urbanization and anthropic disturbance, density of red squirrel populations and presence or absence of alien squirrel species. From HCC measurements emerged that higher values relate to high density population, subjected to a higher predation pressure within areas characterized by deciduous vegetation. Conversely, lower HCC levels have been observed in areas with less density, in urbanized environments that have been conquered by the species for a long time, with mixed vegetation and presence of conifers. Measuring HCC provides good information on long-term activity of hypothalamic-pituitary-adrenal (HPA) axis and allostatic load; besides, it constitutes a reliable and non-invasive method of investigation. The use of hair tubes for sampling further supports our non-invasive approach. Thanks to its simplicity and low cost, this methodology might be applied to the study of larger areas aiming to the promotion of citizen-science.

***Keywords**: Eurasian red squirrel,* Sciurus vulgaris*, stress, hair, cortisol*

Niche overlap between the golden jackal (*Canis aureus*) and the red fox (*Vulpes vulpes*) in a sympatry area in north- eastern Italy (Gorizian karst)

ELENA COSTA[1], ELISA TORRETTA[2], LUCA RIBOLDI[2], ALBERTO MERIGGI[2]

[1] Università di Parma - Dipartimento di Scienze Chimiche, della Vita e della Sostenibilità Ambientale
[2] Università di Pavia - Dipartimento di Scienze della Terra e dell'Ambiente

elena.costa3@studenti.unipr.it

Limiting similarity theory predicts that competing species segregate along one or more dimensions of their ecological niche to coexist. In Europe, the range of the golden jackal (*Canis aureus*) expanded since the mid-twentieth century, but little is known about how it interacts with other carnivores. Therefore, we investigate whether niche segregation occurs between golden jackals and red foxes (*Vulpes vulpes*) in North-Eastern Italy, where these two species are sympatric. We considered three main niche dimensions – habitat, diet, time – and evaluated the extent of their overlap. From March 2017 to November 2018 we recorded the occurrence of target species using non-invasive monitoring techniques, i.e. detection of signs of presence and camera trapping. Moreover, we analysed their diet through scat analysis. We collected 370 observations related to golden jackal presence and 317 observations related to red fox presence. The golden jackal mainly consumed wild ungulates, whether the red fox predominantly consumed rodents and fruit. We found only a partial trophic overlap. Our results confirmed a predominant crepuscular and nocturnal activity of both species and a very high temporal overlap. Our results of habitat assessment showed some degree of habitat partitioning: the golden jackal preferred habitats with relatively high natural vegetation cover and avoided intensively cultivated lands, while the red fox was well adapted to human-altered habitats as agricultural areas. The selection of anthropized habitats by the red fox seems to be linked to the research of resources and not caused by an avoidance behaviour aimed at reducing the competition with the golden jackal. In conclusion, only a partial niche overlap between the two species was confirmed; the red fox and the golden jackal mainly segregated along the trophic dimension, consequently their use of habitat slightly differed. The observed segregation most likely reduced the interspecific interactions between the two carnivores at the ecological dimensions we analysed.

***Keywords**: wild canids, niche dimensions, segregation, competition, Friuli Venezia Giulia*

Home economics in an oak gall. Behavioural and chemical immune strategies against a fungal pathogen in *Temnothorax* ant nests

ADELE BORDONI[1], ZUZANA MATEJKOVA[2], LORENZO CHIMENTI[1], LORENZO MASSAI[1], BRUNELLA PERITO[1], STEFANO TURILLAZZI[1], LEONARDO DAPPORTO[1]

[1] Università di Firenze - Dipartimento di Biologia
[2] Univerzita Karlova - Biologicka sekce, Praha, Czech Republic

leondap@gmail.com

Nest architecture participates to shape immune strategies of social insects. The arboreal ant *Temnothorax unifasciatus*, nests in cavities such as oak galls where the entire colony lives in a unique small chamber. Here, compartmentalization should play a marginal role for colonial immunity and physiological and behavioural strategies likely prevail and are presumably tuned with colony size. We designed two different experiments to study chemical and behavioural immune strategies against the entomopathogenic fungus *Metarhizium anisopliae* in colonies of different sizes. First, we compared spore germination and length of germinal tubes inside artificial nests hosting colonies of different size and inside empty nests. In the absence of direct contact between the ants and the fungus, *T. unifasciatus* colonies inhibit fungal growth inside their nests, presumably through volatile compounds. Colony size had a positive correlation with this fungistatic activity indicating a similar *per capita* effort in producing such substance by workers of small and large colonies. Second, we performed a removal experiment of contaminated and un-contaminated items introduced inside the nests of colonies of different size. Small colonies challenged with contaminated fibers showed an increased removal of all the items (both contaminated and non-contaminated) compared to small colonies challenged with control fibers only. Conversely, larger colonies moved items regardless of the presence of the spores inside the nest. Colony size qualitatively affects removal of waste items showing a pathogen elicited reaction in small colonies to optimize the reduced workforce, while the removal behaviour in larger colonies reveals to be expressed constitutively.

***Keywords**:* Temnothorax unifasciatus, *waste removal,* Metarhizium anisopliae, *alternative strategies, colony size, antimycotic*

Ethological approach in post-adoption follow-up of shelter cats

COSTANZA DE PALMA, MARZIA G. LEA PACELLA

Colonia felina di Piramide Cestia e del Cimitero acattolico di Roma

codepalm@tiscali.it

Once a cat is adopted, in several cases volunteers work with an ethologist in order to avoid returns and guarantee the cats' well-being. Difficult cases relate either to owners' attitudes or cats' personalities. A major problem has been an improper use of litter boxes, particularly as regards urinary marking. Owners' mistakes usually relate to inadequate knowledge of the right type of litter, positioning and cleaning of litter boxes, as well as diet. Another common problem is the introduction of a new cat in a home with one or more other cats. Often owners do not follow a gradual approach, leading to territorial aggressive reactions. Following a home visit to ascertain the home context, individual behaviour of every cat in the household and how owners relate to their pets, we made recommendations for an improved co-habitation, in addition to giving explanations on the behavioural patterns of the *Felis silvestris catus* species. Once the cases were resolved, cats were successfully integrated into their households, thus avoiding their return to the shelters and increasing the success rate. A follow-up analysis to determine whether and to what extent the owner has implemented the advice and whether the problem was solved will be presented.

***Keywords**: cat, adoption, feline well-being, feline behaviour*

Vibrational communication of the greenhouse whitefly *Trialeurodes vaporariorum* (Westwood) (Homoptera: Aleyrodidae)

VALERIA FATTORUSO[1,2], PETRA PAVLOVČIČ[2], GIANFRANCO ANFORA[1,2], VALERIO MAZZONI[2]

[1] Università di Trento - Centro Agricoltura Alimenti Ambiente
[2] Fondazione Edmund Mach - Dipartimento Agroecosistemi sostenibili e Biorisorse, San Michele all'Adige

valeria.fattoruso@guests.fmach.it

Biotremology is a new discipline that studies the vibrational communication of animals. In particular, vibrational communication is known to play an important role in the mating behaviour of many insect species. The applied biotremology investigates the control of insect pests of crops using vibrational signals (VS) to manipulate their behaviour (i.e., attraction, mating disruption, repellence). The greenhouse whitefly (GW), *Trialeurodes vaporariorum* (Westwood) (Homoptera: Aleyrodidae) is considered one of the most harmful insect pests in greenhouses. Even if the GW mating behaviour has been already investigated, its vibrational communication is mostly unknown. A deeper knowledge of its intraspecific communication is necessary to evaluate the applicability of control methods. In this study, we used the laser Doppler vibrometer to record the VS, coupled with video recordings to link the signals production to the insect behaviour. VS were characterized in terms of spectral and temporal parameters and an ethogram was designed. We identified two types of male vibrational signals ("chirp" and "pulses"), differently arranged according to the stage of the mating process, and one female responding signal that has been recorded and described for the first time. The GW showed to have a complex mating behaviour, consisting of four different stages: "call", "alternated duet", "courtship" and "overlapped duet". The analysis performed with the Markovian behavioural transition matrix showed that the "overlapped duet" stage seems to cover a crucial role to achieve a successful mating, in that it seems associated to the female acceptance. This study demonstrates that vibrational communication plays an important role in GW mating process, therefore VS playbacks can be exploited to manipulate its behaviour. In future, the acquired knowledge will be essential to determine the optimal control strategy, trough developing a vibrational device to be applied in greenhouses.

***Keywords**: vibration, behaviour, insect, pest, mating*

Influence of intrinsic and extrinsic factors on behavior and survival of Alpine marmots (*Marmota marmota*)

CATERINA FERRARI[1,2], SANDRO BERTOLINO[1], ANTONIO ROLANDO[1], BRUNO BASSANO[2], ACHAZ VON HARDENBERG[3]

[1] Università di Torino - Dipartimento di Scienze della Vita e Biologia dei Sistemi
[2] Centro Studi Fauna Alpina Parco Nazionale Gran Paradiso
[3] University of Chester - Department of Biological Sciences, UK

caterinaww@gmail.com

Alpine marmot is a key species of high-altitude ecosystems. Being a social hibernating herbivorous mammal, it spends most of the active season (from late April to mid-October) foraging in the territory of the family. Marmots also have to be vigilant on the surroundings to avoid dangerous predator attacks (mainly from foxes and eagles) and they are often involved in social interactions with conspecifics. In the context of an ongoing long-term study project within the Gran Paradiso National Park (North-Western Italian Alps), we investigated the different influence of extrinsic (meteorological conditions, period of the season, time of the day, temperature, site) and intrinsic (sex, age, dominance) factors on marmot time budget allocation. We used Bayesian hierarchical multinomial regression models to disentangle the relative importance of both types of factors. Results indicate that intrinsic factors play a role mostly on social behaviours, while climatic and environmental factors affect all behaviours of marmots. After establishing an effect of environmental conditions on marmot behaviour, we explored if this reflected in differences in survival trajectories in two different sites of the project, characterized by differences in elevation, percentage cover of open meadow, and distance from the forest. To this aim we used a Bayesian Capture Mark Resight model which allowed us to include in the analysis also individuals for which year of birth was unknown (i.e. censored and truncated data). Our model provides support to the hypothesis that sites with contrasting environmental characteristics have different survival rates in Alpine marmots: in the site located at lower elevation (ca. 2100 meters) individuals showed an higher survival between to 6 years old than in the site located at higher elevation (ca. 2300 m). These preliminary results raise interesting questions about optimal habitat for Alpine marmots, considering both the characteristics of the habitat as well as the demographic structure of populations.

Keywords*: time budget allocation, extrinsic intrinsic factors, survival rate, Alpine marmots*

Post-conflict conciliatory tendency and third-party interaction in Amiata donkeys

VIVIANA FORTI[1], PAOLO BARAGLI[1], ELISABETTA PALAGI[2,3]

[1] Università di Pisa - Dipartimento di Scienze Veterinarie
[2] Università di Pisa - Museo di Storia Naturale, Calci
[3] Università di Pisa - Dipartimento di Biologia, Unità di Etologia

forti.viviana@gmail.com

Animal social systems imply competition and conflict of interest. To cope with dispersal forces, group-living animals use several conflict resolution tactics, which have been deeply investigated in primates, carnivores and few species of birds. Here, we focus on aggression and post-conflict behaviour in a domesticated species, the donkey. In particular, this study aimed at evaluating the presence of reconciliation and third-party interactions. Nine females of Amiata donkeys (aging 5.1 ±2.1SD years, hosted at the Department of Veterinary Sciences, University of Pisa) were the subjects of the study. The animals lived together in a paddock (40x60m) with *ad libitum* access to food and water. We collected about 200 hours of video recordings (July-November 2013) and a subset of 50 hrs were analysed via the Post Conflict/Match Control method. Both victims and aggressors were followed for three minutes after an agonistic interaction. In the post-conflict time-window we observed the affiliative behaviours (genital sniffing, nasal sniffing, muzzle-body contact, follow, walk together, contact) occurring between the former aggressor and the victim (reconciliation) and between the victim and a bystander (triadic contacts). The analyses revealed that undecided conflicts were more frequent than decided conflicts, thus suggesting a low level of directionality of aggression in this species which probably experience mild dominance relationships. Animals tended to reconcile by engaging in affiliative behaviours in the first minute of the PC period. Although we did not find the presence of unsolicited triadic affiliation (a post-conflict contact spontaneously offered by a third subject to the victim), we demonstrated the presence of triadic affiliation solicited by the victim, which requests comforting contact to group members. The next steps will be to evaluate if reconciliation and triadic solicited affiliation have a calming effect on the victim and if these two phenomena are driven by the relationship quality of the interacting subjects.

***Keywords**: relaxed dominance, Post-Conflict/Matched-Control method, reconciliation, solicited, triadic contacts, donkeys*

Interspecific interactions among mesocarnivores in the Northern Apennines

Sara Friggi[1], Elisa Torretta[1], Carolina Agrati[1], Andrea Modesti[2], Paolo Ballardini[2], Alberto Meriggi[1]

[1] Università di Pavia - Dipartimento di Scienze della Terra e dell'Ambiente
[2] Regione Lombardia – ERSAF

sara.friggio1@universitadipavia.it

The theory of niche overlap states that the coexistence among similar species is allowed by a certain degree of segregation. This research aimed at study the niche overlap among three sympatric carnivores, namely the red fox (*Vulpes vulpes*), the European badger (*Meles meles*), and the stone marten (*Martes foina*), along three niche dimensions: diet, time, and habitat. The study was carried out in an Apennine area in the province of Pavia (37.2 km^2) with altitudes ranging from 500 to 1250 m a.s.l.; the study area includes a small Natural Reserve (Monte Alpe; 318.3 ha). We used scat analysis to define the diet of the target species, while we investigated their temporal overlap using the data provided by camera-trapping monitoring. All collected data were used to assess habitat overlap. We collected 878 of the red fox, 442 of the European badger, and 140 of the stone marten. The red fox and the stone marten mainly consumed small mammals, while the European badger mainly consumed invertebrates. Their diet breadth was similar and trophic overlap between the red fox and stone marten was high. The three mesocarnivores showed crepuscular and nocturnal patterns of activity and high temporal overlap. Concerning habitat preference, the three species avoided human-altered habitats and preferred natural ones, showing a high degree of overlap. Considering the obtained results, we observed a relevant overlap along the considered ecological dimensions: the three species are sympatric and coexist, but negative interactions, like interspecific killing, seem to be rare. Thanks to the peculiar predation strategy of each mesocarnivore and the abundance of suitable food resources and habitats, these three species can share the ecological niche: the burrowing habits of the badger allow an active search for invertebrates, the agility of both the red fox and the stone marten allows the capture of mammals and the climbing ability of the stone marten promotes the access to birds.

Keywords*: red fox, European badger, stone marten, niche dimensions, competition*

Integration of multisensory information in the ant *Lasius niger*

GABRIELLA GALLI[1], MASSIMO DE AGRÒ[1], FELIX OBERHAUSER[2], MARIA LOCONSOLE[1], FEDERICA DAL CIN[1], LUCIA REGOLIN[1], ENZO MORETTO[3]

[1] Università di Padova - Dipartimento di Psicologia generale
[2] University of Regensburg - Department of Zoology, Germany
[3] Museo vivente degli insetti di Esapolis, Padova

gabriella.galli92@gmail.com

The ability to remember our past experiences enables us to deal with situations similar to those we have already encountered. Episodic memory (EM) in humans is an autobiographical memory of individual past events and the multiple information components they contain. Crucial features of EM have been found in different animal species, however not a lot is yet known about arthropods. Among arthropods, ants represent a promising candidate as they are able to remember multi-sensory information. This ability constitutes a potential basis for the ability to recall past episodes (however, it is not yet known if they can integrate these information). We assessed such ability in a Y-maze. In the first experiment, each arm presented a different scent (rosemary or lemon) one of which was associated with a drop of sugar water as a reward. Each arm was surrounded by coloured walls, either blue or yellow. The position (left-right) of the correct scent was associated with the colour of the wall (e.g. right with the blue wall). Ants performed 12 training visits, and then a single test. At test both arms presented the rewarded scent, therefore ants needed to remember the colour-side combination, to reach the correct target. We found that 87% of the ants successfully solved the Y-maze. Ants demonstrate to be able to integrate different information, for this reason, they represent a promising model for the study of episodic-like memory.

***Keywords**: multisensory information, ants, y-maze, memory*

Behavioural plasticity under predation risk in relation to environmental change in an endemic Italian frog

DANIELE PELLITTERI-ROSA, ALESSANDRO BOLIS, ANDREA GAZZOLA

Università di Pavia - Dipartimento di Scienze della Terra e dell'Ambiente

andreagazzolalor@gmail.com

Human activity has altered almost all environments on Earth. Two of the main human-induced environmental changes are represented by the spread of exotic species and habitat loss or fragmentation. In this contest, animals facing a rapid environmental change can rely on different responses: 1) evolutionary change during generations; 2) dispersal; 3) plastic behavioural responses. Among traits that act to determine success when environmental conditions change rapidly, behavioural plasticity play an important role. In fact, most of the phenotypic modifications rather by genetic evolution are determined by plasticity. Predation is a strong inducer of behavioural changes and comes to be even more crucial in the general context on human-induced environmental change. In this study we explored anuran behavioural plasticity by exposing the Italian agile frog (*Rana latastei*) tadpoles to scent of native (*Anax imperator*) and exotic (*Procambarus clarkii*) predators. In order to explore behavioural variation in relation to environmental change, we collected eggs masses from three different sites, which manifested different levels of anthropogenic disturbance. Odour exposure showed how level of activity decreased differently in relation to the type of cue and population. The strongest defensive response was recorded when tadpoles received tadpoles-fed dragonfly cue, where activity markedly declined in all populations. In contrast, alien predator cue induced different responses among populations and, interestingly, tadpoles coming from the population with the highest level of disturbance showed the strongest activity decrease, when exposed to cues coming from the exotic crayfish.

***Keywords**: behavioural plasticity; biological invasions; cue recognition; dragonflies; red swamp crayfish; anti-predator defences*

Behavioural adaptations to urban environment by ants of *Tetramorium caespitum* complex

MARTINA GHIZZONI, FIORENZA A. SPOTTI, CRISTINA CASTRACANI, DONATO A. GRASSO, ALESSANDRA MORI

Università di Parma - Dipartimento di Scienze Chimiche della Vita e della Sostenibilità Ambientale

martina.ghizzoni@unipr.it

Tetramorium caespitum (Linnaeus, 1758) is one of the most abundant ant species in Europe and it is widespread in several environments, including urban ones. Recently, an accurate systematic revision defined *T. caespitum* as a complex of ten cryptic species, with *T. caespitum* (sensu stricto) and *T. immigrans* principally associated with urban areas. In the past, studies on the ethology and ecology of these species were conducted in natural environments and, currently, few information on adaptations to urban habitats derived only from researches conducted in North America. Consequently, new investigations are needed to clarify the behavioural adaptations of *T. caespitum* s.l. in urban environments and the role of behaviour in shaping ant community structure mainly dominated by this species. The present study aims to understand which strategies *T. caespitum* adopts in order to be so efficient mainly in the competition for food resources in urban environments. In particular the focus of the study is an analysis of the ability to discover and monopolise resources among species of the *T. caespitum* complex and other sympatric ant species. Sampling was carried out in 12 green areas in the city of Parma (Italy), divided into two functional categories: green squares *vs* equipped green areas. These categories differ for the proportion and the distribution of the green surface and foliage coverage, as green squares are cemented areas with some delimited flowerbed with vegetation inside, whereas the latter are covered by grassland for all their extension. The abundance and the distribution of the species were assessed using pitfall traps, whereas baits were used to understand the adaptations connected to interspecific competition. Afterwards, the levels of interspecific competition were analysed calculating behavioural indexes such as Monopolisation Index (MI) and Discovery Ability Index (DAI) that allow the comprehension of the behavioural dominance hierarchy in the urban ant communities. Results allowed to define some trends in the target communities and, being ants regarded as environmental quality indicators, could provide useful information for future applications in the assessment of green areas quality for a sustainable development of the city.

Keywords: Tetramorium caespitum *complex, urban green areas, ant communities, behavioural dominance*

Field survey on ant-gall colonization in Italy: first data on nest architecture and the role of ants as plant defenders

DANIELE GIANNETTI, CRISTINA CASTRACANI, FIORENZA A. SPOTTI, ALESSANDRA MORI, DONATO A. GRASSO

Università di Parma - Dipartimento di Scienze Chimiche della Vita e della Sostenibilità Ambientale

danfornoli@gmail.com

Galls are growths on plant tissue resulting from a parasitic insect attack. First estimates reported that the number of gall-inducer insects reached 132.000 species. These structures represent highly sophisticated systems, characterized by a huge variety of shapes, dimensions and positions on plants. In addition, galls support different communities of secondary fauna such as moths, beetles and ants. Concerning several species of ants, galls represent an ideal environment for the establishment of colonies. Nevertheless, nowadays there are few studies dealing with galls colonized by ants; and none of them investigate behavioural aspects. The present work focuses on galls induced by *Andricus quercustozae* (Hymenoptera: Cynipidae) on oak trees, investigating different behavioural aspects of ant colonization. In particular, field experiments were carried out: a) to study ant species-specific preferences for different features of the galls; b) to describe differences in gall architecture due to ant activity; c) to analyse the effects on plant health due to ant patrolling behaviour. Data show differences among species in gall choice and modification of nest features according to colony organization. Moreover, the analysis on the effects of ants on plant health shows a decrease of leaf damages and number of phytophagous insects when ants were present. In conclusion, ants hosted by galls can represent an indirect plant defense mechanism, although galls are initially a potential cost for the plant.

***Keywords**: ant-plant interactions, mutualism, nest architecture, plant defenders*

Effect of weather conditions on spring migrating Eurasian teals (*Anas crecca*)

GIULIA CERRITELLI[1], LORENZO VANNI[1], NATALE EMILIO BALDACCINI[2], ALFONSO LENZONI[3], MICHELE SORRENTI[4], PAOLO LUSCHI[1], DIMITRI GIUNCHI[1]

[1] Università di Pisa - Dipartimento di Biologia
[2] Università di Firenze - Centro Interuniversitario di Ricerca sulla Selvaggina e sui Miglioramenti Ambientali a fini Faunistici
[3] Associazione Cacciatori Migratori Acquatici, Milano
[4] Federazione Italiana della Caccia - Ufficio Avifauna Migratoria, Roma

dimitri.giunchi@biologia.unipi.it

Weather conditions experienced during migration are expected to influence bird movements and their timing of arrival. We analysed satellite-tracking data from Eurasian teals (*Anas crecca*) fitted with Argos tags in three wintering Italian sites in order to define the migratory strategies of the species. We determined the course, speed and duration of spring migratory movements, together with the number and length of stopovers made along the route. Most of the tracked teals left the wintering grounds in February-March and reached the breeding sites located in North-Eastern Europe in May. Along their migratory route most birds stopped for several weeks at stopover sites, especially at the very beginning of migration, and this led to a slow overall migratory speed. We then focused on investigating the effect of a series of environmental cues on teal's migratory strategies. The analysis mainly aimed at assessing if temperature and winds experienced during teal's sojourn in an area could have had an effect on its decision to leave their wintering grounds and the stopover sites. Given that teal are small ducks and not diving ones, they need shallow water areas to feed which may freeze quite easily when temperatures decrease, so it can be hypothesized that temperatures may be a relevant cue for this species. We tried different models using different time windows, aggregate statistics and response functions, running distinct analysis for wintering and stopover sites. As expected, our data indicate that weather conditions, and especially temperature, affect migration movements, but, as already noted for other Anseriformes, this effect was mostly evident once the migration had started. Under the observed conditions, wind, on the other hand, did not seem to play a major role in teal's decision to leave or not an area.

Keywords*: migratory strategy, telemetry, Eurasian teals, weather conditions, phenology*

Human and non-human primates: visitors' perception in a wildlife sanctuary

CHIARA GRASSO[1], AUGUSTO VITALE[2] ,SIMONE POLLO[3], CHRISTIAN LENZI[1]

[1] Associazione ETICOSCIENZA, Torino
[2] Istituto Superiore di Sanità - Dipartimento di Biologia Cellulare e Neuroscienze, Reparto di Neuroscienze comportamentali, Roma
[3] Sapienza Università di Roma - Dipartimento di Filosofia

chiaragrasso.eticoscienza@gmail.com

The considerable influx of tourists in parks and rescue centers represents a promising opportunity to investigate the relationship between public and primates. The present study was carried out in the free-roaming sanctuary, Monkeyland (South Africa), which hosted 600 rescued primates of 11 different species. An anonymous survey was conducted among visitors, containing general zoo-anthropological questions with the aim to evaluate their perception about wild animals. When analysing the data, macro categories were created for the reasons and motivations behind tourists' choices, and no significant difference emerged between the behavioural categories and the aesthetic categories for the choice of the favourite primate. When inquiring about the desire to physically interact with a monkey (i.e., touching), we found no significant difference between male and female. The desire to interact physically, however decreased with the increase of the visitor age. Moreover, of the 237 visitors who desire such an interaction, only 11.4% think it was an appropriate encounter, while 85.2% think it wasn't. Among those visitors who expressed no desire to touch the monkeys, 61.5% believe it was not correct for animal welfare, while 23.80% thought it can be dangerous for themselves. Finally, visitors were asked to indicate their favourite primate, and why. The preferred species of non-human primate among visitors was *Lemur catta* (15.5%) and the most cited reason for this choice was that this species was "Cute" (23%). The results indicate an awareness of the importance of animal welfare amongst the public, and respect for the primates' wildness.

Keywords*: monkeys, sanctuary, survey, zooanthropology, animal perception*

Social responses of zebrafish induced by different visual stimuli: a cyber-ethological study

CHRISTIAN LENZI[1], CHIARA GRASSO[1], PAOLO PERETTO[2,3], ALEXANDRA SAVUCA[4], ALIN CIOBICA[4], STEFAN-ADRIAN STRUNGARU[5], GABRIEL PLAVAN[4], MIRCEA NICOARA[4]

[1] Associazione ETICOSCIENZA, Torino
[2] Università di Torino - Dipartimento di Scienze della Vita e Biologia dei Sistemi
[3] NICO - Neuroscience Institute Cavalieri Ottolenghi, Orbassano (TO)
[4] "Alexandru Ioan Cuza" University of Iasi - Faculty of Biology, Department of Biology, Romania
[5] "Alexandru Ioan Cuza" University of Iasi - Faculty of Biology, Department of Research, Romania

christianlenzi.eticoscienza@gmail.com

The social behaviour of zebrafish (*Danio rerio,* Cyprinidae) appears complex and little is known about sex-related shoaling preference and mate choice. The aim of this project is studying the potential influence of various stimuli (e.g. habitat colours, conspecifics - of different number and sex -, and 2D images) on shoaling preferences, with a focus on visual communication. In the present study 40 sexually matured GloFish® danios were involved into two non-invasive behavioural experiments using a multipurpose cross-maze, together with a video-tracking software (EthoVision XT) methodology. These experiments were approved by the ethical commission and no animal was harmed or killed during the trials. In the pre-test period of the first experiment two groups, one for males (n=10) and one for females (n=10), were kept in sex-isolated aquariums for 7 days, with a different habitat colour for each one: green (males) and red (females). After that, each group was maintained separated and 8 behavioural tests were conducted, investigating with focal observations the possible influence of environmental colouring on zebrafish social preferences. In the second experiment, various 2D social stimuli (manipulated by graphics software) were used in 9 behavioural tests to study social and sexual interactions (i.e. mate stimulant attraction and shoaling preference) of other two groups, one for males (n=10) and the other one for females (n=10). We did not observe any clear influence of environmental colouring on social zebrafish choices, but there was a significant difference between males and females in response and selection of shoaling partners. For instance, we found that females showed a general preference in shoaling with conspecifics of the other sex, and avoided other phenotypically similar females. Males spent more time close to another male and less with a female, and they were not choosy for social and reproductive partners. This methodology could be used to study social and sexual preference also in other aquatic species, with several applications on husbandry, animal welfare and fish conservation.

Keywords*: zebrafish, environmental coloring, sexual preferences, shoaling, social behavior*

Individual recognition in 4-day-old domestic chicks is not affected by physical contact deprivation

MARIA LOCONSOLE, LUCIA REGOLIN

Università di Padova - Dipartimento di Psicologia Generale

maria.loconsole@phd.unipd.it

Domestic chickens offer an excellent model for comparative studies of early social cognition, as young chicks establish early social bonds with their rearing companions which they do discriminate from unfamiliar individuals. Previous studies demonstrated that such individual recognition is strictly dependent on the possibility to interact during rearing: chicks deprived from physical contact, in fact, failed in discriminating the familiar from an unfamiliar conspecific, approaching either at chance level. Here, we tested whether physical contact affects individual recognition in 4-day-old domestic chicks in a spontaneous choice task. In Exp.1, we reared newly-hatched female chicks in pairs in the same cage for 4 days. Each chick was tested in a free choice between the familiar chick and an unfamiliar chick matched for age and sex. A one-way glass prevented both familiar and unfamiliar chick from seeing the tested chick. Time spent close to each chick was measured as an index of preference for 6 minutes. Consistently with previous literature, chicks significantly spent more time closer to the familiar conspecific. Use of acoustic cues for individual discrimination had been ruled out by a preliminary control experiment. In Exp.2, during rearing a glass partition divided the home cage into two halves, so that chicks could see and interact with one another, but any physical contact was prevented. At test, contrary to our initial expectations, chicks showed able to discriminate their cage-mate and spent longer time by it. These results demonstrate that physical contact is not needed for individual recognition in young chicks, and prompt the investigation of other, more subtle, visual and/or behavioural cues.

***Keywords**: individual recognition, domestic chicks, social cognition*

A year as a bear: welfare monitoring of a pair of zoo-housed brown bears

FRANCESCA BANDOLI[1], DENISE LUMINELLI[1], JESSICA MENTI[2], GIOVANNA MARLIANI[3], DANIELA PESSANI[2], PIER ATTILIO ACCORSI[3], PAOLO CAVICCHIO[1]

[1] Giardino Zoologico di Pistoia
[2] Università di Torino - Dipartimento di Scienze della Vita e Biologia dei Sistemi
[3] Università di Bologna - Dipartimento di Scienze Mediche Veterinarie

francesca.bandoli@zoodipistoia.it

Animal welfare encompasses the physical and psychological health, the emotional state and the behaviour of animals. Since welfare needs vary over time and for individuals within the same group, long-term data collection is recommended to assess the well-being of zoo-housed species. This study aimed to monitor the welfare of a pair of adult European brown bears (*Ursus arctos*) across seasons through the analysis of ethological and physiological parameters. The bears were transferred to Pistoia Zoo (Italy) from Targoviste Zoo (Romania) in 2010 thanks to the cooperation with the International Bear Foundation. Their behaviours were video-recorded over an 8-month period, from December 2016 to November 2017. Ten 1-hour observation sessions per day per individual were conducted and an average of 309 hours of video-recordings per subject were obtained. Video analysis was carried out with the software BORIS and data were analysed with non-parametric and randomization tests. Moreover, 167 fresh faecal samples were collected to measure the concentration of faecal cortisol using the Radio Immuno Assay Technique based on-binding of 3H-steroid by competitive adsorption. The diurnal and nocturnal activity budgets of the bears were found to be similar to those reported in studies on wild conspecifics and in accordance with the species' seasonal rhythmical variation. Bears mainly performed species-specific behaviours and both showed higher percentage of stereotypic pacing in spring. Findings also indicated that the female's pacing could be related to feeding times according to previous studies. Results have been used to modify the bears' daily husbandry routine and enrichment program. For a more comprehensive welfare assessment, they will be integrated with the analysis of faecal cortisol concentration. Finally, a new data collection is currently underway to verify if the applied changes are effective in promoting species-specific behaviours and in reducing stereotypic pacing.

***Keywords**: 24/7 welfare, brown bears, zoo*

Feeding behaviour of the American mink *Neovison vison* introduced to Mikri Prespa (northern Greece)

DARIO MEZZETTO[1], EMILIANO MORI[1], GIUSEPPE MAZZA[2]

[1] Università di Siena - Dipartimento di Scienze della Vita
[2] CREA-DC - Centro di ricerca, difesa e certificazione, Firenze

moriemiliano@tiscali.it

In Greece, free-ranging American minks *Neovison vison* have been recorded since 2010, when two fur farms in the northern part of the country (near the Mikri Prespa lake) were raided, releasing over 50,000 minks in the wild. We analysed the diet of naturalized American mink from the Mikri Prespa lake and surroundings. We collected 88 mink scats along wetland banks and we stored them at -20°C. For the analysis, mink scats were washed and food remains isolated and classified, through comparison with local reference collections and specific hair atlases. We computed absolute and relative frequencies as well as the estimated volume of each food category, following standard methods on carnivore diet assessment. We identified five food categories: Cyprinidae, the Eurasian coot *Fulica atra*, the moorhen *Gallinula chloropus*, the Balkan green frog *Pelophylax kurtmuelleri* and the agile frog *Rana dalmatina*. Waders built up the staple of the diet of this species (46.7% relative frequency, 55.1% relative volume), particularly chicks of the Eurasian coot, followed by Amphibians (29.2% relative frequency, 22.3% relative volume) and Cyprinidae (24.1% relative frequency, 22.6% relative volume), including the locally introduced tench *Tinca tinca*. The diet of feral American mink in Greece reflects its local spatiotemporal behaviour. Accordingly, minks mostly live in the surroundings or within the wetlands and are mostly diurnal. This may explain the total absence of wild mammals (which are mostly nocturnal) and the high presence of waders (Rallidae), which are diurnal birds. Since 2019, the American mink has been included within the list of the alien species of European concern (EU Regulation 1143/2014). The eradication of this alien mustelid species from Greece is still feasible, given the currently limited extent of occurrence of this species in the country, before it would become a potential threat to native riverine mustelids, i.e. the Western polecat *Mustela putorius* and the Eurasian otter *Lutra lutra*.

Keywords: Neovison vison, *alien species impact, diet analysis, waderbirds, spatiotemporal behaviour*

Did Siberian chipmunks colonize areas outside the Sigurtà Garden Park? Dispersal along the Mincio riverbanks and first records on debarking behaviour

ALLEY ANDREONI[1], ANTONY CHIRCO[1], ANDREA GIGLIOTTI[1], RUDY ZOZZOLI[1], GIUSEPPE MAZZA[2], EMILIANO MORI[1]

[1] Università di Siena - Dipartimento di Scienze della Vita
[2] CREA-DC - Centro di ricerca, difesa e certificazione, Firenze

moriemiliano@tiscali.it

Dispersal behaviour is the one-way movement between the place where an individual is born and the place where it sets its home range. Studies on dispersal are particularly important for invasive alien species, which may spread their distribution range where introduced. Alien populations of the Siberian chipmunk *Eutamias sibiricus* in Italy have been reported in north-eastern Italy, along the Piave riverbanks (province of Belluno) and within the Sigurtà Garden urban park in Valeggio sul Mincio (province of Verona). The latter is the currently largest population in Italy, with hundreds of individuals living within the park border. In recent times, some individuals have been observed outside the park border. Juvenile chipmunks have been reported to be involved in the spread of this ground squirrel; thus, they are responsible for any range increase. We also measured whether debarking behaviour by this species have occurred. According to the measurements of dispersal behaviour of this species (160-190 m), even when at low densities, a colonization of the southwestern part of the Sigurtà Garden Park may have been followed by the colonization of part of the Mincio riverbanks outside the park. Accordingly, we collected a total of 25 occurrences outside the Sigurtà Garden Park, in the villages of Valeggio sul Mincio and Borghetto, as well as along the riverbanks of Mincio. Debarking was rare and only observed where population densities are the highest, i.e. within the park borders, mostly on *Quercus* spp. and *Liquidambar styraciflua*. After a lag-phase, the local population of Siberian chipmunk started to increase, colonising areas outside the park at about 70-100 m/year. The local range expansion of Siberian chipmunks may be due to the competition with the larger, native Eurasian red squirrel Sciurus vulgaris, which is colonizing the Sigurtà Garden Park. Therefore, it should be managed now that densities are still low, following the recommendations of the EU Regulation 1143/2014.

***Keywords**:* Eutamias sibiricus, *alien species impact, dispersal behaviour, range expansion, management strategies*

Louder together: intra-specific and inter-specific interactions of macaws

GIORGIO OTTOLINI[1], GIUSEPPE F. LA CAUZA[1], BARBARA REGAIOLLI[1], MARZIA POSSENTI[2], CATERINA SPIEZIO[1]

[1] Parco Natura Viva – Garda Zoological Park, Bussolengo (VR)
[2] Arca ambulatorio veterinario, Cassano D'Adda (MI)

giorgio.ottolini@parconaturaviva.it

Mixed-species exhibits are widespread in modern zoos, allowing different species to be kept together within the same enclosure. Mixed exhibits usually house species sharing the same habitat or geographical range, providing a valuable educational message to zoo visitors. Moreover, they can also be beneficial for animal welfare, as the presence of other species provides a dynamic and unpredictable source of stimulation. However, social housing can also be associated with competition and pressures: understanding how different species interact with each other is fundamental to ensure a good care and management of zoo animals. The subjects of this study were eight macaws belonging to three different species housed in the same aviary at Parco Natura Viva (Italy): two blue-and-yellow macaws (*Ara ararauna*), two scarlet macaws (*Ara macao*) and four red-and-green macaws (*Ara chloropterus*). Ten daily 60-min sessions were done. Frequencies of social behaviours were collected with all-occurrences sampling method and data on space use were collected through instantaneous sampling method. Non-parametric tests were run to evaluate differences between inter and intraspecific affiliative and social behaviours. Data on social behaviour showed a significant difference between inter and intraspecific behaviours. Furthermore, a significant difference was found between inter and intraspecific affiliative behaviours, as well as between affiliative and agonistic inter-specific behaviours. Moreover, blue-and-yellow macaws spent more time in one area of the exhibit and were more selective in space use than scarlet macaws and red-and-green macaws. Data on social behaviour and space use seem to suggest a possible role of chromatic preference in the inter-specific interactions in macaws.

***Keywords**: blue-and-yellow macaw, green-winged macaw, scarlet macaw, social behaviour*

Effects of oxytocin treatment during labour on early mother-infant interactions

GIADA CAMPANA[1,2], DANIELA VIVIANI[2], PIERFRANCESCO FERRARI[3], PAOLA PALANZA[1]

[1] Università di Parma - Dipartimento di Medicina e Chirurgia, Unità di Neuroscienze
[2] Azienda Ospedaliera-Universitaria di Parma - Dipartimento Materno-Infantile e scuola di Ostetricia
[3] CNRS - Institut des Sciences Cognitives Marc Jeannerod, Lyon, France

paola.palanza@unipr.it

Oxytocin (OT) is a key hormone in birth, lactation and maternal care in mammals and is involved in the formation of bonding between mother and infants. During labour OT produced manly by the maternal hypothalamus, stimulates uterine contractions that in turn induce further OT release (positive feedback). In the brain, a "positive loop" of OT is hypothesized to promote higher response and care to children towards a secure attachment. In clinical practice synthetic OT is used to induce and/or augment labour and delivery. Although the blood brain barrier is commonly thought to prevent synth-OT access in the mother's and the infants' brain, the possibility that at childbirth the administered OT can interfere with naturally produced OT cannot be excluded. Here we investigated the impact of synthetic oxytocin (Syntocinon) administered during labour on early mother-infant social interactions. Eighty-four parturient women randomized for age and labour duration, were observed in their first contacts with newborns; among these, 46 women delivered by vaginal delivery associated to synthetic OT infusion and 38 women by natural vaginal delivery. Mother-infant dyads were observed immediately in the 10 min after vaginal delivery (Partum) and up to 2 hrs afterwards (Post-partum) by ethological observation (Scan sampling) of mother 's and infant's behaviour. Results showed that OT administration during labour may induce subtle alterations in infants' and mothers' behaviour. Maternally OT-exposed infants were more prone to persistent, inconsolable cry immediately after parturition and showed lower suckling in the following two hours. OT-treated mothers were generally more passive towards their infants either immediately after delivery or in the following hours. Synthetic OT administration, which is a common clinical practice with recognized benefit to induce and/or augment labour and delivery, might potentially interfere with endogenous oxytocin production and affect breastfeeding and mother-infant synchrony in the early period after parturition.

Keywords: *maternal behavior, attachment, oxytocin, mother-infant dyad*

Lateralization in the Hermann's tortoise (*Testudo hermanni*) in different behavioural contexts

DANIELE PELLITTERI-ROSA[1], ANDREA GAZZOLA[1], LUCA BOSCOLO BURETTI[1], GIORGIO VALLORTIGARA[2]

[1] Università di Pavia - Dipartimento di Scienze della Terra e dell'Ambiente
[2] Università di Trento - CIMeC - Centro Interdipartimentale Mente/Cervello

daniele.pellitterirosa@unipv.it

Lateralization is considered a crucial characteristic of the nervous systems of vertebrates, with the right and left sides of the brain providing different and integrative functions. Lateralization presents clear advantages in ecological contexts, e.g., the dominance of one brain side prevents the simultaneous activation of contrasting responses in organisms with laterally located eyes. There are many different ecological contexts where lateralization can be observed, such as foraging or anti-predatory situations, parent-offspring recognition, courtship displays, exploratory behaviour and spatial cognition. Although these aspects have been investigated in some vertebrate groups, for instance in birds and both terrestrial and marine mammals, little is known about lateralization in reptiles. We examined the possible presence of lateralization in 20 Hermann's tortoises (*Testudo hermanni*) kept in semi-natural conditions, considering behavioural responses to two different experimental tests. First, we considered the preferred direction during basal activity (rotational lateralization) within an outdoor experimental arena (2.5 m^2), and second the preferential side from which they turned when subjected to righting tests, by simulating a predatory attack. We found a preference for tortoise to choose the right-side in the righting test (65%) and an anticlockwise direction in the activity test (60%). For both behavioural responses, we did not observe any significant difference between sexes.

Keywords: *activity, Hermann's tortoise, lateralization, predation, reptiles*

Effects of early maternal environment and limbic NPY-1R expression in reproductive behaviour

GRETA RAMUNDO[1], GIADA CAVIOLA[1], SILVIA PATERLINI[1], LAURA GIOIOSA[1], STEFANO PARMIGIANI[2], PAOLA PALANZA[1]

[1] Università di Parma - Dipartimento di Medicina e Chirurgia, Unità di Neuroscienze
[2] Università di Parma - Dipartimento di Scienze Chimiche, della Vita e della Sostenibilità Ambientale

greta.ramundo@studenti.unipr.it

In rodents, maternal behaviour is variable, is sensitive to socio-ecological conditions, and programs offspring development. Thus, mother-offspring interactions provide a direct, flexible link between the dam and the pups that shape adult behaviours and can also affect their subsequent vulnerability to psychiatric and metabolic disorders. We have previously shown that limbic NPY-Y1 receptors are key targets of maternal care-induced programming of anxiety and energy homeostasis in male conditional KO mice, whereas females seem not to be affected by gene inactivation nor by the different maternal cares. Here we examined the same conditional knockout mouse model, in which the inactivation of the NPY-1r gene was restricted to excitatory neurons of the forebrain, starting from juvenile stages (NPY-1r(rfb)) for female reproductive behaviour in relation to their early maternal environment. At birth wild-type and knockout female mice were reared by two different strains of foster mothers (FVB/J and C57BL/6J) differing for the level of maternal behaviours displayed. Their offspring were examined for body weight growth from birth to adulthood and for behavioural responses; as adults, the female offspring were exposed to a reproductive challenge. Results showed reduced reproductive success and maternal motivation only in NPY-1r knockout female fostered by FVB/J mothers. Through a cross fostering experiment, we determined either a direct effect of limbic NPY-1r conditional reduction or an indirect effect on pups' viability. Further studies are needed to understand possible mechanisms underlying these effects, but the present results indicate a complex relationship between early life environment and genetic background on the development of different physiological and behavioural tracts of offspring in a sex dependent manner.

Keywords: *early maternal environment, knockout mice, reproduction, behaviour*

Greater flamingos at Parco Natura Viva: A "pink" story of success and monogamy

BARBARA REGAIOLLI[1], CAMILLO SANDRI[1,2], VALENTINA BERTONI[1], CAROLINA SAMMARINI[1], CATERINA SPIEZIO[1]

[1] Parco Natura Viva – Garda Zoological Park, Bussolengo (VR)
[2] Università di Bologna - Dipartimento di Scienze e Tecnologie Agro-alimentari

barbara.regaiolli@parconaturaviva.it

Due to the high number of greater flamingos (*Phoenicopterus roseus)* in zoos, studying their behaviour and welfare might be useful to improve their husbandry and breeding. In the wild, greater flamingos have been found to be serially monogamous birds and fidelity decreases as the colony size increases. A zoo flock of greater flamingos housed at Parco Natura Viva (PNV) (Italy) was observed from 2012 to 2018 during the breeding season. Before 2018 breeding season, 15 flamingos were transferred from PNV to another zoo. The aim of this study was to evaluate the breeding success and monogamy of the flamingo flock, focusing on the effect of the transfer. Per breeding season, the number of pairs and pair composition were recorded. To estimate reproductive success, the number of eggs laid, and the number of hatchlings were considered. Reproductive success was calculated using the egg-success ratio (N° hatchlings/ N° eggs laid) and the pair-productivity ratio (N° hatchlings/ N° breeding pairs). To investigate monogamy, information on pair composition in each breeding season was collected and compared across years. Results showed that egg success and pair productivity varied over seasons. A decrease of both egg success and pair productivity was observed in 2018. Monogamy resulted more persistent in consecutive breeding seasons. The transfer of some individuals to another zoo before the last breeding season might have therefore caused changes especially in breeding success. This research provides further evidence that studying the biology and ethology of species in controlled environment is fundamental for *ex-situ* conservation programs.

Keywords*: zoo flamingos, breeding success, pair fidelity, animal welfare*

Observing animal behaviour during science lessons at school

GABRIELLA SALERNO

Istituto Tecnico Statale Carlo Cattaneo, San Miniato (PI)

prof.gabriella.salerno@gmail.com

During my career as a high school science teacher I have underlined in previous SIE conferences and in European meetings dedicated to Science teaching how "hand on" studies of animal behaviour can motivate pupils of biology classes and how behavioural ecology can contribute to their understanding of biological adaptation. Here I present some activities carried out in my classes, with pupils aged 14-16. These activities do not claim to be scientific projects, but are rather aimed at enhancing observational skills, being an occasion to elaborate data, investigating cause/effect relationships, and at promoting the understanding of the complexity of the animal world and the adaptation of animal behaviour. One activity regards the observation of Redstart, *Phoenicurus phoenicurus* L., nesting in nestboxes on the school terrace garden. Videos of the parents and nestlings were collected daily. The videos were analysed and the pupils, guided by some key questions (do parents visit the nest more frequently as nestlings grow up? Are there differences between the behaviour of the parents?), have formulated hypothesis and built interpretative models regarding the observed behaviours. Pupils observed the videos and wrote down the time spent by each parent on the outside roost of the nest box and inside the nest box and reported the elaborated data on graphs. The students then discussed that with the growing of the chicks the time spent for parental care seems to increase and the male invests more time than the female. A database of teaching activities to be shared with other teachers is under development, with the hope to involve other teachers in using ethology in practical science activities in secondary schools.

Keywords: *teaching methods, school, students*

Behavioural observations from the sky: Unmanned Aerial Vehicles (UAVs) as a tool in the investigation of harbour seals' (*Phoca vitulina vitulina*) behaviour

SAMANTA SEGANFREDDO[1], ANDERS GALATIUS[2], JONAS TEILMANN[2]

[1] Istituto Zooprofilattico Sperimentale delle Venezie, Legnaro (PD)
[2] Aarhus University - Department of Bioscience, Marine Mammal Research, Roskilde, Denmark

sseganfreddo@izsvenezie.it

Marine mammals are notoriously challenging to study. Recent developments of Unmanned Aerial Vehicles (UAVs) has permitted their implementation as tools in scientific research e.g. in ecological studies and in wildlife monitoring. Heretofore, aerial surveys to monitor marine mammals were conducted mostly by manned aircraft. Nowadays, UAVs are demonstrated to have low operational costs, easy logistics, high spatial and temporal resolution and to be easily operated without high risk for pilots. Although UAVs have been utilized in a few studies of harbour seals (*Phoca vitulina*), none have focused on the reliability of behavioural data. Here, some aspects of harbour seal behaviour were investigated, using pictures provided by a rotor drone (Phantom 3 Standard). The drone was deployed from a motorboat while approaching two of the main haul-out sites in Limfjord (northern Denmark), as many times as possible during June and August 2017. The collected pictures were analysed by two observers who agreed on age class classification of seals. The most noteworthy finding of this study was the detection of an increasing number of pup aggregations around one or a few females with the progression of the pupping season. This seems related to a babysitting behaviour, never investigated before in this species: foster females look after other pups while their respective mothers are hunting. The number of pup groups, for each group size (aggregations included from two to seven pups), showed a gradual increase in occurrence during the first half of June, followed by a slightly faster decline during the second half. Moreover, there was a progressive delay in the peak date of each curve with the increase of the group size. This research is a pilot study highlighting how drones can be a useful and affordable tool to investigate pinniped behaviour, especially if associated to video collection and other monitoring devices.

Keywords: Phoca vitulina*, babysitting, behaviour, Limfjord, UAVs*

Crayfish track chemical scents in turbulent, unidirectional flows

ELENA TRICARICO[1], MATTHEW JOHNSON[2], JAN KUBEC[3], MILOŠ BUŘIČ[3], IVA JOHOVIC[1], STUART J. MCLELLAND[4], THOMAS BREITHAUPT[5]

[1] Università di Firenze - Dipartimento di Biologia
[2] University of Nottingham - School of Geography, Nottingham, UK
[3] University of South Bohemia - Faculty of Fisheries and Protection of Waters, Vodňany, Czech Republic
[4] University of Hull - Department of Geography, Geology and Environment, Hull, UK
[5] University of Hull - Department of Biological and Marine Sciences, Hull, UK

elena.tricarico@unifi.it

Aquatic animals rely on chemical scents to identify food, conspecifics and potential predators. Climate change can alter the conditions in rivers, affecting the ability to track chemical scents. Ecohydraulic can inform about the relationships between animals and habitats in order to better manage aquatic animals, particularly if they are species introduced by humans (i.e. alien species). Therefore, in July-August 2018 we conducted laboratory experiments at the Total Environment Simulator, University of Hull (UK) to assess the reception by the American signal crayfish *Pacifastacus leniusculus* of chemical signals with two water velocities and depths, and two substrate roughnesses (also simulating the effects of climate change). Ten crayfish were used per combination of depth, velocity and substrate in two channels of the tank. Crayfish were reversibly blindfolded to ensure that they do not respond to visual cues. Behaviour, movements and directions of test crayfish were video-recorded for 15 minutes. Experiments showed that *P. leniusculus* was more successful in tracking the odour on gravel substrate, at low velocity conditions (0.16 m/s), irrespective of low or high-water depth (0.15 m and 0.26 m), highlighting the ability of this species to detect chemical scent in lower velocity but not flood conditions. However, the maximum success rate was 30%, probably due to the complexity of the environment, or to the fear of predation perceived by animals in the open channel.

Keywords: *odour, crayfish, substrate roughness, water depth, water velocity*

Indice degli Autori (√ = Speakers)