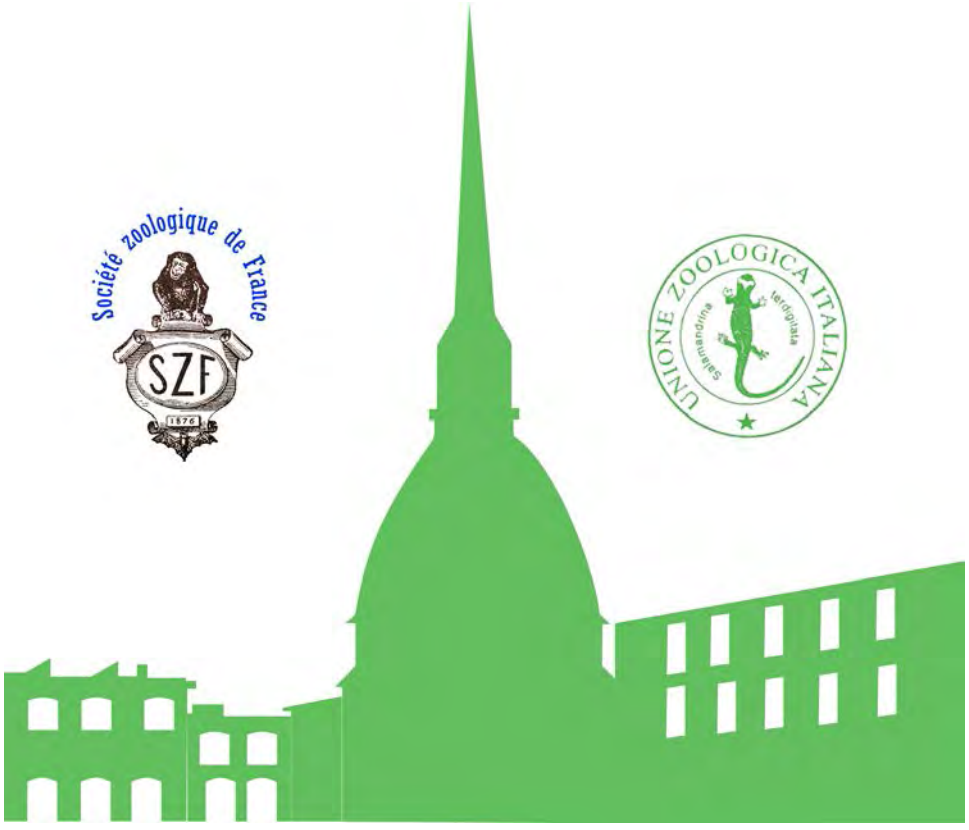
78th Congress of the Unione Zoologica Italiana	118th Congress of the Société Zoologique de France

Second Joint Meeting of Société Zoologique de France and Unione Zoologica Italiana

Torino, 18-23 September 2017

The evolution of animal diversity: a comparative approach

Abstract Book



Department of Life Sciences and Systems Biology - University of Torino

Abstract Book

Edited by

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Claudia Palestrini

Paolo Peretto

Angela Roggero

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Cari amici e colleghi,

sono più di 78 anni che ci si ritrova per condividere non solo conoscenza ma anche quelle esperienze straordinarie che si possono comunicare solo a voce, magari in un intervallo dei lavori. Questi incontri ci hanno portati ad avere una conoscenza della zoologia che va oltre le nozioni e che possiamo trasmettere ai nostri studenti.

Anche quest'anno i simposi affronteranno argomenti fondamentali della biologia animale con l'obiettivo di fornire un quadro aggiornato basato su un approccio il più interdisciplinare possibile. Parleremo di:

1) **Plasticità neurale, dati comparativi ed output comportamentali con il contributo dei relatori ad invito Peter Narins dell'Università della California e Frédéric Levy dell'Università di Tours.**
2) **Conservazione della biodiversità, estinzione e sviluppo sostenibile con i contributi di Francesco Santini e Nando Boero.**
3) **Specie introdotte, parassiti infestanti e malattie emergenti con il contributo di Piero Genovesi coordinatore IUCN.**
4) **Biologia della riproduzione e strategie riproduttive con i contributi di Gil Rosenthal della università Texas A&M e Xavier Turon dello CEAB-CSIC spagnolo.**
5) **Un momento di riflessione su ruolo e conseguenze dell'utilizzazione alimentare della fauna selvatica verrà sviluppato insieme ai colleghi della Università di Scienze Gastronomiche nella splendida sede di Pollenzo.**

L'importanza del nostro approccio comparato allo studio dell'evoluzione verrà discusso da Telmo Pievani che ci parlerà del ruolo evolutivo della cooptazione funzionale. L'avere una cultura biologica e far progredire la consapevolezza scientifica sui meccanismi evolutisi nel tempo a livello molecolare, cellulare, organismico, di popolazione e di specie non sembra però essere sufficiente per consentire di superare le sfide che il mondo universitario e quello culturale in genere, è chiamato ad affrontare oggigiorno. Non basta collaborare con i colleghi, ma occorre fare rete.

E' con questo obiettivo che i colleghi della *Société Zoologique de France* hanno proposto di trasformare la loro 118° riunione annuale nel secondo convegno congiunto tra UZI e SZF, in continuità ideale con il Congresso italo-francese organizzato nel 1984 a Padova. Il congresso si aprirà con un richiamo alla storia delle nostre interazioni a partire dal Risorgimento ricostruita da Pietro Passerin d'Entrèves e da Claudia Palestrini, completata poi da Jean-Loup d'Hondt.

Uno sguardo a come affrontare il futuro verrà presentato durante la tavola rotonda dedicata agli strumenti a supporto della cooperazione in ricerca, alla valorizzazione delle collezioni museali, alla innovazione in didattica e ad innovazioni metodologiche durante il workshop dedicato al programma di gestione dati comportamentali BORIS.

Questo volume riunisce i contributi di oltre 500 autori che lavorano in oltre 10 nazioni e che hanno avuto in questo secondo convegno congiunto un'occasione di confronto

Il comitato organizzatore

Pre-Congress Workshop

Coordinators: Marco Gamba – Olivier Friard
(olivier.friard@unito.it - marco.gamba@unito.it)

Behavioral analysis with BORIS

The workshop aims at training academics and students as users of the acclaimed event-logging software called BORIS. The BORIS program is a free, open-source and multiplatform standalone program that allows a user-specific coding environment to be set for a computer-based review of previously recorded videos or live observations. Being open to user-specific settings, the program allows a project-based ethogram to be defined that can then be shared with collaborators or can be imported or modified. BORIS answers the need to provide researchers with a flexible tool to expand and enhance behavioral investigations. In recent years, quantitative aspects of the study of animal and human behavior are increasingly relevant to test hypotheses and find empirical support for them. Researchers frequently face the need to code considerable quantities of video recordings, often constrained by species-specific options or settings. Projects created in BORIS can include a list of observations, and each observation may include one or two videos (e.g. simultaneous screening of visual stimuli and the subject being tested; recordings from different sides of an aquarium). Once the user has set an ethogram, including state or point events or both, coding can be performed using previously assigned keys on the computer keyboard. BORIS allows the definition of an unlimited number of events (states/point events) and subjects. Once the coding process is completed, the program can extract a time-budget or single or grouped observations automatically and present an at-a-glance summary of the main behavioral features. The observation data and time-budget analysis can be exported in many standard formats. The workshop will start with a short introduction to methods and techniques used in behavioral research.

Analisi comportamentale con gli sviluppatori di BORIS

Il workshop si propone di formare ricercatori e studenti all'utilizzo del software di video-coding BORIS. BORIS è un programma free, open-source, multipiattaforma realizzato dal DBIOS che consente la creazione di un ambiente specifico per la codifica computerizzata di file media registrati in precedenza o la realizzazione di osservazioni in tempo reale.

Workshop d'analyse comportementale avec les développeurs de BORIS

Le workshop propose de former chercheurs et étudiants à l'utilisation du programme d'encodage vidéo BORIS. BORIS est un programme gratuit, open-source et multi-plateforme réalisé par le DBIOS qui permet la création d'un environnement personnalisé pour l'encodage assisté par ordinateur de fichiers média ou la réalisation d'observations en temps réel.

Opening

PIETRO PASSERIN D'ENTRÈVES, CLAUDIA PALESTRINI

(pietro.passerin@unito.it, claudia.palestrini@unito.it)

I LEGAMI STORICO-SCIENTIFICI TRA ZOOLOGI FRANCESI E PIEMONTESI

Riassunto

Pur vicini territorialmente e favoriti dall'uso frequente della lingua francese gli zoologi del Regno di Sardegna non hanno avuto, salvi rari casi, stretti rapporti di collaborazione con i colleghi francesi fino agli inizi dell'Ottocento. I legami diventano invece assai più frequenti dopo la Rivoluzione con l'occupazione francese del Piemonte e la sua conseguente trasformazione in provincia metropolitana. Ciò è avvenuto anche, ma con formule di governo diverse, per altri stati italiani, prima indipendenti, aprendo un canale privilegiato con i centri di ricerca e i ricercatori d'oltralpe. I primi decenni dell'Ottocento sono caratterizzati dalla presenza, a Parigi, nel *Muséum d'Histoire Naturelle*, di zoologi di fama mondiale, mentre nella capitale del nuovo Impero affluiscono materiali biologici frutto delle spedizioni francesi in tutto il mondo. L'Università di Torino dipende strettamente da quella di Parigi e George Cuvier (1769-1832), che visiterà Torino nel 1810, ne è Ispettore generale e poi *Grand Maître*. A Parigi, tra gli altri, insegna Jean-Baptiste de Lamarck (1744-1829) e circa 25 sono i suoi allievi italiani, tra cui il napoletano Giosué Sangiovanni (1775-1849) e il piemontese Franco Andrea Bonelli (1784-1830). Anche se già nel 1802 a Torino Michele Spirito Giorna (1741-1809) è chiamato su una cattedra di Zoologia e Anatomia comparata, in realtà la prima cattedra italiana di zoologia risulta essere quella istituita a Napoli nel 1806. Grazie alla frequentazione di Lamarck gli zoologi italiani diffondono le nuove idee evoluzionistiche in Italia e Torino è uno dei centri più attivi. Anche l'Accademia delle Scienze di Torino annovera fra i suoi soci numerosi zoologi francesi e i rapporti epistolari del periodo sono molto numerosi. Con la caduta dell'Impero francese, rimangono comunque stretti i rapporti fra ricercatori e, in seguito a diverse vicende politico-istituzionali, troviamo in Italia Carlo Luciano Bonaparte (1803-1857), nipote diretto di Napoleone I, noto ornitologo, che fu patrocinatore delle Riunioni degli Scienziati italiani. In Francia, Ferdinando Arborio di Breme, duca di Sartirana (1807-1869) sarà l'unico presidente italiano della *Société entomologique de France*, nel 1844. Infine l'esploratore-naturalista Léon Croizat (1894-1992), di famiglia originaria di Chambery, nasce e si forma a Torino frequentandone il vivace ambiente culturale radunato attorno all'erpetologo Giacinto Peracca. È riconosciuto come il padre del metodo biogeografico noto come Panbiogeografia. Nel corso del Novecento gli zoologi torinesi, pur non tralasciando gli ormai consolidati rapporti con le istituzioni transalpine, sembrano aprirsi con sempre maggiore interesse a un più vasto panorama scientifico internazionale.

LES LIENS HISTORIQUES ET SCIENTIFIQUES ENTRE ZOOLOGISTES FRANÇAIS ET PIEMONTAIS

Résumé

Tout en étant très proches du point de vue territoriale et traditionnellement francophones les zoologistes du Royaume de Sardaigne n'ont jamais eu, sauf quelques cas, de liens étroits avec les collègues français jusqu'au au début du XIXe siècle. Les liens se font beaucoup plus fréquents après la Révolution suite à l'occupation française du Piémont ayant comme conséquence sa transformation en province métropolitaine. Il faut de toute façon considérer que la même chose s'est passée pour la majeure partie des autres états italiens, à l'avance indépendants, mais où se sont installé différent types de gouvernement. Toutes ces situations ont favorisé l'ouverture d'un canal privilégié avec les centres de recherche et les chercheurs au-delà des Alpes. Les premières décennies du dix-neuvième siècle sont caractérisées par la présence au Muséum d'Histoire Naturelle de Paris, de nombreux zoologistes de renommée mondiale, et par l'arrivée dans la capitale du nouvel empire d'une grande quantité de matériel zoologique provenant des expéditions françaises dans tout le monde. L'Université de Torino dépend très étroitement du Ministère français de l'Education nationale e George Cuvier (1769-1832), qui viendra à Turin en 1810, en est l'Inspecteur générale et après le Gran Maître de l'Université. Parmi les professeurs parisiens il-y-a Jean-Baptiste de Lamarck (1744-1829); ses leçons sont suivies par une bonne quantité d'élèves dont à peu près 25 sont italiens. Parmi eux le napolitain Giosué Sangiovanni (1775-1849) et le piémontais Franco Andrea Bonelli (1784-1830). À l'Université de Torino, en 1802 Michele Spirito Giorna (1741-1809) obtient la chaire de Zoologie et Anatomie comparée, mais on considère que la première chaire de zoologie italienne est celle de Naples en 1809. Grace à l'apprentissage de Lamarck les zoologistes italiens commencent à diffuser les nouvelles idées évolutionnistes en toute l'Italie et Torino est un des centres plus actifs. Aussi l'Académie des Sciences de Torino compte parmi ses membres nombreux biologistes français et la correspondance entre chercheurs est très riche. Les rapports entre français et piémontais et avec l'Italie en général restent très étroits même après la chute de l'Empire. En Italie, Carlo Luciano Bonaparte (1803-1857), neveu de Napoleone I, ornithologue, soutient les "Riunioni degli Scienziati italiani". À Paris, Ferdinando Arborio di Breme, duc de Sartirana (1807-1869) est nommé, seul italien, en 1844, président de la Société entomologique de France. Pour terminer, Léon Croizat (1894-1992), explorateur et naturaliste, issu d'une famille originaire de Chambery, se forme à Torino, grâce à la présence d'un cercle scientifique très prenant géré par l'herpéthologiste Giacinto Peracca. Il est reconnu comme le père de la méthode biogéographique connue sous le nom de Panbiogeografia. Dans le cours du Vingtième siècle les zoologistes piémontais, tout en gardant leurs rapports de collaboration avec la France, s'ouvrent avec un intérêt croissant à des rapports scientifiques de plus en plus internationaux.

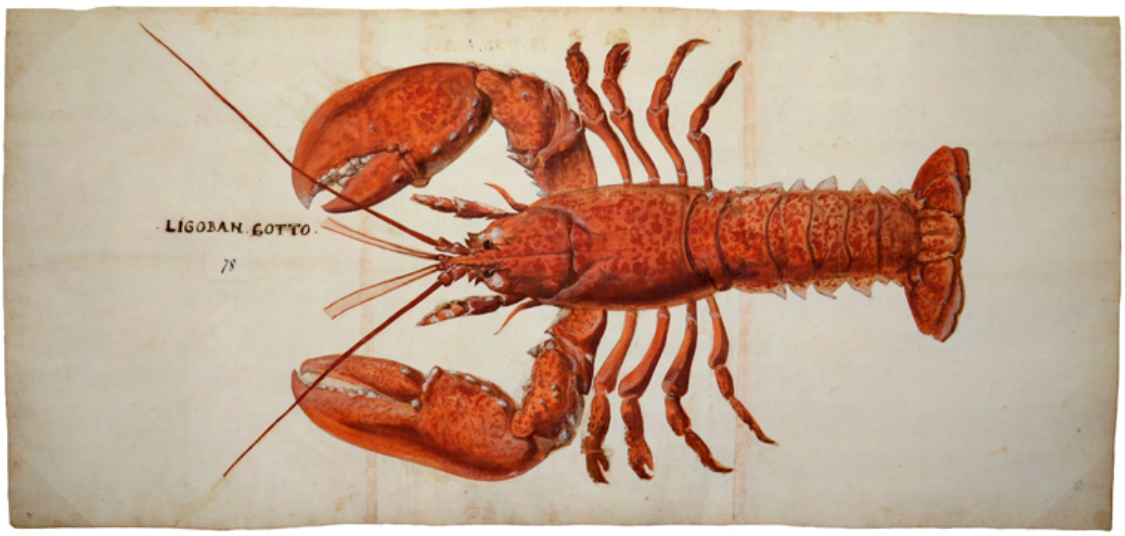
Vorremmo iniziare questo necessariamente breve excursus sui rapporti fra zoologi francesi e piemontesi citando fra i naturalisti del XVI secolo con spiccato interesse zoologico, per quanto riguarda il Piemonte, il duca Carlo Emanuele I di Savoia (1562-1630), che nei primi anni del Seicento si dedica con passione e competenza a raccogliere, all'interno dei propri serragli un discreto numero di animali nostrani ed esotici. Parallelamente acquista tutte le opere di carattere zoologico presenti al momento sul mercato costituendo una fornitissima biblioteca, in buona parte ancora oggi conservata presso la Biblioteca Nazionale Universitaria di Torino e la Biblioteca Reale, in cui spiccano oltre alle opere di Ulisse Aldrovandi, Ippolito Salviani e Conrad Gesner, quelle dei francesi Pierre Belon e Guillaume Rondelet.

Il duca Carlo Emanuele I di Savoia (1562-1630)

Carlo Emanuele I fa inoltre realizzare alcuni album naturalistici riguardanti pesci, rettili e uccelli, disegnati spesso a grandezza naturale che restano a testimonianza, tra l'altro, delle profonde affinità tra l'ambiente culturale lionese e quello ginevrino, con diramazioni verso Basilea e Zurigo, da cui certamente non era estraneo il Duca, signore, fino al 1601 della Bresse e del Bugey, regioni *trait-d'union*, anche geografico, fra i poli precedenti. Infatti il Duca aveva preso l'abitudine di riunire presso di sé studiosi anche di fama, con cui intrattenere discussioni scientifiche. L'esistenza di una

sorta di circolo scientifico-letterario è ben documentata (Mamino, 1999), ma è assai interessante verificare come il Duca non si ponesse al suo interno come semplice spettatore, ma come attivo stimolatore e conduttore della discussione che derivava in seguito alla proposta dei diversi argomenti.

Pesce Re. *Lampris guttatus*, disegno a tempera. Biblioteca Reale di Torino



Astice. *Homarus gammarus*, disegno a tempera. Biblioteca Reale di Torino

I tre album naturalistici, attualmente conservati presso la Biblioteca Reale di Torino, sono dunque un'esplicita testimonianza di come la Corte sabauda partecipasse del clima culturale e delle ricerche naturalistiche più avanzate a livello europeo, inserendosi a pieno titolo in una ben delineata geografia del sapere che aveva come centri soprattutto Lione e, ora, anche Torino.

Gli album naturalistici suscitano ammirazione, curiosità e interesse per molto tempo, tanto che, verso la fine del Settecento, un altro francese, Laurent Fromageot de Verrax († 1793), segretario e bibliotecario a Torino del Marchese di Priero, si specializza nell'arte di naturalizzare gli uccelli con le loro piume, basandosi sul metodo che nel Seicento aveva caratterizzato proprio uno degli album ornitologici del prima citato Carlo Emanuele I. Il Fromageot sviluppa la sua arte una volta rientrato in Francia, a Strasburgo, non prima di averla trasmessa alla figlia del direttore del Museo zoologico torinese, Michele Spirito Giorna, che all'epoca insegnava la Storia Naturale nell'Università di Torino. Giacinta Giorna si specializzerà in questo tipo di arte plumaria realizzando numerosi quadri di uccelli con le loro piume per il Museo, purtroppo oggi perduti.

Comunque, al di là di questi episodi comunque circoscritti e non tali da mettere in evidenza vere e proprie collaborazioni scientifiche, si deve dunque attendere l'inizio dell'Ottocento per osservare un netto cambiamento. Pochi anni dopo la Rivoluzione del 1789, infatti, i legami diventano assai più frequenti e intensi, favoriti anche dalla progressiva occupazione francese del Piemonte, con una prima cessione alla Francia della Savoia e della contea di Nizza imposta con l'armistizio di Cherasco del 1796 e poi con l'occupazione dell'intero Piemonte nel dicembre del 1798. Dopo brevi alterne vicende nel giugno del 1800 Napoleone si impadronisce nuovamente del Piemonte in cui vengono istituiti, con l'Impero (1802), una serie di Dipartimenti metropolitani; Torino è la capitale del *Departement du Po*. La lingua francese, peraltro già tradizionalmente utilizzata in precedenza dalla nobiltà e dalla borghesia piemontese, diviene obbligatoria e al Piemonte vengono applicate anche le leggi e la moneta d'oltralpe.

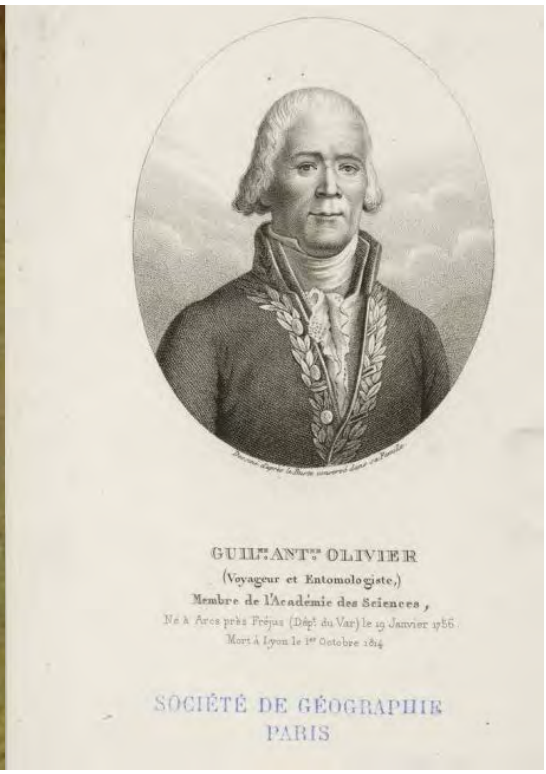
I primi decenni dell'Ottocento sono caratterizzati dalla presenza, a Parigi, nel *Muséum National d'Histoire Naturelle,* di un gruppo di zoologi e più in generale di Naturalisti di fama mondiale – George Cuvier (1769-1832), Etienne Geoffroy Saint-Hilaire (1772-1844), Pierre André Latreille (1762-1833), Jean-Baptiste de Monet cavaliere de Lamarck (1774-1829), Guillaume-Antoine Olivier (1756-1814), - solo per citare i principali - mentre nella capitale del nuovo Impero affluiscono materiali biologici frutto delle spedizioni francesi in tutto il mondo.

George Cuvier (1769 –1832)

Pierre André Latreille (1762-1833)

Jean-Baptiste de Monet

cavaliere di Lamarck (1744-1829)



Guillaume-Antoine Olivier (1756-1814)

Grazie alle aperture concesse ai ricercatori ed all'enorme quantità di campioni animali da descrivere, il *Muséum* parigino diventa, per un certo numero di anni, il polo europeo della ricerca zoologica e quindi il punto di riferimento per tutti i cultori della zoologia italiani. Infatti, pressoché tutti gli Stati italiani del tempo entrano nella sfera di influenza francese, con formule di governo diverse, ma solo apparentemente autonome, aprendo canali privilegiati con i centri di ricerca e i ricercatori d'oltralpe. Le principali istituzioni scientifiche e, in particolare quelle piemontesi, sono chiamate a partecipare alla crescita scientifico-culturale della nuova capitale dell'Impero, ma va detto, si arricchiscono a loro volta grazie a questo scambio.

Nell'Università francese, la zoologia ottiene ben presto la dignità di una scienza autonoma e il suo insegnamento viene separato da quelli dell'Anatomia comparata, della mineralogia e da altre discipline naturalistiche. Nel *Departement du Po*, l'Università di Torino e l'Accademia delle Scienze dipendono strettamente da quella di Parigi, dove George Cuvier è Ispettore generale e poi *Grand Maître*, e, in questa veste ufficiale visiterà Genova nel 1809 e Torino e Siena nel 1810. Da molte parti d'Europa accorrono giovani naturalisti per ascoltare gli insegnamenti dei *Savants* francesi. Fra questi, oltre a Cuvier, vi è Jean-Baptiste de Lamarck le cui lezioni sugli invertebrati sono molto apprezzate anche per la novità dei contenuti di carattere evoluzionistico e filosofico. Fra i circa 980 allievi di Lamarck censiti da Pietro Corsi (2001), sono circa 25 quelli italiani, tra cui spiccano per le loro future carriere i nomi del napoletano Giosué Sangiovanni (1775-1849), che sarà il primo professore italiano di Anatomia comparata, e del piemontese Franco Andrea Bonelli (1784-1830). Anche se già nel 1802, a Torino, Michele Spirito Giorna (1741-1809) è chiamato su una cattedra di Zoologia e Anatomia comparata, in realtà la prima cattedra italiana di zoologia, in senso stretto, risulta essere quella istituita a Napoli nel 1806.

Curiosa è la storia di Franco Andrea Bonelli, zoologo di gran fama, in particolare nei campi dell'entomologia e dell'ornitologia, vero e proprio autodidatta che per le sue capacità viene apprezzato da Cuvier durante il suo più sopra citato soggiorno torinese del 1810.

Cuvier consiglia al giovane zoologo ventiseienne, per affinare la sua formazione tecnica, di recarsi a Parigi e frequentare le lezioni dei professori del *Muséum*. Bonelli parte a piedi da Torino e giunge a Parigi in 10 giorni, percorrendo ogni giorno circa 80 chilometri, sforzo eccezionale data la ben nota scarsa fisicità dello zoologo. Bonelli, nella capitale francese, può ascoltare le entusiasmanti lezioni di Lamarck e al suo rientro ottiene la cattedra di zoologia all'Università di Torino (Passerin d'Entrèves P. e Sella Gentile G., 1983).

Franco Andrea Bonelli (1784-1830) dipinto conservato presso il Dipartimento di Scienze della Vita e Biologia dei Sistemi. Università degli Studi di Torino

Bonelli è al centro di un piccolo giallo ornitologico che vede coinvolti anche altri celebri ornitologi come il tedesco Coenraad Temminck e il francese Louis Jean Pierre Vieillot. Bonelli, ricevuti dalla Sardegna alcuni esemplari di un'aquila presumibilmente sconosciuta li invia a Temminck che riconosciutili come appartenenti a una specie nuova la dedica a Bonelli col nome di *Falco bonelli*. Nel frattempo anche Vieillot ha avuto la possibilità di studiare un esemplare della nuova specie che descrive e pubblica, col nome di *Aquila fasciata*, in pochissimo tempo presso l'*Encyclopédie methodique*, anticipando la pubblicazione di Temminck e conquistando la priorità scientifica (Aimassi, 2015).

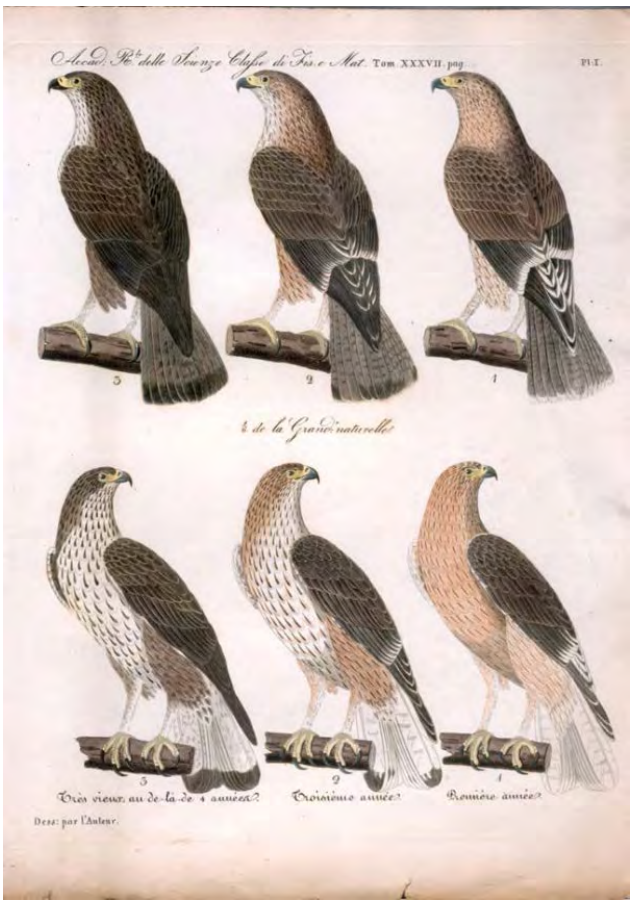


Tavola di Alberto della Marmora, 1834, Détermination et description des différences d'âge de l'Aigle Bonelli (Falco Bonelli, Temm.). Memorie della Reale Accademia delle Scienze di Torino

Grazie alla frequentazione dei professori del *Muséum* gli zoologi italiani si formano ed iniziano a dare vita a una scuola zoologica di elevato livello tale da rivaleggiare con quella francese. Gli allievi di Lamarck diffondono poi le nuove idee evoluzionistiche in Italia e Torino diviene uno dei centri più attivi con Franco Andrea Bonelli, L'Accademia delle Scienze di Torino annovera fra i suoi soci numerosi biologi animali francesi, fra cui Cuvier, de Lacépède, de Blainville, Latreille, Dejean e de Ferussac, oltre al grande enciclopedista d'Alembert e a tutti i principali matematici, fisici e chimici del momento ed i rapporti epistolari del periodo fra studiosi dei due paesi sono frequenti.

Con la caduta dell'Impero francese, rimangono comunque stretti i rapporti fra ricercatori e istituzioni. Il Museo di Zoologia di Torino si rivolge spesso non solo a studiosi accreditati, ma anche ai commercianti naturalisti presenti all'epoca in Francia, acquistando materiali importanti che vanno ad arricchire le sue sempre più importanti collezioni. In particolare il nome di Jules Verreaux (1807-1873) e di Florent Prevost (1794-1870) compaiono spesso nei cataloghi e nella corrispondenza.

Bonelli visiterà ancora Parigi nel 1820, a riprova che i rapporti non sono mutati dopo la Restaurazione e acquisterà importanti materiali per il Museo, tra cui un *pullus* del rarissimo emù nero proveniente dal viaggio di Nicolas Baudin (1800-1804) raffigurato alla *planche* XXXVI dell'*Atlas del Voyage de Découvertes aux terres australes* (1807).

Planche XXXVI dell'*Atlas del Voyage de Découvertes aux terres australes*

Esemplare di emù di King Island o emù nero (*Dromaius novaehollandiae minor* Spencer, 1906) conservato presso le collezioni ornitologiche del Museo Regionale di Scienze Naturali di Torino, è una sottospecie estinta di emù.

Gli anni Quaranta dell'Ottocento vedono ancora molto attivi i rapporti fra zoologi delle due nazioni, anche se il periodo comincia ad essere molto agitato per l'Italia, dal punto di vista politico, per i sempre maggiori fermenti costituzionali prima e unitari poi che attraversano la penisola. Nel campo della zoologia troviamo come personaggio di punta un francese, Carlo Luciano Bonaparte (1803-1857), nipote diretto di Napoleone I, notissimo ornitologo, la cui famiglia si era trasferita a Roma in esilio nel 1804 in seguito a dissapori con l'Imperatore. Carlo Luciano, rientrato in Francia nel 1830 in seguito alle *Trois glorieuses,* o rivoluzione di luglio del 1830, rimane sempre in strettissimo contatto con gli ambienti politici e scientifici italiani. In rapporto ai primi, partecipa nel 1848 a Torino ai lavori della Società nazionale per la Confederazione italiana fondata da Gioberti e, nel 1849, è deputato della Assemblea costituente della Repubblica romana. In campo scientifico è patrocinatore delle Riunioni degli Scienziati italiani che, dal 1839 al 1847, inizialmente con cadenza annuale e poi nel 1861, nel 1862, nel 1873 e nel 1875, pur in mezzo a grandi difficoltà politiche, tengono le loro riunioni in diverse città degli Stati preunitari. Bonaparte è molto spesso presidente della sezione di zoologia. Non entra comunque mai come membro della Reale Accademia delle Scienze di Torino, mentre altre personalità transalpine, come Moquin-Tandon, Solier e Milne-Edwards ottengono la nomina a soci stranieri.

Carlo Luciano Bonaparte (1803- 1857) zoologo e naturalista

Ciononostante Bonaparte definisce Torino “città indubitabilmente la più colta d’Italia” e a lui rimandiamo per uno sguardo sulla zoologia italiana ed europea della metà dell’Ottocento (Bonaparte, 1842)

Per contro, in Francia, importante appare la figura del piemontese Ferdinando Arborio di Breme, duca di Sartirana (1807-1869). Esiliato a Parigi in seguito ai moti rivoluzionari piemontesi del 1821, si dedica con interesse e competenza all’entomologia, allestendo una collezione di Coleotteri di eccezionale importanza, frutto di raccolte, scambi e acquisti e pubblicando sull’argomento.

Ferdinando Arborio di Breme, duca di Sartirana (1807-1869)

Entra in possesso di una parte della collezione del celebre entomologo francese Auguste Dejean che ancora oggi è ben riconoscibile all’interno della sua più vasta. Ferdinando Arborio di Brene è l’unico presidente italiano della *Société entomologique de France*, nel 1844, società di cui peraltro è anche socio un altro entomologo piemontese, il barone Giuseppe Luigi Maria Peyroleri († 1844).

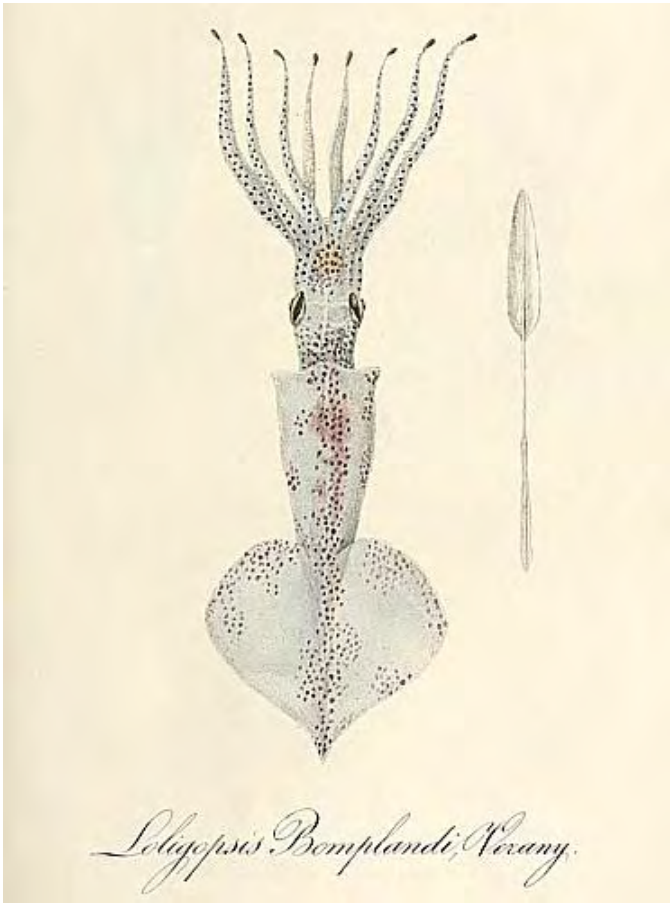
Un’altra consistente parte della Collezione Dejean è acquistata da Massimiliano Spinola (1780-1857), entomologo genovese di chiara fama, nato in Francia, ma rientrato a Genova a causa della Rivoluzione francese, le cui collezioni sono attualmente conservate, come quella di Ferdinando di Breme, presso il Museo Regionale di Scienze Naturali di Torino. Spinola è stato in contatto con tutti gli entomologi italiani e francesi della sua epoca tessendo una rete di scambi di informazioni e di materiali molto stretta e molto produttiva, di cui resta testimonianza nella sua copiosa corrispondenza.

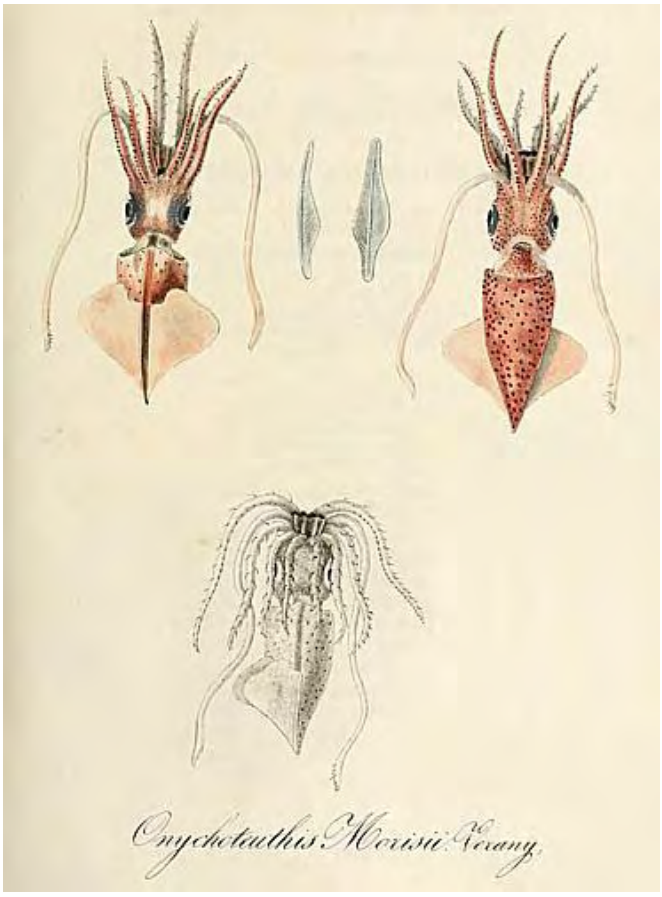
Massimiliano Spinola (1780-1857) e dettagli delle sua collezione restaurata e conservata presso il Museo Regionale di Scienze Naturali di Torino

Un altro personaggio al centro di questo network zoologico, pur non essendo uno zoologo in senso stretto è certamente Matteo Bonafous (1793-1852), appartenente a una famiglia francese originaria di Lione di cui un ramo si era trasferito in Piemonte. Bonafous si dedica, a partire dagli anni 20 dell'Ottocento, alla bachicoltura, già attiva in Piemonte, pubblicando saggi innovativi in questo campo e in altri con particolare riguardo alle scienze agrarie.

Con la formazione del Regno d'Italia nel 1861, non solo non cessano i rapporti con colleghi e istituzioni francesi, ma anzi vengono spesso incrementati. Per il Piemonte, con la cessione definitiva della Savoia e di Nizza alla Francia, i naturali rapporti tra naturalisti delle tre regioni dell'antico Regno Sardo proseguono come se nessun mutamento fosse avvenuto, in particolare con Jean-Baptiste Verany (1800-1865), zoologo specialista di Cefalopodi.

Nel 1836-38 aveva partecipato, in qualità di naturalista di bordo, alla spedizione della fregata Euridice della Marina Sarda salpata da Genova sotto il comando del conte Francesco Serra. Verany scopre nell'Oceano Atlantico due nuove specie di Cefalopodi e ne fa relazione nelle Memorie della Reale Accademia delle Scienze di Torino.





Loligopsis Bomplandi, Verany e *Onychoteuthis Morisii*, Verany litografie a colori di Comba

Di Filippo De Filippi (1814-1867), titolare della cattedra di Zoologia a Torino, ricordiamo solamente una lettera aperta al filosofo francese Émile Littré, nel 1859, in occasione della pubblicazione sulla *Revue des deux mondes* del 1° marzo 1858 dell'articolo *Études d'histoire primitive*, De Filippi riprende i suoi ragionamenti sull'umanità primitiva, esplicitando alcuni interessanti aspetti metodologici legati alla nascita della paleoetnologia, sottolineando l'aiuto che le scienze naturali forniscono all'archeologia e i punti di contatto che esistono tra archeologia e geologia. In campo più strettamente zoologico, De Filippi addotta per le sue lezioni il testo di Zoologia del francese Milne-Edwards.

Filippo De Filippi dipinto conservato presso il Dipartimento di Scienze della Vita e Biologia dei Sistemi, Università degli Studi di Torino.

Nel 1871 viene inaugurato il traforo ferroviario del Frejus che unisce il Piemonte con la Savoia, aprendo così una via di comunicazione privilegiata fra la Francia e l'Italia.

Nell'ambito torinese, dopo la morte del De Filippi si afferma Michele Lessona (1823-1894), figlio di Carlo, professore di veterinaria. Lessona, allievo di Giuseppe Gené, viene nominato professore di Zoologia e Anatomia comparata nell'Università; diventerà nel 1892 senatore, rettore

dell’Università, ma soprattutto importante divulgatore del darwinismo in Italia.

Lorenzo Delleani, Museo Zoologico, 1871, olio su tela,
GAM - Galleria Civica d’Arte Moderna e Contemporanea

Lessona nella prima parte della vita, per contrasti con la famiglia che probabilmente disapprova il suo matrimonio, passa diversi periodi in vari paesi, fra cui la Francia. Rientra a Torino solo dopo la morte per colera della moglie e, più tardi, si risposa con Adele Masi che lo aiuterà soprattutto nella tradizione di opere scientifiche; possiamo citare in particolare la versione italiana del 1869 dell’opera di Félix Archimède Pouchet, docente all’Università di Rouen, sostenitore della generazione spontanea in opposizione a Louis Pasteur.

Michele Lessona dipinto conservato presso il Dipartimento di Scienze della Vita e Biologia dei Sistemi. Università degli Studi di Torino.

Lessona ha molte importanti amicizie, condivide gli interessi dei giovani intellettuali, è uno stimato politico, come studioso diviene un profondo conoscitore della fauna piemontese e trasmette la passione naturalistica a Lorenzo Camerano (1856-1917), che diventerà suo genero e assumerà le cattedre di Zoologia e Anatomia comparata. Anche Camerano è uno scienziato di prim'ordine, entomologo, iniziatore del metodo biometrico applicato agli studi zoologici, prolifico autore di circa 350 pubblicazioni scientifiche. Lorenzo Camerano sarà membro di numerose società scientifiche, fra cui la *Société Zoologique de France*.

Alla scuola di Lorenzo Camerano si forma, tra gli altri, lo zoologo Daniele Rosa (1857-1944), suo successore alla cattedra di Zoologia, importante studioso di Oligocheti, ricordato per la teoria evoluzionistica dell'Ologenesi, a cui si ispirò George Alexis Montandon (1879-1944) antropologo francese di origini svizzere, che pubblica l'*Ologénèse culturelle* nel 1934.

Infine possiamo ancora ricordare l'esploratore-naturalista Léon Croizat (1894-1992), di famiglia

originaria di Chambery, che nasce e si forma a Torino frequentandone il vivace ambiente culturale che si raduna periodicamente attorno all'erpetologo conte Mario Giacinto Peracca. Trascorre un breve periodo a Parigi prima di trasferirsi negli Stati Uniti. È riconosciuto come il padre del metodo biogeografico noto come Panbiogeografia.

Nel corso del Novecento gli zoologi torinesi, pur non tralasciando gli ormai consolidati rapporti con le istituzioni transalpine, sembrano aprirsi con sempre maggiore interesse a un più vasto panorama scientifico internazionale e pertanto i rapporti con i colleghi transalpini appaiono meno intensi.

Al di fuori di Torino desideriamo ricordare, tra tutti, Umberto D'Ancona (1896-1964), professore di Zoologia a Padova, membro del comitato di perfezionamento dell'Istituto oceanografico di Parigi, membro d'onore della *Société zoologique de France* e dell'*Accadémie des Sciences* di Parigi.

Prima di chiudere con questo breve excursus franco-piemontese vorremmo fare ancora una citazione curiosa, che probabilmente nulla ha a che vedere con gli scambi scientifici tra ricercatori: Alfredo Corti, titolare della cattedra di Anatomia comparata nell'Università di Torino, valente scienziato, fugge in Francia dopo l'armistizio dell'8 settembre entrando nella resistenza francese e rimanendovi fino alla fine del conflitto.

Dunque i legami tra i cultori della Zoologia italiani e francesi sono stati, sono e saranno sempre stretti! Del resto molti di noi, qui a Torino hanno lavorato e continuano a lavorare con i colleghi del *Muséum National d'Histoire Naturelle* e del *Laboratoire d'Entomologie* di Parigi.

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JEAN-LOUP D'HONDT

(jean-loup.dhondt@mnhn.fr)

LA SOCIÉTÉ ZOOLOGIQUE DE FRANCE ET LA ZOOLOGIE ITALIENNE

Résumé

Rappel des relations qui se sont établies entre la Société zoologique de France et la zoologie italienne au cours des décennies et du contexte dans lequel elles se sont nouées, notamment lors de manifestations scientifiques et tout particulièrement à l'occasion des congrès internationaux de zoologie réunissant des naturalistes des deux pays. Les premières Journées franco-italiennes de zoologie organisées à l'université de Pavie en 1984 ont notamment illustré avec bonheur l'intérêt et la convivialité de ces relations à la fois professionnelles et amicales.

Abstract

Report on the relationship established between The Zoological Society of France and The Italian Zoological Union in the last decades and this relationship's context, focusing on their scientific events, especially on the upcoming international zoological congress, that joins up naturalists from both countries. The first Franco – Italian Days of Zoology, organized by the University of Pavia in 1984 have shown the interest and the friendly characterization of this relationship, both on the professional and sociable level.

Riassunto

Resoconto delle relazioni stabilitesi tra la Società Zoologica di Francia e l'Unione Zoologica Italiana nel corso degli ultimi decenni e del contesto in cui si sono stabilite, in special modo delle loro manifestazioni scientifiche e in particolare in occasione del congresso internazionale di zoologia, che riunisce i naturalisti dei due paesi. Il primo incontro franco-italiano di zoologia, organizzato dall'Università di Pavia nel 1984 ha illustrato l'interesse e la convivialità di questo legame sia dal punto si vista professionale che amichevole.

Introduction

Vers l'âge de dix ans, les élèves des collèges et des lycées français de formation classique découvraient simultanément à l'époque de ma scolarité, et probablement à un degré plus élevé qu'aujourd'hui, la littérature latine et les sciences naturelles. Ces deux disciplines faisaient traditionnellement l'objet d'enseignements différents. Mais certaines des lectures de jeunesse des lycéens conciliaient ces deux domaines apparemment dissemblables, le littéraire et la discipline scientifique la plus attractive, l'histoire naturelle, champs disciplinaires d'autant plus attrayants pour eux qu'ils étaient avides de découverte et demandeurs d'enrichissement culturel. Les jeunes lycéens, notamment ceux qui étaient tout à la fois latinistes et naturalistes par vocation, et qui espéraient donc pouvoir se consacrer à l'étude de ce que nous appelons à présent la biodiversité, étaient particulièrement sensibles à leur familiarisation avec les œuvres de Virgile (de -70 à -19) et d'Horace (de – 65 à – 28), ouvrages dont la découverte conciliait simultanément leur double désir d'approfondir leur savoir dans ces deux aspects essentiels de l'enseignement qui leur était délivré ; ceci en flattant tant leur sensibilité que leur goût naissant pour la connaissance du monde vivant et la beauté formelle d'une culture et d'une littérature passionnantes, neuves et enrichissantes pour eux. C'est souvent à travers les œuvres de ces auteurs, par exemple ceux décrivant les moeurs des insectes, qu'un lycéen commençait à découvrir l'entomologie ; Virgile leur présentait en particulier sous un jour plus sympathique un insecte que leur jeune expérience leur avait jusqu'alors fait considérer comme plutôt répulsif, le moustique du genre Culex. Les professeurs des lycées évoquaient aussi devant leurs élèves la vie passionnée et l'abnégation du premier naturaliste de notre double millénaire, Pline l'Ancien, qu'ils donnaient en exemple.

En Italie comme dans le reste de l'Europe, les naturalistes pionniers ont été des compilateurs de talent, tels que Pline l'Ancien (23-79), successeur du zoologiste grec Aristote (-384 - -323), tous deux conscients de l'existence d'une échelle de complication des êtres, ou Claude Ebien (175-235) qui fit à son époque une synthèse des connaissances des mœurs de plus de 250 espèces animales. Les premiers authentiques zoologistes français ont été imprégnés par l'oeuvre des grands zoologistes italiens de la période de la Renaissance ; outre sa culture générale, son sens artistique et son esprit inventif, Léonard de Vinci (1452-1519) qui a été une sorte de représentant ou d'ambassadeur de la Renaissance italienne en France, où il avait été invité par le roi François I, était intéressé par les sciences naturelles et avait reconnu l'unicité du plan d'organisation animal. Les valves de Tridacna qui servent actuellement de bénitiers dans l'une des plus grandes églises parisiennes, Saint-Sulpice, furent d'ailleurs offertes par la Sérénissime République de Venise au roi de France François I.

En France, avant de s'intéresser à l'animal d'un point de vue scientifique, les premiers travaux publiés avaient essentiellement eu un usage pratique et avaient été consacrés aux animaux utiles ou

nuisibles à l'homme, ainsi qu'aux espèces sauvages qu'il exploitait ou qui étaient ses prédateurs. Lorsque la zoologie a été reconnue en tant que science bien individualisée, les premiers praticiens français ont, comme leurs homologues britanniques, néerlandais et suisses à la même époque, fait référence aux auteurs italiens en qui ils reconnaissaient des prédécesseurs et leurs premiers maîtres directs. La zoologie française a en effet été fondée tardivement par comparaison avec la zoologie italienne, et ceci par des chercheurs dont la naissance a été contemporaine de la fin du règne de François I, et notamment par Pierre Gilles (ou Gyllius) (1490-1555) ou l'entomologiste Charles Estienne (1503-1564), auxquels succédèrent le pionnier de l'étude de la faune aquatique Guillaume Rondelet (1507-1566) et l'ornithologue et ichtyologue Pierre Belon (1518-1564), tous étant imprégnés des apports de la zoologie italienne alors en pleine éclosion. Mais c'est un siècle et demi après le décès de Léonard de Vinci que le terme de zoologie a été défini comme étant la science de l'étude des animaux (par un allemand Sperling, en 1661), et c'est alors que furent publiés, également en Allemagne les premiers ouvrages dévolus à cette science (dès 1852). C'est dans ce contexte qu'est né le premier grand zoologiste généraliste français, René de Réaumur (1658-1730).
La zoologie italienne correspondait à un bouillonnement de culture à l'époque plus actif qu'en France, et est graduée par un certain nombre de noms prestigieux. Hippolito Salviani (1514-1572) a essentiellement été un ichtyologue, Andrea Caesalpino (1519-1603) s'est intéressé à la circulation du sang, Ulisse Aldrovandi (1522-1607) a figuré de nombreuses espèces d'insectes, Michele Marcati (1541-1593) fonda l'un des premiers cabinets de zoologie, Paolo Sarpi (1552-1623) a décrit les stades embryologiques du poulet, Alfonso Bonelli (1608-1679) s'est intéressé à la dynamique du mouvement des poissons en corrélation avec leur morphologie, Francisco Redi (1626-1697) à la glande à venin de la vipère, Marcello Malpighi (1628-1694) a fondé l'anatomie microscopique et l'histologie, Luigi Marsigli (1658-1730) a réalisé une importante monographie sur le Corail. C'est à Rome que fut créée, par le prince Cési en 1603, la plus ancienne société savante au monde s'occupant d'histoire naturelle, l'Academia Lyncei, qui publia à partir de 1625.

Les congrès internationaux de zoologie

Lorsque la société zoologique de France a été créée en 1876, elle n'a compté qu'un seul zoologiste italien parmi ses membres fondateurs (dont le nombre avait été statutairement fixé à 60 et qui fut atteint en à peine quelques semaines), le comte Hercules Turati, banquier à Milan et détenteur d'une collection personnelle de 20 000 oiseaux naturalisés. Huit autres de ces fondateurs étaient également de nationalité étrangère (Belgique, Grande-Bretagne, Guatemala, Pologne, Portugal, Russie, Suisse). Le recrutement s'est ensuite davantage diversifié durant les 5 années qui ont suivi ; ainsi, en 1881, on dénombrait parmi les sociétaires, outre Turati, trois autres zoologistes italiens :

Eduardo de Betta (Vérone), Lorenzo Camerano (Turin) et Alberto Ninni (Venise). En cette année 1881, un chercheur italien Fernando Gasco, professeur à l'université de Gènes, bien que non-membre de la Société zoologique de France, a été autorisé à publier un article de 12 pages dans notre Bulletin ; peut-être avait-il eu droit à cette faveur parce qu'à l'époque, la publication d'une telle communication aurait pu faire davantage scandale en Italie qu'en France, et compte tenu d'une réputation, sans doute excessive, des français à cette période ; dans son travail en effet il a longuement décrit et en des termes choisis (et, pour reprendre un néologisme, « glamours »), je cite : les phases érotiques de la reproduction des tritons et des Axolotls.

Quand la Société zoologique de France a organisé treize ans après sa fondation, en 1889, le premier Congrès International de Zoologie à l'initiative du directeur du Muséum National d'Histoire Naturelle de l'époque, Alphonse Milne-Edwards (qui fut le président d'honneur de ce congrès), les zoologistes italiens étaient représentés à Paris (sur un effectif total de 251 participants) par une délégation officielle de six personnes, presque toutes des universitaires : Capellini (Bologne), Doria (Gènes), Giglioti (Florence), Maggi (Pavie), Perroncito (Turin) et Trinchese (Naples), l'effectif total des zoologistes italiens regroupant 11 personnes, dont Gasco de Rome, Costa et Dohrn de Naples ; deux d'entre eux, Grassi et Perroncito, furent élus membres d'honneur du congrès. Toutefois, un seul d'entre eux, Magretti, présenta une communication lors de laquelle il fit part de son souhait de voir la communauté savante organiser un congrès international sur les Hyménoptères. Mais deux congressistes italiens seulement, Gulia et Magretti, étaient en séance le jour où fut réalisée la photographie officielle du congrès.

Lors du Congrès international de zoologie tenu du 21 au 27 août 1948 (après son annulation en 1940 en raison de la conjoncture internationale) à Paris, 33 chercheurs italiens se sont pré-inscrits, et 27 d'entre eux ont été effectivement présents: S. Ranzi (université de Milan) en a été l'un des 9 vice-présidents en hommage à son implication dans l'organisation du congrès de Padoue. Les autres participants présents ont été Amprino (Turin), d'Ancona (Padoue), Racci (Naples), de Caporiaco (Pavie), Cigada (Milan), Ciacco (Padoue), Colosi (Florence), Dohrn (Naples), Ghigi (Bologne), Gredelli (Trieste), Jucci (Pavie), Levi (Turin), Montalenti (Naples), Morritu (Pavie), de Nicola (Naples), Omodeo (Naples), Orlandi (Milan), Pasquini (Bologne), Pavan (Pavie), Ranzi (Milan), Rossi (Turin), Schreiber (Milan), Semenza (Milan), Tortonese (Turin), Trombetta (Milan), Valle (Bologne), Vitagliano (Naples). La délégation officielle était constituée de G. Levi (Academia Nazionale dei Lincei, Rome), P. Pasquini (université de Bologne), S. Ranzi (université de Milan), de Caporiaco (Pavie), V. d'Ancona (Padoue), C. Jussi (Pavie) et M. Benazzi (Pise). Ont prononcé des conférences plénières S. Ranzi (Protéines et développement embryonnaire), Montalenti (Sexualité des Crustacés et de Mollusques) A. M. Orlandi (Structure du noyau en réponse à différents facteurs, et différences génétiques chez les Crustacés). et E. d'Ancona (Intersexualité des

Téléostéens), B. Schreiber (Inductions), P Omodeo (Centres morphogénétiques), G. Levi (Anatomie et différentes corrélations dans le développement du système nerveux), E. Tortonese (affinités et position systématique de poissons), G. Ciaccio (inoculation de Rickettsia chez les Insectes). Les 6 pays les mieux représentés étaient, avec indication de leurs effectifs respectifs de participants, la France (282), la Grande-Bretagne (60), les USA (52), la Belgique (34), l'Italie (33), la Suisse (31).

Lors du troisième congrès international de Zoologie organisé à Paris du 25 au 29 août 2008, la participation italienne a été assez restreinte : 6 personnes sur un total de 530 inscrits. Giorgio Bernardi était membre du Comité scientifique et a présenté une communication, Piero Genovesi et Alessandro Minelli chacun une conférence plénière, Sergei Fokin un poster, les deux autres participants étant Lucio Bonato et Luis Neider. Dans l'intervalle, 25 zoologistes français et 20 italiens avaient participé au Congrès international de zoologie organisé à Athènes en l'an 2000.

Le congrès international de Zoologie de 1930 a été organisé par l'Union zoologique italienne du 21au 27 juillet à Padoue, et présidé par le professeur S. Ranzi. Il a réuni 560 participants. La délégation française, conduite par les professeurs Louis Berland et Paul Mathias, comportait 15 membres de la Société zoologique de France qui en étaient presque tous parmi les plus hautes personnalités : André, Berland, Caullery, Chatton, Dehorne, Fage, Gravier, Jeannel, Joubin, Mathias, Pellegrin, Pérez, Roule et Turchini. A cette époque, deux collègues italiens étaient membres de la Société zoologique de France, le comte Oddi degli Arrigoni, et Eduardo Ninni. L'année précédente, le président de la Société avait adressé à Pavie et au nom de la Société une lettre de condoléances lors du décès, à l'âge de 46 ans, d'Aldo Perroncito, fils de l'ancien président d'honneur Eduardo Perroncito.

Autres manifestations scientifiques conjointes

La liste de membres de la Société zoologique de France a été périodiquement publiée dans le Bulletin de la Société. Actuellement, nous ne comptons plus parmi nous qu'un seul adhérent italien, le professeur Alessandro Minelli de l'université de Pavie, qui est l'un de nos membres depuis 1981. Sans doute serait-il judicieux que nos deux associations recrutent l'une comme l'autre de nouveaux sociétaires des deux côtés de notre limite administrative commune, puisque la zoologie n'a pas, elle-même, de frontière, ce qui faciliterait les échanges de vues et les initiatives en commun en une période très difficile pour les disciplines naturalistes dans lesquelles nous exerçons et dans lesquelles nous nous sommes investis, souvent par choix affectif et avec passion.

En plus des relations individuelles et professionnelles, souvent avec le temps devenues amicales, qui se sont établies au fil des années de part et d'autre des Alpes entre les zoologistes français et italiens, les congrès internationaux nous ont permis de nous rencontrer et de mieux nous connaître.

La société zoologique de France a organisé à Paris trois congrès internationaux de zoologie (le premier en 1889, le treizième en 1948, le vingtième en 2008). Si aucun zoologiste italien n'a participé à la célébration du centenaire de la Société zoologique de France en 1976 à Paris, nous nous sommes retrouvés à nouveau quelques années plus tard, à l'occasion des premières Journées franco-italiennes de Zoologie organisées du 26 au 30 juin 1984 à l'université de Padoue par les professeurs Alessandro Minelli et Pietro Omodeo (ce dernier ayant peu après été muté à Rome), et lors desquelles nous avons découvert la beauté des magnifiques villas de la Riviera de la Brenta. Je voudrais à cette occasion rendre hommage à cet homme d'une vaste culture et d'une exceptionnelle affabilité qu'est Pietro Omodeo, avec lequel je suis resté longtemps en relation régulière depuis les Journées de Padoue, et qui m'avait fait l'honneur de me choisir en 1985 comme représentant de la Société zoologique de France au Comité éditorial du Bolletino di Zoologia, ; j'en ai ensuite été membre pendant une trentaine d'années, jusqu'au jour où fut décidé un renouvellement complet de ce Comité, qui était effectivement resté quasiment inchangé pendant un quart de siècle et qu'il était peut-être judicieux de rajeunir.

A ce congrès de Pavie, où la délégation française était constituée de plus d'une trentaine de personnes (accompagnants compris), ont notamment participé la plupart des grandes figures de la zoologie française et pour particulièrement parisienne de l'époque, parmi lesquelles les professeurs Beaumont, Delsol, Dreux, Exbrayat, François (dont la conférence a duré le double du temps qui lui avait été imparti), Génermont, Houillon, Lamotte, Laugé, Lutz, Meunier, Saint-Girons et Stephan, ainsi que Madame Tatusesco, secrétaire de la Société et quelques plus jeunes chercheurs (dont nous-même), ce qui témoigne de l'intérêt collectif qu'ils manifestaient pour cette première rencontre institutionnelle entre nos deux sociétés, pour son caractère exceptionnel et novateur, et pour les perspectives d'avenir qu'elle pouvait ouvrir. Plusieurs zoologistes français y ont présenté des communications: Durand, François, Grassé (absent et dont l'intervention a été présenté par son co-auteur Jean Vovelle), d'Hondt, Koechlin (2 interventions), Lallier, Lamotte, Meunier, Sire, Vovelle. Les membres français de la Société zoologique de France étaient alors beaucoup moins réticents qu'aujourd'hui à l'idée de se déplacer en dehors de leurs frontières nationales, et notre délégation était de ce fait plus nombreuse, tout en comptant un plus grand nombre de figures prestigieuses que celle de cette année.

La Société zoologique de France a proposé une quarantaine de fois à des chercheurs étrangers d'assurer la présidence d'honneur de ses congrès annuels. Cette fonction honorifique a en effet été confiée à 6 reprises à des universitaires italiens: Eduardo Perroncito (Turin), deux fois en 1902 et en 1912 à Paris, Giuseppe Montalenti (Rome et Naples) également deux fois : en 1970 au Mont-Dore et en 1984 à Padoue, Paolo Tongiorgi (Modène) en 1992 à Lyon et Maria Balsamo (Urbino) en 2015 à Bordeaux.

Conclusion

Les relations entre les zoologies française et italienne ont donc reposé à la fois sur des visites mutuelles, souvent très productives, et des relations de travail conjoncturelles ou permanentes, souvent devenues amicales par la suite, mais qu'il est impossible de quantifier puisque beaucoup d'entre elles relevaient d'initiatives individuelles. Elles ont également été fondées sur des relations plus formelles au niveau institutionnel mais plus épisodiques, avec envoi de délégations à des manifestations scientifiques nationales ou à des congrès internationaux organisées par l'une ou l'autre des deux associations représentatives des communautés zoologiques des deux pays concernés. Les langues de travail des deux communautés scientifiques ont une même origine, latine, et beaucoup de problématiques sont communes, un ensemble de facteurs sont donc favorables à de potentielles larges perspectives d'échanges constructifs.

Le premier congrès franco-italien de zoologie, à Padoue, avait permis à l'époque de nouer des liens de travail et conviviaux entre les zoologistes de nos deux pays ; mais cela remonte maintenant à 33 ans, presque à un tiers de siècle ; beaucoup des protagonistes de cette époque ont disparu depuis, et pas uniquement par suite d'un rajeunissement des cadres universitaires ; toutefois, bien des liens d'amitié noués à cette occasion, et faisant suite aux relations professionnelles qui s'étaient établies à cette période, demeurent toujours. Une nouvelle génération de zoologistes est apparue dans les pas de leurs anciens ; aussi sans seulement considérer le passé avec nostalgie, nous ne pouvons qu'espérer voir ces deuxièmes Journées franco-italiennes de zoologie, qui seront – espérons-le – suivies par d'autres dans l'avenir, s'avérer constructives pour le renforcement et le renouveau transfrontaliers d'une science indépendante des barrières nationales et politiques : la Zoologie, dans toute sa diversité mais aussi son unité, et qui nous rassemble tous ici aujourd'hui.

TELMO PIEVANI

(dietelmo.pievani@unipd.it)

PLASTICITA ED EXAPTATION: IL RUOLO EVOLUTIVO DELLA COOPTAZIONE FUNZIONALE

Symposium 1

Coordinators: Paolo Peretto – Mario Pestarino – Frédéric Levy
(paolo.peretto@unito.it - pesta@unige.it - frederic.levy@inra.fr)

Neural plasticity, comparative data and behavioral outputs

The symposium aims at enlighten recent comparative data related to neural plasticity in vertebrates *and invertebrate chordates, in neural development and* in the adult brain. We will describe how neural circuits in different animal species featured by specific anatomical, physiological *and evolutionary* characteristics (e.g., anosmia) adapt their function based on internal and external cues. In addition, we will try to correlate how adult neuroplasticity is related to cognitive behaviors and *specific developmental patterns*.

Plasticità neurale, dati comparativi ed output comportamentali

Il simposio intende illustrare recenti dati comparativi relativi alla plasticità neuronale nei vertebrati, in particolare nella neurogenesi adulta (per esempio la genesi e l'integrazione di nuovi neuroni in circuiti maturi). I partecipanti discuteranno come i circuiti neurali, in diverse specie animali, caratterizzati da specifiche peculiarità anatomiche e fisiologiche (ad esempio l'anosmia), adattino la loro funzione sulla base di segnali interni ed esterni. Inoltre si cercherà di correlare come la neuroplasticità dell'adulto sia legata ai comportamenti cognitivi.

Plasticité neurale, données comparatives et résultats comportementaux

Ce symposium vise à illustrer les récentes données comparatives liées à la plasticité neuronale des vertébrés, en particulier à la neurogénèse adulte (par exemple la genèse et l'intégration de nouveaux neurones dans les circuits matures). Il sera également analysé la corrélation entre la neuroplasticité des adultes et les comportements cognitifs. Les participants examineront, enfin, l'adaptation fonctionnelle des circuits neuronaux de diverses espèces animales, caractérisé par des singularités anatomiques et physiologiques (par exemple l'anosmie), sur la base des signaux internes et externes.

Communications

PETER M. NARINS

Departments of Integrative Biology & Physiology, and Ecology & Evolutionary Biology, UCLA, Los Angeles, CA, USA, 90095 pnarins@ucla.edu

ADVENTURES OF AN EXPEDITIONARY BIOLOGIST: NEUROETHOLOGY OF ULTRASONIC COMMUNICATION IN AMPHIBIANS

Animal communication occurs when a signal generated by one individual is transmitted through an appropriate channel and results in a behavioral change in a second individual. We have explored specific morphological, physiological and behavioral adaptations in a wide variety of taxa that appear to have evolved specifically to tailor and sculpt intraspecific communication systems. In this lecture, I will review one of these adaptational studies, that involves two distantly related organisms: the concave-eared torrent frog (*Odorrana tormota*), calling near fast-flowing mountain streams of Anhui Province, Southeastern China, and the endemic Bornean frog, *Huia cavitympanum*, living in a very similar riverine habitat in Sarawak, Malaysia. In addition to the high-pitched audible components, these species' calls contain previously unreported ultrasonic harmonics. Our studies of these two Asian frogs revealed that they communicate acoustically using ultrasound and that their auditory systems are sensitive up to 34-38 kHz. This extraordinary upward extension into the ultrasonic range of both the harmonic content of the advertisement calls and the frogs' hearing sensitivity is likely to have coevolved in response to the intense, predominately low-frequency ambient noise from local streams. (Supported by NSF Grant #1555734).

pnarins@ucla.edu

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MAINA BRUS, REBECA CORONA, MARYSE MEURISSE, MATTHIEU KELLER, FREDERIC LEVY

UMR INRA, CNRS/Universitè F. Rabelais, IFCE, Physiologie de la Reproduction et des Comportements, Nouzilly, France.

NEUROGENESIS IN ADULT SHEEP: CHARACTERIZATION AND CONTRIBUTION TO BEHAVIOR

Although adult neurogenesis is conserved in higher vertebrates like non-human primates and humans, the dynamics of their neuronal maturation appear to differ from rodents. Similarly, sheep possess a gyrencephalic brain, as large as macaque monkeys, and have a similar lifespan. By using a marker of cell division, bromodeoxyuridine (BrdU), in combination with several markers the maturation time of newborn cells in the dentate gyrus (DG) and the main olfactory bulb (MOB) was determined in sheep. Cell proliferation was found in the subventricular zone (SVZ), the MOB and the DG and a migratory stream was observed from the SVZ up to the MOB consisting of neuroblasts which formed chain-like structures. The first new mature neurons were observed at 1 month after BrdU injections in the DG and at 3 months in the MOB. Thus, the rate of neuronal maturation of adult-born cells is much slower than that of rodents but more resembles that of non-human primates. Sheep are able develop selective bonds with their conspecifics or with young, and adult olfactory neurogenesis could support this recognition. In the context of motherhood, we showed that early post-partum period was associated with a decrease in olfactory and hippocampal adult neurogenesis. In the MOB, this decrease was associated with lamb olfactory recognition whereas in the DG it was related to parturition. In addition, this olfactory learning increased the dendritic length of neuroblasts in the MOB, but not in the DG, suggesting an enhanced maturation of those new neurons involved in the learning of the lamb odor. To better understand the role of olfactory neurogenesis, we investigated whether in sheep mothers adult-born neurons contribute to the processing of odors involved in maternal behavior. Results showed that olfactory neuroblasts are preferentially activated by lamb exposure and that this preferential activation was specific to olfactory neurogenesis. Finally, disruption of neurogenesis using anti-mitotic (Ara-C) infusion into the SVZ was performed and its consequences on maternal behavior were assessed. Ara-C infusion led to a 70% reduction in olfactory neurogenesis, but spared hippocampal neurogenesis. The impairment of olfactory neurogenesis reduced maternal vocalisations at parturition and partly impaired recognition of the familiar lamb. These studies reveal the importance of studying the features of adult neurogenesis in models other than rodents, and highlight sheep as a valuable model to investigate neurogenesis and its function.

frederic.levy@inra.fr

NATHALIE MANDAIRON[1], NICOLA KUCZEWSKI[1], FLORENCE KERMEN[1], JEREMY FOREST[1], MAELLIE MIDROIT[1], MARION RICHARD[1], JOELLE SACQUET[1], CHRISTIANE LINSTER[2], ANNE DIDIER[1]

1 CNRS, UMR 5292; INSERM, U1028; Lyon Neuroscience Research Center, Neuroplasticity and neuropathology of olfactory perception Team, University Lyon1, Villeurbanne, F-69000, France
2 Computational Physiology Lab, Neurobiology and Behavior, Cornell University, Ithaca, NY 13068

OPPOSITE REGULATION OF INHIBITION BY ADULT-BORN GRANULE CELLS IN RESPONSE TO IMPLICIT VERUS EXPLICIT OLFACTORY LEARNING

Brain representations of the environment constantly evolve through learning mediated by different plasticity mechanisms. Several lines of evidence suggested that adult neurogenesis is a plasticity mechanism mediating changes in representations of sensory information. In the olfactory system, both passive (implicit perceptual learning in response to repeated exposure) and active (explicit associative learning in response to reinforcement) learning can improve discrimination between similar odorants. This is thought to occur through the integration of adult-born inhibitory interneurons and their effect on pattern separation for overlapping odorants. Here, we identify a novel and unexpected mechanism. Specifically, while both passive and active learning processes similarly augment neurogenesis, adult-born cells differ in their morphology, functional coupling and the process by which they achieve pattern separation. Morphological analysis, optogenetic stimulation of adult-born neurons and mitral cell recordings, revealed that adult-born neurons were able to enhance inhibitory action as expected for inhibitory neurons after passive learning, but also surprisingly to decrease inhibitory action after active learning through enhanced or reduced connectivity respectively. Data suggest that improvement in discrimination occurs through increasing sparseness of olfactory output thus reducing overlap of odorant representation in passive learning or decreasing sparseness and thus strengthening odorant representation in active learning.

nathalie.mandairon@cnrs.fr

CHIARA LA ROSA[1,2], ALESSANDRA PECORA[1], IRMGARD AMREIN[3], FREDERIC LEVY[4], LUCA BONFANTI [1,2]

1 Neuroscience Institute Cavalieri Ottolenghi (NICO), Orbassano, Italy;
2 Department of Veterinary Sciences, University of Turin, Torino, Italy;
3 Division of Functional Neuroanatomy, Institute of Anatomy, University of Zürich, Zürich, Switzerland;
4 UMR INRA, CNRS/Universitè F. Rabelais, IFCE Physiologie de la Reproduction et des Comportements, Nouzilly, France.

NEUROGENIC VERSUS NON-NEUROGENIC PLASTICITY IN MAMMALS

Brain structural plasticity, including neurogenic and non-neurogenic processes, is an exception to the genetically-determined structure of the nervous system, essential for adaptation to the changing environment and potentially useful for brain repair. Adult neurogenesis substantially decreases in large-brained, long-living species, such as humans and dolphins (SANAI e al., 2011; PAROLISI et al., 2017), and does not provide reparative outcomes. Some brain regions host non-newly generated, immature cells, which express Doublecortin (DCX; a cytoskeletal protein, marker of structural plasticity) and appear to vary in mammals (BONFANTI and NACHER, 2012). Current knowledge about these cells is largely incomplete, most studies referring to small-brained, short-living species. Since laboratory rodents host these cells only in the paleocortex, non-neurogenic plastic events might be higher in large-brained, long-living mammals with reduced neurogenic plasticity.
The aim of this study is to systematically assess the occurrence and features of such "parenchymal plasticity" in 14 mammalian species (belonging to the orders carnivora, primates, chiroptera, macroscelidae, lagomorpha, perissodactyla and artiodactyla) endowed with different neuroanatomy, brain size, lifespan, ecological niche. Preliminary results indicate remarkable presence of DCX+ cell populations in all species analyzed with respect to laboratory rodents. Extra-cortical regions, including white matter tracts, amygdala, claustrum, are also involved. Carnivora host DCX+ cells in more brain areas with respect to other species. These cells can have different morphologies (e.g., bipolar, multipolar) and spatial organization (isolated cells, clusters). The linear density of DCX+ cells in the cortical layer II highly varies, with a 20-fold range from bats to cats. The proliferation of DCX+ cells was evaluated using Ki-67 antigen and never found to occur. In sheep, the prenatal genesis of the parenchymal DCX+ cells was assessed after BrdU treatment. Hence, non-neurogenic structural plasticity appears to be highly heterogeneous in mammals, in terms of neuroanatomical location, amount, cell morphology and spatial organization. Further analyses might clarify the possible link between structural plasticity and species-specific factors (neuroanatomy, lifespan, ecological niche, food habits), as well as the possible occurrence (or not) of a phylogenetic trend.

luca.bonfanti@unito.it

GIANLUCA POLESE[1], VALERIA MASELLI[1], LEONID L. MOROZ[2], ANNA DI COSMO[1]

1 Dipartimento di Biologia, via Cinthia ed. 7, Campus Monte Sant'Angelo, 80126 Napoli, Italy
2 The Whitney Laboratory for Marine Bioscience, University of Florida, 9505 Ocean Shore Blvd, St Augustine, FL 32080, USA

HOW PROBLEM SOLVING CHANGES AFFECT ADULT NEUROGENESYS IN *OCTOPUS VULGARIS*

Octopus vulgaris has a complex and centralized nervous system, located around oesophagus, with a hierarchical organization. It is considered the most intelligent invertebrate due to its advanced cognitive capability, as learning and memory, and complex behaviour that results in an enormous capability of problem solving. "Problem solving" is the capability to use cognitive processing to find a solution to a problematic situation. Several behavioural experiments show that octopus has this kind of skill (FINN *et al*., 2009). Neural plasticity and synaptic remodelling are the base of adult neurogenesis that occur in organisms that have complex and centralized nervous system, as teleosts, amphibians, reptiles, birds and mammals, and among invertebrates, decapods and insects. Recently, our group demonstrated its occurrence also in *O. vulgaris* brain, resulting the first demonstration across Lophotrochozoa clade.

The experimental data have been obtained by problem solving behavioural experiments and the evaluation of the Oct-Pax6 expression. Pax6 gene is known as neurogenic marker during cephalopod brain development (NAVET *et al*., 2017). Specimens of *O. vulgaris* were divided into two experimental groups: challenged and control. After the acclimatization period, the standard housing condition was altered adding jars containing food providing a cognitive challenge. During experimental days, octopuses had not feeding opportunities except to open the jars to reach the food. Control animals were not challenged and they were fed regularly without any task. At last, challenged and control octopuses were scarified as described in POLESE *et al*. (2014) and their brains were dissected out to be processed for RNA extraction with Trizol. cDNA obtained was used to evaluate the amount of Oct-Pax6 through a semi-quantitative PCR, using β-tubulin as normalizer. PCR products were analysed on 2% agarose gel at the Bio-Rad ChemiDoc, and quantified using ImageJ.

Our data show that octopuses challenged with problem solving tasks vs. unchallenged animals result in up-regulation of Oct-Pax6 in areas of the brain previously described as sites of adult neurogenesis (BERTAPELLE *et al*., 2017).

In conclusion, these results support that intellectual, physical and sensory challenges increase neural plasticity and synaptic remodelling through adult neurogenesis.

gianluca.polese@unina.it

SARA FERRANDO[1], LORENZO GALLUS1, ANDREA AMAROLI[1,2], MARINO ROTTIGNI[1], DAVIDE DI BLASI[3], MARINO VACCHI[3]

1 DISTAV, Università di Genova, Corso Europa 26, 16132, Genova
2 DISC, Università di Genova, Largo Rosanna Benzi 8, 16132, Genova
3 ISMAR, CNR, Via de Marini 6, 16149, Genova

THE OLFACTORY SYSTEM OF CHONDRICHTHYES: MAY ANATOMY PREDITCT FUNCTION?

The olfactory system of Chondrichthyes, as that of all vertebrates, is constituted by a peripheral organ and by an olfactory bulb (OB), which receives the afferent axons. The morphology of the peripheral organ and OB, their surface and volume, have been taken in account as proxies for the olfactory capability. However, there is not a general agreement on how morphological parameters should be considered in fish, nor in vertebrates at all. Although the integration of molecular, behavioral, and electrophysiological data is needed for a complete understanding of the olfactory biology of a species, a valid correlation between morphological parameters and olfactory capability would present several practical advantages and, definitely, would contribute to clarify the relationship between form and function in this system. In this frame, we collected anatomical observations from the olfactory organs and OB of several chondrichthyan species, comparing them with the literature, attempting a first, wide range, analysis of anatomical parameters in the light of ecology and phylogeny. Moreover we considered further parameters, usually overlooked in the literature, such as the actual sensory surface area (SSA) and the number of neurons in the OB. It is noteworthy that all Chondrichthyes present secondary olfactory lamellae (SOL) on the primary ones, which greatly increase the SSA. The shape and size of SOL are very variable among species; they have been always overlooked in works when the SSA was evaluated and compared among species (e.g. KAJIURA *et al.*, 2005; SCHLUESSEL *et al.*, 2008). Regarding the OB, usually the volume has been considered in fish as a good proxy of olfactory sensitivity (e.g. YOPAK *et al.*, 2015), but recent studies in mammals suggest that the number of neuron in the OB is not strictly correlated to the bulb volume and it could also be a more reliable proxy of olfactory importance in a given species (MCGANN, 2017). Thus, we evaluated, for the first time in fish and particularly in Chondrichthyes, the number of neurons in the OB. From our results, we suggest that phylogeny should be always considered when comparing olfactory system morphology among different species attempting to correlate anatomy and olfactory capability. Moreover, the typical anatomical proxies for olfactory capability in Chondrichthyes should be used with caution and often reconsidered in the light of a more deep understanding of olfactory biology.

sara131274@gmail.com

SIMONA CANDIANI[1], ELISABETH. ZIEGER[2],
MICHAEL SCHUBERT[2], MARIO PESTARINO[1]

1 Dipartimento di Scienze della Terra, dell'Ambiente e della Vita, Università di Genova,
viale Benedetto XV -5 16132 Genova, Italy
2 Sorbonne Universités, UPMC Université Paris 06, CNRS, Laboratoire de Biologie du Développement de Villefranche-sur-Mer, Observatoire Océanologique de Villefranche-sur-Mer,
181 Chemin du Lazaret, 06230 Villefranche-sur-Mer, France

THE RETINOIC ACID SIGNALING REGULATES NEUROTRANSMITTER IDENTITY IN THE AMPHIOXUS *BRANCHIOSTOMA LANCEOLATUM*

In vertebrates, RA signaling contributes to the patterning of the developing nervous system and to the neural progenitor differentiation by modulating the expression of *Hox* genes and other transcription factors. The role of RA signaling in establishing distinct neural cell populations is still poorly understood and the available data are limited to only a few regions of the vertebrate nervous system. Little is known, however, about how different neural cell types become specified in amphioxus. Our previous data showed that the cholinergic and GABAergic/glycinergic neurons are segmentally arranged in the hindbrain; as well as serotonergic, glutamatergic and dopaminergic neurons are restricted to specific regions of the cerebral vesicle and/or hindbrain (CANDIANI et al., 2012; LACALLI and CANDIANI, 2017). The present study demonstrates that RA signaling establishes discrete boundaries along the anterior-posterior axis of amphioxus embryos in order to restrict the formation of different neural cell populations to specific territories. We hypothesize that in this process *AmphiHox3* is involved in the establishment of the segmental organization of GABA cells in the CNS and Amphi*Hox1* for the dopamine cluster formation in the ectoderm. Both *Hox* genes are direct targets of RA signaling in amphioxus (KOOP et al., 2010) and we show that their expression limits correlate with the boundaries of the respective neural cell populations. Moreover, the analysis of the swimming behavior of amphioxus larvae reveal that the RA-dependent patterning of GABAergic neurons in the hindbrain is crucial for the acquisition of locomotory control in amphioxus larvae. Then, our data point out that amphioxus represents an excellent model for understanding the role of the RA signaling pathway in patterning along the anterior/posterior axis in chordates nerve cord.

candiani@unige.it

ADA MARIA TATA

Department of Biology and Biotechnologies Charles Darwin, Sapienza-University of Rome

ACETYLCHOLINE IN NERVOUS SYSTEM DEVELOPMENT: NEW ROLES FOR AN ANCIENT NEUROTRANSMITTER

Considerable progress has been obtained in understanding the processes that control the development of the nervous system. Notable advances have been mainly generated by molecular biological approaches, which revealed several key aspects of neural development, including the determination of cell identities, target reaching, and synaptogenesis (Francis and Landis 1999, Hatten 1999). Many genes and molecules have been related to specific developmental processes. Among the studied developmentally-related molecules are the neurotransmitters. This unsuspected role of the neurotransmitters has been revealed and in different animal models by experiments using *in vitro* preparations of several neuronal tissues, that demonstrates as neurotransmitters such as serotonin, dopamine, glutamate and acetylcholine were able to promote neurons and glial cells proliferation and differentiation. The morphogenetic roles of neurotransmitters in nervous system development emerged from the evidence that neurotransmitter synthesis as well as neurotransmitter receptor expression are activated in early phase of neurogenesis before the formation of synaptic contacts. Acetylcholine (ACh) and its receptors of muscarinic and nicotinic types are involved in the regulation of several processes such as neural stem cells proliferation, survival and differentiation, neurite outgrowth modulation and in the synapsis formation. The central role played by ACh in nervous system has been confirmed by the evidence that the dysregulated cholinergic activity can largely contribute to neurodevelopmental and neurodegenerative disorders. Cholinergic receptors are largely expressed also in glia cells, supporting the idea that glial cells are colinoceptive. ACh can mediate axon-glia cross talk, regulating the myelinating glia cell development and function both in central and peripheral nervous system. As demonstrated by *in vitro* studies using primary sensory neurons, the ACh can be released in extra-synaptic regions (Corsetti et al, 2012) and directly communicate with glial cells influencing proliferation and differentiation both of the oligodendrocytes and Schwann cell (De Angelis et al, 2012; Loreti et al, 2007; Uggenti et al, 2014). During mice post natal development, the ACh is required to guide the correct organization of the myelin around the axons and, in the adult, may also partecipate to axonal regenerative processes as demonstrated in rat peripheral nervous system.

adamaria.tata@uniroma1.it

ANDREA MESSINA[1], MARIA ELENA CASTELLINI[1], ALESSANDRA SPECCHER[1], XUWEN ZHANG[1], SIMONA CASAROSA[1,2]

1 CIBIO, Università di Trento
2 Istituto di Neuroscienze, CNR, Pisa

ROLE OF EXTRACELLULAR MATRIX PROTEINS IN RETINAL DEGENERATIONS

The Interphotoreceptor matrix (IPM) is the extracellular matrix localized between photoreceptors outer segments and retinal pigmented epithelium (RPE). It is thought to play a role in the communication of photoreceptors with the RPE, and as such, in their function. The IPM consists of proteins (opsin, the alpha-subunit of transducin, interphotoreceptor retinoid-binding protein, and others), carbohydrates and proteoglycans. This composition may suggest multiple functions, such as intercellular communication, cell survival, membrane turnover, photoreceptor function and retinoid transport. Data suggests that alterations in IPM could be correlated to different retinal diseases, such as Retinitis Pigmentosa (RP). Despite this, little is known about the role of the IPM in retinal formation and function. Recently, mutations in IMPG2, a proteoglycan unique to the vertebrate IPM, have been suggested to be the cause of a new form of autosomal recessive RP. Six different nonsense point mutations affect IMPG2 function, with five of them producing a truncated IMPG2 protein. Affected patients present an altered rod-cone pattern and a reduced or deleted ERG response, demonstrating loss of vision. Until now, no animal models are available to study IMPG2-related retinopathies. Moreover, the possible role of IMPG2 in vertebrate retinal development and function, and how a truncated IMPG2 could lead to RP degeneration is not yet known. Genetically modified zebrafish lines represent a powerful tool to study human neurodegenerative diseases and to identify candidates for novel therapeutic approaches. We have started to study IMPG2 role during zebrafish retinal development and function by abolishing its function both by morpholino antisense oligonucleotide microinjection and by CRISPR/Cas9 genome editing. Preliminary results show a disruption in expression and localization of proteins involved in the phototransduction cascade, and a reduced pigmentation of the eye. This new animal model will allow us to study the role of extracellular matrix proteins such as IMPG2 in retinal development and function, and may open the way to large-scale testing of new therapeutic compounds.

simona.casarosa@unitn.it

ERIKA COTTONE[1], ILARIA D'ATRI[1,2], GIULIA ZUCCARINI[1], VALENTINA POMATTO[1], YOAV GOTHILF[3], GIORGIO MERLO[4], PATRIZIA BOVOLIN[1]

1 Dept. Life Science and Systems Biology, University of Torino, Italy
2 University of Exeter Medical School, Exeter, UK
3 Dept. Neurobiology, George S. Wise Faculty of Life Sciences, Tel-Aviv University, Israel
4 Dept. Molecular Biotechnology and Health Sciences, University of Torino, Italy

INTERFERENCE WITH THE CANNABINOID RECEPTOR CB1 INDUCES MISWIRING OF GNRH AXONS IN ZEBRAFISH (*DANIO RERIO)* EMBRYOS

The endocannabinoid (eCB) system, named from the plant *Cannabis sativa*, comprises cannabinoid receptors (CB), endogenous lipid ligands such as 2-arachidonoyl glycerol (2-AG) and n-arachidonoyl ethanolamine (AEA or anandamide), and enzymes involved in synthesis and degradation of these ligands. Whereas CB receptors are unique to Chordates, enzymes for eCB synthesis and degradation occur throughout the animal kingdom and several eCB-like lipids have been identified in plants.
CB1 receptors are the most abundant eCB receptors in Vertebrates and are widely expressed in the brain. CB1-mediated signaling regulates various aspects of adult plasticity and brain development, including wiring of neuronal connections. In the zebrafish embryo, previous data showed that CB1 knockdown causes defects in anterior commissure formation. Since this axonal system contains Gonadotropin Releasing Hormone (GnRH) fibers, we investigated whether pharmacologic modulation of the CB1 receptor could modify GnRH axonal pathfinding and fasciculation in zebrafish embryos. We treated transgenic GnRH3::GFP zebrafish embryos with various CB1 antagonists from 0 to 72 hours post-fertilization (hpf) and analyzed several parameters such as survival, hatching time and morphology. We also performed morpholino-mediated CB1 knockdown and monitored the expression levels of key genes potentially involved in CB1-mediated effects by Real-Time RT-PCR. CB1 antagonist treatment produced a reduction in GnRH neuropil extension and axon misrouting in the anterior commissure. Morpholino-mediated downregulation of CB1 expression reduced the number of GnRH3::GFP positive cells in the olfactory placode while not changing their position. Finally, we observed that CB1 knockdown downregulates the expression of two genes involved in axonal growth and cell migration, namely Stmn2a/b and Sez6a/b.
Taken together these results indicate that during early zebrafish development, CB1 acts as a regulator of axonal pathfinding of GnRH neurons. Future experiments will elucidate if the CB1 miss-regulation also affects GnRH neuron migration from the olfactory placode to the hypothalamus and whether other neuronal systems are affected.

patrizia.bovolin@unito.it

GIULIANO GRIGNASCHI

IRCCS Istituto di Ricerche Farmacologiche Mario Negri, Via La Masa, 19 - 20156 Milano, Italy

RESEARCH4LIFE, LA PRIMA ESPERIENZA ITALIANA DI SCIENCE ADVOCACY

Sebbene sia il frutto di molti anni di collaborazione tra il mondo della ricerca e le associazioni animaliste, l'emanazione della Direttiva Europea 63/2010 "on the protection of animal used for scientific purposes" e stata fin da subito oggetto di forti contestazioni soprattutto in Italia. Il mondo che si definisce animalista ha infatti inizato a premere per la completa abolizione della sperimentazione animale e con l'iniziativa popolare "stop vivisection" ha raccolto in tutta europa circa 1.200.000 firme su un testo che chiedeva all'Europa di vietare l'utilizzo di animali in ricerca. Circa il 70% delle firme raccolte in tutta Europa erano italiane, mostrando con estrema chiarezza quanto poca conoscenza ci sia in Italia su questo argomento. È stato a quel punto che la comunità scientifica ha finalmente aperto gli occhi su questo tema e ha deciso di organizzarsi per sostenere le ragioni della ricerca biomedica facendo attività di divulgazione a tutti i livelli tramite la creazione di Research4life, una piattaforma multistakeholder di cui fanno parte associazioni di pazienti, federazioni di medici, centri di ricerca pubblici e privati e associazioni scientifiche. Nei primi due anni di attività la piattaforma è diventata un punto di riferimento per chi cerca informazioni attendibili sulla sperimentazione animale, grazie anche alla collaborazione con numerose realtà analoghe attive su tutto il territorio europeo.

giuliano.grignaschi@marionegri.it

Round table 1

International tools and networks for supporting the sustainable development of academic teaching and research

CRISTINA GIACOMA

Department of Life Sciences and Systems Biology (DBIOS), University of Torino, Italy

STRUMENTI A SUPPORTO DELLO SVILUPPO SOSTENIBILE DELLA COOPERAZIONE IN RICERCA E DIDATTICA

Numerose sono state e sono tuttora le sinergie tra mondo scientifico francese, direi francofono in generale, e quello italiano a partire dal 1700. Alcune di queste, come l'Università Italo-Francese con sede a Torino, costituiscono un esempio di collaborazione bilaterale tra sistemi accademici, mentre numerose altre sono le collaborazioni attive tra singole sedi universitarie.

Il rafforzamento dell'accesso allo spazio europeo dell'istruzione superiore e della ricerca e il coinvolgimento di reti presenti in altre aree geografiche, rappresentano anche per il futuro, una priorità strategica del sistema universitario italiano ed Europeo. Una importantissima richiesta di formazione origina dal continente africano, incluso i paesi Nordafricani che si affacciano sul Mediterraneo. Molte Università di questa area sono membri dell'*Agence Universitaire de la Francophonie* (AUF), una importantissima rete che include le sedi italiane di Torino, Aosta e Napoli Federico II.

Nonostante che il rafforzamento della cooperazione internazionale sia un obiettivo prioritario a livello di politica universitaria, aumentano le difficoltà nel trovare risorse per sviluppare nuove collaborazioni e rafforzare quelli esistenti. Questa tavola rotonda ha l'obiettivo di diffondere la conoscenza di strumenti che possono essere utilizzati a sostegno delle iniziative internazionali negli ambiti di interesse dei biologi che partecipano al convegno congiunto, grazie al contributo di Ciprian Mihali, direttore regionale dell'AUF e dei referenti dell'Università Italo-Francese UIF, oltre che dei colleghi che da anni sono coinvolti nella programmazione e nella gestione di programmi internazionali.

cristina.giacoma@unito.it

Symposium 2

Coordinators: Raja Ben Ahmed - Sandro Tripepi - Marzio Zapparoli

(raja_benahmed@yahoo.fr - sandro.tripepi@unical.it - zapparol@unitus.it)

Biodiversity conservation, extinction and sustainable development

Maintain natural resources for the next generations is the main goal of sustainable development, intended on the basis of ecosystems protection, economic growth and social equity, both at global and local levels. Biodiversity conservation is strictly related to this aim but extinction of species and habitats loss are increasing threats to this link. In this symposium will be discussed some of the main aspects and latest advances, strategies, and policies of the conservation at population, species and community levels, with particular reference to European and Mediterranean basin fauna.

La conservazione della biodiversità, l'estinzione e lo sviluppo sostenibile

Mantenere le risorse naturali per le generazioni future è l'obiettivo principale di uno sviluppo sostenibile, previsto sulla base della protezione degli ecosistemi, la crescita economica e l'equità sociale, sia a livello globale che locale. La conservazione della biodiversità è strettamente correlata a questi scopi, ma l'estinzione di specie e di habitat stanno invece aumentando le minacce per il raggiungimento di tali obiettivi. In questo simposio saranno discussi alcuni degli aspetti principali ed i più recenti progressi, le strategie e le politiche di conservazione delle specie sia a livello di popolazioni che a livello di comunità, con particolare riferimento alla fauna europea e del bacino mediterraneo.

Conservation de la biodiversité, extinction et développement durable

L'objectif principal du développement durable est la préservation des ressources naturelles pour les générations futures, estimés sur la base de la protection des écosystèmes, la croissance économique et l'équité sociale, au niveau mondial et local. La conservation de la biodiversité est étroitement liée à ces fins, mais l'extinction des espèces et des habitats sont augmentent les menaces à la réalisation de ces objectifs. Dans ce symposium les participants discuteront des principaux aspects et des dernières avancées, des stratégies de conservation des espèces et des politiques au niveau de la population et au niveau communautaire, avec une référence particulière à la faune européenne et du bassin méditerranéen.

Communications

FRANCESCO SANTINI

Associazione Italiana per lo Studio della Biodiversità, Grosseto

THE MACROEVOLUTION OF BIODIVERSITY DYNAMICS: WHAT DEEP-TIME AND PHYLOGENETIC COMPARATIVE APPROACHES HAVE THOUGHT US ABOUT THE GENERATION AND EXTINCTION OF BIOLOGICAL DIVERSITY

Biological diversity is not evenly distributed across taxa, habitats or geographic regions, and ever since Darwin and Wallace biologists have struggled to explain such patterns. Thanks to a series of advances in both empirical methods of data generation (e.g., next-gen sequencing methods; online databases) as well as the development of theoretical frameworks for data interpretation and analyses (e.g, phylogenetic comparative approaches), the past two decades have seen giant leaps in our understanding of how some organismal groups come to be so much more diverse than their close relatives (i.e., teleost fishes vs. non-teleost ray-finned fishes) or certain types of habitats host much greater numbers of species (i.e., coral reefs vs non-reef marine habitats). Understanding the dynamics of biological diversity through deep-time (how lineages originate, persist, and eventually go extinct) is paramount in order to attempt to formulate conservation strategies that can preserve the evolutionary potential of taxa. Drawing from my work on the evolution of coral-reef fish groups - such as pufferfishes and allies, jacks, or surgeonfishes - I will show how phylogenetic comparative methods as well as the integration of both neo- and paleobiological data can be used to investigate the macroevolutionary aspect of biodiversity dynamics. This type of comparative and integrative approaches have the power to answer fundamental questions, such as why did some fish groups survive relatively unscathed the end-Cretaceous mass extinctions while some of their close relatives were wiped away; or why do some clades undergo massive radiations when shifting habitat, while some of their close relatives can repeatedly invade the same type of habitat but experience no diversification.

francesco.santini@alumni.utoronto.ca

HOURIA BOUAZIZ-YAHIATENE, FERROUDJA MEDJDOUB-BENSAAD

1, 2 Laboratoire de production, sauvegarde des espèces menacées et des récoltes. Faculté des sciences biologiques et des sciences agronomiques. Université Mouloud Mammeri de Tizi-Ouzou

DIVERSITE DES HELICIDAE DANS LA REGION DU DJURDJURA (TIZI-OUZOU, ALGERIE)

L'objectif de notre travail est d'étudier la biodiversité des Helicidae (gastéropodes terrestres) au niveau de cinq stations suivant un transect altitudinal dans la région du Djurdjura (36°20° Nord, 36°0° Est et 4°35° Ouest). L'échantillonnage s'est effectué à vue, en temps doux et humide alors qu'en période chaude et sèche, les escargots sont prospectés dans les microclimats humides qui leur servent d'abri. Cette étude malacologique réalisée entre Septembre 2014 à Août 2015, a mis en évidence la présence de huit espèces/sousespèces dont *Cornu aspersa maxima*, *Cornu aspersa aspersa*, *Cantareus apertus*, *Eobania vermiculata* et *Theba pisana* rencontrées au niveau de toutes les altitudes. *Otala punctata* omniprésente en plaine exposée au soleil et *Cantareus subapertus* rencontrée en altitude creusant son nid dans les roches des montagnes. Alors que *Eobania constantina* est une espèce accésoire présente dans les stations rocheuses très riches en calcaires.

houria.bouaziz@gmail.com

RALUCA VODA[1], LEONARDO DAPPORTO[2,3], ALESSANDRO CINI[3], MATTIA MENCHETTI[2,3], SIMONA BONELLI[1], LUCA PIETRO CASACCI[1], VLAD DINCA[1,4], STEFANO SCALERCIO[5], JOAN CARLES HINOJOSA[2], HEINRICH BIERMANN[6], LEONARDO FORBICIONI[7], UMBERTO MAZZANTINI[8], LUCIA VENTURI[9], FRANCA ZANICHELLI[10], EMILIO BALLETTO[1], TIM SHREEVE[11], ROGER L.H. DENNIS[11,12], ROGER VILA[2]

1 Dipartimento di Scienze della Vita e Biologia dei Sistemi, Università degli Studi di Torino, Via Accademia Albertina 13, 10123, Turin, Italy
2 Institut de Biologia Evolutiva (CSIC-Universitat Pompeu Fabra), Passeig Marítim de la Barceloneta 37, 08003, Barcelona, Spain
3 Dipartimento di Biologia, Università degli Studi di Firenze, Via Madonna del Piano 6, 50109, Sesto Fiorentino, Florence, Italy
4 Centre for Biodiversity Genomics, Biodiversity Institute of Ontario, University of Guelph, Guelph, Ontario, N1G2W1, Canada
5 Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, Unità di Ricerca per la Selvicoltura in Ambiente Mediterraneo, Contrada Li Rocchi, 87036 Rende, Italy
6 Markusstrasse, 17D-33014 Bad Driburg, Germany
7 Via Roma 6, 57037, Portoferraio, Italy
8 Legambiente Arcipelago Toscano, 57037, Portoferraio, Italy
9 Parco Regionale della Maremma, via del Bersagliere 7/9, 58100, Alberese (GR), Italy
10 Parco Nazionale Arcipelago Toscano, località Enfola, 57037, Portoferraio, Italy
11 Centre for Ecology, Environment and Conservation, Department of Biological and Medical Sciences, Oxford Brookes University, Headington, Oxford OX3 0BP, UK
12 Institute for Environment, Sustainability and Regeneration, Staffordshire University, College Road, Stoke-on-Trent ST4 2DE, UK

EVOLUTION AND EXTINCTION PATTERNS OF THE TUSCAN ARCHIPELAGO BUTTERFLIES

We describe fine-scale diversity patterns of the entire butterfly fauna occurring on the Tuscan Archipelago. By assessing the traits associated with population diversification, haplotype uniqueness and extinction, we aim to identify the factors determining the origin and maintenance of genetic diversity, and population vulnerability to environmental changes. We built a mtDNA dataset (1303 COI sequences) for the 52 butterfly species reported in the Tuscan Archipelago, also including specimens from neighbouring areas (Corsica, Sardinia and the region of Tuscany), and compiled data on 12 species traits and on the apparent extinction of species from the main islands. We calculated indices that measure genetic differentiation, and using phylogenetic regressions we evaluated the relationships between these indices and species traits. Finally, we inferred which traits are associated with disappearance of species on individual islands using phylogenetic regression. The overall spatial pattern of genetic diversity corresponded with the proximity of the areas, but strong contrasts were also identified between geographically close areas. Together with the island endemics, several common and widespread species had a high genetic diversification among islands and mainland. Phylogenetic regressions revealed that smaller-sized, more specialized species, with a preference for drier regions, displayed greater genetic structure and/or haplotype uniqueness. Species that disappeared from islands had a higher population diversification. Capraia has experienced a notable loss of diversity, which significantly affected species with shorter flight periods. Tuscan island butterflies are characterized by strong genetic contrasts and species differ in their contribution to the overall genetic diversity. By ranking the species for their contribution to genetic diversity and identifying the traits linked to the emergence and maintenance of diversity, we have developed a valuable tool for prioritizing populations as targets for monitoring and conservation action. The dataset constructed also represents a valuable resource for testing biogeographical hypotheses.

raluvoda@gmail.com

FRANCO ANDREONE[1], ROBERTA PALA[1], GIULIA TESSA[1],
SILVIA VALENTI[2], PAOLA NICOLOSI[2]

1 Museo Regionale di Scienze Naturali, Via G. Giolitti, 36, I-10123 Torino, Italie.
2 Museo di Zoologia, Università degli Studi di Padova, Via Jappelli, 1, I-35131 Padova, Italie

LES AMPHIBIENS ET LES REPTILES ETEINTS ET EN VUE D'EXTINCTION DANS LES MUSEUMS ITALIENS D'HISTOIRE NATURELLE

Les collections d'histoire naturelle, en particulier celles de zoologie, représentent des grands réservoirs d'informations sur la biodiversité mondiale. Elles peuvent inclure aussi d'habitude des espèces rares et menacées selon les concepts de l'UICN, tandis que des espèces éteintes. Dans le cadre du projet ACPR14T4_00237 financé par la loi 6/2000 du MIUR, et intitulé *Extinctions. Une exposition, une base des données génétiques et recherche sur les collections de vertebres menacés et éteints dans les musées italiens d'histoire naturelle* (coordonné par l'Université de Padoue, avec le Museo Regionale di Scienze Naturali de Turin, le MUSE Museo delle Scienze de Trento et le laboratoire FEM2 Ambiente de Milan), nous avons conduit une analyse sur la consistance des collections herpétologiques italiennes, avec attention spéciale pour les espèces menacées (CR, EN, VU) et éteintes (EX). Ce travail a été conduit avec consultation directe/informatisée des bases de données. En total nous avons obtenu des réponses positives de la part de 30 muséums et autres institutions (voir en detail le lien bit.ly/2tHSKPQ). Le nombre d'espèces a été totalement de 1039 amphibiens et 2121 reptiles. Les collections avec le nombre plus élevé d'espèces ont été celles du Museo Civico «G. Doria» de Gênes, du Museo di Storia Naturale de l'Université de Florence et du Museo Regionale di Scienze Naturali de Turin. En total, 4 espèces d'amphibiens résultaient éteintes: *Atelopus longirostris* (muséum de Florence), *Pseudophilautus leucorhinus* (muséum de Gênes), *P. nasutus* (muséum de Turin); et *P. variabilis* (muséums de Gênes et de Pise); 1 espèce de reptile (0.05%): *Chioninia coctei* (muséum de Gênes, Florence, Turin, Treviso et Palermo). Pour les amphibiens, 2.9% des espèces on été classifiées CR, 7.9% EN et 9.3% VU; pour les reptiles 1.3% des espèces ont été classifiées CR, 1.3% EN and 4.3% VU. Bien que un certain nombre d'individus doivent être confirmés pour leur attribution spécifique, la mise a disposition de ces collections représente un premier et important pas pour l'activation d'un réseau de connaissance partagée, nécessaire a notre avis pour garantir une adéquate valorisation des muséums d'histoire naturelle.

franco.andreone@regione.piemonte.it

DINO BIANCOLINI[1], TIM BLACKBURN[2], PIERO VISCONTI[2],
CÉLINE BELLARD[2], CARLO RONDININI[1]

1 Global Mammal Assessment program, Dip. Biologia e Biotecnologie "C. Darwin", Sapienza University of Rome
2 Department of Genetics, Evolution and Environment, Centre for Biodiversity and Environment Research, University College London

INTRODUCED MAMMALS OF THE WORLD: PREDICTING THEIR DISTRIBUTION UNDER GLOBAL CHANGE

Allochthonous species introduction is a major driver of biodiversity loss worldwide, second only to habitat destruction and fragmentation (BELLARD et al., 2016). There is still much debate about the scale and magnitude of the future impact of invasive alien species on native ones. Conservation biology needs new, robust methods to predict and quantify impact of allochthonous species and the risk of invasion of the territories where they were introduced (RICCIARDI et al., 2013). Based on habitat suitability (RONDININI et al., 2011) models and climate envelope models (VISCONTI et al., 2016) previously developed in our laboratory, we projected the changes in the distribution (geographic range and available habitat therein) of 258 introduced and established mammals worldwide (BLACKBURN et al., 2017) under alternative scenarios of global change. In the scenarios, change was driven by alternative storylines of socio-economic development, representing business as usual or incorporating climate mitigation policies. Distributional changes were projected based on change in land use and bio-climatic variables. In all scenarios, invasion by alien mammals proceeded at variable speed depending on species' characteristics, suggesting that prevention and control actions of allochthonous species introduction and spread will remain crucial in the future. The species studied showed a partial bioclimatic niche conservatism, confirming the importance of native environment as a good predictor of the capacity of establishment and spread in new ecosystems after human translocation.

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dino.biancolini@uniroma1.it

CHIA L. TAN[1], ROSE MARIE RANDRIANARISON[2], VALERIA TORTI[3], FRANCESCA ROLLE[1], CRISTINA GIACOMA[3], MARCO GAMBA[3], JOHN A PHILLIPS[1]

1 LVDI International, San Marcos, California, United States
2 GERP, Antananarivo, Madagascar
3 Life Sciences and Systems Biology, University of Turin, Italy, Turin, Italy

STRANGER DANGER! UNDERSTANDING FOSSA-LEMUR INTERACTIONS

The fossa (*Cryptoprocta ferox*) is the apex terrestrial predator in Madagascar and a known threat to lemurs. To reduce the risk of predation, lemurs may rely on chemical cues (scents) left by fossa in the environment in order to accurately evaluate their immediate endangerment. We used camera traps to study predator-prey interactions, focusing on the scent-marking behavior of the fossa and subsequent responses of lemurs to those scent-mark sites in Maromizaha, an eastern rainforest in Madagascar. Our data showed that the fossa is active day and night. Lemurs, of diurnal or nocturnal habit, also visited the scent-mark sites during both day and night. Several species of lemur, such as indri (*Indri indri*), diademed sifaka (*Propithecus diadema*), brown lemur (*Eulemur fulvus*), eastern lesser bamboo lemur (*Hapalemur griseus*), eastern woolly lemur (*Avahi laniger*), and small-toothed sportive lemur (*Lepilemur microdon*), did not avoid the scent-mark sites. Quite to the contrary, individual lemurs were observed to feed, rest, play and even sniff and scent-mark over the mark of the fossa. As the home range of the fossa is large relative to that of sympatric lemur species, it is likely that only one fossa overlaps the range of a group or an individual of a particular lemur species. Because the volatiles of fossa scent may communicate an individual's identity, our results suggest that although risky, assessing these scent marks may provide resident lemurs with information essential for the spatial/temporal use of their home range, and thus improving their chance of survival.

ldviinternational@yahoo.com

GIOVANNI FORCINA[1], DOMINIQUE VALLET[2], PASCALINE LE GOUAR[2], ELOY REVILLA[1], RUBÉN BERNARDO-MADRID[1], JOSÉ DOMINGO RODRÍGUEZ-TEIJEIRO[3], GUILLEM MOLINA-VACAS[3], GERMAN ILLERA[4], NELLY MÉNARD[2], CARLES VILÀ[1], MAGDALENA BERMEJO[4]

1 Departments of Integrative Ecology and Conservation Biology, Estación Biológica de Doñana (EBD-CSIC), Spain
2 UMR 6553 EcoBio «Ecosystèmes, biodiversité, évolution», CNRS/Université de Rennes, France
3 Department of Evolutionary Biology, Ecology and Environmental Sciences, Universitat de Barcelona, Spain
4 Great Apes Conservation/Research Odzala-Lossi, SPAC gGmbH Congo & USFWS Project, Republic of the Congo

MOBILITY PATTERNS AND SOCIAL STRUCTURE UNVEILED BY NON-INVASIVE GENOTYPING IN THE WESTERN LOWLAND GORILLA (*GORILLA GORILLA GORILLA*)

Widely acknowledged as a key behavioral and ecological process affecting species persistence and spatial population dynamics, dispersal is of paramount importance in conservation biology. Thus, reproductive success of both sexes is associated with emigration from their natal group. The western lowland gorilla (WLG) (*Gorilla gorilla gorilla*) from central western Africa exhibits natal dispersal of both genders, with females possibly undergoing multiple inter-group transfers. Previous studies evidenced discordant scenarios, with some finding patrilocal population structure or female sibling codispersal to a new group, while others detected no structuring. Understanding mobility between groups would shed light on the social structure of the WLG. The compounded effects of habitat remoteness and high mobility of this great ape call for the adoption of non-invasive genotyping to address a number of socio-ecological questions put forward by long-term and large-scale behavioral studies. Thus, we carried out an extensive sampling of about 300 fecal samples in one of the last WLG strongholds. Sample collection was performed in just a four-month window, trying to sample all groups and solitary individuals in an area of approximately 30 km^2. Genetic identity analyses relying on a panel of 17 microsatellites detected a large number of recaptures (48.7%) and confirmed the occurrence of 17 groups. Overall, 15 inter-unit transfers of both sexes were observed during the short time span considered, with further instances being inferred by paternity analyses. Also, solitary individuals were found to join temporarily one or more groups and group members were occasionally found alone, with sink units usually hosting first-degree relatives of the newcomer. Resident silverbacks were confirmed to sire all the offspring of their groups with only one exception. No correlation emerged between geographical distance and inter-silverback relatedness, yet this was partly consistent with closely related males leading nearby groups. Our results also suggested that closely related adult females were breeding in the same group. Taken together, these results show a surprisingly dynamic view of WLG societies within the dense African forests, with group interaction patterns involving not only nonbreeding, but also breeding social units.

forcina.giovanni@ebd.csis.es

IVAN NORSCIA, ELISABETTA PALAGI

Museo di Storia Naturale, Università di Pisa, Via Roma 70, Calci (Pisa)

ITALIAN ZOO-PARKS AND PRIMATE CONSERVATION: THE CASE OF LEMUR *PROPITHECUS VERREAUXI* FROM THE BERENTY FOREST (SOUTH MADAGASCAR)

Habitat fragmentation seriously threatens the survival of lemurs and other animal populations in Malagasy forests (MITTERMEIER et al. 2006; RAMANAMANJATO 2000). Density and abundance estimations are important tools to monitor lemur population conditions (FEISTNER and SCHMID 1999; LEHMAN et al. 2006). In the small forest fragment of Berenty (around 200 ha; south Madagascar) the demographic studies on the folivorous lemur *Propithecus verreauxi* had been interrupted in the mid-1980s when Norscia and Palagi resumed them in 2006. In this contribution we present the results of the survey conducted in 2011 compared with those of the surveys carried out in 2008 and 2006. In particular, we consider the sex ratio and compare the density of individuals in different forest habitats: the gallery forest dominated by *Tamarindus indica*, the secondary forest dominated by the exotic legume *Pithecellobium dulce*, the scrub forest, and the spiny forest dominated by *Allauadia procera* (Didieraceae) and other xerophytes. The results from 2011 confirm that the population is stable (Mean±SD: 200.33±6.66), the sex ratio within groups is significantly unbalanced toward males (58% of the population) and the highest density is present in the secondary forest built upon exotic plant species (around 25% of the forest population is concentrated here). This situation can be linked to the increased competition by brown lemur (*Eulemur fulvus*) and ringtailed lemur (*Lemur catta*), the protein-rich food present in the secondary forest, and the decreased food production by tamarind trees. The demographic studies on *P. verreauxi* presented here would have not been possible without the contribution of the Italian Zoo-Parks "Giardino Zoologico di Pistoia", "Parco Zoo Falconara", and "Parco Zoo Punta Verde" of Lignano Sabbiadoro, which funded (and still funds) our missions to Madagascar. Population monitoring is particularly important if we consider that the IUCN conservation status of *P. verreaux*i has changed from vulnerable to endangered and that IUCN data indicate an estimated loss of more than half population in the entire Madagascar in the past 50 years (http://www.iucnredlist.org/details/18354/0).

ivan.norscia@gmail.com

CESARE AVESANI ZABORRA

Parco Natura Viva – Garda Zoological Park, Località Figara, 40, 37012, Bussolengo, Verona

IL RUOLO DI UN MODERNO GIARDINO ZOOLOGICO NELLA CONSERVAZIONE DELLA BIODIVERSITÀ

La biodiversità mondiale è sottoposta a continue e diverse minacce. Per garantire un futuro alle specie selvatiche, i moderni giardini zoologici sono chiamati a svolgere il loro ruolo nella conservazione delle specie e nella tutela degli ecosistemi. Il Parco Natura Viva di Bussolengo (VR), attraverso una strategia integrata tra conservazione *in situ* (a favore delle specie nel loro ambiente naturale, a beneficio anche degli ecosistemi e della biodiversità) ed *ex situ* (lontani dal luogo di origine), inserito in network italiani, europei e mondiali sia di enti di settore, sia di università e associazioni, sostiene diversi progetti in natura e, laddove possibile, reintroduce gli individui allevati e nati al Parco nel loro ambiente naturale. Tutto ciò è svolto garantendo il benessere di ciascun individuo ospitato, educando e sensibilizzando il pubblico alla conservazione della biodiversità, collaborando nella formazione e alla qualificazione degli addetti ai lavori. Il Settore Ricerca e Conservazione del Parco promuove e monitora progetti di ricerca *ex situ* e *in situ* e si occupa del monitoraggio del benessere animale; la Direzione Tecnico – Veterinaria gestisce la collezione zoologica garantendone il benessere e prepara gli individui alla reintroduzione; il Settore Educativo lavora con le scuole e con il pubblico per educare le nuove generazioni e non solo alla tutela della biodiversità; il Settore Comunicazione divulga i risultati dei progetti e si occupa di reperire fondi affinché questi si possano realizzare. Conoscere, conservare, educare, sensibilizzare, ricercare sono solo alcune delle azioni che il Parco svolge quotidianamente per assolvere il compito di un moderno giardino zoologico.

assistant.dir@parconaturaviva.it

OSCAR LISI

Dipartimento di Scienze Biologiche, Geologiche e Ambientali – Sezione di Biologia Animale “Marcello La Greca”, Università di Catania, Via Androne 81 – 95124 CT Italy. Email: olisi@unict.it

LA RIVOLUZIONE TASSONOMICA DEI TARDIGRADI LIMNO-TERRESTRI: RICADUTE SU BIOGEOGRAFIA, BIODIVERSITÀ E CONSERVAZIONE

Fino al recente passato, alle specie di Tardigradi limno-terrestri veniva tradizionalmente attribuita una variabilità individuale relativamente alta, ed una ampia distribuzione geografica anche a causa del trasporto passivo. Negli ultimi decenni, soprattutto grazie allo stabilirsi di una tassonomia più moderna e rigorosa, si è avviata una profonda revisione di quelle idee e si sta facendo strada il convincimento che moltissime specie siano, al contrario, poco variabili ed a distribuzione limitata. In molti casi, quelle che erano considerate singole specie si sono invece rivelate complessi di specie, a volte criptiche, e molte di esse, sulla base delle conoscenze attuali, sono da considerare endemiche. Permane ovviamente il problema di ristudiare altre specie descritte nel lontano passato, il cui materiale tipico è andato perduto, che venivano considerate comuni e relativamente variabili, e che sulla base della letteratura sarebbero da considerarsi cosmopolite. L’Autore prende in esame il problema di alcune di quelle specie “cosmopolite” dimostrando, con una analisi dei dati della letteratura dell’ultimo secolo, come tali specie siano probabilmente a distribuzione assai più ristretta poiché molte delle loro segnalazioni in varie aree geografiche sarebbero da mettere in dubbio. Lo stabilirsi di corrette conoscenze tassonomiche e faunistiche, apre la strada non soltanto a considerazioni sulla biogeografia dei Tardigradi limno-terrestri, ma anche sulla stima della biodiversità e la sua conservazione. Alcune specie endemiche, meritano infatti di essere protette perché presentano tratti di eccezionalità non soltanto perché sinora rinvenute una sola volta, ma anche perché alcune sono le uniche rappresentanti di un genere o addirittura di una famiglia e spesso sono legate ad ambienti a rischio quali ruscelli o piccoli laghi.

olisi@unict.it

ELVIRA BRUNELLI, ILARIA BERNABÒ, SANDRO TRIPEPI

Department of Biology, Ecology and Earth Science, University of Calabria, Via P. Bucci 4/B, 87036 Rende (Cosenza), Italy

LA CONTAMINAZIONE DEGLI AMBIENTI ACQUATICI: BIOMARCATORI DI TOSSICITÀ E LORO RUOLO PREDITTIVO NEGLI ANFIBI

L'ecosistema acquatico è un sistema dinamico molto complesso, le cui proprietà chimiche, fisiche e biologiche possono variare a causa di fenomeni naturali o antropici. Tra le cause più comuni d'inquinamento degli habitat acquatici rientrano la modificazione di alcuni parametri abiotici (temperatura, pH, salinità) ed il massiccio rilascio di sostanze chimiche. La contaminazione delle acque è un importante problema ecologico ed è tra le cause principali del declino delle popolazioni di Anfibi. Per le loro caratteristiche ecologiche e biologiche, gli Anfibi sono organismi molto sensibili all'azione degli inquinanti, in particolar modo durante il delicato periodo dello sviluppo, e sono considerati eccellenti bioindicatori di alterazione ambientale. Poiché gli organismi rispondono alla presenza di inquinanti attraverso risposte biochimiche, fisiologiche e comportamentali, è possibile valutare i danni indotti a diversi livelli dell'organizzazione biologica. Nell'ambito di studi conservazionistici mirati a preservare l'ambiente acquatico, diventa quindi cruciale individuare quale dei biomarker utilizzati meglio risponda agli intenti di predittività. Nel presente lavoro abbiamo esposto esemplari di alcune specie di Anfibi italiane a condizioni di stress ambientale (pH, salinità, fitosanitari) ed abbiamo valutato diversi endpoint: comportamento, sviluppo larvale, sex ratio, incidenza di malformazioni, morfologia e ultrastruttura di organi target. Abbiamo evidenziato che l'esposizione a xenobiotici, sia acuta che cronica, è in grado di compromettere la sopravvivenza, la crescita e lo sviluppo e di causare gravi alterazioni comportamentali interferendo inoltre con le caratteristiche morfo-funzionali di organi bersaglio come pelle, branchie, fegato, reni e gonadi. Sebbene spesso gli effetti siano dose-dipendenti, alcuni xenobiotici possono avere un andamento non-lineare e l'incidenza di alcune alterazioni è riscontrabile anche quando le concentrazioni applicate sono estremamente basse e sovrapponibili a quelle rilevate in natura. Dalle nostre analisi è emerso che i cambiamenti nei pattern comportamentale e di sviluppo sono ottimi e precoci marker di contaminazione tuttavia le alterazioni tissutali e ultrastrutturali precedono sempre l'insorgenza di altri effetti patologici. Pertanto riteniamo che la valutazione morfofunzionale rappresenti un importante strumento per lo sviluppo di protocolli applicativi e per le attività di monitoraggio degli ecosistemi acquatici.

elvira.brunelli@unical.it

GENTILE FRANCESCO FICETOLA[1,2], ANDREA MELOTTO[1], MATTEO ELIO SIESA[1,3], MARTINA MURARO[1], FRANCESCO BELLUARDO, FEDERICO FARACI[1], ELIA LO PARRINO[1], SIMONE PITTON[1], RAOUL MANENTI[1]

[1] Department of Enviornmental Science and Policy, Università degli Studi di Milano. Via Celoria 26, 20133 Milano Italy
[2] Univ. Grenoble Alpes, CNRS, Laboratoire d'Écologie Alpine (LECA), F-38000 Grenoble, France
[3] Via L. Settembrini, 14 - 20092 - Cinisello Balsamo (MI)

MULTIFACETED IMPACTS OF THE INVASIVE CRAYFISH, *PROCAMBARUS CLARKII*, ON FRESHWATER COMMUNITIES: FROM FITNESS DECLINE TO POPULATION EXTINCTIONS

Freshwater environments are among the most threatened by invasive alien species (IAS). IAS can determine the extinction of native species through multiple processes, such as spread of diseases, genetic introgression, competition and predation on native species. Knowing the effect of IAS is extremely important to identify management strategies, but IAS can have complex effects on native ecosystems, and interact with multiple components of food webs, making a comprehensive quantification of their direct and indirect effects particularly difficult. The American red swamp crayfish, *Procambarus clarkii*, is invasive in Europe and may alter freshwater communities through both direct (avoidance of invaded wetlands, predation), and indirect effects (habitat modifications and alteration of the food web, with modification of the abundance of native predators). We used multiple approaches to unravel the impacts of the crayfish invasion on amphibian and odonate communities. We repeatedly monitored >150 wetlands in Lombardy (Northern Italy) over 15 years, and recorded the abundance of native species at multiple life-cycle stages (e.g. larvae and adults). For amphibians, we also assessed long-term community changes determined by the crayfish. Immediately after crayfish invasion, most of species continued breeding in invaded wetlands. However, the abundance of larval stages and (for odonates) exuviae was negatively associated with the crayfish occurrence, suggesting poor fitness in invaded wetlands. Long term surveys indicated that newts suffer the strongest impact by crayfish, and can be completely extirpated from invaded areas in less than 10 years. Frog species with a wide niche overlap with the crayfish (e.g. *Rana latastei*) showed a strong demographic decline, while species with limited niche overlap (e.g. tree frogs and salamanders) can survive. The crayfish exerts a negative, direct impact on both amphibian communities and their predators. The negative direct effects of crayfish on amphibians were so strong that they overwhelmed the overall predation by native insects. This crayfish impacts multiple levels of food webs, disrupting natural prey-predator relationships and causing dramatic declines of most amphibians. The persistence of native communities of amphibians and odonates may be helped by the preservation of wetland networks with heterogeneous environmental conditions.

francesco.ficetola@unimi.it

LUCA VECCHIONI[1], ALAN DEIDUN[2], JEFFREY SCIBERRAS[3], ARNOLD SCIBERRAS[3], FEDERICO MARRONE[1], MARCO ARCULEO[1]

1 Dipartimento di Scienze e Tecnologie Biologiche Chimiche e Farmaceutiche, Università degli Studi di Palermo, via Archirafi,18, I-90123 Palermo, Italy
2 Physical Oceanography Research Group, Department of Geosciences, University of Malta, Msida, Malta MSD 2080
3 Animal Kingdom Limited, 136, Ditch Street, Paola, Malta

mtDNA SEQUENCES REVEALS AN OVERLOOKED DIVERSITY HOTSPOT FOR THE FRESHWATER CRAB GENUS *POTAMON* IN NORTH AFRICA (DECAPODA, BRACHYURA, POTAMIDAE)

The Central Mediterranean area, from the southern Balkans to western Maghreb, is inhabited by the *Potamon* subgenus *Eutelphusa*, with three species: *P. fluviatilis* (Herbst, 1785), occurring in the Balkan peninsula, Italy, and Malta, *P. algeriense* Bott, 1967, occurring in the Maghreb, and the recently described *P. pelops* Jesse, Schubart and Klaus, 2010, endemic to the Peloponnesus peninsula of Greece. Currently, the molecular diversity of the European species of the subgenus *Eutelphusa* is well-known; conversely, nearly no information is available on the species occurring in Maghreb, i.e. *P. algeriense*. The aim of this study was to provide the first data on the genetic diversity of *P. algeriense* throughout its known distribution range and to test the possible occurrence of diverging evolutionary lineages in western *vs.* eastern Maghreb, as already known for several other aquatic taxa. We have thus explored the genetic diversity of *P. algeriense* through dedicated sampling surveys in Tunisia and Algeria, and retrieving the mtDNA sequences available on GenBank for a single Moroccan specimen. Based on partial sequences of mtDNA COI and ND1 genes, we obtained sharp evidence that supports the presence in Maghreb of a highly structured molecular diversity and the existence of at least three well-characterised allopatric monophyletic crab lineages. The possible species-status of these lineages was tested with different DNA taxonomy approaches, obtaining contrasting results. An expanded sampling in Maghreb, and the implementation of nuclear markers, is advisable in order to soundly clarify the systematics of Maghrebian freshwater crabs.

luca.vecchioni@unipa.it

FERDINANDO BOERO

Università del Salento, CNR-ISMAR, Italy

MARINE EXTINCTIONS

Most of planet Earth is Ocean: many of the highest expressions of the diversity of life (phyla) are marine only. We do not know much about them and, in spite of alarming declarations about extinctions, documented and recent extinctions of marine species are scant. The list of endangered species is relatively long, but it covers only charismatic species. The bulk of biodiversity is simply ignored. If we cannot provide a substantial list of extinct marine species, however, we can easily produce lists of species that are not being found since a very long time. If a species is absent from all records since more than a century, for instance, we might say that it is presumably extinct. In this case we talk about putative extinction. But the presence of species is documented only if there are specialists able to recognize them. Specialists are almost extinct for many groups: the absence of species might be the by product of the absence of knowledge. The historical biodiversity index measures biodiversity and putative extinctions. The European Union produced the European Register of Marine Species, and also a list of marine habitats. It is possible to produce a matrix that assigns each species to one or more habitats, so as to produce biodiversity master lists for each habitat. Every sample in a specific habitat tests a hypothesis: in that habitat a certain percentage of the master list should be found. It will never happen that the 100% of the master list will be found in a habitat, but matching what has been found in the past (the master list) with what is being found provides two list: the species that have been found, and the species that are absent. If a species is consistently absent from biodiversity explorations, then cases of putative extinction can be raised. This tool is simple and effective, it has only one problem: it requires good taxonomic expertise (even though molecular methods might help). Habitat deterioration is a proxy of extinction. If the Great Barrier Reef is in terrible distress due to global warming, chances are good that the species inhabiting it run the risk of becoming extinct. Some, however, might emigrate in search of proper conditions for their development. When they do so they are considered as aliens: a threat to indigenous biodiversity. These species, escaping from extinction, might well be refugees, instead of invaders. If coral reefs will become established in the Mediterranean, will we call for their eradication?

boero@unisalento.it

MARZIA BO[1], MARTINA COPPARI[1], SIMONE BAVA[2], SIMONEPIETRO CANESE[3], RICCARDO CATTANEO-VIETTI[1], GIORGIO BAVESTRELLO[1]

1 Dipartimento per lo Studio del Territorio, dell'Ambiente e della Vita, Università degli studi di Genova, Corso Europa 26, 16132, Genova
2 Area Marina Protetta Isola di Bergeggi, Comune di Bergeggi, Via De Mari 28/D, 17028, Savona
3 Istituto Superiore per la Protezione e la Ricerca Ambientale, Via Vitaliano Brancati 48, 00144, Roma

LIGURIAN SEAMOUNTS: KNOWN VULNERABILITY OF UNKNOWN ECOSYSTEMS

Seamounts are prominent features of the world's underwater topography, with estimates of about 250 structures for the Mediterranean Sea (WÜRTZ and ROVERE, 2015). Very few data are available on the benthic assemblages of Mediterranean seamounts (BO *et al.*, 2011); explorations carried out so far, however, do highlight lush filter-feeding communities strongly coupled to local dynamics of food, plankton, and pelagic species, including top predators. The Ligurian Sea embraces five major underwater structures: three of these seamounts (St. Lucia, Ulisse and Janua) have been investigated by means of ROV exploration for the first time. The aim of this study was to depict the benthic biodiversity of the top of these three mounts differing in depth (145, 400 and 810 m, respectively) as well as in supposed fishing effort, based on their distance from the nearest continental coast (30, 25 and 30 NM, respectively). All seamounts host ecosystems dominated by structuring species. St. Lucia hosts a well-diversified coral community of black corals and small sea fans. The most striking biological feature of the Ulisse Seamount is a conspicuous forest of the fragile gorgonian *Callogorgia verticillata* on the top, surrounded by a rich, basal coverage of small sea fans and sponges along the most exploited flanks. These two seamounts share a conspicuous amount of species that are also common in deep continental margin and slope ecosystems. Outstanding, instead, is the deep Janua Seamount hosting black corals, gorgonians and hexactinellids never reported before in the Ligurian or Mediterranean Sea. Significant amounts of lost fishing gears (mainly long lines) were found on St. Lucia and Ulisse. Both sites are highly frequented by professional and recreational fishermen, moreover Ulisse has also been well-known, back in the 70s, as an exceptional fishing site for deep groupers (CANESE and BAVA, 2015). Not related to distance from the coast, but rather to bathymetric inaccessibility, Janua Seamount shows the lowest abundance of lost gears. The occurrence of long-living, slow-growing, rare and fragile species contributes to increase the vulnerability of these ecosystems that we just started to explore. Among the many paradigms concerning seamounts' ecology, the one relating low resilience of communities to fishing disturbance is the most supported (ROWDEN *et al.*, 2010); our data agree with this consideration, suggesting that these habitats may no longer be biological refugia.

marzia.bo@unige.it

MARTINA COPPARI[1], GIORGIO BAVESTRELLO[1], PAOLO CARPENTIERI[2], FRANCESCO ENRICHETTI[1], CECILIA MANCUSI[3], FABRIZIO SERENA[4], MARZIA BO[1]

1 Dipartimento per lo Studio del Territorio, dell'Ambiente e della Vita, Università degli studi di Genova, Corso Europa 26, 16132, Genova
2 Dipartimento di Biologia Animale e dell'Uomo, Università La Sapienza, Viale dell'Università 32, 00185 Roma
3 Agenzia regionale per la protezione ambientale della Toscana (ARPAT), Via Marradi 114, 57100 Livorno
4 Consiglio Nazionale delle Ricerche- Istituto per l'Ambiente Marino Costiero, Via Vaccara 61, 91026 Mazara del Vallo

TRAWLING IMPACT IN THE ITALIAN SEAS: BIODIVERSITY, TRENDS AND CONSERVATION OF MEGABENTHIC COMMUNITIES

Benthic communities are influenced by natural and anthropic perturbations, with fishing activity representing one of the main causes of physical disturbance to the seabed, especially in the deep sea (LANGTON and AUSTER, 1999). Bottom trawlers are responsible for a considerable loss of benthic biomass due to the enormous portion of trawl catches removed and then returned, mostly dead, to the sea (BOZZANO and SARDÀ, 2002). Wasted catches include both by-catch species (not marketable target taxa) as well as discard species (non-target taxa). Despite numerous studies have been devoted to target and by-catch species, very little is known about the biodiversity of discard species, especially from a large-scale geographical perspective and a temporal point of view. The entire Italian MEDITS (International bottom trawl survey in the Mediterranean) archive dataset (1994-2015), as well as scientific literature, was used to synthetize the available information regarding megabenthic species found in the trawling grounds between 50 and 1000m depth, with particular focus on the discard invertebrate species and the most vulnerable taxa. A total of 652 invertebrate species have been reported in the trawling catches, constituting approximately 13% of all the species known for the Italian Sea (SIBM Checklist, 2010), with mollusks and crustaceans representing the most abundant taxa. Discard species account for 81%, highlighting the low selectivity of the trawling gear and its impact on the benthic species diversity. Differences among the regions were identified on a geographic and bathymetrical basis, and the Adriatic Sea was the area with the highest number of identified species. Particular attention was given to invertebrate structuring species (e.g. arborescent corals and sponges) that, due to their biological characteristics, are considered key-species of vulnerable ecosystems. *Isidella elongata*, *Funiculina quadrangularis* among others showed various temporal trends of weight highlighting the simplification effect of trawling on the communities.This unique chance to analyze a 20-years survey dataset with a national coverage enhanced our knowledge on the community structure and conservation status of megabenthic assemblages on trawlable grounds. The possibility to gather information on biodiversity patterns, temporal and geographical trends of occurrence of fragile, structuring species are key features to define Vulnerable Marine Ecosystems with priority for conservation.

coppari.martina85@gmail.com

FRANCESCO TIRALONGO, GIUSEPPINA MESSINA, BIANCA MARIA LOMBARDO

Dipartimento di Scienze Biologiche, Geologiche e Ambientali, Università degli Studi di Catania

THE SPREAD OF *OCYPODE CURSOR* (LINNAEUS, 1758) (DECAPODA, OCYPODIDAE), IN THE CENTRAL MEDITERRANEAN SEA

In Sicily mainland, the first records of *Ocypode cursor* (Linnaeus, 1758) came from the area of Sampieri (southern Sicily) in 2009 (RELINI, 2009); while, in the Strait of Sicily area, from the year 1995, the presence of the species, recently recorded in Malta (DEIDUN et al., 2017), was known from Lampedusa (FROGLIA, 1995). Crabs of this genus, belonging to Ocypodidae, are known for their semi-terrestrial habits. The distribution of this species appears to be fragmented: Atlantic (from southern Mauritania to Namibia and Cabo Verde Archipelago), central Mediterranean Sea and eastern part of the Basin (from Egypt to Turkey, Greece and Cyprus). In recent years, and especially from 2016 onwards, on the basis of several observations in the southern and southeastern Sicily and published work (TIRALONGO, 2016), we can assert that *O. cursor* is undergoing a rapid expansion and increase in abundance. In most cases, the species was found abundant right in the beaches crowded by bathers. In the early days of September 2016, on the beach "Cicirata" of Avola (about 600 m long, 30 m width), they were recorded 213 burrows. Despite this, it appears that the nocturnal habits of *O. cursors* enable this species to coexists with humans without considerable disturbance. Although bathing facilities and seasonal beach cleaning by mechanical means could cause physical disturbance to the habitat of the species, also in this case effects seem to be short and reversible. In all cases, this potentially vulnerable species could over time suffers the effects of habitat degradation. Hence the need to monitor and protect the species that is listed (Annex II) among the Endangered or Threatened Species of the Convention for the Protection of Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention, 1995) and among the Strictly Protected Fauna Species (Annex II) of the Convention on the Conservation of the European Wildlife and Natural Habitats (Bern Convention, 1996-98). In conclusion, from our observations and from that of citizen scientists, we have several reasons to believe that the species has undergone a rapid population expansion, in particular since the year 2016, and so is now more abundant and widespread in all the southern Sicily and expanding northward, along the eastern coast of Sicily (Ionian Sea). We underline also that, despite its nocturnal habits, *O. cursor* is a species that hardly goes unnoticed.

fra.tiralongo@hotmail.it

AZZURRA BASTARI[1], DANIELA PICA[1], JACOPO BECCACECE[1], VITTORIA GNETTI[2], FRANCESCO FERRETTI[3], FIORENZA MICHELI[3], DOMITILLA SENNI[2], CARLO CERRANO[1]

1 Dipartimento di Scienze della Vita e dell'Ambiente, Università Politecnica delle Marche, Ancona, Italy
2 MEDREACT Via Urbana 143, 00184 Rome
3 Hopkins Marine Station, Stanford University, Pacific Grove, CA, United States

HABITAT SUITABILITY MODELS AND FISHERS PERCEPTION AS TOOLS FOR SUPPORTING THE CONSERVATION OF VULNERABLE MARINE ECOSYSTEMS (VMEs) IN THE CENTRAL ADRIATIC SEA

The Adriatic Sea has suffered dramatic changes in the last decades, including habitat degradation, biodiversity loss and stocks decline. Of all human impacts, bottom trawling is one of the most destructive. This fishing practice has caused severe declines of Adriatic fish and invertebrate stocks, widespread habitat destruction and is preventing the recovery of these commercial stocks and habitats. In the last years, sponges, coral gardens, sea pens and gorgonian forests together with others important Vulnerable Marine Ecosystems (VMEs) (seamounts, canyons, hydrothermal vents) have faced high pressures because of fishing. These habitats are in need of urgent protection to preserve biodiversity and because they are fundamental for the recovery of fisheries stocks. Despite their vulnerability and ecological importance, little is known on the distribution, abundance, ecology and temporal variation of Adriatic VMEs. The aim of this study is to highlight unconventional tools for collecting information on the distribution and changes in the abundance of VMEs in the central Adriatic basin. In particular, we modelled presence-absence data from trawl surveys with Generalized Additive Models (GAMs) to identify potential suitable habitats of the sea pens *Funiculina quadrangularis* Lamarck, 1816, and *Pennatula* spp. in the central Adriatic sea bottoms. Moreover, we used local ecological knowledge (LEK), coming from 77 interviews of bottom trawling fishers' (51 Italian and 26 Croatian), to describe the changes in the abundance of potential VMEs indicator species living in the central Adriatic soft bottoms. Habitat suitability models reveal with good approximation (AUC values >0.8, indicative of an excellent model performance) that the bottoms of offshore areas of the central Adriatic Sea can host sea pens patches. Analysis of fishers' perceptions show that VMEs were present around 30-40 years ago, with higher abundances in the central Adriatic Sea. However, in some areas of the Adriatic soft bottoms VMEs still persist. Our study reveals that alternative tools such as habitat suitability models and LEK provide important information when conventional scientific data are scarce or absent, and highlight species and ecosystem at risk in need of protection.

c.cerrano@univpm.it

BRUNO COZZI[1], CINZIA CENTELLEGHE[1], SANDRO MAZZARIOL[1], MICHELA PODESTÀ[2]

1 Dipartimento di Biomedicina Comparata e Alimentazione dell'Università di Padova
2 Museo Civico di Storia Naturale di Milano

LA RETE NAZIONALE SPIAGGIAMENTI CETACEI. ATTUALI INIZIATIVE E QUADRO LEGISLATIVO ATTUALMENTE ALLO STUDIO

Gli spiaggiamenti dei cetacei sono eventi scientificamente importanti che consentono di monitorare in maniera indiretta la presenza di determinate specie nelle acque italiane e forniscono un quadro delle cause di morte. Perché i dati abbiano una valenza scientifica rilevante, è essenziale raccogliere informazioni il più possibile complete e provenienti da una rete di segnalamento unica e sistematicamente attiva lungo le coste italiane. Attualmente il monitoraggio avviene attraverso una rete di raccolta che parte dalle Capitanerie di Porto e si basa poi sull'intervento sia di medici veterinari (per la parte sanitaria) sia di biologi e naturalisti (per la raccolta e valorizzazione del dato biologico). Le informazioni vengono convogliate in tre centri scientificamente complementari: 1) i dati biometrici degli esemplari spiaggiati, comprensivi di identificazione di specie, sesso, taglia e altre informazioni rilevanti vengono raccolti, geo-referenziati e posti on-line dalla Banca Dati Spiaggiamenti dell'Università di Pavia e del Museo di Storia Naturale di Milano, con l'egida del Ministero dell'Ambiente; 2) i dati biomedici comprendenti le cause di morte e la eventuale presenza di patogeni diffusibili sono raccolti, vagliati e disponibili presso la sede di Torino dell'Istituto Zooprofilattico Sperimentale del Piemonte e della Liguria (dipendente dal Ministero della Salute); 3) i campioni di tessuto degli animali spiaggiati vengono raccolti e inviati alla Banca per i tessuti dei mammiferi marini del Mediterraneo (anch'essa sotto l'egida del Ministero dell'Ambiente) presente presso l'Università di Padova, che li processa e li rende disponibili ai ricercatori che ne facciano motivata richiesta. La diffusione attuale della rete di raccolta dati relativi ai cetacei spiaggiati rappresenta un'evoluzione notevole rispetto alle prime iniziative su base volontaristica sostenute in gran parte dai Musei naturalistici e zoologici italiani nei primi anni '80 del 900. Tuttavia ci sono ancora notevoli disomogeneità, sovrapposizioni, problemi di competenze e persino difficoltà dovute alle differenti legislazioni regionali. Per regolamentare e armonizzare questa importante rete di intervento i Ministeri dell'Ambiente e della Salute hanno istituito un Tavolo di Coordinamento per arrivare a un quadro normativo che, partendo dai presupposti di legge, sia il più possibile condiviso e inclusivo delle realtà scientifiche istituzionali e locali che rispondano ad alcuni requisiti minimi.

bruno.cozzi@unipd.it

VALENTINA ISAJA

Bioparco Zoom Torino– Strada Piscina 36, 10040 Cumiana, Torino

IL NUOVO CONCETTO DI IMMERSIVITÀ ESPERIENZIALE ED EDUCAZIONALE COME POTENTE STRUMENTO DI SENSIBILIZZAZIONE ALLA BIODIVERSITÀ E ALLA CONSERVAZIONE NELLA SOCIETÀ MODERNA: IL CASO DI ZOOM TORINO

Molte cose sono cambiate dall'epoca dell'apertura dei primi giardini zoologici. Da semplici *menageries*, cioè semplici esposizioni di animali, a parchi zoologici, dove gli animali non vengono più prelevati dalla natura e dove le strutture sono diventate altamente complesse: habitat sempre più ricercati e attenti al benessere animale, un'alta professionalità delle figure che ci lavorano ed un alto livello comunicativo, diventano un punto di partenza nel campo dell'educazione e della conservazione. Una struttura zoologica moderna è da una parte, ormai necessaria per garantire un futuro alle specie selvatiche grazie a ricerche e raccolte fondi per sostenere le organizzazioni e i progetti *in situ*, dall'altra ha un ruolo educativo socialmente, ecologicamente e culturalmente rilevante, poiché influenza il comportamento e i valori delle persone, informando, educando e sensibilizzando alle tematiche ambientali. Per tutte queste ragioni, Zoom Torino, nato nel 2009, ed ancora oggi in costruzione, ha voluto, fin dall'inizio, creare un nuovo concetto di zoo, nello specifico uno "*zoo immersivo"*, completamente diverso dagli altri Zoo italiani e uno dei pochi in Europa, dove i punti di partenza sono: a) habitat ricostruiti similmente a quelli naturali, non solo per il benessere degli animali, ma anche dei visitatori, che in questo modo si sentono coinvolti a 360°, b) animali ospitati in aree con "barriere invisibili" in modo che i visitatori possano vedere davvero da molto vicino le specie più esotiche e a rischio di estinzione, c) creare e fare vivere esperienze sensoriali e di avvicinamento agli animali, d) dare emozione e divertire allo stesso tempo d) contribuire ai progetti di conservazione, e) educare in modo immersivo e coinvolgente. Zoom Torino ha infatti creato un nuovo concetto di educazione, in cui durante tutta la giornata, i visitatori possono incontrare i biologi e i keeper mentre lavorano con gli animali e sentire le loro spiegazioni, come dei veri e propri "cartelli viventi", in modo che tutti, dai più piccoli ai più grandi, siano coinvolti attivamente ed escano dal parco con un know-how unico e forte.

valentina.isaja@zoomtorino.it

Round table 2

Didactic innovation in animal biology

BIANCA MARIA LOMBARDO[1], ISABELLE PERROTEAU[2]

1 Dipartimento di Scienze Biologiche, Geologiche e Ambientali, Università degli Studi di Catania, Via Androne 81, 95124 Catania
2 Dipartimento di Scienze Cliniche e Biologiche, Università degli Studi di Torino, Regione Gonzole 10, 10043 Orbassano, Torino

INNOVAZIONE NELL'INSEGNAMENTO DELLA BIOLOGIA ANIMALE

Il primo obiettivo della tavola rotonda consiste nell'avviare all'interno dell'Unione Zoologica Italiana una riflessione critica sulle modalità di svolgimento delle attività didattiche inerenti la biologia animale, cogliendo anche la possibilità di un confronto con la *Société Zoologique de France*.
L'attenzione all'innovazione didattica è uno degli aspetti in cui si manifesta il cambiamento in atto nelle Università italiane ed arriva in ritardo rispetto ad altri paesi europei.
L'esigenza di porre lo studente al centro dell'azione didattica e di garantirgli un ruolo attivo nei processi di apprendimento è correlata a due principali fattori: da un lato, i ritardi con cui gli studenti italiani mediamente conseguono il titolo, dall'altro, la necessità di fornire loro, ancor più che in passato, capacità di aggiornamento continuo della preparazione acquisita, a causa dai rapidi cambiamenti del mercato del lavoro.
L'applicazione delle tecnologie informatiche e la possibilità di raggiungere studenti altrimenti tagliati fuori dai processi di apprendimento, attraverso l'erogazione a distanza, richiedono uno sforzo non indifferente ai docenti coinvolti e una formazione adeguata.
Così anche l'internazionalizzazione della didattica, sempre più richiesta agli atenei, prevede un impegno aggiuntivo per i docenti coinvolti; non si tratta soltanto della difficoltà nel dover insegnare in una lingua diversa, ma di dover adattare i propri metodi didattici ad una platea non omogenea per formazione precedente ed esperienza. Anche in questo caso sarebbe auspicabile una specifica formazione, che non può essere avulsa dagli specifici contenuti disciplinari.
La comunità scientifica dovrebbe dunque prendersi carico dello sviluppo, nelle aeree di competenza, della didattica disciplinare, anche in relazione alle esigenze che si stanno delineando nell'ambito dei percorsi di formazione iniziale degli insegnanti.
Sono programmati interventi di: Lorenza Operti, Stefano Piraino, Roberto Cazzolla Gatti, Cristina Miceli, Adriana Vallesi.

bm.lombardo@unict.it

isabelle.perroteau@unito.it

Posters

FRANCESCO BAINI[1], MARZIO ZAPPAROLI[1]

1 Dipartimento per la Innovazione nei sistemi Biologici, Agroalimentari e Forestali (DIBAF), Universita` degli Studi della Tuscia, Via San Camillo de Lellis s.n.c., 00100 Viterbo, Italia

STUDIO PRELIMINARE SU TASSOCENOSI A CHILOPODI IN AMBIENTI FORESTALI LUNGO UN GRADIENTE DI URBANIZZAZIONE: IL CASO DI ROMA

Gli effetti dell'urbanizzazione su macroartropodi del suolo sono stati oggetto di studi recenti in molte aree urbane. Tali studi hanno mostrato che l'urbanizzazione porta a significativi cambiamenti sui parametri strutturali delle comunità, in particolare sugli elementi più specializzati. Allo scopo di ottenere informazioni sulla distribuzione spaziale delle comunità di macroartropodi del suolo e sul loro stato di conservazione a Roma, è stato avviato uno studio macroecologico nell'area. Sono state scelte tre stazioni a *Quecuis ilex* in ville storiche e aree protette (Villa Pamphili, PAM; Monte Mario, MAR; Macchiagrande di Fregene, FRE), che si differenziano per: distanza dal centro urbano, matrice circostante, gestione. L'importanza relativa della struttura del paesaggio urbano e della qualità degli habitat forestali sono stati esaminati in funzione di abbondanza, ricchezza specifica e diversità delle tassocenosi a chilopodi, artropodi del suolo, predatori. Il campionamento è stato effettuato con pitfall traps (06.2015-06.2016). Sono stati usati i seguenti indici: Jaccard, Bruy Curtis, Morisita, Shannon Wiener, Pielou. Per studiare gli effetti delle variabili ambientali sulle singole specie è stata effettuata una Canonical Correspondence Analyses. Test di confronto tra i vari set di dati (ANOVA, Tukey, Spearman), sono stati altresì svolti. E' risultato che le tre tassocenosi si differenziano per aspetti strutturali. Inoltre, la cenosi di MAR si caratterizza per una maggiore complessità nella composizione specifica, probabilmente in relazione alle più complesse condizioni strutturali della stazione rispetto ad altre e alla sua vicinanza ad altre aree forestali. I dati ottenuti indicano una maggior attività dei chilopodi in MAR, dovuta alla presenza di una ricca popolazione di *Lithobius tylopus*, endemita appenninico, in genere legato ad ambienti forestali stabili. MAR si caratterizzata inoltre per il maggior numero di specie di geofilomorfi e scolopendromorfi criptopidi, particolarmente influenzati dalla diversità strutturale e completamente mancanti nelle cenosi in PAM e FRE, a loro volta in condizione di una minor complessità e stabilità rispetto a MAR, con caratteristiche di comunità in successione. Nel determinare la distribuzione della biodiversità, appare quindi evidente, oltre alla posizione nella matrice urbana, anche il ruolo della eterogeneità strutturale del frammento.

fran.baini@unitus.it

SARA BEN ABDALLAH, MAKHLOUF SEKOUR, YASMINA KHERBOUCHE

Faculté des sciences de la nature et de la vie, Département des Sciences Agronomiques, Laboratoire de Recherche sur la phoeniciculture, Université Kasdi Merbah Ouargla, Algérie.

ABREGE SUR LA BIODIVERSITÉ DE LA MYRMECOFAUNE DANS LE SAHARA ALERIEN (CAS D'OUARGLA)

Le présent travail porte sur l'inventaire de Formicidae de la région d'Ouargla (Algérie). L'inventaire est réalisé suite à l'utilisation de quatre méthodes d'échantillonnages (pots Barber, pièges sucrés, pièges jaunes et fauchage), dans deux milieux phoenicicoles depuis Janvier jusqu'à Décembre 2015. Cette étude a permis de recenser 14 espèces de Formicidae réparties en 4 sous familles, Formicinae, Myrmicinae, Dolichoderinae et Ponerinae. *Pheidole pallidula* est l'espèce la plus capturée. En fonction des méthodes de piégeages, la méthode de pots Barber offre le maximum d'espèces (S = 12 espèces). L'espèce *P. pallidula* (AR = 60%) est la plus capturée grâce à cette dernière méthode. *Camponotus thoracicus* (AR = 26%), est l'espèce la plus capturée par la méthode de piège sucré. Par contre *Lepisiota frauenfeldi* c'est la plus capturée par les deux méthodes piège jaune (AR = 31%) et filet fauchoir (AR = 28,8%). Pour les valeurs de diversité des espèces, sont varient entre 2,08 et 2,60 bits, ce qui laisse dire que le milieu échantillonné est moyennement diversifiés. Concernant les valeurs de l'équitabilité sont varient entre 0,60 et 0,97, ces valeurs tendent vers 1, cela reflète une tendance vers l'équilibre entre les effectifs des espèces de fourmis.

sarabenabdallah9@gmail.com

FEDERICO BETTI[1], GIORGIO BAVESTRELLO[1], MARZIA BO[1], VALENTINA CAPPANERA[2], MARTINA COPPARI[1], FRANCESCO ENRICHETTI[1], LUCA FRAVEGA[1], GIULIA RAVANETTI[1], SARA VENTURINI[2], RICCARDO CATTANEO-VIETTI[1]

1 Dipartimento per lo Studio del Territorio, dell'Ambiente e della Vita, Università degli studi di Genova
Corso Europa 26, 16132, Genova
2 Area Marina Protetta di Portofino, Corso Rainusso, Santa Margherita Ligure

ANTHROPIC PRESSURE AND ENVIRONMENTAL SUSTAINABILITY IN THE MPA OF PORTOFINO (LIGURIAN SEA)

One of the main concerns in the sustainable management of a Marine Protected Area (MPA) is the assessment of the impact of various stakeholders (professional and amateur fishermen, divers, yachts, etc.) on the benthic and fish communities. The Portofino MPA has a small territorial extension (just over 345 ha), but it has an extraordinary significance particularly with regards to diving activity, reaching a total number of about 50000 dives per year. At the same time, this is an area of great value for fishing, both professional and recreational. In this paper, we have used two biological proxies to evaluate the effects of these two activities on the benthic communities. The effects of diving activities were evaluated by quantifying the broken red coral colonies in the sediments at the base of two cliffs highly frequented by divers, compared with what found in two sites where diving is not allowed (A Zone). The impact of bottom fishing with fixed gears (lines and nets), instead, was estimated by counting the number of gorgonians showing damaged or epibionted branches in 13 fishing sites, along the coastline. The analysis of the red coral biomass found in the sediments normalized on the density of living colonies present on the overlying cliffs shows values of one order of magnitude greater in the sites open to diving with respect to those found in the no-dive zones, indicating a serious impact protracted in time. Also with regards to fishing, the situation is locally alarming: the number of colonies with mechanically damaged branches may exceed 80% in the populations found in areas with a high fishing effort (more than 70 days of fishing activity per year). These data indicate that, despite the protective measures taken and the undoubted results achieved in 15 years of management, a sustainable compromise between conservation and the use of the marine environment is still far off-sight. After the mass mortalities events recorded in the area from 1999 to 2006 caused by the abnormal warming of the surface seawater, red coral and red gorgonians showed evident signs of recovery that could be locally overwhelmed by an excessive fruition. New efforts in maritime spatial planning and, above all, in the education of stakeholders, will have to be put in place to achieve an optimal management level.

info@federicobetti.it

PAOLO COCCI[1], EMANUELA FRAPICCINI[2], MAURO MARINI[2], GIOVANNI CAPRIOLI[3], GIANNI SAGRATINI[3], GILBERTO MOSCONI[1], FRANCESCO A. PALERMO[1]

1 School of Biosciences and Veterinary Medicine, University of Camerino, Via Gentile III Da Varano, I-62032 Camerino MC, Italy
2 National Research Council, Institute of Marine Science CNR-ISMAR, L.go Fiera della Pesca, 2, 60125 Ancona, Italy
3 School of Pharmacy, University of Camerino, Via Sant'Agostino 1, I-62032 Camerino MC, Italy

ASSOCIATIONS BETWEEN LEVELS OF PERSISTENT ORGANIC POLLUTANTS AND TRANSCRIPTIONAL BIOMARKERS IN LOGGERHEAD SEA TURTLES FROM CENTRAL ADRIATIC SEA (ITALY)

Polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) are considered priority contaminants which bioaccumulate through the food webs affecting the biology of a variety of resident and migratory species, including sea turtles. However, studies on the evaluation of toxicological biomarkers of exposure to PAHs and PCBs in sea turtles are very scarce. Within the present work we show a first field study where we quantify the association between plasma concentrations of PAHs/PCBs and whole blood cell expression of gene biomarkers in juvenile loggerhead sea turtles (*Caretta caretta*) recovered along the western coasts of central Adriatic sea. Detectable levels of PAHs were found in all plasma samples examined. On the contrary, only three PCB congeners (*i.e.* PCB52, PCB95, and PCB149) were detected showing percentages of detection in the range between 48% and 57%. A significant correlation between 3 of the 6 gene biomarkers assessed (*i.e.* HSP60, CYP1A and ERα) and plasma levels of some PAH congeners was found. In contrast, any significant association between PCB burden and gene expression was observed. The relation between PAH concentration and gene expression in whole blood cells suggests that these genes respond to environmental contaminant exposure and are promising candidate for the development of biomarkers for monitoring POP exposure in sea turtles.

paolo.cocci@unicam.it

GRETA COLOMBI[1], SIMONA SANVITO[2], FILIPPO GALIMBERTI[2]

1 Dipartimento di Biologia Animale, Università degli Studi di Milano
2 Elephant Seal Research Group, Sea Lion Island, Falkland Islands

SOCIALITY DURING PREDATION EVENTS OF KILLER WHALES (*ORCINUS ORCA*) OF THE FALKLAND ISLANDS

Killer whales (*Orcinus orca*) are a charismatic top predator species with a worldwide distribution. Killer whales have been subject of intensive long-term studies in the Northern Hemisphere, while research on them in the Southern Hemisphere started more recently, and was scarce in particular in the South Atlantic. A notable aspect of killer whale biology is their complex sociality, based on a dynamic and hierarchical social system, and on long-term bonds between genetically related individuals. In 2013 we begun a long-term study of killer whales at Sea Lion Island, a hotspot of killer whale sightings in the Falkland Islands. We studied killer whale sociality focusing on social behaviour and association during predation events, that usually involve southern elephant seals (*Mirounga leonina*) as prey. We studied predation events using direct observation from land, photo-identification, videos taken using a drone (Phantom III, DJI), and necropsies of prey found washed ashore. We found that: 1) the basic social unit of Sea Lion Island killer whales is the mother-calf association, that can include up to three generations of calves; 2) multiple mother-calf pairs are often associated in pods, that are stable social units that last at least for the whole length of the season (September-March); 3) different pods, and non pod individuals, are often associated during predation events, that can involve up to 11 individuals; 4) transient killer whales, i.e. individuals that are recognized but are observed at Sea Lion Island for just a few hours to a few days, can be involved in predations events; 5) predations events involve complex social behaviours, including collaboration to keep the prey carcass floating, calf feeding facilitation by adults, and active prey sharing; 6) the use of drone videos greatly increases the understanding of killer whales sociality during predation events, and at large. All together, predations are special events in killer whales sociality, in which both social behaviour and association are more complex and dynamic than during the rest of killer whales activity. This added complexity is likely related to the problem of capturing a large marine mammal prey that is negatively-buoyant and, therefore, needs the collaboration of various individuals to be handled

greta.star@hotmail.com

ENZO GORETTI, MATTEO PALLOTTINI, FRANCESCA VERCILLO,
GIANLUCA BENCIVENGA, MARIO LUNA, SILVIO SORCINI,
STEFANO TITO, ZERUN ZERUNIAN

Dipartimento di Chimica, Biologia e Biotecnologie (Università degli studi di Perugia)

LA LEPIDOTTEROFAUNA DI INTERESSE EUROPEO IN UMBRIA (PROGETTO SUN LIFE)

L'indagine mediante "butterfly watching" o cattura/rilascio, condotta in Umbria dal 2012 al 2017 sulle specie di lepidotteri di interesse europeo (Direttiva Habitat, 92/43/CEE), arricchisce la precedente indagine del 2006-2011 e, integrata dai dati di letteratura, evidenzia la presenza delle seguenti specie:

- *Eriogaster catax* (All. II, IV, monovoltina), volo in ottobre; M.te Subasio (ZERUNIAN & ZILLI, 2014), M.ti Martani, Piani di Gavelli, M.te Fionchi (Spoleto), dint. Orvieto (BERTACCINI *et al.*, 1994);
- *Proserpinus proserpina* (All. IV, monovoltina), volo in giugno; Pescia (Norcia), dint. Orvieto (PROLA *et al.*, 1978);
- *Parnassius apollo* (All. IV, monovoltina), volo in luglio-agosto; M.ti Sibillini, M.te Pizzuto;
- *Parnassius mnemosyne* (All. IV, monovoltina), volo in maggio-luglio; intero settoreappenninico;
- *Zerynthia cassandra* (All. IV, monovoltina, endemica dell'Appennino), volo in aprile-maggio; ben distribuita in tutta l'Umbria, strettamente associata alla pianta nutrice (*Aristolochia*);
- *Phengaris arion* (All. IV, monovoltina), volo in maggio-luglio; intero settore centro-orientale della regione, associata alla pianta nutrice *Thymus* e alla formica ospite *Myrmica*;
- *Euphydryas provincialis* (All. II, monovoltina, specie del complesso di taxa rappresentato da *E. aurinia*), volo in maggio-giugno; intero settore centro-orientale della regione, in zone pedemontane e montane;
- *Melanargia arge* (All. II, IV, monovoltina, endemica dell'Appennino), volo in maggio-giugno; arte centro-occidentale della regione; in espansione verso nord, raggiunge in Umbria il limite settentrionale del suo areale (Città di Castello); ad oriente colonizza il M.te Subasio e si spinge fino a M.te Cucco a 1350 m s.l.m.;
- *Erannis ankeraria* (All. II, IV, monovoltina), volo in marzo; unica segnalazione sul M.te Subasio (ZERUNIAN & ZILLI, 2014);
- *Euplagia quadripunctaria* (All. II*, monovoltina), volo in agosto-settembre; ben distribuita in tutta l'Umbria.

Su una checklist italiana di 24 specie di lepidotteri di interesse comunitario, 10 sono le specie che colonizzano in vario modo l'Umbria (progetto LIFE13 NAT/IT/000371). Potenzialmente, all'attuale lepidotterofauna umbra potrebbero essere aggiunte solo la sfingide *Hyles hippophaes* (All. IV) e il licenide *Lycaena dispar* (All. II, IV), segnalate entrambe in prossimità del confine nord-orientale con le Marche.

francesca.vercillo@unipg.it

MATTEO DAL ZOTTO[1,2,3], GIUSEPPE ROMEO[1,3], LUIS A. MENA AGUILAR[4], DARIO SONETTI[1,3], AURORA PEDERZOLI[1]

1 Department of Life Sciences, University of Modena and Reggio Emilia, via Campi, 213/d, Modena, Italy;
2 Consortium for the Interuniversity Center of Marine Biology and Applied Ecology, viale N. Sauro, 4, Livorno, Italy;
3 Associazione Foreste per Sempre, Via D'Avia Sud 65/a, Modena, Italy;
4 Asociación Ecológica Paquera, Lepanto y Cóbano, Jicaral, Nicoya, Costa Rica

THE AVIAN COMMUNITY OF THE KAREN MOGENSEN RESERVE, WEALTH OF BIODIVERSITY WITHIN THE POORLY INVESTIGATED AND THREATENED ENVIRONMENTS OF NORTHWESTERN COSTA RICA

Northwestern Costa Rica is among the least known districts of the country in terms of ornithic fauna, despite being characterized by some of the most threatened forest ecosystems of Mesoamerica. Within this region, in the framework of an ongoing international cooperation program, we had the opportunity to investigate the Karen Mogensen Reserve, a protected area distinguished by the presence of a great variety of habitats. Surveys carried out over a 20-year period revealed an avian community composed of 204 species, a high species richness compared to similar areas of northwestern Costa Rica, of which 115 breeding in the zone and other 14 potentially breeding. We recorded four IUCN globally Vulnerable or Near-Threatened species, along with five species reported for the first time from the region, with range extensions of more than 100 km. Twenty-six species, mostly breeding in the area, are at their southernmost range borders, hence greatly susceptible to global environmental alterations, such as climate change. Besides, our study revealed the presence of two species endemic to a restricted area of Central America and four subspecies endemic to Costa Rica, along with breeding populations of two species that are geographically isolated from the main ones. Our analysis led to the ecological characterization of the resident avian community, showing that the 65% of the species is strictly associated to the understory or middle tree level, therefore more vulnerable to environmental change and susceptible of local extinction. These results stress the importance of the area for bird conservation within a vulnerable environmental context, and prompt the continuation of periodic bird surveys and the improvement of local conservations measures. The data collected will be an important tool for future studies aimed at evaluating the consequences of habitat fragmentation and to monitor the effects of climate change on the resident avifauna. We exhort the creation of programs that integrate bird monitoring, ecological research, conservation initiatives, and the involvement of the local communities, by promoting environmental education, capacity-building, and income generation. On this aim, the Karen Mogensen Reserve may represent a convincing model and valuable example to apply in similar contexts of the Neotropics. Eventually, the present study is a promising starting point for an exchange of ornithological knowledge between Italian and Costa Rican researchers.

matteo.dalzotto@unimore.it

TAREK DAAS[1], HIBA REZZAG MAHCENE[1], MOHAMED SAID RAMDANI[1], OUIDED MAAMCHA[1], PATRICK SCAPS[2]

1Laboratoire de Biologie Animale Appliquée-Faculté des sciences-Université Badji Mokhtar-Annaba-Algérie
2Laboratoire d'Ecotoxicologie et d'Ecologie Numérique-UST de Lille-France

INVENTAIRE ET BIODIVERSITÉ DE LA FAUNE MACROBENTHIQUE DU LITTORAL EST ALGÉRIEN

Parmi les invertébrés marins, le taxon le plus abondant dans les communautés benthiques en termes de richesse numérique et biodiversité est celui des Annélides Polychètes (Gözler *et al*., 2009). Ils sont connus pour leur rôle majeur dans le fonctionnement des communautés benthiques en exerçant une action sur l'environnement sédimentaire marin, et constituent 35 à 50% des espèces macro-benthiques (Knox, 1977). Le but de ce travail consiste à comparer l'abondance et la répartition des différentes espèces d'invertébrés mains en général et des Néréidés (Annélides, Polychètes) particulièrement, car cette famille est l'une des plus diverses et ce au niveau de trois sites d'étude de l'Est Algérien: EL-Kala, Annaba et Skikda en tenant compte des différents paramètres physico-chimiques et ce durant l'année 2016. Après l'établissement d'un inventaire selon les critères de classification de Fauvel (1923) et une analyse morphométrique de tous les individus, cette étude a permis l'identification de plusieurs espèces d'annélides polychètes. Les résultats ont permis l'identification de plusieurs espèces de polychètes tels que *Nereis falsa*, *Platynereis dumerilii*, *Perinereis marionii*, *Lepidonotus clava*, *Perinereis macropus*, *Perinereis marionii*, *Nereis succinea*, *Perinereis floridana*, *Nereis virens*), des crustacés, des mollusques, de nématodes, de gastéropodes, des mollusques etc. et ce au niveau des trois sites d'étude. Aussi et par la même occasion, plusieurs espèces d'algues ont été identifiées. Les variations de répartition de certaines espèces dans certains sites sont en rapport avec certains facteurs externes (e.g., température, salinité, O^2 dissous) ainsi que de la période de reproduction et de l'impact direct de la pollution sur l'abondance de ces vers marins et la biodiversité des espèces benthiques dans le littoral Est Algérien. Cependant, l'indice de diversité enregistré à El Kala est le plus élevé par rapport aux autres sites étudiés avec une dominance des annélides suivis des mollusques.

tarek63daas@yahoo.fr

FRANCESCO ENRICHETTI[1], SIMONE BAVA[2], GIORGIO BAVESTRELLO[1], FEDERICO BETTI[1], MARZIA BO[1]

1 Dipartimento per lo Studio del Territorio, dell'Ambiente e della Vita, Università degli studi di Genova, Corso Europa 26, 16132, Genova
2 Area Marina Protetta Isola di Bergeggi, Comune di Bergeggi, Via De Mari 28/D, 17028, Savona

DEEP CORALLIGENOUS BIODIVERSITY AND ARTISANAL FISHING EFFORT: THE CASE OF THE MALEDETTI SHOAL (SAVONA, LIGURIAN SEA)

Marine ecosystems are classified as vulnerable (VMEs) according to a combination of characteristics laid out by FAO in 2009: uniqueness, functional significance, fragility, low resilience of dominant species and structural complexity. VMEs frequently show peculiar topographical features and are subjected to various degrees of fishing effort. Conservation measures require a significant documentation regarding the biological features of the habitat and the quantification of the anthropogenic disturbance. At present this type of information is not available for any highly exploited continental platform site in Italian seas. This study is focused on a deep coralligenous site known as "Maledetti Shoal", located in the Ligurian Sea. It is a 1km-long, vertical wall, parallel to the coastline and extending from 55 m to 90 m. This site is known to host the most important deep population of red coral of Liguria and is highly frequented by artisanal and recreational fishermen. The Marine Strategy working protocol, based on ROV-Imaging, has been applied to assess the environmental status of ecosystems by characterizing the benthic assemblages of the site and their vulnerability along 200 m-long standard video-transects. In addition, a scientific observer was employed to evaluate the fishing effort in the area by quantifying the invertebrate discard in demersal net gears, with particular focus to structuring species.The site is characterized by a dense gorgonian forest, dominated by *Paramuricea clavata* (~ 6 colonies m^{-2}) along the vertical wall and by *Eunicella verrucosa* on the highly silted plateau above the wall. The degree of fishing impact is extremely high: every 100m of seabed explored there are 32 lost gears (41% lines and 14% nets). About 51% of the colonies are entangled by gears, and 17% of them show also evident signs of necrosis or epibiosis. The discard analysis includes approx. 70 OTU, with gorgonians and bryozoans being the most common among the structuring taxa. The estimated fishing effort is quantified as 13 living gorgonian colonies/fragments for every 500 m of trammel net. The Maledetti Shoal has been recently turned into a Special Area of Conservation under the Habitat Directive. This achievement will be fundamental to improve the protection of this valuable marine ecosystem. Data supports also the delineation of fishing restriction zones to minimize the impact of fishing and to improve the exploitation of fishing resources in nearby areas.

fraenrichetti@gmail.com

YANNICK FANIN, FRANCESCA TAMI

Dipartimento di Scienze Agroalimentari, Ambientali e Animali - Università degli Studi di Udine, Via Sondrio, 2/A, 33100 Udine

ACOUSTIC SURVEY OF *ZEUNERIANA MARMORATA* (FIEBER, 1853) (INSECTA ORTHOPTERA) THROUGH THE APPLICATION OF DISTANCE SAMPLING

The Adriatic Marbled Bush-cricket (*Zeuneriana marmorata*) is a grasshopper belonging to Tettigoniidae. It is currently present in only three sites in Italy (all in Friuli Venezia Giulia) and one site in Slovenia. This grasshopper lives in rushes composed mainly of *Juncus* sp. and *Phragmites* sp. that occasionally suffer from floods. Songs of Orthoptera can be used for monitoring the communities. Acoustic parameters of *Z. marmorata* songs are distinctive of this species and cannot be confused with other species in the study area. To extimate the number of singing males, were performed linear transects (70 m long) in two different sites. In each transect were counted the singing males, and was estimated the distance (in relation to the transect axis). Each transect was walked four times during the season in order to avoid estimating influences from the period. The collected data were analyzed using the distance sampling software. Distance sampling is a statistical methodology used to compute animal fares based on the distance of animals to be estimated from a known point of observation, which allows to calculate the expected number and density (Buckland et al., 2010). The first step is to calculate a continuous function of observations called *accounting function* (Franzetti and Focardi, 2006). The function is chosen in base of the minimum AIC (*Aikake's Information Criterion*) value, which provides a quantitative indication of the model's goodness based on maximum likelihood and number of parameters. For this study, the chosen model uses an estimator based on the Half-normal function, with a selection criterion based on the sequential grouping based on the defined distance class.The estimate of the number of singing males is calculated on homogeneous density areas. In 2016, in the first site (Monfalcone, Lisert), a density of 156 caps / ha was estimated for a total of 103 individuals. On the second site (Fossalon di Grado, Caneo), a density of 163 heads per hectare was estimated for a total of 262 individuals. This technique proved to be very effective to estimate the number of males on land difficult to survey.

yannickfanin@gmail.com

ALESSANDRO FERRANDO, GIOVANNA DI NARDO,
GIANFRANCO GILARDI, SIMONA BONELLI

Department of Life Sciences and Systems Biology, University of Turin, Via Accademia Albertina 13, 10123 Torino, Italy

A PROTEOMIC APPROACH TO PROTECT ENDANGERED SPECIES

Proteomics is a very powerful tool to study the whole protein expression profile of an organism, specially related to different environmental conditions or compared to other species. It is a recent branch of biochemistry that has by itself a huge potentiality, because, especially in non-model animals, this peculiar technique allows to discover proteins whose mRNA or locus in the genome in unknown, getting even more useful than transcriptomics or genomics, also for is ability to discover post-transcriptional modification (VALCUN and KEMPENAERS, 2015). However it is not largely used, specially in behavioural ecology, due to its difficulty (collection of samples, precision required,…). We are among the first to use this approach adapted to social parasites, indeed our work is focused on the host parasite system "*Myrmica-Maculinea"*. All *Maculinea* butterfly are are obliged social parasite of ants. Larvae are adopted by *Myrmica* workers, this behaviour is mediated by chemical and acoustical mimicry. Larvae will spend the next 11-23 months inside the colony, directly fed by trophallaxis or as predator of ants larvae; once adults, they leave the colony (WITEK *et al*., 2013). *Maculinea* butterflies are typical representatives of endangered European biodiversity and all species are listed by IUCN as globally threatened, while their host ants are quite common and largely distributed. Because of that, we studied *Myrmica*'s proteome in order to elucidate the relation between larva's adoption and colony characteristics, such as: i) colony size, ii) number of queen, iii) young-old workers ratio. We prepared colony-like sets with all that characteristics combined, first to study their proteome, than to understand what drives the adoption. As a strategy, we decided to use a combination of two-dimensional gel electrophoresis (2-DE) and Mass Spectrometry (MS, to sequence the protein(s) discovered related to the specific environmental conditions). Once obtained, the environment-specific proteins will be identified using a protein-bank to search for homology with other known proteins, discovering their role in cell/ant/community. A very interesting and important feature of that approach is its applicability to other systems, in order to study differences in proteins expressed in response to different environmental conditions.

alessandro.farran@edu.unito.it

ANDREA GALIMBERTI[1], NICOLA TOMMASI[1], ANTONIA BRUNO[1], ANNA SANDIONIGI[1], ALBERTO BAERI[1], TELMO PIEVANI[2], FRANCO ANDREONE[3], MAURIZIO CASIRAGHI[1]

1 ZooPlantLab, Università degli Studi di Milano-Bicocca, P.za della Scienza, 2 20126 Milano
2 Research Unit in Philosophy of Biology, Università degli Studi di Padova, Via U. Bassi, 58/B 35131 Padova
3 Museo Regionale di Scienze Naturali, Via G. Giolitti, 36 10123 Torino

HIGH THROUGHPUT SEQUENCING APPLIED TO MUSEUM SPECIMENS: A NEW FRONTIER FOR BIODIVERSITY CONSERVATION. THE CASE OF *PODARCIS RAFFONEI* (REPTILIA: LACERTIDAE)

Working on ancient DNA belonging to museum collections represents a challenge of current interest in the field of conservation biology. Genetic information, retrieved from past populations of species that are now on the brink of extinction, can provide valuable elements to identify the causes of this phenomenon and address proper conservation strategies. We focused our study on museum samples of *Podarcis raffonei* (Mertens, 1952), an endemic lizard of the Aeolian Islands. *P. raffonei* is categorized as critically endangered by the IUCN Red List, and it can be considered the most threatened lizard in Italy and possibly in the whole Europe. We analyzed 43 samples of *P. raffonei* belonging to three different Italian museums (i.e., University of Florence, Zoological Museum of Palermo and Zoological Museum of Rome) collected at six different locations and in a temporal window ranging from 1970 to 1990. We developed specific protocols for ancient DNA extraction and we were able to extract gDNA of sufficient quality from 37 out of 43 samples. We decided to apply for the very first time on museum samples an innovative high throughput sequencing strategy called double digest Restriction site-Associated DNA Sequencing (ddRAD Seq), which permits to identify genetic markers randomly distributed across the genome of analyzed samples. In total, we obtained 82,766,938 raw reads from the whole sampling, and we got on average 1–3 million reads per individual. The results of bioinformatics analysis showed good quality scores of the ddRAD sequencing reads, with mean phred scores of at least 31. Using the STACKS platform we identified 136,490 tags for 3,160 polymorphic loci and 3,200 putative SNPs to be used for further population genetics comparisons. The SNPs markers allowed to preliminary demonstrate a moderate population structure among the investigated insular sites with high F^{ST} values. The comparison with genomic information retrieved from current populations of *P. raffonei* will reveal the evolutionary and anthropogenic forces acting on the remnant populations of this lizard and to foresee which are the conservation risks if no conservation efforts will be adopted.

andrea.galimberti@unimib.it

MEHREZ GAMMOUDI, SAIDA TEKAYA

Université Tunis El Manar, Faculté des Sciences de Tunis, UR11ES12
Biologie de la Reproduction et du Développement animal, 2092, El Manar Tunis, Tunisie

LES VERS PLATS LIBRES EN TUNISIE

Les «Turbellariés» sont des Plathelminthes libres (non parasites) qui peuvent occuper les milieux aquatiques (marins et dulçaquicoles) et terrestres humides. Malgré leur importance phylogénétique comme étant les premiers métazoaires présentant une céphalisation et l'intérêt qu'ils suscitent en servant de matériel de choix pour les études de la régénération, de la reproduction et du développement embryonnaire, ces animaux, n'ont intéressé jusqu'à présent qu'un nombre restreint de chercheurs. En Tunisie, certains groupes sont encore méconnus et les informations disponibles concernant la systématique et la biogéographie de cette faune dans notre pays sont dispersées dans des documents aussi bien anciens que récents. Notre travail (GAMMOUDI et al., 2017) est la première synthèse disponible sur ce groupe zoologique. Cette présentation consiste en un inventaire réalisé à la fois à partir d'un nouveau matériel que nous avons collecté et à partir des données bibliographiques. 29 espèces appartenant à 3 ordres différents sont signalées. Ces espèces sont réparties comme suit: 14 Polyclades, 14 Triclades et 1 Prosériate. Des données sur la systématique et une illustration de la morphologie externe et interne de chaque espèce sont fournies. En outre, une carte de distribution géographique de toutes les espèces signalées dans les eaux tunisiennes est établie. Pour plus de détails voir Gammoudi et al. (2017).

GAMMOUDI, M ; GARBOUJ, M ; EGGER, B & TEKAYA, S (2017) Updated inventory and distribution of free-living flatworms from Tunisian waters. Zootaxa, 4263 (1): 120–138.

mehrezgamoudi@yahoo.fr

ANITA GIGLIO[1], FRANCESCO CAVALIERE[1], PIERO GIULIO GIULIANINI[2], ANTONIO MAZZEI[1], FEDERICA TALARICO[1], MARIA LUIGIA VOMMARO[1], PIETRO BRANDMAYR[1]

1 Dipartimento di Biologia Ecologia e Scienze della Terra, Università della Calabria, Rende, Italia
2 Dipartimento di Scienze della Vita, Università di Trieste, Trieste, Italia

MODIFICAZIONI ULTRASTRUTTURALI IN TUBULI MALPIGHIANI DI *CALATHUS FUSCIPES* GOEZE 1777 (COLEOPTERA, CARABIDAE) COME BIOMARKERS DI ESPOSIZIONE A DOSI SUBLETALI DI PESTICIDI

L'utilizzo di pesticidi nelle pratiche agricole può compromettere la sopravvivenza di specie benefiche non-target di insetti, che hanno un ruolo importante nel controllo delle popolazioni di specie infestanti. Molti sono i biomarkers di esposizioni misurati a diversi livelli dell'organizzazione biologica per valutare gli effetti sub-letali dovuti ad esposizione cronica. Tuttavia, le analisi riguardano solo organi target, come il sistema nervoso ed endocrino, e tralasciano spesso gli effetti su organi non-target. La finalità di questo lavoro è di valutare il potenziale ruolo che i tubuli Malpighiani (TM) possono avere come biomarkers di esposizione a sostanze xenobiotiche. A tale scopo, abbiamo analizzato le alterazioni ultrastrutturali delle cellule epiteliali dei TM di adulti di *C. fuscipes* prelevati in un campo di patate (1200 m s.l.m.; 39°21′2.04″N, 16°26′28.80″E; Azienda Rizzuti srl, Spezzano della Sila, Calabria) trattato con preparati commerciali a base di piretroidi come lambda-cialotrina (Ercole® e Karate® contro larve di Elateridi e dorifora) e fungicidi come cimoxanil (Shelter®, contro la peronospora). Come sito di controllo è stato campionato un pascolo a vegetazione semi naturale localizzato a 9 km dal sito trattato (39°18′28.69″N, 16°32′4.94″ E, 1390 m s.l.m.; San Nicola Silano, Calabria). Gli esemplari sono stati prelevati mediante cattura diretta da entrambi i siti in settembre ed ottobre 2016 periodo di maggiore attività della specie testata. In laboratorio, gli esemplari sono stati dissezionati, i TM fissati ed inclusi in resina epossidica; le sezioni ultrasottili osservate al microscopio a trasmissione Jeol JEM 1400 Plus. I TM provenienti da esemplari catturati nel campo di patate, confrontati con i campioni di controllo, mostrano evidenti alterazioni ultrastrutturali a carico del nucleo e dei mitocondri, una riduzione delle invaginazione della membrana plasmatica nella porzione basale delle cellule epiteliali ed una dilatazione dei microvilli nella porzione apicale con rilascio di secrezioni nel lume del tubulo. Le alterazioni a livello delle membrane, dovute probabilmente all'effetto della lambda-cialotrina sui sistemi di trasporto attivo, compromettono la capacità di escrezione e di assorbimento da parte dei TM. Questi risultati mostrano che i TM sono ottimi biomarkers di esposizione per valutare gli effetti subletali di piretroidi su specie benefiche al fine di contribuire alla salvaguardia della biodiversità dei sistemi agricoli.

anita.giglio@unical.it

MARTINA GREGORIETTI[1], ELENA PAPALE[1], ROSARIO GRAMMAUTA[1], FRANCESCO FILICIOTTO[2], MARIA CERAULO[1], GIUSEPPA BUSCAINO [1]

1 IAMC – CNR , SS di Capo Granitola, Via del Mare 3, 90121 Mazara (TP)
2 IAMC – CNR, SS di Messina, Spianata S. Raineri 86, 98122 Messina (ME)

MONITORAGGIO ACUSTICO A LUNGO TERMINE DI *TURSIOPS TRUNCATUS* (MONTAGU, 1821) IN UN'AREA AD ELEVATO IMPATTO ANTROPICO NEL CANALE DI SICILIA

Il Canale di Sicilia è una delle zone maggiormente interessate dal traffico nautico, commerciale e relativo all'attività di pesca, ed è quindi particolarmente impattato dal punto di vista acustico. Tuttavia, ancora poco è noto degli effetti del rumore sulle specie di piccoli cetacei (ed in particolare sulla popolazione di *Tursiops truncatus* (Montagu, 1821)) presenti nelle acque costiere tra Capo Feto e Capo San Marco (Sicilia Sud Occidentale). Con l'obiettivo di monitorare la presenza della specie e l'interazione col traffico nautico, sono stati analizzati i dati acustici raccolti nell'anno 2015 tramite un idrofono Reson (TC1414, US) (sensibilità -180 dB re: 1 V/uPa nel range di frequenza da 0.1 Hz a 250 kHz), installato a bordo di una meda elastica a 3 miglia a largo di Capo Granitola. L'idrofono, posizionato a 16 m di profondità, ha registrato dati in continuo per 14 mesi (da gennaio 2015 a febbraio 2016) a 50kHz. I fischi di tursiope sono stati individuati automaticamente con il software Silbido e, dopo verifica manuale, sono stati analizzati in relazione alla presenza di imbarcazioni entro 3 miglia dalla meda (identificate tramite dati AIS e quindi prevalentemente navi commerciali e pescherecci) e ai livelli di rumore registrati (*Sound Pressure Level* (SPL)) alle frequenze di 63 e 125 Hz. I risultati preliminari mostrano una correlazione negativa tra il numero di fischi e il rumore alle basse frequenze, ma una ridotta influenza della presenza delle imbarcazioni stimate tramite AIS. Il risultato ottenuto lascia presupporre una complessa interazione con le differenti componenti del traffico nautico, dato che le piccole imbarcazioni da diporto non sono identificate dal sistema AIS. Queste analisi preliminari sono particolarmente rilevanti nell'ambito della Marine Strategy Framework Directive, sia dal punto di vista dell'impatto del rumore che per la valutazione dello stato di salute delle popolazioni di cetacei nei mari italiani.

martina.gregorietti@gmail.com

ALESSANDRO LENTINI, MARIA GIOVANNA PARISI,
DANIELA PARRINELLO, MATTEO CAMMARATA

Dipartimento di Scienze della Terra e del Mare, Viale delle Scienze ed. 16 Università di Palermo

EFFETTI DELLE VARIAZIONI STAGIONALI IN DUE POPOLAZIONI DI *ANEMONIA SULCATA* (PENNANT, 1777) E PRIME OSSERVAZIONI SULLA RIGENERAZIONE DEI TENTACOLI

Gli organismi bentonici sono utilizzati sia come indicatori delle condizioni oceanografiche che come strumenti per il monitoraggio delle condizioni della fascia marino costiera su cui insistono fattori antropici. La raccolta di informazioni di base sui meccanismi di acclimatazione stagionale è un passo fondamentale per comprendere le risposte fisiologiche degli indicatori biologici. In questo lavoro sono stati valutati i tratti biometrici e i biomarkers enzimatici appartenenti alle classi delle idrolasi e perossidasi in12 mesi nell'antozoo *Anemonia sulcata.* I campioni sono stati raccolti alla base di frangiflutti presso un'area portuale a Termini Imerese (TI) ad alto impatto antropico e nella zona B dell'AMP di Capo Gallo (CG). I morfotipi di CG di *A. sulcata* presentano maggiore intensità cromatica e lunghezza tentacolare durante l'inverno. Gli organismi prelevati a T. Imerese invece, hanno tentacoli più corti e chiari e mostrano un *bleaching* tardo estivo in seguito all'espulsione delle zooxantelle simbionti. La variabile biometrica tentacolare diminuisce significativamente in primavera e in estate sia a CG che a TI. L'attività enzimatica di esterasi, fosfatasi e perossidasi misurata negli estratti proteici dei tentacoli risulta più elevata in primavera e in autunno sia a CGl che a TI rispetto a tutto lo scenario annuale, mentre una significativa diminuzione è stata rilevata nella stagione calda. Anche nel corpo l'attività degli enzimi risulta maggiore durante l'inverno e la primavera. La stagionalità e il sito di campionamento pertanto modulano le risposte degli enzimi a livello dei tentacoli in *A. sulcata*. L'enzima fosfatasiè stato inoltre scelto come marcatore di rigenerazione condotta in laboratorio su organismi prelevati a TI nel periodo invernale. In particolare, è stata indagata, la crescita dei tentacoli, l'attività enzimatica nonché la presenza dell'antigene di proliferazione nucleare (PCNA) tramite immunoblotting su campioni estratti a tempi differenti (48 ore, 7 gg e 15 gg) dopo l'applicazione di un taglio differenziale di 10 e 20 tentacoli. Sia la componente enzimatica della fosfatasi che quella proteica del marker cellulare PCNA risultano maggiormente presenti nei campioni prelevati dopo 10 e 20 gg dall'inizio dell'esperimento in cui erano stati recisi 20 tentacoli. Per la prima volta pertanto sono state ottenute informazioni preliminari circa la proliferazione cellulare nell'antozoo in esame.

alessandrolentini5@gmail.com

RACHELE MACIRELLA, ANTONELLO GUARDIA, ILARIA BERNABÒ, SANDRO TRIPEPI, ELVIRA BRUNELLI

Dipartimento di Biologia, Ecologia e Scienze della Terra, Università della Calabria, Via P. Bucci, 87036 Rende (CS), Italia

EFFECTS OF CHLORPYRIFOS ON THE GILLS OF THE ORNATE WRASSE (*THALASSOMA PAVO)*

The growing exploitation of coastal and marine resources and the increase in pollution due to human activities has led to population depletion and biodiversity reduction. Nowadays, organophosphate compounds are the most popular pesticides and represent the group of contaminants posing the highest risk for the ecosystem. The aquatic environment appears to be one of the primary locations for OPPs, as confirmed by numerous studies. In particular, coastal habitats can be contaminated by OPPs directly from human sources or through atmospheric transport but they also receive these contaminants via river inputs. Chlorpyrifos (CPF) is a broad spectrum OPPs that is commercially used to control pests on cotton, paddy fields, pasture and vegetable crops and it is one of the most frequently used OPPs in the world. It has been detected at low concentrations in coastal waters and at concentrations comparable with some legacy organochlorine pesticides in marine organisms from arctic biota. CPF is an inhibitor of acetylcholinesterase and compared to organochlorine compounds, this insecticide is more harmful to fish because of its high toxicity and persistence. Fish could be used as bioindicators of contamination induced by several toxicants because they are able to very quickly absorb chemicals through the gills, the body surface, and contaminated food. Given this background, we investigated the alterations induced by CPF on gill apparatus of *Thalassoma pavo*, a widespread species in the Mediterranean that inhabits coastal water near breakwater cliffs. We exposed animals (n=24) to two sub-lethal concentrations of CPF (3.5 and 7 µg/l) for 48 and 96 hours and we performed an histological and ultrastructural analysis of gills, along with the assessment of Na^+/K^+ ATPase immunolocalization. LM and TEM observations revealed conspicuous alterations on the gill epithelium, that seem to be both dose and time dependent. One of the main pathological modifications observed in our study were the hyperplasia of pavement cells in the secondary epithelium leading to the fusion of adjacent lamellae; we also observed, in both main and secondary filament, the detachment of epithelium from the connective tissue below, the increase in size and the ectopia of chloride cells and the presence of degenerative phenomena. Moreover we showed vascular damage and appearance of aneurysms and we revealed an increase in Na^+/K^+ ATPase that peaked after 4h of exposure to the lowest concentration.

rachele.macirella@unical.it

FRANCESCO MASTROTOTARO, GIOVANNI CHIMIENTI

Department of Biology and CoNISMa LRU, University of Bari, Via Orabona 4, 70125 Bari - Italy

APLIDIUM POLYTREMA (TUNICATA, ASCIDIACEA): RARE OR MISIDENTIFIED SPECIES?

Biodiversity studies are based on the number of the species. In contrast with the concept of biological erosion, the checklists are steadily increasing, with the progressive adding of new species and without the deleting of missed ones (BOERO, 2011). Rare species, sometimes only described by their authors and never more found, are also included in the checklists despite not always being confirmed by any other occurrence. For instance, 25 species of *Aplidium* genus (Tunicata, Ascidiacea) are known in the Mediterranean Sea but three of them (i.e. *A. nema*, *A. ocellatum* and *A. polytrema*) were never found after their original description. In particular, *A. polytrema* (Monniot C. & Monniot F., 1983) is a colonial tunicate described by the authors as *Sidnyum polytrema* along the Mediterranean French coasts of Port-Cros Island and never found later. The finding of some colonies of *A. polytrema* in February and June 2011, at 10 m depth in the Pozzuoli Gulf, confirmed its presence in the Tyrrhenian Sea. This second occurrence offered the opportunity to re-describe this rare species, highlighting its main taxonomic features such as the 8 lobes in oral siphon together with the high number of rows of stigmata (from 17 to 19), as well as the areolated or slightly plicated stomach surface. Moreover, several embryos and larvae were found in the peribranchial chamber of some colonies. This gave the opportunity to observe and describe the larval morphology, with three adhesive organs on long and slender stalks, two medial ampullae and many ectodermal vesicles arranged in multiple arcs. On the contrary, in the first description of the species the larva was described with only two adhesive organs, despite the same authors were in doubt about this feature and they hypothesized a malformation (MONNIOT and MONNIOT, 1983). Since *Aplidium* genus comprises species with similar external features, it is possible that in the last thirty years after its first description *A. polytrema* has been misidentified as one of the other co-generic species. Thus, rather than representing a rare species, the lack of *A. polytrema* occurrences could be due to the rarity of specialists.

francesco.mastrototaro@uniba.it

ANTONIO MAZZEI, GAETANO ALOISE, ROBERTO PIZZOLOTTO, EMILIO SPERONE, PIERPAOLO STORINO, SANDRO TRIPEPI, PIETRO BRANDMAYR

DiBEST - Università della Calabria – Via Pietro Bucci Cubo 4B - 87036 RENDE CS (ITALY)

PROGETTO PANLIFE 13 NAT/IT/001075: GIS PER LA FAUNA DELLA DIRETTIVA HABITAT NELLA RETE NATURA 2000 IN CALABRIA

Natura 2000 è il principale strumento della politica dell'Unione Europea per la conservazione della biodiversità. Si tratta di una rete ecologica diffusa su tutto il territorio dell'Unione, istituita ai sensi della Direttiva 92/43/CEE Habitat per garantire il mantenimento a lungo termine degli habitat naturali e delle specie di flora e fauna minacciati o rari a livello comunitario. Per verificare l´efficacia delle misure gestionali della Rete Natura 2000 e in attuazione dell'art17 della Direttiva è stato necessario organizzare un programma di monitoraggio, in grado di fornire un quadro completo e aggiornato degli elementi della Rete Natura 2000 in Calabria. Il progetto ***PanLife*** Natura2000 *Action Programme* è nato con l'obiettivo principale di produrre un documento programmatico per il ripristino di uno stato soddisfacente di conservazione, la coerenza ecologica e funzionale e la gestione a lungo termine dell'intera Rete Natura 2000 in Calabria, regione che conta 178 SIC e 6 ZPS che ricoprono il 19% del territorio regionale. Il primo passo per conseguire questi obiettivi è stato quello di creare un database contenente tutti i dati distributivi delle specie particolarmente protette (ossia incluse negli allegati II e IV della Direttiva Habitat e nell'allegato I della Direttiva uccelli). A queste si aggiungono altre di interesse biogeografico o conservazionistico presenti sul territorio regionale, desunte ad esempio dalle Liste Rosse IUCN. Sono stati utilizzati dati estrapolati da fonti bibliografiche e dati inediti ricavati dalle ricerche sul campo effettuati *ad hoc* nel corso degli ultimi anni. Lo stesso database è stato, quindi georiferito e mappato su piattaforma SIT (Sistema Informatico Territoriale) attraverso una elaborazione *multilayer* su sistema di riferimento geografico WGS84. In questo modo si è ottenuta la mappatura della fauna su tutto il territorio, come base indispensabile di partenza per la valutazione dello stato di conservazione delle singole specie. Sono oggi disponibili le mappe per un totale di 165 specie: 2 Cnidari, 1 di Molluschi, 1 di Crostacei, 17 Insetti, 1 di Echinodermi, 6 Pesci ossei, 9 Anfibi, 13 Rettili, 34 Mammiferi e 81 Uccelli. Il collegamento del Database descritto al sistema cartografico della Rete Natura 2000 ha permesso di analizzare la connessione tra siti a diverso grado di naturalità ed a formulare proposte per migliorare la qualità diffusa nel territorio. La metodologia utilizzata permette non solo di migliorare le conoscenze biogeografiche generali, ma anche di valutare nel tempo l'efficacia delle misure di conservazione e di proporre soluzioni gestionali per i Siti Natura 2000. Tutto ciò darà un contributo efficace al raggiungimento degli obiettivi della strategia dell'UE per la biodiversità.

brandmayr@unical.it

ANTONIO MAZZEI[1], FRANCESCO CAVALIERE[2],
ROBERTO PIZZOLOTTO[2], PIETRO BRANDMAYR[2]

1 Museo di Storia Naturale della Calabria. Università della Calabria Via Pietro Bucci Cubo 4B cap 87036 RENDE CS (ITALY)
2 DiBEST - Università della Calabria – Via Pietro Bucci Cubo 4B cap 87036 RENDE CS (ITALY)

IL RUOLO DEI PASCOLI NEL MANTENIMENTO DELLA BIODIVERSITÀ DEI COLEOTTERI CARABIDI NEL PAESAGGIO AGRARIO DELLA SILA

Nelle aree agricole la biodiversità è influenzata dal tipo di conduzione agronomica ed dalla complessità e dalla disposizione delle aree di compensazione ecologica che caratterizzano il paesaggio. Gli habitat semi-naturali sono rifugio per molte specie non dipendenti dagli agroecosistemi ma in grado di colonizzarli contribuendo in maniera utile alla loro biodiversità. Sull'altopiano della Sila, il territorio montano è caratterizzato da un mosaico di coltivi, aree prative adibite a pascolo di bovini allo strato brado, e da aree boschive. La produzione agricola più intensiva, però, in alcune aree, ha portato alla semplificazione e ad una eccessiva frammentazione del paesaggio. I Coleotteri Carabidi sono un'importante componente della biodiversità terrestre epigea, sia in ambienti naturali che in quelli coltivati, in cui possono avere un ruolo chiave nel controllo delle specie infestanti. Nell'ambito di un progetto di monitoraggio che mira ad identificare, valutare e quantificare la biodiversità dei coleotteri carabidi della Sila, sono state campionate varie *patches* che caratterizzano il paesaggio agrario montano e che comprendono coltivi, pascoli ed aree boschive. In questo studio sono riportati i dati di campionamento raccolti nel 2015 per le comunità dei Coleotteri Carabidi dei pascoli montani silani. Sono stati campionati mediante *pitfall traps* 10 siti ad altitudini variabili fra i 1400 e i 1800 m s.l.m. Sono stati catturati 4450 individui, per un totale di 43 specie, rappresentate in gran parte da elementi a vasta distribuzione geografica, con alto potere di dispersione, spesso opportuniste in quanto caratterizzate da dieta onnivora. Le specie con alti valori di densità di attività annua sono: *Calathus fuscipes* (Goeze, 1777) specie euritopa di formazioni aperte, *Calathus cinctus* (Motschulsky, 1850) specie presente dalla macchia mediterranea alle formazioni steppiche montane e in ambienti ruderali, ed *Amara aenea* (De Geer, 1774), molto frequente in ambienti aperti temperati e mediterranei. Dai dati raccolti è emerso che le aree aperte adibite a pascolo estivo rappresentano un importante area di compensazione ecologica per molte specie. Almeno 20 specie (47%) dei pascoli infatti sono abbondanti anche in agroecosistemi a conduzione intensiva. Sono, inoltre, in corso campionamenti in altre aree del mosaico che compongono il paesaggio agrario della Sila, al fine di ottenere informazioni di come la composizione e la disposizione del paesaggio circostante influenzi la presenza di specie e l'abbondanza delle popolazioni dei coleotteri carabidi nei coltivi della Sila.

francesco.cavaliere@unical.it

FRANCESCO PALMAS, CINZIA PODDA, GIACOMO FRAU, MELISSA SERRA, ALESSIO MUSU, VALENTINA CANI, ANDREA SABATINI

Università degli Studi di Cagliari. Dipartimento di Scienze della Vita e dell'Ambiente – Via Tommaso Fiorelli n. 1 – 09126 Cagliari

BROWN TROUT DISTRIBUTION UPDATING IN SARDINIA: A GIS APPROACH FOR THE IDENTIFICATION OF SPECIAL CONSERVATION ZONES (SCZ)

Freshwater species are exposed to numerous anthropogenic stressors such as habitat pollution, habitat fragmentation, restricted water resources and introduction of non-native species. In Sardinia these stressors collectively resulted in two fish species categorized as critically endangered (CR, *Anguilla anguilla* Linnaeus, 1758 and *Salmo cettii* Rafinesque, 1810), and one (*Alosa fallax* Lacépède, 1803) as vulnerable (VU). Among these, the Sardinian trout is a sensitive species that has special conservation status at regional level ("Decree of the Assessor of the Defense of the Environment" 10.05.1995 n. 412). It is also an important freshwater fish due to its high social and recreational value. Therefore, the knowledge of its distribution seems particularly important to implement management and conservation strategies. Thus, the aim of this study is to evaluate the distribution of brown trout forms in Sardinia, using a GIS approach. The study area was the Sardinia Island which encompasses 24 major river basins. Occurrence data for brown trout (802 sampling sites), covering several time periods (1940-2016), were collected from two main data sources: (1) collated databases originating from several scientific reports, (2) and from the literature containing actual and historical information. Data on brown trouts were mapped in order to visualize the historical distribution, compare the more recent with the historical data and describe the native populations occurrence genetically characterized. The brown trout occurred in 81.6% of the investigated sites in the time period 1940-1970 and just 28,6% in 1990-2016. As consequence, comparing the historical Sardinian trout distribution with the more recent the thirty-year period we observed an habitat range contraction of 78% and a displacements towards higher altitudes. The brown trout distribution is currently concentrated in the central-eastern part of Sardinia, strictly close to the Gennargentu mountain system and in small isolated areas where temperature and flow regimens can sustain optimum ecological condition for the species. Currently, natural populations genetically certified are limited to two southern known basins located within the Regional Natural Reserve (Foresta di Monte Arcosu): Cixerri and Pula basins. The ongoing results deepen the knowledge about distribution patterns of brown trout forms in Sardinia. Moreover, this study gives a basic background for the future development of special conservation zones (SCZ) as recommended by the Annex II of the Habitats Directive 92/43/CEE.

f.palmas@unica.it

IRENE PICCINI[1], ENRICO CAPRIO[1], LODOVICO LORETI[1], CLAUDIA PALESTRINI[1], ANTONIO ROLANDO[1]

Università degli Studi di Torino, Via Accademia Albertina 13, Torino 10123, Italia

THE EFFECT OF DUNG BEETLE DENSITIES ON MULTIPLE ECOSYSTEM FUNCTIONS PROVIDED BY SMALL AND LARGE TUNNELER SPECIES

Over the last few decades, rapid biodiversity loss has emphasized the need to understand how species abundance and diversity affect the provisioning of ecological processes. Previous studies have shown that both species abundance and diversity might be necessary for the maintenance of natural ecosystem functioning. In this study, we examine how different densities of a specific group of insects – beetles feeding on cattle dung – affect multiple ecological functions. Specifically, we targeted two dung beetle species representatives of small and large tunnelers species: *Onthophagus illyricus* (Scopoli, 1763) and *Copris lunaris* (Linnaeus, 1758). We investigated the effect of densities on dung removal, seed dispersal and germination. In accordance with natural abundance, we spanned densities from 10 to 90 individuals for the small tunneler and from 2 to 8 for the large one. We have found that, increasing the beetle densities, the large dung beetle species increased the provisioning of all the functions investigated. Contrarily, higher densities of the small tunneler decreased the efficiency in dung removal and did not facilitate germination and seed dispersal. Our findings suggest that small dung beetles at higher densities within the same dung pat competed for the resource and did not remove dung for the nest (i.e. no transportation of dung into soil). On the other side, despite the intraspecific competition at higher densities, large beetles transported dung into soil to construct the nest and, in doing this, they facilitated both seed dispersal and germination. In conclusion, the provisioning of ecological functions depends on densities and sizes of the tunnelers investigated and large species at higher densities perform better than small ones. Given that extinction probability is size-dependent and large species are more prone to extinction than small ones, our results suggest that management measures for the conservation of large dung beetle species should gain priority.

irene.piccini@unito.it

FEDERICA SEMPRUCCI[1], LUCA APPOLLONI[2], LUCIA CESARONI[1],
MARIA BALSAMO[1], ROBERTO SANDULLI[2]

1 Dipartimento di Scienze Biomolecolari (DiSB), University of Urbino, 61029 Urbino, Italy.
2 Dipartimento di Scienze e Tecnologie (DiST), CoNISMa, University of Napoli "Parthenope", 80143 Napoli, Italy.

MEIOBENTHIC COMMUNITIES AS INDICATORS OF THE ECOLOGICAL QUALITY STATUS IN THE APULIAN COASTS

An ecological survey was conducted along Apulian coasts to explore potential relationships between the level of human disturbance and the status of meiobenthos. Sediments were sampled from 3 stations (10 to 50 m depth) in 16 transects. Overall, levels of meiobenthic taxa richness and nematode biodiversity were high. European Directives ((WFD, 2000/60/EC, MSFD, 2008/56/EC) suggest to set specific thresholds for defining the ecological quality status of marine ecosystems. In this study, the thresholds proposed for the meiobenthos showed the worst ecological quality at the Brindisi harbour and the mussel farm of Castro. A moderate impact was detected at the Marine Protect Area of Porto Cesareo, likely due to the increasing tourism disturbance in the area. A total of 138 nematode genera were found during this study. The most abundant family was Xyalidae, followed by Chromadoridae, Comesomatidae and Desmodoridae, all generally known as typical of muddy sediments. When ecological quality was evaluated by nematode thresholds, the worst ecological quality was noticed at the Brindisi harbour, Torre Specchia and Alimini Lakes. The ecological conditions revealed by meiobenthic and nematode communities appeared consistent: these results seemed to highlight a higher anthropogenic impact along the Adriatic than the Ionian coasts.

lucia.cesaroni@uniurb.it

MATTIA TONELLI[1,2], JOSÉ R. VERDÚ[2], MARIO ZUNINO[3]

1 Department of Pure and Applied Science (DiSPeA), University of Urbino "Carlo Bo", 61029 Urbino (PU), Italy
2 I.U.I CIBIO (Centro Iberoamericano de la Biodiversidad), Universidad de Alicante, San Vicente del Raspeig, 03690 Alicante, Spain
3 Free researcher, School of Biodiversity, Asti Academic Centre for Advanced Studies, Asti, Italy

NON SOLO BIODIVERSITÀ, LE DIMENSIONI CONTANO! EFFETTI DELL'ABBANDONO DELL'ALLEVAMENTO SULLE COMUNITÀ DI SCARABEI COPROFAGI

L'abbandono dei pascoli è una delle maggiori cause di perdita di biodiversità in ambiente mediterraneo (QUEIROZ et al., 2014). Fra i taxa maggiormente influenzati vi sono gli scarabei coprofagi, intimamente legati alle deiezioni animali (HALFFTER and MATTHEWS, 1966). Diversi lavori si sono concentrati sugli effetti dell'abbandono del pascolo sulla diversità delle comunità coprofaghe (TONELLI et al., 2017). Tuttavia, gli effetti sulle diverse classi dimensionali hanno ricevuto scarsa attenzione, pur trattandosi di caratteristiche di grande rilievo. Infatti è stato dimostrato come le specie coprofaghe di maggiori dimensioni siano maggiormente sensibili all'estinzione (LARSEN et al., 2005) oltre ad essere quelle che hanno il maggior impatto nei processi di riciclaggio dello sterco (SLADE et al. 2007). Sono state individuate aree con differente intensità di carico di bestiame (abbandonato, basso, moderato), le cui comunità coprofaghe sono state caratterizzate in termini di: α diversità (ricchezza specifica ${}^0D$; esponenziale di Shannon ${}^1D$), biomassa delle tre principali classi dimensionali (piccoli, medi, grandi) e percentuale di sterco rimosso. È stata registrata una progressiva perdita significativa ($P < 0.05$) nella ricchezza specifica passando dal carico moderato (${}^0D^{moderato} = 39.67$; $SE = 0.67$) al basso (${}^0D^{basso} = 35.33$; $SE = 0.33$) fino all'abbandonato (${}^0D^{abbandonato} = 30.67$; $SE = 1.2$). L'esponenziale di Shannon delle comunità ha seguito un pattern particolare con le aree abbandonate (${}^1D^{abbandonato} = 7.93$; $SE = 0.52$) e con carico moderato (${}^1D^{moderato} = 7.33$; $SE = 0.48$) aventi valori comparabili ($P = 0.60$), mentre entrambe hanno valori significativamente ($P < 0.001$) maggiori rispetto all'area con basso carico di bestiame (${}^1D^{basso} = 2.3$; $SE = 0.15$). L'abbandono progressivo del pascolo ha determinato effetti differenti nei confronti delle tre classi dimensionali. L'impatto più importante si è verificato nei confronti delle specie di grandi dimensioni, la cui biomassa è diminuita significativamente ($P < 0.01$) nell'area abbandonata ($B^{abbandonato} = 3.41$; $SE = 0.11$) rispetto alle aree pascolate a bassa intensità ($B^{basso} = 4.11$; $SE = 0.01$) ed intensità moderata ($B^{moderato} = 4.39$; $SE = 0.07$). Gli effetti sulla comunità hanno infine avuto riflessi sulla capacità di riciclare lo sterco, che nelle aree abbandonate (%^{abbandonato} = 15.93 SE = 1.94) e con basso carico di bestiame (%^{basso} = 21.68 SE = 1.31) hanno mostrato una minore capacità ($P < 0.05$) di interramento dello sterco rispetto all'area con carico di bestiame moderato (%^{moderato} = 30.33 SE = 2.77). Risulta quindi che la sola valutazione della biodiversità non sempre riesce ad evidenziare gli impatti di uno stress ambientale. Infatti, nonostante l'elevata biodiversità presente nell'area abbandonata, la perdita delle specie di grandi dimensioni ha determinato un impatto negativo nei confronti del processo ecologico. È perciò importante considerare anche le caratteristiche dimensionali e bionomiche delle singole specie e valutarne il ruolo.

m.tonelli3@campus.uniurb.it

MICHELE ZACCAGNO, GIOVANNA BONADONNA, VALERIA TORTI, MARCO GAMBA, CRISTINA GIACOMA

Department of Life Science and Systems Biology, University of Torino, Torino, Italy

HOME SWEET HOME: HOW *INDRI INDRI* USES ITS TERRITORY

Indri (*Indri indri*), a critically endangered lemur species that inhabits the eastern rainforests of Madagascar, lives in socially monogamous family groups composed of a reproductive pair plus up to four individuals. Indri is considered a territorial species: a group advertises its presence and actively defends its territory through 1) fighting intruders and 2) uttering particular songs that can be heard at a distance up to 2 km. When two neighboring groups meet, they emit specific territorial songs and, occasionally, these encounters could turn into physical fights. We studied the extension and exclusivity of the indris' territories, with a focus on the spatial behavior of six groups living in Maromizaha Forest. We investigated the existence of areas more intensely used by the indris (core areas) and quantified the level of site fidelity over the years. We surveyed 1580 waypoints sampled in 482 days, and we analyzed the data using the software ArcGIS 10.2. We calculated the Exhibition Index (EI) of five different behaviors (singing, resting, sleeping, feeding and marking) comparing between boundary-center and core area-noncore area within each territory. The indris steadily occupied relatively small territories (12.43±2.81 ha) over time, with a low degree of overlap between adjacent groups (2.31±1.59 %). Intergroup encounters were rare (9 during 18 months) and restricted to the boundaries of the territories. Furthermore, indris showed a high level of site fidelity and spent 50% of their time in an area corresponding to 28% of the territory; confirming the presence of core areas. Statistically significant differences in the EIs emerged between the core and non-core areas, but not between center and boundaries. Future studies will investigate which are the main ecological features of the core areas, focusing on the vegetation types and abiotic parameters, to plan specific management measures to increase habitat suitability.

michele.zaccagno@edu.unito.it

Symposium 3

Coordinators: Sandro Bertolino– Mehrez Gammoudi

(sandro.bertolino@unito.it - mehrezgammoudi@yahoo.fr)

Pest, invasive species and disease vectors

The current geological age is called 'Anthropocene' for the strong impact that humans are having on the Earth's environment. The introduction of invasive species is an example. In the last century, the rate of introduction of new species has increased in all environments with negative consequences for native species and ecosystems. This increase regards also pest species impacting agriculture and forestry and vectors of diseases affecting other species and humans. Research groups studying invasive alien species, pest species and vectors of emerging diseases, often have limited contacts with each other. This symposium aims to bring together research groups involved in the study of biological invasions and the impacts that introduced species have on ecosystems and human well-being.

Specie introdotte, parassiti infestanti e malattie emergenti

L'era geologica attuale è chiamata 'Antropocene' per le forti influenze che l'uomo sta avendo sull'ambiente terrestre. Le introduzioni di specie animali ne sono un esempio. Nell'ultimo secolo il tasso di introduzione di nuove specie è andato aumentando in tutti gli ambienti con conseguenze negative su specie native ed ecosistemi. L'incremento di specie esotiche riguarda anche parassiti con impatto negativo su agricoltura e foreste e portatori di agenti patogeni, prima localizzati in aree geografiche ristrette o lontane dall'Europa, che causano malattie in specie animali e talvolta anche nell'uomo. I gruppi di ricerca che studiano invertebrati e vertebrati introdotti, parassiti infestanti le colture agricole e le foreste e specie portatrici di agenti patogeni che causano malattie considerate emergenti, hanno spesso pochi contatti tra loro. Questo simposio si pone l'obiettivo di offrire una sede di incontro e di scambio culturale tra gruppi di ricerca impegnati nello studio degli effetti sugli ecosistemi, sulle specie native, sulle attività economiche e sull'uomo stesso dell'aumentato tasso di arrivo in Italia e in Europa di nuove specie.

Espèces introduites, invasives et maladies émergentes

Ce symposium se concentrera sur les problèmes liés à l'introduction de parasites et de vecteurs d'agents pathogènes d'origine animale.

Communications

PIERO GENOVESI

ISPRA and Chair IUCN SSC Invasive Species Specialist Group, Via Vitaliano Brancati 48, 00144, Rome, Italy

GLOBAL PATTERNS OF BIOLOGICAL INVASIONS AND PROGRESSES IN THE EFFORTS TO PREVENT AND MITIGATE THE RELATED IMPACTS

In the last decade there has been a remarkable scientific production investigating the patterns of invasions, and the outcome of these studies confirm that biological invasions are growing at an unprecedented pace, in all regions of the world and among all taxonomic groups, with no signs of a saturation effect. The increased level of invasions is causing severe impacts on global biodiversity as well as on our economy and health. To respond to this threat, we need to prioritize action, focusing prevention on the most relevant vectors of invasions and high risk species, and concentrating control efforts on the most harmful species and in the most vulnerable sites, adapting the lessons learnt in islands eradications to wider contexts. The 2016 IUCN World Conservation Congress adopted the Honolulu Challenge on invasive alien species calling for greater action on addressing invasive alien species in order to protect biodiversity and human wellbeing from their impacts. Also following this call, in several regions of the world governmental and non governmental organisations are increasingly taking steps to improve biosecurity, and to eradicate and control invasive species, leading to encouraging results. Furthermore, recent developments in methods to control invasive species offer new opportunities to strengthen action on invasive species to much higher levels. In this regard, the Predator Free 2050 vision recently endorsed by the New Zealand government, is indeed a particularly ambitious initiative, that could become a model for other regions of the world. At the European scale the entry into force of the EU Regulation 1143/2014 on invasive alien species is indeed pushing countries to scale up action on invasions, as Member States are required to enforce prevention frameworks, as well as early detection and response systems. ISPRA is particularly active in supporting the enforcement of these provisions at the Italian scale, providing scientific expertise to the implementing authorities, informing the different sectors of the society, including institutions, and raising awareness on this threat among the general public. It is in fact evident that in order to change the behaviours at the basis of the introduction of invasive species, regulations are not enough, and citizens must be aware of the problem and need to support the needed measures.

piero.genovesi@isprambiente.it

LAURA SCILLITANI[1], LARA VOLERY[2], DIVIJA JATAVALLABHULA[2],
SVEN BACHER[2], SANDRO BERTOLINO[3]

1 Department of Agricultural, Forest and Food Sciences, University of Turin, Largo Paolo Braccini 2,10095, Grugliasco (TO), Italy
2 Department of Biology Ecology & Evolution Unit University of Fribourg Ch. du Musée 10 CH-1700 Fribourg, Switzerland
3 Dipartimento di Scienze della Vita e Biologia dei Sistemi, University of Turin, Via Accademia Albertina, 13 - 10123 Torino, Italy.

A GLOBAL ASSESSMENT OF THE ENVIRONMENTAL IMPACT OF ALIEN UNGULATES USING THE ENVIRONMENTAL IMPACT CLASSIFICATION FOR ALIEN TAXA (EICAT)

Invasive alien species (IAS) represent a major threat for the environment, since they have significant negative impacts on biodiversity and ecosystems. Despite the broad agreement on the need to reduce the negative effects of alien species, strategies on how to do this effectively with a limited budget is a controversial issue. Since the type and magnitude of the impacts of IAS vary greatly amongst taxa, identifying the level of the impact of IAS is mandatory for determine appropriate management actions. In fact, it is fundamental to prioritize actions against alien species that cause the highest level of impact or be able to predict the potential impact of species that are not yet established in order to target preventive measures against those with the highest forecast impact. The Environmental Impact Classification for Alien Taxa (EICAT), is a recently developed standardized system for classifying alien taxa in terms of the magnitude of their negative environmental impacts in recipient areas. This classification scheme considers only environmental impacts and lines up with the mechanisms of impact identified in the IUCN GISD, and hence can be used in conjunction with this important database. IAS are classified on the basis of the best available evidence of their most severe documented impacts in regions to which they have been introduced. EICAT follows a similar approach to the IUCN Red Listing: the scheme considers five categories, which follow a sequential series of impact scenarios describing increasing levels of biological organization affected by alien taxa, from the fitness of individuals, to the whole population and species or even ecosystems. The EICAT scheme identify a set of 10 mechanism of impacts, and IAS are classified on the basis of evidence of their most severe impacts under any of the impact mechanisms. The aim of this project is to provide a global assessment of the environmental impacts of alien mammal species. Among vertebrates, alien mammals have a higher overall potential and actual impact on biodiversity and are among the best known taxonomic groups. Here we present the first results based on the classification of ungulate mammals. A review of all available source of information (both published literature and reports, dissertations and other online resources) was undertaken to collect evidences on the environmental impacts of ungulate species with alien populations world-wide.

laura.scillitani@gmail.com

ELENA TRICARICO[1,2], CATHERINE SOUTY-GROSSET[3],
PEDRO ANASTACIO[4], JULIAN REYNOLDS[4]

1 Dipartimento di Biologia, Università degli Studi di Firenze, via Romana 17, 50125 Firenze, Italy
2 Dipartimento di Scienze Agrarie, Forestali e Alimentari, Università degli Studi di Torino, Largo Paolo Braccini 2, 10095 Grugliasco (TO), Italy
3 Laboratoire Ecologie & Biologie des Interactions, Equipe Ecologie Evolution Symbiose, Université de Poitiers, UMR CNRS 7267, F-86073 Poitiers France
4 MARE - Marine and Environmental Sciences Centre, Departamento de Paisagem, Ambiente e Ordenamento, Universidade de Évora, Rua Romão Ramalho, 59, 7000-671 Évora, Portugal
5 Trinity College University of Dublin, 115 Weirview Drive, Stillorgan, Co., Dublin, Ireland

INVASIVE FRESHWATER INVERTEBRATES AND FISHES: IMPACTS ON HUMAN HEALTH

Inland waters are subject to more widespread biotic invasions than terrestrial ecosystems. These invasions may be unintended – with ships ballast or migrating via canals – or intentional – for aquaculture or other human use, with freshwater fishes the most frequently moved aquatic group at global level. During the last century, 756 aquatic species were introduced in Europe, frequently carrying new parasites for native fauna and humans. Parasitized alien species can cause the loss of the invaders' original parasites, the introduction of new parasite species, or can act as new intermediate hosts or vectors for existing parasites. Many parasites are water-borne and need aquatic species to complete their transmission cycles. However, the list of "100 of the World's Worst Invasive Alien Species" (Lowe et al., 2000) was drafted by selecting species with heavy ecological and economic impacts, but without taking into account human health problems, with only seven species signaled. Thus, risk assessment of the consequences of invasive alien species (IAS) requires more attention in freshwater ecosystems. Here, we review the impacts directly and indirectly caused by freshwater IAS on human health. As direct impacts, IAS cause injuries or allergies carry contaminants (bacteria, toxins), and are the intermediate hosts to human parasites: invasive freshwater molluscs have been extensively studied for this latter issue. Indirect impacts include the effects of chemicals needed to control IAS, due to their low selectivity and/or residues that may have side effects on humans; changes on ecosystem services, making the invaded area less suitable for recreational human use (e.g. fishing, boating); damages to some cultivation/aquaculture production affecting human wellbeing in developing countries. A clear management response is needed to halt the spread of the freshwater IAS in order to reduce or minimize human and wildlife disease risk. According to Conn (2014), we need "One Health strategies for integrating human, animal, and environmental monitoring and surveillance to better prepare for or prevent geographic spread of major human health threats associated with aquatic systems".

tricaricoele@gmail.com

AULO MANINO[1], SANDRO BERTOLINO[2], LUCA CARISIO[1], DANIELA LAURINO[1], SIMONE LIOY[1], ANDREA ROMANO[1], MARCO PORPORATO[1]

1 Dipartimento di Scienze Agrarie, Forestali e Alimentari, Università di Torino
2 Dipartimento di Scienze della Vita e Biologia dei Sistemi, Università di Torino

VESPA VELUTINA (HYMENOPTERA VESPIDAE): A GLOBAL THREAT TO BIODIVERSITY AND FOOD SECURITY

The Yellow Legged Asian Hornet (*Vespa velutina* Lepeletier 1836) is native from South-East Asia. It is rapidly spreading out of its distribution area either in Asia, where at the moment it is present in South Korea and Japan, or in Europe, where it arrived in 2004 in France and is now reported from Spain, Portugal, Belgium, Italy, Germany, Great Britain, and Switzerland. *V. velutina* may invade nearly all the warm-temperate areas of the world with sufficient water available during the summer months. *V. velutina* builds large nests and eagerly preys upon other insects to feed its larvae. In the recently invaded areas, its diet consists of diptera, other vespidae, wild bees, and mostly of the Western Honey Bee (*Apis mellifera* L. 1758). Such a behaviour impacts directly on the biodiversity of these insects and indirectly on the biodiversity of the plants which depend on bee pollination for seed production. On this ground, the European Union recently placed *V. velutina* in its first list of invasive alien species of Union concern even though quantitative data on damages it produces are still rather scarce. Therefore, investigations have been started within the LIFE14 NAT/IT/001128 STOPVESPA project in order to assess the impact of this species on beekeeping and wild pollinators in western Liguria, which is the Italian territory where *V. velutina* is mostly prevalent. The beekeepers who have been interviewed complain about substantial reductions in honey production and the loss of many colonies mostly because the hornets flying near the hives impair the normal fly activity of the honey bees. Nevertheless, these outcomes are unevenly present throughout the area and therefore environmental conditions and colony management may reasonably have some influence on the extent of the observed damages. In 2016 and 2017, wild bee and other pollinating insects were sampled every 20 days by means of pan traps in six localities distributed along wester Liguria coast; their abundance tend to change in relation with *V. velutina* density gradient. Altogether, *V. velutina* impact in the studied area appears rather alarming, especially when considering that other invasive alien species of tropical origin, which are also dangerous for bees and beekeeping, are presently spreading from their native areas as a consequence of trade globalization and global warming.

aulo.manino@unito.it

LARA IAIZA, STEFANO FILACORDA

Università degli Studi di Udine, Dipartimento di Scienze Agroalimentari, Ambientali e Animali

HUMAN DIMENSIONS OF AN INVASION: ATTITUDES TOWARD *MYOCASTOR COYPUS* IN ITALY

Non-native and invasive species are one of the main threats to the conservation of biodiversity. Therefore, management programs usually include measures like eradication or reduction of fertility to control the impact of those species; these measures can be controversial and sometimes even opposed by the public to the point of halting them. Consequently, it is fundamental nowadays to understand the underlying attitudes and prior knowledge of the public to ensure the success of management programs. In this work we investigated attitudes toward the coypu (*Myocastor coypus*, Molina, 1782) a sudamerican rodent become invasive in Italy to assess which factors influence the opinion towards the animal itself and the possible solutions to its spread. We completed 1045 questionnaire surveys, distributed both by hand (in the Friuli Venezia Giulia region, N=176) and online (N=869); the questionnaire was divided into five sections and investigated general opinion about the coypu and control methods, prior knowledge of the coypu, valuation of the information sources, personal experience with the coypu and personal information of the respondent. Nearly half (44,98%) of the respondents was willing to cohabit with the coypu in their own municipality, but this willingness diminished with the increase of the prior knowledge of the animal. The level of support for control programs varied depending on the presented method: killing the animals was not a supported option by the public, and until now is the most commonly used in Italy; on the contrary non-lethal methods had a higher level of support (reduction of fertility=75,02%; landscape interventions=64,31%). Eradication by all means showed higher levels of support amongst older people, men and those who experienced damages caused by the coypu. Male respondents had a more negative opinion of the coypu and showed a higher level of support to control programs. Also the respondents with better knowledge of the animal demonstrated a higher level of support to eradication, showing how important is education and awareness of the public to ensure the success and the acceptance of control programs for non-native species.

lara.iaiza90@gmail.com

PIERO G. GIULIANINI[1], LIA ZAMPA[1], LORENZO PALLAVICINI[1], CHIARA MANFRIN[1], ANDREA CAPUTI[1], AULO BEORCHIA[2], ROSSELLA VIDIMARI[2], CINZIA CHIANDETTI[1]

1 Dipartimento di Scienze, della Vita, Università di Trieste
2 Azienda Sanitaria Universitaria Integrata di Trieste, S.C. Fisica Sanitaria

MANAGING OF *PROCAMBARUS CLARKII* BY X-RAY STERILISATION OF MALES: SURVIVAL, IMMUNOLOGICAL COMPETENCE AND BEHAVIOR

The Louisiana's red swamp crayfish *Procambarus clarkii*, native to the Southern United States and currently present all over the world, competes with native species and is a vector of crayfish plague caused by the water mold *Aphanomyces astaci*. *P. clarkii* is also reported among the 100 worst invasive species by the website "Delivering Alien Invasive Species In Europe" and among the 9 with the worst impact on more than 4 threatened species (GENOVESI *et al.* 2015). The Sterile Male Release Technique (SMRT) in combination with intensive trapping has proved to be particularly effective in the lake of Casette (Pordenone, Friuli Venezia Giulia, Italy) with a 87% reduction of *P. clarkii* population after two years of activity (AQUILONI and ZANETTI, 2014). The present study investigates the effect of X-ray irradiation of 40 Gy on 19 males compared to a control group of 10 specimens kept under the same conditions. Immune competence was evaluated with total hemocyte counts (THC), activity of basal and total plasmatic prophenoloxidase. Glycemia, as a generic stress index, and total plasmatic proteins were also measured. Emolymph withdrawals were performed after 5, 12, 28, 35, 65, 99 days post treatment. After 102 days of irradiation, the mean death age was 44.21±4.15 days for irradiated animals and 45.50±13.48 for controls. The survival model with constant hazard estimates an average death age for irradiated animals of 80.28 days and for controls of 197.00. Irradiated and control groups do not differ in survival rate ($p=.13$) and activity of plasmatic prophenoloxidase ($p>.12$). The THCs of irradiated animals are significantly lower than those of irradiated animals 5, 12, 28, 65 and 99 days after treatment ($p<.05$). The two groups also showed habituation of the alert response to a non-noxious stimulus at either 15 ($p=.03$) or 45 ($p<.01$) days after treatment but not spontaneous recovery to a different one, showing that they can generalize the response across similar stimuli in a comparable fashion. Our findings document that despite extensive gonadal damage (PIAZZA *et al.*, 2015) and a significant damage to the immune cell component, neither the humoral prophenoloxidase activity nor learning abilities differ between irradiated and control animals. Our data confirm the validity of SMRT for managing *P. clarkii* in confined basins with the indication of radiating large males a few days before the reproductive season considering life expectancy of about 80 days after treatment.

giuliani@units.it

LUCIA PIEMONTESE[1], MICHELE CESARI[1], LARA MAISTRELLO[1], RAOUL BONINI[1], PARIDE DIOLI[2], MORENO DUTTO[3], STEFANIA VOLANI[4], SARA PASQUALI[5], GIANNI GILIOLI[4], LORENA REBECCHI[1], ROBERTO GUIDETTI[1]

1 Department of Life Sciences, University of Modena and Reggio Emilia, Via G. Campi 213/d, 41125 Modena, Italy
2 Museo Civico di Storia Naturale di Milano, Corso Venezia 55, 20121 Milan, Italy
3 Entomology Consultant, 12100-Cuneo, Italy
4 Department of Molecular and Translational Medicine, University of Brescia, Viale Europa 11, 25123 Brescia, Italy
5 CNR-IMATI, Via Corti 12, 20133 Milano, Italy

THE INVASION HISTORY OF THE BROWN MARMORATED STINKBUG *HALYOMORPHA HALYS* (HETEROPTERA, PENTATOMIDAE) IN THE INVADED TERRITORIES OF ITALY

The spread of *Halyomorpha halys* all over the world seems to be relentless. Native to East Asia, in the last few years it has become a concerning urban nuisance and an invasive pest of many agricultural crops in North America and Europe. The aim of this study is to reconstruct the invasion history of *H. halys* in Italy integrating results from observational data, population dynamics modelling and population genetics. An ongoing massive survey of *H. halys* combining active monitoring and citizen science was started after its first detection (2012) in Emilia Romagna. Collected data have been included in a database, reporting location and date of the detections, and abundance of individuals. Population growth pattern and spread dynamics have been calculated on the database by a transition matrix approach and a simple cell occupancy model. Where possible, specimens were also collected for genetic studies, allowing the molecular analysis of mitochondrial DNA cytochrome c oxidase I and II genes (*cox1* and *cox2*) on more than 230 specimens. Since its first findings in a few sites in Emilia Romagna, Lombardy and Piedmont, *H. halys* presence is now recorded in almost all Northern Italy. It has recently expanded to Central Italy, with also occasional records in Southern Italy, Sicily and Sardinia. The population growth pattern resulted to be exponential and allowed to guess a more precise estimate of the introduction of *H. halys* in Italy. The spread dynamics indicated a stratified dispersal, both by short (natural) and long distance (human mediated) dispersal. Molecular data confirmed this spread pattern and revealed a large genetic diversity in Italy that can be linked both to multiple invasions from Asia, and to secondary invasions from Europe. Multidisciplinary approach has proved to be significant for the invasion study of this pest in Italy and will be essential for developing more appropriate pest control management strategies.

lucia.piemontese@unimore.it

LARA MAISTRELLO[1], ELENA COSTI[1], GIACOMO VACCARI[2], CRISTINA CASTRACANI[3], DONATO GRASSO[3], JERNEJ POLAJNAR[4], VALERIO MAZZONI[5]

1 Dept. of Life Sciences, University of Modena and Reggio Emilia, Via G. Amendola 2, 42122 Reggio Emilia, Italy
2 Consorzio Fitosanitario di Modena, Via Santi Venceslao 14, 41123 Modena, Italy
3 Dept. of Chemistry, Life Sciences and Environmental Sustainability, Università di Parma, Parco Area delle Scienze 11/a, 43124 Parma, Italy
4 National Institute of Biology, Večna pot 111, 1000 Ljubljana, Slovenia
5 Fondazione Edmund Mach, Via E. Mach 1, 38010 San Michele All'Adige, Italy,

"DIABOLIC" FIELD INVASIONS: BIOLOGY, MONITORING, BIOCONTROL AND INNOVATIVE MANAGEMENT APPROACHES OF *HALYOMORPHA HALYS*

The Asian Brown Marmorated Stink Bug (BMSB) *Halyomorpha halys* (Heteroptera, Pentatomidae) is emerging as one of the most invasive insect pests worldwide. It is also called "the diabolic bug" for being among the few insects capable of causing severe damage to many agricultural crops during summer, and to exasperate people as a nuisance pest during the massive overwintering aggregations inside houses. Presently, BMSB management relies on the use of broad-spectrum insecticides, with a negative impact on the ecosystem, and the need for more sustainable approaches is urgent. The first detection in Italy occurred in 2012 in Emilia Romagna region (MAISTRELLO *et al*., 2016), where a network between research centres and plant protection units, allowed to act sinergically in carrying out multidisciplinary projects on this invasive pest. A 3-year field survey with active monitoring techniques assessed the abundance, seasonality and impact of BMSB and other Heteroptera, showing that a few years after its discovery *H. halys* already largely outnumbers all the other Heteroptera, and has become a season-long key pest of fruit crops in northern Italian regions, causing severe yield losses especially on the orchard borders, with more than 50% deformed fruits in some farms (MAISTRELLO *et al*., 2017). A detailed life table study performed in outdoor conditions showed that BMSB has two generations/year with overlapping adult and juvenile instars during summer, and has a remarkable invasive potential due to its very high reproductive rates for both generations (R0 = 24.04 and 5.44 for the overwintering and summer generation, respectively) (COSTI *et al*., 2017). A survey on the potential of native natural antagonists as biocontrol agents, targeting both egg parasitoids and generalist predators, is being performed with field and laboratory studies. In particular, trials using *Crematogaster scutellaris* showed that this ant has a significant impact on suppressing BMSB pre-imaginal stages in the laboratory, ranging from 95% to 52% predation success according to the instar tested (CASTRACANI *et al*., 2017), suggesting that ants deserves consideration in integrated pest management programs in agroecosystems. The discovery of the vibrational patterns involved in the mating communication of BMSB (POLAJNAR *et al.* 2016) and the demonstration that the female vibrational signal type, FS2, played back into natural or artificial substrates is significantly attractive to males (MAZZONI *et al*., 2017) opens the way for their use in the implementation of multi-modal traps. The integration of all these findings provides important baseline data that can be used for the development of a decision support system, of innovative trapping devices and of specific behavioural manipulation strategies for the sustainable management of BMSB in both agricultural and urban environments

lara.maistrello@unimore.it

FERROUDJA MEDJDOUB-BENSAAD[1], MOHAMED ANOUAR KHELIR[2], JACQUES HUIGNARD[3]

1 Université Mouloud Mammeri de Tizi-Ouzou. 15000 Algérie.
2 Université Aboubaker Belkaid de Tlemcen 13000. Algérie
3 Université de Tours. France

BRUCUS *RUFIMANUS* UN RAVAGEUR POTENTIEL DE LA FEVE *VICIA FABA* DANS LA REGION DE KABYLIE (ALGERIE).

La bruche de la fève, *Bruchus rufimanus* est le ravageur potentiel de la fève. Espèce cosmopolite dont les larves causent des dégâts sur les graines de fève (*Vicia faba*). Cette bruche est univoltine, la ponte a lieu sur les gousses vertes de la plante hôte, le développement larvaire se déroule pendant la maturation des graines. Les adultes émergent des graines mûres et sèches. Ils sont en diapause reproductrice et vont passer l'hiver dans les stocks pour certains et dans d'autres sites naturels pour d'autres, leur longévité peut atteindre 120 jours sans êtres nourris. La colonisation des cultures a lieu pendant la période de floraison de la fève et les œufs sont pondus sur les gousses vertes en formation. Le développement embryonnaire, celui du premier stade et du deuxième stade larvaire ont lieu sur les gousses vertes. Les 3ème et 4ème stades larvaire ainsi que la nymphe se développent dans les graines mûres entreposées jusqu'à l'émergence des adultes qui vont recommencer le cycle.

medjdoubferroudja@yahoo.fr

MARCO BALLARDINI[1], ALESSANDRA PAUTASSO[1] , STEFANO FERRETTI[2], GIORGIO CHIARANZ[2], MARIA VITTORIA RIINA[1] , GIORGIA TRIGLIA[1], FEDERICA VERNA[1], VERONICA BELLAVIA[1], MARIA CRISTINA RADAELLI[1], GABRIELLA PORCHEDDU[1], ANNALISA ACCORSI[1], UMBERTO CARDELLINO[3], ILARIA CREMONESI[4], MASSIMO SERRA[4], MARINA DE CAMILLI[2], MARIO MERELLO[2], ANGELO FERRARI[1], PIER LUIGI ACUTIS[1], CRISTINA CASALONE[1], WALTER MIGNONE[1]

1 Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta (IZSPLV), Torino, Italy
2 Comune di Genova, Ufficio Animali, Genova, Italy 2
3 S.C. Sanità Animale, ASL 3 Genovese, Genova, Italy
4 Dipartimento Salute e Servizi Sociali, Regione Liguria, Genova, Italy

INVASIVE MOSQUITO SPECIES AND RISKS FOR HUMAN HEALTH: *AEDES ALBOPICTUS* AND *AEDES KOREICUS* (DIPTERA: CULICIDAE) IN NORTH-WESTERN ITALY

Container-breeding mosquitoes of the Genus *Aedes* (Meigen) are a source of increasing concern, given their ability to spread and become invasive into new territories, and cause outbreaks of human viral diseases (SCHAFFNER *et al*., 2013). Originally from SE Asia, the tiger mosquito *Aedes albopictus* (Skuse, 1894) was the first invasive mosquito species (IMS) to establish in Europe and in Italy, where it was first found in the city of Genova in 1990 (SABATINI *et al*., 1990). Another IMS, *Ae. koreicus* (Edwards, 1917), first detected in Belgium in 2008 (Versteirt, 2009) and in NE Italy in 2011 (CAPELLI *et al*., 2011), is rapidly expanding its range (MONTARSI *et al*., 2013 and 2015). *Aedes* spp. are able to produce cold- and drought-resistant eggs and are supposed to be introduced at the immature stage, through the trade of used tyres or plants (SCHAFFNER et al., 2009). Entomological and virological surveillance are pivotal to early detect IMS presence and mosquito-borne virus circulation. IZSPLV has been performing surveillance activity on mosquitoes in NW Italy (Piedmont, Liguria and Valle d'Aosta Regions) since 2011. In 2016, due to the global zika emergency, mosquito surveillance in the Liguria Region was intensified, particularly in Genova city, one of the most important commercial and tourist hubs in the N Mediterranean. Between June and November 2016, 4,406 adult mosquitoes, including 1,789 *Aedes* spp., were caught by means of BG-sentinel traps baited with CO2 and a lure (N=6) and plant infusion-baited Gravid traps (N=4) in 10 sites in Genova. Eleven *Ae. koreicus* female individuals were trapped in three urban sites between 29 June and 10 October, representing the first report of the species in NW Italy. Species identity was confirmed either morphologically (REE, 2003; ECDC, 2012) or by sequencing the mtDNA locus ND4 (CAMERON, 2010). Both morphotype and genotype data support a common origin for the Ligurian and the other European populations. A retrospective investigation on damaged *Aedes* sp. individuals collected in Genova in 2015 allowed to date the species presence back to September 2015. In May-June 2017, other four *Ae. koreicus* specimens were found in the city, including samples from three new sites. Such data seem to indicate the establishment and expansion of *Ae. koreicus* in the area. A further and accelerated spreading of the species in Italy and beyond is expected, as already happened for *Ae. Albopictus*, posing further risks for human health.

marco.ballardini@izsto.it

UMBERTO PALATINI, ELISA PISCHEDDA, MARIANGELA BONIZZONI

Department of Biology and Biotechnology, University of Pavia, Pavia, Italy

NONRETROVIRAL INTEGRATED RNA VIRUSES IN THE GENOME OF MOSQUITO VECTORS: A NEW FORM OF IMMUNITY

Emerging or resoursourging infectious diseases in humans include those caused by arthropod-borne viruses (arboviruses) such as Zika, Dengue and Chikungunya, transmitted by hematopagous mosquitoes. In Europe, the primary vector for such viruses is the Asian tiger mosquito *Aedes albopictus*, an invasive species coming from South East Asia. Control of vectors is essential to prevent arboviral diseases and the understanding of the interaction between the pathogen and the vector is expected to identify targets for the development of novel vector control strategies. The main antiviral mechanism of mosquitoes is RNA interference (RNAi), which consists of three pathways. These pathways follow the same operational strategy: they act on the target based on sequence complementarity through small RNAs, whose length and biogenesis is different across pathways. The small interfering RNA (siRNA) pathway is the pillar of antiviral defense in mosquitoes. Besides siRNA, in *Aedes* mosquitoes the piRNA pathway contributes to antiviral immunity. piRNAs are generated from regions of the genome called piRNA clusters, which in *Aedes* mosquitoes contain remnants of transposable elements and uncharacterized viral sequences. Interestingly, when mosquitoes are infected with arboviruses, viral DNA fragments are produced and interact with the RNAi machinery to generate persistent infection. To understand whether these viral DNA fragments integrate into piRNA clusters and affect subsequent infections, we performed the most-up-do date comprehensive analyses of the presence of viral integrations across currently-available mosquito genomes. We probed bioinformatically the sequence of 425 viruses and identified viral integrations with similarities to viruses of the *Rhabdoviridae*, *Flaviviridae*, *Bunyaviridae* and *Reoviridae* families. Viral integrations were ~10-fold more abundant in *Aedes* mosquitoes than in all other tested species, they were enriched in piRNA clusters and, accordingly, they expressed piRNAs. Differences in number of viral integrations in the genomes of mosquito species from the same geographic area support the conclusion that integrations of viral sequences depends not only on virus exposure, but also on specific virus-host interactions. The abundance of viral integrations, their genome locations and production of piRNAs indicate that viral integrations represent an un-appreciated source of genome variability in *Aedes* mosquitoes and confer heritable immune signals.

m.bonizzoni@unipv.it

Round table 3

ROSA BOANO, BEATRICE DE MARCHI

Università degli studi di Torino, Dipartimento di Sceinze della Vita e Biologia dei Sistemi,
Via Accademia Albertina 13, 10123 Torino Italy

FROM SCIENTIFIC RESEARCH TO AUDIENCE ENGAGEMENT: NEW PERSPECTIVES FOR ZOOLOGICAL SAMPLES IN MUSEUMS AND UNIVERSITY COLLECTIONS

Zoological collections are irreplaceable sources of information for understanding animal biodiversity as well as for the study of the origins, motivations and/or symbolic significance of specific assemblages from a cultural perspective. Biological archives support teaching and research programs, and provide a valuable resource for students, staff and the community. It is crucial that the research, documentation and preservation of these archives adhere to the guidelines set by cultural heritage legislation. This round table will explore the dynamic interactions at the interface of science, teaching and audience engagement within the framework of the care and sustainable management of natural history collections. We will specifically address questions on the role of scientific investigation, including new analytical tools, for bringing some of these collections back into the spotlight, as well as the role of museums and universities in guaranteeing inclusive access to research-generated knowledge.

rosa.boano@unito.it

beatrice.demarchi@unito.it

Poster

FERROUDJA MEDJDOUB-BENSAAD[1], AICHAR LARDJANE-HAMITI[2]

1,2 Département de biologie. Faculté des sciences Biologiques et des Sciences Agronomiques. Université mouloud Mammeri de Tizi-Ouzou 15000. Algérie

COMPORTEMENT DE LA BRUCHE DE LA FÈVE *BRUCHUS RUFIMANUS* DANS UNE PARCELLE DE FÈVE DANS LA REGION DE TIZI-OUZOU (ALGÉRIE)

Le présent travail porte sur les relations spatio-temporelles liant la bruche de la fève *Bruchus rufimanus* à sa plante hôte *Vicia faba* dans la région de Tizi-Ouzou. La colonisation au champ coïncide avec la pleine floraison et la fructification de la fève. Les principaux facteurs qui pourraient influencer les déplacements des adultes de *B. rufimanus* dans la parcelle sont les conditions climatiques et les ressources trophiques. Leurs différentes activités semblent êtres plus importantes à partir de 13h. Les femelles présentent un comportement de ponte qui comprend la recherche et l'identification de la plante hôte puis l'acte de ponte lui même. L'ingestion du pollen de la fève s'avère nécessaire pour l'activité de ponte, son effet est plus intense que celui du pollen des plantes adventices ainsi que le miel. De même, la quantité du corps gras importante chez les diapausants diminue avec la reprise de l'activité reproductrice. Les résultats ont montré que les relations qui lient la bruche à sa plante hôte sont intimes et complexes ; cet insecte utilise son hôte pour sa reproduction, son développement, sa dissémination et comme site d'hivernation.

medjdoubferroudja@yahoo.fr

Symposium 4

Coordinators: Sadjia Hammouche - Andrea Pilastro - Stefano Piraino

(sadjiah@yahoo.fr - andrea.pilastro@unipd.it - stefano.piraino@unisalento.it)

Biology of reproduction and reproductive strategies

This symposium aims to gather contributions on the complexity of vertebrate and invertebrate reproductive systems at the molecular, cellular and organism levels, and the diversity of reproductive strategies and interactions leading to the structuring of populations and the accommodation of biological communities. This will include a) analysis of reproductive traits fostering adaptation to environmental and social heterogeneity (including effects of climate change, species translocation, habitat modification, etc.), of traits under sexual selection, and their interaction; b) inter- and intraspecific variation in the seasonality and periodicity of reproduction; c) evolutionary and developmental innovations; d) cell fate, cell stemness, reproductive investment and organismal longevity; e) hormonal control of reproductive and behavioural processes."

Biologia della riproduzione e strategie riproduttive

Questo simposio si propone di raccogliere contributi sulla complessità dei sistemi riproduttivi nei vertebrati e negli invertebrati sia a livello molecolare, cellulare che a livello di organismo, ed inoltre nelle diversità di strategie riproduttive e nelle interazioni che conducono alla strutturazione delle popolazioni ed alla sistemazione delle comunità biologiche. Ciò includerà a) analisi delle caratteristiche riproduttive che favoriscono l'adattamento all'eterogeneità ambientale e sociale (inclusi gli effetti dei cambiamenti climatici, traslocazione di specie, la modifica degli habitat, ecc), di caratteristiche nella selezione sessuale e loro interazioni; b) variazioni inter ed intra specifiche nella stagionalità e nella periodicità della riproduzione; c) le innovazioni evolutive e di sviluppo; d) destino della cellula, cellule staminali, investimenti riproduttivi e longevità degli organismi; e) controllo ormonale dei processi riproduttivi e dei processi comportamentali.

Biologie de la reproduction et stratégies de reproduction

Ce symposium vise à recueillir des contributions sur la complexité des systèmes de reproduction des vertébrés et des invertébrés au niveau moléculaire, cellulaire et de l'organisme, et sur la diversité des stratégies de reproduction et des interactions qui mènent à la structuration des populations et à l'aménagement des communautés biologiques. Ils seront traités a) l'analyse des caractéristiques de reproduction qui favorisent l'hétérogénéité de l'adaptation environnementale et sociale (effets des changements climatiques, translocation des espèces, modification de l'habitat, etc.), et des caractéristiques de la sélection sexuelle et leurs interactions ; b) les changements inter- et intra-spécifiques de la saisonnalité et de la périodicité de la reproduction ; c) les innovations évolutives et de développement ; d) le destin des cellules, cellules souches, investissement reproductif et longévité des organismes; e) le contrôle hormonal des processus reproductif et comportementales.

Communications

GIL ROSENTHAL

Department of Biology Texas A&M University. 3258 TAMU College Station, TX 77843

MATE-CHOICE MECHANISMS AND THE EVOLUTIONARY PROCESS

The origin of species remains the central problem of evolutionary biology. This is a complex problem to unravel, in part because speciation and hybridization depend critically on individual mating decisions. The mechanisms underlying these decisions are subject to functional constraints and responsive to environmental and social influences. Our work uses behavioral, environmental, and genomic approaches to understand the dynamics of reproductive isolation and hybridization between sister species of livebearing fish, *Xiphophorus birchmanni* and *X. malinche*. Extensive behavioral studies by our group have shown that conspecific mate preferences in these species depend on divergent, experience-dependent female responses to male pheromone signals. Conspecific mate preferences are so fragile that they fail when the physical or social environment is disrupted. This fragility of mate preferences may explain rampant recent hybridization between these species in their natural habitats following an increase in anthropogenic disturbance within the last few decades. Evolutionary-genomic analyses of contemporary patterns of mating and introgression, as well as phylogenomic analyses of historical patterns of genetic exchange, suggest that punctuated episodes of interspecific genetic exchange are a defining feature of *Xiphophorus* evolution. While early-generation *birchmanni-malinche* hybrids show reduced fitness, later-generation hybrids likely persist due to purging of genetic incompatibilities, adaptation to intermediate thermal environments, and increased attractiveness of hybrid males. Ongoing work centers on a long-term study of how environmental gradients and mating preferences interact to shape hybrid phenotypes and patterns of gene flow across lineages.

grosenthal@bio.tamu.edu

Gil Rosenthal attendance is supported by a Fulbright fellowship.

XAVIER TURON

Center for Advanced Studies of Blanes (CEAB-CSIC)

RE-EXAMINING WHAT WE THINK WE KNOW ABOUT REPRODUCTIVE STRATEGIES OF BENTHIC INVERTEBRATES: LESSONS LEARNT FROM GENETICS

Life-history traits and, in particular, reproductive strategies, are key for the successful establishment of marine invertebrates and for the maintenance and resilience of benthic communities. Connectivity, a close correlate of the reproductive parameters, plays a fundamental role in population and metapopulation dynamics, vulnerability to human impacts, and adaptation to global change. Yet, no biological trait is so variable, rich in nuances and difficult to grasp with one-sided approaches than the reproductive strategy. As happens with other aspects of benthic ecology, reproductive processes cannot be encapsulated by simple paradigms. Many long held ideas have been challenged as being too simplistic and unrealistic, such as predicting offspring sizes based on fecundity-time models, the planktotrophic/lecithotrophic dichotomy, the growth/reproduction dichotomy, or the relationship pelagic larval duration/connectivity. In most parameters, a continuum of strategies seems to be possible, stubbornly resisting modeling. Nowadays the development of the genetics field provides us with independent tools to assess the direct and indirect effects of the reproductive strategies of invertebrates. I will review the lessons we have learnt from contrasting genetic results with more traditional views. My emphasis will be on temperate littoral communities, particularly in the Atlanto-Mediterranean transition. The overall message is that mating is non-random, the ocean is not as open as previously thought, and effective population sizes are much smaller than census sizes. A wealth of instances of cryptic speciation, assortative mating (f.i., related to gamete recognition proteins), sub-population structure, clonality and chimerism, and restrictions to gene flow have been uncovered in recent years. I will suggest future directions to better characterize and integrate molecular, ecological, and abiotic data.

xturon@ceab.csic.es

MARIA ASSUNTA BISCOTTI[1], ADRIANA CANAPA[1], MARCO BARUCCA[1], ALBERTO PALLAVICINI[2], MARCO GERDOL[2], ETTORE OLMO[1], MANFRED SCHARTL[3]

1 Dipartimento di Scienze della Vita e dell'Ambiente, Università Politecnica delle Marche, Ancona, Italy
2 Dipartimento di Scienze della Vita, Università di Trieste, Trieste, Italy
3 Physiological Chemistry, Biocenter, University of Wuerzburg Wuerzburg, Germany

A COMPARATIVE VIEW ON SEXUAL DEVELOPMENT GENES IN LUNGFISH AND COELACANTHS

Sexual dimorphism is one of the most pervasive and diverse features of animal morphology, physiology, and behavior. The process of sexual development involves a high variety and fine-tuning of complex mechanisms, regulating gametogenesis, molecular sex determination and differentiation. Despite the generality of the phenomenon itself the mechanisms how sex is determined are very different among various organismic groups, have evolved repeatedly and independently across metazoans and the underlying molecular pathways can change quickly during evolution. The aim of this study was to expand the knowledge on basal sarcopterygian sexual development by characterizing fifty genes and their expression values in gonads and several other organs. We find that the intermediate position of lungfish between the acanthopterygian fish group and the tetrapods is also reflected on the level of gene expression profiles related to sexual development. Our analysis of lungfish ovary and testis RNA-Seq transcriptomes and comparison to similar datasets from zebrafish and the testis transcriptome of a coelacanth revealed a situation that is a reflection of the peculiar phylogenetic position of the Dipnoi. There are some genes whose expression pattern in the lungfish and, as far as testis is concerned also in *Latimeria*, is more similar to the teleosts and different from tetrapods, on the other hand, for a number of genes we found in lungfish a situation that reflects more the tetrapods than the teleost fishes and others genes neither follow the teleost nor the tetrapod scheme

m.a.biscotti@univpm.it

PAOLO BONIVENTO[1], LORENZO TUFANO[2], MASSIMILIANO BELLAVISTA[2]

1 IEMEST – Istituto Euro-Mediterraneo di Scienza e Tecnologia – via Via Michele Miraglia n.20 - 90139 Palermo (Italy)
2 DarwinLab s.a.s.. via L. Einaudi 64 - 61032 Fano (PU)

DEVELOPMENT OF A LATERAL FLOW KIT FOR EARLY SEX DETERMINATION IN *TESTUDO MARGINATA*, SCHÖPFF, 1792

Turtle sex is usually indeterminable up to 5 years or more since birth. This fact poses serious difficulties both to the operators of the repopulation sector and to the breeders who are called to determine the sex of the specimen as soon as possible, in order to organise the future of the natural population or of the breeding. Depending on many factors, first at all on the incubation conditions, the male / female frequency may vary greatly. Nowadays many breeders adopt the standard method, that consider sex expression linked to environmental temperature. This method is not reliable because the indexes varies greatly between different populations of the same species. Even economically, there is a large difference between the value applied to a male specimen compared to that applied to a female specimen, usually 1: 2. Our study starts with the need to develop a system that can help early sex determination of a specimen, that is, before 5 years of life, from the time of birth. The hypothesis of this study is based on a lateral flow strips test that can identify the presence and amount of oestrogens (oestradiol) and androgens (testosterone). In support of this hypothesis, many papers have been analysed, including MATSUMOTO MORK L. et al. (2014), BIESER K.L. Et al. (2015), CZERWINSKI M. et al. (2016). In addition, given the importance of testing for repopulation of endangered or endangered turtle species, some additional studies have been made of the influence of climatic temperature on the change of the two hormones mentioned above. In this regard, before the development of the prototype, the most recent papers relating to the relationship between climatic variations and sexual determination in turtles have been studied, including SANDRIAN TOMILO P. et Al. (2015), SCHROEDER A.L. Et al. (2016), DIAZ-HERNANDEZ V. et al. (2016).

paolobonivento@iemest.eu

RAJA BEN AHMED, SAÏDA TEKAYA

Université Tunis El Manar, Faculté des Sciences de Tunis,
UR 11ES12 Biologie de la Reproduction et du Développement Animal, 2092, Tunis, Tunisia.

OVARY CORD STRUCTURE AND OOGENESIS IN THE AMPHIBIAN LEECHE *BATRACOBDELLA ALGIRA* (ANNELIDA, CLITELLATA, HIRUDINEA) FROM TUNISIA

Ovary organization in Euhirudinea was classiffied within four different types: non polarized ovary cords were found in glossiphoniids, egg follicles were described in piscicolids, ovarian bodies were found characteristic for erpobdellids, and polarized ovary cords in hirudiniforms (Swiatek, 2008).
The aim of the present study is to provide a detailed description of the ovary cord organization and oogenesis in *Batracobdella algira* (Rhynchobdellidae, Glossiphoniidae) , and to compare it with already known systems of ovary organization in other leeches. *B. algira* has paired ovaries whose shape and dimensions change as oogenesis proceeds: during early previtellogenesis they are small and club-shaped, whereas during vitellogenesis they broaden and elongate considerably. During early oogenesis (previtellogenesis), each ovary is composed of an outer envelope (ovisac) that surrounds the ovary cavity and is filled with hemocoelomic fluid, in which a single and very convoluted ovary cord is bathed. The ovary cord consists of germline cells, including nurse cells and young oocytes surrounded by a layer of elongated follicle cells. Additionally, follicle cells with long cytoplasmic projections occur inside the ovary cord, where they separate germ cells from each other. The ovary cord contains thousands of nurse cells. Each nurse cell has one intercellular bridge, connecting it to a central anucleate cytoplasmic mass, the cytophore ; it in turn is connected by one intercellular bridge with each growing oocyte. Numerous mitochondria, RER cisternae, ribosomes, and Golgi complexes are transported from the nurse cells, via the intercellular bridge and cytophore, to the growing oocytes. The youngest observed oocytes are slightly larger than nurse cells, and usually occupy the periphery of the ovary cord. As previtellogenesis proceeds, the oocytes gather a vast amount of cell organelles and become more voluminous. As a result, in late previtellogenesis the oocytes gradually protrude into the ovary cavity, lose contact with the ovary cord (which begins to degenerate) and float freely within the hemocoelomic fluid. A mixed mechanism of vitellogenesis is suggested. The present study when compared to the ovary cords and oogenesis described earlier in Arhynchobdellids we found that the ovary cords of the “Erpobdella” type (i.e. *Erpobdella johanssonii*) are short, conically shaped, polarized and five zones containing germ cells at consecutives stages of their development can be distinguished along their long axis, while in “Hirudo” type (i.e. *Hirudo troctina*) the ovary cords are long,convoluted , polarised with only three zone of oocytes developpement: a club-shaped apical part, a very long convoluted main part and a last third zone contains degenerating cells and cytophore remnants. In both cases, the ovary cords possess the apical cell, which seems to be the apomorphy of Arhynchobdellida (for review see Ben Ahmed et al., 2010 and 2013).In the case of *B. algira* we note the absence of the apical cell, the ovary cord, as mentionned above, are very long convoluted and non -polarised structure: oogenesis is synchronous and all oocytes are in the same stage of developpement. Ben Ahmed et al (2013), suggest that the ovaries with polarized structures equipped with apical cell (as found in arhynchobdellids) are considered as plesiomorphic for Euhirudinea while non-polarized ovary cords (rhynchobdellids) represent apomorphic condition.

Ben Ahmed R, Fuchs AZ, Tekaya S, Harrath AH, Swiatek P. 2010. Ovary cords organization in *Hirudo troctina* and *Limnatis*

raja_benahmed@yahoo.fr

JEAN-LOUP d'HONDT

Muséum National d'Histoire Naturelle, Département « Adaptations du Vivant », BOREA,
55, rue Buffon, F-75005 Paris.

STRATEGIES DE REPRODUCTION CHEZ LES BRYOZOAIRES : DIVERSITES MORPHO-ANATOMIQUE ET SYSTEMATIQUE, SIGNIFICATION EVOLUTIVE

Les différents types de développements embryonnaires, larvaires et morphogénétiques observés chez les Bryozoaires, phénomènes ontogénétiquement pré-programmés, et qui sont notamment caractérisés par des devenirs distincts de l'ébauche endodermique en fonction des lignées évolutives, correspondent à autant de stratégies reproductrices destinées à améliorer la survie, la capacité de dispersion et la prospérité des espèces correspondantes. Il s'agit, selon les larves, les lignées et par suite des taxons, de planctotrophie, de transformation d'un tube digestif abortif en réserve énergétique ou en concrétion minérale amorphe, ou d'une lécitotrophie banale sans régression particulière. Outre le bourgeonnement direct de nouvelles zoécies, on connait dans certaines de ces lignées une autre stratégie reproductrice, la capacité de reproduction par voie asexuée. Celle-ci s'effectue selon différentes modalités : nautozoïdes, sessoblastes, flottobalastes, *sacculi*, hibernacles ; chez d'autres on a signalé des phénomènes de polyembryonie (Cyclostomes) ou de viviparité (Phylactolaemates). Ces différents aspects sont analysés et interprétés en fonction des lignées phylogénétiques, de la délimitation et de la définition des taxons, ainsi que des avantages que les organismes peuvent en retirer.

jean-loup.dhondt@mnhn.fr

LIVIO FAVARO, MARCO GAMBA, DANIELA PESSANI

Dipartimento di Scienze della Vita e Biologia dei Sistemi, Università degli Studi di Torino,
Via Accademia Albertina, 13 - 10123 Torino

MATING CALLS OF BANDED PENGUINS ENCODE HONEST CUES TO THE BODY SIZE IN THE VOCAL PARAMETERS LINKED TO ANATOMICAL CONSTRAINS

Penguins' display songs have long been fascinating scientists. These vocalisations play a key role in mate choice and recognition and are highly exposed to ecological sources of selection. Indeed, mechanisms used to encode biologically meaningful information vary according to the breeding ecology of the different species. Non-nesting penguins (genus *Aptenodytes*) use independent contributions from the two sides of the syrinx (two-voice system) to generate display songs with and extreme intra-individual stereotypy. Nesting species use the pitch of the call and the relative energy distribution across the spectrum for individual recognition. Accordingly, the source-filter theory of voice production has recently been proved to allow a far greater understanding of the information encoded in banded penguins (*Spheniscus* spp.) vocalisations by considering independent contributions from lungs (determining duration), syrinx (fundamental frequency, f_0) and the supra-syringeal vocal tract (formants). In mammals, where vocal features are linked to anatomical constraints that cannot be faked, the vocal signal can also provide "honest" information about the body size of the emitter. Here we tested whether also in penguins, syrinx- and vocal tract-related acoustic parameters has the potential to encode such information. We collected display song from two *ex-situ* colonies of Humboldt (*S. humboldti*) and Magellanic (*S. magellanicus*) penguins in Italy. For each vocalization, we measured the duration and several syrinx- and vocal tract-related acoustic parameters in Praat. We also measured the body weight and seven descriptors of the skeletal size of each penguin. Using a series of Generalized Linear Mixed Models, we showed that call duration positively correlates with bill length, while f_0 negatively correlates with the body weight. However, we did not find any effect of body dimension on vocal tract-related parameters. We explained the pitch and duration allometry as a result of the lungs capacity and mass of the vibrating membranes in the syrinx, respectively. We suggest that the lack of relationship between the skeletal size and filer-related parameters should be interpreted in the light of the mobility of the penguins' trachea, which can be voluntarily contracted to change its length during phonation. Our results add important information to a growing body of literature on the mechanisms used by birds to encode biologically meaningful information in mating vocalisations.

livio.favaro@unito.it

TYRONE LUCON-XICCATO[1], ANGELO BISAZZA[1], ANDREA PILASTRO[2]

1 Dipartimento di Psicologia Generale, Università di Padova, Padova, Italy
2 Dipartimento di Biologia, Università di Padova, Padova, Italy

INDIVIDUAL DIFFERENCES IN EXPLORATORY BEHAVIOUR PREDICT NOVEL MALE PREFERENCE IN FEMALE GUPPIES (POECILIA RETICULATA, PETERS, 1859)

Exploration of novel environments is an important dimension of animal behaviour and it contributes to the survival and reproductive success of individuals. In many species, individuals show consistent differences in exploratory tendency. These differences often correlate with the behaviour of the individuals in other contexts, such as boldness under predation risk and aggressiveness in social groups. We hypothesised that individual differences in new environment exploration might covary with neophilia. That is, individuals showing greater exploratory tendency might show greater attraction toward novel stimuli. We tested this hypothesis in female guppies (*Poecilia reticulata*, Peters, 1859) focussing on both reproductive and non-reproductive contexts. In this species, individual differences in exploration have been previously reported and it is known that females exibit attraction toward new males and new objects. The results of this study provided partial support for our hypothesis: female guppies with greater exploratory tendency showed greater preference for novel males over familiar males during mate choice, but exploration did not correlate with preference for novel over unfamiliar objects. Individual differences in exploration might thus covary with individual differences in neophilia during reproduction in guppies.

tyrone.luconxiccato@unipd.it

CHIARA MOROSINOTTO[1,2], ROBERT L. THOMSON[1,3], ERRKI KORPIMÄKI[1], RAFAEL MATEO[4], SUVI RUUSKANEN[1]

1 Department of Biology, Section of Ecology, University of Turku, Finland
2 Dipartimento di Biologia, Università di Padova, Italy
3 Percy FitzPatrick Institute of African Ornithology, DST/NRF Centre of Excellence, University of Cape Town, Rondebosch, South Africa
4 Institute of Research in Game resources, CSIC-UCLM-JCCM, Spain

MATERNAL FOOD SUPPLEMENTATION AND PREDATION RISK AFFECT EGG COMPOSITION BUT NOT OFFSPRING CONDITION IN *FICEDULA HYPOLEUCA*

Mothers may affect the future success of their offspring by varying allocation to eggs and embryos. These maternal effects may be adaptive towards the environmental conditions perceived by mothers during early breeding. We manipulated key environmental elements, food supply and nest predation risk, and measured the consequences to egg composition and eggshell traits, using a 2x2-factor design in the pied flycatcher (*Ficedula hypoleuca*). Eggs laid in food supplemented nests had heavier yolks and thicker shells independently of risk perceived by the mothers, while eggs laid in nests exposed to cues of nest predators had lower levels of immunoglobulins compared to controls, independently of food supplementation. Under low predation risk, shell biliverdin levels were higher in eggs laid in food supplemented nests compared to unfed nests, while in food supplemented nests, eggs laid under low predation risk tended to have more biliverdin than eggs from fed nests but under high predation risk. Female immunoglobulin levels were not affected by either maternal treatments. Incubation duration was in average one day shorter in food supplemented nests than in unfed nests, and it affected hatching success, with lower success in nests with longer incubation period, although direct effects of maternal food supplementation or predation risk were not observed. Two days after hatching a full brood cross-fostering was performed, transferring the chicks to unmanipulated nests, to investigate the impact of egg composition on offspring growth and immune capacity. Offspring mass was not affected by maternal treatment group, neither on the day of cross-fostering or just before fledgling. Also immunoglobulin levels in the nestlings did not vary according to food supplementation or nest predation risk perceived by the mother during egg formation. These results suggest that although food supplementation and nest predation risk modify egg composition, these egg-mediated effects may not have consequences on offspring growth or immune capacity. Unpredictable environmental stressors, such as nest predation risk and food availability in the early breeding season, may thus affect parental investment in the eggs, but the parental care offered by the foster parents may compensate for eventual costs, or benefits, of maternal allocation.

chimor@utu.fi

Posters

RAJA BEN AHMED, SAÏDA TEKAYA

Université Tunis El Manar, Faculté des Sciences de Tunis,
UR 11ES12 Biologie de la Reproduction et du Développement Animal, 2092, Tunis, Tunisia.

OVARY CORD STRUCTURE AND OOGENESIS IN THE AMPHIBIAN LEECHE BATRACOBDELLA ALGIRA (CLITELLATA, ANNELIDA) FROM TUNISIA

Ovarian morphology and the course of oogenesis show great diversity within Annelida; especially in Polychaeta, the location, number, morphological complexity and patterns of oogenesis are highly variable (Eckelbarger 2005, 2006). The aim of the present study is to provide a detailed description of ovary cord organization and oogenesis in *Batracobdella algira*, and to compare it with already known systems of ovary organization in other leeches. *B. algira* has paired ovaries whose shape and dimensions change as oogenesis proceeds : during early previtellogenesis they are small and club-shaped, whereas during vitellogenesis they broaden and elongate considerably. During early oogenesis (previtellogenesis), each ovary is composed of an outer envelope (ovisac) that surrounds the ovary cavity and is filled with hemocoelomic fluid, in which a single and very convoluted ovary cord is bathed. The ovary cord consists of germline cells, including nurse cells and young oocytes surrounded by a layer of elongated follicle cells. Additionally, follicle cells with long cytoplasmic projections occur inside the ovary cord, where they separate germ cells from each other. The ovary cord contains thousands of nurse cells. Each nurse cell has one intercellular bridge, connecting it to a central anucleate cytoplasmic mass, the cytophore ; it in turn is connected by one intercellular bridge with each growing oocyte. Numerous mitochondria, RER cisternae, ribosomes, and Golgi complexes are transported from the nurse cells, via the intercellular bridge and cytophore, to the growing oocytes. Oogenesis in *B. algira* is synchronous with all oocytes in the ovary in the same stage of oogenesis. The youngest observed oocytes are slightly larger than nurse cells, and usually occupy the periphery of the ovary cord. As previtellogenesis proceeds, the oocytes gather a vast amount of cell organelles and become more voluminous. As a result, in late previtellogenesis the oocytes gradually protrude into the ovary cavity, lose contact with the ovary cord (which begins to degenerate) and float freely within the hemocoelomic fluid. A mixed mechanism of vitellogenesis is suggested.

raja_benahmed@yahoo.fr

AMINA BEZZAOUIA, SAÏDA TEKAYA

Université Tunis El Manar, Faculté des Sciences de Tunis,
UR 11ES12 Biologie de la Reproduction et du Développement Animal, 2092, Tunis, Tunisia

FÉCONDATION IN VITRO ET DÉVELOPPEMENT EMBRYONNAIRE CHEZ INVASIVE *STYELA PLICATA* (LESUEUR, 1823)

L'ascidie solitaire *Styela plicata* (Lesueur, 1823) appelé aussi l'ascidie plissée est une espèce introduite en Méditerranée et considérée comme invasive (BARROS et *al*, 2009). En effet, des travaux rapportent que cette ascidie semble avoir remplacé les tuniciers solitaires indigènes comme sur quelques côtes américaines (LAMBERT et *al*,1995). En Tunisie, cette espèce menace l'aquaculture en se fixant sur les cordes et dans les cages d'huitres et de moules en élevage. Elle rend le travail des aquaculteurs difficile et contribue à accroître les coûts de l'exploitation des mollusques (BARROS et *al*, 2009; EL BAWEB et *al*, 2012). La connaissance de sa reproduction et ses modalités pourraient être utiles pour les aquaculteurs. Pour ces raisons, nous avons entrepris l'étude de la structure démographique d'une population dans la lagune de Bizerte, les étapes de son ovogenèse en microscopie photonique et électronique ainsi que la réalisation pour la première fois de la fécondation in vitro et le suivi de son développement embryonnaire au laboratoire. Dans cette communication nous proposons présenter l'étude de la fécondation in vitro et le suivi du développement embryonnaire au laboratoire de *Styela plicata* récoltée dans la lagune de Bizerte au Nord de la Tunisie. La réalisation de la fécondation in vitro n'a été possible qu'au mois de Décembre ce qui a mené à conclure à l'existence d'une période de ponte en hiver. Nos observations ont montré la formation du bourrelet de contraction caractéristique des ascidies et qui marque la région dorsale de l'embryon. Le suivi du développement embryonnaire a permis de distinguer et d'illustrer les 3 principales étapes (segmentation, gastrulation et organogenèse) et de donner des informations sur sa chronologie chez cette espèce à 18°C. Le stade têtard d'ascidies est observé environ 12 H après la fécondation.

saida.tekaya51@gmail.com

SARA CASTELLAZZI[1], BARBARA REGAIOLLI[2], MATILDE FRANCHIN[3], ALESSANDRA PICCIRILLO[3], CATERINA SPIEZIO[2], CAMILLO SANDRI[1]

1 Animal Care & Health Management, Parco Natura Viva – Garda Zoological Park srl., Bussolengo (VR), Italy.
2 Settore Ricerca e Conservazione, Parco Natura Viva – Garda Zoological Park, Bussolengo (VR), Italy.
3 Dipartimento di Biomedicina Comprata e Alimentazione, University of Padua.

SI SCHIUDERÀ OPPURE NO? DIFFERENZE NEL COMPORTAMENTO DI CURA DI UOVA FERTILI E NON FERTILI NEI FENICOTTERI ROSA (*PHOENICOPTERUS ROSEUS*)

La fertilità dei fenicotteri in ambiente controllato può variare a seconda della specie, delle dimensioni della colonia e della stagione (PICKERING et al., 1992; BROWN & KING, 2005). Ottenere informazioni sulla fertilità dell'uovo può essere utile nella gestione delle specie in cattività. Ad esempio, rimuovendo un uovo non fertile dal nido, è possibile stimolare la deposizione di un nuovo uovo, aumentando la probabilità della coppia di avere un pulcino (WEBSTER et al., 2015). Lo scopo di questo studio è investigare il comportamento parentale di una coppia di fenicotteri rosa (*Phoenicopterus roseus*) in presenza di un uovo non fertile e di uno fertile. Lo studio era composto da due diversi periodi in cui sono stati raccolti dati sulla postura e sul comportamento di ciascun partner quando era sul nido. Nel primo periodo, l'uovo deposto non era fertile, mentre nel secondo l'uovo è giunto alla schiusa. Per ciascun periodo, sono state fatte 28 sessioni di 10 minuti per ciascun partner. Dai risultati è emerso che le femmine sono state per più tempo in piedi sul nido nel primo periodo rispetto che nel secondo, manifestando inoltre più comportamenti di cura e attenzione all'uovo. Nel maschio non sono invece state riscontrate differenze significative fra i due periodi né per la postura né per il comportamento. Questi risultati sembrano suggerire che le femmine di fenicottero rosa passino più tempo in piedi sul nido in presenza di un uovo non fertile, prestandogli più attenzione ed esaminandolo più a fondo rispetto a quanto avviene in presenza di un uovo fertile. Questo studio fornisce nuovi spunti nella comprensione dei rapporti fra femmina e embrione nei fenicotteri rosa, stimolando nuove ricerche volte a sviluppare più a fondo questo argomento, anche al fine di migliorare la gestione di questa specie in ambiente controllato.

assistant.dir@parconaturaviva.it

AGATA CESARETTI[1], MATTEO DAL ZOTTO[1,2], M. ANTONIO TODARO[1]

1 Department of Life Sciences, University of Modena and Reggio Emilia, via Campi, 213/d, 41125 Modena, Italy;
2 Consortium for the Interuniversity Center of Marine Biology and Applied Ecology, viale N. Sauro, 4, 57128 Livorno, Italy

NOVELTIES IN THE EVOLUTION OF THE *URODASYS* REPRODUCTIVE SYSTEM (GASTROTRICHA, MACRODASYIDA)

Macrodasyidan gastrotrichs are hermaphrodites with complex accessory reproductive organs that function in sperm transfer and receipt. Unfortunately, homology among the organs of members of different clades is largely undetermined, troubling a clear understanding of the evolutionary trends in the reproductive biology of these animals. The present study investigates the evolution of reproduction in species of the peculiar genus *Urodasys*, quite popular among researchers working on meiofauna in virtue of their very long tail. These gastrotrichs are extremely interesting also because they show a wide range of structures, modes, and reproductive strategies. It is likely that a phylogenetic study of these taxa may shed light on the evolutionary trends in the reproductive biology of the genus and possibly of the entire phylum. *Urodasys* presently consists of 15 species, one of which, *U. viviparus*, is parthenogenetic and ovoviviparous, while the others are hermaphroditic and oviparous. Four of the latter species show paired ovaries and testes, but no accessory sexual organ, whilst 10 possess two ovaries, a single testis and a sclerotic, copulatory organ called a stylet. Recently, a new species bearing a stylet but two testes was found at Lanzarote (Canary Islands). All this data was opportunely coded and cladistically analyzed. Meanwhile, phylogenetic analyses based on sequences of the 18S rDNA gene obtained from representative species were concurrently carried out. The results of the two analyses are widely overlapping and substantially separate the investigated species into two clades, with the new species that appears as an early divergent line along the evolutionary branch of the stylet-bearing taxa. However, *U. viviparus* appears to be allied with the stylus-lacking species in the morphological analyses, while the molecular analyses place it amongst the stylet-bearing species. In any case, regardless of the position of *U. viviparus*, the results indicate that the sequence of evolutionary transformations occurred in the reproductive system of the species of *Urodasys* is likely dissimilar from those previously proposed by other authors.

gattaca10-7@hotmail.it

CHIARA DE GREGORIO[1], VALERIA TORTI[1], GIOVANNA BONADONNA[1], DARIA VALENTE[1], ROSE MARIE RANDRIANARISON[2], OLIVIER FRIARD[1], LUCA POZZI[3], MARCO GAMBA[1], CRISTINA GIACOMA[1]

1 Department of Life Sciences and Systems Biology (DBIOS), University of Torino, Italy
2 Département de Paléontologie et d'Anthropologie Biologique, Faculté des Sciences, Université d'Antananarivo, Antananarivo, Madagascar
3 Department of Anthropology, The University of Texas at San Antonio, One UTSA Circle, San Antonio, TX 78249, United States of America

PATRILINEAR SIGNATURES IN THE MALES' SINGING MAY MEDIATE KINSHIP RECOGNITION IN *INDRI INDRI*

In primates, monogamy is rare. Even when social monogamy occurs, genetic studies showed that extra-pair copulation (hereafter EPC) could occur. Due to the relevant reproductive cost, an adaptive mating strategy for a female is to choose a mating male that would give to her offspring genetic benefits. Female choice can lead to sexual selection for males that are advantaged by the possession of some characteristic that females value, also resulting in EPC. In this scenario, kinship recognition is a critical requirement for inbreeding avoidance, but it is unclear what mechanism species use to discriminate kin. The lemur *Indri indri* lives in socially monogamous family groups in the eastern rainforest of Madagascar. The group is composed of the adult pair and their immature offspring. As territories overlap is very low, animals from different group very rarely have visual contact. The most distinctive communication trait in this species is the song, a long-distance call that can be perceived up to 3 km away. In an environment in which visual and olfactory signals could not transmit efficiently, it is likely that a song also transmits information about identity and relatedness. Whereas we do not know which animal characteristic can drive kinship recognition, we investigated if the acoustic structure of the songs' phrases varies between closely and distantly related indris. The result of Mantel test showed that the temporal structure of males' phrases of two units (DP2) was significantly correlated with their genetic relatedness (N = 12, R = 0.3059, P = 0.0035), while we have not found significant p-values for phrases of three units (DP3) (N= 12, R = 0.1643, P = 0.0801). On the contrary, for females the correlation between phrases and genetic was markedly non-significant. Male vocal signatures have been suggested as an important mechanism for inbreeding avoidance, where females in dispersion, the dominant sex, should avoid mating with any male that resembles their fathers. This mechanism may also play a role in a scenario in which extra-pair copulation that has been reported for this species may contribute to increasing levels of genetic diversity in the population. Besides, song similarity between related males may mediate and de-escalate aggressive behaviour between kin during group encounters. Further studies are necessary to obtain a stronger understanding of role played by acoustic cues in relation to the different possible mechanisms.

chiara.degregorio@unito.it

LORETTA GUIDI[1], M. ANTONIO TODARO[2], LUCIA CESARONI[1], MARIA BALSAMO[1]

1 Dipartimento di Scienze Biomolecolari, Università di Urbino 'Carlo Bo', Italy
2 Dipartimento di Scienze della Vita, Università di Modena-Reggio Emilia, Modena, Italy

THE UNUSUAL SPERMATOZOA OF *DOLICHODASYS* SP. (GASTROTRICHA, MACRODASYIDA)

The spermatozoon of an undescribed species of *Dolichodasys* (Cephalodasyidae) from the Pacific coast of Panama was studied at a structural and ultrastructural level. Under optical microscopy, it appears short and wide cell with pointed extremities but without a flagellum; the cell body is made up of two well distinct regions, the anterior homogeneous in appearance, and the posterior one containing an evident rod-like nucleus. Under TEM, a peripheral layer of microtubules densely arranged run parallel to each other for the whole cell length. In the anterior cell region, microtubules surround many tubular cisternae of smooth endoplasmic reticulum (SER), and a thin layer of vesicles with a probable acrosomal function lies just beneath the plasma membrane. The rod-shaped nucleus fills up the posterior cell region and forms a pouch that hosts a single large, irregular mitochondrial mass. A hypothesis about the motility of this aflagellate cell is advanced, on the base of the coexistence of singlet microtubules and SER. The general architecture of *Dolichodasys* sp. spermatozoon departs from the Macrodasyida sperm basic model, consisting of a filiform cell with a corkscrew-shaped acrosome, a spring-shaped nucleus surrounding a mitochondrial axis and an ordinary flagellum. The unusual morphology of the *Dolichodasys* sperm seems to be unique in the family Cephalodasyidae: the data available for 6 species belonging to the other 4 genera of the family report spermatozoa perfectly matching the basic sperm plan of the Macrodasyida. A sister-taxon relationship between *Dolichodasys* and *Cephalodasys*, two genera drastically differing in sperm shape, emerged from recent phylogenetic molecular studies, but it needs confirmation due to the still limited number of molecular data and the likely polyphyletic nature of the family Cephalodasyidae.

loretta.guidi@uniurb.it

GIACOMO MILISENDA[1], CINZIA GRAVILI[2], SERGIO ROSSI[2], STEFANO PIRAINO[2]

1 Dipartimento Terra e Ambiente, CNR-IAMC, Mazara del Vallo, Italy
2 Dipartimento di Scienze e Tecnologie Biologiche ed Ambientali, Di.S.Te.B.A., University of Salento, Lecce, Italy

SOME LIKE IT HOT: EFFECT OF GLOBAL WARMING ON REPRODUCTION OF MEDITERRANEAN CNIDARIANS

Water temperature directly affects life cycles, reproductive periods, and metabolism of organisms living in the upper zone of the oceans. Due to the ocean warming, changes in water stratification and primary productivity are affecting trophic chains in sensitive world areas, such as the Mediterranean Sea. Benthic and pelagic cnidarians exhibit composite responses to climatic conditions. The structure and phenology of the Mediterranean hydrozoan community displayed marked changes in species composition, bathymetric distribution, and reproductive timing over the last decades. The regional species pool remained stable in terms of species numbers but not in terms of species identity. This is due to a combination of abiotic features and biotic interactions, favouring (native and non-indigenous) species of warm-water affinity with increased survival rate and their spread towards higher latitudes. The holopelagic scyphozoan *Pelagia noctiluca* is one of the most abundant jellyfish in the Mediterranean Sea and eastern Atlantic waters, with massive outbreaks increasingly frequent and associated to warmer winters. Variations in metabolic activities, such as respiration and excretion, are strongly temperature-dependent, with direct increment of energetic costs with jellyfish size and temperature, leading to growth rate reduction. However, water temperature affect sexual reproduction through opportunistic changes in the energy storage and gonad development cycles. The application of morphometric indexes and biochemical analyses provide mechanistic explanations of the year-round occurrence of *P. noctiluca* in the Mediterranean Sea by flexibility and temporal extension of reproduction, with more, smaller eggs in high prey availability periods and fewer larger eggs in low food availability months. Similarly, anthozoan life cycles depend on primary productivity and temperature: gonadal production and spawning are tightly related in shallow populations (0-30 m depth) with the spring-summer temperature trends and autumn food availability. Overall, the energy transferred from the mother polyp colonies to the offspring may decrease, negatively affecting their potential to settle, metamorphose and feed during the first months of their lives, eventually impairing the dominance of long-living cnidarian suspension feeders in shallow benthic habitats.

cinzia.gravili@unisalento.it

DANIELA PESSANI[1], MARCO BATTUELLO[1,2], STEFANO CROVELLA[1], DANIELE GUARNERI[3], ROCCO MUSSAT SARTOR[1,2], NICOLA NURRA[1,2]

1 Dipartimento di Scienze della Vita e Biologia dei Sistemi, Via Accademia Albertina, 13 10123 - Torino
2 Pelagosphera Soc. Coop. Via Umberto Cosmo, 17 bis 10131 – Torino
3 Parco Nazionale del Circeo, Via Carlo Alberto, 188 04016 – Sabaudia (LT)
rocco.mussat@unito.it

THE HERMIT CRAB *PAGURISTES EREMITA* AND ITS EPIBIONTS: THE USEFULNESS OF THE SPONGE *SUBERITES DOMUNCULA* IN THE REPRODUCTIVE SUCCESS

INTRODUCTION - The hermit crab *Paguristes eremita* (Linnaeus, 1767) occupies mainly shells strengthened by different epibiont *taxa*: filamentous and encrusting algae, sponges, anemones, serpulids, bryozoans, and so on. The sponge *Suberites domuncula* (Olivi, 1792) plays an important but controversial role in respect to the crab species: according to Williams and McDermott (2004) it is not considered an obligate epibiont because found associated with different species and substrata. In turn, *P. eremita* may choose a shell bearing *S. domuncula* because the sponge grows with crab, until to cover it and its shell totally.
MATERIALS AND METHODS - Two groups of *P. eremita*, collected in North Adriatic Sea on two different substrata (A: detritic bottom, depth -9, -23 m; B: terrigenous sediments, depth -21,-42 m) were examined. The occupied shell was identified at specific level (when possible) and the percent coverage (c %) of the epibiont *taxa* calculated, considering also a c % >100, if a layer of epibionts covered the underlying ones. The crabs were sexed, distinguishing males, ovigerous and not ovigerous females.
RESULTS - In the group A 129 males and 136 females (62 = 45.6 % ovigerous) were sampled; the main occupied shell is *Gibbula magus* (39 %); Serpulids and Briozoans c % reaches or exceeds 100, followed by filamentous or encrusting algae and not *S. domuncula* porifera. The 58 % of ovigerous females occupied shell with c % >100.
Group B consisted of 26 males and 32 females (23 = 71.9 % ovigerous); the main occupied shells were *Gibbula magus* (19 %) and *Fusinus pulchellus* (15.5 %). *S. domuncula* was observed on 100 % of the ovigerous females; the shell of 93.7 % of those specimens bears very numerous rounded structure (sponge gemmulae ?; Sanford and Kelly-Borges, 1997).
CONCLUSIONS - It is possible to hypothesize that on soft substrata (an unusual habitat for the crab) the ovigerous females of *P. eremita* use the protective coverage offered by the sponge, which growing with them, avoids the research of a shell of soft bottom, probably not suitable for this crab.
If a future study will demonstrate that the rounded structure are sponge gemmulae, *S. domuncula* should be used the couple crab/shell when the habitat lacks hard substrata and/or when it needs the dispersion of its gemmulae.

rocco.mussat@unito.it

DARIA VALENTE[1], MARCO GAMBA[1], CHIARA DE GREGORIO[1], VITTORIA ESTIENNE[2], VALERIA TORTI[1], OLIVIER FRIARD[1], GIOVANNA BONADONNA[1], ROSE MARIE RANDRIANARISON[3], CRISTINA GIACOMA[1]

1 Dipartimento di Scienze della Vita e Biologia dei Sistemi, Università di Torino, Via Accademia Albertina 13, 10123 Torino, Italia
2 Department of Primatology, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany
3 Département de Paléontologie et d'Anthropologie Biologique, Faculté des Sciences, Université d'Antananarivo, Madagascar

SINGING OUT LOUD: SEX AND INDIVIDUAL RECOGNITION IN *INDRI INDRI*

Singing behavior has been reported in only four families of Primates: Indriidae, Tarsiidae, Pitheciidae, and Hylobatidae. Since all singing primates are also thought to be socially monogamous, the singing behaviour seems to be related to monogamy. *Indri indri*, the unique singing lemur species, is a socially monogamous primate living in family groups. All juvenile and adult members of the group may potentially participate in the song, which follows a precise structure. To unravel the role of singing in regulating intra- and inter-group dynamics, we investigated the turn-taking among individuals and the acoustical variability of particular descending phrases (composed of two, three, or four notes; hereafter DP) emitted during the song. We quantified the singing pattern identifying individuals by sexes and reproductive status (18 dominant adult males, 14 dominant adult females, three non-adult males, one non-adult female). The adult male timing influenced the adult female in 68% (N=94) and the non-adults in 78% (N=46) of the cases. The timing of the adult female affected the adult male singing in 73% (N=91) and non-adults timing in 81% (N=57) of the songs. Non-adults timing influenced adult male and adult female singing in 94% (N=47) and 75% (N=63) of the songs. Focusing on the DPs structure, we found a marked sexual dimorphism and individuality encoded in both the spectral and temporal features of the phrases, for all DP types. The permuted Discriminant Function Analysis, indeed, correctly classified the emitter's gender (93% - 98%) and the emitter's individuality (82% - 99%). We used two General Linear Mixed Models to investigate gender influence on rhythmic and frequency variation. In the first case, we used the interval between notes' onsets (IOI) as the response variable. IOI significantly decreased during a phrase, with males showing longer intervals than females. We then used the Q50 (frequency at the upper limit of the second quartile of energy in the spectrum) to investigate the spectral variation; despite a similar trend in frequency change, Q50 was significantly higher in males. Singing in indris, thus, potentially play a role in sex recognition and in establishing reproductive relationship, by facilitating mate finding, pair formation, and even extra-pair copulation.

daria.valente@unito.it

Symposium 5

Coordinators: Simona Bonelli – Silvio Greco - Roberto Valvassori

(simona.bonelli@unito.it - s.greco@unisg.it - roberto.valvassori@uninsubria.it)

Animals as source of food

The symposium deals with the theme of wild animals used as a source of food, with the idea of highlighting often conflicting aspects that must be the subject of a serious scientific research. Ethical, legal and cognitive problems of using these protein sources are addressed by focusing on the animals and not on the consumer.

Animali come fonte di cibo

Il simposio affronta proprio il tema degli animali perlopiù selvatici come fonti di cibo, con l'idea di evidenziarne aspetti spesso contrastanti che devono essere oggetto di una seria ricerca scientifica. Problemi etici, legali e conoscitivi dell'uso di queste risorse proteiche sono affrontati a partire dall'animale e non dal consumatore.

Les animaux comme source de nourriture

Le symposium traite du thème des animaux sauvages utilisés comme source de nourriture, avec l'idée de mettre en évidence des aspects souvent contradictoires qui doivent être objet d'une sérieuse recherche scientifique. Les problèmes éthiques, juridiques et cognitifs de l'utilisation de ces sources de protéines sont traitées en concentrant sur les animaux et non sur le consommateur.

Communication

SIMONA BONELLI[1 2], ROBERTO VALVASSSORI[3], SILVIO GRECO[1]

[1] Università degli Studi di Scienze Gastronomiche, Pollenzo (CN)
[2] Università degli Studi di Torino, Dipartimento di Scienze della Vita e Biologia dei Sistemi, Torino
[3] Università degli Studi dell'Insubria, Dipartimento di Biotecnologie e Scienze della Vita, Varese
[1] Università degli Studi di Scienze Gastronomiche, Pollenzo (CN)

GLI ANIMALI COME FONTE DI CIBO PER L'UOMO

L'idea di questo Simposio nasce dal corso di Zoologia gastronomica tenutosi nell'anno accademico 2016-2017. Nel corso, rivolto agli studenti di Scienze gastronomiche, sono stati considerati gli animali invertebrati e vertebrati come fonti di cibo. La grande varietà di specie viventi frutto dell'evoluzione biologica può essere anche vista come una fonte di proteine. La storia evolutiva della nostra specie si fonda su questa opportunità ed è anche una storia di coevoluzione tra uomo e animali, solo in parte addomesticati, molti invece cacciati. Il simposio affronta proprio il tema degli animali, perlopiù selvatici, come fonti di cibo, con l'idea di evidenziarne aspetti spesso contrastanti che devono essere oggetto di una seria ricerca scientifica. Problemi etici, legali e conoscitivi dell'uso di queste risorse sono affrontati a partire dall'animale e non dal consumatore. Gli animali saranno trattati con particolare riguardo alle specie non allevate, quindi insetti, aracnidi e cnidari tra gli invertebrati e riflettendo sulle specie consumate che sono rare o minacciate di estinzione. Da un lato le meduse e soprattutto gli insetti, in analogia a quanto discusso in occasione di EXPO 2015, saranno visti come fonti alternative di proteine necessarie data la non sostenibilità del consumo di carne bovina. Dall'altro canto l'allevamento e il consumo di crostacei e di molluschi ha modificato le cenosi creando conflitti spesso insanabili tra specie alloctone vincenti per caratteristiche fisiologiche e specie autoctone. Un consumo sostenibile e consapevole non dovrebbe prescindere dalla conoscenza di queste dinamiche che ad esempio nel nostro Mar Mediterraneo, o in parte del nostro reticolo idrografico, hanno portato all'estinzione locale di molte specie eduli. Questo aspetto verrà affrontato in un intervento sul depauperamento della fauna ittica e sulle prospettive future del consumo di questa risorsa. Allo stesso tempo una relazione illustrerà come alcune specie alloctone posso essere contenute se convertite in fonte di cibo, come accaduto ad esempio in Inghilterra con lo scoiattolo grigio. Parlando di vertebrati non allevati saranno considerati gli aspetti etici e il modo di vedere gli animali in una società dove questi sono visti come *pets* e dove la cultura vegana o vegetariana stanno diffondendosi. Sarà quindi significativo il contributo di relatori di ONG ambientaliste. Gli studenti stessi del corso di Zoologia gastronomica, grazie alle loro provenienze molto diversificate, parteciperanno all'evento con poster che porteranno le loro esperienze di consumo di specie selvatiche fornendo testimonianze importanti sul ruolo che certe specie animali occupano nella dieta. Altri studenti ci illustreranno i lavori realizzati durante il corso per valorizzarne l'originalità e sottolineare l'importanza dell'aspetto scientifico nelle scelte alimentari.

simona.bonelli@unito.it

SANDRO BERTOLINO[1], ADRIANO MARTINOLI[2]

1 Università degli Studi di Torino, Dipartimento di Scienze della Vita e Biologia dei Sistemi, Via Accademia Albertina, 13 - 10123 Torino, Italia
2 Università degli Studi dell'Insubria, Dipartimento di Scienze Teoriche e Applicate, Unità di Analisi e Gestione delle Risorse Ambientali - Guido Tosi Research Group, Via J. H. Dunant 3, 21100 Varese, Italia

USE AS FOOD OF ANIMALS IN THE PAST HAS CAUSED SPECIES EXTINCTIONS: NOW GASTRONOMY CAN BE A BIODIVERSITY CONSERVATION TOOL?

The loss of biodiversity is one of the most critical environmental problem, threatening valuable ecosystem services and human well-being. Even worst, a growing body of evidence indicates that current species extinction rates are higher than in the past. Extinctions are being caused mainly by human activities: habitat degradation and destruction, introduction of invasive species, overhunting and overfishing, and more recently climate change.People have always depended on wildlife and plants for food and clothing. Hunting, fishing and collecting has been often conducted at unsustainable levels, with overexploitation of populations leading to extinction. In the last centuries, the introduction of invasive alien species has become one of the major threat to biodiversity conservation. Moving animals has always been linked to human's life, with negative consequences for species and ecosystems. For instance, since the time of European exploration and colonization of America, Africa and other continents, 500 years ago, humans have been responsible for the extinction of nearly 1,000 species of animals and plants. Invasive species may out-compete or prey on native species, leading to their decreased or extinction. In many cases, species went extinct on islands after modern humans arrive with their courts of sheep, goats, rabbits and rats. Past explorers had the habit of leaving goats and rabbits on the islands where they dredged, so as to form live stocks to exploit as food during subsequent passages. Nowadays, the eradication of invasive alien species is a key conservation tool to mitigate the impacts caused by biologic invasions. The eradications of 251 invasive mammals on 181 islands benefitted through positive demographic responses 236 native species with 596 island populations. In many cases the removal of large numbers of mammals, like sheep, goat, rabbits, represents a cost linked to the disposal of carcasses. However, this biomass may be transformed in a food resource for local people and there is a growing interest, even from top chefs, to innovate dishes with a focus on invasive species. The use of animals as food in the past has caused many species extinctions, maybe it is time for gastronomy to help biodiversity conservation.

sandro.bertolino@unito.it

ANTONELLA LEONE[1], STEFANO PIRAINO[2], FERDINANDO BOERO[2,3]

1 Consiglio Nazionale delle Ricerche, Istituto di Scienze delle Produzioni Alimentari (CNR-ISPA), via Prov.le Lecce-Monteroni, 73100, Lecce, Italy
2 Università del Salento, DiSTeBA, via Prov.le Lecce-Monteroni, 73100, Lecce, Italy
3 Consiglio Nazionale delle Ricerche, Istituto di Scienze Marine (CNR-ISMAR), Genova, Italy

FROM PROBLEM TO SOLUTION: EUROPEAN JELLYFISH ON WESTERN MENUS?

Jellyfish outbreaks are increasingly frequent in many coastal regions. Seasonally, billions of jellyfish prey on larvae of commercially important fish and shellfish, compete with them for food, clog fishermen's gears, and affect maritime tourism. In spite of their negative impacts, jellyfish may turn into a resource and economic opportunity. Jellyfish as food is a consolidated tradition in Southeastern Asia, and jellyfish fishery has reached an average global catch around 1 million tons (GIBBONS *et al.*, 2016). However, jellyfish-based products are traditionally processed by unsafe preservative treatments as alum salts, and traceability issues and mislabeling are being frequently reported. In Europe, the lack of safe protocols and processing methods in compliance with EU rules, together with legal restraints and restricted market size, resulted in the absence of a comprehensive jellyfish food system, from harvesting to processing to consumption. Recently, research identified three scyphozoan jellyfish (*Cotylorhiza tuberculata*, *Rhizostoma pulmo* and *Aurelia coerulea)* as biomasses potentially useful for the biotechnological and food production sectors, also because of the occurrence of bioactive metabolites with antioxidant and cancer-preventive properties (LEONE *et al*., 2013; LEONE *et al*., 2015; D'AMICO *et al*., 2017). By investigating on innovative processing methodologies, the newly funded H2020 EU project Go-Jelly will deal with Mediterranean jellyfish as putative food or feed ingredient or for bioprospecting. Controlled fishery and exploitation of wild jellyfish (including aliens) may represent local adaptation against seasonal outbreaks, but the potential of a productive system based on cultivable jellyfish will be explored together with a risk assessment procedure to disclose the potential impacts on both consumers and ecosystem health, and to regulate their commercialization. The involvement of multiple stakeholder categories, including producers, managers of biodiversity conservation, as well as professional chefs and potential consumers, will be key to the socio-economic and ecological assessment of a new sustainable jellyfish food/feed processing system. Scientific demonstration of jellyfish nutraceutical and health properties, improvement of processing methodologies and introduction of jellyfish as ingredient to the Mediterranean cuisine may contribute to enlarge the jellyfish market to Western Countries, turning European jellyfish into a EU approved "novel food".

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antonella.leone@ispa.cnr.it

GABRIELE VOLPATO

Università degli Studi di Scienze Gastronomiche – UNISG, Pollenzo

EDIBLE INSECTS, THE HIDDEN CROP OF AFRICAN AGROECOLOGICAL SYSTEMS

Edible insects are an integral part of at least two billion people's diet, mainly in tropical areas. Entomophagy is embedded in complex agroecological and land use systems whose outputs are agricultural crops *and* edible insects, among other products. Several species of grasshoppers and crickets are collected from cultivated plots and homegardens across Africa, including crop pests such as *Agonoscelis pubescens* (Thunb.) and *Coridius viduatus* (F.) in Sudan, and the caterpillars of *Cirina forda* (Westwood), a pest of the shea tree, in west Africa. In the Sahelian region, the sale of grasshoppers and locusts collected in millet fields may yield more revenue than the millet itself. The Bemba of Zambia practice a form of slash and burn agriculture known as chitemene; fallows' management in chitemene has been shown to raise the capacity of the woodland to support the populations of two edible caterpillars, *Gynanisa maja* Strand and *Gonimbrasia zambesina* Walker, which generate income comparable to that of agricultural crops. Land grabbing and agricultural intensification are occurring at vast scale in Africa, affecting people's livelihoods *also* by reducing edible insect populations (e.g. due to cutting of host trees) and by making insects toxic due to widespread use of pesticides. This occurs when farmers are pushed or forced to switch to intensive forms of agriculture, when intensive fields are established close to subsistence plots, or when wintering/aggregating or reproduction areas of insect species are converted in plantations (e.g. for biofuel, wheat, etc.). In South Africa, conversion of woodlands to tea plantations is threatening the reproduction area of the inflated stinkbug *Encosternum delegorguei* (Spinola), widely used for subsistence and trade. Similarly, the use and trade of the mopane caterpillar *Gonimbrasia belina* (Westwood) depends on the protection of the mopane woodland from changes in land use, and the Bemba's chitemene is currently witnessing a shift towards maize monoculture, which not only tends to exhaust the soils but also threats caterpillar's populations due to widespread clearings and use of pesticides. The possible loss of edible insects and of their nutritional and income value due to land grabbing and agricultural intensification should be fully included into discourses on food security, which is better achieved by valuing and sustainably using biological and cultural diversity and ecologically-tuned agricultural practices

gabrielevolpato7@gmail.com

Poster

FABIO TUCCILLO[1], FULVIO CAPRIOLO[2], SIMONA BONELLI[1,2]

1 Università degli Studi di Scienze Gastronomiche, Pollenzo (CN)
2 Università degli Studi di Torino, Dipartimento di Scienze della Vita e Biologia dei Sistemi, Torino

THE CULTURAL BARRIERS OF DISGUST IN WESTERN SOCIETY: THE RELATIONSHIP BETWEEN HUMANS AND ARTHROPODS

The perception of disgust for certain sources of food is one of the factors that highlights the cultural differences between Western people and other cultures. The fact that one food (e.g. insects) is considered delicious for some cultures and at the same time disgusting for others suggests that this distinction unfortunately has a cultural matrix. However, the study carried out by Curtis et al., 2011 showed that disgust is also a behavioral adaptive system for preventing illnesses. For these reasons, the work intends to understand (i) whether disgust for certain foods is an emotion determined by the culture and the environment in which the individual lives or (ii) if it is an innate feature of human beings. For the research methodology, a questionnaire was set up using Qualtrics® software. The survey consists of 16 different types of questions on demographics, habits, perception of disgust for various elements and opinions on insects and insect consumption. The software used allows the data to be processed automatically, with the ability to create cross tables, weightings and reports in order to split the responses by age, sex, origin and habits. Analysis of the data collected through the survey, which was developed in two languages (Italian and English), aimed at understanding the daily and dietary habits of individuals of different cultures. Then, through statistic tests, it was possible to verify the accuracy of both hypotheses about disgust on a vast sample of responses. Moreover, a key point in the work is the demonstration of a link between disgust and fear. The more an animal is considered dangerous, the more it causes disgust in the individual who perceives it as such. The ultimate aim of the work is to find opportunities to overcome the western cultural barriers in the form of disgust and to study solutions on how to include unconventional foods in the western gastronomic landscape.

f.tuccillo@studenti.unisg.it

Poster Session

Tema Libero

MATILDE BOSCHETTI, ALESSANDRO CULICCHI, MONICA GUERRINI, FILIPPO BARBANERA, GIULIO PETRONI

Department of Biology, Zoology-Anthropology Unit, Via A. Volta 4 - 56126 Pisa, Italy

PRELIMINARY DISTRIBUTION AND GENETIC DATA OF *AUSTROPOTAMOBIUS ITALICUS* (FAXON, 1984) IN LUNIGIANA (TUSCANY)

White-clawed crayfish *Austropotamobius italicus* (Faxon 1984) is a keystone species for freshwater environments. The *A. pallipes* species complex, which includes *A. italicus*, is listed as Endangered by the IUCN, having declined by 50-80% over the last decades due to competition with alien crayfish, pathogens, habitat degradation and overharvesting. Our goal was to carry out a fine-scale distribution and genetic survey in remote areas of wilderness, aiming to gain useful information and to offer management recommendations for the long-term protection of the species. In spring-summer 2015-2016 we investigated 8 mountain or hilly streams of the upper part of River Magra Basin, in the Lunigiana region (Tuscany). Despite the occurrence of some SCIs, data on the torrential fauna of Lunigiana are still scarce, with many streams having never been investigated and yet threatened by the planned construction of mini-hydroelectric plants. For each stream, we defined a 500 m-long transect; we carried out 51 surveys in total, both diurnal and nocturnal, to record crayfish occurrence, take morphometric measurements (cephalothorax and rostrum length), collect non-lethal samples for genetic analysis (one pereiopod per specimen) and check for ectosymbionts. Crayfish were found in two streams (Civasola and Verdesina), both located within the municipality of Pontremoli. Morphometric and genetic analysis (COI mtDNA gene: 36 specimens; microsatellite DNA genotyping at six loci: 60 specimens) indicated that both population belonged to the taxon *A. italicus carinthiacus*. DNA crayfish diversity was very low within each stream, whereas the two populations proved to be significantly differentiated from each other. Ectosymbionts were genetically identified (COI mtDNA gene: 10 specimens) as *Branchiobdella italica* Canegallo 1929 (Annelida, Clitellata). Civasola individuals (both genders) not only were larger than those found in the Verdesina stream but also not infested by branchiobdellids. We hypothesized that these two factors might be related to each other, with branchiobdellids being able to shift to parasitic habits and limit host growth when found at high density. In the light of the long-lasting occurrence of *A. italicus* in the study area and of remote location, altitude and other habitat features of both streams, we suggest that Civasola and Verdesina streams could be considered as “natural Ark sites” for the species, thus deserving further studies and ad hoc conservation actions. In the light of the long-lasting occurrence of *A. italicus* in the study area and of remote location, altitude and other habitat features of both streams, we suggest that Civasola and Verdesina streams could be considered as “natural Ark sites” for the species, thus deserving further studies and ad hoc conservation actions

matilde.boschetti@for.unipi.it

FEDERICO BUONANNO[1], DAVIDE CERVIA[2-3], CLAUDIO ORTENZI[1]

1 Laboratory of Protistology and Biology Education, Università degli Studi di Macerata, 62100 Macerata, Italy
2 Department of Biomedical and Clinical Sciences "Luigi Sacco" (DIBIC), Università degli Studi di Milano, Italy
3 Department for Innovation in Biological, Agro-food & Forest systems (DIBAF), Università degli Studi della Tuscia, Viterbo, Italy

THE PREDATOR-PREY INTERACTIONS AMONG CILIATED PROTISTS BY MEANS OF TOXIC SECONDARY METABOLITES

Most species of ciliated protists developed a number of behavioral, morphological, and physiological strategies intended to improve prey capture or to limit/avoid the competition and predation. These strategies have been recently far studied, and great attention has been paid to the repertoire of toxic secondary metabolites adopted in the prey capture, as well as in chemical defense against predators. In this context, particular attention was focused on the important role of specialized ejectable membrane-bound organelles, generally called extrusomes, and widely distributed in protists. These organelles are usually localized in the cell cortex and attached to the cell membrane, and they share a common characteristic in discharging their contents to the outside of the cell in response to mechanical or chemical stimuli. To date, the chemical nature of the characterized extrusive compounds in protists is extremely variable, including proteins, carbohydrates, lipids, and dozens of additional classes of secondary metabolites. However few data are now available for a particular group of protists, the ciliated protozoa. It is worthy of note that, in addition to their physiological functions, at least some of the secondary metabolites produced by ciliates (such as climacostol, euplotin C and blepharismins) have been demonstrated to show antibiotic, anti-cancer and pro-apoptotic properties. A paradigmatic example is represented by the well characterized and now commercially available climacostol, from *Climacostomum virens*, recently recognized as an antibiotic and a powerful anti-cancer agent *in vivo* targeting the intrinsic apoptotic program linked to p53 system in melanomas.

federico.buonanno@unimc.it

ADRIANA CANAPA[1], MARIA ASSUNTA BISCOTTI[1], MARCO BARUCCA[1], ALBERTO PALLAVICINI[2], MARCO GERDOL[2], ETTORE OLMO[1]

1 Dipartimento di Scienze della Vita e dell'Ambiente, Università Politecnica delle Marche, Ancona, Italy
2 Dipartimento di Scienze della Vita, Università di Trieste, Trieste, Italy

THE EVOLUTION OF VITELLOGENIN GENE FAMILY IN VERTEBRATES

The genes of vitellogenin, from which the main egg-yolk proteins of oviparous animal species arise, are an excellent example to understand how a gene family arises and has been changing during the evolutionary history. In this study several sequences belonging to vertebrates, included those of the "fossil species" coelacanth and lungfish, have been investigated through phylogenetic and micro-syntenic analyses. The phylogenetic analysis evidenced the orthology between the *VtgC* genes of actinopterygians and the *VtgI* genes of tetrapods including also a sequence of *Latimeria* and the shark *Callorhinchus milii*. This result is in agreement with our micro-syntenic analyses performed in those organisms of which genomes are available. Moreover for the other paralog genes the phylogenetic analysis showed different/independent duplication events occurred in the various evolutionary lineages.

adriana.canapa@univpm.it

SALMA CHAIB, AHLEM RAYANE, OURIDA KHERBOUCHE-ABROUS

Laboratory of Dynamics and Biodiversity, Biological Sciences Faculty, University of Sciences and Technology Houari Boumediene, BP 32 El Alia, Bab Ezzouar. Algiers-Algeria

ECOLOGY OF THE DYSDERIDAE FAMILY (ARANEAE, ARACHNIDS, ARTHROPODA) IN TIKJDA (DJURDJURA NATIONAL PARK)

The Dysderidae is an araneomorph haplogyne spider family, medium to large size. Found mostly under stones, logs and other debris in warm dry wasteland or grassland sites. They hunt their prey at night. The aim of the present work is to study the Ecology of the Dysderidae family in 11 different sites located in Tikjda (National Park of Djurdjura). The epigean Dysderidae are collected using pitfall traps, filled third with a formaldehyde solution (4%) as fixative. The traps were emptied monthly during 9 months between 2015/2016. A total of 164 individuals were collected. They belong to 3 genus and 7 different species. *Harpactea dumonti* is the most represented in the region (82 individuals) followed by *Harpactea sp1* (17 individuals) and *Dysdera crocata* (10 individuals). *Harpactea dumonti* is present in all biotopes of Tikjda region, it is ubiquist specie. Our study showed many ecological preferences for the different species collected relationship with some abiotique factors as altitude and recovery rate of vegetation.

selmach88@gmail.com

ELISABETTA COLUCCIA, FEDERICA DEIDDA, CINZIA LOBINA,
ANNA MARIA DEIANA, SUSANNA SALVADORI

Dipartimento di Scienze della Vita e dell'Ambiente, Università di Cagliari, via T. Fiorelli, 1- 09126 Cagliari, Italy

INTERSTITIAL TELOMERIC SITES IN NATIVE AND INVASIVE SPECIES OF CRUSTACEA DECAPODA

By definition, telomeric sequences are located at the very ends of chromosomes. However, several eukaryotic species show blocks of telomeric repeats in non-terminal regions, called interstitial telomeric sequences (ITSs). They are localized close to the centromeres or at interstitial sites, between the centromeres and the telomeres, and might originate from ancestral intrachromosomal rearrangements, from differential crossing-over or from the repair of double-strand break during evolution. ITSs could play a significant role in genome instability and evolution, they also might be hotspots of chromosome breakage, rearrangement and amplification sites. Crustacea Decapoda includes species of highly economical value, like lobsters, and of ecological interest such as the Louisiana crayfish, species became invasive in European freshwaters. Although a lot of genetic studies are available on this taxon, many phylogenetic and taxonomic aspects are still unclear. Cytogenetics, and in particular the localization of the telomeric sequence, could provide useful cytotaxonomic data, but very few species have been studied. Here, we examine the chromosomal location of telomeric repeats in 10 species of decapods belonging to different families in order to analyze the extent of ITSs occurrence in the chromosomes of representatives of this taxon. TTAGG telomeric repeat and 45S rDNA have been mapped by fluorescence *in situ* hybridization (FISH) on mitotic and meiotic chromosomes obtained from gonads and hepatopancreas of males by the air-drying technique. Beside terminal signals, detected in all species, in four of them several interstitial telomeric sites were present. These ITSs varied among different species in number and position and in some case were coincident with major ribosomal genes. Additionally, the invasive Louisiana crayfish *Procambarus clarkii* (Girard, 1852) presented two conspicuous and adjacent ITSs in one chromosome pair. It is remarkable the presence of ITs in almost 40% of the decapods studied, that suggests a intense chromosome dymanism in this group. In fact, ITs could be the remnant of chromosomal rearrangements, like tandem chromosome fusions, or might be associated with rDNA, satellite DNAs or transpsons, which could explain the interstitial distribution. Our results give new insights both for karyological comparative and cytogenomic analyses in crustacean decapods, underlying the relevance of this approach within this taxon.

coluccia@unica.it

ERIKA COTTONE[1], VALENTINA POMATTO[1], PAOLO COCCI[2], ERIK NELSON[3], MATTEO MOZZICAFREDDO[2], GILBERTO MOSCONI[2], FRANCESCO A. PALERMO[2], PATRIZIA BOVOLIN[1]

1 Dept. Life Sciences and Systems Biology, University of Torino, Italy
2 School of Biosciences and Biotechnologies, University of Camerino, Italy
3 Dept. of Molecular and Integrative Physiology, University of Illinois at Urbana-Champaign, IL, USA

PLASTICIZERS AS POSSIBLE ENDOCRINE DISRUPTING CHEMICALS: IN VITRO EFFECTS ON ADIPOCYTE DIFFERENTIATION AND LIPID ACCUMULATION

Endocrine Disrupting Chemicals (EDCs) are environmental chemicals that can interfere with hormone action in animal organisms. Studies on cell cultures, laboratory animals, wildlife, and humans suggest that EDCs can cause a wide range of reproductive, developmental, and behavioral problems. Most of these effects are traced to estrogenic, androgenic, antiandrogenic, and antithyroid actions. Recently the adipose tissue has been recognized as a true endocrine organ, and a subset of EDCs have been named Metabolism Disrupting Chemicals (MDCs) because of their ability to promote adiposity and alteration of energy homeostasis. MDCs include plasticizers such as BisphenoI A (BPA) and certain phthalates used in PVC plastics. In the present work we focused our attention on four plasticizers permitted by EU regulation for food-contact materials and which are often employed as alternatives to more toxic plasticizers: Di-iso-nonyl-phtalate (DiNP), Di-iso-decyl-phtalate (DiDP), Diethylen glycol dibenzoate (DEGDB), and Tri-m-cresyl phosphate (TMCP). These chemicals were investigated for their ability to affect adipogenesis in cultured mouse preadipocytes (3T3-L1 cells). 3T3-L1 cells were exposed to scalar concentrations of the above plasticizers, including BPA and the PPARγ agonist Rosiglitazone as reference compounds. All concentrations of plasticizers were able to significantly enhance lipid deposition, with TMCP being the most effective one. Accordingly, when comparing *in silico* and in gene-reporter experiments the ligand binding efficiencies to the nuclear receptor PPARγ, TMPC displayed the highest affinity. Differently from BPA, all plasticizers were most effective in enhancing lipid accumulation when added in the terminal phase of differentiation. qRT-PCR studies showed that all plasticizers were able to increase the expression of CCAAT/enhancer binding protein β (*Cebpβ)*, a gene involved in the early steps of adipogenesis, and *Pparγ2*, the adipogenesis master gene. In addition, TMCP was able to modulate the expression of both Fatty Acid Binding Protein 4/Adipocyte Protein 2 (*Fabp4/Ap2)* and Lipoprotein Lipase (*Lpl)* transcripts in the late phase of adipogenesis. Taken together, our results suggest that exposure to low, environmentally relevant doses of chemicals used as alternative plasticizers can affect adipogenesis and lipid accumulation in fat cells *in vitro*. Future experiments will test if these chemicals act as MDCs also *in vivo*.

erika.cottone@unito.it

MATTEO DAL ZOTTO[1,2], M. ANTONIO TODARO[1]

1 Department of Life Sciences, University of Modena and Reggio Emilia, via Campi, 213/d, 41125 Modena, Italy;
2 Consortium for the Interuniversity Center of Marine Biology and Applied Ecology, viale N. Sauro, 4, 57128 Livorno, Italy

ITALIAN KINORHYNCHA: STATUS OF BIODIVERSITY AND DISTRIBUTION

Kinorhyncha are microscopic marine metazoans constituting a phylum that comprises more than 250 described species living from intertidal to abyssal depths. Studies on the Italian kinorhynch fauna have been rather erratic in space and time, with most records originating in the first decades of the XX century from the Gulfs of Naples and Trieste. Here, we provide information based on a careful taxonomic revision of published material but mainly on new data from recent surveys carried out in areas of Ligurian Sea (4), Tyrrhenian Sea (8), Ionian Sea (1), and Adriatic Sea (3 localities). New data derives from qualitative as well as from quantitative samples. During our surveys, 30 species in 11 genera and 6 families were recorded. Of the species found, 16 appear new to science or new to the national fauna, while 14 were previously known from Italian waters. Particularly relevant is the finding of two new species of the rare genus *Condyloderes*, unreported before from the Mediterranean Sea. The new faunistic information, along with novelties in the systematics of the phylum, prompted us to prepare an updated checklist, which brings to 37 species, 11 genera and 6 families the number of kinorhynch taxa known from the Italian seas. The most speciose genus is *Echinoderes*, followed by *Pycnophyes*, with 11 and 10 species, respectively. The former genus includes the species showing the highest abundances, *E. capitatus*, with recorded densities up to 184 ind./10 cm^2, while the latter includes the most common species *P. communis*, found in 12 localities from the Ligurian, Tyrrhenian, and Adriatic Seas. Concerning distribution, it appears that five species only can be considered ubiquitous in the four Italian sea basins, whereas the other species seem to be restricted to one or two basins. However, many sectors of the national waters remain unexplored. Further research should concentrate especially on peculiar habitats, such as coarse biogenic sediments, submarine caves, and lagoons, which our studies indicated as biodiversity hotspots for the ‘mud dragons’.

matteo.dalzotto@unimore.it

CINZIA FERRARIO[1,2], YOUSRA BEN KHADRA[3], ANNA CZARKWIANI[4], ANNE ZAKRZEWSKI[4], MIRIAM ASCAGNI[5], FRANCESCO BONASORO[1], MARIA DANIELA CANDIA CARNEVALI[1], PAOLA OLIVERI[4], MICHELA SUGNI[1,2]

1 Dipartimento di Scienze e Politiche Ambientali, Università degli Studi di Milano, Via Celoria, 2, 20133, Milano, Italia
2 Center for Complexity & Biosystems, Dipartimento di Fisica, Università degli Studi di Milano, Via Celoria, 16, 20133, Milano, Italia
3 Laboratoire de Recherche, Génétique, Biodiversité et Valorisation des Bioressources, Institut Supérieur de Biotechnologie de Monastir, Université de Monastir, Monastir, Tunisia
4 Department of Genetics, Evolution and Environment, University College London, Darwin Building, Gower Street, WC1E 6BT, London, United Kingdom
5 Dipartimento di Bioscienze, Università degli Studi di Milano, Via Celoria, 26, 20133, Milano, Italia

EXPLORING ECHINODERM REPAIR EVENTS AFTER ARM INJURY

Traumatic amputations are severe damages that can heavily impair animal life and survival. All animals are able to heal minor injuries but only few efficiently face the loss of whole body parts and completely regenerate them. Regeneration is prevented or limited if the initial repair phase is not ensured and highly effective. This is achieved only if different events properly occur, among which wound closure, inflammatory and immune responses, and extracellular matrix remodelling. Echinoderms are one of the best known examples of invertebrates displaying outstanding regenerative abilities. In this research the starfish Echinaster sepositus and the brittle star Amphiura filiformis were used as models to compare the main repair events after arm amputation using both microscopy and molecular tools. A comparison with the healing phenomena of scarcely regenerating models, such as mammals, is discussed as well. Our studies highlighted that the first emergency reactions, namely wound contraction and re-epithelialization, are similar in the two echinoderm species and faster and more effective than in mammals. The immunodetection of a TNF-α-like molecule suggested a possible conservation of this inflammatory pathway between echinoderm classes and within deuterostomes. Considering extracellular matrix remodelling, molecular analyses suggested that the identified collagen genes are not expressed in the new tissues till the beginning of the regenerative phase. This is in agreement with microscopy analyses that showed that collagen deposition is limited and delayed in both echinoderm species and in comparison to mammals. This difference may be relevant to understand why echinoderms subsequently regenerate so efficiently: indeed, abundant and quick scar formation and/or fibrosis in mammals have been suggested as a limiting factor for the regenerative process. Overall, echinoderms showed similar wound closure events, characterized by absence of fibrosis and delayed collagen deposition, and quicker and more efficient than those of mammals. Therefore, also considering their key phylogenetic position, they proved to be valid experimental systems to study the repair processes. Further molecular analyses must be performed to better understand the gene regulatory network and the molecule cross-talk underpinning echinoderms' repair events and compare them with those of mammals to reveal fundamental similarities and differences between animals able and unable to regenerate.

cinzia.ferrario@unimi.it

NICOLA FRANCHI, ANNA PERONATO, LORIANO BALLARIN

Dipartimento di Biologia, Università di Padova

THE COMPLEMENT SYSTEM IN *BOTRYLLUS SCHLOSSERI*

Among the various effector mechanisms involved in immune responses, the complement system is one of the most ancient, deeply-rooted and important for its ability to orchestrate different cells and factors of both innate and adaptive immunity. The comprehension of the evolution of the main complement components can provide clues to understand changes related to adaptations to new environmental conditions and life-cycles or, in the case of vertebrates, to interactions with the adaptive immunity. Data on tunicates, evolutionary close to vertebrates, are of primary importance for the elucidationof the changes associated with the invertebrate-vertebrate transition. In our model tunicate *Botryllus schlosseri*, we described both a lectin and an alternative pathway of complement activation, similar to those of vertebrates. All the described complement-related genes such as *c3, bf, ficolin, mbl* and *masp* are transcribed by morula cells, i.e., the immunocytes involved in cytotoxic responses and immunomodulation. Functional data suggest the presence of a complement-related immunocyte dialogue during the immune response. When *B. schlosseri* immunocytes are incubated with yeast (*Saccharomyces cerevisiae*) we observed an over-expression of C3 by morula cell that led to an increased amoebocyte-mediated phagocytosis. When a specific C3 inhibitor (compstatin) is added to the medium, this activity decreases. These new data pave the way for a better comprehension of the evolution lof complement-system behavior during immune responses. In the next future, our efforts will focus on the regulation of complement system in tunicates to shed light on the complement system function in a pre-adaptive immunity scenario.

loriano.ballarin@unipd.it

SILVIA GUATELLI[1], ARIANNA DAVIDDI[1], CINZIA FERRARIO[1,2], FRANCESCO BONASORO[1], MARIA DANIELA CANDIA CARNEVALI[1], ANA VARELA COELHO[3], MICHELA SUGNI[1,2]

1 Dipartimento di Scienze e Politiche Ambientali, Università degli Studi di Milano, Via Celoria, 2, 20133, Milano, Italia
2 Center for Complexity & Biosystems, Dipartimento di Fisica, Università degli Studi di Milano, Via Celoria, 16, 20133, Milano, Italia
3 Instituto de Tecnologia Química e Biológica António Xavier, Universidade Nova de Lisboa, Av. da República, 2780-157 Oeiras, Portugal

THE COELOMIC EPITHELIUM AND COELOMOCYTES OF THE STARFISH *Marthasterias glacialis* (LINNEUS, 1758) IN NON-REGENERATING ARM-TIP: MICROSCOPIC ANATOMY AND PROTEOMICS CHARACTERIZATION

In echinoderms the coelomic epithelium (CE) is hypothesized to be the source of circulating coelomocytes, echinoderms' immune cells, and to play a key role during arm regeneration as source of stem cells.
In this context, we decided to characterize the starfish CE and free wandering coelomocytes (CO) in non-regenerating conditions by means of a multidisciplinary approach combining microscopy and proteomics analyses. This was done in an attempt to address the above mentioned issues and provide a fundamental basis for further regeneration studies. For this purpose, we used *Marthasterias glacialis* as model system. For microscopy analyses, CE and circulating CO were collected and processed for standard protocols of light and transmission electron microscopy (TEM). For proteomics analysis, the CE was removed from amputated arms and processed for the identification of soluble proteins by Liquid Chromatography Tandem-Mass Spectrometry (LC-MS/MS) analysis. Microscopy results confirmed that *M. glacialis* CE presents the same complex multi-layered structure described for other asteroids. However, we observed the presence of a never described layer of flagellated cells, filled by swollen RER cisternae. TEM images indicated that the peritoneocytes are actively involved in apocrine-like secretion, especially in the distal most arm-tip. Among the CO, we identified two main subpopulations: a thrombocyte-like cytotype, characterized by numerous electron-lucent vesicles and several long filopodia, and a macrophage-like cytotype (immunocytes), characterized by a less electron-dense cytoplasm, phagosomes and short cytoplasmic processes. No presumptive stem cells were found among the circulating CO. Proteomics results indicated that the CE contains proteins involved in the rearrangement of the cytoskeleton, related to phagocytosis and endocytosis, proteins involved in the immunity response, and in apocrine secretion. Overall, our findings suggested that *M. glacialis* CE and CO are involved in several physiological functions: active secretion of protein material, some of this possibly needed for the distal arm growth; immune-related functions, such as pathogen or endogenous cell removal; haemostatic function. Shared ultrastructural features between CE and CO suggested that at least one of the CO subpopulations might derive from the CE.Further integrated studies on normal and regenerating arms are necessary to deeply understand the role of CE and CO in starfish physiology.

silvia.guatelli@studenti.unimi.it

GIUSEPPINA MESSINA[1], LORENZO URSINO[1], SARA IGNOTO[1],
ROBERTO CAZZOLLA GATTI[2], BIANCA MARIA LOMBARDO[1]

1 Department of Biological, Geological and Environmental Science, University of Catania, Via Androne 81, 95124 - Catania, Italy
2 Biological Diversity and Ecology Laboratory, BioClimLand Centre of Excellence, Tomsk State University (TSU), Lenin Prospekt, Tomsk 634050, Russia

TONIC IMMOBILITY IN TERRESTRIAL ISOPODS

Terrestrial Isopods are capable of entering a state of tonic immobility for many reasons, including defending themselves from predators. When there is a threat (i.e. a predator), they respond in several ways and the reactions is linked to a particular body form. We studied how three species, belonging to different ecotype (roller and clinger) and with different conglobation (euspheric and mesospheric), respond to three mechanical stimuli. The species considered are: *Armadillo officinalis* Duméril 1816, *Armadillidium vulgare* (Latreille, 1804) and *Armadillidium granulatum* Brandt, 1833; in particular we considered two groups for each species, Wild-type (specimens collected in a natural reserve) and Captivity-type (specimens raised in laboratory), in order to verify if the groups respond in a different way. Three different stimuli (drop, squeeze, touch) were administered to each individual (240 totally) and the possible reactions were recorded; furthermore the reactions time were annotated. Statistical analysis of results showed that there is a significant difference between the expression and intensity of the response in the groups considered.

bm.lombardo@unict.it

FRANCESCO A. PALERMO, PAOLO COCCI, MASSIMILIAMO CUCCIOLONI, MAURO ANGELETTI, GILBERTO MOSCONI

School of Biosciences and Veterinary Medicine, University of Camerino, Via Gentile III Da Varano, I-62032 Camerino (MC), Italy

BIOSENSOR-BASED METHOD FOR THE QUANTIFICATION OF VITELLOGENIN PRODUCED BY GRAY MULLET (*MUGIL CEPHALUS*) HEPATOCYTES EXPOSED TO ESTROGEN-LIKE COMPOUNDS

Vitellogenin (Vtg) has proven to be a sensitive biomarker for assessing the estrogenic potency of chemicals and the exposure of fish to estrogen-like compounds present in aquatic environments. In this regard, the gray mullet (*Mugil cephalus*) can be considered a key species for monitoring xenoestrogens due to its benthic feeding behavior, to its wide geographical distribution and also to its commercial value. The aim of this work was to develop an *in vitro* assay for measuring Vtg induction using cultured primary hepatocytes of gray mullet. Vtg production was measured by a rapid detection method based on the surface plasmon resonance (SPR) technique. Anti-Vtg was surface-blocked onto an IAsys plus optical biosensor and sensor optimisation was carried out using gray mullet Vtg at different concentrations. Limits of detection (LOD) and quantification (LOQ) of the proposed biosensor for Vtg were 0.2 and 0.7 nM, respectively. The antigen-antibody complex was characterized by extremely high affinity (KD = 1.07 ± 0.14 nM), with a significant contribution of both association (kass) and dissociation kinetic parameters (kdiss). The developed immunosensor was tested with Vtg secreted into the culture medium from gray mullet hepatocytes exposed to estradiol-17β (E2) or 4 nonylphenol (4NP), a persistent and ubiquitous xenoestrogen. Results from our study demonstrated that gray mullet primary hepatocytes combined with a rapid biosensor-based method for quantification of Vtg could be absolutely useful for investigating the impact of environmental estrogens on fish.

francesco.palermo@unicam.it

CLAUDIA PALESTRINI, PHILIPPE MORETTO, ENRICO BARBERO, ANGELA ROGGERO

University of Torino, Department of Life Sciences and Systems Biology, Italy

THE AFROTROPICAL 24TH AND 28TH *ONTHOPHAGUS* SPECIES GROUPS OF D'ORBIGNY (COLEOPTERA: SCARABAEIDAE)

Onthophagus is commonly regarded as the largest genus in the Scarabaeidae family, comprehending nowadays more than 2500 species with a worldwide spreading distribution, and showing essentially coprophagous habit although necrophagous species are not uncommon. They are tunnelling, and exhibit a simple behaviour with a limited male-female cooperation. Besides, they are also characterized by an extremely successful evolutionary strategy. In recent studies, it was highlighted that the genus *Onthophagus* may be, or may be not, monophyletic on the basis of the species dataset used in the phylogenetic analysis, or the applied phylogenetic method, being employed both morphological and molecular approaches. Lately, various new genera were described, and part of the species were removed from the speciose genus *Onthophagus*, whose oldest lineages can be found in Africa, and the youngest in Australia and New World (Philips 2016). A major issue concerns the systematic evaluation of the species groups proposed in the past and maintained so far by convenience and easiness in the use of tested dichotomous keys. In this framework, it was set agoing a large joint survey project on the revision of the 32nd species groups established by d'Orbigny in 1913 for Afrotropical *Onthophagus*. Here, the species included by the French author in the 24th and 28th groups were examined. At present seven species are included in the 28th group, showing a Western African distribution, while more than fifty species, with a widespread distribution in the Afrotropical region, are listed in the 24th group. In the species of both groups the vertex carina is usually modified into a horn, a tubercle or a lamina, more markedly in major males. The differential forms of vertex are seemingly related to extremely differently-shaped internal structures, as male and female genitalia and epipharynx, which were here examined and their features were compared. The conformation of vertex carina and these structures (either primary or secondary sexual traits, or also not depending on sexual selection) showed congruent, well-differentiated patterns in all the species examined.

claudia.palestrini@unito.it

CLAUDIA PALESTRINI, PHILIPPE MORETTO, ANGELA ROGGERO

University of Torino, Department of Life Sciences and Systems Biology, Italy

MALE GENITALIC ASYMMETRY: THE CASE OF *ONTHOPHAGUS PRAESTANS* PÉRINGUEY, 1901 (COLEOPTERA: SCARABAEIDAE)

The *Onthophagus* species are tunneling, and the males exert a guard behaviour of the female and ephemeral, limiting food sources (i.e., dung or carrion). Due to their behavioural semplicity, the genus has had a massive reproductive success. The speciose genus *Onthophagus* fit exactly the suggested scenario in studies of morphological traits involved in the insect mating system. The combination of such factors as the intense reproductive competition, limiting resources, and one-on-one contests of strenght (i.e., duels) engrossed in the rapid evolution of exaggerated morphological weapons. In *Onthophagus*, the intensity of the male-male reproductive competition has led to the development of such weapons as long horns or laminae used to keep out the rival males from their territory by a face-to-face combat. Aspects related to the reproductive contest refer to evolution of extreme weaponry (secondary sexual traits), but also to striking changes in primary sexual traits, as could be the haphazardly appearance of genitalic asymmetry that can affect different parts of the genitalia. Studies on the evolution of asymmetry in male genitalia refer to many taxa, being the phenomenon widespread in insects. Its taxonomic distribution nevertheless suggests numerous events of parallel evolution, being indipendently developed in various un-related taxa. The phylogenetic patterns of symmetry/asymmetry of male genitalia are beginning to be elucidate, although a comprehensive knowledge of the phenomenon is far to be acquired. It was suggested that in insects the evolution to the male-dominated position during the copula have led to male genitalia asymmetry to accommodate the rotation and flexing of the abdominal tips (SCHILTHUIZEN et al, 2016). Additional explanations are surely required, and various alternative hypotheses are suggested to explain the asymmetry evolution, that can be viewed as a component of the more general rapid and divergent evolution of male genitalia. In *Onthophagus praestans* peculiar features of male genitalia and female pygidium were highlighted. In this species the vertex carina of males constitutes a small pointed tubercle which does not show any exaggerated development as in other *Onthophagus* species. Besides, also the pygidium can be regarded as a secondary sexual trait and in *O. praestans* its development is rather interesting: a markedly asymmetric paramers were paired to the presence of a single evident tooth on the inner lateral surface of female pygidium, allowing thus the two structures to be tightly joined together, making easier the coupling. This dramatic case of coevolution is not a common phenomenon, since in other known cases of asymmetry of paramers, as *O. savanicola* Cambefort, 1984, the female pygidium doesn't carry a toothed structure similar to the one of *O. praestans*.

claudia.palestrini@unito.it

MATTEO PALLOTTINI[1], RICCARDO ROSSI[1], ENZO GORETTI[1],
CHIARA PETROSELLI[1], ROBERTA SELVAGGI[1], DAVID CAPPELLETTI[1],
PAOLA SECHI[2], BENIAMINO CENCI GOGA[2], TIZIANO GARDI[3]

1 Dipartimento di Chimica, Biologia e Biotecnologie (Università degli studi di Perugia)
2 Dipartimento di Medicina Veterinaria (Università degli studi di Perugia)
3 Dipartimento di Scienze Agrarie, Alimentari e Ambientali (Università degli studi di Perugia)

LE API *(APIS MELLIFERA LIGUSTICA)* COME BIOINDICATORI DELLA CONTAMINAZIONE DA METALLI PESANTI

Un ruolo importante nella bioindicazione è svolto dalle le api, *Apis mellifera ligustica* (Spinola, 1806), per la loro capacità di accumulare contaminanti come i metalli pesanti. L'indagine (finanziata dalla Fondazione Cassa di Risparmio di Perugia) ha avuto come scopo lo studio dei livelli di bioaccumulo dei metalli pesanti (Cd, Cr, Ni, Zn, Cu, Pb) da parte delle api in vari siti del territorio umbro sottoposti a diversi livelli di inquinamento ambientale. Obiettivo del lavoro è stato quello di valutare se il bioaccumulo di metalli pesanti nei tessuti delle api sia in relazione con la contaminazione del particolato atmosferico (PM_{10}) dove i metalli pesanti, poco volatili, tendono ad accumularsi. In effetti, il fattore di rischio principale è dovuto alla biodisponibilità del metallo stesso e solo indirettamente ai valori presenti nell'Ambiente. Il campionamento è stato realizzato nel periodo primaverile-estivo (2014-2015) in varie zone dell'Umbria. Le stazioni (35 apiari) sono state selezione sulla base del diverso grado di inquinamento atmosferico per la presenza/assenza di insediamenti produttivi. L'area di studio interessa i territori limitrofi a Città di Castello, Gubbio, Perugia, Magione, Castiglione del Lago, Assisi, Bevagna, Spoleto, Todi, Terni e Norcia. Il prelievo ha riguardato quasi esclusivamente le sole api bottinatrici che svolgono la mansione di raccolta del nettare e del polline, quindi più facilmente esposte alla contaminazione ambientale. Per ogni apiario sono stati prelevate in media circa 200 api. La determinazione dei metalli pesanti (due test analitici), mediante l'analisi spettroscopica (ICP-OES), è stata effettuata su un peso umido di api pari a circa 1,00 g (sub-campione di circa 13 esemplari) corrispondente ad un peso secco di circa 0,30 g. Ogni metallo esaminato ha evidenziato una specifica mappa regionale di bioaccumulo nelle api. I tassi più elevati di bioaccumulo dei metalli nelle api si riscontrano per Cd nella parte orientale dell'Umbria, Pb nel territorio perugino e nella parte orientale dell'Umbria, Cr e Zn nella conca ternana, Ni nella parte centrale della regione, Cu nella parte meridionale e orientale della regione. Tali andamenti sono solo in parte connessi alla contaminazione atmosferica a livello del particolato (PM_{10}), riscontrata da ARPA Umbria e Università di Perugia (2008-2009), evidenziando una mappatura di rischio associabile con l'inquinamento atmosferico riscontrato solo per Cr, Zn e in parte Pb.

pallottini.matteo@gmail.com

GUIDO PIRAINO[1], PAOLA MARIA VALSECCHI[1], CATERINA SPIEZIO [2]

1 Università degli studi di Parma
2 Giardino zoologico “Parco Natura Viva”

VALUTAZIONE DELLO STATO DI BENESSERE ATTRAVERSO PARAMETRI ETOLOGICI DI NANDÙ (*RHEA AMERICANA*) E TAPIRI (*TAPIRUS TERRESTRIS*) OSPITATI IN *MIXED SPECIES EXHIBIT* (MSE)

I giardini zoologici hanno sempre più un ruolo chiave nella tutela della fauna selvatica. Per poter svolgere al meglio il proprio ruolo i giardini zoologici devono garantire il benessere degli individui adottando strategie di gestione adeguate. È quindi necessario effettuare ricerche volte alla valutazione dello stato di benessere degli individui sia nella gestione ordinaria, sia nella gestione straordinaria. L’obiettivo di questo studio, è quello di valutare lo stato di benessere di 5 individui appartenenti a due specie diverse, *Tapirus terrestris* e *Rhea americana*, ospitate al Parco Natura Viva, e l’efficacia del *mixed species exhibit* (MSE**),** un arricchimento sociale che vede specie diverse condividere la stessa area. Gli individui dello studio sono tre tapiri, già ospiti del parco, e due nandù, arrivati poco prima dell’inizio dello studio. Lo studio è stato suddiviso in due periodi: un primo periodo, detto familiarizzazione, in cui le specie erano ospitate in due reparti diversi, ma adiacenti, separati da una rete che consentiva agli animali di vedersi e annusarsi; un secondo periodo detto *mixed species exhibit* in cui le due specie condividevano lo stesso reparto esterno. Per periodo e per individuo sono state effettuate due sessioni giornaliere di raccolta dati della durata di 20 minuti, per un totale complessivo di 200 sessioni di raccolta dati (4000 minuti di osservazione). I dati sono stati raccolti con registrazione continua con campionamento ad animale focale e analizzati attraverso la “*single case analysis*”. I risultati dello studio mostrano come nel secondo periodo di convivenza, nel *mixed species exhibit*, sia i nandù sia i tapiri manifestano comportamenti tipici della specie per diversità e distribuzione delle attività giornaliere. La presenza, invece, di comportamenti anormali nei nandù, manifestati durante la familiarizzazione seppur in modo sporadico, indica che questo periodo è stato problematico per i nandù sia per la familiarizzazione con i tapiri, sia per l’adattamento al nuovo reparto. Tuttavia, questa fase è stata necessaria e ha permesso ai tapiri, animali territoriali, di familiarizzare con i nandù in modo graduale e accettarli successivamente nel proprio reparto. In conclusione, il MES sembra essere un buono strumento di gestione per garantire il benessere animale nei giardini zoologici. Va tuttavia definito un programma di attuazione del MES in maniera adeguata controllando e valutandone sempre l’efficacia.

guido.pirano@studenti.unipr.it

F. PROIETTI SERAFINI[1], E. CATALANI[1], F. BUONANNO[2], C. ORTENZI[2], E. MARCANTONI[3], A. M. FAUSTO[1], M. MAZZINI[1], S. PICCHIETTI[1], E. CLEMENTI[4], D. CERVIA[1]

1 Dept. for Innovation in Biological, Agro-food and Forest systems, Tuscia Univ., Viterbo, Italy
2 Lab. of Protistology and Biology Education, Macerata Univ., Macerata, Italy
3 School of Sciences and Technologies, Section of Chemistry, Camerino Univ., Camerino, Italy
4 Dept. of Biomedical and Clinical Sciences "Luigi Sacco", Milano Univ., Milano, Italy

THE PRO-APOPTOTIC COMPOUND CLIMACOSTOL, A NATURAL TOXIN PRODUCED BY THE FRESHWATER CILIATED PROTOZOAN *CLIMACOSTOMUM VIRENS*, DISRUPTS AUTOPHAGIC FLUX IN MOUSE MELANOMA

Autophagy is a self-eating process by which aged or damaged intracellular organelles and proteins are degraded into lysosomes via autophagosomes. The over-activation of autophagy in cancer cells may promote metastasis and chemoresistance. Accordingly, different clinical trials are using autophagy inhibitors in combination with other drugs for the treatment of multiple neoplasms. We have previously demonstrated that climacostol, a compound produced by the ciliated protozoan *Climacostomum virens*, displays cytotoxic and apoptotic effects in tumoural cells. Of interest, climacostol also showed anti-cancer activity in *in vivo* models of mouse melanoma although its role in the regulation of autophagic machine remains to be elucidated. In this study, both *in vitro* and *in vivo* analysis of B16 mouse melanomas treated with climacostol revealed an increase of autophagosome and melanosome cell content which is due to an impairment of the autophagic flux. In particular, we monitored autophagy over time and we observed that short treatments with climacostol (3h-6h) progressively blocked autophagosomes-lysosomes fusion and disrupted autophagy, likely through the modulation of the Akt/mTOR pathway. The dual role of climacostol as an apoptotic inducer and an autophagy inhibitor might provide new insights in the combined therapies for melanoma treatment.

pserafini@unitus.it

MANUELA REBORA, SILVANA PIERSANTI

Dipartimento di Chimica, Biologia e Biotecnologie, University of Perugia, Via Elce di Sotto, 1, 06121 Perugia, Italy

LARVAL ANTENNAE IN ODONATA

The larval antennal sensilla of two dragonfly (*Libellula depressa*, *Onychogomphus forcipatus*) and two damselfly (*Calopteryx haemorroidalis*, *Ischnura elegans*) species belonging to four families (Libellulidae, Gomphidae, Calopterygidae, Coenagrionidae) have been investigated under scanning and transmission electron microscopy (SEM, TEM). These four species have different antennae (geniculate, short and flat, setaceous) and live in different environments (lotic, lentic waters). Notwithstanding this, similarities in the kind and distribution of sensilla have been outlined: in the four species the majority of sensilla types is located on the apical portion of the antenna, namely a composed coeloconic sensillum (possible chemoreceptor), two other coeloconic sensilla (possible thermo-hygroreceptors) and, only in the two damselfly species, an apical seta (direct contact mechanoreceptor). Other mechanoreceptors such as filiform hairs sensitive to movements of the surrounding medium or bristles positioned to sense the movements of the flagellar segments are present on the antenna. A peculiar structure with an internal organization similar to that of a gland has been observed in the apical antenna of the four species. The possible function of this structure is at the moment unknown but it deserves further investigations owing to its widespread presence in Odonata larvae.

manuela.rebora@unipg.it

MANUELA REBORA[1], GIANANDREA SALERNO[2], STANISLAV GORB[3]

1 Dipartimento di Chimica, Biologia e Biotecnologie, University of Perugia, Via Elce di Sotto, 1, 06121 Perugia, Italy
2 Dipartimento di Scienze Agrarie, Alimentari e Ambientali, University of Perugia, Borgo XX Giugno, Perugia, Italy
3 Department of Functional Morphology and Biomechanics, Zoological Institute, Christian-Albrechts-Universität zu Kiel, Am Botanischen Garten 2-9, 24098 Kiel, Germany

THE ATTACHMENT DEVICES OF THE STINKBUG *NEZARA VIRIDULA* (HETEROPTERA, PENTATOMIDAE)

Insect attachment ability has been extensively studied, but many insects are still uninvestigated, such as the southern green stink bug, *Nezara viridula*, a serious crop pest in the world. The attachment devices of *N. viridula* are represented by a pair of smooth flexible pulvilli and a hairy pad located on the ventral side of its basitarsus. with no evident sexual dimorphism. Footprints obtained from living resting individuals show that the insect touches the substrate with the ventral surface of the distal portion of the two pulvilli and with the distal portion of the hairs. Together with these attachment devices, the insect always touches the substrate with the distal portion of the two paraempodia, which represent mechanosensory setae. Each pulvillus of the adult N. viridula is a cuticular sac constituted of complex cuticular layers.The attachment ability of males and females of *N. viridula* were studied on artificial surfaces (smooth hydrophilic, smooth hydrophobic, different surface roughness) and on both leaf surfaces of a typical host plant species Vicia faba, using a centrifugal force tester and a traction force experiments set up. Notwithstanding the different body mass between the sexes, no difference was found between friction forces generated by females and males. Friction force was higher on hydrophilic surfaces than on hydrophobic ones and was lower on both sides of *V. faba* leaf compared with both hydrophilic and hydrophobic artificial smooth surfaces. On the surfaces with different roughness, the friction force values varied significantly, with the higher attachment ability on the surface with very high asperity size followed by the smooth surface. The lowest attachment was on the surfaces with intermediate asperity sizes. These results could be related to the specific combination of attachment devices of *N. viridula*.

manuela.rebora@unipg.it

LAURA REDAELLI[1], SIMONA SANVITO[2], FILIPPO GALIMBERTI[2]

1: Collegio interdipartimentale di scienze naturali, Università degli Studi di Milano
2: Elephant Seal Research Group, Sea Lion Island, Falkland Islands

NON-INVASIVE ESTIMATION OF BODY SIZE OF SOUTHERN ELEPHANT SEALS (*MIROUNGA LEONINA*)

Body size is one of the most important phenotypic trait of animals, is related to physiology, ecology and behaviour, and has important implications for conservation of wild species. Direct estimation of body size of large mammals requires physical or chemical restrain of subjects, that presents risks for both subjects and operators. The practical and ethical drawbacks of direct size measurement promoted the development of non-invasive measurement methods, most of which are based on photogrammetry, in which pictures of the animals are taken with a scale in the picture frame. A significant drawback of these methods is that pictures need to be processed to generate measurements. Therefore, they cannot provide a size estimate directly in the field, often requiring a significant amount of time for picture processing. Here, we present a new method based on simple trigonometry by which we estimated body length of female southern elephant seals (*Mirounga leonina*), that are large (weight up to 900 kg) and cannot be handled without sedation. Field work was carried out in 2016 at Sea Lion Island, the main colony of the species in the Falklands. The length of female elephant seals was estimated by applying simple trigonometry to: a) the distance between the measurement apparatus and the tip of the nose of seals; b) the distance between the measurement apparatus and the base of the rear flippers; and c) the angle between the two distances. We used a laser range finder (Leica Disto A8) to measure distances and a digital protractor (Wixey WR410) to measure angles. The range finder was mounted co-axial to the protractor, that was in turn mounted on a tripod. We carried out extensive trials measuring objects of know size, obtaining repeatabilities close to 1 and small measurement errors, independent from operator identity, wind and light conditions. We measured a large sample of elephant seal females in the field (N =134) in different position (on the belly, on the side with straight back, on the side with curved back), we obtained a high repeatability of measurements (> 0.90), and we estimated equations to convert measurements obtained in different positions. All together, the new method based on trigonometry proved a very effective approach to obtain fast and accurate measures of elephant seal females non-invasively and directly in the field. The method is definitely applicable to other pinniped species, and mammals at large, that can approached at short distance.

laura.redaelli.95@gmail.com

ANGELA ROGGERO, CLAUDIA PALESTRINI

University of Torino, Department of Life Sciences and Systems Biology, Italy

HINDWING AND BODY VARIATIONS IN DUNG BEETLES: SIZE AND SHAPE MIRROR FUNCTIONAL CONSTRAINTS AND PHYLOGENETIC RELATIONSHIPS

As a rule, in dung beetles the flight ability is well-developed, eliciting the search for a partner and food sources. In those insects, only hindwings are used to fly, thus they are of great importance, and deserve to be carefully evaluated. The hindwing of twenty-seven species of Onthophagina and Oniticellina was recently studied, and two distinct morphological patterns of shape variation were recognized. Since each group included only the members of one of the two subtribes, it was confirmed the goodness of this anatomical trait in taxa recognition at higher rank. To evaluate its applicability at lower taxonomic level, in the present research thirty-four Afrotropical *Onthophagus* species (Scarabaeidae, Onthophagini) were examined using the geometric morphometric methods on the hindwing and pronotum. These anatomical traits are strictly related given that the hindwings develop from thoracic segments (i.e., tergal and pleural structures). The overall shape variation was highlighted using Principal Component Analysis (PCA) and Canonical Variate Analysis (CVA), showing two distinct, well separate patterns for both anatomical traits. The analysis of size variation, expressed by the CS values, gave significant, well differentiated patterns for both the structures. The results were congruent, for the same species were included together in each group in all the analyses. The hindwing size was then compared to the body size (i.e., CS values of pronotum), evidencing a linear correlation for these dimensions. According to the present findings, it has been highlighted that: 1) the studied species can be divided in two distinct groups by the size and shape of both anatomical traits; 2) the hindwing size increases at the increasing of body size, thus it should be hypothesized that functional constraints related to flight mechanism can have affected their evolutionary trends; 3) within each identified group, the shape and size variations of hindwing and pronotum displayed phylogenetic signals. Thus, the hindwing traits can be efficacely used in taxa recognition also at lower rank.

angela.roggero@unito.it

FRANCESCO RUSCONI[1], CINZIA FERRARIO[1,2], TIZIANA MARTINELLO[3], CHIARA GOMIERO[3], FRANCESCO BONASORO[1], SILVIA FERRO[3], VINCENZO VINDIGNI[4], MARIA DANIELA CANDIA CARNEVALI[1], MARCO PATRUNO[3], MICHELA SUGNI[1,2]

1 Dipartimento di Scienze e Politiche Ambientali, Università degli Studi di Milano, Via Celoria, 2, 20133, Milano
2 Center for Complexity & Biosystems, Dipartimento di Fisica, Università degli Studi di Milano, Via Celoria, 16, 20133, Milano
3 Dipartimento di Biomedicina Comparata e Alimentazione, Università degli Studi di Padova, Viale dell'Università, 16, 35020, Legnaro (PD)
4 Dipartimento di Neuroscienze, Università degli Studi di Padova, Viale dell'Università, 16, 35020, Legnaro (PD

NEW FRONTIERS IN APPLIED ZOOLOGY: INNOVATIVE 3D MARINE-DERIVED COLLAGEN SCAFFOLDS FOR REGENERATIVE MEDICINE

Living organisms, and particularly marine ecosystems, are a huge source of still largely unexplored “blue” innovations for different human applications. The sustainable exploitation of resources from the sea and their eco-friendly management are currently two of the main challenges of marine biotechnology. Among the others, marine biomaterials (and marine collagens in particular) are a frontier field in regenerative medicine. Echinoderms, and especially echinoids, have been recently proposed as sustainable sources of marine collagen for this purpose. Particularly from *Paracentrotus lividus* peristomial membranes high value fibrillar collagen can be obtained to prepare very thin but resistant two-dimensional (2D) membranes, useful for Guided Tissue Regeneration (FERRARIO et al. 2016). In this work, we developed and optimized a new protocol to produce three-dimensional (3D) scaffolds for novel tissue engineering applications, such as skin regeneration. Different collagen and additive (ethanol) concentrations were tested as well as two freeze-drying conditions: -80°C *vs* -196°C. The so obtained 3D scaffolds were characterized and compared in terms of ultrastructure, stability and behaviour in wet conditions. The dry scaffolds observed at SEM presented a highly porous structure which could be tuned according to the different protocol conditions. Once identified the best protocol in terms of ultrastructural features and stability it was used to prepare sponge-like scaffolds (1-2 mm in thickness) to perform experiments of cell seeding with mammalian fibroblasts. In parallel, to evaluate the biocompatibility of this novel marine collagen biomaterial, *in vivo* tests were performed by sub-skin implantation of thin membranes in rat models. First results indicated that the animals did not show clinical signs of sufferance nor marked inflammatory reactions (*i.e.* rejection, abscess formation) compared to commercial bovine collagen devices used as controls, suggesting a promising biocompatibility of this material. Overall, our data indicated that sea urchins might be considered a valuable eco-friendly alternative source of marine collagen to produce different types of devices for regenerative medicine applications, including complex 3D scaffolds. Further *in vivo* tests with larger size animals (*i.e.* sheep) are necessary to validate the biocompatibility of this innovative marine biomaterial and to test its actual efficacy in promoting tissue regeneration

michela.sugni@unimi.it

SUSANNA SALVADORI[1] ELISABETTA COLUCCIA[1], FEDERICA DEIDDA[1], CINZIA LOBINA[1], ANNA MARIA DEIANA[1], VALERIO SCALI[2]

1 Department of Scienze della Vita e dell'Ambiente, Università di Cagliari
2 Department of BiGeA, Università di Bologna

CO-LOCALIZATION OF RIBOSOMAL AND HIGHLY AMPLIFIED TELOMERIC SEQUENCES IN *BACILLUS* (INSECTA PHASMATODEA)

A peculiar karyotypic feature of stick insects relates to the varying number and size of satellites/NOR both among co-generic species and even within the same species (TINTI & SCALI, 1991; MANARESI *et al.*, 1992a,b; GHISELLI *et al*., 2007; SCALI *et al.*, 2012); the large cytological satellites were labeled by AgNO3 reaction proving to be the site of active 45S rDNA (MANARESI et al. 1991; 1992a, b; TINTI & SCALI 1991). Of recent we located by dual-FISH 45S rDNA and telomeric pentameric repeat (TTAGG)n sequences in *Leptynia montana* Scali and two subspecies of *L. attenuata* Pantel. In those analyzed taxa 45S and (TTAGG)n signals always overlapped on the same satellites, thus demonstrating a co-localization of the two highly amplified repetitive sequences (SCALI et al., 2016). We therefore planned to analyze the same features in the Mediterranean genus *Bacillus* starting from Sardinian specimens of the bisexual *B. rossius rossius* (2n=36/35; XX/X0) and the thelytokous *B. atticus* (2n=33-34; XX). Chromosomal preparations and FISH of ribosomal 45S and telomeric (TTAGG) n sequences were carried out according to Scali *et al*., 2014. In the two analyzed species 45S FISH showed that the probes constantly labeled large areas on a single chromosome pair, always corresponding to the NORs, located on large cytological satellites, often in a heterozygous condition, of pair 13 in *B. rossius (*MANARESI *et al., 1992*) and 17 in *B. atticus* (TINTI & SCALI, 1991). FISH of the telomeric repeats, beside ordinary telomeres, also labeled the NOR satellites; dual-FISH of ribosomal and telomeric sequences showed that both 45S and telomeric signals were extensively co-localized on the same satellites. The new findings fully support that even in *Bacillus* the co-localization between NOR and highly amplified telomeric sequences, first evidenced in *Leptynia,* occurs. This shared feature among taxonomically distant species of Phasmatodea cannot be a casual one. The association of (TTAGG)*n* pentameric repeats with the 45S rDNA in the spiny lobster *Jasus lalandii* (Salvadori et al. 2012) and of hexameric (TTTAGG)*n* ones in many fish species (OCALEWICZ 2013) has been also demonstrated. The evolutionary meaning of those co-localizations waits an answer.

salvador@unica.it

ALESSANDRO SARACINO, LUCA PIETRO CASACCI, SIMONA BONELLI

Dipartimento di Scienze della Vita e Biologia dei Sistemi, Via Accademia Albertina 13, 10123, Torino

STRATEGIE DI MIMETISMO E RICONOSCIMENTO CHIMICO NELLE LARVE DEL GENERE *MACULINEA* (LEPIDOPTERA, LYCAENIDAE) NELLA FASE DI ADOZIONE

Le farfalle del genere *Maculinea* sono parassite di formiche del genere *Myrmica*. I bruchi si sviluppano inizialmente sulla pianta nutrice, cadono a terra e vengono "adottati" da operaie delle formiche ospite. Una volta dentro il nido, i bruchi completeranno il suo sviluppo facendosi nutrire per trofallassi dalle operaie (specie cuckoo) o nutrendosi delle larve della colonia (specie predatrici). Gli idrocarburi cuticolari (D'ETTORRE and LENOIR, 2010), essenziali per il riconoscimento dei compagni di nido nelle formiche, svolgono un ruolo chiave anche nell'adozione e nell'integrazione delle larve parassite (AKINO *et al.*, 1999). Il presente studio ha lo scopo di confrontare i profili chimici delle larve parassite in pre-adozione di *Maculinea alcon* (cuckoo) e *Maculinea teleius* (predatrice) e di verificare se gli alcani lineari presenti sulla cuticola delle larve parassite rivestano un ruolo chiave durante il processo di riconoscimento tra ospite e parassita durante l'adozione. Gli idrocarburi di cuticola sono stati estratti da larve di IV stadio dei due parassiti e da operaie di *Myrmica scabrinodis* e analizzati tramite gas-cromatografia e spettrometria di massa. Le larve delle due specie mostrano profili idrocarburici con grado di somiglianza comparabile (15-18%) rispetto al profilo delle operaie ma il profilo di *M. alcon* è povero di composti (soprattutto alcani e alcani metilati), mentre quello di *M. teleius* ne presenta molti (in prevalenza alcheni). I cinque alcani lineari presenti sulla cuticola di entrambe le larve parassite e delle formiche operaie (C25, C27, C29, C30, C31) sono stati successivamente applicati separatamente sulla superficie di larve di formica lavate con esano. Larve trattate con i singoli idrocarburi e larve di controllo lavate con il solvente sono state posizionate singolarmente all'interno delle colonie di *M. scabrinodis* e i comportamenti delle operaie nei confronti della larva sono stati osservati. A differenza delle larve di controllo, spesso ignorate, le operaie esibiscono diversi comportamenti nei confronti delle larve trattate con alcani lineari, che vanno dall'antennamento, al *grooming* fino al trasporto della larva all'interno del nido. Il presente lavoro mostra come le due specie parassite a diversa strategia alimentare abbiano evoluto una diversa strategia di mimetismo chimico nella fase di pre-adozione e come gli alcani lineari svolgano un ruolo importante nel promuovere l'inizio e il mantenimento del rituale di adozione.

saracinoalessandro@live.it

ADRIANA VALLESI, FRANCESCA RICCI, ANNALISA CANDELORI, PIERANGELO LUPORINI

Laboratory of Eukaryotic Microbiology and Animal Biology, University of Camerino, Camerino (MC), Italy

EUPLOTES PHEROMONE GENES: STRUCTURALLY SIMPLE STRUCTURE AND COMPLEX EXPRESSION MECHANISMS

Ciliates are unique in possessing two genomes within the same cytoplasm: a chromosomic transcriptionally silent germinal genome residing inside the cell micronucleus and a sub-chromosomic transcriptionally active somatic genome residing inside the cell macronucleus. The latter is anew generated from the former at every sexual event through short-term dramatic phenomena of chromosome fragmentation, DNA elimination and gene amplification. In spirotrichous ciliates such as *Euplotes*, the macronuclear genome comprises only gene-size DNA molecules characterized by telomere-capped extremities and a single coding region flanked by 5' and 3' un-translated regions of variable lengths. We analyzed the expression of these macronuclear genes in two gene families encoding water-borne signaling pheromones responsible for cell-cell communication and recognition phenomena in two common marine species of *Euplotes*, *E. crassus* and *E. raikovi*. Although structurally simple, these genes regulate their expression through mechanisms that are much more complex than previously thought. They result in the synthesis of multiple transcripts generated by the use of different transcription start sites and the removal of intron sequences from the conserved 5' regions. However, the presence of several in-frame UAA and UAG stop codons positioned far from the gene poly(A) tail raises the question on whether every transcript is actually able to specify a functional product. We are currently verifying the hypothesis that these stop codons are translated, as it occurs in other ciliates, as sense codons specific for the amino acid glutamine.

adriana.vallesi@unicam.it

MATTEO VECCHI[1], AGNESE FERRARI[1], IRENE G. NEWTON[2], MICHELE CESARI[1], LORENA REBECCHI[1] ROBERTO GUIDETTI[1]

1 Department of Life Sciences, University of Modena and Reggio Emilia. Via Campi 213/D, 41125 Modena, Italy
2 Department of Biology, Indiana University. Jordan Hall 221, 1001 E. 3rd St., 47405 Bloomington, IN, USA

THE CHARACTERIZATION OF TARDIGRADE MICROBIOTA

Symbiotic associations of metazoans with bacteria are ubiquitous and all animals are holobionts, containing abundant and diverse symbiotic microorganisms (ROSENBERG and ROSENBERG, 2014). The microbiota associated with metazoans has been characterized for many phyla (*e.g.* Porifera, Cnidaria, Annelida, Mollusca, Nematoda, Arthropoda, Chordata) and has a strong influence on their biology, but our knowledge of microbiota composition of the currently recognized diversity of animal hosts is far from being complete. Tardigrades (also known as "water bears") are famous for their ability to undergo anhydrobiosis (*i.e.*, ametabolic state of life in response to environmental dehydration, GUIDETTI et al., 2011), but very little is known about their associated bacteria (VECCHI et al., 2016). We designed an experiment to determine i. the composition of the microbial community of tardigrades: ii. if tardigrade microbial communities are species-specific; iii. the presence of potential tardigrade symbionts; iv. the relationship between microbiota communities of tardigrades and those of their habitats. Using 16S rRNA gene amplicons, we characterize the microbiota of six tardigrades species from Italy, Sweden and Antarctica, spanning the two classes Heterotardigrada and Eutardigrada, and the bacteria associated with the substrates (mosses, lichens, freshwater sediments) on which these tardigrades were found. The results indicate that tardigrade microbiotas are species-specific and consistently differ from that of their substrates allowing us to rule out environmental bacterial community as a contributor to the tardigrade microbiota. Putative symbionts from Rickettsiales and Holosporales in different tardigrade species were also identified and molecularly characterized. The potential effects of tardigrades microbiota and symbionts on the evolution of their host biology (e.g. anhydrobiosis and reproductive modes) need to be further investigated.

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roberto.guidetti@unimore.it

ARIANNA ZAMPOLLO, LUCA PIETRO CASACCI, CINZIA M. BERTEA, SIMONA BONELLI, FRANCESCA BARBERO

Dipartimento di Scienze della Vita e Biologia dei Sistemi, Università degli Studi di Torino

CHEMICAL SIGNALS INVOLVED IN THE OVIPOSITION CHOICE OF *MACULINEA* BUTTERFLIES

In the tight interaction between *Maculinea* butterflies and *Myrmica* ants, larval host plants (LHP) play a pivotal role, representing the oviposition site and the first food-source for the early-instar caterpillars. After hatching, *Maculinea* larvae feed on flower buds and eventually fall to the soil, where *Myrmica* ants collect them for further rearing. These obligate myrmecophilous butterflies have to find a suitable plant (i) for the nutrition of their offspring, (ii) to ensure the encounter of the grown-up larva with its associated host ant and (iii) to minimise the intraspecific competition among its off-spring. The mechanism allowing *Maculinea* females to find the plant growing near the ant colonies has been recently disentangled and the role of volatile compounds (VOCs) has been brought to light (PATRICELLI *et al*., 2015), whilst the importance of cuticular hydrocarbons (CHC) as chemical cues, used in both plants and insects, has long been known (BARBERO, 2016). The aim of our research is to unravel how and which chemical signals can drive the selection by *Maculinea* gravid females of the ideal LHPs. In particular, we would like to assess how females can detect the presence of non-visible conspecific eggs and avoid the LHP on which oviposition has already occurred, thus lowering brood competition. We investigated the chemical patterns of *Maculinea's* LHPs and we compared plants with and without eggs. Cyclohexane and sorptive extraction methods coupled with GC-MS were used to analyse CHC and head-space VOCs, respectively. Our results show that the LHPs react to the oviposition of *Maculinea* butterflies by quantitative variations in both the volatile and the cuticular chemical patterns. The major variations were measured in the plant CHC profiles, thus indicating that the landing of the gravid butterfly and the contact with the plant surface is necessary for the females to detect the chemical signal. These variations can be interpreted by the females as a proxy for the presence of conspecific eggs, at least in those *Maculinea* species whose eggs are not detectable through sight. Finally, the analysis of CHCs revealed which compounds are shared among the LHPs, the butterfly larvae and the host ants, shedding light on the mechanisms which has prompted the evolution and the persistence of such a complex multi-trophic system.

zampolloarianna@gmail.com

PAOLA ZARATTINI[1], ANNARITA WIRZ[2]

1 Dipartimento di Scienze della Vita, Università degli Studi di Trieste
2 Fondazione Santa Lucia Irccs, Roma

IL RESPONSABILE DEL BENESSERE E DELLA CURA DEGLI ANIMALI: UN NUOVO RUOLO OPERATIVO E DI VIGILANZA NELL'AMBITO DELL'ALLEVAMENTO ED UTILIZZO DI ANIMALI A FINI SCIENTIFICI

Il decreto legislativo 4 marzo 2014, n. 26 in attuazione della direttiva 2010/63/UE stabilisce rigide disposizioni a tutela della protezione degli animali utilizzati a fini scientifici ed educativi. In particolare l'articolo 3 introduce la nuova figura individuale del Responsabile del benessere e dell'assistenza degli animali e del funzionamento delle attrezzature degli stabilimenti autorizzati (stabulari). Tale profilo professionale è fondamentale nell'organizzazione e nella gestione di uno stabulario, luogo in cui egli svolge la sua attività quotidiana coadiuvato dal medico veterinario designato. Tra i compiti pratico-operativi del Responsabile del benessere c'è anche la gestione delle colonie animali allevate. Questo impegno presuppone una profonda conoscenza non solo della biologia, fisiologia ed anatomia di numerose specie di vertebrati (roditori, conigli, primati non umani, uccelli, anfibi, pesci e specie esotiche) e di taluni invertebrati (come i Cefalopodi), ma anche delle loro esigenze etologiche sia in condizioni di cattività che in natura. Inoltre, il Responsabile del benessere è coinvolto nella correzione, approvazione e sottomissione al Ministero della Salute dei progetti di ricerca che prevedono l'utilizzo del modello animale e, pertanto, deve avere una preparazione adatta a questo compito prettamente consultivo-valutativo. Ad oggi la disciplina del personale abilitato (art.23) non definisce i requisiti professionali necessari per adempiere a tale funzione. In questo contesto si sottolinea che l'ampia preparazione in materia di biologia animale posseduta dallo zoologo al termine del suo percorso formativo rappresenti non solo una giusta risposta a questo nuovo requisito di legge ma anche un valido sbocco professionale per i giovani laureati.

pzarattini@units.it

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