XXXI Congresso S.It.E.

Adattamenti degli Ecosistemi alle Pressioni dell'Antropocene

Siena, 13-15 Settembre 2022

UNIVERSITÀ DI SIENA 1240

SOMMARIO

PRESENTAZIONE DEL CONGRESSO

Il principale obiettivo di questo **XXXI Congresso della Società Italiana di Ecologia** è quello di puntare l'attenzione sul ruolo dell'Ecologo nello studio degli adattamenti degli ecosistemi alle molteplici pressioni antropiche della nostra era. I cambiamenti ambientali causati dalla società umana possono infatti indurre, sugli ecosistemi, stress singoli o multipli sia a diversi livelli di organizzazione, che su diverse scale spaziali e/o temporali. Questi possono determinare risposte adattative e non adattative nella componente biotica degli ecosistemi. L'Ecologo svolge quindi un ruolo chiave nello studio degli effetti causati da queste pressioni antropiche per orientare specifiche misure di conservazione e mitigazione a sostegno della gestione delle risorse naturali.

ENTI ORGANIZZATORI

Società Italiana di Ecologia (S.It.E.)

Università di Siena

COMITATO SCIENTIFICO

Elisa Anna Fano, Antonio Pusceddu, Maria Cristina Fossi, Letizia Marsili, Ilaria Corsi, Silvia Casini, Edoardo Calizza, Gianluca Corno, Antonio Mazzola, Antonio Finizio, Antonella Penna, Flora Angela Rutigliano, Salvatrice Vizzini

COMITATO ORGANIZZATORE

Maria Cristina Fossi, Letizia Marsili, Ilaria Corsi, Silvia Casini, Simonetta Corsolini, Cristina Panti, Ilaria Caliani, Stefania Ancora, Matteo Baini, Tommaso Campani, Salvatrice Vizzini

PROGRAMMA

Legenda Aule

CRIPTA
AULA COLONNE
AULA 8
AULA 9

MARTEDI' 13 SETTEMBRE

13:00-14:00 Accoglienza, registrazione dei partecipanti e affissione dei posters

14.00-14.30 Apertura ufficiale dei lavori: Elisa Anna Fano (Presidente della S.It.E.) e Maria Cristina Fossi (Chair del XXXI Congresso S.It.E.)
Consegna del Premio Luigi e Francesca Brusarosco: Elisa Anna Fano e Marino Gatto **(CRIPTA)**

14.30-15.00 Plenary lecture S1: Salvatore Aricò "Ecological science in action: An international and intergovernmental perspective" **(CRIPTA)**

15.00-16.30 S4. Stress multipli sugli ecosistemi acquatici e terrestri: metodi diagnostici e meccanismi adattativi *Chairs: Antonio Finizio, Antonio Di Guardo* **(CRIPTA)**

Bellasi *et al.* **A meal of microplastics and ferrihydrite: does the co-occurrence influence the uptake and elimination rate in *Lumbriculus variegatus*?**

Cesarini *et al.* **Accumulation of small microplastics (<100 μm) and additives in the freshwater bivalves *Anodonta cygnea***

Magni *et al.* **The impact of COVID-19 pandemic on plastic contamination**

Nava *et al.* **Unraveling the microalgae community of the plastisphere: results of a mesocosm experiment across an environmental gradient**

De Felice *et al.* **Sub-individual and individual effects induced by polystyrene nanoparticles in *Daphia magna***

Santini *Gio. et al.* **Effects of bioplastic and plastic mulches on soil microbial populations**

15.00-16.30 S5. Focus Mediterraneo: biodiversità, impatti antropici e cambiamenti climatici *Chairs: Maria Cristina Fossi, Antonella Penna* **(AULA COLONNE)**

Maiorano *et al.* **Deep-water species assemblages from the central Mediterranean: what is changed in the last thirty years?**

Mikac *et al.* **Diversity and structure of faunal assemblages associated with mussel and oyster habitats in the Adriatic Sea, with special emphasis on non-indigenous species**

Pedicini *et al.* **Role of biofilm in controlling the recruitment of a Canopy-forming Alga**

Pusceddu *et al.* **Effects of the sea cucumber *Holothuria tubulosa* Gmelin 1788 on quantity, biochemical composition, and nutritional quality of sedimentary organic matter**

Santorufo *et al.* **Organic matter stability and microarthropod community under different vegetation covers of Mediterranean area**

Simbula et al. **Can environmental heterogeneity sustain butterflies' diversity?**

15.00-16.30 S1. Capitale naturale, servizi ecosistemici e contabilità ambientale *Chairs: Pier Paolo Franzese, Fausto Manes* **(AULA 9)**

Capasso *et al.* **Assessing natural capital and ecosystem services of *Posidonia oceanica* meadows: The SEEA-EA framework**

Caviglia *et al.* **The importance of dead seagrass (*Posidonia oceanica*) matte as a biogeochemical sink**

Bordoni *et al.* **Distribution of natural capital and environmental flows values along the marine coastal habitats of Ligurian Sea (NW Italy)**

Rigo *et al.* **A dynamic model for the assessment of environmental carrying capacity overcoming due to tourist flows: the San Fruttuoso bay case study**

Tamburini *et al.* **Sustainable bivalves farming is a permanent carbon sink against climate change**

Paoli et al. **Donor-side and user-side evaluation of the Atlantic blue crab invasion on a Mediterranean lagoon.**

16.00-16.30 Apertura votazioni per le elezioni per il rinnovo delle cariche di Vice presidente e del Consiglio Direttivo per gli anni 2023/24

16.30-17.00 Pausa caffè e sessione poster (tutte le sessioni)

17.00-17.30 Keynote lecture Jeffrey Sachs, Direttore del Center for Sustainable Development, Columbia University, *Introduzione di Francesco Frati, Rettore dell'Università di Siena* **(CRIPTA)**

Jeffrey D. Sachs is University Professor and Director of the Center for Sustainable Development at Columbia University, where he directed the Earth Institute from 2002 until 2016. He is President of the UN Sustainable Development Solutions Network, Chair of the Lancet COVID19 Commission, Co-Chair of the Council of Engineers for the Energy Transition, Commissioner of the UN Broadband Commission for Development, academician of the Pontifical Academy of Social Sciences at the Vatican, and Tan Sri Jeffrey Cheah Honorary Distinguished Professor at Sunway University. He has been Special Advisor to three United Nations Secretaries-General, and currently serves as an SDG Advocate under Secretary General António Guterres. He spent over twenty years as a professor at Harvard University, where he received his B.A., M.A., and Ph.D. degrees. Sachs has received 40 honorary doctorates, and his recent awards include the 2022 Tang Prize in Sustainable Development, the Legion of Honor by decree of the President of the Republic of France, and the Order of the Cross from the President of Estonia. His most recent book is The Ages of Globalization: Geography, Technology, and Institutions (2020).

17.30-18.45 S4. Stress multipli sugli ecosistemi acquatici e terrestri: metodi diagnostici e meccanismi adattativi Chairs: *Flora Angela Rutigliano, Edoardo Calizza* **(CRIPTA)**

Bellingeri *et al.* **Ecologically based methods for promoting safer nanosilver for environmental applications**

Corsi **Current knowledge and future challenges in the ecological risk assessment of engineered nanomaterials in a changing environment**

Nigro *et al.* **Are water-soluble polymers a new environmental threat? The case of polyvinyl alcohol**

Parolini *et al.* **Ecotoxicological assessment of a new Plasmix-based material**

Elia *et al.* **Aquatic ecotoxicity assessment of new peroxide-based biocides**

17.30-18.45 S5. Focus Mediterraneo: biodiversità, impatti antropici e cambiamenti climatici *Chairs: Antonio Pusceddu, Cristina Panti* **(AULA COLONNE)**

Capanni *et al.* **Is it possible to determine hazards associated with organochlorine compounds (OCs) in Mediterranean apex predators? A theoretical statistical models' approach for striped dolphin (*Stenella coeruleoalba*)**

Consales *et al.* ***Galeus melastomus* (Rafinesque, 1810) as potential bioindicator in two different Mediterranean deep-sea environments**

Penna *et al.* **How to improve bathing and coastal water management from microbial contamination in the Mediterranean coasts**

Signa *et al.* **Does seasonality influence trace element accumulation in transplanted *Posidonia oceanica*? Ecological implications for the restoration of degraded coastal areas**

17.30-18.45 S1. Capitale naturale, servizi ecosistemici e contabilità ambientale Chairs: *Pier Paolo Franzese, Fausto Manes* **(AULA 9)**

Gaglio *et al.* **Towards assessment and mapping of ecosystem services in the river Po delta**

Nardella *et al.* **Assessment of PM10 removal in three Italian coastal Metropolitan Cities along a latitudinal gradient**

Russo *et al.* **Ecosystem Services by Bats in Urban Areas**

Canedoli *et al.* **A review of methods and indicators for the evaluation of mountain ecosystem services**

Rota *et al.* **Evaluation and mapping of Ecosystem Services in alpine protected areas: the cases of the Gran Paradiso National Park and Adamello Regional Park (Italy)**

19.00-22.00 Apericena ice breaking: Come combattere il marine litter nel Mediterraneo: esperienze progettuali nazionali ed internazionali (AULA COLONNE)

Il Mediterraneo rappresenta uno dei 25 "*hot spots*" di biodiversità a livello planetario. Questa enorme ricchezza biologica coesiste però con fortissime pressioni antropiche, una delle quali è rappresentata dal *marine litter*, che rende il Mediterraneo una delle aree più contaminate al mondo. Per questo sono necessari, su scala di bacino, sforzi congiunti sia dal punto di vista dell'armonizzazione delle tecniche di monitoraggio degli impatti sugli ecosistemi, che strategie di mitigazione e di *governance* a livello regionale. L'obiettivo di questo evento conviviale è quello di presentare alcune delle principali iniziative, coordinate dall'Università di Siena, su questa tematica, sia a livello nazionale che internazionale, come ad esempio i Progetti EU ENI-CBC, COMMON (https://www.enicbcmed.eu/projects/common) e Plastic Busters CAP (https://www.enicbcmed.eu/projects/plastic-busters-cap).

L'evento sarà aperto da una Keynote di Christos Ioakeimidis (United Nations Environment Programme – Barcelona Convention Secretariat (UNEP/MAP) dal titolo "Marine Litter Policy Advances in The Mediterranean".

Christos Ioakeimidis (UNEP/MAP)

"**Marine Litter Policy Advances In the Mediterranean**"

The updated Regional Plan on Marine Litter Management in the Mediterranean was adopted in December 2021 during COP22 (Antalya, Turkey, 7-10 December 2021). The Regional Plan includes new elements, including new definitions, updated scope of measures expanded under four key areas (economic instruments, circular economy principles, land-based and sea-based sources of marine litter) and amended targets for plastic waste and microplastics. Moreover, additional principles are included, such as phasing out single-use plastic items and promote reuse options; setting targets for plastic recycling and other waste items; introducing economic instruments such as environmental taxes, banning and design requirements; EPR (land and sea-based sources); promoting new technologies and measures for the removal of marine litter; supporting the application of prevention measures to achieve a circular economy for plastics; reducing packaging; promoting voluntary agreements with industry; taking measures to integrate the informal sector into regulated waste collection and recycling schemes; strengthening measures related to SCP programmes; phasing-out chemical additives used in plastic products; introducing concrete measures on microplastics reduction; implementing measures to prevent and reduce marine litter in MPAs; minimizing the amount of marine litter associated with fishing and aquaculture; establishing marine litter monitoring programmes as part of IMAP EO10; enhancing public awareness and education; and including measures in the SPAMIs to combat marine litter. The added value of the updated Regional Plan is pertinent to reflecting and addressing recent directions by UNEA resolutions including of UNEA 5.2, global conventions and regional initiatives, encompassing substantive elements and lessons learnt over the 2013 version of Regional Plan on Marine Litter Management in the Mediterranean, as well as mobilizing significant resources to enable its effective implementation including from the Mediterranean Trust Fund (MTF) and the European Union.

MERCOLEDI' 14 SETTEMBRE

9.00-9.30 Plenary lecture S6: Giampiero Sammuri "The management of alien species in the islands: action and results in Arcipelago Toscano national Park" (CRIPTA)

9.30-10.30 S4. Stress multipli sugli ecosistemi acquatici e terrestri: metodi diagnostici e meccanismi adattativi *Chairs: Antonio Di Guardo, Ilaria Caliani* **(CRIPTA)**

Ancora *et al.* **Mercury and cadmium in Greenland shark tissues: effects of feeding habit, depth distribution, sex, size, and age**

Limonta *et al.* **Establishing a set of molecular biomarkers for the determination of hospitalized *Caretta caretta* health conditions using skin biopsies**

Louis *et al.* **Thermal preconditioning upregulates heat shock protein 70 expression and maintains antioxidant enzymes activities in corals**

Montalbetti *et al.* **Manganese benefits heat-stressed corals at the cellular level**

Terzaghi *et al.* **Improving the ecological realism in bioaccumulation prediction of organic chemicals into plants: combining field data and modelling tools**

9.30-10.30 S6. Biodiversità e Rete Natura 2000 *Chairs: Salvatrice Vizzini, Letizia Marsili* **(AULA 9)**

Ambrosini *et al.* **Investigating avian migratory connectivity in the framework of the CMS/EURING/Movebank Eurasian-African bird migration atlas**

Franceschi *et al.* **A sampling strategy for assessing habitat coverage at broad spatial scale**

Lanzoni *et al.* **Which presence and status of the wolf (*Canis lupus italicus*) in the Po Delta territory?**

Marcelli *et al.* **"Reckoning without the host" The estimation of species richness in vegetation surveys**

10.30-11.00 Pausa caffè e sessione poster (tutte le sessioni)

Discussioni posters candidati al *premio Carlo Gaggi*

11.00-12.00 S4. Stress multipli sugli ecosistemi acquatici e terrestri: metodi diagnostici e meccanismi adattativi *Chairs: Antonio Finizio, Flora Angela Rutigliano* **(CRIPTA)**

Conti *et al.* **Chemistry-driven distribution in the Enchytraeidae explains their role as ecosystem engineers**
Mulder *et al.* **BEFANA: A Tool for Biodiversity-Ecosystem Functioning Assessment by Network Analysis**

Marzaioli *et al.* **Land cover/management affects soil microbial community and carbon dynamics in Mediterranean sites under desertification risk**

Picariello *et al.* **Microbial communities of forest soils contaminated by PAHs: a new quality index to evaluate their functional and structural stability**

11.00-12.00 S5. Focus Mediterraneo: biodiversità, impatti antropici e cambiamenti climatici *Chairs: Maria Cristina Fossi, Antonio Pusceddu* **(AULA COLONNE)**

Berlino *et al.* **Disentangling the effect of ocean acidification on Posidonia oceanica through functional traits: a hydrothermal vent case study**

Grossi *et al.* **Climate change effects on phenology of the spring phytoplankton bloom in the NW Mediterranean Sea**

Simonetti *et al.* **Mediterranean CO$_2$ vents as open-lab for broadcasting future organism's responses to ocean acidification scenarios: the case study of the cyanobacteria *Halomicronema metazoicum***

Vitale *et al.* **Quantitative evaluation of carbon and water fluxes in Mediterranean mixed forest undergoing climate change by simulating models at different spatial scales: the study case of Palo Laziale Wood (Rome, Italy).**

11.00-12.00 S6. Biodiversità e Rete Natura 2000 *Chairs: Elisa Anna Fano, Salvatrice Vizzini, Letizia Marsili* **(AULA 9)**

Appolloni *et al.* **Fish assemblages in two Marine Protected Areas along the Campania coast (central Tyrrhenian sea): the role of physiographic features of *Posidonia oceanica* beds.**

Gobbato *et al*. **Spatial Ecology of the association between demosponges and *Nemalecium lighti* at Bonaire, Dutch Caribbean.**

Maggioni *et al.* **Integration of molecular and morphological data to study symbiotic hydrozoans**

Sigovini *et al.* **The last stronghold of *Pinna nobilis*. An overview of the distribution and status of the critically endangered fan mussel in the Venice Lagoon and surrounding waters**

11.00-12.00 S3. Prospettive in ecologia del paesaggio *Chairs: Irene Petrosillo, Emilio Padoa-Schioppa* **(AULA 8)**

Doretto *et al.* **Disentangling the role of mesohabitat and geographical position on the spatial and temporal variation of macroinvertebrate communities at river network scale**

Innangi et al. **Dunes under attack: mapping iceplant invasion (*Carpobrotus sp. pl., Aizoaceae*) using UAVs in coastal environments**

Sarmati *et al.* **Natural and anthropogenic factors affecting plant diversity in Mediterranean coastal landscapes**

Simonelli *et al.* **Supporting the conservation and management of riverscapes: the case of the LIFE Brenta 2030 project**

12.00-13.30 TAVOLA ROTONDA "PLASTICA ED ECONOMIA CIRCOLARE" (CRIPTA) *Organizzatori: Andrea Binelli e Diego Rubolini (Università degli Studi di Milano), Maria Cristina Fossi (Università di Siena)*
Moderatore: Andrea Binelli

Alla tavola rotonda su "Plastiche ed economia circolare" interverranno come speakers:

il **Prof. Andres Cozar Cabañas** dell'Università di Cadice, uno dei massimi esperti internazionali sul tema del marine litter, che interverrà sulla tematica della distribuzione del marine litter a livello globale.

Il **Dr. Oliviero Montanaro** Direttore Generale della Direzione Generale patrimonio naturalistico e mare del Ministero della Transizione Ecologica, sulle tematiche relative alle misure di mitigazione del marine litter adottate dall'Italia nell'ambito della Marine Strategy Framework directive e sulla legge Salvamare.

La **Dr.ssa Tosca Ballerini** che presenterà la campagna A Buon Rendere (www.buonrendere.it), che mira all'introduzione in Italia di Sistemi di Deposito Cauzionale obbligatori (*DRs -Deposit Return Systems*) per i contenitori monouso di bevande, illustrandone i vantaggi ambientali ed economici.

13.30-14.30   Pranzo

14.30-15:00 Plenary lecture S4: Giulia Maisto "Methods of investigation for assessing the effects of environmental changes on ecosystems" (CRIPTA)

15.00-16.30 S4. Stress multipli sugli ecosistemi acquatici e terrestri: metodi diagnostici e meccanismi adattativi *Chairs: Antonio Di Guardo, Ilaria Caliani* **(CRIPTA)**

Cavallini *et al.* **Irrigation dams alter biogeochemical cycles in intermittent streams of Apennines**

Di Noi *et al.* **Evaluation of honey bee colonies ecotoxicological health status using a multi-tier approach, based on biomarkers, proteomic analysis and quality and origin of bees' products**

Nyqvist *et al.* **Filling knowledge gaps to safeguard river ecosystems from anthropogenic impacts: movement, behaviour and habitat use of Italian riffle dace (*Telestes muticellus*) and brook barbel (*Barbus caninus*) in a small mountain stream**

Campani *et al.* **Assessment of the health status of the Elsa River (Tuscany) through a holistic approach; from the bioindicators to the ecosystem as a whole.**

Giovanetti *et al.* **Application of a non-invasive approach integrating biochemical, cellular, behavioural and ecological endpoints to monitor avian species, Great tit and Common kestrel**

Sporta Caputi *et al.* **Diet variation of the dominant macroinvertebrates in the wetland ecosystem of Saline di Punta della Contessa under external pressures assessed by stable isotope analysis**

15.00-16.30 S6. Biodiversità e Rete Natura 2000 *Chairs: Elisa Anna Fano, Salvatrice Vizzini, Letizia Marsili* **(AULA 9)**

Angiolini *et al.* **The approach of the NATural Network Tuscany (NATNeT) project to Habitat monitoring: bad vs good news**

Carluccio *et al.* **In situ observation of biodiversity of deep-sea Vulnerable Marine Ecosystem for the designation of Natura 2000 sites along the Apulian coasts (central Mediterranean)**

Donati *et al.* **Application of spatial food web simulations at a marine Natura 2000 site: analysis of vulnerability and management actions**

La Porta *et al.* **LifeIMAGINE Umbria: Adaptive management actions for Coenagrion castellani conservation**

15.00-16.30 S3. Prospettive in ecologia del paesaggio *Chair: Laura Carranza* **(AULA 8)**

Bellino *et al.* **The Unravelled Voting Algorithm: a novel framework to investigate the spatial organization of ecological systems**

Biella *et al.* **Urban landscape and climate shape aspects of the pollination ecosystem service**

Petrosillo *et al.* **The effects of *Xylella fastidiosa* on the provision of landscape services**

Pioltelli *et al.* **Landscape anthropization drives the foraging of an urban bumblebee: A nutritional perspective**

Valente *et al.* **Land consumption vs landscape services' provision: some insights for landscape planning**

16.00 Chiusura delle votazioni per le elezioni per il rinnovo delle cariche di Vice presidente e del Consiglio Direttivo per gli anni 2023/24

16.30-17.00 Pausa caffè e sessione poster (tutte le sessioni)

Discussioni posters candidati al *premio Carlo Gaggi*

17.00-17.30 Plenary lecture S3: Ioannis Vogiatzakis "Linear infrastructure an insidious agent of biodiversity loss" (CRIPTA)

17.30-19.00 Assemblea dei soci, **(CRIPTA)**

20.30 Cena sociale presso Antica Trattoria Papei, Piazza del Mercato

GIOVEDI' 15 SETTEMBRE

9.00-9.30 Plenary lecture S2: Caterina Lorenzi e Stefania Pinna "L'ecologia che permea la società: dall'educazione ambientale alla formazione ecologica delle figure professionali" (CRIPTA)

9.30-10.30 S4. Stress multipli sugli ecosistemi acquatici e terrestri: metodi diagnostici e meccanismi adattativi *Chairs: Antonio Finizio, Edoardo Calizza* (CRIPTA)

Fattorini *et al.* **Global warming increases intraspecific competition through vegetation-mediated effects in a mountain-dwelling herbivore**

Gervasio *et al.* **Temperature dependence of denitrification in sediments of the Po River: an unexpected effect of climate warming on the self-purification capacity of nitrates loads**

Rindi *et al.* **Thermal legacies determines the stability of rocky intertidal biofilm to warming extremes**

Santini Gia. *et al.* **Do the urban heat island effect influences food choice in ants?**

9.30-10.30 S5. Focus Mediterraneo: biodiversità, impatti antropici e cambiamenti climatici *Chairs: Antonio Pusceddu, Antonella Penna* (AULA COLONNE)

Andolina *et al.* **Trophic niche features influence microplastic ingestion in Mediterranean fish species**

Baini *et al.* **From hydrozoa to whale: A cross-taxon across analysis to assess differences in the exposure to macro and micro marine litter**

Galli *et al.* **Mediterranean seabirds: are these poorly investigated species under the threat of marine litter ingestion?**

Giani *et al.* **Assessment of marine litter presence and impact on environment and biota in the Maremma (Italy) coastal area**

9.30-10.30 S6. Biodiversità e Rete Natura 2000 *Chairs: Salvatrice Vizzini, Letizia Marsili* (AULA 9)

Ceciarini *et al.* **Fishermen and sea turtle let's turn the light on under the sea**

Giovacchini *et al.* **The role of Threat Analysis and Threat Reduction Assessment in the effectiveness of a conservation project on two threatened birds in a mediterranean wetland.**

Muresan *et al.* **Different scale approaches for biodiversity and ecosystem services analysis provided by urban green**

9.30-10.30 S2. Didattica ed Educazione Ambientale *Chairs: Riccardo Santolini, Giuseppe Barbiero* (AULA 8)

9:30-9:40 Ricordo della prof.ssa Elisabetta Falchetti (1948-2022)

Drius *et al.* **Learning about ecosystem services by means of capacity matrices**

Giamberini *et al.* **A Virtual Museum of Ecosystems**

Pinna *et al.* **Ecopsychology: Nature can be a real influencer for teenagers**

Sangiorgio *et al.* **Young ambassadors of sustainability: environmental education as a tool for inclusion education.**

Stocco *et al.* **Outdoor Education: are we really ready?**

10.30-11.00 Pausa caffè e sessione poster (tutte le sessioni)

11.00-11.30 Plenary lecture S5: Roberto Danovaro "The contribution of ecology to the Ecological transition in the Mediterranean Sea" (CRIPTA)

11.30-13.00 S4. Stress multipli sugli ecosistemi acquatici e terrestri: metodi diagnostici e meccanismi adattativi *Chairs: Antonio Di Guardo, Edoardo Calizza, Ilaria Caliani* **(CRIPTA)**

Calizza *et al.* **Intraspecific niche partitioning in a key herbivore species (*Branta leucopsis*): implications for nutrient cycling and vegetation control in the high-Arctic tundra**

Soana *et al.* **Climate change effects on nitrogen loads of the Po River and eutrophication potential in the Adriatic Sea**

Della Torre *et al.* **Investigating the adaptive mechanisms to ocean acidification in different invertebrates from the CO_2 vent systems of Ischia (Italy)**

Pastorino *et al.* **Combined effect of temperature and chemical pollution on *Daphnia middendorffiana* (Crustacea, Daphniidae) from a high-mountain lake**

Bertolini *et al.* **Coupling habitat specific temperature forecasts with tolerance landscape for two species of commercial bivalves to predict the impacts of climate change**

11.30-13.00 S5. Focus Mediterraneo: biodiversità, impatti antropici e cambiamenti climatici *Chairs: Maria Cristina Fossi, Cristina Panti* **(AULA COLONNE)**

Bolinesi *et al.* **Aquaculture biomasses as structuring element of phytoplanktonic communities in a transitional water system. Management implication in the Sacca degli Scardovari deltaic lagoon in the frame of the ongoing climatic changes.**

Casabianca *et al.* **Plastic debris and marine phytoplankton assemblage structure and functioning: impacts and ecological implications in the Mediterranean Sea**

Menicagli *et al.* **Leachates from beached microplastics: A potential threat to coastal dune plants**

Rubolini *et al.* **The Mediterranean Sea: a hotspot of plastic exposure for seabirds of conservation interest**

11.30-13.00 S2. Didattica ed Educazione Ambientale *Chairs: Franca Sangiorgio, Giuseppe Barbiero* **(AULA 8)**

Barbato *et al.* **From citizen science to science education: the experiences of the Natural History Museum of Accademia dei Fisiocritici (MUSNAF) about teaching and learning biodiversity**

Barbiero *et al.* **BRACING BIOPHILIA. A comparative study on the effect of conventional vs biophilic learning environments on school performance.**

Ferretti *et al.* **Using storytelling in ecological education**

Padoa-Schioppa *et al.* **Ecology teaching in primary education theses: experiences at UNIMIB during COVID years**

Santolini *et al.* **The biophilya hypotesis: the affiliation with Nature since the primary school**

13.00-14.00   Pranzo

14.00-14.45   Discussione e Consegna premi, Chiusura del congresso (CRIPTA)

18:00- 20:00   Eventi sociali per la visita della città: Percorsi Urban trekking e Siena monumentale

SESSIONE 1
CAPITALE NATURALE, SERVIZI ECOSISTEMICI E CONTABILITÀ AMBIENTALE

La sessione "Capitale Naturale, Servizi Ecosistemici e Contabilità Ambientale", in linea con le attività dell'omonimo Gruppo di Lavoro nazionale della Società Italiana di Ecologia (SItE), accoglie contributi teorici, metodologici e casi di studio tesi a delineare lo stato dell'arte e le prospettive di sviluppo della ricerca ecologica in materia di "capitale naturale" e "servizi ecosistemici". Sono, inoltre, pertinenti contributi relativi all'utilizzo di tecniche di contabilità ambientale per la valutazione biofisica ed economica del capitale naturale e dei servizi ecosistemici e dei relativi benefici per l'uomo in un'ottica di sviluppo sostenibile.

Chairs:

Pier Paolo Franzese, Fausto Manes

INVITED SPEAKER

Aricò S.

UNESCO and International Science Council

Ecological science in action: An international and intergovernmental perspective

The session "Natural Capital, Ecosystem Services and Environmental Accounting" of the 0 Annual Congress of the Italian Society of Ecology, and the Congress as a whole, provide an opportunity to take a step back and look at the theme of the session through a historical lens: what is the origin of terms such as "natural capital" that we tend to give for granted nowadays but that were not existing until a few years ago? What is the scientific evidence underpinning their adoption by policymakers and how some of these concepts and terms, such as in the case of the term "ecosystem services", may have raised a sparkling debate involving multiple stakeholders beyond the scientific community? How the science of biodiversity and the environment impinge on major economic forces at work? What is the societal responsibility of the community of ecologists at large in this regard? This presentation will attempt to answer these and other similar questions from the experience of ecological theory in action, using examples of what has worked – or not – at the international and intergovernmental level while applying the findings of scientific research related to ecosystems and their services and benefits, in the broader context of the sustainable development agenda

SESSIONE 1
CAPITALE NATURALE, SERVIZI ECOSISTEMICI E CONTABILITÀ AMBIENTALE

COMUNICAZIONI ORALI

Distribution of natural capital and environmental flows values along the marine coastal habitats of Ligurian Sea (NW Italy)

BORDONI R. [1]*, PAOLI C [1,], DAPUETO G. [1,], RIGO I. [1,], VASSALLO P. [1]

1 Department of Earth, Environment and Life Science (DISTAV), University of Genoa, Corso Europa 6, 1613 Genoa, Italy

CONISMA, Consorzio Nazionale Interuniversitario per le Scienze del Mare, Piazzale Flaminio, 9, 00196 Rome, Italy

* e-mail: rachele.bordoni@edu.unige.it

The natural capital stocks characterizing coastal ecosystems provide resources essential for the natural system functioning, the human activities and well-being. The aim of this study is to assess and quantify the spatial distribution of the natural capital (NC) and environmental flows (EF) of the marine benthic habitats of Ligurian Sea. The study area was divided into 43 functional spatial sections defined "biomarine units". NC and EF values have been estimated for each of them following the procedure developed in previous studies for Marine Protected Areas (MPA), based on emergy analysis. It is a thermodynamic methodology that accounts the resources invested by nature to maintain a process. Specifically, in this study, the resources amount required to maintain the marine coastal habitats of Ligurian Sea was assessed. This assessment allows to quantify the NC and EF values in biophysical terms. Biophysical values are then translated in money units to facilitate stakeholders' understanding and open the way to the inclusion of marine resources value in socio-economic and political contexts. The total value of natural capital for study area is .11 billion em€, while for environmental flows is 1.43 billion em€. Greater intensive CN and EF values belong to biomarine units included within the boundaries of Marine Protected Areas, proving the efficiency of the protection measures taken. Over the past few years international authorities have increased their interest in including the assessment of natural capital for public and business decision making. In particular the European Commission acted over the last 30 years in order to put in place a legislative framework to protect and restore natural capital aiming at promoting an international natural capital accounting initiative. This work perfectly with this goal proposing a method useful to monitor the natural capital and environmental flows status that can be exported to any marine area.

A review of methods and indicators for the evaluation of mountain ecosystem services

Canedoli C.[1]*, Rora N.[1], Vogiatzakis I.[2], Padoa-Schioppa E.[1]

[1]*Dipartimento di Scienze dell'Ambiente e della Terra, Università Milano Bicocca*
[21] *Faculty of Pure and Applied Sciences, Open University of Cyprus*

* e-mail: claudia.canedoli@unimib.it

Evaluation of ecosystem services (ES) has become a fundamental subject in ecology and studies aiming to evaluate these services are multiplying worldwide. A copious variety of methods and indicators exists currently to compute ES evaluations, and this limits our capacity to produce comparable studies of ES. This study presents a literature review of the current indicators and methods used to evaluate ES, limited to mountain environments. The aim is to identify the most common indicators used. Specifically, we address the following questions: i) what are the indicators and methods currently used for the evaluation of ES; ii) which are the most common ES analyzed; iii) which type of assessment is most frequent among ecological, economic and social; iv) What are the characteristics of these assessments in terms of mapping, scale, geographic distribution, and capacity to provide solutions?; and v) Are the most common indicators also the best?. Using ISI Web of Knowledge we selected 360 papers from 015-00 and for each article we extracted relevant information. Results show that the most frequently ES evaluated are regulating and provisioning, less supporting, the study areas are mainly in Europe and Asia and mostly regional or local scale. There is high heterogeneity in indicators used for the same ES, and in nomenclature. As the most frequently used indicators do not imply necessarily that they are the most adequate, we finally analyze the suitability of the most common indicators in terms of significance, simplicity, cost, replicability, easy of interpretation and policy relevance using an expert-based survey. Results help in identifying which indicators are more useful. This study highlights the need to discuss 'a set of' indicators suitable for evaluation and monitoring.

Donor-side and user-side evaluation of the Atlantic blue crab invasion on a Mediterranean lagoon

Paoli C.[3]*, Bevilacqua S.[1,2], Cilenti L.[4], Lago N.[4], Scirocco T. [4], Vassallo P.[3], Rigo I.[3], Cannarozzi L.[1]

[1] Department of Life Sciences, University of Trieste, 3417 Trieste, Italy

[2] CoNiSMa, Piazzale Flaminio 9, 00196 Roma, Italy

[3] Department of Earth, Environment and Life Science (DISTAV), University of Genoa, Corso Europa 6, 1613 Genoa, Italy

[4] CNR-IRBIM, National Research Council - Institute of Marine Biological Resources and Biotechnologies, 71010 Lesina, Foggia, Italy

* e-mail: chiara.paoli@unige.it

The blue crab *Callinectes sapidus* (Rathbun, 1896) is native to the western coasts of the Atlantic Ocean. First reported in the Mediterranean Sea in the 50's, nowadays it is distributed in most coastal areas of the basin. In native habitats, *C. sapidus* has long been recognized to influence the structure and functioning of benthic food webs. On the contrary, limited information are available on the specie ecological impact. The recent invasion of *C. sapidus* in the Lesina Lagoon, located in the Gargano National Park (south-east Italy), raises great concern about its potential impacts on the ecosystem and on local fishing. In this context, the effects of the blue crab presence on the receiving ecosystem were evaluated from both a donor-side and a user-side perspectives. The collection of data related to the habitat in which the crab grows and the macrozoobenthic communities associated allowed to analyse possible influences of *C. sapidus* presence on ecosystem. In this regard, emergy analysis was applied to assess the natural capital and the environmental flows values inside system, considering all the resources, space and time necessary for its production and maintenance in the presence and absence of the crab. In addition, impacts on several economic activities and its socio-economic consequences were also analyzed. The indirect loss on the local economy caused by the presence of the blue crab was evaluated by means of interviews to fishermen. As the first quantitative assessment of the ecological and economic impact of *C. sapidus*, this research provided innovative and useful information for an overall risk assessment of the species in European waters.

Assessing natural capital and ecosystem services of *Posidonia oceanica* meadows: The SEEA-EA framework

Capasso L. [1]*, Buonocore E. [1], Franzese P.P.[1], Russo G.F.[1]

[1]*International PhD Programme/UNESCO Chair "Environment, Resources and Sustainable Development", Department of Science and Technology, Parthenope University of Naples, via F. Petrarca 80, (8013), Naples, Italy.*

* e-mail: ludovica.capasso001@studenti.uniparthenope.it

Humans are currently facing several challenging environmental problems. Ecosystem degradation and the loss of biodiversity undermine the resilience of natural ecosystems and their functioning, thus threatening natural capital stocks and their ability to supply flows of goods and services for present and future generations. The current and future climate change scenarios call for significantly reducing greenhouse gases emissions while boosting effective strategies to mitigate climate change through the intrinsic capacity of natural ecosystems of sequestering and storing carbon. In this context, marine ecosystems play a major role in maintaining global biodiversity while providing several ecosystem services vital for human well-being, among which carbon sequestration and stocking. In particular, *Posidonia oceanica* meadows, an endemic seagrass of the Mediterranean Sea, rank among the most productive ecosystems in the world, contributing to the sequestration and storage of significant amounts of carbon known as "coastal blue carbon". The important role played by marine ecosystems in climate regulation has led to several initiatives aimed at defining standardized protocols for assessing the biophysical and economic value of natural capital stocks and ecosystem services flows. In 01, the United Nations Statistical Commission adopted the System of Environmental Economic Accounting–Ecosystem Accounting (SEEA-EA) framework as a standard for organizing data about habitats and landscapes, measuring the ecosystem services, tracking changes in ecosystem assets, and linking this information to economic and other human activity. In this study, we propose the implementation of the SEEA-EA framework for assessing natural capital and ecosystem services of *Posidonia oceanica* meadows. We shed light on the important role played by *Posidonia oceanica* in generating ecosystem services, with particular reference to its role in mitigating climate change towards the achievement of carbon neutrality, in compliance with the EU strategy "Going climate-neutral by 050".

The importance of dead seagrass (*Posidonia oceanica*) matte
as a biogeochemical sink

Caviglia L.[1]*, Apostolaki E.T.[2], Santinelli V.[1], Cundy A.B.[3], Tramati C.D.[1,4], Mazzola A.[1,4], Vizzini S.[1,4]

[1]*Department of Earth and Marine Sciences, University of Palermo, Palermo, Italy*

Institute of Oceanography, Hellenic Centre for Marine Research, Heraklion, Greece

[3]*School of Ocean and Earth Science, National Oceanography Centre (Southampton), University of Southampton, Southampton, United Kingdom*

[4]*Consorzio Nazionale Interuniversitario per le Scienze del Mare, Rome, Italy*

* e-mail: laura.cavilgia@you.unipa.it

Seagrass meadows are important Blue Carbon ecosystems, capable of storing large amounts of organic carbon in their soils, preserving it even for millennia, contributing to global carbon sequestration and thus representing an ally in climate change mitigation strategies. These ecosystems have shown another important ecological service: they act as pollutant filters and sinks. Furthermore, following dating of their stratified sediment, seagrass soils can provide a reliable and long-term record of the past environmental history of coastal marine systems, and retain a sedimentary archive of anthropogenic pressure over time. *Posidonia oceanica* (L.) Delile is an important endemic species in the Mediterranean Sea, forming biogenic reefs known as "mattes" where large quantities of nutrients are stored. In the case of regression and death of *Posidonia* meadows, mattes however are susceptible to erosion and may release carbon and stored pollutants. In our study we inferred the potential of dead *P. oceanica* matte to act as a biogeochemical sink and to represent an archive of anthropogenic pressure over time in a degraded coastal basin in eastern Sicily (Augusta Bay) that hosts the most important chloro-alkali plant in Italy. High accumulation of mercury (Hg) in seawater has been reported and *P. oceanica* meadows completely disappeared in the late 1970s. We reconstructed the historical trends in concentration and accumulation of C, N and Hg in sediments beneath dead *P. oceanica* matte, sediments beneath an adjacent living *P. oceanica* meadow and in unvegetated sediments. Our results suggest that dead *P. oceanica* mattes act as biogeochemical sinks and may be used as archives to identify environmental shifts in areas with unknown environmental history, reinforcing the paramount importance of *P. oceanica* mattes, even after their death.

Towards assessment and mapping of ecosystem services in the river Po delta

Gaglio M. [1]*, Lanzoni M.[1], Vincenzi F.[1], Fano E.A.[2], Castaldelli G.[1]

[1]Dipartimento di Scienze dell'Ambiente e della Prevenzione, Università di Ferrara, Via L. Borsari, 46, 4411 Ferrara, Italia

[2]Dipartimento di Scienze della Vita e Biotecnologie, Università di Ferrara, Via L. Borsari, 46, 4411 Ferrara, Italia

* e-mail: gglmts@unife.it

River deltas have an extraordinary ecological value for both biodiversity conservation and human well-being through the provision of a wide range of ecosystem services (ES). Their assessment includes their quantification in biophysical and monetary terms, as well as the description of their spatial distribution, and is fundamental to inform environmental managers. The study presents the ongoing assessment of ES provided by River Po delta (Northern Italy), one of the most important transitional areas in Europe, where local population has a long tradition of natural resources exploitation both in wetlands and in the reclaimed agricultural land. In the delta portion comprised in the Emilia-Romagna Region, the main ES provided by each ecosystem type were identified according their peculiar ecological structures and functions. Biophysical quantification was carried out using experimental results, questionnaires and collecting available data. Monetary evaluation was performed market and other surrogates values. Finally, the spatial distribution of such values was used to produce ES maps. The results highlight that the ecosystems of the river Po delta provide highly valuable services and goods and that wetlands types contribute differently according to their characteristics and ecological functioning. While agricultural land is intensively exploited to maximize one service (i.e. food production), the extensive uses of the differ wetland types ensure a diverse set of ES, which concur to the reach of sustainable goals. Finally, existing and feasible payment for ecosystem services schemes are analyzed. Overall, the study can significantly inform environmental managers on the importance of ES and possible solutions for sustainable development in the Po delta.

Assessment of PM$_{10}$ removal in three Italian coastal Metropolitan Cities along a latitudinal gradient

Nardella L. [1]*, Stafoggia M.[2], Buonocore E.[1], Franzese P. P.[1], Manes F.[3]

[1]*International PhD Programme / UNESCO Chair "Environment, Resources and Sustainable Development", Department of Science and Technology, Parthenope University of Naples, Via F. Petrarca 80, (8013) Naples, Italy.*
[2]*Department of Epidemiology, Lazio Regional Health Service/ASL Roma 1, Via C. Colombo 11, 00147 Rome, Italy.*
[3]*Department of Environmental Biology, Sapienza University of Rome, 00185, Rome, Italy.*

* lorenza.nardella001@studenti.uniparthenope.it

Air pollution is regarded as the largest environmental risk in Europe, and Particulates specifically are among the most harmful pollutants. Among the several Ecosystem Services they provide, Urban Green Infrastructures, and woody vegetation in particular, are capable of capturing and adsorbing pollutants by means of removal mechanisms. As envisaged in the National Plan for Recovery and Resilience, in which the EU's environmental agenda and the post-covid-19 roadmap converged, Italy is planning on investing part of the Next Generation EU funds in urban reforestation programs which will target Italian Metropolitan Cities. Successful implementation of such plans is underpinned by a thorough knowledge of the presence and distribution of existing vegetation and its capacity to deliver Ecosystem Services providing multiple benefits to the complexity of environmental and socio-economic challenges facing humanity. In the present study, we selected three Italian coastal Metropolitan Cities along a latitudinal gradient, namely Genoa, Bari, and Reggio Calabria, and assessed PM$_{10}$ removal by urban and peri-urban forests in both biophysical and monetary terms. In 019, the total removal for Genoa, Bari and Reggio Calabria amounted to 5331, 363, and 448 Mg respectively, for a corresponding monetary value of 536, 39, and 435 million euros. Our elaborations were conducted on a seasonal basis, and further aimed at investigating the role of functional diversity in Ecosystem Service provision, which was done by classifying the vegetation into three Functional Groups. According to our findings, in all three Metropolitan Cities the highest annual average PM$_{10}$ removal efficiencies were exhibited by evergreen broadleaves, which in the summer in Reggio Calabria also displayed the overall highest average seasonal efficiency (36.49 kg/ha). Contrarily, the lowest average seasonal removal efficiency was obtained for the deciduous broadleaves in Bari in the fall season. In conclusion, our results provide useful insights to support the planning of Urban Green.

A dynamic model for the assessment of environmental carrying capacity overcoming due to tourist flows: the San Fruttuoso bay case study

Rigo I.[1]*, Vassallo P. [1], Bordoni R.[1], Cappanera V.[3], Dapueto G. [1], Merotto L. [3], Povero P. [1], Venturini S. [3], Paoli C.[1]

[1] Department of Earth, Environment and Life Science (DISTAV), University of Genoa,
Corso Europa 6, 1613 Genoa, Italy
CONISMA, Consorzio Nazionale Interuniversitario per le Scienze del Mare,
Piazzale Flaminio 9, 00196 Rome, Italy
[3] Portofino Marine Protected Area,
Viale Rainusso 1, 16038 Santa Margherita Ligure (Genoa), Italy

* e-mail: ilaria.rigo@edu.unige.it

Sustainable tourism requires environmental quality and integrity to be maintained through management strategies. In Marine Protected Areas (MPAs) unmanaged tourism represents one among the major threats for natural environment. In order to avoid dangers, it is then necessary to know tourism flows in order to handle pressures and impacts on both economy and environment. For these reasons, this research aims at proposing a model for tourism flows monitoring and prediction in order to allow managers to be rapidly warned when ecosystem limits are exceeded. The model has been tested in San Fruttuoso bay, Liguria, NW Italy, located in Portofino MPA. Data about arrivals, departures and presences in San Fruttuoso bay were collected during 017 and 018 tourist seasons through direct monitoring. Later arrivals, departures and presences in the bay were analyzed by means of Random forest (RF) regression, considering set of explanatory variables. The impact exerted on the environment by tourists' flows (consumption) as well as the resources availability of the bay were assessed using Emergy: an environmental accounting biophysical procedure. Finally, a balance on a daily basis between tourists' resources consumption and bay resources availability was realized in order to check if and when the bay carrying capacity is overtaken. Main results obtained were: 1) a forecasting tourists' flows system) the evaluation of the impacts exerted by a tourist presence on an hourly and daily basis 3) a forecasting tool for regulating access to the bay also intended to avoid the carrying capacity overcoming.

Evaluation and mapping of Ecosystem Services in alpine protected areas: the cases of the Gran Paradiso National Park and Adamello Regional Park (Italy)

Rota N. [1]*, Canedoli C.[1], Comolli R.[1], Ferrè C.[1], Abu El Khair D.[1], Padoa-Schioppa E.[1]

[1]Dipartimento di Scienze dell'Ambiente e della Terra, Università di Milano Bicocca, Piazza della Scienza, 1, 016 Milano, Italy

* e-mail: n.rota4@campus.unimib.it

Alpine areas play an important role in the provision of many ecosystem services (ES), most of which are still poorly evaluated. The interest in ES as a tool for the management of protected areas is growing, including these in policies and management strategies. In this study, we aimed to evaluate the provision of the climate regulation ES and biodiversity in alpine protected areas. The study took place in an Italian alpine area, we investigated 151 plots at the Gran Paradiso National Park (PNGP), and 94 plots at the Adamello Regional Park (AD). We focused on the Organic Carbon (OC) Stock of the most representative habitats of the Parks, and vegetation biodiversity and structure. OC stock was evaluated in three pools: soil, litter, and tree above-ground biomass. Then, we correlated OC stock values, the environmental features of the study areas, biodiversity, and tree vegetation structure. The results showed that habitat type affected the OC stock values in both areas. The PNGP resulted in a mean value of OC stock of 131,4 t ha^{-1}, storing the majority of OC in soils of grasslands and mixed broadleaf forests, the highest stock considering the three pools compounded was *Abies alba* forests (158,0 t ha^{-1}). Biodiversity was mostly influenced by altitude, OC stock in litter, and coniferous forests. Results of the AD are still preliminary, the mean value of OC stock is 157,8 t ha^{-1}, and the highest OC stock is stored in mixed coniferous forests (04,3 t ha^{-1}). Biodiversity resulted to be affected by altitude, OC stock in organic layers, and stoniness of the area. Maps of the OC stock were created for both Parks using the Software QGis. From the results, interesting correlations emerged, further aspects must be investigated for cause-effect relationships and the creation of models for other estimations of ES provisioning.

Ecosystem Services by Bats in Urban Areas

Russo D.[1]*, Coleman J.L., Ancillotto L.[1], Korine C.[3]

[1]Wildlife Research Unit, Dipartimento di Agraria, Università degli Studi di Napoli Federico II, via Università, 100, 80055, Portici (Italy)

Department of Biology, Queens College at the City University of New York, 6530 Kissena Blvd, Flushing, NY 11367

[3] Mitrani Department of Desert Ecology, Jacob Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev, 84990 Midreshet Ben-Gurion, Israel

*e-mail: danrusso@unina.it

Preserving biodiversity and the ecosystem services (ES) it provides is vital to sustainability. With over half of all people living in urban areas, urban ES play an especially important role. Bats are the most speciose mammalian group in many cities and may provide a variety of important ES. We explore the available literature and provide unpublished information on bats' urban ES, covering insectivory, pollination, seed dispersal, and bat-related tourism. We find that although research interest in bat-mediated ES has grown considerably, ES by urban bats have been relatively neglected. Twenty-two studies on various continents that used molecular identification of prey remains in bat droppings revealed substantial consumption of urban pests, including "nuisance" insects, such as drain flies and mosquitos, and species that bite or induce allergic reactions. Bats also consume mosquitos that are vectors of the West Nile virus and malaria, phlebotomine sandflies that transmit leishmaniasis, as well as insects that damage stored products. Ecosystem services rendered by phytophagous bats (pollination and seed dispersal) in urban areas are poorly known, but potentially important. However, urbanisation might hinder the movement of bats and thus limit the provision of such ES. The few studies available fail to prove that phytophagous bats in urban areas mediate plant recruitment, yet there is some anecdotal evidence that they do. Urban bats also provide cultural ES, such as bat-related tourism, which in some cases generate considerable revenue. We highlight a significant gap in research on urban ES by bats that must be filled given its expected importance. We call for studies to document and quantify such ES, especially studies that adopt rigorous methods, such as DNA metabarcoding in faecal analysis, exclosure experiments to study insect suppression, or bat-mediated pollination, and provide evidence that demonstrates the role of bats in increasing fruit set and /or plant recruitment.

Sustainable bivalves farming is a permanent carbon sink against climate change

Tamburini E.[1]*, Turolla E.[2], Lanzoni M.[1], Summa D.[1], Fano E.A.[3], Castaldelli G.[1]

[1]Department of Environmental and Prevention Sciences, University of Ferrara, via. L. Borsari 46, 4411, Ferrara, Italy

Istituto Delta Ecologia Applicata, Via B.Bartok 9B, 4414 Ferrara, Italy

[3] Department of Life Sciences and Biotechnology, University of Ferrara, via. L. Borsari 46, 4411, Ferrara, Italy

* e-mail: elena.tamburini@unife.it

Aquaculture is a globally expanding industry that contributes to feeding an increasing global population. Bivalves farming is one of the largest sector of aquaculture and one of the few food productions that have the potential capacity of acting as carbon sink. In fact, more than 90% of bivalve shells are $CaCO_3$, formed during biocalcification process, which incorporates a molecule of CO. Manila clam (*Venerupis philippinarum*, Adams&Reeves, 1850) and Mediterranean mussel (*Mytilus galloprovincialis*, Lamarck, 1819) are two of the major groups of cultivated bivalves. Our aim was to assess the potential role of those two bivalve species in the overall marine carbon balance using an ecosystem approach, and to evaluate if they can act definitely as carbon sink. As case studies we chose the Sacca di Goro lagoon, in the Po River (northern Italy) delta, the premier site in Europe for clam farming, and the adjacent coastline of the Adriatic Sea as one of the most important European sites for mussel farming. The contribution to CO emissions (as CO eq./kg of fresh products) due to mollusk farming has been also calculated by means of Life Cycle Assessment (LCA). LCA is nowadays the most shared and accepted tool for evaluating the environmental impacts of aquaculture productions. The carbon sequestration capacity during biocalcification process has been also calculated. Our study shows that for each kilogram of harvested and packaged clams and mussels, shell formation throughout the mollusk growth allows to permanently capture 54 and 146 g of CO, in the face of and 55 g CO eq. emitted for farming, respectively. Thus, clams and mussels aquaculture could be considered as a carbon sink, with a net carbon capture capacity of 33 and 91 g CO/kg of fresh product, respectively. Bivalve aquaculture could be included in the carbon trading system and played a role towards the carbon-neutral economy.

SESSIONE 1
CAPITALE NATURALE, SERVIZI ECOSISTEMICI E CONTABILITÀ AMBIENTALE

POSTERS

S1.P1 EST: an exploratory model for Ecosystem Services in the Venice lagoon

Brigolin D.[1]*, Moda F.[2], Rova S.[2], Stocco A.[2], Pranovi F.[2]

[1]Dipartimento di Culture del progetto, Università IUAV, Santa Croce, 191, 30135 Venezia

Dip.to di Scienze Ambientali, Informatica e Statistica, Università Ca' Foscari, Venezia, via Torino, 155, 30174 Mestre

* e-mail:dbrigolin@iuav.it

The Venice lagoon is a complex socio-ecological system, where Ecosystem Services (ES) and benefits for people result as emergent properties from the interactions between ecological processes and human activities. Such a complex system is threatened by several drivers of change, including those connected to resource exploitation and ecosystem fruition, along with climate related drivers. EST (Ecosystem Services Screening Tool) is an exploratory numerical model based on dynamic system theory, aimed at investigating the interactions among the different ES, the lagoon resources and the social dynamics, and compare possible scenarios of evolution of the whole socio-ecological system. The conceptual model was inspired by the "Social-ecological systems framework" and considers 13 Ecosystem Services, along with the biophysical component, represented by specific macrohabitats characterizing the lagoon seascape and key faunal groups, and the main groups of actors involved in services fruition. Increase in water temperature and relative sea level rise were provided as external forcings in the model, which also attempted to account for the feedbacks on services produced by the regulation of lagoon high tides through the closure of mobile gates. EST was implemented in Simile v. 6.1 software environment, as an attempt to improve its applicability for participatory modelling applications. Model development and parameterization is presented, and contrasting tendency scenarios are preliminarily explored, considering a 50 year time horizon. Scenarios included both changes in climate-related forcings and in governance choices aimed at preserving the biophysical component, ensuring ES sustainability.

S1.P2 Ecological Economics and theory of value

Corsi G. [1]*, Guarino R.[1], Sapio A.[2], Lepore L.[3], Franzese P.P.[1]

[1]*International PhD Programme / UNESCO Chair "Environment, Resources and Sustainable Development", Department of Science and Technology, Parthenope University of Naples, Italy.*

[2]*Department of Business and Economics, Parthenope University of Naples, Italy.*

[3]*Department of Law, Parthenope University of Naples, Italy.*

*e-mail: giulio.corsi001@studenti.uniparthenope.it

The achievement of Sustainable Development Goals (integrating environmental, economic, and social aspects) requires a paradigm shift moving from a reductionist approach based on an analytical method and mono dimensional metrics to a holistic approach rooted on a deeper understanding of the relationships linking ecological systems and human economy. In this regard, Ecological Economics (starting its development in the 1980s) has gained popularity as a modern economic theory that provides an interdisciplinary and integrated perspective, considering human economy like a sub-system embedded in a larger ecological system while acknowledging the importance of natural capital as a third factor of the production function (together with man-made capital and human labor). This integrated view of the relationships interlinking humans and nature has contributed to move from a weak to a strong sustainability. However, Ecological Economics is still a heterogeneous field of science including different approaches: from those rooted in the Neo-Classical Economics to more radical ones such as the Social Ecological Economics accounting for both the biophysical and sociological/political bases of economic activity. An important question in this domain of science is how to assign a value to natural resources stocked within ecosystems (i.e., natural capital) and the benefits they provide to humans (i.e., ecosystem services), overcoming the full reliance on individual preferences not always applicable to resources, products and services missing a market value. From an epistemological point of view, Ecological Economics can be regarded as an inter-disciplinary (for some authors even trans-disciplinary) set of tools for the integrated assessment of local and global environmental issues. This paper will explore the global scientific literature in the field of Ecological Economics while summarizing the main features of the theory of value in Economics and Ecology.

S1.P3 Accounting for environmental costs and impacts of conventional and organic apple production: The case study of the Trento Province (Northern Italy)

El Alam R.[1]*, Buonocore E.[1], Paletto A.[2], Franzese P.P.[1]

[1] International PhD Programme / UNESCO Chair "Environment, Resources and Sustainable Development", Department of Science and Technology, Parthenope University of Naples, Italy.
Council for Agricultural Research and Economics – Research Centre for Forestry and Wood (CREA), Trento, Italy.

* e-mail: Razane.elalam001@studenti.uniparthenope.it

The agricultural sector is vital for human well-being and economic development. On the other hand, food production entails significant environmental costs and impacts due to natural resources use and greenhouse gas (GHG) emissions. Therefore, the sustainability of cropping systems is becoming an urgent need. Organic agriculture is proposed as a promising approach to reduce the impact of agriculture by lowering the use of pesticides and other chemicals harmful to the environment and to human health. Italy is among the European countries with the largest organic agricultural area, but further improvements are needed to achieve the requirements of the European Green Deal. In this study, Life Cycle Assessment (LCA) was applied to evaluate the environmental performance and sustainability of conventional and organic apple production in the Trento Province (Northern Italy). The results of this comparative study show that, despite a lower productivity, preferring organic apple production could reduce the contribution to most of the impact categories, with significant benefits on both ecosystem and human health. For instance, climate change resulted 5600.15 kg $CO_{eq.}$ per hectare of conventional production and 1989.13 kg $CO_{eq.}$ per hectare of organic production, while human toxicity resulted in 005.9 kg 1,4-$DCB_{eq.}$ per hectare of conventional production and 67% lower (656.45 kg 1,4-$DCB_{eq.}$) in the case of organic production. A similar reduction is observed in most of the evaluated impact categories except for the terrestrial acidification due to emissions resulting from manure application. Furthermore, a detailed analysis shows that a significant share in the overall environmental impacts is due to agricultural machinery and related diesel consumption for field activities, in addition to fertilizers and pesticides used especially in the conventional production. In conclusion, this study proved that organic farming has the potential of significantly reduce the environmental impacts of apple production, preserving human health, the environment, and biodiversity.

S1.P4 Pit lakes from gravel and sand quarrying in the Po River basin: extent, status and ecosystem services potential

Ghirardi N.[1]*, Bresciani M.[2], Pinardi M.[2], Nizzoli D.[1], Viaroli P.[1]

[1]Dipartimento di Scienze Chimiche, della Vita e della Sostenibilità Ambientale, Università di Parma, Parco Area delle Scienze, 33/A, 4314 Parma, Italia.
CNR – Istituto per il Rilevamento Elettromagnetico dell'Ambiente, via A. Corti, 1, 0133 Milano, Italia.

* e-mail: nicola.ghirardi@unipr.it

During the last half century, intense extractive activity led to the formation of many pit lakes that have changed the river basin morphology. The quarrying activity determines the formation of depressions that modify the hydrographic network. In general, these artificial ecosystems can have both positive and negative impacts on the territory, depending on morphology and morphometry, location and anthropogenic pressures in the watershed. In the last decade, a renewed interest has been growing on pit lakes as tools for restoring rivers and their floodplains, in order to exploit their ecological functions, such as freshwater storage, compared to pristine riverine wetlands and small lakes which were lost due to anthropogenic pressures. In this regard, the primary aim of this study is to quantify, within the Po River basin, the number, distribution, and major morphometric characteristics of these ecosystems and the evolution of land use around them, in order to assess their relevance and suitability for ecological restoration purposes and to identify possible solutions to drought and water supply. To achieve this aim, a synergistic approach was used between regional databases, satellite archives, and remote sensing techniques. Comparison of satellite data with regional databases shows that there are more than 1,500 artificial water bodies in the Po River basin, most of which are agricultural ponds. It also emerges how pit lakes (159) are significantly more than natural wetlands (05) and their total area is 6361.03 ha compared to only 614.74 ha for natural wetlands (e.g., river oxbows). These data will help identify their ecological features, for managing and restoring these artificial environments to maximize the ecosystem services previously provided by natural aquatic environments (e.g., freshwater storage, nitrate regulation, habitat for many species, etc.).

S1.P5 Natural capital value and ecological complexity of lake ecosystems: The case study of the UNESCO-MAB Tuchola Forest Biosphere Reserve (Poland)

Grande U.[1,2]*, Buonocore E.[1,2] , Piernik A.[1], Franzese P.P.[1,2]

[1] Department of Geobotany and Landscape Planning, Nicolaus Copernicus University, 87-100 Toruń, Poland
[2] International PhD Programme / UNESCO Chair "Environment, Resources and Sustainable Development", Department of Science and Technology, Parthenope University of Naples, Italy.

*e-mail: umbertogrande@doktorant.umk.pl

Healthy ecosystems are capable of maintaining their structures and functions, ensuring the generation and maintenance of natural capital stocks delivering ecosystem services flows vital for human well-being. The development of ecosystems can be investigated by using different Ecological Goal Functions. Among them, emergy and eco-exergy can be used to unfold the role of matter and energy flow exchanges in the functioning of ecological systems. Emergy (developed by H.T. Odum) measures the cumulative environmental support to a system in terms of direct and indirect solar energy flows. Eco-exergy (developed by S.E. Jørgensen) accounts for the chemical energy stored in organic matter and the genetic information embodied in the biomass stocks of living organisms, providing a measure of the organizational level of an ecosystem. In particular, eco-exergy accounts for the available energy of all living biotic components in an ecosystem, compared to the non-living state (i.e., the detritus). In this paper, three forest lakes (Czarne, Zmarle, and Laska) located in the Tuchola Forest UNESCO-MAB Biosphere Reserve (Northern Poland) were investigated using the emergy and eco-exergy methods. The biomass of autotrophic (e.g., algae and macrophytes) and heterotrophic (e.g., zooplancton, zoobenthos, fishes and aquatic birds) organisms was evaluated to assess the eco-exergy value of the investigated lakes. Finally, the Eco-exergy / Emergy ratio was calculated to assess the efficiency of the three lake ecosystems. Results suggest that emergy accounts for the work of nature invested to generate natural capital stocks, while eco-exergy is capable of characterizing the development stage of lake ecosystems reflecting their trophic and health state. The indicators and indices calculated in this study, together with other biotic, network, and thermodynamic goal functions, can support local managers and policy makers committed to ensure nature conservation and the sustainable management of lake ecosystems.

S1.P6 Exploring the issue of food waste and loss through multicriteria environmental accounting

Mokrane S.[1]*, Buonocore E.[1], Capone R.[1], Franzese P.P.[1]

[1] UNESCO Chair "Environment, Resources and Sustainable Development", Department of Science and Technology, Parthenope University of Naples, Centro Direzionale, Isola C4, 80143 Naples, Italy.
International Center for Advanced Mediterranean Agronomic Studies (CIHEAM), Mediterranean Agronomic Institute of Bari, Italy.

* e-mail: selma.mokrane001@studenti.uniparthenope.it

The exponential growth of the global human population is driving the intensification of food production systems to cope with a growing food demand. This requires more and more natural capital (e.g., fertile soil and water) to be invested in the food production while increasing emissions due to the high chemical inputs used in conventional agricultural processes. The result is that the "foodprint" of human societies is reaching unsustainable thresholds. In contrast, paradoxically, Food Waste and Loss (FWL) is becoming a global issue since one third of all the food produced worldwide for human consumption is wasted every year, exposing vulnerable populations to more poverty, health problems, rising conflicts, and food insecurity. FWL occurs across the food supply chain from primary production, processing, retail, till food service and household consumption stages. FWL is a multidimensional issue, owing to its numerous environmental and socio-economic implications. In addition, FWL exacerbates the food security issue posing major questions on the sustainability of modern lifestyles. Indeed, in 0, 811 million people are still undernourished with serious health, social, and ethical implications. In this study, we explore the global scientific literature on FWL focusing on an environmental accounting perspective. In particular, the study highlights the main research trends connected to food security and FWL, and proposes the calculation of the environmental footprints of food production at individual and national level for selected countries characterized by different socio-economic features and food culture.

S1.P7 Integrating Urban Metabolism and Life Cycle Assessment to explore the sustainability of cities

Moscatelli A.[1,2]*, Buonocore E.[1], Fullana-i-Palmer P.[2], Franzese P.P.[1]

[1] UNESCO Chair on "Environment, Resources and Sustainable Development", Department of Science and Technology, Parthenope University of Naples, Via F. Petrarca, 80, 8013 Naples, Italy.

[2] UNESCO Chair in "Life Cycle and Climate Change", ESCI-UPF, Universitat Pompeu Fabra, Pg. Pujades, 1, 08003 Barcelona, Spain.

* e-mail: alessandra.moscatelli@studenti.uniparthenope.it

Finding new solutions and strategies to enhance the sustainable management of urban ecosystems is among the most critical challenges of the 1st century. Currently, cities consume about 70% of the global energy and it is expected that in 030 about 60% of the global population will live in city areas accounting for only about % of the Earth's surface. At the European level, there is a higher concentration of population in medium and small cities compared to mega-cities, with about 80% of the European population living in cities with less than 50,000 inhabitants. The European Commission has supported the sustainable development of urban systems through the EU Green Deal, with the purpose of transforming the EU into a competitive and resource-efficient economy achieving carbon neutrality by 050. In this context, it is essential to quantify local and global environmental impacts and express them by indicators of pressure on the environment and human health. The aim of this research was to implement a multi-criteria and multi-scale framework for assessing the environmental performance and sustainability of cities, integrating Urban Metabolism (UM) and Life Cycle Assessment (LCA) methodologies, and using the municipality of Piaggine (Southern Italy) as a pilot case study.

A multicriteria set of indicators for assessing the sustainability of cities was calculated by investigating multiple variables (energy, transport, water, construction materials, food, and waste) in the UM and quantifying the environmental impacts through LCA. This type of integrated UM–LCA analysis provides a solid scientific base for assessing the environmental footprints of cities while supporting policy makers in charge of ensuring sustainable development and human well-being.

S1.P8 Fossil fuels dependence and climate change: an environmental accounting perspective

PICONE G.[1]*, BUONOCORE E.[1], FRANZESE P.P.[1]

[1] International PhD Programme / UNESCO Chair "Environment, Resources and Sustainable Development", Department of Science and Technology, Parthenope University of Naples, Italy.

*e-mail: gianfranco.picone001@studenti.uniparthenope.it

In the past two centuries, fossil energy storages accumulated over millions of years have been exploited at an increasing rate to support human economy. Fossil fuels were formed over millions of years from the burial of photosynthetic organisms, including plants on land (mainly generating coal) and plankton in the oceans (mainly generating oil and natural gas). To grow these organisms carbon dioxide was removed from the atmosphere and the ocean, and their burial inhibited the movement of that carbon through the carbon cycle. Burning fossil fuels returns CO back into the atmosphere at a rate that is hundreds to thousands of times faster than it took to be buried, and much faster than it can be removed by the carbon cycle. This affects the Earth system in a variety of ways and represents the primary cause of the current climate change due to the massive emission of greenhouse gases altering the Earth's dynamics at a global scale. Nearly two-thirds of carbon dioxide emissions, along with a significant amount of nitrous oxide and methane, derive from the burning of fossil fuels such as oil, natural gas, and coal. This scenario has a strong impact on both human and ecosystem health. For this reason, a global political commitment is needed to build up a safe and just space for humanity. If emissions are to be reduced while economies still continue to grow, then more clean and efficient technologies need to be developed and applied at large scale. In this context, environmental accounting represents a useful tool to quantify environmental costs and impacts at local and global scales, allowing the identification of suitable green technologies and sustainability pathways. In this paper, we summarize the main effects of burning fossil fuels on climate change and ecosystems, identifying possible future pathways towards the sustainability of human societies.

S1.P9 Coastal cultural ecosystem services and human wellbeing, a case study to approach the complex relation between people and nature

Pinna S.[1]*, Barbieri N.[2], Farina S.[3,4], Grech D.[5], Guala I.[5], Cabana D.[5]

[1]GREEN LEAF - Groupe de Recherche en Education à l'Environnement et à la Nature, Laboratorio di Ecologia Affettiva, Università della Valle d'Aosta - Université de la Vallée d'Aoste, Strada Cappuccini °, 11100 Aosta, Italy

[2]Istituto Comprensivo "G.B. Toschi" Via Toschi 4, 4031 Baiso-Viano, RE, Italy

[3]Department of integrative Marine Ecology (EMI), Stazione Zoologica Anton Dohrn – National Institute of Marine Biology, Ecology and Biotechnology, Genoa Marine Centre, Villa del Principe, Piazza del Principe 4, 1616Genoa, Italy

[4]IAS-CNR, Institute for the Study of Anthropic Impacts and Sustainability in the Marine Environment, National Research Council,Località Sa Mardini, 09170, Torregrande, Oristano, Italy

[5]IMC - International Marine Centre, Località Sa Mardini, 09170, Torregrande, Oristano, Italy

* e-mail: s.pinna1@univda.it

The benefits people obtain from their interaction with nature and the coastal systems has been studied across multiple disciplines and frameworks. Although the body of literature tackling cultural ecosystem services and human wellbeing is increasing there is yet a need to better understand this complex relation, especially amongst teenagers. Thus, in this research by adopting the cultural ecosystems framework we study how teenagers engage with and culturally value the coastal systems to better understand how contributes to their wellbeing. The analysis is based in 0 questionnaires conducted across Sardinia, an island in the middle of the Mediterranean Sea. The results show how teenagers experiencing the coast, engage with the coastal systems and relate the perceived beauties and good state of conservation to positive affect, physical wellbeing, social integration, social acceptance, and social coherence. Differently, human impacts on the coastal systems operate at different levels on human wellbeing, promoting negative affect and social contribution, the last signified in different forms of pro-environmental behaviour, social actualization, and social coherence. Here we discuss how better understanding the way teenagers perceive the natural environment and engage through cultural activities can provide an insight into personal and social human wellbeing. We contend that coastal governance commonly driven by economic and environmental objectives need to integrate human wellbeing and cultural values at the core of their objectives. Our results highlight how case studies, in combination with a complexity science perspective, provide important new tools for studying systems where people and nature interact.

S1.P10 The Importance of Green Infrastructures to Enhance Natural Capital and Ecosystem Services in Cities and Urban Ecosystems

Sokolova M.[1]*, Buonocore E. [1], Franzese P.P.[1]

[1]International PhD Programme / UNESCO Chair "Environment, Resources and Sustainable Development", Department of Science and Technology, Parthenope University of Naples, Italy.

*e-mail: milena.sokolova001@studenti.uniparthenope.it

The sustainability of cities and urban ecosystems is one of the key topics of the United Nation 030 Agenda for Sustainable Development. The SDG 11 "Sustainable Cities and Communities" suggests that cities should become inclusive, safe, resilient and sustainable human settlements. In this context, Green Infrastructure (GI) can play a key role to enhance natural capital and ecosystem services in terrestrial, coastal, and marine ecosystems. GI can be defined as a strategically planned network of natural and semi-natural areas designed and managed to deliver a wide range of ecosystem services. GI can contribute to improve ecosystem functioning and resilience, protect biodiversity, promote societal health and well-being, and develop local green economy and sustainable land and water management. The concept of GI in cities is becoming increasingly important in the development of urban policies since it allows improving the quality of life while mitigating the adverse effects of climate change. One of the key features of GI is its multifunctionality: its ability to perform several functions and provide several benefits on the same spatial area. These can be environmental functions, such as conserving biodiversity or adapting to climate change, social functions, such as providing water drainage or green space, and economic functions, such as supplying jobs and raising property prices. In this paper, we integrate social network analysis and bibliometric science to explore the global scientific literature on GI and cities, focusing on their role to enhance natural capital and ecosystem services in urban ecosystems. Finally, we identify the main trends in this interdisciplinary domain of ecological research.

S1.P11 Sustainability assessment of different oyster (Crassostrea gigas) farming scenarios in the Northern Adriatic Sea

SUMMA D.[1]*, TUROLLA E.[2], CASTALDELLI G.[1], TAMBURINI E.[1]

[1]Department of Environmental and Prevention Sciences, University of Ferrara, Via L.Borsari 46, 4411 Ferrara, Italy

[2] Istituto Delta Ecologia Applicata, Via B.Bartok 9, 4414 Ferrara, Italy

* e-mail: daniela.summa@unife.it

In the global panorama of animal productions, bivalves farming is one of the most sustainable in terms of impact on ecosystems. In this context falls oyster farming which, despite the commercial image of luxury product, also interprets all characteristics of high environmental sustainability. In Europe the most productive country is France, settling in second position as a worldwide producer. Only recently the production of oysters has been started in Italy, since the demand for oysters has been progressively increasing and the opportunity to propose to the market a local product seems to have good perspectives both in the BB (business to consumers) and BC (business to business) segments. Therefore, there are high potentials for production improvement. As in any other production chain, oyster farming generates environmental impacts. This study aims to compare the environmental sustainability of two different oyster farming scenarios, taking the production system in Goro as a model. The production cycle usually provides three phases, i.e., seed production, pre-fattening, fattening. The two scenarios considered differ in the place of prefattening, which can take place off-shore, in long-line plant in scenario 1 or within the lagoon in scenario . The environmental impact analysis has been carried out by means of life cycle approach (LCA). The functional unit (FU) chosen was 1 kg of oysters. The analysis will be developed based on literature data and data collected through interviews with fishermen. Eco-indicator 99-H and ReCiPe midpoint (H) v.1.1 are used to perform the impact assessments. The outputs, defined as environmental impact categories, i.e. the global warming potential, are the starting points for identifying opportunities for improvement. The results show that, in both scenarios, the construction of the long lines plant and diesel consumption had the greater impact. Comparing the two scenarios, all impacts are lower with prefattening in lagoon, with a total reduction of about 9%.

S1.P12 Deep-sea species as potential *reservoir* of chemodiversity

Terzo S.M.C.[1,2,3]*, Palma Esposito F.[2], Mangano M.C.[4], Sarà G.[3], Spanò N.[1], Della Sala G.[2], de Pascale D.[2]

[1] Department of Chemical, Biological, Pharmaceutical and Environmental Sciences, Viale Fernando Stagno d'Alcontres 3, University of Messina, Messina, Italy

[2] Department of Ecosustainable Marine Biotechnology, Stazione Zoologica Anton Dohrn, Via A.F. Acton, Molosiglio, Napoli, 80133, Italy

[3] Laboratory of Ecology, Earth and Marine Sciences Department, University of Palermo Vialedelle Scienze Ed. 16, 9018 Palermo, Italy

[4] Department of Integrative Marine Ecology (EMI), Stazione Zoologica Anton Dohrn, Sicily Marine Centre, Lungomare Cristoforo Colombo (complesso Roosevelt), Palermo, Italy

* e-mail: stella.terzo@gmail.com

Deep-sea habitats are of great importance as hosting more than 95% of global biosphere. The deep-sea communities are dominated by cnidarians (hard and soft corals), sponges and bryozoans. Species that are well known promoter of seabed biodiversity and recently recognised *reservoir* of chemodiversity, potentially useful in marine pharmacology. Despite the biopotential role of the shallow species is widely studied - with hundreds of interesting new compounds discovered every year - the bioactivity of deeper species still remains poorly explored. Here we report the preliminary results from the investigation of the bioactivities of extracts from deep marine cnidarians, non-target species accidentally caught by bottom trawling activities along the north-west coast of Sicily (*Pennatula phosphorea, Pteroeides griseum, Pennatula rubra, Alcyonium palmatum*) against fish pathogen bacteria (*Vibrio anguillarum, Photobacterium damselae former known as Pasteurella piscicida.*) and human pathogen bacteria (*Staphylococcus aureus, Acinetobacter baumannii*). The extractions have been performed following both the direct extraction with several solvents (methanol, hexane, ethyl acetate) and the liquid-liquid partitioning extraction (modified Kupchan protocol) in order to evaluate the inhibitory effect on the growth of bacteria culture. *P. phosphorea* exhibited the strongest inhibitory effect on the growth of bacteria (in particular against *Vibrio anguillarum*) followed by the *P. rubra* e *P. griseum*, while *A. Palmatum* had the lowest inhibitory effect. The studied deep species showed a promising potential in marine pharmacology and could encourage the investigation of new compounds.

SESSIONE 2
DIDATTICA ED EDUCAZIONE AMBIENTALE

La sessione "Capitale Naturale, Servizi Ecosistemici e Contabilità Ambientale", in linea con le attività dell'omonimo Gruppo di Lavoro nazionale della Società Italiana di Ecologia (SItE), accoglie contributi teorici, metodologici e casi di studio tesi a delineare lo stato dell'arte e le prospettive di sviluppo della ricerca ecologica in materia di "capitale naturale" e "servizi ecosistemici". Sono, inoltre, pertinenti contributi relativi all'utilizzo di tecniche di contabilità ambientale per la valutazione biofisica ed economica del capitale naturale e dei servizi ecosistemici e dei relativi benefici per l'uomo in un'ottica di sviluppo sostenibile.

Chairs:

Franca Sangiorgio, Riccardo Santolini, Giuseppe Barbiero

INVITED SPEAKERS

LORENZI C.[1], PINNA S.[2]

[1]Università di Roma Tre
[2]Università della Valle d'Aosta

L'ecologia che permea la società.

Dall'educazione ambientale alla formazione ecologica delle figure professionali

La speciale vocazione dell'educazione ambientale storicamente è sempre stata quella di trasferire i risultati della ricerca ecologica nella società, utilizzando il canale dell'educazione, sia formale, nei vari gradi di formazione scolastica, sia informale nell'attività di promozione della conservazione ambientale. Tuttavia, le emergenze ambientali della prima metà del XXI secolo richiedono la capacità di mettere a fattore comune le diverse competenze specialistiche che possono contribuire ad affrontare la crisi globale e completare la transizione ecologica dei processi produttivi. Di conseguenza, nella società sta crescendo una richiesta di nuove competenze ecologiche, spesso molto specifiche e di alto profilo, che possano completare la formazione di figure professionali come, ad esempio, gli architetti e gli ingegneri, gli economisti, i medici, gli psicologi, i sociologi. Il gruppo di lavoro DEA - Didattica ed Educazione Ambientale è pronto ad accogliere questa nuova sfida, facendo forza sul tradizionale approccio sistemico dell'educazione ambientale, impegnata da sempre a rilevare le molteplici dimensioni dei problemi ambientali – in particolare: la perdita di biodiversità, la produzione di cibo, i cambiamenti climatici e l'uso di acqua dolce – esaminando le connessioni scientifiche, tecnologiche, politiche, economiche, etiche e educative di tali problemi. La lezione vuole riannodare i nessi tra ricerca sul campo nella conservazione e nella gestione degli ecosistemi, nelle strategie per il mantenimento della sostenibilità della biosfera e l'attività educativa volta al rispetto della Natura e alla valorizzazione degli aspetti affettivi della relazione con l'ambiente naturale.

SESSIONE 2
DIDATTICA ED EDUCAZIONE AMBIENTALE

COMUNICAZIONI ORALI

From citizen science to science education: the experiences of the Natural History Museum of Accademia dei Fisiocritici (MUSNAF) about teaching and learning biodiversity

Barbato D.[1,2]*, Benocci A.[2], Manganelli G.[1,2]

[1]Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente, Università di Siena, via P.A. Mattioli, 4, 53100 Siena, Italia
[2] Museo di Storia Naturale dell'Accademia dei Fisiocritici, Piazzetta Silvio Gigli, 2, 53100 Siena, Italia

* e-mail: debora.barbato@unisi.it

As citizen science expands, it is becoming increasingly important to consider its potential to foster education and learning opportunities. The COVID-19 pandemic has demonstrated the need for public trust to be strengthened, especially concerning collective awareness of biodiversity and its role for sustainable development. In 2020 the Natural History Museum of Accademia dei Fisiocritici promoted citizen science that allowed the Museum to interact with the public, and people to reconnect with nature without leaving home. The inaugural project was "CLIC! Snails and Slugs in Cities", the first Italian crowdsourcing research dedicated to the monitoring of land molluscs in urban environments; CLIC! was followed by "AIDA Animal Intruders Inside Home". These monitoring projects could help researchers understand the mechanisms of the spread of alien species and the effects of climate change, also empowering and informing learners. Non-formal school education was also used to promote outdoor activities to bring students closer to the environment of their neighborhoods; friendly open-access apps (iNaturalist and Seek) were used to identify biodiversity through image recognition technology. In this sense, educational outdoor itineraries promote skills developing such as understanding of environment as a complex system and supporting "scientific literacy". Museum offers were recently implemented with Siena BiodiverCity, an education and research project to enhance biodiversity in Siena and promote its conservation through an inclusive approach. A 24-hour BioBlitz took place to start a participative census of urban biodiversity, thanks to the collaboration between citizens and experts. Training sessions were organized with theoretical and field data collection activities. Good practice operations for urban regeneration were also promoted. Finally, the "Biodiversity Desk", a service to offer free consultations and identification of natural vouchers, is going to be launched. "Siena BiodiverCity" is a model that can be replicated in other cities for a different nature-based education experience.

BRACING BIOPHILIA. A comparative study on the effect of conventional *vs* biophilic learning environments on school performance

BARBIERO G.[1]*, BERTO R.[1], VENTURELLA A.[1], MACULAN N.[1]

[1]GREEN LEAF - Groupe de Recherche en Education à l'Environnement et à la Nature, Laboratorio di Ecologia Affettiva, Università della Valle d'Aosta - Université de la Vallée d'Aoste, Italy.

* e.mail: g.barbiero@univda.it

Bracing Biophilia is an exploratory research program which verifies the effect of Nature-based Innovative Learning Ecosystems on pupils' attentional performance and affiliation with Nature. To this aim, the effect of a conventional learning environment was compared with two Nature-based environments made according to biophilic design and the Biophilic Quality Index (BQI) respectively. The experimental assessments spanned three school years; in the first-year assessments were carried out in a conventional classroom, while in the next two years they took place in a biophilic designed classroom and in a BQI certified classroom. Measurements, i.e., the administration of the Perceived Restorativeness Scale-children, the Continuous Performance test, and the Connectedness to Nature Scale-children, were deployed at regular intervals at three different times (autumn, winter, spring) of each school year. Results showed that the conventional classroom, as well as being less preferred and perceived less restorative, was also less effective in supporting pupils' attentional performance than biophilic classrooms. Also, over time, the biophilic classrooms have proven capable of strengthening the pupils' feeling of affiliation with Nature. More specifically, the BQI certified classroom turn out to be the most effective among the indoor environments, i.e., the conventional and the biophilic design classrooms, and just less effective than the outdoor learning environment used as a comparison for the Nature-based environments. The objective limitation of this study is the number of pupils, nevertheless the trend is clear and cannot be attributed to pupils' cognitive maturation processes. This case study allows appreciating the importance of the learning environments with Nature-based features capable of supporting the learning process, restoring attention from mental fatigue and strengthening the affiliation with Nature.

Learning about ecosystem services by means of capacity matrices

Drius M.[1]*, Silveri L.[1]

[1]Faculty of Education, Free University of Bolzano-Bozen, viale Ratisbona, 16, 39042 Bressanone, Italy

* e-mail: mita.drius@unibz.it

Matrices are flexible tools for ecosystem services mapping and assessment, which link ecosystem types or land cover types to ecosystem services by providing a score for ecosystem service (ES) capacity, supply, use, or demand. Although they have become popular for the qualitative assessment of ES, or for their integration with other ES assessment approaches, their use as communication tools for conveying the conceptualization of ES has not received much attention. In this preliminary study, matrices are applied for the qualitative assessment of ES capacity in different landscapes, following the approach and the classification of landscape services. The target group is composed by 80 primary school perspective teachers enrolled in the master's course of Primary Education. A didactic unit of four hours was planned, in which the students did practically approach the conceptualization of ES for the first time, by means of a capacity matrix assessment. A list of landscape services was provided, and their meaning was briefly explained before the laboratory activities started. Through a group work, first the students did identify the main landscape elements of different landscapes, and then they analyzed them considering the potential services they can provide. A score from 1 to 5 was then assigned to each landscape service; subsequently, the cumulative values were derived and plotted. Finally, each group prepared a brief discussion and presented their analyses. The results, although preliminary, showed that through the use of capacity matrices students could reach a good level of understanding of the concepts ES, ES capacity and multifunctionality.

Using storytelling in ecological education

FERRETTI J.[1]*, LORENZI C.[1]

[1]Dipartimento di Storia, Patrimonio culturale, Formazione e Società, Università degli studi "Tor Vergata", via Columbia, 1, 00133, Roma, Italia

* e-mail: jessica.ferretti8@gmail.com

The environmental crisis we are living requires effective practices of Ecological Education. This is underpinned by intergovernmental environmental organizations and clearly arises in national and international environmental reports. Some authors look at storytelling as an educational technique highly engaging people evoking emotions and stimulating imagination. It seems to be adequate to create an immersive participatory atmosphere. It also activates the ethical-value dimension and the development of critical thinking in processes of negotiating meanings. In the last decades, storytelling applied to EE (Ecological Storytelling) has been quite successful. This requires an in-depth thinking concerning strengths and weaknesses of this practice. As strengths could be the suitable use of Ecological Storytelling in the transformative learning process, weaknesses could be the possible establishment of ecological misconceptions and an over-simplification of ecological concepts (es.: ecosystem structures and processes).

A Virtual Museum of Ecosystems

Giamberini M.S. [1]*, Mazari Villanova L.[2], Re S.,[1], Bogliani G. [1], Fano E.A.[3], Ferrari M.[4], Sangiorgio F.,[5] Provenzale A.[1]

[1]Istituto di Geoscienze e Georisorse, Consiglio Nazionale delle Ricerche, via G. Moruzzi 1, 56124 Pisa, Italia

[2] Dipartimento di Scienze del Sistema Terra e Tecnologie per l'Ambiente, Consiglio Nazionale delle Ricerche, Piazzale Aldo Moro, Roma

[3] Dipartimento di Scienze della Vita e Biotecnologie, Università di Ferrara, via L. Borsari, 46, 44121 Ferrara, Italia

[4] Biologo, giornalista e divulgatore scientifico, libero professionista.

[5] Dipartimento di Scienze e Tecnologie Biologiche e Ambientali-Università del Salento

* e-mail: mariasilvia.giamberini@igg.cnr.it

A Virtual Museum devoted to ecosystems is being developed by CNR in the framework of the project PON IR LifeWatchPLUS. This initiative aims to offer an interactive and innovative web-based tool for experiencing the complexity of ecosystems and for learning about their functioning, with a special focus for schools. It also aims to establish a multidisciplinary community composed by researchers in ecology, teachers, students, science communicators and experts in ICT technologies aimed to enhance visualization and learning (e.g. immersive visualisation). The Virtual Museum includes a general introduction to ecosystems and to the ecological challenges for the future of biodiversity conservation and response to anthropic pressures and climate change, analysing four habitats in more detail (Mediterranean-semi arid, Mountains, Coastal wetlands, Arctic), also planning to include more habitats in the future. The "Museum halls" are made of immersive 360 pictures of real environments that enable the visitors to access pictures, videos, interviews, texts and documents. The Museum also provides the tools for building "communities" of visitors (e.g. school classes, interest groups) which may stay connected, plan guided tours, share documents, plan on-line events, access archives, play interactive games, and will provide access to virtual archives. In this presentation, we show the scope, the structure, the scientific contents and the learning tools that will be implemented in this unique Virtual Museum. The Museum will have a long life only if it will be an open space for scientific, technological, methodological innovation. Thus, a scope of this presentation will also be to foster a discussion among this session participants, in order to receive comments and suggestions for a continuous improving of the Museum itself.

Ecology teaching in primary education theses: experiences at UNIMIB during COVID years

PADOA-SCHIOPPA E.[1]*, ROTA N.[1], CANEDOLI C.[1]

[1]Dipartimento di Scienze dell'Ambiente e della Terra – Università degli Studi di Milano-Bicocca

* e-mail: emilio.padoaschioppa@unimib.it

Primary education students are required in their fifth year of study to carry out an internship in a school, develop a teaching project in partial autonomy and in the meantime to write a dissertation, which should have research aspects. Between 2020 and 2022, the difficulties caused by the pandemic and the resulting lockdowns and school closures forced us to revise both our teaching plans and our research activities. For those students who had chosen to tackle a thesis relating to the teaching of ecology, we proposed three different lines of research and action. In 2020, given that primary and nursery schools were closed for most of the second semester, we proposed a pathway for our thesis students to better describe and disseminate the work of some female ecologists. In 2021, our students worked on the concept of ecosystem services, proposing educational projects where possible and collecting field data (a total of more than 3,000 interviews) on the perception of ecosystem services in protected mountain areas. In 2022 (all projects are still often ongoing), on the other hand, the topics proposed concern the development of playful activities related to learning basic concepts of ecology and environmental education. In all three cases, an attempt was made to maintain a close link between the internship and research activities. The results obtained show that the three different paths can, however, bring valuable dissemination of ideas and concepts of ecology that are often neglected in the school world.

Ecopsychology: Nature can be a real *influencer* for teenagers

Pinna S.[1]*, Danon M.[2], Mongili S.[3], Barbiero G.[1]

[1]GREEN LEAF - Groupe de Recherche en Education à l'Environnement et à la Nature, Laboratorio di Ecologia Affettiva, Università della Valle d'Aosta - Université de la Vallée d'Aoste, Strada Cappuccini 2°, 11100 Aosta, Italia

[2] International Ecopsychology Society (IES), Ecopsiché – Scuola di Ecopsicologia, via Archimede 1/1, 23875, Osnago, Italia

[3] International Ecopsychology Society (IES), Ecopsiché - Scuola di Ecopsicologia, via ricovero 84, 09170, Oristano, Italia

* e-mail: s.pinna1@univda.it

Numerous scientific publications show how the detachment from Nature affects our state of health and well-being. The loss of contact with wild Nature, which characterizes the contemporary lifestyle, brings with it mechanical damage (little movement, little access to healthy air) and cognitive damage: ignorance of the basic principles of interconnection, lack of stimulus to exploration, curiosity about otherness and, on an existential level, few opportunities to question oneself on the origin of life, on the sense of sharing, on the larger dimensions compared to everyday life. The relationship with our world, with Nature, therefore, involves not only environmental education, ecology, but also psychology: Ecopsychology, a young science born in the 90s in California and now increasingly widespread also in the world, proposes working guidelines for a green education that reconnects the different human dimensions - body, emotions, mind, and spirit - and lays the foundations for an educational process necessary for our future, towards what sociologist Edgar Morin calls 'terrestrial citizenship'. There is a correspondence between Nature inside and Nature outside: to feel at home outside, one must have been accompanied to feel at home inside; learn to look inwards and ask the crucial Socratic question: 'who am I?'. This is the challenge of Ecopsychology: to simultaneously awaken psychological well-being and ecological maturity in the same work in which Nature is the protagonist as a physical setting and as a metaphor. With our contribution we want to bring attention to adolescents, who have suffered an abrupt disconnection with Nature, with a worsening following the pandemic. We will show how and why a more direct contact with Nature can foster healthy growth - from a physical, relational, and social point of view - healing the consequences of two years of lockdown and preparing young people for an increasingly necessary resilience.

Young ambassadors of sustainability: environmental education as a tool for inclusion education

Sangiorgio F. [1]*, Pinnelli S. [2], Ciotti M. [1], Basset A.[1,3]

[1]*Dipartimento di Scienze e Tecnologie Biologiche e Ambientali, Università del Salento, Piazza Tancredi 7, 73100 Lecce, Italia*

[2] *Dipartimento di Scienze Umane e Sociali, Università del Salento, Piazza Tancredi 7, 73100 Lecce, Italia*

[3] *LifeWatch ITALIA, Via Monteroni, 73100 Lecce, Italia*

* e-mail: franca.sangiorgio@unisalento.it

A project titled "Young ambassadors of sustainability: environmental education as a tool for inclusion education" is carried out by University of Salento, in collaboration with Municipality of Melpignano, for students from primary school to university. This project, funded by Salento Interprovincial University Consortium, aims to raise awareness on ecological issues among the younger generation through the knowledge and deepening of environmental sustainability and inclusion issues. The activities for students were based on a co-teaching model for more inclusive classroom. A course was implemented across generations by working in a joint training module for university students (Master's Degree Program in Primary Education) and high school students, trained by experts from academia on ecology and pedagogy, to become trainers at primary and middle schools. All students' activities were carried out under the guidance of the teachers as mentors. The course included lectures, webinar, classroom and online activities, combined with free digital resources available on the web platform (https://ecologicamente.lifewatchitaly.eu/). A total of 650 students, from 23 primary and middle schools, and about 100 students from university participated in the project activities. The students coming from each school realized collaboratively a digital product through which gave the message on sustainability and inclusion and participated in an online competition on ecological issues. High school teachers have been granted training on a ministerial platform (SOFIA). The students realized interesting digital products working as main protagonists of their learning, encouraged to work collaboratively and to become critical thinkers. The project has proven to be a relevant experience because put the student exploration at the centre of learning and gave students the opportunity to spread innovation and creativity, developing new competencies. Based on the experience of this project, we are looking to improve the collaboration with other partners to involve teachers and students from national to European scale.

The biophilya hypotesis: the affiliation with Nature since the primary school

Santolini R. [1]*, Morri E. [1]

[1] Dipartimento di Studi Umanistici (DISTUM), Università di Urbino, Via Bramante, 17, 61029 Urbino

* e-mail:riccardo.santolini@uniurb.it

Affective Ecology is a new branch of ecology concerned with emotional relationships between human beings and the rest of the living world. The basic instinct that guides the evolution and maturation of a well-tuned relationship with the living world seems to be biophilia, our innate tendency to focus upon life and life-like forms and, in some instances, to affiliate with them emotionally (The Biophilia Hypothesis). As amply demonstrated the Nature-child connection contributes to a healthy and correct biological, psychological and social development, reduces stress and improves the level of learning. Unfortunately, modern people, especially children, lack direct and frequent contact with Nature and this can have negative consequences on their physical and mental health. This research aim to show how children are closely linked to natural elements in comparison with artificial ones since the primary school to demonstrate the Biophilia Hypothesis and the fascination provided by Nature. We analyzed 2 primary school with 31 (school A) and 22 (school B) children respectively, comparing 4 different elements and specifically testing the time (seconds) need to give attention to each 4 elements and how long children focused on the elements (seconds).

We tested children attention for 4 these elements:
1. moving living element; little rabbit (School B) or little dog (School A)
2. not moving living element (plant)
3. moving not living element (a remote controlled car),
4. not moving not living element (a painting)

Results show a less time to notice the moving living element (1) compared to other (2, 3,4) for both school A and B and also that children give more attention to 1. In school A there are no significant differences about the gender of the subjects while in school B female give attention to moving living element in half the time. These results suggest how child, can be fascinated by Nature, that have a restorative power, using these approach in creating the school activities.

Outdoor Education: are we really ready?

Stocco A.[1]*, Vio G.[1], Pranovi F.[1]

[1]Dip.to di Scienze Ambientali, Informatica e Statistica, Università Ca' Foscari, Campus Scientifico via Torino, 155, 30174, Mestre (Venezia), Italia

* e-mail:alice.stocco@unive.it

Outdoor education (OE) has recently gained popularity in Italy as it has elsewhere, especially after the indoors confinement experienced due to the pandemic. OE has been shown to foster stress recovery, cognitive performance, and affiliation with Nature in children, exploiting benefits produced by natural ecosystems (Ecosystem Services, ES). To explore the hypothesis of implementing OE programs in the Venice lagoon, we assessed the "information for cognitive development" ES focusing on the *valli da pesca*, peculiar habitats that still maintain the features of transitional waters environments. According to the results of our questionnaire addressed to teachers in the Metropolitan City of Venice, all respondents would be very interested in conducting OE in such environments, suggesting a high demand potentially involving more than 2700 teachers. However, 37.5% of the teachers are frightened by the additional bureaucratic effort it might require, and 20.8% express concerns about risk/safety conditions. The results furthermore reveal that their current idea of OE is more similar to schoolyard playtime, or to occasional school trips: indeed, 40.2% of the interviewed teachers consider a once-per-year trip to be definable as OE, whereas only 3.9% agreed that the frequency should be at least one day per month. Another frequently reported drawback dwells within the difficulty of adapting a frontal lesson for OE context. Therefore, despite the valli da pesca have a high capacity to provide suitable places for OE, a non-negligible portion of the local school system does not seem currently ready for this kind of experience, as OE is portrayed as "experiences outside the classroom" where the environmental features don't really 'make the difference'. The concerns expressed by the teachers suggest the latter need strong support to implement a real OE program as opposed to just "teaching in outdoor settings", so that the lack of classical teaching tools (such as blackboards, desks and school furniture) may not be seen as an obstacle anymore, but as an opportunity to discover the affordances of the environmental elements that could stimulate the students to learn-by-doing.

SESSIONE 2
DIDATTICA ED EDUCAZIONE AMBIENTALE

POSTERS

S2.P1 Biophilia can be measured. Some evidence in children

Barbiero G.[1]*, Berto R.[1]

[1]GREEN LEAF - Groupe de Recherche en Education à l'Environnement et à la Nature, Laboratorio di Ecologia Affettiva, Università della Valle d'Aosta - Université de la Vallée d'Aoste, Italy.

* e.mail: g.barbiero@univda.it

In the last ten years, affective ecology has engaged in the experimental verification of the biophilia hypothesis and in defining more and more precisely the two fundamental constructs of biophilia: *fascination for* and *affiliation with* Nature. Unfortunately, the weak point of the matter consists in the lack of operationalization of affiliation and fascination, which instead would allow estimating the psychological effects of biophilia. Theoretically, exposure to natural environments triggers fascination for and affiliation with Nature which in turn favor restoration of cognitive resources after mental fatigue, as a part of the broader stress-recovery process. In our research activity that has lasted for 15 years, we have successfully faced the operationalization issue with two self-rating scales: the Perceived Restorativeness Scale-children (PRS-ch) and the Connectedness to Nature scale-children (CNS-ch), and one performance task: the Continuous performance test (CPT). We have tailored the self-rating scales for children (they derive from two reliable and widely used tools designed for adults) to assess fascination for Nature (PRS-ch) and affiliation with Nature (CNS-ch), while the CPT - a validated measure of sustained attention and inhibition in children - measures the effect of fascination and affiliation on attentional performance. Over time, these instruments have turn out reliable and effective in our attempt to monitor children's affiliation with and fascination for Nature in experimental studies within and between subjects, and to single out the relationship between the two constructs of biophilia and children's attentional performance. The more children are affiliated with and fascinated by Nature, the better their attentional performance. Last but not least, biophilia steers children's preference for natural environments. The measurement of the biophilia constructs is the starting point to develop educational program to enhance pro-environmental behavior and to plan biophilic and restorative environments for children. Biophilia is the less abstract thing that you think.

S2.P2 The Kindergarten of the lagoon: a Manifesto for an outdoor education project in Venice

Stocco A.[1]*, Barbiero G.[2], Santoro F.[3], Venturella A.[2], Pranovi F.[1]

[1] Dip.to di Scienze Ambientali, Informatica e Statistica, Università Ca' Foscari, Campus Scientifico via Torino 155, 30174 Mestre Venezia

[2] Laboratorio di Ecologia Affettiva (LEAF), Università della Valle d'Aosta, Strada Cappuccini 2°, 11100 Aosta

[3] UNESCO Intergovernmental Oceanographic Commission, Salizada Zorzi 4930, 30122 Venezia

* e.mail:alice.stocco@unive.it

Venice and its lagoon represent an emblematic example of co-evolution across the centuries, recognized also by the UNESCO as a World Heritage Site. The close connection between Venetians and the surrounding ecosystem, however, has cracked in recent decades, due to many factors, driving to a significant decrease of the ecosystem state. Anyway, if we were able to reconnect young people to Nature by fostering a personal and friendly relationship with the lagoon they inhabit, we could stimulate the citizens' pro-environmental behaviors. To achieve this goal, outdoor education seems to be a promising path that may be beneficial for developing responsibility toward the lagoon ecosystem, since it has shown to positively influence children's relationship to the natural environment, as well as improving their self-perceptions and social skills. The "Kindergarten of the lagoon" project, recently promoted in collaboration with the Intergovernmental Oceanographic Commission of UNESCO, aims to offer pre-school children a quite innovative outdoor education program based on the observation and exploration of the lagoon. In this work we present the "Manifesto of the Kindergarten of the lagoon", describing the objectives of this educational program. To carry out the project in such a multifaceted, heterogeneous, and complex social-ecological system, a pedagogical approach is not enough: the expertise in lagoon ecology and sustainability is also required, both to choose places representative of a transitional waters environment, and to assess the overall sustainability of the proposal.

SESSIONE 3
PROSPETTIVE IN ECOLOGIA DEL PAESAGGIO

Il gruppo di lavoro di ecologia del paesaggio propone una sessione nella quale si accolgono contributi teorici, metodologici e casi studio che aiutino a comprendere lo stato dell'arte e le prospettive dell'ecologia del paesaggio con particolare riferimento alle sfide poste dalla transizione ecologica, energetica e sostenibile. Nella sessione sarà possibile presentare contributi alle diverse scale di paesaggio, volti ad identificare politiche e strategie di gestione utili alla mitigazione e compensazione di rischi ed impatti ambientali, oltre a valutazioni ambientali spaziali e temporali. Verranno accolte inoltre ricerche mirate alla caratterizzazione della biodiversità del paesaggio ed i relativi servizi ecosistemici cosi come studi che attraverso sistemi di monitoraggio in situ e da remoto descrivono i mosaici urbani, agricoli o naturali e ne e modellizzano la dinamica in diversi scenari di cambiamento globale.

Chairs:

Irene Petrosillo, Laura Carranza, Emilio Padoa-Schioppa

INVITED SPEAKER

VOGIATZAKIS I.

Faculty of Pure and Applied Sciences, Open University of Cyprus, PO Box 12794, 2252 Nicosia, Cyprus

Linear infrastructure an insidious agent of biodiversity loss

In our quest for biodiversity conservation there have always been issues we underestimate or we do not know enough about, which contribute to biodiversity loss disproportionately to the importance we give them. Whether wildlife is getting closer to us or we are getting closer to wildlife the result is the same i.e. *human nature conflict.* Linear infrastructure is among the agents which exacerbate this conflict. Roads in particular, despite their importance for economic development, continue to expand rapidly worldwide, leaving but few areas intact. What does this mean for a large Mediterranean island with limited space, high biodiversity and an expanding road network? Cyprus is the EU country with the highest land take and sealed surfaces area and a road density as high as large European countries. Despite the dramatic increase of the road network over the past decades, it is still expanding with new highways planned. Roads on the island cut through Natura 2000 sites, which have similar road density to non protected areas, roadless areas are limited, protected habitats are highly fragmented, while no proper evaluation of the impacts of the road network on wild fauna has been conducted to date. In addition, data on Wildlife Vehicle Collisions (WVC) remain fragmented, collected in an ad hoc manner with absence of centralized sharing and analysis. As a result road effects on biodiversity are understudied which in turns hinders decision-making, including consistent assessment and planning. The paper provides an overview of the work carried out in Cyprus since 2014 to evaluate road impacts on protected areas and biodiversity. In addition it reports on the first concerted effort to set up a system for roadkills' monitoring as a means to improve our knowledge on road ecology, raise public awareness on the effects of roads and develop recommendations for mitigation measures.

Sessione 3
Prospettive in ecologia del paesaggio

Comunicazioni orali

The Unravelled Voting Algorithm: a novel framework to investigate the spatial organization of ecological systems

Bellino A.[1]*, Baldantoni D.[1]

[1]Dipartimento di Chimica e Biologia "Adolfo Zambelli", Università degli Studi di Salerno, via Giovanni Paolo II, 132, 84084 Fisciano (SA), Italia

* e-mail: abellino@unisa.it

The identification of spatial scales is a fundamental topic in ecology, commonly addressed through multiscale analyses like the Moran's Eigenvector Maps (MEMs). This technique entails the derivation of scales through the definition of a model of spatial organization, i.e. of the spatial relationships among the elements of ecological systems. Defining the spatial organization model is highly nontrivial, but has fundamental implications for both the technical implementation of the analysis and, most importantly, the ecological understanding of the system. To address this issue, we developed the Unravelled Voting Algorithm (UVA), a novel paradigm and analytical framework based on MEMs, to investigate the spatial organization and scales of ecological systems. UVA revolves on three key points: i) consensus in moving from the univariate to the multivariate domain, ii) post-selection inference, iii) rank-based techniques. Its performances were evaluated, through simulations and real data, in terms of accuracy in identifying the spatial organization model and scales, computational costs and flexibility. UVA demonstrated an outstanding accuracy in recognizing both the spatial organization model and the spatial scales, and can be used with signal-to-noise ratios as low as ≈ 0.5. The current implementation for the R programming language can already attain ×50 faster computation time than related procedures, with far superior accuracy. The generation of novel non-spatial attributes, coding the relative preference of each element of the ecological system toward different spatial organization models, allows exploring the relative variations in spatial patterns. UVA defines a modular framework setting new standards in the investigation of spatial organization and scales of ecological systems. Its flexibility makes it adaptable to any analytical requirement, open to large improvements and future-proof. On top of its outstanding accuracy, it paves the way to the analysis of the variations in patterns and scales among the elements of ecological systems.

Urban landscape and climate shape aspects of the pollination ecosystem service

Biella P. [1]*, Nicola T. [1], Pioltelli E. [1], Guzzetti L. [1], Galimberti A.[1], Labra M.[1], Galli P.[2,3]

[1]ZooPlantLab, Department of Biotechnology and Biosciences, University of Milano-Bicocca, P.zza della scienza 2, Milan, Italy

[2]Earth and Environmental Science Department, University of Milano-Bicocca, P.zza della scienza 2, Milan, Italy

[3]MaRHE Center (Marine Research and High Education Center), Magoodhoo, Maldives

* e-mail: paolo.biella@unimib.it

Testo (in lingua inglese): Urbanization and habitat fragmentation influence biodiversity and the ecosystem services provided, especially plants and pollinators, by shaping both landscape and climate. Cities are emblematic scenarios for understanding species responses to artificially driven environmental transitions and islands could serve as open air laboratories for disentangling the direct effects of habitat alteration on pollination ecology. We investigated several aspects of pollination ecology in response to landscape and climate along gradients of habitat modification by urbanization, both in the landmass and in a group of islands. Both in Milan and in the Maldives islands, we focused on some components of the pollination ecosystem service: pollinator abundance, flower nectar used by pollinators for feeding, the transported pollen and the pollen deposited on the flower stigmas. The results indicate linear and nonlinear relationships of the investigated components of pollination ecology with landscape and climate along the urbanization gradient. Pollinator abundances peaked at medium levels of urbanization but was affected by green-area distance and by low temperature seasonality; while nectar resources peaked in the city core and the pollen transported decreased with urbanization. Furthermore, only the largest bees expanded the foraging diet at increasing fragmentation of green areas; while pollination efficiency increased with pollinator species richness in two sentinel plants in this context. This study shows that moderate landscape alteration shapes many aspects of the pollination ecosystem service.

Disentangling the role of mesohabitat and geographical position on the spatial and temporal variation of macroinvertebrate communities at river network scale

Doretto A.[1,2]*, Bona F.[2,3], Falasco E.[2,3], Marino A.[2,3], Fenoglio S.[2,3]

[1]Dipartimento per lo Sviluppo Sostenibile e la Transizione Ecologica, Università del Piemonte Orientale, Piazza S. Eusebio 5, Vercelli, Italia

[2]ALPSTREAM – Alpine Stream Research Center, Ostana, Italia

[3]Dipartimento di Scienze della Vita e Biologia dei Sistemi, Università degli Studi di Torino, Via Accademia Albertina 13, Torino, Italia

* email: alberto.doretto@uniupo.it

The goal of this case study is to evaluate the spatial and temporal variation in the diversity and composition of benthic macroinvertebrate communities at river network scale by examining simultaneously the role of the mesohabitat type. A total of 12 river reaches, belonging to 12 different tributaries, were selected in the upper part of the Po River Basin (Italy; elevation range: 658-1525 m asl) and classified as central (<1 Km from the mainstem, N = 6) or peripheral (>1 Km from the mainstem, N = 6). All river reaches were pristine and showed very comparable conditions in terms of land use, climate, geology and channel morphology. At each river reach, three riffles and three pools were surveyed: one Surber sample was collected from each of them, along with several near-bed (i.e. flow, substrate, CPOM and periphyton) and physical and chemical variables (i.e. pH, water temperature, conductivity and dissolved oxygen). Macroinvertebrate sampling was carried out on three different seasons: spring (April 2021), summer (July 2021) and Autumn (November 2021). Results show that, on average, riffles had higher macroinvertebrate richness and abundance than pools. When looking at the effect of environmental variables on the community composition we found that the effect of species sorting was generally higher in riffles than pools. Moreover, among riffles, the pure contribution of local environmental variables on the macroinvertebrate community composition was higher in peripheral reaches than central reaches; while this trend was not corroborated with respect to pool communities. These results highlight the importance of the mesohabitat type when studying the biodiversity variation at river network scale.

Dunes under attack: mapping iceplant invasion (*Carpobrotus* sp. pl., Aizoaceae) using UAVs in coastal environments

Innangi M.[1]*, Acosta A.T.R.[2], De Simone W.[1], Di Febbraro M. [1], Frate L.[1], Marzialetti F.[1,3], Villalobos Perna P.[1], Carranza M.L.[1]

[1]Dipartimento di Bioscienze e Territorio, Università degli Studi del Molise, Contrada Fonte Lappone, s.n.c., 86090 Pesche (IS), Italia

[2]Dipartimento di Scienze, Università degli Studi Roma Tre, Viale Guglielmo Marconi, 446, 00146 Roma, Italia

[3]Dipartimento di Ingegneria Industriale e dell'Informazione, Università di Pavia, Via A. Ferrata, 5, 27100 Pavia, Italia

* e-mail: michele.innangi@unimol.it

Invasive alien plants (IAPs) pose a major threat to biodiversity and habitat conservation. Coastal environments host numerous habitats of high conservation concern with a limited extent where IAPs can have strong impacts. To contain and manage IAPs, one of the first challenges is their early detection and mapping which can be done through satellite remote sensing, but due to the limited extent of Mediterranean coastal dune habitats, this approach could be useless due to coarse spatial resolution. The recent use of UAVs providing very high spatial resolution images, can be very useful particularly for herbaceous IAPs detection. Among the invasive herbaceous plants, one of the most important is *Carpobrotus* sp. pl. (Aizoaceae). In this study, we deployed a UAV equipped with passive sensors (RGB and multispectral) along dunes highly invaded by *Carpobrotus* in the Tyrrenian seashore of central Italy to map its presence and abundance during the flowering period of the species (May). We developed a protocol to optimize image segmentation for predictive machine learning models. We specifically addressed three complex issues regarding the use of UAVs for this application: a) identify the best combination of spectral bands and indices to detect the presence of *Carpobrotus*; b) establish the minimum training area for modelling; c) establish the best approach to detect vegetative, reproductive parts or the entire plant. Metrics derived from RGB camera (such as hue, saturation and intensity H-I-S) or multispectral camera (including near-infrared) can both detect *Carpobrotus* with high accuracy (K > 0.6), but reproductive parts or entire plants can be better detected by H-I-S, while identifying reproductive parts benefits from near-infrared band. The results also showed that a model training area as small as 20% of the total area is adequate to obtain sufficiently robust predictions, although increasing the training area to 30% improves the performance.

The effects of *Xylella fastidiosa* on the provision of landscape services

Petrosillo I.[1]*, Marinelli M.V.[1,2], Valente D.[1]

[1]*Lab. of Landscape Ecology, Dept. of Biological and Environmental Sciences and Technologies, University of Salento, prov.le Lecce-Monteroni, 73100 Lecce, Italy*

[2] *Institute for Advanced Space Studies "Mario Gulich" (IG), National Commission for Space Activities (CONAE), Córdoba 5186, Argentina*

* e-mail: irene.petrosillo@unisalento.it

Landscape multifunctionality is strongly related to its capacity to provide a wide range of landscape services, which contributes to human well-being. During the last decade the infection of *Xylella fastidiosa* has interested the southern provinces of Apulia region, causing a potential substantial impairment of the flow of landscape services. Given the ecological role played by olive groves, the aims of this research are: (1) to analyze the landscape transformation related to the diffusion of *Xylella fastidiosa*; (2) to investigate its effects on the provision of landscape services; and (3) to identify possible landscape recovering strategies. The spatio-temporal dynamics of temperature and photosynthetic activity have been studied in the province of Taranto, Brindisi and Lecce. More in particular, we have investigated the temporal trend of EVI (Enhanced Vegetation Index) and LST (Land Surface Temperature), used as proxies of the photosynthetic activity (supporting landscape service) and temperature regulation (regulating landscape service) respectively, from 2002 to 2021. The photosynthetic activity has shown an overall yearly increasing trend, but a different seasonal trend before and after the infection. The interannual variation has shown the areas where the photosynthetic activity was higher in 2002 than in 2021, noticing a decreasing trend due to a new spatial pattern of olive groves in the province of Lecce, which has been strongly interested by the infection of *Xylella fastidiosa*. The annual mean of the LST has shown an increase of 1.05 °C in the same time range, meaning that the temperature regulation has been affected by the change in vegetation cover, which has faced a conversion from an arboreal (evergreen) to a seasonal herbaceous behavior. These changes in landscape structure directly affect landscape functionality and their resolution asks for suitable landscape planning strategies.

Landscape anthropization drives the foraging of an urban bumblebee: A nutritional perspective

PIOLTELLI E.[1]*, GUZZETTI L.[1], OULED LARBI M.[1], GALIMBERTI A.[1], BIELLA P.[1]

[1]*Department of Biotechnologies and Biosciences, University of Milano-Bicocca, Piazza della scienza, 2, 20126, Milano, Italia*

*e-mail: emiliano.pioltelli@unimib.it

Urbanization is dramatically modifying the landscape occupied by insect pollinators through the conversion of agricultural and semi-natural areas into concrete-dominated habitats. In this context, the radical change in landscape configuration and composition imposes constrictions to the foraging activity of pollinators that could ultimately determine variations in the nutritional profile of their diet. Starting from this hypothesis, the aim of this study was to investigate the putative correlation between environmental features and the nutritional composition of pollen collected by urban foragers of bumblebees (*Bombus terrestris* Hymenoptera:Apidae). In 2020, we placed 15 commercial colonies of *B. terrestris* at 14 sites of varying green area size, spread across the city of Milan (Italy) and we periodically sampled the pollen transported by foragers returning to the colonies for a total of more than 1500 samples. For each site, several metrics that quantify the extension and fragmentation of green areas were computed using QGIS within a buffer of 1000 m around each colony. Pollen samples were analyzed for their macro-nutrient (proteins, lipids and carbohydrates) and micro-nutrient content by using different chemical analytics pipelines. The results highlighted a clear and significant impact of landscape configuration and composition on *B. terrestris* diet quality. In particular, the protein content varied in a non-linear manner in response to green patches fragmentation while lipids increased in relation to the same environmental feature. Moreover carbohydrates content decreased along with the decrease in green area coverage and the protein:lipid ratio was positively related both to the extension and connectivity of green patches. As bumblebee foraging was strongly influenced by the urban matrix, these outcomes stress the need of such studies as they can provide valuable guidelines for policy makers in regard to urban planning and design aimed at ensuring the strengthening of conservation measures for local pollinator insect populations.

Natural and anthropogenic factors affecting plant diversity in Mediterranean coastal landscapes

Sarmati S.[1,2]*, Angiolini C.[1], Acosta A.T.R.[2], Barták V.[3], Bertacchi A.[4], Bonari G.[5], Foggi B.[6], Gennai M.[6], Maccherini S.[1], Viciani D.[6], Bazzichetto M.[7]

[1]Department of Life Sciences, University of Siena, Siena (Italy),

[2]Department of Science, University of Roma Tre, Rome (Italy),

[3]Department of Applied Geoinformatics and Spatial Planning, Faculty of Environmental Sciences, Czech University of Life Science (CULS), Prague (Czech Republic),

[4]Department of Agriculture, Food and Environment, University of Pisa, Pisa (Italy),

[5]Faculty of Science and Technology, Free University of Bozen-Bolzano, Bolzano (Italy),

[6]Department of Biology, University of Florence, Florence (Italy),

[7]Centro de Investigaciones sobre Desertificación (CSIC/UV/GV), Valencia (Spain).

* e-mail: simsar691@gmail.com

A long history of human colonization has profoundly altered the functioning of Mediterranean coastal ecosystems, as well as their capacity of providing important services. The provisioning of these services depends on the integrity of the dune system, which is formed and maintained by coastal plant communities. In this context, analysing the drivers of plant diversity loss is crucial for planning management actions aimed at preserving the functioning of coastal ecosystems. Here, combining field-collected vegetation relevé (470 random plots) and remote sensing data, we analysed how landscape configuration, shoreline dynamism and human-related activities affect plant diversity along a wide Tyrrhenian coastal sector (Tuscany, Italy). Specifically, using 20 cm resolution orthophotos, we produced a land-cover map of the coastal landscape (2022 spatial polygons). From rectangular buffers (100 × 300 m) built around each plot and overlayed to the land-cover map, we derived a series of landscape variables (e.g. number, relative area and diversity of land cover classes). Also, we computed the distance between each plot and the closest bathhouse to account for the effect of tourism, as well as a proxy of coastal erosion. We then modelled plant diversity (i.e. native species richness, Shannon and Simpson indices) as a function of the remote sensing variables through linear and generalized linear regression. We found that anthropogenic classes (610 polygons) dominate the coastal landscape, followed by herbaceous dune habitats (305), and Mediterranean shrubs (295). Regression showed that plant diversity is higher in coastal sectors characterised by high habitats heterogeneity. On the contrary, plant diversity is lower in areas undergoing strong coastal erosion. Our results evidence the importance of preserving well-structured dune systems to guarantee the provisioning of coastal ecosystem services.

Supporting the conservation and management of riverscapes: the case of the LIFE Brenta 2030 project

SIMONELLI F.G. [1]*, IACOPINO S.[1], CAMPAGNARO T. [1], PICCO L.[1], ALTERIO E. [1], CARRANZA M.L.[2], SITZIA T. [1]

[1]Dipartimento Territorio e Sistemi-Agro Forestali, Università degli studi di Padova, via dell'Università, 16, 35020 Legnaro (PD), Italia

2 ENVIX Lab, Dipartimento Bioscienze e Territorio, Università degli Studi del Molise, Contrada Fonte Lappone, 86090 Pesche, Italy

* e-mail: floragiulia.simonelli@phd.unipd.it

The LIFE Brenta 2030 project aims at improving the management and biodiversity conservation of a riparian Natura 2000 site: the "Grave e zone umide della Brenta" of the Veneto Region. Actions of the project aim to define and implement good management favouring the dialogue and interaction between several public bodies operating in the area and improving the conservation status of habitats and species of community interest by reducing anthropogenic pressures and threats. The geomorphological settings and dynamics of the Brenta River have been strongly modified during the last decades. In fact, this river is located in a highly urbanized landscape of the north-eastern part of Italy. However, its riverscape is important for biodiversity as it hosts 10 habitat types and several species of community interest. Here we present a set of monitoring activities and related preliminary results on the Brenta riverscape. The approach integrates surveys on the presence and distribution of animal species (birds, amphibians and reptiles), phytosociological relevés of the habitat types of community interest, high-definition aerial survey (LiDAR) and the mapping of the current habitat type distribution. The collected data over the whole riverscape will enable to deepen our knowledge on the conservation status of habitat types and species. Furthermore, it will be possible to understand the role of different pressures and threats on habitat types, and plant and animal species within this riparian landscape.

Land consumption vs landscape services' provision: some insights for landscape planning

Valente D. [1]*, Scardia Scardia A.M. [1]; Lovello E.M. [1]; Petrosillo I. [1]

[1]Lab. of Landscape Ecology, Dept. of Biological and Environmental Sciences and Technologies University of Salento, Prov.le Lecce-Monteroni 73100 Lecce, Italia

* e-mail: donatella.valente@unisalento.it

Landscape is the place where human activities take place, causing land-use/land-cover changes with consequent land consumption with consequences on the provision of landscape services (LS). In this perspective, urban level seems the right scale where planning actions against it. In this context, the aims of this research are: (1) to carry out a systematic review focused on land consumption, ecosystem services and LULC change; (2) to assess the land consumption of the municipalities of Lecce and Galatone and its effects on natural capital flow; and (3) to discuss the urban plan towards the Land Degradation Neutrality. A spatial analysis of LULC change has been carried out from 2006 to 2019 followed by the estimation of the natural capital flow in terms of landscape services provided by both landscapes. The systematic review has combined 1,361 articles and 3,775 keywords through the Network Analysis, identifying 9 clusters useful to analyze the linkages among different but convergent ecological topics. The results have shown that from 2006 to 2019, land consumption has increased, while natural capital flow has decreased in both cities. Surprisingly, the land consumption of the municipality of Galatone is higher, more spatially distributed and with more negative effects on landscape services' provision, putting them more at risk to be lost. The management of both municipalities is still far from the land degradation neutrality, however, the inclusion of land consumption assessment as well as natural capital flow estimations into the decision-making process, can support a novel way to think about urban landscape planning. In this perspective the environmental strategic assessment can help in making urban planning adaptive by learning from the past management choices and improving the future environmental policies.

SESSIONE 3
PROSPETTIVE IN ECOLOGIA DEL PAESAGGIO

POSTERS

S3.P1 Landscape perception, spatial scales, and the wild boar-human being ecological interaction

BELLINO A.[1]*, BALDANTONI D.[1]

Dipartimento di Chimica e Biologia "Adolfo Zambelli", Università degli Studi di Salerno, via Giovanni Paolo II, 132, 84084 Fisciano (SA), Italia

* e-mail: abellino@unisa.it

Perception generates eco-fields by associating organismic functions with specific environmental features, thus translating a neutral matrix of features into a cognitive landscape regulating the interactions between organisms and environment. The change of cognitive landscape across spatial scales, due to the scale-dependence of both eco-fields and neutral landscape patterns, implies that different features may concurrently control organism-environment interactions at different scales. The present research embraces this perspective in evaluating how landscape features at increasing spatial scales shape the occurrence of negative interactions between wild-boars and human beings. The problem was tackled through species distribution modelling, evaluating the importance of landscape features across spatial scales. To this end, data on wild-boar damages in the Campania region (Southern Italy) during 2020-2021 were modeled using metrics of diversity/complexity, shape, area/edge and fragmentation. Metrics were calculated within circular buffers of 50, 100, 200, 400, 800, 1600 and 3200 m from a 10 m resolution categorical raster obtained from the 3rd level of the Nature Map. Several tree-based algorithms, scoring the highest consistency in performances across scales over multiple independent runs with randomly selected pseudo-absences, were adopted to evaluate the importance of predictors. Clear importance profile, consistent among algorithms, were observed, with mostly unimodal variations across spatial scales. Moving from local to larger scales, patch richness becomes critical in predicting wild-boar damages, especially at middle scales, whereas fragmentation (mesh size) is relevant mostly at local scale and landscape complexity (relative mutual information, joint entropy) increases its relevance at larger scales. Overall, findings provide novel insights into how wild boars perceive landscape patterns and how such cognitive landscape can affect their interaction with human beings.

S3.P2 Managing trees with conservative arboriculture to sustain biodiversity in fragmented landscapes

CANEDOLI C.[1]*, CARDARELLI E.[1], CORENGIA M.[2], PADOA-SCHIOPPA E.[1], CORENGIA D.[3,4]

[1] Dipartimento di Scienze dell'Ambiente e della Terra, Università Degli Studi Milano Bicocca
[2] Facoltà di Comunicazione, Cultura e Società, Università della Svizzera Italiana
[3] socio Società Italiana di Arboricoltura
[4] Associazione Arboricoltori

* e-mail: claudia.canedoli@unimib.it

Trees are fundamental elements of the landscape because they contribute to the biophysical structure and to the maintenance of landscape functional connectivity. In particular, old trees are central to sustaining biodiversity, because they are rich in the so-called 'Tree related Microhabitats' (TreMs). TreMs are distinct structures that constitute particular and essential life sites for species. Despite their importance, they are very scarce in cities because of management practices that deplete and simplify trees' architecture and structure and thus threaten biodiversity. The current trend is to remove old and replace them with young specimens, unable in the short and medium-term to replace the ecological role of the removed trees. By linking ecological knowledge and management practices, we aim to propose a novel concept of modern arboriculture, a 'conservative arboriculture', which objective is to reconcile human needs with the conservation of biodiversity in fragmented landscapes. We present an examination about which are the current criteria that determine trees' management choices, the relationships between these factors and biodiversity, and how the current practices are affecting the provision of habitat for species. Our results show that three are the main foundation criteria of modern arboriculture: safety for people and artifacts, ornamental beauty, plant health. All these factors decreased when trees reach the more mature stages, which is the phenological phase where biodiversity associated with trees starts to increase. These contrasting trends generate a conflict between human intervention and biodiversity conservation. We discuss how this conflict can be overcome by highlighting which are the paradigms and practices that need to be rethought: the difference between objective safety and perceived safety, the cultural concept of 'beauty' associated with trees, and management practices. We finally present examples of these practices such as maintenance of deadwood in the crown, simulation of natural breakages, or creation of TreMs.

S3.P3 Ecosystem services and multifunctional landscapes: the case of the Gran Paradiso National Park

PADOA-SCHIOPPA E.[1]*, ROTA N.[1], CANEDOLI C. [1]

[1]Dipartimento di Scienze dell'Ambiente e della Terra – Università degli Studi di Milano-Bicocca

* e-mail: emilio.padoaschioppa@unimib.it

In land management policies, the importance of the concept of ecosystem services and natural capital has become evident. In our study on the Gran Paradiso National Park, we developed a field data collection campaign aimed at defining the carbon stored in the soil and vegetation. The results obtained, were compared with those of national inventory of carbon stored in forests, and significant differences emerged (up to 40 C t/ha). Differences vary based on carbon pool: OC stock in organic layers is higher in our data compared to inventory data in particular for the Piedmont area, while OC stock in mineral layers is lower in our data; Lower differences have been found for epigeal biomass, probably because of the use of allometric equations that are similar. The differences bend with the different scales and resolutions at which the national inventory data are taken compared to the detailed field work carried out by us. But if the financing of protected areas really goes through the evaluation of the provision of ecosystem services (see the National Strategy for Biodiversity or the law 221/2015), a more precise analysis becomes indispensable. Furthermore, from a management perspective, it is essential to consider ecosystem services in their full complexity: focusing on a single aspect may unbalance analysis and produce misleading assessments. For example, the parameter of carbon stored in vegetation attribute great importance to forests, in which, the carbon stored in the aboveground vegetation is higher than in other habitats. Analyses and studies on the pyramids of biomass in the Gran Paradiso Park, however, have highlighted the importance of high-altitude herbaceous habitats, which support (habitat provisioning service) insect populations (many of them have a conservation value). Only an integrated study that considers the multiple functions of the landscape allows management choices to be correctly assessed and directed.

S3.P4 A starting point for the study of IAPs in coastal ecosystems using remote sensing

Villalobos Perna P.[1]*, Di Febbraro M.[1], Carranza M.L.[1], Marzialetti F.[2,1], Innangi M.[1]

[1] Dipartimento di Bioscienze e Territorio, Università degli Studi del Molise, Contrada Fonte Lappone, s.n.c., 86090 Pesche (IS), Italia

[2] Dipartimento di Ingegneria Industriale e dell'Informazione, Università di Pavia, Via A. Ferrata, 5, 27100 Pavia, Italia

* e-mail: p.villalobosperna@studenti.unimol.it

Coastal environments are among the most endangered ecosystems worldwide, and invasive alien plant species (IAPs) are one of the main threats to these habitats, requiring effective tools for early detection and mapping. Remote sensing (RS) has become one of the most efficient methods to deal with biological invasions. Nevertheless, there is a lack of an overview of the progress and extent of RS applications in monitoring IAPs in coastal ecosystems. This review is especially needed to support the development of more operational RS frameworks that can enhance the management of coastal IAPs invasions. Here, we conducted a systematic literature review of 86 research publications that implemented, recommended or discussed RS tools for IAPs management in coastal environments from 2000 to 2021. Our research evidenced that most of the research have been carried out in China and USA, with *Sporobolus* (17.3%) being one of the better studied genera. Although the number of studies increased between 2000 and 2021, this rise was more pronounced from 2015, and while most of them have primarily focused on the detection of IAPs, interest in modeling has increased at this time. The most used instruments at the beginning of the analyzed period were aircraft, but satellites have increased since 2005, while the use of UAVs has taken importance around 2014. While frequentist inference was the most adopted classification approach in the first years, machine learning has shown a significant increase after 2009. Our results evidenced certain preferences when considering some aspects of RS in relation to the type of coastal ecosystem under study, and underlined the great possibilities offered by RS data to further improve IAPs monitoring. We offer a reference point of the available literature useful to support the establishment of appropriate frameworks for dealing with IAPs through RS in coastal ecosystems

SESSIONE 4
STRESS MULTIPLI SUGLI ECOSISTEMI ACQUATICI E TERRESTRI: METODI DIAGNOSTICI E MECCANISMI ADATTATIVI

I cambiamenti ambientali causati dagli esseri umani possono indurre, sugli ecosistemi, stress singoli o multipli a diversi livelli di organizzazione, a diverse scale spaziali e/o temporali. Questi possono determinare risposte adattative e non adattative nella componente biotica degli ecosistemi. Nella sessione invitiamo a presentare contributi che riguardino metodi di indagine, approcci modellistici, esperimenti di laboratorio e di campo per fare il punto sulla presenza e sul ruolo di stressor e disturbi ambientali (dai classici contaminanti ambientali ad altri fattori di stress/disturbo chimici, fisici e biologici) nell'alterazione della struttura e del funzionamento degli ecosistemi acquatici e terrestri.

Chairs:

Antonio Finizio, Antonio di Guardo, Flora Angela Rutignano, Edoardo Calizza, Ilaria Caliani

INVITED SPEAKER

Maisto G.

Dipartimento di Biologia, Università di Napoli Federico II, Napoli, Italia

Methods of investigation for assessing the effects of environmental changes on ecosystems

In recent decades, human activity has caused deep changes in environmental quality, altering the structure and the functionality of terrestrial and aquatic ecosystems. The various stressors can act individually or in combination, determining responses at different levels of the hierarchical organization (individual, population, community) on both spatial and temporal scales. Hence the need to investigate the effects and the responses of environmental changes on the biotic component of ecosystems. Methods of investigation are numerous and of various types. For example, laboratory experiments allow the assessment of the effects of single and multiple stressors (chemical, physical and biological) on the study model, under controlled conditions; semi-field or field experiments allow the assessment of the integrated effects of multiple stressors on the biotic component of the ecosystem; modelling approaches, using data obtained from laboratory and field experiments, allow the extension of knowledge at different spatial and temporal scales, making increasingly reliable short- and long-term predictions of the possible scenarios of ecosystem changes in different spatial areas. The obtained data by each method of investigation ant their integration contribute significantly to increase the current knowledge about the response of the biotic component of the ecosystem to environmental changes. This is fundamental in order to implement management policies aiming to preserve ecosystems with high level of naturalness and to improve the degraded ones.

SESSIONE 4
STRESS MULTIPLI SUGLI ECOSISTEMI ACQUATICI E TERRESTRI: METODI DIAGNOSTICI E MECCANISMI ADATTATIVI

COMUNICAZIONI ORALI

Mercury and cadmium in Greenland shark tissues:

effects of feeding habit, depth distribution, sex, size, and age

ANCORA S.[1]*, BIANCHI N. [1], MARIOTTI G. [1], LEONZIO C.[1], BARONI D. [1], CORSOLINI S.[1]

[1]*Department of Physical Sciences, Earth and Environment, University of Siena, Via Mattioli, 4, 53100 Siena, Italy.*

e-mail: stefania.ancora@unisi.it

The Greenland shark, *Somniosus microcephalus* (Bloch & Schneider, 1801), is an extremely long-lived and large predator species, inhabiting the Arctic Ocean and North Atlantic. Still poorly known for its biology and ecology, this species is deemed a sentinel from an ecotoxicological standpoint. The present study aims to provide data on mercury (Hg) and cadmium (Cd) in muscle and liver, to examine for evidence of relationships with size and to asses any differences between sexes. Results are interpreted considering available literature information on the feeding habit and the depth distribution. Specimens (34 females and 11 males) were caught in south-eastern and south-western waters of Greenland between 2012 and 2014, under the auspices of the 'Old & Cold—Greenland shark project' (http://bioold.science.ku.dk/jfsteffensen/OldAndCold/). Analytical determinations were performed using atomic absorption spectrometry and results are expressed as mg/kg on dry weight basis. Mercury levels in muscle and liver ranged respectively 0.691–5.331 and 0.068–2.816. Levels of Cd were lower in muscle (0.003-0.147) than liver (0.558-21.083). A progressive accumulation of Hg in muscle and liver as function of size was found. In liver Cd concentrations showed negative relationship with size. Likely, this can be explained by considering the shark's diet of young specimens based, almost exclusively, on mollusks, known as vector of Cd through marine food webs, and the shark's depth distribution of large female specimens, mainly captured at depths >1000 m. Differences between sexes were not statistically significant, even though male specimens were smaller than females. Furthermore, since some of the specimens (n = 11) had been included in a previous dating study with radioactive carbon (^{14}C), and their age was estimated (up to 272 years for specimens reaching up to 500 cm in length), some considerations are given on the levels of Hg and Cd in relation to age as well as size.

A meal of microplastics and ferrihydrite: does the co-occurrence influence the uptake and elimination rate in *Lumbriculus variegatus*?

BELLASI A.[1]*, THOMAS ARRIGO L.K. [2], BETTINETTI R.[3], MITRANO D.[2]

[1] *Department of Science and High Technology, University of Insubria, Via Valleggio 11 – 22100 – Como, Italy*
[2] *Environmental Systems Science Department, ETH Zurich, 8092, Zurich, Switzerland*
[3] *Department of Human and Innovation for the Territory, University of Insubria, Via Valleggio 11 – 22100 – Como, Italy*

*e-mail: abellasi@uninsubria.it

Water ecosystems are known to be strongly impacted by microplastics (MPs), and in this context, sediments represent a key environmental compartment by acting as a sink for a wide variety of contaminants, including MPs and heavy metals. Moreover, benthic invertebrates that spend a significant fraction of their lifespan living in sediments contribute up to 90% of fish prey biomass. Consequently, bioaccumulation of MPs and associated heavy metals in sediments can enhance contaminant biomagnification and, therefore, investigate the ingestion, elimination, and retention rates of anthropogenic particles - such as MPs and geogenic colloids as iron oxides - for benthic species is necessary to globally understand how multiple stressors can influence organism health and function. We hypothesize that MPs ingestion could be influenced by the co-occurrence of heavy metals sorbed to the MPs surface, leading to differences in bioavailability for both MPs and metals when organisms are co-exposed to both materials in the sediment. At this purpose, this study aims to evaluate the uptake and retention rates of MPs and ferrihydrite by *Lumbriculus variegatus* by using metal-doped plastic particles. Four exposure conditions were set including: 1) MPs alone, 2) ferrihydrite alone, 3) co-exposure of MPs and ferrihydrite and 4) control (no particle addition). Spiked additions of MPs and ferrihydrite were added to acid washed sand, and metal contents in worms, soil and the overlying water were analyzed by inductively coupled plasma mass spectrometry (ICP-MS). 20 worms were exposed to each of the conditions and after a 10 day exposure period 10 were sacrificed for understand uptake while the remaining 10 were depurated to assess particle elimination. Collectively, this experiments tells us that the ingestion of MPs by worms is principally related to MPs and the co-occurrence of MPs and ferrihydrite didn't influence the amount of ingested particles. During this 10-days exposure tests no negative effects were observed on reproduction and surviving, however a chronic test is needed in the future to understand if the co-occurrence of plastics and heavy metal can negative affect worms' life.

Ecologically based methods for promoting safer nanosilver

for environmental applications

Bellingeri A.[1,4] *, Scattoni M.[1], Bono N.[2], Candiani G.[2], Protano G.[1], Faleri C.[3], Battocchio C.[4], Venditti I.[4], Corsi I.[1]

[1] Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente, Università degli Studi di Siena, Via P.A. Mattioli, 4, 53100, Siena, Italia

[2] Dipartimento di Chimica, Materiali e Ingegneria Chimica "Giulio Natta", Politecnico di Milano, via Mancinelli, 7, 20131, Milano, Italia

[3] Dipartimento di Scienze della Vita, Università degli Studi di Siena, Via Aldo Moro, 2, 53100, Siena, Italia

[4] Dipartimento di Scienze, Università degli Studi Roma Tre, Via della Vasca Navale, 79, 00146, Roma, Italia

* e-mail: arianna.bellingeri@uniroma3.it

Silver nanoparticles (AgNPs) are promising tools for a wide variety of applications, from biocides in consumer products to sensor and adsorbents for water remediation. Since their occurrence in natural waters is a cause of concern for the environment, their synthesis and application should rely on a more ecological exposure testing strategy. This study aimed at establishing the environmental safety of AgNPs coated with citrate and L-cysteine (AgNPcitLcys) synthetized for water remediation, while also investigating the ecological implications of AgNP long-term exposure of aquatic microorganisms. Microalgae (Raphidocelis subcapitata, Phaeodactylum tricornutum) and microcrustaceans (Ceriodaphnia dubia, Artemia franciscana), from freshwater and marine environment, were exposed to AgNPcitLcys (1µg/L–100mg/L) in acute (48–72h) and chronic (7–14d) scenarios. As focus on the role of the coating in AgNPcitLcys behaviour, their acute toxicity (24–72h) towards microalgae (Raphidocelis subcapitata, Phaeodactylum tricornutum) and bacteria (Escherichia coli) was compared with a differently coated (3-mercapto-propansulfonate) kind of AgNPs (AgNP3MPS). Both AgNPs were investigated for their properties and behaviour in exposure media by Dynamic Light Scattering and Transmission Electron Microscopy, and for Ag ion release, by Inductively-coupled Plasma Mass Spectrometry. AgNP behaviour and ion release resulted to be strongly influenced by medium chemistry, with salinity acting as the main trigger for the enhanced dissolution observed in seawater-based media. Toxicity of AgNPcitLcys resulted low towards all tested microorganisms. However, the chronic exposure revealed effects in the long-term and suggested a toxicity linked to the nano-size rather than to the amount of dissolved Ag. Effect comparison of AgNPcitLcys and AgNP3MPS confirmed the former to be mainly influenced by the nano-size while showed a dissolution-based toxicity for AgNP3MPS. Our findings support the hypothesis of an additional nano-related effect linked to AgNP toxicity and showed how this is affected by the coating type, while also showing that longer exposure times are necessary to unravel AgNP ecotoxic effects.

Coupling habitat specific temperature forecasts with tolerance landscape for two species of commercial bivalves to predict the impacts of climate change

BERTOLINI C. [1]*,GLASER D.[1], CANU D.[2], PASTRES R.[1]

[1]Dipartimento di Scienze Ambientali, Informatica e Statistica, Università Ca' Foscari di Venezia, via Torino 155, 30170 Venezia, Italia

[2] Istituto Nazionale di Oceanografia e di Geofisca Sperimentale (OGS), 34010 Trieste, Italia

* e-mail: Camilla.bertolini@unive.it

With ongoing climate change, heatwaves are predicted to increase in frequency, intensity, and duration. The thermal tolerance of organisms is also dictated by a combination of these factors: tolerance curves of bivalves are characterized by a wide range of CTmax (the intercept) and z (the slope), of tolerance landscape curves. Bivalves inhabit different dimensions of the marine environment, and their cultivation can take place all the way in the water column down into the sediment, depending on species ecological niche. The aim of this work was to use a tolerance landscape approach for two different bivalve species, *Mytilus galloprovincialis* and *Ruditapes philippinarum*,coupled with temperature scenarios for water and sediment at sites characterized by different granulometry, to estimate survival towarming in the 2030-2100 decades. Temperature tolerance curves were built based on literature data, whereas water temperature scenarios were based on an additive time series model. Trends and annual seasonality were estimated from a deterministic model forced, with RCP 8.5 emission scenario. Daily oscillations twere estimated based on the statistical analysis of in situ data of water and sediment temperatures *M. galloprovincialis*, an epibenthic species, had higher tolerance values compared to *R. philippinarum*, an endobenthic species. The tolerance landscape models, however, predicted a sudden increase in the mortality risk for both species starting from 2070 . Some differences could be seen between the risk scenarios using water temperature forecast computed with the trend of monthly means versus the one using the full scenario that included seasonal patterns. This shows the importance of micro habitat modulation and it points to the need of using habitat specific forecasts for estimating the consequences of heat waves on bivalve survival.

Intraspecific niche partitioning in a key herbivore species (*Branta leucopsis*): implications for nutrient cycling and vegetation control in the high-Arctic tundra

CALIZZA E.[1]*, CAREDDU G.[1], SPORTA CAPUTI S.[1], MACCAPAN D.[1], VENTURA M.[1], GUBINELLI F.[1], ROSSI L.[1], COSTANTINI M.L.[1]

[1] *Department of Environmental Biology, Sapienza University of Rome, Via dei Sardi 70, 00185 Rome, Italy*

* e-mail: edoardo.calizza@uniroma1.it

High-Arctic freshwater ecosystems are important carbon sinks. Here, ecological processes are regulated by relatively few species, being thus vulnerable to changes in resource-consumer interactions expected as a consequence of climate change. In Svalbard, the Barnacle goose *Branta leucopsis* plays a key role in regulating nutrient cycling and vegetation, affecting the amount of carbon and nitrogen accumulated in soil and sediment. This species is experiencing a strong demographic and range expansion. In this study, by combining elemental and stable isotope analyses in droppings from adults and goslings, we aimed at elucidating (i) mechanisms of intraspecific niche partitioning that allow Barnacle geese to thrive under conditions of limited resources, and (ii) the effects of individual dietary differences on nitrogen inputs and vegetation control by geese in shallow Arctic lake ecosystems. Overall, grass consumption was directly related to its productivity at the beginning of summer. Data revealed a strong niche partitioning between adults and goslings. Goslings were highly specialised on grass (a high-quality food), while adults had much broader diets including mosses and aquatic vegetation. In turn, dietary differences determined differences in the nitrogen content between droppings from adults (6.3±0.1 mg/g) and goslings (32.8±0.2 mg/g). Results suggest a tight link between individual feeding choices and the role of specimens on nitrogen cycle and vegetation control in the high-Arctic tundra, and highlight a link between the terrestrial and aquatic compartments of the food web that has not been noticed before. This may represent an important mechanism underlying the success of Barnacle geese at high latitudes. Given the increasing primary productivity and the ongoing range expansion of geese across the Arctic, our results help predict ecological effects of this species in newly colonized areas, and improve our mechanistic understanding of the structure and functioning of high-Arctic ecosystems affected by climate change.

Assessment of the health status of the Elsa River (Tuscany) through a holistic approach; from the bioindicators to the ecosystem as a whole

Campani T.[1]*, Leonzio C.[1], Giani D.[1], Ancora S.[1], Fiaschi T.[3], Centorrino P.[2], Marsili L.[1], Fossi M.C.[1], Angiolini C.[3], Casini S.[1], Calattini I.[1,2]

[1]Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente, Università di Siena, via Pier Andrea Mattioli, 4, 53100 Siena, Italia

[2] Associazione LaGorà, Vai Garibaldi 82/84 53034Colle val d'Elsa (Siena), Italia

[3]Dipartimento di Scienze della Vita, Università di Siena, Via Pier Andrea Mattioli, 4, 53100 Siena Italia

* e-mail: campani@unisi.it

The Elsa river is a tributary of the Arno river, in Tuscany. It is an ecosystem highly stressed with many contamination inputs, along its shores. The area is characterized by agricultural and industrial activities in a wider urban context. To evaluate the health status of the river, we proposed an integrated methodology that takes into account chemical ecological and ecotoxicological parameters. Data collection of water concentrations of nitrates, phosphates, ammonium and pH, was allowed thanks to a citizen science project of "Fresh Water Watch", carried on by the population and high schools of the area. For the chemical and ecotoxicological analyses, the freshwater fish Italian chubs (*Squalius squalus*) were used as bioindicators. On the bioindicator, we evaluated the microplastics ingestion, heavy metals and OCs concentration and the biomarkers AChE, EROD, PAHs metabolites, LPO, GST, LDH, IDH and ENA Assay. The results showed a general negative trend going from upstream to downstream, mainly in the stretch that passes through the town of Colle Val d' Elsa and Poggibonsi, with many sources of macronutrients and contaminants. The biomarkers analysis revealed genotoxic effects, significantly correlated to the presence of Hg, PCBs and B(a)P metabolite in bile. Their presence is probably due to agricultural and industrial activities, vehicular traffic and inappropriate disposal of waste. The greatest abundance of microplastics was found in chubs (2,5 items/individual) caught in Colle di Val d'Elsa, due to the presence of the urban area, the regular release of waste along the river in the past, and the increase of tourism in the last years. Thanks to this integrated approach it was possible to understand the health status of the Elsa river, identify the contaminant's presence and hypothesize the source and permit to identify mitigation actions to block the sources and bring the whole river to a good ecological state.

Irrigation dams alter biogeochemical cycles in intermittent streams of Apennines

CAVALLINI E.[1]*, LONGHI D.[1], VIAROLI P.[2], NIZZOLI D.[3]

1 Department of Chemistry, Life Sciences and Environmental Sustainability, University of Parma, Viale delle Scienze, 11/A, 43124 Parma, Italy

2 Department of Chemistry, Life Sciences and Environmental Sustainability, University of Parma, Viale delle Scienze, 11/A, 43124 Parma, Italy,

3 Department of Chemistry, Life Sciences and Environmental Sustainability, University of Parma, Viale delle Scienze, 11/A, 43124 Parma, Italy

*e-mail: edoardo.cavallini@unipr.it

Dammed streams have a central role to ensure irrigation and drinking water in catchments characterized by summer water scarcity. However, while dams allow water availability during the dry season, they also cause stream discontinuity, modify transport of essentials nutrients and alter magnitude and stoichiometry of nutrient loads. The net effect can depend on season and dam management, which is also a function of catchment hydrology, precipitation patterns and water residence time. This study aims to examine the coupling of Si, N, and P cycling, together with their stoichiometry in two dammed streams located in the Mediterranean area (Apennine side of the Po river watershed, Northern Italy) during a particularly dry year. Water samplings were conducted in each stream at the beginning and at the end of three reaches: two free flowing reaches located upstream and downstream the artificial lake and the third containing the dam. Changes in dissolved and particulate concentrations of Si, N, and P and their mass budgets were calculated by quantifying loads in each of the reaches over a period of 12 months during both base flow and high flow events. The two artificial lakes, managed as irrigation reservoirs, alter river flow along with nutrients loads and stoichiometry. Filling and draining of lakes determine an anti-seasonal flow rate, with a higher flow in summer to supply irrigation demand and lower flow in winter to storage, and alternatively change dam behaviour as trap or source of nutrients.

Accumulation of small microplastics (<100 μm) and additives in the freshwater bivalves *Anodonta cygnea*

CESARINI G.[1]*, CORAMI F.[2,3], ROSSO B.[3], SCALICI M.[1]

[1] *Department of Science, University Roma Tre, viale G. Marconi 446, 00146 Roma, Itlay*

[2] *Institute of Polar Sciences, CNR-ISP, Campus Scientifico – Ca' Foscari University of Venice, Via Torino, 155, 30172 Venezia-Mestre, Italy*

[3] *Department of Environmental Sciences, Informatics and Statistics, Ca' Foscari University of Venice, Via Torino, 155, 30172 Venezia-Mestre, Italy*

*e-mail:giulia.cesarini@uniroma3.it

Plastics are to date considered one of the main detrimental drivers for the health of aquatic ecosystems. In particular, freshwaters are very threatened and impacted by microplastics (<5 mm), despite being less studied than marine environments. To fill this knowledge gap, bivalves could be employed to investigate plastic pollution as they are filter feeders. Bivalves can uptake microplastics (generally < 100 μm, small microplastics, SMPs) that can be transferred to the gastrointestinal tract (GIT) and accumulated in their body. To evaluate the accumulation of SMPs, fifteen specimens of the freshwater bivalve, *Anodonta c*ygnea Linnaeus, 1758, commercially bought were exposed in three rivers of the Lazio Region (Italy): Marta River, Aniene River, Sacco River. Two different times of environmental exposure were investigated, short term (one month) and long term (three months). After the environmental exposure, the gills and the GITs were removed and analyzed separately to evaluate the possible uptake and ingestion of SMPs. After chemical digestion, the slurred samples were filtered and the analysis for the quantification and simultaneous polymer identification were performed via Micro-FTIR. The polymers most found were nylon, widely used in clothing, fishing and agriculture fabrics, and polyarylamide, used in the automotive industry, electronics, and water treatment. Several plastic additives were found, the most common were thanediamide, a stabiliser and titanium dioxide, a colourant. In the gills, the amount of SMPs and additives decreased over time, so gills act as a zone of interchange between medium and organism, while in GIT the total amount of SMPs and additives accumulates over time. These results highlighted plastic pollution by SMPs using freshwater bivalves as sentinel organisms and the need to further investigate the additives that can be tracers of the presence of microplastics in the environment and biota.

Chemistry-driven distribution in the Enchytraeidae explains their role as ecosystem engineers

CONTI E. [1]*, MULDER C.[1]

[1]*Dipartimento di Scienze Biologiche, Geologiche ed Ambientali, Università di Catania, via Androne, 81, 95124 Catania, Italia*

* e-mail: econti@unict.it

Soil is one of the most articulate and complicate ecosystems and its entire fauna actively contributes to promote the rapid turnover of soil organic matter. Soil invertebrates are structured into complex interacting networks, functionally responding to disturbance or environmental changes, with all resulting ecological processes and ecosystem services. Within invertebrates, enchytraeids are by far the most likely taxon to play a key functional role in ecosystem services, as they were ranked as the most important soil invertebrates in 16 ecosystem services, and one of the most important agents for regulating and supporting services like decomposition and nutrient cycling. Enchytraeids are in fact active members in detrital soil food webs, are considered as ecosystem engineers of the organic layers and last but not least are the only group present in both green and brown pathways. Nevertless, few data on enchytraeids are at our disposal to assess their functional responses to heavy metals. For this purpose, we investigated and evaluated the effects of these elements on the occurrence and biomass of enchytraeids in 297 different soils (specifically sandy soils, river clay and sea clay) under different environmental stress. Our results pointed out that the biomass of the most widespread enchytraeid species is highly correlated with Cr, Cu and Zn in sandy soils (all 2-tails significance values share $p < 0.005$) but is correlated with Cu and Hg in clay-rich soils ($p < 0.05$), whilst the biomass of the remaining species is highly correlated with either Cd, Cu and Pb in sandy soils ($p < 0.025$) or Hg and Pb in clay-rich soils ($p < 0.05$). Given that clay-rich soils retain a much higher amount of heavy metals in contrast to sandy soils, most enchytraeids share different values as bioindicators according to the soil type, even comparing river clay with sea clay.

Current knowledge and future challenges in the ecological risk assessment of engineered nanomaterials in a changing environment

Corsi I.[1]*

[1]*Dipartimento di Science Fisiche, della Terra e dell'Ambiente, Università di Siena, via Mattioli, 4, 53100 Siena, Italia*

* e-mail: ilaria.corsi@unisi.it

The increased production of engineered nanomaterials and nanoparticles (ENM/Ps) (1-100 nm) and their integration in everyday life applications impose a pressing need to shed light on environmental health consequences. ENM/Ps are currently unmonitored and unregulated, thus categorized as contaminants of emerging concerns (CECs) potentially accumulating in the natural environment and causing adverse effects to population and communities. Being manufactured worldwide in huge quantities and employed in a wide range of applications including several popular consumer products (e.g. sunscreens, paints, disinfectants), they end up into water bodies and reach marine coastal areas through industrial activities and uncontrolled anthropogenic processes. Although the risks posed by ENM/P to natural ecosystems have been investigated in the last 20 years, the marine environment as potential final sink as for other anthropogenic pollutants have been scarcely investigated. Sources, main pathways, transformation and toxicity under varying environmental conditions and the resulting risks to marine communities are yet unclear. Harmful effects on marine species have mostly been reported in bench-scale studies and single model species, but these investigations lack the complexity of natural settings and the intricate interplay between the different environmental compartments (abiotic and biotic) and physiological sensitiveness/acclimation of natural communities. Marine coastal regions, for instance, are more vulnerable to multiple stressors as large influxes of pollutants from terrestrial ecosystems and those associated with climate changes (i.e., warming and acidification) and their combination on ecosystems and biodiversity is largely unknown. Based on more than 10 years of research on this subject, here we address current knowledge on ecological risks associated with the release of ENM/Ps in the marine environment and the challenges associated with predictions on cascade effects on communities and whole ecosystems including identification of those at higher risks in terms of loss of biodiversity and functions.

Sub-individual and individual effects induced by polystyrene nanoparticles in *Daphia magna*

DE FELICE B.[1]*, CASATI L.[2], SUGNI M.[1], PAROLINI M.[1]

[1] *University of Milan, Department of Environmental Science and Policy, Via Celoria 26, I-20133 Milano, Italy*
[2] *University of Milan, Department of Health Science, Via di Rudinì, 8, Milano, Italy*

* e-mail: beatrice.defelice@unimi.it

Nanoplastics (NPs) are plastics particles < 0.1 μm in size that can cross cell membranes and threat the health status of organisms. Although some preliminary studies have detected the presence of NPs in oceans and freshwaters, the information of their hazard for organism is still limited. The aim of this study was to investigate the potential effects induced by a 21-days exposure to two different concentrations (0.05 and 0.5 μg/mL) of polystyrene NPs (PS-NPs) on the freshwater cladoceran *Daphnia magna*. A multi-level approach to assess the PS-NPs effects at sub-individual (i.e., molecular and biochemical) and individual (i.e., behavioral) levels was applied. At molecular level, the modulation of the expression of different genes involved in the response to oxidative stress (*cat* and *sod*), defense mechanism (*hsp70*), physiological and behavioral pathways (*flot, SERCA and JHE*) was assessed. The onset of oxidative stress, in terms of changes in the activity of antioxidant enzymes and lipid peroxidation levels, and alterations in energy reserves were investigated to assess the effects at biochemical level. The effects at individual level were assessed as changes in the swimming activity (i.e., distance moved and swimming speed). Our results showed that the exposure to PS-NPs induced a slight modulation of gene involved in oxidative stress response, although treated individuals did not suffer an oxidative stress condition. Significant changes in energy reserves of individuals exposed for 21 days to both the PS-NPs concentrations were observed, but no alterations of swimming activity occurred. Our results suggest that the exposure to low concentrations of PS-NPs might represent a low risk for cladocerans, at least under the experimental conditions we relied on, confirming the importance of a multi-level approach to assess the risks of NPs on aquatic organisms.

Investigating the adaptive mechanisms to ocean acidification in different invertebrates from the CO₂ vent systems of Ischia (Italy)

Della Torre C.[1]*, Signorini S.G.[1], Chiarore A.[2], Cannavacciuolo A.[2], Nannini M.[2], Federico L.[1], Magni S.[1], Binelli A.[1], Gambi M.C.[3], Munari M.[2]

[1] Department of Biosciences, University of Milan, Milan, Italy

[2] Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, Ischia Marine Centre, Ischia (Naples), Italy.

[3] National Institute of Oceanography and Applied Geophysics, OGS, Trieste, Italy.

*e-mail: camilla.dellatorre@unimi.it

Ocean acidification (OA) is reported to have several detrimental effects across many taxa based on laboratory studies. Besides, pioneering studies carried out in CO₂ vent systems showed that some species are able to counteract the effects of OA through a range of adaptive processes including acclimatisation and genetic adaptation. However, the molecular and cellular mechanisms that promote tolerance to OA are still poorly investigated. Therefore, we focused on different invertebrate species living in the CO₂ vent of the Castello Aragonese of Ischia Island such as: the polychaetes *Platynereis* spp. and *Syllis prolifera* known to be adapted to OA, and the calcifying mollusks *Mytilus galloprovincialis*, and *Patella* spp. to improve understanding of life under OA pressure. The overarching objectives were to 1) identify potential pathways underlying the adaptive response to OA 2) achieve a broader picture of the metabolic changes occurring in organisms under OA conditions through metabolomics analysis 3) evaluate if organisms able to cope with acidified conditions have also an enhanced resistance against chemical contamination or whether the occurrence of this further challenge will impact more heavily their health. Overall results showed a limited influence of OA on the functionality of the antioxidant system. Conversely, organisms living in the CO₂ vent boost a higher energy consumption, to maintain homeostatic conditions. Finally, the adaptation to OA might compromise the ability of the organisms to respond to pollution. Our study confirmed the importance of CO₂ vent systems as natural analogues to study OA, since they provide realistic information on the impacts of this phenomenon, helping to broaden the current knowledge on the capability of organisms to face multiple challenges occurring in the future oceans of the Anthropocene.

Evaluation of honey bee colonies ecotoxicological health status using a multi-tier approach, based on biomarkers, proteomic analysis and quality and origin of bees' products

Di Noi A.[1]*, Casini S.[2], Caliani I.[2], Campani T.[2], Del Casino C.[1], Romi M.[1], Cai G.[1]

[1] Department of Life Sciences, University of Siena, via Mattioli, 4 53100 Siena, Italy
[2] Department of Physical, Earth and Environmental Sciences, University of Siena, via Mattioli, 4 53100 Siena, Italy

e-mail: agata.dinoi@student.unisi.it

Pollinating insects play an extremely important role both in agriculture and in the conservation of biodiversity. Among pollinators, *Apis mellifera* L. (1958) is the most known and widespread species and the most valuable for its pollination service and for honey production. One of the main causes of the decline of bee populations in the last decades is the massive use of pesticides; honeybees are exposed particularly to insecticides, herbicides and fungicides. The aim of this work was to evaluate the health status of honey bee colonies, using a multi-tier methodology based on biomarker responses, proteomic analysis and quality and origin of bees' products. This work was divided in different phases: (1) a laboratory study in which *A. mellifera* specimens were exposed to two environmentally realistic doses of the commercial fungicides Sakura®, of the commercial herbicide 2FD, and to their mix; this was followed by analysis of their effects using neurotoxicity (AChE and CaE), metabolic (GST and ALP), immune system (lysozyme and differential haemocyte count) and genotoxicity (NA assay) biomarkers and proteomic analysis. (2) A 2-years monitoring study for the evaluation of the ecotoxicological status of bees sampled in nine sites in Tuscany characterized by different contamination patterns; in this step we applied the same set of biomarkers and analysed pesticides residues. (3) The characterization of chemical-physical properties, of the melissopalinological profile and of pesticide residues of honeys. The selected pesticides proved to affect mostly the metabolic processes and to modify the presence and abundance of different proteins in the honey bees; the monitoring study highlighted that the bees sampled in the cultivated areas are more exposed to chemical stressors with respect to a wood or an orchard environment; results on quality and origin of bees' products were compared to sublethal responses, thereby investigating possible interlinkages.

Aquatic ecotoxicity assessment of new peroxide-based biocides

Elia A.C.[1]*, Magara G.[1], Pastorino P.[2], Anselmi S.[3], Federici E.[1], Provenza F.[3], Prearo M.[2], Broccoli A.[3], Renzi M.[3]

[1] Department of Chemistry, Biology and Biotechnology, University of Perugia, via Elce di Sotto, 8, 06123 Perugia, Italy;
[2]The Veterinary Medical Research Institute for Piemonte, Liguria and Valle d'Aosta, via Bologna 148, 10154 Torino, Italy;
[3]Department of Life Sciences, University of Trieste, via L. Giorgieri, 10, 34127 Trieste, Italy

*e-mail: antonia.elia@unipg.it

The aquatic ecotoxicity of two new hydrogen peroxide-based biocides (compound A and compound B) was assessed for the first time. A battery of ecotoxicity assays using species belonging to different levels of biological and ecological complexity (*Aliivibrio fischeri*, *Raphidocelis subcapitata* and *Daphnia magna*) was chosen. Effects of increasing concentrations of the three compounds on bioluminescence, growth and movement inhibition were assessed. The trademark compound C based on hydrogen peroxide and peracetic acid, was used as reference. The ecotoxicity rank was the following: compound B < compound A < compound C. The Cladocera *D. magna* was the most sensitive model compared to bacteria and algae for all the biocides. These first findings suggest that the two new hydrogen peroxide-based biocides (A, B) may be used as eco-friendly compounds in productive sectors related to water compartment.

Global warming increases intraspecific competition through vegetation-mediated effects in a mountain-dwelling herbivore

Fattorini N. [1]*, Lovari S. [1,2], Franceschi S.[3], Chiatante G. [4], Brunetti C. [1], Baruzzi C. [1,5], Ferretti F. [1]

[1]*Dipartimento di Scienze della Vita, Università di Siena, Via P.A. Mattioli, 4, 53100 Siena, Italia*
[2]*Museo di Storia Naturale della Maremma, Strada Corsini, 5, 58100 Grosseto, Italia*
[3]*Dipartimento di Economia Politica e Statistica, Università di Siena, Piazza San Francesco, 46, 53100 Siena, Italia*
[4]*Dipartimento di Scienze della Terra e dell'Ambiente, Università di Pavia, Via Ferrata, 1, 27100 Pavia, Italia*
[5]*School of Forest, Fisheries, and Geomatics Sciences, University of Florida, Gainesville, Florida, USA*

* e-mail: niccolo.fattorini@gmail.com

Herbivorous species are particularly sensitive to warming/drought due to direct effects on behaviour and indirect weather effects on primary productivity. In mountain ecosystems, the ongoing climatic change has negatively affected cold-adapted plant communities, as well as population dynamics of wild herbivores reliant on them. Yet, potential consequences of global warming on resource-dependent ecological responses of mountain organisms are poorly understood. As predicted by the resource competition hypothesis, if warming/drought limit food availability for herbivores, climate change may exacerbate intraspecific conflicts. In two sites differing in habitat quality for the Apennine chamois *Rupicapra pyrenaica ornata*, we quantified individual- and population-level indicators of intraspecific resource competition and food acquisition (1650 animal-hour observations), coupled with remote-sensing estimates of vegetation productivity. Through modelling, we investigated responses of chamois to warming/drought during the growing season, and their interactions with habitat quality. Warmer temperature/lower rainfall increased group-fission events, rate of agonistic contests, interference at feeding, and the probability of foraging interruption. The temporal scale of chamois responses (15-30 days) matched that of warming/drought in reducing vegetation productivity. Additionally, we found no direct effects of weather on chamois responses, which were also consistent in both sites. Thus, increased intraspecific competition and reduced resource allocation of chamois were driven by cumulative effects of unfavourable weather on vegetation growth, and did not depend on habitat quality. Locally-calibrated temperature projections simulated for the following 60 years, reflecting CMIP6-scenarios, predict the progression of chamois responses with ongoing warming (e.g., suggesting 50% increase in resource competition by 2080). Our study emphasises how the prolonged, negative effects of climate change on sensitive mountain vegetation can alter key-aspects of the behavioural ecology of wild herbivores. As global (c. 75% World's grasslands) primary productivity would be impacted by warming/drought, bottom-up effects on intraspecific animal conflicts could emerge as widespread resource-mediated responses to climate change.

Temperature dependence of denitrification in sediments of the Po River: an unexpected effect of climate warming on the self-purification capacity of nitrates loads

Gervasio M.P.[1]*, Soana E.[1], Vincenzi F.[1], Castaldelli G.[1]

[1]Dipartimento di Scienze dell'Ambiente e della Prevenzione, Università di Ferrara, via L. Borsari, 46, 44121 Ferrara, Italia

* e-mail: grvmrp@unife.it

In a climate change scenario, the increase of water temperature is one of the main factors potentially affecting biogeochemical dynamics in rivers, such as NO_3^- removal via microbial denitrification. This unexpected effect of climate change on nitrogen cycle is not described in literature and deserves attention as it may have an impact on the eutrophication process. We have studied it in the Po River (Northern Italy), a hotspot of NO_3^- pollution, which generates severe eutrophication in the transitional environments of its delta area and along the north-western Adriatic coast. The main aim of the study is to assess the temperature response of benthic nitrogen dynamics and denitrification rate in the sediments of the Po lowland reaches, right upstream the delta. Dark fluxes of oxygen and dissolved inorganic nitrogen forms (NO_3^-, NH_4^+, N_2) across the sediment–water interface and denitrification rates (Isotope Pairing Technique) were measured via laboratory incubations of intact sediment cores collected seasonally at Pontelagoscuro (Ferrara). In each season, different temperature treatments were applied, based on historical data and future predictions. The preliminary results demonstrated that denitrification was stimulated by the raise of water temperature in the seasons until now investigated, i.e., winter (temperature range 4-13°C), spring (temperature range 12-21°C) and summer (temperature range 21-32°C), the most important seasons for triggering eutrophic processes in the delta lagoons and coastal sea. The correlation between rates of NO_3^- consumption and N_2 production demonstrated that denitrification was the main process responsible for reactive N removal, sustained mostly by water column NO_3^- diffusing in the sediments. Like all microbial processes, denitrification is controlled by temperature, and higher water temperatures also enhance sediment oxygen demand and the extent of hypoxic conditions in the benthic compartment, favouring the anaerobic metabolism.In conclusion, the predicted increase of water temperature in the Po River deeply controls the denitrification process and may have negative feedback on eutrophication, contributing to partially buffer the nitrate loads exported to the coastal environments.

Application of a non-invasive approach integrating biochemical, cellular, behavioural and ecological endpoints to monitor avian species, Great tit and Common kestrel

Giovanetti L.[1]*, Caliani I.[1], Griggio M.[2], Schiavinato M.[3], Beccardi M.[4], Campani T.[1], Damiani G.[5], Ancora S.[1], Monti F.[1], Casini S.[1]

[1]*Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente, Università di Siena, via Mattioli, 4, 53100 Siena, Italia*
[2]*Dipartimento di Biologia, Università di Padova, via Ugo Bassi, 58/B, 35131 Padova, Italia*
[3]*Wegeningen University & Research, Helix, Stippeneng, 4, 6708 Wageningen, Olanda*
[4]*Institute of Avian Research - Vogelwarte Helgoland, An der Vogelwarte, 21, 26386 Wilhemshaven, Germania*
[5]*Ornis italica, Piazza Crati, 15, 00199 Rome, Italia*

* e-mail:giovanetti@student.unisi.it

Habitat destruction, environmental contamination and global warming represent the main threats to avian species. Here we focus on two cavity nesting species inhabiting agricultural, rural and urban environments: great tit (*Parus major*) and common kestrel (*Falco tinnunculus*). Great tit's territoriality can provide accurate information on a given territory. Common kestrel is a diurnal raptor and, as a top predator, can be more affected by contamination. The aim of this study was to evaluate the effects of anthropogenic contaminants on the two avian species through an integrated and non-destructive approach that combines chemical analysis, biochemical and cellular responses, behavioural traits and reproductive success data. From an idea of Prof. Matteo Griggio, nest boxes for great tit were installed in agricultural, urban and wooded areas of Veneto region (northern Italy). Nest boxes for common kestrel, located in agricultural, rural and urban areas of Lazio region (central Italy), were also monitored. Neurotoxicity (esterases inhibition), genotoxicity (ENA and comet assay), immunotoxicity (complement system, respiratory burst and differential WBCs count) and, oxidative stress (TAS assay) effects were evaluated in the nestlings of the two species from the different areas. At higher biological levels, behavioural traits (tonic immobility and agitation state) and reproductive success were assessed. For great tit, a strong increase of the total antioxidant status was found in nestlings from agricultural areas, as well as DNA damages, present also in specimens from urban area. Responses of tonic immobility showed differences between urban and agricultural sites. DNA damages were also observed in nestlings' kestrels from the agricultural area, while immunotoxicity endpoints were altered in specimens from the urban area. The developed protocol is a useful tool for the ecotoxicological monitoring of bird species considering that an integrated approach is fundamental to obtain a complete picture of the species health status.

Establishing a set of molecular biomarkers for the determination of hospitalized *Caretta caretta* health conditions using skin biopsies

LIMONTA G. [1]*, BAINI M. [1], CALIANI I. [1], CONCATO M. [1], DARMON G [2]., FOSSI M.C. [1], FURII G. [3], GAI G. [1], GALLI M. [1], LOZA A. L.[4], MIAUD C.[2], NOVILLO O. [5], SENEGAS J.B.[6], TOMAS J. [5], PANTI C.[1]

[1]*Department of Physical Sciences, Earth and Environment, University of Siena, Siena, Italy*
[2]*CEFE, University Montpellier, CNRS, EPHE-PSL University, IRD, University Paul Valéry Montpellier 3, Montpellier, France.*
[3]*Sea Turtle Rescue Centre Legambiente, Molo di Ponente, 71043 Manfredonia, Italy.*
[4] *University of Las Palmas de Gran Canaria, Las Palmas, Spain.*
[5]*Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia, Valencia, Spain.*
[6]*CESTMED, Centre d'Etude et de Sauvegarde des Tortues marines de Méditerranée, Le Grau du Roi, France*

* e-mail: giacomo.limonta@unisi.it

The loggerhead sea turtle (*Caretta caretta*) is considered one of the most important bioindicators of marine litter ingestion and impacts on marine organisms in the Mediterranean basin. Other than marine litter and pollution, the loggerhead sea turtle is subject to numerous other threats of anthropogenic nature, such as habitat destruction, by-catch, and marine traffic. In this context, it is of great importance to monitor the health condition of rescued and hospitalized turtles causing minimal stress to the animal. One of the least invasive techniques is the quantification of gene expression in skin biopsies, the mRNA levels can represent a first indicator of the organism response to disease or poor health condition. Skin biopsies were collected from turtles hospitalized in rescue centers around the Mediterranean Sea: CESTMED (Le Grau du Roi, France), CRTM (Manfredonia, Italy), ULPGC (Las Palma, Spain) and University of Valencia (Spain). The expression of target genes involved in the immune (CD83, CCR7, LYZ) and endocrine systems (THRα, RXRα, Erα, PRα) in the energy metabolism (ACADL, PPARα), detoxification and antioxidant responses (CYP1A, GST) and cellular stress (HSP70) was quantified through droplet digital PCR. The ecotoxicological analysis was carried out on captive turtles as well, attempting to set a gene expression baseline, valid for specimens in stable and controlled health condition. Finally, the concentration of phthalates, extensively used plastic additives, was measured in blood samples as potential tracer of macro- and microplastic exposure, aiming to discover potential interactions between plastic-associated chemicals and the molecular biomarkers analyzed. In hospitalized sea turtles, compared to captive specimens, significant up-regulation of genes involved in all the biological processes investigated was observed. While weak but significant correlation was found between mRNA levels and the concentration of phthalates compounds in blood. The results obtained suggest that a selection of the proposed genes could be employed as non-invasive biomarkers to help assess loggerhead sea turtle health status.

Thermal preconditioning upregulates heat shock protein 70 expression and maintains antioxidant enzymes activities in corals

Louis Y.D. [1,2]*, Montalbetti E.[1,2], Isa V.[1,2,3] , Maggioni D.[1,2], Pravettoni L.[1], Pollutri R.[1], Lavorano S.[3], Galli P. [1,2], Seveso D. [1,2]

[1]Earth and Environmental Science Department, University of Milano Bicocca, MI 20126, Italy
[2]MaRHE Center (Marine Research and High Education Center), Magoodhoo Island, Faafu Atoll, Maldives
[3] Costa Edutainment SpA - Acquario di Genova, GE 16128, Italy

* e-mail: yohan.louis@unimib.it

Half of the world's tropical coral reefs have already been lost or severely impacted. Rising sea surface temperature, due to global warming, has been recognised as a prominent cause of coral bleaching and mass mortality. Yet, a growing number of recent studies found that corals exposed to sub-lethal temperatures (preconditioned) resist stress more effectively. The underlying mechanisms of thermal preconditioning are not entirely understood. So far, preconditioning has been studied mostly at the gene expression level. Such studies suggest that heat shock proteins, antioxidant enzymes and other processes such apoptosis regulation and innate immune response could be involved in the process. However, changes in gene expression are not always directly mirrored at the protein level and/or activity. Therefore, in this study, using heat-stress experiments, we compared the expression of Hsp70, a protein involved in cellular protection, and we measured the activity of three antioxidant enzymes (superoxide dismutase, catalase, and glutathione peroxidase) in preconditioned and non-preconditioned coral colonies. Two coral species, *Pocillopora damicornis* and *Stylophora pistillata,* were studied and the molecular identity of their symbiotic microalgae (Symbiodinaceae) was also determined. We found that following a heat stress of 32-33 ^{o}C, coral colonies preconditioned for 2 weeks at 28 ^{o}C, were able to upregulate the expression of Hsp70 compared to non-preconditioned corals. Furthermore, assays show that antioxidant activities of the enzymes were maintained or increased in preconditioned colonies, whereas a decrease in activity was observed in non-preconditioned following thermal stress. No difference in Symbiodinaceae identity was observed in preconditioned and non-preconditioned colonies. Our results bring evidence at protein and enzymatic level that thermal preconitioning increases or maintains cellular homeostasis and protection from oxidative damage. Understanding thermal resistance mechanisms is of upmost importance for coral conservation, such as developing coral stocks with enhanced stress tolerance to increase the efficiency of coral farming.

The impact of COVID-19 pandemic on plastic contamination

Magni S. [1]*, Della Torre C.[1], Nigro L.[1], Binelli A.[1]

1Dipartimento di Bioscienze, Università degli Studi di Milano, via Celoria, 26, 20133 Milano, Italia

* e-mail: stefano.magni@unimi.it

Plastic contamination represents one of the main ecological problems, barely investigated in freshwater ecosystems. For this reason, the aim of this study was the evaluation of plastic contamination in the main seven water courses of the metropolitan city of Milan, one of the largest urbanized and industrialized areas in the North Italy, represented by the Navigli system (Martesana, Pavese and Grande Canals), the two natural water courses (Olona and Lambro Rivers), as well as Vettabbia and Redefossi Canals. We performed the sampling of plastics using two twin plankton nets with a mesh of 100 μm in November 2019 and 2020. In particular, the first sampling was conducted few months before the advent of SARS-CoV-2 virus, which changed dramatically our daily activities, while the second sampling matched with the COVID-19 pandemic and, consequently, with severe regional and national lockdowns. This aspect allowed us to compare the eventual impact induced by the restriction to limit the diffusion of pandemic, in the plastics release by anthropic activities. Collected plastics in the selected water courses were quantified and characterized in terms of shape, size, colour and polymer composition using a Fourier Transform Infrared Microscope System (μFT-IR). The obtained results showed a different contamination induced by plastics between the two different sampling periods, in terms of both amount and qualitative characteristics. Despite we obtained heterogeneous results about plastic contamination between the selected water courses, with a pick of contamination in the Lambro River observed in 2020 (more than 2000 plastics/m3), a clear shift from plastics with an industrial origin (pellets) to those with a secondary origin (fibers and fragments) was observed, respectively before and during the COVID-19 pandemic.

Land cover/management affects soil microbial community and carbon dynamics in Mediterranean sites under desertification risk

Marzaioli R.[1]*, Castaldi S.[1], Coppola E.[1], Grilli E.[1], Rutigliano F.A.[1]

[1]*Department of Environmental Biological and Pharmaceutical Sciences and Technologies, University of Campania "Luigi Vanvitelli", Via Vivaldi 43, 81100 Caserta, Italy*

* e-mail: rossana.marzaioli@unicampania.it

Land management may act as a multiple disturbance which causes soil degradation and compromises the soil's ability to provide ecosystem services, mainly in the Europe's Mediterranean Regions that are already at risk of desertification. Soil microbial community plays a key role in the provision of ecosystem services, thanks to its involvement in soil formation processes, organic carbon dynamics and in nutrient cycling. It is also recognized as highly sensitive to changes in environmental conditions and in land management as well as a suitable indicator of soil quality changes. This study, part of the LIFE Desert-Adapt project, aimed to evaluate the variability of soil microbial and physicochemical variables in Mediterranean sites at risk of desertification of Italy, Spain and Portugal, differing for land cover/management (coniferous tree stands, broad-leaved stands, shrublands, pastures/grasslands and croplands). In particular, soil samples collected in each site were analysed for microbial biomass (C_{mic}), its activity (as soil potential respiration), some indices of microbial metabolism (C_{mic}/C_{org} ratio, metabolic quotient, mg CO_2-C g^{-1} C_{mic} d^{-1}, mineralization quotient, CO_2-C mineralizable % C_{org}) and some physicochemical properties (bulk density, pH, cationic exchange capacity, total soil organic carbon content, C_{org}, its labile components, *i.e.*, extractable C, C_{ext}, and mineralizable C, C_{min}). Results showed that in Mediterranean areas at risk of desertification, the type of land cover/management played an important role in determining the magnitude of the soil variables, with microbial biomass and activity as well as organic carbon pools (C_{org}, C_{ext}, C_{min}) being higher in the coniferous tree stands and lower in croplands. The data also highlighted that sites with lower values of organic carbon pools tended to lose C more rapidly compared to sites with higher values.

Manganese benefits heat-stressed corals at the cellular level

Montalbetti E.[1,2]*, Maggioni D.[1,2], Gobbato J.[1,2], Ferrier-Pagès C.[4], Houlbrèque F.[3], Orlandi I.[5], Forcella M.[5], Galli P.[1,2], Vai M.[5], Louis Y.D.[1,2], Seveso D.[1,2]

[1]Department of Environmental and Earth Sciences (DISAT), University of Milano – Bicocca, Piazza della Scienza 1, 20126, Milano, Italy

[2]MaRHE Center (Marine Research and High Education Centre), Magoodhoo Island, Faafu Atoll, Republic of Maldives

[3]ENTROPIE, IRD, Université de la Réunion, CNRS, IFREMER, Université de Nouvelle-Calédonie, Nouméa, France

[4]Centre Scientifique de Monaco (CSM), Equipe Ecophysiologie corallienne, 8 Quai Antoine 1er, 98000 Monaco, Monaco

[5]Department of Biotechnologies and Biosciences, University of Milano – Bicocca, Piazza della Scienza 2, 20126, Milano, Italy

* e-mail: enrico.montalbetti@unimib.it

The intensity and frequency of coral bleaching events have increased worldwide especially due to thermal stress and seawater pollution. Although it has been observed that metal concentration in seawater can affect the coral's ability to adopt cellular defensive mechanisms to counteract bleaching, more investigations are needed to better understand the role of metals in coral physiology. In this study, we analyzed the individual and combined effects of prolonged heat stress and manganese (Mn) and iron (Fe) enrichments at the cellular level on the coral *Stylophora pistillata*. Thermal stress caused an up-regulation in the expression of the host Heat shock proteins (Hsps) 60 and 70, which showed a parallel pattern of modulation in all treatments, as well as an increase of lipid peroxidation (LPO) in the holobiont. Fe enrichment did not induce any change in Hsp expression or in the oxidative status of the corals both at the ambient temperature of 26 °C or at increased temperature, suggesting that Fe didn't seem to play a role in mitigating the cellular damages and the coral bleaching. Mn or MnFe enrichment at 26 °C seemed to increase the oxidative stress in zooxanthellae, since high LPO and glutathione reductase (GR) levels were recorded, but it did not cause any effect on polyp Hsp expression, probably due to the antioxidant action of GR. With the temperature increase, Mn enrichments prevented any increase in Hsp levels and caused a significant decrease of LPO and GR activity, strengthening a previous hypothesis suggesting that Mn could mitigate the negative cellular effects produced by the thermal stress.

BEFANA:

A Tool for <u>B</u>iodiversity-<u>E</u>cosystem <u>F</u>unctioning Assessment by Network Analysis

Mulder C. [1]*, Conti E. [1], Debeljak M. [2], Marzidovšek M. [2], Podpečan V. [2]

[1] *Dipartimento di Scienze Biologiche, Geologiche ed Ambientali, Università degli Studi di Catania, Catania (Italia)*
[2] *Jozef Stefan Institute, Department of Knowledge Technologies, University of Ljubljana, Ljubljana (Slovenia)*

* e-mail: christian.mulder@unict.it

BEFANA is a free and open-source software tool for ecological network analysis and visualisation. It is adapted to ecologists' needs and allows them to study the topology and dynamics of ecological networks as well as to apply selected machine learning algorithms. BEFANA is implemented in Python, and structured as an ordered collection of interactive computational notebooks. It relies on widely used open-source libraries, and aims to achieve simplicity, interactivity, and extensibility. BEFANA provides methods and implementations for data loading and pre-processing, network analysis and interactive visualisation, modelling with experimental data, and predictive modelling with machine learning. We showcase BEFANA through a concrete example of a detrital soil food web of one agricultural grassland, and demonstrate all of its main components and functionalities.

Unraveling the microalgae community of the plastisphere: results of a mesocosm experiment across an environmental gradient

Nava V.[1]*, Matias M.G.[2,3], Castillo-Escrivà A.[3], Messyasz B.[4], Leoni B.[1]

[1]Department Earth and Environmental Sciences, University of Milano-Bicocca, Piazza della Scienza, 1, 20126, Milano, Italy

[2]Department Biogeografía y Cambio Global, Museo Nacional de Ciencias Naturales, CSIC, c/ José Gutiérrez Abascal, 2, 28006 Madrid, Spain

[3]MED - Mediterranean Institute for Agriculture, Environment and Development & Rui Nabeiro Biodiversity Chair, Universidade de Évora. Casa Cordovil 2ª Andar, Rua Dr. Joaquim Henrique da Fonseca, 7000 – 890 Évora, Portugal

[4]Department of Hydrobiology, Institute of Environmental Biology, Adam Mickiewicz University in Poznan, Uniwersytetu Poznanskiego 6, 61-614 Poznań, Poland

* email: veronica.nava@unimib.it

The interaction of plastics with aquatic biota starts from low trophic levels through the provision of novel habitats for rafting organisms. For this reason, the term "plastisphere" was coined to define the diverse community growing on the surface of plastic debris. The presence of microalgae within the epiplastic biofilm has been repeatedly documented. However, further research is needed to explore the microalgae-plastic interactions and several questions remain to be addressed, especially for freshwaters. The present study aims at assessing the biomass growth of microalgae on microplastics and determining whether plastic surfaces exert a strong enough selection to drive species sorting, overcoming other niche-defining factors. In 15 pond mesocosms located in 5 different regions of the Iberian Peninsula, we added microplastic pellets of high-density polyethylene (HDPE), polyethylene terephthalate (PET), and a combination of the two polymers. After one month, we assessed the species composition and biomass of microalgae developed on plastic surfaces. Our findings revealed that, regardless of regions or plastic polymers, all the samples analyzed have been colonized by microalgae, showing that colonization can occur across a variety of environmental conditions. Generally, within the sites, higher values of biomass were detected on PET compared to HDPE. We found a diverse community of microalgae (242 species) growing on the surface of plastic debris, with several cosmopolite species. However, we did not observe species-specificity in the colonization of the different plastic polymers. Regional species pool and nutrient concentration seem to be the most crucial factors driving species sorting of epiplastic community. We showed that many species may co-exist on the surface of small plastic items, revealing that microplastics could have a significant carrying capacity and potentially an impact on the larger ecological context.

Are water-soluble polymers a new environmental threat?
The case of polyvinyl alcohol

Nigro L.[1]*, Magni S.[1], Ortenzi M.A.[2], Gazzotti S.[2], Della Torre C.[1], Binelli A.[1]

[1]*Dipartimento di Bioscienze, Università di Milano, Via Celoria 26, Milano 20133, Italia*
[2] *Dipartimento di Chimica, Università di Milano, Via Golgi 19, Milano 20133, Italia*

* e-mail: lara.nigro@unimi.it

Plastic pollution represents a well-known and documented global issue, bringing many Countries to adopt legislative restrictions to limit their use and production. However, no information about the impact on ecosystems of another emerging category of synthetic polymers, the water-soluble polymers (WSPs) are available in scientific literature. WSPs are produced in large quantities and used in many industrial products, with a consequent continuous release in the environment. For this reason, the aim of this study was to investigate of the possible toxicity induced by polyvinyl alcohol (PVA), one of the main produced and used WSPs. We evaluated the effects of two PVA materials, represented by solubilized standard PVA powder and PVA-based commercial bags for carp-fishing. Firstly, we characterized the hydrolysis degree as well as the eventual presence of additives in the PVA bag through Fourier-Transform Infrared Spectroscopy (FT-IR) and Nuclear Magnetic Resonance (NMR), respectively. We assessed the chronic and acute toxicity of different concentrations of these materials on two different biological models, represented by the crustacean *D. magna* (exposure of 14 days in semi-static conditions) and the embryos of the teleost *D. rerio* (exposure from 0 to 120 hours post fertilization - hpf). As acute effects we evaluated the immobilization/mortality of specimens, while for chronic toxicity we selected the behavioural alteration on both horizontal swimming performance and vertical migration, and on the activity of monoamine oxidase (MAO), a neuro-enzyme with a potential implication in the organism movement. The results showed a hydrolysis degree of 98% for the PVA powder and 85% in the PVA bag, which was also characterized by the presence of some additives. Besides, lack of significant effects induced by the selected substances, at all tested concentrations and in both model organisms has been observed. However, considering the wide plethora of available WSPs, other investigations are necessary to clarify and characterize their ecotoxicological impact.

Filling knowledge gaps to safeguard river ecosystems from anthropogenic impacts: movement, behaviour and habitat use of Italian riffle dace (*Telestes muticellus*) and brook barbel (*Barbus caninus*) in a small mountain stream

Nyqvist D. [1]*, Schiavon A.[2], Tarena F. [1], Candiotto A. [3], Spairani M. [4], Watz J. [5], Holker F. [2], Comoglio C.[1]

[1] Politecnico di Torino – DIATI, Corso Duca degli Abruzzi, 24, 10129 Torino, Italy

[2] Leibniz Institute of Freshwater Ecology and Inland Fisheries – IGB, Müggelseedamm 301 and 310, 12587 Berlin, Germany

[3] Ittiologo libero professionista – Via Del Ricetto 6, 15077 Predosa, Italy

[4] FLUME srl, Loc. Alpe Ronc 1, 11010, Gignod, Italy

[5] Karlstad University, Universitetsgatan 2, 651 88 Karlstad, Sweden

* e-mail: daniel.nyqvist@polito.it

Freshwater biodiversity is declining worldwide. River fragmentation, together with flow modifications and habitat degradation are major anthropogenic threats affecting freshwater ecosystems and in particular fish populations, further amplified by hydrological regime and water temperature alterations induced by climate change. Knowledge of the ecology and habitat use is important to understand threats and to protect fish fauna. At the same time, there is an almost general lack of scientific knowledge on habitat use and movement of many fish species, particularly for small endemic species and in relation to reproduction. With this in mind, we study the habitat use and movement patterns of Italian riffle dace (*Telestes muticellus*) and brook barbel (*Barbus caninus*), two understudied species endemic to Italy, in a small Appennine stream. Individual fish movements and habitat use are tracked manually using PIT (Passive Integrated Transponder) telemetry and will be analyzed in relation to season and environmental conditions, with a special focus on the spawning time. In a tank experiment, no extra mortality from tagging was detected and both species displayed a very high tag retention. Preliminary data from the field show that most fish remained relatively close to their capture locations, while a few individuals embarked on movements over several hundreds of meters. No directed spawning migration was detected for any of the two species, perhaps explained by the diversity of available habitat and substrates in the study stream. Within the available stream habitats, Italian riffle dace show a tendency to use mainly pools, while brook babel display a more generalist behavior. In addition, both species displayed higher detectability at night, likely associated to higher activity and lowered predator avoidance.

Ecotoxicological assessment of a new Plasmix-based material

Parolini M.[1]*, De Felice B.[1], Gazzotti S.[1], Antonioli D.[3], Gianotti V.[3], Laus M.[3], Ortenzi M.A.[2]

[1]Department of Environmental Science and Policy, University of Milan, via Celoria 26, I-20133, Milan, Italy

[2] Department of Chemistry, University of Milan, via Golgi 19, I-20133, Milan, Italy

[3] Department of Science and Technological Innovation (DISIT), Università del Piemonte Orientale "A. Avogadro", viale T. Michel 11, I-15121 Alessandria, Italy

* e-mail: marco.parolini@unimi.it

The development of new strategies to tackle the accumulation of plastics in the environment due to an improper or inefficient disposal represents a priority in waste management. Many efforts in developing and optimizing recycling of plastics are ongoing but, although the most of plastics are potentially recyclable, only 15% of the worldwide plastic wastes is currently recycled, while the remaining 85% is usually incinerated to recover thermal energy or landfilled. This heterogeneous mixture of non-recyclable plastic wastes generated at the end of the sorting procedures in Italian plastic recycling plants is called 'Plasmix'. To date, Plasmix is landfilled or used for thermal recovery, leading to secondary pollution and loss of economic value for materials that could be reused or recycled profitably. We developed an innovative approach based on mechanical recycling aimed at modifying the Plasmix to generate a new Plasmix-based material to be used in the production process. Before being used, this material needs to be tested for its eco-safety because once in environment it can interact with aquatic and terrestrial organisms, mainly after its fragmentation in microplastics. Thus, the present study aimed at evaluating the ingestion and the potential acute and chronic toxicity induced by exposure to different concentrations of microplastics deriving from the fragmentation of Plasmix-based material, both 'native' and 'added with peroxides', towards the freshwater crustacean *Daphnia magna* and the earthworm *Eisenia fetida*. The results highlighted that both the model organisms were able to ingest microplastics, but no effects on their survival occurred. However, impairments of the reproductive success of *D. magna* and body weight of earthworms were induced by the experimental treatments. These findings suggest the crucial role of ecotoxicological analyses in the characterization of new materials.

Combined effect of temperature and chemical pollution on *Daphnia middendorffiana* (Crustacea, Daphniidae) from a high-mountain lake

Pastorino P.[1]*, Anselmi S.[2], Prearo M.[1], Bentivoglio T.[2], Esposito G.[1], Pizzul E.[3], Bertoli M.[3], Elia A.C.[4], Barcelò D.[5,6], Renzi M.[3]

[1] *Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle, d'Aosta, Torino, Italy*

[2] *Bioscience Research Centre (BsRC), Orbetello (GR), Italy*

[3] *Dipartimento di Scienze della Vita, Università degli Studi di Trieste, Trieste, Italy*

[4] *Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Perugia, Italy*

[5] *Catalan Institute for Water Research (ICRA-CERCA), Girona, Spain*

[6] *Institute of Environmental Assessment and Water Research (IDAEA-CSIC), Barcelona, Spain*

* e-mail: paolo.pastorino@izsto.it

Climate change has well-known direct effects on aquatic systems (i.e., increased water temperature), leading to range shifts and changes in the distribution of aquatic organisms. Effects of climate change on aquatic ecosystems are expected in all biomes, but Alps are predicted to be particularly affected by climate change. Besides direct climate change effects, it is well established that the state and quality of aquatic systems, high-mountain lakes included, depend strongly on other anthropogenic activities as chemical pollution. Importantly, climate change and environmental contaminants can also interact. To better understand the effects of both increasing in temperature and environmental pollution on high-mountain lakes, an ecotoxicological assay was performed on *Daphnia middendorffiana* collected during summer 2021 in a high-mountain lake (Upper Balma Lake-UBL, Cottian Alps, 2.212 m a.s.l.). For the assay, 15 °C (water temperature of UBL) and 20 °C (temperature rise; UNI EN ISO 6341:2013) were considered as temperatures of exposure, potassium chloride (KCl) as reference toxicant and *D. magna* as model organism for comparison. Results showed a lower half maximal effective concentration-EC_{50} (46.9 mg/L; 24h) for *D. middendorffiana* exposed to 20 °C (KCl) compared to *D. magna* (EC_{50}=255 mg/L; 24h). On the other hand, *D. middendorffiana* exposed to 15 °C (KCl) showed a higher EC_{50} value (273.4 mg/L; 24h) compared to *D. magna* (EC_{50}=50.6 mg/L; 24h). Findings from this study, albeit preliminary, highlighted the combined impact of climate change and chemical pollution on *D. middendorffiana* which hold a central position in food webs of high-mountain lakes in Alps.

Microbial communities of forest soils contaminated by PAHs: a new quality index to evaluate their functional and structural stability

PICARIELLO E. [1]*, BALDANTONI D.[2], DE NICOLA F.[1]

[1]Dipartimento di Scienze Tecnologie, Università del Sannio, via F. De Sanctis snc, Benevento, Italia

[2]Dipartimento di Chimica e Biologia "Adolfo Zambelli", Università degli Studi di Salerno, Via Giovanni Paolo II, 132 – 84084, Fisciano, Italia

* e-mail: e.picariello@unisannio.it

Understanding and assessing changes in microbial community structure and function can predict ecosystem stability under anthropogenic stresses and help to deepen the knowledge of the risks related to ecosystem perturbations, from anthropogenic contamination to environmental changes, a critical issue in ecology. The microbial community succession on forest soils recently contaminated by PAHs was investigated during one year in a mesocosm trial. To this end, soils under holm oak, black pine and beech were spiked with three PAHs (phenanthrene, pyrene, benzo[a]pyrene) characterized by different molecular weights and the effects on the structural and functional stability were studied. The PAH short-term effects on soil microbial community structure were estimated by PLFA pattern and ergosterol content, and those on soil microbial community activity by fungal and bacterial growth. The derived information was summarized with synthetic soil quality indices useful to quantify the ecological impact of soil perturbations. To investigate the microbial community stability, an index proposed in first formulation (MAI) as a soil quality index, was applied to these results. Actinomycetes, fungi and Gram+ bacteria were initially resistant to PAH contamination in all the forest systems. PAH treatments seemed to have an overall negative effect on Gram- groups in all the soils at the beginning of incubation. Considering the MAI values, soil under beech showed the highest resistance to contamination. Overall, microbial community under holm oak and beech selected different groups capable of quick recovering from the new soil condition.

Thermal legacies determines the stability of rocky intertidal biofilm to warming extremes

Rindi L. [1]*, Miculan M. [2,3], Dell'Acqua M. [2], Pe' E. [2], Benedetti-Cecchi L. [1]

[1]Dipartimento di Biologia, Università di Pisa, via L. Ghini, 1, 56126 Pisa, Italia
[2]Institute of Life Sciences, Scuola Superiore Sant'Anna, Pisa, Italia
[3]Center for Desert Agriculture, Biological and Environmental Sciences and Engineering Division (BESE), King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia

* e-mail: luca.rindi@unipi.it

Future changes in Earth's climate extremes and variability are projected to substantially impair the ability of ecosystems to cope with future perturbations. However, the history of disturbance affects the ability of ecological systems to respond to future perturbations remains largely unknown. Here, we used rocky intertidal biofilm as a model system to experimentally assess how multiple components of ecological stability (sensitivity, resilience, temporal invariance and recovery) were affected by two scenarios of thermal variability (regular and variable) and how such scenarios modified the ability of biofilm to respond to subsequent warming extremes. Results indicate that past-thermal disturbance, whether variable or regular, reduced the sensitivity and enhanced biofilm resilience to subsequent extreme temperatures. Preliminary results of an integrated metagenomic analysis showed that the microbial functional community of biofilm was altered by thermal variability, promoting the abundance of genes involved in resistance to warming. Altogether, our results suggest that thermal legacies can increase the resilience and stability of microbial communities to extreme warming events through adaptation and selection of resistant taxa.

Do the urban heat island effect influences food choice in ants?

Santini Gia.[1]*, Palchetti V.[1], Balzani P.[1], Frizzi F.[1], Marucelli F.[1], Masoni A.[1]

[1]Dipartimento di Biologia, Università egli studi di Firenze, via Madonna del Piano, 6 50019 Sesto Fiorentino, Italia

* e-mail: giacomo.santini@unifi.it

Living in urban habitats may be challenging for most animals, which must adapt to extreme environmental conditions. Urban areas usually experience higher temperatures than outlying areas, leading to the so-called Urban Heat Island Effect (UHIE). In many cases, the increase in temperature is associated with water shortage, and distinguishing between the two effects is not always straightforward. One option available to urban species to cope with the UHIE is to regulate their intake of the different macronutrients, whose metabolism produces or requires different amounts of water. In principle, lipids produce the most water per unit mass, while protein metabolism produces the least water and causes additional water loss for excreting nitrogenous waste. On this basis, it has been hypothesized that in arthropods, individuals of the same species living inside or outside urban areas should consume different amounts of lipids and proteins. However, as little evidence supports this hypothesis we performed an experimental test using ants as model organisms. Ants have a widespread influence on community dynamics in most terrestrial habitats where they also provide several ecosystem services, and understanding their response to environmental stressors can be of wide interest. Colony fragments of the dominant ant *Crematogaster scutellaris* were collected within the urban area of Sesto Fiorentino (Florence) and from the surrounding woodlands. The ants were experimentally exposed to two different temperatures (25 and 30 °C), with and without access to water, for two consecutive days before being allowed to choose between a protein- or lipid-rich food source. The results showed that ants adjusted their food intake according to exposure to environmental stressors, although the difference between ants from urban and non-urban colonies was not as clear as hypothesized. These results can be interpreted in light of current knowledge on ant nutritional needs, which are affected by environmental factors as well as endogenous mechanisms linked to the colony developmental stage.

Effects of bioplastic and plastic mulches on soil microbial populations

Santini Gio.[1]*, Santorufo L.[1,2], Memoli V.[3], Ceccherini M.T.[4], Maisto G.[1,2]

[1] Department of Biology, University of Naples Federico II, Via Cinthia, 80126 Naples, Italy

[2] BAT Center-Interuniversity Center for Studies on Bioinspired Agro-Environmental Technology, University of Naples Federico II, 80126, Naples, Italy

[3] Department of Environmental, Biological and Pharmaceutical Sciences and Technologies, University of Campania Luigi Vanvitelli, via Vivaldi, 43, 81100, Caserta, Italy

[4] DAGRI Department of Agriculture, Food, Environment and Forestry University of Florence, P.le delle Cascine, 28 - 50144 Firenze, Italy

* e-mail: giorgia.santini@unina.it

Microplastics (MPs), constituted by particles with size lower than 5 mm, are among the main global environmental pollutants. Agricultural practices, such as plastic mulching, sewage and sludge application, wastewater irrigation and atmospheric transport are among the main sources of soil MP. This causes alterations in soil properties and nutrient availability, that, in turns, modify soil microbial biodiversity and functionality. The research aimed to evaluate the effects of bioplastic (M) and plastic mulches (PE) on soil properties and on microbial abundances and activities. The experiment was performed in mesocosms (5 pots M, 5 pots PE and 4 pots as control, C) left outdoor. Surface soils (0-10 cm) were collected, at each pot, at the beginning of the experiment (T0), and after three (T1), six (T2) and twelve months (T3). The soils were analyzed for pH, water content, concentrations of organic C, total C and N, DNA yield, microbial respiration and activities of hydrolase (HA), dehydrogenase (DHA), β-glucosidase (β-GLU) and urease (URE). The abundances of eubacterial DNA (16S rDNA) and fungal DNA (18S rDNA) were quantified by qPCR. The results showed that there were no significant differences in soil properties due to the exposure of different kinds of mulches, but significant differences were due to the exposure time. Soil pH significantly increase at T1 and reached the initial values at T3; water content increased whereas C_{org} and N concentrations decreased over the time. The microbial activities showed different temporal behaviors as respiration, HA and β-GLU increased, whereas DHA and URE decreased. Finally, bacterial and fungal DNA decreased till T2 but then increased. In conclusion, after one year of exposure, the different kinds of mulches did not differently affect the soil properties. Besides, the temporal changes of the soil properties did not show a unique behavior.

Climate change effects on nitrogen loads of the Po River and eutrophication potential in the Adriatic Sea

SOANA E. [1]*, GERVASIO M.P. [1], GRANATA T.[2], FANO E.A.[3], CASTALDELLI G.[1]

[1] Dipartimento di Scienze dell'Ambiente e della Prevenzione, Università di Ferrara, via L. Borsari 46, 44121, Ferrara

[2] CESI - Centro Elettrotecnico Sperimentale Italiano, via Rubattino 54, 20134, Milano

[3] Dipartimento di Scienze della Vita e Biotecnologie, Università di Ferrara, via L. Borsari 46, 44121, Ferrara

e-mail: elisa.soana@unife.it

Rivers worldwide are under stress from eutrophication and nitrate pollution, but the ecological consequences are superimposed and interplay with climate change and the resulting interactions may be complex and unexpected, and until now scarcely explored. Understanding the effects of climate change on water quality is crucial to define and implement effective watershed management strategies aimed at mitigating nitrogen pollution in heavily exploited settings as the Po River basin. Here, it remains unclear whether climate change impacts on water temperature and hydrological cycle are already affecting nitrogen processing and delivery to the coastal zones. The present work deals with long-term trends (1992-2020) of nitrogen export from the Po River basin by investigating both the annual magnitude and the seasonal patterns and their relationship with trajectories of water temperature and discharge. Despite large inter-annual variations, from the early 90s, the Po River experienced a significant reduction in total nitrogen loads (-30%) represented mainly by nitrate, although agricultural nitrogen surplus in croplands has remained constant. In parallel, the river water is steadily warming (+0.11°C yr^{-1}, for average annual temperature) and the number of warm days is increasing (+50%, in the spring-summer period). The inverse relationship between water temperature and nitrogen loads indicated that higher temperatures recorded in recent decades may have boosted the sediment denitrification capacity along the lowland reach. Based on these observations, it is suggested that near-term effects of climate change may have unexpected negative feedback on eutrophication. Temperature warming and an increase in the duration of low-flow periods may enhance rates of microbial processes and sustain more favourable conditions for denitrification and nitrate removal, resulting in a net decrease in nitrogen delivery especially when the ecological consequences in the terminal water bodies are the most severe, i.e., in the spring-summer months.

Improving the ecological realism in bioaccumulation prediction of organic chemicals into plants: combining field data and modelling tools

Terzaghi E.[1]*, Cetti G.[1], Lipari A.[1], Rubello G.[1], Di Guardo A.[1]

[1]*Department of Science and High Technology, University of Insubria, via Valleggio, 11, 22100 Como, Italy*

* e-mail: elisa.terzaghi@uninsubria.it

Ecosystems are continuously exposed to multiple stressors, including anthropogenic (i.e., contaminants) and natural ones (i.e., temperature, water, salinity, pH, etc.). Interactions among these stressors can occur at different levels, influencing the toxicity of the contaminants, as well as their physico-chemical properties, emissions (e.g., from secondary sources), transport, degradation, and bioaccumulation processes. Plants can accumulate organic compounds from soil and air and these processes generally represent the first step in the food web uptake. Therefore, the quantification and the prediction of organic contaminant plant uptake is fundamental for assessing ecological risk. In this context, plant uptake experiments performed in field-like conditions rather than in laboratory setups, could provide important information to improve the ecological realism when modeling the uptake of organic chemicals by plants. Moreover, multimedia fate models could help in predicting the role of stressor interactions on the bioaccumulation. However, many of the studies performed so far mainly included short-term laboratory and greenhouse experiments, using hydroponic systems or spiked soils. These types of experiments allow to produce results under controlled conditions, but they generally diverge from realistic field conditions. The aim of this work was to assess the suitability of the existing lab based predictive equations in estimating the root uptake and translocation to stem of Polychlorinated Biphenyls (PCB) for five plant species through a semi-field experiment. The new root uptake equations highlighted a species-specific and time-dependent accumulation of PCB in plant roots and predictions with these equations were considerably higher than the existing approaches. This was also true for translocation equations probably because of the relevance of another uptake path (i.e., air). Finally, simulations run with the SoilPlusVeg model allowed to evaluate the role of climate change (i.e., temperature and rainfall regime) in plant bioaccumulation.

Diet variation of the dominant macroinvertebrates in the wetland ecosystem of Saline di Punta della Contessa under external pressures assessed by stable isotope analysis

Sporta Caputi S.[1,2]*, Careddu G.[1], Calizza E.[1], Zei G.[1], Shokri M.[2], Cozzoli F.[2], Basset A.[2], Rossi L.[1], Costantini M.L.[1]

[1]Department of Environmental Biology, Sapienza University of Rome, via dei Sardi 70, 00185 Rome, Italy

[2] Department of Biological and Environmental Sciences and Technologies, University of Salento, 73100 Lecce, Italy

* e-mail: simona.sportacaputi@uniroma1.it

The Regional Protected Area of *Saline di Punta della Contessa (SPC)* (Brindisi, Italy) is a highly productive ecosystem that supports a high animal diversity, which includes migratory and sedentary birds and important ecological and social values. Anthropic activities in the surrounding areas, such as agriculture and industry, together with the predicted effects of climate change, strongly threaten the persistence of biodiversity and the functioning of the ecosystem. Describing the carbon (terrestrial vs marine) and nitrogen (natural or anthropogenic) inputs affecting SPC ponds and the main energy pathways in food webs is important for understanding community responses to environmental changes and for identifying the main compartments on which to focus possible management and conservation actions. Several basal resources and invertebrate samples were collected, and chemical-physical parameters were measured at three adjacent ponds. C and N stable isotope analysis of samples were used to reconstruct the food webs and to identify natural or anthropogenic nitrogen inputs (e.g., animal/human wastewaters vs agricultural fertilizers). We hypothesized that variation in external inputs affecting availability of resources were reflected on aquatic macroinvertebrates, influencing their diet and interactions with other species in the community. A southeast-northwest gradient of temperature, salinity, and terrestrial vs. marine C-inputs characterized the ponds. In addition, N-inputs were inorganic in the northern pond and highly organic in the others. Gammarids modified their diet towards herbivory along this gradient, since they assimilated almost exclusively macroalgae in the northernmost pond, thus affecting nutrient flow in the food web. Our results identify organic matter in sediments and grazing chains as the most important pathways of energy flow and possible pollutants, and gammarids as useful bioindicator of N-inputs. This information can be crucial in the monitoring, management, and conservation actions of ecosystem also in medium-long term.

SESSIONE 4
STRESS MULTIPLI SUGLI ECOSISTEMI ACQUATICI E TERRESTRI: METODI DIAGNOSTICI E MECCANISMI ADATTATIVI

POSTERS

S4.P1 Trace elements concentrations in soft tissues of *Phorcus turbinatu*s and *Patella sp*. from ex-mining areas of Elba Island

Ancora S.[1]*, Fantozzi F. [1], Bianchi N. [1], Mariotti G. [1], Casini S. [1], Leonzio C.[1]

[1]*Department of Physical Sciences, Earth and Environment, University of Siena, Via Mattioli, 4, 53100 Siena, Italy.*

e-mail: stefania.ancora@unisi.it

Concentrations of some trace elements (Hg, Cu, Pb, Cd) were investigated in samples of *Patella sp.* and *P.turbinatus* from Elba Island (Italy) to provide information on coastal contamination in some ex-mining areas. Several deposits have been the target of exploitation especially in Rio Marina district, characterized by hematite-pyrite ore association, and in Punta Calamita, with magnetite and Fe-Cu sulphides ores. One important effect of open pit mining activity is the acid mine drainage (AMD) process that leads to an enhanced environmental distribution and an increase in bioavailability of heavy metals ions as Hg, Cu, Pb and Cd. Patella sp. and P.turbinatus samples were collected from five stations in the east coast of Elba Island including ex-mining areas, and control area (Cavo village) far from any direct AMD output. Elements concentrations were analysed, in samples dry weight, with absorption atomic spectrometry techniques. Found Hg, Cu and Pb levels, with exception of Cavo village, were higher than those from literature for uncontaminated areas. The highest levels of Hg were found in Punta Calamita (0.86±0.24 µg/g in Patella sp. and 0.92±0.32 µg/g in P.turbinatus)Cala Seregola (Rio Marina district), mainly affected by AMD process, showed the highest concentrations of Pb (8.94±3.61 µg/g in *Patella sp.* and 8.96±1.78 µg/g in *P.turbinatus*), Cu (90.85±17.83 µg/g in Patella sp. and 80.19±7.72 µg/g in *P.turbinatus*) and Cd (7.41±2.71 µg/g in *Patella sp.* and 0.87±0.11 µg/g in P.turbinatus). Cd levels were higher than literature background values also in Cavo Village. The analysed species revealed good suitability as bioincators, especially *Patella sp.* for Cd and *P.turbinatus* for Cu, with Hg and Pb showing similar levels.

S4.P2 Non-destructive cellular biomarkers in the bioindicator organism *Lumbricus terrestris* exposed to heavy metals

CALISI A.[1]*, ANTIPERINI S. [1], GUALANDRIS D. [1], LORUSSO C. [1], ROTONDO D. [1], DONDERO F. [1]

[1]*Dipartimento di Scienze e innovazione Tecnologica, Università del Piemonte Orientale, Alessandria*

* E-MAIL: ANTONIO.CALISI@UNIUPO.IT

Biomarker approach, is a specific and sensitive tool for the early identification of the pollution effects on terrestrial ecosystems and provides a monitoring tool that can be used to certify the quality of the environment. Early detection of pollution can help prevent any damage from spreading to higher levels of biological organisation by developing appropriate sustainable environmental management programmes and enabling short-term interventions. The aim of this work is the study of non-destructive cellular biomarkers in soil bioindicator organisms that allow for preliminary investigations ("early warning" systems) aimed at highlighting the possible presence of pollutant compounds and predicting the impact that they may have on the environment. Our study focused on assessing the potential cytotoxicity and genotoxicity of two heavy metals, mercury and cadmium, by laboratory exposure on immune system cells (coelomocytes) of sexually mature *Lumbricus terrestris* specimens sampled from natural populations at a unpolluted site. Alongside biomarkers of genotoxicity (micronuclei formation), novel biomarkers such as alterations in the actin cytoskeleton of the coelomocytes were investigated. The results obtained show that heavy metals have a direct cytotoxic and genotoxic effect on cells of the immune system (morphometric alterations, cytoskeleton alterations, increased frequency of micronuclei). Furthermore, the use of immune system cells can be considered as non-destructive biomarkers in non-target bioindicator organisms for soil quality assessment.

S4.P3 From shore to the bottom: detecting anthropogenic nitrogen inputs on Lake Bracciano through δ^{15}N of epilithon and Characeae

CAREDDU G.[1]*, FIORENTINO F.[1], CALIZZA E.[1], VENTURA M.[1], SPORTA CAPUTI S.[1], ROSSI L.[1], COSTANTINI M.L.[1]

[1] Department of Environmental Biology, Sapienza University of Rome, via dei Sardi, 70, 00185, Roma

* e-mail: giulio.careddu@uniroma1.it

Nitrogen inputs represent a notable threat for aquatic ecosystem structure and functioning, promoting cultural eutrophication and algal blooms. Detecting external N inputs is particularly complicated due to the combined effects of dilution and assimilation processes. Moreover, in monitoring aimed at managing eutrophication, it is crucial to determine the sources of pollution. Due to its ability to reflect the 'organic' or 'inorganic' origin of the inputs, the nitrogen isotopic signature of algal primary producers (δ^{15}N) is currently recognized as a flexible tool in the environmental monitoring of nitrogen pollution. In this study, we tested the ability of δ^{15}N signatures of Characeae species to intercept the nitrogen inputs spreading from the coastline to depth in a lacustrine ecosystem. The results of this study highlighted the usefulness of Characeae for detecting sources of N inputs. We observed a rapid decrease in the nitrogen isotopic values along the bathymetry, from 0 to 15 meters depth, in the sampling sites characterized by steep slopes (North and East), while, in the sampling sites with a steep slope (South and West) we observed a propagation effect form the shoreline (0 m) to the first 5 meters. Moreover, we found a decrease in Characeae occurrence compared with previous studies. This reduction is likely related to the effects of the recent drought and water level reduction that affected the investigated lake.

S4.P4 Using aquatic moss *Fontinalis antipyretica* to assess mesoplastics and microplastics in rivers

CARRIERI V.[1]*, VARELA Z.[2], ABOAL J.R.[2], FERNÁNDEZ J.A.[2], DE NICOLA F.[1]

[1]*Dept. Sciences and Technologies, University of Sannio, 82100 Benevento, Italy;*
[2]*CRETUS, Ecology Unit, Dept. Functional Biology, Faculty of Biology, Universidade de Santiago de Compostela, 15782 Santiago de Compostela, Spain*

*e-mail: carrieri@unisannio.it

Mesoplastics (MEPs, 5-25 mm) and microplastics (MPs, 0.001-5 mm) are emerging contaminants of great concern due to their ubiquitous presence in the environment. However, reliable methods for monitoring these types of pollutants in rivers are still lacking. The goal of this research is to evaluate, for the first time, the feasibility of the aquatic moss *Fontinalis antipyretica* in MEPs and MPs monitoring in rivers through a comparison between a native and a moss clone, in a laboratory and field experiment. Both native and moss clone were incubated in water with three different concentrations at each of three different sizes of polystyrene particles (0.05-0.20; 0.20-0.50; 0.50-1.25 mm) and analysed with a stereomicroscope to count the number of items per moss surface. In field, bags with clones were exposed during seven days at 100-400 m from sewage discharge outlets of three wastewater treatment plants, identified as the main source of release of plastic debris. Simultaneously, at each site a composite sample of the native moss was obtained. The possible plastics isolated at naked eye from the native and clone samples were examined in a stereomicroscope, classified as fibres or films based on their shape and analysed by FTIR comparing their spectra with reference spectra of the most common plastics. The findings demonstrated that both native and clone *F. antipyretica* moss can capture MEPs and MPs. The laboratory experiment highlighted a greater accumulation efficiency, regardless the plastic particle size, for the clone respect to the native one, affected by its variable morphology because of adaption to different flow velocities. In field, the clone retained more MEPs and MPs which the FTIR analysis confirmed to be polyamide tipe6 fibres and polyethylene film. Thus, *F. antipyretica* clones are suitable for monitoring MEPS and MPs in freshwater ecosystems.

S4.P5 State of the art, knowledge gaps and future perspectives of honey bees ecotoxicological studies

CASINI S.[1]*, DI NOI A.[2], CAMPANI T.[1], CAI G.[2], CALIANI I.[1]

[1]Department of Physical, Earth and Environmental Sciences, University of Siena, via Mattioli, 4 53100 Siena, Italy

[2] Department of Life Sciences, University of Siena, via Mattioli, 4 53100 Siena, Italy

* e-mail: silvia.casini@unisi.it

Honey bees and the pollination services they provide are fundamental for agriculture and biodiversity. Agrochemical products and other classes of contaminants, such as trace elements and polycyclic aromatic hydrocarbons, contribute to the general decline of bees' populations. For this reason, effects, and particularly sublethal effects of contaminants needs to be investigated. We carried on a review of the existing literature regarding the type of effects evaluated in *Apis mellifera*, collecting also information about regions, methodological approaches, type of contaminants, and honey bees life stages. Europe and North America are the regions in which *A. mellifera* biological responses were mostly studied and the most investigated compounds are insecticides. *A. mellifera* was studied more in the laboratory than in field conditions. Through the observation of the different responses examined we found several knowledge gaps that should be filled, particularly within enzymatic and molecular responses, such as those regarding the immune system and genotoxicity. We underline the importance to develop an integrated approach, supported by statistical models, in order to combine responses at different levels, from molecular to organism and population. This could be a valid tool to evaluate the impact of contamination on these organisms and to support monitoring strategies not only at scientific but also at regulatory level.

S4.P6 Analysis of PFAS contamination and adverse effects in passerine birds breeding nearby a fluorochemical production plant

DE FELICE B.[1]*, MORGANTI M.[2], RUSCONI M.[2], PALUMBO M.T.[2], RUBOLINI D.[1], POLESELLO S.[2], PAROLINI M.[1], VALSECCHI S.[2]

[1]Dipartimento di Scienze e Politiche Ambientali, Università di Milano, Via Celoria, 2, 20133 Milano, Italia
[2]Istituto di Ricerca sulle Acque, Consiglio Nazionale delle Ricerche, via Mulino, 19, 20861 Brugherio, MB, Italia

* e-mail: beatrice.defelice@unimi.it

Per- and polyfluoroalkyl substances (PFAS) encompass a large, heterogeneous group of chemicals of potential concern to human and environmental health. Among PFAS, in recent years the attention has been focused on next generation (next Gen), short-chain compounds, which are expected to be less persistent, bioaccumulative and toxic than long-chain, but more used and discharged in the environment. However, the information on the occurrence, the fate and the potential toxicity of next Gen PFAS, both individually and in mixture, in natural ecosystems is very limited. Thus, there is an urgent need for the implementation of comprehensive monitoring programs to support the exposure assessment and to explore biological effects of PFAS mixtures. The present study aimed at monitoring the occurrence and adverse effects of PFAS mixture in the surroundings of a perfluoropolymer plant (PFP) located in the Western sector of the Po River valley (Northwestern Italy), compared with a reference site. The presence of legacy and Next Gen PFAS was measured in the eggs of two resident species, such as the European starling (*Sturnus vulgaris*) and the Great tit (*Parus major*), breeding in nest-boxes located nearby the PFP and 20 km far from the PFP. In addition, the adverse effects, in terms of the onset of an oxidative stress condition, were assessed on nestlings of the same nest-boxes. As expected, the concentrations of both legacy and Next Gen PFAS in eggs from nest-boxes close to the PFP were higher compared to those from the reference site. Accordingly, a modulation of antioxidant defences and an increase in lipid peroxidation levels were noted in *S. vulgaris* nestlings born nearby the PFP. Our results showed that the exposure to environmental mixture of PFAS induced adverse effects on free-living organisms, suggesting the necessity of field studies to assess the risk of these emerging compounds.

S4.P7 Testing physiological tolerance to marine heatwaves in the canopy-forming macroalgae *Gongolaria barbata*

Fabbrizzi E.[1,2]*, Munari M.[1], Tamburello L.[1], Arena C.[2], Cannavacciuolo A.[1], Chiarore A.[1], Colletti A.[2], Costanzo G.[2], Fajardo A.S.[1], Nannini M.[1], Savinelli B.[2], Silvestrini C.[2], Vitale E.[2], Fraschetti S.[2]

[1] *Department of Integrative Marine Ecology, Ischia Marine Centre, Stazione Zoologica Anton Dohrn, Ischia (Naples), Italy.*

[2] *Department of Biology, University of Naples Federico II, Naples, Italy.*

* e-mail: erika.fabbrizzi@unina.it

Seawater warming and marine heatwaves (MHWs) are among the most critical processes related to climate changes. They are affecting the integrity of coastal marine habitats including macroalgal forests of the genus *Cystoseira sensu latu*. Understanding the resilience and potential for adaptation of marine habitat formers to future ocean warming becomes pivotal for predicting upcoming changes, improving current conservation and restoration strategies. In this work we investigated the eco-physiological behaviour of short *vs* long MHWs occurring at different timing on recruits of *Gongolaria barbata* collected from the La Strea Lagoon (Porto Cesareo, Puglia), by means of a thermo-tolerance experiment. At this purpose photosynthetic pigment content, antioxidant amount as well as photosynthetic efficiency (Fv/Fm) were measured. Results demonstrated that all variables are consistently affected by the length and timing of the thermal stress period, without a significant interaction between the factors included in the experiment. From a physiological point of view, the higher chlorophyll and carotenoid content, as well as the higher value of Fv/Fm ratio in recruits exposed to early long-term stress likely suggest an acclimation of thalli to the new environmental conditions and an increased tolerance of *G. barbata* to thermal stress.

S4.P8 In vivo interaction of polystyrene nanoplastics after acute and chronic exposures in *Ciona robusta* early development stages

FERRARI E. [1,2]*, ELISO M.C.[2], SPAGNUOLO A.[2], CORSI I.[1]

[1]*Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente, Università degli Studi di Siena, Banchi di Sotto, 55, 53100 Siena, Italia*

[2] *Dipartimento di Biologia ed Evoluzione degli Organismi Marini, Stazione Zoologica Anton Dohrn, Villa Comunale, 80121 Napoli, Italia*

* *e-mail: emma.ferrari@student.unisi.it*

Plastic pollution is recognized as a global threat for natural ecosystems and recent findings documented the occurrence of the smallest fraction named as nanoplastic (<1μm) in marine waters, including marine coastal areas of the Mediterranean Sea. The smallest size rebounds to their safety associated with remarkable biological, chemical and physical reactivity that allow them to interact with the cellular machinery by crossing biological barriers and causing damage to living beings. Therefore, the understanding of bio-nano interactions, occurring with the most sensitive early life stages of marine species, is essential to predict nanoplastic impact and make predictions on cascade events at community level. The ascidians, as chordate marine model, could be very useful to assess the impact of nanoplastics and also predict scenarios for higher chordates as fish. In this study we assess the role of un-charged polystyrene nanoparticles (PSNP, 20 nm) as proxy for nanoplastics on *Ciona robusta* early development up to the juvenile stage under realistic environmental concentrations and scenarios (10-50 μg/L) after acute and chronic exposure. For acute exposure PSNP were administered immediately after in vivo fertilization and the effects observed after 22 hours when they became larvae. For chronic exposure, the nanoplastics were administered 4 days post fertilization, when the larvae become juvenile and begin filtering for feeding, and left under exposure for 21 days, sampling every seven days. No effects on *C. robusta* embryos development were observed after 22h of acute exposure and besides the hatching success, no phenotypic alterations in the larvae. Chronic exposure showed, after about 10 days, the death of most of the juveniles exposed to the highest dose (10 ug / ml) and a morphological and physical change in most of those exposed to 1 ug/ml after several days of exposure. Our preliminary findings suggest bio-nano-interactions occurring between nanoplastics at environmentally realistic exposure concentrations and ascidians embryos later after hatching thus suggesting that prolonged exposure scenarios could unravel potential detrimental impact on early life stages of marine life.

S4.P9 Lost in the river: the plastic vegetation index for detecting plastics within vegetation

GALLITELLI L. [1]*, CUTINI M.[1], SCALICI M.[1]

[1]*Department of Sciences, University Roma Tre, Viale Guglielmo Marconi, 446, 00146 Rome (Italy)*

* e-mail: luca.gallitelli@uniroma3.it

Plastics are a well-known problem that accumulate in the environment causing detrimental effects to ecosystems. Macroplastics in rivers are only recently studied, with most of studies focusing on the transport of plastics to the sea. However, most plastics is retained in the fluvial system. To date, only abiotic factors have been considered in the transport process, but recently vegetation has proven to block plastics having a pivotal role in influencing the plastic riverine drift. Given that few is known on the biotic component influencing the riverine plastic transport, we aimed at investigating further on (i) the three-dimensionality structure of riparian vegetation in trapping plastics along watercourse and (ii) to develop a vegetation index to understand the plastic entrapment service provided by plants. To do so, we sampled field data from central Italy rivers considering riparian vegetation in relation to river width. Data on plastics within vegetation has been recollected. Also, data on plant structures (i.e. the number of individuals and the number of branches per species) were sampled and then used to develop the 3D vegetation index (i.e. 3D Vegetation Index, 3DVI) considering tridimensionality and diversity index. The obtained 3DVI is correlated with the number of plastics entrapped by vegetation. Overall, we developed for the first time a vegetation index to describe the structure and diversity of the plant community related to the plastic entrapment service. We highlighted the plant structures that are important variables for understanding entrapment efficiency of macrolitter, highlighting that the complexity of riparian vegetation structure is key for the trapping net effect. As vegetation retain plastics efficiently in all the zones providing us the ecosystem service of trapping macrolitter, the 3D vegetation index could be applied for future solution to plastic pollution – such as detecting plastic hotspot areas for mitigation and clean-up activities.

S4.P10 Effects of wildfire on soil biological and physicochemical properties in a Southern Italy pinewood

Marfella L.[1,2]*, Marzaioli R.[3], Pazienza G.[4], Mairota P.[4], Glanville C.H.[2], Rutigliano F.A.[3]

[1] School of Geography, Geology and the Environment, Keele University, ST5 5BG, UK

[2] School of Social Sciences and Humanities, Loughborough University, LE11 3TU, UK

[3] Dipartimento di Scienze e Tecnologie Ambientali Biologiche e Farmaceutiche, Università degli Studi della Campania Luigi Vanvitelli, Via Vivaldi, 43, 81100 Caserta, Italia

[4] Dipartimento di Agricoltura e Scienze Ambientali, Università di Bari "A. Moro", via Amendola 165/A, 70126 Bari, Italia

*e-mail: luigi.marfella.92@gmail.com; l.marfella@keele.ac.uk.

Wildfire is a natural or anthropic disturbance historically affecting Mediterranean forest ecosystems. However, wildfire frequency and severity have greatly increased over the last few decades and are expected to further increase in the coming years due to climate change. Wildfires impacting nature conservation areas such as European Natura 2000 sites are of particular concern. Here, we studied Site IT9130006 - *Pinete dell'Arco Ionico* with a 24-years forest fire chronosequence (1997-2021). This study aimed to assess the effects of wildfire on soil biological and physicochemical properties, which in turn influence the functioning of the whole ecosystem. Two Aleppo pine (*Pinus halepensis* Mill.) stands (Romanazzi and Marziotta) were selected which have each been affected by fire events (1997/2006 and 2000/2012, respectively). Within each stand, three plots were selected to represent different fire frequencies: i) two fires ii) single fire and iii) unburnt/control. The weight and organic carbon content of the organic layer (O-layer) and biological and physicochemical properties of soil beneath (0-10 cm depth) were determined in all plots. Results show that fire effects are still evident in both stands after many years. Compared to control and single-fire plots, with an O-layer of about 0.5 cm depth (range 397-625 g m^{-2}), two-fires plots lacked the O-layer, indicating a loss of this organic carbon pool. Moreover, compared to controls, both single and two-fire plots generally showed significant changes in soil microbial biomass, total microbial activity, nitrogen mineralization and nitrification and in some chemical variables (pH, electrical conductivity, total and labile organic carbon, ammoniacal and nitric N content). Data suggest that 9-24 years after wildfires, a recovery occurred only in the O-layer of single-fire plots, whereas fire effects are still evident in soils beneath and likely to be related to the interaction between fire frequency and time since the last fire.

S4.P11 Sub-lethal effects induced by different nanoplastic polymers to *Daphnia magna*

Masseroni A.[1]*, Fossati M.[2], Collini M.[3], Della Torre C.[2], Villa S.[1]

[1]*Department of Earth and Environmental Sciences, DISAT, University of Milano-Bicocca, Piazza della Scienza, 1, 20126 Milano, Italy*

[2]*Department of Environmental Science and Policy, University of Milan, via Celoria, 26, 20133, Milano, Italy*

[3]*Department of Physics "Giuseppe Occhialini", University of Milano-Bicocca, Piazza della Scienza, 3, 20126 Milan, Italy,*

* a.masseroni2@campus.unimib.it

Nanoplastics (NPs) are particles within the size range from 1 to 1000 nm which mainly derive from the environmental fragmentation of larger plastic items. In recent years, the scientific interest in NPs has significantly increased because their unique properties make them potentially hazardous for organisms. To date, most of ecotoxicological studies carried out on aquatic species have tested the effects of only polystyrene NPs (PS-NPs) at concentrations (mg/L) higher than the measured environmental exposure (ug/L), resulting therefore in toxicity data that are not representative of a real environmental scenario. In this perspective, this study aimed to evaluate the sub-lethal effects induced by three different NPs polymers (PS-NPs, polyethylene PE-NPs, and polyvinyl chloride PVC-NPs) of a nominal size of 200 nm, on the freshwater cladoceran *Daphnia magna*. For each polymer, five environmental relevant concentrations were tested (2.5-12.5-25-125-250ug/L), with 60 individuals exposed for 48hrs to each concentration. After the exposure, NPs effects at biochemical level were assessed investigating the activity of an antioxidant enzyme (catalase-CAT) and the amount of reactive oxygen species (ROS), while for the individual level we evaluated the swimming response (distance moved) of *D. magna*. The 48-hrs exposure to PS-NPs and PE-NPs did not induce either oxidative stress conditions or alteration in the swimming behavior. Statistically significant changes (p-value<0.05) in swimming distance were observed for PVC-NPs, where the higher concentrations (125 and 250ug/L) induced an increased swimming stimulation. At the concentration of 250ug/L, the negative effect of PVC-NPs is confirmed also at the biochemical level, where the ROS production was almost double that of the control ones. Our results highlighted that the exposure to environmentally relevant concentrations of PVC-NPs could pose sublethal effects to *D. magna.* It is therefore recommended to conduct further studies on different NPs polymers, to better establish their different toxicity.

S4.P12 The A.M.I.P.A.E. project: innovative grazing management in inner areas of Campania Region and its effect on soil microbial community

MEMOLI V.[1]*, MARZAIOLI R.[1], COPPOLA E.[1], STRUMIA S. [1], RUTIGLIANO F.A.[1]

[1] Dipartimento di Scienze e Tecnologie Ambientali Biologiche e Farmaceutiche, Università degli Studi della Campania Luigi Vanvitelli, Via Vivaldi, 43, 81100 Caserta, Italia

* e-mail: valeria.memoli@unicampania.it

Unsustainably managed grazing can trigger soil degradation, resulting in reduction or loss of ecosystem services (as food provisioning, carbon sequestration, regulation of water and nutrient cycles). The project A.M.I.P.A.E. (funded by the Campania Region within the Rural Development Programme 2014-2020) aimed to apply, in inner areas of Campania Region, the innovative rotational grazing (RG) to reduce the impact of this disturbance on plants and soil. The RG consists in dividing the grazing area in plots that are heavily grazed for 1-4 days until the total phytomass consumption. After, animals are moved in another plot so that the vegetation of the previous plot can fully recover. Aim of this research was to evaluate the effects of RG, compared to traditional grazing (TG, each applied using 20 sheep in about 2.3 hectares), on soil microbial biomass and activity (as soil respiration) as well as on physicochemical properties. Soil was sampled in four plots of experimental area: un-grazed plot (control), TG plot, two RG plots left by the sheep from 6 and 9 days, respectively. The preliminary results generally did not show significant differences in microbial biomass (C_{mic}) and physicochemical properties (water content, water holding capacity, bulk density, porosity, mineralizable and extractable organic carbon), compared to TG, probably due to too little time elapsed from the beginning of treatments. However, compared to TG plot, un-grazed and grazed with RG plots showed a small but significant reduction in metabolic quotient (i.e., mg CO_2-C g^{-1} C_{mic} day^{-1}), an index of microbial metabolism which takes higher values in stress conditions for microorganisms. This reduction represents the first positive evidence of RG. A longer-time monitoring is anyway required to clarify if RG may significantly improve soil quality and, consequently, plant growth.

S4.P13 Preliminary analysis of persistent organic pollutants (POPs) in stranded Risso's dolphin (*Grampus griseus*) specimens along the Italian coasts

MINOIA L.[1,2]*, CONSALES G.[1,2], MAZZARIOL S.[3], MANCUSI C.[4], TERRACCIANO G.[5], CECIARINI I.[1], CAPANNI F.[1], NERI A.[1], MAHRER M.[1], D'AGOSTINO A.[6], MARSILI L. [1,7]

[1]*Department of Environment, Earth and Physical Sciences, University of Siena, Via Mattioli 4, 53100 Siena, Italy*

[2]*Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, Italian National Institute for Marine Biology, Ecology and Biotechnology, Genoa Marine Center (GMC), Via De Marini 6, 16149 Genoa, Italy*

[3]*Department of Comparative Biomedicine and Food Science – BCA, University of Padua, Agripolis, Viale dell'Università 16, 35020 Legnaro (PD), Italy*

[4]*Tuscany Regional Agency for the Environmental Protection (ARPAT), Via Giovanni Marradi 114, 57125 Livorno, Italy*

[5]*Istituto Zooprofilattico Sperimentale delle Regioni Lazio e Toscana, Via Appia Nuova 1411, 00178, Rome, Italy*

[6]*Department of Management Studies and Quantitative Methods (DISAQ), University of Naples Parthenope, Via Generale Parisi 13, 80132 Napoli, Italy*

[7]*Centro Interuniversitario per la Ricerca sui Cetacei (CIRCE), Department of Environment, Earth and Physical Sciences, University of Siena, Strada Laterina 8, 53100 Siena, Italy*

*e-mail: l.minoia@student.unisi.it

Both globally and in the Mediterranean Sea, ecotoxicological studies on Risso's dolphin (*Grampus griseus*, Cuvier 1812) are scarce. In general, we can say that little is known about this species; in fact, the International Union for Conservation of Nature (IUCN) has classified this cetacean as "Data Deficient" in the Mediterranean Sea. To fill these gaps at least in a small part, in this study, toxicological analyses were performed in 20 specimens of *Grampus griseus* stranded along the Italian coasts between 1998 to 2021. In the biological material (blubber, liver, muscle and brain) the presence of some Persistent Organic Pollutants (*POPs*): hexachlorobenzene (*HCB*), polychlorinated biphenyls (*PCBs*), dichlorodiphenyltrichloroethane and its metabolites (*DDTs*) were assessed. These contaminants can be found in considerably higher concentrations at the top of the food chain and then in Risso's dolphin, which are top predators in the marine food chain, as a result of the biomagnification process. Both a quantitative and qualitative evaluation of these pollutants were conducted. The blubber is the biological material with the higher levels, followed from liver, muscle and brain, confirmed the results found in this species and in other cetaceans in the world. The results were discussed according to sex, age and stranding areas. No statistically significant differences were found between genders, age and stranding areas. The levels of *POPs* found in these specimens were the highest recorded among this species, except for two specimens stranded in 1995 in Ligurian and Tyrrhenian Sea.

S4.P14 The role of cryptogams in the biogeochemical cycling of mercury at a contaminated site

MONACI F.[1]*, ANCORA S.[2], BARONI D.[2], BONINI I.[1], LOPPI S.[1]

[1]Dipartimento di Scienze della Vita, Università degli Studi di Siena, Via Mattioli 4, 53100 Siena, Italia

[2] Dipartimento di Scienze Fisiche della Terra e dell'Ambiente, Università degli Studi di Siena, Via Mattioli 4, 53100 Siena, Italia

*e-mail: fabrizio.monaci@unisi.it

Mercury is especially capable of pervasive environmental impacts, as it is distributed globally through its gaseous elemental form (GEM), which is predominant (approx. 95%) and long-lasting (6-18 months) in the atmosphere. In terrestrial ecosystems, sorption of GEM via vegetation assimilation is considered dominant, even exceeding wet terrestrial deposition, and is reckoned to be the main source of Hg transfer to soils and water basins. Placed at the interface between atmospheric and terrestrial compartments, cryptogams play an important role in the biogeochemical cycling of mercury (Hg) and are commonly used as indicators of Hg enrichment in remote and anthropogenically impacted environments. Here we report our recent and ongoing collaborative research in and around the mine of Abbadia San Salvatore (Mt. Amiata, Central Italy), a major source of GEM at both local and global scale. Different field experiments were performed in this contaminated area by deploying lichen and moss transplants, at very different atmospheric GEM concentrations, concurrently quantified by passive air sampling. The adopted experimental design enabled the comparison, for the first time, of real-world atmospheric and bioaccumulation Hg data produced with identical temporal and spatial resolution, which is unachievable with common approaches based on active monitoring instruments. We were therefore able to define species-specific, quantitative relationships between GEM concentrations and the amount of Hg accumulated in the lichen thalli. This result can primarily be used to trace the pathway of atmospheric Hg at a local scale, near sources of contamination. However, the combined use of passive air sampling and biomonitoring techniques at contaminated sites also provide the appropriate data for deriving a more comprehensive assessment at regional scale (e.g., at remote sites) of the role of cryptogams in the biogeochemical cycling of Hg.

S4.P15 Effects of the co-presence of antibiotic mixture and copper in soil amended with cattle manure or digestate on the microbial community

Narciso A.[1,2]*, De Carolis C. [1,3,6], Visca A.[1], Garbini G.[1,2], Rolando L.[1], Mariani L.[1], Rauseo J.[4], Patrolecco L.[4], Pescatore T.[4], Spataro S. [4], Grenni P. [1], Bustamante M.A.[5], Alvarez-Alonso C.[5], Iannelli M.A.[6], Barra Caracciolo A.[1]

[1]Istituto di Ricerca sulle Acque, Consiglio Nazionale delle Ricerche (IRSA-CNR), SP 35d, Km 0.7 Montelibretti 00010, Roma

[2] Dipartimento di Scienze Ecologiche e Biologiche, Università degli Studi della Tuscia, Largo dell'Università s.n.c., 01100, Viterbo

[3] Dipartimento di Biologia Ambientale, Sapienza Università di Roma, Via Cesare de Lollis 21, 00185, Roma

[4] Istituto di Scienze Polari, Consiglio Nazionale delle Ricerche (ISP-CNR), SP 35d, Km 0.7 Montelibretti 00010 (Roma)

[5] Dipartimento di Agrochimica e Ambiente, Gruppo di Ricerca GIAAMA, Università Miguel Hernandez, EPS-Orihuela, Ctra. Beniel Km 3.2, 03312 Orihuela, Alicante, Spagna

[6]Istituto di Biologia e Biotecnologia Agraria, Consiglio Nazionale delle Ricerche (IBBA-CNR), Area della Ricerca di Roma 1 Montelibretti (Roma), SP 35d, Km 0.7 Montelibretti 00010 (Roma)

*e-mail: alessandra.narciso@irsa.cnr.it

The use of organic fertilizers (e.g. animal manure) and irrigation water in agricultural practices can unintentionally introduce antibiotics and trace elements (e.g. Cu) with negative effects on terrestrial ecosystems. Antibiotics are emerging and pseudo-persistent organic pollutants and owing to their biocide properties can affect biodiversity of natural microbial communities, by killing or inhibiting natural bacterial populations involved in key ecosystem functioning. In addition, their presence in environment increases selective pressure and promotes a rapid spread of antibiotic resistant bacteria (ARB) and antibiotic resistance genes (ARGs). Moreover, in agricultural practices, copper (Cu) is commonly used to control fungal disease and this can increase the occurrence of antibiotic resistant bacteria. In fact, there are some genes which confers resistance to several types of antibiotics and metals and many of these genes are located in the same mobile genetic elements. In this context, the aim of this work was to increase knowledge on this issue and for this soil microcosms amended with manure/digestate and spiked with different combination of three antibiotics and copper mixture were performed. The effects of the mixture of three antibiotics (Sulfamethoxazole, Chlortetracycline and Ciprofloxacin, 7.5 mg/kg each) and Cu (30 mg/Kg) on the soil microbial community in presence or in absence of lettuce (Lactuca sativa, var. Rufus), were evaluated in terms of microbial microbial abundance, vitality, and enzymatic activity. The results showed that manure and digestate stimulated the abundance, vitality and activity of the soil microorganisms. Adding antibiotic did not inhibit microbial community demonstrating the presence in the organic amendments of bacterial populations able to grow and resist to antibiotics. The plant generally had a positive effect on the microbial community. Interestingly copper alone had a detrimental effect on microbial abundance in the rhizosphere. Further analyses are in progress to evaluate antibiotics and antibiotic resistance genes in soil and leaves.

S4.P16 PCB sulfonated metabolites as new stressors for the terrestrial ecosystem: earthworm uptake and biomagnification through the trophic chain

Palladini J.[1]*, Bagnati R.[2], Passoni A.[2], Davoli E.[2], Lanno A.[2], Terzaghi E.[1], Falakdin P.[1], Di Guardo A.[1]

[1] Department of Science and High Technology (DiSAT), University of Insubria, Via Valleggio 11, 21100 Como, Italy

[2] Department of Environmental Health Sciences, Istituto di Ricerche Farmacologiche "Mario Negri" IRCCS, Via Mario Negri 2, 20156 Milan, Italy

* e-mail: jpalladini@studenti.uninsubria.it

Sulfonated-PCBs (-SO3H) and hydroxy-sulfonated-PCBs (−OH, −SO3H) are more than one hundred PCB metabolites, recently discovered by our group in soil samples collected in the Site of National relevance for remediation, located in the city of Brescia. This site was heavily contaminated by PCBs due to the industrial activity of the nearby Caffaro S.p.A., which produced PCB mixtures between 1930 and 1984 for various industrial applications. Sulfonated and hydroxy-sulfonated-PCBs were demonstrated to derive from a *in situ* PCB degradation and represent approximately 1% of native PCBs in soil. Nevertheless, being novel chemicals, no CAS number is available for them, nor information on their environmental behavior and their ecotoxicity. In the current work, the fate of these metabolites in the soil-earthworm system was investigated for the first time. Earthworms represent the most important invertebrate biomass in many terrestrial ecosystems and play a relevant role in the food chain. For this reason, it is important to evaluate the bioaccumulation potential of the chemicals in these organisms, in order to predict the concentration potentially reached at higher levels of the trophic chain. In this study, for the first time, three bioaccumulation experiments were performed with four species of earthworms (one epigeic, one anecic, and two endogeic) to evaluate PCB metabolite uptake. The results indicate a moderate bioaccumulation potential, which varies with chlorination, polar groups and ecological behavior. However, more efforts are needed to measure the earthworm metabolic production of these chemicals or, more in general, the organisms responsible for their presence in soil. In this work, an overview of the different aspect raised will be given to illustrate the state of the knowledge for the role of these metabolites as stressors in the terrestrial ecosystem.

S4.P17 Bacterial infections responsible for abnormal mortalities of the common frog (*Rana temporaria*) in high-mountain ponds: the effect of climate change?

Pastorino P.[1]*, Prearo M.[1], Meletiadis A.[1], Acutis P.L.[1], Renzi M.[2], Esposito G.[1], Pizzul E.[2], Elia A.C.[3], Barcelò D.[4,5], Colussi S.[1]

[1] *Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle, d'Aosta, Torino*
[2] *Dipartimento di Scienze della Vita, Università degli Studi di Trieste, Trieste, Italy*
[3] *Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Perugia, Italy*
[4] *Catalan Institute for Water Research (ICRA-CERCA), Girona, Spain*
[5] *Institute of Environmental Assessment and Water Research (IDAEA-CSIC), Barcelona, Spain*

* *e-mail: paolo.pastorino@izsto.it*

Global declines in amphibian population are perhaps one of the most pressing environmental problems of the late 20th century. Emerging infectious diseases have been reported increasingly as causes of amphibian declines associated to environmental changes and in particular to climate changes. Chytridiomycosis, a fungal disease and Ranaviral disease are reported among the main causes of global mortality in amphibian populations; moreover red-leg syndrome, a bacterial disease caused by *Aeromonas hydrophila*, has already been reported as cause of mortality. Despite the recent geographic spread and impact of chytrids and ranaviruses, these diseases do not account for all the reports of declining amphibian populations. During April and May 2021 two episodes of mortality have been reported in the common frog (*Rana temporaria*) from two high-mountain ponds in Piedmont (northwest Italy). In the first episode (Lago delle Rane, Usseux, Turin) *Carnobacterium maltaromaticum* has been reported associated to mortality while in the other one (Lago Selleries, Roure, Turin) *Aeromonas salmonicida* and *A. sobria* have been reported. PCR for 16S-23S and rpoB gene were carried out for Carnobacteria and *Aeromonas* respectively, followed by BLAST identification of the pathogens. Moreover, phylogenetic trees were inferred using a Neighbour-joining method with 1000 replicates. The results obtained indicated how bacteria previously not described in anomalous mortality of amphibians, probably in association with climate change and environmental issues, can rise to the role of emerging pathogens causing a real threat to the biodiversity of aquatic ecosystems as well as habitat destruction and pollution.

S4.P18 Disentangling the multiple drivers of temperature adaptation in a microorganism

PERNA A.[1]*, RIVOLI E.[1], PERKINS D.[1]

[1]School of Life and Health Sciences, Roehampton University, Whitelands College, Holybourne Avenue, SW15 4JD London

* e-mail: andrea.perna@roehampton.ac.uk

The survival and reproduction of living organisms depend on their ability to achieve an adequate balance between energy intake and energy consumption. Multiple quantities contribute to this energetic balance, such as the feeding rate, and the allocation of available energy to growth, maintenance, movement and reproduction. Many of these quantities scale in a predictable way with the size of the organism and with environmental parameters, so that by measuring these scaling relations it should be possible to predict how organisms will adapt to a different environment by adjusting their metabolic rate, their body size, and their feeding behaviour. In a series of experiments, we adapted axenic experimental populations of the ciliate Tetrahymena pyriformis to different environmental conditions of temperature (15°C, 20°C and 25°C) and resource levels (50%, 100%, and 200% of a standard protein solution). We measured population growth, metabolic rate (from respiration), cell size, cell shape, and movement speed (from video-tracking). On a very short time scale, movement speed and metabolic rate increased with environmental temperature in a way that can be predicted from simple physical scaling relations such as the Boltzmann-Arrhenius equation and the viscous drag acting on movement, but soon after the introduction into a novel environment all the measured quantities were further modulated in a direction that provided higher biological reproduction efficiency. We propose a theoretical model that accounts for all our observations, based on known and observed scaling of individual quantities combined with reasonable optimization principles.

S4.P19 Microplastics in mussels from different aquatic ecosystems and associated ecotoxicological effects

Provenza F.[1,2]*, Anselmi S. [2], Leporatti Persiano M.[3], Scirocco T.[4], De Rinaldis G.[4], Renzi M.[1,4], Fossi M.C.[5], Specchiulli A.[4]

[1]Dipartimento di Scienze della Vita, University of Trieste, 34127 Trieste, Italy

[2]Bioscience Research Center, via Aurelia Vecchia, 32, 58015 Orbetello (GR), Italy

[3] Supporto tecnico-scientifico direttore dell'esecuzione sistema di gestione 2022 della laguna di Orbetello, Via Leopardi, 9, 58015, Orbetello

[4]National Research Council—Institute for Biological Resources and Marine Biotechnologies (IRBIM), Lesina, Italy

[5] Department of Physical, Earth and Environmental Sciences, University of Siena, Via Mattioli, 4, Siena 53100, Italy

*e-mail: francesca.provenza@bsrc.it

Transitional water ecosystems are potential pollution hotspots among aquatic ecosystems as they are characterized by low water exchange and represent a connection between land and sea. For these reasons, these ecosystems could be highly efficient traps not only for chemicals but also for microplastics. Furthermore, human activities in such ecosystems have strong implications for increasing local pressures on abiotic and biotic compartments, contributing to potentially high microplastic release. Fisheries and aquaculture activities could be significantly affected by the accumulation of microplastic particles in farmed organisms, which in turn could be a source for humans through food. In this study, microplastic levels in a filter-feeding species of commercial interest (*M. galloprovincialis*), farmed in two different lagoon ecosystems (Orbetello and Varano), were detected and compared. The measured levels were used as basis for calculating dietary intake, in order to estimate human exposure. In addition, the ecological effects of exposure to microplastics were determined through an *in vitro* study, in which accumulated concentrations were measured as a function of exposure to environmentally relevant doses of different types of microplastics and the biochemical stress caused by the exposure was assessed.

S4.P20 Ecological risk assessment of Polycyclic Aromatic Hydrocarbons in the Amazon River

Rizzi C.[1]*, Villa S.[1, 2], Rico A.[3,4]

[1]Department of Earth and Environmental Sciences (DISAT), University of Milano-Bicocca, Piazza della Scienza 1, Milan 20126, Italy

[2]EURIS Center, Piazza della Scienza 1, Milan 20126, Italy

[3]IMDEA Water Institute, Science and Technology Campus of the University of Alcal´a, Av. Punto Com 2, Alcalá de Henares 28805, Madrid, Spain

[4] Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia, c/ Catedr´atico Jos´e, Beltr´an 2, 46980 Paterna, Valencia, Spain

* e-mail: cristiana.rizzi@unimib.it

The Amazon region is the biggest drainage basin and one of the most important tropical ecosystems in the world. Nevertheless, the rapid rise in urban population and the consequent increased anthropic pressure have caused a growing input of organic contaminants. Among these, polycyclic aromatic hydrocarbons (PAHs) are one of the most important contaminant groups, which due to their physico-chemical properties (i.e., medium-to-large molecular weight, hydrophobicity), can be transported sorbed to suspended solids and accumulate in sediments, constituting a threat for aquatic organisms. The aim of this study was to investigate the occurrence of PAHs in the Amazon River and to characterise their ecotoxicological risks for Amazonian freshwater ecosystems. For this, 40 water samples were collected in 2019 from different sites along the Brazilian part of the Amazon River, including also three major tributaries (i.e, Negro, Tapajos, and Tocantins Rivers) and smaller streams crossing the urban areas of Manaus, Santarem, Macapa and Belem. The results showed that PAHs are widespread in the Brazilian Amazon. The concentrations of Σ16 priority PAHs were highly variable mainly in the Amazon River and near cities, with values up to 140 and 160 ng/L, respectively. On the contrary, the concentration in the three tributaries was generally lower, with values ranging from 3 to 30 ng/L. In all samples, the contamination pattern was dominated by low molecular weight PAHs. We assessed the risk for freshwater biodiversity using species sensitivity distributions. The results indicated that the PAHs mixture does not induce an unacceptable risk to aquatic organisms based on the calculated hazard index and species sensitivity distributions. However, the risk induced by pharmaceuticals, personal care products and currently used pesticides in the Amazon River, as demonstrated in previous published papers, could be exacerbated by the presence of PAHs.

S4.P21 Effects of human outdoor recreation and proximity to settlements on mammalian communities monitored with systematic camera-trapping in Italian protected areas

Salvatori M. [1, 2]*, Greco I.[1], Massolo A.[3], Petroni L.[3], Seidenari L.[4], Rovero F.[1]

1Dipartimento di Biologia, Università di Firenze, via Madonna del Piano, 6, 50019 Sesto Fiorentino, Italia

2 MUSE – Museo delle Scienze di Trento, Corso del Lavoro e della Scienza, 3, 38122 Trento, Italia

3Dipartimento di Biologia, Università di Pisa, S.S. 12 Abetone e Brennero 4, 56127 Pisa, Italia

4Dipartimento di Ingegneria dell'Informazione, Università di Firenze, Via di S. Marta 3, 50139 Firenze, Italia

* e-mail: marco.salvatori@unifi.it

An emergent issue in biodiversity conservation in the Anthropocene is how the diffuse human presence in natural areas impacts wildlife. Outdoor recreation, in particular, is an increasingly popular activity globally, resulting in intense human frequentation of protected areas (PAs). Reconciling human access to nature with wildlife conservation requires sound evaluations of how human presence affects animal communities. We combined systematic camera-trapping, artificial intelligence and multi-species spatio-temporal modelling to study the mammalian community in four Italian protected areas, focusing on responses to outdoor tourism and proximity to settlements. In one of these PAs monitored for seven years we also assessed temporal trends. We found that all PAs showed intense and pervasive anthropogenic activity, and this increased the probability of nocturnal behaviour in wild mammals, reducing their diurnal and crepuscular activity, which instead was higher at greater distances from settlements and at sites with lower human frequentation rates. In the focal area monitored over time, the rate of human outdoor activities increased through the years, yet both community- and most species-level occupancies increased too. Across all years in this PA, human activities caused a strong temporal avoidance in the whole community, while spatial avoidance was observed only for bigger-sized species. Our study shows that when human outdoor recreation is intense and widespread, wild mammals respond by concentrating their activities at times of lower human presence and that sensitive species also avoid sites with higher human frequentation. While these responses may represent effective coping strategies, unforeseen drawbacks of forced nocturnality and altered spatial patterns might impact wildlife persistence in the long term, with ecosystem-level consequences that are largely unknown. Our findings offer insights that are relevant to managing PAs, and the approach proposed represents a valuable model to assess and monitor biodiversity, suitable to scaling-up at national level.

S4.P22 Effects of bio-microplastic and microplastic on *Spinacia oleracea* L. plants

SANTINI GIO.[1]*, SANTORUFO L.[1,2], MEMOLI V.[3], VITALE E.[1], ARENA C.[1,2], MAISTO G.[1,2]

[1] Department of Biology, University of Naples Federico II, Via Cinthia, 80126 Naples, Italy

[2] BAT Center-Interuniversity Center for Studies on Bioinspired Agro-Environmental Technology, University of Naples Federico II, 80126, Naples, Italy

[3] Department of Environmental, Biological and Pharmaceutical Sciences and Technologies, University of Campania Luigi Vanvitelli, via Vivaldi, 43, 81100, Caserta, Italy

* e-mail: giorgia.santini@unina.it

Microplastics (MPs) are emergent pollutants characterized by particles smaller than 5 mm. The use of plastic mulches results in the main input of MPs in agricultural soils. MPs represent an important environmental problem because they may accumulate over the trophic chain, causing serious damages to crop quality and human health. The research aimed to evaluate the effects of two kinds of MPs (Mater-bi: bio-MPs; Polyethylene: PE-MPs) ranged from 10μm to 5mm on: *i*) soil properties and some eco-physiological traits of spinach (*Spinacia oleracea* L.), a crop largely consumed in Mediterranean diet; *ii*) the concentrations (0.5, 1 and 2% d.w.) of both bio-MPs and PE-MPs at which the effects on soil properties and spinach traits are evident. To this purpose, mesocosm trials were set up, using 35 pots in which MPs were mixed to soil and spinach seedlings were grown for 4 months. The performed analyses on soil were pH, C, C_{org} and N total concentrations. Plant growth was analyzed monitoring shoot (EPI), root (IPO) and total biomasses as well as stem length and leaf number. The plant health status was assessed by fluorescence emission measurements analyzing the indexes maximum PSII photochemical efficiency (Fv/Fm) and quantum yield of PSII electron transport (ΦPSII). Our results showed that photochemistry was not affected by different MPs. In contrast, the plant growth traits were affected by bio-MPs. In particular, the IPO/EPI biomass ratio of plants treated with 2% bio-MPs was significantly lower than those found for other concentrations. The plant and root lengths did not significantly change in spinach treated with PE-MPs, while they significantly lower in plants treated with 2% bio-MPs. In conclusion, the high concentration of bio-MPs exerted the highest impact on spinach physiological and growth traits.

S4.P23 Impact of unbiodegradable and biodegradable mulches on soil microarthropod community structure

Santorufo L.[1,2]*, Santini Gio.[1], Memoli V.[3], Maisto G.[1,2]

[1] Department of Biology, University of Naples Federico II, 80126 Naples, Italy

[2] BAT Center—Interuniversity Center for Studies on Bioinspired Agro-Environmental Technology, University of Naples Federico II, 80126 Naples, Italy

[3] Department of Environmental, Biological and Pharmaceutical Sciences and Technologies, University of Campania Luigi Vanvitelli, via Vivaldi, 43, 81100, Caserta, Italy

* e-mail: lucia.santorufo@unina.it

Mulching is defined as the contribution of artificial or natural layers of materials to soil surface. Widely used in agricultural farming, this technique influences the soil physico-chemical characteristics as it limits erosion, enriches the soil organic matter, reduces soil evapotranspiration. It is well known the positive impact of mulching on soil abiotic characteristics; instead, less is known about the impacts on soil microarthropods. Soil microarthropods, being good indicators of soil changes, could be altered in their assemblage because of the mulch sheets, as its presence could release microplastics and altering soil nutrient composition. In this framework, the research aimed to evaluate the changes in the structure of microarthropod community in soils covered by bioplastic (M) and plastic (PE) mulches. The research was performed in outdoor mesocosm trials (5 pots M, 5 pots PE and 4 pots as control, C). After one year of exposure, soils were characterized for pH, water content, concentrations of organic and total carbon and total nitrogen. Besides, the microarthropods were extracted, recognized and counted and the community was analysed for density, taxa richness, diversity and evenness indices and for the soil biological quality (QBS) index calculated on the basis of the microarthropod ecomorphological forms. The results showed that, the most abundant taxa were Collembola and Acarina in both M and PE soils, Coleoptera larvae and Pauropoda were recorded only in M soils. After one year of exposure microarthropod density, taxa richness and QBS-ar decreased in M and increased in PE soils. Diversity (H) and Evenness (E) indices did not show significant differences between M and PE soils. Detritivores were the most abundant group in both M and PE soils, but predators were present only in M soils. In conclusion, the presence of mulches changed the composition of microarthropod community especially in M soils.

S4.P24 Monitoring of plastics in the sediments of four tributaries of the Po River

Sbarberi R. [1]*, Magni S.[1], Della Torre C.[1], Nigro L.[1], Binelli A.[1]

[1]Dipartimento di Bioscienze, Università degli Studi di Milano, via Celoria, 26, 20133 Milano, Italia

* e-mail: riccardo.sbarberi@unimi.it

Most of the studies concerning the monitoring of plastics in freshwaters are referred to the aqueous matrix. However, based on polymer density, plastics can settle on the bottom of water bodies, also contaminating the sediment compartment, representing a possible threat also for benthic organisms. For this reason, the aim of this study was the quali-quantification of plastics in the sediments of four tributaries of the Po River: Ticino, Adda, Oglio and Mincio Rivers. The sediment sampling was performed using a Van Veen grab on the bottom of selected water courses at the level of their entry into the Po River. Subsequently, sediment samples for each river, analyzed in triplicate, were treated with a hypersaline solution of zinc chloride to separate plastics from the natural materials exploiting the density gradient. Collected plastics were quantified and characterized (shape, size, colour and polymer) using a Fourier Transform Infrared Microscope System (µFT-IR). Preliminary results highlighted the presence of plastics in all analyzed sediments. Ticino River showed the lowest contamination, with 2.7 plastics/Kg w.w., while Mincio River presented the highest amount with 42.7 plastics/Kg w.w. We observed a similar contamination in Ticino, Adda and Oglio Rivers from the qualitative point of view, represented mainly by fibers of polyester (100% in Ticino and Oglio, and 71% in the Adda River). We observed a very different situation in Mincio River, since the 75% of plastic debris were polystyrene pellets, followed by fibers (25%). These preliminary results suggest a different contamination of sampled rivers, represented by secondary plastics in the Ticino, Adda and Oglio Rivers and by primary and industrial sources in the Mincio River.

S4.P25 Increasing temperature as threat or benefit to marine shallow benthic Mediterranean communities

TANTILLO M.F.[1]*, SARÀ G.[1] BOSCH-BELMAR M.[1]

[1]Dipartimento di Scienze della Terra e del Mare, Università degli studi di Palermo, Viale delle Scienze 16, 90128 Palermo, Italia

* e-mail: mariofrancesco.tantillo@unipa.it

Marine heat waves affect marine ecosystems and the provision of services. Shallow benthic communities in the Mediterranean Sea have experienced mass mortality events affecting populations of some habitat formers such as the coral *Astroides calycularis*. Some species are instead taking advantage of rising temperature, such as the corallivorous polychaete *Hermodice carunculata*, a 'native invader' in the Basin. In this context, the investigation of coupled thermal tolerance may be of particular interest to predict the distribution of both "interactors" to get insight on future biodiversity loss rates due to exacerbation of biotic interactions related to climate change. Here we investigated the thermal tolerance of both species, to trace the thermal performance curves by measuring the individual respiration rate (as a proxy of metabolic machinery functioning) under 12 different temperatures (11°-33°C). Thermal optima and thresholds were identified and while the coral seems to currently living close the edge of maximum critical temperature, polychaete seems to be under maximal performance (i.e. spikes due to heat waves may be easily accommodated within the range of optimum temperature). Thus, increasing temperature seems realistically a threat to the coral with the risk that polychaete interaction further impair the coral performance. We derive that heat waves will impair the habitat former performance and will simplify the habitat complexity, while the distribution of habitat former interactors will be larger with possible further negative effects on ecosystem functioning.

SESSIONE 5
FOCUS MEDITERRANEO: BIODIVERSITÀ, IMPATTI ANTROPICI E CAMBIAMENTI CLIMATICI

Il Mediterraneo rappresenta uno dei 5 "hot spots" di biodiversità a livello planetario. Questa enorme ricchezza biologica coesiste però con una fortissima pressione antropica. La sessione sarà focalizzata sui principali impatti antropici che generano pressioni sulle comunità naturali, dai cambiamenti climatici, all'impatto dei contaminanti emergenti e dei rifiuti marini, fino alle molteplici attività antropiche sia costiere che pelagiche. Una particolare attenzione sarà data anche alle strategie di governance dell'intero bacino.

Chairs:

Maria Cristina Fossi, Antonio Pusceddu, Antonella Penna, Cristina Panti

INVITED SPEAKERS

DANOVARO R.

Polytechnic University of Marche

The contribution of ecology to the Ecological transition in the Mediterranean Sea

In recent decades, the over-exploitation of natural resources coupled with the reckless consumption and the consequent erosion of the natural capital, along with climate crisis have increased the urgency to act in order to preserve the whole ecosystem functioning and the ecosystem services and to stop biodiversity loss. In this perspective, the Ecological Transition (ET) has emerged as the solution to cope with this global crisis, while re-launching the economies threatened by the Covid pandemics. The Ecological Transition is at the heart of the current political in EU and several projects are being approved in the context of the PNRR. The transition towards a sustainable development is also crucial for academics and scientists, which are called to provide ideas and solutions to face the current crisis. The risk is that the economic interests prevail over the need of an ecological transformation needed to face the current environmental problems. The blue economy could provide an important momentum for the implementation of the transition toward the best targets. In this talk I will discuss the possible contribution of the ecological research and competence for contributing to the ET in the Mediterranean Sea.

SESSIONE 5
FOCUS MEDITERRANEO: BIODIVERSITÀ, IMPATTI ANTROPICI E CAMBIAMENTI CLIMATICI

COMUNICAZIONI ORALI

Trophic niche features influence microplastic ingestion in Mediterranean fish species

Andolina C.[1,2]*, Giani D.[2,3], Baini M.[2,3], Panti C.[2,3], Sciandra M.[4], Vizzini S.[1,2], Fossi M.C.[2,3]

[1]Dipartimento di Scienze della Terra e del Mare, Università di Palermo, via Archirafi, 18, 90123, Palermo, Italia

[2]CoNISMa, Consorzio Nazionale Interuniversitario per le Scienze del Mare, Piazzale Flaminio, 9, 00196, Roma, Italia

[3]Dipartimento di Scienze fisiche, della Terra e dell'ambiente, Università di Siena, via P.A. Mattioli, 4, 53100, Siena, Italia

[4]Dipartimento di Scienze Economiche, Aziendali e Statistiche, Università di Palermo, Viale delle Scienze, Ed. 13, 90128, Palermo, Italia

* e-mail: cristina.andolina01@you.unipa.it

Widespread microplastic (MP) contamination in the marine environment has raised global concern in the last decade. Scientific evidence of the adverse effects of MP on organisms is growing fast and there is urgent need to fulfil the knowledge gaps about the trophic drivers that lead to such contamination processes and resulting impacts. Fish are considered good bioindicators of MP contamination due to their easy availability, high ecological and commercial value, however our understanding of how trophic niche influences MP ingestion is limited. Here, we investigated the occurrence and abundance of MP in the gastrointestinal tract of 8 commercial fish species (*Boops boops*, *Engraulis encrasicolus*, *Merluccius merluccius*, *Micromesistius poutassou*, *Mullus barbatus*, *Sardina pilchardus*, *Scomber scombrus* and *Trachurus trachurus*) from North-western Mediterranean Sea, with the aim to assess the relationship with fish trophic niche features (trophic position, isotopic niche width and diversity), trophic habit (zooplanktivorous, benthivorous and piscivorous), habitat (demersal, pelagic and benthopelagic) and body condition. 25% of the 396 fish analysed presented MP particles. Trophic niche features, evaluated through stable carbon and nitrogen isotope analysis, revealed to influence the occurrence of MP ingested, while fish trophic habit and habitat seemed to influence the abundance of ingested MP. Fish species displaying wider isotopic niche and higher trophic diversity resulted to be more likely to incur in MP ingestion in each habitat. Also, MPs were more abundant in zooplanktivores, benthopelagic and pelagic species than in demersal species and in individuals with lower body condition. These results suggest that the more the diet of a species is differentiated, the higher is the risk of plastic ingestion, which is also linked to the individual body condition. Overall, this study highlights the importance of considering trophic niche features as a promising approach to study the drivers of MP contamination.

From hydrozoa to whale: A cross-taxon across analysis to assess differences in the exposure to macro and micro marine litter

Baini M.[1]*, Galli M. [1], Giani D. [1], Panti C.[1], Fossi M.C.[1]

[1]Department of Physical, Earth and Environmental Sciences, University of Siena, Siena, Italy

* e-mail: matteo.baini@unisi.it

Marine litter can harm biodiversity in different ways, ingestion is one of the most noxious impacts on marine organisms and it has been documented in highly polluted areas such as the Mediterranean Sea. However, the published data are not collected homogeneously worldwide, and this makes a comparison difficult to make among different species and studies. In the Plastic Busters initiative 41 Mediterranean species belonging to 6 different taxa were analysed to properly evaluate the rate of marine litter ingestion and to obtain information about the size and type of ingested litter. Gastrointestinal tract of 104 Chondrichthyes, 2147 teleosts, 109 sea turtles, 3 seabirds, 60 cetacean and 107 Invertebrates sampled along the Italian coast were examined for the analysis of ingested marine litter following specific protocols. An additional analysis was performed to better understand the composition and origin of the ingested litter, using Fourier transform infrared (FT-IR) spectroscopy technique. Marine litter, mainly plastic, were found in 38 out of 41 (92%) species with an overall FO% of 34% (865/2530 organism with ingested debris), while seabirds, cetacean and sea turtle seems to be the most impacted taxa. Although high variability was observed within the taxa for both % presence and number of particles ingested, it was possible to highlight which species were most impacted by the ingestion of macro- or microliter. The measurement and characterisation of the 3960 items isolated provide useful information about the ingestion preferences by different species and possible sources of plastic litter. The polyethylene and polypropylene plastic, widely used as packaging material, are the most ingested debris in all species investigated. The results achieved constitutes an important advancement in the knowledge of this issue in the Mediterranean Sea and provide the background information for the selection of bioindicator species for future monitoring programs at local and Mediterranean level.

Disentangling the effect of ocean acidification on *Posidonia oceanica* through functional traits: a hydrothermal vent case study

Berlino M. [1,2]*, Di Bona G. [2], Pansini A. [3], De Vittor C. [2], Ceccherelli G. [3], Sarà G. [1], Mangano M.C. [4],

[1] *Dipartimento di Scienze della Terra e del Mare, DiSTeM, Università degli Studi di Palermo Ed. 16, 90128 Palermo, Italy*

[2] *National Institute of Oceanography and Applied Geophysics - OGS, via A. Piccard 54, 34151 Trieste, Italy*

[3] *Dipartimento di Architettura, Design, Urbanistica, Università di Sassari, Via Piandanna 4, Sassari, 07100, Italy*

[4] *Stazione Zoologica Anton Dohrn, Department of Integrative Marine Ecology (EMI), Sicily Marine Centre, Lungomare Cristoforo Colombo (complesso Roosevelt) 90149 Palermo, Italy*

* e-mail: manuel.berlino@unipa.it

Uptake of CO_2 by the ocean changes carbonate chemistry increasing the concentrations of inorganic carbon, and decreasing pH levels leading to possible negative effects on functional traits of several marine consumers or positively affecting producers. Ocean acidification (OA) adds up to all the other drivers of environmental change, altering community composition, biodiversity, trophic structure with impacts on food webs and repercussions on ecosystem functioning and on associated goods and services. *Posidonia oceanica* represents one of the most important natural carbon sinks on Earth and, therefore, plays an important role in such a scenario of increasing environmental changes, by mitigating the effect of OA and providing necessary services to maintain the stability of ecosystems thanks to benefits of associated communities. Here, we evaluated how altered acidified environmental conditions were able to affect the expression of the phenological traits of *P. oceanica* using the presence of a natural gradient of hydrothermal emissions in Panarea (Aeolian Archipelago, Italy) as a proxy of ocean acidification disturbance. Results showed how shoot sampled in acidified sites exhibit lower leaves length, width and total surface area compared to control site. Moreover, lepidochronological analysis carried out on the rhizomes of the plant together with carbon and nitrogen stable isotope analysis allowed us to highlight patterns of variation on production and growth of *P. oceanica* revealing statistical differences between site and lepidochronological year leading us to the analysis of the correlations with other environmental variables change over time along the OA gradient. Our evidence provides insights to the OA vulnerability framework by adding data on sensitivity to exposure, helping to identify risks from OA impacts on *P. oceanica* and useful to when planning adaptation measures at local level.

Aquaculture biomasses as structuring element of phytoplanktonic communities in a transitional water system. Management implication in the Sacca degli Scardovari deltaic lagoon in the frame of the ongoing climatic changes

Bolinesi F. [1]*, Rossetti E. [2], Mangoni O. [1]

[1]Dipartimento di Biologia, Università degli Studi di Napoli Federico II, Complesso Universitario di Monte Sant'Angelo, via Cinthia 21, 80126 Napoli, Italia

[2]Consorzio Cooperative Pescatori del Polesine O.P. S.C.Ar.L., 45018 Scardovari, Rovigo, Italy

* e-mail: francesco.bolinesi@unina.it

The environmental problems induced by the ongoing changes of the global climatic conditions are particularly felt in those systems ecologically structured by incoming freshwaters from land and salt waters from the sea. These sometimes-dramatic changes in hydrographic conditions go far beyond the purely meteorological dynamics, as they affect directly basic chemical inputs and the consequent biological growth mechanisms. Within this general frame, biological biomasses obviously play a role in the general equilibrium of the system. In the case of transitional water bodies utilized for aquaculture, particularly shellfish culture, this biological activity influences macroscopically a basic functional aspect of phytoplankton communities, basically their size fraction composition, a parameter which sets the conditions for maintaining the entire food web of the lagoon. In the Sacca degli Scardovari (Po Delta), the data provided by our ongoing research, demonstrate the strong influence of the shellfish filtration activity in setting the size composition of phytoplankton communities. In fact, the coastal reference station and the innermost northeastern part of the Sacca, occupied by shellfish plants, show a strong trend going from a phytoplankton community dominated by micro-size to others where this same fraction is reduced by ten times in terms of biomass (Chl-a concentrations). In this presentation we address the time and spatial evolution of the phytoplankton community structure, comparing its structure before and after the dramatic drought which has affected the entire lagoonal system.

Is it possible to determine hazards associated with organochlorine compounds (OCs) in Mediterranean apex predators? A theoretical statistical models' approach for striped dolphin (*Stenella coeruleoalba*)

CAPANNI F.[1]*, D'AGOSTINO A.[2], CONSALES G. [1], CECIARINI C.[1], MINOIA L.[1], MARSILI L.[1,3]

[1]*Department of Physical Sciences, Earth and Environment, University of Siena, Via Mattioli, 4 - 53100 Siena, Italy.*
[2]*Department of Management and Quantitative Studies, Parthenope University of Naples, Naples 80132, Italy*

[3]*Centro Interuniversitario per la Ricerca sui Cetacei (CIRCE), Department of Environment, Earth and Physical Sciences, University of Siena, Strada Laterina 8, 53100 Siena, Italy*

* e-mail: francesca.capanni@unisi.it

The striped dolphin (*Stenella coeruleoalba*) is one of the most studied cetaceans in the field of environmental contamination. As a marine apex predator, it bioaccumulate lipophilic pollutants such as organochlorine compounds (OCs). In the past, high levels of OCs found in the blubber of Mediterranean striped dolphins have been linked with a mass standing event caused by a dolphin morbillivirus (DMV) epidemic outbreak in 1994. The cause-effect link was not established, but the OCs were supposed to have enhanced the virus lethality because of their immunosuppression potential. In this study, data regarding the toxicological status (PCBs, DDTs and HCB levels) of stranded and free-ranging specimens of Mediterranean striped dolphins collected between 1985 and 2016 have been reviewed. A series of statistical theoretical models were formulated to evaluate the potential hazards associated with OCs in individuals of this subpopulation, wherein we considered live specimens in good health as our control population and compared them to stranded individuals. The results obtained suggest a greater degree of potential hazard due to OCs for cetaceans inhabiting Ligurian waters, compared to specimens from other Italian coastal regions. This conclusion becomes more significant considering that the Ligurian Sea is one of the richest areas in terms of biodiversity in the entire basin, and that it hosts the Pelagos Sanctuary, the largest protected marine area of the Mediterranean Sea. The proposed models may be beneficial for continuing surveillance of the toxicological health status of this subpopulation and of the entire Mediterranean ecosystem in order to promote management measures for its conservation. Taking into account the potential immunosuppressive effects of OCs, this approach also aims to provide a valuable tool to identify any possible correlations between the high levels of chlorinated xenobiotics and the pathologies causing the observed specimen mortality.

Plastic debris and marine phytoplankton assemblage structure and functioning: impacts and ecological implications in the Mediterranean Sea

Casabianca S.[1]*, Bellingeri A.[2], Capellacci S., Sbrana A.[3], Russo T.[3], Corsi I.[2], Penna A.[1]

[1]Department of Biomolecular Sciences, University of Urbino, Campus E. Mattei, 61121, Urbino, Italy

[2]Department of Physical, Earth and Environmental Sciences, University of Siena, 53100, Siena, Italy

[3]Laboratory of Experimental Ecology and Aquacultura - Department of Biology, University of Rome Tor Vergata, 00133, Rome, Italy

* e-mail: silvia.casabianca@uniurb.it

The Mediterranean Sea, a semi-enclosed basin, has been identified as a great accumulation of plastics. Anthropogenic plastic presence has been reported in various ecosystems indicating that they are ubiquitous at the shores, as well as in the pelagic and deep-sea representing a major environmental issue due to the wide production, use, and dispersion coupled with inadequate and/or ineffective waste management plans. Plastic pollution has ecological implications beyond the toxicological outcomes posing a potential threat for phytoplankton assemblage structure and functioning with negative impacts on primary production, trophic web, and ecosystem services. Plastic debris and/or micro and nanoplastics may have negative impacts on phytoplankton functioning affecting cell growth, chlorophyll *a* content and photosynthetic efficiency. In this context, a virtual meta-analysis on cause-effect relationships of plastic pollution on phytoplankton species revealed the significant effect posed by polymer type on reducing cell density. Floating plastics can transport toxic chemicals and are also subjected to the bio-adhesion of marine biota including harmful phytoplankton together with a variety of biotoxin compounds. These new substrata may favor the dispersal and transport of the surface communities from native to new habitats posing the threat on the bioinvasions in the Mediterranean Sea. Moreover, a potential impact of plastics on marine carbon pump might be observed due to shading effect caused by marine floating plastic affecting primary producer's photosynthesis, growth rate, colony size and morphology. The hetero-aggregates formation, trapping various micro-organisms including autotrophic taxa, might also lead to a decrease of carbon export by subtracting phytoplankton assemblages with negative effects on ocean productivity and the biological pump. In this context, understanding of the effects of plastics on phytoplankton functioning is fundamental to raise awareness on the overall impact on the first level of marine food web.

Galeus melastomus (Rafinesque, 1810) as potential bioindicator in two different Mediterranean deep-sea environments

Consales G. [1,2]*, Bottaro M. [2], Mancusi C. [1,3], Neri A. [1,4], Mordente M.P. [1], Bisignano M. [1], Marsili L. [1,5]

[1] *Department of Physical Sciences, Earth and Environment, University of Siena, Via Mattioli 4, Siena 53100, Italy*

[2] *Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn - Italian National Institute for Marine Biology, Ecology and Biotechnology, Genoa Marine Centre, c/o CNR-IAS, Via De Marini, 6 16149 Genoa, Italy*

[3] *ARPAT - Regional Agency for Environmental Protection of Tuscany, Via Marrani 114, 57126 Livorno, Italy.*

[4] *Consortium for the Inter-University Center of Marine Biology and Applied Ecology "G.Bacci", Viale Nazario Sauro 4, 57128 Livorno, Italy*

[5] *Centro Interuniversitario per la Ricerca sui Cetacei (CIRCE), Department of Environment, Earth and Physical Sciences, University of Siena, Strada Laterina 8, 53100 Siena, Italy*

* e-mail: consales@student.unisi.*it*

The blackmouth catshark (*Galeus melastomus*, Rafinesque, 1810), is a small demersal species widely distributed in the Mediterranean Sea. Here, its ecology and biology have been extensively studied while there is a complete lack of information regarding contamination by legacy contaminants. The Mediterranean, due to its geomorphological characteristics, its anthropized coastlines and intense human activities in its waters, is prone to environmental pollution. Both old and new generation contamination could pose a threat to the conservation of various species, including many elasmobranchs. In this study *G. melastomus* was chosen as a potential bioindicator of the presence of organochlorine contaminants (OCs) such as hexachlorobenzene (HCB), polychlorinated biphenyls (PCBs), and dichlorodiphenyltrichloroethane and its metabolites (DDTs) in the deep-sea environments of two different Geographic Sub Area (GSA): the GSA9, which includes the Ligurian and the Tyrrhenian Sea, and the GSA10 which includes the central-southern Tyrrhenian Sea, where the sampling effort were focused in the Dohrn Canyon, an unexplored canyon in front of the Gulf of Naples. HCB, PCBs, DDTs were detected both in the liver and muscle of *G. melastomus* sampled in the two GSAs. Specimens collected in the GSA9 had higher levels of all the contaminant groups than those sampled in the Canyon. It was also highlighted the use of an enriched op' formula of DDT and presumably the use of Dicofol especially in the Dohrn Canyon. The results of this study filled a little gap in *G. melastomus* toxicological assessment, and, indirectly, allowed us to know a little more on deep environments poorly known from a toxicological point of view.

Mediterranean seabirds: are these poorly investigated species under the threat of marine litter ingestion?

GALLI M. [1]*, BAINI M.[1], CALIANI I. [1], PANTI C.[2], BACCETTI N.[2], CECCHERELLI R. [3], FOSSI M.C.[1]

[1]*Department of Physical, Earth and Environmental Sciences, University of Siena, Via Mattioli 4, 53100 Siena, Italy*
[2]*ISPRA (formerly INFS), via Ca' Fornacetta 9, I-40064 Ozzano Emilia BO*
[3]*Centro Recupero Uccelli Marini e Acquatici - CRUMA, Via delle Sorgenti 430, Livorno*

e-mail: galli13@student.unisi.it

Mediterranean seabirds are threatened by several anthropogenic impacts on land and at sea. The main threats include interaction with fisheries (bycatch) and acute and chronic exposure to pollutants. Although litter ingestion has been globally studied in seabirds, in the Mediterranean Sea this impact is underestimated with only a little evidence on these organisms. *Calonectris diomedea* (Cd) and *Puffinus yelkouan* (Py) due to their distribution and feeding habits could represent an interesting bioindicator species on a wide scale to monitor plastic ingestion. Within the Plastic Busters MPAs Interreg-Med Project, plastic presence in the gastrointestinal tracts (GITs) and phthalates acid ester levels (PAEs) in different biological tissues were evaluated in three specimens (n°1 Cd and n°2 Py) stranded along the Tuscany coast. The GITs have been digested through a standardized protocol based on potassium hydroxide solution, filtered and observed under a stereomicroscope. The plastic found was physically and chemically characterized. PAE loads were evaluated in liver, kidney, muscle, fat and preen oil gland via gas chromatography-mass spectrometry technique. A total of 301 particles were isolated from the GIT of Cd and 14 ± 9 plastic items were found in the Py specimens analysed, accounting for 97% of MPs and 3% of mesoplastics. Fragment (>70%) and filament (>10%) mainly composed of polyolefins materials (> 95%) resulted in the categories mostly ingested in the two considered species. The highest concentration of PAEs was found in the fat tissue (561.2 ng/g w.w.) and preen oil gland (359.5 ng/g w.w.) of Cd and Py, respectively. No differences in the accumulation patterns among the different tissues were found, with DEHP>DIBP>DNOP as the most abundant compounds. These results suggest an urgent need to assess the impacts and effects of litter ingestion on seabirds by applying this approach to a larger number of samples and in other areas of the Mediterranean Sea.

Assessment of marine litter presence and impact on environment and biota in the Maremma (Italy) coastal area

Giani D.[1]*, Baini M.[1], Caliani I.[1], Casini S.[1], Concato M.[1], Galli M.[1], Panti C.[1], Fossi M.C.[1]

[1]*Department of Physical Sciences, Earth and Environment, University of Siena – Via P.A. Mattioli 4, 53100, Siena, Italy*

e-mail: dario.giani@unisi.it

The ENI CBC COMMON project aimed to study the impact of marine litter in five Mediterranean coastal areas and how this can affect the marine environment and biota. This study was carried out through the monitoring of marine litter in several compartments: beaches, sea surface (floating micro and macro litter) and biota in the Maremma (North Tyrrhenian Sea , Italy). The beach litter and floating litter (macro and micro) monitoring was seasonally performed on 3 different areas. In addition, the occurrence of plastic ingestion in fish and invertebrates species (*Boops boops, Engraulis encrasicolus*, *Mullus barbatus, Sardina pilchardus*, *Sardinella aurita*, and *Mytilus galloprovincialis*) were assessed. The results show an average concentration of floating micro and macrolitter on the sea surface in line with the average values of the Western Mediterranean Sea (ranging between 0.05 - 0.32 items/m^2). For beach litter, the data confirm that artificial polymer materials are the most frequently found (94%) and 40% of these were single-use plastic objects. Plastic ingestion was found in 69 out of 276 fish specimens accounting for 25% of the total individuals analysed. The evaluation of gastrointestinal contents showed the different occurrences of litter ingestion among the species, with *E. encrasicolus* showing the highest occurrence (54%) followed by *B. boops* (40%). Regarding *M. galloprovincialis,* 26% of the 30 analysed specimens were affected by microplastics. Plastic fragments and microfibers were the most widespread items in biota. Overall, these results are of crucial importance for the identification of marine litter sources, to assess their impact on biodiversity and design effective mitigation actions in the study area.

Climate change effects on phenology of the spring phytoplankton bloom in the NW Mediterranean Sea

Grossi F. [1,2]*, Nidhin S.[3], Morin K.[4], Lagasio M.[2], Tepsich P.[2]

[1]PhD in Security, Risk and Vulnerability, Università di Genova, Via Balbi 5, 16126 Genova GE, Italia
[2]CIMA Research Foundation, Via Armando Magliotto, 17100 Savona SV, Italia
[3]Università di Genova, Dipartimento DITEN, Via Balbi 5, 16126 Genova GE, Italia
[4]Université de Poitiers, UFR Sciences Fondamentales et Appliquées, 40 Avenue du Recteur Pineau, 86022 Poitiers, France

* e-mail: francesca.grossi@cimafoundation.org

The Mediterranean Sea is among the "hotspots" in every future climate change projection. Studies on effects of climate change on different biotic and abiotic component are essential to evaluate the real consequences that shall be expected on the Mediterranean ecosystem. For the pelagic realm, the main event influencing ecosystem richness is the spring phytoplankton bloom occurring in NW Mediterranean Sea. With this work we aim to investigate interannual changes in timing and magnitude of the bloom and correlate this variability with rainfall anomalies in the Northwestern Mediterranean Sea used as proxy for climate change effects. Daily maps of ChLa concentration from 1998 to 2020 obtained by CMEMS were used to analyse bloom phenological metrics in 5 sites in NWMedSea. Data from 1998 to 2007 were used for a climatological analysis while 2008-2020 was identified as the reference study period. For this period, yearly spring bloom were identified and for each considered phenological metric, interannual variability and overall trends were analysed. Rainfall data were analysed in order to investigate possible correlation of draught/rainy winters on the subsequent spring bloom. Our preliminary analysis showed a strong interannual variability with the presence of some anomalous years, as well as an important negative trend of the chlorophyll bloom magnitude during the study period. Moreover, phenology metrics variability and trends highlight a possible temporal shift in the spring bloom. Analysis of rainfall confirms a negative trend, showing an increase in frequency of dry periods, with the presence of anomalous years compared to climatology. As rainfall data were used as a proxy for river discharge, a correlation analysis was performed to highlight the effects of dry winters on the timing and magnitude of the spring phytoplankton bloom. This work will contribute to a better understanding of an area already under the threat of human activities.

Deep-water species assemblages from the central Mediterranean: what is changed in the last thirty years?

Maiorano P.[1,2]*, Capezzuto F.[1,2], Carlucci R., Carluccio A.[1,2], Chimienti G.[1,2], Mastrototaro F.[1,2], Ricci P., Sion L.[1,2], D'Onghia G.[1,2]

Department of Biology, University of Bari Aldo Moro, Via E. Orabona, 4 - 70125 Bari, Italy

CoNISMa, Piazzale Flaminio, 9 - 00196 Roma, Italy

* e-mail: porzia.maiorano@uniba.it

Overexploitation, marine habitat loss, non-indigenous species, marine litter and climate change are the main human impacts presently occurring throughout the Mediterranean Sea, which are also affecting deep waters. About 40% of the total landing of Mediterranean deep-water species is caught in the central basin. Although significant changes in the abundance of some of these resources with time, increasing sea bottom temperature and decreasing fishing effort have been detected in the north-western Ionian Sea, the two main deep-water species assemblages identified on the slope show a clear overlap in their species composition and relative abundance with those detected thirty years ago in the area. The upper and middle slope assemblages are differently characterized in terms of key representative species and biodiversity pattern. Long-lasting exploitation of the Ionian deep-sea ecosystems mostly affects the upper slope assemblages where the dominance of small fast-growing species as well as the presence of undersized specimens of commercial species in the catches also documented an ecosystem overfishing. In addition, data collected during trawl surveys allowed to detect a widespread presence of marine macro-litter on the Ionian deep-sea bottoms where the plastic resulted the most occurring and abundant waste category.

Leachates from beached microplastics: A potential threat to coastal dune plants

MENICAGLI V.[1,2]*, BALESTRI E.[1], BIALE G.[3], CORTI A.[3], LA NASA J.[3], MODUGNO F.[2,3], CASTELVETRO V.[2,3], LARDICCI C.[2,4,5]

[1]*Department of Biology, University of Pisa, Via Derna 1, Pisa, Italy*
[2]*Center for the Integration of Scientific Instruments of the University of Pisa (CISUP), Via S. Maria 53, Pisa, Italy*
[3]*Department of Chemistry and Industrial Chemistry, University of Pisa, Via Giuseppe Moruzzi 13, Pisa, Italy*
[4]*Department of Earth Sciences, University of Pisa, Via S. Maria 53, Pisa, Italy*
[5]*Center for Climate Change Impact, University of Pisa, Via Del Borghetto 80, Pisa, Italy*

*e-mail: virginia.menicagli@biologia.unipi.it

Beach-dune systems are prone to accumulate large amounts of plastic debris, mostly made of conventional polymers such as polyethylene (PE) and polypropylene (PP). As a result, plants colonizing polluted dunes can be frequently exposed to beached microplastics (MPs). Laboratory migration tests demonstrated that weathered MPs could leach out in water a broad range of chemicals potentially toxic to a variety of organisms, but their effects on dune plants are poorly known. Since these plants play a fundamental role in the formation and maintenance of coastal dunes, assessing the impact of leachates released from MPs on their development is critically important. Here, we explored the effects of leachates obtained from different concentrations of two pools of beach-collected MPs and virgin MPs, made of PE and PP, and of their mixture (PE+PP) on seed germination using standard phytotoxicity tests (based on *Allium cepa* and *Lepidium sativum*) and a mesocosm experiment to simulate environmentally realistic conditions (based on the foredune foundation species *Thinopyrum junceum*). Leachates were also analyzed by using chemical analytical techniques. Leachates from beached PP and PE adversely affected all the study species by reducing seed germination, radicle length, and coleoptile length. The extent of these effects varied according to polymer type and concentration. Virgin MPs had weaker effects than beached ones, and the effects of leachates from mixtures of beached MPs differed from those from individual polymers. Several potentially phytotoxic oxidized compounds, like aldehydes and saturated ketones, were detected in leachates by GC/MS analysis. Our results suggest that beached MPs could have relevant consequences for dune plant populations and communities emphasizing the importance of removing all plastic items from beach-dune environment to prevent their degradation and release of phytotoxic compounds in sand.

Diversity and structure of faunal assemblages associated with mussel and oyster habitats in the Adriatic Sea, with special emphasis on non-indigenous species

Mikac B.[1]*, Colangelo M.A.[2,3], Abbiati M.[1,3,4], Asunis A.[2], Fossi E.[2], Mecca M.[2], Cappucci V.[2], Tarullo A.[2], Costantini F.[2,3,4]

[1]*Dipartimento di Beni Culturali, Università di Bologna, Campus Ravenna, via degli Ariani, 1, 48121 Ravenna, Italia*

[2]*Dipartimento di Scienze Biologiche, Geologiche e Ambientali, Università di Bologna, Campus Ravenna, via S. Alberto, 163, 48123 Ravenna, Italia*

[3]*Centro Interdipartimentale di Ricerca per le Scienze Ambientali – CIRSA, Università di Bologna, Campus Ravenna, via S. Alberto, 163, 48123 Ravenna, Italia*

[4]*Consorzio Nazionale Interuniversitario per le Scienze del Mare (CoNISMa), Piazzale Flaminio, 9, 00196 Roma, Italia*

* e-mail: barbara.mikac@unibo.it

Mussels and oysters are ecosystem engineers that can create habitats which harbour rich fauna, including pests and non-indigenous species. Molluscs' aquaculture is one of the main vectors for the introduction and spread of non-indigenous species worldwide. The aim of this study was to examine diversity and structure of the faunal assemblages associated with wild and farmed populations of Mediterranean mussel *Mytilus galloprovincialis* Lamarck, 1819 and Pacific oyster *Magallana gigas* (Thunberg, 1793) in the Adriatic Sea, with special emphasis on non-indigenous species. Molluscs were sampled in spring and autumn from 3 mussel farms and 3 sites with wild mussel populations and from 2 oyster farms and 2 sites with wild oyster populations, along the coast of Emilia-Romagna region (Italy, northern Adriatic). Altogether 147 invertebrate taxa were found from mussels (114 from wild and 91 from farmed populations) and 103 taxa from oysters (47 from wild and 90 from farmed populations), with annelids, molluscs and arthropods being the most species-rich phyla, and arthropods being the most abundant group. Significant differences in diversity and structure of associated faunal assemblages were observed between farmed and wild molluscs' habitats and between sampling seasons. Fourteen non-indigenous species were found from mussels populations (12 from wild and 8 from farmed ones; 5 molluscs, 4 crustaceans, 4 polychaete annelids and 1 ascidian) and 13 from oysters populations (10 from wild, 9 from farmed ones; 6 crustaceans, 3 molluscs, 3 polychaete annelid and 1 ascidian). Many of them are reported for the first time within these habitats in the Mediterranean Sea. This is also the first study of the fauna associated with wild populations of Pacific oysters in the Mediterranean. Our results suggest that mussels and oysters play an important role in the spread of non-indigenous species and confirm the need for a regular monitoring of their associated fauna.

Role of biofilm in controlling the recruitment of a Canopy-forming Alga

Pedicini L.[1]*, Bertocci I. [1], Bulleri F. [1]

1Dipartimento di Biologia, Università di Pisa, via Derna, 1, 56121 Pisa, Italia

* e-mail: ludovica.pedicini@phd.unipi.it

Brown algae belonging to the *Ericaria* genus are key Mediterranean habitat formers, supporting marine biodiversity and ecosystem functioning. The decline of *Ericaria* populations, due to human perturbations, has prompted attempts for restoring lost or threatened populations. Although epilithic microbial biofilms are recognized as key determinants of macroalgal settlement, their role in regulating the potential of populations to recovery through recruitment of new individuals is yet to be explored. By means of field and laboratory experiments, we assessed the effects of microbial biofilms developed at sites characterized by different anthropogenic activities on the settlement of *Ericaria amentacea* var. *stricta*. Plexiglass supports with clay tiles were deployed in two areas at each of three study sites in the Ligurian Sea (Capraia Island, Secche della Meloria and the mainland coast of Livorno), to allow colonization by a bacterial biofilm. In the laboratory, gametes from apical fronds of *E. amentacea* were released on tiles and the survival of embryos and germlings was monitored for two weeks. Bacterial composition of biofilms from different sites were assessed through DNA Metabarcoding analysis. Tiles from Capraia Island had higher zygote settlement than tiles from the other two sites, which did not differ between them. This suggests that the composition of biofilms on settlement surfaces affects the settlement of *E. amentacea*. Thus, assessing the suitability of available rocky substrata for the settlement of *E. amentacea* appears a crucial aspect for successful restoration.

How to improve bathing and coastal water management from microbial contamination in the Mediterranean coasts

Penna A.[1]*, Baldrighi E.[2], Penna P.[2], Ricci F.[1], Moro F.[2], Ferrarin C.[3], Grilli F.[2], Marinchel N.[1], Campanelli A.[2], Betti M.[2], Capellacci S.[1], Casabianca S.[1], Bolognini L.[4], Romei M.[5], Marini M.[2], Manini E.[2]

[1]Department of Biomolecular Sciences, University of Urbino, Campus E. Mattei, 61121, Urbino, Italy

[2]Institute for Biological Resources and Marine Biotechnologies - IRBIM CNR, 60125, Ancona, Italy

[3]Institute of Marine Sciences - ISMAR CNR, 30122, Venezia, Italy

[4]Department Territory and Environment, Regione Marche, 60125, Ancona, Italy

[5]ASET – Azienda Servizi sul Territorio S.p.A., 61032, Fano, Italy

*email: antonella.penna@uniurb.it

In the Adriatic Sea, massive rainy events are causing floods of rivers and streams with relevant consequences on environment. The anomalous rainy episodes, as negative effect of climate change, induce flood and relevant consequences. During these events, the microbial contamination significantly affects the quality of bathing water with beach closure, negative impact on marine environment and biota, and on tourism of coastal towns in summer. Bathing water management and monitoring is regulated by Eu Bathing Water Directive (BWD; 2006/7/EC). The BWD strongly requires public health protection in bathing water through improved monitoring and management. It sets restrictive water quality standard based on the concentration of fecal indicator bacteria, as intestinal enterococci and *Escherichia coli* to prevent health risk associated with bathing in marine waters. Bathing water quality is determined after massive precipitation events. The results of bacterial analyses are available only after 48 h. The urban wastewater treatment and the collecting systems in each municipality are often not fully efficient, and rainfall exceeds the capacity of the fragile sewerage systems of towns. For urban wastewater management it is required to reduce the contamination interval to a few hours through infrastructure retaining the pollution loads and provide assessing the risk of bathing. The EU Interreg Italy-Croatia WATERCARE Project aimed to improve the environmental quality and resource efficiency in the Adriatic bathing and coastal waters reducing the microbial contamination by using and developing an innovative water quality integrated system (WQIS). It was composed by a real time hydro-meteorological monitoring network and an ad hoc infrastructure for bathing water management in a pilot site through a forecast operational model. The study was aimed to develop a real-time alert system able to preventively identify the potential ecological risk from fecal contamination of bathing waters and to support governance decision in bathing water management.

Effects of the sea cucumber *Holothuria tubulosa* Gmelin 1788 on quantity, biochemical composition, and nutritional quality of sedimentary organic matter

Pusceddu A.[1]*, Pasquini V.[1], Giglioli A.A.[1], Moccia D.[1], Addis P.[1]

[1]*Dipartimento di Scienze della Vita e dell'Ambiente, Università di Cagliari, via T. Fiorelli, 1, 09126 Cagliari, Italia*

* *e-mail: apusceddu@unica.it*

Holothuria tubulosa, one of the most common sea cucumbers in the Mediterranean Sea, is generally found in organically enriched coastal sediments and seagrass beds. As a deposit-feeder, it is responsible for strong bioturbation processes and likely plays a key role in benthic trophodynamics. To explore the potential use of sea cucumbers for remediating eutrophicated sediments, we investigated the effects of *H. tubulosa* on sedimentary organic matter (OM) quantity, biochemical composition, and nutritional quality in two sampling sites (namely, the Gulfs of Teulada and Oristano, Western Mediterranean Sea) characterized by contrasting sediment grain size and sedimentary organic loads. We compared the biochemical composition (proteins, carbohydrates, lipids) of ambient sediment vs sea cucumbers' faeces and the sedimentary proteins content vs protein content in the ingested sediments from the holothurians' oesophagus, mid gut, and end gut. Our results reveal that *H. tubulosa* can influence the sedimentary contents of the most labile molecules (i.e., proteins and lipids) and, by producing protein- (from 1.5 to 1.8 times in Oristano and Teulada respectively) and lipid-enriched faeces (from 1.3 to 2 times in Oristano and Teulada respectively), can contribute to making these labile substrates more available for higher trophic levels. We report here also that *H. tubulosa* is can actively select labile food particles during feeding, as revealed by the protein contents in the oesophagus that can be from 2 to 2.7 times higher than those in the ingested sediment. After ingestion, up to 30-40% of the proteins ingested by sea cucumbers are assimilated. We conclude that *H. tubulosa* can influence the benthic trophic status, specifically modifying the biochemical composition of sedimentary OM more than its quantity, thus paving the way to its possible use in bioremediation actions of eutrophicated sediments.

The Mediterranean Sea: a hotspot of plastic exposure for seabirds of conservation interest

Rubolini D.[1,2]*, De Pascalis F.[3], De Felice B.[1], Parolini M.[1], Cecere J.G.[3]

[1]Dipartimento di Scienze e Politiche Ambientali, Università di Milano, Via Celoria 26, 20133 Milano

[2]Istituto di Ricerca sulle Acque (IRSA-CNR), via Mulino 19, 20861 Brugherio (MB)

[3]Area BIO-AVM, Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA), via Ca' Fornacetta 9, 40064, Ozzano dell'Emilia (BO)

* e-mail: diego.rubolini@unimi.it

The Mediterranean Sea is massively contaminated by plastics, which negatively affect marine life including petrels (Procellariidae, Hydrobatidae), medium/small-sized pelagic seabirds that are suffering worldwide population declines due to competition with fisheries, pollution, and climatic changes. Petrels are marine predators that forage in the upper water layer on pelagic fish, cephalopods and plankton, are wide-ranging and migratory, exploiting different ocean basins during their annual cycle. Due to their ecology, petrels are regarded as excellent sentinels for environmental alterations. Their movements can be followed using tracking devices (e.g. GPS), allowing a spatially explicit assessment of the threats they are exposed to. They are sensitive to floating plastics, which they can ingest both directly and indirectly (via prey) and can have lethal and sub-lethal effects related to physical damage and blockages, or chemical contamination. Compared to other seabirds, petrels can retain ingested plastics for longer periods because they are less capable of egesting plastic items, and during breeding they can transfer ingested plastics to their growing chicks through regurgitates. Based on our own tracking studies, we provide an overview of the movements of two endemic Mediterranean taxa (Scopoli's shearwater *Calonectris diomedea* and Mediterranean storm petrel *Hydrobates pelagicus melitensis*), identifying key areas where these birds can be exposed to floating plastic debris. An analysis of year-round movements highlighted that the Mediterranean region is a global hotspot of plastic exposure for petrels, endangered taxa being disproportionately more exposed to plastic pollution than non-endangered ones. Finally, we focus on microplastic ingestion in the planktonic Mediterranean storm petrel, a small species which targets marine areas characterized by water stirring and mixing for finding food. We highlight the potential sensitivity of this species of European conservation interest to plastic pollution and suggest that storm petrel regurgitates can be a valuable matrix to investigate microplastic ingestion in planktonic foragers.

Organic matter stability and microarthropod community under different vegetation covers of Mediterranean area

SANTORUFO L.[1,2]*, SANTINI GIO.[1], MEMOLI V.[3], DE MARCO A.[2,4], BARILE R.[5], MAISTO G.[1,2]

[1] Department of Biology, University of Naples Federico II, 80126 Naples, Italy

[2] BAT Center—Interuniversity Center for Studies on Bioinspired Agro-Environmental Technology, University of Naples Federico II, 80126 Naples, Italy

[3] Department of Environmental, Biological and Pharmaceutical Sciences and Technologies, University of Campania Luigi Vanvitelli, via Vivaldi, 43, 81100, Caserta, Italy

[4] Department of Pharmacy, University of Naples Federico II, 80126 Naples, Italy

[5] Vesuvius National Park, Via Palazzo del Principe c/o Castello Mediceo, 80044 Ottaviano, Italy

* e-mail: lucia.santorufo@unina.it

The above-ground and below-ground interactions play fundamental roles in controlling ecosystem processes. Through litter fall, plants provide resources for decomposers, that, in turns, regulate nutrient availabilities by litter degradation. The rate of litter degradation influences the quantity and quality of soil organic matter, that represent the most significant driver of soil microarthropods presence. Despite the importance of plant cover in influencing soils processes, less is known about its impact on litter degradation, soil organic matter stability and soil arthropod biodiversity, above all in Mediterranean environment. The present research aimed to evaluate the impact of different plant covers, typical of Mediterranean area, on abiotic characteristics and biodiversity of litters and soils. To achieve the aim, litters and soils were collected under holm oak, pine and black locust specimens and grass. The samples were analysed for the main abiotic properties, microbial and fungal biomasses, microbial respiration and enzymatic activity, and microarthropod taxonomical and functional biodiversity. The findings highlighted that litters of black locust and grass showed higher contents of N and lower C/N ratios than litters of pine and holm oak. These properties would seem to attract high microbial biomass and activity, and microarthropod abundance. Instead, soils under black locust and grass showed lower organic matter content, N concentrations, microbial biomass, microbial activity and microarthropod abundance than those under pine and holm oak. In conclusion, the investigated plant covers differently affected the biodiversity in litter and soil. In fact, the highest amount and activity of organisms were observed in litter of black locust and grass and in soils under pine and holm oak. An overall evaluation highlighted a different role of shrubs and trees in controlling litter degradation, the accumulation and stability of soil organic matter and the assemblage of microarthropods.

Does seasonality influence trace element accumulation in transplanted *Posidonia oceanica*? Ecological implications for the restoration of degraded coastal areas

Signa G.[1,2]*, Tomasello A.[1,2], Cilluffo G.[1,2], Tramati C.D.[1,2], Savona A.[1,2], Mazzola A.[1,2], Calvo S.[1], Vizzini S.[1,2]

[1]*Department of Earth and Marine Sciences, University of Palermo, Palermo, Italy*
[2]*CoNISMa, Consorzio Nazionale Interuniversitario per le Scienze del Mare, Roma, Italy*

* e-mail: geraldina.signa@unipa.it

The high potential of ecosystem restoration to reverse the trend of ecological change is globally recognised. However, marine restoration is still a challenge, especially when ecosystems are highly degraded. In this framework a pilot restoration has been carried out by transplanting the seagrass *Posidonia oceanica* from a pristine meadow to the highly polluted Augusta Bay (Mediterranean Sea) in two seasons of the same year to investigate the seasonal dynamics of accumulation and partitioning of trace elements into the plant tissues and the plant biochemical response to environmental contamination. We found a higher accumulation of chromium (Cr), copper (Cu) and mercury (Hg) in the plants transplanted in summer than in winter, alongside an increase in Cr and Hg in the plants exposed to higher contamination levels. However, increase in leaf phenolic compounds and decrease in rhizome soluble carbohydrates were associated to Hg accumulation, suggesting the occurrence of defence strategies to cope with environmental stress. We also found a different partitioning of trace elements between the below- and above-ground tissues, with Cr tending to accumulate in roots, while Cu and Hg in both roots and leaves. Despite this different uptake and compartmention dynamics confirm that *P. oceanica* may act as a sink, sequestering trace elements and potentially decreasing their bioavailability, at the same time, it opens questions about the risks to remobilize buried contaminants. However, the estimation of the amount of TEs potentially transferable from *P. oceanica* to the environment seems to be low under the peculiar conditions of the study site. Considering the great ecological benefits and services provided by seagrass meadows, but also the relevant role that *P. oceanica* may play in the trace element cycling, further investigations including cost-benefit assessments of restoring degraded sites by transplanting seagrasses would improve current knowledge in support of efficient ecosystem-based coastal management.

Can environmental heterogeneity sustain butterflies' diversity?

Simbula G.[1]*, Bruschini C.[1], Benetello F.[1], Pasquali L.[1], Dapporto L.,[1]

[1]Dipartimento di Biologia, Università degli studi di Firenze, Via Madonna del Piano 6, 50019 Sesto Fiorentino FI
* e-mail: giulia.simbula@unifi.it

Climate change is one of the most pressing menaces that animals and plants have currently to face. It is well known that climate change could be mitigated by environmental heterogeneity providing the opportunity of micro-refugia in extreme conditions. Previous studies have detected climate change-driven altitudinal shifts in butterflies mainly on alpine areas where the heterogeneity is guaranteed by wider altitude range and complex geomorphological structures. Although the effects of increasing temperatures and drought are expected to produce stronger effects in Mediterranean areas there are only few systematic studies on climate change effect on butterflies. We aim at assessing the positive effect of an environmental mosaic on butterfly populations and diversity in a typical heterogeneous Mediterranean area: the Monte Peglia UNESCO World Biosphere Reserve (837 m s.l.m. maximum). Field work has been carried out every two weeks from April 2022 in 90 plots (50 x 50 m) in five macro-areas within the Reserve's Core and Buffer areas. The plots were chosen by selecting an equal number of micro-habitats between grassland and woodland plots at different altitudes. Thanks to our detailed dataset and the use of indices for climatic preferences available for butterfly species, we documented how environmental heterogeneity can sustain local butterflies' diversity through temporal shifts of individuals in shaded, resource-rich micro-areas during the critical period of the summer months. We found that grassland and forest environments are complementary to preserve alpha diversity of butterflies and provided evidence that during current climatic crisis, butterflies need more habitat resources other than the larvae's host plants and the nectar for adults, thus possibly reducing habitat availability. As a main output of this project, we are developing a protocol indicating evidence based on mitigation actions that could be replicated in other Mediterranean areas.

Mediterranean CO₂ vents as open-lab for broadcasting future organism's responses to ocean acidification scenarios: the case study of the cyanobacteria *Halomicronema metazoicum*

SIMONETTI S.[1,2]*, ROMANO P.[1], GAMBI M.C.[3], ZUPO V.[2], CORSI I.[1]

[1]*Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente, Università di Siena, via P. A. Mattioli, 4, 53100 Siena, Italia*
[2]*Dipartimento di Biotecnologie Marine Ecosostenibili BluBioTech, Stazione Zoologica Anton Dohrn, Istituto Nazionale di Biologia, Ecologia e Biotecnologie Marine, Villa Comunale 80121 Napoli*
[3]*Istituto Nazionale di Oceanografia e di Geofisica Sperimentale, OGS, Trieste, Italia*

* e-mail: silvia.simonetti@student.unisi.it

Increased fossil fuel combustion has led the rise of atmospheric carbon dioxide (CO_2) concentration by 30% producing an increase in CO_2 ocean absorption and a consequent fall in surface pH by near 0.1 units. This phenomenon, also called ocean acidification (OA), can severely affect marine ecosystems at different levels, from single species to communities. However, certain marine organisms have remarkable abilities to deal with and tolerate naturally acidified environments. Recent findings on Cyanobacteria have underlined the involvement of ATP-binding cassette (ABC) transporters in acid stress responses, probably due to the transport of molecules facilitating acid stress tolerance. Cyanobacteria have a great ecological relevance and play key roles in biogeochemical cycles. The marine cyanobacterium *Halomicronema metazoicum* has been isolated from *Posidonia oceanica* leaves in meadows also exposed to natural low-pH conditions at CO_2 vents off Ischia (Tyrrhenian Sea), and it is considered able to tolerate such acidified environments. This feature makes it an interesting organism to evaluate molecular mechanisms of resistance to low-pH/high-pCO_2 environments. Hence, *Halomicronema* mattes from cultures maintained at the Stazione Zoologica (Naples) have been exposed to three low-pH levels (7.70, 7.20, 6.50) for 7 days. The data collected provide a first assessment of ABC transporter involvement in tolerance to OA scenarios, through ABC-like *slr2019* gene expression analysis. Results have confirmed that *Halomicronema* can tolerate low-pH environments since it has grown during the 7-days exposition. Upregulation of *slr2019* gene has been detected at pH 7.70 (predicted-pH by 2100) while no gene modulation has been observed at lower pH values (6.50). An hormesis response to decreasing pH environments could be hypothesized and further investigation will unravel the mechanism behind it. The understanding of molecular mechanisms ruling cyanobacteria responses/adaptations to acid stress conditions will permit to predict impacts on other species and related communities of shallow coastal areas of the Mediterranean.

Quantitative evaluation of carbon and water fluxes in Mediterranean mixed forest undergoing climate change by simulating models at different spatial scales: the study case of Palo Laziale Wood (Rome, Italy)

Vitale M.[1]*, Lombardi D.[1], Perez M.[1]

[1]*Dipartimento di Biologia Ambientale, Sapienza Università di Roma, Piazzale Aldo Moro 5, 00185 Roma, Italia*

* e-mail: marcello.vitale@uniroma1.it

Desertification and aridity of the soil, in conjunction with the water emergency, are today among the main threats to forest health. These phenomena intensified by ongoing climate change led to a reduction or loss of biological productivity. This is the case of the Palo Laziale Wood (Rome), a Mediterranean ecosystem in a serious decline phase caused by the presence of the *Biscogniauxia mediterranea*, pathogen fungi, and triggered by an increase of aridity due to a progressive decrease of rainfall and rising temperature. Using a completely modelling approach, a general model was assembled to quantify Gross and Net Primary Productivity (GPP, NPP - gC/m^2) and Evapotranspiration (ET - mmH_2O) as a function of the variables and increasingly extreme local climatic conditions for the entire forest stand (TOP -DOWN approach) and for the main plant species that characterize it (BOTTOM-UP approach). A time-series climate analysis carried out from 1951 to 2020 was useful for the calculation of the Standardised Precipitation Evapotranspiration Index (SPEI), individuation and quantification of the climatic trend (ITA and Change point analysis) and the extreme events (NEVA analysis) and for the development of climate short-term (five years) predictive model (ARIMA model). Since 2003 (the year of the appearance of the pathogen *Biscogniauxia mediterranea*), the Palo Laziale Wood is showing signs of recovery, but the forest ecosystem is moving towards a status in which the Mediterranean scrub (*Pistacia latifolia, P. lentiscus)* is expanding causing the degradation of the wood component (*Q. Ilex* and *Q. cerris*). This vegetational dynamism is mainly linked to local climate change. The constant increase in temperature and decrease in rainfall negatively affect the productivity capacity of the forest, especially in summer. The tendency towards increasing aridity of the Palo Laziale Wood is also confirmed by the SPEI and trend climate analysis.

SESSIONE 5
FOCUS MEDITERRANEO: BIODIVERSITÀ, IMPATTI ANTROPICI E CAMBIAMENTI CLIMATICI

POSTERS

S5.P1 Deposit-feeding sea cucumbers in integrated multitrophic aquaculture: a stable isotope study

Ciriminna L. [1,3]*, Rakaj A.[2,3], Grosso L. [2,3], Pensa D. [2,3], Fianchini A. [2,3], Scardi M. [2,3], Mazzola A. [1,3], Vizzini S.[1,3]

[1]Dipartimento di Scienze della Terra e del Mare, Università degli Studi di Palermo, via Archirafi, 18, 90123 Palermo, Italia

[2]Laboratorio di Ecologia Sperimentale ed Acquacoltura – LESA, Dipartimento di Biologia, Università di Roma "Tor Vergata", via Cracovia 1, Roma, Italia

[3] CoNISMa, Consorzio Nazionale Interuniversitario per le Scienze del Mare, Piazzale Flaminio,9, 00196 Roma, Italia

* e-mail: laura.ciriminna@unipa.it

The fast growth of the aquaculture sector may generate concern about increasing amount of solid and dissolved nutrients dispersed in the aquatic environment. Aquaculture cages can release a considerable amount of waste, such as faeces, excreta and uneaten feed, causing organic loading in nearby areas. Recently, bioremediation of seawater and sediment enriched in aquaculture-derived organic matter, through different extractive species (e.g., suspension and deposit feeders) has been developed in the context of integrated multi-trophic aquaculture (IMTA). Aligned with these considerations, a preliminary assessment in an IMTA was carried out throughout stable isotope analysis (SIA, δ^{15}N and δ^{13}C) with the aim to investigate on the potential exploitation of aquaculture waste by the Mediterranean sea cucumbers *Holothuria tubulosa* and *H. polii*. In detail, adult specimens of both species were placed in tanks located close to the cages of an intensive fish farming in the Central Tyrrhenian Sea. In addition, tanks without sea cucumbers were used as experimental controls. SIA was conducted on sea cucumbers before the start of the experimental period and after six months; analysis was also carried out on the organic matter accumulated in the tanks. Isotopic results confirm the assimilation of aquaculture waste by the holothurians as their isotopic composition changed throughout time, matching that of waste at the end of the experimental period. The comparison of isotopic values of the accumulated organic matter collected from tanks with and without sea cucumbers did not change suggesting that, at the tested experimental density, sea cucumbers did not significantly transformed organic matter. These preliminary results corroborate the potential use of sea cucumbers in IMTA systems and their role in the mitigation of environmental impacts of aquaculture.

S5.P2 Phthalate acid esters detection in Mediterranean muscles (*Mytilus galloprovincialis*) sampled in three islands of the Tuscan Archipelago National Park with different levels of protection

Concato M. [1]*, Galli M.[1], Baini M.[1], Giani D.[1], Panti C.[1], Fossi M.C.[1]

[1]*Department of Physical, Earth and Environmental Sciences, University of Siena, via P. A. Mattioli, 4, 53100 Siena, Italy*

*email: margherita.concato@student.unisi.it

Phthalate acid esters (PAEs) are a class of pollutants that can affect the environment, wildlife, and humans. PAEs are often used as plastic additives, it has been shown that they can be released into the marine environment as a result of the presence of plastic litter. Mediterranean mussels *(Mytilus galloprovincialis)* tend to accumulate microplastics and several persistent contaminants, have often been referred as a potential bioindicators of anthropogenic pollution. The aim of this study was to evaluate the levels of eleven PAEs in *Mytilus galloprovincialis* sampled in three Islands of Tuscan Archipelago National Park: Capraia, Giglio, and Montecristo, which are characterized by different level of protection and are thus exposed to a different anthropogenic pressure. The levels of PAEs have been correlated to the ingestion of microplastics in specimens collected simultaneously, as well as the concentration of microplastics in the same area, within the Interreg-Med Plastic Busters MPAs project. Eight out of eleven PAEs were detected, represented mainly by Diisobutyl phthalate (42%) and Dibutyl phthalate (37%). Mediterranean mussels collected in Capraia, have reported the highest ΣPAEs, with a total mean of 1,519.65 ± 243.21 ng/g w.w., as well as the occurrence of microplastics found in the specimens (71% of MP occurrence) and in the superficial waters collected in the same area 211,650 ± 159,736 items/km^2. The lowest levels of ΣPAEs, microplastics occurrence (48%) in mussels and in the superficial waters were found in Montecristo, which is the most protected Island among the three. The results obtained show that the anthropogenic pressures, affecting the Islands under study can influence the concentration of microplastic in the environment and accumulation of PAEs by marine organisms, confirming Mediterranean mussels as a suitable local-scale bioindicator for microplastics and plastic additives.

S5.P3 Modeling maritime traffic exposure for marine megafauna: differentiated potential risk assessment for bottlenose dolphins in the Sicily Channel and surrounding waters

GREGORIETTI M.[1,3]*, RUSSI M.[1], DI BONA G.[1], ARCANGELI A.[2], SARÀ G.[1]

[1]Dipartimento di Scienze della Terra e del Mare, Università di Palermo, viale delle Scienze Ed. 16, Palermo, Italia

[2] ISPRA, Bio. Dep., via Brancati 60, Roma, Italia

[3] Accademia del Leviatano, via dell'Ospedaletto 53, 00054 Fiumicino, Roma, Italia

* e-mail: martina.gregorietti@community.unipa.it

The Mediterranean Sea, listed among the global hotspots of biodiversity, is as well one of the busiest waterways of the world. The negative effects of maritime traffic can involve several elements of the ecosystems, and in particular marine mammals. They are essential component of the marine biodiversity playing a key role of apical predators, and their specific life-history traits make them particularly susceptible to human threats. The target species of this study was the common bottlenose dolphin, whose widespread distribution mostly associated with -but not limited to- the continental shelf, has made it particularly vulnerable to maritime traffic. Using data collected on board of passenger ferries (FLT Med Monitoring Network project) three different shipping categories were considered to empirically evaluate the potential influence of vessels' intensity on the presence of the species. Then, employing 11 categories of vessel density rasters from the EMODnet platform, the potential spatial footprint of the threat and a seasonal index of exposure risk were assessed. Overall, in presence of bottlenose dolphins the number of vessels was always lower than the one registered in random locations in absence of sightings, stratifying for both seasons and vessel categories. The percentage of the study area interested by the presence of naval traffic changed over time with the considered category with Fishing, Cargo, and Tanker showing the higher values of both spatial footprints and the risk index. The coastal areas, the Egadi Island and the Sicilian Channel were the areas which showed medium to high risk values, and then potentially more dangerous for the species. Despite acknowledged as a ubiquitous threat to the conservation of marine megafauna, shipping is rarely actively managed. Nevertheless, understanding how cetacean habitats overlap with shipping distributions throughout the years is crucial for improving future decision-making regarding the zoning of the marine space.

S5.P4 The effect of acidification on planktonic metabolism in the Panarea Island (Southern Tyrrhenian)

Lucchese M.[1,2] *, Berlino M.[1,2], De Vittor C.[2], Sarà G.[1]

[1]Laboratory of Ecology, Earth and Marine Science Department (DiSTeM), Viale delle Scienze Ed. 16, University of Palermo, Palermo, Italy

[2]National Institute of Oceanography and Applied Geophysics - OGS, via A. Piccard 54, 34151 Trieste, Italy

* e-mail: martalook94@gmail.com

Nowadays, global climate change is a central theme of the marine science and acidification (OA) of our seas represents one among the most crucial issue for the future of marine ecological communities. Ecological alterations due to OA are pervasive across all ecological components, from benthic to pelagic communities. Nevertheless, there is no still deep understanding about the role of OA on structure and dynamics of planktonic communities. Here, taking advantage from a natural acidified area in Southern Tyrrhenian, we investigated the role of acidification on plankton using the O_2 consumption (here after respiration) rate at community level as a proxy of community metabolism. Plankton plays a key role within the marine biogeochemical cycle playing a role to buffer climate change by regulating the air-water exchange of O_2 and CO_2 through its metabolic processes. Thus, here the respiration of plankton communities was measured at Panarea Island (Aeolian Archipelago, Sicily) under two levels of acidification by exploiting the natural emission of CO_2 from the hydrothermal vents and correlated with the structure and composition of the communities. Although data showed homogeneity in the composition of the planktonic communities under two different pH levels, the respiration was significant different with a lesser oxygen consumption rate for the planktonic community exposed to lower pH levels. Even though still preliminary, present results however offers a new perspective based on community metabolism to study the effects of climate change. This may improve our understanding on how and whether global climate change is able to influence the metabolism and composition of the ecological community, here represented for instance by plankton.

S5.P5 A metabarcoding approach for investigating a preliminary community structure of phytoplankton resting stages in the Mediterranean Sea

Marinchel N.[1,2]*, Casabianca S.[2], Girardi M.[3], Scardi M.[4], Vernesi C.[5], Penna A.[2]

1 Department of Pure and Applied Sciences, University of Urbino, Campus E. Mattei, via Ca le Suore 2/4, 61029 Urbino (PU), Italy

2 Department of Biomolecular Sciences, University of Urbino, Campus E. Mattei, via Ca le Suore 2/4, 61029 Urbino (PU), Italy

3 Conservation Genomics Unit, Research and Innovation Centre, via E. Mach 1, 38010, San Michele all'Adige (TN), Italy

4 Department of Biology, University of Rome Tor Vergata, Rome, Italy

5 Forest Ecology Unit, Research and Innovation Centre, Fondazione Edmund Mach, via E. Mach 1, 38010, San Michele all'Adige (TN), Italy

* email: n.marinchel@campus.uniurb.it

Nowadays, eDNA metabarcoding is increasingly becoming the preferential method to investigate biodiversity. Marine sediments are still poorly studied even though resting stages can provide information on the ecological structure of phytoplankton. To obtain information on taxonomic diversity and ecological structure of communities from marine sediments, we applied eDNA metabarcoding to Mediterranean sediments retrieved around Italian regional seas targeting resting stages. The results showed that the presence of dinoflagellate cysts is higher than diatom spores. The highest occurrence of spores is reported in the Ionian Sea with 29% of spores, against 71% of cysts, while in the Tyrrhenian Sea, the highest dinoflagellate cysts' occurrence with 97% of cysts including 26% of parasitic order of *Syndiniales* and only the 3% of diatom spores were found. We analysed patterns of α- and β-diversity across the Mediterranean sub-regions splitting the Adriatic Sea in north, central and south according to hydrodynamic and currents. Indexes of α-diversity (Shannon, Simpson, richness and Pielou's eveness) were calculated for each sub-region. The three areas of the Adriatic Sea are quite homogenous. Ionian Sea has the highest Shannon and richness index representing the richest sub-region. Tyrrhenian Sea has the lowest indexes (except for richness). The β-diversity was decomposed into two dissimilarity components of replacement, measured as Simpson dissimilarity, and nestedness, as nestedness-resultant fraction of Sørensen dissimilarity, for each site of the sub-regions. β-diversity reveals high diversity between sites, mostly explained by spatial turnover. The highest total β-diversity recorded is in Ionian Sea. Northern and central part of the Adriatic Sea show homogeneity between sites, while in the southern part, the total β-diversity increases. These are preliminary results, and in the next steps, we will integrate these data with environmental variables understanding which may influence community variation and inferring the full ecological structure of phytoplankton resting stages in the Mediterranean Sea.

S5.P6 Structure and functioning of a coastal lagoon over time: a review on the Stagnone of Marsala (Trapani, Sicily)

Marsiglia N.[1]*, Mancuso F.P.[1], Belmar M.B.[1], Sarà G.[1]

[1]Dipartimento di Scienze della Terra e del Mare, Università degli Studi di Palermo, viale delle Scienze, ed. 16, 90128, Palermo, Italia

* e-mail: nicoletta.marsiglia@unipa.it

Coastal lagoons are highly productive ecosystems contributing to the overall productivity of coastal waters by supporting high levels of biodiversity and primary production, playing also a key role in local fisheries. Despite their ecological, economic and social value these semi-enclosed ecosystems are sensitive to environmental changes such as eutrophication, pollution, biological invasions and habitat alteration, which could influence habitat structure and biodiversity composition. The Stagnone of Marsala is a shallow semi-enclosed coastal lagoon in the western coast of Sicily that is not only relevant for its historical and archaeological values, but also for the hydrodynamic system (low depths of the northern basin with high evaporation and significant effects on surface currents due to the presence of different islands within the lagoon), high nutrient levels and high associated biodiversity. Here, a systematic review was performed to investigate the potential effects of climatic stressors on the structure and functioning of this lagoon over time. To this end, we applied the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, by searching a complex string in the online databases Scopus, Wos and Scholar, as well as different sources of grey literature, yielding a total of 51 outcomes. Overall, result covered monitoring information on a broad range of habitats, including seagrass meadows (mainly *Posidonia oceanica* and *Cymodocea nodosa)* and macroalgae (mainly *Cystoseira spp., Caulerpa prolifera* and *Chaetomorpha linum),* where physical variables (mainly temperature and salinity) were correlated to sediment and water column biochemical characteristics, and biodiversity (species richness), in a temporal range between 1990 and 2022.

S5.P7 Functional diversity of the faunal assemblages associated with Mediterranean mussel (*Mytilus galloprovincialis*) clumps

Mikac B.[1]*, Colangelo M.A.[2,3], Abbiati M.[1,3,4], Asunis A.[2], Fossi E.[2], Mecca M.[2], Tarullo A.[2], Costantini F.[2,3,4]

[1]Dipartimento di beni culturali, Università di Bologna, Campus Ravenna, via degli Ariani, 1, 48121 Ravenna, Italia

[2]Dipartimento di Scienze Biologiche, Geologiche e Ambientali, Università di Bologna, Campus Ravenna, via S. Alberto, 163, 48123 Ravenna, Italia

[3]Centro Interdipartimentale di Ricerca per le Scienze Ambientali – CIRSA, Università di Bologna, Campus Ravenna, via S. Alberto, 163, 48123 Ravenna, Italia

[4]Consorzio Nazionale Interuniversitario per le Scienze del Mare (CoNISMa), Piazzale Flaminio, 9, 00196 Roma, Italia

* e-mail: barbara.mikac@unibo.it

Mussel clumps provide a favourable habitat for a wide range of invertebrates which live in the spaces between shells and on their surfaces. Diversity and structure of these assemblages can be described by functional traits – a series of morphological, biochemical, physiological, structural and behavioural characteristics of organisms, which determine how they interact with the environment and with the individuals of the same and other species. The aim of this study was to assess functional diversity and structure of the faunal assemblages associated with wild and farmed populations of Mediterranean mussel *Mytilus galloprovincialis* Lamarck, 1819. Mussel clumps were sampled in spring and autumn from 3 mussel farms and 3 sites with wild mussel populations, along the coast of Emilia-Romagna region (Italy, northern Adriatic Sea). A total of 147 invertebrate taxa were identified. Life modalities of the five selected life traits (Bioturbation, Body size, Feeding habit, Larval development and Adult mobility) were assigned to each taxon, using fuzzy coding procedure. Overall, the most abundant life modalities were Superficial modifier, Body size 10-50 mm, Suspension/filter feeder, Direct development, and Swimmer. Univariate functional diversity indices were calculated. Functional richness and Functional evenness of the faunal assemblages were not significantly different between wild and farm habitats in the two seasons, while functional distinctness resulted significantly higher in the wild habitat. Functional structure of the faunal assemblages resulted different between seasons, farm and wild habitats and sites. This was due to the different species composition and abundance between habitat types and seasons, and related to the different life cycles of the species, and presumably to the different environmental conditions and anthropogenic disturbances in the two habitats. Results of this research can be considered as a starting point for the further studies regarding functional ecology of mussel beds in the Mediterranean.

S5.P8 Ecotoxicological study on Osprey (*Pandion haliaetus*) nestlings from coastal environments of central Italy: an integrative approach by using blood and feathers

Monti F.[1]*, Sforzi A.[2], Caliani I.[1], Marsili L.[1,3], Ancora S.[1]*

[1]*Department of Physical Sciences, Earth and Environment, University of Siena, Via Mattioli, 4, 53100 Siena, Italy.*
[2]*Maremma Natural History Museum, Strada Corsini 5, Grosseto 58100, Italy.*
[3]*Centro Interuniversitario di Ricerca sui Cetacei, c/o DSFTA, Università di Siena, Strada Laterina 8, 53100 Siena, Italy.*

*e-mail: flaviomonti00@gmail.com

High-trophic level species are particularly susceptible and vulnerable to exposure and bioaccumulation of environmental contaminants, thus representing excellent sentinel species that can provide integrated and relevant information on the related ecosystems. The osprey *Pandion haliaetus* is an apical predator of the trophic webs of aquatic ecosystems, subject to a considerable impact of pollutants. As part of a long-term monitoring program applied to the conservation of the species in Italy, this research aims to investigate trace elements and organochlorine compounds through the analyses of blood and feather samples of 46 wild-born osprey chicks, collected during 2015-2021. Erythrocytic nuclear abnormalities (ENA assay) and differential WBCs count were also conducted. At population level, Selenium had the highest concentration in blood (4.182 ± 1.67; n=26) and Mercury in feathers (2.35 ± 1.39; n=45). In contrast, both Cadmium and Lead showed very low levels, sometimes below the detection limits. Mercury and Selenium were positively correlated in blood but not in feathers. Mean values of abnormalities varied from the lowest number of kidney (0.30 ± 0.60), which accounted for only 1.92% of total ENAs to the highest of lobed nucleus (12.55 ± 8.89) accounting for 80.71%. Lymphocytes were the most common WBC, followed by heterophils, eosinophils, monocytes and basophils; thrombocytes showed high values also. Analysis of some Persistent Organic Pollutants (*POPs*) such as polychlorinated biphenyls (PCBs) and organochlorine pesticides (OCPs: HCB, o,p'-DDT, p,p'-DDT, o,p'-DDE, p,p'-DDE, o,p'-DDD, p,p'-DDD), confirmed the presence of these xenobiotic contaminants in Tuscan coastal environments, potentially affecting the local breeding osprey population. This study provides new data for the species in the Mediterranean region, and indirectly informs on the quality of the habitats attended by breeding individuals of this critically endangered population, which deserves a long-term monitoring and attentive management.

S5.P9 Target, non-target and suspect screening of Per-and PolyFluoroalkyl Substances (PFAS) in striped dolphin *Stenella coeruleoalba* (Tuscany coast, Mediterranean Sea)

Parolini M.[1]*, Roscioli C.[2], Mazzetti M.[3], Marsili L.[4,5], Valsecchi S.[2], Polesello S.[2], Altemura P.[3], Voliani A.[3], De Felice B.[1], Fochi I.[6], Mancusi C.[3,4]

[1]*Dipartimento di Scienze e Politiche Ambientali, Università di Milano, Via Celoria, 2, 20133 Milano, Italia*

[2]*Istituto di Ricerca sulle Acque, Consiglio Nazionale delle Ricerche, via Mulino, 19, 20861 Brugherio, MB, Italia*

[3]*Agenzia Regionale Per l'Ambiente Toscana (ARPAT), Via Marradi, 114, 5716 Livorno, Italia*

[4]*Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente, Università degli Studi di Siena, strada Laterina, 8, 53100 Siena, Italia*

[5]*Centro Interuniversitario di Ricerca sui Cetacei (CIRCE), DSFTA, strada Laterina, 8, 53100 Siena, Italia*

[6]*Thermo Fisher Scientific, Via Milano 3, Rodano, MI, Italia*

* e-mail: marco.parolini@unimi.it

Analysis 18 target of Per- and PolyFluoroalkyl Substances (PFAS) and suspect and non-target screening were carried out on liver, muscle, blood and brain of 26 striped dolphins *Stenella coeruleoalba* stranded along Tuscany coasts (Italy, North Western Mediterranean Sea) from 2020 to 2022. Dolphins were collected thank to the Regional networking group. Morphometric parameters total length, weight, sex, age were collected when possible and also their conservations status and exact localization of stranding. Samples of striped dolphin' tissues were extracted by QuEChERS protocol and the extracts were analysed by ultra-high performance liquid chromatography coupled with high-resolution mass spectrometry. Target analysis included perfluoroalkyl-carboxylates (PFCA), -sulfonates (PFSA) and –sulfonamides (FASA). Data treatment workflow for PFAS discovering included, beside standard NTS workflow steps, mass defect filtering, exact mass matching to catalogued PFAS, homologous series detection (CF2 and CH2), retention time pattern analysis, neutral losses, fragment screening (in-source and MS2 fragments), and predicted MS/MS from structures. Preliminary suspect screening analysis allowed identifying long chain perfluorocarboxylic acids, novel perfluorosulfonamides and a series of X:3 fluorotelomer carboxylic acids in cetacean tissues. It is evident from the present study that long-chain PFAS accumulate in the different tissues, with a similar distribution pattern of the target PFAS in liver, blood and muscle, but different from that found in brain, where the longest perfluoroalkylcarboxylates prevail. The highest concentrations have been determined in liver, where the precursors undergo oxidation to perfluoroalkylacids. The detection of PFAS, and the discovering previously uncatalogued PFAS, underlines a remarkable impact of anthropic activities of the regions of the Mediterranean sea on wildlife, and prompts further researches about the impact of PFAS on marine mammal conservation and health.

S5.P10 Mucilage-induced necrosis reveals cellular oxidative stress in the Mediterranean gorgonian *Paramuricea clavata*

Seveso D.[1,2]*, Montalbetti E.[1,2], Cavallo S.[1], Azzola A.[3], Montano S.[1,2], Maggioni D.[1,2], Louis Y.D.[1,2], Gobbato J.[1,2], Montefalcone M.[3], Galli P.[1,2]

[1]Department of Earth and Environmental Sciences (DISAT), University of Milano - Bicocca, Piazza della Scienza, 1, Milano, 20126, Italy

[2]MaRHE Center (Marine Research and High Education Centre), Magoodhoo Island, Faafu Atoll, Maldives

[3]Department of Earth, Environment and Life Sciences (DiSTAV), University of Genova, Corso Europa 26, 16132 Genova, Italy

* e-mail: davide.seveso@unimib.it

The red gorgonian Paramuricea clavata is a fundamental ecosystem engineer of coralligenous biocenosis in the Mediterranean Sea, where it plays crucial ecological functions and enhances the habitat biodiversity. However, it is strongly endangered due to climate change-related stressors such as mucilage events, which have increased in recent decades causing extensive damage and mortality, but whose impacts at the molecular and cellular levels are still unexplored. In this study, different cellular stress biomarkers were analysed in mucilage-colonized P. clavata specimens living in the Portofino Marine Protected Area (Ligurian Sea, Italy), in order to elucidate the cellular pathways affected by mucilage and the cellular defense mechanisms adopted. Within these colonies, portions of healthy tissue located at different distances from mucilage-induced necrosis were considered. Our results showed that mucilage affected the cellular oxidative status and impaired lipid cell membranes of the whole P. clavata colony. Indeed, an increase in the superoxide dismutase (SOD) and glutathione reductase (GR) enzymatic activity and in the level of lipid peroxidation (LPO) was detected in colonies showing mucilage-induced necrotic tissues compared to healthy ones. In particular, fragments sampled just next to the necrotic tissue displayed the highest levels of SOD and LPO, indicating that harmful oxidative damage was in progress, especially in portions neighboring the mucilage colonization. In this context, the up-regulation of the antioxidant mechanisms might represent a defense and a barrier from hypoxic or anoxic conditions created by mucilage overgrowth or by the invasion of toxic organisms embedded in the mucilaginous aggregates. On the contrary, the cellular protein homeostasis, analyzed by the expression of the 60-kDa Heat shock protein (Hsp60), was not altered. This analysis contributes to providing new insights into the impact of mucilage on gorgonians, and could represent a useful diagnostic tool for developing stress mitigation strategies and conservation plans in light of future climate change.

SESSIONE 6
BIODIVERSITÀ E RETE NATURA 2000

La sessione sarà incentrata sulla analisi della struttura e della funzione della Biodiversità, in ecosistemi naturali ed antropizzati. Verranno prese in considerazione le perdite di Biodiversità per cattivo uso del Capitale Naturale da parte dell'Uomo e le conseguenti misure di gestione e protezione che vengono o possono essere messe in atto per la salvaguardia della Biodiversità e dei Servizi ecosistemici gratuitamente forniti alla Società umana.

Chairs:

Elisa Anna Fano, Salvatrice Vizzini, Letizia Marsili

INVITED SPEAKER

SAMMURI G.

Presidente Federparchi
Presidente del Parco Nazionale dell'Arcipelago Toscano

The management of alien species in the islands: action and results in the Arcipelago Toscano National Park

Islands are crucial sites for the world's biodiversity. Although they cover only the 5.3% of the landmasses of the Earth, they host 19% of bird species, 17% of rodents and 27% of flowering plants, moreover, according to the IUCN red list, 61% of extinct species were insular and the main cause was the alien species (Bernie *et al.*, 2015). Many eradications of invasive alien species from the islands have been implemented around the world, among them very significant examples are in the Galapagos and Macquarie islands. The Arcipelago Tuscano National Park extends over 7 islands whose sizes range from 22,350 ha (Elba) to 223 ha (Gorgona). Contrasting the threats of alien species, is one of the Park's main aims for the biodiversity conservation. In this presentation the activities carried out and still ongoing over the last 10 years by the park are described, highlighting used techniques and critical issues faced regarding public opinion.

SESSIONE 6
BIODIVERSITÀ E RETE NATURA 2000

COMUNICAZIONI ORALI

Investigating avian migratory connectivity in the framework of the CMS/EURING/Movebank Eurasian-African bird migration atlas

Ambrosini R. [1]*, Costanzo A. [1], Rubolini D. [1], Romano A. [1], Spina F.[2], Fattorini N. [1,3]

[1]Dipartimento di Scienze e Politiche Ambientali, Università degli Studi di Milano, via G. Celoria, 26, 20133 Milano, Italia

[2]Area Avifauna Migratrice, Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA), Via Ca' Fornacetta 9, 40064, Ozzano dell'Emilia (BO), Italia

[3]Dipartimento di Scienze della Vita, Università degli Studi di Siena, Via P.A. Mattioli 4, Siena, 53100 Italia

* e-mail: roberto.ambrosini@unimi.it

Migratory connectivity is defined as the linkage among individuals between the periods and areas where they spend different phases of their annual life cycle. In consideration of the aims shared in the Eurasian African Bird Migration Atlas (https://www.migrationatlas.org), funded by the Italian Government to CMS, and with the involvement of EURING and Movebank, we performed migratory connectivity analyses on 137 bird species breeding within the Palearctic-African migration system. We first checked the robustness of the results by sensitivity analysis and showed that the power of these analyses was reasonable for a sample size of at least 30 individuals. We also compared the strength of migratory connectivity obtained by different methods of analysis and found that they showed good agreement and repeatability. We then summarized the results in a meta-analysis that allowed disclosing some ecological processes that drive the strengths of migratory connectivity observed in the different species. Overall, the strength of migratory connectivity in the European-African bird migration system showed high interspecific variability, but it was significant in almost all (c. 92%) of the species analysed. In addition, the analyses showed that migration strategies also varied at the intraspecific level, with most species showing geographically distinct migratory populations. In conclusion, our analyses offer a critical tool that can be used to inform conservation and management strategies of European birds by describing migratory connectivity patterns accurately on a case-by-case basis. This analytical exercise also prompted a theoretical work aiming at providing a clearer definition of migratory connectivity that we hope will foster our understanding of the geographical links between individuals during different periods of their annual life-cycle and will facilitate the conservation and management of migratory species at the population level.

The approach of the NATural Network Tuscany (NATNeT) project to Habitat monitoring: bad *vs* good news

Angiolini C.[1]*, Gennai M.[2], Bonini I.[1], Calbi M.[2], Castagnini P.[1], De Simone L.[1], Fanfarillo E.[1], Fiaschi T.[1], Gabellini A.[2], Mugnai M.[2], Sarmati S.[1,3], Viciani D.[2], Maccherini S.[1], Foggi B.[2]

[1]*Dipartimento di Scienze della Vita, Università di Siena, via P.A. Mattioli, 4, 53100 Siena, Italia*

[2] *Dipartimento di Dipartimento di Biologia, Università di Firenze, via La Pira 4, 50121 Firenze, Italia*

[3] *Dipartimento di Scienze, Università di Roma Tre, Viale G. Marconi 446, 00146 Roma, Italia*

* e-mail: claudia.angiolini@unisi.it

In the last years, the Tuscany region began to acquire data to assess the current conservation status of target animal and plant species and habitats, as required by the 92/43 CEE Directive (Habitat Directive). This was achieved with the projects MONITORARE and NATNeT, carried out by the three Tuscan Universities (UNISI, UNIPI, UNIFI). The Habitat Directive defines Natural habitats as: "Terrestrial or aquatic areas distinguished by geographic, abiotic and biotic features, whether entirely natural or semi-natural". The scientific community agrees that the identification and description of a habitat is mainly linked to the plant component characterizing its structure. Thus, plant communities are used as proxies for habitat detection and identification. The habitat monitoring process was based on the detection of some parameters (range, occupied area, structure and functions, and future perspectives), mainly in accordance with the ISPRA Manual for the monitoring of habitats of community interest in Italy. However, several changes were necessary according to the available resources, and different procedures were adopted based on the habitat type. Our main aim is to propose a method for habitat monitoring in which all the steps are clearly described to facilitate sampling repeatability. So far, more than 1,270 vegetation plots have been collected on Directive habitats in Tuscany. In this contribution, we analyze some problems encountered during the implementation of the monitoring plan, which deserve a discussion about their positive and/or negative implications. Four examples are shown: 1) effects of opportunistic (i.e, phytosociological) *vs* random selection of sampling points in the case of *Fagus sylvatica* forests; 2) how many plots are needed for an exhaustive sampling in the case of dune ecosystems; 3) the problem of the selection of typical species in the case of salty-mud habitats; 4) whether to use floristic and/or structural data in the case of *Quercus suber* woodlands.

Fish assemblages in two Marine Protected Areas along the Campania coast (central Tyrrhenian sea): the role of physiographic features of *Posidonia oceanica* beds.

Appolloni L. [1,2]*, Pagliarani A.[3], Cocozza di Montanara A. [1,2], Ciorciaro D. [1,2], Donnarumma L. [1,2], Rendina F. [1,2], Ferrigno F. [1,2], Di Stefano F. [1,2], Sandulli R. [1,2], Russo G.F. [1,2]

[1] *Consorzio Nazionale Interuniversitario per le Scienze del Mare (CoNISMa) Rome, URL-Centro Direzionale—Isola C4, 80143 Napoli, Italy;*

[2] *Department of Science and Technology (DiST), Marine Ecology Laboratory, Parthenope University of Naples, Centro Direzionale—Isola C4, 80143 Napoli, Italy;*

[3] *Dipartimento Infrastrutture di Ricerca per le Risorse Biologiche Marine, Stazione Zoologica "Anton Dohrn", Ischia Marine Centre - Punta San Pietro, 80077 Ischia, Napoli, Italy - Villa Comunale 80121 Napoli, Italy*

* e-mail: luca.appolloni@uniparthenope.it

Posidonia oceanica is an endemic seagrass species of the Mediterranean Sea. It is included in the "Habitats Directive" (92/43/CEE) and it is of primary importance for Marine Protected Areas (MPAs) conservation measures. Spatial and temporal variations of fish community structures living in this habitat have been deeply investigated; however, little is known about the relationship between physiographic parameters of *P. oceanica* beds and fish assemblages. Hence, the aim of this study was to investigate this topic. PERMANOVA analyses were performed on data collected in two Italian MPAs, Santa Maria di Castellabate (SMC) and Costa degli Infreschi e della Masseta (CIM). At each MPA, three zones with different protection levels (no-take zone, general reserve and partial reserve) and three depth levels (shallow limit, 15 meters depth and deep limit) were considered. DistLM and dbRDA analyses were used to correlate fish communities with physiographic parameters of *Posidonia* beds. *P. oceanica* beds showed differences in density among depth levels for both MPAs, while structure of fish assemblages followed different trends at the two MPAs. Specifically, at SMC, differences in fish abundances and biomasses were detected only among depth levels; while, at CIM, these differences were detected for both protection and depth levels. Shoot density and total leaf surface were the main physiographic parameters of *P. oceanica* beds influencing the structure of fish assemblages. At both MPAs, physiographic parameters of *P. oceanica* beds and structure of fish assemblages are higher at intermediate depth levels (15 meter). This can be related to the higher leaf surface and the consequent increase in settling organisms, which reflects along the trophic chain up to the high-level predators. Finally, protection effects have been observed only at CIM, probably due to the SMC very small "no-take zone", which is confined at the northern edge.

In situ observation of biodiversity of deep-sea Vulnerable Marine Ecosystem for the designation of Natura 2000 sites along the Apulian coasts (central Mediterranean)

Carluccio A.[1,3]*, Capezzuto F.[2,3], Maiorano P.[2,3], Sion L.[2,3], D'Onghia G.[2,3]

[1] Dipartimento di Scienze e Tecnologie Biologiche ed Ambientali, Università del Salento, S.P. Lecce-Monteroni - Ecotekne, 73100 Lecce, Italia

[2] Dipartimento di Biologia, Università degli Studi di Bari Aldo Moro, via E. Orabona 4, 70125 Bari, Italia

[3] CoNISMa, Piazzale Flaminio 9, 00196 Roma, Italia

* e-mail: angela.carluccio@unisalento.it

A belt of deep-sea Vulnerable Marine Ecosystems (VME), such as those characterised by cold-water corals (CWC), is present along the Apulian margin (central Mediterranean Sea). Although some of these VMEs have been protected through the institution of Fishery Restricted Area (FRA) by the GFCM, as done for the CWC provinces of Santa Maria di Leuca (SML) and Bari Canyon (BC), none of these deep-sea VME have been designated as a Natura 2000 site. The exploration of VME requires the use of low impact sampling techniques such as baited lander, which allows collecting information on species which could not be sampled with traditional methods and often included in IUCN Red List, such us CWC species and cartilaginous fishes. In order to collect information on the biodiversity of benthopelagic fauna of deep-sea VME, the baited lander MEMO (Marine Environment Monitoring system) equipped with 2 video cameras was deployed in 3 VMEs, characterized by the presence of CWC, along the Apulian coasts: BC, off Monopoli (Mn) and SML. A total of 31 deployments were carried out between 427 and 792 m, for a total of 223 hours of video record. A total of 45 species were recorded: 9 cephalopods, 13 crustaceans, 7 cartilaginous fishes and 16 osteichthyes. The cartilaginous fishes *Centrophorus granulosus* and *Dalatias licha,* classified as critically endangered ad vulnerable, respectively, were recorded in all areas, whereas *Dipturs oxyrinchus*, classified as near threatened was recorded in Mn and SML. *Somniosus rostratus* classified as data deficient, was recorded only inside BC. The least concern species *Etmopterus spinax* and *Hexancus griseus* were recorded in all areas. Conservation strategies depend on the available information on the biodiversity and studies conducted with video systems can reveal new aspects of deep-sea VMEs that can lead to new conservation measures, such as the designation of Natura 2000 sites.

Fishermen and sea turtle let's turn the light on under the sea

Ceciarini I.[1,3]*, Franchi E.[1], Consales G.[1,3], Capanni F.[1], Minoia L.[1], Fanciulli P.[3], Marsili L.[1,2,3]

[1]Department of Physical Sciences, Earth and Environment, University of Siena, Via Mattioli, 4 - 53100 Siena, Italy

[2]Centro Interuniversitario per la Ricerca sui Cetacei (CIRCE), Department of Environment, Earth and Physical Sciences, University of Siena, Strada Laterina 8, 53100 Siena, Italy

[3]Associazione onlus La casa dei Pesci, Via Montianese, 41 – 58015, Talamone, Italy

* e-mail: ilaria.ceciarini@student.unisi.it

Since fishing activities is putting more pressure on marine biota, sustainable management practices must be implemented to support marine ecosystem conservation especially for marine protected area. Commercial fishing leads to accidental catches (bycatch) of non-target species with significant effects on fish stocks and major marine vertebrates such as sea turtles. We investigated the occurrence and frequency of sea turtle bycatches in the Northern Tyrrhenian Sea, where are located sites protected from Natura 2000 network such as "Padule della Trappola, Bocca d'Ombrone" (IT51A0039) and "Tutela del *Tursiops Truncatus*" (IT5160021). We tested the efficacy of UV-LED lamps as a Bycatch Reduction Device. During summer 2020, BRD trials took place on two vessels in Talamone (Grosseto) and Viareggio (Lucca) using "equipped" trammel nets set with lamps and "control" nets without devices. In Talamone, the total "equipped" and "control" net lengths were respectively 19.600 and 16.800 m, while in Viareggio the total length was 9.600 m for both net types. Once the net was on board, the commercial quantity caught (by species), sale price, discards (species/size), and accidental catches of protected and endangered species were recorded. No sea turtle bycatch was recorded, and the catches of "equipped" and "control" nets were compared to assess any disturbances from the visual devices on commercial fishing success. The catches per unit of effort (CPUE) were calculated to obtain $CPUE_N$ and $CPUE_W$ values. The $CPUE_N$ for the "control" was 73.93 and 35.00 respectively in Talamone and Viareggio, whereas "equipped" was 60.00 in Talamone and 34.38 in Viareggio. The $CPUE_W$ "control" was 70.81 and 13.81 in Talamone and Viareggio, respectively, but "equipped" was 98.55 in Talamone and 23.68 in Viareggio. Statistical analysis concluded the use of UV-LED lamps in nets did not decrease the capture of commercial species in Tuscan small-scale artisanal fisheries which mostly (80%) used gillnets ($p > 0.05$).

Application of spatial food web simulations at a marine Natura 2000 site: analysis of vulnerability and management actions

Donati E.[1]*, Fabbri F.[2], Russo E.[2], Pranovi F.[2], Ponti M.[3], Turicchia E.[3], Airoldi L.[4], Mazzotta M.[3] Brigolin D.[1]

[1] *Università IUAV di Venezia, Dipartimento di Culture del Progetto, Dorsoduro 2196, Cotonificio veneziano, 30123, Venezia*

[2] *Università Ca' Foscari Venezia, Dipartimento di Scienze Ambientali, Informatica e Statistica, Via Torino, 155, 30172, Venezia Mestre*

[3] *Università di Bologna, Dipartimento di Scienze Biologiche, Geologiche ed Ambientali, P.za Porta S. Donato, 1, 40126, Bologna*

[4] *Università di Padova, Dipartimento di Biologia, Viale G.Colombo, 3, 35131, Padova*

* e-mail: edonati1@iuav.it

Marine Natura 2000 sites play an important role in nature conservation, while representing an opportunity to promote sustainable natural resources exploitation. To be effective, Natura 2000 sites should be managed considering spatial and temporal ecosystem dynamics. In this study, conducted within the Interreg project CASCADE, we applied a spatially explicit food web model in Ecopath with Ecosim to the Tegnùe di Chioggia SCI, a Natura 2000 site characterized by biogenic rocky outcrops and still lacking a proper management plan. Following the principles of the Ecosystem Approach, biological and economic compartments were included in the model. Species groups distribution and spatial dynamics of main fishing fleets were considered. Through temporal simulations, we first assessed the vulnerability of the socio-ecological system to climate change and fishing effort scenarios. Spatial simulations and multi-criteria analysis were combined, to compare the effects of alternative management actions on the ecosystem (artisanal fishing in the SCI, SCI area extension and mussel farms expansion). Ecosystem indicators were used to summarize simulations outputs. Results confirm the expected vulnerability to climate change: increased water temperature induces a reduction in biomass diversity (lower Kempton index) and commercial species abundance, while species associated to rocky outcrops (e.g., *Diplodus annularis*) are predicted to decrease substantially. Results indicated that bycatch threats trophic groups when fishing effort is increased over time. Spatial food web simulations also reveal how ecosystem complexity can lead to unexpected results when different management options are compared. Indeed, based on the multi-criteria analysis, the expansion of mussel farming areas was the best management scenario, partly explained by the collateral no-take zone effect for trawlers. Constraints on model performances imposed by data availability, and future monitoring efforts to fill these gaps, are discussed.

A sampling strategy for assessing habitat coverage at broad spatial scale

Franceschi S.[1]*, Fattorini L. [1], Cervellini M.[2,3], Chiarucci A.[3,4]

[1]*Department of Economics and Statistics, University of Siena, P.zza San Francesco, 8, 53100 Siena, Italy*

[2]*School of Biosciences and Veterinary Medicine, Plant Diversity and Ecosystems Management Unit, University of Camerino, Via Pontoni 5, 62032 Camerino, Italy*

[3]*BIOME lab, Department of Biological, Geological and Environmental Sciences, Alma Mater Studiorum, University of Bologna, Via Zamboni, 33, 40126, Bologna, Italy*

[4]*Inter University Centre PlantDATA, Department of Biological, Geological and Environmental Sciences, Alma Mater Studiorum, University of Bologna, Via Zamboni, 33, 40126, Bologna, Italy*

* e-mail: sara.franceschi@unisi.it

One of the major tasks for European Union Member States, in compliance with the Council Directive 92/43, is the quantitative assessment of habitats conservation status. Up to now, various approaches are adopted for national assessments and there is no consensus on how to achieve common statistically sound estimates of the criteria indicated by the EU Directive for the evaluation of the status and trend of habitat types. The aim of the work is to present an adaptive monitoring approach based on a two-phase sampling scheme to estimate the coverage of EU terrestrial habitat types, as one of the four criteria indicated by the Habitat Directive. 8 habitats, distributed among different EU Member States, are considered and Italy is chosen as case study. In addition, a simulation study is performed to check the precision of the coverage estimators accounting for the lack of sampled data (nonresponse treatment), subregions and real constrains. The proposed approach has the potential to increase precision in estimating the coverage of habitat types (approximated at 1 ha cell size) respect to simple random sampling without replacement, taken as benchmark. In the challenging context of a 'mandated' monitoring type our approach provides sound statistical estimates of habitat coverage. The possibility to apply a standardised and transferable sampling scheme that can be easily repeated over time could be an applicative achievement in building a reliable approach to detect habitat coverage changes or trends in the EU terrestrial habitat network.

The role of Threat Analysis and Threat Reduction Assessment in the effectiveness of a conservation project on two threatened birds in a mediterranean wetland

Giovacchini P.[1]*, Battisti C.[2], Marsili L.[1]

[1] Department of Physical Earth and Environmental Sciences, Università degli Studi di Siena, via P.A. Mattioli 4, 53100 Siena, Italy.

[2] Torre Flavia' LTER (Long Term Ecological Research) Station, Protected Areas–Regional Park Service, Città Metropolitana di Roma Capitale, viale G. Ribotta 41, 00144 Rome, Italy.

* e-mail: p.giovacchini1@student.unisi.it

In projects carried out in Natura 2000 sites may be strategic apply new approaches. Here, we applied the Threat Analysis (TAN) and the Threat Reduction Assessments (TRAs), assessing the effectiveness of a project focused on two water-related bird species (*Sterna hirundo* and *Sternula albifrons*), in a wetland of central Italy (The "Diaccia Botrona" wetland in the municipalities of Grosseto and Castiglione della Pescaia - Grosseto, Tuscany, central Italy), located within a Regional Reserve. We used the IUCN standardized lexicon for the classification of threats, utilizing a panel of experts to assess a set of regime attributes of each human-induced disturbance. Our aims were: (i) through the TAN approach, to carry out an arrangement and quantification of the main threats acting on our focal species and select the priority ones; (ii) through the TRA approach, to test the effectiveness of an operational project focused on mitigating the threats and improving the breeding success of species. Using the TAN approach, experts identified the following human- induced threats (IUCN code): 6.1—Generic disturbance; 7.2—Water stress; 7.3—Salinization; 8.8— Vagrant dogs; 8.8—Mediterranean gulls; 8.8—Wild boars, all significantly different in their magnitude. Among them, wild boars and Mediterranean gulls appeared the priority threats with the greatest extent, intensity and magnitude. Using the TRA approach, after the project, we assessed an overall decrease in the threat magnitude of 23.08% (21.42% when considering only the threats directly affected by our project). These data suggest that further efforts should be devoted to achieving greater effectiveness of conservation actions focused on our target species. With limited time and resources to quantify threats, expert-based approaches could be useful for rapidly assessing the effectiveness of small conservation projects by providing a range of scores obtained following an analytical procedure.

Spatial Ecology of the association between demosponges and *Nemalecium lighti* at Bonaire, Dutch Caribbean

Gobbato J.[1,2]*, Magrini A.[1], Garcìa-Hernàndez J.E.[3], Virdis F.[4], Galli P.[1,2], Seveso D.[1,2], Montano S.[1,2]

[1] Department of Earth and Environmental Sciences (DISAT), University of Milan – Bicocca, Piazza della Scienza, 20126 Milan, Italy

[2] MaRHE Center (Marine Research and High Education Center), Magoodhoo Island, 12030 Faafu Atoll, Maldives

[3] Marine Genomic Biodiversity Laboratory, Department of Marine Sciences, University of Puerto Rico - Mayagüez, PO Box 9000, Mayagüez, PR 00681, USA

[4] Reef Renewal Foundation Bonaire, Kralendijk, Bonaire, Dutch Netherland

* e-mail: jacopo.gobbato@unimib.it

Coral reefs are known to be among the most diverse marine ecosystems and one of the richest in terms of associations and species interactions, especially involving invertebrates such as corals and sponges. The study of cryptofauna diversity associated with coral reefs is recently gaining momentum. There is an ever-growing body of scientific literature supporting the ecological importance that cryptofauna play in the survival and resilience of the reef ecosystem. Unfortunately, in the last decades, these associations have been threatened by climate change and anthropic pressure. Despite that, our knowledge about cryptic fauna remains remarkably scarce, therefore this study aimed to address this gap by defining for the first time the spatial ecology of the association between the epibiont hydrozoan *Nemalecium lighti* and the Porifera community of shallow coral reef systems at Bonaire. In particular, the host range, prevalence, and distribution of the association were examined in relation to different sites, depths, and dimensions of the sponge hosts. *Nemalecium lighti* has been found in association with 9 out 16 genera of sponges and 15 out 16 of the dive sites examined. The prevalence of the hydroid – sponge association in Bonaire reef was 6.55%, with maximum value of over 30%. This hydrozoan has been found to be a generalist symbiont, with a strong preference for sponges of the genus *Aplysina* and no significant preference in relation to depth. On the contrary, the size of the host resulted to influence the prevalence of association with large tubular sponges found to be the preferred host. Although further studies are needed to better explain the main biological and ecological reason for these results, this study improved our understanding about the cryptofauna diversity of coral reefs associations in Bonaire.

LifeIMAGINE Umbria: Adaptive management actions for *Coenagrion castellani* conservation

LA PORTA G.[1]*, ELIA A.C.[1]

[1]*Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, via Elce di Sotto, 8, 06123 Perugia, Italia*

* e-mail: gianandrea.laporta@unipg.it

Despite internationally and nationally set goals and environmental policies, biodiversity continues to decline at an alarming rate. In Europe, the most relevant structure for species protection is the Natura 2000 network. LifeIMAGINE Umbria (LIFE19 IPE/IT/000015) is the project through which the European Commission is funding the protection and restoration of the environment and reversing the biodiversity loss in the Umbria region. The project focuses on several threatened habitats and species and among them the damselfly *Coenagrion castellani* (Odonata: Zygoptera). Odonates can act as flagship and umbrella species for wetland areas and thus contributing to the conservation of freshwater habitats and associated species. In particular, *C. castellani* has been investigated in small freshwater bodies, generally neglected by biodiversity research programs, that run in the intensively managed lowland farmland of the region. Multiple aspects of the ecology of this declining damselfly are being monitored, including home range, routine movement, dispersal, abundance, survival, and capture probability. The goal is to assess the conservation status of populations, highlight trends, and analyze the interactions of the species with the agricultural landscape. These preparatory activities of the Life project were instrumental in clarifying some key elements for the development of an adaptive management protocol for the maintenance of drainage ditches inhabited by this species, identifying essential prescriptions and recommending best (or at least better) practices for its *in-situ* conservation.

Which presence and status of the wolf (*Canis lupus italicus*)
in the Po Delta territory?

Lanzoni M.[1]*, Grignolio S.[2], De Curtis O.[3], Nobili G.[4], Gavioli A.[5], Castaldelli G.[1], Fano E.A.[2]

[1]University of Ferrara - Department of Environmental Sciences & Prevention
[2]University of Ferrara - Department of Life Sciences & Biotechnology
[3]Emilia-Romagna Region - Protected Areas, Forestry and Mountains Development Department
[4]Carabinieri for Biodiversity - Punta Marina Department
[5]Management Body for the Parks and Biodiversity Po Delta

*mattia.lanzoni@unife.it

The Italian wolf population is rapidly expanding, and this phenomenon also affects Emilia-Romagna and, more recently, the macroarea of the Delta Po, the last frontier of the wolf population at a regional level. After the first occasional registration of the presence data of the species during 2019-2020 in Po Delta areas, Emilia-Romagna Region, Po Delta Regional Park, University of Ferrara and the Carabinieri for Biodiversity, carried out a first survey during of the first national wolf monitoring organized by ISPRA. From October 2020 to March 2021, extensive monitoring was set up through systematic sampling supported by opportunistic sampling. N. 6 squares, 10x10km grid were selected n. 23 transepts, travelled no. 89 transepts, with an average of 3.78 times per transept, recording no. 59 signs of presence with an average of 0.42 for transept. The opportunistic data collected in the same period are 12, for a total of no. 71 signs of presence detected. The data collected to date have confirmed the presence of the wolf in stable form in three distinct protected areas of the Po Delta, which cover 5 sites of Community Interest and Special Protection. It was also possible to identify the areas of greatest attendance and possible reproduction. Starting from 2020 a family unit has settled permanently in the station Valli di Argenta Regional Park, birth of n. 7 puppies in 2020 and n. 8 puppies in 2021, it is also possible to hypothesize a reproduction in 2021 and 2022 of all three herds settled in the Park stations. Furthermore, from these first results it is evident that the maintenance and conservation of the ecological characteristics of natural and semi-natural areas are fundamental for the wolf species and above all for its management in extremely antropized systems such as the plains and the Po Delta.

Integration of molecular and morphological data to study symbiotic hydrozoans

Maggioni D. [1,2]*, Seveso D.[1,2], Montalbetti E. [1,2], Gobbato J. [1,2] Louis Y.D. [1,2], Siena F. [1,2], Dehnert I. [2], Galli P. [1,2,3], Montano S. [1,2]

[1]*Dipartimento di Scienze della Terra e dell'Ambiente, Università degli Studi di Milano-Bicocca, Milano, Italia*
[2]*Marine Research and High Education Center, Università degli Studi di Milano-Bicocca, Faafu Magoodhoo, Maldives*
[3]*University of Dubai, Dubai Academic City, Emirati Arabi Uniti*

* e-mail: davide.maggioni@unimib.it

Hydrozoan polyps are mostly generalist in the choice of the substrate, but some species establish symbiotic associations with other benthic organisms. In the superfamily Zancleida, several species are associated with other organisms, including bryozoans, hard and soft corals, sponges, bivalves, and algae. These symbiotic hydroids can be both host-generalists or host-specific and show a diverse array of morphologies and behaviours. With this work, we present an updated phylogeny of the group, based on five molecular markers, and we use the obtained phylogenetic hypothesis to assess the evolution of symbiosis in the superfamily. Also, we assess the influence of the establishment of a symbiotic lifestyle on selected features, including polyp and medusa morphology, and modification of the hosts. Specifically, morphological characters were assessed using light microscopy, whereas modifications of the hosts were assessed using scanning electron microscopy. The phylogenetic hypotheses obtained using different methods were congruent and moderately to well resolved. The symbiotic lifestyle likely appeared multiple times during the evolution of the Zancleida and the analysed hydrozoan species showed variable levels of morphological variation and integration with the hosts. Overall, convergence in morphological and ecological features was observed for different species, revealing the need of a taxonomic revision of the Zancleida and contrasting some previous hypothesis about the evolution of the symbiotic lifestyle in this group.

"Reckoning without the host" The estimation of species richness in vegetation surveys

Marcelli A. [1]*, Di Biase R.M. [2], Fattorini L.[3]

[1]Dipartimento per l'Innovazione nei sistemi Biologici, Agro-alimentari e Forestali, Università della Tuscia, via S. Camillo de Lellis snc, 01100 Viterbo, Italia

[2] Dipartimento di Sociologia e Ricerca Sociale, Università di Milano-Bicocca, Piazza dell'ateneo nuovo 1, 20126 Milano, Italia

[3] Dipartimento di Economia Politica e Statistica, Università di Siena, piazza S. Francesco 7, 53100 Siena, Italia

* e-mail: agnese.marcelli@unitus.it

The work considers the issue of estimating the number of species in vegetation surveys. Sometimes, this problem is faced without taking into account some important factors that, if ignored, can lead to the construction of inaccurate estimators. The methodology and problems encountered when surveying plant communities by means of plot sampling are discussed. Three different probabilistic schemes typically adopted in these surveys are considered: uniform random sampling, tessellation stratified sampling, and systematic grid sampling. These schemes could virtually lead to Monte Carlo estimators based on the Horvitz-Thompson criterion, ensuring unbiasedness, consistency and, for the first two schemes, normality in a design-based approach, therefore completely objective. Unfortunately, such approaches suffer from the impossibility of quantifying the inclusion probability of the observed species. Alternative solutions based on the modelling of presence-absence data are mentioned, with a particular emphasis on the Chao-Colwell model, which is the basis of several estimators of species richness proposed in the literature. The unrealistic assumptions of Chao-Colwell model in vegetation surveys carried out by means of plots are outlined, underlying the possible inconsistency of the estimators based on such assumptions. All these estimators are implemented in the well-known softwares EstimateS and SPADE, widely used by botanists and foresters. In order to test the unreliability of these estimators in terms of bias, accuracy, accuracy estimation and coverage of confidence intervals, a simulation study was performed on a real forest stand completely surveyed in 2010 in a rectangular region of 50 ha located in the lowland tropical moist forest of Barro Colorado Island (Panama). The simulation results confirm the unreliability of these strategies in vegetation surveys.

Different scale approaches for biodiversity and ecosystem services analysis provided by urban green

Muresan A. N.[1]*, Gaglio M.[1], Vincenzi F.[1], Castaldelli G.[1], Fano E.A.[2]

[1]Department of Environmental and Prevention Sciences, University of Ferrara, via L. Borsari, 46, 44121 Ferrara, Italy
[2]Department of Life Sciences and Biotechnology, University of Ferrara, via L. Borsari, 46, 44121 Ferrara, Italy

*e-mail: alexandranicoleta.muresan@unife.it

Biodiversity loss is one of the major problems for decision makers. Habitat loss, overexploitation, pollution, climate change are the main cause of change. This loss in terms of biodiversity has negative effects on ecosystem functions and services as well. Urban areas are ecosystems characterized by low levels of biodiversity that affect environmental well-being and human health and welfare. This study aims to analyse how three different scale approaches (macro-, meso- and micro-scale) can be used to analyse the diversity in tree functional traits in urban green areas and their relation with the provision of ecosystem services. This will inform on the selection of more efficient strategy to improve citizen well-being. The results show that different ecosystem services are provided according to tree community composition and its complex interactions with local environmental conditions. The analysis at macroscale revealed that the same tree species supply different levels of ecosystem services according on environmental context. Moreover, mesoscale allows emphasizing the spatial distribution of air depuration service, while microscale modelled the specific effect of each leaf trait. Overall, this study demonstrates the importance to promote high level of biodiversity in cities, in order to maintain the ecosystem functioning and provide a wider range of ecosystem services.

The last stronghold of *Pinna nobilis*. An overview of the distribution and status of the critically endangered fan mussel in the Venice Lagoon and surrounding waters

Sigovini M.[1]*, Basso A.[2], Bergamasco Alessandro[1], Bergamasco Andrea[1], Bernardi Aubry F.[1], Donnici S.[3], Fadini A.[1], Guarneri I.[1], Lorenzetti G.[1], Manea E.[1], Manfé G.[1], Menegon S.[1], Pessa G.[4], Pretto T.[2], Sabino A.[1,5], Scarpa G.M.[1], Tagliapietra D.[1], Tosi L.[3], Vetri A.[2]

[1] *Consiglio Nazionale delle Ricerche, Istituto di Scienze Marine (CNR-ISMAR), Venezia, Italia*
[2] *Centro Specialistico Ittico - Istituto Zooprofilattico Sperimentale delle Venezie - Legnaro (PD), Italia*
[3] *Consiglio Nazionale delle Ricerche, Istituto di Geoscienze e Georisorse (CNR-IGG), Padova, Italia*
[4] *Gruppo Sommozzatori Caorle, Caorle, Italia*
[5] *Università degli Studi Milano-Bicocca, Milano, Italia*

* e-mail: marco.sigovini@ve.ismar.cnr.it

The fan mussel *Pinna nobilis* is the largest endemic bivalve of the Mediterranean. The species plays a key ecological role in transitional and coastal waters by increasing biodiversity and improving ecosystem functionality, and it is subject to protection by national and international laws (e.g. Habitat and Marine Strategy Framework directives). In 2016 an epidemic broke out in the western Mediterranean, soon spreading eastwards, causing Mass Mortality Events (MME) and a drastic decline of populations. The disease has been associated to the protozoan *Haplosporidium pinnae*, however its cause has not yet been fully clarified. *Pinna nobilis* is present in the Venice lagoon and surrounding waters, however no systematic information is available so far. Therefore, to contribute to fill the gap, several research activities have been started. Since 2018, the populations in major bio-geogenic rocky outcrops (*tegnùe*) in the Veneto coastal waters have been subject of monitoring surveys. The overall species distribution in the Venice Lagoon was mapped through a citizen science initiative, called "*Mappa La Pinna*", launched in 2020. Moreover, a collection of quantitative data at different scales and through different approaches was started, including small-scale, high-resolution photogrammetric surveys by Structure-from-Motion approach. A site near Ottagono Alberoni in the central lagoon was monitored monthly from October 2020, and a MME associated to an 80% mortality, confirmed also in other lagoon sites, was recorded. Molecular analysis on the partially decomposed tissues of a dead specimen, collected in October 2020, identified the presence of *H. pinnae*. Whereas populations of the surrounding coastal waters appear compromised, with mortality near 100%, the Venice lagoon, characterised by large and dense colonies and a survival rate of 20-30%, possibly hosts the largest extant productive population of the species. These results and the continuation of the research activities will inform management policies and conservation strategies for the species.

SESSIONE 6
BIODIVERSITÀ E RETE NATURA 2000

POSTERS

S6.P1 Biodiversity assessment in natural and urbanized sites. An insight in LIFEPLAN project sites in central Italy

CARRANZA M.L.[1]*, RASINO M.V.[2]*, SCIARRETTA A.[3], DI FEBBRARO M.[1], STANISCI A.[2]

[1] *Dipartimento Bioscienze e Territorio, Università degli Studi del Molise, c.da Fonte Lappone – 86090 Pesche (IS), Italia*

[2] *Dipartimento Bioscienze e Territorio, Università degli Studi del Molise, Via Duca degli Abruzzi, 67, 86039 Termoli (CB), Italia*

[3] *Agricoltura, Ambiente e Alimenti, Università degli Studi del Molise, Via De Sanctis - 86100, Campobasso (CB), Italia*

*e-mail: carranza@unimol.it

At present a critical loss of biodiversity is occurring while it is estimated that about the 80% of all species on Earth still await to be discovered. LIFEPLAN is an ERC project (led by the University of Helsinki) aimed at assessing planetary biodiversity by systematically collecting data on a broad range of taxonomical groups across a network of 150 sites globally distributed. The two LIFEPLAN sites in Italy are in charge of the University of Molise-Termoli and CNR IRSA-Verbania, and are part of LTER network (Long Term Ecological Research). The University of Molise is engaged for a six years period (2021-2026) for collecting data inside one natural (LTER N2K Foce Trigno Marina di Petacciato), and one urban area (Circolo Vela Termoli). Biodiversity data is weekly collected using a set of modern semi-automated sampling methods: a) Malaise trap for surveying flying arthropods, b) camera traps for detecting fauna, b) audio recordings to record birdsong, c) cyclone sampler to survey spore and pollen and d) soil sampling for detecting fungi. Each trap is identified with a unique QR and collected data is uploaded on real-time to the Lifeplan Project system. Samples are preserved for later DNA barcoding analysis, a big component of this global research initiative, while artificial intelligence will be used to process the vast amounts of data. A preliminary analysis of the photos taken at the natural site in 2021 and at the urban site this year allowed us to detect the presence of several mammals (e.g. foxes, porcupines and wild boar) and birds. Biodiversity data from the University of Molise together with data from other parts of the world are made comparable by using identical equipment and sampling protocol. Expected results will provide a fundamental improvement of our knowledge on less known biodiversity across main ecosystems of the world.

S6.P2 The LIFE DREAM project - Deep REef restoration And litter removal in the Mediterranean sea

D'Onghia G.[1]*, Vassilopoulou C.[2], Gallas F.[3], Papadopoulou E.[4], Fanelli E.[5], Loiacono C.[6], Fraschetti S.[7], Dibitonto C.[8], Veneti A.[9], Cardone F.[10], Valentini S.[11], Gallart Garcia J.M.[12], Russo T.[13], Foglini F.[14]

[1]Dipartimento di Biologia, Università degli Studi di Bari Aldo Moro; [2]Hellenic Centre for Marine Research; [3]Net European Consulting srls; [4]Enaleia Astiki mi Kerdoskopiki Etaireia; [5]Università Politecnica delle Marche; [6]Agencia Estatal Consejo Superior de Investigaciones Cientificas – CSIC; [7]Università degli Studi di Napoli Federico II; [8]Regione Puglia; [9]Perifereiako Tameio Anaptyksis Perifereias Thessalias; [10]Stazione Zoologica Anton Dohrn, Napoli; [11]Federazione Nazionale delle Imprese di Pesca – Federpesca; [12]Organizacion de Productores Pesqueros de Almeria; [13]Università degli Studi di Roma Tor Vergata; [14]CNR ISMAR, Bologna.

*e-mail: gianfranco.donghia@uniba.it

The EU's biodiversity strategy for 2030 promotes the recovery of the biodiversity of European natural ecosystems through extending conservation networks, preventing and reducing anthropogenic impacts, and restoring the degraded natural heritage. Marine Deep Reefs (DR) are ecologically relevant benthic habitats acting as CO_2 sinks and attracting a highly diverse associated fauna. The multiple pressures DR are currently facing (e.g., climate change, fishery and littering) make the need to protect and restore these habitats more urgent. Marine Litter (ML) can affect the health status of DR, leading to the loss of associated ecological functions. Through an innovative, sustainable approach, the LIFE DREAM project (Federica Foglini PI) aims at mitigating the human pressure on deep sensitive habitats (DR) and promoting their protection, recovery and preservation. LIFE DREAM will comprise active intervention to aid the regeneration of DR and will provide supporting information to extend the Natura 2000 network to the deep-sea by integrating biological data on DR and ecosystems services they supply with spatial data on human activities. Active restoration (deployment of artificial structure as substrate for DR the forming-species growth) will be integrated with passive restoration activities (ML removal in correspondence of DR). The involvement of fishers and stakeholders within LIFE DREAM activities intends to enhance the impact of the project and boost a social behavior change. Following the principles of the circular economy, among the ambitions of the project is pairing the recovery with recycling of materials at the end of their lifecycle, converting the recovered ML in 2nd generation fuel that will reduce the CO_2 emissions. The results of LIFE DREAM would represent the baseline to extend the Natura 2000 network to the deep Mediterranean Sea and to restore deep sensitive habitats by providing best practices for DR restoration and the related costs and benefits.

S6.P3 Using botanic gardens as butterfly gardens: a pilot project in the Gran Sasso and Monti della Laga National Park (Italy)

FATTORINI S.[1]*, MANTONI C.[1], DAPPORTO L.[2], DAVINI G.[3], DI BIASE L.[1]

[1]Dipartimento di Medicina clinica, Sanità pubblica, Scienze della Vita e dell'Ambiente, Via Vetoio snc, 67100 Coppito, L'Aquila, Italia

[2] Dipartimento di Biologia, Università degli Studi di Firenze, via Madonna del Piano 6, 50019 Sesto Fiorentino, Firenze, Italia

[3] Ufficio Sviluppo Territoriale, Area Valorizzazione Economica e Sociale, Parco del Gran Sasso e Monti della Laga, Via del Convento snc, 67010, Assergi, L'Aquila, Italia

* e-mail: simone.fattorini@univaq.it

Butterfly gardens are green spaces designed to attract butterflies and offer them a space for feeding, mating, and resting. Despite the increasing interest in butterfly gardening, scientific literature on the subject remains limited. However, there is evidence that butterfly gardening can be an effective tool to: (1) mitigate habitat loss in anthropized landscapes, (2) record the occurrence of rare and endangered species, and (3) promote conservation awareness in the general public. Although butterfly gardening is mostly done in urban environments, it may represent a useful strategy in assisting butterfly conservation also in protected areas. Samplings conducted in the framework of a project on the conservation status of pollinators in the Gran Sasso and Monti della Laga National Park (Abruzzo, Italy) revealed that the already existing Botanical Garden hosts a very rich community of butterflies, including 41 species of butterflies (the highest richness recorded among all sites we have investigated within the Park). This high diversity may be explained by its location at an intermediate elevation and the presence of many attractive plants and a small pond. Thus, this Botanical Garden is already acting as a Butterfly Garden, and may represent an ideal occasion to investigate the role of butterfly gardening in promoting insect conservation in protected areas. As a first action, we have installed within the Botanical Garden a series of posters illustrating the importance of butterfly conservation, the butterfly fauna of the Park, and the species that visitors can easily observe in the Garden, with the aim of integrating botanical and entomological dissemination (hence the name "Butterflower Garden" coined for this initiative). We also planned to improve plant species composition, disposition and management to better assist butterflies. Using this case study, we aim at providing solid guidelines for the realization and management of other butterfly gardens in similar contexts.

S6.P4 Relationship between Lepidoptera diversity and coastal dune vegetation: an insight in the Italian Central Adriatic coast

Rasino M.V.[1]*, Stanisci A.[1], Sciarretta A.[2], Carranza M.L.[1]

[1] Dipartimento Bioscienze e Territorio, Università degli Studi del Molise, Via Duca degli Abruzzi, 67, 86039 Termoli (CB), Italia

[2] Dipartimento Agricoltura, Ambiente e Alimenti, Università degli Studi del Molise, Via De Sanctis - 86100, Campobasso (CB), Italia

* e-mail: m.rasino@studenti.unimol.it

Insect biodiversity is threatened by several anthropogenic factors as habitat loss, climate change and biological invasions. Coastal dune landscape consists on a mosaic of unique habitats, hosting a highly specialized entomofauna, including numerous species of lepidopterans often confined to very specific habitats. This research aims to explore the relation between Lepidoptera diversity and dune plants in the Central Adriatic coast (NK2 site Petacciato Marina, Molise, Italy). Moths and vegetation are sampled according with Long Term Ecological Research (LTER) protocol which determines data collection across transects perpendicular to the seashore, while butterflies are sampled following Butterfly Monitoring Schemes (BMSs). Lepidoptera specimens are caught at night-time, using UV-LED light traps, and by butterfly net during day-time, every 15 days (from December 2021 to November 2022), on mobile dunes with *Ammophila arenaria* (EU-2120) and on the Mediterranean maquis (EU-2260). Specimens are determined by the analysis of wing patterns (compared with scientific collections and specialized text illustrations) and by genitalia analysis. Vegetation sampling is carried out following a random stratified protocol on 4x4 plots distributed on the main habitats across the dune zonation. On each plot, the complete list of vascular plants is recorded and their relative abundance estimated. Plants are identified to species level following the Flora d'Italia. The analysis of the vegetation plots confirmed the presence several habitats (sensu 92/43/EC Directive) of dune zonation: 2110-Embryonic shifting dunes; 2120-Shifting dunes along the shoreline with *Ammophila arenaria*; 2230-*Malcolmietalia* dune grassland and 2260-Cisto-Lavanduletalia dune sclerophyllous scrubs. Preliminary results of Lepidoptera samplings for the period December-June evidenced a consistent number of individuals (415 on the Mediterranean maquis and 355 on the *Ammophila* community). The presence of different ecosystems in coastal dune zonation with a variety of plant species, structure and phenology supply a wide variety of niches which seems to favor a high Lepidoptera diversity value

Sessione 7
Studi trasversali in Ecologia

Posters

S7.P1 Atmospheric trace element deposition around an industrial site and potential for transfer to adjacent terrestrial environments

BARONI D.[1]*, MONACI F.[2]

[1] Dipartimento di Scienze Fisiche della Terra e dell'Ambiente, Università degli Studi di Siena, Via Mattioli 4, 53100 Siena, Italia

[2] Dipartimento di Scienze della Vita, Università degli Studi di Siena, Via Mattioli 4, 53100 Siena, Italia

* e-mail: davide.baroni@unisi.it

Pyrite roasting for sulphuric acid production has been carried out in the coastal area of the Scarlino valley (Central Italy) for about three decades, since the 1960s. The metallurgical activities caused extensive and deleterious land disturbances of contiguous natural environments associated with widespread soil and groundwater pollution by toxic elements. In this area, we carried out a field-based study targeting thirteen trace elements (As, Cd, Co, Cr, Cu, Mn, Ni, Pb, Sb, Sn, Tl, V, and Zn) with the aim of: i) establishing topsoil concentrations as a baseline for long-term monitoring and remediation; ii) measuring atmospheric deposition rates outside the main industrial area, and iii) estimating the transfer from air to the adjacent terrestrial environment. As a result of the historical mineral processing and roasting activities (arsenopyrite), soil As concentration for the overall study area (avg.: 32.3 $\mu g/g$) was much higher than the European baseline (11.6 $\mu g/g$) and the national limits (20 $\mu g/g$) for contaminated soils for residential areas. Analysis of bulk deposition (monthly, over one year) indicated atmospheric fluxes of elements generally low and those of As, Cd, Ni, Pb and Tl were much lower than the German guidelines. For As, measured deposition rates are at least three times lower than the target value, ranging within intervals typically found in rural (0.06-0.43 $\mu g/m^2/d$) and urban areas (0.22-3.4 $\mu g/m^2/d$). Since present atmospheric deposition contribute little to elemental soil baseline, the general framework of our findings refers to strongly altered soil conditions where contributions of human activity is superimposed to diffuse geochemical anomaly. However, As and other elements enrichment in agricultural soils adjacent to the industrial site prompts careful considerations on the health risks associated to the potential transport of these contaminants to biotic compartments through the soil-forage-herbivore-man food chain.

S7.P2 What Are Lake Beaches Made of? An Assessment of Plastic Beach Litter on the Shores of Como Bay (Italy)

BELLASI A.[1]*, BINDA G.[1,2], BOLDROCCHI G.[3]*, POZZI A.[1], BETTINETTI R.[3]

1 Department of Science and High Technology, University of Insubria, Via Valleggio 11, 22100 Como, Italy; abellasi@uninsubria.it (A.B.); andrea.pozzi@uninsubria.it (A.P.)

2 Norwegian Institute for Water Research (NIVA), Økernveien 94, 0579 Oslo, Norway

3 Department of Human and Innovation for the Territory, University of Insubria, Via Valleggio 11, 22100 Como, Italy

*e-mail: abellasi@uninsubria.it

Plastic waste dispersion is a well-recognized environmental threat, despite continuous efforts towards improving waste disposal management over the last few decades. Plastic litter is known to strongly impact upon water bodies and shorelines, affecting the health of ecosystems and impacting upon the aesthetic value of sites. Moreover, plastic waste that is abandoned on beaches contributes towards different degradation processes that potentially lead to the formation of secondary microplastics (MPs), with likely cascade effects upon the whole ecosystem. In this view, this study aims to characterize the plastic beach litter found on the shores of the western basin of Como Lake (Italy) to better understand the origin of MPs in littoral sediments, including the recognition of object typologies and the chemical characterization of polymers using Fourier-transformed infrared analysis (FTIR). The results highlighted that the most abundant polymers on beaches are polypropylene (PP) and polyethylene (PE), representing 73% of the collected polymers. This confirms that floating, low-density polymers are more likely to accumulate on beaches. Moreover, almost 66% of litter is represented by commonly used manufactured items (disposable objects, packaging, and everyday items). This evidence, combined with the analysis of the main environmental features of the sampling sites (the main winds, distance to urban areas, and the presence of tributaries) indicate that abundance of beached litter is mainly linked to beach accessibility and the local winds. These results highlight that multiple factors affect the environmental fate of plastic litter and give insights into the assessment of secondary microplastics in beach sediments.

S7.P3 Autoecology of alien species *Gymnocehalus cernua* in Lake Bracciano (Italy)

Cera A.[1]*, Scalici M.[1]

[1]Dipartimento di Scienze, Università degli studi di Roma "Roma Tre", v.le G. Marconi, 446, 00146 Roma, Italia

* e-mail: alessandra.cera@uniroma3.it

Gymnocephalus cernua is a teleost native to central-northern European and Asian marine and inland waters. Its range has expanded over the last decades, reaching the Mediterranean biogeographical region. Here, *G. cernua* is considered a potentially invasive alien species due to its broad ecological adaptations which allow it to compete with autochthonous species and alter the community. This study analyses the autoecology of a non-native population of *G. cernua* recently established in a Mediterranean volcanic lake. Specifically, biological (i.e. length, body weight, gonads weight, liver weight, sex, age) and ecological (i.e. diet) parameters were collected across 8 months. The length-weight relationship, length at age, gonadosomatic and hepatosomatic indices were calculated. Results showed a significant difference between males and females for all biological parameters, the latter showing the highest values. The fastest growth of females is also confirmed by the von Bertalanffy growth function. The diachronic analysis allowed the identification of May-July as the reproduction season by the gonadosomatic index outputs. July is also the most stressful timing for *G. cernua*. Indeed, during July the weight length relationship show thinner fish, according to the allometric index, as well as a lower R^2 hence more dispersed data. Temporal variations are observed in the hepatosomatic index of females but not of males. The diet of males and females is dominant of Chironimidae throughout the sampled months. Future research shall evaluate the relationship between this species and the communities of Lake Bracciano. Research on the management of *G. cernua* invasions is scarce, highlighting a knowledge gap which could hinder the containment of *G. cernua* expansion in water bodies.

S7.P4 Microplastics contamination of supraglacial debris differs among glaciers with different anthropic pressure

Crosta A.[1]*, De Felice B.[1], Antonioli D.[2], Chiarcos R.[2], Perin E.[2], Ortenzi M.A.[3], Gazzotti S.[1], Azzoni R.S.[4], Fugazza D.[1], Gianotti V.[2], Laus M.[2], Diolaiuti G.[1], Pittino F.[5,6], Franzetti A.[6], Ambrosini R.[1], Parolini M.[1]

[1] University of Milan, Department of Environmental Science and Policy, Via Celoria 26, I-20133 Milan, Italy

[2] University of Piemonte Orientale "A. Avogadro", Department of Science and Technological Innovation (DISIT), viale T. Michel 11, I-15121 Alessandria, Italy

[3] University of Milan, Laboratory of Materials and Polymers (LaMPo), Department of Chemistry, Via Golgi 19, I-20133, Milan, Italy

[4] University of Milan, Department of Earth Sciences "A. Desio", Via Mangiagalli 34, I-20133 Milan, Italy

[5] WSL Swiss Federal Research Institute, Birmensdorf, Switzerland

[6] University of Milano-Bicocca, Department of Earth and Environmental Sciences (DISAT), Piazza della Scienza 2.I-20131 Milan, Italy

* e-mail: arianna.crosta@unimi.it

Microplastics (MPs) contamination has become a global issue encompassing different terrestrial and aquatic ecosystems, be they in densely populated or remote areas. However, to this day, information on the presence and distribution of MPs in high-altitude ecosystems, such as glaciers, remains scattered and incomplete. The purpose of the present study was to investigate the occurrence, spatial distribution, and contamination pattern of MPs within and among glaciers with different anthropic pressure. Therefore, samples of supraglacial debris were randomly collected from three glaciers within the Ortles-Cevedale massif (Central Alps, Northern Italy), namely the Forni, the Cedec and the Ebenferner – Vedretta Piana glaciers. The latter suffers a notable anthropic pressure due to the presence of a ski area on its surface. The detected MPs were isolated and characterised in terms of shape, size, and polymeric composition. The mean concentration of MPs (± SE; MPs/g dry weight) measured in the debris from the Forni, the Cedec and the Ebenferner – Vedretta Piana glaciers was respectively 0.033 ± 0.007, 0.025 ± 0.009, and 0.265 ± 0.027 MPs/g. MPs abundance and its contamination pattern in debris from the highly-impacted Ebenferner – Vedretta Piana glacier significantly differed from those on the other glaciers, both in terms of prevailing shape and polymeric composition. Moreover, no significant spatial gradients in the distribution of MPs were detected along the ablation areas of any of the glaciers. Our results suggest that local contamination may constitute a notable source of MPs in glacier ecosystems that are subject to high anthropic pressures, while long-range transport may be the main source on other glaciers.

S7.P5 Effects of different combinations of organic amendments, copper and antibiotics on *Lactuca sativa* (var. *Rufus*) plant growth

De Carolis C.[1,3,4]*, Narciso A.[1], Pietrini F.[2], Costantini M.L.[3], Frugis G.[4], Iori V.[4], Iannelli M.A.[4], Grenni P.[1], Barra Caracciolo A.[1]

[1]*Istituto di Ricerca sulle Acque, Consiglio Nazionale delle Ricerche - (IRSA-CNR), SP 35d, Km 0,7 Montelibretti 00010 (Roma)*

[2]*Istituto di Ricerca sugli Ecosistemi Terrestri, Consiglio Nazionale delle Ricerche (IRET-CNR), SP 35d, Km 0,7 Montelibretti 00010 (Roma)*

[3]*Dipartimento di Biologia Ambientale Università di Roma "La Sapienza", Via dei Sardi 70, 00185 Roma*

[4]*Istituto di Biologia e Biotecnologia Agraria, Consiglio Nazionale delle Ricerche - (IBBA-CNR), SP 35d, Km 0,7 Montelibretti 00010 (Roma)*

* e-mail: chiara.decarolis@uniroma1.it

Manure has been using for centuries to fertilize agricultural soils. However, recent investigations have demonstrated manure as to be a potential source of heavy metals and emerging contaminants (e.g. antibiotics and bacteria carrying antibiotic resistance genes) into agroecosystems. The antibiotics frequently found in ecosystems are sulfamethoxazole (SMX), chlortetracycline (CTC) and ciprofloxacin (CIP), commonly used in both human and veterinary medicine. In addition, copper (Cu), already used in integrated pest management at high concentrations, also in organic farming, can be found in soil and cause toxic effects to both microbial community and to plants. Heavy metals can also induce amplification of antibiotic resistance mechanisms in antibiotic resistant bacteria. Moreover, both deficiency and excess of Cu affect plant growth with drastic effects on plant biomass production and yield. These contaminants can also accumulate into edible plants and then pass through food chain to animals and humans. Recent studies highlighted the possibility that cattle digestate produced by anaerobic processes from biogas plants can be an alternative and suitable organic amendment for agricultural soils. The objective of the present research was to investigate the effect of the co-presence of antibiotics (SMX, CTC and CIP, 7.5 mg/kg each) and Cu (30 mg/Kg) on the growth and development of lettuce plants (*Lactuca sativa*, var. *Rufus*), under different types of soil organic fertilization (cattle manure or digestate). For this purpose, greenhouse microcosm experiments were set up. The physiological plant performance was assessed through growth analyses (plant height, number of leaves, aboveground biomass) and biochemical and physiological parameters (photosynthetic efficiency (Fv/Fm), specific leaf area index, pigments content, malondialdehyde measurements). The soil rhizosphere microbial community was also analyzed, evaluating the microbial abundance and vitality (DAPI count, dehydrogenase activity). The overall results suggest that digestate, even in co-presence with antibiotics and Cu, improved lettuce plants performance and growth.

S7.P6 Impact of urbanization and agriculture on soil heavy metal contamination in a Mediterranean riparian ecosystem

De Marco A.[1]*, Napoletano P.[2], Guezgouz N.[3], Guerriero G.[4], Colombo C.[2]

[1] Department of Pharmacy, University of Naples Federico II, 80131 Naples, Italy

[2] Department of Agricultural, Environmental and Food Sciences, University of Molise, 86100 Campobasso, Italy

[3] Department of Biology, Mohamed Cherif Messaadia University, Souk-Ahras, Algeria

[4] Department of Biology, University of Naples Federico II, 80126 Naples, Italy

* e-mail: ademarco@unina.it

Riparian systems are functionally defined as "zones of interaction between terrestrial and aquatic systems", where soil properties can be affected by the combined effects of human impact and fluctuation in water level. The aim of the research was to evaluate the soil quality, focusing on heavy metal concentration (Cd, Cu, Fe, Mn, Ni, Pb and Zn) in the riparian ecosystems along the Medjerda river in northern Algeria. In order to highlight the impact of urbanization and agriculture on soil quality, single (Geo-accumulation index and Enrichment factor) and integrated indices (Pollution load index and Ecological risk index) were estimated. In addition, heavy metal accumulation in the skin of *Bufo spinosus* D. was measured, as possible biosentinel in both terrestrial and aquatic environments to understand the overall environmental health status. Around the city of Souk-Ahras, three agricultural soil profiles (0-60 cm depth) were sampled along an increasing gradient of anthropogenic impact in non-urban, peri-urban and urban areas. Our results showed that several soil properties along the Medjerda river vary significantly, whereas few changes were detected with depth. Although the investigated heavy metals never exceeded the geochemical background levels reported for European soils, the concentrations of Cd and Zn were similar to the EU limits. Geo-accumulation index for Cd highlighted strongly contaminated soils, and Enrichment Factor showed a moderate and high enrichment degree of the urban and peri-urban soils for all investigated heavy metals, except for Ni. Despite Pollution Load index showed no pollution for all the investigated sites, the potential ecological risk index highlighted a strong impact of metals on soil mainly along the urban profile. The skin heavy metal content confirmed the relationship between the intensity of urbanization and the environmental damage and emphasised that the agricultural input is an important source of soil contamination.

S7.P7 From model selection to maps: a completely design-based data-driven inference for mapping forest resources

Di Biase R.M.[1]*, Fattorini L.[2], Franceschi S.[2]

[1]Dipartimento di Sociologia e Ricerca Sociale, Università di Milano-Bicocca, Piazza dell'Ateneo Nuovo, 1, 20126 Milano, Italia

[2] Dipartimento di Economia Politica e Statistica, Università di Siena, Piazza S. Francesco, 8, 53100 Siena, Italia

* e-mail: rosamaria.dibiase@unimib.it

Wall-to-wall maps of forest attributes, such as basal area and biomass, are crucial sources of information for forest management, but the distribution of such attributes is an unknown parameter and sampling procedures are needed for its estimation. In this paper, we present an alternative approach to model-based strategies for forest mapping, in which an assisting model is used, but uncertainty stems from the adopted sampling scheme, in accordance to a model-assisted perspective. In particular, we propose a completely data-driven design-based strategy for mapping those forest attributes distributed within spatial units partitioning the study area, also exploiting auxiliary sources of information. Indeed, the growing availability of remote sensed data provided by satellites and aircraft based sensors is an important asset for improving the resulting estimates. The first step is the selection of a model using an Akaike-type criterion to remove from the set of available auxiliary variables those that are poorly correlated to the interest variable. Then, the set of selected variables is used to obtain the values of the interest variable within the spatial units by means of the ordinary least-squares method. The residuals of the regression model are interpolated using the inverse distance weighting method, also applying a leave-one-out cross-validation to select the smoothing parameter that minimizes the sample estimate of the overall squared error. At this point, densities for each unit are obtained by summing predictions and interpolated errors. Finally, densities are rescaled so that the sum of mapped values coincides with the estimate of total performed using traditional estimators. The uncertainty is accounted for by a bootstrap procedure that consists in resampling from the estimated map using the same sampling scheme adopted to produce the original sample. A simulation study and an application to a real case have also been conducted.

S7.P8 A worldwide perspective of long-term oxygen dynamics in two deep subalpine lakes

Leoni B.[1]*, Nava V.[1], Dresti C.[2], Rogora M.[2]

[1]DISAT, Università degli studi di Milano –Bicocca, Piazza della Scienza 1 20126 Milano, Italy.
[2]CNR, Water Research Institute (IRSA), Largo Tonolli, Verbania Pallanza, Italy.

*email: barbara.leoni@unimib.it

In a warming world, the decrease of gas solubility could lead to a decrease of DO concentrations in lakes. However other causes might also affect DO, such as primary production and heterotrophic respiration, changes in thermal dynamics. Climate change has been shown to have an impact on the deep subalpine lakes in Northern Italy, raising water temperature, deteriorating water column stability, and reducing the frequency and depth of vertical water mixing. Additionally, due to changes in the thermal regime, meso-eutrophic lakes have seen an increase in the extent of anoxic conditions, while oligo-mesotrophyc lakes have seen a recent drop in hypolimnetic oxygen concentration. Favourable environmental conditions promoted algal production, determining an increase in DO in epilimnetic layers. Forty-year trends in temperature and dissolved oxygen of two deep Italian lakes with distinct trophic levels, L. Iseo and L. Maggiore, will be debated in relation to patterns seen and expected for lentic ecosystems globally (Jane et al. 2021).

S7.P9 Bioadsorption of heavy metals by polysaccharides extracted from invasive marine macroalgae

Macrì A.[1]*, Agostino E.[1], Spagnuolo D.[1], Morabito M.[1], Genovese G.[1], Nicolò M.S.[1], Grillo E.[1], Spanò A.[1], Caccamo M.T.[2], Magazù S.[2], Zammuto V.[1], Gugliandolo C.[2]

[1]Department of Chemical, Biological, Pharmaceutical and Environmental Sciences, Messina University, Viale Ferdinando Stagno D'Alcontres 31, 98166 Messina, Italy;

[2]Department of Mathematics and Computer Science, Physics and Earth Science, Messina University, Viale Ferdinando Stagno D'Alcontres 31, 98166 Messina, Italy;

* e-mail: angela.macri@studenti.unime.it

Macroalgae inhabiting transitional environments, such as the brackish lake of Ganzirri (Messina, Italy), produce large amounts of biomass which needs to be periodically removed and treated as waste. Macroalgal polysaccharides possess several activities with attractive interest for the valuable transformation of waste into an economic and eco-friendly resource. Due to the anthropic activities, the concentration of heavy metals in the aquatic ecosystems is increasing, with negative consequences on the environmental and human health. In this study, crude polysaccharides extracted from *Agardhiella subulata* (Rhodophyta), *Ulva ohonoi* (Chlorophyta) and *Sargassum muticum* (Pheophyta) were evaluated for their biosorption of mercury, arsenic and vanadium (100ppm) by the ATR-FTIR spectroscopy. Carragenans from *A. subulata* (A1), alginate from *S. muticum* (S1) and ulvans from *U. ohnoi* (U1) were the main polysaccharides chemically identified. The spectra from the three polysaccharides after the exposition to As (III) and Hg (II) showed significant modifications in the peaks observed in the region attributed to OH groups of carbohydrates (800 to 1250 cm^{-1}), whereas no changes were observed after exposition to V (V). In details, changes in the spectra of A1 and U1 indicated that both carragenans and ulvans adsorbed Hg, mainly through the adsorbed complexation of Hg ions by the polysaccharidic OH groups. Moreover, spectra showed that carragenans adsorbed As, by both OH groups and carbons bonds (C-C) (2930 and 815 cm^{-1}). Exposed to As and Hg, S1 spectra showed significant changes in the region attributed to C-C bonds, but did not in that of OH groups, suggesting a weak interaction between alginate and these heavy metals. The collection of invasive, marine algal species may represent a double chance both for the mitigation of their negative impacts, and transforming waste into valuable resource of polysaccharides that could be used to remove heavy metals from aquatic systems.

S7.P10 Measuring urban expansion by multitemporal active remote sensing data: a trajectory analysis in a big city of south America

MARZIALETTI F.[1,2]*, GAMBA P.[2], SORRISO A.[2], CARRANZA M.L.[1]

[1]Envix-Lab, Department of Biosciences and Territory, Molise University, Contrada Fonte Lappone, snc, 86090 Pesche (Is), Italy

[2]Department of Electrical, Biomedical and Computer Engineering, University of Pavia, via Ferrata, 5, 27100 Pavia, Italy

* e-mail: flavio.marzialetti@unimol.it

The development of indicators to assess the expansion of urban areas embodies a crucial challenge to monitor the Sustainable Development Goals claimed by the United Nations (SDGs 2030). Uncontrolled and unsustainable urban sprawl as a consequence of population rise, socio-economic factors and technological development are altering the earth surface at unprecedented rates. This research explore the usefulness of active remote sensed data for monitoring urban sprawl processes in a subtropical city of south America. Specifically, based on multi-temporal urban cover maps of Cordoba in central Argentina derived from Cosmo-SkyMed SAR images we quantified the surface increase of urban areas and described urban sprawl process occurred during the last decade (2010-2021) in sectors characterized by different levels of urban cover (very low, low, medium, high, very high) through trajectory analyses. We mapped built up areas of 4 time steps using multi-temporal images (S1: 2010-11, S2: 2012-13, S3: 2018-19, S4: 2020-21). We quantified urban expansion in each time step identifying newly built areas over 2.5 ha. For these areas, we analyzed urban cover and a set of spatial pattern indices (UPIs), and by projecting them in a Cartesian space we performed a trajectory analysis. The results indicated a significant growth of urban areas (890 ha) according with two main process: the establishment of newly built up nuclei embedded on agricultural and natural landscapes in suburbs areas and the filling of remnant non-urban/semi-natural areas inside the city. The trajectory analysis highlighted non-linear relations between urban cover and PIs, offering some insights for better understanding urban sprawl processes. Multi-temporal analysis could be a useful tool detect and monitor different moments of urban expansion processes (form early settlement to dense urban conditions). This approach can be extended to other cities and landscapes in order to better understand urban dynamics at different scales and geographical conditions.

S7.P11 Carbon and nitrogen content analyzed with Vis-NIR spectroscopy in newly constructed soils in New York City

Napoletano P.[1,2]*, Colombo C.[1], Deeb M.[3], Egendorf S.P.[4], Singer B.[5], Cheng Z.[6], De Marco A.[7], Groffman P.[2,6,8]

[1] Department of Agricultural, Environmental and Food Sciences, University of Molise, via F. De Sanctis, snc, 86100 Campobasso, Italy

[2] Advanced Science Research Center (ASRC) at the Graduate Center, The City University of New York (CUNY), 85 St Nicholas Terrace, New York, NY, 10031 USA

[3] Microhumus, allée de Chantilly, 3, 54500 Vandoeuvre-les-Nancy, France

[4] School of Integrative Plant Science, Soil and Crop Sciences Section, Cornell University, Emerson Hall, 233, 14853 Ithaca, NY, USA

[5] Purchase College, State University of New York, Anderson Hill Road, 735, 10577 Purchase, NY, USA

[6] Department of Earth and Environmental Sciences, CUNY-Brooklyn College, Bedford Ave, 2900, 11210 Brooklyn, NY, USA

[7] Department of Pharmacy, University of Naples Federico II, via D. Montesano, 49, 80131 Naples, Italy

[8] Cary Institute of Ecosystem Studies, Sharon Turnpike, 2801, 12545 Millbrook, NY, USA

* e-mail: p.napoletano@studenti.unimol.it

There is great interest in urban greening efforts to address climate change and other ecosystem services in cities across the world. These efforts often involve the construction of artificial soils, classified as Technosols. These soils can function as a site for carbon (C) sequestration, by stabilizing organic by-products of microbial metabolic processes. The goal of this research was to monitor C dynamics over 21 months in newly constructed Technosols located in New York City (USA) made of 1/3 compost and 2/3 fluvial sediments in plots covered by different vegetation (bare, sunflower and cover crops). Soil parameters evaluated included pH, organic matter by loss on ignition (LOI), organic carbon (C) and nitrogen (N) content, C/N, C and N fractionation in light and heavy fractions, β-glucosidase, dehydrogenase and catalase. The soils were also analyzed with Vis-NIR spectroscopy. The results showed that pH was close to neutrality, and dropped slightly by the end of the experiment, driven by plant activity. LOI, C/N and enzymatic activity were highest in the intermediate part of the experiment due to the plant phenological stages. Light fractions of C and N gradually decreased as heavy fractions increased. Plant cover affected the investigated soil properties as marked and heterogeneous differences were highlighted between sunflower, cover crops and bare soils. Vis-NIR spectra of the soils provided evidence of changes in carbon fractions over time. These preliminary results highlight the capacity of Technosols to stablize organic carbon compounds over time and to function as a strong carbon sink in urban areas.

S7.P12 Ecohydrology: a holistic framework to study the interactions between water and ecological systems

Nardi M.[1]*, Aricò S.[2], Franzese P.P.[1]

[1]International PhD Programme / UNESCO Chair "Environment, Resources and Sustainable Development", Department of Science and Technology, Parthenope University of Naples, Italy.

[2]International Science Council, Paris, France.

*e-mail: margherita.nardi001@studenti.uniparthenope.it

The interlinkage between hydrological processes and water-related ecosystem services represents a fertile research area much needed to counteract the effects of an increasing climate instability and related threats to human and ecosystem health. Indeed, despite the importance of aquatic ecosystems and the dependency that most sectors have on them, they are still poorly studied with a holistic approach, hindering the development of adequate management strategies. In response to this lack, the Ecohydrology framework combines the study of the ecological relationships among living organisms and their physical environment with hydrological concerns about water quality, quantity, location and timing. Moreover, Ecohydrology provides a theoretical background for the transition from hard-grey to green and blue infrastructures, or at least their better integration, still far from being embraced in the decision-making and implementation processes. This paper aims to provide an overview of the state-of-the-art on the field of Ecohydrology, identifying former achievements and potential future research directions. In addition, the possibility to consistently integrate the use of environmental accounting within the interdisciplinary framework of Ecohydrology is explored. Indeed, environmental accounting could enrich the Ecohydrology framework with tools capable of quantitatively assess flows of ecosystem services generated by aquatic ecosystems and impacts related to their exploitation. These biophysical and economic assessments are important for steering the decision-making process towards human well-being and ecosystems health. The study also shows how the integration of ecology and hydrology into a consistent theoretical and operational framework, together with spatial planning tools, is crucial to achieve effective and sustainable long-term planning and management schemes.

S7.P13 Stomach content analysis of a Risso's dolphin *Grampus griseus* (G. Cuvier 1812) stranded in Tuscany (north-western Mediterranean)

Neri A.[1,2]*, Mancusi C.[1,3], Sartor P.[2], Voliani A.[3], Marsili L.[1,4]

[1] Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente, Università di Siena, via P.A. Mattioli, 4, 53100 Siena, Italy

[2] Centro Interuniversitario di Biologia Marina ed Ecologia Applicata "G. Bacci", viale N. Sauro, 4, 57128 Livorno, Italy

[3] Agenzia Regionale per la Protezione Ambientale della Toscana, via G. Marradi, 114, 57126 Livorno, Italy

[4] Centro Interuniversitario di Ricerca sui Cetacei, via P.A. Mattioli, 4, 53100 Siena, Italy

* e-mail: alessandra.neri@student.unisi.it

Risso's dolphin, *Grampus griseus* (G. Cuvier 1812), is a cosmopolitan species, inhabiting deep oceanic and continental slope waters in all tropical and temperate coastal waters of the world. Risso's dolphins feed on crustaceans and cephalopods, with a preference for deep-sea squids. Stomach content composition of a specimen of *G. griseus* stranded in Tuscany, north-western Mediterranean, is shown in this study. The specimen examined was found stranded on March 9th, 2021 in the southern Tuscany coast; the stomach was collected by personnel of the Regional Agency for Environmental Protection of Livorno (Tuscany, Italy) after the necropsy. The identification of preys was carried out using specific guides and comparing the undigested remains found in the stomach with original samples. The preys were identified at the lowest possible taxonomic level, though they were found highly digested. A total of 1210 cephalopods beaks (577 lowers and 633 uppers) and remains of 12 crustaceans were found. We suppose that crustaceans, identified as Spottail mantis shrimp (*Squilla mantis*), constituted the last meal of this Risso's dolphin; the absence of fresh remains of cephalopods and the presence of some worn beaks indicate that the specimen examined didn't feed on cephalopods for some time. The cephalopods were identified as 677 individuals belonging to 11 different Taxa. Worthy of note is that the most abundant species was the pelagic Octopod *Argonauta argo,* not common species both in the commercial catches and scientific surveys. Out of the 677 specimens of Cephalopod identified, 591 belonged to *A. argo*. Even if this species has already been found in other stomachs of Risso's dolphin, the high abundance showed by the specimen investigated in this study is an interesting finding. These results are important for the assessment of the state of Mediterranean biodiversity to the implementation of appropriate management and protection measures.

S7.P14 Valle Agricola Chickpeas: Mineral content of a Typical Landrace Legume from Southern Italy

Papa S.[1]*, Landi N. [1], Di Maro A. [1]

[1]Dipartimento di Scienze e Tecnologie Ambientali, Biologiche e Farmaceutiche, Università degli Studi della Campania, via Vivaldi, 43, 81100 Caserta, Italia

* e-mail: stefania.papa@unicampania.it

Legumes, with their diversity in nutrients, represent a key food for the sustainable and healthy Mediterranean diet. In fact, legumes (e.g., lupins, green beans and peas, peanuts, soybeans, dry beans, broad beans, dry peas, chickpeas, and lentils) are a rich source of raw proteins, dietary fibers, carbohydrates, vitamins and minerals. In light of this, having a large reservoir of legume landraces is of interest to make up for the decrease in diversity imposed by mechanized agriculture and to dispose of a rich crop gene pool (large genetic variability) necessary to improve both the health effects and a cultivation capable of promoting a sustainable agriculture. Locally cultivated legumes are consumed as traditional food in Italy, where several communities preserve typical landraces, which are endemic varieties. These latter have been domesticated and locally adapted to the specific environment through the isolation from other populations of the same species. Valle Agricola chickpea is classified as a typical product from the Campania Region. This chickpea is morphologically characterized as a small seed, very light hazel colour, thin skin (integument), highly digestible, with a distinguishing and intense flavour, and valuable organoleptic features. It is mainly used dried, for the preparation of traditional dishes of the cultivation area, linked to family and local consumption. Thus, as typical products represent an attractiveness of our agri-food system, nutritional value knowledge of Valle Agricola chickpea is of great interest. In fact, while many studies on the nutritional value of cultivated chickpea seeds are available, there is virtually no information on those of Valle Agricola chickpea. Chickpea seeds showed very good levels of several mineral nutrients, especially magnesium, potassium, calcium, zinc and manganese, data comparable to that reported by the food composition database for CREA.

S7.P15 Different physio-molecular mechanisms affect water storage strategy and drought tolerance in olive trees

Parri S.[1]*, Piritore F.C.[1], Romi M.[1], Pereira Dias M.C.[2], Cantini C.[3], Cai G.[1]

[1] Department of Life Sciences, University of Siena, Via Mattioli 4, 53100 Siena, Italy
[2] Department of Life Sciences, University of Coimbra, Calçada Martim de Freitas, 3000-456 Coimbra, Portugal
[2] National Research Council of Italy, Institute for Bioeconomy (CNR-IBE), 58022 Follonica, Italy

* e-mail: sara.parri@student.unisi.it

Future projections depict a decrease in water availability due to climate change, that cause a serious limit in the quantity and quality of water available for agriculture, especially in a semi-arid area such as the Mediterranean. Olive tree is an evergreen plant belonging to the family Oleaceae and the genus Olea. This plant is known to be quite resistant to drought. However, different genotypes do not respond to water stress to the same extent. In this work, 18-months-old plants of three olive cultivars (Giarraffa, Leccino and Maurino) were monitored during thirty days of drought stress (no-irrigation). The experiment was set in a growth chamber. The aim of the work is to investigate the management of the hydric resource in a condition of water scarcity and its influence on plant health and photosynthesis. The three cultivars mainly differ in water compartmentalization by using leaves (Leccino) or soil (Giarraffa) as water tank. Instead, water content in stems is quite similar among the genotypes, although Maurino has a poor capacity of water storage. Maurino shows also the highest levels of membrane damage as well as the fastest decrease in photosynthetic efficiency among the cultivars. These results suggest that water management strategy under drought conditions could play a central role in stress tolerance. The early appearance of the protein osmotin and the rapid and significant increase in proline in the cv. Leccino could be valuable traits to conserve water in leaves, allowing this cultivar to better maintain the photosynthesis. The identification of physio-molecular mechanisms behind an efficient strategy of water storage can be a starting point for selection and valorisation of drought-adapted cultivars to support agriculture in anticipation of climate change.

S7.P16 A double-approach study on the effect of an experimental fertilizer derived from olive pomace ash

PARRI S.[1]*, CAMPANI T. [2], CAI G.[1], CONTI V.[1], CASINI S.[2], ROMI M.[1], MARSILI L.[2]

[1]Dipartimento di Scienze della Vita, Università di Siena, via Mattioli 4, 53100 Siena, Italia

[2]Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente, Università di Siena, via Mattioli 4, 53100 Siena, Italia

*e-mail: sara.parri@student.unisi.it

Every year, the olive industry faces the problem of environmental pollution caused by mill wastes, such as mill wastewater and pomace. One of the most common reuses of pomace is pomace oil extraction, which uses the extracted pomace in the drying stage of the process and is energetically demanding. The use of extracted pomace as fuel generates ash as waste. In this study, we investigated the effect of the pomace ash and flour when applied to the soil as improvers through a double-approach study. The pomace mixture was evaluated in two different formulations (powder and pellet). Both are composed of pomace flour and pomace ash in different proportions: one mixture was 70% pomace flour and 30% pomace ash while the second mixture was 50% pomace flour and 50% pomace ash. A first evaluation was led on the soil organism *Eisenia fetida* by using a set of biomarkers to determine the sub-lethal effects caused by the pomace mixtures. A second approach focused on crop responses by evaluating the effect of mixtures on the physiology and yield of olive (*Olea europaea*, cv. Frantoio) and tomato (*Solanum lycopersicum*, cv. Sanmarzano nano). Comparison between treated and control samples revealed no statistical differences in gas exchange parameters, photosynthetic efficiency, and number/weight of harvested fruits. This preliminary study opens the way to the use of pomace–derived mixture as a soil improver, thereby valorising this waste product.

S7.P17 The use of artificial baits in swordfish longline fishery: potential impacts on trophic web assessed from fishers' Local Ecological Knowledge and stomach content analysis

Laface F.[1,2]*, Longo F.[1], Pedà C.[1]*, Stipa M.G.[1,2], Battaglia P.[1], Berti C.[3], Consoli P.[1], Greco S.[4], Romeo T.[1,5]

[1]Stazione Zoologica Anton Dohrn, Sicily Marine Centre, Dipartimento di Ecologia Marina Integrata, Villa Pace-Contrada Porticatello 29, 98167 Messina

[2]Dipartimento di Scienze Chimiche, Biologiche, Farmaceutiche e Ambientali, Università degli Studi di Messina, Via Stagno d'Alcontres 31, 98166 Messina

[3]Stazione Zoologica Anton Dohrn, Sicily Marine Centre, Dipartimento di Infrastrutture di Ricerca per le Risorse Biologiche Marine, C. da Torre Spaccata, 87071 Amendolara

[4]Stazione Zoologica Anton Dohrn, Calabria Marine Centre CRIMAC, Dipartimento di Ecologia Marina Integrata, C. da Torre Spaccata, 87071 Amendolara

[5]Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA), Via dei Mille 56, 98057 Milazzo

* e-mail: federica.laface@szn.it

In the framework of marine litter pollution, the impact of artificial baits used in Mediterranean fishery activities has been poorly investigated. In the last decades, artificial baits have been partially replaced natural ones in swordfish longline fisheries, because of their durability, reusability and cost-effectiveness. Present study aims to assess the potential impact of artificial baits used in mesopelagic longline fisheries targeting swordfish (*Xiphias gladius*) through fishers' Local Ecological Knowledge. A questionnaire was submitted to professional fishermen using as key study area in the northern Sicilian coast (southern Tyrrhenian Sea), between November 2021 and January 2022, to obtain information on swordfish fishery, fishermen perceptions and artificial baits related impacts. Interviewed fishermen used mesopelagic longline between June and August 2021, with an average CPUE of 8.6 ± 4.4 kg. Most fishermen used artificial lures combined with natural baits (sardines or frozen squids). The most common artificial baits were soft squids and mackerels of different colors, made of polyvinyl chloride. In few cases, fishermen referred that artificial baits were lacking from longline, probably ingested by swordfish which escaped the catch (1%). Our investigations were integrated by stomach content analysis of swordfish landed in the same area and fishing season, with the aim of verify the frequency of occurrence of artificial baits in the guts. Only in few cases (2%) artificial baits were found in swordfish stomachs. Interviews also referred that artificial baits were often chewed by large squids, which probably ingest lure particles. Squids are among the main prey of swordfish and then the problem of secondary ingestion of plastic in swordfish should be assessed. Considering the importance of these fishery activities on Mediterranean scale and the potential transfer of plastics across the trophic web, further investigations replicated in other fishing areas should clarify these aspects and eventually suggest management and mitigation measures.

S7.P18 Monitoring of feral horses and wild mammals through camera trapping in a Natura 2000 site

Santini Gia. [1]*, Berti E.[2,3], Masoni A.[1], Avetta V.[1], Pini G.[1], Bartoli R.[1], Argenti G.[4], Dibari C.[4], Santi A.[4], Brose U.[2,3], Rovero F.[1], Greco I.[1]

[1]Dipartimento di Biologia, Università egli studi di Firenze, via Madonna del Piano,6, 50019 Sesto Fiorentino, Italia

[2]Institute of Ecology, Friedrich Schiller University Jena, Jena, Germany

[3]German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Leipzig, Germany

[4]Dipartimento di Scienze e Tecnologie Agrarie, Alimentari, Ambientali e Forestali, Università egli studi di Firenze, Piazzale delle Cascine, 18, 50144 Firenze, Italia

* e-mail: giacomo.santini@unifi.it

The calcareous massif of Calvana mountains (Northern Tuscany, Italy) is a protected area designated as Special Area for Conservation (SAC) within the Natura 2000 Network (IT5150001). The area extends over 4991 ha and is characterized by deciduous forest and *Pinus nigra* stands, interspersed with small agricultural patches, and unmanaged grasslands concentrated on the upper ridges of the mountains (maximum elevation 950 m a.s.l). The area is enriched by a wide variety of fauna and flora and hosts one of the few existing populations of feral horses *(Equus ferus* sub. *caballus*) in Italy. Although this population originated nearly forty years ago from a few abandoned individuals, little is known about the social organization of the herds, the population dynamics, the interactions with other species, and how it contributes to maintaining the ridge prairies. Here, we used camera trapping to survey the horse population and eventually estimate their spatial patterns and occurrence probability, together with the ones of other wild mammal species living in the area. The survey carried out between April-July 2022 consisted of 40 camera stations (CTs) deployed in two consecutive arrays of 20 CTs each, and following a regular grid of 1 km cell-size to cover the entire area above 500 m a.s.l.. We also collected environmental data (e.g. elevation, slope, dominant vegetation type) and calculated different anthropogenic variables (frequency of human passage, distance to closest road, etc.) for each CT station, to be used as covariates in the occupancy analyses. The results allowed to obtain a first spatial description of the horse population density and how they used the area. The results also provided an updated checklist of the mammal community in the area and an index of the relative abundance for the most common species (*Canis lupus*, *Vulpes vulpes, Martes martes, Sus scrofa, Capreolus capreolus, Meles meles*).

S7.P19 The effects of two emerging contaminants (nanoplastics and gadolinium) on freshwater *Hydra vulgaris* morphology

Secco S.[1]*, Patricelli R.[1], Cesarini G.[1], Scalici M.[1]

[1]*Dipartimento di Scienze, Università di Roma Tre, viale G. Marconi, 446, 00146 Roma, Italia*

* e-mail: silvia.secco@uniroma3.it

The increasingly widespread use of pollutants represents a serious threat to aquatic habitats, as the effects on the ecosystem and biota are not yet known. In detail, the use of two emerging contaminants is exponentially increasing: plastics and rare earths elements. Nanoplastics represent the smallest dimensional category of plastics ($\varnothing$ < 0,001 mm), and due to their small size, they can provoke numerous mechanical and physiological hazards not completely understood. Rare earths elements include 17 elements of a metallic nature, including Gadolinium (Gd), which is increasingly used in a wide range of applications from technological to sanitary devices. Furthermore, the possible effects caused by the interaction between these two pollutants are completely unknown, since the ability of the plastic particles to adsorb the pollutants present in the surrounding environment has been confirmed. From these assumptions, this research aims to identify the effects of these two types of pollutants using the biomodel *Hydra vulgaris* (Pallas 1766), a freshwater cnidarian inhabiting slow moving permeant water bodies. This species has been widely used to test the toxicity and teratogenicity of numerous environmental contaminants through the assessment of the number and the type of morphological aberrations of the individuals. We subministered increasing concentrations of nanoplastics (0.1 µg/L, 1 µg/L, 100 µg/L, 10000 µg/L) and gadolinium (10 µg/L, 50 µg/L, 250 µg/L, 500 µg/L) and a mix of these two type of pollutants in 96 hours of experiments, and teratogenic effects on the studied organisms were analyzed. While at lower concentrations the responses on teratogenicity are minimal, at higher concentrations the number and the type of aberrations were more severe. The mix of contaminants amplified the responses providing a higher number of aberrations even at lower concentrations.

S7.P20 An innovative photogrammetric approach for the biomonitoring of the endangered fan mussel *Pinna nobilis*: a case study from the Venice Lagoon

Sigovini M.[1]*, Sabino A. [1,2,*], Scarpa G.M.[1]

[1] *Consiglio Nazionale delle Ricerche, Istituto di Scienze Marine (CNR-ISMAR), Venezia, Italia*
[2] *Università degli Studi Milano-Bicocca, Milano, Italia*

* *e-mail: marco.sigovini@ve.ismar.cnr.it*

Several Mass Mortality Events (MMEs) recently hit populations of the fan mussel *Pinna nobilis* (Mollusca: Bivalvia) across the Mediterranean basin, leading the species to the brink of extinction. In light of that, biomonitoring activities are of fundamental importance, even though often challenging and constrained by several logistics limitations. In the attempt to overcome these limitations, this study proposes an innovative biomonitoring approach based on the photogrammetric technique 'Structure from Motion' (SfM), applied on a *Pinna nobilis* population of the Venice Lagoon (Italy). About 6000 underwater digital photos of a 120 m^2 area densely populated by *P. nobilis* were acquired , which allowed the generation of high-resolution digital models (3D, orthomosaic, digital terrain model) reconstructing 115 fan mussel specimens and surrounding habitat . Digital models were analyzed and utilized to georeference specimens, retrieve digital measurements of main shell biometrics (unburied length: UL; maximum width: W; minimum width: w) and discriminate between dead and alive individuals. A comparison between classical on-field measures and digitally retrieved measures was performed to validate the sampling protocol, revealing a strong correlation: Pearson correlation coefficient was 0.92 for UL, 0.89 for W and 0.79 for w. Furthermore, information about spatial distribution, and the ecological context were successfully obtained, demonstrating the SfM approach to be a valid tool, and an effective alternative to classical biomonitoring approaches. *Pinna nobilis* populations and several other sessile benthic organisms are suitable candidates for future applications, even if living in turbid water environments. Future applications would involve the quantification of changes in distribution and shell size, allowing the study of growth and population dynamics.

S7.P21 Hydrocarbon-utilizing bacilli of marine shallow hydrothermal vents origin as producers of biosurfactants

Zammuto V.[1,3]*, Spanò A.[1], Nicolò M.S.[1], Grillo E.[1], Caccamo M.T.[2], Magazù S.[2,3], Cappello S.[3,4], Gugliandolo C.[1]

[1]Dept of Chemical, Biological, Pharmaceutical and Environmental Sciences, University of Messina, V.le Ferdinando Stagno D'Alcontres 31, 98166 Messina, Italy.

[2]Dept of Mathematics, Computer Sciences, Physics and Earth Sciences, University of Messina, V.le F. Stagno D'Alcontres 31, 98166 Messina, Italy

[3]ATHENA Green Solutions S.r.L., V.le Ferdinando Stagno d'Alcontres, 31, 98166 Messina (ME)

[4]Inst of Biological Resources and Marine Biotechnology (IRBIM)-CNR of Messina, Sp. San Raineri 86, 98122 Messina, Italy

* e-mail: vzammuto@unime.it

Crude oil dispersion phenomena occur more frequently in the marine environment, where biodegradation is carried out *in situ* by highly diverse microbial communities. The exploration of diversity of marine hydrocarbon-utilizing extremophiles could provide a valuable source of biomolecules to be exploited as novel eco-friendly surfactants. To these purposes, a total of 80 thermophilic bacilli, isolated from shallow hydrothermal vents of Eolian Islands (Italy), were firstly screened for their ability to utilize kerosene or gasoline (2% v/v), as only carbon sources. Biosurfactants (BSs) production in cell-free supernatants (CFSs) from 15 hydrocarbon-utilizing strains was preliminarily assayed for both surface-active properties (drop-collapse test and surface tension reduction) and emulsification activity. Under optimised conditions, CFSs from *Bacillus licheniformis* B3-15 and the recently described *Bacillus horneckiae* SBP3 (DSM 103063) were both surface active and able to emulsify different hydrocarbons (1:1, v/v), mainly kerosene (E24%= 62 and 64, respectively), followed by decane and hexadecane, and olive oil. Extracted BSs from B3-15 (910 mg L^{-1}) and SBP3 (950 mg L^{-1}), characterized by ATR-FTIR as two different surfactine-like lipopeptides, possessed specific mineral-, castor- and crude oil removal ability from the cotton matrix. For their surfactant abilities, CFSs from the 15 thermophilic hydrocarbon-utilizing strains could be used as industrial detergents, as well as in bioremediation and as surface cleaning agents (*e.g.*, for oil pipelines, bilge tanker or industrial silos), whereas the crude BSs, as high-value compounds, may be also considered for detergent, cosmeceutical and pharmaceutical industries.