Exploring species interactions in wetland restoration and their effects on ecosystem processes and services.

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Coastal wetlands are some of the most valuable but at the same time threatened marine coastal ecosystems and their restoration is emerging as a pressing management strategy to combat and reverse their loss. Many restored wetlands, however, fail to completely achieve the structure and functioning of natural communities, and the cost/effectiveness of these interventions is currently low. This underperforming has been at least in part attributed to a limited understanding and incorporation of species interactions in wetland restoration practice. The aim of this PhD project is to study the biotic regimes that can support the restoration of wetland vegetation (saltmarsh and/or seagrasses) in Venice Lagoon. Here, current work has focused mostly on the physical and hydrologic regimes needed to sustain wetland restoration, but virtually nothing is known about the role of critical biotic factors, such as the control by grazers and/or top predators or habitat facilitation cascades. The student will use a combination of field sampling of ongoing real-scale restoration actions in the region and field- and laboratory- based manipulative experiments to: 1) identify relevant biotic control in wetland restoration; 2) measure how the strength and generality of these controlling mechanisms vary with critical environmental conditions (such as levels of nutrient enrichment or wave exposure); and 3) measure how biotic control affects restoration success not only in terms of vegetation growth, but also influencing the delivery of critical ecosystem services such as species richness and carbon sequestration.

Unveiling fine-scale patterns of biodiversity above and below the ground in a terrestrial European hotspot.

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Measuring biodiversity and prioritizing areas for conservation, both at global and regional scales, are acknowledged as urgent tasks for the future human well-being. However, even within since long investigated continents like Europe, we have only imprecise and biased hints on the true amount of syntopic invertebrate species and the actual spatial turnover of their species-level and intraspecific lineages. The PhD project is intended to develop and test an optimal methodological pipeline allowing to fill such knowledge gaps substantially, for selected invertebrate taxa, over a time frame of a few years. The methodology will encompass a strategy of geographical sampling, integrative analyses of species delimitation (by means of morphological and morphological differentiation), and statistical modelling of local species richness and spatial variation. It will be applied to selected invertebrate taxa within a representative area of the South-Eastern Alps, which host high levels of invertebrate species richness and complex intraspecific differentiation and species-level turnover especially because of past climatic changes and current environmental variation and fragmentation. The methodology will be applied comparatively to taxa expected to show different level of fine-scale differentiation, because of different dispersal capacity, like strictly endogeic Chilopoda and fully epigeic diurnal Lepidoptera. The PhD project will benefit from long-term ecological and taxonomic investigations on soil invertebrates by the supervisor and a newly established collaboration with the Ente Parco Nazionale delle Dolomiti Bellunesi on epigeic insects.

ABC: microAlgae, Bivalves and Crustaceans as model organisms to assess transfer and effects of emerging contaminants through a marine food chain.

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Emerging contaminants (ECs) are chemicals that are not currently - or have been only recently - regulated and are not commonly monitored in the environment. ECs include for example

disinfection by-products, pharmaceutical and personal care products, fragrances, persistent organic chemicals and their degradation products. ECs have the potential to enter aquatic environments and cause adverse effects to organisms. The potential transfer of ECs through aquatic food chains, as well as the effects to consumers due to ingestion of contaminated food, are poorly investigated. Consequently, this research project is aimed at improving knowledge concerning potential transfer and effects of ECs through a simplified marine food chain. Model organisms representative of three trophic levels will be used: microalgae (*Isochrysis galbana* and/or *Dunaliella salina*, as primary producers), bivalves (*Ruditapes philippinarum* and/or *Mytilus galloprovincialis*, as primary consumers) and crustaceans (*Carcinus aestuarii*, as secondary consumers). Differing ECs will be tested alone or as mixtures and accumulation and toxic effects will be assessed in microalgae by means of biochemical, morphological and ultrastructural analyses. Further, ECs-treated microalgae will be supplied to bivalves as food and several biomarkers will be then measured after time intervals at the cellular, tissue and organism levels. Treated bivalves will be then supplied to crabs as food and biomarkers will be measured in crabs at time intervals. Accumulation of ECs in microalgae, bivalve and crustaceans will be also measured.

Estimating survival rates of juveniles of sharks, skates and rays to develop effective management strategies for fishery.

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Elasmobranchs include some of the most threatened species in the marine environment. Indeed, their life history traits and behavioural characteristics make these species highly vulnerable to fishery. In particular, in the Mediterranean Sea more than half of the elasmobranch species are considered threatened by the regional IUCN assessment. The sustainable exploitation of sharks, skates and rays is not an easy task, considering that they often represent bycatch of other more valuable commercial species. One promising strategy to contribute to the conservation and possibly the recovery of elasmobranch populations is represented by the reduction of fishing mortality on newborns and juveniles, through their discard at sea after capture, with the purpose to allow them to growth and reproduce. While there are some data regarding survival rates of several species in other areas, essentially no data are available for the Mediterranean Sea and for the juveniles of several species.
This project aims at estimating the survival rates of newborns and juveniles of the main commercial species in the Italian waters of the Mediterranean Sea. The study species will include the smooth-hounds (*Mustelus* spp.), catsharks (*Scyliorhinus* spp.), rays (*Raja* spp.), and dogfishes (*Squalus* spp.). Data will be collected onboard of commercial fishing boats and in controlled conditions and will include the estimation of At-Vessel-Mortality, Short-term (a few hours) and Long-term (days) Post-Release-Mortality. Different fishing gears will be evaluated: bottom and midwater trawls, gillnets. Survival rates will be estimated and compared among species, geographic areas and fishery techniques. The results will provide a scientific background for exploring the reduction of juvenile mortality as a management strategy.

Mitochondrial genes and the pace of life in fish.

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Several theories try to explain what factors are associated with and shape increased longevity in animals. Among these, the mitochondrial theory of ageing posits that mutation rates are reduced by selection in long-lived taxa to reduce the chance of mitochondrial damage over their lifespan. Recently, a negative association between the rate of mitochondrial molecular evolution and longevity has been shown for a few mitochondrial genes in some species of the genus *Sebastes*

(rockfish). However, the generality of these conclusions remains to be assessed. Therefore, the prospective PhD student is expected to ascertain if the proposed theory of low mitochondrial mutation rates derived from some species generalizes to more than one lineage of fish at the entire mitochondrial genome scale and for nuclear genes coding for mitochondrial proteins. Fish groups that could be particularly interesting as target of this research are Antarctic fish, sturgeons, other species of the genus *Sebastes* and sharks (e.g., *Somniosus* spp.). The research activity implies a) collating a dataset of well annotated mitochondrial genomes and nuclear genes coding for mitochondrial proteins of target species, b) estimating the mutation rate, as evolutionary process, of the selected genes, c) verifying if this is statistically slower in long-lived than in short-lived fish species and d) ascertaining if any indication of coevolution between mitochondrial genes of nuclear and mitochondrial origin exists.
The PhD student will collaborate with different research groups that work jointly with Prof. Papetti Chiara, mainly with Prof. Michael Matschiner (University of Oslo) and Prof. Enrico Negrisolo (University of Padova).
The ideal candidate is a motivated young prospective PhD student, fluent in English, able to work in team, with a MSc in the Biological field and with some knowledge of and interest in bioinformatics techniques for sequence handling and analysis.

Social, environmental, and evolutionary dynamics of replicated hybrid zones in swordtails (Teleostei: *Xiphophorus*) of Mexico's Sierra Madre Oriental.
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The evolutionary consequences of gene flow between divergent populations can range from the reinforcement of reproductive barriers to the formation of new hybrid lineages. This position starts five years into a long-term study of replicated natural and artificial populations of hybrid swordtail fish (*X. birchmanni* and *X. malinche*) to understand how selection acts on early-generation hybrids. The project builds on extensive work in behavioral mechanisms and evolutionary genomics of this system. The primary focus is to use pedigree data, high-resolution genotyping, and behavioral experiments to elucidate the dynamic role of mate choice, sexual selection, and the social environment in hybrid evolution. Research experience in animal behavior and/or evolution, and some combination of Spanish language, field experience, and bioinformatics skills preferred. The project will require minimum 10-day stays at CICHAZ (www.cichaz.org) in central Mexico every May-June and December-January, with longer stays possible and encouraged.