



Scienze Marine, Tecnologie e Gestione

Progetto di ricerca/ Research project	<i>"The legal basis for representative networks of marine protected areas and the implementation of other effective area-based conservation measures in the Maldives and the wider Indian Ocean region"</i>
Type	DM 351 of 9 April 2022
Docente proponente/ Proposing Professor	Prof. Paolo Galli
Abstract	<p>ENG</p> <p>The project of research builds upon the most recent developments reached in the context of international negotiations related to marine conservation and the sustainable use of marine natural resources. It aims at emphasizing the role of specific area-based management tools, namely marine protected areas (MPAs) and other effective area-based conservation measures (OECMs), in the achievement of broader objectives defined under legal instruments at global, regional and sub-regional level.</p> <p>MPAs and OECMs play an increasing role in the context of inter-State relations. In fact, they facilitate inter-State cooperation and coordination, based on the identification, establishment and management of marine spaces included in an ecological network secured by legal means at regional or global scale, whose boundaries fall either within the jurisdiction of one or more coastal States, or even beyond national jurisdiction, where there is no coastal State by definition. The latter circumstance is the focus of the current discussions in the negotiations held at United Nations Headquarters (New York) on an international legally binding instrument under the United Nations Convention on the Law of the Sea (Montego Bay, 1982) on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction, under the package's component "Area-based management tools, including marine protected areas".</p> <p>The difference between the two different, but concurring, concepts of MPAs and OECMs is becoming a fundamental aspect in the modern trends in environmental policy and law. While the notion of MPA has today a solid background, OECMs represent a new conservation approach, separate from MPAs, where conservation is achieved mainly as a by-product of other management.</p> <p>The project aims at analyzing the role of both MPAs and OECMs, as well as their potential, in the context of already existing legal frameworks at global and regional level, under a comparative perspective that takes into account the achievements, challenges and opportunities that characterize selected regional contexts (e.g., the Mediterranean Sea, the North-East Atlantic, the Southern Ocean, the Arctic Ocean). Building on this knowledge, the researcher will collect information and undertake local surveys and interviews with representatives of international, national and local institutions, with a view to supporting the proposal for the establishment of a representative network of MPAs and the implementation of OECMs in the Maldives and the wider region of the Indian Ocean, with the support of the MaRHE Center.</p>



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Progetto di ricerca/ Research project	"Marine protected areas: socio-spatial patterns and environmental conflicts"
Type	DM 351 of 9 April 2022
Docente proponente/ Proposing Professor	Prof. Paolo Galli
Abstract	<p>ENG</p> <p>Biodiversity, as well as being important from a biological and ecological point of view, plays a role in people's culture. Several traits, practices and objects of Mediterranean culture, expressly refer to the biodiversity of the sea. Unfortunately, biodiversity as an object of cultural practices and events in many contexts - not only in the Mediterranean but across the World - risks to be neglected, commodified or even depleted. The establishment of marine protected areas (MPA) is the main instrument for the protection of biodiversity. MPAs generate direct benefits to marine habitats, both in terms of biodiversity protection and ecosystem health. At the same time, MPA projects aim to integrate the protection of marine areas with the development of human activities (fishing, sustainable tourism, etc.). For this reason, the management of potential conflicts between users and the direct involvement of stakeholders in the design and implementation of MPA is crucial for the durability and sustainability of the project.</p> <p>Candidates, by combining quantitative and qualitative data, will select a case study and perform a spatial analysis of environmental conflicts in MPA. Project aims at providing guidelines and recommendations for policy makers and practitioners. The research will include field activities and collection of data, aimed at verifying the significance of the relationships between protected areas and human activities.</p>



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Progetto di ricerca/ Research project	<i>"Using marine environmental DNA for biodiversity monitoring and conservation planning"</i>
Type	DM 351 of 9 April 2022
Docente proponente/ Proposing Professor	Prof. Paolo Galli
Abstract	<p>ENG</p> <p>Marine ecosystems and their resources are severely threatened by multiple pressures including climate change, over-exploitation, and habitat degradation. As a result, we are witnessing worldwide biodiversity loss and/or perturbation. Effective conservation measures need to rely on sound background information concerning not only species presence but also their role and interactions within the biological community they belong to. The analysis of environmental DNA (eDNA) has the potential of providing high-throughput information on multiple taxa simultaneously present within a single water sample representing local communities at any given spatio-temporal frame.</p> <p>In this project, the molecular information obtained through eDNA analysis of over 600 samples, that will be collected in the Mediterranean from operating ferries over a multi-year project (EU funded LIFE grant), will be used for filling the information gap on spatiotemporal ecological needs of marine vertebrates, with a particular focus on cetacean and sea turtles, useful for the identification of important offshore marine sites, and for developing surveillance protocol for monitoring the conservation status of these marine species and for assessing the impact of human activities.</p> <p>The project involves the processing of a vast amount of data (not only molecular, given the transdisciplinary nature of the LIFE project), therefore, a good familiarity with and/or predisposition to the use of bioinformatics tools is welcome and desirable.</p> <p>Possible research exchange visits are envisaged with other Italian and foreign universities currently involved in on-going collaborations, such as the University of Bari, as well as the Liverpool John Moores University (UK) and University of Leeds (UK).</p>



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Progetto di ricerca/ Research project	"Ocean bioprospecting: exploring the pharmaceutical potential of tropical corals"
Type	DM 351 of 9 April 2022
Docente proponente/ Proposing Professor	Prof. Paolo Galli
Abstract	<p>ENG</p> <p>Oceans cover over 70% of the earth's surface. Marine environments are among the richest and most diverse ecosystems, with an enormous diversity of different life forms. Over 200,000 species of invertebrates and algae have been identified, and this number is estimated to be only a small fraction of what is yet to be discovered. Harsh chemical and physical conditions in the marine environment are important drivers for the production of a wide range of bioactive natural products with structurally unique features. These marine natural products exhibit a variety of bioactivities that have potential applications in the pharmaceutical and medical fields.</p> <p>Among marine invertebrates, coral are promising providers of marine bioactive compounds. Some are these marine natural products are used by corals for chemical defense to slow and prevent cell growth of invading sponges. Studies suggest that these natural products from corals can stop the uncontrolled division of cancer cells in humans. In this vein, this proposed study aims to explore the anticancer potential of selected tropical corals from the Maldives (a biological hotspot) with the objective to identify bioactive extracts that can open new avenues in the global hunt for novel chemotherapeutics.</p> <p>The project will employ advanced chromatographic techniques to extract, purify, and isolate natural products. Their structures will be characterized via mass spectrometry. The cytotoxic potencies of the isolated compounds will be evaluated against a panel of cancer cell lines using cellular cytotoxicity assays.</p> <p>Overall, this project will present a great opportunity to explore the application of marine derived compounds as anticancer therapeutics.</p>



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Progetto di ricerca/ Research project	"Advanced materials for coral protection, healing, and restoration"
Type	Borse finanziate da enti convenzionati (IIT) / Scholarships funded by other affiliated universities (IIT)
Docente proponente/ Proposing Professor	Prof. Paolo Galli
Abstract	<p>ENG</p> <p>Coral reefs are the most biodiverse ecosystems in the world, together with the rainforest in South America. Coral reefs are made of corals and all the ecosystem that is around them. These animals live in a symbiotic relationship with algae called Zooxanthellae which provide a significant part of the energetic need and the typical color of corals. This extraordinary but fragile relationship is the base of life in the coral reefs. However, corals are experiencing a dramatic decline because of climate changes, water pollution induced by humans, and diffusion of outbreaks. Several attempts have been made to restore coral reefs, but more efforts should be made to protect this unique environment successfully.</p> <p>This project will aim to design and produce advanced strategies and therapies for protecting and healing corals, and subsequently, preserving the biodiversity of the ecosystems around them, by combining knowledge of materials science, pharmaceutics, and marine biology. Innovative materials will be fabricated using sustainable and eco-friendly methodologies to support coral restoration and delivery of nutrients and drugs to corals. The obtained materials will be tested on corals both in aquaria and sea environments.</p> <p>This multidisciplinary project will be developed in the Smart Materials laboratory at Istituto Italiano di Tecnologia (IIT) of Genoa, the University of Milan-Bicocca (Prof. Galli), the Marine Research and High Education Center (MaRHE) in the Maldives, and the MaRHE Facility at the Aquarium of Genoa.</p> <p>The ideal candidate should have a master's degree in Materials Science, Chemistry, Pharmaceutical Chemistry, Polymer Science, or Applied Physics.</p> <p>This work will be conducted at the Smart Materials Group of the Italian Institute of Technology (IIT) Genova. Collaborations with the Translational Pharmacology Facility of IIT for the in-vivo aquatic models, and with the Aquarium of Genoa are envisaged.</p>



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Progetto di ricerca/ Research project	"Bioinspired robots for marine biodiversity"
Type	Borse finanziate da enti convenzionati (IIT) / Scholarships funded by other affiliated universities (IIT)
Docente proponente/ Proposing Professor	Prof. Paolo Galli
Abstract	<p>ENG</p> <p>The research project will focus on the design and development of robots inspired by benthic marine species aimed at mapping and protecting marine fragile/sensitive habitats (such as prairies of Posidonia oceanica, coral reefs, etc.). These ecosystems are of crucial importance in terms of biodiversity. Posidonia oceanica is a seagrass species that is endemic to the Mediterranean Sea. This flowering plant creates large colonies, or prairies, and it represents the core part of the equilibrium of marine ecosystems and biodiversity protection. One of the most important feature of this underwater plant is its very high carbon absorption capacity and production of oxygen, being an excellent carbon sink and representing a valid allied to combat climate change. The Posidonia prairies help in stabilizing the seabed, and provide habitat and nutrition for many species of fish, crustaceans, mollusks, bryozoans.</p> <p>The research will include the study of natural models, such as structural materials of the body, biomechanics and behavior in natural environments, in order to design and develop similar artificial systems. Robots will be made of smart/multi-functional materials integrated with a sensorized system for measuring environmental parameters (e.g., light, oxygen, salinity, etc.) and will be endowed with onboard systems for the release of curative substances where necessary.</p> <p>The bioinspired robots will show adaptive morphologies and be intrinsically safe to act within the natural ecosystems with no damage for marine living organisms, and to work as a tool for the analysis of the environmental quality.</p> <p>This multidisciplinary project will be developed in the Bioinspired Soft Robotics Group of the Istituto Italiano di Tecnologia (IIT) in Genoa, in collaboration with the Smart Materials Group of IIT.</p> <p>The ideal candidate should have a master's degree in Bioengineering, Biotechnology, Mechanical Engineering or relevant.</p>



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Progetto di ricerca/ Research project	"Effects of the environmental pollution to sea microfauna and corals"
Type	Borse finanziate da enti convenzionati (IIT) / Scholarships funded by other affiliated universities (IIT)
Docente proponente/ Proposing Professor	Prof. Paolo Galli
Abstract	<p>ENG</p> <p>Environmental pollution and especially emerging water pollutants such as micro and nanoplastics, pharmaceuticals, fluoroalkyl compounds but also the temperature increase and the acidification of the oceans may affect significantly the life under water.</p> <p>Micro and nanoplastics are released to the water bodies by diverse products and processes or by the degradation of plastic litter, and pass through the food chain to the aquatic organisms. The smaller the size of these plastic particles the more difficult is to recover them from the environment and for this reason commercially available polymeric particles, not really representative of their real nature and surface chemistry, are used in order to conduct studies on the interactions with other pollutants and on their biological fate.</p> <p>Furthermore, the continuously growing utilization of pharmaceuticals in livestock and the introduction of novel chemical compounds to materials that we use to everyday life applications, result in the continuously growing amount of different types of novel pollutants that enter to the water bodies with unknown effects to the living systems. This comes in combination with the overall acidification and temperature increase of the oceans with further negative effects.</p> <p>During the PhD activity, will be studied the effects that emerging pollutants and their complexes in different aquatic environments, may have to aquatic living organisms, such as to the zebrafish and corals. Proteomics, metabolomics and lipidomics experiments will be used to identify the biological pathways altered after the exposure to the pollutants. For the study of realistic systems, nano and micro plastics with characteristics similar to the real environmental samples will be fabricated by adopting top-down approaches starting from bulk polymeric films and following innovative fabrication methods such as the laser ablation or milling processes. Their interactions with other emerging water pollutants will be also investigated in different conditions, such as different water temperature and acidity, in order to define the most stably interacting components.</p> <p>This work will be conducted at the Smart Materials Group of the Italian Institute of Technology (IIT) Genova. Collaborations with the Translational Pharmacology Facility of IIT for the in-vivo aquatic models, and with the Aquarium of Genoa are envisaged.</p> <p>The ideal candidate should have a master's degree in Materials Science, Applied Physics, Chemistry, Biology, Chemical Engineering, or Bioengineering,</p>