The SEA-UNICORN European COST Action: Advancing Knowledge on Marine Connectivity to Support Transition to a Sustainable Blue Economy

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Advancing Knowledge on Marine Connectivity to Support Transition to a Sustainable Blue Economy

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ABSTRACT

The European COST Action "Unifying Approaches to Marine Connectivity for improved Resource Management for the Seas" (SEA-UNICORN, 2020–2025) is an international research coordination initiative that unites an interdisciplinary community of scientists and policymakers from over 100 organizations across Europe and beyond. It is establishing a globally harmonized framework to deliver actionable, transdisciplinary knowledge of marine functional connectivity, promoting a sustainable blue economy and ocean conservation. Planning sustainable development in rapidly changing oceans requires a thorough comprehension of marine biodiversity and the processes underpinning the functioning of ecosystems. Connectivity among marine populations and habitats facilitates the persistence and resilience of vulnerable species and ecosystems and controls the spread of invasive species. Constructing effective networks of restoration or conservation areas and promoting sustainable harvesting requires knowledge of connectivity. SEA-UNICORN advances worldwide collaboration by coordinating the collection, sharing, and application of knowledge on species, community, and ecosystem connectivity at sea and at the land–sea interface. It engages scientists from diverse areas and early-career researchers and creates a stronger match between natural and social science and policy needs to better address key environmental issues that challenge the future of our planet.

Vision and Potential Transformative Impact

SEA-UNICORN is establishing a globally coordinated framework to advance research and deliver more effective, transdisciplinary knowledge in the emerging field of marine functional connectivity (MFC). MFC characterizes all the migratory and passive flows of marine organisms that determine the interdependency of populations, species, and ecosystems at sea and at the land–sea interface. Understanding its future developments and identifying its ecological consequences is pivotal to fully understand how species and ecosystems persist, supported by the movements of organisms, energy, and matter. Such knowledge will be transformative for better understanding how environmental and human factors may alter marine ecosystem services. To address these needs, SEA-UNICORN fosters multidisciplinary collaborations among the different research communities that study the distribution and movements of marine organisms and their ecological consequences, and strengthens their interaction with (1) the modelers involved in producing future environmental and economic scenarios and (2) the decision makers involved in governance and management (Figure 1). SEA-UNICORN coordinates transdisciplinary interactions among all these stakeholders (1) to advance concepts, unify and communicate methods in MFC science to improve our ability to anticipate the responses of marine life to environmental changes, (2) to design and apply MFC research that effectively addresses current societal issues, and (3) to facilitate the incorporation of MFC knowledge into marine policy and management strategies. This is a critical primary step to achieve the ambitious goals traced for the Ocean Decade by 2030.

How Is the Project Realizable, With Connections to Existing Scientific Infrastructure, Technology Development, and Public–Private Partnerships

Although focused primarily on European research and policy needs, SEA-UNICORN is developing linkages with academia, government agencies, non-governmental organizations, and the private sector worldwide (Figure 2). Marine resources and ecosystems often extend beyond political boundaries, and local threats to biodiversity can have impacts at local, regional, but also global scales. Therefore, advancing MFC research requires multinational networking and

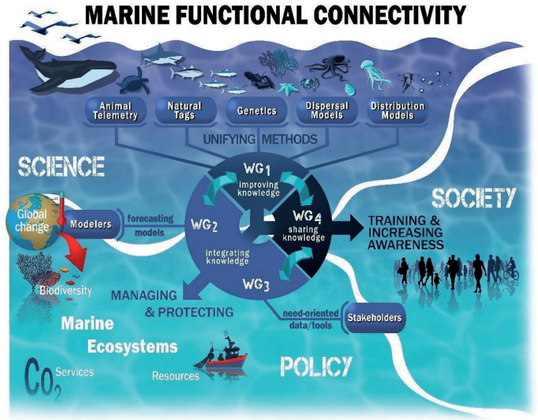

FIGURE 1. Global framework of the SEA-UNICORN Action, structured in four Working Groups (WG1 to WG4) operating at the Science-Policy-Society interface (Drawing by Sebastien Lerigoleur).

spatial management and policymaking tools, but also to introduce stakeholders to the methods providing MFC data relevant to decision making. This capacity-building approach will promote appropriate MFC data use by the stakeholders and help scientists generate datasets that can be more easily and effectively applied to decision making from local to global scales.

Opportunities for International Participation and Collaboration

SEA-UNICORN is an open collaborative platform that encourages broad international participation to help (1) provide a general methodological framework for integrating MFC data across disciplines, (2) facilitate their inclusion in models predicting the evolution of marine biodiversity and related socio-ecological systems, and (3) ensure that the scientific information produced is operational and effectively communicated to a wide audience of stakeholders and end users. Current activities to advance worldwide knowledge and capacity exchange include cross-cutting training schools, workshops, webinars, publications, and joint international fund-raising, as well as collaboration with European and other global research coordination initiatives endorsed under the Ocean Decade (e.g., Marine Life 2030).

FIGURE 2. SEA-UNICORN—Network of participants, as displayed on the SEA-UNICORN website (https://www.sea-unicorn.com/our-network) on March 11, 2022.

Scientific/Technological Sectors Engaged Outside of Traditional Ocean Sciences

MFC knowledge can significantly improve sustainable marine management and policymaking by informing the decisions of national to international stakeholders and providing useful indicators to benchmark the achievement of UN Sustainable Development Goals, post-2020 CBD goals, Ramsar Convention, global biodiversity assessments (IPBES), and transboundary fisheries treaties. This knowledge integration requires MFC data to be generated in such a way that it can easily be incorporated into decision-making processes and decision-support tools for policy. Networking is an effective approach to this challenge, as only direct interaction between MFC scientists and the diverse actors in management and policy will ensure that future MFC research meets societal needs. SEA-UNICORN will innovate by forging strong operational links between MFC researchers, socio-ecological system modelers, and managers and policymakers. Transdisciplinary collaborations will be fostered, and multiple training opportunities provided, aiming not only to familiarize MFC scientists with the specific needs of cooperation. Towards this goal, the SEA-UNICORN network seeks to deepen its international connections in the coming years, notably by building on U.S. academic participation and on partnerships initiated with several global initiatives including diverse U.S. partners like the Decade Program Marine Life 2030, the Migratory Connectivity in the Ocean (MiCO) consortium, the IUCN WCPA Marine Connectivity Working Group, and the Ocean Knowledge Action Network (Ocean-Kan). SEA-UNICORN will coordinate among existing national and international groups to integrate critical scientific knowledge on MFC into global marine biodiversity mapping, trans-boundary ecosystem modelling, and forecasting strategies for the global ocean and coastal areas. This knowledge is fundamental for mapping the present and future distribution of resources in the U.S. EEZ, as called for in the National Ocean Mapping, Exploration, and Characterization (NOMEC) plan, and for meeting the U.S. ocean policy needs, in line with the U.N. Ocean Decade goals for 2030.

Develops Global Capacity and Encourages the Development of the Next Generation of Ocean Scientists, Engineers, and Technologists

SEA-UNICORN gathers scientists and decision makers with varied expertise, interests, and focus across national and international networks from varied disciplines and facilitates their interaction via transdisciplinary and multinational training schools, workshops, and collaborations. The network provides professionals of diverse ethnic and national groups, backgrounds, career stages, and gender with unprecedented career development opportunities. In particular, SEA-UNICORN fosters the involvement and development of early-career experts, enabling the emergence of pioneering transdisciplinary research fields and of a new, more efficient generation of interdisciplinary MFC scientists uniquely prepared to tackle tomorrow's challenges around Blue Growth and the international governance of the seas.

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