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A multi-stage analytical framework for the integration of Nature-based Solutions into climate risk management and adaptation

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Climate change and environmental degradation are severely affecting marine and coastal systems and the innumerable ecosystem goods and services on which people rely. As result, biodiversity loss and reductions in ecosystem functioning have been recorded across marine and terrestrial systems. A transformative change in the way we adapt to climate change is needed, centered around preserving and restoring nature. Nature-based Solutions (NbS), an umbrella term for conservation, restoration and other management measures (e.g., regulation law implementation), offer an opportunity to transform climate adaptation pathways while providing environmental and societal benefits. They can act as risk reduction measures and address ecological, political, societal, economic issues at multi-level from individual targeted local interventions to collective regional upscaling.

To facilitate the adoption of evidence-informed NbS responding to environmental targets as posed by relevant EU acquis (e.g., Marine Strategy Framework Directive) and specific contexts, in the frame of the MaCoBioS project, a harmonized modeling framework has been developed. It brings together risk assessment approaches, NbS suitability mapping and a decision-support system guiding the selection of most appropriate NbS in marine and coastal ecosystems. In particular, following a progressive analytical process, Machine Learning techniques and GIS are exploited to recognize risk-prone areas against the combined effect of human and climate-related pressures, while identifying suitable areas for marine-coastal NbS implementation today and into the future. Drawing on this, the designed decision-support system offers a portfolio of potential actionable interventions based on a variety of factors (e.g., from ecological to socio-economic) that will need

to be considered during NbS planning and implementation. It allows practitioners an overview of NbS approaches that are best suited to addressing societal challenges, also linked to climate-related risks, thereby potentially helping to achieve value for money from the often-limited resources available for environmental conservation and management.

Overall, the proposed multi-stage analytical framework aims to provide evidence-based guidance on the inter-relations between climate change, biodiversity and ecosystem services, offering a basis for strategic discussions and better alignment of marine-coastal NbS with respect to societal challenges. Its adoption by marine-coastal managers can facilitate an effective pathway towards NbS adoption that enhances the adaptation and resilience capacity of marine-coastal ecosystems.