

The fundamental methodological concept around which **MARBEFES** is arranged is that biodiversity is connected across space and time, so to fully understand it and its value, we must move past siloed thinking that separates the natural world into 'estuary', 'coast' and 'offshore'; biological entities do not necessarily recognise the intangible boundaries we place in the sea. MARBEFES explicitly considers the river-ocean gradient; the MARBEFES tools are tested and implemented in 12 broad belt transects (BBTs) in the four main marine regions of the EU - **Arctic, Baltic, Atlantic and Mediterranean**. The BBTs are the foundation of the MARBEFES research, providing both a testing ground and a mechanism for broadening the knowledge and evidence on biodiversity status and changes across the European continent. In the last few decades European coastal seas have been regularly studied; changes are widespread but geographically variable, telling us there is no one, universal response of marine ecosystems to global change, and there is no one universal management practice that can be implemented equally in all regions. The crux is that biodiversity is deviating from past conditions, with some gains and some losses. Gaining biodiversity does not always equate to a positive situation (in the Arctic, subject to severe climate change impacts, and in the Mediterranean, with its influx of non-native species, more is not always better). This is a core concept addressed by **MARBEFES**; work to understand biodiversity across the European domain must include this range of circumstances and the BBTs are selected specifically to address this - covering subtropical to subarctic, from closed to open systems, from brackish to marine and from low to high biodiversity.

**We will progress substantially beyond the current state-of-the-art understanding of the causes and consequences of the maintenance, loss and gain of biodiversity and ecological and economic value and the repercussions of this for the management and governance of European seas**

. Involving 23 highly experienced partners, the project outputs and outcomes are based on developing and validating a set of ecological, economic and socio-cultural valuation tools using existing and new information and data in 12 Broad Belt Transect case studies. These cover the breadth of European marine biodiversity, from the Arctic to semi-tropical areas, across dominant habitats and iconic species, and from shallow to deep areas and encompass a range of socio-economic contexts. As such, and through stakeholder co-creation for policy relevance, MARBEFES shows the tools to value different natural capital resources and inform planning from financial allocations to management and with monetary and non-monetary benefits. In this, the project

advances our knowledge through linking marine biodiversity and its ecological structure and functioning to ecological and economic valuation.

The **overall aim of MARBEFES** is to determine the links between biodiversity, ecosystem functioning and the resulting ecosystem services and societal goods and benefits and to achieve ecological and socio-economic valuation through a validated set of innovative tools in a distributed toolbox to enhance policy and governance for the marine environment to secure its benefits for current and future generations. We will progress substantially beyond the current state-of-the-art understanding of the causes and consequences of biodiversity decline, and the loss and gain of ecological and economic value and the repercussions for marine management and governance across European seas.

MARBEFES will apply an interdisciplinary methodology to the study of marine and coastal biodiversity and ecosystem services, bringing together natural science disciplines including biology, genomics, functional ecology, climate science, physical oceanography and biogeochemistry, with economics, social sciences and humanities. We will employ the Double Diamond approach which has four alternatively convergent and divergent actions: to Discover whereby we identify, research and understand the initial problem; Define by giving the boundaries and definitions of the problems to be solved; Develop a solution to tackle the problem, and then finally to Deliver and disseminate a tested and validated product for the wider community. The diamond shapes conceptually represent the amount of effort required by each stage.

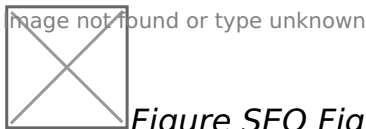
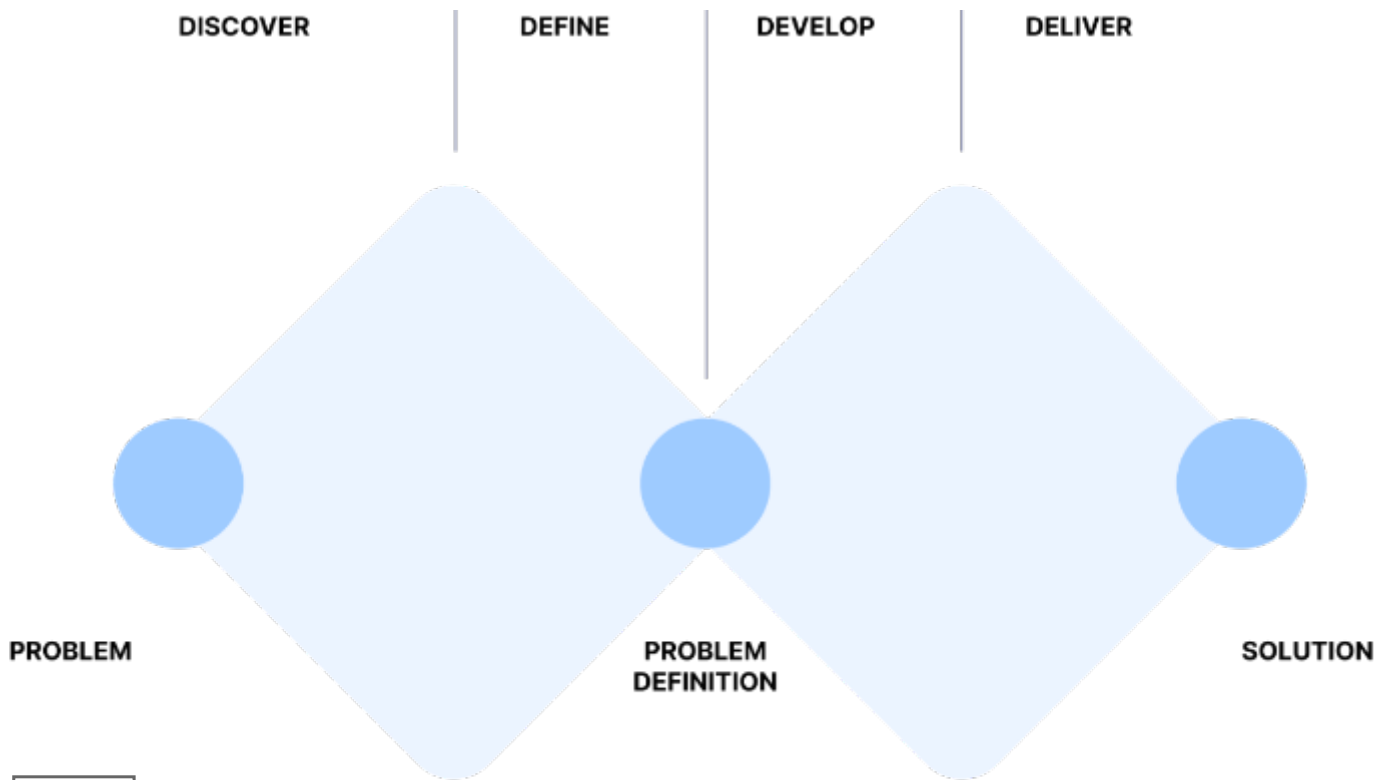


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MARBEFES

(original concept The Design Council, UK, 2005)

Through the co-creation process and applied multi-actor approach, the project employs a **transdisciplinary framework, where non-expert participants contribute to knowledge and decision-making**. The interdisciplinary integration of stakeholders will be facilitated by the multi-actor approach and the underlying concept of prototyping. Through iterative development, the disciplines can more easily learn from each other as the project proceeds, while allowing adjustments to the project outputs. This is cost-effective risk reduction, as critical functions and disciplinary integrations are defined early in the project. Through the iterations, the disciplines and stakeholders can be closely tied to almost every step of the process, which also facilitates the monitoring of project progress. This framing of biodiversity as intimately connected to society allows the consideration of its value. MARBEFES is arranged around the central concept that there are multiple ways to value biodiversity:

- apportioning monetary value to the services provided by biodiversity is now well-known;
- cultural value that may not fit a monetary framework is increasingly recognised, although how to measure this is less well understood;
- both concepts are anthropocentric but MARBEFES recognises the ecological value of marine biodiversity and habitats, wherein nature is of value in of itself; it has

intrinsic importance that transcends human needs or desires.

The latter value has fallen out of favour compared to the ecosystem services valuation, but it has an important role in how we may think about and plan to protect the natural world. The pathway from biodiversity to value is via ecosystem services. Some of these are intuitive to the public, even if traditionally couched in different terms (the sea providing food and the coast preventing flooding is commonly understood) but others are less familiar, e.g. “blue carbon”, carbon sequestration as a climate regulation service; MARBEFES recognises that the blue carbon data and knowledge gap is particularly pressing, with the potential for further CO<sub>2</sub> release from habitat disruption. On land there are already a number of sound ecosystem services models capable of providing information but modelling of aquatic ecosystem services is underdeveloped and there is little understanding of relationships and feedbacks.

<b>Podmiot udostępniający:</b>	Paulina
<b>Odpowiedzialny za treść:</b>	Paulina
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