Introduction. Marine spatial planning in the tropical Atlantic

From a Tower of Babel to collective intelligence

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1 Marine environments and the blue economy are seen to offer a tremendous promise of growth at a time when the possibilities of terrestrial environments appear exhausted. Yet marine environments are subject to intense and increasing pressures (HALPERN *et al.*, 2008; 2015) such as maritime traffic, increasing land use demand in coastal areas, seabed exploitation, dredging and mining, fisheries, tourism, renewable energy development, etc. As a result, the oceans are today at the centre of various and complex interests, at the crossroads of biodiversity conservation, climate change regulation, economic development, food security, etc. In Europe, for example, marine environments are at the heart of the new Green Deal growth strategy, which aims to achieve "an equitable and prosperous society with a modern, resource-efficient and competitive economy, where there are no net greenhouse gas emissions by 2050, and where economic growth is decoupled from resource use" (EC communication, 2019); as well as its Biodiversity Strategy (EC communication, 2020), which aims to halt biodiversity loss, "bring nature back into our lives", and put Europe's biodiversity on a path to recovery by 2030 for the benefit of people, the climate and the planet. This political commitment to a trade-off between human use of natural resources and nature conservation marks a departure from previous EU roadmaps, which focused solely on the economy and aimed to maximise blue growth (EC communication, 2014).

2 In this policy context, marine spatial planning (MSP) aims to reconcile human demands and conservation needs, providing a framework for reflection and decision-making on how to combine different uses of marine resources in the same space through spatial zoning (CRAIG, 2012; KOEHN *et al.*, 2013; EHLER, 2014). MSP is often defined as "a practical means of creating and establishing a more rational use of marine space and interactions between its uses in order to balance development demands with the need to protect the environment, and to provide social and economic amenities in an open and planned manner" (EHLER and DOUVERE, 2009). The first MSPs were implemented in countries in the Global North in the 2000s. Since then, solid experience has been gained

in Europe, North America and Australia (see, for example, JAY *et al.*, 2013). As of July 2014, each European Union (EU) member state has to establish and implement maritime spatial plans (EU directive, 2014). Several European countries have now adopted binding texts on maritime spatial planning (e.g. for Portugal, FERREIRA *et al.*, 2015).

3 MSP remains a very active area of research, because while it offers a promising vision for the management of human activities in ocean spaces, it is not yet clear whether and how it can take into account a number of characteristics typical of marine socio-ecosystems. For example, existing approaches to MSP do not yet incorporate the occurrence of ecological surprises (KATES and CLARK, 1996; PAINE *et al.*, 1998; WILLIAMS and JACKSON, 2007), non-territorial approaches, globalization or, on a larger scale, the speed of environmental change in the context of the Anthropocene (GISSI *et al.*, 2019; COSENS *et al.,* 2021), which generates considerable uncertainty about the sustainability of the functioning of coastal and marine environments (MAES, 2008; WOLFF, 2015; LEENHARDT *et al.*, 2015; BENNETT *et al.*, 2015). Spatial planning frameworks are designed for specific areas, whereas social and natural dynamics have no boundaries. Multinational companies have both global and regional strategies, and the environmental impacts of their activities can be observed worldwide, at multiple scales. Global change and the continuous evolution it triggers in marine ecosystems also calls into question the very nature of a planning exercise that involves setting rules for a given period. Moreover, it leads to a crucial question: how will MSP *ultimately* be used? Does MSP aim to ensure ecologically and socially sustainable use of the oceans or rather to organise as many uses as possible? Will this process result in just decisions and equity between stakeholders or will it create winners and losers? Some authors (FLANNERY *et al.,* 2018) have expressed serious concerns about this for some time: "There is a growing concern that MSP may not facilitate a paradigm shift towards public interest-driven management of marine spaces, but it may simply be a distortion of power dynamics through participatory rhetoric in order to legitimise the agendas of dominant stakeholders." To examine these different issues, a series of research projects on MSP have been undertaken in Europe (PLASMAN, 2008; TROUILLET *et al.*, 2011; QUEFFELEC, 2013) and elsewhere in the world (DAY, 2008; JAY *et al.*, 2013; EHLER *et al.*, 2019).

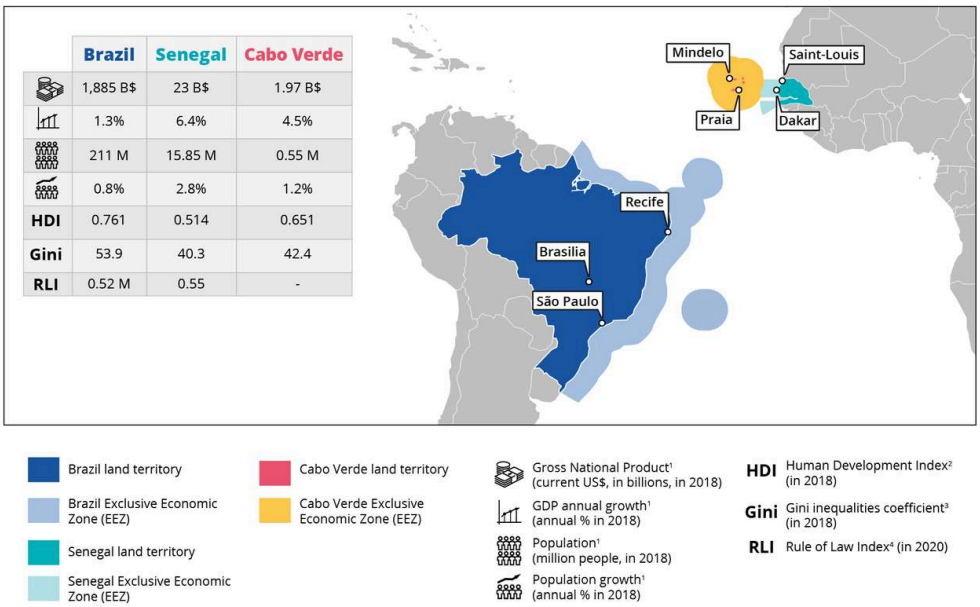
4 Following these initial implementations in the Global North, MSP is now being extended to tropical environments (via conventions such as the Abidjan Convention, with the African Union and others) as part of a wider process to organise the exploitation of marine environments and to design modern forms of governance in these regions. Although very few countries in the Global South are currently formally engaged in maritime spatial planning processes, a growing number of governments are preparing initial policy documents aimed at reconciling resource exploitation and environmental protection (see, for example, the Cabo Verde[1] marine strategy and Brazil's integrated coastal zone management plan). To support this, and to ensure that the exploitation of marine resources contributes significantly to the policy priorities of poverty and hunger reduction (SPALDING *et al.*, 2013; SALE *et al.*, 2014), there is a pressing need for research on the possible applications of MSP in tropical areas. A crucial aspect of this research is that the policy framework initially designed for the EU may not be adapted to the specificities of the Global South. The political instability of certain countries, especially in Africa, and the economic power of transnational corporations affect the balance of power at the MSP negotiating table. In this way, MSP could

potentially pave the way for ocean grabbing, i.e. “the dispossession or appropriation of use, control or access to ocean spaces or resources at the expense of previous resource users, rights holders or inhabitants” (BENNETT *et al.*, 2015; see also WOLFF, 2015; FLANNERY *et al.*, 2016; QUEFFELEC *et al.*, 2021).

5 The tropical Atlantic is a shared ocean that links developed, emerging and developing countries. In recent decades, human exploitation of the sea has developed rapidly on both sides of the tropical Atlantic. The economic and social stakes linked to oil exploitation, fishing, seabed exploitation, food security, etc. are high. The populations of the countries bordering the tropical Atlantic share historical and economic links as well as natural resources. These countries also share some other characteristics, such as the scarcity of longitudinal scientific data and a sectoral approach to ocean management. In northeast Brazil and in West Africa, marine spatial planning is still in its infancy (AGARDY, 2010; QUEFFELEC *et al.,* 2021). However, as MSP spreads it will have an impact on ocean management policies as well as on the connections between political and administrative authorities, legal measures, civil society (local and international) and natural science research. At this early stage, the analysis of the diffusion of MSP and its planning process allows us to highlight opportunities and identify its limitations for the tropical Atlantic.

6 Three case studies are presented in this handbook: Senegal, Cabo Verde and Brazil. All three countries face significant issues related to fisheries, current and future offshore energy projects, the need to maintain artisanal and subsistence fisheries, and negotiations with other countries around the exploitation of the country’s exclusive economic zone (EEZ) and continental shelf (fisheries agreements, oil exploitation, offshore wind farms, etc.). Attempting to reconcile human activities at sea generates both common and specific challenges for these regions and their respective realities (fig. 1): sharing their failures and successes provides valuable insights.

Figure 1. Geographic, demographic and socio-economic indicators illustrating the contrasting realities of Senegal, Brazil and Cabo Verde



Source:
[1] World Bank, Brazil and Senegal profiles. World Development Indicators database;
[2] UNDP, Human Development Data (1990-2018);
[3] World Bank, GINI index;
[4] World Justice Project, Rule of Law Index.

7 MSP is intended to be a collective and rational decision-making process that enlists all the stakeholders concerned, via a mechanism based on spatially explicit transversal information (ecological, legal, social, economic, etc.). Assimilating all the information necessary for this process is a real challenge. It must go beyond the mere juxtaposition of the perceptions and cognitive capacities of single entities (individuals, states, institutions, etc.) – which would lead to a non-operational "Tower of Babel" – to construct a true transdisciplinary approach of collective intelligence. A generic definition of collective intelligence or "swarm intelligence", encompassing both animal and human realities, can be formulated as follows (KRAUSE *et al.*, 2010): "Two or more individuals independently acquire, or at least partially acquire, information and these different packages of information are combined and processed through social interaction, thus providing a solution to a cognitive problem in a way that cannot be implemented by isolated individuals." MCCAULEY *et al.* (2019) chose a collective intelligence methodology to consolidate a narrative for the emergence of an oceanic culture. These authors expected this methodology to "empower a group of people to act as a coherent and intelligent organism working with one mind, rather than the leadership of a collective that would design policy directions". A collective intelligence approach seeks a compromise between different desirable directions, with governance institutions playing their role as guarantors of the values of legitimacy, equity and justice in the process (COSENS *et al.*, 2021). This approach seems the most relevant mechanism for overcoming personal views and transforming an individual, sectoral objective into a collective one. To build this collective intelligence, decision-making within the framework of MSP requires addressing a first challenge, that of finding ways to capitalise on knowledge produced in silos.

8 In the following sections we examine, in relation to the three case studies this handbook focuses on: (1) How can MSP capitalise on existing knowledge silos? (2) What can be done to overcome the structural barriers that may hinder the path to collective intelligence? and (3) How can we make room for nature to "come back into our lives", in particular at the MSP negotiation table in a way that is informed by collective intelligence?

From knowledge silos to collective intelligence

Capitalising on knowledge silos

9 Marine socio-ecosystems can be understood as complex systems. A complex system is defined as a set of a large number of interacting entities, the integration of which results in an overall trajectory. Complex systems are characterised by emergent properties that are distinct from those of their constituents, by non-linear interactions, by different levels of organisation, or by non-trivial collective behaviour (e.g. multiple stationary states, bifurcations, emergent phenomena, feedback loops). The consequence of these properties is that an observer cannot easily or completely understand and anticipate changes in these systems by intuition or calculation.

10 Approaching a complex system such as a marine socio-ecosystem by first breaking down the problem into parts or disciplinary "silos" is a natural and indispensable premise. This allows for an in-depth understanding of the functioning of the different components of the system, the governance that controls them and their possible evolution. Silos allow, for example, an understanding of a legal-political pitfall common to the three case studies considered in this handbook around the question of the distribution of responsibilities (see the contributions of GALLETTI and DA SILVA LEITE NOURY: chapter 7; LY *et al.*: chapter 8; GUERREIRO *et al.*: chapter 9). In Brazil, this complex issue is linked to its federal structure, with a number of powers shared between the state and federal governments. In Senegal and Cabo Verde, the challenges emerge from the sectorisation of institutions and the lack of a culture of integrated coastal zone management. Differences between the case studies are also highlighted and underline the importance of (1) supra-regional incentives in West Africa, which seem to be linked to the emergence of a supranational concern framed notably by the Abidjan Convention on the Protection of the Marine Environment in Atlantic Africa (LY *et al.*: chapter 8) and (2) the risks associated with inconsistencies in Brazil's legislative system, which could thwart attempts to find a balance between economic development and environmental protection (GALLETTI and DA SILVA LEITE NOURY: chapter 7). A disciplinary approach is also a necessary prerequisite for shedding light on the state of ecosystems and their dynamics (BERTRAND and ZIMMER: chapter 1) and on the specific issues at stake in certain activity sectors, such as shellfish farming in Brazil (SOUDANT *et al.*: chapter 5) or the vulnerability of certain sectors, such as artisanal fishing in Senegal (THOMAS: chapter 6).

11 Knowledge arising from silos thus allows a rich and kaleidoscopic understanding of the challenges affecting the different facets of marine socio-ecosystems. The risk, however, is that when complexity is broken down into its many parts, this neglects the links, interactions and overlaps between them. Silos can emerge from a disciplinary approach if it is compartmentalised. But silos can also result from a lack of integration between

scales. SUÁREZ DE VIVERO *et al.* (chapter 11) show that in the South Atlantic – unlike the North Atlantic – a powerful network of common interests has not yet emerged and argue that the construction of a transatlantic community will be an essential prerequisite to standardise MSP approaches.

12 For all the knowledge specific disciplines provide, it is not sufficient to understand the individual parts of complex systems in isolation. These systems by definition are characterised by complexity: by the existence of emergent phenomena and feedback loops that cause the trajectory of the system to differ from that of the sum of its parts, making forecasting uncertain (see, for example, COSENS *et al.*, 2021). In addition, the impacts of climate change exacerbate the natural variability of these systems, in both frequency and magnitude, further increasing uncertainty. Thus, circumscribing knowledge in silos, whether disciplinary, sectoral or scale-dependent, results in cognitive limitations that may hamper the possibilities of addressing the future sustainability of marine socio-ecosystems.

Identifying barriers to a system view of the complex ocean

Technical and informational challenges

13 MSP strives to be a rational and evidence-based process (PINARBAŞI *et al.*, 2017). Decision support tools (DSTs), rooted in data analysis, have thus proven to be essential to inform the decision-making process. DSTs are spatially explicit tools, involving interactive software including maps, models, communication modules and additional elements that can help solve multifaceted problems too complex to be resolved by human intuition or conventional approaches alone. While these tools can support more systematic and objective decision-making (PINARBAŞI *et al.*, 2017), they have also introduced a high degree of technicality into the process of selecting ocean-use zoning scenarios. As illustrated by BRUNEL and LANCO BERTRAND (chapter 15) in a Brazilian case study, the results provided by these DSTs can be very sensitive to the formatting of the input data, the parameters of the models, and even the way the zoning issue is formulated mathematically. Fairness in the MSP negotiation process would require a minimum level of technical training for all stakeholders on the functionality of these DSTs and how they may affect the optimal zoning scenarios under discussion. FOTSO (2019) makes the same observation: DSTs have acquired such a critical role in the MSP decision-making process that there is a need to establish a clear legal framework to ensure that this technical issue does not override transparency, equity or fairness in negotiations.

14 Given that DSTs, and the spatially explicit data they require, have become central to the MSP process, TROUILLET *et al.* (chapter 10) highlight the emergence of an "informational challenge": the simple fact of having data (ideally spatially explicit) on one's activity gives a stakeholder an undeniable advantage in the negotiation process. Taking the example of artisanal fishing in Senegal, these authors question the role of geographical information and associated geo-technology in MSP in order to identify the main points of vigilance to consider, particularly in developing or emerging countries where data is often scarce.

An anthropocentric view of human–nature relations

15 Human societies are linked to marine environments in various ways: people live near seas, they use them for transport and travel, they extract from them, they depend on their resources. However, they do not actually live in this three-dimensional environment, with the consequence that the relationship is usually quite utilitarian and definitively anthropocentric. The main perspective is activity-based and economic (e.g. the great promise of blue growth), with the marine environment seen as a provider of resources, or even, as MACHU *et al.* (chapter 2) well illustrate, a neglected outlet for the negative externalities of land-based activities, such as pollution in Senegal. The paradigm of an immense ocean, of a sea capable of "feeding humans" while "consuming their waste", persists despite all scientific evidence to the contrary – evidence that has been accumulating for centuries.

The Red Queen's race in a context of climate change

16 The ocean is strongly affected by the effects of climate change caused by emissions of CO_2 and other greenhouse gases from human activities: the impacts include changes in water temperature, acidification and deoxygenation, leading to changes in ocean circulation and chemistry, rising sea levels, increased storm intensity, and changes in marine species diversity and abundance. These effects combine with hysteresis – a property of a system that does not follow the same path when an external cause increases or decreases – which is quite common in the functioning of marine systems (see, for example, FAUCHALD, 2010; BLACKWOOD *et al.,* 2012; GARBE *et al.,* 2020). As a consequence of this fundamental non-stationarity, non-linearity and high uncertainty in the future trajectories of marine socio-ecosystems subject to the effects of climate change, stakeholders and governance institutions face the challenge of constant adaptation. As RODDIER (2012) suggests, humanity will be engaged in a race in which the more efficiently we consume energy, the more rapidly we change our environment, the more rapidly we must acquire information about that environment – which in turn consumes energy – in order to adapt to it. This brings to mind the paradox of the Red Queen's race in *Alice's Adventures in Wonderland* (CARROLL, 1865): "Now, here, you see, it takes all the running you can do to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!"

Innovative approaches to breaking down silos

Towards impact-based governance

17 Interacting with a complex system is a challenge, as it introduces a tension between the need to act and the fact that we will never fully understand the system. Nevertheless, this interaction with complex systems is practised in many areas of life. Medicine is one example. Faced with a problem (a disease), a practitioner, using established knowledge, suggests an intervention (a treatment) for the patient. The appropriateness of the treatment is assessed by the clinical follow-up of the patient, and readjusted until the objective of improving the patient's health is achieved. In other words, this involves an adaptive, dynamic process, based on the constant evaluation of the impact of actions and their continuous readjustment, to achieve the goals of survival and well-being.

There is no absolute guarantee that the goal of good health will be achieved, but the chances of improvement are maximised by this continuous clinical feedback.

18 In the framework of ocean governance, which controls our interventions in complex marine socio-ecosystems, this process of refinement has not yet really been adopted. The diagnosis is there: as elsewhere on the planet, biodiversity is declining at an unprecedented rate (IPBES, 2019), resources are being depleted (JACKSON *et al.,* 2001; MYERS and WORMS, 2003), and tensions between users over access to spaces and resources are intensifying (FLANNERY *et al.,* 2016; QUEFFELEC *et al.*, 2021). Policies are being put in place to implement measures in response to these "diseases" affecting socio-ecosystems. However, "clinical monitoring", i.e. the continuous evaluation of the impact of these remedies, their possible challenges and readjustment to improve the treatment, is still lacking. In the medical analogy, the value we place on human life is clear: this prevents us from taking risks with the treatment we choose, which is why dynamic and adaptive clinical evaluation is so fundamental to medical science. "Increasing the value placed on the protection and restoration of natural ecosystems", as proposed by the EU, for example, therefore requires, among other things, a shift in our ocean governance tools to dynamic procedures that are continuously readjusted according to observed impacts. Although the need for this transition has already been identified (see, for example, DOUVERE and EHLER, 2011), in practice we still use frameworks in which governance decisions are based on static snapshots of the oceans.

19 In the case of MSP, DSTs aim to inform a partition of the marine space, with distinct rules of access and use, making it possible to achieve objectives targeting human well-being (fewer conflicts) and/or biodiversity (maximising conservation while minimising the negative impacts on human activities). However, each DST uses partial representations of a socio-ecosystem that explain only a part (small or large) of the mechanisms that drive the system: syntheses of stakeholders' visions (Seasketch), static representations of socio-ecosystems to optimise the architecture of marine protected areas (Marxan and prioritizR), or dynamic models of the environment (Atlantis, ISIS-fish). Each of these approaches has its strengths, but none is capable of (1) bringing together points of view from different disciplines (e.g. oceanography, ecology, economics, sociology, political science) and the representations of the different stakeholders involved in these measures, (2) anticipating the dynamics and short-term evolution of the system in different scenarios of governance or global change, or (3) providing a transparent representation of the effects of uncertainty (in data, processes, or the effects of global change) or of the multiplicity of competing objectives in the simulated scenario. Yet in the three-dimensional liquid world of the ocean, natural and anthropogenic changes are rapid and permanent and occur in distinct (coastal, offshore, surface, deep) but interconnected domains. Furthermore, there is no formal and/or standardised feedback procedure to ensure that the effectiveness of these zoning tools is periodically reviewed or that their size, architecture or other properties (e.g. the stringency or lenience of bans, the permanent or temporary nature of the protected area) are readjusted in response to observed effects. What chance do we really have of "bringing nature back into our lives" if the treatments are applied without any formal "clinical monitoring" of their effects?

20 To remedy these limitations and better protect ourselves from the risks they entail, we need to imagine a new relationship between governance and marine socio-ecosystems, one that is capable of continuously evaluating the impact of actions and to constantly

revise its modes of action according to the effects observed. In other words, it is a question of moving from the current form of management where objectives are viewed as the means, to management in which the objectives are the ends. Tools and protocols must therefore be put in place to allow this type of adaptive feedback loop.

Developing new types of observations

21 Tools, data processing methods and their representations can be used to enrich and decompartmentalise the kaleidoscopic vision that we have of marine socio-ecosystems. LEBOURGES DHAUSSY (chapter 3) illustrates, for example, how acoustic survey data, which has been implemented in many countries in the Global North and South with the primary aim of assessing the size of exploited fish stocks, can now be used to document ecosystems as a whole. BRUNEL *et al.* (chapter 12) give a Brazilian case study that shows how Google Earth data can be used to quantify, in a spatially explicit way, indicators of anthropogenic activities on the coast and potential fishing power through vessel counts. An atlas of the legal rules applying to Senegal's marine environment has also been produced as part of the Paddle project (Planning in A liquiD worlD with tropicaL stakEs). A study on the use of this atlas highlights how, by making complex legal rules intelligible, this geographical approach can have an impact on administrative authorities (LE TIXERANT *et al.,* 2020).

Building interdisciplinarity

22 The need for interdisciplinarity is often asserted, however, it is rarely put into practice on a large scale. RAGUENEAU (chapter 16) examines this paradox by revisiting different approaches that allow interaction between disciplines (multi-, inter- or transdisciplinary), illustrating why this is essential in order to understand complex systems, and identifying the conditions that would allow its emergence. The urgent need for interdisciplinarity does not only concern scientific fields. PETTORELLI *et al.* (2021) have illustrated how scientific and political agendas need to be brought together on the questions of global climate change and biodiversity.

Reintegrating local communities into participatory governance

23 Although often underrepresented in MSP processes, local communities are essential stakeholders in the dynamics of a socio-ecosystem, and are the ultimate target of policies at the national level. SILVA *et al.* (chapter 4) provide an overview of the interactions between a local community and global resources through the example of the yellowfin tuna fishery in Cabo Verde. TOONEN *et al.* (chapter 13) describe how serious games and participatory mapping can improve public participation in defining new rules of governance. Finally, DUARTE *et al.* (chapter 14) report on a new collective management experiment through the creation of reserves dedicated to recreational uses, such as surfing. These initiatives are in line with what COSENS *et al.* (2021) envisage: developing bottom-up, innovative, collaborative processes, facilitated by clear objectives set by the government "to resolve trade-offs between stakeholders and to link local and indigenous knowledge to the biophysical system, allowing adaptation to emerging outcomes of complexity".

The promise of artificial intelligence

24 Today artificial intelligence (AI) is revolutionising the way we approach the information analysis and the simulation of systems. It adopts an approach that algorithmically mimics natural intelligence digitally, and thus allows us to consider new, perhaps more operational, ways of dealing with complex systems. AI methods involving deep learning algorithms are able to learn through their own data processing. In other words, they can process raw data and autonomously identify the set of metrics and derived variables that best describe and simulate the behaviour of the system under study.

25 AI, along with deep learning, is at the heart of a "digital twin" concept that began in aeronautics, then spread to industry, and is now emerging in force in many scientific fields, including those related to the ocean. A "digital twin" can be understood as a virtual representation of a real system, which evolves over time in parallel with the real system through a continuous supply of data collected by sensors. The digital twin "learns" on its own to resemble the real system using the initial data provided at the outset and acquired continuously, but also by integrating specialised knowledge or by taking inspiration from other real systems with similar functioning. In theory, a digital twin should be able to predict the states of the system, in a time frame that is short enough to be compatible with decision-making. A digital twin could also provide a representation of the same system from different perspectives, thus facilitating interdisciplinary dialogue and pooling of knowledge between, for example, the natural and human sciences.

Bringing nature back into MSP

26 Restoring nature to its rightful place in methods such as MSP is not just important but urgent. How can this challenge be met? How can "nature" be integrated in a practical way into ocean governance mechanisms? While we are far from having a clear and definitive roadmap on this subject, we suggest some conceptual and practical avenues to initiate progress in this direction.

Rephrasing the problem: what if we invited Bartleby to the negotiating table?

27 The "avoid, reduce, compensate" hierarchy is now included in the legislation of several nations. In France, legislation since 1976 (L122-3 of the Environmental Code) has specified that any development project must avoid environmental damage, reduce the impacts that could not be avoided, and compensate for any damage that could not be avoided or reduced. In Europe, this hierarchy is an objective of Directive 2011/92/EU of 13 December 2011 (Article 5-b, see EU directive, 2011). It is also included in the EU Green Deal, "a roadmap for making the European economy sustainable by turning climate and environmental challenges into opportunities in all policy areas and ensuring a just and inclusive transition for all". To this end, the explanatory memorandum accompanying each EU legislative proposal or delegated act must include a specific section explaining how the initiative respects this principle.

Unfortunately, project managers and governance bodies are usually quick to skip the first step, which is to avoid creating a negative externality in the first place. This is partly what led VAROUFAKIS (2020) to consider that "The EU Green Deal is a huge greenwashing exercise."

28 *Bartleby* is the title of a short story by Herman Melville published in 1856. Bartleby is hired as a clerk by a solicitor to copy documents. As time goes by, the clerk, who had at first been hard-working and conscientious, begins to refuse to do what's asked of him, simply saying "I would prefer not to." This story has long fascinated philosophers, many of whom have commented on it (Deleuze, Derrida, Blanchot, Zizek, Lordon; see BERKMAN, 2011). An embodiment of passive resistance, the story highlights "the power of doing nothing" (EGO, 2011). In today's public space, a "Bartleby-like" stance might be to cease activities that do not create anything truly new and/or useful, and thus mark the starting point for a different world.

29 More concretely, in the context of MSP, it is time to deploy tools that objectively document what could be gained by foregoing certain human activities. DSTs, as well as strategic impact assessments, should include formal protocols for considering, evaluating and weighing up the pros and cons of banning human activity in certain marine areas. DSTs now widely used in the systematic selection of reserves, such as Marxan, are formulated mathematically in such a way that minimum biodiversity maintenance targets are set (e.g. to maintain "at least 50% of current biodiversity"), and then the tool seeks the protected area architecture that will maximise the maintenance and/or development of human activities. Inviting Bartleby to the MSP table might mean reversing the burden of effort in mathematical optimisation formulas: setting a level of human activity considered indispensable, with the biodiversity to be maximised being the degree of freedom for optimisation.

Questioning certain "axioms" to imagine new solutions

30 In her books, the environmental philosopher Virginie Maris has put forward a number of valuable insights into our societies' relationship with nature (MARIS, 2010; 2014; 2018). Notably, she has highlighted how certain notions presented as axiomatic undermine our ability to rethink and reinvent our relationship with nature. We have borrowed elements from her thinking below to attempt to identify ways in which they might be useful in the context of MSP.

Towards less reductionist and more inclusive management methods

31 The concept of ecosystem services was initially a strategy to argue for a redefinition of nature and its protection in terms that were audible in the economic sphere. This concept has been so attractive to business, policymakers and scientists that the strategy has become a pseudo-axiom. The immediate corollary of the notion of ecosystem services is the valuation of these services. To this end, economists have adopted various methodological tools to make visible values that are often hidden. These tools have been the subject of much criticism from both a methodological and conceptual point of view. Generally speaking, the very principle of quantification, inherent in monetary evaluation, presupposes, while almost never explicitly stating it, that the various values of nature are reducible to their instrumental aspect alone; that this value can be expressed in a common unit, and as a result becomes substitutable

(giving rise to the concept of compensation or offsetting). By adopting an economic approach, first metaphorically, then very concretely, allowing a market logic to infiltrate increasingly deeply into public policy on nature protection, we have opened the way to the dissolution of nature in the economic sphere. In a rationale of maintaining natural capital and associated ecosystem services, decision-makers are encouraged to focus solely on nature's instrumental value: i.e. to protect natural environments only to the extent that benefits can be derived from them.

32 An alternative vision, and one particularly relevant to MSP, is to involve local people in an approach that makes nature protection a lever to reduce the vulnerability of human communities (see, for example, DIAZ *et al.*, 2018; LINDQUIST, 2017). Preserving the natural character of a site should not imply excluding all use, but rather ensuring that human activities do not disrupt the trajectory of the ecosystem as a whole. Conservation can thus serve as a bulwark to protect cultures and ways of life threatened by the multiple projects developed in the neoliberal logic of economic growth that engenders competition between peoples and territories. In this respect, the "extractive reserves" created under Brazilian legislation (Resex: protected geographical areas whose objective is to protect the livelihoods and culture of traditional populations, as well as to ensure the sustainable use of the area's natural resources) are an interesting framework that could be explored in the context of marine spaces.

Reference environments, shifting baselines and the non-regression principle

33 Nature conservation, especially with the emergence of the notion of rewilding (NOGUÉS-BRAVO *et al.*, 2016; PERINO *et al.*, 2019), is faced with the problem of defining spatial and temporal reference states on which to base restoration objectives. Yet it is difficult, if not impossible, to identify what a "natural reference state" would be, as this is so affected by the shifting baseline syndrome (PAULY, 1995) and the environmental amnesia it engenders. This is particularly true in marine environments, where direct observation is quite difficult. Inviting nature back into MSP, through the rewilding of certain areas, does not necessarily mean actively restoring wild ecological conditions with the reintroduction of species, for example. It could mean much less intrusive behaviour that integrates the notion of rewilding with the notion of "letting go" in order to establish a feral nature (SCHNITZLER and GENOT, 2020). In this perspective, managers should not try to manufacture nature, but support it on its journey, repairing damage where it occurs to allow it to get back on track and removing obstacles and impediments.

34 In law, the application of the principle of non-regression (PRIEUR, 2012) would be fundamental to guide such an approach within MSP. This principle requires that we do not go back on our commitments made at the UN Conference on Environment and Development held in Rio in 1992. In order to assess whether a new rule or the modification of an old rule is regressive, a special chapter should be included in the impact assessment of a bill or decree to demonstrate non-regression on the basis of relevant scientific and legal indicators of the state of the environment. Currently, there is no legal implementation of this in Senegal and West Africa. In Brazil, it is certain that this principle is being undermined by a growth policy that is cut off from the environmental protection process. One example is the reauthorisation of hundreds of banned pesticides in Brazilian legislation by the Bolsonaro government (see, for example, BRAGA *et al.*, 2020). In Europe, countries attach varying degrees of importance

to the non-regression principle. European and international institutions such as the Council of Europe and the UN have recognised that a healthy environment is a human right, and human rights law is increasingly being used to protect the environment.

Overcoming the nature–culture divide in marine ecosystems

35 Different anthropological perspectives (Lévi-Strauss, Descola, Pignochhi) have alerted us to the fact that the relationship between humans and nature is likely be the most crucial question in the years ahead. These anthropologists have described the way humans perceive the environment around them as their way of "composing" the world. So-called Western societies have historically composed the world on the opposition between nature and culture, which confines them to taking a strictly utilitarian view of natural ecosystems in general and marine ecosystems in particular. The challenge of transitioning from this will involve transforming our utilitarian and anthropocentric vision of the world into a view that recognises the intrinsic value of marine ecosystems. In this new vision, the definition of the governance of marine spaces would go beyond the sole objective of maintaining the functions performed or the services rendered by ecosystems to recognise that the preservation of healthy marine spaces and living beings is an axiom that needs no justification, in the same way as human well-being. In such a paradigm, the notion of compensation becomes irrelevant: if one accepts the axiom that a human being can never be replaced by another living being, then every living being is equally irreplaceable.

36 The grounds for such a paradigm shift are emerging from all sides: in science, environmental ethics and law. The Gaia hypothesis formulated by the environmentalist James LOVELOCK (1979) revisits the human–environment relationship. Instead of considering the Earth as a universe where living beings coexist, it starts from the idea that the Earth is itself a living meta being. Its organs, tissues and circulatory systems are integrated and function together. In the field of law, the proposal to consider nature or its elements as legal persons would be a decisive step towards "bringing nature back into our lives" (HERMITTE, 2011). At the frontiers of ecology and geography sciences (MATHEVET *et al.*, 2010; MATHEVET, 2012), the concept of "ecological solidarity" has developed, inspiring France's national park legislation since 2006, and its 2016 biodiversity legislation. Ecological solidarity is defined as a concept "that recognises the close interdependence of living beings with each other and with natural or managed environments". This concept also emphasises the "community of destiny" between humans, societies and their environment, considering the co-evolution of human societies and nature through the use of space and natural resources. Ecological solidarity is expressed in practice when the inhabitants, users and visitors to an area judge their actions or non-actions on their consequences on the components of the community. Applied to MSP, these concepts can challenge the current generic objective of the MSP process (resolving conflicts to best satisfy each of the stakeholders) and advocate for a shift to another type of pact, in which stakeholders make decisions based on the evaluation of the impacts of their actions and non-actions on the marine socio-ecosystems they live within.

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NOTES

1. The Republic of Cape Verde changed its official name in all languages to the Republic of Cabo Verde on 24 October 2013 in a request submitted to the Secretary-General by the country's Permanent Representative to the United Nations. In accordance with this request, the country is referred to as Cabo Verde in this publication, unless it occurs in titles of previously published works, references or printed sources mentioning Cape Verde.

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Marine spatial planning in the tropical Atlantic

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IRD Editions

IRD Éditions

Marine spatial planning in the tropical Atlantic

From a Tower of Babel to collective intelligence

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Publisher: IRD Éditions
Place of publication: Marseille
Year of publication: 2023
Published on OpenEdition Books: 11 September 2023
Series: Synthèses

https://books.openedition.org

Electronic reference
BONNIN, Marie (ed.) ; LANCO BERTRAND, Sophie (ed.). *Marine spatial planning in the tropical Atlantic: From a Tower of Babel to collective intelligence.* New edition [online]. Montpellier: IRD Éditions, 2023 (generated 11 septembre 2023). Available on the Internet: <http://books.openedition.org/irdeditions/46585>.

Cover caption
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