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A tale of two sectors: Offshore wind and fisheries out for a row in the ocean

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1 Introduction

"Beside the sea (…), there lived a cow, a donkey, a sheep, a pig, and a tiny little mouse. They were good friends, and […], they decided to go for a row in the bay" (Allen, 1983). So goes the introduction to a children's book, which nicely pictures a challenge faced by contemporary developments in the blue economy. The boat cannot fit all five friends, and the last to board makes it sink. "Do you know who sank the boat?" In the original version, the tiny little mouse is blamed for this mismanagement of cumulative impacts.

The boat provides a useful analogy for a limited resource (in this case, space and its use for a dedicated purpose) in a 'tragedy of the common-pool' scenario where individual choices lead to collective failure. The 'Who sank the boat' story adds a temporal dimension to this narrative, emphasizing the order and timing of the actors' access to the resource. This highlights a number of issues with real world management implications.

First, as more actors board the boat, the focus shifts to the yet-to-allocate space. In addition to being the only space accessible to future actors, it also provides the 'room to move' for both short-term management and long-term planning. As the remaining space shrinks, options for future actors, the scope of uses, management and planning, decrease. Second, blame for overuse, overcrowding and poor management is likely to fall on new arrivals. Third, the access order can affect the extent to which 'optimal' resource use (however defined) might be achieved, depending on the type of actors joining. In 'Who sank the boat', no matter the access order, the last animal to board (in the original version, the tiny mouse) appears to be responsible for sinking the boat. A wise manager tasked with averting collapse, and called into action late in the process, will prevent the tiny mouse from boarding, leaving very little boat capacity unused. With the access order reversed, preventing the cow from boarding, a significant amount of boat's capacity would remain unused.

Using this children's story as a metaphor, and building on the results of previous modelling work carried out by the authors to address the issue of biodiversity offsets across multiple development projects (Thébaud et al., 2015), we reflect on what seems to be the currently dominant way of addressing the impacts of offshore wind developments on fisheries, and envisage the potential benefits of a more strategic approach to such assessments.

2 Background: Offshore wind energy and fisheries

Indeed, this children's story is a particularly powerful metaphor for the challenges faced by blue growth. A case in point is the rapid emergence of offshore wind farms as a promising global source of renewable energy. With the scale of planned development worldwide, conflicts over the allocation of maritime areas to this sector are already observed and should intensify in the next two decades. This is the case in Europe[1] and in Australia[2]. In both contexts, new regulatory frameworks are being considered to address the issues of space allocation and compensation across sectors.

Of particular relevance is the interaction between offshore wind farms and fisheries. In the 'Who sank the boat' analogy, the boat is the shared use of coastal marine areas. Fisheries boarded long ago and have since enjoyed ample (albeit progressively decreasing) room. The other animals are

[1] See for example: https://ec.europa.eu/commission/presscorner/detail/en/ip_19_4749 ; https://www.eoliennesenmer.fr/

[2] See for example: https://www.dcceew.gov.au/energy/renewable/establishing-offshore-infrastructure

current and proposed wind farm developments. As more developments materialize, less room is available for both fisheries and future developments of any kind, including potentially more efficient wind farms. Faced with some initial offshore wind energy development, fisheries may find ways of adapting (e.g. reallocating effort to alternative areas, or changing target species). Eventually, however, fisheries may be left with no suitable space, leading to significant tension between actors (Letschert et al., 2021; Stelzenmüller et al., 2022). This may lead to decreased social acceptability of large-scale marine energy production, if this sector is perceived to crowd out fisheries and other activities, potentially contributing to the social push-back as has been experienced in recent years in France (see also (Chaji and Werner, 2023; Firestone et al., 2012; Kermagoret et al., 2016)) (Figure 1).

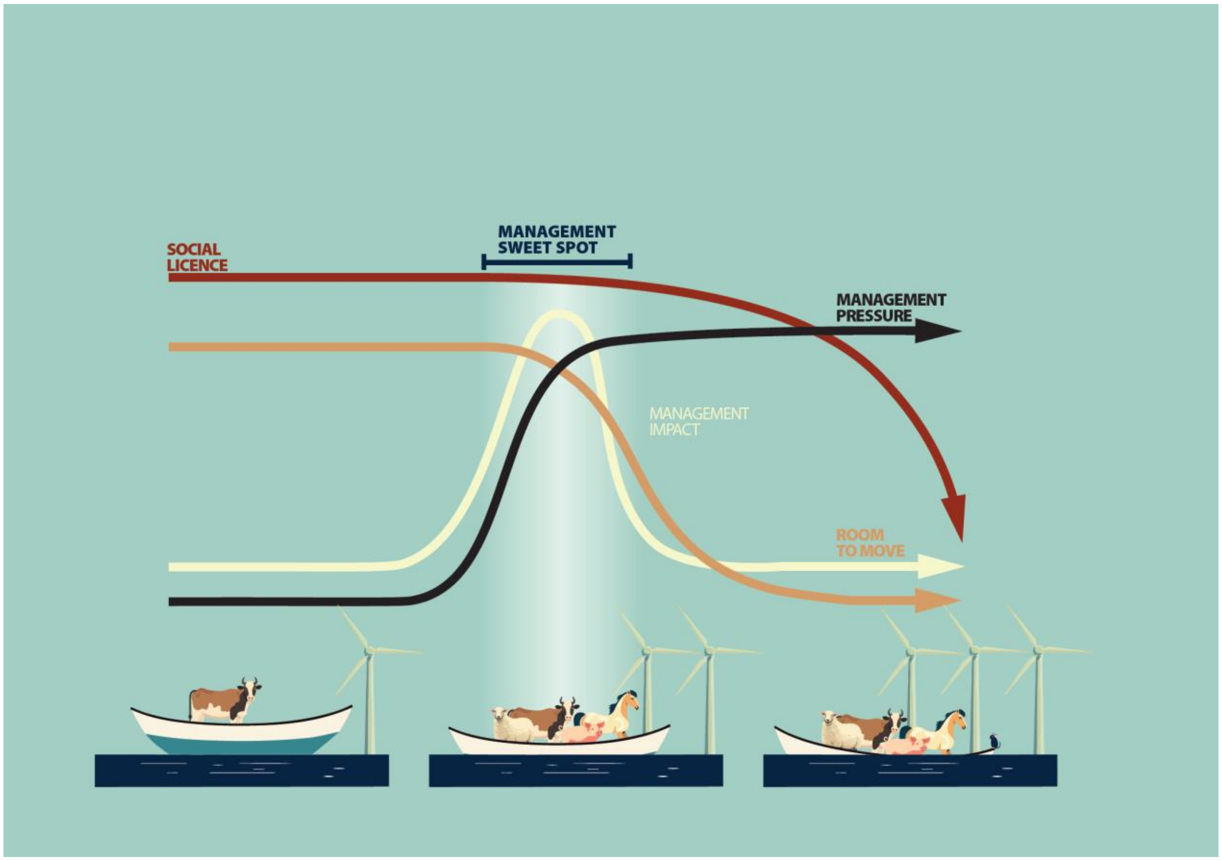

Fig. 1. Key factors justifying the need for a strategic management of offshore wind energy development. In the early stages, when a single occupant sits in the boat, management may not be perceived as necessary. When only space for one additional occupant is left in the boat, few management options are available, short of withdrawing access rights, which normally carries considerable legal, political and economic costs. In between, there is a “sweet spot” in which management can both be perceived as useful and have a chance of being impactful. Of course, the space occupied by the original occupant, and the size of the newcomers, will affect the timing of this window of opportunity.

The extent of these difficulties is likely to be affected by the context of the pre-existing fisheries. Where these have strong management institutions in place, and fisheries generate high returns, higher resistance to new wind farm project developments might be encountered, as well as stronger constraints on the ability to redistribute fishing activities around these projects, as has been shown in other contexts (Beckensteiner et al., 2023). Where fisheries only generate limited economic returns or political clout, resistance may still be observed as stakeholders struggle with degraded bio-economic conditions. However, one expects well-supported offshore wind development projects to more easily find their way in the latter contexts, with indirect effects related to effort redistribution and cumulative impacts leading to further reductions of fishing activities.

3 The problem : a project-by-project, tactical approach

The dominant approach to this development is a project-by-project approach, ignoring cumulative impacts. 'Who sank the boat' also pictures sequential, short-term (tactical) decision-making. Neither the boat's overall capacity, nor the likely interactions between animals are assessed. In addition, no consideration is given to whether the strategy (allocation of space on the boat) fits the purpose (a pleasant row in the bay). This is an analogy for currently prevailing scientific and regulatory frameworks, which largely address development and resource management at a project (e.g., individual wind farm) level.

For example, in France, the regulatory process for approving wind farm developments[3] involves specific regulations that depend on environmental impact assessments and the location in coastal waters up to 12nm from shore or the Exclusive Economic Zone (see also (Bonsu et al., 2024)) for the North Sea context). These authorizations and assessments are carried out at individual project level. Project-level evaluations have also been the focus of many scientific studies (see e.g. (Buchholzer et al., 2022; Raoux et al., 2018) and the review by (Galparsoro et al., 2022)). Some studies have considered the broader impacts of individual farms at fishery (e.g. (Scheld et al., 2022)) or ecosystem level (e.g. (Pezy et al., 2019; Wawrzyczek et al., 2018)). In 'Who sank the boat', this resembles the attempt to assess the impact of each additional animal boarding in isolation, independent of the impacts of those already in the boat, and of possible new ways that they might use space on board. In practice, the system has memory, the past matters, and impacts accumulate in different ways depending on the sequence (Thébaud et al., 2015), as well as on the distribution of animals on board and on their adaptability to newcomers.

4 Analysis: the time dimension

This sequential, project-by-project assessment approach has at least three drawbacks leading to inadequate management of time and space, and associated development incentives. First, at each step, management targets the shrinking yet-to-allocate space. Not only is the boat as a whole never the target of management, but in most cases, options involving already-allocated space are effectively foreclosed at the time of their allocation. Second, the impact of the currently proposed project is assessed in the context of the already-allocated space, without this being given explicit recognition. In 'Who sank the boat', the impact of the tiny mouse would hardly be noticeable at any time in the boarding sequence, but becomes pivotal at the very last step. This results in responsibility for resource use (or blame for its overuse), and potential requests for compensation, to be unequally distributed: the role of the tiny mouse in the boat collapse is apparent, while the role of the first boarded animal may be forgotten. This is even more so when resource use and impacts are not linear, as we discuss in (Thébaud et al., 2015). This should lead to incentives for wind farm proponents to come in first (when potential push back and claims for compensation are limited), before the cumulative impacts reach a level attracting significant management and public scrutiny. Third, as for responsibility and blame, costs and benefits are also unequally distributed. In 'Who sank the boat' it is advantageous to board first, when ample space is available and the

[3] See https://www.eoliennesenmer.fr/

boat is most stable. Each new animal in the boarding sequence needs to juggle less space and a rockier boat.

A consequence is that the financial costs and benefits, regulatory burden and social acceptance implications to an operator of the energy sector are likely to vary significantly depending on whether previous projects have been implemented that have paved the way. While variations in financial costs and benefits may to some extent at least be assessed in advance, regulations and social license may vary abruptly and unpredictably (see e.g. (Blanchard et al., 2019)), making the process highly risky for new operators.

5 Recommendation: a strategic, holistic assessment to support adaptive management

So, how should our good friends manage their row in the bay? We believe that what is needed is a strategic assessment approach, which builds on two components. First, the typical adaptive management cycle (Bunnefeld et al., 2011; Folke et al., 2005; Smith et al., 1999) suggests that, they should start by discussing a goal (a day out), a strategy (via a boat ride) and a plan (how to board). They would then start implementing, observing and assessing the outcomes, taking due account of the dynamics of boarding and reorganisation on board, boat status and enjoyment dimensions, applying the principles of integrated assessment. Yet, in a project-by-project approach, by the fourth animal, the viability of the strategy would be questioned and the plan would likely be abandoned. Or the boat would drift off leaving some important members of the group onshore, thereby decreasing the enjoyment of the day out.

A genuinely strategic, holistic assessment approach requires a second component. That is providing for a *collective* in-depth discussion of *purpose*, in this case enjoying the day out, involving all potential participants. Such a discussion would likely identify the fact that by the boarding of the third animal, the enjoyment would unlikely be achieved in the crowded boat, in addition to some being unable to board. Other questions might address the capacity of the boat, and whether this could be enhanced somehow, as well as getting a better sense of the risks of losing the boat. Yet other questions might focus on the future: will anyone else wish to enjoy the boat? Should we leave some space for them? Should the boat be returned by a certain time for others to use? Could the animals disembark more or less easily in case the purpose for using the boat changes?

These questions have very practical implications for managing the development of offshore wind farms, as of coastal regions in general. Fundamental questions to consider include the following: what should the purpose of coastal marine areas be? How do fisheries and wind farms fit within this purpose? How much of the present marine ‘viable’ space should be allocated to current versus future use, including not-yet-envisaged uses? How much do we understand of the future commitments required by a wind farm, versus a fishery? What could the interactions be between the responses to new developments in both sectors, and the ecosystems that support them? And what allocation and compensation mechanisms may be acceptable to the affected parties?

A strategic assessment approach to the evaluation of likely impacts of alternative wind farm expansion should be developed at the scale of entire fishing regions, along the lines of Integrated Management (Stephenson et al., 2019). This implies a change in the scale at which the coastal system is understood and managed. It can involve the development of methods and tools addressing the combined effects of multiple wind farm locations, their design and sequence of installation, along with the likely adaptation possibilities for marine fisheries and other uses of marine areas, as recommended by (Fulton et al., 2022). It would also require sector-based marine planning with a consistent and repeatable methodology which can help managers and stakeholders reach a shared understanding of system interactions into the medium-to-long term future. As highlighted in Figure 1, the timing of this strategic approach is crucial. Too early, and it may be considered irrelevant or impossible (since it may be impossible to practically envisage possible uses and constraints). Too late, and there will likely be no room to move for management.

While indications of overall negative impacts have been reported (Galparsoro et al., 2022; Watson et al., 2024)), wind farms may also entail positive ecological effects, e.g., through the reduction of fishing pressure, potential de facto reserve effects, and habitat provision. If well managed, these effects may in turn lead to positive outcomes in terms of the potential for ecosystems to support fisheries, both outside wind farms, due to spill-over effects ((Stelzenmüller et al., 2021)), and within via the development of co-activities, although this faces multiple economic, ecological, technical and legal uncertainties and risks ((Bonsu et al., 2024)). As for effort displacement ((Scheld et al., 2022)), such impacts should also be considered cumulatively across the entire set of potential developments, using a strategic management approach.

The allocation of marine areas across competing uses, some of which pre-exist while others have arisen more recently, raises difficult questions, particularly relating to social outcomes. We believe that a strategic assessment approach will help address the allocation questions in a more complete and transparent way, as it will require considering all the stakeholders directly and indirectly affected, taking into account tradeoffs between economic, social and ecological consequences of the proposed developments. For example, one could develop an ecoviability approach (see e.g. (Doyen et al., 2017)) to explore alternative offshore wind development strategies, taking into account the associated costs and benefits for the different categories of stakeholders. Applying this approach would require identifying acceptability constraints reflecting the objectives collectively set for the use of marine areas. In addition, such approaches could lead to identify possible compensation mechanisms as a possible pathway for the resolution of cross-sectoral conflicts ((Bellanger et al., 2021)). Developing strategic assessment approaches would also require bringing stakeholders involved in or affected by local development projects together, to acquire the data and understanding of development options and possible impacts, as well as to analyse and discuss the results, and finally to plan development. This could contribute to the institution of coordination mechanisms for the integrated management of ocean areas, that are often still lacking (Boschetti et al., 2020). Support for such strategic management would likely require in-depth reviews of the existing data, methods, tools as well as practitioner experience in measuring the effects of offshore developments, integrating both ecological and social responses.

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