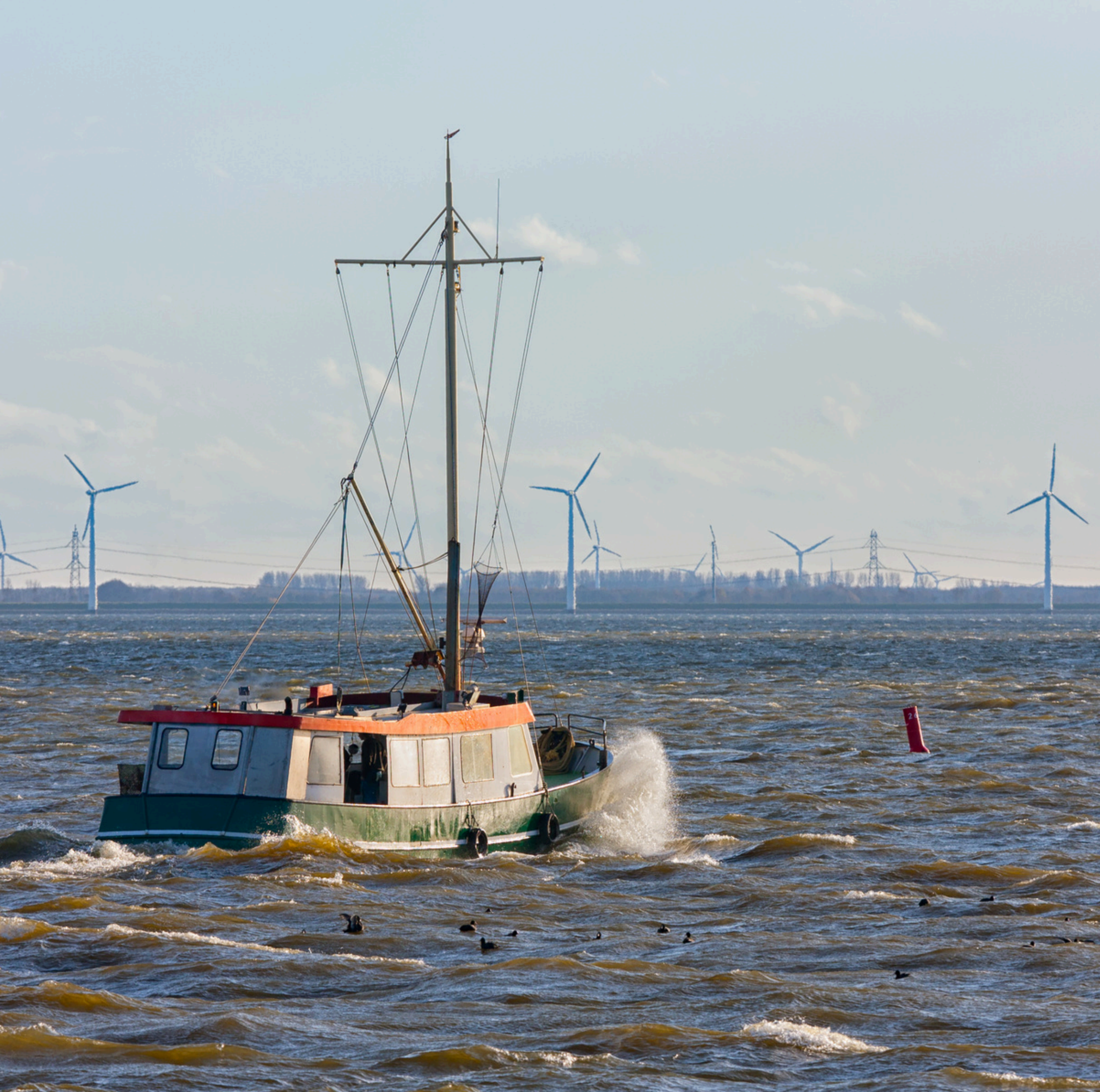
SEAWISE POLICY BRIEF ON

RECOMMENDATIONS FOR EFFECTIVE SPATIAL MANAGEMENT ACROSS EU WATERS



PURPOSE OF THIS BRIEF

Ecosystem Based Fisheries Management (EBFM) is vital to achieving sustainable fishing. **Amid growing competition for ocean space, delivering on its potential will require innovative and tailored spatial management approaches that address the combined pressures of both fishing and climate change on marine ecosystems.**

This brief consolidates SEAwise's assessment of the impact of existing and potential spatial management scenarios across our case study regions of the North Sea, Mediterranean Sea and Western Waters region. This brief specifically focuses on exploring the impact and feasibility of 'fit-for-purpose' areas, designed on the basis of protecting critical habitats and threatened species. Beyond this, by assessing potential changes to the spatial distribution of fish and fisheries under climate change and modelling the impact of essential fish habitat restoration, SEAwise has advanced knowledge to inform spatial management design that is both fit-for-purpose and fit for the future.

KEY POINTS

SEAwise evaluated the feasibility and effectiveness of various spatial management measures across our case study regions, finding that:

- Spatial management measures did not achieve their desired results without being accompanied by non-spatial management measures (such as effort restriction).
- Climate change may overwhelmingly affect marine ecosystems and therefore diminish the effect of existing and proposed area closures.
- Gear-specific measures in fit-for-purpose areas were found to limit the risk of bycatch (from gear such as gillnets) and degradation of benthic habitats (i.e. from bottom trawling activity).

KEY RECOMMENDATIONS

- **Implement a suite of complementary measures beyond spatial restrictions alone.** Our findings indicate that spatial restrictions do not offer a 'one-size-fits-all' solution and that, instead, management should rely on additional, complementary measures, including area-based, effort-based, and technical measures.
- **Area-based management tools and closures should be appropriately tailored to be species-, habitat- and gear-specific,** i.e. the fit-for-purpose areas proposed by SEAwise that are designated in accordance with evidence on the vulnerability of stocks and habitats and the impact of different gear types.
- **Climate change impacts must be accounted for within existing and future spatial management plans.** SEAwise's work highlights that managers should be prepared to enact additional measures if or when climate impacts render existing management measures unfit.
- **Prioritise restoration and maintenance of essential fish habitats.** Our modelling work suggests that essential fish habitats should be better incorporated in fisheries management, due to the potential for habitat restoration to be complementary to, and as or more beneficial than, regulating fishing pressure.
- **Pursuing more effective governance is essential to navigate trade-offs associated with area closures.** Our research affirms this is a crucial pre-condition for delivery on successful spatial management, to ensure that managers are able to obtain social license for area closures and can co-design spatial management plans that mitigate trade-offs where possible.

BACKGROUND

Spatial fisheries management encompasses the range of measures that restrict or ban fishing activities within a given geographically-defined area. Aimed at protecting and restoring marine ecosystems, these measures can be temporary or permanent. As a crucial component of EBFM, spatial management can remove or limit fishing pressure on sensitive habitats and species, allowing not only the restoration of marine habitats but also supporting sustainable and resilient fisheries.

In line with international commitments, the EU Habitats Directive and EU 2030 Biodiversity Strategy, in particular, have placed spatial management high on the agenda of fisheries managers (1) – who have been tasked with delivering on the EU's commitment to protect 30% of its waters by 2030 (with 10% strictly protected). Beyond this, the EU Marine Action Plan lays out targets to phase out bottom trawling across existing designated areas by 2030, and to instate a ban on bottom trawling across all newly designated Marine Protected Areas (MPAs) (1).

Within European waters, spatial fisheries management is not new, with examples dating back more than six centuries in the Mediterranean (e.g. 2, 3). To date, around 12% of EU waters fall under some form of protected status (4). Yet, despite this, recent research indicates that only 0.2% of EU waters are strictly protected and that of the EU's protected areas, over 80% fail to meet conservation targets, providing only 'marginal' protection against bottom trawling (5). According to the European Commission (4), substantial and accelerated efforts are vitally needed to deliver on the protection and restoration of marine ecosystems that the EU's objectives strive toward.

To achieve EU's target of expanding its MPA network, the EU Ocean Pact (4) underlines the need for siting and designation to be guided by scientific evidence, in addition to stakeholder input – to ensure that MPAs address specific ecological concerns and recognise the socio-economic costs and benefits associated. This includes assessing, on a case-by-case basis, which fishing techniques may be compatible with the conservation of target species and habitats within each MPA.

To this end, **SEAwise has modelled the impact of various existing and potential spatial management scenarios** across our case study regions of the North Sea, Mediterranean Sea and Western Waters region. **Specific focus was given to exploring the impact and feasibility of 'fit-for-purpose' areas, designed on the basis of protecting critical habitats and threatened species**. Beyond this, by exploring changes to the spatial distribution of fish and fisheries under climate change and modelling the impact of essential fish habitat restoration, SEAwise has advanced knowledge to inform spatial management design that is both fit-for-purpose and fit for the future.

This brief consolidates this work, highlighting key, policy-relevant findings as they relate to the EU's efforts to expand its MPA network with the target of protecting 30% of its waters by 2030 ("30 x 30").

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MODELLING THE EFFECT OF SPATIAL MANAGEMENT ON FISH AND FISHERIES

Spatial management efforts today encounter complex seascapes. Diverse human activities in the ocean (such as offshore renewable energy development) mean increasingly crowded sea space, and potential displacement of fishing activity. At the same time, climate change is accelerating ocean warming, causing a redistribution of some commercial stocks and favouring the establishment of invasive species that thrive in the warmed waters of some seas (6).

Designing effective management measures requires contending with this context – to ensure that spatial management measures are optimally placed to safeguard the socio-ecological benefits from fishing whilst maintaining long-term ocean productivity, conserving sensitive species, and protecting vulnerable habitats.

To evaluate this, SEAwise modelled management scenarios through two different approaches **to establish the potential effects of spatial restrictions to fishing activities** (6, 7) – allowing us to test the feasibility of several fisheries spatio-temporal closures in the real world.

The first being a 'static' approach, employing simple models to project effort displacement in the short-term, drawing on historical fish stock and effort distribution data (7). This approach allowed us to **explore the efficacy of existing spatial measures**, including but not limited to Natura 2000 sites, existing national MPAs and spatio-temporal closures (such as Fisheries Restricted Areas), and areas restricted to fishing due to other maritime uses, such as offshore windfarms.

The second being more complex, 'dynamic' bioeconomic models to incorporate for the influence of factors such as fishers' decision making and market dynamics (6, see also our Policy Brief on Social and Economic Effects). These models predict the medium to long-term effects of spatial measures – accounting for the impacts of restoring essential fish habitats and ramifications on vulnerable marine life (6, 7). This approach allowed us to **explore the impact of new spatial protections that meet environmental targets**, including 'no-take' closures to protect hotspots of marine life or essential marine habitats, instating a bottom-trawling ban in existing Natura 2000 sites, and restrictions on account of future offshore wind developments.

Across both approaches, our models allowed us to investigate the additional impact of climate change and different fishing effort scenarios (see box on next page) – ensuring that our findings were salient for management decision-making.

SEAWISE AT A GLANCE

Involving 24 universities and research organisations from across Europe funded under Horizon2020, the **SEAwise project has worked to deliver the knowledge needed to support fishers, managers, and policy makers in the practical implementation of Ecosystem Based Fisheries Management (EBFM)** across European waters.

Building on the recognition that societal and ecological objectives are interdependent under EBFM, SEAwise has assembled a new knowledge base that captures the social, economic and ecological complexity of European fisheries. Drawing on this to develop predictive models, tools, and ready-for-uptake advice, SEAwise's work enables stakeholders to evaluate the potential trade-offs of management decisions and forecast their long-term impacts.

Through this, SEAwise has laid the foundation for a whole-ecosystem approach to management in Europe – one that would equip both fisheries and management with the resilience needed to successfully navigate future challenges and change.

SEAWISE'S CLIMATE AND ALTERNATIVE MANAGEMENT SCENARIOS

MANAGEMENT SCENARIOS

- **FMSY-min:** Fishing according to a strict Maximum Sustainable Yield approach, whereby fleets must stop fishing once the first species in their target mix reaches FMSY levels.
- **PGY:** Fishing according to a more flexible MSY approach consistent with the Multiannual Plans for fisheries, whereby fishing can continue until, for example, an upper range of FMSY is reached.
- **Case-specific:** Entailing region-specific measures relating to changes in active versus passive gear allocations, and closed areas.
- **Status Quo:** A continuation of current fishing effort levels.

CLIMATE SCENARIOS

Scenarios were tested under both current conditions and future climatic projections to examine how severe (RCP8.5, equivalent to around 5 degrees of warming) and moderate (RCP4.5, equating to around 2.5 to 3 degrees of warming) scenarios, and resulting changes in fish productivity, might alter outcomes.

LESSONS FROM SEAWISE FOR "30X30"

Across our case study regions, SEAwise's research suggests that fit-for-purpose area closures could complement the EU's existing MPA network, positively impacting, over time, the overall fisheries economy and fish populations (6). Tailored, fit-for-purpose closures that reduce bycatch, protect vulnerable habitats, and improve gear selectivity offer the greatest long-term benefits for both biodiversity and fisheries. Whilst these measures often entail short-term economic trade-offs, i.e. on account of effort displacement and associated higher operating costs, these are expected to be offset over time when stock and ecosystem recovery are accounted for (6, 8).

The following sections detail our key findings by region, highlighting significant contributions from our work to the EU's "30 x 30" ambitions and other fisheries policy objectives.

NORTH SEA

In the North Sea, our work highlights that efforts to phase out bottom trawling in the region's Natura 2000 sites may not deliver the benefits expected (6, 8). Modelling demonstrated that these measures would have an inadequate effect on enhancing stocks and restoring habitats, due to the level of fishing effort with gears coming in direct contact with the seabed in these areas being limited (6, 8). Moreover, **these measures were found to amplify impacts on benthic habitats outside closed areas – evidencing that rather than effort being reduced, it is instead displaced.**

Other models, including those that account for existing and future spatial and gear closures, MPAs and offshore wind developments, were less conclusive (6, 8). Despite this, they highlight **the importance of the placement and size of area closures, indicating the increased efficiency of larger, coherent protection zones.**

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Our modelling in the North Sea also evidences the effect of closures on displacing fishing effort to 'unprotected' areas. Across models this was shown to have dire ecological consequences on stocks and habitats if total fishing effort was not reduced, due to a concentration of effort on a smaller area (6, 8). This was also shown to have significant socio-economic impact, with effort displacement on account of closures increasing fuel costs due to longer steaming time and reducing profits (6, 8). These findings highlight **the need to complement any spatial restrictions with broader management measures, such as effort restrictions, catch quotas, or technical measures.**

MEDITERRANEAN SEA

Our modelling in the Mediterranean indicated that instating essential fish habitats (such as hake nursery grounds, see also box opposite) as 'no-take' zones for bottom trawling delivered positive results for commercial stocks, on account of reducing juvenile catch (6, 8). However, we found that these benefits were only noticeable when accompanied by effort reduction (i.e. reducing effort by at least 15%) (6, 8).

Given the scale of the Mediterranean small-scale fleet and limited data on its fishing footprint, our modelling is inconclusive in determining whether a phase out of bottom trawling by 2030 across existing MPAs would fully achieve its goal of reducing pressure on benthic habitats (6, 8). However, results indicate that such a ban in the Mediterranean would increase the biomass of endangered, threatened and protected species, suggesting clear benefits for sensitive benthic habitats and key predators (such as sharks) (6, 8).

Nonetheless, our projections highlight that with the long-term effects of climate change, the positive gains from closures may be countered (6, 8). As such, **managers must take into account how change may materialise into the future, integrating within spatial management plans additional measures that may be required to restore marine habitats and protect vulnerable species under climate change** (see box on next page)**.**

MAINTAINING ESSENTIAL FISH HABITATS

Habitat loss and degradation of the quality of coastal ecosystems impacts the productivity and renewal of marine species exploited by fisheries. With this in mind, SEAwise has explored the relationship between commercial fish stocks and the habitats that they depend on, identifying how simulated restoration of important fish habitats, such as nurseries, would impact stocks (9, 10).

Our findings indicate that restoration of coastal habitats would result in sizable gains for some species, with knock-on implications for fisheries and wider ecosystem health, suggesting that in the future, fish habitat should be considered in greater depth within fisheries management decision-making.

If substantial recovery of essential fish habitats could be achieved, this restoration will likely be complementary to, if not as or more beneficial than, regulating fishing pressure (9, 10).

WESTERN WATERS REGION

Across the Western Waters, our simulated 'no-take' zones, based on areas of high abundance of threatened species, evidenced positive results for these species (6, 8). In particular, our findings highlight that restricting longline fisheries from areas of medium to high abundance of Balearic shearwaters over the summer-autumn period would be an easy measure to implement – with the impact on active and passive gear fleets' profitability being negligible (6, 8).

Nonetheless, we found closing dolphin hotspots to have a significant negative impact on the profits of the large-scale fleet (including demersal trawlers and gill netters) (6, 8) – resulting in high resistance from the fishing industry, as has already been seen. As the success of any management measure is based on its acceptance, compliance with instated restrictions rests on changing fishers' mindset

FISH AND FISHERIES DISTRIBUTION UNDER CLIMATE CHANGE

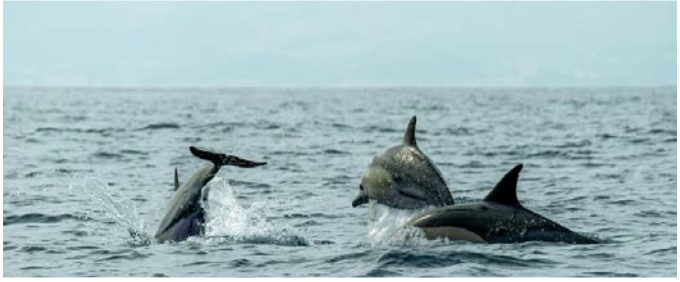
To explore the spatial impacts on fisheries from climate change, SEAwise modelled the distribution of fish stocks and fishing effort.

Trends in species distribution appear to be species-specific. Likely driven by species' tolerance and preference regarding warming waters, we found some species have shifted northward whilst others have either shifted in a more southerly direction or not changed in distribution (11). Our projections also suggest climate change will minimally affect fishing effort distribution across the Mediterranean and northeast Atlantic - though these findings are likely skewed by our focus on demersal species, which exhibit smaller distributional changes under climate change (12).

Future changes in fisheries management targets, access regulations, international agreements, fish and fuel prices, technological developments, and marine spatial planning, however, will play an equally or more important role in shaping future fisheries as climate change over the next few decades (12).

and/or adequate monitoring, control and surveillance**. Further improvements to deliver more effective governance are, therefore, essential to obtain stakeholder buy-in and to enable co-design of spatial management plans that mitigate negative socio-economic impacts where possible** (see also our policy brief on Effective Fisheries Governance).

The results of our static modelling highlighted that effort relocation due to MPAs reduced local bycatch risk and benthic impacts. However, we found that the extent of this was regionally variable, and dependent on the size of closed areas. For example, in the Bay of Biscay sub-region, bycatch risk to common dolphin was substantially reduced through the instatement of MPAs, particularly those over larger spatial scales (6, 8). Nonetheless, again our modelling highlighted that effort-based measures contributed more to the health of benthic habitats than spatial management (6, 8).



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CONCLUSIONS

Overall, SEAwise's work contributes essential knowledge to guide the EU's implementation and enforcement of its spatial management objectives and legislation for fisheries.

For the EU to achieve its goal of delivering 30 x 30 and phase out bottom trawling from Natura 2000 sites by 2030, we conclude that fit-for-purpose areas need to be explicitly designed to achieve the desired results for fish stocks, bycatch risk, and sensitive benthic habitats. These areas should involve t**ailored restrictions on specific fleets and gears based on scientific evidence**, i.e. on fleets posing a high risk to certain species or habitats.

More broadly, we conclude that for protection and restoration of marine ecosystems to be most effective, **spatial management must be combined with non-spatial management measures** (including effort restriction, quota, and technical measures). **More effective, inclusive governance processes must also be pursued across EU fisheries,** to limit resistance to new measures and successfully navigate any trade-offs associated.

Given the potential for climate change to render the positive effects of area closures void, **further work is needed to explore additional scenarios for reactive or 'real-time closures'**. This is essential so as to equip managers with the alternative tools that may be needed to effectively manage marine ecosystems under the uncertainties of climate change.

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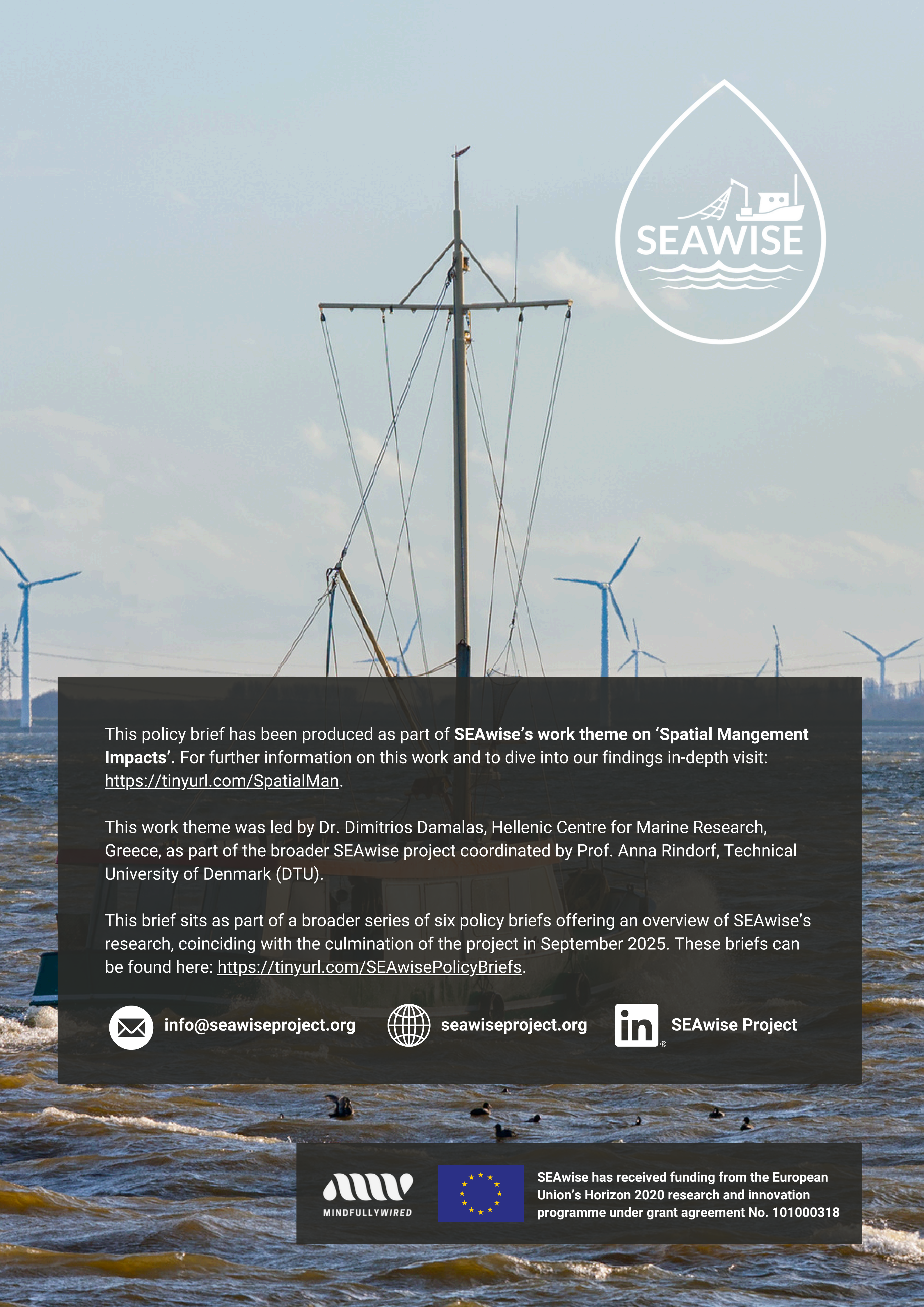

This policy brief has been produced as part of **SEAwise's work theme on 'Spatial Mangement Impacts'.** For further information on this work and to dive into our findings in-depth visit: https://tinyurl.com/SpatialMan.

This work theme was led by Dr. Dimitrios Damalas, Hellenic Centre for Marine Research, Greece, as part of the broader SEAwise project coordinated by Prof. Anna Rindorf, Technical University of Denmark (DTU).

This brief sits as part of a broader series of six policy briefs offering an overview of SEAwise's research, coinciding with the culmination of the project in September 2025. These briefs can be found here: https://tinyurl.com/SEAwisePolicyBriefs.

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MINDFULLYWIRED

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