

Ms Charlina Vitcheva
Director-General for Maritime Affairs and Fisheries
European Commission
Rue Josef II 99
1000 Brussels
Belgium

Cc: North Sea Member States

NSAC Advice Ref. 13-2425

NSAC Advice on the Mapping of Important Fishing Grounds

This paper was approved with consensus by the NSAC Executive Committee on 19 May 2025 via written procedure.

1 Background

European seas have seen rapid growth in human activities in recent years, with fishing, aquaculture, shipping, renewable energy, nature conservation, and other uses continuously competing for space. Marine Spatial Planning (MSP) has been progressing in Europe for over 20 years¹, with the EU MSP Directive (Directive 2014/89/EU²) coming into force in 2014, establishing MSP as a vital management tool for efficiently allocating marine areas in a safe and sustainable manner. However, MSP currently falls short of fairly and legitimately incorporating all stakeholders and data with sufficient precision to avoid over-generalisation.

The North Sea ranks among the world's most crowded marine areas³. In May 2023, the NSAC held a workshop on MSP and stakeholder engagement in light of identified spatial squeeze in particular for fisheries. The workshop aimed to assess the current state of MSP in the North Sea and explore ways for NSAC to represent legitimate stakeholders in this process.

On this occasion, concerns were raised about the challenges in claiming traditional fishing grounds amid the influx of new players in the sea basin. To address these concerns, NSAC members established a Mapping Focus Group (FG) to identify best practices among North Sea Member States on data collection and handling, technical issues, stakeholder engagement, and advocacy for traditional fishing grounds. The FG's focus spans both large- and small-scale fisheries.

The aim of the FG was to ensure fisheries are represented and prioritized in MSP. This includes addressing potential concerns about fishing displacement due to Marine Protected Areas (MPAs) and Offshore Renewable Energy (ORE) developments. This goal aligns with recent findings of EMFAF-funded project [MSP GREEN](#)'s section on Sustainable Seafood

¹ <https://www.sciencedirect.com/science/article/pii/S0308597X24004251#bib50>

² <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0089>

³ <https://link.springer.com/article/10.1186/2212-9790-12-13>



NSAC is supported by The European Commission

Production Insights, calling for a shift from exclusion-based planning for fisheries to proactive inclusion of all segments⁴.

In this advice, we shed light on the current challenges in mapping key fishing grounds, identify solutions, and propose recommendations based on input from presentations held at the Focus Group, discussions with members, as well as the relevant literature review. Due to the length and level of detail in this paper, we provide the summarised list of recommendations immediately after the Background section, followed by chapters on identified issues and detailed solutions.

Information was gathered from the following projects presented across a number of FG meetings:

1. **The Fisheries Sensitivity Mapping and Displacement Modelling** project ([FiSMaDiM](#)), part of the Offshore Wind Evidence and Change Programme (OWEC), aims to provide evidence on fisheries activity and the impact potential that offshore windfarms development will have on the activity of the sector.
2. **Seafloor Footprint of Fishing** by [DTU Aqua](#). The interactive mapping tool shows the distribution and intensity of the fishing activity by Danish fishing vessels that use various bottom-towed fishing gears with a 1000 times higher spatial resolution than the standard fisheries distribution maps.
3. **Zone d'Importance pour la Pêche** ([ZIP Project](#)): addresses the challenge of identifying important fishing grounds for marine spatial planning, highlighting that areas important to fisheries should not be limited to bio-economic metrics but should also consider cultural, historical, emotional, and other dimensions.
4. **VISTools**: a data platform designed for fishing vessels, facilitating real-time data exchange between vessels and scientific institutes with focus on real-time updates to improve fleet sustainability and help fishers analyse their vessels' economic performance.
5. **European MSP platform**: an information and communication gateway designed to offer support to all EU Member States in their efforts to implement MSP.
6. **Greater North Sea Basin Initiative** ([GNSBI](#)): established in 2023 between the nine North Sea countries (Belgium, Denmark, France, Germany, Ireland, the Netherlands, Norway, Sweden and the United Kingdom) for continued cross-sectoral and cross-border collaboration to effectively address ecosystem challenges and balance sustainable human activities in the Greater North Sea Basin.
7. **CRANIMPACT project**: investigates the impact of brown shrimp fishery on benthic habitats in the Wadden sea by analysing recent and historical composition of benthic communities along gradients of fishing intensity, and recovery of benthic communities and habitat structures after experimental fishing.
8. **Predicting important fishing grounds for the small-scale fishery (SSF)** ([AZTI project](#)): describes a novel approach to identify important fishing grounds for SSF, by implementing a habitat modelling approach, using environmental predictors and Automatic Identification System (AIS)-B data coupled with logbook and First Sales Notes data, within the SE Bay of Biscay.
9. **ICES Working Group on Spatial Fisheries Data** ([WGSFD](#)): collates and analyses spatial fisheries data in order to evaluate fishing effort, intensity, and frequency in European waters.

⁴ https://mspgreen.eu/wp-content/uploads/2024/10/Reccomendations_green-2rev.pdf

10. **Global Fishing Watch** ([Global Fishing Watch Map](#)): an open-access online platform for visualization and analysis of vessel-based human activity at sea such as apparent fishing effort, encounters between vessels, night light vessel detection and vessel presence. To estimate the apparent fishing effort, GFW collects AIS data and apply a fishing detection algorithm. However, we urge⁵ users to cross-verify the algorithm output with other data sources such as production data due to the current overestimation of the fishing effort by the algorithm.
11. Exchanges with the [Scottish White Fish Producer Organisation](#) regarding spatial data use for mapping.
12. **Geofish** ([geofish.be](#)): The essence of the Geofish tool is interactive visualization: the user selects the data he or she wants to know and the tool projects them on geographical maps. This facilitates the interpretation of the data and shows variations between areas and between years or seasons. The tool is accessible to everyone with the exception of certain data for which approval by the sector is needed, but currently only integrates the data of the Belgian fleet. It is hosted and moderated by [ILVO](#).
13. **European Marine Observation and Data Network** ([EMODnet](#) and [EMODnet Map Viewer](#)): EMODnet is a federated Spatial Data Infrastructure (SDI), a network of geo-data servers spread across Europe, each of which is maintained by the respective EMODnet thematic, e.g., Bathymetry, Biology, Geology etc. Each of the geo data servers publish their respective EMODnet products using the Open Geospatial Consortium (OGC) standards for geodata webservice.
14. **AC FishMap**: This interactive map lets users explore the regulations, designations, and infrastructure of Europe's North Western Waters. Commissioned by the North Western Waters Advisory Council (NWWAC), the tool provides information useful to the fishing industry and other marine stakeholders. This includes regulatory measures, areas for conservation and other marine uses such as offshore wind and cables. The map currently only covers the EU Northwestern Waters with possibility to expand to other sea basins.

2 Advice: recommendations and stakeholder considerations

Below, we provide a series of recommendations derived from reflections and discussions within the NSAC Mapping Focus Group on existing mapping projects and initiatives as well as additional considerations related to mapping of fishing grounds.

Active engagement and collaborative stakeholder involvement

- Fishers should be proactive contributors rather than reactive participants in MSP processes. Their involvement should begin at the projects' outset and continue through all stages. Preliminary results should be shared with the fishing industry prior to broader dissemination, allowing for feedback to refine final outputs and enhance their relevance.
- Supporting bottom-up initiatives from the fishing industry enables genuine science-industry partnerships, addressing issues directly relevant to stakeholders. Tools like [DTU Aqua's mapping tool](#) developed at DFPO's request exemplify how industry-driven

⁵ Hintzen et al. 2025. Bias in Global Fishing Watch AIS data analyses results in overestimate of Northeast Atlantic pelagic fishing impact. Accessible at: <https://academic.oup.com/icesjms/article/82/3/fsaf033/8090016>

solutions can foster trust and facilitate discussions on fisheries-related topics. Similarly, initiatives like ILVO's VISTools highlight best practices in collaboration, starting from a fisher's inquiry and evolving into a broader partnership between industry, science, NGOs, and government.

- Projects and initiatives, such as Norsaic and GNSBI, should utilize established stakeholder groups like those under the Advisory Councils for broader and more effective engagement. Advisory Councils may serve as a trusted platform for knowledge exchange and dissemination of information.
- Fishers and other stakeholders are possessors of unique knowledge. Their timely and proactive engagement in procedures, such as consultation in MPA designation, is crucial to incorporate valuable (industry) knowledge and build trust.

Standardized, integrated, and inclusive methodology

- Harmonization across datasets and standardization of methodologies is crucial to achieve accurate mapping of fishing grounds. To this end, the work performed by the EU Technical Expert Group on Data for MSP should be reinforced.
- Accurate classification of fishing activity remains challenging, particularly near ports where vessels slow down, leading to frequent misclassifications. Speed-based models combined with onboard observer data can enhance classification accuracy, as applied in OWEC's project on mapping. Combining AIS, VMS, and logbook data offers a more comprehensive depiction of fishing activity by enabling cross-verification. Still, additional data on factors such as fishing traditions, and fishing identity should be included. Particularly, social and cultural factors must be integrated to better define fishing patterns and their community benefits.
- Vessel size limitations for AIS at EU level, currently mandatory only for vessels over 15 meters, hinder accurate representation of small-scale fleets. Tools like Sentinel-2 and Planet Imagery data detect vessels as small as 10 meters, but direct input from fishers remains essential to complete the picture, as undertaken in the French ZIP project.
- Decreasing VMS costs should be leveraged to increase transmission intervals and improve the tracking of small-scale fleets. However, increasing transmission frequency must be done intelligently, i.e., in geofencing.
- To reflect dynamic fishing activity, historic data, which alone fail to provide an accurate representation of current fishing areas, should be complemented with real-time (or near-real-time) data to accurately reflect current fishing trends and dynamic activity. Spatial planners should also keep in mind that fishing grounds evolve over time.

Fostering political will and transparent data sharing

- Data sharing must occur with fishers' consent, for the purposes approved, and with the level of detail previously agreed upon. Scientists should work with fishers to process the raw data into useful information for managers. Access should be strictly controlled as any breach of trust could compromise the system.
- It is crucial to ensure fishers' anonymity to prevent any misuse of tracking devices for control purposes. There must be a clear distinction between the benefits of data sharing and the perception of constant surveillance.

- Positive incentives should be introduced for data sharing. Linking data provision to benefits such as sustainability certifications can encourage participation. For mandatory measures such as those in the revised Control Regulation, it is essential to clearly communicate and stick to the rationale for data collection to foster understanding and compliance. An environment conducive to sharing real-time data on vessel positions, trip yield summaries, catch composition, catch predictions, and fuel efficiency needs to be fostered to support effective vessel-based management. Benefits for fishers shall be explicitly communicated, for example noting that based on the data collected, they, as the primary beneficiary, will be empowered to make informed decisions on improved operations (for example, by improving fleet sustainability and enhancing economic and environmental performance). However, technical challenges should be acknowledged and addressed as well.
- Governments and ministers need to establish a clear legal mandate to share data across borders to enable efficient MSP. Such a mandate could leverage existing infrastructure and expertise within EU Member States and non-EU countries such as the United Kingdom, facilitating effective collaboration and data sharing across borders.
- A Memorandum of Understanding (MoU) should be developed to clarify objectives and procedures for data sharing between Member States, with recognition of the shared nature of sea basins and resources, and the commercial sensitivity of data. This process needs to follow a rigorous and commonly agreed procedural framework. Ideally, this procedure should also apply to the United Kingdom, whose waters are highly frequented by EU vessels.
- A centralized data center with clear data-sharing agreements is essential to protect confidentiality and commercial sensitivity. Data can be converted into indicators or indexes to avoid disclosing sensitive details while still being useful. High-resolution information on location of other activities, such as shapefiles for OWFs and MPAs, should also be made available.
- NGOs have an important role in advancing innovative and sustainable fishing techniques. However, the need to maintain trust when sharing data on sensitive subjects such as mapping of fishing grounds must be recognized. Ethical use of data is paramount. For instance, revealing precise fishing spots, particularly for small-scale fishers who have invested years in finding these areas, might jeopardize their livelihoods. Additionally, differing agendas should not hinder data-sharing efforts, as the ultimate goal is transparent fisheries management, which can only be achieved through trust and collaboration.

Ensuring sustainable mapping of fishing grounds through funding and centralized information

- The securement of funding for the continuation and long-term management of mapping tools is a necessity. Developed maps and other tools should be maintained as a service rather than solely as a research output by ensuring they are regularly updated with new and current data.
- Centralized funding for mapping of fishing grounds could be established to ensure consistent support and resource allocation.

- Before initiating new projects, project leaders should conduct a basin-level assessment of past, ongoing and upcoming initiatives, alongside a data gap analyses, to avoid redundancy and ensure efficient use of resources.
- Support platforms, such as the EU MSP Platform, that allow for the integration information on maritime spatial planning from different Member States and maintain a comprehensive catalogue of mapping projects are crucial considering the need for greater coherence between MSP plans across MS within the same sea basin to ensure harmonized and effective management. Additionally, they help avoid duplication of efforts and promote the sharing of existing knowledge. Commission and Member States should keep exploring potential options for a one-stop-shop avenues.
- Platforms representing activities at sea should be user-friendly and accessible to both experts and the general public, but access should be subject to different levels of authorisations. For fishers, spatial files should be easily exported to maritime GPS formats, in collaboration with the main providers (Furuno, etc.).

Guaranteeing fair, responsible and comprehensive representation of fishing data in maps

- Fishing grounds mapping projects need to strike a balance between displaying fishing data informing MSP with the need to respect commercial sensitivity and safeguard confidentiality. It is essential to ensure the confidentiality of represented data to protect fishers' interests and prevent potential misinterpretation or misuse of maps when data is read in isolation. Tools like VISTools demonstrate how this balance can be achieved.
- Particular care should be placed in protecting the sensitive fishing spots of small-scale fishers, whose livelihoods often rely on years of investment in specific locations.
- Defining important fishing areas cannot rely solely on data, regardless of its accuracy; it requires the co-expertise of fishers or their representatives.
- Fisheries should not be valued solely for their economic contributions. Equal emphasis must be placed on their social dimensions, including cultural and historical significance, regulatory frameworks, working conditions, and their contribution to Europe's food sovereignty. Additionally, the environmental role of fisheries, beyond their impact on marine ecosystem services, deserves greater attention. Fishers are the sentinels of the sea, observing the ecosystems and being instrumental in relaying first signs of change. Fostering co-expertise between researchers and fishers and integrating the three pillars – economic, social, and environmental – into mapping efforts will provide a more comprehensive representation of the importance of fisheries and ensure they are accurately reflected on marine spatial planning maps.
- Produced data and maps representing fishing grounds should always be accompanied by clear explanations to reduce the risk of misinterpretation. To this end, users of maps need to be trained to correctly interpret and use data. Tutorials help prevent misuse and misinterpretation. Managers using these maps are particularly responsible for cross-verification of map data when they use them as evidence for management decisions. All users of GFW or any other publicly available platform should cross-check those maps with local regulations on activity management, so as not to misjudge fishing activity in a particular area.
- A visible user disclaimer (pop-up window) should be placed on GFW website, notifying the user that the output of apparent fishing effort based solely on geolocalisation data should be supplemented by other types of data.

- When representing MPAs areas, GFW or other map provider should indicate their conservation objectives and specific regulations applying to the area to not misread any activities that could take place there.

Integration of environmental variables in mapping to better define management priorities

- Advanced modelling techniques should be developed to effectively capture interactions between fisheries and environmental features, offering strong predictive capabilities of shifting conditions, including under climate change scenarios. Spatially explicit data from such models can support MSP and simulate changing conditions under climate change scenarios.
- Datasets should be refined and made more nuanced to differentiate between areas of light marine ground impact and those with significant sediment disturbance and greater effects on marine life. One approach is adopting the ICES advice methodology with the PD model, though model-specific limitations need to be considered.
- Management should be based on nuanced research on the impact of bottom-gear on benthic fauna, flora, and the seafloor in both hydrodynamic and less dynamic areas, accounting for natural variability. Findings should inform risk-based management approaches.
- Calculating fishing footprints can be achieved by identifying the maximum fishing intensity within grid cells over several years while paying special attention to the grid cell resolution, which can change the outputs tremendously. Such combined maps can help estimate the percentage of the seabed impacted by fishing activity, and that impact's relative intensity. However, habitat data and gear-specific considerations are also crucial; for example, flyshoot fishing, with its extensive spatial footprint but lower seafloor impact, demonstrates the need for nuanced mapping approaches.
- Management strategies should clearly define preservation goals, considering the timescale of potential effects and incorporating stakeholder priorities.

Addressing fisheries displacement: analysis, mitigation and compensation

- Classifying fishing grounds is complex due to varying significance across fleets. Focus should be given to understanding which fleets are most affected and prioritize displacement analysis for these sensitive groups.
- Displacement studies should be conducted to evaluate how new maritime developments, such as Offshore Renewable Energy (ORE), impact existing activities and assess the consequences of relocating activities, such as increased risk of conflict. Positional tracking data, fisheries databases, and government records may be used to identify vulnerable areas and quantify effects. Projects like OWEC are paving the way in this area.
- The side-lining of fisheries under the justification of "overriding public interest" in offshore wind farm development often allows developers to prevail in legal disputes. However, the question remains: if fishers lose access to their grounds, where can they go? We need to do more to ensure that European fisheries are allocated their space in the sea, not least in light of renewed EU concerns about food sovereignty.

- When all else fails, evidence-based data on the scale of fisheries displacement should be provided to help states design effective compensation schemes for fishers.

3 Identified challenges with the mapping of important fishing grounds

3.1 General

The core challenge currently lies in the difficulty for fisheries to ensure adequate representation on MSP maps, where presence on the map equates existence. Certain activities and stakeholders are more prominent and easier to map, creating a dynamic in which dominant actors shape the process, leaving fisheries marginalized. Economic metrics, such as sales value, economic dependence, and added value offer a limited view of fisheries' importance. The broader social and cultural significance of fishing grounds often reduced to employment statistics, is underexplored and rarely integrated. Nutritional value of sustainable seafood is also not emphasized enough.

The fisheries struggle to achieve comprehensive representation on MSP maps is amplified by the dynamic nature of fish stocks and the sensitivity of disclosing fishing activity. For instance, revealing precise fishing spots, particularly for small-scale fishers who have invested years in finding these spots, might jeopardize their livelihoods. However, without accurate information on fishing grounds, managers cannot effectively account for competing uses. This emphasizes the critical need for detailed fishing maps to understand potential displacement effects, particularly when planning for Offshore Wind Farms (OWFs) or MPAs. There is a balance to be struck between provision of data and protection of commercial sensitivity.

The involvement of the fishing industry in the MSP discussions usually happens at the stakeholder consultation phase after site boundaries have already been defined. During the process, fishers bear the burden of proof to demonstrate the level of dependence of fishing operations in certain designated spatial areas, with nuanced and precise maps required as evidence. Additionally, consultation procedures may be extensive and protracted, with delays both influencing and being influenced by shifting priorities. This can cause stakeholders to lose focus on the original objectives and the underlying rationale for the designation of the area

Management approaches further add to these challenges by focusing on fleet-level policies rather than individual vessel's or producer organisations' efforts to improve sustainability. The top-down management restricts opportunities for inclusive science-industry partnerships, limiting stakeholder input.

In general, stakeholder engagement in mapping projects faces challenges. Insufficient, delayed, or absent engagement is widespread, with some projects failing to involve fishers or fisheries representatives until after the projects are finalized.

Moreover, the funding of national and international projects on fishing-ground mapping is often fragmented and insufficient, jeopardizing resource (both human and material) availability and project legacy. Lack of funding also limits outreach, restricting the dissemination of project

findings and ultimately preventing broader engagement among national and international stakeholders.

3.2 Data

3.2.1 Data collection

Mapping projects can have very different purpose and goals (i.e., assessing the impact of fishing activity on habitats, showing the importance of fishing in different areas etc.) which directs the type of data being used (i.e., geolocation, production, environmental data). The MSP and mapping data are generally difficult to locate and retrieve, partly due to limited awareness of the different data, and their restricted nature due to privacy and sensitivity issues. This lack of visibility and global overview of data sources makes accurate and comprehensive data difficult to obtain.

In data collection and standardization, consistency and harmonization of datasets is lacking, both nationally and internationally. Positive incentives for data provision are lacking, along with a clear understanding of the benefits of improved reporting but also safeguards for unauthorised use and disincentives for misuse. High-quality data is needed to accurately characterize fishing activities within mapping projects, which requires better data collection methods, including improved logbooks and catch-recording systems. Historical fishing activity data (often 10 or 20 years old) are frequently used and integrated into current mapping projects, allowing for an overview of the evolution and changes of the fishing activity throughout a time period. However, for inclusion in a mapping project, up to date data or recent tracking data (from the year before) is challenging considering the time, financial and human resources needed for the collection, validation, treatment, analysis and integration of the data in the mapping tool. Hence, the current available online mapping tools, if not regularly updated, fail to represent accurately recent changes in fishing activities.

3.2.2 Data sharing

International communication and collaboration between mapping projects are minimal, with limited sharing of data and methods, though some efforts in breaking the silos exist. This is further complicated due to technical constraints and because sensitive data is used, such as Vessel Monitoring System (VMS). VMS is generally only available and accessible for national fleets for national analyses. To avoid conflict, data sharing requires well-established confidentiality agreements and Member States having a legal mandate for data sharing across the EU, as well as with third countries such as the UK and Norway. Furthermore, the reformed Control Regulation is currently hindering progress.

In ICES, currently the only body with comprehensive access to detailed fisheries data from several parties, the process for obtaining VMS data from multiple countries for spatial fisheries analysis faces a key constraint related to the specific wording of their data call, which frames the agreement through which data submitters agree to provide their data to ICES. The data call specifies that *"ICES will use submitted VMS/Logbook data to develop ICES advice addressing requests to describe fisheries activities and to evaluate the spatial and temporal effects of fishing, for example to describe fisheries activities in, and around, sensitive habitats"*

(i.e., *Vulnerable Marine Ecosystems, VMEs*) and to map the aggregated distribution of fishing by different gear types." This framework enables ICES to collect detailed VMS and logbook data but restricts data sharing with external parties to the purposes explicitly defined in the data call. Consequently, broader uses, such as developing MSP are currently not permitted. All submitted data are securely stored in a protected database and processed into data products before being used or published.

Additionally, knowledge sharing between industry and mapping project coordinators is limited by difficulties in replicating and adapting project methodologies and by trade-offs between sharing and protecting sensitive information, critical to prevent potential misuse by authorities or competitors. Data protection is critical to safeguarding commercially sensitive data, limiting potential misuse by external stakeholders, and preventing increased competition among fishers. However, it conditions the map outputs, often using wide scales, and consequently reducing information detail. The fishing industry is also particularly cautious about sharing data due to longstanding distrust, especially towards environmental NGOs, which are perceived as likely to misrepresent the industry's activities. While open discussions can help build trust, they also risk involving stakeholders with conflicting agendas, further discouraging fishers from sharing data.

3.3 Methodology

Several methodological challenges have been identified in mapping fishing activity. As indicated previously, multiple type of data can be used to map and characterize fishing activities. AIS (Automatic Identification System) is one of the main geolocalized data used across mapping projects, maybe due to its relatively easy access. However, when used on its own, it can lead to great mis-estimation of the fishing activity (i.e., length of fishing activity over estimated, gear mis-identification, etc.). Furthermore, in EU, AIS is mandatory only for vessels over 15 meters. For smaller vessels it is either voluntary or an obligation depending on national regulation, resulting in data gaps for vessels under 15 meters. Challenges in AIS accuracy could be related to the fact that AIS data were initially intended for nautical security and not for Marine Spatial Planning (MSP). However, given the rise of offshore wind energy and other developments, this data is increasingly used across mapping projects and initiatives.

The inclusion of factors, such as gear type, target species, vessel speed, bathymetry, habitat types, environmental characteristics (biotic and abiotic), and social aspects (i.e., fishing traditions), is essential for accurate mapping. Lack of speed profiles in VMS/AIS data and data generalisation can lead to misrepresentation of actual fishing activity, while omitting habitat and broader environmental qualities, such as biotic and abiotic baselines, results in inaccurate representations and interpretation of fishing footprints, particularly regarding gear impacts on specific seabed types. Representing fishing footprints for various fleets in specific environments is complex and requires careful consideration. For example, a DTU Aqua-led study on the [Seafloor Footprint of Fishing](#) highlighted difficulties in defining footprints for flyshooters creating large loops with their nets. While these vessels have a significant footprint, their seafloor impact is minimal due to the gear only slightly touching the seabed. Additionally, VMS data lacks the precision needed for accurately capturing such nuances. Addressing environmental data gaps requires large-scale data on interannual and seasonal variability, which remains limited at present. Additionally, combining data across multiple years

complicates calculations and representation, making it difficult to provide a consistent depiction of fishing activity.

3.4 Presentation and Interpretation

Significant challenges exist in the presentation and interpretation of mapping data. Producing maps alone is insufficient for accurately depicting fishing activity, as maps without accompanying explanations are prone to misinterpretation. Effective mapping must go beyond quantifying fishing distribution and impact, providing clear context to prevent misunderstandings and incorrect representation. Classifying special fishing grounds is also particularly complex, as different areas hold varying importance for different vessels, often resulting in overly dense maps that are difficult for managers to interpret effectively.

User-friendly interfaces for accessing and visualizing maps are limited. Many maps are inaccessible to the public and restricted to users within the fishing sector. This is not negative per se, as authorised use allows to safeguard particular interests. We believe that authorisation of use should be conditional upon clearly specified intended use.

There is a notable absence of unified MSP platforms that display various marine uses and allow for tracking of their development over time. For instance, maps depicting fishing activity often fail to include data on the expansion of ORE or the designation of Marine Protected Areas (MPAs). This issue is particularly pronounced across different Member States, even within the same sea basin.

The lack of precise and comprehensive mapping of fishing grounds exposes fisheries to a heightened risk of displacement. In general, there is little understanding regarding the risks and sensitivities of fishing fleets to displacement caused by competing activities. Marine areas highly profitable for fisheries are increasingly being repurposed for other lucrative uses, such as offshore wind farms, often justified by the legal argument of "overriding public interest". This frequently allows wind farm developers to win court cases, sidelining fisheries.

Currently, numerous projects and initiatives focus on mapping fishing grounds. While these projects may address different regions, some overlap in their goals and potential outcomes. However, a lack of coordination among these initiatives often results in them operating in parallel rather than jointly. This issue is compounded by challenges in data sharing and leads to an inefficient use of resources and missed opportunities for synergies.

4 Identified solutions

4.1 General aspects

The projects presented during the focus group meetings all came with a suite of solutions, which will be displayed below. Some have features that are specific to the project and/or country of origin. We tried to adapt or generalise those to better suit the North Sea fisheries context. The identified solutions in this section are not necessarily supported by NSAC stakeholders in their original form or at all. In light of this, the agreed list of viable solutions and important caveats as identified by our stakeholders under the 'Advice' section at the beginning of this paper.

4.1.1 Addressing the rationale for mapping out important fishing grounds

In a display of proactive attitude and engagement in MSP processes to legitimately defend their rights, fisheries are engaged in various projects aimed at mapping of valuable fishing grounds. In general, we believe that fishers should be empowered to act as active stakeholders and engage in research projects, contributing to diversification of perspectives on fisheries' importance in recognition that no single metric can fully capture the significance of the sector. A more nuanced understanding of reality on the ground can be achieved through promoting co-expertise between researchers and fishers in designing an interactive mapping tool and a shared knowledge base with information on fisheries distribution and activity accessible to them and the interested public.

Such maps could not only help make the case in defense of traditional fishing grounds vis-à-vis other competing activities, but could also help fishers demonstrate that their activities can be conducted without harm to habitats, aid with the transition to vessel-based management and improved efficiency through real-time data on trip yields, catch composition, catch predictions, and fuel efficiency, and help with displacement analysis, providing the necessary evidence to national administrations developing compensation schemes (see VISTools).

4.1.2 Quantifying vs. interpreting fishing activity

One of the challenges in the representation of fishing activity in maps is that they quantify it rather than interpret it, failing to differentiate between fishing activity, pressure, and impact. A solution for relaying a message consistent with reality would be allowing additional features on the map, providing clarifications and improving viewers' understanding and interpretation of the map's features. This is particularly important when maps are used to develop arguments for policy-making.

When analysing fisheries, their environmental and economic dimensions are often more explored and considered compared to the social one, usually limited to employment, or to the nutritional one, always put aside. This narrow focus does not allow to take into account the cultural significance and heritage, regulatory frameworks, as well as safety and working conditions that characterize fisheries. In terms of environmental considerations, those are normally focused on the provision of ecosystem services, but fail to account for the value of ecosystems specifically for fisheries. As well, there is much more to fisheries than their monetary value. It is, therefore, essential to adopt a broader perspective that represent fisheries comprehensively, incorporating their cultural, social, nutritional, economic and environmental dimensions fully.

4.1.3 Stakeholders, science-Industry partnerships and the role of NGOs

To ensure ownership and successful implementation, bottom-up approaches and early and regular exchanges with stakeholders, including NGOs, are paramount. Science-industry partnerships benefit from frequent follow ups, ground truth-testing, pre-reviewing and validating of results and other engagement gathering feedback, fostering trust and mutual understanding. Incorporated stakeholder perspectives and iterative processes enhance final results and ensure longevity of the project.

Trust-building is a long-term, delicate process with the potential to fail at every step of the way. All actors have a unique responsibility to safeguard valuable relationships between science, policy and society. For fisheries, scientists and policymakers this goes without saying, as all have pre-determined stakes in such collaborations with potentially far-reaching consequences.

NGOs had and continue having an important role in advancing innovative fishing techniques. For example, in VISTools, the NGOs provided an important element of support and a signal of societal approval of both initiatives. This may further motivate fishers to pursue improvements in their operations. We also know that NGOs withdrawing their support may create setbacks for innovation and disrupt trust-building. The NSAC has been an advocate for cooperation between the industry and NGOs and this paper should serve as a reminder of our commitment to transition in partnership.

Stakeholders bring invaluable insights and help finetune the project's outputs as well as ensure their longevity and application. It is therefore important to design a thorough stakeholder engagement strategy from the outset and develop a frequent feedback loop with relevant actors. This is especially crucial in the mapping of fishing grounds and activities, where fishers hold critical knowledge about where fishing occurs and the potential impacts it may have. This unique information, unavailable to other stakeholders, should be recognized and valued.

Additionally, Advisory Councils should be promoted as relevant platforms for information dissemination for fisheries stakeholders. Increased efforts and resources should be placed in adequate representation in different fora across sectors. Also important is consideration of adequate incentives. All actors are increasingly stretched between multiple activities and garnering attention and support requires clear communication of the potential benefits and risks. This task is easier when projects address direct fisheries problems and provide direct benefits. Mapping of important fishing grounds is one of those examples. Multi-sectoral cooperation in MSP is becoming increasingly important. Ways to better access, share, and aggregate data should be accompanied by measures safeguarding commercial sensitivity. Discussions on these issues have begun at various levels, and it would be beneficial to unify these efforts into a larger, coordinated conversation on how to achieve this. Efforts in the Greater North Sea Basin Initiative and discussions in the NSAC and other ACs are some ways to do this.

4.1.5 International coordination and funding

Lack of data sharing arrangements and cross-border, multidisciplinary management is one of

the critical aspects of MSP, aiming to attain both societal and ecosystem objectives. In the North Sea, the Greater North Sea Basin Initiative is one pioneering example of an integrated sea basin strategy for multiple societal objectives: food, energy and nature. Strong cross-border and cross-sectoral cooperation will be the hallmarks of future MSP, ensuring ways to better access, sharing, and aggregating data while respecting commercial sensitivity.

Sufficient funding should be ensured not only for research output but for sustainable management of the mapping tool, which should be maintained as a service. Funding should also be ensured for legacy: regular updates to the map, so that the data remains representative of the on-ground reality, as well as communications outreach and promotion, including contacts with Advisory Councils for dissemination of information. Centralized funding is advised for mapping purposes, so as to streamline financing and reduce red-tape.

4.2 Data

In this section we focus on data requirements: data availability, collection, processing and sharing, data accuracy and grids, complementarity (AIS/VMS), confidentiality and sensitivity, and other considerations.

We also draw attention to the Fisheries Sensitivity Mapping and Displacement Modelling project (FiSMaDiM) [report](#)⁶ providing a brief overview of the different types of data available to identify the spatial distribution of fishing activity. This review focuses on vessel location data, rather than catches or landings data. A brief overview of methods and tools available to identify the spatial distribution of fishing activities is included. The report also illustrates the strengths and limitations of existing data, methods and tools used to identify the spatial distribution of fishing activities and provide recommendations relevant to the application of these data to evaluate potential impacts of offshore wind developments. Despite its restricted focus on the UK, we believe the report to be valuable for consideration beyond.

4.2.1 Data availability, confidentiality and sensitivity

To ensure the right incentives for data collection and provision, it is suggested to link these actions to dedicated sustainability labels.⁷ In terms of incentives, also advised is to make the fishers the first “clients” of an agreement on data provision and make all sharing conditional upon their approval as to the type and amount of data supplied to authorities/scientists/interested stakeholders. Benefits for fishers shall be explicitly communicated, for example noting that based on the data collected, they, as the primary beneficiary, will be empowered to make informed decisions on improved operations (by, for example, reducing fuel consumption). The new Control Regulation provides the necessary legal basis for enhanced data collection. That said, positive incentives rather than control would constitute a better impetus.

⁶ Mendo, T.; Wright, K.; Sweeting, C.; Mark, J.; Gibson, T.I.; Muench, A. (2023): Mapping fishing activities in the UK EEZ: a brief overview of data, methods, and tools; Report produced for The Crown Estate, OWEC funded project: FiSMaDiM, 14 pages. Doi: 10.14465/2023.OWEC.001

⁷ See project: VIStools and Visserij Verduurzaam initiative

Specific attention and careful consideration should be given to data confidentiality and commercial sensitivity. There is a need to maintain a fine line between data sharing and oversharing, with emphasis on trust-building through only sharing the data with fishers' approval and for the purposes for which the sharing was approved and with the level of detail that it was approved. The VISTools project approached trust issues with appropriate seriousness, knowing that trust was the single most critical component of the project, without which it was bound to fail. The data collected by individual vessels are sent to scientists who, in agreement with fishers, prepare data into useful information for managers. Administrations do not get raw data per se. They can request it, but in a kind of an unwritten rule they usually do not in order to build trust. If someone from another research institute or PO requests access, the PO is notified and has a say in the decision. Each project includes discussions with ship owners regarding what information is available and accessible. Access is limited to special computers to maintain strict controls, as any breach of trust could undermine the entire system.

Fishers only see their own data on catches, fuel, depth and pulling force. The installation of VISTools is also necessary to join several projects. This data helps fishers with the economic viability and helps them improve sustainability (projects with innovations, catch data and fuel-use through behaviour of the skipper). That said, VISTools has only been applied in Belgian fleet so far. To further exploit and assess the benefits of such initiative, it would require propagating it in other member states covering a broader scope of métiers.

While a centralized EU map for the entire European fleet would be beneficial, from the fishers' perspective, concerns about data visibility are significant. While real-time data could assist in quota management, it is crucial to ensure anonymity. It was reported that the recent increased oversight from one Member State's control authorities has caused concern among fishers, leading to worries that tracking devices could be misused. There is a fine line between the utility of the data and the perception of constant surveillance. This goes also for providing input to public consultations, where balance must be struck between providing comprehensive data while protecting sensitive information.

4.2.2 Data collection and processing

EU Technical Expert Group (TEG) on Data for MSP produces [guidance documents](#) for spatial planners on data usage, such as standardization and harmonization of data presentation across EU MSP plans. Furthermore, the EU MSP platform includes a compilation of various databases and platforms offering information and data suitable for MSP, along with mapping of activities.

Due to the significant time lag in data provision and level of detail in available data, which do not ensure sufficient nuance in fishing activity analyses (i.e. fishing vs. steaming), it is critical that efforts toward real-time data supply and processing are enhanced. In this context, positional data such as AIS and VMS could be supplemented through optical and radar satellite imagery to enable real-time or near-real-time representation of activities.⁸ The ICES Working Group on Spatial Fisheries Data ([WGSFD](#)) is exploring how to create a workflow for integrating VMS data from multiple countries, potentially including AIS data.

⁸ See project: Global Fishing Watch

Nevertheless, to ensure an accurate depiction of fishing effort, geolocalized data (VMS, AIS) are not sufficient and should not be used as a standalone but be complemented and cross-verified with production data (logbook, sales...). This dual integration provides a better resolution, a wider spectrum of relevant data (tonnage, value, species, gear (active/passive), speed, bathymetry), and thus a more realistic and detailed picture of fishing activity.

In addition, identification of areas important to fisheries should not be limited to bio-economic metrics but should also consider cultural, historical, nutritional, and other dimensions. Systematic collection of data on fishing activities, gear used, and targeted areas, validated through meetings with local communities should complement technical data (on vessel size, gear, and maritime district), including data on sales in fish markets, with additional data from the Joint Research Centre (JRC) for vessels not covered in other surveys. Multiple data sources could provide a more comprehensive view of annual production by vessel segment and maritime region. This data can be supplemented by systematic literature reviews to identify elements for a composite index of fisheries' importance, in order to develop a holistic picture of EU fisheries.⁹

4.2.3 Data sharing between Member States, third parties and industries

There is an increased awareness of the need for the sharing of data across borders for comprehensive MSP and ecosystem protection. Efficient and regular data sharing needs political will and legislative enablers, while ensuring the necessary protection of commercial data. Governments and ministers, with support from the EU Commission, need to provide a legal mandate to facilitate efficient MSP. With the right mandate, existing infrastructure, and expertise, Member States could support this effort.

We view the Greater North Sea Basin Initiative, in particular, as the adequate high-level platform for such discussions that is also able to trickle down those political decisions to executive levels at a fairly rapid pace. However, it shall be pointed out that GNSBI currently only has a fisheries and nature restoration tracks, resulting in maps for specific uses, while there is no specific ORE track, leading to a perspective where ORE is of overriding public interest. We need to avoid that fisheries and nature restoration objectives have to adapt to ORE.

We suggest developing a centralized data center with clear data-sharing agreements to protect confidentiality and commercial sensitivity. As some of the projects demonstrated, data can be converted into indicators or indexes to avoid disclosing sensitive details while still being useful. A central database with high-resolution information, such as shapefiles for OWFs and MPAs is also needed. The challenge of managing fisheries displacement due to OWF development also underscores the need for timely and accessible OWF plans. The current reliance on commercial maps for OWF planning is not optimal and there is a need for an agreement to ensure that national plans are uploaded to a centralized database in a timely manner.

When it comes to data sharing between fisheries and industries, guidance is needed on methods, as well as facilitators and appropriate platforms, where this knowledge could be shared. Advisory Councils offer one such platform, where knowledge and access to local

⁹ See project: Zone d'Importance pour la Pêche.

experts is ensured, with special attention placed on the protection of confidential data when sharing innovative tools, algorithms and project documentation. One idea would be to make public availability of certain information a condition for accessing public funds.

4.2.4 Data accuracy and grids

In terms of accuracy, improvements in tracking intervals in VMS (higher transmission rates) are advised. Real-time data provision solutions are highly welcome. When this comes at a cost for fisheries, dedicated incentives and financial support are necessary. Fishers have demonstrated, on various occasions, that they are open to increased transparency provided any arrangements safeguard the interests of the industry such as including geofencing measures when increasing VMS transmission rate.

Traditional grid methods are not always suitable for complex sea basin structures as they might overstate actual fishing pressure. A polygon-based approaches might provide better understanding on habitat connectivity and community replenishments.

To develop a comprehensive map of fishing activity, it is essential to grid the fishing effort while carefully considering spatial resolution and consistency between projects and uses. This process involves a delicate balance, aiming for fine resolution without overdoing it. To construct the maps, the fishing pressure is calculated using a Swept Area Ratio (SAR) indicator within a gridded map area. This indicator is computed by dividing the swept area in a grid cell (in m²) by the total surface area of the grid cell (also in m²). The resulting map displays the SAR indicator for each grid cell, where $SAR > 1$ indicates areas fished more than once per year. However, within grid cells with $SAR > 1$, there may still be unfished areas due to the inability to differentiate between more and less fished areas within grid cells.

The primary discussion revolves around determining the extent of seabed being fished, which can be approached in two ways. The first method involves calculating the Percentage of Unfished Grid cells (PUG), where if there is fishing activity in a grid cell, the entire cell is considered completely fished. However, this method does not account for the possibility that some grid cells marked as completely fished may only be partially fished. The second method entails considering SAR and calculating the Percentage of Unfished Area (PUA). This indicator sums the SAR values and divides them by the total number of grid cells in the area, allowing for the consideration of partially fished areas within grid cells.

4.3 Methodology

4.3.1 Methodology for accuracy in depicting fishing activity

Combining data from multiple years poses a challenge in determining a reasonable way of calculating and representing fishing activity. The solution recommended is to identify the maximum fishing intensity within each grid cell across the years. This approach results in a combined final map that allows for calculation of the fishing footprint, specifically as the percentage of seabed type that remains untrawled.

Visualisation of vessel's trajectory is important for both demonstrating important fishing grounds but also providing evidence on the (degree or absence of) impact on marine ecosystems. The current methodologies and tools do not allow for differentiation between lightly impacted marine ground and areas with more substantial sediment disturbance and impact on marine life. It would be sensible to investigate ways to make datasets more refined and nuanced (substantial impact vs. light impact). One possibility could be adopting the ICES advice methodology with the PD model, although this introduces its own complexities and limitations that need to be accounted for.

4.3.2 Inclusion of environmental and other fisheries-related variables

Incorporation of data on habitat types, gear, target species (demersal/pelagic), speed, catch information, impact assessments, bathymetry, biotic and abiotic features in bespoke maps could greatly improve fishing analyses for the purposes of MSP and others.

Fishing vessels often slow down their steaming speed as they approach the harbour, which may be mistakenly recorded as fishing activity. Efforts are ongoing to tackle this issue by removing such data points near harbours. Another approach is the one adopted by the Global Fishing Watch (GFW), that refers to its map representations as “*apparent fishing effort*” as the platform is only using location data (mainly AIS) to characterize the fishing effort. To improve accuracy, GFW users can report overestimated fishing hours, such as transits misclassified as fishing, through the feedback tool on the map, allowing these corrections to be integrated into the models. However, this process of continuous revisions can be painstaking. GFW also refines its models to enhance activity classification and reduce noise in datasets. Still, Hintzen et al, 2025¹⁰ show that assumptions made by GFW to define fishing events lead to an overestimated duration of gear deployment within a range of 30%–380%, depending on the target species and vessel type. The study recommended that authorities and GFW allow scientists free access to the unprocessed AIS data or that organizations such as GFW work closer with the fishing sector and scientific community to improve their data products.

This shows that correctly identifying and interpreting behaviour at sea poses a challenge, as it is difficult to differentiate between actual fishing activity and vessel navigation. Establishing narrower speed profiles and developing practical rules for identifying fishing activity are recommended for a more nuanced approach. Additionally, integrating multiple sources of information, such as production data, helps minimize misinterpretations and provides a more reliable representation of fishing activity.

The public nature of platforms using aggregated data or single-source data is prone to misinterpretation, especially as visualizations are not accompanied by clarifications on how to interpret the represented effort. The burden of proof then lies on the fishers, who would be able to use their detailed fisheries maps to rectify any misrepresentations and ensure the level of detail needed for effective policy support and correct public perception.

Non-environmental factors, like fishing traditions and social aspects, can influence fishing decisions. This can be partially addressed by including fishing effort indicators and vessel type in the model.

¹⁰ Hintzen et al. 2025. Bias in Global Fishing Watch AIS data analyses results in overestimate of Northeast Atlantic pelagic fishing impact. Accessible at: <https://academic.oup.com/icesjms/article/82/3/fsaf033/8090016>

Regular data updates are also important in a context where fishing activity is evolving and adapting to a dynamic environment (e.g., fish migration driven by climate change). Modelling techniques that effectively capture the interaction between fisheries and environmental features should therefore be developed. This would facilitate simulations of changing conditions under different environmental scenarios, such as climate change.

Modelling techniques can effectively capture the interaction between fisheries and environmental features, demonstrated by the models' strong predictive capabilities. The inclusion of results of research on the impact of bottom-gear on fauna and seafloor in hydrodynamic and less dynamic areas, with information on natural variability, could enable a risk-based approach to management. For example, the CRANIMPACT project examining the effects of brown shrimp fisheries on habitats and benthic communities in the Wadden Sea found that 8.9% of variability in endobenthic communities is related to fishing while more than 90% can be attributed to natural effects, which remain unknown. Fisheries impacts tend to occur more in softer sediments with lower hydrodynamics, but even there, long-lasting effects, such as those lasting more than six months, are unlikely. Large-scale natural events, like ice winters, have had far more significant impacts on the Wadden Sea ecosystem in the past.

Therefore, having a nuanced view of fishing operations and impact could greatly improve management and avoid generalizations. Furthermore, providing spatially explicit information could benefit MSP efforts and facilitate simulations of changing conditions under climate change scenarios.

4.4 Visualisation and interpretation

4.4.1 Data visualisation

Currently, there are many national platforms promising a centralized approach to MSP and mapping, with GeoFish being the most notable one, and the NWWAC Mapping Tool known amongst Advisory Councils members. However, as of yet, there is no agreement as to which platform could serve as the go-to integrated and centralized hub covering all EU Member States and fleets, and regional third countries. A multipurpose tool for fishers, decision-makers, NGOs, researchers and interested public would allow users to explore data through a map interface, focusing on areas of interest, by adding or removing layers.

The online tool [GeoFish](#), developed by ILVO, provides a spatial visualisation of fisheries-related data and MSP. The tool can be used to create a visualisation of the status of a fish stock, as drawn up by ICES. In terms of spatial planning, a clear picture is formed of activities or possible restrictions (MPAs, wind farms, Brexit) that influence the economic importance (expressed in fishing hours, landings) for the Belgian fisheries sector. Policymakers can use the interactive tool during negotiations on the use of space and possible compensations. Finally, while the tool can be used for broader communication to the public, the information available is still quite broad and background knowledge is needed for accurate interpretation. The portal is currently in Dutch but it is to be translated in English for use in other Member States than Belgium.

The [AC FishMap](#), commissioned by the North Western Waters AC, is an interactive map that allows to explore the regulations, designations, and infrastructure of Europe's North Western

Waters. The tool provides information useful to the fishing industry and other marine stakeholders. This includes regulatory measures, areas for conservation, other marine uses such as offshore wind and cables, and information on TACs and quota. The tool could easily be expanded and replicated in other sea basins.

[DTU Aqua Mapping Tool](#) is another such platform aimed, initially, at Danish fishers. It shows the spatial distribution and intensity of all bottom-towed gears used by Danish fishers and provides quantitative fishing pressure indicators as advised by ICES. The platform only provides spatial and temporal information of the direct, physical contact between the fishing gears and the seabed; the actual impact on the benthic community and seafloor status, and any indirect impacts of the fisheries (e.g. fish population status, or resuspension of sediments), are not included in the tool or accounted for. Under the tab 'Areas of interest', special attention is given to Natura-2000 areas and offshore wind farms. In version 2, the multi-year footprint is presented, in line with the D6C2 descriptor of fishing pressure on the seabed under the Marine Strategy Framework Directive (MSFD).

4.4.2 Data for interested public and catalogue of mapping projects

The interested public has limited access to data, with a lack of comprehensive overview and interface delineating space for fisheries, OWF, and other activities. [EmodNET](#) allows for a partial overview of ongoing operations, though in limited capacity. Process is ongoing to eventually provide a global overview of activities. A web tool is needed to make all data layers publicly accessible and downloadable in different formats, including ones compatible with fishing boat software, through a data portal that can be integrated into existing national platforms.

The [Global Fishing Watch](#) provides a platform for near-real-time visualization of apparent vessel activity, tracking various marine uses and their temporal development within a single interface. However, as shown by research, the accuracy of the tool should be further improved, and we welcome GFW's closer collaboration with the fishing industry to refine their models. Additionally, we invite all users of GFW to cross-check their maps with local regulations on activity management, so as not to misjudge fishing activity in a particular area. The NSAC would also welcome a visible user disclaimer (pop-up window) on GFW website, notifying the user that the output of apparent fishing effort based solely on geolocalisation data should be supplemented by other types of data. Finally, when representing MPAs coordinates, GFW or other map provider should indicate their conservation objectives.

The [EU MSP platform](#) encompasses various sections offering general information on MSP as well as specific MSP processes in individual countries. It features updates on MSP developments, key documents, and next steps for each Member State and sea basin. The platform also aggregates new academic publications on MSP within its best practice and scientific publications section. The platform could function as the centralized hub with an overview of different projects on spatial analyses and MSP, enhancing awareness of the mapping landscape and fostering synergies while avoiding duplication of efforts. The Commission and Member States should explore potential options for a one-stop-shop avenues, while also involving third countries in shared sea basins.

Many successful projects end with the final deliverable, with insufficient consideration and effort being placed in its 'after-life'. Outreach and public relations are an important element in proliferation of project's benefits. Dissemination of information amongst stakeholders and potential users is an important part and adequate resources should be placed in ensuring proper outreach and communication plans.

4.4.3 Interpretation of maps: areas of importance and displacement risks

Classifying fishing grounds can be challenging because different areas hold varying significance for different vessels and métiers, resulting in very dense maps that can be difficult for managers to interpret. The key is understanding which fleets are most affected, as their responses can vary, and to integrate displacement analysis.

The OWEC study designed displacement sensitivity indexes based on indicators, resulting in maps to illustrate areas with varying sensitivity to OWF development. These maps revealed that areas highly sensitive to displacement due to OWF often corresponded with regions of high annual landing value but also identified additional zones where conflicts between fisheries and offshore wind development may arise. Notably, fleets with a more nomadic nature showed greater variability in displacement sensitivity.

In terms of sensitivity to displacement, there is a need for assessing the sensitivity of fishing activities to identify low- and high-risk areas based on fishing intensity. This includes modelling displacement to predict areas that may be affected by offshore wind farm development and conducting an economic impact assessment to evaluate the effects of activity reallocation on the fishing sector.

Sensitivity indicators may include:

- Business Impact: Number of vessels relying heavily on annual revenues from specific areas and % of annual turnover.
- Business Concentration: Areas where fishing businesses are highly concentrated.
- Site Specificity: Value of species harvested in limited grid cells.
- Substitutability: Average catch concentration (HHI) for vessels operating in a grid.
- Inter-Annual Variability: Frequency of area usage over the past decade.
- Seasonal Behaviour: Average number of months an area was fished annually over the past decade.

A compensation model based on the average income from fisheries over the past decade, projected for the next 30 years, was considered. This could provide fair compensation and help fishermen invest in technological improvements.

5 Conclusion

Mapping fishing grounds is a complex task. Fishing activities are influenced by the dynamic nature of fish stocks, further exacerbated by climate change. Additionally, the sensitive nature of commercial information poses additional challenges. Many fishers have invested years into identifying optimal fishing grounds and trajectories, which makes them hesitant to share this

crucial data. This reluctance is enhanced by past instances where shared data was misused or misinterpreted, deteriorating trust within the fishing community. Building trust and fostering cooperation require considerable time and effort, on the other hand such trust can be quickly lost. Positive incentives through empowerment (“fisher as the primary beneficiary of collected data”) could support this change of mindset.

For maps of fishing grounds to serve as reliable tools for management decisions within a given sea basin, it is essential to include comprehensive fishing data and involve all relevant stakeholders. This ensures the maps accurately reflect the reality of fishing activities in an area. However, an additional challenge lies in avoiding maps that are overly dense or complex, as these can hinder readability, understanding, and decision-making.

Creating effective maps requires thorough collaboration with fisheries stakeholders. This involves understanding what the industry wishes to represent or emphasize, such as core areas consistently fished over time versus peripheral areas showing annual variability and adaptation to environmental factors. The design of the map also depends on the specific question it seeks to address.

The NSAC remains committed to continuing discussions on the mapping of fishing grounds in the future, with the goal of ensuring fair representation of such areas on MSP maps especially in light of the rapid expansion of human activities in the North Sea. We welcome any follow up questions or feedback regarding this paper.