Fish-X

White Paper 3 - Leveraging fishery technology to safeguard marine resources and support small-scale fisheries activities

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Abstract	The Fish-X series of white papers reflects on exchanges of information and opinions between stakeholders around the implementation of the EU Fisheries Control Regulation and other regulations that are relevant to small-scale fisheries (SSF), suggesting improvements needed for industry bodies and regional fisheries organisations. The white paper series is also a tool for mapping out policy priorities within the fisheries sector in the medium to long term, feeding into the writing of final policy recommendations and the Fish-X EU Fisheries Roadmap for Digitalisation by 2030. This third and final white paper builds on the discussions from the 3rd Fish-X Conference, *"Small-scale fisheries turning digital: how to do it right*?", held on 23 April 2025. It aims to inform decision-makers at all governance levels – European, national, regional and local –, as well as external stakeholders such as non-governmental organisations, fishing and seafood industry actors, scientific bodies, and think tanks. The focus is on promoting the integration of small-scale fisheries and fisheries technology into the evolving EU political agenda. This supports the achievement of the Common Fisheries Policy (CFP)'s long-term environmental sustainability goals.

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Acronyms and abbreviations

Abbreviation	Meaning
EU	European Union
CFP	Common Fisheries Policy
SSF	Small-scale fisheries
REM	Remote electronic monitoring
CCTV	Closed-circuit television
AIS	Automatic identification system
VMS	Vessel monitoring system
MCS	Monitoring Control Surveillance
EMFAF	European Maritime Fisheries and Aquaculture Fund
FAO	(United Nations) Food and Agriculture Organisation
IUU	Illegal, unreported and unregulated
FLUX	Fisheries Language for Universal Exchange
GDPR	General Data Protection Regulation
CMO	Common Market Organisation
SFSF	Sustainable Food System Framework
STECF	Scientific, Technical and Economic Committee for Fisheries
ETP	Endangered, Threatened and protected
CAM	Common Assessment Methodology
DG Mare	Directorate-General for Maritime and Fisheries Affairs
PAA	Preferential Access Areas
TURF	Territorial Use Rights Fisheries
EP	European Parliament

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Executive Summary

This white paper is the first of a series of four publications from Fish-X, a technology and open-source driven project. It is a 3-year project and is co-funded by the Horizon Europe Programme. The project aims at developing a Fisheries Dataspace, an Insight Platform, and a Traceability Application to support the objectives of the European Union (EU) Common Fisheries Policy (CFP), EU Green Deal, and Farm to Fork Strategy. It aims to overcome key sets of challenges including data collection and sharing, particularly from small-scale and recreational fisheries, as well as accessing, managing, and utilising data to strengthen the monitoring and control as well as the sustainability of EU fisheries.

A white paper is a concise policy document that provides a forward-looking position on a given topic for a specific organisation or entity. The Fish-X series of white papers reflects the exchange of information and opinions between stakeholders around the implementation of the and other related regulations, pointing to improvements needed for industry bodies and regional fisheries organisations. This white paper series is also a tool for mapping out policy priorities within a specific field in the medium to long term. Within Fish-X, each white paper precedes the organisation of a conference to provide common ground and food for thought for the event discussion. The white paper is then complemented with the conference's outcomes to present the position of the Fish-X consortium on key topics. Ultimately, the set of white papers will feed into the writing of final policy recommendations.

The third white paper is the final document in a series of three. The first white paper focused on the digital transition of small-scale fisheries while the second one investigated seafood digital traceability. The third one grounds its recommendations in the latest EU political agenda to push for better recognition of small-scale fisheries and the adoption of fisheries technology which will help meet the CFP's objectives of ensuring fisheries activities are sustainable in the long term.

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White Paper 3 - Leveraging fishery technology to safeguard marine resources and support small-scale fisheries activities

1.1 Introduction

After nearly three years of collaboration, the Fish-X project is ready to share key insights from its work with small-scale fishers, technology providers, and environmental organisations. The project exemplifies successful cross-sector cooperation, integrating diverse expertise and perspectives. It offers concrete recommendations for policymakers, research institutes, industry stakeholders, seafood supply chain stakeholders and civil society on advancing the digital transformation of small-scale fisheries.

This paper reflects on the evolving political landscape with the nomination of Costas Kadis as new European Commissioner of Oceans and Fisheries and the broader shift in political dynamics during the Commission President Ursula von der Leyen's second term. The current agenda places a strong emphasis on competitiveness and regulatory simplification while upholding the progress made under the EU Green Deal. As such, the implementation of legislation remains tied to the timetable set out in existing regulations. In this context, the Fish-X project plays a crucial role by piloting use cases that support the planned uptake of tracking electronic devices by small-scale fisheries, as required under the revised EU Fisheries Control Regulation.

Marine technologies provide the means for action to tackle the twin climate and biodiversity crises, for example by strengthening conservation measures without compromising fisheries profitability. The European Commission's initiative, the Digital Twin of the Ocean (DTO), allows modelling of ocean features in real-time, and could improve decision-making thanks to more accurate projections.[1] In line with the projections presented in the "Fishers of the Future"

[1] Digital Twin of the Ocean Official website, accessible here: https://digitaltwinocean.mercator-ocean.eu/

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foresight report, the fishing sector will have to adapt, and is already doing so, to a fast-changing marine environment and species distribution patterns.[2]

This document is divided in five sections: (1) understanding the new political landscape and fisheries priorities of the new Oceans and Fisheries Commissioner, (2) how the Fish-X technology solutions can support the Commission's agenda in sustainably managing marine resources, (3) engagement with small-scale fisheries as a prerequisite for successful policy implementation, (4) the takeaways of the third Fish-X in-person conference at the EU Parliament on 23rd April 2024 and (5) these takeaways translated into policy recommendations.

1.2 Oceans and Fisheries Commissioner priorities for the mandate 2024-2029

On 17 September 2024, the new Oceans and Fisheries Commissioner, Costas Kadis, received his Mission Letter from the President of the European Commission, Ursula von der Leyen, considering the new mandate from 2024 until 2029.[3] Costas Kadis comes from Cyprus, and has held several ministerial duties on Health, Education and Culture, Agriculture, Rural development and Environment. Prior to his designation as Commissioner, he was appointed Professor of Biodiversity Conservation at Frederick University, providing him with a relevant background to fulfil his Commissioner's role.[4] Compared to the previous mandate (2019-

[2] European Climate, Infrastructure and Environment Executive Agency, Foresight study on fishers of the future, 2025. Accessible here: https://cinea.ec.europa.eu/publications/digital-publications/foresight-study-fishers-future_en

[3] Costas Kadis Mission Letter, Commissioner-Designate for Fisheries and Ocean, 17 September 2024. Retrieved from: https://commission.europa.eu/document/download/028ce7d5-e328-4416-8f0d-35c8884acaa8_en?filename=Mission%20letter%20-%20KADIS.pdf

[4] EU Commission website, Costas Kadis biography. Retrieved from: https://commission.europa.eu/about/organisation/college-commissioners/costas-kadis_en#biography

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2024), the Commissioner's portfolio related to oceans and fisheries has been streamlined, with environmental responsibilities now under Jessika Roswall.[5] [6]

The priorities of the new Commission are to implement the European Green Deal and ensure the competitiveness of European businesses.[7] In his Mission Letter, Commissioner Kadis is tasked to work on the CFP and its ongoing evaluation and to deliver a European Ocean Pact. Commissioner Kadis is asked to develop a vision for the fisheries sector for 2040, ensuring the sector's long-term sustainability and competitiveness and, among others, an EU Ocean Research and Innovation Strategy.

The EU Ocean Pact refers to a Commission Communication setting out the vision for the current mandate with regards to ocean-related policies. The Commission engaged with stakeholders to define the EU Ocean Pact under various formats such as a public call for evidence opened from 20 January until 17 February 2025 to which stakeholders could submit their own views, and "Fisheries and Ocean" dialogues.[8] As indicated in the call for evidence opened from January to February 2025, the EU Ocean Pact will be structured around five strategic goals: (1) A Competitive and Sustainable European Blue Economy, (2) Ocean Health, Productivity and Resilience, (3) Resilience for Coastal Communities & Cities, (4) Global Ocean Governance and Ocean Diplomacy, (5) A Robust Marine Knowledge Framework.[9]

As part of the Blue Economy, fisheries are high on the Commissioner's political agenda with the CFP evaluation and the associated public consultation from 27 January 2025 until 21st April 2025.[10] Earlier this year, the Directorate-General for Fisheries and Maritime Affairs (DG

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[5] 2019 Virginijus Sinkevičius Mission letter. Retrieved from: https://commissioners.ec.europa.eu/document/download/60fda991-40c8-48fa-bb0c-06db1ece97fb_en?filename=mission-letter-sinkevicius-2019-2024_en.pdf

[6] Poster of the Commissioner 2024-2029: https://commission.europa.eu/document/download/fc98eb73-955c-4dd7-9627-11ce1e332580_en?filename=poster-of-commissioners-2024-2029_en_0.pdf

[7] See First 100 days of the new Commission highlights, with the release of the Competitiveness Compass, Clean Industrial Act and two omnibus packages to cut red tape and simplify the business environment. Retrieved from: https://ec.europa.eu/stories/100-days/.

[8] EU Oceans Pact Call for Evidence. Retrieved from: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/14474-The-European-Oceans-Pact_en

[9] As indicated in Call for evidence - Ares(2025)419841 to be downloaded on the EU Oceans Pact call for evidence webpage here: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/14474-The-European-Oceans-Pact_en

[10] Accessible here: https://ec.europa.eu/eusurvey/runner/CFP_Regulation_Evaluation

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Mare) released the study “Fishers of the future”, developing four scenarios projecting the fisheries sector's possible evolution by 2050 based on analyses of current transdisciplinary trends.[11] As shown in Figure 1, two main variables were considered: climate change’s impact on fish stocks and the demand for EU-caught seafood. The four scenarios are based on the intersection of these two variables at different gradients – low or high impact – aiming at “informing debate, investment, innovation and action”.[12] Despite some caution on the robustness of the consultation process to develop the foresight report,[13] the publication of this document creates a momentum to start acting now on identified patterns including access to the fishery resource, climate change induced effects, marine biodiversity decline or illegal, unreported, unregulated fishing pressure. The foresight report may also contribute to the forthcoming EU Commission’s 2040 Vision for the fisheries and aquaculture sectors.

Figure 10 – Scenarios overview

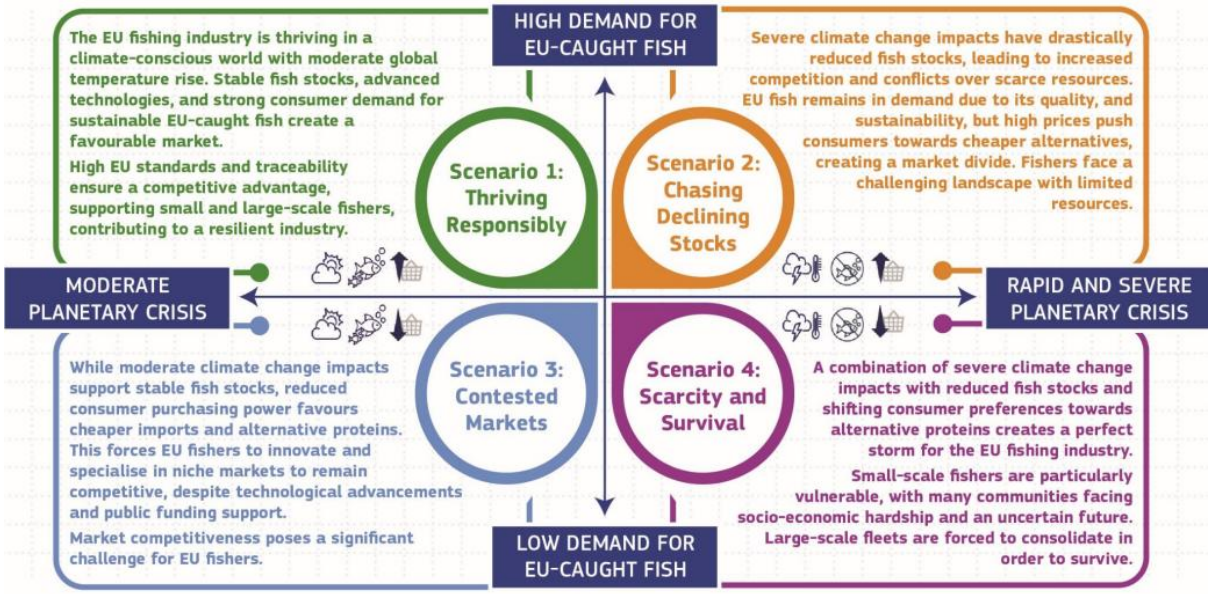

Figure 1: Scenario overview. Source: Foresight Study on Fishers of the Future - Final Report

[11] European Commission: European Climate, Infrastructure and Environment Executive Agency, Davies, M., Macfadyen, G., Brugere, C., Chiarelli, N. et al., Foresight study on fishers of the future – Final report, Publications Office of the European Union, 2024, https://data.europa.eu/doi/10.2926/3984926

[12] Ibid, Recommendations section, p115.

[13] Joint Advisory Councils letter on “Fishers of the Future” EU-wide participatory foresight project, 12 May 2024. Accessible here: https://marketac.eu/wp-content/uploads/2024/05/Multi_AC_letter_Fishers_of_the_Future_May2024_EN.pdf

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Subsequently, the EU vision for the fisheries sector with a perspective by 2040 will be an important milestone from Commissioner Costas Kadis' mandate to address the sector's challenges and ensure its long-term sustainability and competitiveness. In parallel, the Vision for Agriculture and Food released on 19 February 2025 gives an early indication of the Commission's commitment to address the primary sector concerns, including the agri-food and fisheries sectors, and puts emphasis on securing food security across Europe.

Considering all the recent and forthcoming EU policy developments presented above, the Fish-X project, funded by the European research and innovation programme Horizon Europe, intends to share its expertise, knowledge and learnings after three years of activity. Based on groundwork with fishers and their representatives, the project's results may help support DG Mare's policy initiatives. The consortium developed a set of innovative technological outputs shaped by and for small-scale fishers to support their sustainability and their compliance with EU regulations, including the EU Fisheries Control Regulation. The next section will give an overview of the diversity of digital tools and how these can support EU fisheries policy's objectives.

1.3 Fish-X technology solutions for sustainable fisheries management

The future of fisheries may lie in the hands of innovative, cross-cutting, and transdisciplinary approaches to science and policy. The development of cutting-edge technology using spatial and temporal data, real-time monitoring and incorporating traditional knowledge and oceanographic science could support fisheries management adapted to fast-changing climate change effects (i.e. increase of data collection, automation of data processes and quality checks, use of AI to support analysts).[14] The opportunities offered by artificial intelligence applied to fisheries is promising because it may lead to more responsive fisheries

[14] E. L. Hazen, K. L. Scales, S. M. Maxwell, D. K. Briscoe, H. Welch, S. J. Bograd, H. Bailey, S. R. Benson, T. Eguchi, H. Dewar, S. Kohin, D. P. Costa, L. B. Crowder, R. L. Lewison, A dynamic ocean management tool to reduce bycatch and support sustainable fisheries. Sci. Adv. 4, eaar3001 (2018).

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management, seafood traceability along the supply chain, assistance in decarbonisation analysis and selectivity of fisheries techniques.[15]

Mandating electronic monitoring, control, and surveillance measures remains a cornerstone of the revised EU Fisheries Control Regulation No 2023/2842, as included in Article 9 on VMS, Article 13 on REM and Article 15 on Electronic submission of the fishing logbook.[16] Included in the revised IUU Regulation, the digital EU Catch Certification System (CATCH IT) is another example of how technology can speed up control processes.[17] Prior to the implementation of the provisions contained in the EU Fisheries Control Regulation, the Fish-X consortium deployed 104 units of VMS devices and 11 satellite markers for fishing gears.[18] The VMS device is a solar-powered position transmitter adapted to small-scale fisheries practices providing a unique vessel identifier number, a red button for emergency alerting, hybrid connectivity with a cellular network connection along coastlines and satellite communication when outside cellular coverage. Given the transmission of positions at frequent intervals, the VMS device describes with precision the vessels' movements, providing valuable data for fishing effort assessment, monitoring marine protected areas, and supporting maritime spatial planning. The VMS device is also helpful to document fishing grounds and fishing activity and for the safety of fishers at sea.

In a context of increased competition for access to marine space, mapping fishing grounds has become increasingly necessary to protect fishers' livelihoods. To appropriately represent fishing activities, fine scale depictions of fishing effort (0.01 x 0.01 degrees, roughly 1 x 1 km)

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[15] Fernandes-Salvador, J.A., Oanta, G.A., Olivert-Amado, A., Goienetxea, I., Ibaibarriaga, L., Aranda, M., Cuende, E., Foti, G., Olabarrieta, I., Murua, J., Prellezo, R., Iñarra, B., Quincoces, I., Caballero, A., SobrinoHeredia, J. M, 2022, Research for PECH Committee – Artificial Intelligence and the fisheries sector, European Parliament, Policy Department for Structural and Cohesion Policies, Brussels

[16] Regulation (EU) 2023/2842 of the European Parliament and of the Council of 22 November 2023 amending Council Regulation (EC) No 1224/2009, and amending Council Regulations (EC) No 1967/2006 and (EC) No 1005/2008 and Regulations (EU) 2016/1139, (EU) 2017/2403 and (EU) 2019/473 of the European Parliament and of the Council as regards fisheries control.

[17] EU Commission, Frequently Asked Questions on the EU catch certification system, April 2025. Retrieved from: https://webgate.ec.europa.eu/circabc-ewpp/d/d/workspace/SpacesStore/ab2ae1c8-b7a6-4811-9c98-8479fb110d92/file.bin

[18] For more information on the pilot cases, please refer to the following reports: (1) Fish-X Deliverable 5.3 Live Use Cases, November 2024. Retrieved from: https://fish-x.eu/wp-content/uploads/FISH-X_D5.3_Live-Use-Cases_FINAL.pdf. (2) Fish-X Deliverable 5.4 – Live Use Case Reports, November 2024. Retrieved from: https://fish-x.eu/wp-content/uploads/20241127_FISH-X-DVL_5.4-Live-Use-Case-Reports_FINAL.pdf

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provide a granular visualisation of fishing activities and offshore windfarms, as some offshore wind sites can cover areas of only a few square kilometres.[19] To ensure effective spatial mapping of fishing activity based on VMS data, the latest scientific advice recommends a spatio-temporal resolution of VMS data transmission to be of one position every five minutes.[20]

The electronic marker for fishing gears is a connected buoy allowing the geolocalisation of the fishing gear in real time. The connected fishing gear buoys were tested on 11 gears, including pots, traps, nets and demersal longlines, using a satellite communication system transmitting one position every hour. With ghost gears making up for 46% of the Great Pacific Garbage Patch, and 20% of fishing gear lost at sea in the EU, tagging and recovering fishing gears is of utmost importance to limit gear loss, reduce marine litter production of fisheries origin, ultimately minimising the ecological impact of fisheries.[21]

In combination with the installation of these two electronic devices, the Fish-X project developed three technological outputs:

1.3.1 Fish-X Data Space

In alignment with the European Strategy for Data of February 2020, the Common European Data Spaces aims to provide a trustworthy and sovereign data infrastructure for storage, collection, and exchange for European businesses and citizens.[22] The Fish-X Data Space, developed and run by north.io, is composed of two interfaces for data providers (i.e. fishers

[19] Stelzenmüller, V., Letschert, J., Gimpel, A., Kraan, C., Probst, W.N., Degraer, S. and Döring, R. 2022. From plate to plug: The impact of offshore renewables on European fisheries and the role of marine spatial planning. Renewable and Sustainable Energy Reviews 158, 112108

[20] ICES. 2023. Workshop on Small Scale Fisheries and Geo-Spatial Data 2 (WKSSFGEO2). ICES Scientific Reports. 5:49. 105 pp. https://doi.org/10.17895/ices.pub.22789475

[21] EU Commission, Newsroom "Circular economy: From abandoned fishing nets to sustainable clothing", 2020. Retrieved from: https://ec.europa.eu/newsroom/mare/items/691756/en ; WWF, Ghost Fishing Gear, 2020. Retrieved from: https://www.worldwildlife.org/stories/ghost-fishing-gear#:~:text=Discarded%20nets%2C%20lines%2C%20and%20ropes,a%20name%3A%20ghost%20fishing%20gear; Roberts, C., Béné, C., Bennett, N. *et al.* Rethinking sustainability of marine fisheries for a fast-changing planet. *npj Ocean Sustain* 3, 41 (2024). https://doi.org/10.1038/s44183-024-00078-2

[22] COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A European strategy for data; Commission staff working document on Common European Data Spaces, February 2022. Retrieved from: https://digital-strategy.ec.europa.eu/en/library/staff-working-document-data-spaces

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transmit their position at sea) and data users such as fisheries management authorities, scientists, civil society and academia.

1.3.2 Insight Platform

The Insight Platform is a web geographic information system developed by CLS to share daily, monthly and yearly aggregated information on the distribution of fishing activity of small-scale fisheries at kilometric level (0.025° x 0.025° grid) ensuring the anonymisation of individual fishing vessels tracks.[23]

This information is produced by artificial intelligence and machine learning using the real-time VMS data flow collected from small-scale fishing vessels and the e-logbooks they report. The confidentiality of individual fishing tracks (covered by both commercial secrecy and personal data protection of individuals) is safeguarded throughout this processing.[24] [25]

The use of machine learning allows for automatic estimation of the most probable fishing gear used during the fishing trip and automatic detection of the start and end of the fishing operation(s) undertaken during the fishing trip, resulting in the calculation of the estimated fishing effort per type of fishing gear**.** For passive gears, a ”track matching” method was developed to pair the ”hauling track” with the ”setting track” and calculate over successive fishing trips the subsequent “soaking time“ used in the fishing effort definition. Once fishing activities are identified, fishing vessel catch reporting and landings data can be linked to provide a clearer picture of what is being caught, where, and the economic importance of the area.

[23] Information is only shown in grid cells for which at least three vessels were operating.
[24] Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) (Text with EEA relevance) and Regulation (EU) 2018/1725 of the European Parliament and of the Council of 23 October 2018 on the protection of natural persons with regard to the processing of personal data by the Union institutions, bodies, offices and agencies and on the free movement of such data, and repealing Regulation (EC) No 45/2001 and Decision No 1247/2002/EC (Text with EEA relevance.)
[25] Link to the Insight Platform: https://insight.groupcls.com/map;
Link to Insight Platform Functional Definition and Use Cases: https://fish-x.eu/wp-content/uploads/FISH-X_D4.1_Insight-Platform-Functional-Definition-and-Use-Cases.pdf

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The Insight Platform was demonstrated using data from CLS VMS units rolled out on small-scale fishing vessels in the use cases and landings declarations. VMS units were programmed by CLS to record one position every three minutes, a value set by CLS data scientists so that the AI analysis has enough information to cluster data into fishing trips and classify operations on fishing trips for the types of gear used.

This approach is consistent with the recommendations of the ICES WKSSFGEO2 workshop on the "optimal frequency of acquisition of geopositional data to infer relevant fishing activities" in the context of the use of VMS data for scientific research and advice (EU Fisheries Control Regulation 2023/2842, article 110 (3)).[26] Scientists did not reach a consensus on this "optimal value", as it depends greatly on the type of fishing gear used. They therefore proposed a conservative recommendation of one position every five minutes to manage complex tracks. The Insight Platform shares Fishing Effort Maps for five types of fishing gears (passive gears,[27] handlines, drifting long-lines, purse seines and dredgers) used by the SSF operating in the use cases' areas, with a wide audience not restricted to the usual recipients of VMS data and not requiring expertise in fisheries science, elevating the transparency on the fishing footprint at the level of these coastal communities.

1.3.3 Traceability Platform

The prototype for a Traceability Platform, led by OURZ, is composed of two interfaces: one for supply chain stakeholders (i.e. producers, processors, brands), and one for end-users (i.e. consumers). The platform is specifically tailored to the needs of SSF in the EU, collecting data and ensuring its integrity in the early stages of the seafood supply chain, and providing end-consumers with transparency and sustainability information.

These technologies were developed in the Fish-X project. Some of them reached a level of pre-operationality and could be further developed to serve specific requirements of the EU Fisheries Control Regulation. To ensure the long-term acceptance and relevance of these tools, engagement with fishing communities and the broader industry sector is essential.

[26] WORKSHOP ON SMALL SCALE FISHERIES AND GEO-SPATIAL DATA 2 (WKSSFGEO2) VOLUME 5 | ISSUE 49 ICES SCIENTIFIC REPORT 2023 https://doi.org/10.17895/ices.pub.22789475

[27] A group encompassing traps and pots, gillnets and set longlines.

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Consequently, the Fish-X consortium was expanded in June 2024 to include the Low Impact Fishers of Europe (LIFE) Platform and the Irish Islands Marine Resource Organisation (IIMRO), both representing small-scale fishers in Europe, and the latter specifically on the offshore islands of Ireland. The next section will put the spotlight on the collaboration with small-scale fishers that took place during the pilot phases and, more generally, over the course of the project to raise their voice and concerns to European and global fisheries management fora.

1.4 Collaboration with small-scale fishers

Small-scale fisheries contribute globally to support livelihoods, healthy food provision, eradicate poverty, and enhance gender equality, amounting to 40% of global wild capture fisheries and supplying 2.3 billion people with 20% of their dietary micronutrient intake.[28] Despite SSF's key role, public subsidies from government bodies go disproportionately more (3.5 times) to large-scale fisheries.[29] As stated by the High-Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, access to food is one of the six components of food security.[30] For that reason, considering preferential access to coastal waters for small-scale fisheries remains a powerful policy tool that can take the shape of preferential access areas (PAAs) and territorial use rights fisheries (TURFs), the latter usually locally defined and of small size.[31] Finally, the involvement and buy-in from the small-scale fisheries community (i.e. bottom-up approach) prevails in ensuring efficient policy

[28] Basurto, X., Gutierrez, N.L., Franz, N. *et al.* Illuminating the multidimensional contributions of small-scale fisheries. *Nature* 637, 875–884 (2025). https://doi.org/10.1038/s41586-024-08448-z

[29] Schuhbauer A, Skerritt DJ, Ebrahim N, Le Manach F and Sumaila UR (2020) The Global Fisheries Subsidies Divide Between Small- and Large-Scale Fisheries. Front. Mar. Sci. 7:539214. doi: 10.3389/fmars.2020.539214

[30] HLPE-FSN. Food security and nutrition: building a global narrative towards 2030. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. (Rome, 2020). Retrieved from: https://openknowledge.fao.org/server/api/core/bitstreams/8357b6eb-8010-4254-814a-1493faaf4a93/content

[31] Basurto, X., Virdin, J., Franz, N. *et al.* A global assessment of preferential access areas for small-scale fisheries. *npj Ocean Sustain* 3, 56 (2024). https://doi.org/10.1038/s44183-024-00096-0

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implementation, transparent and fair decision-making for fisheries management and prioritising of selectivity measures.[32]

In the European Union, small-scale fisheries contribute to the EU's food sovereignty as a key component of the European food supply and a pillar of the sustainable coastal blue economy. Over the course of the Fish-X project, the engagement with small-scale fishers occurred at various levels: (1) local level with the three use cases (i.e. Velebit channel in Croatia, Algarve coast in Portugal and offshore islands in Ireland) piloted by WWF Adria, Sciaena, WWF Portugal and IIMRO, (2) enlargement of the consortium's members with LIFE and IIMRO, (3) direct small-scale fishers' participation to high-level events (i.e. Mediterranean Advisory Council General Assembly on 28/02/2024, WWF Side Session at the General Fisheries Commission for the Mediterranean and the Black Sea (GFCM) Forum on 18/04/2024, EU Parliament event on 23/04/2025), (4) Co-design process for the development of Traceability Platform.

Principles of stakeholder engagement were applied to ensure robust and meaningful collaboration such as involving stakeholders as early as possible and defining clear objectives from the outset with a selected method.[33] For example, the installation of VMS and e-gear buoys required the fisher's signatures of the informed consent form and General Data Protection Regulation (GDPR) form on the participation to the Fish-X pilot use case and the processing of personal data (i.e. data recipients' identity, conservation periods, data security etc.).

A questionnaire was circulated to the 104 participants of the use cases asking for feedback and 34 answers were received, which represents close to one third of the fishers involved.[34] Participants were overwhelmingly satisfied with their participation in the project (one third of respondents were "very satisfied" and one third felt "satisfied"). As shown by Figure 2, respondents were mostly convinced to participate in the piloting for the following reasons: (1)

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[32] Research for PECH Committee – Increasing selectivity in EU fisheries – State of play and best practices, February 2024. Retrieved from: https://www.europarl.europa.eu/RegData/etudes/STUD/2024/752438/IPOL_STU(2024)752438(SUM01)_EN.pdf

[33] Mark S. Reed, Stakeholder participation for environmental management: A literature review, Biological Conservation, Volume 141, Issue 10, 2008, Pages 2417-2431, ISSN 0006-3207, https://doi.org/10.1016/j.biocon.2008.07.014.

[34] Ibid. Fish-X Deliverable 5.4 – Live Use Case Reports, November 2023. Retrieved from: https://fish-x.eu/wp-content/uploads/20241127_FISH-X-DVL_5.4-Live-Use-Case-Reports_FINAL.pdf

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they were members of a fishery representative organisation, (2) they wanted to be the first ones to test the devices, (3) the devices were free of charge, and (4) they believed the applications could benefit their work.

Figure 2 - Answers to the question "What convinced you to participate in the Fish-X?", Source: Fish-X project, questionnaire for Deliverable 5.4

Based on the answers, the effective roll-out of electronic devices depends on the status of the relationship with fisheries organisations, the innovative component of the devices and associated curiosity with new functionalities, the cost, and the potential to improve the visibility of SSF in marine spatial planning and fishing practices through these new technologies.

Interestingly, the survey also showed that the knowledge related to new EU fisheries control rules (i.e. mandatory use of VMS and e-logbook by 2030 for SSF) is variable across countries. When, in Croatia, all respondents except one knew about the new rules, less than half were aware of it in Portugal and Ireland. Figure 3 highlights the role of the fishery representative organisation and other fishers in spreading the news.

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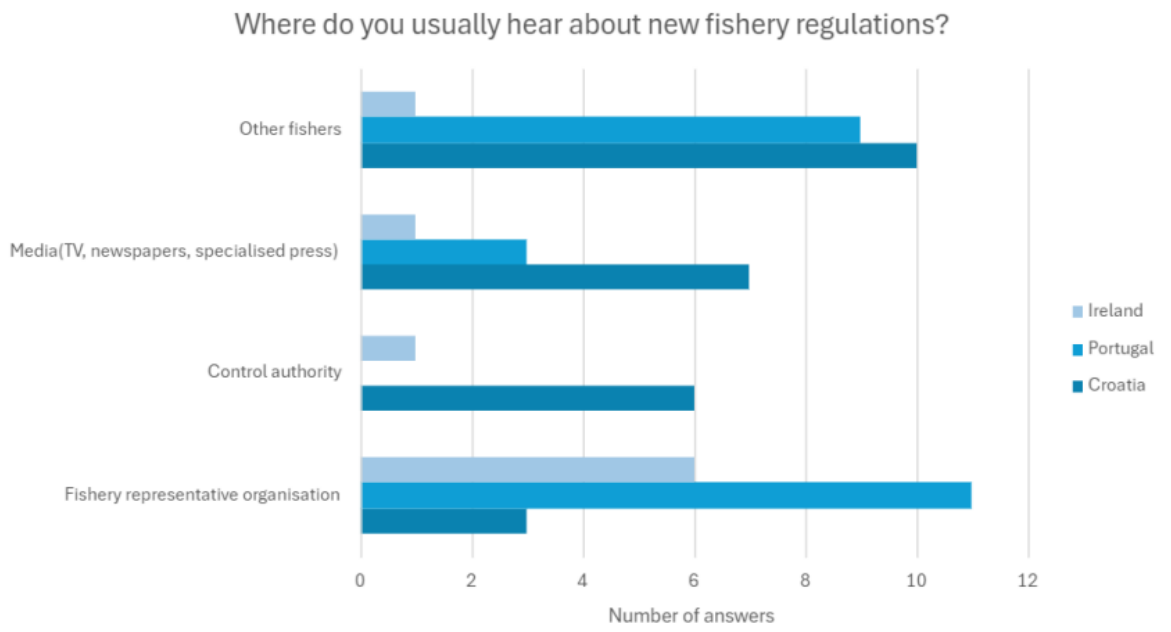

Figure 3 - Answers to the question "Where do you usually hear about new fishery regulations?". Source: Fish-X project, questionnaire for Deliverable 5.4

As a result, the role of SSF fishery representative organisations remains crucial to reach a clear understanding, generate buy-in for EU laws and upcoming requirements by fishers, as a knowledge and policy information hub inside the fishery community.

1.5 Takeaways from the Fish-X event at the EU Parliament on 23 April 2025

On 23 April 2025, WWF organised an event at the European Parliament entitled "Small-scale fisheries turning digital: how to do it right?" to present the results of the Fish-X project. This event was co-sponsored by two Members of the European Parliament, Stéphanie Yon-Courtin (France, Renew) and Željana Zovko (EPP, Croatia). The audience included around 50 people, ranging from political groups advisors for the Fisheries parliamentary committee, representatives from the fisheries and digital sectors, civil society, and decision-makers from the European Commission, the European Parliament (EP) and the Council of the European Union.

The speakers took the floor in the following order:

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- **MEP Željana Zovko** (EPP, Croatia)
- **Jana Stünkel,** Fish-X project coordinator, TransMarTech
- **Eckehard Reussner**, Head of unit (C4) on Data Management, DG Mare, European Commission
- **Marko Kožul**, Croatian small-scale fisher
- **Nelson Caracol**, Portuguese small-scale fisher
- **MEP Stéphanie Yon-Courtin** (Renew, France)

A summary report of the event as well as the PowerPoint presentation is available.[35]

The Fish-X project was highlighted as a successful collaboration between consortium partners originating from different sectors to learn how to speak the same language and understand each other's expertise and concerns working towards a common goal. In addition, the Fish-X project demonstrates that engagement with fishers from the start, with a clear and delimited scope of joint action agreed beforehand, is a must. Robust stakeholder engagement enabled successful pilot testing of digital technologies and subsequent solutions to drive fisheries innovation tailored to small-scale fisheries.

The specificities of small-scale fisheries were recalled, emphasising the need for visibility and attention in public policies. Including this major fleet segment in the digital transition is essential, given its importance for employment and the value of landings, and it must proceed in parallel with the digitalisation of the broader fisheries sector. The digital transition is also an opportunity for the fishers to simplify their reporting duties and to make sure that all fishers abide by the same rules. The design of the secondary legislation of the EU Fisheries Control Regulation should encompass the specific needs of SSF to ensure an efficient implementation. MEP Stéphanie Yan-Courtin declared in her concluding remarks that the concrete examples of Fish-X will contribute to her report on maritime spatial planning and its impact on fisheries.

[35] Here is the link to the summary report: https://fish-x.eu/wp-content/uploads/Summary-Report-Fish-X-High-level-Event-on-23-April-2025.pdf and here is the link to the Power Point Presentation: https://fish-x.eu/wp-content/uploads/Master-Deck_Fish-X-EP-Event-23-April-1.pdf.

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1.6 Recommendations

Based on the outcomes of the project, both with the engagement with fishers and the development of innovative technological tools, and on the exchange during the EP event on 23 April, the Fish-X consortium would like to recommend the following actions:

Strengthening small-scale fisheries engagement and collaboration

- **Deepen SSF representation** in policy dialogues to ensure the development and the implementation of fit for purpose rules; strengthen fishery representative organisations which act as a vital link between authorities and fishers.
- **Guarantee fishing grounds for SSF:** by mapping the distribution of SSF activities to provide evidence for discussion on maritime spatial planning and fishery management measures, thanks to VMS data and other analyses of position data tools such as the Insight platform. Small-scale fishers should be required to record their position at a frequency not higher than once every 5 minutes. This is the minimal value to properly monitor SSF and estimate fishing effort to map the marine space use including the designation of offshore wind farm sites, cable layouts and marine protected areas.
- **Guarantee coastal access priority**: guarantee preferential access to coastal areas for small-scale fisheries to safeguard access to marine resources closer to the shore to smaller fishing units and maintain the connectivity of digital tools used on board.
- **Recognise traditional ecological knowledge into digital tools**: Co-design tools with end users.
- **Ensure multilingual engagement**: provide translation and interpretation to ensure communication in communities' native languages.
- **Deliver digital literacy training:** offer training on digital tools, ideally delivered by fishery representative organisations.
- **Reinforce fishers' data ownership**: uphold stakeholder engagement principles when working with fishers with clear data frameworks where fishers own their data, sign informed consent form and ensure GDPR compliance in the data collection and processing.

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- **Promote cross-sector collaboration**: promote integrated collaboration among fisheries, environmental, and technology stakeholders when designing policies or conducting research, innovation and technological projects.
- **Enable data-driven management**: encourage the use of digital tools for effective resource management and sustainability monitoring, which can be used for fish stock assessment to factor in climate effects or for drafting maritime spatial plans.

Foster the use of science for fisheries technology

- **Support the development of real-time, automated, machine learning algorithms to** inform sustainable fisheries management measures (i.e. fisheries closure areas, prediction of bycatch probability, forecast climate change effects based on oceanographic data).
- **Ensure the development and availability of onshore infrastructure** on which technology depends such as connectivity and secure data storage.
- **Foster standardisation and interoperability** of electronic monitoring and control tools to cross-check seafood legality and traceability between VMS, AIS, REM, e-logbook and CATCH IT certificate.
- **Support an ecosystem-based fisheries management (EBFM) approach**: Use of fisheries data to improve EBFM model fostering a holistic approach to management measures to marine and fisheries resources, such as integrating fisheries into broader marine spatial planning frameworks.
- **Innovative financial mechanisms**: Leverage "blue bonds" and other financial instruments to support environmental conservation objectives, sustainable low impact fisheries and the digital transition. Provide financial support to cover adoption and ongoing operational costs of mandatory digital tools.
- **Market the valorisation of low-carbon fisheries**: Introduce certificates and labels for low impact seafood products.
- **Strengthen short supply chains**: Encourage fully traceable direct seafood sales to consumers and local restaurants through digital platforms.

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2. Fish-X project description and goals

Supported by the Horizon Europe Programme, the Fish-X project wants to make a key contribution to sustainable EU fisheries management by supporting a digital transformation in the SSF industry. The project's main goals are to improve data management via new technologies, to empower fishers with the co-design of future seafood supply chain monitoring and traceability systems, and to actively contribute to more sustainable fisheries management. To achieve these objectives, the Fish-X project aims to create a new secure and interoperable digital infrastructure, comprising three components: 1) the Fish-X Data Space, 2) the Insight Platform, and 3) the Traceability Platform. Fish-X is carried out by nine consortium partners: TransMarTech (TMT, Germany), EU Tech Chamber (EUTECH, Germany), Collecte Localisation Satellites (CLS, France), north.io (Germany), Sciaena (Portugal), OURZ (Germany), and WWF (European Policy Office, ANP/Portugal, Mediterranean Marine Initiative and Adria), Low Impact Fishers of Europe (LIFE, Belgium), Irish Islands Marine Resource Organisation (IIMRO).

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