Fish-X

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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.

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Document history

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Table of Content

This project has received funding from the European Union's Horizon Europe programme under grant agreement No 101060879.

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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
KDE	Key Data Element
CFR	Common Fleet Register
IUU	Illegal, unreported and unregulated
FLUX	Fisheries Language for Universal Exchange
GDPR	General Data Protection Regulation
CMO	Common Market Organisation
CTE	Critical Tracking Events
GDST	Global Dialogue for Seafood Traceability
GS1	Global Standards 1
EPCIS	Electronic Product Code Information Series
eCDT	Electronic Catch Documentation Traceability System
TRACES	Trade Control and Expert System
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
RecFishing	Recreational Fisheries

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List of figures

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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 first white paper was put together prior to Fish-X's first conference, entitled "The digital transition: New technologies to support sustainable small-scale fisheries" which took place in Brussels on 29 September, 2023.[1] The document was then complemented with outcomes from the discussions that took place with the speakers and the audience, who attended both in person and online. This white paper is dedicated to informing decision-makers at European, national, regional and local levels, as well as external stakeholders such as non-governmental organisations, fishing and seafood industry actors, scientific organisations and think tanks on the state of play of the digitalisation of small-scale fisheries in the EU.

The second white paper is an outcome of the 2nd Fish-X Conference, entitled "Digital traceability: Boosting sustainable seafood consumption in the EU" which took place in Brussels on 10 April 2024. This white paper seeks to inform decision makers at European,

[1] The summary of the conference is accessible here: https://fish-x.eu/wpcontent/uploads/2023/12/Report-Fish-X-Conference-27Oct2023-final.pdf

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national, regional and local levels, as well as external stakeholders such as non-governmental organisations, fishing and seafood industry actors, scientific bodies and think tanks on the state of play of digital traceability aimed at promoting seafood sustainability all along the supply chain.

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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1. White Paper 1 - The digital transition of small-scale fisheries in the European Union

1.1 Introduction

On 17 October 2023, the European Parliament approved the revision of the EU Fisheries Control Regulation in a landmark vote that followed five years of interinstitutional effort to review this key piece of legislation. The fisheries control rules are a cornerstone of the CFP to ensure the full and complete implementation of its provisions via monitoring, control and surveillance measures that deliver more sustainable fisheries management. The agreement of the revised Control Regulation also represents a turning point for EU fisheries, especially the small-scale fishing fleet, to move towards more digitalisation. In essence, the use of digital tools while fishing will become more predominant.

Within this context, this white paper explores the meaning of the digitalisation of EU small-scale fisheries (SSF), what it concretely entails for SSF and how the Fish-X project can provide a meaningful contribution to this change. The document will first provide an overview of the EU's broader push for a digital transition for the fishery sector. The second section will focus on characterising the EU's small-scale fishery and its current challenges. The third section will zoom out on the EU fishery regulatory and political context, which will be followed by a closeup in the fourth section on the new provisions contained in the revised EU Fisheries Control Regulation and the changes expected from SSF to comply with the new measures. Given the increasing amount of data that will be generated, the fifth section will give special attention to the Gaia-X framework which sets standards for data collection and exchange that will be applied by Fish-X when developing the data space. The main takeaways of the Fish-X conference will be detailed in the sixth section, which have been considered in preparing the policy recommendations presented in the final section.

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1.2 The EU digital transition applied to the fishery sector

In its Communication on the Shaping of Europe's digital future, the European Commission identified the digital transition as a key policy priority[2] that would deliver benefits for every citizen, businesses and the planet. Digitalisation can be understood as the "integration of digital technologies into everyday life where contemporary technologies can transform socioeconomic, environmental, sustainability and climate research applications",[3] which would generate novel opportunities and accelerate the transition towards a more sustainable fishing sector and reverberate along the seafood supply chain.[4]

Applied to a fishery context, digitalisation refers to electronic catch data collection and transmission systems (e-logbooks, and any relevant use of technological tools such as smartphones); electronic monitoring systems or Remote Electronic Monitoring (REM), including closed-circuit television (CCTV) or sensors in nets; and spatial data collection tools such as satellite vessel localisation systems, e.g. automatic identification system (AIS), vessel monitoring system (VMS). A digital transition in the sector implies a gradual and ongoing process to build up the skills, technologies, and the necessary infrastructure to monitor, collect and process generated data for monitoring fishing activities. EU SSF are directly concerned by the digital transition due to requirements introduced in the revised EU Fisheries Control Regulation to better enforce Monitoring, Control and Surveillance (MCS) measures.

1.3 The EU small-scale fleet

Small-scale coastal fishing is defined by the European Maritime, Fisheries and Aquaculture Fund (EMFAF) Regulation as fishing activities carried out by marine and inland fishing vessels of an overall length of less than 12 metres and not using towed fishing gear, and by fishers on

[2] European Commission, Shaping Europe's Digital Future, February 2020. Accessible here: https://ec.europa.eu/commission/presscorner/detail/en/fs_20_278

[3] René Ceipek, Julia Hautz, Antonio Messeni Petruzzelli, Alfredo De Massis, Kurt Matzler, A motivation and ability perspective on engagement in emerging digital technologies: The case of Internet of Things solutions, Long Range Planning, Volume 54, Issue 5, 2021, 101991, ISSN 0024- 6301, https://doi.org/10.1016/j.lrp.2020.101991 .

[4] Neil J. Rowan, The role of digital technologies in supporting and improving fishery and aquaculture across the supply chain – Quo Vadis?, Aquaculture and Fisheries, Volume 8, Issue 4, 2023, Pages 365- 374, ISSN 2468-550X, https://doi.org/10.1016/j.aaf.2022.06.003 .

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foot, including shellfish gatherers.[5] This definition provides a baseline to characterise SSF, even though national definitions can have an expanded scope. The Food and Agriculture Organisation (FAO) goes beyond a technical definition and emphasises the socio-economic and cultural importance of SSF for coastal communities.[6]

In the EU, even though SSF employed 62,650 fishers in 2022, accounting for 75% of active fishing vessels and 48% of the crew, it only represented 7.5% of the gross tonnage and around 5.4% of landings.[7] SSF are facing several challenges, including the difficulty to access fish quota, competition with recreational fisheries, an aging workforce and a lack of digital literacy. SSF is not only an economic sector, but also deeply embedded into the livelihoods of coastal communities and produces unique traditional ecological knowledge.[8]

1.4 Overview of the EU fisheries legal and policy context

To ensure the sustainable management of marine biological resources and the long-term viability of the fishing sector, fisheries in the EU are managed by the CFP.[9] As stated in article 2 of the CFP, its ultimate objective is "to ensure that the activities of the fishing and aquaculture sectors are environmentally sustainable in the long term and are managed in a way that is consistent with the objectives of achieving economic, social and employment benefits". The CFP is a comprehensive legal framework complemented by other pieces of legislation focused notably on funding, fisheries control, and the marketing of fisheries and aquaculture products.[10]

When evaluated against its own objectives established under article 2, the CFP has not fully delivered on its ambition. First, although EU fisheries remain profitable,[11] economic

[5] Regulation (EU) 2021/1139 of 7 July 2021 establishing the European Maritime, Fisheries and Aquaculture Fund and amending Regulation (EU) 2017/1004

[6] See the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication, FAO, 2015. Accessible here: https://www.wto.org/english/tratop_e/rulesneg_e/fish_e/2015_fao_ssf.pdf

[7] Committee on Fisheries, REPORT on the small-scale fisheries situation in the EU and future perspectives, December 2022. Accessible here: https://www.europarl.europa.eu/doceo/document/A9-2022-0291_EN.html

[8] Said, A., Peri, I. and Molina, M., 2020. MedTEK: Traditional Ecological Knowledge of Mediterranean Small-scale Fishing Communities. Preliminary Findings in Cabo de Gata (Spain), Malta and Pantelleria island (Italy) sites. Published by Low Impact Fishers of Europe.

[9] Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013 on the Common Fisheries Policy

[10] Regulation (EU) 2021/1139 (and predecessors); Regulation (EC) No 1224/2009 (revision to be adopted); Regulation (EU) No 1379/2013.

[11] https://op.europa.eu/en/publication-detail/-/publication/bba413d1-484c-11ed-92ed-01aa75ed71a1

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performance has been deteriorating since 2019[12] and almost half of all EU fishers earn less than minimum wage,[13] while EU marine biodiversity is still under threat.[14] On this basis alone, the CFP's objective of achieving economic sustainability cannot be considered as achieved. Second, while the state of many fish populations has improved, overfishing persists in most sea basins and many stocks remain outside safe biological limits,[15] contrary to the objective of sustainably managing fisheries. In line with its objective to improve the collection of scientific data, the CFP did lead to a strengthened data collection regime and framework, but this has yet to be sufficiently implemented.[16] Finally, the more specific objectives listed under article 2(5) are only partly achieved, such as the gradual elimination of discards, given the persisting high levels of reported discards.[17] Further, the poor implementation of the so-called landing obligation (article 15), which aims to minimise unwanted catches and reduce the wasteful practice of discarding has, overall, not been complied with.[18] Modern tools such as REM and digital reporting tools can help address these shortcomings, as well as significantly improve data collection and SSF visibility. Finally, fully documented fisheries and effective control is of utmost importance to ensure transparency and compliance by the sector. To deliver this, implementing the measures laid out in the EU Fisheries Control Regulation, which mandates the use of the most efficient digital control tools (e.g. REM, VMS, e-logbooks), and enhanced catch recording and reporting is critical.

1.5 The digital transition foreseen by the revised EU Fisheries Control Regulation

[12] Ibid. Due notably to the adverse impacts of the COVID-19 pandemic and the war in Ukraine on the sector.

[13] https://wwfeu.awsassets.panda.org/downloads/wwf_cfp_socio_economic_impact_study_2021.pdf

[14] https://www.eca.europa.eu/Lists/ECADocuments/SR20_26/SR_Marine_environment_EN.pdf

[15] https://oceans-and-fisheries.ec.europa.eu/system/files/2022-06/com-2022-253_en.pdf

[16] https://eur-lex.europa.eu/legalcontent/EN/TXT/?uri=CELEX%3A52020DC0664&qid=1604498138038. 'The overall focus for the next years of the DCF should be on solidifying its implementation in continued cooperation with the MS. This includes addressing upcoming challenges (such as on protected, endangered and threatened species or broader ecosystem knowledge); responding to and integrating evolving data needs (as identified by end users); streamlining and simplifying processes; and further improving and harmonising methods and their application at sea-basin level.'

[17] https://op.europa.eu/en/publication-detail/-/publication/89868cc6-015f-11ec-8f47-01aa75ed71a1, Fish-X Deliverable 2.6 providing a Summary & Best Practices on Discards accessible here: https://fish-x.eu/wp-content/uploads/2024/01/FISH-X_D2.6_Discards-Paper_Final.pdf

[18] https://cinea.ec.europa.eu/publications/synthesis-landing-obligation-measures-and-discardrates_en ; https://cinea.ec.europa.eu/publications/synthesis-landing-obligation-measures-anddiscard-rates-mediterranean-and-black-sea_en

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The revision of the EU Fisheries Control Regulation addressed the need for better monitoring and control.[19] Following the European Commission's proposal to revise the Regulation, released on 30 May 2018, it took five years of interinstitutional negotiations to come up with an agreement. On 27 June 2023, the European Parliament Committee on Fisheries endorsed the provisional agreement. During the plenary session on 17 October 2023, the European Parliament approved the new EU Fisheries Control Regulation with 438 votes in favour, 146 against and 40 abstentions.[20] Given the green light of the European Council of the EU to the revised EU fisheries control system on 13 November 2023, the Regulation entered into force on 9 January 2024. The approved text contains a set of new requirements in terms of monitoring and control measures, including for the SSF segment which was previously exempted. When it comes to the tracking of fishing vessels mandated by the new Regulation, there will be a gradual implementation until all EU fishing vessels have installed a tracking device on board to enable localisation at sea. There are three thresholds of these installations that need to be reached: all vessels under to 12 meters in length must be equipped by 2026, all vessels between 9 and 12 meters by 2028, and finally the entirety of the EU fishing fleet by 2030. Whereas previously vessels under than 10 meters long were exempt, the new EU Fisheries Control Regulation enforces the mandatory electronic reporting of all catches within 4 years (i.e. by 2028), which will ensure accurate data on seafood catches. As stated in Article 15 of the Regulation, vessels below 12 meters shall electronically submit their fishing logbooks after the last fishing operation has been completed and before the landing starts. If requested by Member States within four weeks after the entry into force, the Commission will develop a system for a fishing logbook for SSF. By means of implementing act and six months after the date of entry into force of this amending Regulation, the Commission would lay down detailed rules, including on the frequency of fishing logbook data submissions.

With regards to REM and the installation of CCTV, these will be required for vessels above 18 meters in length or for boats which constitute a "high risk" of being non-compliant with the rules (with "high risk" being defined at a later stage via an implementing act). Concerning traceability, the law requests additional key data elements (KDE) for catch certificates such as the common fleet register (CFR) number, the estimated quantities of each fish species retained on board with the quantities or individuals below the applicable minimum conservation reference size, and the estimated quantities of each species discarded. All catch certificates will have to be digitalised and encoded into the EU's electronic database. Finally,

[19] Regulation (EU) 2023/2842: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L_202302842

[20] Press release of the EU Parliament, Parliament approves new EU fisheries control rules, 17 October 2023, accessible here: https://www.europarl.europa.eu/news/en/pressroom/20231013IPR07124/parliament-approves-new-eu-fisheries-control-rules

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within five years after entry into force of the Regulation, a digital traceability system will need to be up and running to collect several KDEs for all seafood products, including processed and preserved, wild-caught and aquaculture products.

Fully documented fisheries cannot be achieved without the digital transition. Digital technologies, such as VMS, electronic logbooks, onboard sensors and traceability systems play a vital role in achieving full documentation. Digital technologies enable SSF to participate in fully documented fisheries by providing the means to collect and transmit real-time tracking and recording data accurately, efficiently, and transparently. Digital tools will ensure that all fishing activities are fully documented and traceable from catch to market, reducing the chances of illegal, unreported, and unregulated (IUU) fishing. Effective fisheries control measures are strengthened by the availability of reliable digital data, allowing authorities to make informed decisions, allocate resources effectively, and enforce regulations more rigorously. In summary, the digital transition of SSF, when coupled with fully documented fisheries and effective fisheries control measures, contributes to improved sustainability, transparency, and governance in the fishing industry. These elements work together to address key challenges such as overfishing, IUU fishing, and resource management in a more comprehensive and effective manner.

1.6 Gaia-X framework for SSF data production and exchange

With regards to fisheries data exchange in the EU, the FLUX format, which is the official fisheries data format developed by the EU Commission,[21] is the norm. As a result of implementing the revised EU Fisheries Control Regulation, more data coming from SSF will be collected, stored, exchanged and processed. Current digital infrastructure will need to adapt to this foreseen change, which is why Fish-X is developing a Fish-X data space to securely and efficiently handle large amounts of data.

There are similarities between the FLUX format and the protocol of the Fish-X data space. Fish-X proposes a general standard for exchanging data in the SSF domain, based on Gaia-X.[22] Gaia-X is an EU initiative focused on crafting a software framework for regulating,

[21] Here for more information on the FLUX format: https://joinup.ec.europa.eu/collection/ifdmintegrated-fisheries-data-management/solution/flux-tl

[22] Website of the Gaia-X initiative: https://gaia-x.eu/

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governing and hosting cloud and edge technologies. It establishes a shared set of policies and regulations to promote transparency, controllability, portability and interoperability across data and services. Gaia-X's architectural foundation is rooted in the decentralisation principle, whereby the structure is spread over smaller entities, not relying on one single central authority. The result is a cooperative ecosystem of individual platforms that brings together all relevant fisheries stakeholders under a common standard for data input. The Gaia-X standard is dedicated to developing a data infrastructure founded on the principles of openness, transparency and trust. What emerges is not a unique cloud (i.e. computer system resource), but a networked system that links many cloud service providers together.

Through Gaia-X, the formation and enhancement of data spaces are facilitated by trusted platforms that follow stringent and consistent rules. Its framework fosters mutual trust between users and providers on an open technological basis, free to be used by everyone, allowing users to exchange data securely across multiple entities. The Fish-X dataspace builds on the Gaia-X framework and offers its users the accompanying benefits of guaranteeing secure data exchanges. Therefore, the Fish-X project aims to incorporate the FLUX standard as one way among others to exchange SSF data in the Fish-X data space.

1.7 SSF and the digital transition: Takeaways from the Fish-X conference on 27 September 2023

The Fish-X project seeks to propose concrete applications of digital solutions that empower SSF and enhance the analysis of marine data. The hybrid conference on the digital transition of SSF explored how to operationalise the measures of the revised EU Fisheries Control Regulation that seek to digitalise the small-scale vessel fleet, and to bring more transparency and traceability to fishery products.

During the morning panel discussion, it was highlighted that the enforcement of the new control law will increase data sharing between Fisheries Monitoring Centers within Member States and with those outside the EU which should follow the EU standard, namely the UN/FLUX ((Fisheries Language for Universal Exchange) standard. The OceanStore project, which revamps the Commission’s fisheries data ecosystem and underlying applications, delivers common features for all FLUX domains and services to Member States to ensure interoperability and data quality regarding vessel positions, catch reports and aggregated catch data. In addition, DG MARE has been testing the RecFishing programme whereby marine

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recreational fishers report their catches.[23] Another point was raised about how the increased amount of data generated by and with SSF going digital will make them more visible on a governance level. Regarding the legal aspect of data sharing and data processing, fisheries data may be considered as personal if related with the identification of a natural person and shall comply with protection measures as laid down in the General Data Protection Regulation (GDPR). Finally, the inclusion of civil society in this process was emphasised to ensure SSF buy-in of digital tools.

A breakout session was dedicated to better understanding the challenges and benefits of the digital transition for SSF. Digitalisation could be used to reduce administrative burden, empower fishers to be owners of their own data, improve fisheries management, increase seafood traceability, and improve safety at sea while providing greater market access, including for high-value products. As regards to the challenges, fears revolve around losing control over the generated data, the aging of the fishers, the possible flaws in the digital tools' design, the lack of digital literacy, the costs associated with such tools, the top-down enforcement and, finally, the incompatibility between tools and the real-life conditions of the fishing sector (i.e. swell, rain, wind). Therefore, to achieve successful digitalisation, efforts should be made to educate and build capacities for fishers and fishers' associations, to build trust, to demonstrate the tangible and clear benefits of embracing new technologies, to codesign the tools, and to seek institutional support whether financial or regulatory.

Further discussion took place on Gaia-X and the future Fish-X data space which will collect all VMS data and other fisheries datasets. The data space shall ensure automatic quality control checks to secure data exchanges between fishers, the EU Fisheries Control Center, national authorities and the European Commission.

In addition, a breakout session touched upon the Insight web portal developed by Fish-X, which receives, anonymises, aggregates and displays fisheries data on charts. The process is specific, as it ensures that data providers (fishers, in this case) remain assured of their data ownership and control its usage.

Finally, another breakout session focused on the traceability platform to be developed under the Fish-X project, which aims to provide relevant information regarding all supply chain actors involved in the harvest and production of a given seafood product, as well as additional information such as sustainability indicators. This would bring benefits such as reducing IUU fishing, preventing greenwashing and false green claims, and providing a fair and transparent

[23] https://recreational-fishing.ec.europa.eu/

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value chain. Ultimately, the platform will work towards greater sustainability and fairness in the fishery sector.

1.8 Recommendations

To support new digital requirements in ways that are beneficial for small-scale fisheries in the EU, the Fish-X consortium recommends the following:

Build trusted relationships with fishers: Engaging fishers along the digital transition is key to match the reality of SSF and to effectively comply with EU regulations. Empowering SSF should be at the centre of endeavours to improve their visibility and representativity in fisheries management and maritime spatial planning. Fishers should also be part of the designing process of the digital tools they will ultimately use.

Foster scientific knowledge: The digitalisation of SSF can be of great value to scientific knowledge by collecting quality data to be shared with relevant stakeholders such as maritime authorities or science centres (i.e., on species presence and abundance, stock fluctuations), which would contribute to improved science-based stock management.

Inclusive and sustainable fisheries management: Giving SFF a voice in the decision-making process is essential for better representativity and sense of ownership by the sector. Fishers' socioeconomic and ecological knowledge must be integrated with the collected data to inform policies that value low-impact fisheries and protect marine biological resources, habitats and threatened, endangered and sensitive species.

Interoperability: Careful attention should be given to ensure datasets are interoperable and shareable between systems and across governance levels - whether local, regional or international - with special emphasis on the protection of fishers' privacy. Accessibility to and replication of these systems for wider use is also essential.

Standardisation: Data collection and submission processes must follow a given standard (i.e. be based on the Gaia-X framework) to facilitate exchanges among Fisheries Monitoring Centers, as well as more widely with other stakeholders to ensure quality and reliable data (i.e. collected by VMS, logbooks). For fishery data exchanged within the EU, the FLUX format is the norm and should apply. For seafood traceability, the international standard of the Global Dialogue for Seafood Traceability (GDST) should be the reference.

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2. White Paper 2 – Digital traceability driving sustainable seafood consumption in the European Union

2.1 Introduction

This document aims to support the effective implementation of the European fisheries and seafood market management as laid down in the EU Common Market Organisation Regulation (CMO)[24] and in the revised EU Fisheries Control Regulation.[25] Therefore, this white paper puts forward recommendations to advance the development of a digital traceability system, taking into account all stakeholders along the seafood value chain with a focus on SSF in the EU. Ultimately, this paper showcases the benefits of a digital traceability system to enable sustainable seafood supply and consumption, fair economic returns for small-scale fishers and reliable information on seafood products for consumers.

According to the European legislation on food law and food safety, traceability is defined as "the ability to trace and follow a food, feed, food-producing animal or substance intended to be, or expected to be incorporated into a food or feed, through all stages of production, processing and distribution".[26] Article 18 of the same law specifies the conditions to achieve a robust traceability, indicating that these should (1) be established at all stages of production, processing and distribution, (2) provide the supplier's identification, (3) indicate a system and procedure to identify the supplier and share information with authorities, and (4) provide food and feed labelling or identification.

Fishery and aquaculture products are subject to special rules covered by the CMO which include the marketing standards defined in three older Regulations from the Council of the

[24] Regulation (EU) No 1379/2013 of the European Parliament and of the Council of 11 December 2013 on the common organisation of the markets in fishery and aquaculture products, amending Council Regulations (EC) No 1184/2006 and (EC) No 1224/2009 and repealing Council Regulation (EC) No 104/2000

[25] 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

[26] Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety

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European Union.[27] These marketing standards set out seafood quality characteristics and certain requirements for a given product's content and presentation. They apply to both EU and non-EU products placed on the EU's internal market. A revision of the marketing standards was expected in 2022 to allow for "modern, sustainable marketing standards for seafood to provide comparable information to consumers and operators in the supply chain on the environmental and social sustainability of seafood and on its carbon footprint".[28] However, its revision was delayed until the new European Commission takes shape in autumn 2024 and unveils its programme.

This document is divided into six main sections, kicking off with a description of traceability measurement tools and technological innovation. The second section dives into the new requirements on traceability stemming from the revised EU Control Fisheries Regulation, providing tools to collect comprehensive data on seafood. The third section leverages new technological solutions and regulatory rules to foster sustainable seafood consumption. The fourth section digs into the traceability platform developed by Fish-X that is tailored to the needs of SSF. The fifth section provides a short summary of the discussion that took place at the second Fish-X in person conference on the same topic. Finally, based on the previous sections, this white paper concludes with recommendations to European and national fishery authorities, producers, seafood businesses and technology providers.

2.2 Traceability for trustworthy seafood

2.2.1 Improving fisheries management with traceability

Fishery and aquaculture products are among the most traded commodities in the world.[29] The EU is one of the largest seafood markets worldwide, with imports of seafood products supplying up to 70% of is the total amount of seafood consumed in the EU.[30] With such

[27] Regulation 2406/96 for certain fishery products, Regulation 1536/92 for preserved tuna and bonito and Regulation 2136/89 for preserved sardines and sardine-type products.

[28] Communication from the Commission to the European Parliament, the Council, the European Economic and social Committee and the Committee of the regions on a new approach for a sustainable blue economy in the EU Transforming the EU's Blue Economy for a Sustainable Future, COM/2021/240 final, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021DC0240

[29] Food and Agriculture Organisation (FAO), Trade in fisheries and aquaculture products: a major, international commodity, 2021. Retrieved from https://openknowledge.fao.org/server/api/core/bitstreams/9fb67a0f-c305-49d6-89d9-4499139ce341/content

[30] EUMOFA, The EU fish market, 2024. Retrieved from: https://eumofa.eu/the-eu-market

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extensive trade of seafood products, ensuring robust and verifiable traceability is key for three main reasons. First, traceability is a requirement to track a given product back to where it was caught, by whom, and with what fishing gear. Second, transmitting Key Data Elements (e.g. weight/quantity of catch, vessel name, vessel registration, gear type, catch area, species,) along the seafood supply chain is needed to prevent seafood products deriving from illegal, unreported and unregulated fishing from entering the EU market. With one out of six fish imported in the EU at risk of being untraceable, much still needs to be done.[31] Finally, traceability provides authorities with the information needed to assess the sustainability of a product, including economic, social and environmental impacts of given fishery and aquaculture products. Traceability helps secure healthy fish populations, fair living standards and decent income for fishers, and better information for consumers.

2.2.2 Traceability markers along seafood supply chains

Traceability is measured by the collection of KDE across Critical Tracking Events (CTE). The KDEs are "critical data that are required to successfully 'trace' a seafood product and/or its ingredients through all relevant CTEs within the supply chain".[32] The CTEs are considered as a "point in the supply chain where a seafood product is moved between actors, premises, or is transformed, or at a point which is determined to be where data capture is necessary to maintain traceability".[33] CTEs cover the whole seafood supply chain and involve the phases of production, landing, transportation, transformation and depletion. As an example, the Dover sole (*Solea solea*) is a demersal flatfish species caught by British beam trawlers and sold in auction houses at Brixham, Newlyn and Plymouth in the southwest of England. Thereafter, Dover sole is bought by processors, export companies, wholesale markets or fishmongers, with 79% of landings being ultimately exported from England in 2021.[34]

[31] WWF, Seafood traceability, exemptions risk fuelling illegal fishing, 2021. Retrieved from https://wwfeu.awsassets.panda.org/downloads/wwf_seafood_treacability___exemptions_risk_fuelling_illegal_fishing_jan_2021.pdf

[32] Data Requirements for Catch Documentation and Traceability in Southeast Asia: Critical Tracking Event and Key Data Element Framework and Glossary, Tetra Tech, 2017. Retrieved from: https://www.researchgate.net/publication/377181581_Data_Requirements_for_Catch_Documentation_and_Traceability_in_Southeast_Asia_Critical_Tracking_Event_and_Key_Data_Element_Framework_and_Glossary

[33] Ibid.

[34] C.R. Hopkins, S.I. Roberts, A.J. Caveen, C. Graham, N.M. Burns, Improved traceability in seafood supply chains is achievable by minimising vulnerable nodes in processing and distribution networks, Marine Policy, Volume 159, 2024,105910, ISSN 0308-597X, https://doi.org/10.1016/j.marpol.2023.105910

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The United Nations FAO steers global traceability by providing technical guidance on how to ensure robust traceability with a thorough gathering of KDEs at key moments along the seafood value chain. The FAO also sheds light on private initiatives such as the Global Dialogue for Seafood Traceability (GDST).[35] Building on internationally recognised Global Standards 1 (GS1), the GDST has developed traceability standards and guidelines to be followed by seafood companies across the globe to enable trade and sale of seafood products as well as seafood-related data exchange. The Electronic Product Code Information Services (EPCIS) format is used by the GDST as a global standard to share supply chain information.[36] Adhering to these standards enables the interoperability of digital traceability systems, thus facilitating effective data sharing and verification. However, seafood traceability remains underdeveloped and fractured across geographies and sectors. Gaps have been observed with regards to awareness, commitment, technology and standards as well as inconsistencies within and between institutions.[37] This points to the need for increasing the adoption of international recognised standards and consistent reporting of key data elements along supply chains.

2.2.3 Digital traceability system

Moving from a paper-based to an electronic traceability system allows for automatic, accurate, uniform and harmonised data collection. It also facilitates data exchanges between various operators located in different parts of the world. In the context of a globalised seafood market with multiple supply chain operators, having a robust digital traceability system in place is essential to deliver key information about a given food product's journey from sea to plate.

[35] Blaha, F., Vincent, A. & Piedrahita, Y. 2023. Guidance document: Advancing end-to-end traceability – Critical tracking events and key data elements along capture fisheries and aquaculture value chains. Rome, FAO. Retrieved from: https://doi.org/10.4060/ cc5484en

[36] GDST, Standards & Guidelines for Interoperable Seafood Traceability Systems — Core Normative Standards (Version 1.2), June 2023. Retrieved from: https://thegdst.org/resources/standard/

[37] FAO. 2016. Seafood traceability systems: gap analysis of inconsistencies in standards and norms, by Melania Borit and Petter Olsen. Fisheries and Aquaculture Circular No. 1123. Rome, Italy

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2.2.4 Existing digital traceability initiatives for small-scale fisheries

Digital traceability systems need to adapt to the scale of the fleets, especially for small-scale ones which do not have the same means as larger ones. Two initiatives showcase how SSF are using digital traceability tools.

Launched in South Africa, ABALOBI is a not-for-profit initiative developing technological solutions adapted to the needs of small-scale communities in areas such as data collection, skill-building and establishing a cooperative marketplace. The technologies are co-designed in partnership with small-scale fisheries communities to achieve the main objectives that are to promote fair market access, transparent supply chains, and broader food security.[38] In addition, 88% of participant fishers declared that they were "food secure" after one year of engagement with ABALOBI.[39]

TrazApp is another example of the use of technology to support sustainable SSF. Developed by WWF-Peru jointly with actors from the artisanal fisheries supply chain and government entities, Trazapp is an Electronic Catch Documentation and Traceability System (eCDT) aimed at improving food safety, legality and product quality. In addition, the purpose of Trazapp is to allow all stakeholders along a given supply chain to access, share and connect information in a digital manner and in a simple way with a mobile application and web platforms.[40] The project participated in reducing illegal, unreported and unreported fishing and to match an increased international demand for sustainable and legal fishing. As a result, policy recommendations were drawn up such as ensuring equitable access by fishers to eCDT and to identify and highlight needs, incentives and benefits for fishers from the beginning.[41]

These two examples showcase how technology can be used to advance the digitalisation of SSF in areas such as better traceability, improved communication between actors involved in the seafood value chain, and reinforcing local capacity of small-scale communities. Importantly, these examples underscore the importance of digital tools being easy-to-use, user-friendly and co-developed with the SSF community.

[38] https://abalobi.org/
[39] https://abalobi.org/impact/#tbl
[40] https://www.trazapp.org/
[41] Leslie, A., Lugo-Mulligan, F., (2021). The Application and Evolution of eCDT Systems in Seafood Supply Chains: Addressing the Issue of Governance. A report for WWF.

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2.3 Dive into the revised EU Control Fisheries Regulation

Entering into force on 9 January 2024, the EU Fisheries Control Regulation introduces major changes to the EU monitoring, control and surveillance obligations of the EU fishing sector.[42] This piece of legislation brings policy coherence to key EU fishery legal texts operating under the umbrella of the EU CFP. For example, the revised Control Regulation promotes a transition towards fully digital EU fishing fleets, requests the recording of landing declaration data regardless of vessel size, as well as the recording of minimum traceability information for fishery product lots (i.e. a batch of units of fishery or aquaculture products).

On the external dimension, a digital information management system will be put in place for imports and exports outside of the European Union (CATCH system) to be integrated into the Trade Control and Expert System (TRACES).

All fishing vessels are now obliged to electronically report their catches and to have a fully functioning tracking device or application on board to respond to the law's requirement for a VMS. A REM system is also now mandatory for vessels above 18 metres that are at high risk of non-compliance with the landing obligation, which requires all species subject to catch limits to be landed. The geolocation of all vessels at sea, including small-scale vessels, allows for precise identification of a given catch area. Coupled with the unique fishing trip identification number that is generated by the electronic fishing logbook for each fishing trip, the information now provided by the fishers allows for more comprehensive traceability, and closer monitoring of the volume and composition of catches.

2.3.1 Article 58 on traceability rules

Article 58 of the EU Fisheries Control Regulation lays out the traceability provisions for lots of fishery and aquaculture products which must be traceable at all stages of production, processing and distribution, from catching or harvesting to retail. Paragraph 5 of Article 58 details the list of information to be made available:

[42] DG Mare, The EU fisheries system gets a major revamp, 2024. Retrieved from: https://oceans-and-fisheries.ec.europa.eu/news/eu-fisheries-control-system-gets-major-revamp-2024-01-09_en#:~:text=The%20regulation%20enters%20into%20force,years%2C%20from%2010%20January%202026

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(i) identification number of the lot,

(ii) for products not imported into the Union: unique fishing trip identification number for fishery products or the name and registration number of the producer for aquaculture products,

(iii) for imported products: the IMO number (unique ship identifier) or the registration number of the aquaculture production unit,

(iv) FAO alpha-3 code of the species and scientific name,

(v) relevant geographical area for fishery products caught at sea,

(vi) category of fishing gear,

(vii) date of catches,

(viii) quantities in kilogrammes.

Operators are required to ensure that these data sets are kept on record and made available to the operators to whom the products are supplied. This implies the use of inter-operable systems along the value chain.

2.3.2 Minimum traceability information for prepared and preserved seafood

Paragraph 9 of Article 58 of the EU Fisheries Control Regulation indicates that the European Commission should conduct a feasibility study on traceability systems and procedures, including minimum traceability information, for fishery and aquaculture products falling under heading 1604 and 1605,[43] which are "Prepared or preserved fish; caviar and caviar substitutes prepared from fish eggs" and "Crustaceans, molluscs and other aquatic invertebrates, prepared or preserved" with a view to defining rules for such products. It is also specified that the study should include an analysis of available digital solutions or methods which meet the requirements on traceability.

[43] European Commission, Explanatory notes to the combined nomenclature of the European Union, Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52015XC0304(03)&from=GA

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2.4 Towards seafood sustainability assessment

As detailed in the communication of the European Commission for a sustainable blue economy in the EU, the revision of the Marketing Standards for fishery and aquaculture products should take into account the environmental and social sustainability of seafood and its carbon footprint. Considering the various challenges faced in European waters by the fisheries sector when it comes to overfishing, high rate of bycatches, carbon footprint of the fisheries and seafood sectors, and impacts of human activities on the seabed and coastal ecosystems, the seafood sector has a responsibility to reduce its environmental impacts and to be more transparent on the sustainability assessment of its products. Traceability is a powerful tool to gather various information on fishery and aquaculture products that can be screened against a series of criteria to assess seafood sustainability levels, and ultimately inform consumers on the environmental impact of the seafood they buy.

The CMO aims to establish a level playing field for all seafood products marketed in the EU by reinforcing the capacity of the seafood sector with a network of 200 producer organisations, defining clear marketing standards, requiring food labelling that provides a minimum amount of information to consumers, outlining competition rules and improving market intelligence.[44] However, in the implementation report on the CMO released in February 2023, the European Commission points out that the existing framework plays a limited role in ensuring that products marketed in the EU are sustainable, requiring a revision of the marketing standards and a harmonised EU approach to sustainable food production.[45] As a follow up, the European Parliament issued a report, as part of its right of initiative to write a report and present a motion for a resolution, to echo the need for improving consumer information on sustainability, tackling mislabelling, as well as simplifying and modernising the marketing standards.[46]

[44] Regulation (EU) No 1379/2013 of the European Parliament and of the Council of 11 December 2013 on the common organisation of the markets in fishery and aquaculture products, amending Council Regulations (EC) No 1184/2006 and (EC) No 1224/2009 and repealing Council Regulation (EC) No 104/2000

[45] Implementation of Regulation (EU) No 1379/2013 on the common organisation of the markets in fishery and aquaculture products, COM(2023)101 final

[46]Report on the implementation of the Common Market Organisation (CMO) Regulation in fisheries and aquaculture - Regulation (EU) 1379/2013 (2023/2049(INI)). Retrieved from: https://www.europarl.europa.eu/doceo/document/A-9-2023-0406_EN.html.

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2.4.1 The Sustainable Food Systems Framework Law

In 2020, the European Commission announced the proposal for a legislation on sustainable food systems framework (SFSF) as part of the "Farm to Fork" strategy. While the SFSF proposal was expected to be released by October 2023, it has still not been published, despite its key role to bring sustainability to the forefront of the design of food production systems.

The new European Commission should not delay in delivering this long-overdue proposal and should make sure it includes three policy instruments: minimum requirements to push for more sustainable practices, a sustainability labelling scheme to empower consumers to make informed and sustainable food choices, and a sustainable public procurement mechanism.[47] The policy instrument on labelling should be either a voluntary or mandatory scoring label for all food products, regardless of whether they are domestic or imported.

While the SFSF will cover all food product types, seafood will need to be tackled in a specific way given its unique nature of being a common good, collectively managed under a European regime with the CFP, and supplied by both wild-capture fisheries and aquaculture. Therefore, possible options to measure seafood products sustainability should be developed by the Scientific Technical and Economic Committee for Fisheries (STECF).

2.4.2 The development of fishery sustainability indicators

The STECF is mandated by the European Commission to develop fishery-specific sustainability criteria and indicators to better assess the sustainability of seafood products.[48] Eight measurable and verifiable criteria were selected: fishing pressure, fisheries management, impact on endangered, threatened, protected (ETP) and sensitive species, unwanted landings and discards, impacts on the seabed, impact on marine food webs, carbon footprint, and waste and pollution.[49] Identified as key sustainability issues, three of these

[47] DG SANTE, Food information to consumers - legislation, 2024. Retrieved from: https://food.ec.europa.eu/safety/labelling-and-nutrition/food-information-consumers-legislation_en

[48] Scientific Technical and Economic Committee for Fisheries, Fishery sustainability indicators, 2024. Retrieved from: https://stecf.ec.europa.eu/index_en

[49] European Commission, Joint Research Centre, Scientific, Technical and Economic Committee for Fisheries, Druon, J., Gascuel, D., *Scientific, Technical and Economic Committee for Fisheries (STECF) – Criteria and indicators to incorporate sustainability aspects for seafood products in the marketing standards under the Common Market Organisation (STECF-20-05)*, Druon, J.(editor), Gascuel, D.(editor), Publications Office, 2021, https://data.europa.eu/doi/10.2760/211065

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indicators were selected to develop a scoring system, namely: fishing pressure, impact on ETP and sensitive species, and impact on the seabed.

To fine tune the scoring system, the STECF recommends the revision of the CMO to better define types of fishing gear to distinguish, for instance, gear used in pelagic versus demersal fisheries. In addition, the STECF is calling for the CMO revision to require full and robust traceability of products originating from non-EU, waters which the implementation of the CATCH IT system under the revised EU Fisheries Control Regulation would help to ensure. CATCH IT is an EU-wide information technology system to manage the EU catch certification scheme for fishery products entering the EU market.[50]

2.4.3 Initiatives to assess seafood sustainability

Initiatives to integrate different criteria to assess a given fishery's sustainability already exist at national level, such as Valduvis in Belgium or VAL+ in Portugal.

Valduvis is a tool to measure and visualise the sustainability of Belgian fisheries. The tool consists of 11 indicators (five ecological, three social and three economic) presented in a 'sustainability star'. Via Valduvis, the sustainability data of the entire Belgian fisheries sector, can be easily displayed on the tool, facilitating comparison to the wider fleet performance. This can be done at the level of an individual vessel as well as for the entire fleet and both for one individual sea voyage and for several years.[51] However, the assessment of multispecies fisheries can require further work to come up with an overarching indicator including stock status, discards and retained species.[52] It should be noted that this tool has been developed for a relatively limited fleet, as Belgium has just 64 vessels, of which half are small-scale.[53] Therefore, the replicability of this tool for a greater number of vessels and for multispecies fisheries will require careful assessment.

VAL+ was a project developed by Docapesca, Sciaena and the Portuguese Society for Birds Study in Portugal. Its objective was to develop and test a series of criteria to assess the

[50] Frequently Asked Questions, WHAT IS NEW IN THE EU CATCH CERTIFICATION SCHEME AFTER THE AMENDMENT OF THE EU IUU REGULATION (May 2024). Retrieved from: https://oceans-and-fisheries.ec.europa.eu/document/download/4b92c8f5-9f96-46ec-babc-3bc880ff4ad3_en?filename=FAQ-amendment-IUU-Regulation_en.pdf&prefLang=fr

[51] https://valduvis.be/

[52] Arne Kinds, Kim Sys, Laura Schotte, Koen Mondelaers, Hans Polet, VALDUVIS: An innovative approach to assess the sustainability of fishing activities, Fisheries Research, Volume 182, 2016, Pages 158-171, ISSN 0165-7836, https://doi.org/10.1016/j.fishres.2015.10.027.

[53] ANNUAL FLEET REPORT 2021 – Belgium 'Sustainable balance between fishing capacity and fishing opportunities' 31.5.2022

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sustainability of SSF and create a sustainability matrix which could then be used by anyone to assess their fishery's performance. The final criteria were decided with the scientific guidance from the Portuguese Institute for the Ocean and Atmosphere and were tested with several fisheries along the Portuguese coast. The matrix includes 35 indicators used to measure social, economic, environmental and fisheries management dimensions.[54]

At the transnational level, WWF has proposed its own methodology: the WWF Common Assessment Methodology (CAM) assesses the sustainability of seafood species from wild-capture fisheries and aquaculture, translating the results into a color-coded 'traffic light' system. Used for the WWF seafood guide, the CAM accompanies consumers in choosing their seafood products.[55] The methodology for assessing wild-capture fisheries is comprised of 25 criteria that are grouped under three umbrella categories: addressing the stock status, the environmental impacts and the quality of the fishery management. A selection of assessments is reviewed on a yearly basis to keep the CAM up to date.

Digital traceability can be harnessed to encourage more sustainable choices and practices, leading to the achievement of desired changes in supply and consumption patterns with environmental benefits. The Fish-X project aims to put useful technologies in the hands of SSF, to support them in sustaining socio-economic activities that are respectful of marine ecosystems and continue to provide jobs in coastal areas.

2.5 The Fish-X Traceability Platform

One of the major technological outcomes of the Fish-X project will be the development of a prototype for a Traceability Platform, specifically tailored to the needs of SSF in the EU. It will be based on the Traceability Platform framework established by OURZ, one of the Fish-X consortium partners, and adjusted according to the results of a dedicated practical use case. To this end, OURZ has set up meaningful collaborations with relevant stakeholders across the entire seafood supply chain, effectively following a co-development approach to inform the successful implementation of the Traceability Platform.

To ensure a holistic execution, an exemplary seafood supply chain model was used as a starting point. Four separate supply chain steps were defined (namely fishing operations;

[54] https://www.valmais.com/

[55] https://wwf.panda.org/act/live_green/out_shopping/seafood_guides/methodology/

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transportation and storage; processing and packaging; branding and retailing) to guide the overall platform development process. For each of these steps, a thorough analysis was conducted and information from various sources were incorporated, such as the collaboration with trial partners, regulatory requirements, market and bibliographic research, as well as discussions and conclusions from a series of Fish-X events. This process allowed for effective preliminary scoping of the individual interfaces on the platform, which will be continuously refined and adjusted throughout its incremental development and testing until the end date of the Fish-X project.

The Traceability Platform aims to be tailored to the needs and specifications of the SSF sector while adhering to the regulatory requirements set out by the EU. In addition, it aims to support the sustainable sale and consumption of seafood in the EU. In this vein, OURZ is therefore also developing a consumer-centric app which will allow informed and conscious purchasing by providing consumers with detailed information regarding the origin and journey of their seafood, as well as other relevant insights pertaining to the sustainability of any given product. The specificity of the Fish-X traceability platform relies on its focus on the Baltic region, its emphasis on the SSF sector, as well as the objective to effectively combine sustainability-focused messaging with regulatory compliance.

2.6 Digital traceability driving sustainable seafood consumption: Takeaways from the second Fish-X conference

The second Fish-X conference took place on 10 April 2024, gathering 42 participants from EU institutions, research institutes, civil society and the fisheries sector, as well as fisheries advisors from national authorities.[56] The conference's objective was to explore how digital traceability can steer sustainable seafood consumption by effectively implementing relevant EU legislation and providing meaningful information to consumers.

The first panel discussion revolved around the implementation of new traceability measures in the revised EU Fisheries Control Regulation. The discussion highlighted the need for

[56] The summary report of the conference is available here: https://fish-x.eu/wp-content/uploads/Report-Fish-X-Conference-10-April-2024.pdf

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ensuring accurate, consistent and harmonised collection of traceability data across all supply chain actors as well as across national authorities. Traceability should also be made profitable and tailored to the needs of producers, including small-scale segments, to provide accurate information to consumers and better differentiate locally-caught products from imported ones. As a key word often cited, interoperability of data and devices is essential to speed up exchanges and complete assurance checks. Traceability is key to enable trustworthiness in seafood certification schemes, such as the Marine Stewardship Council. The collection and exchange of data should follow global standards such as the ones developed by the GDST. Finally, transparency requires granular information collection and comprehensive coverage of the entire seafood value chain, including the food service sector.

A technical session focused on policy tools, i.e. labelling, certification and sustainability ranking, to boost seafood sustainability. The session found that effectiveness of policy tools depends on their mandatory or voluntary application, public or private initiative, more or less obvious and visible display to the consumer, among other components. Further, implementation of the EU Fisheries Control Regulation could be hindered by the quantity of collected data, the implementation timeline's feasibility, changing political contexts, as well as the buy-in and capacity of relevant stakeholders. There is a need to clearly define sustainability, to adopt a holistic approach and a sound methodology for how to rank sustainability, to require the same information for fresh, frozen, prepared and processed products regardless of whether they are sourced in the EU or imported, to require this information along the entirety of the food service sector, and to build sufficient capacity to process the data collected by digital tools (i.e. REM, logbooks, VMS).

The second technical session examined the main traceability challenges faced by seafood supply chains and solutions to overcome these. Challenges raised included the lack of IT infrastructure and of technical capability, knowledge gaps on regulations, compliance issues for some actors, as well as the provision of standardised and verifiable data on traceability and access to this data by consumers. Suggestions for improvement included reinforcing capacity for meeting the traceability's requirements, showcasing the benefits of reporting traceability information for fishers, fostering interoperability of data exchanges among small-scale organisations, provoking a mentality shift about fishery data disclosure under certain conditions, promoting a collective approach to designing traceability tool, and valuing products sourced from transparent supply chains.

Finally, the conference ended with a second panel discussion on the use of digital traceability tools to increase consumption of sustainable seafood products. Several initiatives were presented, such as the Metro business-to-business digital tool that utilizes a QR code to share

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a wealth of information on the origin and composition of fresh and frozen products. Another example from France showcased fish boxes delivered by Poiscaille with a selection of seafood products originating from low-impact and local fisheries. The Fish-X traceability platform was also presented as a blockchain based technology with the aim of providing a marketing and differentiation tool while also ensuring regulatory compliance throughout the SSF sector. The WWF CAM for grading the sustainability of seafood products was showcased as a relevant tool for setting time-bound and ambitious goals from seafood retailers for the products they sell, and to provide clear information for consumers to make more-informed and sustainable purchasing choices.

2.7 Recommendations

Based on the outcomes of the second Fish-X conference and on learnings accumulated since the Fish-X project started, a series of policy recommendations is presented below. To support the meaningful development of digital traceability systems, the Fish-X consortium recommends to European and national fishery authorities, producers, seafood businesses and technology providers the following:

Traceability requirements should be coherently applied as laid out in the EU's Marketing Standards for fishery and aquaculture products, the Common Market Organisation and the Fisheries Control Regulation. The requirements should apply to processed and prepared products, as is already done for fresh and frozen products, as well as to imported and domestically-produced products. The information displayed to consumers should be standardised for all retail actors, including the food service sector. Supplying granular and reliable information, including more precise data on the catch area, is crucial for efficiently assessing the legality and safety of seafood products and ultimately improving fisheries management.

Improve data collection along the entirety of the value chain with comprehensive and robust data sets, including for processed and prepared seafood products. Collected data should be made available for scientific purposes, including the work conducted by scientific bodies such as the STECF and the International Council for the Exploration of the Sea. Establishing benefits and opportunities for better data collection would be beneficial for improving monitoring programs and overall transparency of the seafood industry.

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Data exchange should occur in an interoperable, harmonised, and standardised way. The GDST standards – which are based on the internationally-recognised "Global Standards 1" but applied to seafood - offer a strong guidance for software development to exchange data. Data ownership by fishers and supply chain actors is an important part of building trust with all involved stakeholders. Specific and robust strategies for achieving high levels of stakeholder engagement, such as workshops and consultations, should be put in place.

A cross-EU sustainability assessment for seafood products should be developed. The provision of sustainability indicators on seafood products would incentivise seafood operators to improve their practices, better inform consumers and ultimately protect and preserve marine ecosystems by reducing environmental and climate impacts of seafood products. The long-awaited EU Sustainable Food System legislation must be put forward and establish cross-cutting sustainability scoring for all food products, including seafood.

Adaptation to the needs of SSF must be central to ensure the buy-in from this sector. Digital reporting tools should be easy to use and useful for fishers, for which co-designing is essential. Activities to raise awareness and build digital literacy towards traceability should be done to ensure proper implementation and compliance with relevant EU legislation. In addition, the benefits to SSF from improved transparency and traceability should be made clear with regards to market access, product valorisation and fair economic return (amongst other potential uses and benefits). Seafood product labelling could turn traceability information collected along the full supply chain into eye-catching displays to promote products harvested by small-scale fishers and how these generate socio-economic benefits.

Ensure effective data infrastructure across the EU with strong mobile data coverage to support robust data collection, management and storage complying with traceability requirements and standards. Data infrastructure should fit within SSF distribution along coastlines and the multiplicity of landing sites.

This project has received funding from the European Union's Horizon Europe programme under grant agreement No 101060879.

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

3.1 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.[57] In line with the projections presented in the "Fishers of the Future" foresight report, the fishing sector will have to adapt, and is already doing so, to a fast-changing marine environment and species distribution patterns.[58]

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

[58] 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

This project has received funding from the European Union's Horizon Europe programme under grant agreement No 101060879.

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.

3.2 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.[59] 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.[60] Compared to the previous mandate (2019-2024), the Commissioner's portfolio related to oceans and fisheries has been streamlined, with environmental responsibilities now under Jessika Roswall.[61] [62]

The priorities of the new Commission are to implement the European Green Deal and ensure the competitiveness of European businesses.[63] In his Mission Letter, Commissioner Kadis is tasked to work on the CFP and its ongoing evaluation and to deliver a European Ocean Pact.

[59] 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

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

[61] 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

[62] 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

[63] 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/.

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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.[64] 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.[65]

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.[66] Earlier this year, the Directorate-General for Fisheries and Maritime Affairs (DG 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.[67] 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".[68] Despite some caution on the robustness of the consultation process to develop the foresight report,[69] 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.

[64] 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

[65] 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

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

[67] 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

[68] Ibid, Recommendations section, p115.

[69] 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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Figure 10 – Scenarios overview

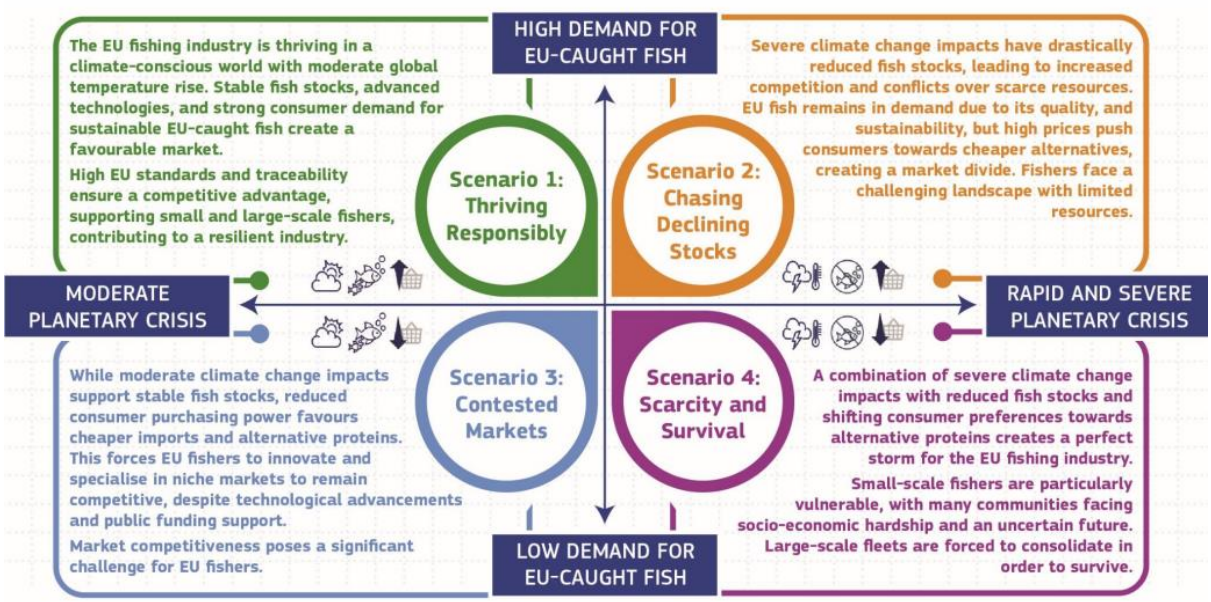

Figure 1: Scenario overview. Source: Foresight Study on Fishers of the Future - Final Report

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.

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3.3 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).[70] The opportunities offered by artificial intelligence applied to fisheries is promising because it may lead to more responsive fisheries management, seafood traceability along the supply chain, assistance in decarbonisation analysis and selectivity of fisheries techniques.[71]

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.[72] 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.[73] 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.[74] 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

[70] 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).

[71] 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

[72] 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.

[73] 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

[74] 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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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) provide a granular visualisation of fishing activities and offshore windfarms, as some offshore wind sites can cover areas of only a few square kilometres.[75] 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.[76]

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.[77]

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

[75] 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

[76] 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

[77] 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

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3.3.1 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.[78] The Fish-X Data Space, developed and run by north.io, is composed of two interfaces for data providers (i.e. fishers transmit their position at sea) and data users such as fisheries management authorities, scientists, civil society and academia.

3.3.2 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.[79]

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.[80] [81]

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

[78] 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

[79] Information is only shown in grid cells for which at least three vessels were operating.

[80] 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.)

[81] 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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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.

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)).[82] 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,[83] 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.

3.3.3 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.

[82] 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

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

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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.

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.

3.4 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.[84] Despite SSF's key role, public subsidies from government bodies go disproportionately more (3.5 times) to large-scale fisheries.[85] 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.[86] 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.[87] Finally, the involvement and buy-in from the small-scale fisheries community (i.e. bottom-up approach) prevails in ensuring efficient policy

[84] 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

[85] 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

[86] 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

[87] 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.[88]

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.[89] 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.[90] 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) 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.

[88] 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

[89] 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.

[90] 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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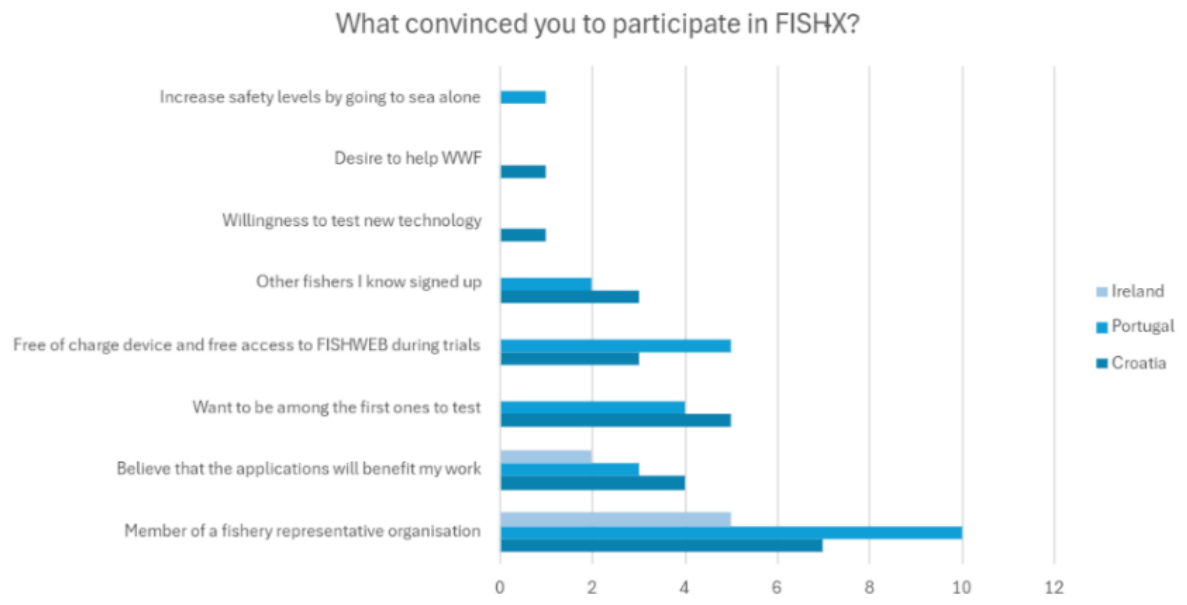

Figure 2 - Answers to the question "What convinced you to participate in the Fish-X?", Source: Fish-X project, questionnaire for Deliverable 5.4

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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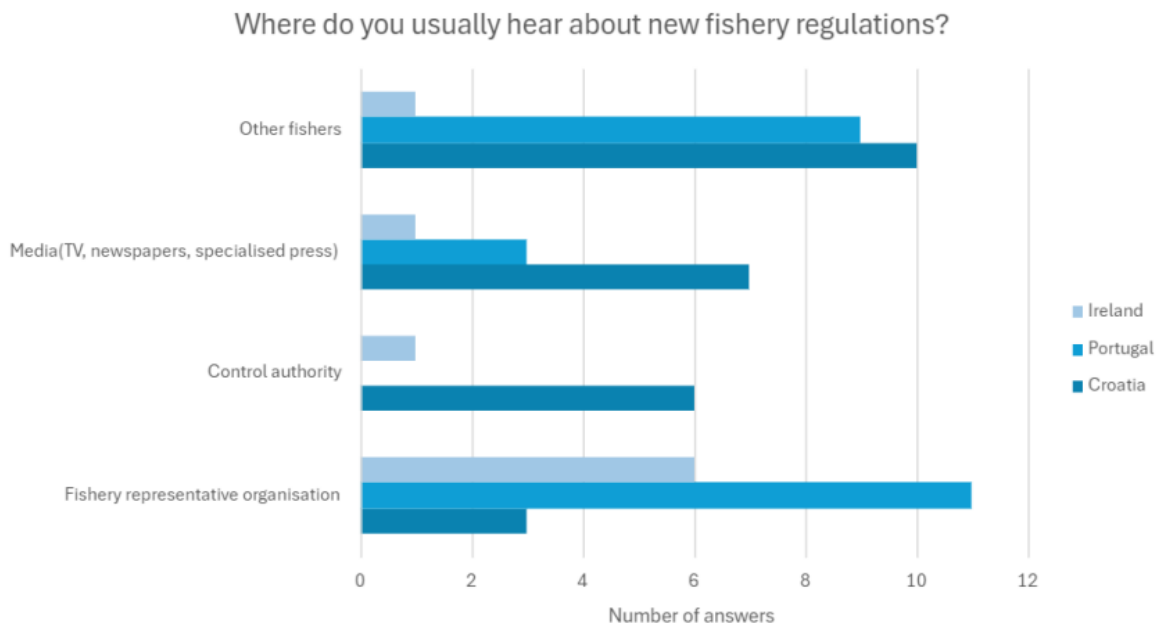

Figure 3 - Answers to the question "Where do you usually hear about new fishery regulations?". Source: Fish-X project, questionnaire for Deliverable 5.4

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.

3.5 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.

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The speakers took the floor in the following order:

- **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.[91]

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.

[91] 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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3.6 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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4. 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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