Fish-X
D5.4 Live Use Case Reports – WP 5

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Abstract	The deliverable 5.4 presents the outcomes of the four use cases conducted under Work Package 5 “Monitoring Control Surveillance Use Case”. Three of the use cases engaged with fishers to install Vessel Monitoring System (VMS) and, to a lesser extent, gear-marking devices aboard small-scale fishing vessels. As a result, from August 2023 to September 2024, 104 geolocation beacons were installed, provided by the technological company Collecte Localisation Satellites

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	(CLS) together with 11 e-gear-markers. The use cases took place in Portugal, supported by ANP|WWF Portugal and Sciaena, in Croatia with WWF Adria and in Ireland with IIMRO. The fourth use case has a slightly different focus on seafood traceability and gathers stakeholders across the seafood supply chain along the Baltic coast to develop a platform both for the seafood sector and consumers. The deliverable presents the conclusions of the testing of the devices and the growing acceptability and interest towards technology by the fishers involved. A questionnaire was circulated among participants from June 2024 to September 2024 to collect feedback on their experience with Fish-X and also to analyse the perception of fishers regarding the EU Fisheries Control Regulation and the digital transition.

Document history

Version	Issue Date	Stage	Description	Contributors (Name/affiliation)
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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
AI	Artificial Intelligence
AIS	Automatic Identification System
CFP	Common Fisheries Policy
DG Mare	Directorate-General for Maritime Affairs and Fisheries
EC	European Commission
eCDS	electronic Catch Document Scheme
EEZ	Exclusive Economic Zone
EMFF	European Maritime and Fisheries Fund
ERS	Electronic Reporting System
EU	European Union
FAO	Food & Agriculture Organisation of the United Nations
FISHWeb	CLS Web-platform for the management of VMS and ERS data
GES	Good Environmental Status
GFCM	General Fisheries Commission for the Mediterranean and the Black Sea
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
IUU	Illegal, Unreported, and Unregulated fishing
MEDAC	Mediterranean Advisory Council
MCS	Monitoring, Control, and Surveillance
MPA	Marine Protected Areas
MS	Member States
NAOS	CLS satellite tracking buoy for fishing gears
NEMO	CLS VMS for SSF
REM	Remote Electronic Monitoring
RFMO	Regional Fisheries Management Organisation
RPOA-SSF	Regional Plan of Action for SSF
SDG	Sustainable Development Goals
SSF	Small-Scale Fisheries
STECF	Scientific, Technical and Economic Committee for Fisheries
TAC	Total Allowable Catch
VMS	Vessel Monitoring System

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List of figures

List of tables

List of annexes

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Executive Summary

The deliverable 5.4 draws learnings from the four use cases conducted under the Work Package 5 of the Fish-X project.

Three use cases collaborate with fishers took place in Portugal (Algarve), Croatia (Velebit Channel and Vis Archipelago) and Ireland (Islands off Donegal and Galway). In Portugal, Sciaena and ANP|WWF Portugal succeeded in installing 59 beacons on vessels from six fishing associations of the Western Algarve. In Croatia, WWF Adria secured 31 VMS installations and 9 e-gears. Both field work started in August 2023 while the Irish use case kicked off a bit later given that the responsible partners, the Irish Islands Marine Resource Organisation (IIMRO) joined the Fish-X consortium in June 2024. From that date on, IIMRO installed 14 devices and 2 e-gears. A total of 104 Vessel Monitoring System (VMS) beacons on board and 11 fishing gear markers were installed.

The fourth use case has a different purpose to support the development of the traceability platform with stakeholders along the seafood value chain in the Baltic Sea, led by OURZ. All this field work comes together to implement digital solutions directed towards the marine small-scale fleet segment.

The analysis first provides an overview of each of the use cases and their respective achievements. The second section details the contextualisation of the engagement with fishers with regards to the legislative and political framework, the path to the decarbonisation of the small-scale sector, the two regional capacity-building workshops organised in the Mediterranean and a brief overview of ongoing international projects of Small-Scale Fisheries (SSF) digitalisation. In the third part, the responses to the questionnaires circulated across fishers in the use case are presented. In the fourth section, the responses to the questionnaires are compared across Ireland, Portugal and Croatia. Finally, the last section takes stock of the learnings of the field work and gives a forward-looking perspective on how a Fish-X 2.0 project could look like.

Based on the 34 answers to the questionnaire, there is a mixed understanding on the upcoming requirement in the EU Fisheries Control Regulation to be geolocalised at sea, among others. In Croatia, fishers are more aware of legislation than in Portugal and Ireland. Information typically circulates via word of mouth between fishers but also through the channels of the fishery organisations. The main motivation to participate in Fish-X are the fact of being a member of the fishery representative organisation and the benefits gained through the use of the devices, namely safeguarding their fishing grounds in an ever more crowded maritime space. The role of the fishery representative organisation is highlighted as being key to meet this need for fishes.

The deliverable 5.4 is closely connected with the deliverable 5.3 as the latter focuses more on the technicality of the devices, both VMS beacon and e-gear marker and of the web platform to visualise the vessels' trajectories (called FISHWeb). Therefore, this present document complements the information provided in D5.3 with qualitative data collected directly from fishers about their perception and acceptance of technology. More widely, WP5 activities are the backbone of the consortium's work as it is the gateway with fishers to collect data from the ground that are then used for the three technological Fish-X outputs (Data Space, Insight and Traceability Platforms).

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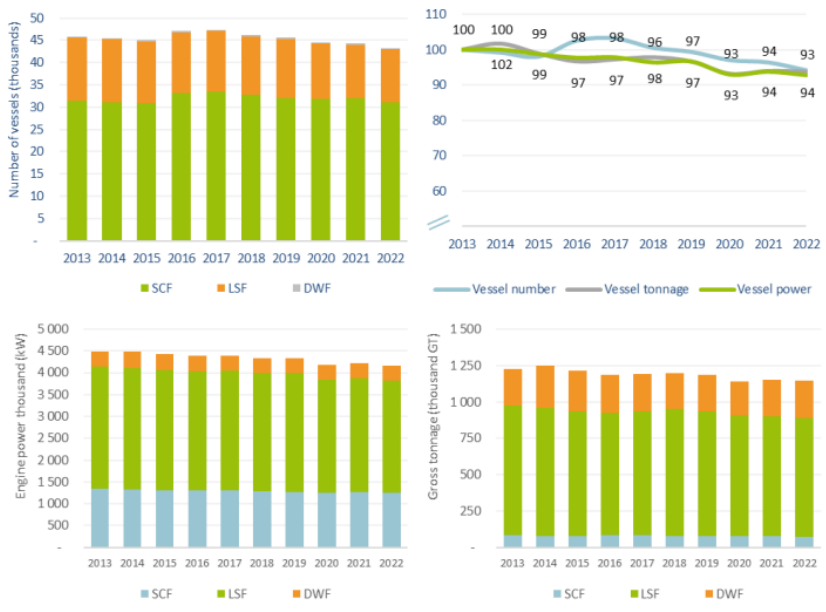
1. Use Cases' Description and Purpose

As shown by the 2024 Annual Economic Report on the EU Fishing Fleet of the Scientific Technical and Economic Committee for Fisheries (STECF), 52,380 fishing vessels were active in 2022 in the European Union. Breaking it down, 76% were small-scale vessels, 23% large-scale vessels and 0.5% distant-water fleet (i.e. EU flag vessel fishing in non-EU waters).[1] SSF represents 8% of the gross tonnage, 21% of the engine power and 53% of the overall fisher's employment (see Figure 1: Trends and variations on capacity in number of vessels, gross tonnage and engine power). Small-scale fisheries are defined by the Regulation (EU) 2021/1139 establishing the European Maritime, Fisheries and Aquaculture Fund (EMFAF) as vessels under 12 meters, not using towed gears and fishers on foot such as shellfish harvesters.

Small-scale fishing vessels are characterised by coastal fishing and daily trips, are not species specific, using multiple gears depending on the season. They typically set gears and haul them the same day or in the following days. Their fishing patterns need high resolution sampling rates as they travel over limited distances compared to the larger fleets and the duration of their fishing activity within a fishing trip is significantly shorter.



Data source: MS data submissions under the 2024 Fleet Economic data call (MARE/A3/ACS(2024)). Trends exclude Greece for time-series consistency.

Figure 1: Trends and variations on capacity in number of vessels, gross tonnage and engine power (excluding GRC). Source: STECF, 2024. SSCF: small-scale coastal fleet, LSF: large scale fleet, DSW: distant water fleet

Overall, there is a decrease in terms of landings, value, tonnage and number of vessels even though SSF remains the most important fleet segment in EU fisheries and of the fishing industry's employment. This picture can be further analysed per sea basin with the Mediterranean region accounting for 41% of the total value. The Southern Western Waters, with the Atlantic coastline, represents the second largest total value with 33%.

[1] European Commission, Joint Research Centre, Scientific, Technical and Economic Committee for Fisheries (STECF) – The 2024 Annual Economic Report on the EU Fishing Fleet (STECF-24-03 & STECF-24-07), Prellezo, R., Sabatella, E.C, Virtanen, J., Tardy Martorell, M., and Guillen, J. editor(s), Publications Office of the European Union, Luxembourg, 2024.

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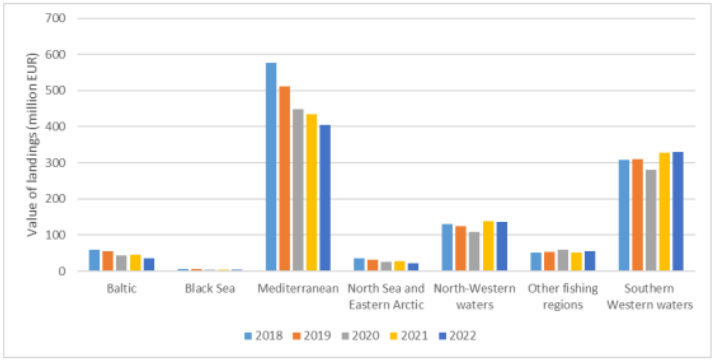
In the Baltic and Black Sea regions, a decline was continuously observed over the period from 2018 until 2022 (see Figure 2 on trends on landings in value for the SSF by main fishing region).



Data source: MS data submissions under the 2024 Fleet Economic data call (MARE/A3/AC(2024)). All monetary values have been adjusted for inflation; constant prices (2022).

Figure 2: Trends on landings in value for the SSCF by main fishing region. Source: STECF, 2024.

The use cases tested several devices provided by the technology company CLS, namely the NEMO, NAOS and FISHWeb. The NEMO VMS devices are standalone and self-contained, are easy to install, reliable and user friendly. The high-resolution data generated is accessible by fishers for their own vessel through the CLS FISHWeb platform which provides useful information for fishing operations and safety at sea.

1.1 Portuguese Use Case

Small-scale fisheries (SSF) are a significant part of Portuguese fisheries (according to DGRM, the Directorate-General for Natural Resources, Safety and Maritime Services, around 91% of the fleet is less than 12m long), playing an important socio-economic and cultural role. SSF target a wide range of species using various types of gear, including gillnets, trammel nets, longlines, pots and traps. The Algarve region (the south of Portugal) is a key area for SSF, where many coastal communities rely on fishing as their primary source of income. However, limited data and information on SSF activities continue to hinder effective management of the sector and the stocks they depend upon.

In the Fish-X Portuguese use case, fishers are being engaged to test Vessel Monitoring System (VMS) devices, known as NEMOs, to analyse their performance and functionality, as well as to gather data from SSF and get a glimpse of what the future control rules will imply from a practical perspective. Prior to Fish-X project, other initiatives, such as ParticiPESCA and AMPIC.COM already engaged local fishers in monitoring efforts, emphasising the importance of data to protect fishing grounds from emerging economic activities and other uses and to advocate for their livelihoods.[2] One particular case refers to the ParticiPESCA project, which led to the establishment of a co-management committee for the octopus fishery in this region and laid a foundation of trust between the NGOs responsible for the use case and local fishers, guiding the selection of target communities for the Fish-X project.

[2] https://participesca.pt/; https://ampiccomprojeto.pt/

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In the initial phase of the Portuguese case study, Fish-X project partnered with the Algarve Centre of Marine Sciences (CCMAR) and the Portuguese Institute for Sea and Atmosphere (IPMA) to exchange knowledge and best practices on supporting digitalisation and integrating VMS devices in Portuguese SSF. Since 2010, the ganchorra (clam dredges) fleet is already being monitored in real time by the IPMA and since 2022 around 60 octopus fishing boats in the Algarve have GPS devices on board due to ParticiPESCA project. These engagements helped to find the best way to avoid overlapping with existing projects and to identify information gaps. Therefore, the target gears selected were gillnets, trammel nets, and longlines. In August 2023, the installation of VMS devices began, with the number of participants gradually increasing until July 2024. Currently, 59 vessels from six fishing associations of the Western Algarve are equipped with these devices **(Figure 3)**. Most of these vessels are multi-gear, with 85% classified as local (up to 9 meters in length) and 15% as coastal (9 to 12 meters). The volunteer fishers range in age from 24 to 69 years old, with an average age of 51 years old, and all are male.

Raquel Pereira (Sciaena) installing a NEMO device on a vessel, 17.07.2024, ©Joana Jesus

Figure 3: Map of the Western Algarve Coast, showing the fishing associations participating in the project.

While a few fishers immediately recognised the benefits of collaborating in such a project, namely due to free-of-charge access to a platform which enables them to access their data and be part of the transition to fully transparent fisheries, others remained apprehensive. The major concerns were the fear of data being used against them, leading to excessive control, loss of privacy, and making their operations visible to competitors. Additionally, many fishers were unaware of the ongoing revision of the EU Fisheries Control Regulation, which will mandate real-time tracking devices for SSF vessels.

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The revised EU Fisheries Control Regulation was approved on 9 January 2024.[3] As the ANP|WWF and Sciaena team began raising awareness about these new requirements, fishers became more willing to adopt the technology. They feared that, in the future, they might be required to install similar devices at their own expense or have to that was published through the resolution of the Council of Ministers (n.º 1/2024), in January 2024. This resolution stipulated that all vessels authorised to work in this area will have to have real-time tracking devices installed. Realising that compliance would be mandatory by January 2025, many fishers opted to adopt the technology ahead of the deadlines set by the revised EU Fisheries Control Regulation.

The introduction, almost at the same time, of these new obligations has caused some confusion among fishers regarding the work carried out within the Fish-X project. The Portuguese government has yet not communicated which devices or requirements will be mandatory, leaving uncertainty over whether the NEMO devices being installed will meet future requirements or if different systems will be needed. However, it is expected that the data collected by these devices should be stored in Portugal in line with national requirements.

Joana Oliveira (ANP|WWF Portugal) filling up out the questionnaire and the GDPR informed consent with the fisher, 17/07/2024, ©Joana Jesus

This uncertainty posed an additional challenge in engaging fishers, but the Fish-X team was careful to be transparent, avoiding promises about NEMO's future compliance, to prevent feelings of mistrust or betrayal. The team's main objective was to build the capacity of fishers on the requirements under the EU Fisheries Control Regulation.

Despite all these challenges, the NEMO devices offer some technical advantages that appeal to fishers, when compared to previously tested devices. The solar panel eliminates the need to connect to the vessel's battery, and Portuguese weather conditions have minimised concerns about charging. Additionally, the FISHWeb platform, which provides fishers access to their own data, enhances transparency and empowers them to optimise their activities. Positive experiences shared among peers also played a crucial role in encouraging more fishers to join the project.

[3] 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

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Raquel Pereira (Sciaena) and Joana Oliveira (ANP|WWF Portugal) providing explanations on NEMO and FISHWeb at Albufeira, 20 May 2024. ©Ankith Kumar

To support fishers and family members in using the FISHWeb platform effectively, five training sessions were organised, which gathered between 35 to 40 participants, including some family members (Table 1). Participants learned how to access their data, navigate the platform, and activate key features, such as the sound alert that notifies them when they enter a specific area. A step-by-step FISHWeb guide in Portuguese was also created to overcome the language barrier, as the platform is not available in Portuguese yet.

Table 1: Number of training sessions for the fishers in the Portuguese use case. Source: Fish-X project.

Fishing Community	Date	Number of Participants
Alvor	29 November 2023	5
Armação de Pêra	26 March 2024	6
Albufeira	20 May 2024	2
Ferragudo	20 May 2024	7
Quarteira	17 July 2024	15-20

To enhance the project's impact, several collaborations were established from the beginning. Alongside partnerships with CCMAR and IPMA, a collaboration protocol was signed with Docapesca, the entity responsible for fish auctions in Portugal, providing access to the sales notes of participating vessels. This information offers valuable insights into their fishing activities and further enriches the project's data collection. Additionally, meetings were held with the Secretary of State for Fisheries, where the team presented Fish-X project and emphasised the importance of support for the digital transition and the implementation of the revised EU Fisheries Control Regulation.

With the installation of NEMOs now complete, the team is focusing on maximising the use of collected data and incorporating lessons learned from fishers' engagement and feedback. Key policy recommendations include the need for clear, coordinated communication regarding regulatory developments. As future mandates for real-time tracking in small-scale fisheries (SSF) come into effect, it is essential that policymakers clarify the specific timeline and requirements in order that these systems, such as NEMO (or other types) can be adapted to meet these standards. Transparent dialogue between authorities and fishing communities will help build trust and avoid confusion. It is also essential to provide technical support to fishers, capacity-building and financial support mechanisms to acquire and operate the devices.

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1.2 Croatian Use Case

1.2.1 Engagement with Croatian Fishers and their Acceptance of Technology: An Analysis

The Croatian small-scale fishing (SSF) community operates within a complex, vibrant marine ecosystem, holding approximately 3,500 fishing privileges, with each vessel measuring under 12 meters in length. Collectively, these fishers bring in around 6,000 tonnes of catch annually, contributing an estimated €25 million in economic value. Targeted species include a diverse range, such as hake, red mullet, sole, sea bream, monkfish, and whiting, each selected based on seasonality, market demand, and the habitat of the species. Croatian SSF fishers employ various fishing gears suited to these needs, such as gillnets, trammel nets, longlines, and traps, tailored to different habitats and fishing areas. The fish they catch is typically sold directly to local markets, restaurants, or through larger distribution networks, bringing fresh, local seafood to the public while also supporting coastal economies.

NAOS installation on demersal longline in Croatia, ©Hrvoje Čeprnja

In recent years, the SSF sector has faced increased pressures to ensure sustainable fishing practices while maintaining its economic vitality. To support this transition, SSF fishers are being gradually introduced to Fish-X technological solutions, including Vessel Monitoring Systems (VMS) such as NEMO and electronic gear tracking devices like NAOS, which help monitor their activities in real time. While some fishers were hesitant, raising concerns over privacy and the potential for stricter regulation or loss of traditional fishing grounds, others recognised the potential for these technologies to support better management and resource sustainability.

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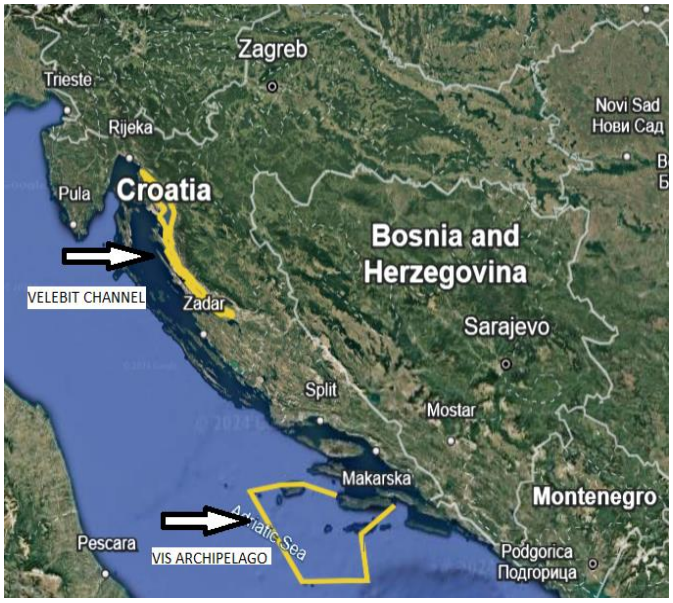

Figure 4: Map of the two main pilot project areas: the Velebit Channel (FRA area) and the Vis Archipelago. Source: Fish-X project.

As part of this initiative, the project has actively engaged SSF fishers from various small harbours along the Adriatic, particularly focusing on two pilot project areas: the Velebit Channel, designated as a Fishery Restricted Area (FRA)[4], and the Vis Archipelago, both vital fishing zones. These locations serve as demonstration sites to showcase how new monitoring approaches can support sustainable fishing while respecting the SSF community's traditional knowledge and practices. The project aims to build a model for future SSF management across the Adriatic, emphasising the importance of SSF for both marine biodiversity and the livelihoods of coastal communities.

1.2.2 Initial Hesitation and Resistance

When the VMS devices (NEMO) were first introduced to Croatian small-scale fishers within the Fish X project starting August 2023, significant hesitation was evident. Many fishers expressed concerns about the potential negative impacts of these systems, particularly the fear that the data collected could lead to the closure of traditional fishing areas, the imposition of new restrictions, or even penalties. Privacy and security concerns were also prominent, with fishers apprehensive about the possibility of their activities being closely monitored, potentially making their operations transparent to other fishers, and the implications this transparency might have negative impact on their livelihoods.

The timing of the VMS introduction, coinciding with the early indications that the Nature Restoration Law and the Action Plan for Fishery Resources and Marine Ecosystem would be accepted, intensified these concerns.[5] Many fishers perceived the VMS introduction as part of a broader regulatory push that could further restrict their activities.

[4] Regulation on specific habitats of fish and other marine organisms and on fishing rules in the Velebit Channel, Novigrad and Karin Sea, Prokljan Lake, Marin Bay and the Neretva Channel https://faolex.fao.org/docs/pdf/cro190597.pdf

[5] Regulation (EU) 2024/1991 of the European Parliament and of the Council of 24 June 2024 on nature restoration and amending Regulation (EU) 2022/869; COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS EU Action Plan: Protecting and restoring marine ecosystems for sustainable and resilient fisheries

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1.2.3 Gradual Acceptance and Growing Enthusiasm

Despite the initial resistance, a noticeable shift in attitude towards these technological innovations, including VMS and NAOS e-gear tracking devices, has occurred among Croatian fishers. The first installations of VMS and NAOS e-gear tracking devices began in the summer of 2023, and since then, the number of fishers testing these devices has steadily increased. Currently, 31 vessels are equipped with VMS, and 9 e-gear devices are in use, reflecting a growing acceptance of these new technologies within the fishing community.

Several factors have driven this shift. First, fishers have recognised the significant advantages of using VMS to enhance the management and sustainability of their operations. The FishWeb platform, accessible via mobile phones, provides real-time data on vessel movements, which has sparked considerable interest. This feature allows fishers to monitor their own activities, offering a level of control and transparency that was previously absent. In Croatia, while fishers are required to report their catches to the Ministry through the m-logbook, this system only allows for one-way communication, offering no feedback or access to data. In contrast, Fish-X VMS and FISHWeb not only allow fishers to submit data but also grants them exclusive access to monitor their own movements and tracking, fostering a more interactive and empowering experience.

Moreover, the introduction of NAOS e-gear tracking devices has further increased the acceptance of technology among Croatian fishers. These devices, which enable fishers to monitor the positions of their fishing gear, have proven particularly appealing. Fishers have even suggested several ideas and recommendations on how to further improve the options available with the e-gear device. In cases of unforeseen circumstances, such as lost or damaged gear, the ability to track the movement patterns of their gear provides a valuable safeguard. Also a real-time data on local weather conditions at the fishing location (wind, rain, storm), sea currents data, oceanographic data (sea temperature), alarming if the fishing gear has significantly changed position (for example, fishing gear theft), presence and position other fishing tools nearby and similar. Additionally, this geolocation data can serve as evidence of their presence in specific fishing areas, which can be crucial for asserting tenure, fishing rights and negotiating with regulatory authorities.

1.2.4 Engagement and Outreach Efforts

The gradual acceptance of VMS, e-gear, and other technologies has been facilitated by extensive engagement and outreach efforts. WWF Adria, in collaboration with Fisheries Local Action Groups (FLAGs), the Chamber of Trades and Crafts for Fishers, and the Ministry of Agriculture, has played a central role in these efforts. Through conferences, meetings, and workshops, the initiative has reached approximately 150 SSF fishers, providing them with the information and support needed to adapt to these new technologies. Notably, one Croatian fisher attended a regional workshop at the Mediterranean Advisory Council (MEDAC), reflecting the growing interest in these innovations giving feedback on VMS usage and acceptance of this new technology. Additionally, an initial meeting was held in May/2023 with the Ministry of agriculture, forestry and fisheries/Department of Fisheries at the very beginning and prior testing the VMS, where the Fish-X project was presented to emphasise the importance of support for the digital transition. The Ministry provided support and has been following our work with great interest the whole time. A meeting was also organised between

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the project partner CLS and the Croatian Ministry where potential cooperation was communicated.

These engagement efforts have also highlighted the importance of personalised communication and support, particularly given the dispersed nature of Croatian fishers across numerous small harbours along the Adriatic coast. Fishers, who are accustomed to selling their catch directly, often require tailored communication strategies to address their specific concerns and needs. With upcoming mandates for real-time tracking in small-scale fisheries, it's crucial for policymakers to clearly outline specific requirements and ensure that systems like NEMO meet these standards. Open dialogue between authorities and fishing communities will foster trust and prevent misunderstandings.

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1.3 Irish Use Case

Ireland has an extensive small-scale fisheries fleet segment (under 12-meter vessels) with 1,636 boats making up 88% of the Irish fishing fleet. The Irish Islands Marine Resource Organisation (IIMRO) is a representative organisation located on the offshore islands of Ireland. Island based vessels make up 6% of the fleet which indicates their importance culturally[6], socially and economically[7] and shows the reliance on fisheries in offshore island communities.

SSF as well as being weather dependent often fish seasonally depending on the target species. This could be because of management measures such as a closed season, the target species is migratory and is only available at a certain time of year, or they are spawning/moulting and not suitable for consumption, or a combination of the above. SSF may also combine their time with other sources of income like small scale farming, tourism or other part-time employment that all adds to an annual income allowing them to stay in their communities.

Table 2: Ireland fleet segments. Source: Irish Fleet Register. January 2024. Excluding aquaculture vessels

Fleet Segment	No. Vessels	% Overall (rounded)
Total	**1,863**	**100%**
Under 12 m	1,636	88%
RSW[8]	23	1%
Island Vessels	118	6%
12-18m Vessels	83	5%

IIMRO joined the FISH-X consortium in June 2024 and has installed 14 devices on vessels from two islands, one in County Donegal and one in County Galway. Two of the NEMO devices were installed in March 2022 as part of a separate IIMRO technical trial and the participants had their legacy data included in the project. In addition to the NEMO VMS units, two NAOS e-gear markers were deployed for testing off Arranmore Island, Co. Donegal. Most boats are under 12 meters with one larger vessel fishing brown crab further offshore. Targeted species can vary by season and includes non-quota species such as lobster, crab and other shellfish, which are caught using pots, to quota species such as pelagic mackerel, herring and demersal whitefish species such as pollack that are targeted using nets and hook and line.

[6] https://nationalinventoryich.tcagsm.gov.ie/marcanna-na-talamh/

[7] Curtin, R. 2023. An economic analysis of the Irish small-scale fleet. Economics and Strategic Services Unit, Bord Iascaigh Mhara.

[8] Refrigerated Sea Water vessels that target pelagic species.

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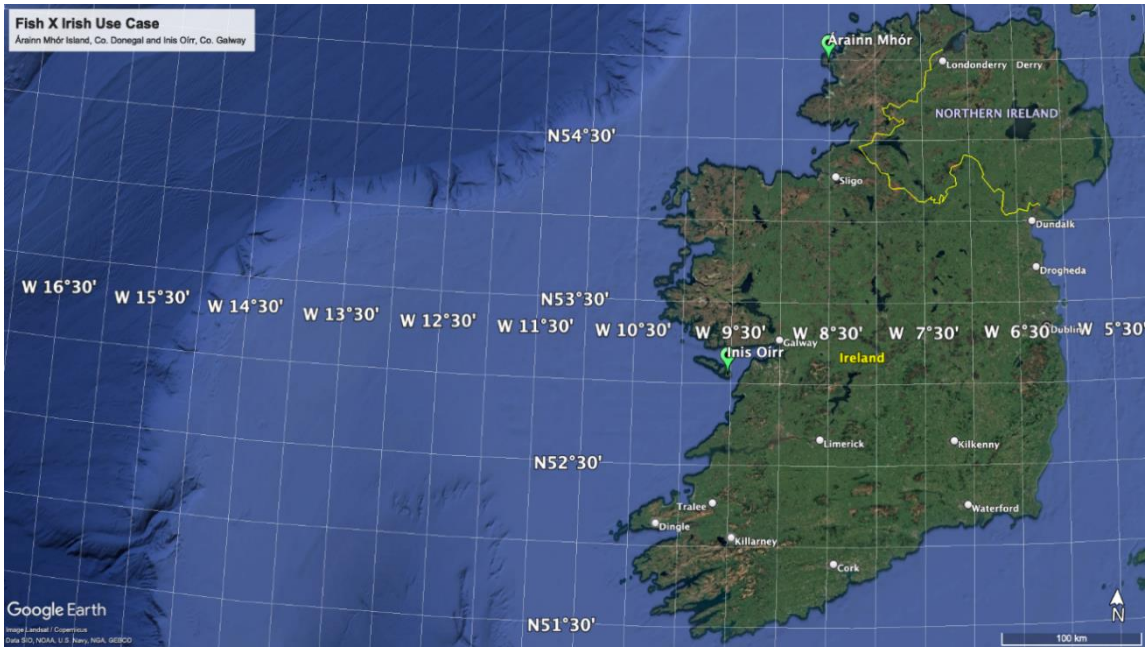

Figure 5: Irish Use Case locations and spatial context. Source: Fish-X project.

IIMRO members are keenly aware of the importance of spatial data for fisheries. Small vessels under 12 meters are currently not required to install Vessel Monitoring System (VMS) or Automatic Identification System (AIS) tracking devices, with the result that there is very little data available on where these boats operate. This has serious implications for marine spatial planning decision making, including the development of offshore renewable installations with associated cables and onshore infrastructure, as well as the designation of marine protected areas for environmental protection. The risk of displacement of small-scale vessels by other Blue Economy activities who cannot move to other areas presents a serious risk to fishing communities on the offshore islands and other coastal areas.

Feedback from users on NEMO and FISHWeb has been positive to date and most are happy to recommend the devices to other fishers.

Engagement with IIMRO members was carried out through a series of information meetings, online and in person where the devices were demonstrated and questions were answered about the Fish-X project. Initial concerns about privacy and the public availability of an individual's private data were allayed by safeguards such as data ownership, General Data Protection Regulation (GDPR), anonymisation, secure

Fishing vessel testing NEMO, Polyvalent general licensing (hand line, pots, fish trap, gill net, jigging machine), ©Seamus Bonner

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

storage and restricted access to data via a formal data sharing and ownership agreement between participants and the project.

Fishing vessel testing NEMO for polyvalent potting (crab and lobster), registered in Sligo port. ©Seamus Bonner

This positive word of mouth is very important for adoption and the implementation of digitisation, as a previous focus on control and enforcement for VMS has sometimes resulted in reluctance to adopt these devices. There is a wide scope for potential future uses of this collective data when suitably safeguarded and anonymised, such as mapping of traditional fishing grounds, habitats, seasonal changes to the environment, migration patterns of fish stocks, catch traceability for consumers, the tracking of trips to optimise fuel use and many other benefits.

One issue which was highlighted during engagement with participants was the lack of communication by the EU and/or Member States on future requirements for SSF so that they can comply with the various regulations that are in force. While there have been some briefings on a high level overview of the control regulation to fishery organisations there is very little information available on what exactly is proposed, when it will be implemented and what the changes mean for those working in the SSF catching sector.

IIMRO are continuing to arrange installations with additional members and plan to do so until the end of the project (May 2025). Engagement with state agencies such as the Irish Marine Institute, the Seafood–Offshore Renewable Energy (ORE) Working Group, the Sea Fisheries Protection Authority, the Department of Housing and the Department of Agriculture Food and the Marine is continuing to ensure that the benefits of high resolution spatial and temporal data on small-scale fisheries are incorporated into decision making processes.

Through Fish-X, IIMRO is leading a model for data-informed, community-driven stewardship in small-scale fisheries, demonstrating the power of digitisation to support sustainable marine resource use and protect Ireland's island and coastal communities.

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

1.4 Baltic Use Case

1.4.1 Introduction to the Baltic Use Case

The Baltic Use Case within the Fish-X project has a pivotal focus on enhancing the traceability of fisheries supply chains, particularly in the Baltic Sea region. This effort is part of the Fish-X project to address the pressing challenges faced by small-scale fisheries in Europe, a sector that is both significant and vulnerable. Given the ecological sensitivity of the Baltic Sea and the importance of its fish stocks to both local communities and broader European markets, this use case offers an opportunity to demonstrate the potential of digital technologies in transforming fisheries practices.

The overarching goal of the Baltic Use Case is to implement the OURZ blockchain-based traceability platform tailored to the specific needs of the fisheries industry in the region. In cooperation with a small number of key partners, the project seeks to map out exemplary fisheries supply chains, with a particular emphasis on enhancing transparency and improving communication along every step of the chain, from the catch to the final consumer. This traceability system, developed by OURZ, is designed to ensure that all stakeholders, including fishers, processors, retailers, regulators, and consumers, have access to accurate information about the origins, handling, and sustainability of seafood products. Figure 6 shows the dashboard overview of the platform.

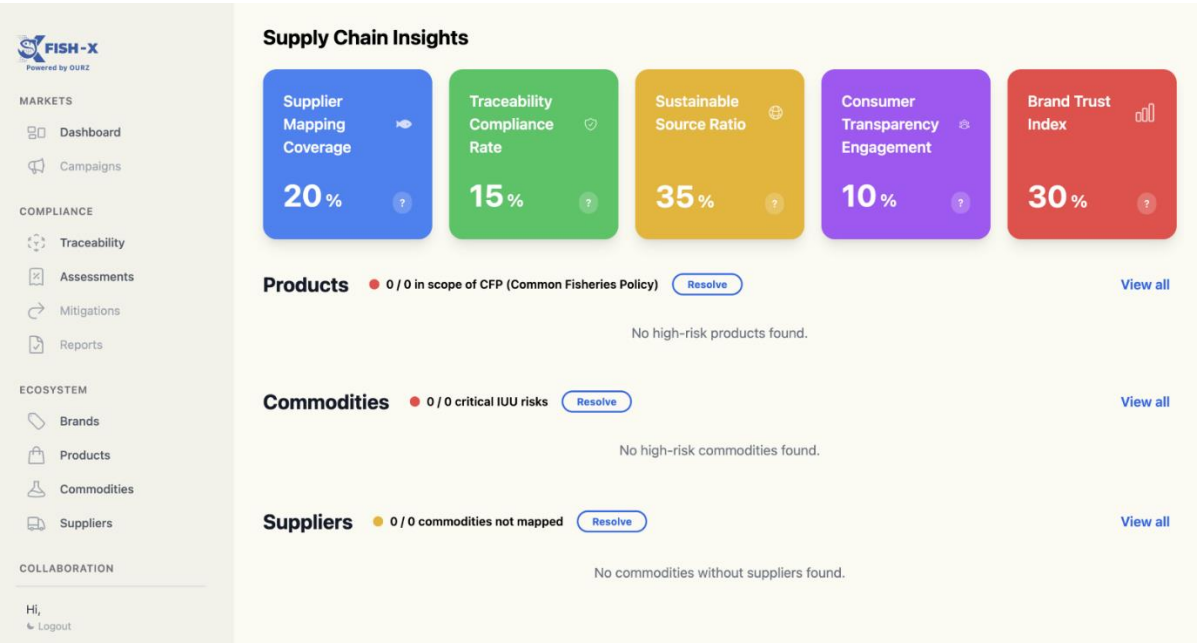

Figure 6: Dashboard Overview of the OURZ blockchain-based traceability platform. Source: Fish-X project.

As the challenges of overfishing, illegal fishing, and environmental degradation intensify, especially within the Baltic Sea ecosystem, this project has become increasingly urgent.

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1.4.2 Adapting to Baltic Fisheries Conditions and Stakeholder Engagement

At the outset, the Fish-X Baltic Use Case aimed to focus on small-scale fisheries in the Baltic Sea. However, engaging with these fishers presented several challenges. One significant hurdle was the difficulty in identifying and recruiting local partners who could actively participate in the project. This issue is not unique to this initiative; a 2023 study by von Storch identified that stakeholders in the Baltic Sea region are facing a multitude of environmental and regulatory pressures.[9] The study, which surveyed students and young scholars at academic institutions around the Baltic Sea, found that the most pressing concerns were overfishing, climate change, and waste. Scientific studies, such as those by Andersson et al. (2023) and the ICES Baltic Fisheries Assessment Working Group (WGBFAS), have highlighted the critical state of cod and herring stocks in the Baltic Sea and the potential impact of climate change on these species.[10] The Baltic Use Case aims to address these issues by improving the accuracy and accessibility of fisheries data, enabling fishers and regulators to make more informed decisions regarding catch limits, fishing efforts, and sustainability practices. Given these complexities, finding partners to collaborate on the project was challenging.

Despite these hurdles, the OURZ project team expanded its focus beyond small-scale fisheries, broadening the scope to include larger fisheries and stakeholders beyond the Baltic Sea. This decision provided valuable feedback on how to adapt the OURZ system to meet the needs of various fisheries. As a result, the platform could be optimised not only for small-scale fisheries but also for larger commercial operations that are equally critical to the seafood supply chain.

To ensure the platform met the needs of all stakeholders, the project team conducted extensive stakeholder mapping and consultation activities. These consultations included local fishers, fishing associations, processors, and other key players in the seafood supply chain. Partnerships were established with local initiatives and brands such as "Frisch gefischt," "Follow Food," the Fischereigenossenschaft Wismarbucht, "Fisch vom Fischer," the Fischereischutzverband SH, and "Fish4Ever".

[9] Von Storch, H. (2023). Perceptions of an endangered Baltic Sea. Oceanologia, 65(1), 44-49. https://doi.org/10.1016/j.oceano.2023.01.002

[10] Andersson, L., André, C., Johannesson, K., & Pettersson, M. (2023). Ecological adaptation in cod and herring and possible consequences of future climate change in the Baltic Sea. Frontiers in Marine Science, 10, 1101855. https://doi.org/10.3389/fmars.2023.1101855; ICES (2021). Baltic Fisheries Assessment Working Group (WGBFAS). ICES Scientific Reports. Copenhagen: ICES. https://doi.org/10.17895/ices.pub.8181

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

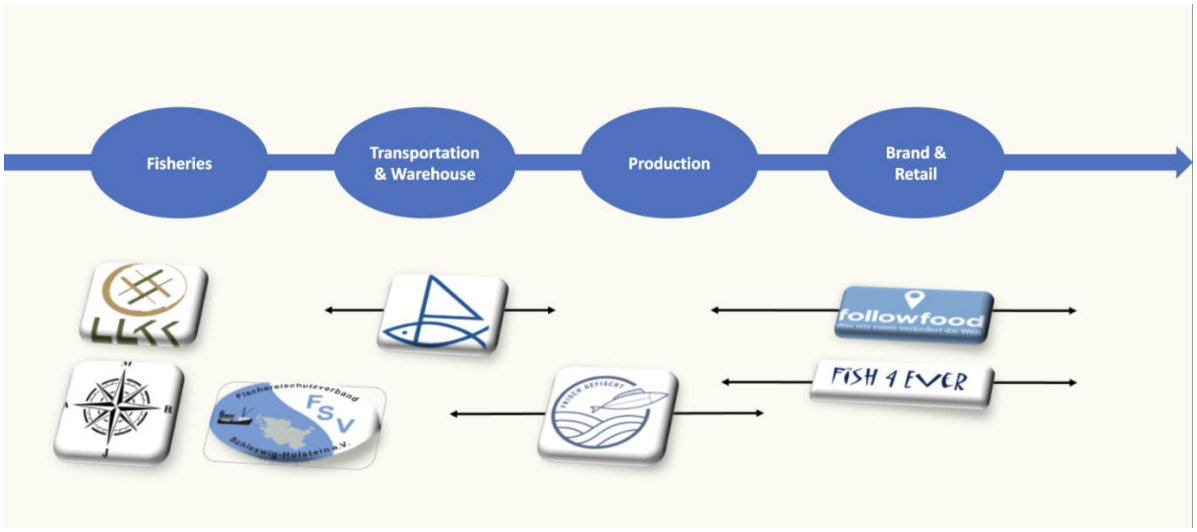

Figure 7: Collaborative framework of Fish-X partnerships, illustrating the flow from fisheries to brands and retailers. Source: Fish-X project.

“Frisch Gefischt" is a local initiative dedicated to promoting sustainable and fresh seafood, while ”Followfood” focuses on improving transparency and sustainability throughout the food supply chain. ”Fischereigenossenschaft Wismarbucht" is a cooperative of fishers committed to sustainable fishing practices in the Wismarbucht area, and” Fisch vom Fischer" is a network that facilitates direct marketing between consumers and local fishers. Additionally, the ”Fischereischutzverband Schleswig-Holstein” actively works to support and protect regional fishers, and “Fish4Ever” advocates for sustainable fisheries and responsible seafood consumption. Figure 7 visually represents the collaborative framework of the fisheries supply chain, highlighting the key partnerships that have shaped the development of the platform.

These partnerships were invaluable in shaping the platform, providing insights into the unique challenges faced by fisheries in the Baltic Sea and helping to tailor the traceability solution to address those needs.

1.4.3 Leveraging Digital Technologies for Sustainable Fisheries

The Fish-X Baltic Use Case focuses on employing digital technologies to enhance fisheries management, sustainability, and transparency. A central role in these efforts is played by the OURZ platform, which is based on blockchain technology. Blockchain is a decentralised data storage technology that securely records transactions in an immutable and transparent ledger, allowing for the reliable tracking of information. This technology is particularly beneficial for traceability in fisheries, ensuring that data can be securely recorded and shared throughout the entire seafood supply chain.

By utilising blockchain, every step of the process can be made transparent and verifiable. This transparency not only provides consumers with detailed information about the seafood they purchase but also helps regulatory bodies ensure compliance with environmental and legal standards, specifically the Common Fisheries Policy (CFP) and regulations against Illegal, Unreported, and Unregulated Fishing (IUU). As a result, the platform significantly contributes to promoting sustainability within the fishing industry.

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1.4.4 Comparing the Baltic Use Case with Other Fish-X Case Studies

The Fish-X project includes several other regional use cases, each with its own distinct focus and approach. In comparison to the Mediterranean and Atlantic case studies, which are led by WWF Adria and Sciaena/ANP|WWF Portugal/IIMRO respectively, the Baltic Use Case places a stronger emphasis on end-to-end traceability through blockchain technology. While the Mediterranean and Atlantic use cases prioritise data collection and operational digitalisation through NEMO devices, the Baltic Use Case is unique in its integration of blockchain into a full supply chain solution. This approach is particularly well-suited to the regulatory and environmental challenges of the Baltic Sea, where overfishing and stock depletion are critical concerns.[11]

1.4.5 Conclusion: A Path Toward Sustainable Fisheries in the Baltic Sea

In conclusion, the Fish-X Baltic Use Case demonstrates the transformative potential of digital technologies, particularly blockchain, in addressing some of the most pressing challenges facing the fisheries sector. By improving transparency, enhancing data collection, and ensuring compliance with regulatory standards, the OURZ platform offers a viable solution for ensuring the sustainability of fisheries in the Baltic Sea. Although the region presents unique challenges, including ecological pressures and the limited number of small-scale fishers, the flexibility and scalability of the OURZ solution make it well-suited to addressing these issues. The Baltic Use Case serves as a model for how digital innovation can support sustainable fisheries practices, not only in the Baltic region but across Europe and beyond.

[11] FISH-X (n.d.). Use Cases. Retrieved from https://fish-x.eu/use-cases/

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2. Contextualise Fishers' Engagement

2.1 Legislative and Political Framework in the European Union

The Fish-X project started in June 2022 and will conclude in May 2025. Over this period, the political fisheries landscape has been affected by major legislative changes. The revision of the EU Fisheries Control Regulation 2023/2842 is one of them, pushing EU fisheries to become more digital.[12] The adoption of the Nature Restoration Law 2024/1991 in June 2024 has also been an important milestone to restore marine and coastal areas together with the EU Action plan on protecting and restoring marine ecosystems for sustainable resilient fisheries (COM(2023) 102) released in February 2023.[13] These additional legislative requirements had an impact on Fish-X partners engaging with fishers in the various locations of the use cases as some of the fishers can perceive these new rules as an additional burden on their shoulders which are already well loaded with administrative, regulatory, financial or sustainability duties.

The role of the use cases' partners has been to explain and break down the various laws into measurable and achievable steps that could be beneficial for small-scale fishers. Within the project, the focus was set on the pilot testing of remote vessel monitoring system for vessels below 12 meters by 2030 as stated in the EU Fisheries Control Regulation by installing geolocation beacons on the vessels. In addition, gear markers on fishing gears have been installed to complement the data collection. The project team will also touch upon the obligation of digitalising logbooks and catch capture declaration by testing an electronic reporting system application on a mobile phone with a number of fishers in the South of Portugal, in the Algarve region.

If the initial approach was driven by fisheries control applications, WP5 Fish-X activities revealed other issues impacting EU coastal fisheries such as the deployment of offshore wind farms to respond to the EU's renewable energy targets of 42.5% by 2030 and the designation of marine protected areas as stated in the Nature Restoration Law and in the EU Biodiversity Strategy calling on Member States to protect 30% of EU's seas with 10% being strictly protected and restore 20% of sea areas, which both protection measures could be overlapping.[14] Expansion of off-shore renewables and protected areas is causing "spatial squeezing" on fisheries, with fisheries increasingly needing to justify their claims to access their traditional fishing grounds.

[12] EU Fisheries Control Regulation, 2024, ibid.

[13] Regulation (EU) 2024/1991 of the European Parliament and of the Council of 24 June 2024 on nature restoration and amending Regulation (EU) 2022/869 (Text with EEA relevance); COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS EU Action Plan: Protecting and restoring marine ecosystems for sustainable and resilient fisheries, COM/2023/102 final.
Regulation (EU) 2024/1991 of the European Parliament and of the Council of 24 June 2024 on nature restoration and amending Regulation (EU) 2022/869

[14] COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS EU Biodiversity Strategy for 2030 Bringing nature back into our lives, COM/2020/380 final.

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Therefore, the requirement to protect EU marine ecosystems and sustain EU fisheries and domestic seafood supply are not mutually exclusive. However, the underpinning idea behind Fish-X is also to bridge these two positions and try to find solutions for achieving a win-win situation, both for the environment and fishers, while leveraging digital technology. In that regard, acknowledging and respecting the crucial role of small-scale fishers in coastal communities, the whole approach consisted of showcasing how digital tools could be of use for fishers to document their fishing grounds within a participatory process for designing maritime spatial plans including offshore wind or protected marine areas. The gathering and collection of position data is an asset for fishers to assert their rights in fisheries management instances and larger maritime sector planning. Over the past three years, the Fish-X partners worked as brokers between authorities, fishers, and ocean conservation organisations to come up with tailored digital solutions to small-scale fisheries needs.

2.2 The Ecological Transition of SSF Towards Decarbonisation

The decarbonisation of the EU fishing fleet requires a reduction in greenhouse gas emissions (GHG) arising from the use of fossil fuels as an energy source to navigate and fish. According to the 55% of GHG emission reduction target in Europe by 2030, and the overall Green Deal objective to become carbon neutral by 2050, the fishing sector must revisit its practices by improving its energy efficiency and exploring alternatives to fossil fuel use.[15]

2.2.1 Implications of Decarbonisation

The marine fishing industry relies heavily on the use of fossils fuels, which typically account for 50-80% of total fishing costs[16]. Recent energy costs increase is imposing an economic burden in the financial profitability of the EU fishing fleet. Therefore, indicators of the fuel consumption (CO2 emissions per kg of fish, Fuel (use) Intensity (the quantity of fuel consumed per quantity of fish landed (litre per tonne)), Fuel efficiency (the ratio between fuel costs and revenue, expressed as a percentage (%), Fuel Use per income generated) are published online by the EC averaged per Member States over their flagged fishing fleet.[17] As the quantity of fuel used by the EU fishing fleet is influenced by a number of factors, in particular the type of fishing operation and gear used, dis-aggregated national statistics by activity type and technique are also displayed. These dashboards are aiming at quantifying the marginal impact of fuel price on the economic performance of the EU fishing sector, informing on trends and measuring progress towards this overall emission reduction target. In the Union, the three fishing techniques DTS (Demersal trawlers and/or demersal seiner), TBB (Beam Trawlers) and TM (Pelagic trawlers) account for 74-76% of the overall annual energy consumption in

[15] European Parliamentary Research Service (EPRS), Decarbonising the fishing sector: Energy efficiency measures and alternative energy solutions for fishing vessels, June 2023. Available here: https://www.europarl.europa.eu/RegData/etudes/STUD/2023/740225/EPRS_STU(2023)740225_EN.pdf.

[16] Greer, K., Zeller, D., Woroniak, J., Coulter, A., Winchester, M., Palomares, M. D., & Pauly, D. (2019). Global trends in carbon dioxide (CO2) emissions from fuel combustion in marine fisheries from 1950 to 2016. Marine Policy, 107, 103382

[17] https://blue-economy-observatory.ec.europa.eu/fishing-fleet-fuel-analysis_en

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EU fleet.[18] Across the EU fishing fleet, the figure below shows that bottom trawls, traps and lift nets in the over 12 metre fleet segment are the most fuel-intensive fishing gears per catch. According to the same figure, the species requiring the most fuel to be caught are lobsters, shrimps and flatfishes (by the over 12 metre fleet segment). Auxiliary power should also be counted as it is used in industrial fishing operations such as for refrigeration, deck machinery, electricity generation. The amount of GHG emission is hugely different in SSF and LSF, on the 207 million CO2 tonnes emitted in 2016 by the fisheries sector globally, 159 million tonnes are emitted by the large-scale fleet segment, accounting for 77% of the overall amount.[19]

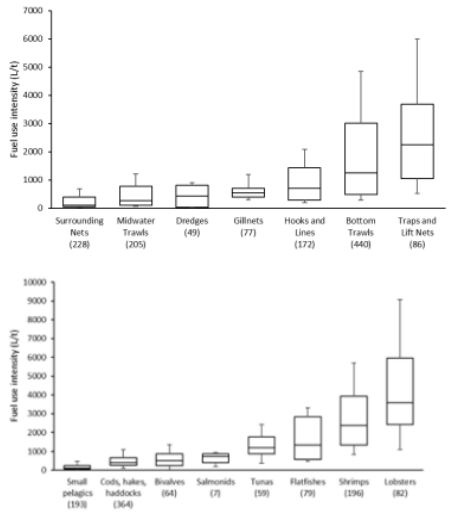

Figure 8: Fuel use intensity by gear classes and by groups of target species. Source: Cavraro et al., 2023

As stated by the Directive 2003/96/EC on energy taxation, the EU fishing sector is exempt from paying Value Added Tax (VAT) on fuel for the purposes of navigation within Community waters.[20] Even though, it is worth noting that many SSF are not registered for VAT and cannot reclaim it. Likewise, petrol which is used in many boats in outboard engines does not receive any relief on costs. Therefore, to operate an ecological transition within the fishing sector, and more specifically for small-scale fisheries, several solutions could be leveraged. Among these, the overall ban of fossil fuel by 2050 could set a clear direction and incentivise the sector towards energy-efficient practices - these have to be accessible and affordable - and opting for alternative energy supply such as electric/ battery power, use of sails, liquefied natural/fossil gas, electrification, biofuels such as methane and methanol, hydrogen and ammonia. Use of alternative energy sources will have implications for vessel design, stability, work space etc., whilst supply chains, after sales service, technical backup, availability of mechanical components/ spare parts, and sales outlets for energy supply will have implications for the viability of such alternatives.

[18] European Commission: Joint Research Centre, Scientific, Technical and Economic Committee for Fisheries, Prellezo, R., Guillen, J., Tardy Martorell, M. et al., *The 2023 annual economic report on the EU fishing fleet (STECF 23-07)*, Prellezo, R.(editor), Guillen, J.(editor), Tardy Martorell, M.(editor), Virtanen, J.(editor) and Sabatella, E.(editor), Publications Office of the European Union, 2023, https://data.europa.eu/doi/10.2760/423534

[19] Francesco Cavraro, Marco Anelli Monti, Alberto Caccin, Fabio Fiori, Fabio Grati, Elisabetta Russo, Giuseppe Scarcella, Dario Vrdoljak, Sanja Matić-Skoko, Fabio Pranovi, Is the Small-Scale Fishery more sustainable in terms of GHG emissions? A case study analysis from the Central Mediterranean Sea, Marine Policy, Volume 148, 2023, 105474, ISSN 0308-597X, https://doi.org/10.1016/j.marpol.2023.105474.
Krista Greer, Dirk Zeller, Jessika Woroniak, Angie Coulter, Maeve Winchester, M.L. Deng Palomares, Daniel Pauly, Global trends in carbon dioxide (CO2) emissions from fuel combustion in marine fisheries from 1950 to 2016, Marine Policy, Volume 107, 2019, 103382, ISSN 0308-597X, https://doi.org/10.1016/j.marpol.2018.12.001.

[20] Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity (Text with EEA relevance)

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2.2.2 WWF ongoing projects on decarbonisation and ecological transition in the Mediterranean

WWF has developed two significant initiatives to support decarbonisation and ecological transition in Mediterranean fisheries, focusing on both small-scale fisheries (SSF) and large-scale trawling operations.

The first project, Transforming SSF in the Mediterranean, aligns with the General Fisheries Commission for the Mediterranean 2030 Strategy and aims to fast-track the implementation of the Regional Plan of Action for SSF (RPOA-SSF).[21] By focusing on community-driven conservation efforts, this project seeks to boost the resilience of SSF communities, enhance sustainable fishing practices, restore marine resources, and contribute to the Accelerating Coastal Community-Led Conservation Initiative (ACCLCI) for scalable global solutions. This strategy underscores the social, economic, and cultural roles of SSF, representing 83% of fishing vessels and 57% of fishing-based jobs in the Mediterranean. WWF supports climate adaptation and CO_2 reduction in SSF by conducting a pioneering assessment on emissions across five Mediterranean countries. The study develops a protocol to assess the CO_2 footprint of SSF while considering ecological impacts.

The second project, DecarbonyT, targets fuel efficiency and CO_2 reduction in large-scale fisheries through optimised trawling gear.[22] Focusing on high-fuel trawling methods like otter trawls, beam trawls, and pelagic trawls, the project aims to identify ways to reduce fuel dependency by auditing energy use, reviewing existing research, and piloting trawl modifications. Additionally, DecarbonyT includes a socio-economic analysis of the project's impact, engaging fishing industry representatives, gear manufacturers, and stakeholders in advancing decarbonisation in the sector.

Together, these projects demonstrate WWF's commitment to sustainable, low-impact fishing practices that support ecological transition in the Mediterranean region.

2.3 Regional Capacity Building Workshops

Two regional capacity building workshops were organised to share good practices from the Fish-X project to a wider audience, including small-scale fishers, SS representatives, national authorities and researchers. These two workshops took place in Spain and Italy and for both occasions a fisher involved in the Portuguese and in the Croatian use case participated to the panel discussion to bring their direct experience.

[21] https://www.wwfmmi.org/what_we_do/fisheries/transforming_small_scale_fisheries/ ; https://www.fao.org/gfcm/2030strategy/en/ ; https://www.fao.org/gfcm/activities/fisheries/small-scale-fisheries/rpoa-ssf/en/
[22] https://decarbonyt.eu/project/

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2.3.1 Mediterranean Advisory Council (MEDAC) - Rome (Italy)

The Fish-X event, titled “The Digital Transition: How New Technologies Can Support Sustainable Small-Scale Fisheries in the Mediterranean,” was successfully held at the Mediterranean Advisory Council’s (MEDAC) General Assembly in Rome on February 28th 2024. This special session of 90 minutes included simultaneous translation into six languages, aimed to present the Fish-X project to Mediterranean European stakeholders and facilitate a regional dialogue on digital integration in small-scale fisheries.

From left to right: *Sime Stojak, Croatian small-scale fisher involved in Fish-X Use Case, Hrvoje Čeprnja, WWF Adria Fisheries Officer, Alessandro Buzzi, WWF MMI Fisheries Officer*

The event began with a concise overview of Fish-X’s structure, objectives, and methodology, providing a solid foundation for the audience. The Croatian use case was then highlighted, illustrating how digital tools, such as the NEMO tracking device, could contribute to more effective implementation of the Common Fisheries Policy and the Control Regulation. A Croatian fisher involved in testing the NEMO device shared first-hand experiences and preliminary results, which allowed attendees to understand the practical implications of digital transition in small-scale fisheries. This interactive and participatory session fostered an engaging exchange of best practices and insights, promoting a shared understanding of how technology can enhance the sustainability of Mediterranean fisheries.

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2.3.2 GFCM Forum - Torrevieja (Spain)

The WWF side session, titled “The Digital Transition: How New Technologies Can Support SSF Organisations in Promoting Sustainable Small-Scale Fisheries,” was held successfully at the GFCM Forum in Torrevieja, Spain, on April 18th, 2024.

From left to right: *Alessandro Buzzi WWF MMI Fisheries Officer, Rita Sá Head of Marine Policy ANP|WWF Portugal, Hrvoje Čeprnja, WWF Adria Fisheries Officer and Nelson Caracol - Fisher representative from Alvor*

The session showcased the Fish-X project, with representatives and stakeholders from various regions engaging in dynamic discussions on the role of digitalisation in enhancing sustainable small-scale fisheries (SSF).

The session began with an introduction to Fish-X, outlining the project’s aims and scope. WWF Portugal and WWF Adria presented case studies from Croatia and Portugal together with one fisher involved in the trial in Algarve to share his experience, highlighting the benefits and challenges of digitalisation for SSF. Following this, additional examples were shared, including an initiative in Motril, Spain, where a local representative and the Spanish NGO SOLDECOCOS presented on tracking and data collection efforts.

The event concluded with a lively Q&A session, addressing key questions such as how digitalisation aids in the effective implementation of EU Fisheries Control Regulations and exploring opportunities for non-EU countries to adopt similar innovations. The discussion was highly engaging, fostering valuable insights on digital solutions that can support sustainable fisheries across the Mediterranean.

2.4 Global Digital Tools Use for SSF

The digital transition of Small-Scale Fisheries is a global trend and is anchored in the need to achieve sustainability in the management of marine resources including stocks harvested by

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the coastal small-scale fleets (setting reliable science-based catch limits), to ensure the economic viability for coastal communities, as well as to recognize their importance.

At the global scale with a focus on the poorest countries and in alignment with the UN SDG 14.9 target, the need for SSF VMS is referenced in widely promoted documents.

The first one is the "FAO Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries (SSF) in the Context of Food Security and Poverty Eradication (SSF Guidelines, 2015)". This document acknowledges the lack of data and poor understanding of this sector that may hamper its sustainability.[23] The guidelines recognise "the need for states to put in place systems for monitoring, control and surveillance. Small-scale fishers are, in turn, encouraged to support and uphold such Monitoring, Control, and Surveillance (MCS) systems." Practically speaking, this means responsible states must regulate these fisheries with a national fisheries control policy including MCS measures specific and adapted to SSF while getting them endorsed by the fishers.

The second one, "Illuminating Hidden Harvests" (2023) faced the issue of the lack of fisheries data to quantify at the global scale, trust worthfully, the contribution of SSF to sustainable development. [24] The report underscored that SSF suffer from a lack of reliable, digitalised and comprehensive *catch data*, particularly in remote areas where much of the fishing effort is underreported or unmonitored. This lack of systematic data affects both *landed catches* and those declared at sea, with a focus on improving the capture of at-sea data through enhanced monitoring. The data gap is attributed to logistical challenges in reaching dispersed, low-production fisheries, and a lack of resources in national statistical systems. To bridge these gaps, the report recommends increasing support for local and participatory data collection, using modern digital technologies such as remote sensing, geospatial data, and environmental sensors. These tools can improve tracking and monitoring at sea, particularly for small-scale operations. Enhanced monitoring, control, and surveillance through these technologies would enable better policy-making and adaptive management, especially in the face of climate change impacts on small-scale fisheries.

[23] UN SDG Target 14.9 = "provide access for small-scale artisanal fishers to marine resources and markets"; FAO. 2015. Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication. Rome. https://openknowledge.fao.org/handle/20.500.14283/i4356en

[24] FAO, Duke University & WorldFish. *2023. Illuminating Hidden Harvests – The contributions of small-scale fisheries to sustainable development.* Rome. https://doi.org/10.4060/cc4576en

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3. Analysis of Fishers' Answers to Questionnaires

3.1 Portuguese Use Case

Note: From the 59 volunteer fishers, 16 answered the questionnaire, so all the further comments are based on that sample. The graphics with the results can be found in Annex 1.

Fishers from the Portuguese use case go out to sea frequently, with 68% of the respondents going 3 to 4 times per week and 18% going every day. This highlights the high dependency of fishing as the main economic activity for the overwhelming majority of small-scale fishers. However, most of the fishers surveyed were not aware of the revised EU Fisheries Control Regulation (62,5%) and did not know that VMS and e-logbooks will be mandatory in the next few years (56%), showcasing the feeling of being left out of the decision-making process often shared from small-scale fishers, leaving them less informed about evolving regulations. They pointed out that their source for this type of information is usually their fishing association (68%) or other fishers (56%), with a smaller number citing the media (18%). Considering the complexity of successfully implementing the revised EU Fisheries Control Regulation, direct and clear contact between the national administration and local fishing associations will be of paramount importance to clarify "when" and "how" new measures will be implemented, and to enhance fishers' cooperation and compliance in this process.

Encouragingly, the answers revealed a strong openness among participant fishers toward new technology. A staggering 81% of fishers expressed feeling comfortable in trying new technologies, with 93% finding the VMS devices useful and 87% considering it easy to use. The "alert button" function of the VMS device is an important feature for a large majority of fishers (81%), since they feel, it can contribute to their safety. However, many fishers do not have this function activated due to limitations in the way the alert is transmitted. Most fishers prefer that the alert be given via direct contact to the rescue authorities (78%) or to their families (64%).

Despite their openness to technology, engagement with FISHWeb, the data visualisation platform provided by CLS, remains low. Although fishers had access to their individual fishing trip data through FISHWeb, almost two thirds of respondents stated they never accessed it (62%). Among those who did log in, usage was poor, with 75% accessing it only once. These results can be related to the fact that the FISHWeb platform was not available in Portuguese and most of the participant fishers have over 50 years old and are not very familiar with digital technologies Despite the low usage, 68% still considered the platform useful, but many noted that it did not improve their activities. Some reported challenges included lacking access to a computer or finding the platform difficult to navigate. When asked about other functionalities for the platform which fishers think could be useful for their work, having information about local weather (56%), automatic activation of the fishing trip (50%) or the capacity to register an important location (43%) were the three highest voted features.

Looking back at what made fishers willing to participate in the use case and have VMS devices on board their vessels, the most popular causes were that it was another member of their fishing association that helped convince them (62%), the fact that the device and access to the platform were free (31%), and that they could be some of the first ones to try these new technologies (25%).

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Feedback on the device installation and overall project experience was largely positive. Many fishers (81%) did not perceive any barriers to adopting the VMS device, and 68% believed the device and platform would benefit their fishing activities, primarily by ensuring compliance with both current and future Fisheries Control Regulations. However, there remains some uncertainty about this, as the Portuguese government has yet to announce the specific requirements for the devices that will meet the new standards. Improved understanding of fishing routes and grounds was also a valued benefit. The use case proved quite successful with regards to communication with fishers with 81% of them pointing out that all the information about the project and the device was clear to them, and 93% would recommend the device to others.

Their overall satisfaction with the project was high, with 25% rating it at a 4 and 43% at a 5 (5 being the maximum). Regarding their opinion about VMS devices, 75% have the same stance since the beginning of the project, and 25% changed it. For those whose opinion on the device changed, the reasons pointed out were that it helped them comply with the future EU Fisheries Control rules, to be able to prove usage of their fishing grounds and to own their own data. All the fishers who answered showed interest in keeping the device after the project ended.

3.2 Croatian Use Case

Note: From the 31 volunteer fishers, 12 answered the questionnaire, so all the further comments are based on that sample. The graphics with the results can be found in Annex 2.

The Mediterranean use case summarises findings from 12 Croatian fishers across various ports who participated in the Fish-X trial, designed to explore their fishing activities, regulatory awareness, and experiences with digital tools like NEMO (a VMS device), NAOS (an e-gear device), and the FISHWeb platform. Most fishers joined the Fish-X trial between August 2023 and April 2024, reflecting broad interest in digital technologies to enhance their operations.

The survey showed that around 75% fish frequently, with a significant number fishing daily or three to four times per week. Approximately 60% reported fishing between 120–180 days per year, and around 25% reported 90–120 days. In terms of regulatory awareness, over 80% were aware of the new EU Fisheries Control Regulation, which mandates VMS and e-logbooks which showcases that a good job was done among collaborative fishers. Fishers primarily stayed informed on regulations through communication with other fishers (90%) and various media sources (60%), with less input from control authorities or fishing organizations. This level of awareness suggests that Croatian fishers are actively keeping pace with regulatory changes affecting their industry, however, additional efforts from control authorities and fishing organisations could further strengthen awareness and compliance.

Regarding digital tool use, over 70% of participants expressed comfort with new technology, with most finding the NEMO device easy to use and beneficial for daily operations. Features such as automatic trip activation, SMS/email communication with authorities, location tracking for important areas and lost gear, and an alert button were especially valued. Other functionalities for the platform which fishers think could be useful for their work is to have an automatic activation of the fishing trip (80%), the capacity to register an important location (50%) and information about local weather (40%) were the three highest voted options.

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About 25% expressed concerns over privacy and limited functionality, particularly regarding how VMS data might be used for monitoring and enforcing potential restrictions on fishing activities. From the outset, fishers' main concerns centred on fears that data might be used against them, resulting in excessive control, loss of privacy, restricted fishing grounds, or visibility of their operations to other fishers.

To help fishers use FISHWeb effectively, a Croatian-language step-by-step guide was created to overcome language barriers. This guide taught participants how to access data, navigate the platform, and activate some features. Despite these efforts, FISHWeb usage varied: some fishers accessed it daily, while others used it monthly or less. Frequent users found it useful for recording fishing operations and accessing marine spatial data, though others saw it as less impactful on their daily work, mainly due to a perceived lack of necessity. Meanwhile, the NAOS e-gear buoys, proposed to several fishers, were ultimately accepted and used by two. Despite the limited uptake, the devices were well-received by the participating fishers for their simplicity, though user feedback remained limited.

Overall, the trial highlighted a positive reception to digital tools, with over 80% of fishers satisfied with their Fish-X experience. Many participants reported maintaining or improving their views on these tools over time, seeing benefits in data management, regulatory compliance, and insights into fishing grounds and activities. The majority expressed interest in continuing device use after the trial, showing strong openness to integrating digital technology into their fishing operations.

In conclusion, the Fish-X trial indicates a promising readiness among Croatian fishers to adopt digital tools, despite some privacy and operational concerns. Continued support, improved functionality, and responsiveness to fishers' feedback could further increase the acceptance and effectiveness of these tools, supporting a more compliant, data-driven, and sustainable fishing sector.

3.3 Irish Use Case

Note: From the 14 volunteer fishers, 6 answered the questionnaire, so all the further comments are based on that sample. The graphics with the results can be found in Annex 3.

There had been 14 NEMOs deployed starting with 2 beacons prior to Fish-X whose data was also included, followed by 5 installations in June 2024 and 4 more in July.

Respondents operate in two fishing ports: Arranmore Island and Inis Oírr and all except one go fishing three to four times per week for a total of less than 90 days for two fishers, between 90 to 120 days for another two, and between 120 and 180 days for the two remaining fishers. Most of them have heard about the new EU Fisheries Control Regulation (5 out of 6) and half of the interviewees knew that VMS and e-logbook are set to become mandatory. They all heard about new fishery rules through the IIMRO, as well as by the control authority, media and other fishers.

On the use of devices, two thirds of the respondents feel comfortable with technology in general. All of them consider NEMO useful and five think the beacon is easy to use and are interested in the alert and assistance button, preferably by contacting authorities directly by

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SMS. Half of the interviewees used the software FISHWeb either themselves (=2), by a family member (=2) or a staff member of the fishery representative organisation. The majority only used it once and consider the device useful and easy to use. The fishers would also find relevant that both tools could include information on local weather conditions, automatic activation of fishing trips and the ability to record lost gear.

Most of them participated in Fish-X as they are members of IIMRO and they don't think that there are barriers to the use of VMS, with the exception of one fisher. The majority believe that these devices could benefit their activity to get more informed about their fishing activities, to better understand fishing trajectories and fishing grounds and respect current and future fisheries laws. Five of them would recommend these devices to other fishers and felt satisfied or very satisfied with the overall experience with Fish-X. Two of the respondents changed their opinion about the device since the start of their participation given the need to comply with the law but also to be able to document fishing grounds and be owners of the fishing data. All of them wish to keep the device once the project ends.

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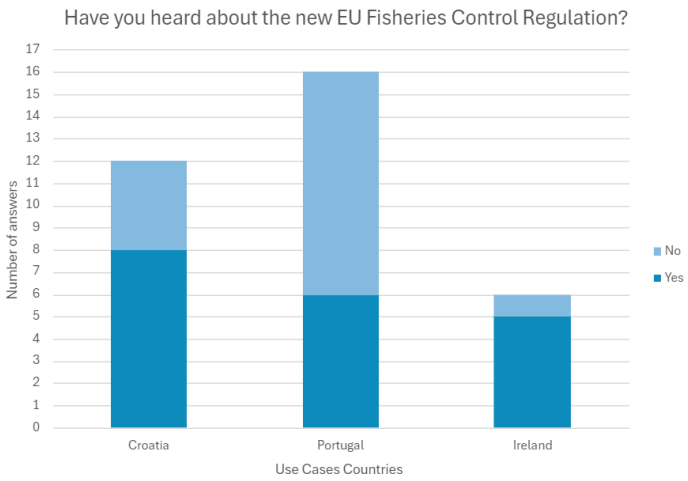
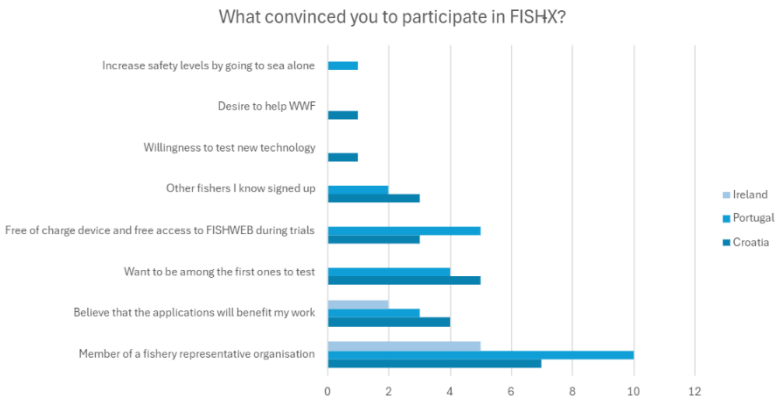
4. Comparison Across Use Cases



On the question “Have you heard about the new EU Fisheries Control regulation?”, fishers’ awareness largely depends on how proactive the European Union, each Member State and the specialised media outlets have been in conveying information on the regulation. Not all fishers may be exposed to the same information, as it depends on which sources they rely on for updates. While there have been some briefings on the high-level overview of the regulation there is very little information on what exactly is proposed, when it will be implemented and what the changes mean for those working in the catching sector.

In the Adriatic context, several workshops were conducted to keep fishers informed about the latest changes in fisheries regulations, increasing their likelihood of being aware. It's also important to note that the EU Fisheries Control Regulation has been under negotiation for five years, leading to different viewpoints, opinions, and, at times, misunderstandings within the fishing community, which may also affect how well fishers grasp the details of the regulation. In the Portuguese context, fishers have different levels of awareness. The ground work carried out by NGOs and Scientific bodies, namely within the co-management committee established in the Algarve, have contributed to increasing their awareness. However, there is still a general lack of awareness regarding these topics. Some of them also know some of the measures that are to be implemented, but don't relate them with the name "EU Fisheries Control Regulation".



These graphs highlight the importance of fishery representative associations influencing small-scale fishers in all three use cases. Moreover, different aspects of the devices are valued. Some fishers, especially in Croatia, believe that the use of the devices will benefit their work. Beyond the associations’ strong impact on fishers and some decision-making processes, a key motivation for fishers during the testing phase was the opportunity to be among the first to try new technologies and recognize how these devices could enhance their work.

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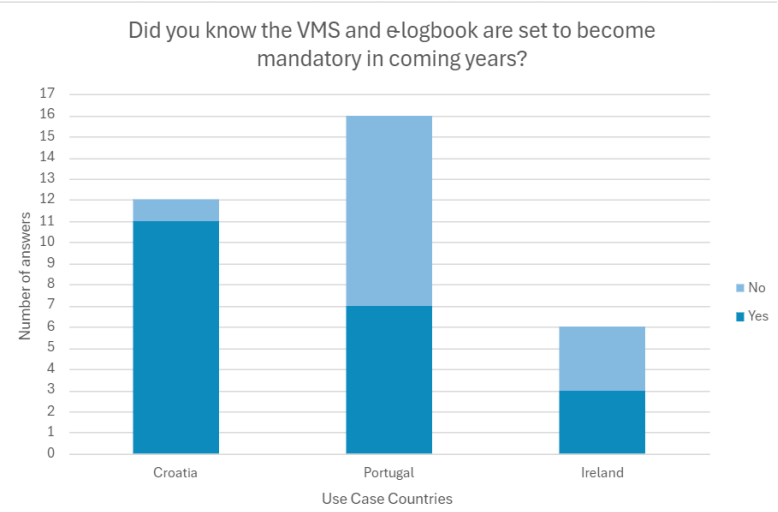
The question "Did you know the VMS and e-logbook are set to become mandatory in the coming years?" requires some context.



VMS (Vessel Monitoring Systems) testing under the Fish-X project occurred in the second quarter of 2023, prior to the formal approval of the EU Fisheries Control Regulation. At that stage, the specifics of the VMS requirement—including the timeline, targeted groups, and enforcement details—were still unclear, as decisions on how the Member States would implement the regulation had not yet been made. Fishers, therefore, engaged in testing based mostly on general expectations rather than confirmed obligations. During workshops organised in Croatia and Portugal, fishers received comprehensive updates on the anticipated regulatory changes and requirements.

The situation with e-logbooks varies between countries. For example, in Croatia, an e-logbook is already mandatory for large-scale fisheries (LSF) and also for small-scale fisheries (SSF) to register their daily catch. In contrast, Portugal has different regulations, highlighting the disparity in the implementation of these tools across the EU.

Pointing also issues with communication, an information campaign with leaflets for SSF outlining the changes for SSF is needed, together with information days, media campaigns and mail shots to those on the fishery register will improve knowledge.

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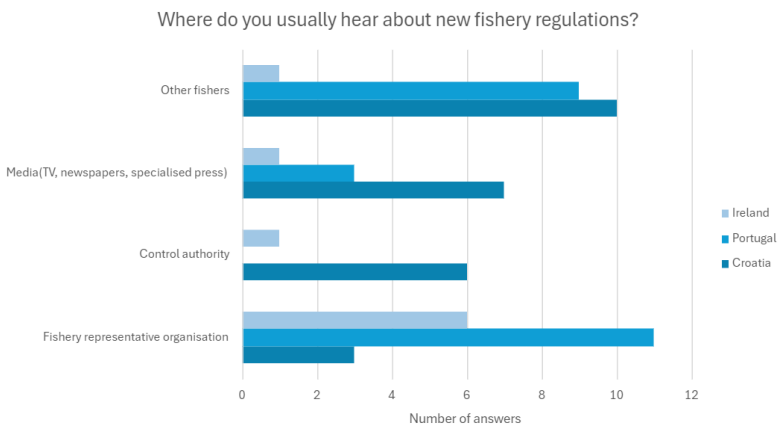
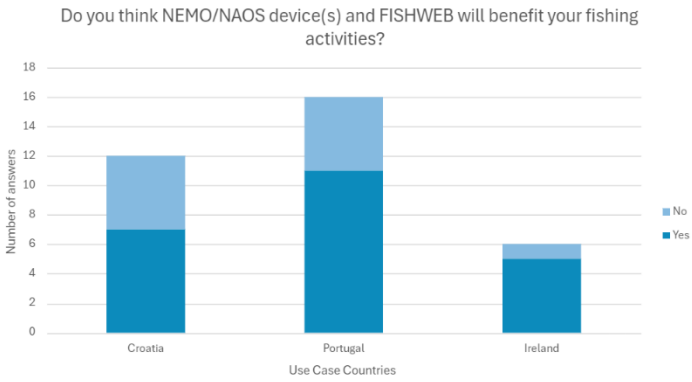


The question "Where do you usually hear about new fishery regulations?" often reflects the informal networks and habits of fishers. Fishers frequently share information among themselves, making word of mouth a common and reliable way to spread news about regulations and changes. Ideally, fishery representative organisations should take the lead in providing fishers with updates on legislation, new policies, and other developments that directly impact their livelihoods. These two sources—fellow fishers and representative organisations—are expected answers in a questionnaire. Even if word of mouth is a common way to get new information, it can be problematic when there is an information vacuum from the authorities as incorrect information can be circulated. A regular and reliable source of timely information is needed without information overload as not all SSF are members of representative organisations.

However, there are notable differences between countries. In Portugal, fishery organisations are generally more developed and have closer connections with the fishers, facilitating better communication. On the other hand, in Croatia, fishers tend to rely more on information from national authorities than their Portuguese counterparts. Media plays a similar role in both countries but is not always the primary source of regulatory updates.



Most fishers consider that the devices will benefit their activities (23 respondents), mainly because it will allow them to comply with future regulations, be more informed about their fishing activities or better understand their trajectories. This might help improve the efficiency of their activities. However, some of them don't use the FISHWeb platform regularly and therefore don't benefit from it.

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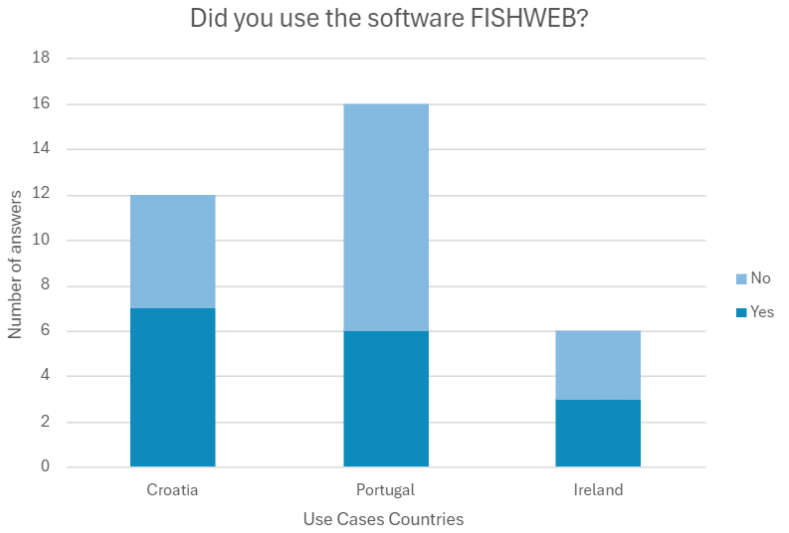
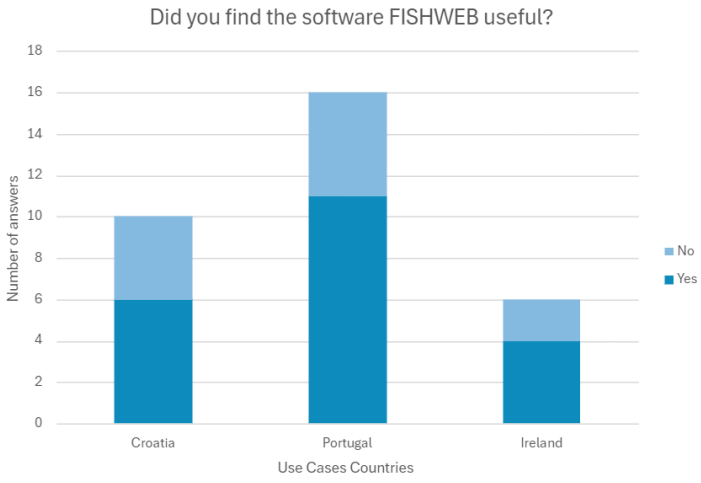
Almost half of the respondents used the software FISHWeb (47%) across the three use cases. It is noticeable a slight lesser use of the FISHWeb platform in Portugal compared to the other countries.



When asked about " Did you find the software FISHWeb useful?", more than half of the respondents in each country answered "yes". Despite them pointing that they are not using the platform that much, they do think it is useful. More training sessions with the fishers on how to use the platform and having the platform translated into their native language can help them use it more. The platform could also be useful for future use in documenting fishing activity for marine spatial planning purposed such with the production of heatmaps.



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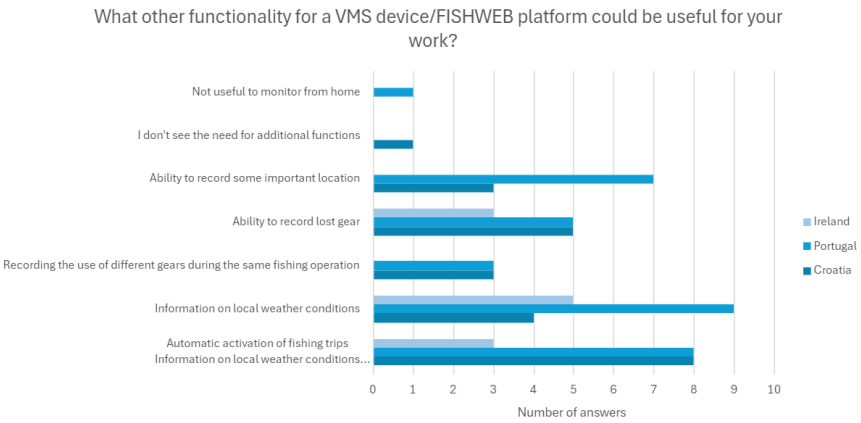
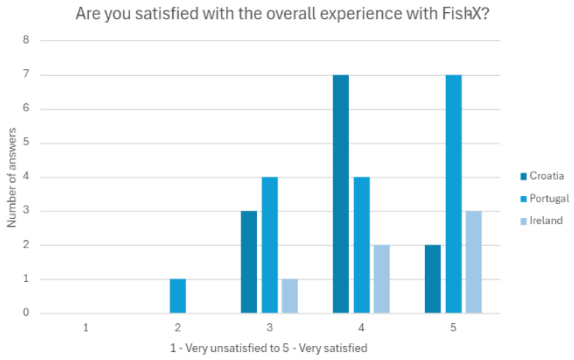
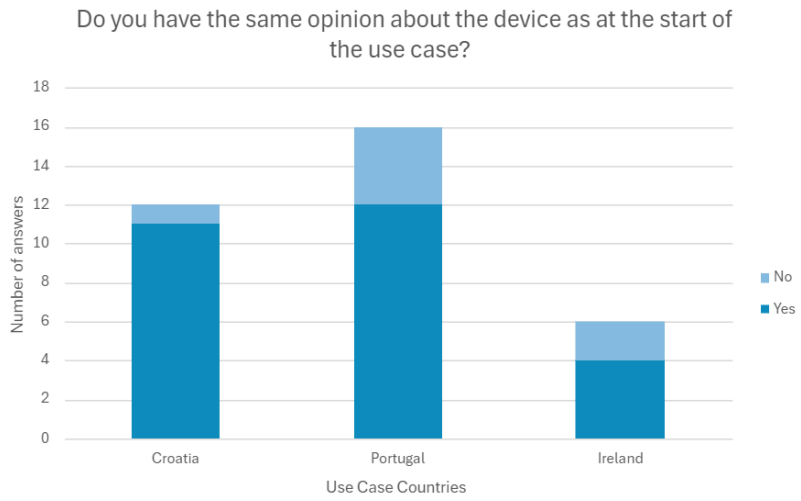


When asked about "What other functionalities for a VMS/FISHWeb platform could be useful for our work?" there were similar answer in the three countries. For Croatia, fishers pointed out the automatic activation of fishing trips and the ability to record lost gear as the main preferences. For Portugal, the information about local weather was the preferred option, followed by the automatic activation of the fishing trips. For Ireland, information on local weather conditions together with the ability to recover lost gears and the automatic activation of fishing trips would be interesting features. These answers express fishers' need to get clear information about some specificities of their work, in order to take advantage of the new technologies and be more up to date in their daily routines.



To the question "Are you satisfied with the overall experience with Fish-X", one third of the respondents answer that they are very satisfied. Another third feels satisfied, eight fishers are neutral and one fisher responded unsatisfied. Overall, one can conclude that there is an overall satisfaction from the project's participants.



73% of the respondents kept the same opinion about the devices than at the start at the project.

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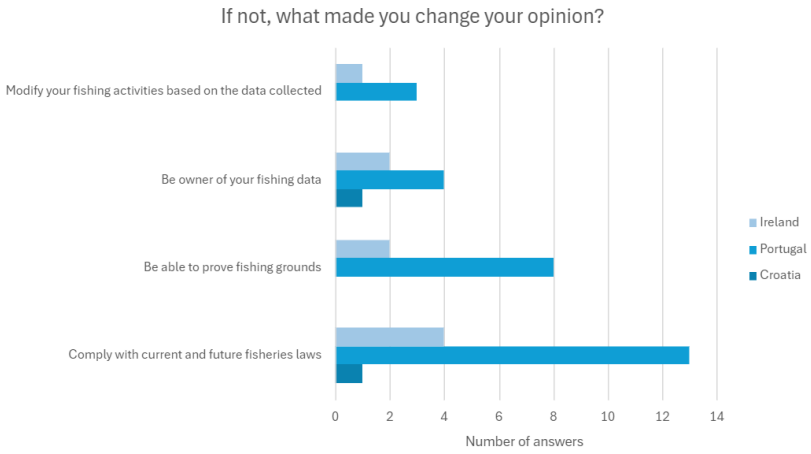
For the seven respondents who changed their opinion on the device, what made them change their opinion was the opportunity to comply with current and new legislations, being able to prove their fishing ground, be owner of their fishing data and being able to modify their fishing activities based on the data collected.



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5. Forward-looking and next steps

5.1 Lessons learned from Fish-X

The use cases started back in August 2023 for Croatia and Portugal and in June 2024 for Ireland. A total of 104 NEMO beacons were installed by use cases partners, distributed as follow: 14 in Ireland, 31 in Croatia and 59 in Portugal. The installations started relatively slowly but kept increasing steadily due to the trust building and stakeholder engagement efforts. Stakeholder engagement is a key element to increase adoption of fishers of new technology. Use cases partners have continuously contacted fishers' associations and individual fishers to convince them to participate in the project. As shown by the literature review on stakeholder participation for environmental management, participatory processes benefit environmental decision-making with regards to its widely accepted approach and outcome by citizens.[25] To ensure the robustness of the engagement, the process should be underpinned by a philosophy mixing empowerment, equity, trust and learning. Furthermore, a couple of practical advice are given such as involving stakeholders as early as possible and throughout the process, defining clear objectives from the outset with a selected method and highly skilled facilitation. Putting effort in to building trusted relationships with the main beneficiaries throughout the project are two key aspects for meaningful engagement with small-scale fishers.

Based on the answers received from the questionnaires, there is an overall satisfaction from the fishers participating in the pilot project with 73% of them feeling satisfied and very satisfied about their overall experience with Fish-X. Another relevant metric is the massive interest to keep the devices after the project ends demonstrated by 31 out of the 34 respondents to the questionnaire.

Therefore, this enthusiasm shows the positive impact of a pilot project such as Fish-X can have on the fishers' perception towards technology and more generally about the benefits of vessel tracking. The positive attitude of the respondents towards technology is also dependent on the broader context at sea with an increased competition for space where the offshore wind industry, the designation of marine protected areas and other maritime sectors tend to limit the fisheries activity, in particular near the shore. As a consequence, fishers are starting to recognise the importance of geolocalisation data as evidence to prove their fishing grounds in consultation processes.

Finally, from the outset of the use cases and to comply with the General Data Protection Regulation, involved fishers had to sign an informed consent form specifying the framework for collection and processing of the personal data (i.e. terminal geolocation, vessel trajectories, terminal serial number etc.). To be specific, the other fishers would not have access to the other vessels' trajectories, the collection would only happen during the duration of the project and results will be anonymised prior to any further dissemination. As a result, ensuring data ownership and privacy is essential for the credibility of the engagement.

As the adoption of VMS, e-gear, and other technological innovations continues to grow, it is expected that these systems will become the "new normal" within the SSF community. The

[25] 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.

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benefits of these systems—including improved management of fishing grounds, enhanced regulatory compliance, and greater transparency—are increasingly being recognised by fishers. Over time, the initial resistance is likely to diminish, and VMS will become a standard component of fishing operations.

However, the journey towards full acceptance is ongoing. Continued efforts to address the remaining challenges, such as data ownership, privacy concerns and ensuring the permanent free use of the application and vessel monitoring, will be essential. Additionally, as more fishers become familiar with these systems and recognise the tangible benefits they offer, the transition to using VMS is expected to accelerate. The deployment of both NEMO vessel tracking devices and NAOS e-gear devices has already shown promise, and ongoing testing and refinement of these systems will be key to their long-term success.

In conclusion, while the initial introduction of VMS and other technological solutions was met with scepticism, Croatian, Irish and Portuguese fishing communities are gradually embracing these innovations. Through sustained engagement and outreach efforts, fishers are becoming more aware of the benefits these systems offer, leading to a steady increase in adoption and acceptance. As these technologies become more integrated into their daily operations, they are likely to play a crucial role in ensuring the sustainability and efficiency of small-scale fisheries in the years to come. Digital tools can simplify the reporting process for fishers, making it easier to report catches, ensure compliance with regulations, and ultimately protect marine resources.

5.2 What could a Fish-X 2.0 look like?

Based on the lessons learned of the three-year project Fish-X, if the project were to continue, the following features could be considered:

- With the gradual implementation of traceability requirements included in the EU Fisheries Control Regulation with additional traceability information for lots of fishery and aquaculture products (Article 58), including minimum information for prepared and preserved products, the NEMO beacons (VMS) could provide the accurate position of the catch area, improving the traceability for short supply chains and coastal fishing.

- With the development of the traceability application as one of the technological developments of Fish-X, this application could be further expanded and tested in the other use cases such as in Portugal, Croatia and Ireland. The consumer interface of the traceability application could support market access and small-scale seafood product price valorisation towards the consumer to reward financially low impact fisheries practices. Exploring the incentives to add value to small-scale seafood products could be a way forward to sustain the sector.

- The Data Space is a solution to the management, data-exchange and dissemination of fisheries data in a standardised way that would comply with the various regulations and requirements. Knowing that there will be a huge amount of new data generated by VMS, catch e-logbooks, REM, among others, the Data Space is potentially an easy ready-made solution for the EU and Member States to comply with their obligations. Further work could also explore the possibilities of storing data in each of the Member States.

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- More exchanges with the Member States and DG Mare should be organised in the format of the DG Mare fisheries science seminars or workshops, providing opportunities for comparing technical experiences of each member state and trying to standardise the technical concepts and techniques.

- The scope of the use cases could be extended to additional small-scale fishers for the purpose of solidifying the collected dataset for the Insight Platform which is a Key Exploitable Result of the Fish-X project, and ensuring an effective implementation of the EU Fisheries Control Regulation and of the other ocean-related legislations. Also, it would be relevant to scale the use case locations where small-scale fisheries are numerous such as in France or Italy and to include other regions (i.e. North Africa for instance).

- The transition to digital technologies by small-scale fishers could be supported by further research and pilot testing in marine social sciences to accompany and appropriately support the change of practices. The organisation of workshops by use cases partners to demonstrate the FISHWeb platform was critical to enhance the digital literacy of the participants. Further training will be essential to ensure the necessary digital skills are acquired particularly considering the senior age profile of the SSF workforce.

- Collaborating with marine institutes and scientific bodies together with technological partners and civil society organisations enables consistency and credibility of the project in relation to other pilot testing conducted in parallel or previously by other consortium and stakeholders.

- Finally, funding for the continuation of the IT services and maintenance of the device and platform should be secured to ensure the proper use of the devices. The provision of technical assistance and of capacity-building is also an essential part of the success of a project as Fish-X.

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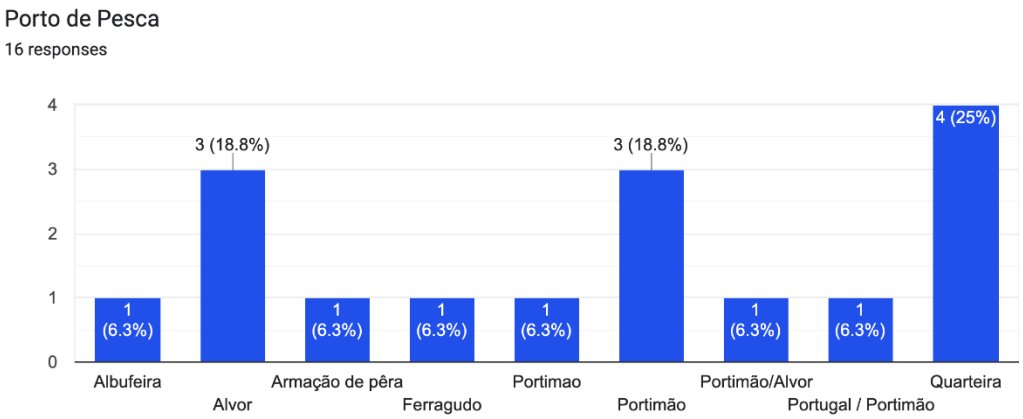
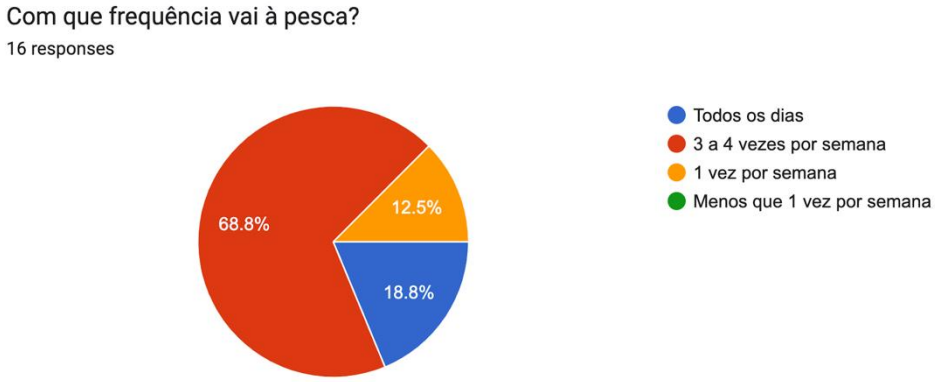
Annex 1: Portuguese Use Case – Questionnaire Answers

1. Fishing Activity

Working Fishing Port



How often do you go fishing?



On average, how many days a year are you fishing?

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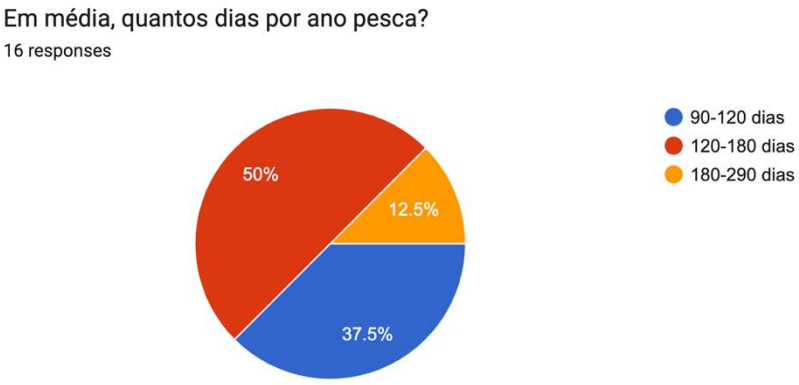
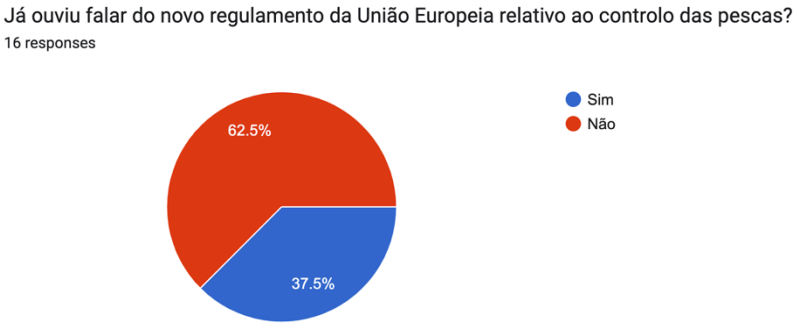
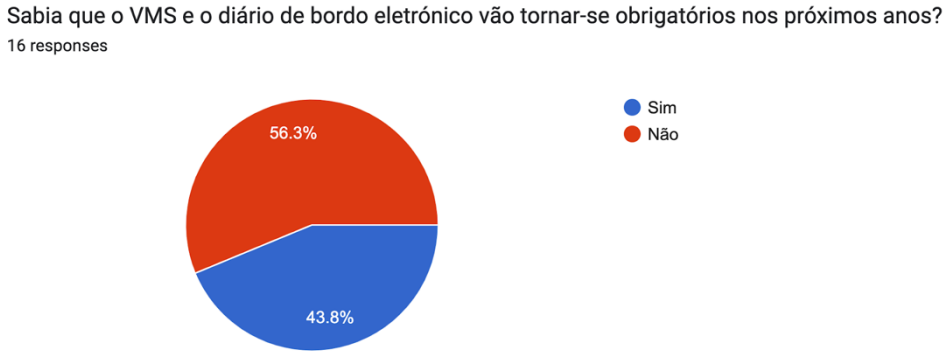


2. Fisheries regulation

Have you heard about the new EU Fisheries Control regulation?



Did you know the VMS and e-logbook are set to become mandatory in coming years?



Where do you usually hear about new fishery regulations?

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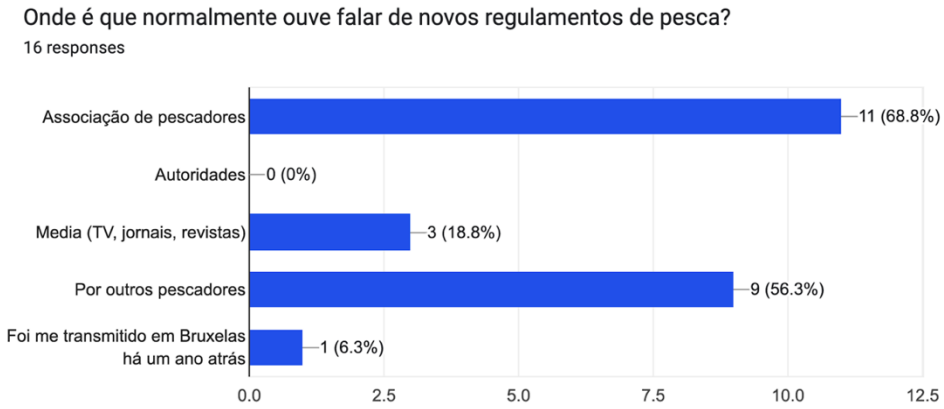
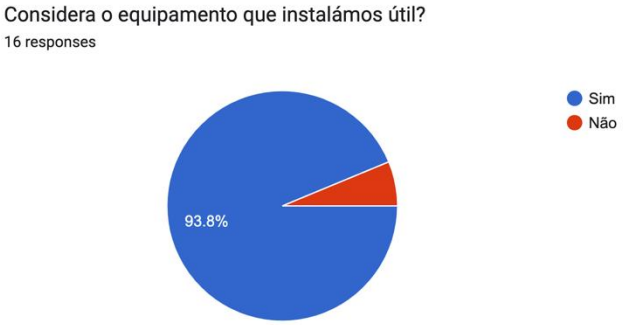


3. Use of devices

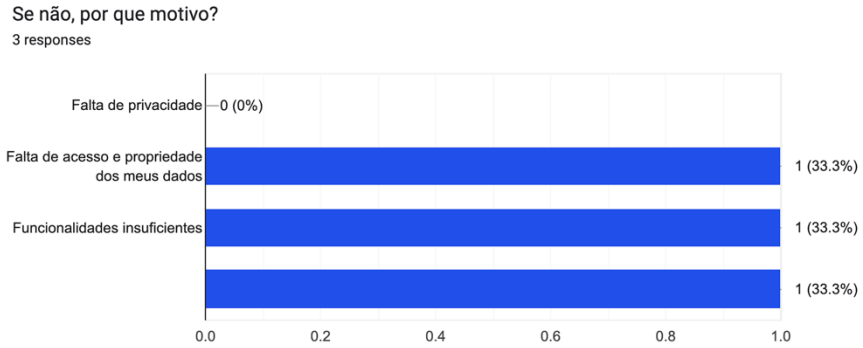
Do you feel comfortable using new technology in general?

Do you consider NEMO useful?



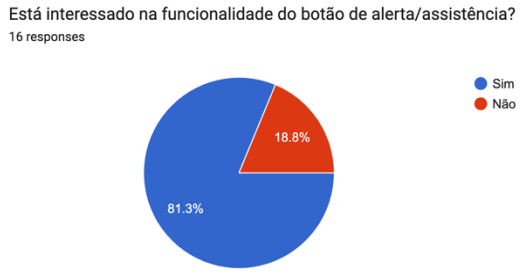
If not, for what reasons?

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



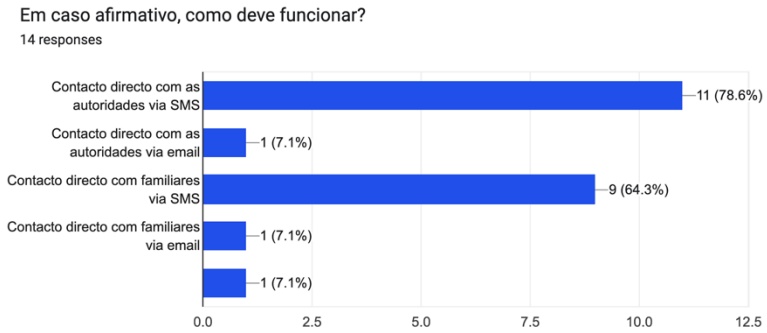
Do you consider NEMO easy to use?

Are you interested in the functionality of the alert/assistance button?

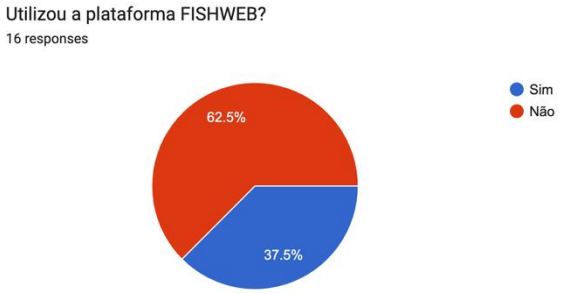


If yes, how should it work?

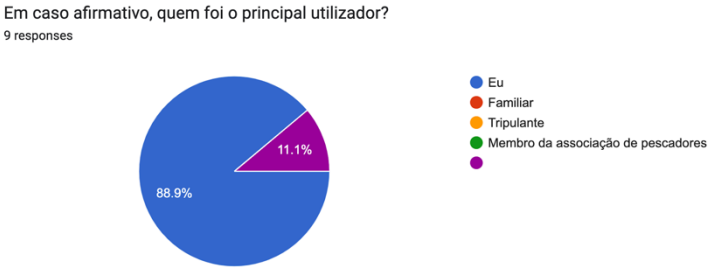
This project has received funding from the European Union's Horizon Europe programme under grant agreement No 101060879.



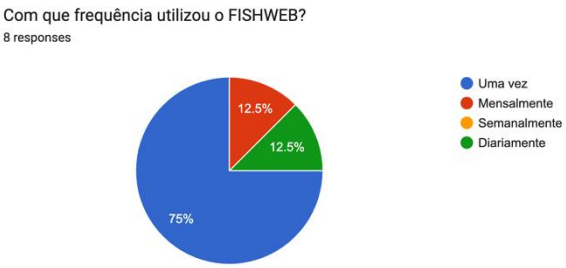
Did you use the software FISHWEB?



If yes, who is the main user?

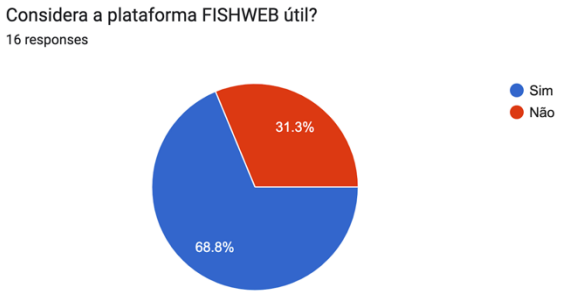


How often did you use FISHWEB?

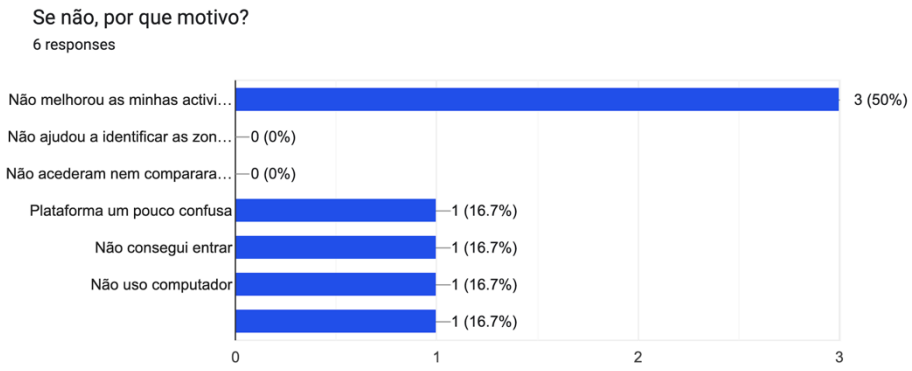


This project has received funding from the European Union's Horizon Europe programme under grant agreement No 101060879.

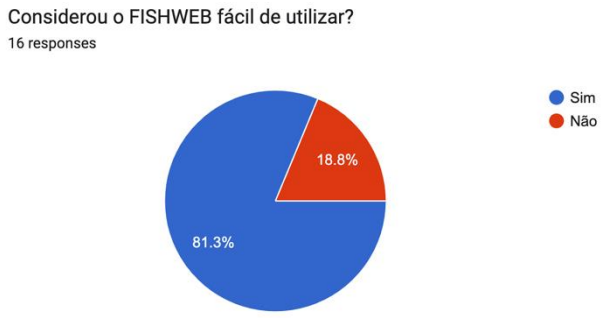
Did you find the software FISHWEB useful?



If not, for what reasons?

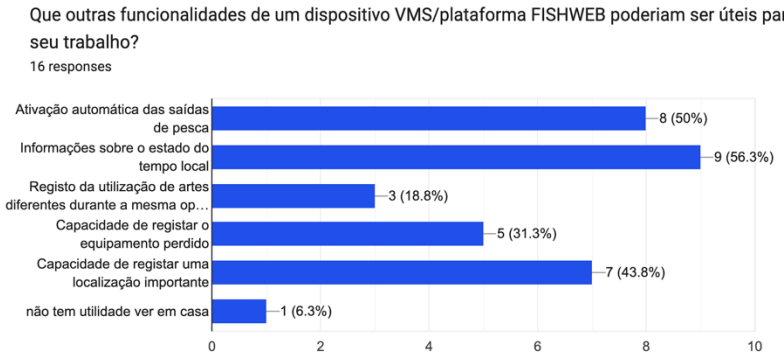


Did you find FISHWEB easy to use?



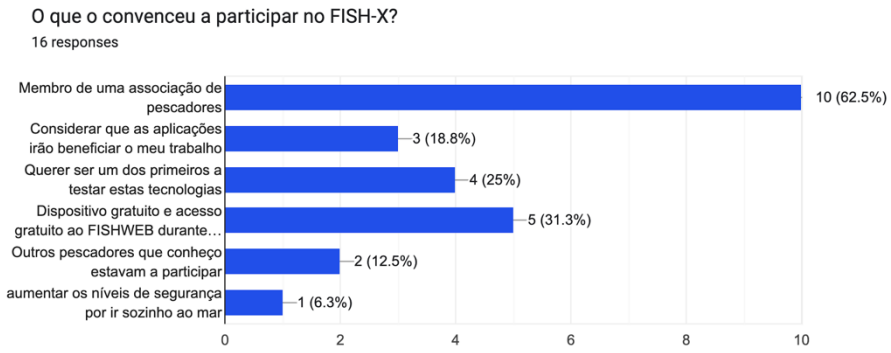
What other functionality for a VMS device/FISHWEB platform could be useful for your work?

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



4. Participation in Fish-X and feedback

What convinced you to participate in FISH-X?



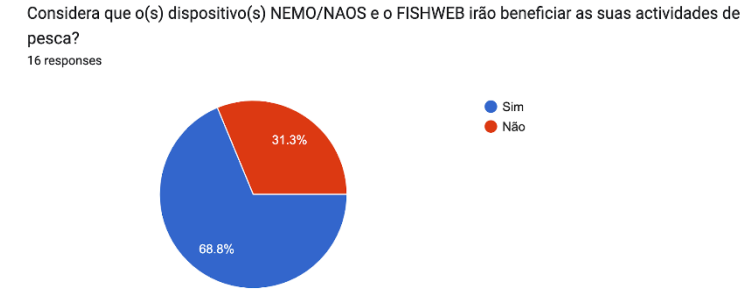
Are there any barriers to the use/adoption of VMS?

If yes, what are they?

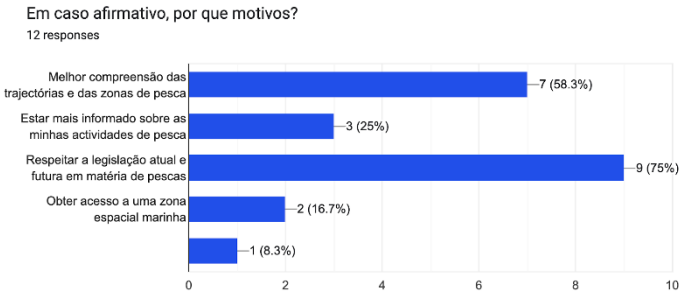
1 answer only – Can't get along with tecnologies ("Não me entendo com tecnologias)

Do you think NEMO/NAOS device(s) and FISHWEB will benefit your fishing activities?

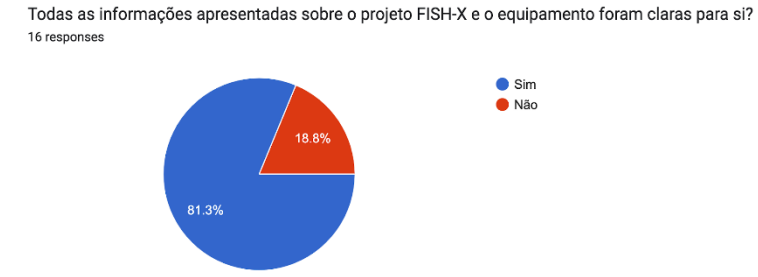
This project has received funding from the European Union's Horizon Europe programme under grant agreement No 101060879.



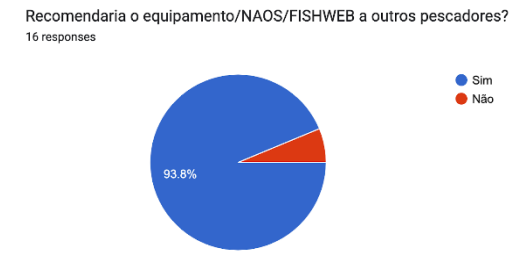
If yes, for what reasons?



Was all the information presented about FISH-X and NEMO clear to you?

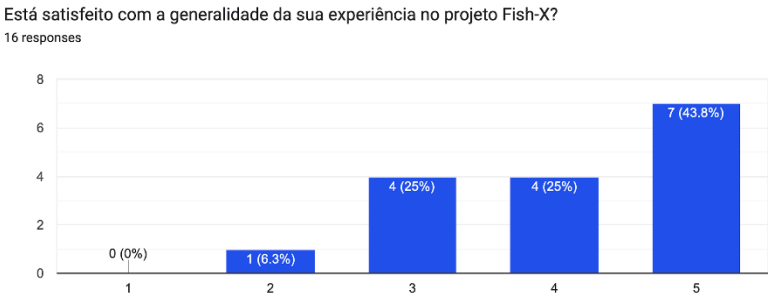


Would you recommend VMS/NAOS/FISHWEB to other fishers?



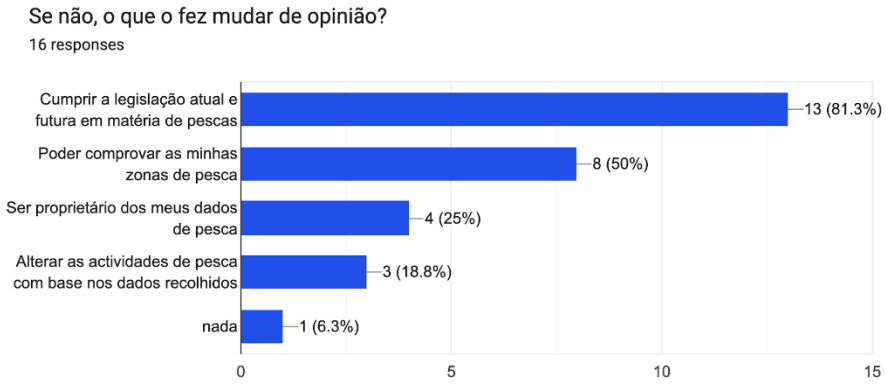
This project has received funding from the European Union's Horizon Europe programme under grant agreement No 101060879.

Are you satisfied with the overall experience with Fish-X?



Do you have the same opinion about the device as at the start of the use case?

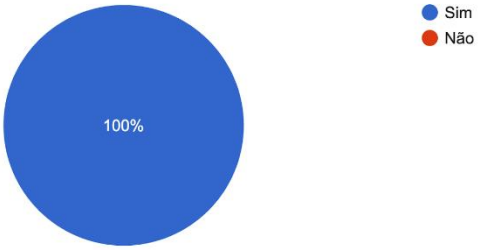
If not, what made you change your opinion?



Do you want to keep the device after the project ends?

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

Pretende manter o equipamento após a conclusão do projeto?
16 responses



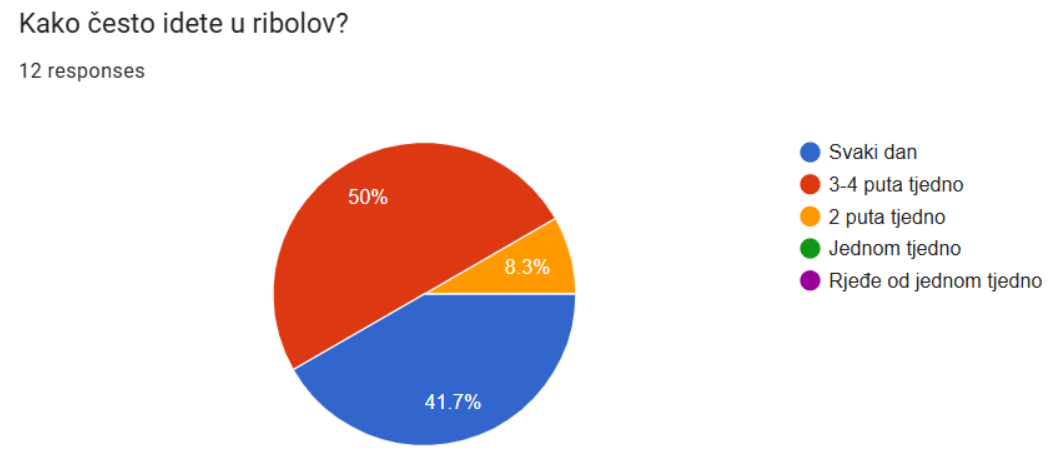
This project has received funding from the European Union's Horizon Europe programme under grant agreement No 101060879.

Annex 2: Croatian Use Case – Questionnaire Answers

1. Fishing Activity

Fishing ports

How often do you go fishing?

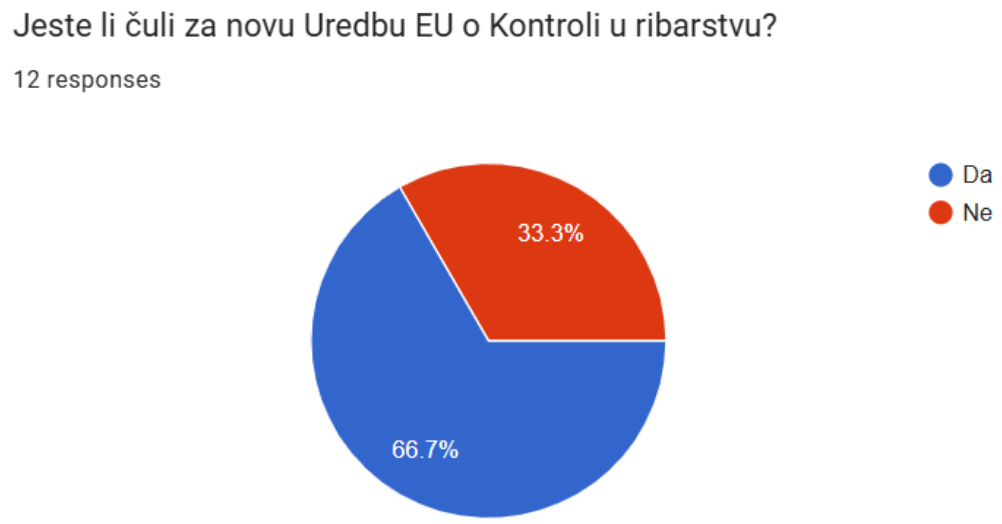


On average, how many days a year are you fishing?

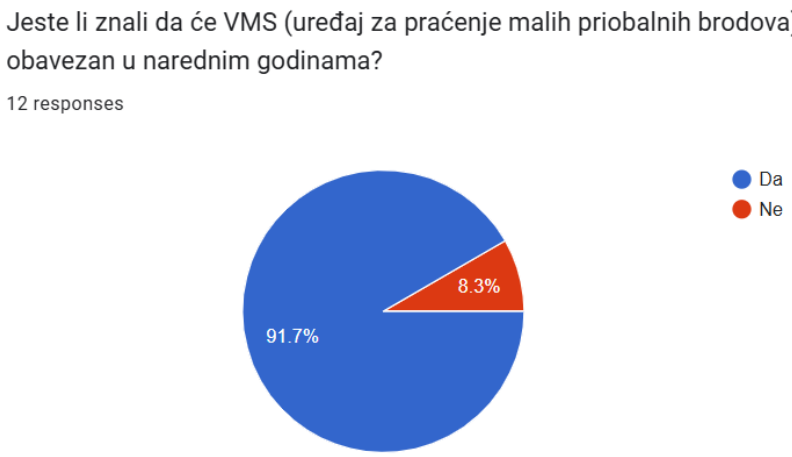
This project has received funding from the European Union's Horizon Europe programme under grant agreement No 101060879.

2. Fisheries regulation

Have you heard about the new EU Fisheries Control regulation?

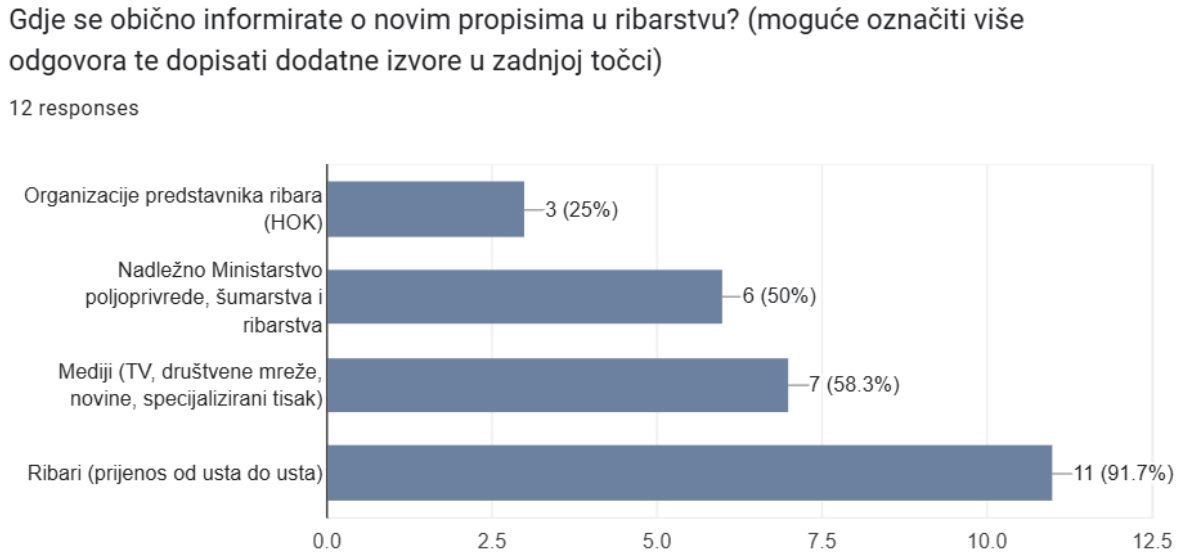


Did you know the VMS and e-logbook are set to become mandatory in coming years?



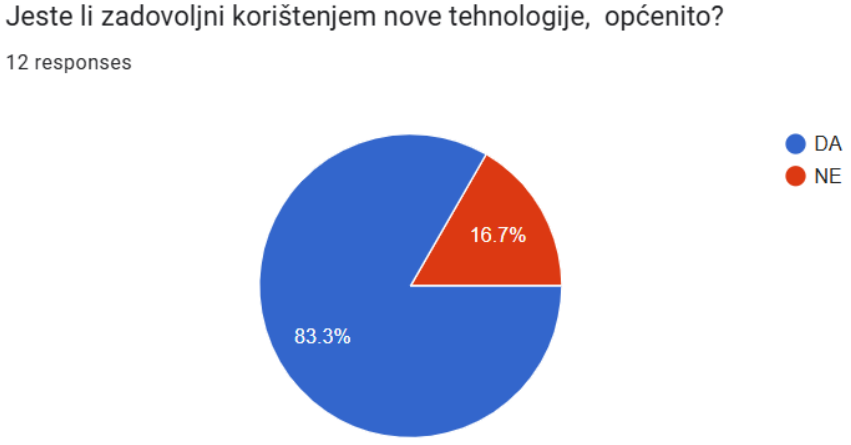
Where do you usually hear about new fishery regulations?

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



3. Use of devices

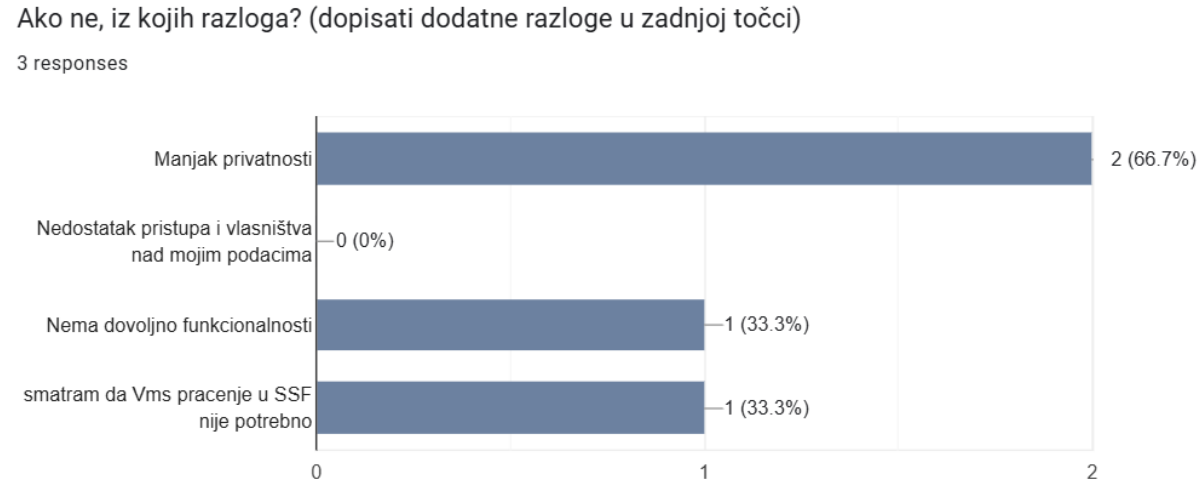
Do you feel comfortable using new technology in general?



Do you consider NEMO useful?

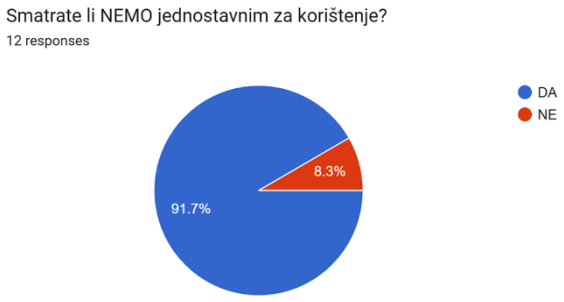
This project has received funding from the European Union's Horizon Europe programme under grant agreement No 101060879.

If not, for what reasons?

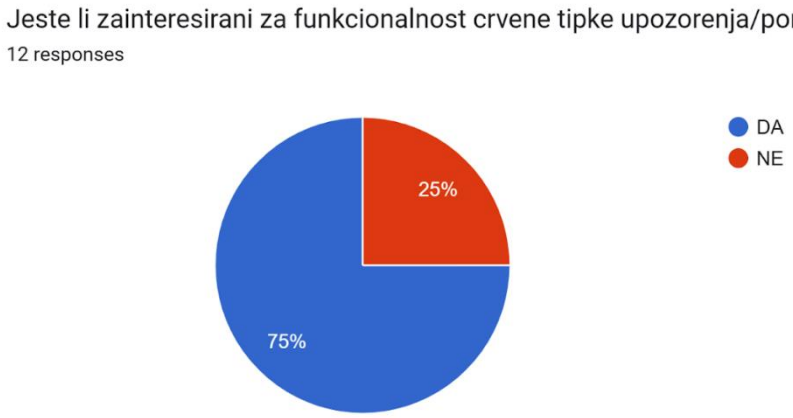


Do you consider NEMO easy to use?

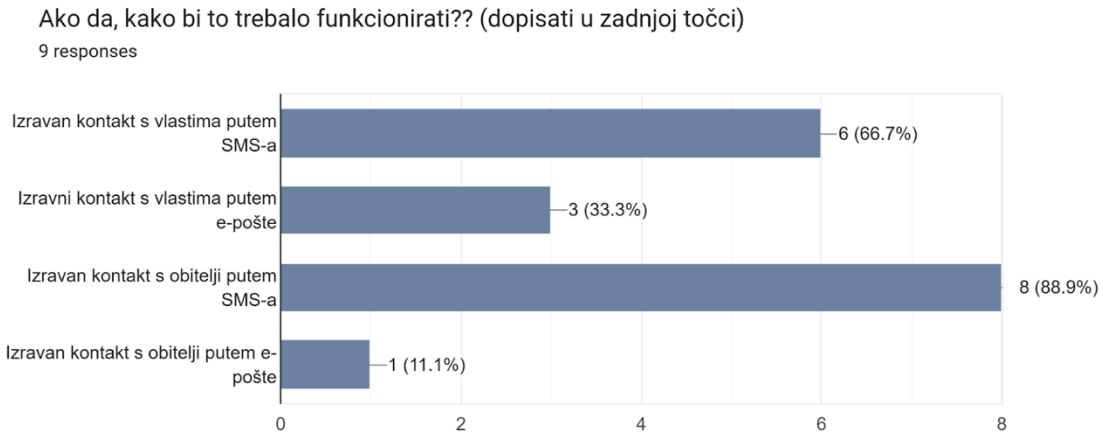
This project has received funding from the European Union's Horizon Europe programme under grant agreement No 101060879.



Are you interested in the functionality of the alert/assistance button?

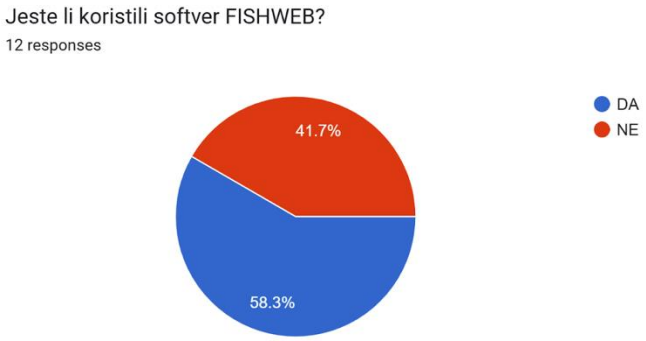


If yes, how should it work?

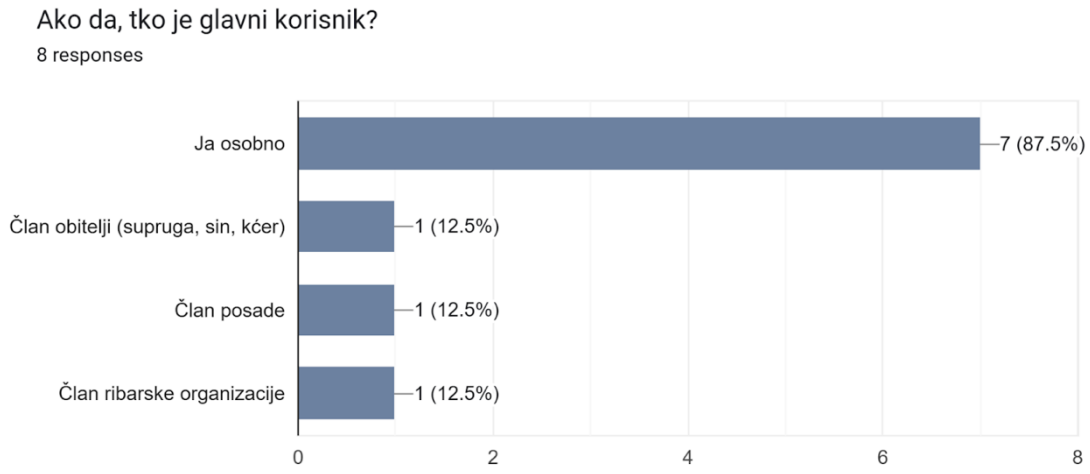


This project has received funding from the European Union's Horizon Europe programme under grant agreement No 101060879.

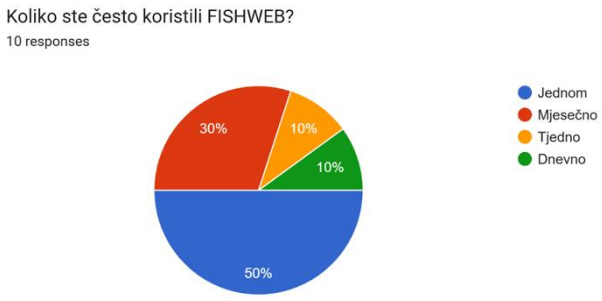
Did you use the software FISHWEB?



If yes, who is the main user?

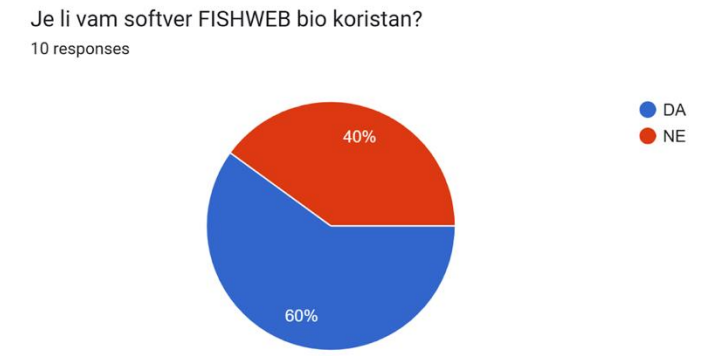


How often did you use FISHWEB?

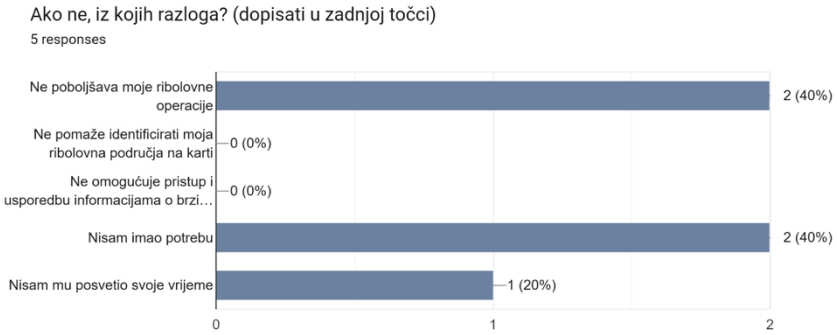


This project has received funding from the European Union's Horizon Europe programme under grant agreement No 101060879.

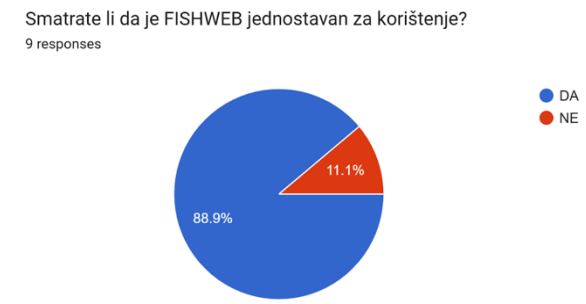
Did you find the software FISHWEB useful?



If not, for what reasons?

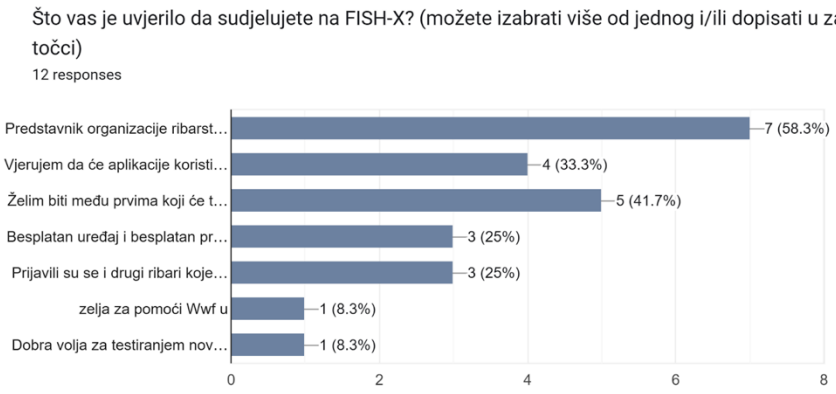


Did you find FISHWEB easy to use?



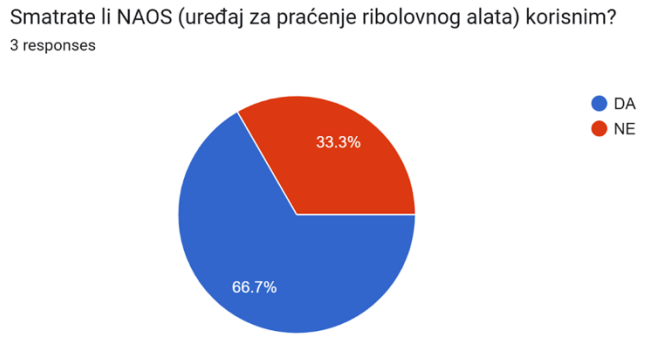
This project has received funding from the European Union's Horizon Europe programme under grant agreement No 101060879.

What other functionality for a VMS device/FISHWEB platform could be useful for your work?



ONLY for fishers who have NAOS (gear marking device)

Do you consider NAOS useful?

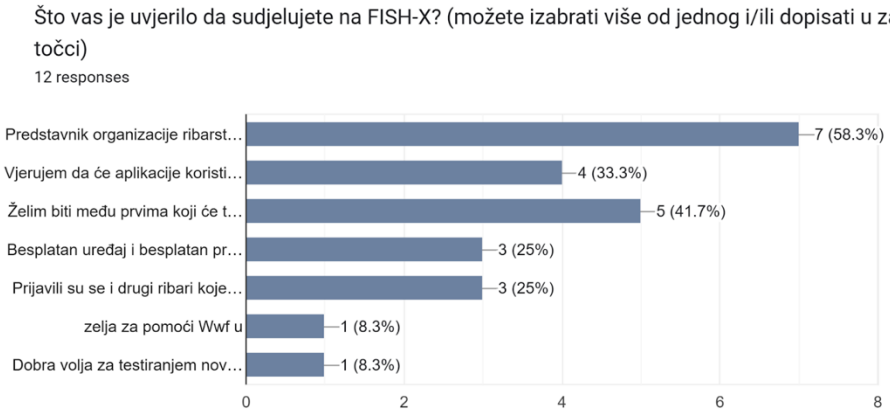


Do you consider NAOS easy to use?

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

4. Participation in Fish-X and feedback

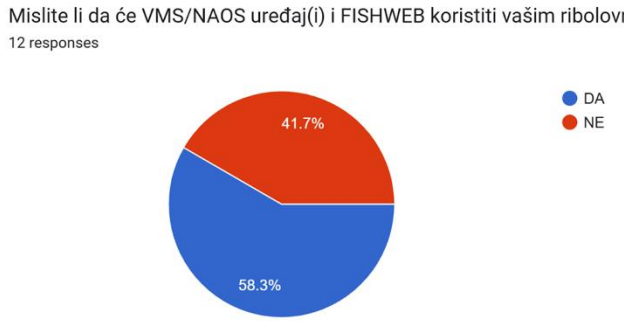
What convinced you to participate in FISH-X?



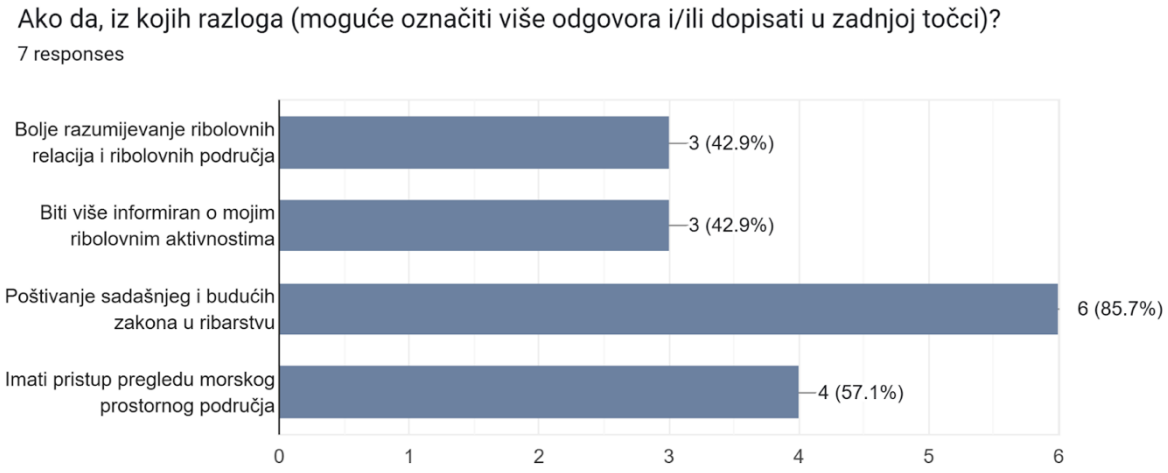
Are there any barriers to the use/adoption of VMS?

Do you think NEMO/NAOS device(s) and FISHWEB will benefit your fishing activities?

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



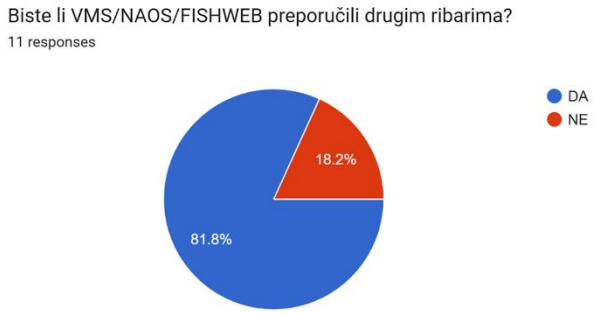
If yes, for what reasons?



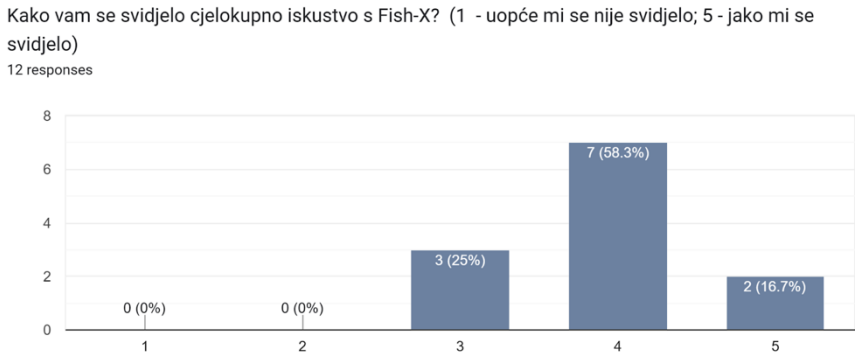
Was all the information presented about FISH-X and NEMO clear to you?

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

Would you recommend VMS/NAOS/FISHWEB to other fishers?



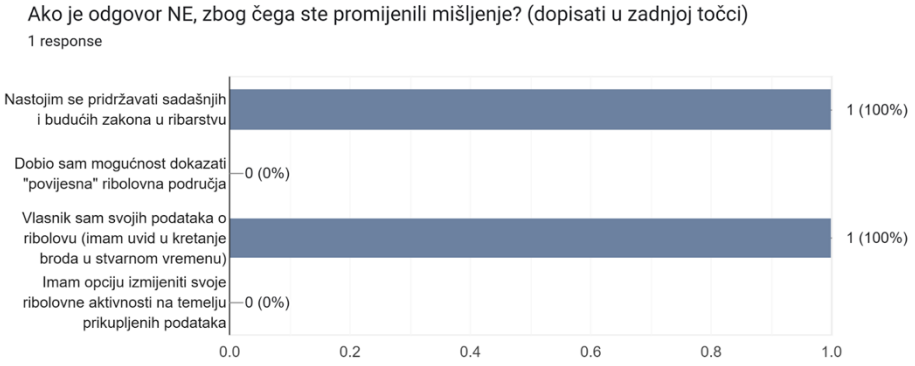
Are you satisfied with the overall experience with Fish-X?



Do you have the same opinion about the device as at the start of the use case?

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

If not, what made you change your opinion?



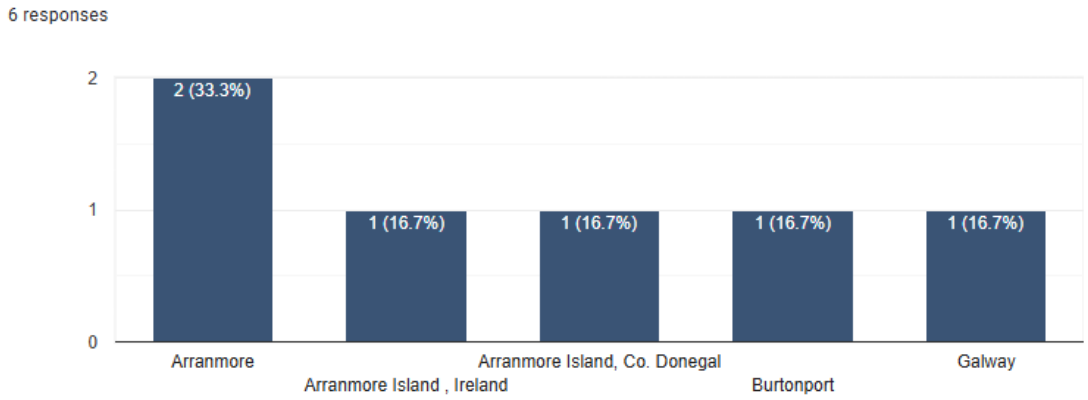
Do you want to keep the device after the project ends?

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

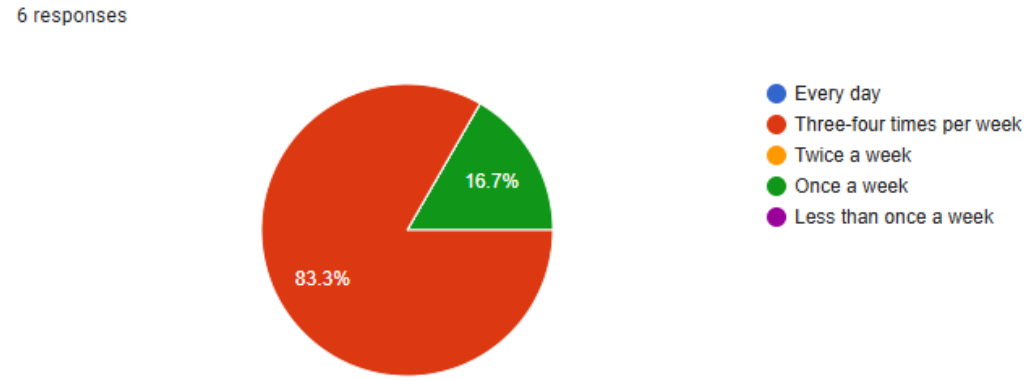
Annex 3: Irish Use Case – Questionnaire Answers

1. Fishing activity

Fishing port



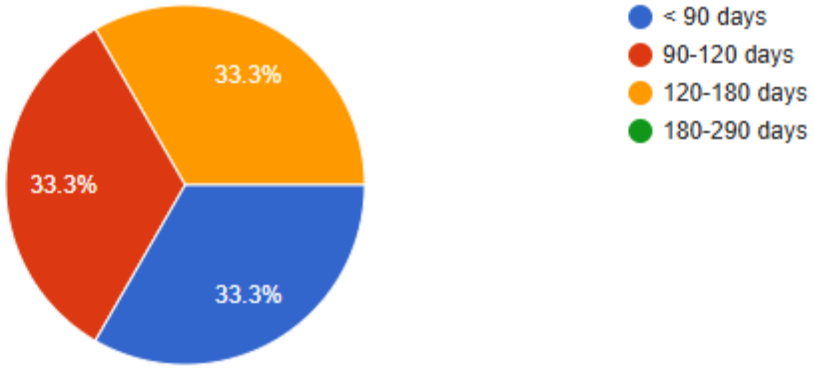
How often do you go fishing?



On average, how many days a year are you fishing?

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

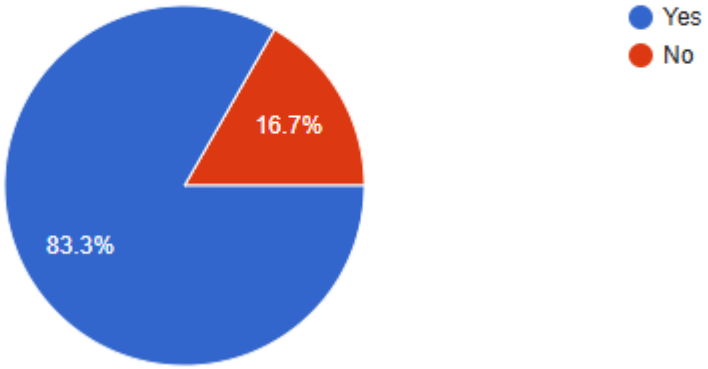
6 responses



2. Fisheries regulations

Have you heard about the new EU Fisheries Control regulation?

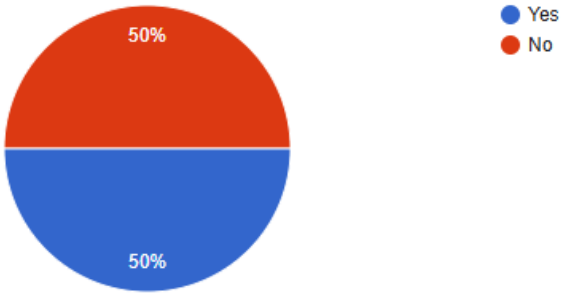
6 responses



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

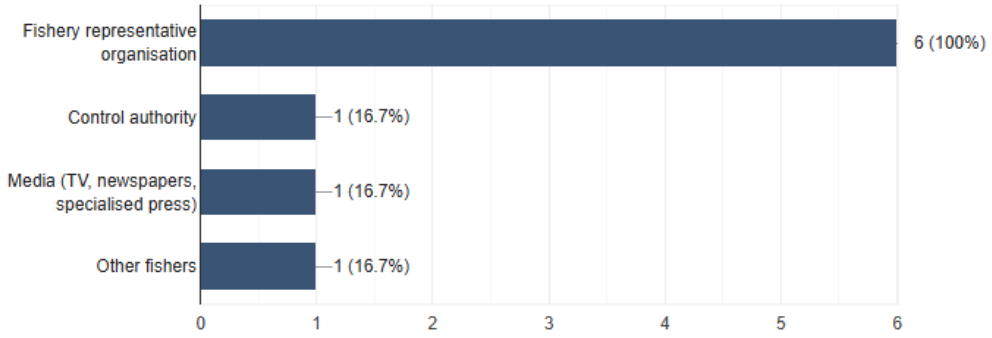
Did you know the VMS and e-logbook are set to become mandatory in coming years?

6 responses



Where do you usually hear about new fishery regulations?

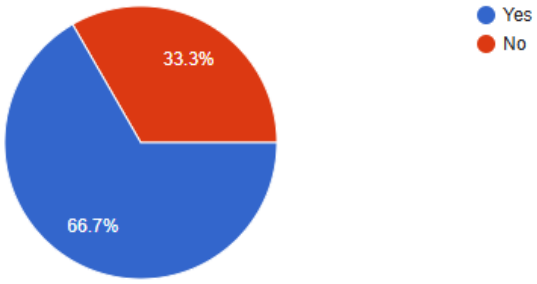
6 responses



3. Use of devices

Do you feel comfortable using new technology in general?

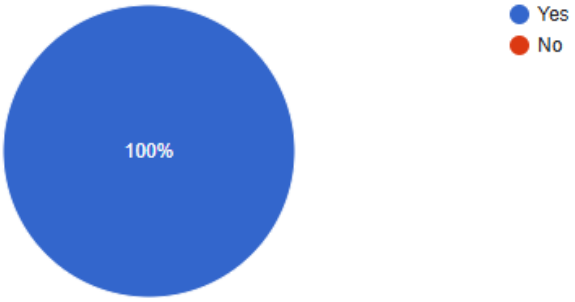
6 responses



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

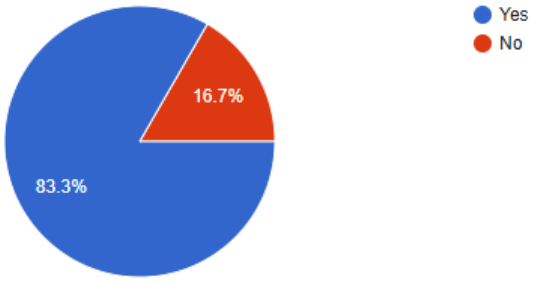
Do you consider NEMO useful?

6 responses



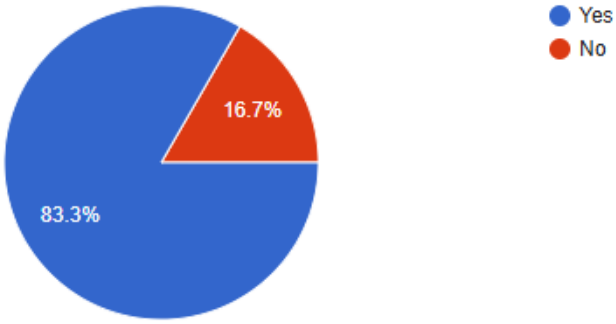
Do you consider NEMO easy to use?

6 responses



Are you interested in the functionality of the alert/assistance button?

6 responses



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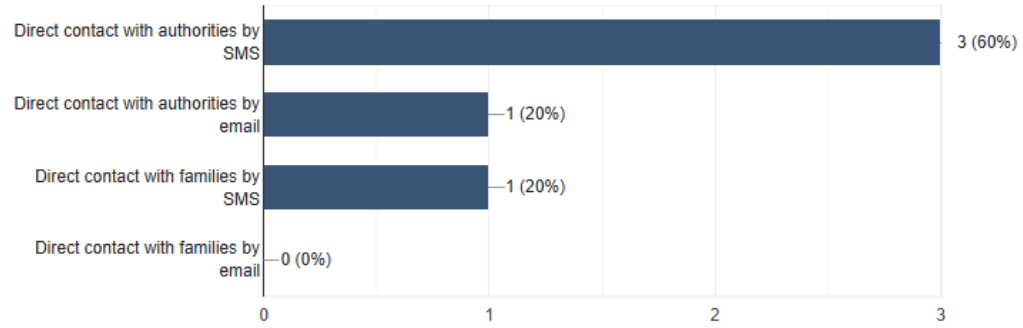
If yes, how should it work?

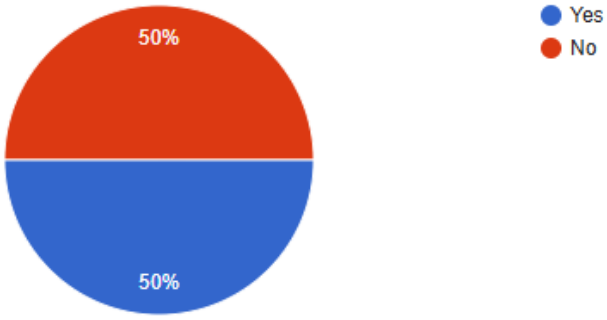
Copy chart

5 responses



Did you use the software FISHWEB?

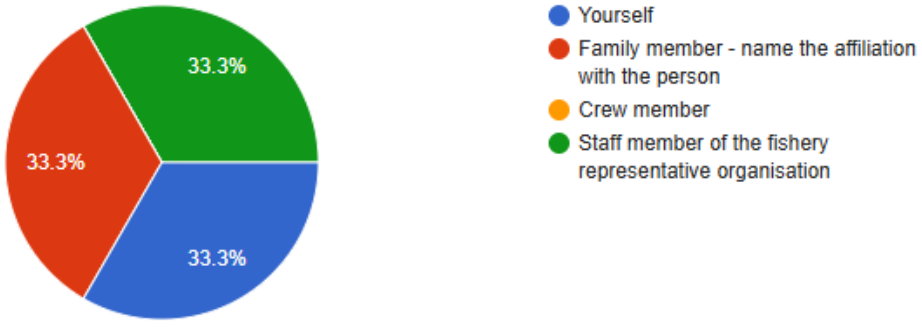
6 responses



If yes, who is the main user?

Copy

3 responses



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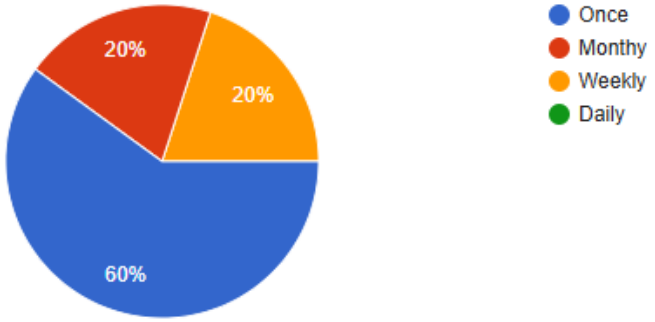
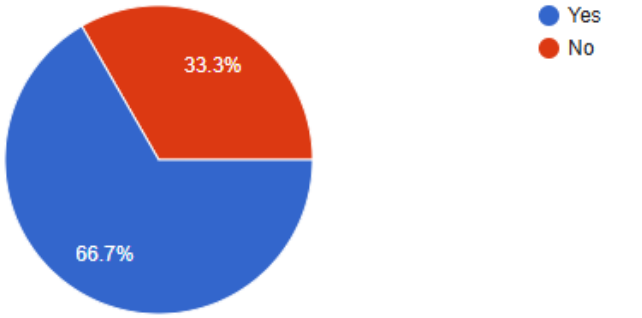
How often did you use FISHWEB?

5 responses



Did you find the software FISHWEB useful?

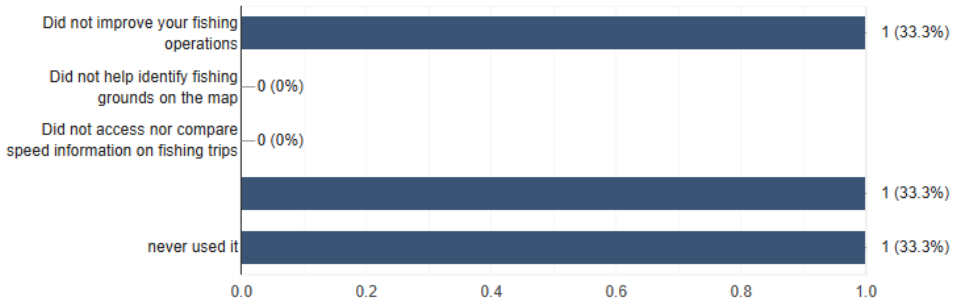
6 responses



If not, for what reasons?

Copy chart

3 responses



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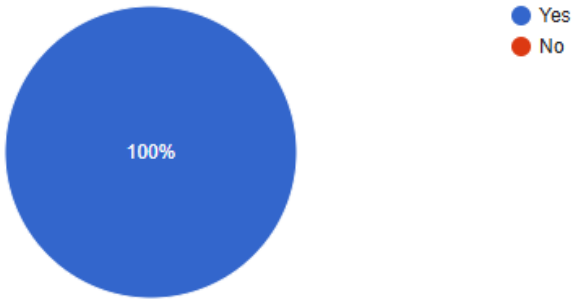
Did you find FISHWEB easy to use?

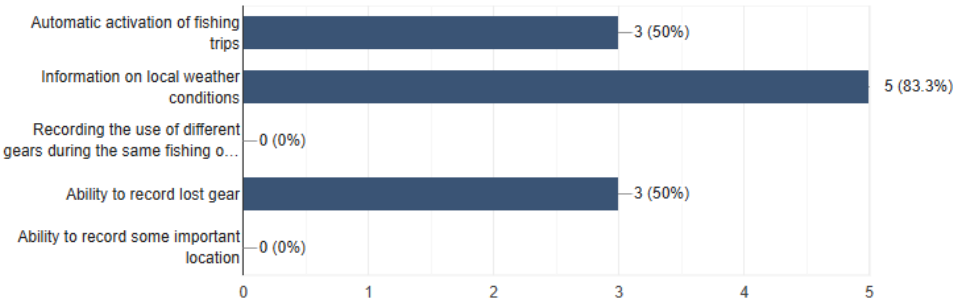
6 responses



What other functionality for a VMS device/FISHWEB platform could be useful for your work?

Copy chart

6 responses

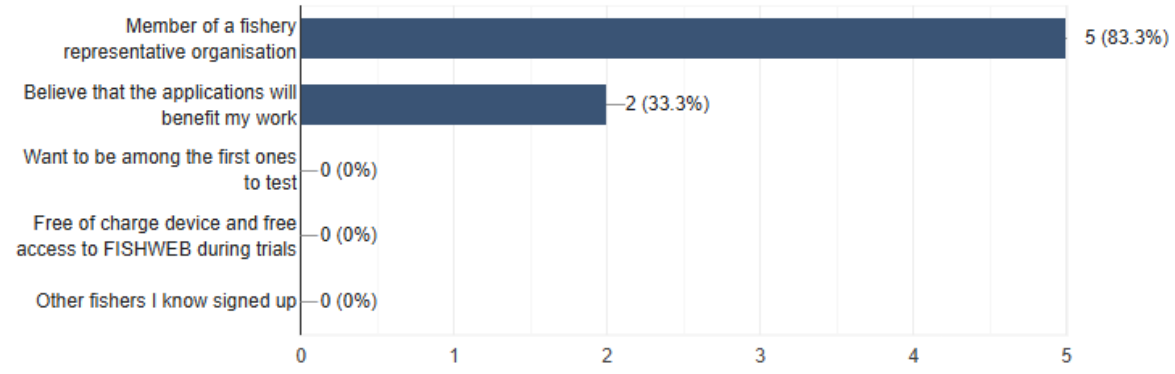


4. Participation in Fish-X and impression

What convinced you to participate in FISH-X?

Copy chart

6 responses



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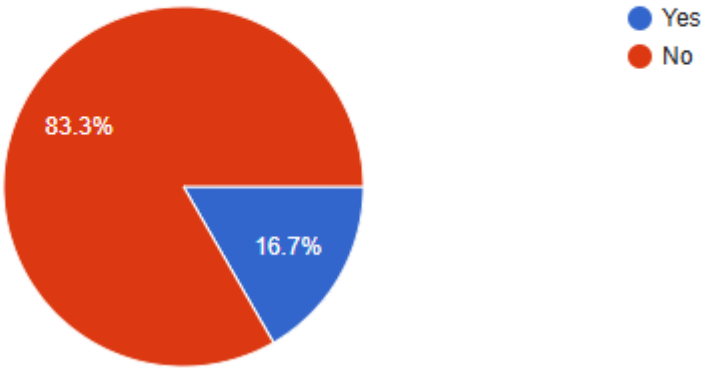
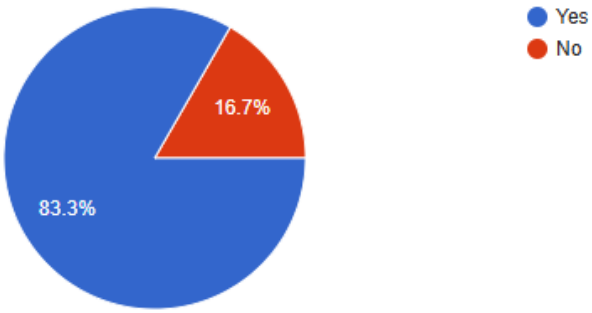
Are there any barriers to the use/adoption of VMS?

6 responses



Do you think NEMO/NAOS device(s) and FISHWEB will benefit your fishing activities?

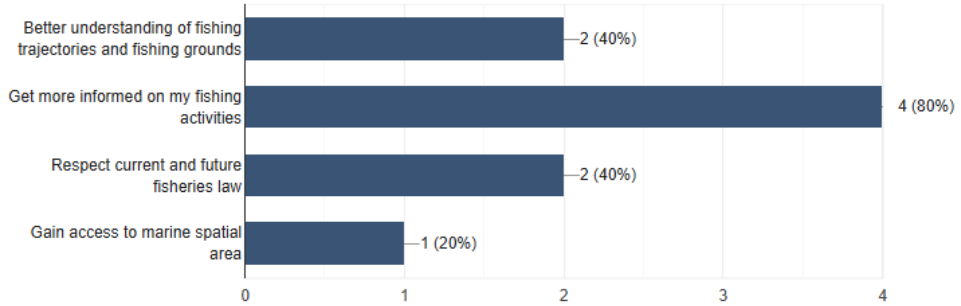
6 responses



If yes, for what reasons?

Copy chart

5 responses



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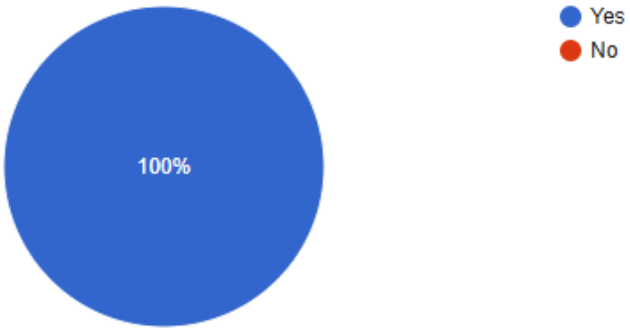
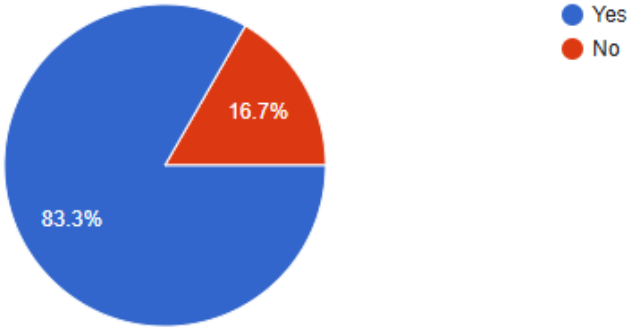
Was all the information presented about FISH-X and NEMO clear to you?

6 responses



Would you recommend VMS/NAOS/FISHWEB to other fishers?

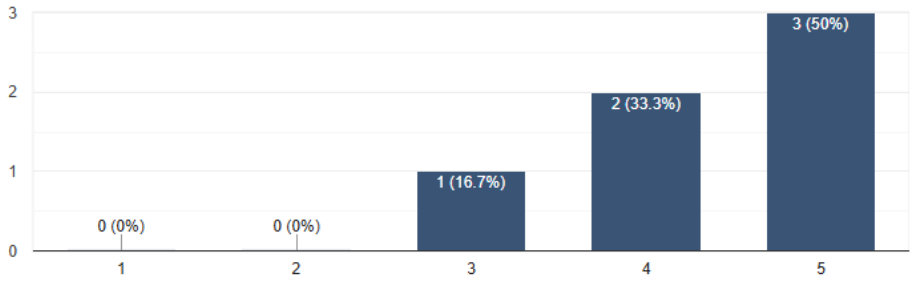
6 responses



Are you satisfied with the overall experience with Fish-X?

Copy chart

6 responses



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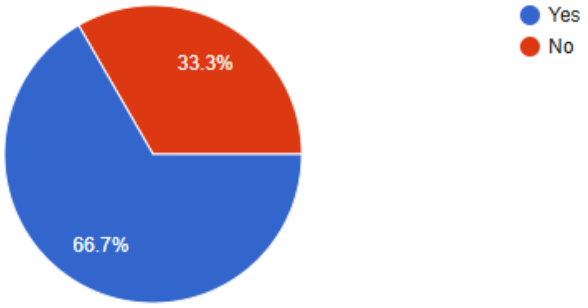
Do you have the same opinion about the device as at the start of the use case?

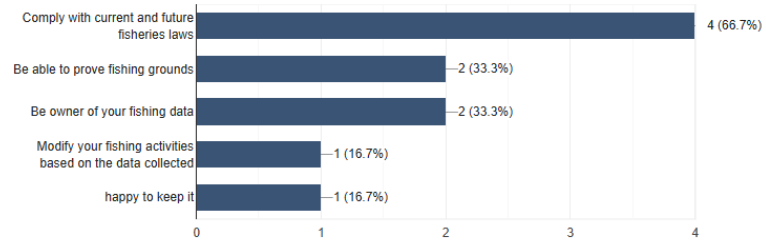
6 responses



If not, what made you change your opinion?

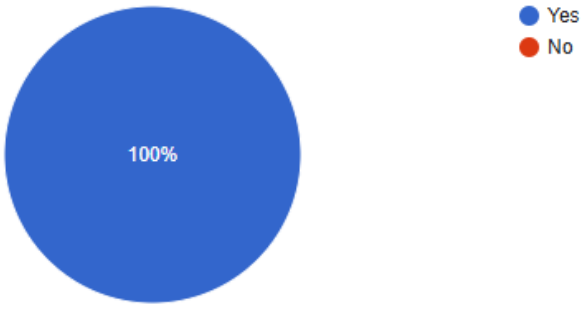
Copy chart

6 responses



Do you want to keep the device after the project ends?

6 responses



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