

ICES ANNUAL SCIENCE CONFERENCE
15-18 September 2026
Theme session M: Data quality in small-scale fisheries

Contents

Mapping Data Incompleteness Risk in European Small-Scale Fisheries	2
Strengthening Fisheries Data Systems for Sustainable Small-Scale Fisheries Management: Insights from FAO Voluntary Guidelines for Securing Sustainable Small- Scale Fisheries (SSF Guidelines)	2
Impact of sampling design on monitoring small-scale fisheries	3
Combining on-site sampling and declarative data to improve monitoring of small-scale coastal fleets in the French Outermost Regions	4
Smarter Sampling for Better Management: Optimizing Fishing Effort Estimates in Small- Scale Fisheries with High Resolution Tracking Data	4
Estimating fishing effort in Basque small-scale fisheries using high-resolution geospatial data and iapesca	5
Improving small scale fisheries effort metrics: integrating data sources for better bycatch assessment	6
Guess the Gear: A Machine Learning Framework for Automated Gear Classification in Small-Scale Multi-Gear Fisheries	6
The depth of bycatch risk: a biologging-informed assessment of exposure to artisanal fisheries	7
Understanding the relevance of participatory GIS approaches in small-scale fisheries and socioecological systems to support spatial planning efforts	8
Temporal evolution and socio-economic relevance of small-scale fisheries in the Northern Adriatic Sea: a market-based analysis.	8
Where Science Meets Experience: Local Ecological Knowledge through modular interviews, in Small-Scale Fisheries of Southwest Portugal	9
Small Scale Fisheries Socio-economic Data in Ireland: The Good, The Bad and The Ugly.	10
Marine Observation System: building fishermen-oriented logbooks in the Adriatic Sea using a bottom-up approach with small scale fishermen	10
Improving data quality in a data-limited fishery with video surveys and object detection	11
Narratives of challenges in small-scale fisheries across island and isolated territories.	12

Mapping Data Incompleteness Risk in European Small-Scale Fisheries

Sebastien Demaneche

Fisheries landings and effort data are essential for effective fisheries monitoring (including e.g., spatial planning and stock assessment) and to support their long-term sustainable socio-economic development. The high diversity of European small-scale fisheries (SSF), combined with historically limited monitoring and reporting requirements, have contributed to substantial gaps in their available fishing activity data (e.g., spatio-temporal fishing effort and landings per species in weight and value). These gaps limit the ability to accurately assess aspects such as fishing mortality, bycatch rates, or the overall socio-economic value of SSF across different fishing fleets or gear types. In Europe, SSF activity is generally documented through sales notes, coastal logbooks, or other declarative forms, often applied in combination within a census-based framework. However, the coverage, completeness and reliability of these data remain uncertain, hindering their suitability for scientific assessment and evidence-based management.

This study develops a data-quality risk-assessment methodology to identify missing information and evaluate the magnitude and risk of data gaps for SSF activity data collected through census-based approaches. The method relies on two key indicators: (i) the proportion of officially registered vessels reporting at least one fishing-activity record, and (ii) the annual number of declared fishing trips per vessel. A multivariate analysis of these indicators allows to position countries or regions within a canonical 'space risk map', classifying data-incompleteness levels from low to very high, and facilitating the detection of potential under- or over-declaration.

Indicators were compiled by detailed vessel length classes, encompassing both SSF and large-scale fleets (LSF), for 17 European countries or regions and two reference years (2019 and 2023). Using the 2019 dataset, the developed risk map enables the classification of country-region units according to their degree of data incompleteness risk; e.g., highlighting differences in status between SSF and LSF across all surveyed countries. Units facing higher levels of incompleteness risk may require a targeted review of their national reporting systems or the implementation of complementary monitoring approaches to address critical data gaps. The 2023 dataset further captures temporal dynamics in data completeness, highlighting shifts in countries-regions positions within the multivariate canonical space and allowing progress to be assessed over time. Overall, this work provides a baseline for tracking long-term improvements in SSF data quality within evolving census-based frameworks, particularly in light of the progressive implementation of the new EU Fisheries Control Regulation (EU 2023/2842), which seeks to strengthen data consistency and support the transition toward more comprehensive digital reporting in European SSF.

Strengthening Fisheries Data Systems for Sustainable Small-Scale Fisheries Management: Insights from FAO Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries (SSF Guidelines)

K.H.Kaumi Lakmali Piyasiri

In Sri Lanka, as well as globally, the small-scale fisheries (SSF) subsector is threatened by high rates of resource exploitation, unregulated technological change, increasing fishing pressure, use of environmentally unfriendly fishing practices, etc, leading to resource degradation, human ill-being and poverty. This has made sustainable management of fisheries resources an urgent need of paramount importance. Reliable data forms the foundation to sustainable fisheries management, particularly in small-scale fisheries, where livelihoods, ecological sustainability and social well-being are closely interwoven. During national consultations carried out in 12 out of 15 coastal districts in Sri Lanka, under the FAO-led, SSF Guidelines implementation project

during 2018-2019 period, state actors consistently pointed out the lack of proper, reliable fisheries data as one of the major impediments in sustainable fisheries resource management. Due to the scattered nature of small-scale fishing communities, their use of multiplicity of craft-gear combinations, SSF management is constrained by poor data availability, which is a hindrance to design effective management measures, monitor resource status, ensure compliance with regulations, and support co-management arrangements with small-scale fishing communities. The FAO Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries (SSF Guidelines) adopted in 2014, recognise the pivotal role of fisheries data and information in enabling evidence-based and participatory fisheries management. “Information, research and communication” forms the 11th section of the SSF Guidelines and the articles 11.1, 11.5 and 11.9 particularly call for the states to establish fisheries data collection systems, including bioecological, social, cultural and economic data relevant for decision-making on sustainable management of SSF. This shall be done in a transparent manner, while ensuring data availability on illegal, unreported and unregulated (IUU) fishing practices, disaster risks, climate change, livelihoods and food security. Moreover, these articles highlight the need to develop Information systems with low data requirements for data-poor situations, and the need for collaborative and participatory data collection involving small-scale fishing communities. Since SSF Guidelines frame fisheries data not merely as a technical input, but as a governance tool that underpins ecosystem sustainability, social development, and human rights, effective implementation of SSF Guidelines would be a critical step towards achieving evidence based, sustainable small-scale fisheries management.

Impact of sampling design on monitoring small-scale fisheries

David Espino García

Spanish fisheries management classifies small-scale fisheries (SSF) under the category called "*artes menores*," which are present in all Spanish fishing grounds: 6,606 vessels representing 82.0% of the total fleet, as well as 39.4% of the total power (kW) and 19.4% of the total tonnage (GT). The Spanish SSF are characterized by the use of diverse fishing gears (gillnets, trammel nets, longlines, pots, etc.) and target a large number of coastal fish, crustacean, and cephalopod stocks from Atlantic and Mediterranean waters. Both the quantity and variety of these fisheries make their scientific monitoring a complex challenge, especially when providing robust scientific data to ICES or GCFM to advise on the management of the fishing resources under their jurisdiction.

The Spanish program of scientific sampling of fish landings, included under the European Data Collection Framework (DCF), follows a two-stage procedure in Atlantic Iberian ports, in which the primary sampling unit is the “visit” (port-day combination) and the secondary sampling unit is the fishing trip. Since the 1980s, both sampling units have been selected in a fixed manner, establishing a short list of ports considered representative, as well as a predetermined number of trips by fishery or metier, with special coverage of the industrial fleet. In 2022, the respective Spanish DCF Work Plan was modified to allow the random selection of fishing trips within each visit, which remained fixed for logistical reasons.

The study aims to evaluate the impact of a change in sampling methodology on data quality and representativeness using specific indicators. For that, an analytical comparison of the data collected under both sampling designs is presented here: fixed sampling period (2009-2021) vs. quasi-probabilistic period (2022-2025). We selected three indicators to apply statistical tests: sampling intensity of secondary sampling units (ratio between the number of sampled trips and total number of trips), number of different species sampled, and number of total individuals measured. The results show greater representativeness, during the quasi-probabilistic period, of the fishing activity of the Spanish small-scale fleet, as well as an improvement of the length frequency distributions quality of secondary species that were previously undersampled during

the fixed sampling period. This improvement in data collection will support the scientific basis for fisheries management, facilitating the assessment of new species and improving advice for data-limited stocks.

Combining on-site sampling and declarative data to improve monitoring of small-scale coastal fleets in the French Outermost Regions

Julien Rodriguez

In mainland France, estimates of fishing effort and landings by species are usually derived by combining multiple declarative data sources, including sales notes, logbooks, fishing forms and geolocation data. This approach relies on comprehensive, reliable and representative datasets, conditions rarely met for small-scale coastal fleets (<12 m) operating in the French Outermost Regions (French West Indies, French Guiana, La Réunion, and Mayotte). With 1,848 vessels in 2024, this fleet represents 30% of the total French population covered by the Data Collection Framework (DCF).

To address this limitation, in the mid-2000s, Ifremer's Fisheries Information System (SIH) implemented the ObsDeb program based on weighted random cluster sampling of fishing trips observed in harbours, a framework designed to ensure statistical representativeness. The recent increase in declarative data in these regions (although still insufficient to fully meet end-users needs and consequently replace ObsDeb observations), provides a relevant opportunity to supplement the data obtained from sampling. However, these two inherently distinct data sources, self-reported and statistically sampled, differ in representativeness, accuracy, and volume. This study presents a new methodology leveraging these complementary datasets to improve estimates of fishing effort and landings by species for small-scale coastal fleets in the French Outermost Regions.

The workflow incorporates extensive data-quality control procedures including assessment of the completeness and consistency of vessels' declarations via the calculation of a reliability score, refinement of fishing areas and métiers using machine-learning models trained on survey data, and recoding of selected species. These steps ensure consistency with observer-derived data. Ultimately, a set of control repositories based on field expertise is applied to identify and remove any remaining questionable data.

Estimates are calculated at the level of fishing sequences ("day x gear type x fishing area") rather than per fishing trips, better reflecting the complexity and mixed strategies of artisanal fisheries in these regions. Achieving this level of detail is made possible through the integration of these complementary declarative datasets. Additionally, the application of a series of machine-learning steps for interpretation enables finer stratification than that achievable with conventional methods.

In the end, the workflow produces vessel-level monthly estimates of fishing effort and landings by species, providing the level of detail required to meet end-users needs, including responses to data calls (e.g., ICES RDBES) and compliance with DCF requirements. In 2026, this work will undergo validation by data users and consultations with stakeholders, including Outermost Regions fisheries committees and relevant administrative bodies. A phased implementation is planned for 2027, involving an update of the complete time series.

Smarter Sampling for Better Management: Optimizing Fishing Effort Estimates in Small-Scale Fisheries with High Resolution Tracking Data

Marta Rufino

Small-scale fisheries (SSF, vessels under 12 m) represent ~90% of global fisheries and over 80% of the EU fleet, employing around 100,000 people (https://rpubs.com/MRufino/SSF_EU_Map). Despite their socioeconomic importance, SSF fishing effort remains poorly quantified. Unlike large-scale fleets equipped with Vessel Monitoring Systems (VMS), tracking for SSF is only now

emerging following EU legislation requiring electronic tracking by 2030 (EU 2023/2842). However, the mandated temporal resolution is only 30 minutes (Implementing regulation - C(2025)7501), even though recent studies show that tracking at scales of seconds to minutes is essential for reliably estimating SSF effort. This creates several challenges to properly estimate fishing effort (FE). In some cases, higher-resolution data could complement the mandatory tracking, in others, the estimates can be improved with optimized sampling strategies and for countries with very large SSF fleets, where full fleet tracking is economically unfeasible, statistically efficient sampling may be done. This poses the question of how many samples are required.

In this study, using Portuguese SSF case studies, we investigated how many samples are needed to retrieve 90% of total fishing effort. We compared two sampling strategies, (i) by fishing trips and (ii) by vessels, and evaluated three effort indicators describing the *dimension*, *location*, and *quantity* of FE. High-resolution GPS data (30-s intervals) were collected between 2016 and 2024 for bivalve dredgers operating in three regions (South, Southwest, Northwest), trammel-net (Southwest), and pot/trap vessels targeting octopus (South). Data were processed, classified and mapped, following Rufino et al. (2023) and Samarão et al. (2024).

Indicators were estimated through replicated random subsampling, for a sequence of sampling numbers. Different analyses were used to estimate the minimum sampling size required to retrieve 90% of the effort. Overall, fewer than 200 boat trips were required to capture 90% of fishing effort across case studies, independent of sampling year and gear. Southern Portugal required larger samples, whereas pot/trap fleets showed the highest variability. These results provide practical guidance for designing cost-efficient SSF monitoring programmes, supporting improved management, compliance, and marine spatial planning.

Estimating fishing effort in Basque small-scale fisheries using high-resolution geospatial data and *iapesca*

Maria Mateo

Mapping small-scale fisheries (SSF) supports the understanding and assessment of their interactions with coastal ecosystems and biodiversity. The spatial distribution of fishing effort provides information to identify areas of fishing activity and associated pressures on sensitive habitats and vulnerable species, supporting the development of management measures to address overfishing, habitat degradation, and bycatch.

The EU Fisheries Control Regulation (EU 2023/2842) incorporates vessel geolocation as a standard component of fisheries monitoring, increasing the availability of vessel tracking data for SSF. Translating these data into fishing effort indicators remains challenging, particularly for passive gear fisheries, where fishing operations are not solely determined by vessel movement and therefore cannot be directly inferred from vessel movement metrics alone, such as speed or time at sea.

In this context, the Basque Government launched in 2015 a voluntary programme to equip fishing vessels under 15 m length overall (LOA) with AIS Class B devices, with the objectives of improving safety at sea and enabling activity monitoring. Approximately 40% of the Basque SSF fleet is currently tracked, generating a high-resolution spatial and temporal dataset characterised by one-minute time intervals, which allows the analysis of SSF fishing behaviour and anticipates forthcoming regulatory requirements.

Using the *iapesca* R package, a standardized methodology is applied to estimate fishing effort metrics derived from AIS data. Vessel behaviour is classified using machine-learning models based on random forests and evaluated through cross-validation. For passive gears, fishing effort is further estimated using a geocomputation approach to identify gear deployment and

setting events. Model outputs are validated using independent onboard observer data, enabling the assessment of data quality, methodological performance, and uncertainty. Results indicate that AIS Class B data, when analysed using appropriate analytical workflows and supported by validation datasets, can be used to derive spatially explicit fishing effort estimates for passive SSF. This case study shows that estimating fishing effort and vessel behaviour in passive small-scale fisheries relies on the availability of vessel geolocation data with short temporal intervals and demonstrates the applicability of the proposed methodology across different regional and regulatory contexts.

Improving small scale fisheries effort metrics: integrating data sources for better bycatch assessment

Josefine Egekvist

Improving effort estimation in small-scale fisheries (SSF) is central to assessing the bycatch risk of sensitive species, yet data availability, resolution, and comparability remain challenges. Under the EU LIFE CIBBRiNA project, a dedicated workshop brought together experts to evaluate how multiple data sources and high-resolution geolocation tools can be integrated to strengthen effort quantification in the project case studies that are using passive gears such as gillnets and longlines.

The workshop reviewed the availability of diverse effort-related datasets, including EU Fisheries Dependent Information (FDI), ICES RDBES, VMS, and high-resolution geolocation outputs from the R package *iapesca*, which differ in spatial resolution, data formats, and available effort measures. Participants identified common variables and used the effort metric Days at Sea (DaS) for comparison. Data confidentiality constraints from Member States were also considered.

Participants concluded that effort can be represented at multiple levels of detail, ranging from fleet-level summaries at ICES division scale to fine-scale examples based on VMS or *iapesca* analysis. The workshop confirmed that the *iapesca* R package performs well for gillnet fisheries in detecting hauling, setting, net length, and deriving soaking time for enhanced effort estimation. In addition, by calculating DaS, results can be compared to other effort data sources. The use of *iapesca* can be extended to longlines when sufficient positional data exist. These findings align closely with the implementation of the new EU Fisheries Control Regulation (EU 2023/2842), which mandates digital catch reporting, vessel geolocation, and detailed recording of setting/hauling positions for static gears. These requirements will substantially strengthen SSF effort metrics relevant to sensitive-species bycatch assessment.

The harmonised effort metrics and data structures developed through the workshop support refinement of bycatch estimation frameworks such as those used by WGBYC, which currently rely on DaS aggregated at broad spatial scales. Because DaS does not always reflect true fishing activity, particularly for passive gears, high-resolution case study data enable direct comparison between DaS and operation-based metrics such as soaking time and net length. This allows quantification of potential biases across métiers and regions. By integrating these high-resolution datasets with monitoring observations, the project aims to develop bias-corrected or alternative effort units that improve the accuracy and spatial resolution of sensitive species bycatch risk assessments.

Guess the Gear: A Machine Learning Framework for Automated Gear Classification in Small-Scale Multi-Gear Fisheries

Pamela Lattanzi

Small-scale fisheries (SSF) are fundamental to coastal economies, yet they remain historically underrepresented in management frameworks due to data scarcity. In Europe, the new Fisheries Control Regulation (EU 2023/2842) mandates tracking for vessels under 12 meters by 2029, creating an unprecedented opportunity for monitoring SSF. However, a significant technical bottleneck remains: vessel tracking data lacks inherent gear information, and for many SSF, official logbook records are either non-existent or lack the spatial resolution to distinguish between specific hauling events. This creates a reliance on manual, trip-by-trip validation that is unscalable for regional fleets.

This study presents a Machine Learning (ML) framework designed to identify specific fishing gears at the hauling-event level. Using a validated dataset from the Adriatic Sea encompassing over 7,000 hauling events (1,634 trips), we evaluated five predictive models (Ridge Classifier, Logistic Regression, Decision Tree, Random Forest, and Extreme Gradient Boosting) across two different classification levels based on the FAO ISSCFG standards: two broad categories (Nets vs. Pots) and five specific gear types (gillnets, trammel nets, and three distinct pot types). Results demonstrate that optimised ensemble models significantly outperform traditional statistical baselines: Random Forest achieved 95% accuracy for broad gear category classification, while Extreme Gradient Boosting reached 86% accuracy for specific gear types. Sensitivity analysis revealed that seasonality (month of the year), distance from the coast, and soak time were among the most informative predictors for discriminating between gears. Distinct spatio-temporal behaviours observed across passive gears underscore their diverse ecological footprints. As these selective gears target different species and habitats, they create heterogeneous environmental impacts requiring tailored management. Automated gear detection can enhance these efforts by improving stock assessments and the identification of key fishing grounds. Indeed, this framework may enable the integration of automatic gear recognition into international monitoring, replacing time-consuming manual labelling with rapid, automated validation. Deploying these models could allow regulatory bodies to process large data volumes for near real-time alerting of misreporting or unauthorised activity. Moreover, integrating ML outputs with electronic logbooks facilitates automatic cross-validation of declared gears, improving data integrity, seafood traceability, and Illegal Unreported and Unregulated (IUU) fishing detection. While dependent on high-resolution tracking data, this workflow offers a scalable solution to transform raw GPS pings into actionable management information.

The depth of bycatch risk: a biologging-informed assessment of exposure to artisanal fisheries

Isabel García-Barón

Seabird bycatch in artisanal fisheries remains a critical issue in marine conservation, particularly in coastal regions where small-scale fleets operate in areas that overlap with key seabird foraging habitats. The European shag (*Gulosus aristotelis*), a pursuit-diving species currently listed as Vulnerable, is especially susceptible to incidental capture due to its benthic feeding behaviour and strong reliance on nearshore environments heavily used by artisanal fisheries. In this study, we assess the exposure of European shags to artisanal fishing activities in the southern Bay of Biscay through the integration of high-resolution seabird tracking data and fisheries monitoring information. Between 2022 and 2025, several individuals were equipped with GPS and time-depth recorders, yielding 20 complete, high-quality datasets. This biologging data allowed us to describe foraging areas, incorporating not only the spatial distribution of dives but also dive behaviour and effort. We produced both unweight and time-weighted maps of foraging intensity that better represent habitat use and potential encounter probability with fishing gear. To quantify spatial and temporal exposure, we integrated these biologically informed foraging layers with contemporaneous Automatic Identification

System (AIS) data from artisanal longliners and netters operating in the region. This combined approach reveals the extent to which foraging grounds overlap with the distribution, timing, and activity patterns of different métiers. Core foraging areas were concentrated in the inner Bay of Biscay and along the Cantabrian and northern French coasts, with notable interindividual and interannual variability. Exposure levels differed between fishing gears, shaped by the degree of spatial overlap as well as gear-specific characteristics such as deployment depth and operational schedules, and how these align with the diving behaviour and ecological traits of the species. Overall, this interdisciplinary framework, integrating biologging, AIS-based fleet monitoring, and métier-specific gear attributes, provides a robust basis for identifying where and when potential interactions are most likely to occur. Studies like ours provide essential evidence for developing targeted mitigation strategies and supporting sustainable management of artisanal fisheries, thereby contributing to the advancement of ecosystem-based fisheries management approaches.

Understanding the relevance of participatory GIS approaches in small-scale fisheries and socioecological systems to support spatial planning efforts

Maylis Sontot---Marjary

The rapid growth of human activities in marine environments requires increased regulation to reduce ecosystem impacts and sustain the delivery of ecosystem services. Historically, marine governance has been driven by top-down approaches, however, resulting management practices are not always effective; especially in small-scale fisheries (SSFs) where socioecological systems (SESs) are more fragile. To support a progressive shift in marine governance towards bilateral and multidisciplinary management strategies, there is a clear role for participatory methods.

I used Public Participation GIS (PPGIS) to investigate how stakeholder-driven GIS data can support decision-making processes in Marine Spatial Planning (MSP) and conservation planning. PPGIS surveys, which allowed for cross analysis of social and ecological data, were carried out in one remote insular SSF with fishers (Marettimo, Sicily) as well as in a multi-scale case study covering all stakeholders of Irish seas.

In Marettimo, data on local fishers' ecological knowledge (FEK) informed the management of the local Marine Protected Area (MPA) (AMP Isole Egadi). Results demonstrated a unanimous will to collaborate with MPA managers, using FEK to support socioecologically meaningful conservation plans. It also highlighted clear channels of collaboration between managers and recreational and professional fishers. In Ireland, areas perceived as valued or concerning were mapped by stakeholders, highlighting clusters of overlapping activities and pressure hotspots. Proxy scores were calculated to quantify participants' connectedness to ecosystems. This tests the capacity for a multidisciplinary proxy to evaluate planning impacts on stakeholders across different groups and scales.

As major global conservation planning objectives, such as the 30x30 MPA target, attempt to implement integrated solutions to safeguard biodiversity and livelihoods, the use of stakeholder-driven GIS data is a valuable tool to map the behaviours, perceptions and preferences in marine SESs that influence MSP. These case studies demonstrate how PPGIS outcomes can support data-rich and inclusive decision-making in marine spaces.

Temporal evolution and socio-economic relevance of small-scale fisheries in the Northern Adriatic Sea: a market-based analysis.

Emily Sepe

Small-scale artisanal fisheries (SSFs) play a key socio-economic and ecological role in the coastal areas of the Northern Adriatic Sea, supporting local livelihoods and cultural heritage. However, this sector has historically been underrepresented in scientific research and management, leaving its structure and economic contribution insufficiently quantified. Data collection for SSFs in the Mediterranean remains challenging, as vessels under 15 m are generally not required to carry AIS or VMS tracking systems and are often exempt from mandatory logbook reporting. This regulatory framework creates substantial data gaps regarding fishing effort, its spatial distribution, and catch composition.

This study aims to reconstruct and analyses temporal changes in fishing activities, target species, and the economic value of SSFs in the Northern Adriatic Sea. The analysis is based on long-term daily landing records from the Chioggia wholesale fish market, one of the main reference points for fisheries in the basin. As a key limitation of market-based datasets is the absence of explicit information on fishing gears, complicating the identification of SSF activities relative to industrial fleets, fishing gears were inferred from the species composition and seasonal patterns of landings using literature and expert knowledge. Because manual attribution over long time series is highly time-consuming, Artificial Intelligence (AI) tools were explored to automate gear classification. Daily records are available from 1997 onwards. An 11-year subsample was manually labelled by a trained researcher, and five of these years were independently cross-validated to ensure consistency. The selected years reflect major changes in fisheries management and dataset structure, including the implementation of EU Regulation 1967/2006 on spatial restrictions for towed gears and subsequent modifications in market data recording from 2012 onwards. These structural shifts were explicitly considered during model training to reduce classification bias.

The labelled subset was used to train AI-based models, enabling gear attribution across the full 1997–2025 time series and generating an enriched dataset. This improved dataset allows the analysis of temporal shifts in landing composition, gear-specific fishing pressure, and distribution patterns, providing a robust characterization of SSFs in the Northern Adriatic Sea and supporting more informed management and ecological assessments. Furthermore, this study provides additional information that can support more specialized research and analyses at broader fishing area scales: for example, by enabling the classification of daily landings marine vs. lagoon environments, the enriched dataset allows for improved spatial interpretation of fishing activities. We anticipate that this methodology can be applied to landing data from other fish markets, enhancing the characterization of small-scale fisheries across different regions.

Where Science Meets Experience: Local Ecological Knowledge through modular interviews, in Small-Scale Fisheries of Southwest Portugal

Carina Duarte

In Portugal, 90% of the fishing fleet corresponds to small-scale vessels (<12 meters). Nonetheless, data scarcity and absence of proper fishing effort estimates increase Small-Scale Fisheries' (SSF) vulnerability to ocean grabbing (appropriation of maritime space and control of its resources). In this study we developed a semi-structured modular interview (16 modules, 174 questions ~1hour interview per fisher) to analyze fishers' Local Ecological Knowledge (LEK) to: (i) map fishing grounds and biodiversity, (ii) assess socioeconomic challenges, (iii) determine fishing patterns under pressures, and (iv) explore science-fishing community collaboration for adaptive management. Data was collected across two fishing ports in southwest Portugal (Setúbal and Costa da Caparica) through 31 interviews, assembling information on 1) fishers demographics, 2-4) vessel, species and gear characteristics, 5) fishing grounds, 6-7) economical aspects, 8-10) problems affecting SSF, 11) spatial conflicts, 12-13) climate change perception, 14-15) solutions and 16) participatory mapping. Fisher's average age was 53.2

years, and in 93% fishing was a family tradition whereas 94% rely exclusively on fishing. Fishers using trammel nets (58%) primarily targeted sole (31%) and cuttlefish (29%), while gillnet fishers (32%) aimed for surmullet (42%) and mullet (33%). Major challenges include low first sale price (84%) and crew shortages (87%). In 90% of the interviews, the main spatial conflict involved recreational fishing (90%) and the bivalve dredge fishery operating in the same fishing grounds (80%). Regarding climate change, fishers perceived an increase of sea temperature (64%) as their primary environmental concern. The community interviewed considered it important to cooperate with scientists, namely through involvement in projects (96%) and indicated the need to access scientific results (76%). Our approach allows us to collect essential data for sustainable SSF management, enhancing resilience and providing adaptive governance in the context of environmental and socioeconomic pressures, adaptable to other areas and fleets.

Small Scale Fisheries Socio-economic Data in Ireland: The Good, The Bad and The Ugly.

Debbi Pedreschi

Small-scale fisheries (SSF) represent a cornerstone of Ireland's coastal economy and maritime heritage, yet persistent data limitations continue to constrain their full integration into scientific assessments and ecosystem-based management.

The Bord Iascaigh Mhara (BIM) National Seafood Survey provides insights into the economic performance of Ireland's catching sector and the social demographics of people employed in the sector. The annual report highlights key trends and developments within the sector, offering evidence-based insights relevant to fishing industry stakeholders and policy makers. Over 49% of the active fleet participated in the most recent survey, with over 80% of returns arising from the inshore sector, greatly increasing our data and knowledge in this critical area. Survey results consistently underline the importance of SSF to employment, income diversification, and community resilience in peripheral coastal regions, reinforcing the need for governance frameworks that reflect both biological sustainability and socio-economic viability.

Despite this, challenges remain. Notwithstanding the external challenges of Brexit, Covid-19, spatial competition, and fuel prices, internal assessment challenges also exist. Changes in methodology affect time series, with serious implications for trust, reliability, interpretation and understanding. Delays in data collection and reporting to align with financial reporting timelines lead to critique and criticism of outputs, despite industry, management, and policy reliance on them. Additional 'snapshot' survey schemes have the potential to improve knowledge, but can also face additional challenges in implementation, resourcing, comparability, and stakeholder fatigue. Awareness and technical challenges can also present barriers to participation. A lack of spatially resolved data, coupled with data protection requirements, leaves us poorly equipped to respond to the increasingly complex requests for socio-economic impact analyses.

Here we present an overview of the National Seafood Survey for Fisheries in the context of SSF, the challenges faced, and the efforts taken to overcome them to ensure accurate, reliable and transparent provision of social and economic data to support the sustainable development of the Irish Seafood Sector.

Marine Observation System: building fishermen-oriented logbooks in the Adriatic Sea using a bottom-up approach with small scale fishermen

Igor Celić

The small-scale fishery is getting under an increased scrutiny for monitoring their activities, catches and effect on the ecosystem as anticipated by the new EU Fisheries Control Regulation (Reg. EU 2023/2842). Often in this case the monitoring requirements are imposed top-down with insufficient consultations with the actual users, the fishermen. However, if correctly

designed, the monitoring systems could not only be a monitoring system, but also a useful tool for the fishermen. Therefore, we selected a case study in the Adriatic Sea in the Mediterranean to develop a new fishery digital logbook based upon the experience spent with fishermen and tailored to be compatible with the fishing operations. The digital logbook aims to integrate monitoring the fishery catches while also acquiring additional physical properties of the catch through non-invasive methods of image recognition by implementing machine learning principles. To promote the adoption of logbooks by fishermen the whole concept and data are primarily thought to be made useful to their users, providing catch information and analysis. Also, these data would document ecosystem changes, providing insights of potential causes related to changes of environmental conditions, in hindsight of ongoing climate changes and changes in the productivity of the regional seas.

The Marine Observation System was developed as a rugged, camera-enabled handheld tablet, and delivered to selected small-scale fishermen for further prototyping and in field testing. The operations on board consisted in taking the pictures of the boxes with the catches and documenting the catches. After the initial familiarization the fishermen used the system proficiently and were monitoring all their catches during the following months. Over two tons of catches were monitored by the small vessels operating in Marano lagoon or near the coast. The pattern showed a predominance of sea bream, mullets, seabasses and crabs, in accordance with the local seasonality, thus proving the possibility to integrate informatic solution in fishery operations.

The testing allowed us to analyse the strengths and weaknesses of the system and gather precious feedback from fishermen on way to further improve the system and make it easier to use. The main observation regards its useability, which is good with calm weather, but rough weather requires the fishermen to insert their data only at the end of fishing operations onshore. To complement manual entries, the project integrated a CV pipeline-trained on annotated images of catch boxes—to automatically detect fish species and estimate individual size, then infer weight, thereby providing decision support and paving the way for REM in SSF.

Additionally, the training of the image recognition system is a lengthy process relying on a substantial image dataset, a requirement that cannot be overlooked when identifying rare or uncommon seasonal species.

Improving data quality in a data-limited fishery with video surveys and object detection

Gina Brøten

The Norwegian brown crab fishery is a valuable small-scale inshore fishery. Despite its commercial importance; data limitations persist and constrain stock assessments. A key constraint is a lack of fisheries-independent data, as traditional survey methods using crab pots are too recourse demanding to cover the species' large spatial distribution.

Baited remote underwater surveys (BRUV) are increasingly used in Norwegian coastal monitoring programs due to their non-invasive and cost-effective nature. Substantial BRUV material exists from these monitoring programs covering ecosystems along most of the Norwegian coast, representing an underutilized resource for brown crab assessments. However, the recourse demanding manual annotation process of these videos remains a major bottleneck that limits how much of this data can be translated into assessment-ready data. Here we investigate if object detection models can streamline the processing of BRUV data and improve the data quality for the brown crab fishery.

We developed and applied an object detection model to identify and quantify brown crabs in BRUVs. The model achieved a mean average precision of 0.75, precision and recall of 0.83 and 0.65, respectively, and few false positives. Crab abundance was estimated using the maximum number of crabs visible within a single frame per station (MaxN), which showed positive correlation with catches from nearby crab pots.

Rather than relying on conventional confidence thresholds for retaining predictions, which risks discarding correct predictions, we developed an ecology-informed filtering pipeline that retains or removed predictions based on known crab behavior and ecology in the footage. This approach produced more accurate MaxN estimates than unfiltered predictions and reduces the need for manual reviews. Together, the results suggest that combining existing BRUV-data with object detection models offers a low-cost pathway to improving the data quality and coverage for the data-limited brown crab stocks in Norway.

Narratives of challenges in small-scale fisheries across island and isolated territories.

Juanjo Martín-Estarellas

Small-scale fisheries are facing increasing ecological, economic, social, and cultural challenges that threaten their continuity, particularly in island or geographically isolated territories. In this context, integrating scientific knowledge with small-scale fishers' perceptions of the future of their activity is key to fostering collaboration and strengthening participatory management to ensure the long-term sustainability of the sector. This study analyses fishers' discourses to identify the factors shaping the future of small-scale fisheries in four territories: Old Providence (Colombian Caribbean), Chocó (Colombian Pacific), and northern Mallorca and Menorca (western Mediterranean, Spain). In each location, groups of small-scale fishers participate in workshops in which they describe their vulnerabilities and risks.

In a second phase, we apply Q methodology. This method makes it possible to construct narratives based on the statements extracted from the participatory workshops. Through the question, "What are the key ecological, social, economic, and cultural elements needed to ensure the future of small-scale fishing in...?", participants prioritise these elements. This approach makes it possible to identify shared patterns of perception and the emergence of distinct discourses about the fishing system and its future.

These discourses provide a better understanding of how the fishing system functions, help identify perceived opportunities, and enable the analysis of adaptive capacities from the perspective of local experience. In addition, comparison across case studies highlights how geographical isolation, insularity, and socio-cultural contexts shape priorities and narratives regarding the future of small-scale fisheries.