WORKING GROUP ON RECREATIONAL FISHERIES SURVEYS (WGRFS; OUTPUTS FROM 2023 MEETING)

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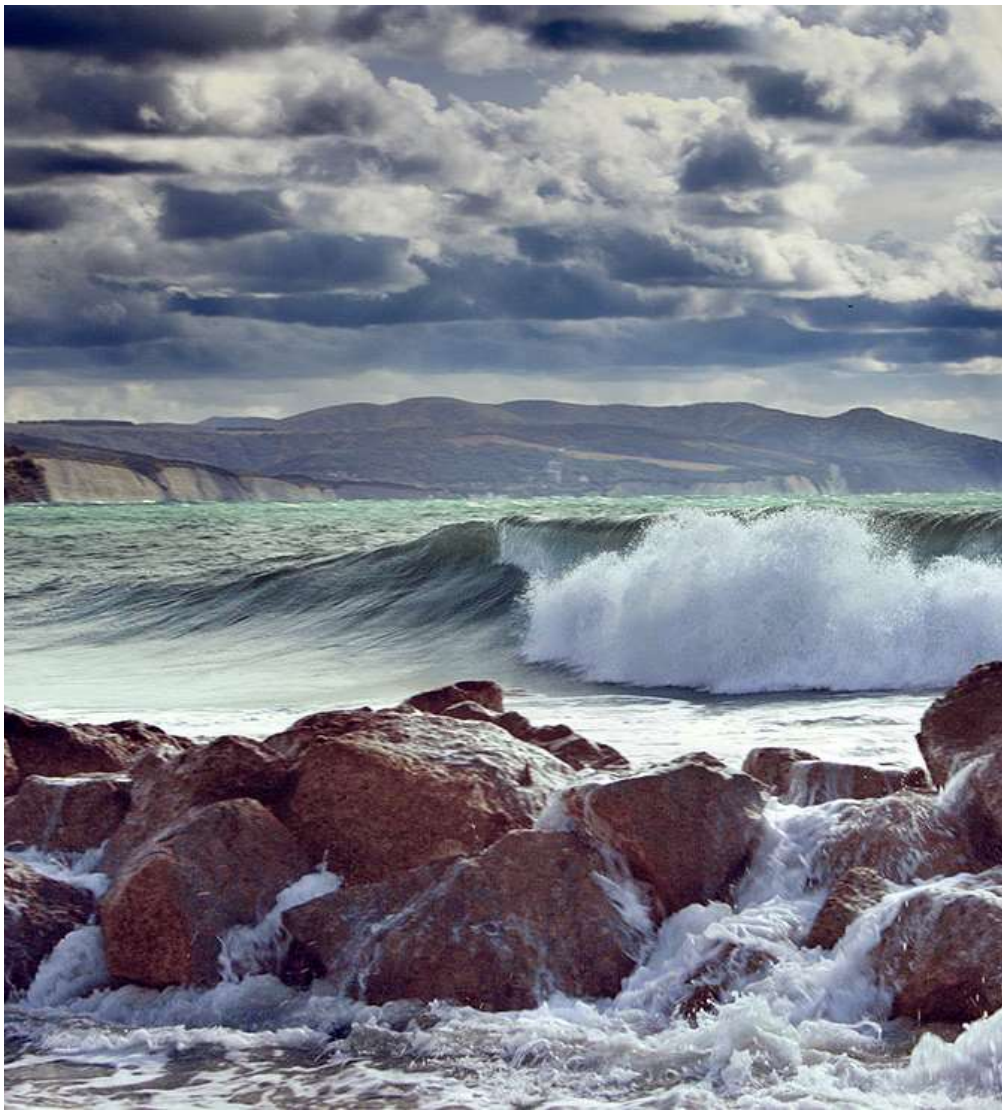

ICES INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA
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i Executive summary

The role of the ICES Working Group on Recreational Fisheries Surveys (WGRFS) is to compile and validate data from European countries' recreational fisheries and contribute to the ICES advisory process regarding marine recreational fisheries (MRF) issues. In 2023, WGRFS actively engaged in various aspects of MRF, involving the consolidation and evaluation of national survey programs, validating new methodologies, offering guidance on data availability, quality, and usage, facilitating regional data gathering and storage, exploring human dimensions, and assessing workshops organized by the group. The sessions primarily aimed at information exchange, evaluating the quality of national survey programs, intersessional group activities, and scientific publication plans.

A wide array of topics was discussed, including the introduction of new national survey programs and their outcomes in countries like Australia, the French Caribbean, Germany, Italy, Latin America, Namibia, South Africa, Spain, the UK, and the USA. Insights on MRF were shared by the European Commission and representatives from the angling community. Updates were provided on the outcomes of the Regional Coordination Group (RCG) intersessional group on Recreational Fisheries. Presentations summarized the findings of stock assessments involving MRF. Using the WGRFS Quality Assurance Tool, assessments were conducted on two national survey schemes: Finland and the UK Catchwise. Issues with the approaches were highlighted, and recommendations were proposed for future enhancements.

The primary focus of the meeting centred on reviewing advances, formulating strategies, and setting the course for the intersessional groups (ISGs), which serve as the main delivery mechanism for WGRFS. The ISGs encompass governance, survey methodologies, quality assurance, regional coordination and data storage, catch and release, animal welfare, stock assessment and reconstruction, innovative methodologies, human dimensions, and communication and engagement. Due to the breadth of discussions and outcomes, a comprehensive summary is not feasible here, but detailed information is available within the main text.

The WGRFS has consistently produced results focused on several key areas: establishing an extensive network for sharing expertise, refining methodologies, enhancing the scientific profile, and providing scientific evidence to support the integration of recreational data in fisheries management.

ii Expert group information

Expert group name	Working Group on Recreational Fisheries Surveys (WGRFS)
Expert group cycle	Multiannual fixed term
Year cycle started	2023
Reporting year in cycle	1/3
Chair(s)	Kieran Hyder, UK
	Estanis Mugerza, Spain
Meeting venue(s) and dates	19–23 June 2023, Ancona, Italy, 74 participants

iii Terms of reference

Term of reference	Addressed in this report
Collate and review quality of national estimates of recreational catch and effort, catch-and-release impacts, and socio-economic benefits for candidate stocks, identify significant data gaps in coverage and species, and support the ICES TAF and ecosystem approach.	Yes
Assess the validity of traditional knowledge, new survey designs, novel methods (e.g. citizen science, apps), innovative statistical methods for data provision, and approaches for selecting appropriate cost-effective methods.	Yes
Provide guidance to ICES and respond to ad hoc requests from ACOM on the availability of data, design of data collection programs, data storage systems, use of data in assessments, catch allocation, and ecosystem approach.	Yes
Develop approaches for regional data collection programmes that generate robust data for end users and support the ICES TAF and ecosystem approach.	Yes
Evaluate the use of economic (e.g. impact, valuation), social (e.g. governance, behaviour, welfare, health), and communication (e.g. participatory process, messaging) to support the assessment and management of recreational fisheries.	Yes
Review outcomes of the workshops organized by the group.	Yes

1 Summary of the work plan

Year	Work Plan
Year 1	1) Review progress of intersessional groups (i.e. governance, survey design, quality and analysis, regional coordination, data storage, catch-and-release impacts, novel methods, assessment and catch allocation, human dimensions, and communication) and agree approach for the next year. (a, b, c, d, e) 2) Evaluate the quality of up to three national survey programmes using the QAT and provide feedback on tasks requested by ICES. (a, c) 3) Review the outputs from ICES WRGRFS led workshops and discuss next steps for the inclussion of outcomes. (f) 4) Scope data call for ICES based on the formats developed by WGRFS and the RDBES core group. (c, d, f) 5) Assess priorities for inclusion of recreational fisheries in stock assessment using data from the pilot studies. (a, c, d) 6) Develop ICES workshop proposal with WGCATCH for intergrating probabilistic and non-probabilistic surveys. (b) 7) Create ICES workshop proposal to evaluate post-release mortality estimates, potential sublethal effects, and reasonable extrapolations across species and fisheries for inclusion in stock assessments. (a) ~~8) Assess the potential for food safety and human health issues from consumption of recreational caught fish (e.g. environmental toxins). (e)~~ 9) Review and share methods for engaging with stakeholders and the potential for particpatory approaches. (e) 10) Draft a roadmap to increase the inclusion of recreational fisheries data into advisory processes. (c)
Year 2	1) Evaluate the outcomes from the intersessional work and agree approach for the next year. (a, b, c, d, e, f) 2) Review national programmes including assessment of quality of up to three programmes and provide feedback on tasks requested by ICES. (a) 3) Assess the potential of novel survey methods to deliver recreational fisheries data (e.g. citizen science approaches, smartphone apps, traditional knowledge). (b) 4) Develop a framework for allocation of catches between sectors based on a review of existing systems and provide best-practice guidance. (c,d) 5) Develop MSE approaches to assess the impact of uncertainty in recreational catches on assessment and regional sampling programme. (d). 6) Review and share methods for engaging with stakeholders and the potential for particpatory approaches. (e) 7) Assess outcomes of workshop on inclusion of recreational data in stock assessments. (f) 8) Assess the potential for food safety and human health issues from consumption of recreational caught fish (e.g. environmental toxins). (e)
Year 3	1) Review progress of intersessional groups (i.e. governance, survey design, quality and analysis, regional coordination, data storage, catch-and-release impacts, novel methods, assessment and catch allocation, human dimensions, and communication) and agree approach for the next year. (a, b, c, d, e) 2) Evaluate the quality of up to three national survey programmes using the QAT and provide feedback on tasks requested by ICES. (a, c) 3) Review the outputs from ICES WRGRFS led workshops and discuss next steps for the inclussion of outcomes. (f) 4) Collate advances in survey methods that could be used to improved national approaches. (b) 5) Assess the potential for impact of climate change on species caught by recreational fisheries and how that coud impact on DCF and regional species requirements. (c, d) 6) Develop ICES workshop proposal on MSE approaches to assess the impact of uncertainty in recreational catches on assessment and regional sampling programmes. (d). 7) Assess the potential of novel survey methods to deliver recreational fisheries data (e.g. citizen science approaches, smartphone apps, traditional knowledge). (b) 8) Evaluate progress against three year plan and develop new ToRs. (a, b, c, d, e, f)

2 Progress report on terms of reference and work-plan

2.1 Country updates (ToR a)

Recreational fishing surveys are carried out across Europe covering a range of species and areas. In EU member states, all species and areas are required under the DCF (EC 199/2008, 2010/93/EU, 2016/1251/EU, and 2016/1701/EU) and control regulations (EC 1224/2009) are covered. These relate solely to surveys of recreational fishing defined by WGRFS (ICES, 2013) as:

> **"***Recreational fishing is the capture or attempted capture of living aquatic resources mainly for leisure and/or personal consumption. This covers active fishing methods including line, spear, and hand–gathering and passive fishing methods including nets, traps, pots, and set–lines***".**

Country updates were presented for Australia, French Caribbean, Germany, Italy, Latin America, Namibia, South Africa, Spain, UK and USA.

2.2 Perspectives from end-users

2.2.1 European Commission update

The Commission gave a short recap on the requirements for data collection on recreational fisheries under EUMAP that came into force in January 2022 through the Delegated Decision (EU) 2021/1167 and Implementing Decision (EU) 2021/1168. Member States are required to: *"implement statistically robust multispecies sampling schemes that enable catch quantities to be estimated for stocks agreed at regional level, in accordance with the relevant end user needs with the regional list of species provided in table 4 in (EU) 2021/1167"*. Biological sampling is required "*where recreational catches affect the development of fish stocks*". Based on the EUMAP requirements, Member States (MSs) implemented new sampling schemes for recreational fisheries from 2022 onwards, as part of their national work plans (NWPs). They have now reported on their first year of implementation and STECF assessed the annual reports. The output of the assessment and the dedicated data call on recreational fisheries should give insights on whether the new schemes are successfully implemented and how the coverage and quality of data has improved. Most MSs submitted NWPs for 2022-2024 with the exception of Estonia, Ireland, Netherlands and Spain who provided NWPs until 2027 (see NWP 2022-2027 https://dcf.ec.europa.eu/wps-and-ars/work-plans_en).

All MSs are expected to submit NWPs in October 2024 for the period of 2025-2027, with updated elements covering:

a. New Regional Work Plans and how these are considered in NWPs.
b. Marine Action Plan which requires improved bycatch monitoring.
c. Regular sampling programmes following delays in finalising pilot studies on recreational fisheries.

The Commission provided further details on the Marine EU Action Plan for protecting and restoring marine ecosystems which was adopted on 21 February 2023 in the 'Fisheries and Ocean package' and noted that it also has implications for sampling programmes on recreational fisheries. The Action Plan states that the knowledge base needs to be strengthened by "*designing*

targeted monitoring programmes to improve observations and reporting of incidentally by-caught species. The programmes should cover their impact on the stocks and the marine environment including high-risk fisheries and the potential impacts of all relevant fleet segments incorporating smaller vessels. They should also look at data on recreational fisheries, including recreational fishing boats." It further calls upon MEMBER STATES to *"By the end of 2024, submit updated national DCF work plans to improve data collection planning and efforts, including in relation to by-catch of sensitive species and impact of fishing on the seabed*".

A number of activities relating to recreational fisheries are carried out in the DCF regional coordination groups (RCGs). The RCG covering the Mediterranean and Black Sea has undertaken the following activities of relevance to recreational fisheries:

- Workshops 21/22 to present the pilot studies and compare list of species and methodologies, with the assistance of MARE regional grant Streamline.
- Follow methodologies described in the "Handbook for data collection on recreational fisheries in the Mediterranean and the Black Sea." FAO, 2021 (GFCM).
- Collect data from 2022 for, at least, relevant species from the list provided in the EU MAP eel (including in fresh water), elasmobranchs, and highly migratory ICCAT species.
- Online workshop on recreational fisheries on 29 June 2023 will feed in the discussions on the RWP for Med & BS.

The RCG North Atlantic, North Sea and Eastern Arctic, and RCG Baltic met 6-9.6.23 with the following activities relevant to recreational fisheries:

- Work with ICES on the inclusion of the marine recreational fisheries data in the RDBES (Regional Data Base Estimation System) with discussions ongoing with the governance group of the regional data base ICES WGRDBESGOV.
- The development of a regional sampling plan, review regional list of species to enlarge the list of mandatory species with set criteria based on scientific knowledge in close collaboration with WGRFS.
- Identify potential case studies for regional sampling plans.

RCG Large Pelagics fisheries (met 26-28.6.23) covers all EU recreational fisheries on large pelagics. This resulted in: discussion with end-users (e.g. ICCAT) to define stocks for sampling schemes for catch estimation and collection of biological variables, and review a draft RWP on tropical tunas.

The Commission elaborated on the state of play and development of an electronic catch reporting and recording system for recreational fisheries. The Commission has been working on a catch reporting system since 2019 with significant input from scientific experts such as ICES WGRFS (e.g. new list of species). The Commission provided an overview of the main outcomes of the second phase of developments of RecFishing system to collect recreational catch data. The project started as a pilot requested by the EP (2017) with a second phase to further develop the system. The second contract ended on 4 April 2023. RecFishing is an EU web platform for catch reporting of marine recreational fisheries. It is a web-based platform developed by the Commission to better monitor and control recreational fisheries activity, open to all marine recreational fishers that register in the platform. The reporting of catches is on a voluntary basis and recreational fishers can report their catches from multiple apps, allowing direct online registration of data. The data is anonymised and can be aggregated in reports. It is hosted in the "Europa.eu" domain and the platform is available in the 24 EU official languages. At this point in time, it can collect catch data for more than 80 priority species. These species lists have been developed in collaboration with ICES WGRFS. Further information about the second phase of development can be found in the final report and the platform can be accessed here: https://recreational-fishing.ec.europa.eu/.

Currently, there are two certified apps collecting recreational fisheries data and uploading the information in RecFishing: FishFriender (FR) and FangstJournalen (DK). More are welcome and they just need to follow the certification process that ensures that the data requirements are met and the IT specifications are aligned with the Commissions' standards. The integrated data dashboard can visualise variables on different spatial and temporal scales and outputs can be exported. Biological data outputs include size and weight distributions by species, fishing method, etc. The third phase is to be launched soon with the call for tenders planned to be open in Q4 2023. This will entail a 3-year contract for services with the aim of further developments, on boarding of more apps, scale up and dissemination. The presentation generated discussion with participants asking whether the data can be collected via phone apps, whether national systems can be integrated with the Commission system and how the data can be disseminated. This was confirmed and it was explained that the access to data depend on access right levels, e.g., national authorities can access national data, while specific entities (e.g. angling clubs) can visualize their own data.

2.2.2 Regional Coordination Groups

The overall aim for the Regional Coordination Groups (RCGs) is to review the current issues, achievements and developments of regional coordination and identify future needs in line with DCF regulation (EU 1004/2017) requirements and the wider European environmental monitoring management. Under these RCGs, several Intersessional subgroups (ISSGs) were created with the aim of responding to specific issues related to the DCF. One of this ISSGs is the Recreational Fisheries ISSG. The main issues discussed in the RCG NANSEA-Baltic technical meeting were presented and future actions to be taken by the WG were discussed.

One of the most relevant issues was the initiation of the process for further Regional Work Plan (RWP). What should be included under this RWP, and which are the potential case studies to develop under them. The Northern sea bass and the cod stocks in the western Baltic Sea and the Northern shelf were initially agreed as case studies. Under the assessment of these stocks, MRF data is being used and some first attempts of coordination have been also carried out. The plan is to start working in these case studies between the Member Staes and countries collecting recreational fisheries data for these stocks. WGRFS role will be to provide advice in the technical part needed (e.g. survey designs, standardize protocols etc.).

Furthermore, under the current DCF, there are few species that are mandatory to collect data in relation to recreational fisheries. WGRFS recommendation has always been to carry out multispecies surveys as the cost of conducting these surveys is minor considering the benefits of collecting information from more species that are relevant for recreational fisheries without significant resource implications. However, many countries still solely focus on mandatory species, meaning that there is limited data for other species. As a result, the Commission asked to the RCGs to generate a list of species relevant for MRF, that could be considered by the RCGs for future inclusion as mandatory species. This list will be presented alongside the importance of these species by ICES ecoregion. WGRFS is developing a methodology to identify these species (See 2.4.6 section). During 2024, WGRFS experts will be working on this list and the main results will be presented to the Recreational Fisheries ISSG and also during the RCG annual technical meeting to discuss about the incorporation of these species as mandatory species.

After several years of negotiation, the revision of the EU fishery control system was agreed on 30 of May 2023. The new control regulation will enter into force on the 01.01.2024. For recreational fisheries there are new (mandatory) rules applicable after 2 years (01.01.2026):

- Marine recreational fishers must register and report their catches through an electronic catch reporting system on a daily basis.

- Relevant species that need to be covered are those covered by fishing opportunities, by multiannual plans or subject to the landing obligation.
- Electronic catch reporting of recreational catches will expand to species covered by fishing opportunities, multiannual plans or landing obligation and those for which scientific advice from STECF, ICES or equivalent indicates that recreational fishing is having a significant impact on mortality. The list of species will be regularly updated.
- An electronic system to register and report catches must be in place within 2 years.
- MSs may develop an electronic catch reporting system at national level or use the one provided by the Commission.

The new rules cannot be implemented without the involvement of recreational fisheries organisations, so disseminating this information is critical, including promoting the introduction of electronic catch reporting tools. Although WGRFS generally supports this new development it also possesses a major threat to recreational data collection and data quality if Member States rely on electronic catch reporting without ground proofing the "self-reported" data. In addition, end users/administrations need to be aware that the new control regulation provides another mechanism for collecting recreational fisheries data in addition to the EUMAP and therefore requires strong coordination and cooperation at country level in order not to undermine recreational fisheries data collection efforts. Finally, in terms of limiting electronic catch reporting to certain species, support for multispecies catch reporting is essential as catches and effort of recreationally targeted species may become important or negligible over time.

Another recent revision is that of the European Fisheries and Aquaculture Statistics Regulation (EFAS), which currently stipulates that Member States shall send specific data regarding: *"Statistical population of natural or legal persons exercising recreational fisheries in the Union & Volume of catches from recreational fisheries exploiting marine biological resources".* As the regulation does not contain any further definitions (e.g. the term "catch" is not defined), it remains unclear which data must be submitted and no indicators are provided for the quality of the data submitted. Other problems associated with EFAS are data gaps and inconsistencies, as not all countries collect data on recreational fisheries or cover all segments (inshore, boat, charter fishing, etc.) of marine recreational fisheries. Time inconsistencies is another problem, as not all countries report data every year, for example because surveys are conducted less frequently (e.g. biennially), so there is no consistency between years. Finally, DCF species vary from region to region: there are therefore differences in the reporting of catches by species and region. However, EFAS has not yet been adopted and is still in the consultation.

2.2.3 Recreational fishing community

Hannah Rudd presented a perspective from the Angling Trust (the governing body for recreational angling in England) and the European Anglers Alliance covering stakeholder perceptions of marine recreational fisheries surveys and wider data collection. Hannah then offered insights to improve communications and subsequent engagement from the recreational angling community with surveys and wider data collection.

2.2.3.1 Marine Recreational Fisheries Data Collection

It is widely acknowledged that there is a need for better data on marine recreational fisheries. The Angling Trust, and the European Anglers Alliance, welcome more robust data collection on marine recreational fisheries as it is recognised that poor data often leads to poor management and policy decision-making. Data collection on marine recreational fisheries typically focuses on catch data and seldom assesses the social, cultural and economic value of recreational fishing to coastal communities and wider national economies within the context of specific stocks:

although it is acknowledged that there is a growing recognition on the importance of gather socio-economic data. As recreational fisheries become further embedded within fisheries management and policy, this information will be essential to inform decision-making. For example, within the United Kingdom recreational fisheries are now formally recognised as a stakeholder within fisheries management under the Fisheries Act (2020). However, fisheries managers may encounter difficulty in balancing the needs of all stakeholders within policy and management plans due to the limited socio-economic and catch data available on the sector. This is of particular concern when focusing on fisheries management and policy at a regional or local level, especially when considering specific species. Without sufficient data to inform these processes there is a risk that marine recreational fisheries and the sustainability of fish stocks will both suffer as a result. This is a clear gap that must be addresses by fisheries managers and scientists in collaboration with marine recreational fishing stakeholders.

Many barriers exist when collecting data on marine recreational fisheries; including species identification, recall bias, avidity differences, population significance, and long coastlines with many access points. This can further complicate engagement with the sector to submit data as participants can quickly loss interest. There are also then subsequent concerns with the accuracy and reliability of the outputs. For these reasons, catch reporting should be just one tool among many to collect data on marine recreational fisheries. Traditional methods like on-site surveys will remain important while new methods of collecting data will improve the data outputs. Compliance with catch apps may well also be very limited unless marine recreational fishers can see clear benefits through policy and management changes to the benefit of the sport. It should also be noted that adequate resourcing is desperately needed to implement and support these data collection efforts.

2.2.3.2 Marine Recreational Fisheries in Stock Assessments

The European Angler Alliance welcomes the inclusion of marine recreational fisheries in stock assessments for species that are recreationally important, such as sea bass, cod and flatfish (spp.). Inclusion of marine recreational fisheries within stock assessments demonstrates to fisheries managers the importance of those stocks to marine recreational fisheries and enables the sector to have a voice in how those stocks are managed. When marine recreational fisheries are included within relevant stock assessments it is vital that the data is representative of the sector as stock assessment advice often has real-world consequences for fishing opportunities.

There are many species of interest to marine recreational fisheries that do not have stock assessments, for example, mullet, wrasse, sea bream. While these stocks may be of relatively low commercial value, they are recreationally important in many locations and therefore stock assessments and evidence on their socio-economic recreational value at various scales are needed. As the role of marine recreational fisheries in fisheries management and policy evolves, there is a critical need for baseline data on the sector and recreationally valuable species.

2.2.3.3 Stakeholder Perceptions and Communication with MRF Stakeholders

Within the UK context, given the relatively new stakeholder status of marine recreational fisheries under the Fisheries Act (2020; https://www.legislation.gov.uk/ukpga/2020/22/enacted) data collection is more important than ever to inform fisheries management and policy decision-making that can improve the sustainable development of the sector; however, scepticism and distrust in data collection remain common throughout the marine recreational fishing community. Often this distrust leads to poor engagement with data collection and can hinder progress to support the sustainable development of the sector.

Well-designed transparent communication is therefore integral to the success of recreational fisheries surveys. Often recreational fisheries surveys are conducted by government science agencies with a clear goal of either: a) informing policy and management decision-making; or b) a legal requirement to collect data for monitoring purposes. As a result, it is fundamental that there is trust within the recreational community in the data that is subsequently being used to represent their sector, particularly if the resultant data collection or survey leads to restrictions.

Barriers to engagement from the marine recreational fishing sector with data collection may be due to there being a widely held view within the recreational fisheries sector that all data collection leads to restrictions. It is, therefore, important that a distinction is made between policymaking and management processes, and science. While holistic thinking is needed to improve outcomes across fisheries for all players, and there is a need for different disciplines to no longer operate in silos, there must be clear guidance on each organisations role.

Early communication that is clear and transparent on the data being collected and how the final outputs will be used, fosters trust and further encourages honest and accurate reporting. When participants trust the data collection process, they are more likely to provide accurate data and share relevant insights that can improve the validity and reliability of the data. Stakeholder buy-in of data collection and its outputs is also important for the success of any resultant policy or management decisions.

By sharing survey findings, discussing results, and seeking input from relevant parties, scientists can improve the survey's overall design and enhance the relevance and applicability of the collected data. Open lines of communication also allow participants to address any concerns, provide feedback, or seek clarification on survey-related matters. This helps survey administrators identify and address issues promptly, improving the overall survey experience. Responding to participant inquiries or concerns also demonstrates that their input is valued, which encourages continued participation. Effective communication ensures that participants understand the survey's expectations and requirements. This includes informing participants about survey deadlines, data submission methods, and any specific instructions for reporting their fishing activities. Clear communication minimises confusion, reduces errors, and improves the overall quality of the collected data.

Reframing data collection as being beneficial to the recreational sector may also lead to improvements in engagement with data collection. For example, sustainable fish stocks will likely lead to better fishing opportunities; evidencing the socio-economic value of the sector may lead to better access for sea angling and higher investment in the sector; understanding fisheries interactions with the marine environment will inform proportionate management; and collaborating on data collection will lead to more representative and higher quality data. While it is often impossible for scientists to have full control over how data can be interpreted once in the public domain, this reframing of the value of data collection could alleviate some barriers to engagement. It is advisable to liaise with communications and stakeholder-engagement professionals when designing and implement a communications strategy to support data collection.

2.2.3.4 Key Messages

Ultimately, anglers want to feel heard by scientists, government and fisheries management. Marine recreational fishers possess a wealth of knowledge and experience following often decades spent along the coast and at sea. Building trust with the community and engagement with data collection can therefore we highly valuable for informing fisheries science, management and policy. Given the growing role of marine recreational fisheries in fisheries management it is,

therefore, vital to gather data on not only the impact of marine recreational fisheries on fish stocks, but also the socio-economic value of recreational fisheries to coastal communities. This is particularly important when considering natural capital and ecosystem-based approaches to fisheries management.

Finally, a strong communications strategy should be seen as integral to any data collection program, rather than a supplement. Communications should also be delivered throughout the project to build trust and transparency, rather than only shared at the end of the data collection. Part of a wider communications strategy with stakeholders should also centre on social responsibility and the importance of data collection to improve the sector's development and sustainability and foster wider buy-in.

2.3 Stock assessment

Incorporating marine recreational fisheries (MRF) into stock assessments is a time-consuming and intricate process, requiring considerable effort. Firstly, understanding the potential magnitude of the impact of MRF on the stock is important (e.g. Hyder et al., 2017, 2018, Radford et al., 2018) and, where significant, this is listed in the stock assessment issues. This leads to its inclusion in the data call during the subsequent benchmark, prompting discussions on the best approach to integrate it into the assessment procedure. Integration into the assessment and subsequent recommendations are dependent on various factors, including available data and modelling techniques.

Ideally, MRF data for an assessment should encompass retained and released catches, sizes of retained and released fish, biological information (e.g., age-length relationships), and estimates of post-release mortality. Comprehensive time series data covering the assessment period is preferred yet gathering MRF data poses challenges. Different countries employ diverse methods influenced by their cultural, budgetary, and fisheries contexts. Consequently, gaps in MRF data often exist, spanning gears, spatio-temporal resolution, and lack assessments of uncertainties (e.g., errors). The absence of post-release mortality studies is notable despite its importance, particularly due to high release rates in many recreational species (e.g., Ferter et al., 2013).

In scenarios where data are scarce, custom solutions are necessary, tailored to the advice requirement, stock assessment approach, and the scale of MRF removals. Consequently, two approaches emerge: utilizing MRF data to support advice; or integrating it directly into the assessment model. Underpinning advice involves techniques like sensitivity analysis or including MRF considerations in advisory documents. Incorporating MRF data into the assessment typically involves reconstructing time series, making assumptions about catches over time or across regions, or relying on expert judgment.

Inclusion of MRF in assessments and advice in Europe is currently limited to: cod (Northern Shelf, Irish Sea, Western Baltic), sea bass (northern, Biscay), pollack, and salmon (Baltic). A summary of the approaches used and the issues faced was provided for the group. There was recognition of the need for more WGRFS members to engage with the benchmark process, but it was important to target resource where it is most needed and understand how best to include recreational data in the advisory process. WGRFS is working on a productivity-susceptibility analysis (PSA) to identify stocks where recreational data is most important (see Section 2.4.6.1) and is leading a workshop on the inclusion of recreational fisheries in stock assessment (WKRFSA; https://www.ices.dk/community/groups/Pages/WKRFSA.aspx).

In addition, DGMARE has updated its grant agreement with ICES requesting specific advice on recreational fisheries. This states: "*Where recreational fisheries take a significant part of the catches, the catch scenarios shall be calculated assuming that changes in fishing mortality are caused by the commercial*

fishery alone, the recreational fishery alone and a combination of the two. In these cases, the gears responsible for significant recreational catches should be identified, and when possible, some estimate of the magnitude or relative proportion of their catches should be also provided. In addition, in the light of available information, ICES will review and incorporate where possible, in its stock assessments recreational fisheries management measures and options agreed and/or implemented which are made known to ICES following a request for information by ICES and will comment on their contribution to reaching MSY objectives for the stocks concerned.". This means that ICES will need to provide more advice on recreational fisheries alongside addressing the challenges of inclusion of recreational catches in stock assessments. The WGRFS PSA and WKRFSA will underpin the approach and a roadmap to guide the process will be developed with ACOM leadership and ICES Secretariat.

2.4 Intersessional groups (ToRs a–e)

The ICES WGRFS encompasses a broad spectrum of specialized topics demanding expert insight and in-depth exploration. Given the time constraints of annual meetings, the WGRFS has opted to institute nine intersessional groups. These will cover governance, survey methods, quality assessment of surveys, regional coordination and data storage; catch and release and fish welfare; stock assessment and reconstruction; novel methods; human dimensions; and communications and engagement. Comprising WGRFS members and select experts, these groups convene regularly to tackle defined objectives. Each group is overseen by two WGRFS members responsible for updating the WGRFS on their progress. Below is a summary detailing the advancement achieved by each group.

2.4.1 Governance

Leads: Fabio Grati and Kieran Hyder

MRF governance exhibits significant variation among countries (Arlinghaus et al., 2019; Potts et al., 2020). Effective governance necessitates a clearly defined legal framework, coherent policy, collaborative management, monitoring, cost recuperation, and adaptive strategies (Potts et al., 2020). In Europe, MRF is not fully embedded within fisheries governance, but there is a growing acknowledgment of its significance, alongside efforts toward more comprehensive inclusion in the future. The governance intersessional group aims to explore pathways for this integration and provide support for its future incorporation. While recognizing the increasing global recognition of MRF's importance, the group specifically aims to assess how to effectively integrate MRF into the broader framework of European fisheries governance, which currently focuses on commercial fisheries.

The focus of the intersessional group was to develop a critique of the current European governance of MRF, highlighting issues and providing recommendations to generate an effective system in future. Initial analysis alongside developing ideas to develop future approaches was done in in 2022 (ICES, 2023) that had been used to underpin a manuscript. At the WGRFS this year, the manuscript was further developed with the aim of submission for publication later this year. Future sessions will be aimed at understanding how to align national competencies for governance and regulation in the context of shared stocks. Finally, Rhode University delivered a presentation on a global review of recreational fisheries licensing, leading to a discussion on the elements that constitute effective licensing.

2.4.2 Survey methods

Leads: Annica de Groote and Stephen Taylor

The overall aim of the Survey Methods group is to assess traditional and novel approaches for surveying MRF. This includes the design, implementation, and analysis processes, and the potential utility of the data generated. The primary focus of the group is on the use of probabilistic and non-probabilistic methods to estimate broad-scale estimates of catch and effort.

Since the last WGRFS in June 2022, the group has organized two intersessional online seminars:

- "Frame errors in recreational fishing surveys" (2022-11-16). Jon Helge Vølstad from the Institute of Marine Research in Norway and Karina Ryan from the Department of Primary Industries and Regional Development in Western Australia shared their experiences of dealing with frame imperfections in recreational fishing surveys in their respective countries.
- "Collection of recreational fishing data" (2023-05-03). Samantha Hook from Substance in the UK presented the on-site survey Catchwise, and Laura Santangelo and Federico Andreoli from CNR - IRBIM in Italy presented an on-site survey where a new probability-based sampling approach was taken.

Both seminars had high levels of participation (25 and 31 participants, respectively) and spurred lively discussions. In addition, the group has managed to secure ICES support for a symposium in 2025 (see below).

For the coming three-year period, the agreed goal of the group is to support the decision-making processes that underpin the use of survey methods by:

- Accessing international experience in different survey techniques (what has worked and not worked elsewhere).
- Identifying best practice for selecting and applying survey methods for different types of recreational fishery.
- Promote consistent use of survey terminology.

In order to meet this goal, co-operation with other intersessional groups, especially the Novel Methods and Quality Assessment groups, will be crucial. It is recommended that the following activities occur:

- Continued organization of regular online seminars on various topics related to survey methods.
- The organization of an ICES Symposium in 2025, "Future-proofing surveys: integrating probability and non-probability methods in fisheries", in Lysekil (Sweden).
- The writing of a scientific manuscript related to the mitigation of frame errors in probabilistic recreational fishing surveys.
- Joint work with the Quality Assessment group on consistent use of survey terminology in recreational fishing surveys.

2.4.3 Quality assessment of surveys

Leads: Pedro Veiga, Mafalda Rangel, and Bruce Hartill

The WGRFS Quality Assurance Toolkit (QAT) was created in 2013 (ICES, 2013). It was developed to ensure the quality of recreational catch estimates from national surveys, and to document bias in data collection to satisfy ICES and EU-MAP requirements. This evaluation aimed at providing statements of quality of MRF data for end-users including stock assessment scientists, and identifying potential improvements to survey design (ICES, 2018).

Since its development, the QAT has been used to assess quality and provide guidance on the design and implementation of multiple types of national survey programmes. In 2018 and 2019, the tool was reviewed to assess if it was still fit-for-purpose and/or if improvements could be made to the whole assessment framework. A thorough update was undertaken to address the subjectivity of some of the existing questions, provide a more logical flow of the questions, and create different assessment criteria for onsite and offsite surveys. Examples of text alongside what needs to be considered to answer the questions were also added to the QAT template. The main intent was to minimize different interpretations of the questions and increase consistency in the QAT assessments. Since then, the assessment template is reviewed and improved on an annual basis.

In 2023, and following up on previous work, the QAT ISG session focused on three main points:

1. Review the latest improvements to the QAT template.
2. Finalize existing tools to support the QAT, namely:
    a. The QAT and expert advice process.
    b. Glossary.
    c. Library of existing QATs.
    d. List of experts.
3. Discuss the overall idea and preliminary outline of the QAT related publication, lead authors and timelines.

The changes to the QAT template included three main aspects:

1. An introductory section with a short description of the survey. The added information includes the main objective, scope, and key details on the sampling approach and implementation stage. This additional information provides critical background context, enabling reviewers and readers to better understand the responses in the assessment template.
2. Additional guidance on each question in the template, with examples depending on the type of survey.
3. A more detailed recommendations section, now divided into three components: Strengths, Weaknesses, and Recommendations. The updated QAT template (Annex 3) was already used in the 2023 assessments of the national surveys.

The group discussed the persisting weaknesses and ambiguity in terms of both the assessment process and roles and responsibilities of the country surveys. In terms of the process of the quality assessment of surveys, the group discussed and agreed that the type of assessment of the quality of the survey should depend on the stage a survey is at. i.e., for:

1. Regarding surveys that are at an initial stage (e.g., sampling design), the support from the WG should be more informal and in the format of advice. The support could be provided by one or more volunteer experts (from a pre-existing list of experts, also to be developed by the ISG), which could take place via email (with moderation by the group chairs), or via a potential online platform forum for all WGFRS members. The ISG would also compile a library of all the QATs conducted so far, potentially organized by survey type (in part to provide examples, which might be helpful at the planning and sampling design stage).
2. The formal assessment process and existing template would then be used only for surveys that are in an advanced stage (e.g., already being implemented in the field, or at the data analysis phase). Here, the group reviewed and discussed the workflow of the review process (e.g., identify tasks, roles, and communication format and strategy). To foster the

process, the QAT template should also be pre-filled (and shared) in advance of the formal evaluation, along with a summary (short report or presentation) that covers all the needed details to evaluate the quality assessment. The formal discussion would then focus on reviewing the pre-filled template, clarify any pending questions, and develop a formal recommendation on the survey being assessed.

In terms of the QAT related publication, the group revisited the idea of a concept note explaining the QAT, which would be a potential interesting first paper from this intersessional group. The overall idea remains around a concept paper, which would include a problem statement that led to the development of the QAT, the evolution of the tool since 2013, its current format structure, and, finally, how well it adapts to evaluating recreational fishing surveys in multiple contexts (using tool such as a SWOT analysis). The authors of the paper are to be agreed before the end of 2023, and work on the publication is planned to start in early 2024.

Next agreed steps for the QAT Intersessional working group were to:

1. Finish the draft workflow and decision tree, with the key steps, and roles and responsibilities in the quality assessment of surveys process.
2. Finalize the library with all the QATs conducted so far by the WGRFS.
3. Review and complete the existing WGRFS glossary.
4. Complete the template with a list of experts to provide scientific support to the ISG. This would involve several ISGs working together to complete the list as it would serve multiple ISGs.
5. Develop a rough outline for the first QAT potential paper, define the list of authors and expected timelines.

The ISG is considering a follow up call in early 2024, to discuss advances and next steps in each of the proposed items of the 2023/24 workplan.

2.4.3.1 Assessing the quality of national survey programmes

The quality of the Finland and UK Catchwise onsite survey programmes were assessed using the QAT. The full QATs for each programme can be found in Annex 3, but the outcomes are summarised below.

2.4.3.1.1 Finland

Recreational fishing statistics includes data on the number of recreational fishers, gear used, effort, and catches in Finland. The statistics are published in odd-numbered years by the end of October in the year following the statistical year from 1998 onwards. The survey covers all resident recreational fishers in Finland, but excludes non-residents and fishing abroad. It is a national survey based on stratified random sampling from the Finnish Population Register. The full QAT for Finland can be found in Annex 3.

Outcome: the WGRFS judged the design of the survey to be fit-for purpose to fulfil the defined objectives. No major sources of bias were identified, but some suggestions were made to improve the design (e.g. declining response rates, precision estimates, mandatory reporting).

2.4.3.1.2 UK Catchwise onsite survey

The primary objective of the Catchwise (https://www.catchwise.org/) survey is to obtain a probability-based estimate of sea angling effort and catch around the coast of England and Wales by shore, private boat and charter boat anglers. In addition, the project aims to help quantify any potential bias in the ongoing offsite logbook study (Sea Angling Diary - https://www.seaangling.org/). Catchwise comprises of an onsite shore and private boat survey, and a charter boat

logbook. Currently, the survey is only planned for a single year and at the time of writing the survey was ongoing, so only the design phase was evaluated using the QAT (see Annex 3).

Outcome: the WGRFS judged the design of the survey to be robust and fit-for-purpose to fulfil the defined objectives. No major sources of bias were identified, but some suggestions were made to improve the design (e.g. charter boats outside the frame and non-response, private boat effort, shore/private boat sampling times). These will be assessed and incorporated in the design where possible.

2.4.4 Regional coordination and data storage

Leads: Lucia Zarauz and Estanis Mugerza

There is currently a Regional Database (RDB) which is used to store detailed commercial fisheries sampling data. This regionally coordinated database covers fisheries in the North Atlantic, the North Sea and the Baltic Sea. However, ICES and the RCGs are moving towards a new version, the Regional Database and Estimation System (RDBES). The aim of this database is to ensure that data can be made available for the coordination of regional fisheries data sampling plans and in particular for the RCGs. In addition, to provide regional estimation system such that statistical estimates of quantities of interest can be produced from sample data in order to deliver data for ICES stock assessments and advice. WGRFS together with the RDBES core group experts and WGRDBESGOV, have been working on a database format that allows incorporation of MRF data. The minimum requirement is to include catch and effort estimates and, in the longer term, incorporate raw sampling data and provide final estimates following the sampling schemes.

In 2023 the first official MRF data call was launched by ICES. WGRFS experts were involved in the development of these formats for the RDBES, and will analyse the responses from MSs. This will involve checking if MSs responded to the data call, if the data reported was complete or partial, identify issues with provision of data in the required format. A report will be generated containing the main outcomes and recommendations for inclusion of MRF data in the RDBES, and shared with ICES. In addition, WGRFS continues to participate and work with the WGRDBESGOV, to ensure that MRF remains on the agenda, with the agreed objective of incorporating data from these fisheries.

2.4.5 Catch and release and animal welfare

Leads: Simon Weltersbach and Keno Ferter

Catch-and-Release (C&R) has become a common practice in recreational fisheries in many countries worldwide (Policansky, 2002, Arlinghaus, 2007). This is also the case for many species in European MRF (Ferter et al. 2013). C&R involves catching fish (the term here usually refers to catching them with rod and line) and then releasing them alive back into the waters where they were caught, if they survive this process unharmed (Policansky, 2002; Arlinghaus et al., 2007). Nevertheless, in most cases, not all individuals survive after release. Furthermore, C&R can have sublethal impacts such as physiological stress responses (Cooke et al., 2013), behavioral changes (Thorstad et al., 2004; Baktoft et al., 2013), and reduced growth or reproductive rates (Diodati & Richards, 1996; Suski et al., 2003; Siepker et al., 2006; Pinder et al., 2017). Systematic reviews and meta-analyses of studies on post-release mortality of freshwater and marine fish species have shown that post-release mortality rates can vary from 0% to 95%, averaging at 15-20%, but are less than 10% for many fish species (Muoneke and Childress, 1994; Bartholomew & Bohnsack, 2005; Hühn and Arlinghaus, 2011). Although an increasing number of studies to assess the impacts of C&R on European marine species have been conducted in recent years (e.g., Alós et al., 2009; Weltersbach and Strehlow, 2013; Ferter et al., 2015a; Ferter et al., 2015b; Pinder et al., 2017;

Lewin et al., 2018; Watson et al., 2020, Skov et al., 2022, 2023), there is still a lack of knowledge on the potential negative impacts of C&R on various European marine species and fisheries. Therefore, the objective of this session was to discuss the status of studies on the impacts of C&R in European marine recreational fisheries and beyond, animal welfare issues, and future research needs. In total, 35 people attended the session in person or online. An important part of the session was the presentation and discussion of several planned, ongoing or recently finished research projects on potential lethal and sublethal C&R impacts for various species.

In Germany, a study on post-release survival of flatfish in the Baltic recreational fishery was started in spring 2023. The study aims to estimate post-release survival rates for plaice, dab and flounder under realistic angling conditions. In addition, species and fishery-specific recommendations to reduce the lethal as well as non-lethal impacts of C&R and to improve fish welfare during and after C&R will be developed for anglers and managers. The study consists of two parts. First, a citizen science study with 200 voluntary flatfish anglers investigated the selection patterns, catch-per-unit-effort, and hooking position of two different hook sizes of a standard flatfish hook. For this, anglers received standardized flatfish rigs with two different hook sizes and a diary where they could record all relevant data for each angling day. Second, a field experiment was run from March to August to estimate post-release survival rates of flatfish. In that experiment, flatfish were caught by voluntary anglers from a charter vessel using the same standardized rigs as in the citizen science study. After capture, fish were tagged and data on, e.g., fish length, hook size and hooking position was recorded. Afterwards all fish were released in cages that were returned to capture depth. Following a holding period of 6-7 days the cages were retrieved and the status of each fish was checked.

Next, preliminary results from a Swedish study on lethal and sublethal impacts of C&R on Atlantic salmon (*Salmo salar*) in the recreational trolling fishery were presented. The study consists of two parts. In the first part, post-release survival of salmon caught and released in the Baltic recreational trolling fishery was investigated by using pop-up satellite archival tags (PSATs). This study focuses on large salmon in the Baltic Sea that are feeding or migrating to their spawning grounds. The tagging started in spring 2023 but due to low catch rates only 14 of 45 planned salmon could be tagged. Therefore, the tagging will continue in 2024. However, so far only one individual died indicating a low post-release mortality rate. The second part of the study consists of a telemetry study in the Swedish lake Vättern where landlocked salmon occur. The aim is to use acoustic tags to get a more detailed picture of any behavioral changes associated with C&R of troll caught salmon. This study will start in autumn 2023.

A presentation on multiple catch and release studies from Australia was presented. These studies were focused on large pelagic species including, southern bluefin tuna (*Thunnus maccoyii*) (Tracey et al., 2016), swordfish (*Ziphias gladius*) (Tracey et al. 2023) and shortfin mako shark (*Isurus oxyrinchus*) (French et al., 2015) using pop-up satellite tag technology. All three studies had been conducted with the assistance of recreational fishers to ensure the capture methodologies were replicating that used by anglers. The study on mako shark identified a high post-release survival rate of 90%, and that circle hooks had a significantly lower probability of deep hooking. The low number of mortalities, however, meant that causes of mortality could not be determined. Southern bluefin tuna also had a relatively high survival rate, 83%, but it was lower for fish caught with hard body lures affixed with treble hooks (60%). Analysis of blood showed that stress was significantly related to 'fight time', but again, due to low number of mortalities, significant factors leading to mortality could not be determined. Post-release survival of swordfish was assessed using the daytime deep dropping method where fish were targeted between 350 and 650 m deep. Post-release survival was relatively high (85%) of fish that were deemed in a suitable condition to release, but a significant proportion of fish were identified as moribund boatside or could not descend due to gas trapped in the peritoneal cavity. It was presumed this

was caused due to lactic acidosis producing carbon dioxide released into the swim bladder which likely ruptured. Fifty-six percent of fish could not be released due to this.

In addition, Portugal gave an update on their study on immediate and short-term post-release mortality and sub-lethal impacts of two white seabream species (*Diplodus spp*.). White seabream is among the most important recreational target species in Portugal and releases rates are high, but limited information is available regarding post-release mortality and sublethal effects. The study design comprises experimental angling with two different sizes of the same J-hook and blood sampling (glucose, lactate, and cortisol) after capture, death or after 4 and 24 h after C&R. Various parameters are recorded for each fish, e.g., fight time, fish length, bleeding, air exposure, vitality score etc. The fish are tagged after capture and released into sea cages and held in the cages for 24 h. First experimental trials were conducted in summer 2022 but a few practical issues occurred (e.g., problems with the net cage) that prevented a successful completion of the study. The group discussed the issues and suggested potential solutions. It is planned to continue the study in summer 2023.

At the end of the session, progress on the intersessional work was presented. As already identified in previous meetings, there is a lack of an up-to-date review on studies investigating lethal and sublethal impacts of C&R. Furthermore, methods need to be developed and applied to extrapolate mortality rates in data-poor situations between similar species and fisheries. To address the lack of an up-to-date review of post-release mortality studies in recreational fisheries (Muoneke and Childress, 1994; Bartholomew and Bohnsack, 2005; Hühn & Arlinghaus, 2011) a project funded by the Centre for Environment, Fisheries, and Aquaculture Science (Cefas) has recently been launched. This project involves several members from the WG including people from the Cefas (UK), Rhodes University (South Africa), the University of Tasmania (Australia), the Institute of Marine Research (Norway), the Leibniz Institute of Freshwater Ecology and Inland Fisheries (Germany), and the Thünen-Institute of Baltic Sea Fisheries (Germany). The project encompasses two major studies. First, it is planned to conduct a global systematic review of lethal and sublethal impacts of C&R across taxa, gears, techniques, fisheries and environmental conditions. This will include peer-reviewed and grey literature using structured and reproducible database searches. Following this, a quality assessment of C&R studies to date using the ICES WGMEDS critical review framework for discard studies will be undertaken (ICES, 2021). The study aims to provide the most comprehensive synthesis of C&R research to date and will provide a much-needed database of quality-weighted post-release mortality estimates for various species, fisheries, and environments. The second study aims to build a structured decision tree model that incorporates significant factors that influence C&R mortality by species, family or life-history traits. The outcome of this will be a user-friendly, open-access management tool through which a variety of variables can be selected to evaluate the expected post-release mortality associated with any C&R recreational fishery. The predicted mortality estimates will be bounded and weighted depending on the quality and quantity of the input review data. While there is no doubt that this tool will be indispensable to fisheries managers, it will also highlight which species need attention and what factors that influence their post-release mortality need further research attention to minimize negative impacts of C&R fishing.

2.4.6 Stock assessment and reconstruction

Leads: Martina Scanu and Zachary Radford

2.4.6.1 Productivity-susceptibility analysis

Understanding the susceptibility of different species to MRF pressure constitutes a crucial initial step, given the diverse array of species captured, each subject to varying levels of exploitation. Additionally, while certain species might frequently be exploited by MRF, the level of

exploitation might be small in comparison to the commercial fishery. To address this, the WGRFS has embarked on a project aimed at pinpointing species highly vulnerable to MRF, utilizing a productivity-susceptibility analysis (PSA) framework. This framework evaluates both a species' susceptibility to fishing pressure and its life-history characteristics, amalgamating them into a comprehensive vulnerability index (Patrick et al., 2009). Moreover, recognizing potential data constraints within MRF, the WGRFS approach incorporates an uncertainty score for each parameter, akin to the methodology proposed by McCully Phillips et al. (2015). Both the vulnerability score and the uncertainty score collectively classify species into four categories: low priority (low vulnerability and uncertainty), medium priority (low vulnerability, high uncertainty), high priority for inclusion (high vulnerability, low uncertainty), and high priority for data collection (high vulnerability and uncertainty), as illustrated in Figure 1. These categorizations are determined on an ICES ecoregion basis.

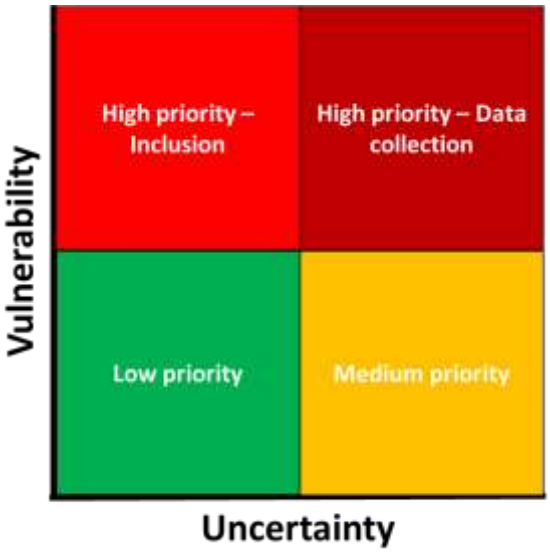

Figure 1: The proposed categories for the productivity susceptibility analysis being conducted by the ICES working group on recreational fisheries surveys. Scores will be provided per species and ICES ecoregion.

Expert opinion uncertainty scores were diverse and depended on the species (Figure 2). In general, respondents were most sure on the availability of species to MRF, and least sure on the post-release mortality score possibly owing to the lack of studies on this research area. Whilst biological importance scores in the group were identified to be broadly accurate, missing productivity parameter data for many species meant that conservative scores had to be given to these species. These high productivity scores made species with limited-to-no recreational catches some of the most vulnerable species to recreational fisheries (Figure 3; Table 1). Thus, additional work is required within the analysis to handle missing productivity data. Several suggestions were made within the working group that are currently being explored. Furthermore, as this analysis was tested on a limited set of species, the updated analysis will be conducted on an expanded set of species in future.

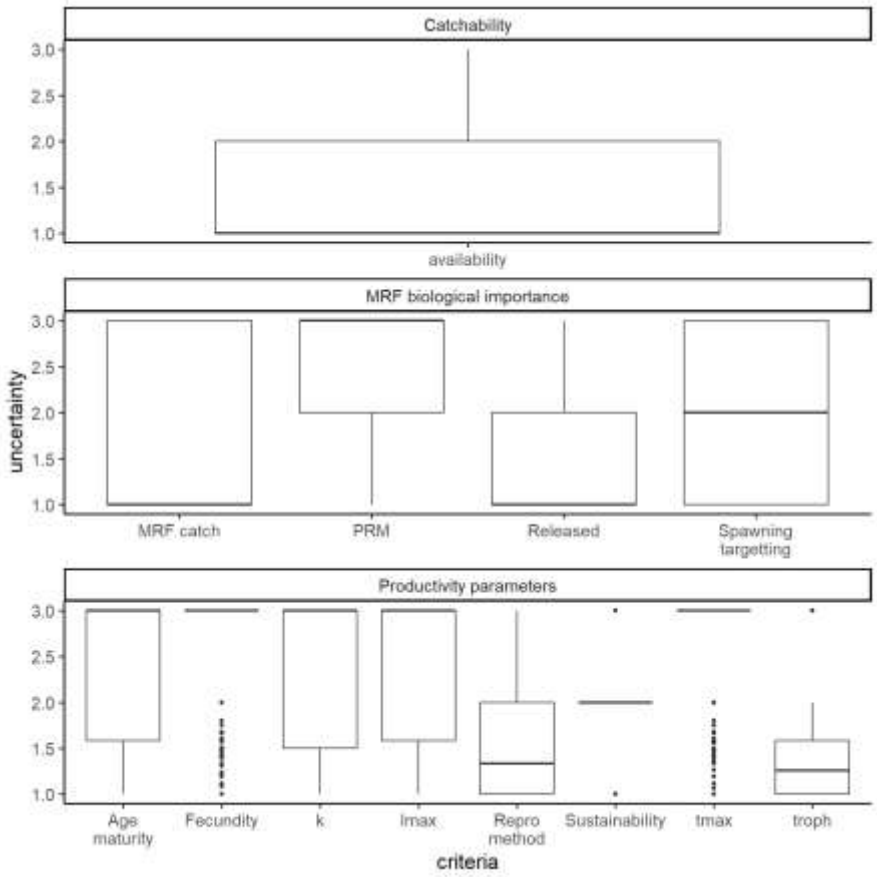

Figure 2: The uncertainty scores from both the importance and productivity parameters. Higher values mean more uncertainty.

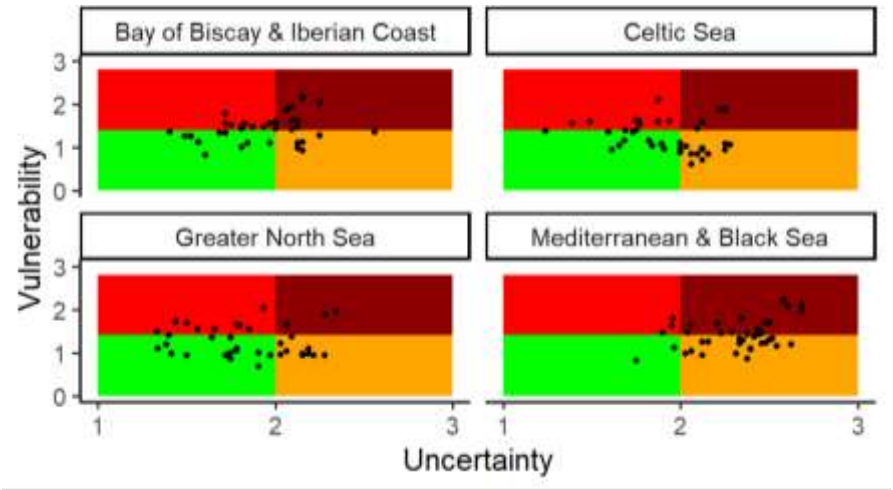

Figure 3: Classifications for the species assessed as part of this survey. Please note, the WGRFS identified a need to update the analysis due to inconsistencies in the results, so these are not the final outputs from this project.

Table 1: The top 10 species by overall vulnerability score per sea area assessed by the current productivity-susceptibility analysis, tested within the WGRFS. Please note, due to the analysis' sensitivity to missing data these scores are not final and need updating prior to use.

Bay of Biscay & Iberian coast		Celtic Seas		Greater North Sea		Mediterranean & Black Sea	
Species	**Score**	**Species**	**Score**	**Species**	**Score**	**Species**	**Score**
Porbeagle	1.9	Porbeagle	2.1	Porbeagle	2.0	Dusky grouper	1.8
European seabass	1.8	Spurdog	1.6	European seabass	1.7	Mediterranean parrotfish	1.8
Spurdog	1.6	European seabass	1.6	Spurdog	1.7	Greater weever	1.7
Common skate	1.6	Common skate	1.6	Greater weeverfish	1.7	European conger	1.7
Ballan Wrasse	1.6	Thornback ray	1.6	Lesser weeverfish	1.6	Common dentex	1.7
Bluefin tuna	1.6	Greater weeverfish	1.6	Common skate	1.6	Lesser weeverfish	1.6
Gilthead seabream	1.6	Lesser weeverfish	1.6	Thornback ray	1.6	Seabream	1.6
Thornback ray	1.5	Lesser-spotted dogfish	1.6	Lesser-spotted dogfish	1.5	John Dory	1.5
Spotted seabass	1.5	Atlantic pollack	1.5	Spotted Ray	1.5	White seabream	1.5

2.4.6.2 Roadmap for the inclusion of MRF to ICES advisory products

The ISG initiated a discussion on generating an ICES roadmap for the inclusion of MRF in ICES advisory products through a presentation with the key topics for inclusion. These were:

1. Introduction to legislative instruments for MRF nationally (e.g. MSs), regionally (e.g. EU), and internationally (e.g. FAO).
2. Current ICES framework for MRF (i.e. expert groups, data, databases).
3. Future science needs for MRF in terms of the data gaps, blockers to inclusion, and EU request to ICES to provide advice including MRF.
4. Existing advice that includes MRF.
5. Workflow for the incorporation of RFS data to ICES advice.

A first draft will be presented and discussed with ACOM in September 2023. The document will have to describe the legislative background, the scientific needs, and a path for ICES to strengthen its advice on MRF. The approach will follow the template of the ICES roadmaps on bycatch of protected, endangered, threatened species (ICES, 2022).

Some future needs were highlighted. For example, short-term goals should include targeting data calls to relevant researchers on MRF, and inclusion of MRF experts in the stock assessment WGs. It was recognised that it is important to include MRF in advice even if it cannot be included in the assessment model. The Workshop on Recreational Fisheries in Stock Assessment (WKRFSA) will develop approaches for inclusion in the advice process and will be held in Sukarrieta (Spain) from 3-5 July 2023. WKRFSA aims to identify key issues preventing the inclusion of MRF in advisory and stock assessment processes, create a decision tree for their inclusion in the framework, and develop agreed criteria for doing it based on the data quality and the contribution of MRF to the total catch for a given stock.

2.4.7 Novel methods

Leads: Christian Skov, Valerio Sbragaglia and Paul Venturelli

Novel methods to collect data from recreational fisheries to supplement or even replace existing, more traditional methods are emerging in recent years, and are a focus of the WGRFS. Examples of novel methods are internet scraping, internet search volume, social/online listening, georeferenced photographs, trail cameras/car counters and smartphone applications (apps). During the meeting, the ISG discussed the overall aims of the group for the 2023-2025 period. There was agreement that the ISG should assist and support managers and researchers in the EU (and beyond) that plan to implement novel methods in their data collection, e.g., app development and data use. The group also wishes to encourage the development and evaluation of non-probability sampling methods, comparisons to traditional methods, the exploration of opportunities and limitations, and fisher cooperation and engagement (e.g., through citizen science) as appropriate.

During the period 2023-2025, the ISG should focus on one of the general ToR´s of WGRFS for year 3 (2025), as this relates specifically to the ISG, i.e., "Assess novel approaches for surveys (e.g., combining probabilistic and non-probabilistic sampling) and analysis methods (e.g., treatment of outliers, machine learning)." To meet the ToR, the ISG decided to focus on being involved in the ICES Symposium planned for 2025 (contact person Anika de Groote) that will focus on non-probabilistic vs. probabilistic sampling methods and how they compare.

During the annual meeting, several speakers presented food for thought for the ISG. First, Valerio Sbragaglia (Ramón y Cajal Fellow, Department of Marine Renewable Resources, Institute of Marine Sciences (ICM-CSIC), Spain) gave an online presentation around social media and search volumes on the internet, with a focus on the potential that these methods hold for supporting traditional data sampling methods, and the limitations that need to be considered when

working with such methods. Many of these limitations were also identified at a workshop during the WRFC, in Australia early 2023 that was led by two of the ISG leads. The main conclusion was that it could be beneficial with scientific work that would summarize the current potential and limitations and give advice on how we can best move forward.

Second, Asta Audzijonyte (Senior research fellow, Institute for Marine and Antarctic Sciences, University of Tasmania & Centre for Marine Socioecology, Australia) gave an online presentation about a consortium that she is establishing. The focus of the consortium is to share knowledge among researchers that work (or plan to work) with machine learning for fish species and size identification. Asta invites all who are interested to join an email list. We appreciate Asta for reaching out because this consortium is of great relevance and interest to the ISG, and the people involved. The ISG plans to stay in touch with Asta regarding the consortium. More information can be found here: https://fishaiconsortium.github.io/website/.

Third, Kevin Hasse (PhD student, Institute of Baltic Sea Fisheries, Johann Heinrich von Thünen Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries, Germany) presented a project proposal to develop an app for German anglers that should collect data to support the current data-collection as well as fulfill the requirements of the new EU-Control Regulation. Kevin presented the thoughts that they had on how to build an app that is motivating and easy to use and able to collect the needed data. Not surprisingly, this undertaking is not trivial, and he reached out to the ISG for input and support. This led to a follow-up presentation by Asta Audzijonyte and Christian Skov on how the ISG can best assist in advising new apps, which is also a part of one of the overall aims of the ISG, presented in the first paragraph of this summary. Asta and Christian shared their thoughts on when apps succeed and when they fail, and gave several specific recommendations on what to consider when building an app and, in relation to that, a data collection programme. One of the recommendations was to produce some written guidelines, e.g., a "best practice" document.

The final presenter was David Smith (Fisheries Biologist, Texas Parks and Wildlife Department, Inland Fisheries Division, USA) who introduced the "Angler Survey Committee" which is a construct under the American Fisheries Society that is somewhat like WGRFS, and specifically the subcommittee "Emerging Technologies". The presentation illustrated clear venues for collaboration between the ISG and the AFS subcommittee, not least since ISG co-lead Paul Venturelli is part of the chair in both groups.

Based on the presentations, discussion, and feedback during the Ancona meeting, the following milestones were set for the period 2023/2024, with names in parentheses are suggested coordinators for the different milestones:

- Maintaining the online spreadsheet for members about ongoing and planned activities related to novel methods. The idea is that the spreadsheet can support information sharing and foster collaborations (Paul).
- Initiate the process of developing a best practice document that can support managers who wish to include data collection via angler apps in their data collection programme (Christian, Paul, Kevin).
- Formalize collaboration with the AFS and, if possible, Australian groups that use apps to collect data (Paul, Christian).
- Engage in the consortium "Machine learning for fish species and size identification" (Christian, Valerio).
- Summarize current potential and limitations for social media and search volumes on the internet (Valerio).
- Arrange an online meeting during 2023/2024, including 1-3 presentations of ongoing or completed work relevant for the ISG (Christian).

2.4.8 Human dimensions

Leads: Harry Strehlow, Warren Potts, and Christian Skov

The human dimension of recreational fisheries is a multidimensional topic that encompasses different research areas. In fisheries, it is commonly accepted that the management of fisheries largely involves the management of people and that the human dimension of management needs to be recognized. This year the human dimension intersessional group focused on (1) exploring, if the condensed set of questions (specialization framework) can predict angler heterogeneity, (2) identifying a framework to study behavioural change and how to influence it, and (3) identify and develop social and economic indicators particularly to aid resource allocation decisions.

The condensed set of questions identified during the WKHDR workshop was tested in Denmark and Germany. First results presented last year suggested some consistency issues. Repetition of the survey in Denmark showed a temporal stability between years. Testing the condensed set in Germany revealed that although the items had good correlation and all pointed in the same direction the root mean square of the residuals had a large value and therefore indicated a rather poor fit. Also, the fuzzy c-mean clustering revealed two large clusters with avidity being the strongest predictor variable. However, comparisons from the catch and harvest rates between the two clusters revealed only small differences. In conclusion, we can say that we are still learning how to interpret the data, especially with regard to method selection. Further work is required to thoroughly check the validity and reliability of the items.

The interplay between fish populations, anglers and management measures has a direct impact on the sustainability of recreational fisheries. Different angler behaviours can have a significant impact on the sustainability of fisheries (e.g. choice of target species, compliance with regulations, voluntary catch and release, catch and release behaviour). Even though there are rules and regulations, the effectiveness of the management system depends on how anglers behave. Despite the importance of human behaviour in maintaining sustainable recreational fishing systems, few behaviour change measures have proven successful. One strategy for behavioural change used in recreational fisheries is the Knowledge Attitude-Behaviour model (KAB). The model assumes that the problem lies in anglers' lack of understanding and knowledge of environmental issues. Education campaigns are one of the most common approaches to improve angler behaviour in order to increase angler awareness and public attitudes towards conservation. These measures assume that education will change attitudes and ultimately human behaviour. There is little empirical evidence that these cognitive interventions have been successful. LaPierre (1934) noted that people's actions do not necessarily reflect their attitudes, and several questions have been raised about the relationship between attitudes and behaviour (Herberlein, 2012; Matthews & Riley, 1995). To date, there are few studies that have documented changes in response to a KAB intervention. Delle Palme et al. (2016) found that the catch and release behaviour of those who had received training improved significantly. However, the change in behaviour was observed immediately after training and the long-term consequences were not observed.

Herberlein (2012) suggested that technological and structural fixes can be used as alternatives to cognitive fixes when attempting to influence environmental behaviour. A technological solution attempts to change a process or object in the environment, bypassing the need for attitude change altogether. For example, a technological solution might involve preventing access to a particular area characterized by poor compliance (by closing a road) and restricting recreational fishing. A structural solution refers to changing the context in which the behaviour takes place, such as levying fees or changing fishing regulations. Using trip reports from recreational fishing charter vessels in New Jersey, USA, Trudeau et al. (2022) investigated how effort and target species changed in response to longer closed seasons and changes in catch limits. They found that charter

vessel effort remained stable, but target species changed (substitution). In contrast, party boats were less willing to switch to other species and had to reduce their effort due to the longer closed seasons. Technical and structural corrections often have unintended consequences and the expected consequences should always be tested first (using economic models such as discrete choice experiments).

Other strategies to behavioural change are the use of nudges. Examples of nudges used in Tasmanian recreational fishing, e.g. a spray-painted reminder to measure catch that is the same size as the minimum legal size of the commonly caught flathead can be found in Mackay et al. (2018). Changing social norms is another strategy to alter people's behaviour. A social norm has to do with beliefs about others, i.e. social expectations within a reference group that are maintained through social approval, disapproval or influence. People therefore generally adhere to social norms to avoid the disapproval of others (Elster, 1989). Herberlein (2012) believes that these norms are key to influencing behaviour because they explicitly include a social rather than a personal component. Stern et al. (1985) presented a theoretical model of norms that relates concepts to each other as a social psychological guide for supporting environmental protection. This involved the activation of moral norms against harming innocent people, referred to as norm activation theory. An alternative and simpler method that may be suitable for recreational fishing was developed by Berkowitz (2005) and is known as the social norms approach (SNA). SNA uses research to identify social descriptive, injunctive and subjective norms and intervenes by attempting to correct any negative misperceptions of social norms through targeted advertising campaigns. Central to the requirements of SNA is the presence of "pluralistic ignorance", where individuals perceive the behaviour of others as deviating from their own and then align their behaviour more closely with the presumed majority (Berkowitz, 2005). Critically, the misperception should be an overestimation of undesirable behaviour (Berkowitz, 2005).

Pro-environmental behaviour refers to behaviour that harms the environment as little as possible, or even benefits the environment Steg and Vleg (2009). Geller (2002) found that promoting behavioural change is more effective when you:

- Carefully select the behaviours that you would like to change.
- Examine what factors cause these behaviours.
- Apply well-tuned strategies to change relevant behaviour.
- Systematically evaluate the effects of these interventions.

This approach was tested in South Afrika in a C&R competitive angling league, see Mannheim et al. (2018). Engagement with the league started 2012 and continued in subsequent years. Baseline data on angler behavior and fish health information were collected prior to the intervention. Intervention strategies included rule changes (e.g., distance from fish handling bucket), antecedent strategies (e.g., information and education to raise problem awareness), and consequence strategies (e.g., rewards for best C&R handling practices). After the intervention, the success of the project was reviewed to determine whether it was sustainable and whether deficiencies had been corrected. In fact, air exposure time had improved (decreased) and improvements continued even after Covid (two year break for the league). The competitive nature of this group had spilled over into environmental behavior, emphasizing the need to understand what motivates anglers in their specific environment and find a way to connect with that motive.

The recommendations of the South African experience include being in it for the long term. Build trust - join the anglers, offer a service to the anglers. Measure your baseline and develop a strategy. Use a combination of strategies (structural changes, technical corrections, nudges, precursors and follow-ups) for the intervention. Rule changes or recommendations should be based on evidence and justification, and well communicated to anglers. Monitor the measures and adjust them if necessary. For sustainable projects, find out what motivates the angling community and try to make a connection.

UK provided an economic impact assessment of sea angling in 2016, 17 and 21 based on angler expenditure (capital and travel) using an input-output approach. Total economic impact was £1.2 billion, GVA was £310 million and supported 12.3 thousand jobs in 2021. The 2021 figures were lower than 2016 and 2017 despite similar spend per angler due to fewer anglers and fishing days. It was argued that it was difficult to use economic impact data to inform management and policy as spending is likely to be redistributed. A German study on regional economic impact of recreational fisheries in the federal state of Mecklenburg Western Pomerania (MV) argues the opposite, as non-resident domestic angling tourists outside MV are responsible for 2/3 of the value added and that these resource flows to local and regional economies would not be present without fishing by nonresident anglers (Strehlow et al., 2023). Therefore, the economic contribution of anglers to the local economy should be considered in future management decisions. Finally, a case study from Angola pointed out that economic leakage can undermine local benefits from recreational fishing (Butler et al., 2020). In their example over 90% of the economic contribution stayed outside the region and only little value was retained in the region from informal market expenditures and domestic work. Therefore, local development strategies should focus on supporting local (informal) markets for value retention and addressing the opportunity costs identified in the study.

2.4.9 Communication and engagement

Leads: Pablo Pita and Sean Tracy

Effective communication and engagement of science is vital to develop public understanding and appreciation of scientific advancements and application in the decisions around fisheries management. If done well, it can bridge the gap between researchers and society, leading to informed decision-making and support for scientific and management initiatives. Furthermore, effective communication promotes collaboration and knowledge-sharing among scientists, enabling them to build upon each other's work and accelerate the pace of scientific progress, ultimately benefiting society as a whole.

The aim of this intersessional group is to progress knowledge and provide content to allow the development of communication skills in the recreational fishing research sector. This will be achieved by: 1) raising the profile of communication and engagement in research funding and result dissemination; 2) reviewing strategies to improve communication and engagement with the recreational fishing community; and 3) developing measures to assess effectiveness of communication and engagement strategies.

During the 2023 WGRFS meeting the communications and engagement intersessional working group invited three attendees to deliver presentations covering three key areas of communication and engagement in recreational fisheries research. The first presentation was delivered by Hannah Rudd, the Policy & Advocacy Manager of the Angling Trust. Hannah's presentation titled "Communication is integral to recreational fisheries survey success – here's why" focused on the benefits of effective communication from the lens of the recreational sector and how it can lead to better participation and data quality in recreational fishing surveys. It was noted that when the recreational sector has a deeper understanding of the methods, need for and outcomes of recreational fishing surveys they are more likely to willingly contribute to what are predominantly voluntary or respondent driven requests for participation.

The second presentation was delivered by Zach Radford from CEFAS. This showcased a data transparency initiative called "UKSAIL – UK Sea Angling Information library" led by Wendy Edwards with contributions from Zach and Kieran Hyder (CEFAS). The initiative utilises an R Shiny interface that is located on the world wide web and openly accessible to all (stakeholders, fisheries managers, recreational fishers, etc) that provide an interactive data visualisation tool

and summary dashboards for all UK Sea Angling Diary results. Data can be scrutinised by type (effort, catch, etc), temporal period, species of interest, region of interest and a range of measurement characteristics (e.g., number caught). This piece of work dovetailed well into the ISG discussions around the need for transparency of data and survey results to the recreational community to encourage greater participation in future surveys.

The final presentation was delivered by Sean Tracey (Institute for Marine and Antarctic Studies – University of Tasmania, Australia) titled "Tuna Champions – A national communications, engagement and stewardship program" (www.tunachampions.com.au). Stewardship of fisheries resources by the recreational sector is growing a recognition as an effective method to deliver meaningful engagement of fishers in the resources they interact with. The Tuna Champions stewardship program was initiated to improve the handling practices of the recreational fishery whether they were releasing fish (minimising impact and post-release mortality) or harvesting fish (maximising meat quality and yield from individual fish to reduce wastage and unnecessary mortality). The initiative is a collaboration between the Australian Recreational Fishing Foundation (ARFF) and IMAS. IMAS' role is to manage the project and ensure the information provided through the program is underpinned by evidence-based information. It has been highly successful in Australia with evidence of extensive reach among the target group (tuna fishers) and also with demonstrable evidence of behavioural change among the sector. Key findings of the program are that appropriate funding is required for a stewardship initiative to be successful, and it needs to have strong ties and input from the recreational community to maximise adoption and engagement.

Following the presentations, the working group focused on discussing activities and outputs from the group. Two initiatives that were supported to progress were the development of an infographic that could be used to quickly describe the key factors of recreational fishing through the Europe. The focus was on high level statistics that would give a lay person a comprehensive insight into the magnitude of recreational fishing including catch, effort and economic and social values. The target audience would be broad, and could include members of Government, interested members of the community and recreational fishers directly. It was acknowledged by the group that to do this well would require the engagement of a dedicated graphic designer. It was discussed that engaging the appropriate personnel with experience in communication was a good strategy as the science community are often not skilled in translating the science to a lay audience. The discussion was greatly assisted by the presence of Maria Torres Karlsmose (Graphic Designer – ICES). Maria noted that she had a limited knowledge of recreational fishing which was of benefit to the group as many of the concepts that were discussed to be presented were perceived to be simple and digestible by a lay audience by the majority of the group (scientists, recreational fishing advocacy groups), however, Maria identified that this would likely not be the case and provided some excellent alternative suggestions to simplify the messaging. As a result, Maria is now designing the infographic on behalf of the working group and we expect this to be complete by the 2024 WGRFS meeting.

The second major initiative that was discussed was a contemporary peer-reviewed synthesis paper on communications and engagement of recreational fisheries science to the recreational sector. It was recognised that the last significant paper in this space was published in 2013 (Dedual et. al., 2013). Since this time there have been many progressions both in communication mediums, particularly web and social media tools, and also communication methodologies and theories. The working group will undertake the development of a manuscript over the coming twelve months.

2.5 Publications

Emphasizing the accomplishments made and strategizing for future contributions is crucial for elevating the group's visibility. Our recent focus has centred on peer-reviewed papers, given their longer lead times, while broader communication mediums like blogs, reports, and social media fall under the Communications and Engagement intersessional group. Papers that were prosed included the following: governance, assessment of quality, impacts and allocation, novel methods and big data, non-probabilistic approaches, and angler heterogeneity. Workshops have already taken place on novel and survey methods, and additional sessions are in progress, particularly regarding sampling approaches.

3 Revisions to the work plan and justifications

All the ToRs and tasks were covered, but tasks food safety was delayed for a year due to key people not being available to attend the meeting. No further changes are requested at this stage.

4 Next meeting

The next meeting of WGRFS will be held in Horta (Azores, Portugal) from 3–7 June 2024. It will be hosted by Hugo Diogo at the Secretaria Regional do Mar e Pescas, Direção Regional das Pescas.

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Annex 2: Resolutions

2022/2/FRSG36 The **Working Group on Recreational Fisheries Surveys (**WGRFS**)**, chaired by Kieran Hyder, UK, and Estanis Mugerza, Spain, will work on ToRs and generate deliverables as listed in the table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2023	19–23 June 2023	Ancona, Italy	Interim report by 01 November 2023 to FRSG	
Year 2024	10–14 June 2024	Horta, Azores, Portugal	Interim report by 01 November 2024 to FRSG	Estanis Mugerza completes 4 years as chair
Year 2025	14–18 June 2025	TBD	Final report by 01 November 2025 to FRSG	Kieran Hyder completes 3 years as chair

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Collate and review quality of national estimates of recreational catch and effort, catch-and-release impacts, and socio-economic benefits for candidate stocks, identify significant data gaps in coverage and species, and support the ICES TAF and ecosystem approach.	Most countries are engaged in data collection. This activity collates national participation, catch and socio-economic data sets together, understands the quality of data, and highlights where new data are needed. This is important for supporting the ICES TAF and ecosystem appoach.	2.1, 3.1, 3.2, 5.4	Regular activity in each year, with intersessional tasks and workshops to develop new approaches.	Report WG perspectives and publication of scientific papers
b	Assess the validity of traditional knowledge, new survey designs, novel methods (e.g. citizen science, apps), innovative statistical methods for data provision, and approaches for selecting appropriate cost-effective methods.	Recreational data can be collected in many ways, with different associated biases. This supports improvement of analysis of existing surveys and understanding the utility of new methods. This will lead to the most robust and broad evidence-base to underpin asessment and advice.	3.1, 3.2, 3.3, 3.6, 4.1, 4.3, 4.4, 5.4	Regular activity in each year, with intersessional tasks and workshops to develop new approaches.	Report WG perspectives and publication of scientific papers
c	Provide guidance to ICES and respond to ad hoc requests from ACOM on the availability of data, design of data collection programs, data storage	Recreational catches are not included in many assessments and data collection is limited to a few species. This activity supports data collection requirements, access to data and methods	3.1, 3.2, 3.3, 3.5, 3.6, 5,1	Regular activity in each year, with intersessional tasks and workshops to	Report WG perspectives and publication of scientific papers

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
	systems, use of data in assessments, catch allocation, and ecosystem approach.	needed. This will facilitate embedding recreational fisheries into fisheries management.		develop new approaches.	
d	Develop approaches for regional data collection programmes that generate robust data for end users and support the ICES TAF and ecosystem approach.	Regionalisation is an important goal, but implementation is unclear This is a challenge for recreational fisheries due to the different actors, gears and survey instruments. This will underpin generation of transparent and robust regional data to support end users needs.	3.1, 3.2, 3.3, 3.6,	Regular activity in each year, with intersessional tasks and workshops to develop new approaches.	Report WG perspectives and publication of scientific papers
e	Evaluate the use of economic (e.g. impact, valuation), social (e.g. governance, behaviour, welfare, health), and communication (e.g. participatory process, messaging) to support the assessment and management of recreational fisheries.	Recreational fisheries have broad benefits and behavioural responses are difficult to predict due to diverse motivations. Hence, understanding of the human dimension is needed. This develops understanding of the data and methods needed for codesign.	7.1, 7.4, 7.6	Regular activity in each year, with intersessional tasks and workshops to develop new approaches.	Report WG perspectives and publication of scientific papers
f	Review outcomes of the workshops organized by the group.	Recreational fisheries is a diverse topic, so not all aspects can be adressed at WGRFS. A number of workshops on specific topic have been done or are in the workplan. This reviews outcomes of the workshops and the implications for recreational fisheries.	5.4, 7.1, 7.4	Activity-dependent on workshop	Report WG perspectives and publication of scientific papers

Summary of the work plan

Year 1	a) Review progress of intersessional groups (i.e. governance, survey design, quality and analysis, regional coordination, data storage, catch-and-release impacts, novel methods, assessment and catch allocation, human dimensions, and communication) and agree approach for the next year. (a, b, c, d, e) b) Evaluate the quality of up to three national survey programmes using the QAT and provide feedback on tasks requested by ICES. (a, c) c) Review the outputs from ICES WRGRFS led workshops and discuss next steps for the inclussion of outcomes. (f) d) Scope data call for ICES based on the formats developed by WGRFS and the RDBES core group. (c, d, f) e) Assess priorities for inclusion of recreational fisheries in stock assessment using data from the pilot studies. (a, c, d) f) Develop ICES workshop proposal with WGCATCH for intergrating

	probabilistic and non-probabilistic surveys. (b) g) Create ICES workshop proposal to evaluate post-release mortality estimates, potential sublethal effects, and reasonable extrapolations across species and fisheries for inclusion in stock assessments. (a) h) Assess the potential for food safety and human health issues from consumption of recreational caught fish (e.g. environmental toxins). (e) i) Review and share methods for engaging with stakeholders and the potential for particpatory approaches. (e) j) Draft a roadmap to increase the inclusion of recreational fisheries data into advisory processes
Year 2	a) Evaluate the outcomes from the intersessional work and agree approach for the next year. (a, b, c, d, e, f) b) Review national programmes including assessment of quality of up to three programmes and provide feedback on tasks requested by ICES. (a) c) Assess the potential of novel survey methods to deliver recreational fisheries data (e.g. citizen science approaches, smartphone apps, traditional knowledge). (b) d) Develop a framework for allocation of catches between sectors based on a review of existing systems and provide best-practice guidance. (c,d) e) Develop MSE approaches to assess the impact of uncertainty in recreational catches on assessment and regional sampling programme. (d). f) Review and share methods for engaging with stakeholders and the potential for particpatory approaches. (e) g) Assess outcomes of workshop on inclusion of recreational data in stock assessments. (f)
Year 3	a) Review progress of intersessional groups (i.e. governance, survey design, quality and analysis, regional coordination, data storage, catch-and-release impacts, novel methods, assessment and catch allocation, human dimensions, and communication) and agree approach for the next year. (a, b, c, d, e) b) Evaluate the quality of up to three national survey programmes using the QAT and provide feedback on tasks requested by ICES. (a, c) c) Review the outputs from ICES WRGRFS led workshops and discuss next steps for the inclussion of outcomes. (f) d) Collate advances in survey methods that could be used to improved national approaches. (b) e) Assess the potential for impact of climate change on species caught by recreational fisheries and how that coud impact on DCF and regional species requirements. (c, d) f) Develop ICES workshop proposal on MSE approaches to assess the impact of uncertainty in recreational catches on assessment and regional sampling programmes. (d). g) Assess the potential of novel survey methods to deliver recreational fisheries data (e.g. citizen science approaches, smartphone apps, traditional knowledge). (b) h) Evaluate progress against three year plan and develop new ToRs. (a, b, c, d, e, f)

Supporting information

Priority	High—the biological, social and economic impact of recreational fishries is becoming increasing recognised and needs to be included in the fisheries assessment and management processes.
Resource requirements	None.
Participants	The WG is normally attended by around 60 members and chair-invited experts.
Secretariat facilities	Normal backstopping support in the organization of the group.

Financial	None.
Linkages to ACOM and groups under ACOM	ACOM, WGBFAS, WGEEL, WGBAST, WGCSE, WGNSSK, WGBIE, WGMEDS, and benmarks workshops for stocks that have recrational catches.
Linkages to other committees or groups	WGCATCH.
Linkages to other organizations	• EC, STECF, Regional Coordiantion Groups, Advisory Councils. • WECAFC/OSPESCA/CRFM/CFMC/MEDAC Working Group on Recreational Fisheries. • Many linkages to (inter)national angling associations, since WGRFS members estimate national marine recreational catches. • Links to broader organizations with interests in angling and fisheries management including EIFACC and FAO.

Annex 3: Assessment of national survey programmes using the QAT

ICES WGRFS – QAT template (2023 version)

The QAT has been in existence since 2013 and has been reviewed since 2018. WGRFS felt that there was the need to update some of the questions and to reflect onsite and offsite surveys. The revised QAT presented below is a working draft and the first step in this process. Further work will be needed in the coming years to improve the QAT further and consider how to ember this within the TAF. The text in blue relates either to examples of text or what needs to be considered to answer the question.

SHORT DESCRIPTION OF THE SURVEY (main objective, scope, and key details on sampling approach and implementation stage) *List the study main objective(s) and scope of the study. Some additional details should be provided on the recreational fishing modes being surveyed, scale (regional, national, multi-country), the study area, if it is a long-term monitoring survey, one-time study, stage at which is the survey (i.e, design, implementation, data analysis, report writing, completed) etc*	
Objective(s)	*Obtain catch and effort estimates for marine spearfishing at the national scale*
Target population	*All resident marine recreational fishers of a given country or region*
Sampling approach	*A complemented sampling approach was used, combining a phone survey to obtain participation rates and effort estimates, and an onsite (roving creel) to obtain cpue data…*
Scale	*Regional / national / local*
Fishing modes	*All recreational fishing modes, marine spearfishing, boat angling, hand harvesting, …*
Stage	*Completed, ongoing (if ongoing, at which stage)*
Country presentation (yes / no)	

DESIGN				
	QUESTION	ANSWER	OFF-SITE SURVEY COMMENTS (if not applicable, type NA)	ON-SITE SURVEY COMMENTS (if not applicable, type NA)
Target population	Have all components of the target population been identified?	Yes / No	*A component could be a specific fishing mode or another segment for the fisher population (e.g., non-resident fishers)* *Example: On a national scale survey, non-resident fishers are usually not well identified, as these are not part of the national phone lists etc.*	*Private access points not considered.*
	Is there a component of the target fishery that is not covered by the survey and if so, what was it?	Yes / No	*For example, in a telephone survey, fishers without a listed phone number (either because they do not have a phone or are not in the national phone list (e.g., tourists)*	*For example, for roving creel or access point surveys it is common to exclude night fishing for safety reasons. When this is the case, it should be noted here, along with an explanation on why.*

	Are there elements of the target population that are not accessible, and if so, what are they (e.g. private access points or unlisted telephone numbers)?	Yes / No	*For example, in a telephone survey, fishers without an identified/ associated phone number (either because they do not have a phone or are not in the national phone list (e.g. tourists)*	*Private access points not surveyable.*
	Study population		*Describe what parts of the target population were covered*	
Sampling frame	What is the sample frame(s) and the associated PSU?		*Examples:* *on mail survey it would be the list of addresses; PSU = address* *on phone survey, it could be the number of licensed fishers that provided a valid phone number; PSU = phone number*	*Sample frame = days of the year; PSU = day*
	Does the sampling frame adequately cover the target population?	Yes / No	*Example for No – Fishers from overseas*	*No - only part of the day surveyed.*
	Are there elements of the sample frame that have been deliberately excluded, and if so and what were they (e.g. quiet season)?	Yes / No	*Yes – visitors from overseas*	*Yes – night fishing*
Stratification	Are the strata well defined, known in advance (spatial/temporal)?	Yes / No	*No – poor or inadequate record keeping for license database.*	*Fishing season / area not well understood.*
	Is there adequate sampling within each stratum (e.g. days surveyed during weekend/summer)?	Yes / No		*No – proportion of days allocated to weekend strata too low*
Selection	Is sampling probability based (e.g. stratified random, PPS -Proportional to Population Size)?	Yes / No	*If No, provide short explanation on approach.*	*If No, provide short explanation on approach.*

	Has the survey been designed to achieve target precision in an analytically optimal fashion?	Yes / No	*No – no prior data to inform sample size determination.*	*No – no prior data to inform sample size determination.*
	Have issues associated with ethics/ permits and privacy been addressed?	Yes / No	*If No, provide short explanation on approach.*	*If No, provide short explanation on approach.*
IMPLEMENTATION *Fill the section below, IF* *A. The survey has started, OR* *B. The survey hasn't started but advice or assessment by ICES WGRFS is requested.* *Check this box and skip the section(s) if the survey hasn't started and advice or assessment by ICES WGRFS is not required* ☐				
	QUESTION	ANSWER	OFF-SITE SURVEY COMMENTS (if not applicable, type NA)	ON-SITE SURVEY COMMENTS (if not applicable, type NA)
Selection	Has the survey actually followed the sampling design?	Yes / No / Unknown	*Unknown – survey is still running* *If No, provide short explanation on approach.*	*Unknown – survey is still running* *No – New temporal strata introduced pathway through survey* *If No, provide short explanation on approach.*
	Have sampling protocols been documented and followed at each stage (selection of individuals, times, boats, biological samples)?	Yes / No		
	Have contingency protocols been specified to deal with issues such as incomplete interviews of un-surveyable weather and were they required?	Yes / No		*Yes – to deal with need to sub-samples large catches for measuring.*
	Has there been any major departure from the survey design (frequent refusal to take observers on board a charter vessel)?	Yes / No		*Yes - frequent refusal to take observers on board a charter vessel.*

	Is there a language barrier (tourist fishery)?	Yes / No / Unknown		
	Have the planned number of sampling events and/or interviews taken place and have the completion rates been documented?	Yes / No	*No – low uptake by spearfishermen.*	*No – too many days cancelled because of poor weather*
Nonresponse	What were the following nonresponse rates were relevant? - Screening – blocked contact - Screening – no reply - Screening – language problem - Panel survey – not contactable - Creel survey – refusal - Creel survey – language problem - Other	Yes / No / Unknown	*Screening – blocked contact (xx%), etc.*	*Creel survey – refusal (xx%), etc.*
Recall	What is the recall period and is it appropriate for the questions asked?	Yes / No / Unknown	*Please note and explain any relevant information on if the recall period is different depending on the indicator. For example, for effort (number of fishing trips) it can be one month, three months or 12 months. For catch it could only refer to the last fishing trip (which could also be variable depending on the fisher avidity).* *Example of excessive recall period: Three months for catch data*	*Not an issue as fishers interviewed when they returned at end of day.* *Could be an issue if you call them later on because they were still fishing when interviewed on the water.*
Effort	How is effort defined (unit, fishing mode, target species, location) and related to CPUE measures?			
	Was the measure of effort clearly communicated to the fisher (i.e. time	Yes / No / Unknown		*No – if not asked to distinguish between time on the water vs time actually spent fishing*

	spent with gear in the water)?			
	Is it possible to record incorrect fishing areas?	Yes / No	*Yes – map not provided to phone respondents*	
Catch	Is the retained catch verified by surveyors (e.g. all filleted, don't show)?	Yes / No		*No – if too many cases where fishers refuse to show their catch*
	Is species identification and naming reliable?	Yes / No / Unknown		*No – if too many cases where fishers refuse to show their catch*
	Is there a clear division between fish kept and fish released?	Yes / No	*No – if no question made about the fate of the fish caught*	*No – if no question made about the fate of the fish caught*
	Is it possible that an individual will have also reported the catch of those fishing with them?	Yes / No / Unknown	*Yes – evidence of multiples of the individual bag limit reported by the individual fisher.*	
	Is there a digit preference in the reports (catch numbers and/or length frequencies)?	Yes / No	*Yes - Catches reported at multiples of 5.*	*Yes – length frequency peaks at every 5 cm.*
ANALYSIS & REPORTING (fill out if the survey is complete) Check this box if not applicable ☐				
	QUESTION	ANSWER	OFF-SITE SURVEY COMMENTS (if not applicable, type NA)	ON-SITE SURVEY COMMENTS (if not applicable, type NA)
General	Does the estimation procedure follow the survey design?	Yes / No	*If no, clearly explain why.*	*If no, clearly explain why.*
	Has imputation been used to account for missing observations and, if so, is the procedure documented?	Yes / No		
	Has there been weighting to correct for	Yes / No		

	nonre-sponses/avidity bias			
	Has the preci-sion of estimates been calculated and, if yes, how have they been calculated and where are they documented?	Yes / No	*Yes – data bootstrapped at all levels.*	
	Were estimates estimated with acceptable pre-cision.	Yes / No	*For example, a coefficient of vari-ance less than 20% is good, less than 30% is acceptable, but 40% above is considered to be poorly estimated*	*For example, a coefficient of variance less than 20% is good, less than 30% is acceptable, but 40% above is considered to be poorly estimated*
WGRFS ASSESSMENT on the SURVEY				
	Strengths			
	Weaknesses			
	Recommendations			
Short description of the survey and key issues followed by conclusion and suggestions form improvement.				

Finland

SHORT DESCRIPTION OF THE SURVEY (main objective, scope, and key details on sampling approach and implementation stage)	
Objective(s)	Recreational fishing statistics includes data on the number of recreational fishers, the use of gear, effort, and catches in Finland. The statistics are published in odd-numbered years by the end of October in the year following the statistical year. Data are available in the database starting from 1998.
Target population	All resident recreational fishers in Finland. The statistics do not include fishing by foreign visitors in Finland or fishing by Finns abroad.
Sampling approach	Stratified random sampling from Finnish Population Register
Scale	National
Fishing modes	Fishing is considered as such when a person has used gear of some kind at least once in the year. Person is considered to have fished even if he or she had only rowed or steered the boat while someone else was fishing.
Stage	Data from year 2022 was collected in the beginning of 2023 and was published in October. https://www.luke.fi/en/statistics/recreational-fishing
Country presentation (yes / no)	Yes

DESIGN				
	QUESTION	ANSWER	OFF-SITE SURVEY COMMENTS (if not applicable, type NA)	ON-SITE SURVEY COMMENTS (if not applicable, type NA)
Target population	Have all components of the target population been identified?	Yes	The statistical unit in the recreational fishing statistics is a household-dwelling. Recreational fishing covers all fishing of Finnish household-dwellings (including the catching of crayfish), with the exception of fishing carried out by professional fishers and their households.	NA
	Is there a component of the target fishery that is not covered by the survey and if so, what was it?	No	People under permanent institutional care are not included to the target population.	NA
	Are there elements of the target population that are not accessible, and if so, what are they (e.g. private access points or unlisted telephone numbers)?	Yes	If all people in a single household-dwelling have restricted access to their address. Not a large problem.	NA
	Study population		All parts of the target population were covered.	NA

Sampling frame	What is the sample frame(s) and the associated PSU?		The sampling frame is the Finnish Population Register of peoples and household-dwellings. One household consists of the persons living permanently in the same dwelling unit. Sampling is targeted at people aged 18–74 years. Since 2020, the sample size is 11,000 households. PSU is the household-dwelling	NA
	Does the sampling frame adequately cover the target population?	Yes	Target population includes only residents.	NA
	Are there elements of the sample frame that have been deliberately excluded, and if so and what were they (e.g. quiet season)?	No	Target population includes only residents.	NA
Stratification	Are the strata well defined, known in advance (spatial/temporal)?	Yes	Seven strata. One including households with national fishing fee and six spatial strata.	NA
	Is there adequate sampling within each stratum (e.g. days surveyed during weekend/summer)?	Yes	The sample is balanced by region and paid fisheries management fees.	NA
Selection	Is sampling probability based (e.g. stratified random, PPS -Proportional to Population Size)?	Yes	Stratified random sampling.	NA
	Has the survey been designed to achieve target precision in an analytically optimal fashion?	Yes		NA
	Have issues associated with ethics/ permits and privacy been addressed?	Yes		NA
IMPLEMENTATION Fill the section below, IF A. The survey has started, OR B. The survey hasn't started but advice or assessment by ICES WGRFS is requested. Check this box and skip the section(s) if the survey hasn't started and advice or assessment by ICES WGRFS is not required ☐				
	QUESTION	ANSWER	OFF-SITE SURVEY COMMENTS (if not applicable, type NA)	ON-SITE SURVEY COMMENTS (if not applicable, type NA)

Selection	Has the survey actually followed the sampling design?	Yes		NA
	Have sampling protocols been documented and followed at each stage (selection of individuals, times, boats, biological samples)?	Yes	The sampling protocols, sampling design and quality report are on the statistics webpage https://www.luke.fi/sites/default/files/2023-03/Vapaa-ajankalastus%20Laaturaportti_EN.pdf	NA
	Have contingency protocols been specified to deal with issues such as incomplete interviews of un-surveyable weather and were they required?	Yes		NA
	Has there been any major departure from the survey design (frequent refusal to take observers on board a charter vessel)?	No	Response rate has declined for many years but it was expected.	NA
	Is there a language barrier (tourist fishery)?	No	The questionary is in Finnish, Swedish and English.	NA
	Have the planned number of sampling events and/or interviews taken place and have the completion rates been documented?	Yes		NA
Nonresponse	What were the following non-response rates were relevant? - Screening – blocked contact - Screening – no reply - Screening – language problem - Panel survey – not contactable - Creel survey – refusal - Creel survey – language problem - Other	Yes	Screening – no reply 75%. After follow-up survey non-response dropped to about 65%.	NA

Recall	What is the recall period and is it appropriate for the questions asked?	Yes	Calendar year. There can be some recall bias due to the long period.	NA
Effort	How is effort defined (unit, fishing mode, target species, location) and related to CPUE measures?		The total fishing days of the household is asked. In the case of angling, the term "fishing day" means that one person has used a certain type of angling gear for one day. In the case of gill nets, fish traps, crayfish traps and trap nets, "fishing day" means that a person has hauled the gear in question for one day.	NA
	Was the measure of effort clearly communicated to the fisher (i.e. time spent with gear in the water)?	Yes		NA
	Is it possible to record incorrect fishing areas?	Yes	Yes, if the respondents don't know the province where they have fished. Possible measuring error but very unlikely.	NA
Catch	Is the retained catch verified by surveyors (e.g. all filleted, don't show)?	No	NA	NA
	Is species identification and naming reliable?	Yes	People in Finland recognize species.	NA
	Is there a clear division between fish kept and fish released?	Yes	This is clearly asked in the questionnaire.	NA
	Is it possible that an individual will have also reported the catch of those fishing with them?	Yes	The reported catch by household is complemented by the fishers in the household.	NA
	Is there a digit preference in the reports (catch numbers and/or length frequencies)?	Yes	Digit preferences in reporting catch weight.	NA
ANALYSIS & REPORTING (fill out if the survey is complete) Check this box if not applicable ☐				
	QUESTION	ANSWER	OFF-SITE SURVEY COMMENTS (if not applicable, type NA)	ON-SITE SURVEY COMMENTS (if not applicable, type NA)
General	Does the estimation procedure follow the survey design?	Yes	Stratified response homogeneity group estimation using calibration to	NA

			the population (age group, gender, household group).	
	Has imputation been used to account for missing observations and, if so, is the procedure documented?	Yes	Mainly hierarchical hot deck imputation in some groups (region, gears used etc.). Documented in quality report.	NA
	Has there been weighting to correct for nonresponses/avidity bias	Yes	Response homogeneity group modelling and calibration in reweighting corrects bias.	NA
	Has the precision of estimates been calculated and, if yes, how have they been calculated and where are they documented?	Yes / No	Standard errors can be estimated. Not included currently in official statistics.	NA
	Were estimates estimated with acceptable precision.	Yes / No	Depends on the variable. Estimates for number of fishermen and catches of common species are good or acceptable. Rare catches are often not estimated with acceptable precision.	NA
WGRFS ASSESSMENT on the SURVEY				
	Strengths		Sampling design, coverage, correcting non-response bias, replying possible both by mail and electronically (suitable also for mobile devices)	
	Weaknesses		Declining response rate, long recall period, precision of catch estimates for some species.	
	Recommendations		Apply mandatory catch reporting information of certain species (national legislation enforced in 2024).	
Outcome: the WGRFS judged the design of the survey to be fit-for purpose to fulfil the defined objectives. No major sources of bias were identified, but some suggestions were made to improve the design (e.g. declining response rates, precision estimates, mandaotry reporting).				

United Kingdom

SHORT DESCRIPTION OF THE SURVEY (main objective, scope, and key details on sampling approach and implementation stage)

The primary objective of the Catchwise (https://www.catchwise.org/) survey is to obtain a probability-based estimate of sea angling effort and catch around the coast of England and Wales by shore, private boat and charter boat anglers. In addition, the project aims to help quantify any potential bias in the ongoing offsite logbook study (Sea Angling Diary - https://www.seaangling.org/). Catchwise comprises of an onsite shore and private boat survey, and a charter boat logbook. Currently, the survey is only planned for a single year and at the time of writing the survey was ongoing, so only the design phase was evaluated.

Onsite shore and private boat survey: shore sampling is to be conducted via roving creel, unless site conditions make this unsafe or unfeasible at which point an access point survey will be used. All boat sampling is to be conducted using an access point survey. Within the survey we have split the coastline up into unfishable, low activity, and high activity sections using existing data, which form the basis of the shore sites to be sampled and the sampling probability for each site. In tandem, we identified all boat ramps and harbours where launching angling boats was possible, which were again classified into high and low activity sites through the same study classifying the coastline fishability. All days of the year are included in the sampling frame, where weekends and public holidays are given a higher sampling probability. The survey primary sampling unit is a combination of the day of the year and site (site*day). Each sample site is split by the UK NUTS1 statistical regions, including Wales. Further division of the Southwest and Wales was done to account for the angling population and/or length of coastline in the region. For sampling, each region is given 45 days/quarter of sampling effort, where 60% sampling probability is assigned to the shore survey. Sampling effort of 45day/quarter is defined to generate relative standard errors of less than 25% based on a simulation approach using data from an onsite survey in 2012. In summary, the stratification in this portion of survey is quarter*region*survey type*site activity*day type.

Offsite charter boat logbook survey: the charter boat survey is run as an offsite logbook survey where all the charter boats that advertise online, and agree to take part in the survey, are part of the sampling frame. Online advertisement was used to identify the target population. Charter boats were split by their home ports ICES subdivision, and 20 weeks within the year were randomly sampled for each region, where quarters 2 and 3 (summer) were given a higher sampling probability. If a week is randomly selected, all boats signed up to the survey in the region fill out the survey. Thus, the PSU is the region*week.

Objective(s)	Obtain catch and effort estimates for marine angling within England and Wales
Target population	For the shore/boat survey the target population site days For the charter boat survey the target population is all charter boats operating in England and Wales
Sampling approach	For the shore/boat survey, a probability-based onsite creel/access point survey with a sample frame comprising of all sites and days. For the charter boat survey, an offsite diary of charter boats selected from a sample frame by location.
Scale	England and Wales
Fishing modes	Sea angling which is the main gear used in the UK
Stage	Ongoing, Design phase
Country presentation (yes / no)	Yes

DESIGN				
	QUESTION	ANSWER	OFF-SITE SURVEY COMMENTS (if not applicable, type NA)	ON-SITE SURVEY COMMENTS (if not applicable, type NA)
Target population	Have all components of the target population been identified?	Yes	Yes, although charter boats unlicensed in the UK, but frame identified through online advertising boards.	Private access points, moorings & marinas not considered. Not considering places that are too dangerous to fish. Weather events that are too dangerous to sample will not be covered.
	Is there a component of the target fishery that is not covered by the survey and if so, what was it?	Yes	If charter boats do not advertise online they will be excluded from the frame, but this is likely to be very few boats.	Night fishing excluded for safety reasons.
	Are there elements of the target population that are not accessible, and if so, what are they (e.g. private access points or unlisted telephone numbers)?	No	Charter boats refusing to participate in the survey will not be accessible.	Private access points not surveyable.
	Study population		All charter boats in England and Wales.	All marine recreational angling trips conducted in England and Wales.
Sampling frame	What is the sample frame(s) and the associated PSU?		Frame = list of weeks PSU is the week	Frame = list of site and days PSU = site x day
	Does the sampling frame adequately cover the target population?	Yes	Yes frame is comprehensive, issue is more on response rates	Yes
	Are there elements of the sample frame that have been deliberately excluded, and if so and what were they (e.g. quiet season)?	No & Yes	No	Yes – night fishing (Between 8pm – 6am) Language barrier – English speakers only Anglers under 16 excluded

Stratification	Are the strata well defined, known in advance (spatial/temporal)?	Yes	Yes, boats registered to home port which has a defined region.	Yes – region, day type and activity level defined.
	Is there adequate sampling within each stratum (e.g. days surveyed during weekend/summer)?	Yes	Yes – power calculations conducted.	Yes – power calculations conducted.
Selection	Is sampling probability based (e.g. stratified random, PPS -Proportional to Population Size)?	Yes	Yes – weeks randomly selected	Yes – known increased selection probability for shore, high activity sites, & shore angling (60% vs 40%)
	Has the survey been designed to achieve target precision in an analytically optimal fashion?	Yes	Yes – simulation study done to predict sample size for survey to generate RSE of below 25%.	Yes – simulation study done to predict sample size for survey to generate RSE of below 25%.
	Have issues associated with ethics/ permits and privacy been addressed?	Yes	Yes	Yes
WGRFS ASSESSMENT of the SURVEY				
	Strengths		• Limited burden on skippers. • Responses for all boats in designated window helps understand variance within fleet.	• Site data facilitates inclusion of additional variables (e.g., habitat maps) for model-assessed raising. • Site list is comprehensive. • Simulation for RSE enhances survey confidence.
	Weaknesses		• No licence for charter fishing means nothing is known about non-respondents. • Potential for low response rate.	• Non-English speakers struggle to respond. • No nighttime sampling. • Large number of strata. • Private boats may be difficult to find using probability-survey.
	Recommendations		• Try and gather non-response data.	• Try to set up boat counters to find boats being launched
Outcome: the WGRFS judged the design of the survey to be robust and fit-for purpose to fulfil the defined objectives. No major sources of bias were identified, but some suggestions were made to improve the design (e.g. charter boats outside the frame and non-response, private boat effort, shore/private boat sampling times). These will be assessed and incorporated in the design where possible.				