

WORKING GROUP ON RECREATIONAL FISHERIES SURVEYS (WGRFS)

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i Executive summary

The role of the ICES Working Group on Recreational Fisheries Surveys (WGRFS) is to summarise and quality assure recreational fishery data collected in European countries and feed into the ICES advisory process on recreational fishing issues. In 2020, WGRFS met virtually to start work on the Terms of References (ToRs) for the period 2020–2022. The new ToRs cover many aspects of marine recreational fisheries (MRF) including the collation and review of national survey programmes; assessment of the validity of new approaches; provision of guidance on availability, quality and use of data; supporting regional data collection and storage; the human dimension; and review of workshops organized by the group. The focus of the 2020 meeting was on understanding new national surveys developing a delivery plan for 2020–2022. It was not possible to review the quality of national schemes due to the virtual nature and limited time available at the meeting

The WGRFS covers a large range of topics requiring in-depth work meaning that there is not enough time to cover these topics thoroughly during the meeting. As a result, nine intersessional groups were established on 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. These discussions were used to develop a publication strategy. Each group will be led by two members of the WGRFS and was discussed in detail at the meeting. This has been used to generate a summary of the background and goals for each group.

The European Commission (EC) funded a pilot project to develop control schemes for catches of important recreational species (e.g. sea bass). This aims to provide an assessment of the state of the art and develop innovative IT tools for the effective monitoring and control of MRF. The findings to date were discussed with the group. A practical integrated fishery information solution is needed, based on an integrated catch declaration scheme, along with the development of data standards and certification of eligible fisher apps. The pilot project will deliver the information system into which apps and websites will be able to be integrated by the process of certification. The use of this system to support data collection is being considered.

An online survey has been distributed in eight countries to obtain information on socio-ecological impacts of COVID-19 on MRF such as perceptions of ecological changes in marine ecosystems, economic impact derived from the loss of direct investments, and the impact on physical health and well-being of fishers. Response to the questionnaire has been good and, once complete, will be used to assess the impact of COVID-19, differences between countries, and support decision making for future disease outbreaks.

ii Expert group information

Expert group name	Working Group on Recreational Fisheries Surveys (WGRFS)
Expert group cycle	Multiannual fixed-term
Year cycle started	2019
Reporting year in cycle	1/3
Chairs	Kieran Hyder, UK Keno Ferter, Norway
Meeting venues and dates	Year 1: 15–19 June 2020, online meeting (50 participants) Year 2: 14–18 June 2021, Las Palmas, Gran Canaria, Spain (TBC) Year 3: 13–17 June 2022, (TBD)

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.	Yes
Assess the validity of traditional knowledge, new survey designs, novel methods (e.g. citizen science, apps), and innovative statistical methods for data provision.	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, and catch allocation.	Yes
Develop approaches for regional data collection programmes that generate robust data for end users and support the ICES TAF.	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

This is the first year of a three-year work plan that is given here:

Year	Work Plan
Year 1	<ol style="list-style-type: none"> 1) Establish intersessional groups and leads within WGRFS to progress key tasks including governance, survey design, quality and analysis, regional coordination, data storage, post-release mortality, novel methods, assessment and catch allocation, human dimensions, and communication. 2) Develop a plan for at least three WGRFS publications. 3) Review national programmes including assessment of quality of up to three programmes and provide feedback on tasks requested by ICES, RCGs, EC and STECF. 4) Support initiatives by STECF and RCGs to assess the impact of recreational fisheries on a broad range of stocks using data from the EU-MAP pilot studies. 5) Assess existing governance structures and what constitutes 'world-class' recreational fisheries management. 6) Investigate animal welfare issues related to recreational fisheries (e.g. catch and release) and identify how these could impact management. 7) Review outcomes from WKHDR and assess potential for inclusion of angler behaviour in future surveys. 8) Assess progress with storage of data within RDBES and agree on future needs. 9) Develop framework for inclusion of recreational data in stock assessments and propose workshop to design reconstruction approaches.
Year 2	<ol style="list-style-type: none"> 1) Review national programmes including assessment of quality of up to three programmes and provide feedback on tasks requested by ICES, RCGs, EC and STECF. 2) Assess the potential of novel survey methods to deliver recreational fisheries data (e.g. citizen science approaches, smartphone apps, traditional knowledge). 3) Review and share methods for engaging with stakeholders and the potential for participatory approaches. 4) Assess novel approaches for traditional surveys (e.g. combining probabilistic and non-probabilistic sampling) and analysis methods (e.g. treatment of outliers, machine learning). 5) Develop a framework for understanding potential allocation of catches between sectors through review of existing systems and provide best-practice guidance.
Year 3	<ol style="list-style-type: none"> 1) Review national programmes including assessment of quality of up to three programmes and provide feedback on tasks requested by ICES, RCGs, EC and STECF. 2) Review food safety and human health issues from consumption of recreational caught fish (e.g. environmental toxins). 3) Review the potential for impact of climate change on species caught by recreational fisheries and how that should impact on species lists. 4) Review new post-release mortality estimates, potential sub-lethal effects, and reasonable extrapolations across species and fisheries for inclusion in stock assessments. 5) Review progress against the three-year plan and design future WGRFS programme.

The WGRFS agenda was agreed and followed, although some changes were made to timings to complete discussions, and was as follows:

Day	Agenda Item
15 June 2020	Introduction and ToRs COVID-19 survey Control scheme for recreational catches of sea bass
16 June 2020	Country updates (ToR a)
17 June 2020	Establish intersessional groups (ToRs a, b, c, d, e, f): <ul style="list-style-type: none"> • Governance • Survey methods • Quality assessment of surveys • Regional coordination & data storage
18 June 2020	Establish intersessional groups (ToRs a, b, c, d, e, f) continued: <ul style="list-style-type: none"> • Catch and release and animal welfare • Inclusion of recreational fisheries in stock assessment • Novel methods
19 June 2020	Establish intersessional groups (ToRs a, b, c, d, e, f) continued: <ul style="list-style-type: none"> • Human dimensions Publication strategy Date, new chair & venue of next meeting

2 List of outcomes and achievements of the working group in this delivery period (2020–2022)

The latest ToRs for the WGRFS started in 2020, so given that the meeting occurred in June it is too early to collate achievements in the period 2020–2022. However, the aim is to build upon the success between 2017–2019 that centred around: creating a broad network to share expertise; developing methods (surveys, assessment, regional cooperation, assessing quality, novel methods); raising the scientific profile (presentation, conference sessions, papers); and providing the scientific evidence for inclusion in fisheries management. This will include broadening the scope of the group and expanding the network beyond Europe to generate more collaborations and wider learning.

3 Progress report on ToRs and work plan

3.1 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 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.

Annex 3: below includes a table that provides an overview of the current/most recent surveys countries have in place to estimate marine recreational catches and the most recent harvest/release estimates for the relevant species. The tables cover four major sea areas as defined by the current DCF:

- Baltic Sea (ICES subdivisions (SD) 22–32)
- North Sea (ICES divisions 3.a, 4 and 7.d) and Eastern Arctic (areas 1 and 2)
- North Atlantic (ICES areas 5–14 and NAFO areas)
- Mediterranean Sea and Black Sea

These tables 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”.

An overview of the most recent recreational catch data can be found in Annex 4: below and economic surveys of recreational in Annex 5: below.

Country updates were presented for Uruguay by Martín Laporta, Sweden by Andreas Sundelöf, the Netherlands by Tessa van der Hammen, Greece by Anastasios Papadopoulos, Finland by Pentti Moilanen, and Ireland by William Roche and Diarmuid Ryan.

3.2 Impact of COVID-19

Pablo Pita presented a research project conducted by a group of researchers at different institutions to assess the impacts of the COVID-19 pandemic on marine recreational fishing (MRF). The project originated from the Spanish Working Group on MRF (GT PMR) and was made international through the involvement of the ICES WGRFS. It involved researchers from Argentina, Belgium, Brazil, France, Greece, Italy, Portugal, Spain, Uruguay, and other countries. Academic and research centres, recreational fishers' associations, environmental organizations, and some public administrations were involved in both the design and dissemination of the survey.

An online survey was designed to obtain information from recreational fishers on socioecological impacts of COVID-19 on MRF. The survey included questions on perceptions of ecological changes in marine ecosystems, economic impact derived from the loss of direct investments, and impact on physical health and well-being of fishers. Eight countries received online questionnaires in six different languages that have been active since early April 2020, generating a good response. Once complete, the responses will be analysed to assess the impact of COVID-19 on MRF and differences between countries. The results will be of the interest to both fisheries managers and public officials managing outbreaks of diseases.

3.3 Control scheme for recreational catches of sea bass

Jules Selles presented a project on a control scheme for recreational catches of sea bass on behalf of the consortium of Halieuticom, Scenent, and Seaneo. MRF activities are difficult to monitor and control due to the heterogeneity of the practices and their seasonality, the diversity of their locations and the 'nomadism' of the users. The requirements for MRF data collection under the Data Collection Framework have led to the implementation of surveys in many European countries, but there is still a lack of data available to support management. The European Commission (EC) funded a pilot project to develop control schemes for catches of important recreational species (e.g. sea bass) by providing an assessment of the state of the art and developing innovative IT tools for the effective monitoring and control of MRF by the Members States.

The characterisation of MRF monitoring and control measures is organized in three phases. The first phase was an inventory of control schemes for MRFs in the EU (8 EU Member States, 3 external countries, and 4 species) focusing on three dimensions: regulatory/control measures, data collection and monitoring, and surveillance activities. In the second phase, a survey of fishers was conducted to assess their needs and expectations in terms of control and catch reporting. Thirdly, a survey of stakeholders based on the Q methodology, still ongoing, intends to investigate the perspectives of key identified stakeholders regarding control measures to ensure the sustainable management of MRF the use of IT tools in MRF monitoring and control.

Based on scientific literature (review of angler apps as a data collection tool in Venturelli *et al.*, 2017) and exchanges with stakeholders, the consortium proposed a practical solution based on an integrated catch declaration scheme. Along with the development of data standards and certification of eligible fisher apps, the consortium recommends the development of new integrated fishery information systems that compile and synthesise data from multiple fishery-relevant data sources (i.e. data gathering from the range of relevant fishers Apps) and provide catch declaration certificates.

The pilot project will deliver the information system into which apps and websites will be able to be integrated by the process of certification. The tool the consortium is developing will be a database for declarations, with web portals for fishers and administrators. This database will be able to accept data from existing applications. In this proof of concept phase, FishFriender will be the test application. The tool entered the test phase in July 2020 and would benefit from proper testing by some scientific users.

The IT-tool will provide a Single Sign-On (SSO) system to link to the scheme. A personal history of declared data for each fisher will be available on any certified app or the EC website and declarations will be entered in the certified applications suiting the habits of the users. To declare a catch, fishers will need to follow a few steps; first add a catch by selecting the species (mandatory) and adding a picture (not mandatory), then add the number of fish (mandatory) and select the sizes (mandatory), weight (not mandatory) and release status (mandatory). Once fishers have reviewed and saved the information, the app transfers the catch to the new EC IT Tool and displays the resulting receipt along with the declared data. Some further information such as fishing session times may be declared but is not mandatory to obtain a catch receipt.

This pilot project intends to make standardised MRF catch and fishing population data easily available across the EU. The consortium thinks that the scientific community would benefit from this new data stream and will have the opportunity to open surveys through the scheme page. The work of the consortium may influence the future of MRF data collection through recommendations fed back through the programme and the application certification process.

3.4 Establish intersessional groups (ToRs a–f)

The ICES WGRFS covers a large range of topics, with many of these topics being quite specific and requiring expert knowledge and in-depth work. During the yearly meetings, there is not enough time to cover these topics thoroughly, so the WGRFS has decided to establish 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. The groups consist of WGRFS members and chair-invited experts that will meet regularly to address agreed goals. They will be led by two members of the WGRFS, who will be responsible for reporting progress to the WGRFS. A summary of the background and goals for each group is provided below.

3.4.1 Governance

The nature of MRF governance varies greatly between countries (Arlinghaus *et al.*, 2019; Potts *et al.*, 2020). Potts *et al.* (2020) conducted a global review of MRF governance. Recreational fisheries were included in the fisheries legislation of 67% of the countries reviewed, but a clear definition was rare and often outside the main legislation (Potts *et al.*, 2020). Generally, recreational fisheries were not considered to be effectively managed and compliance was an issue (Potts *et al.*, 2020). Effective governance requires a clear legal definition, policy, co-management, monitoring, cost recovery, and must be adaptive (Potts *et al.*, 2020).

The current situation is that MRF is not effectively embedded in European fisheries governance. Comparisons with the components of effective governance identified by Potts *et al.* (2020) shows Europe to be lagging behind other parts of the world. For example, the CFP contains only a single statement about MRF, data are limited with only catch data mandated, few stock assessments included MRF, allocation decisions are not transparent, stakeholders are not included in decision making, and enforcement is limited. However, there is increasing recognition of the importance of MRF and moves to include it more effectively in future. As a result, there is a need to consider how this should be developed and identify best practice.

This group will be led by Kieran Hyder and Fabio Grati to review existing governance structures and develop an understanding of 'world-class' recreational fisheries management that could be embedded in a future revision of the CFP. This will be done by addressing the following questions related to the governance of MRF:

- What constitutes world-class?
- What is the current situation in Europe?
- What is needed to improve governance in Europe in the future?
- How could this be embedded in the fisheries policy and management?
- How can WGRFS support this process?

The output for the first year is to develop the structure and draft a paper for on governance of MRF in Europe and consider how to move forward based on the outcomes from the paper.

3.4.2 Survey methods

MRF are difficult to survey due to the diverse and dispersed nature of the activity, and the lack of lists (e.g. licenses) makes sample frames of individual fishers difficult to compile. Many different survey approaches are available (e.g. onsite roving creel, offsite diary), each of which has

its sources of bias (see Pollack *et al.*, 1994). This makes each survey challenging to design, implement, and analyse, meaning that bespoke approaches are needed based on the fishing situation and resources available.

Response rates to screener surveys are decreasing, making representative samples more difficult to obtain. The use of non-probability approaches is increasing, but the impact on data quality is largely unknown. Non-probability sampling is an alternative method that is often used when it is unfeasible or impractical to conduct probability sampling (see Pennay *et al.*, 2018). The main problem is that it is difficult to generalize research findings from non-probability-based surveys and to assess sampling variability and identify possible biases, as compared to probability-based sampling. This is not a problem that is unique to MRF, with similar issues found for commercial fisheries. WGCATCH have discussed non-probability sample selection categories including expert judgement; convenience sampling; and quota sampling. For MRF surveys, non-probability sampling methods may be particularly relevant in the study of specialized fishers that take a large portion of the catch but are too rare within existing sampling frames to be sampled cost-effectively using probability-based methods. Additional categories of non-probability sampling of relevance for recreational fisheries surveys include network sampling (including snowball sampling); opt-in web panels; and opt-in app surveys.

The overall aim of this intersessional 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 overall leads for the group are yet to be established, but the ideas are being developed by Jon Helge Vølstad and Jeremy Lyle.

A lot of work has been done by the group on traditional survey approaches and survey analysis, so the initial focus will be on non-probability sampling. Discussions are underway with WGCATCH to development a joint group with WGRFS on this topic. There is a need to develop criteria for including non-probabilistic methods in fisheries surveys and to document assumptions. A key feature of statistical inference from sample surveys is that it requires some theoretical basis and explicit set of assumptions for making the estimates and for judging the accuracy of those estimates. The validity of model-based inferences from non-probability samples depends on the appropriateness of the assumptions underlying the model and how deviations from those assumptions affect the specific estimates. Topics for the intersessional group are likely to include:

- Describing assumptions that must be met for non-probability samples to yield accurate results;
- Gathering empirical evidence on the accuracy of non-probability sample surveys;
- Designing regional validation studies to evaluate the utility of non-probability sampling.

3.4.3 Quality assessment of surveys

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

Since its development, the QAT has been used to assess the quality and provide advice 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. The QAT was still seen as an effective and valuable tool for quality assessment. However, a thorough update was needed 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 or what needs to be considered to answer the questions were added to the QAT template. The main intent was to minimize different interpretations to the questions, and ultimately increase consistency in the QAT assessments.

In 2020, the QAT session focused on three main points: (a) revisit the most recent (2019) changes to the QAT template; (b) discuss persisting gaps to the tool, and the main working areas for the next year; and (c) agree on a 'core' team for the intersessional group. In general, the group viewed the changes to the template as positive, and there were no immediate proposed changes, or key questions flagged to still be missing from the revised QAT template. However, the adequacy of the latest format and revised set of questions in the QAT is yet to be tested on specific new survey evaluations. The qualitative nature of the QAT was also discussed, with different opinions on whether QAT results should include some type of more quantitative measures. Regardless of the type of outputs from the QAT assessments, some of the ICES WG members highlighted the importance that recreational data (its quality, any assumptions on estimates, etc.) is better incorporated in the stock assessment process. There was no general agreement on how to best proceed, but the group felt that it is a relevant topic for future discussions. Finally, the feedback loop of the QAT was discussed. Here, some of the members noted the relevance of 'closing the loop' by better tracking how the results from the QAT were considered in the future of the survey programmes evaluated.

This group will be led by Pedro Veiga, Mafalda Rangel, and Bruce Hartill, with the main tasks to be completed before the ICES WGRFS meeting in 2021 as follows:

- Agree on the list of core participants and meeting schedule of the QAT intersessional group (December 2020);
- Finalize the revisions to the QAT template (May 2021);
- Draft a proposal for improving the feedback loop of the QAT (May 2021);
- Draft a proposal for improved inclusion of the QAT assessment results and recreational data on the stock assessment process (May 2021);
- Agree on two research topics (and potential leads) for publication related to the QAT (May 2021).

3.4.4 Regional coordination and data storage

The Common Fishery Policy (CFP) is moving towards a regional approach for fisheries management, so regionalisation is one goal of the EU MAP (2016/1251/EU). Currently, data collected at regional scale utilise diverse national sampling schemes. The EU MAP identifies the need for a regional sampling approach, with regional cooperation at the heart of this regulation. Also, recreational fisheries impact on stocks in both inshore and international waters, so the data needs for management may differ and make trade-offs necessary between national and regional needs. Although both CFP and EU MAP are specific to EU member countries, the objective of better coordination and cooperation at the regional level is equally relevant to non-EU countries for the same reasons.

This group will be led by Estanis Mugerza and Lucia Zarauz. The main objective for the creation of an intersessional group covering this topic is to provide support the main relevant bodies and end-users on issues related to regionalization and MRF. This covers many areas including, but not limited to, possible regional sampling plans, identification of the most relevant species by region, and incorporation of marine recreational fisheries data into a common database. The

members of this group will be responsible for establishing the necessary collaboration and communication with the main bodies mentioned above to provide scientific recommendations on issues related to regionalization.

The issue of regionalization related to marine recreational fishing is a topic that has been working in recent years within the WGRFS. The main milestones in a short-term perspective have already been identified by the group. Among these objectives or milestones, the main priorities are to move towards regional sampling plans for some species/stocks (e.g. seabass, cod), a database for marine recreational fisheries that allows storing all data collected during recent years (e.g. RDBES), and identification of the most important species on which to collect the information needed for better management of these species.

3.4.5 Catch and release and animal welfare

Catch and release and animal welfare issues in recreational fisheries have become increasingly important during recent years and have direct management implications. Catch and release rates are high for many recreationally targeted species, both due to regulations and due to voluntary decisions by the anglers. The main concern about catch and release practice are the potential negative impacts on the released fish, e.g. post-release mortality and sub-lethal impacts. Although there are some studies on the impacts of catch and release on selected European marine species (e.g. Atlantic cod, sea bass and halibut) there is still a lack of knowledge for many species. Moreover, many of these studies are fisheries-specific and the results cannot easily be transferred to fisheries in other countries due to different fishing practices and environmental factors. Also, studies on sub-lethal impacts of catch and release such as behavioural alterations and reduction of growth or reproduction are particularly rare for European marine species.

The main objectives of this intersessional group are to collect the current status of knowledge on catch and release impacts in a European marine recreational fisheries context, identify knowledge gaps, develop extrapolation methods of existing studies, suggest study needs, and provide the scientific basis for potential request for advice on catch and release and animal welfare issues related to European marine recreational fisheries.

This group will be led by Keno Ferter and Simon Weltersbach. The first milestones in the short term will be to collect and review all studies that are relevant for catch and release impacts on European marine fish species. Furthermore, the group will identify species for which post-release mortality may be relevant to be considered in stock assessments. Current animal welfare issue that is relevant for the management of European marine recreational fisheries will be highlighted and discussed from a natural science perspective. In the longer term, the group will design and provide advice on studies which will improve our understanding of catch and release impacts on relevant species. In addition, the group could provide the scientific basis for potential requests for advice.

3.4.6 Stock assessment and reconstruction

MRF significantly contributes to the total fishing mortality for several marine fish stocks, with some studies finding as high as 43% total removals by MRF (Radford *et al.*, 2018). Despite the potentially large removals, the majority of fish stocks around the world do not incorporate this source of mortality in the stock assessment. This is particularly apparent within waters surrounding the European continent as the default position for stock assessments is to argue to include MRF catch. There are many reasons why the inclusion of MRF data in stock assessments is not the default position, but the primary reasons are the perception of low MRF impact and a lack of data.

This group will be led by Zachary Radford and Andreas Sundelöf to develop approaches to support inclusion of MRF data in stock assessment. This will include approaches for determining stocks where MRF is a substantial proportion of the total removals, using screening methods to identify important stocks. Further, approaches for incorporating MRF data in stock assessments from around the globe will be reviewed and used to identify potential approaches. This will include the data needs of the current assessment used for the stock and dealing with biased or partial data.

The first year is likely to be a scoping exercise that includes an initial online meeting to develop approaches and agree on a plan. Then a review and categorisation of methods for inclusion of MRF in the stock assessment will be conducted and reported at the WGRFS meeting in 2021.

3.4.7 Novel methods

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 area for 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). The WGRFS has so far focussed mostly on the latter (apps), which allow anglers to record and share their catches with others, and might provide valuable recreational fisheries data (Pappenfus *et al.*, 2015; Jiorle *et al.*, 2016; Venturelli *et al.*, 2017).

At the WGRFS in 2020, Paul Venturelli and Christian Skov introduced some of the central challenges that relate to most of these novel methods. These related to a lack of knowledge about the type and quality of data that are being generated, including the use of non-probabilistic sampling, the lack of user characteristics (when applicable), the lack of standards, and whether these novel data can be included in existing management/governance frameworks.

An outline for the work of this intersessional group that centred on the challenges above was presented and discussed. The WGRFS agreed that the group will be led by Christian Skov and Paul Venturelli and should aim to encourage activities that:

- Further the theoretical basis for non-probability sampling methods and their empirical evaluation;
- Evaluate data from novel methods against data from traditional methods;
- Explore the opportunities and limits associated with novel methods;
- Evaluate how this group can assist in advising new and existing novel methods concerning data collection so that the data are of use to managers and researchers.

The group should also direct attention toward the citizen science aspects that are inherent to many novel methods, including the opportunities for fisher cooperation and engagement that are a common element of citizen science approaches.

Between June 2020 and June 2021, the group expects to:

- Use its expertise and influence to provide recommendations, encourage cooperation, and establish standards concerning the development of new apps;
- Cooperate with the WGRFS intersessional group on survey methods to initiate and plan a process to develop a rigorous approach to non-probability sampling in general and app data in particular;
- Submit manuscripts on a) evaluating novel data against data from traditional methods; illustrating how novel methods can produce novel insights into recreational management and b) a survey of WGRFS members regarding the use and potential of apps in recreational marine fisheries.

3.4.8 Human dimensions

Management of fisheries is often thought to be more about managing people than fish, as it is predicated on behavioural responses to measures imposed (Hilborn, 2007). This is likely to be more important for recreational fisheries, where the individual's motivations for participation are very diverse (Fedler and Ditton, 1994; Arlinghaus, 2006; Beardmore *et al.*, 2011). Many aspects of human dimensions of recreational fisheries have primarily been studied in freshwater systems including extensive research into how angler heterogeneity can impact on management (e.g. Arlinghaus *et al.*, 2017). However, understanding the human dimensions of marine recreational fisheries is limited, so there is a need to increase focus on this topic to underpin successful management of fish stocks.

In November 2019, WGRFS members ran a workshop, WKHDR–Integrating Angler Heterogeneity into the Management of Marine Recreational Fisheries, to develop approaches for integrating the human dimensions into the future assessment and management of marine recreational fisheries. Here, it was agreed that angler heterogeneity is highly relevant to the management of MRF. This relates to data collection (i.e. that some angler segments may have higher catch rates and harvest propensity which can result in survey biases) and management in general (e.g. responses to fishing regulations may depend on human dimension aspects). At the workshop, two central frameworks were identified as relevant in the future exploration of angler heterogeneity in an MRF context; the specialization framework (e.g. Bryan, 1977; Scott and Shafer, 2001) and the catch orientation framework (Aas and Vitevsø, 2000; Schroeder and Fulton, 2013). Moreover, suggestions for a condensed set of questions were provided, which could be included in future studies. However, there is an initial need for testing if these questions perform in an expected way, e.g. if they, across time, between countries/cultural differences and between survey methods (e.g. onsite vs online surveys), can actually predict angler segments and subsequently variation in catch metrics.

This group will be led by Harry Strehlow, Robert Arlinghaus, and Christian Skov. This intersectoral group continues the work initiated by WKHDR with the overall aim to:

- Highlight the importance of accounting for angler heterogeneity in surveys;
- Provide questions to include in future surveys;
- Assess the ability of different questions to predict the effect of angler heterogeneity on catch metrics;
- Produce a paper based on the outcomes.

The group will have the following milestones for 2020–2021:

- Produce a specific set of HD survey questions that WGRFS members could pick from for their future studies;
- Include a condensed set of HD questions (i.e. within the specialization framework) in minimum two national surveys;
- Initiate a test of how the specialization framework predict catch metrics;
- Submit a publication that summarises the outcomes of WKHDR.

3.4.9 Communication and engagement

Effective communication is essential to establishing trust and respect and is fundamentally the cornerstone of human relationships. The development of effective communications strategies for science communication can be a challenging landscape as the often-complex methods or findings need to be translated to a lay audience. In the recreational fishing research space, translating key messages to a lay audience is particularly complicated by the broad characteristics of the sector

both with respect to demographics, but also drivers and needs from the fishery. The need to effectively communicate results that may result in management change need to be justified with science. Furthermore, to ensure trust in results, explaining methods is becoming increasingly important in science communication as there appears to be a societal 'lack of trust' developing perhaps through the development of unsubstantiated counter-science (or pseudo-science) perpetuated by large scale communication mediums such as social media.

Barriers to good communication need to be overcome to move forward into a truly collaborative management space (Dedual *et al.*, 2013). Communication mediums have changed rapidly over the last decade and the research community needs to consider how best to adapt and ultimately utilize new mediums such as social media to communicate with stakeholder groups. The use of trusted ambassadors from within stakeholder groups is also a particularly effective strategy that complements the use of a range of communication mediums but in particular social media. They understand the language of their peers and are often best placed to convey science messages if they can be successfully translated and key communication requirements identified.

As researchers, we are most commonly working in an environment where results are measurable. This will ensure that the best methods are being utilized to communicate with the broadest range of the target audience including those that are actively seeking the information as well as those that are hard to reach and often dis-engaged from communication strategies but still represent an important component of the recreational fishing community.

Another major barrier to successful science communication is effectively resourcing the important extension component of research. This component is often under-funded in part due to under-budgeting by researchers but also a potential lack of understanding of the importance of this component by funding agencies. Looking at the heavy investment in marketing by nearly all businesses in the private sector it would appear that we are significantly underestimating the importance of appropriately funding science communication.

This intersessional group will be led by Sean Tracey and Pablo Pita with the aim to progress knowledge and provide content to enable the development of communication skills in the recreational fishing research sector and develop methods to measure the success of communications drawing on the social sciences as well as 'marketing' strategies. This will be done by:

- Raising the profile of communications and engagement in research funding and result dissemination;
- Review strategies to improve communications and engagement with the recreational fishing community;
- Develop measures to assess the effectiveness of communications and engagement strategies.

The outputs will be to:

- Collate materials for communication and engagement, strategies, and assessment of effectiveness for WGRFS;
- Deliver engagement/media/communications on the WGRFS considering mainstream and online media and stakeholders and ambassadors;
- Develop manuscripts covering international case studies, approaches for talking to recreational fishers, and understanding your target audience (meta-analysis, partitioning groups).

3.5 Publication strategy

Given that the WGRFS is just entering a new three-year cycle of ToRs, it is important to consider the outputs that could be generated to raise the profile of the group. The focus of this discussion

was on peer-reviewed papers due to the lead times but will also cover presentations and broader communications materials (e.g. blogs, reports, and social media). Ideas for papers were collated with a potential lead author covering governance, impacts of COVID-19, assessment of quality, impacts and allocation, novel methods and big data, non-probabilistic approaches, and angler heterogeneity. A publication plan will be created for the group and reviewed each year.

There were also suggestions about workshops that should be proposed covering: animal welfare in fisheries; new technologies; and interactions between recreational fisheries and marine protected areas.

4 Revisions to the work plan and justification

Due to the restrictions on travel due to COVID-19, the WGRFS was an online meeting. To account for time zones and maintain participation, the meeting was shortened to five afternoons rather than full days. This meant that it was not possible to run the broader discussion sessions and debates that are usually an important part of the meeting. The focus of the meeting was on kicking off the intersessional groups identified within the new 3 years terms of reference. As a result, it was not possible to assess the quality of three national survey programmes (work plan year 1, item 4). No further changes are requested at this stage.

5 Next meeting

The next meeting of WGRFS will be held in Gran Canaria from 14–18 June 2021. It will be hosted by David Jiménez at Instituto Universitario de Acuicultura Sostenible y Ecosistemas Marinos (IU-ECOQUA), Universidad de Las Palmas de Gran Canaria, (ULPGC), Las Palmas, Gran Canaria, Spain.

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Annex 2: Resolutions

The Working Group on Recreational Fisheries Surveys (WGRFS), chaired by Kieran Hyder, United Kingdom, and Keno Ferter, Norway, will work on ToRs and generate deliverables as listed below:

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2020	15–19 June 2020	Online	Interim report by 01 November 2020 to EOSG	Keno Ferter's 3-year term as chair ends; new incoming chair from 2021 Estanis Mugerza
Year 2021	14–18 June 2021	Gran Canaria	Interim report by 01 November 2021 to EOSG	Kieran Hyder's 3-year term as chair ends
Year 2022	13–17 June 2022	TBC	Final report by 01 November 2022 to EOSG	

ToR descriptors

ToR	Description	Background	Science Plan topics addressed	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.	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.	5.4	Regular activity in each year, with specific intersessional tasks 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), and innovative statistical methods for data provision.	Recreational data can be collected in many ways, with different associated biases. This supports the 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 assessment and advice.	3.1, 3.2, 3.3, 3.6, 4.1, 4.3, 5.4	Regular activity in each year	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 sys-	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 needed. This will	3.1, 3.2, 3.3, 3.6, 5.1	Regular activity in each year, with specific intersessional tasks to develop new approaches.	Report WG perspectives and publication of scientific papers

ToR	Description	Background	Science Plan topics addressed	Duration	Expected Deliverables
	tems, use of data in assessments, and catch allocation.	facilitate embedding recreational fisheries into fisheries management.			
d	Develop approaches for regional data collection programmes that generate robust data for end users and support the ICES TAF.	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-user needs.	3.1, 3.2, 3.3, 3.6,	Regular activity in each year.	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.	Recreation 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 an understanding of the data and methods needed for co-management to ensure engagement in the process.	7.1, 7.4, 7.6	Regular activity in each year, with specific intersessional tasks to develop new approaches.	Report WG perspectives and publication of scientific papers
f	Review outcomes of the workshops organized by the group.	Recreational fishery is a diverse topic, so not all aspects can be addressed at WGRFS. Several workshops on specific topics have been done (e.g. WKHDR) or are in the work plan (e.g. inclusion in assessment). 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

Supporting information

Priority	High—the biological, social and economic impact of recreational fisheries is becoming increasingly recognised and needs to be included in the fisheries assessment and management processes.
Resource requirements	None.
Participants	The Group is normally attended by around 40 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 benchmark workshops for stocks that have recreational catches.
Linkages to other committees or groups	PGDATA, WGCATCH
Linkages to other organizations	<p>EC, STECF, Regional Coordination Groups, Advisory Councils</p> <p>WECAFC/OSPESCA/CRFM/CFMC/MEDAC Working Group on Recreational Fisheries</p> <p>Many linkages to (inter)national angling associations, since WGRFS members estimate national marine recreational catches.</p> <p>Links to broader organizations with interests in angling and fisheries management including EIFACC and FAO.</p>

Annex 3: Marine recreational fish surveys

Table A3.1. Baltic Sea (ICES subdivisions 22–32). Most recently carried out, ongoing and/or planned marine recreational fishing surveys.

Country	Cod	Eel	Salmon	Sea Trout	Comments
Denmark	<p>Two types of surveys are conducted. A web-based recall survey designed together with Statistic Denmark (DST survey) and an on-site survey. The recall survey is conducted bi-annually. The DST survey is targeting recreational fishers with a valid annual fishing licence. When a licence is issued, the Danish social security number of the purchaser is registered, providing an efficient way to contact these persons. However, the list does not cover (i) tourists (since they do not have a Danish social security number), (ii) those fishing without a valid licence, and (iii) people with a valid reason not to have a licence. The second survey, the “omnibus survey”, targeted a subsample of the entire Danish population. This survey was intended to estimate the number and effort of fishers who fished without a valid licence. In this survey, no questions concerning their harvest were asked. Data on the average size of eel, cod and seatrout are obtained by a reference panel of 75 fishers. No data on the average size of catches are available.</p> <p>The on-site survey is an onboard roving creel survey, targeting charter boat anglers in ICES SD 22–23.</p>	<p>Sampled similar to cod (DST survey).</p>	<p>Sampled similar to cod (DST survey) and with an access-point survey targeting salmon trolling anglers.</p>	<p>Sampled similar to cod (DST survey).</p> <p>A pilot on-site study using aerial survey and roving creel survey was carried out in 2017 to collect biological samples and supporting catch and effort estimates to the DST survey.</p>	<p>From 2013 the annual licence list recall survey is web-based only.</p>
Estonia	<p>The main catch of cod in recreational fisheries comes from passive gears. The data</p>	<p>Catch data are reported and stored in the Estonian Fisheries Information System (EFIS)</p>	<p>The catch comes from gillnets in sea and angling in rivers. For recreational fishers, it is</p>		<p>Catch reporting has been mandatory since 2005. The data are reported and stored</p>

Country	Cod	Eel	Salmon	Sea Trout	Comments
	are reported and stored in the Estonian Fisheries Information System (EFIS).	for passive gears (gillnets, longlines). Eel is mainly caught in inland waters.	obligatory to have a licence and report catch, which is stored in the Estonian Fisheries Information System (EFIS).		in the Estonian Fisheries Information System (EFIS) for passive gears (gillnets, longlines) and salmon and sea trout angling in rivers. Latest recreational fishery survey was carried out in 2016 and was based on a phone call approach.
Finland	Cod catch is known to be very low. Catch estimate by postal survey of the whole Finnish population (see comments).	Catch estimate by postal survey of the whole Finnish population (see comments).	Catch estimate by postal survey of the whole Finnish population (see comments). For Salmon rivers, there is an additional postal survey conducted based on local fishing licenses.		A nationwide biennial recreational fishing survey is done for all species and gears. A stratified sample of about 7500 household-dwellings is done with response rates of around 30–40% after a maximum of three contacts. A telephone interview is done for a sample of the non-respondents. Harvested catch and released catch is measured separately by species.
Germany	Effort estimates are derived from a nationwide CATI-Bus telephone screening (50 000 households), followed by a 1-year telephone diary survey (586 panellists) in 2014/2015. Effort estimates will be updated with new estimates from a similar survey (150 000 households) conducted in 2021. CPUE data are derived from an annual stratified random access point survey covering all access points along the German Baltic coast (Strehlow <i>et al.</i> , 2012).	A telephone–diary survey to estimate eel harvests of the recreational passive gear fishery was implemented in 2011–2012 as a pilot study. The panel consisted of 180 recreational passive gear fishers of which 120 have been recruited from the Baltic Sea across seven strata. Participants were called every four months to remind them to fill in the diary. For rod-and-line fisheries: Nationwide CATI-Bus telephone	A regular salmon trolling survey has been established since 2017 (ICES, 2018; Hartill <i>et al.</i> , 2020). Trolling boat fishing effort is evaluated by trolling boat trip counting via remote cameras in three relevant marinas (covering ~60% of the total fishing effort) during the salmon trolling season Salmon trolling effort from marinas not monitored by cameras ($n = 4$) is extrapolated using monthly instantaneous trolling boat counts covering	Nationwide CATI-Bus telephone screening (50 000 households), followed by a 1-year telephone diary survey (586 panellists) in 2014/2015 covering all species, methods and platforms. In 2021 a similar survey (150 000 households) will be conducted to update the 2014/2015 data.	

Country	Cod	Eel	Salmon	Sea Trout	Comments
	<p>Length distributions are collected via onboard sampling of charter vessels by survey agents (Strehlow <i>et al.</i>, 2012).</p> <p>Length-weight keys from commercial sampling are used for conversion of numbers in biomass.</p> <p>Post-release mortality is included by using a post-release mortality rate of 11.2% based on a containment study for sea-based releases (Weltersbach & Strehlow, 2013) and a precautionary mortality rate of 100% is used for land-based releases.</p>	<p>screening (50 000 households), followed by a 1-year telephone diary survey (586 panellists) in 2014/2015 covering all species, methods and platforms. In 2021 a similar survey (150 000 households) will be conducted to update the 2014/2015 data.</p>	<p>all marinas and the proportions of boats that went out for fishing derived from the marinas with camera monitoring. The camera monitoring is complemented by random on-site interviews of trolling anglers in relevant marinas to determine catch-per-unit-effort to estimate catches and collect biological catch data and socio-economic information.</p>		
Latvia	<p>The last survey of the recreational cod fishery from tour boats was conducted in 2012. In 2018, a new pilot study started where contracted tour boats collect biological and haul information. At the end of the year, the “snowball” method will be applied to estimate total fleet.</p> <p>The first 5 months of sampling showed no activity for cod fishing due to low density of cod in Latvian waters.</p>	<p>Data in 2018 are collected by an Internet questionnaire www.makskerniekukarte.lv (Internet site where fishers could buy the mandatory fishing card for angling in Latvian waters).</p>	<p>The same as for cod, information is collected from tour boats to cover salmon trolling in the sea. Licensed angling is allowed in few rivers and catches could be estimated from the returned licenses.</p> <p>Additional information will be obtained from an Internet questionnaire.</p>	<p>The same as for cod and salmon, the information will be collected from tour boats. Seatrout angling from the seashore is not developed and according to expert estimates is at a low level.</p> <p>Additional information will be obtained from an Internet questionnaire.</p>	<p>The catches taken in the recreational fishery with commercial gears (self-consumption fishery) are reported from every haul by fish species. Information is available and could be included in total estimates of the recreational fishery.</p>
Lithuania	<p>All the vessels/boats are registered. From 2013 Lithuania implemented a new system of data collection. The total number of charter vessels and boats engaged in recreational fishing can be obtained from daily reports of the coast guard. The total catch and catch per boat are gathered from the direct interviews.</p>	<p>Information on catch volumes can be obtained from the census, direct interviews and questionnaires only. Respondents selected by visiting known fishing spots (The Curonian Lagoon, lakes and rivers) where they come to fish from all over of Lithuania. Eel is only caught in inland waters. Recreational eel catches at sea are forbidden. Recrea-</p>	<p>Separate recreational fishing licence for salmon or seatrout is mandatory (while fishing in inland waters). All salmon catches have to be reported to the Ministry of Environment, but the number of reported fish is very low. An online survey, a face-to-face interview survey and a personal interview survey was implemented in 2015 as a pilot study to estimate recreational salmon catches.</p>		<p>All recreational fishers are licensed (with exceptions of anglers under the age of 16, retired and impaired persons).</p>

Country	Cod	Eel	Salmon	Sea Trout	Comments
		tional eel catches are observed under the DCF programme annually.			
Poland	In 2019, 22 onboard observer trips were performed to collect biological data and nine harbour masters offices were visited to collect data on number of angling trips and number of anglers on board of charter and private vessels. Also, data on number of cod recorded in recreational daily catch reports from angling trips were collected following new marine fishery act making catch reports mandatory since 2016 for legal persons organizing angling trips and angling competitions.	The recreational eel fishery will be investigated within the framework of the Polish Eel Management Plan following Council Regulation 1100/2007 adopting the Eel Management Plan (EMP).	Baltic salmon is mainly caught by trolling. Harvest has not yet been monitored. In 2017–2018, a pilot study on salmon and sea trout recreational fishing in Polish Exclusive Economic Zone (EEZ) was conducted. The pilot study aimed to gather necessary information and to identify potential issues to allow setting the program for monitoring the recreational salmon trolling catches and coastal recreational fisheries focused on sea trout. Results of this study will be implemented in the future regular monitoring.	Covered by a Pilot Study (see Salmon part).	
Sweden	National screening survey (postal) supported by regional on-site studies (see comments).	It is prohibited to fish for eel—additional information to RCM.	Trolling fishery was surveyed in 2011 and 2015 with catch reports collected with a combination of onsite and online (web). Recreational fishing with passive gear was also surveyed in 2015 with a total census of gear. Simrishamn and Ystad, two important access point for salmon trolling, was surveyed during spring 2020.	National screening survey (postal).	A national annual recreational fishing screening survey (postal), including most frequently fish and crustacean species targeted in recreational fisheries in subareas and for most common gears have been ongoing since 1990. A new improved design was implemented in 2013. Newly updated data are available for years 2013–2019. This survey does not cover tourist fishers and Swedish residents younger than 16

Country	Cod	Eel	Salmon	Sea Trout	Comments
					<p>years as well as Swedish residents older than 80 years of age.</p> <p>The national survey is supported by a regional study on cod (including bycatch) from tour boats fishing primarily in the Sound (SD 23) as well as shoreline anglers and fishers from private boats arriving at access points in SD 23 and 24.</p>

Table A3.2. North Sea (ICES 3.a, 4 and 7.d) and Eastern Arctic (ICES 1 and 2). Most recently carried out, ongoing and/or planned marine recreational fishing surveys.

Country	SEA BASS	COD	POLLACK	EEL	SALMON	ELASMOBRANCHS	Comments
Germany	Nationwide CATI-Bus telephone screening (50 000 households), followed by a 1-year telephone diary survey (586 panellists) in 2014/2015 covering all species, methods and platforms. In 2021 a similar survey (150 000 households) will be conducted to update the 2014/2015 data.	Nationwide CATI-Bus telephone screening (50 000 households), followed by a 1-year telephone diary survey (586 panellists) in 2014/2015 covering all species, methods and platforms. In 2021 a similar survey (150 000 households) will be conducted to update the 2014/2015 data.	Nationwide CATI-Bus telephone screening (50 000 households), followed by a 1-year telephone diary survey (586 panellists) in 2014/2015 covering all species, methods and platforms. However, no pollack catches have been reported in this survey. In 2021 a similar survey (150 000 households) will be conducted to update the 2014/2015 data.	<p>A telephone–diary-recall survey to estimate eel harvests of the recreational passive gear fishery was implemented in 2011–2012 as a pilot study. The panel consisted of 180 recreational passive gear fishers of which 60 were recruited from the North Sea across two strata. Participants were recalled every four months to remind them to fill in the provided diary.</p> <p>For rod-and-line fisheries: Nationwide CATI-Bus telephone screening (50 000</p>	Nationwide CATI-Bus telephone screening (50 000 households), followed by a 1-year telephone diary survey (586 panellists) in 2014/2015 covering all species, methods and platforms. However, no salmon catches have been reported in this survey. In 2021 a similar survey (150 000 households) will be conducted to update the 2014/2015 data.	A pilot study based on expert interviews was carried out in August 2011 to estimate recreational shark catches in the German North Sea. Findings show that recreational shark catches are negligible and have no impact on the stocks.	<p>See also nationwide CATI-Bus telephone screening survey. No catches of elasmobranchs have been reported in this survey.</p>

Country	SEA BASS	COD	POLLACK	EEL	SALMON	ELASMOBRANCHS	Comments
				households), followed by a 1-year telephone diary survey (586 panellists) in 2014/2015 covering all species, methods and platforms. In 2021 a similar survey (150 000 households) will be conducted to update the 2014/2015 data.			
Denmark	See the Baltic (DST survey) (Table A3.1)	See the Baltic (DST survey) (Table A3.1).	See the Baltic, DST survey (Table A3.1)	See the Baltic, DST survey (Table A3.1).	See the Baltic (DST survey) (Table A3.1).	See the Baltic (DST survey) (Table A3.1).	
Sweden	NA, recreational catches are not considered to be a limiting factor for populations of sea bass in Swedish waters, as their occurrence is mainly regulated by warm-water outflows. Therefore, no ongoing monitoring is done.	Covered by the national screening questionnaire (See comments for the Baltic in Table A3.1)	Covered by the national screening questionnaire (See comments for the Baltic in Table A3.1)	It is prohibited to fish for eel—additional information to RCM.	Covered by the national screening questionnaire (See comments for the Baltic in Table A3.1).	NA, recreational catches are not allowed due to Swedish legislation.	See comments for the Baltic in Table A3.1.
Norway	See “Cod”	Norway has conducted a study funded by the Norwegian research Council from 2017–2020 where the primary objective was to increase knowledge of the extent and development of the marine recreational fishery in Norway with respect to catch, effort and	See “Cod”				

Country	SEA BASS	COD	POLLACK	EEL	SALMON	ELASMOBRANCHS	Comments
		<p>socio-economic dimensions. The aim was to estimate participation, activity and catches and releases for resident recreational anglers nationally, and to develop methods for studying non-resident anglers that cannot be accessed via telephone registries.</p> <p>The project aimed at developing cost-effective off-site and on-site probability-based survey sampling methods with multiple sampling frames to improve sampling coverage of resident and non-resident recreational fishers. Catch estimates based on this survey will become available in 2021.</p>					
UK		<p>A new sampling survey was set up for 2016 which had three strands: 1) A national omnibus survey which randomly surveyed the population to get national participation rates. 2) An online survey which</p>		<p>Marine recreational survey estimates as for cod.</p>		<p>Marine recreational survey estimates as for cod.</p>	

Country	SEA BASS	COD	POLLACK	EEL	SALMON	ELASMOBRANCHS	Comments
		<p>fishers completed as a pre-questionnaire to completing monthly diaries.3) The monthly diaries which were completed throughout 2016 to record participation, gear, catches and spend throughout the year. Covers all species.</p>					
France	<p>France started a multi-species survey in 2017. The screening survey took place in November–December, and the diary survey has been launched in 2018 and 2019. Fishers are recruited to describe their monthly catches based on logbooks.</p> <p>No data will be available because catches are not reliable (low number of panellists). Different types of surveys in the UK, France, Belgium, and the Netherlands collect data. It is not obvious to combine the data for use in the assessment. The next benchmark and peer-reviewed will ensure its robustness in order to use data as input for stock assessment models. As data quality is unsatisfactory, data from recent</p>						<p>The pilot study from 2010–2011 covered cod, eel and sharks, but the marginal nature of these fisheries does not allow obtaining a reliable estimate of harvest for these species. The French recreational fisheries cod, eel, sharks and bluefin tuna catches have no (or low) impact on the stocks.</p> <p>Data were not used for 2020 stock assessment.</p>

Country	SEA BASS	COD	POLLACK	EEL	SALMON	ELASMOBRANCHS	Comments
	<p>surveys (2017–2019) cannot be disseminated.</p> <p>A new national survey will be launched at the end of the year 2020. Particular attention will be paid to bias treatment and results quality.</p>						
Belgium	<p>Belgium has a continuous multispecies survey running from 2017 until 2021. On-site surveys (beach, marinas, aerial, interviews) are combined with a logbook survey (on trips basis) to estimate catches (numbers and weights).</p>						
Netherlands	<p>The RECFISH programme consists of the following elements:</p> <p><u>Online Screening Survey</u> (omnibus panel) to estimate the number of recreational fishers (marine and freshwater). Surveys were carried out in 2009, 2011, 2013, 2015, 2017 and 2019. In 2013 a parallel online and random digit dialling survey was done.</p> <p><u>Online monthly Logbook Survey</u> to estimate the annual catches. 12 months surveys were carried out starting in March 2010, March 2012, April 2014,</p>						<p>Weight estimates can be based on lengths in the onsite survey or the logbook survey.</p>

Country	SEA BASS	COD	POLLACK	EEL	SALMON	ELASMOBRANCHS	Comments
	April 2016, March 2018 and March 2020. <u>Onsite survey</u> to determine length frequency of landed (marine) species carried out at the same time as the logbook survey.						

Table A3.3. North Atlantic (ICES areas 5–14 and NAFO areas). Most recently carried out, ongoing and/or planned marine recreational fishing surveys.

Country	SEA BASS	COD	POL-LACK	EEL	SALMON	ELASMO-BRANCHS	ICCAT species	Comments
UK	See North Sea (Table A3.2).			See North Sea (Table A3.2).	Recreational fishing for salmon is almost entirely in inland waters and is monitored by the Environment Agency.	See North Sea (Table A3.2).		See North Sea (Table A3.2).
Ireland	A pilot study in 2011 found that median annual bass harvest by domestic shore anglers, the dominant angler category, was two fish per angler in 2010. Catch and release by this angler category was 79% of the catch. No reliable estimate of bass angler numbers available for study. Charter angling boat catch (2007–2009) was negligible (no impact on stocks).			Eel is a protected species in Ireland since 2009. No fishing (commercial or angling) allowed in the Republic of Ireland. Various life stages being monitored annually (under EU Reg.1100/2007).	Recreational fishing (angling) is entirely in freshwater. Harvest permitted in freshwater where surplus over Conservation Limits exists. Carcass tagging scheme with mandatory reporting for anglers.	Negligible landings based on fisheries officers observations.	Atlantic Bluefin Tuna (ABFT) Scientific Data Collection Pilot Study (Tuna CHART) commenced in 2019. A limited number of authorised charter vessels permitted to catch, tag and release ABFT by angling.	A DCF funded pilot study commenced in late 2019 to characterise the fishery for all relevant species. Random-stratified surveys are in operation which is currently sampling charter, private boat and shore angling populations. The species-specific catch, size and catch & release data are being collected until July 2021 and fed into a database for analysis in 2021. An online 'behaviour and attitudes' survey of sea anglers was conducted in 2020 and an online angler diary is being designed. Effort data will be collected via omnibus & related surveys in 2020–2021.

Country	SEA BASS	COD	POL-LACK	EEL	SALMON	ELASMO-BRANCHS	ICCAT species	Comments
France	See North Sea (Table A3.2).							See North Sea (Table A3.2).
Spain (Basque Country)	<p>A DCF-funded pilot study was carried out in 2012 to estimate sea bass recreational catches in the Basque Country. E-mail, telephone, and post-surveys were carried out and resulted in estimates of 129, 156, and 351 tonnes respectively (Zarauz <i>et al.</i>, 2015).</p> <p>A new survey was carried out in 2013 to estimate recreational catches in 2012 and 2013. The main species targeted by recreational fishers were included in the surveys apart from sea bass. These species were different depending on the fishing technique used (shore, boat, spearfishing). E-mail, telephone, and post-surveys were used. Three independent surveys were carried out. The three different sampling frames were the list of surface licences (for shore fishing), the list of spearfishing licences (for spearfishing) and the list of registered recreational vessels (for boat fishing). Contact information is complete for post, but incomplete for e-mail (14% approx.) and telephone (19% approx.). Surveys were done in June 2013 and December 2013 (Ruiz <i>et al.</i>, 2016).</p>			<p>A routine glass eel sampling has been carried out since 2004. Fishers have to fill in a diary logbook in order to obtain a fishing license. These logbooks are used to estimate total catches and cpue and the results are presented in WGEEL.</p>				

Country	SEA BASS	COD	POL-LACK	EEL	SALMON	ELASMO-BRANCHS	ICCAT species	Comments
Spain (Galicia)	<p>A 5-year project led by the University of Santiago de Compostela and funded by the Regional Government of Galicia started in 2015 and will be finished in 2020. The project included a survey to estimate marine recreational effort, catches by species and direct expenditures, among other attributes of the fishery. The study provided the first comprehensive analysis of MRF in Galicia, from a survey of 363 recreational fishers. It was estimated that there are 60 000 recreational fishers, comprised of 45 000 shore anglers, 12 000 boat anglers and 3000 spearfishers. Recreational fishers reported catching 38 species, but the most common were ballan wrasse (<i>Labrus bergylta</i>), European seabass (<i>Dicentrarchus labrax</i>), and white seabream (<i>Diplodus sargus</i>). The annual recreational catch is about 7500 t (5–13% of commercial and recreational landings of the same species); shore anglers are responsible for 50% of total MRF catches, boat anglers for 40%, and spearfishers for 10% (Pita <i>et al.</i>, 2018).</p>							
Portugal	The pilot project Pescardata (September 2017–December 2018) was defined for studying DCF recreational fisheries in mainland Portugal. During the		Incl. In the Pescardata pilot			Incl. in the Pescardata pilot		Included in the Pescardata pilot project.

project, and to maximize effort, data on all recreationally caught species were collected. For this project, a comprehensive sampling strategy was defined, where the Portuguese mainland coast was divided into 5 km sections of coastline within NUTS II areas (North, Centre, Metropolitan Area of Lisbon— AML, Alentejo and Algarve). Data collection started in January 2018 using face-to-face questionnaire surveys (ODK Android application), angling logbooks, historical sport fishing activity data from anglers’ clubs, and fishing tournaments. Onboard observers were also used for boat angling, while face-to-face questionnaires were conducted via roving creel surveys for shore angling and spearfishing, and access point surveys used for boat angling and spearfishing.

project.

pilot project.

Table A3.4. The Mediterranean Sea and the Black Sea. Most recently carried out, ongoing and/or planned marine recreational fishing surveys.

Country	Eel	Elasmobranchs	ICCAT Species	Comments
Spain	Regional governments Valencia and Catalonia collect information provided to the DGFisheries.	Negligible catches.	Reported to ICCAT collected by IEO.	No standard surveys are performed. Only in the framework of research projects. The regional government of Catalonia launched in 2019 a pilot study using an online voluntary survey, which obtained 9217 responses for marine recreational fishing. These were complemented with an onsite roving creel survey, consisting of 30 sampling days in beaches, ports and boat interviews. Results of this study showed high discrepancies in CPUE values using both methods. The total regional catch was estimated in 602 t using CPUE from the onsite surveys, whereas the online productivity produced a total catch estimate of 1.366 t.

Country	Eel	Elasmobranchs	ICCAT Species	Comments
				Since 2020, a continuous data collection programme is being implemented. It includes online surveys, which are now distributed directly to licence holders, and an onsite roving creel survey consisting of 90 sampling days. Data are obtained on fishing indicators, catches, trip expenses, motivation for fishing and fishing techniques.
France			A recreational fishery targeting bluefin tuna is subject to an authorisation issued annually by the administration. Catch reporting must then be sent within 48 hours to FranceAgriMer and must indicate the weight and size of the bluefin tuna caught. A recreational fishery targeting swordfish is only allowed to catch-and-release practices.	See North Sea (Table A3.2).
Italy			A survey is carried out according to a previous pilot study on the bluefin tuna and other ICCAT species including elasmobranchs.	A pilot study on the relative share of catches of recreational fisheries compared to commercial fisheries, for the species considered in the EU-Map work plan, is going to be completed by June 2019.
Greece	The recreational fishery of eel is prohibited in the application of the framework of regulation EU/1100/07.	The recreational fishery of various species of sharks is prohibited according to regulation EC.53/2010.	The fishery of tunas is practised only by professional fishers and is prohibited for recreational fishers by the Ministerial Decision 170317/162669. <i>E. alleteratus</i> , an ICCAT species, was reported caught by recreational fishers, but very small quantities do not allow for reliable estimates on the	During the 2017–2019 pilot study, a nationwide telephone survey was conducted with 16 501 households. The survey allowed for estimates of the number of RF in the country, effort and expenditures. The telephone survey was followed by a diary survey and an on-site survey in ports, piers and beaches in three selected areas of the country in the North Aegean, Ionian sea and South Aegean (Saronikos Gulf). Results from the telephone survey of the pilot study suggested that 8% of the population, approximately 700 000 residents in the country engage in marine recreational fishing. Regarding avidity, 53% went fishing 1–5 times/year, 17% 6–10 times/year, 14% 11–25 times/year and 9% 26–50 times/year. On average they fish 16 times/year (median 5 times/year).

Country	Eel	Elasmobranchs	ICCAT Species	Comments
			relative share of recreational catches.	<p>Three modes of fishing were identified a) fishing from the shore, b) fishing from a boat and c) spearfishing. The most common way of fishing is from the shore (63%) and 37% fish from a boat, both using line or rod. 21% practice spearfishing and 11% fish with longlines from a boat. Obviously, many of the fishers practice fishing in more than one way.</p> <p>Regarding annual catch, 66% catch 0–5 kg/year, 15% catch 6–15 kg/year, 8% 16–30 kg/year, and 5% 31–50 kg/year, and 5% more than 50 kg/year. The average total annual catch per fisher is 13 kg (median 3 kg/year) and this corresponds to 9.100 t/year nationally.</p> <p>Sparidae are the most common catches (<i>Sparus aurata</i> (26%), <i>Diplodus annularis</i> (16%), <i>Diplodus sargus</i> (16%), followed by <i>Mugil cephalus</i>, (12%), <i>Octopus vulgaris</i> (11%), <i>Dicentrarchus labrax</i> (10%), <i>Pagellus erythrinus</i> (9%).</p> <p>Results from the diary survey and on-site survey are being analysed.</p> <p>The pilot survey will continue for the period 2020–2021.</p>

Country	COD		EEL		SALMON		SEA TROUT		Comments
	Harvest	Release	Harvest	Release	Harvest	Release	Harvest	Release	
Sweden	392 t (2019)*	58%*			177 t* (2019) 2400 #** (2018)	70%* 5600 #** (2018)	56 t*	80%*	*Data from 2019-years national screening questionnaire **Expert estimation of salmon caught in Swedish trolling anglers based on surveys from 2011 and 2015 of trolling.

Table A4.2. North Sea (ICES 3.a, 4 and 7.d) and Eastern Arctic (ICES 1 and 2). Most recent marine recreational harvest estimates, in tonnes (t) or numbers (#); figures in brackets indicate differing years.

Country	Sea bass		Cod		Pollack		Eel		Salmon		Elasmo-branches		Comments
	Harvest	Release	Harvest	Release	Harvest	Release	Harvest	Release	Harvest	Release	Harvest	Release	
Germany	15 338 (11 278, 19 362 CI) # (2015)	6577 (4828, 8339 CI) # (2015)	47 391 (35 315, 59 685 CI) # (2015)	20 158 (15 028, 25 447 CI) # (2015)	0 # (2015)	0 # (2015)	19 627 (14 614, 24 716 CI) # (2015) (2012)	8743 (6497, 11 067 CI) #	0 # (2015)	0 # (2015)	< 50 (2011)		Findings from a pilot study in 2011 show that recreational shark catches (mainly tope shark, <i>Galeorhinus galeus</i>) are marginal and have no impact on the stocks.
Denmark	9.3 t (2019)	24 800 # (2019)	362 t (2019)	113 650 # (2019)	16.5 t (2019)	11 560 # (2019)	39 t (2019)	75 750 # (2019)	2368 # (2019)	11800 # (2019)	0 # (2019)	212 # (2019)	Extrapolated catch estimates for sharks, sea bass, Pollock and salmon

								are based on a very small number of catches. Estimates should therefore be interpreted with caution! Data on seatrout are also available.	
Sweden	41 t (2018)	59%		It is prohibited to fish for eel.	NA	2.8 t	40%*	It is prohibited to fish for lesser spotted dogfish, the most common shark in Swedish waters.	Data from 2019-years national screening questionnaire. *From 2018 years screening questionnaire.
Norway	Marine angling tourists*: 1613 t (2009) 543 000 # (2009) (RSE 22%) Local Norwegian recreational fishery (all gear types,	Marine angling tourists Northern Norway***: 66% (SE 4%) (2010–2011) Marine angling tourists Southern Norway: 62% (SE 8%)		Eel is a protected species in Norway since 2010. No recreational harvest of this species is allowed. No recreational catch estimates are available.				Spiny dogfish, porbeagles, basking shark and silky shark are protected species. No targeted fishing is allowed. No recreational catch estimates are	*Vølstad <i>et al.</i> (2011) **Hallenstvedt and Wulff (2004) ***Ferter <i>et al.</i> (2013) ****Kleiven <i>et al.</i> (2012)

			high potential for bias)**:	(2010–2011) Norwegian Skagerrak recreational fishery****:55% (2012)						available for other shark species.		
UK (England)	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	2012	These results cover the catches for the whole of England including North Sea, Channel, Celtic Sea and Irish Sea. See Armstrong <i>et al.</i> (2013) for full details.
	229–436 t (RSE 38–35%)	152–25 t (RSE 29–53%)	427–817 t (RSE 26–49%)	50–62 t (RSE 28–34%)	169–190 t (RSE 21%)	87–126 t (RSE 30–35%)	Not enough eels caught in fishing trips to reliably raise catches	0 t	0 t	Skates & rays: 40 800–66 000# (RSE 37–49%) smooth-hound (<i>Mustellus</i>): 4200–6800# (RSE 37–42%) tope (<i>Galeorhinus</i>): 20# (RSE 92%) dogfish (all species): 45 900–52 200# (RSE 28–37%)	Skates & rays: 39 200–41 700# (RSE 31–42%) smooth-hound (<i>Mustellus</i>): 189 600–261 400# (RSE 33–35%) tope (<i>Galeorhinus</i>): 6500–6800# (RSE 35–36%) dogfish (all species): 448 300–515 000# (RSE 26–30%)	
	242 900–365 500# (RSE 36–35%)		281 000# (RSE 30%)	201 000# (RSE 36%)	114 600–122 700# (RSE 23–25%)	249 600–272 100# (RSE 37–50%)						
France	2345 (total catch: 3173 t, with ±51%; min:	828										Sea-bass national catches from Rocklin <i>et al.</i> , 2014. The pilot study from

	1554 t and max: 4791 t)												2010–2011 covered cod, eel and sharks, but the marginal nature of these fisheries does not allow obtaining a reliable estimate of harvest for these species. The French recreational fisheries cod, eel, sharks and bluefin tuna catches have no (or low) impact on the stocks.
Belgium	3.1 t (2018)	15.1 t (2018)	19.4 t (2018)	2.1 t (2018)	1.1 t (2018)	NA (22% of pollack catches (in numbers) were re-released (2018)	0.2 t (2018)	NA (37% of eel catches (in numbers) were re-released (2018)	0 t (2018)	0 t (2018)	<0.1 t	NA (89% of Elasmobranch catches (in numbers) were re-released (2018)	
Netherlands	108 000 # (2016)	778 000 # (2016)	165 000 # (2016)	324 000 # (2016)	There are some records of pollacks in	There are some records of pollacks in	48 000 # (fresh 2016)	166 000 # (fresh 2016)	There are some records of salmon in	There are some records of salmon in	There are some records of	There are some records of	All data from March 2016–March 2017 and

95 t (2016)	191 t (2016)	the log-books, however, the numbers are too low to raise them to the population number.	the log-books, however, the numbers are too low to raise them to the population number.	10 t (fresh 2016) 55 000 # (marine 2016) 14 t (marine 2016)	76 000 # (marine 2016)	the log-books, however, the numbers are too low to raise them to the population number.	the log-books, however, the numbers are too low to raise them to the population number.	elasmobranchs in the log-books, however, the numbers are too low to raise them to the population number.	elasmobranchs in the logbooks, however, the numbers are too low to raise them to the population number.	anglers only. Data from van der Hammen (2019). Weights of retained cod and sea bass are based on lengths measured in an onsite survey. Eel weight estimates are based on lengths in the logbook survey.
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Table A4.3. North Atlantic (ICES areas 5-14 and NAFO areas). Most recent marine recreational harvest estimates, in tonnes (t) or numbers (#); figures in brackets indicate differing years.

Country	Sea bass		Cod		Pollack		Eel		Salmon		Elasmobranchs		ICCAT		Comments	
	Harvest	Release	Harvest	Release	Harvest	Release	Harvest	Release	Harvest	Release	Harvest	Release	Harvest	Release		
UK (Scotland)																
UK (England)	See Table A4.2															
Ireland							No marine recreational catches.				0 t Bluefin Tuna (2019)	36 t Bluefin tuna (2019) for the Tuna CHART	See Table A 3.3.			

Country	Sea bass		Cod		Pollack		Eel		Salmon		Elasmo-branches		ICCAT		Comments	
	Harvest	Release	Harvest	Release	Harvest	Release	Harvest	Release	Harvest	Release	Harvest	Release	Harvest	Release		
France	2345 (total catch: 3173 t, with ±51%; min: 1554 t and max: 4791 t)	828													catch, tag and release survey pro- gramme	Sea-bass national catches from Rock- lin <i>et al.</i> , 2014. The pilot study from 2010- 2011 cover- ed cod, eel and sharks, but the mar- ginal nature of these fisheries does not al- low obtain- ing a relia- ble estimate of harvest for these species. The French rec- reational fisheries cod, eel, sharks and bluefin tuna

Country	Sea bass		Cod		Pollack		Eel		Salmon		Elasmo-branches		ICCAT		Comments
	Harvest	Release	Harvest	Release	Harvest	Release	Harvest	Release	Harvest	Release	Harvest	Release	Harvest	Release	
															catches have no (or low) impact on the stocks.
Spain (Basque Country)	145 t [112–180] (2013)						1.5 t (2012–2013)								Reported eel catches correspond to glass eel.
Spain (Galicia)	2111 t (2017)											Some skates were reported by recreational fishers, but low numbers do not allow reliable estimates			
Portugal															Pilot project (Pescar-data) work finished Dec 2018. Data available soon.

Table A4.4. The Mediterranean Sea and the Black Sea. Most recent marine recreational harvest/release estimates, in tonnes (t) or numbers (#); figures in brackets indicate differing years.

Country	Eel		Elasmobranchs		ICCAT		Comments
	Harvest	Release	Harvest	Release	Harvest	Release	
Spain							
France							The pilot study from 2010–2011 covered cod, eel and sharks, but the marginal nature of these fisheries does not allow obtaining a reliable estimate of harvest for these species. The French recreational fisheries cod, eel, sharks and bluefin tuna catches have no (or low) impact on the stocks.
Italy					Survey on ICCAT species currently produce tons estimates only for bluefin tuna: for the other species, only relative estimates of catches of species respect to the other species are given.		Estimates on the relative share of catches from recreational fishery respect to commercial are expected to come from the pilot study for the species considered in the EU-Map
Greece	The recreational fishery of eel is prohibited in the application of the framework of regulation EU/1100/07.		The recreational fishery of various species of sharks is prohibited according to regulation EC.53/2010. No sharks or rays were reported by recreational fishers during the pilot study.		The fishery of tunas and swordfish is practised only by professional fishers and is prohibited for recreational fishers by the Ministerial Decision 170317/162669. <i>Euthynnus alleteratus</i> , an ICCAT species, was reported caught by recreational fishers, but very small quantities do not allow for reliable estimates on the relative share of recreational catches.		The pilot study is multispecies. It commenced in 2017 and will continue for the period 2020–2021.

Annex 5: Economic information by country

Table A5.1. Most recent marine recreational economic information.

Country	Survey Methods (description of method, assumptions made, and applicable species)	Economic Value (direct, indirect, and induced), trip spend, and willingness to pay estimates	Magnitude and direction of bias
Austria			
Belgium	The onsite interviews at the beaches and in the marinas, part of the current Belgian monitoring program, also include socio-economic questions which will provide first quantitative insights in the expenditures of Belgian recreational fishers (expenses big material (rod, etc.), small material (bait, etc.), travelling costs, boat-related costs). The direct expenditures of the Belgian marine recreational fisheries sector are estimated at minimum 8.6 million euro on an annual basis.		
Bulgaria			
Croatia			
Cyprus			
Czech Republic			
Denmark	<p>1. Web panel (1500 respondents; no tourism) Economic impact analysis (input/output) Jacobsen (2010); Ministry of Food, Agriculture and Fisheries of Denmark (2010); Jensen <i>et al.</i> (2010).</p> <p>2. Tourism; Economic impact (input-output). Unclear how the number of tourists is found and how relative share of angling related economic activity is established (but see Jacobsen, 2010; Jensen <i>et al.</i>, 2010).</p>	<p>1. Economic impact: Total 388 536 824 euro (2 900 000 000 DKK) Excluding taxes and leakages 147 376 037 euro (1 100 000 000 DKK). An average angler spends 543 euro (4051 DKK) per year, but specialized sea anglers (trolling fishers) spend on average 3349 euro (25 000 DKK).</p> <p>2. Economic impact from Tourism: Total 50 241 830 euro (375 000 000 DKK), excluding taxes, leakages 33 896 488 euro (253 000 000 DKK)</p>	

Country	Survey Methods (description of method, assumptions made, and applicable species)	Economic Value (direct, indirect, and induced), trip spend, and willingness to pay estimates	Magnitude and direction of bias
	<p>3. CE analysis (DK angler= no distinction between marine and freshwater (Cowi, 2010), Web panel 1500 respondents)</p> <p>4. Tourism (German web panel, no distinction between marine and freshwater fishing)</p> <p>CE analysis, (Jensen <i>et al.</i>, 2010). (Table 6.1)</p>	<p>3. CE Analysis: Average WTP is about 100 euro (736 DKK) angler, but a methodological very insecure estimate. Important WTP estimates (ranked from highest to lowest) 1) Nature component (beautiful scenery), 2) Water quality, 3) catch opportunity (numbers). Note that in a higher quality study (Toivonen <i>et al.</i> 2000) WTP for Danish anglers was estimated to 82 euro (616 DKK) at 1999/2000 prices.</p> <p>4. Tourism CE analysis: WTP -34 to 59 euro (-255 to 444 DKK); positive WTP for increased catch opportunity, Increased size of fish, Beautiful surroundings and improved water-quality. Negative WTP if the distance to fishing water is increased and/or if the number of other anglers increases.</p>	
Estonia			
Finland	<p>Several surveys have been done in Nordic countries to evaluate the economic value of recreational fisheries including:</p> <ul style="list-style-type: none"> <li data-bbox="427 890 994 995">• Toivonen, A.-L., Appelblad, H., Bengtsson, B., Geertz-Hansen, P., Guðbergsson, G., Kristofersson, D., Kyrkjebø, H., Navrud, S., Roth, E., Tuunainen, P., Weissglas, G. In: <i>TeMaNord 6042000</i>. 1–70. <li data-bbox="427 1018 994 1098">• Toivonen, A.-L. In: Pitcher, T. J., Hollingworth, C. (eds). <i>Recreational Fisheries: Ecological, Economic and Social Evaluation</i>. Blackwell Science. 2002. p. 137–143. <p>A comparison of the economic effects of salmon fishing: commercial vs recreational with input-output model (abstract eng):</p> <ul style="list-style-type: none"> <li data-bbox="427 1193 994 1364">• Lohenkalastuksen taloudellisten vaikutusten vertailua: lohen ammattikalastus Pohjanlahden maakunnissa ja vapaa-ajankalastus Torniojoella ja Simojoella. Storhammar E, Pakarinen T, Söderkotalahti P and Mäkinen T 2011. Riista- ja kalatalous – Tutkimuksia ja selvityksiä 13/2011. 35 pp. 		

Country	Survey Methods (description of method, assumptions made, and applicable species)	Economic Value (direct, indirect, and induced), trip spend, and willingness to pay estimates	Magnitude and direction of bias
France	<p>Between 2011 and 2013, a nationwide survey was implemented in two steps: a random-digit-dialling (RDD) survey combined with a diary survey.</p> <p>RDD survey produced an initial estimate of the population of recreational fishers and a description of the diversity of their fishing practices. Diary survey provided more precise information about the diversity of practices, catch characteristics (size, weight etc.) and expenditures.</p> <p>Data were compared and then used in combination to provide a reliable estimate of the socioeconomic value of recreational fisheries activity in France (Levrel <i>et al.</i>, 2013).</p>	<p>According to the 2011–2013 survey, fishing expenditure was estimated at 200 million euro: recreational sea anglers spend an average of €146 per year on equipment, including €83 for fishing gear and €36 for bait and lures. Approximately 25% of recreational sea anglers have a boat. Boat-related expenditures are estimated at around 1000 € per year on average (with 50% for anchorage and trailer, 30% for maintenance and 20% for insurance purposes) (Levrel <i>et al.</i>, 2013).</p>	
Germany	<p>In 2014/2015, a nationwide telephone-diary survey with quarterly follow-ups was initiated contacting 50 000 households. This survey produced estimates of marine anglers, effort and expenditures per category for the North and Baltic Sea. During the screening, survey respondents were asked to provide a 12-month recall estimate of annual expenditures for recreational sea angling. Furthermore, participants of a complementary one-year diary study were asked to report quarterly expenditures for marine angling. In 2021, a similar survey (150 000 households) will be conducted to update the 2014/2015 data.</p>	<p>There were 174 000 sea anglers in Germany in 2014/2015, with the majority (161 000) going angling in the Baltic Sea. Average annual expenditure was 938.8 € per angler resulting in overall expenditures of 184.6 million €.</p>	
Greece	<p>During the 2017–2019 pilot study, a nationwide telephone survey was conducted with 16 501 households. The survey allowed for estimates of the number of RF in the country, effort and expenditures. During the survey respondents were asked to provide a 12-month estimate of annual expenditures for marine recreational fishing.</p>	<p>Results suggest that 8% of the population, approximately 700 000 residents, in the country engage in marine recreational fishing. Regarding annual expenses 13% spend no money, 43% spend between 1–50 €/year, 13% 51–100 €/year, 12% 101–250€/year, 7% 251–500€/year and 8% 500+ €/year. On average, fishers spend 181 €/year (median 38 €/year) which amounts to 126 700 000 €/year nationally.</p>	
Hungary			

Country	Survey Methods (description of method, assumptions made, and applicable species)	Economic Value (direct, indirect, and induced), trip spend, and willingness to pay estimates	Magnitude and direction of bias
Ireland	<p>‘Socio-economic Study of Recreational Angling in Ireland’ (TDI, 2013), commissioned by IFI, was based on a sample size of 903 participants (692 face to face interviews, 211 online). Findings include an estimated 406 000 individuals (aged 15+) participated in recreational angling in 2012 (252 000 domestic, 113 000 overseas, 41 000 Northern Irish).</p> <p>http://www.fisheriesireland.ie/media/tdistudyonrecreationalangling.pdf.</p> <p>An omnibus survey was carried out in 2015 to estimate total domestic participation in angling (IFI, 2015). Results indicate a total of 273 600 Irish individuals aged 15+ who consider themselves to be ‘anglers. Of these, approximately 4% consider themselves to be bass anglers (11 000) and a further 24% consider themselves to be sea anglers who target other sea species (65 600). Lower bound estimates for overseas anglers in 2014 are in the region of 132 000. These combined figures give a total value of angling in 2014 in the region of €836 million; of this approximately €71 million relates to bass angling and €158 million relates to angling for other sea species.</p> <p>A study, ‘Economic Impact of Irish Angling Events’ (based on a sample of 314 anglers in 2013) (O’Reilly, 2014) found that competitive anglers fish more often, stay for longer and spend more money than ‘ordinary’ anglers. The travel cost model was used to estimate consumer surplus in this study.</p>	<p>The estimated value of angling to the Irish economy in 2012 of €755 million revised up to €836 million in 2014. Using the contingent valuation method, Irish anglers were asked their Willingness to Pay to preserve Ireland’s natural fish stocks and the current quality of Irish angling—WTP estimates of €67 per angler per annum (2012) were estimated. Study of Irish angling events (festivals/competitions) estimates a much higher CS for participants using travel cost method; results indicated a CS of up to €252 per angler per day (see below).</p> <p>Per trip expenditure range of €858–€1027 per person for overseas anglers. Domestic anglers’ annual expenditure estimated at €1740.</p> <p>From the omnibus survey and an increase in overseas angling tourism the total value of angling in 2014 in the region of €836 million; of this approximately €71 million relates to bass angling and €158 million relates to angling for other sea species.</p> <p>Case study sea angling event with 124 participants was estimated to be worth nearly €200 000 to the host region in southwest Ireland. CS estimates of €252 per angler per day.</p>	
Italy	No data currently. Some estimates are foreseen to come from the pilot study now ongoing.		
Latvia	Value of landings in self-consumption fishery	9762 EUR	
Lithuania	Have not been performed similar studies in Lithuania	No data on economic value, no economic-social surveys have been done.	
Luxembourg			
Malta			

Country	Survey Methods (description of method, assumptions made, and applicable species)	Economic Value (direct, indirect, and induced), trip spend, and willingness to pay estimates	Magnitude and direction of bias
Netherlands	Screening survey (50 000 households) followed by 12 months Diary Survey (1377 marine participants, 2238 freshwater participants) (van der Hammen and de Graaf, 2017).	200 € per fisher per year, 341 € million (accommodation, travel, durable equipment, consumables, etc.).	
Norway	<p>In 2009, a survey using a sampling frame of 434 fishing tourism enterprises was conducted to compile data on fishing tourism season, capacity in number of beds and rental boats, the number of fishing tourism guest nights and the length of stay (nights) of fishing tourists. Additional data on expenditure during a fishing tourism holiday in Norway was collected from 597 tourists (that had visited Norway to participate in tourist fishing the previous year). The data were used in an input-output model to calculate total economic impact from fishing tourism in 4 regions (including indirect and induced effects). For more information about results see Borch, T., M. Moilanen and F. Olsen (2011a). "Marine fishing tourism in Norway: Structure and Economic Effects." <i>Økonomisk fiskeriforskning</i> 21 (1), 1–17. Also, a more comprehensive report of results was produced in Norwegian: Borch, T., M. Moilanen and F. Olsen. (2011b) <i>Sjøfisketurisme i Norge - debatter, regulering, struktur og ringvirkninger</i>. Tromsø: Norut, report no 1.</p> <p>In 2014, a profitability study was performed of businesses that offer marine angling services to tourists in Arctic Norway (Borch & Svorken 2014). The most important findings in this are that profitability varies with distance to airport, number of beds relative to boats available for rent and with capacity utilization of beds throughout the year. (E.g. if the businesses have other types of guests during the winter season like skiing or aurora borealis tourists.</p> <p>In 2017, a valuation study was performed in Arctic Norway on the value of the coast for outdoor recreational activities. This study concluded that marine recreational fisheries were the most important outdoor recreational activity in this region. For more results see Aanesen, M., J. Falk-Andersson, K. Vondolia, T. Borch, S. Navrud, D. Tinch (2018): <i>Valuing coastal recreation in the Arctic and the visual intrusion from commercial activities</i>, <i>Ocean and Coastal Management</i>, 153, pp 157–167.</p>	Average daily expenditure by fishing tourists visiting Norway was 173 euro and an average length of stay 7.4 days (this implies that the total average expenditure on a fishing holiday in Norway is 1280 euro). Total expenditure from fishing tourists that visiting the 434 enterprises in the year 2008 was 104 million euro.	

Country	Survey Methods (description of method, assumptions made, and applicable species)	Economic Value (direct, indirect, and induced), trip spend, and willingness to pay estimates	Magnitude and direction of bias
Poland	Have not been performed similar studies in Poland.	No data on economic value, no economic-social surveys have been done.	
Portugal	The pilot project Pescardata (September 2017–December 2018) was defined for studying DCF recreational fisheries in mainland Portugal. During the project, and to maximize effort, data on all recreationally caught species were collected. For this project, a comprehensive sampling strategy was defined, where the Portuguese mainland coast was divided into 5 km sections of coastline within NUTS II areas (North, Centre, Metropolitan Area of Lisbon—AML, Alentejo and Algarve). Data collection started in January 2018 using face-to-face questionnaire surveys (ODK Android application), angling logbooks, historical sport fishing activity data from anglers' clubs, and fishing tournaments. Onboard observers were also used for boat angling, while face-to-face questionnaires were conducted via roving creel surveys for shore angling and spearfishing, and access point surveys used for boat angling and spearfishing. The pilot project has finished, and the results will be made available as soon as possible.	The questionnaires survey included questions regarding the economic contribution of the activity according to the fishing mode. In total 996 questionnaires were validated for shore angling recreational fishery and 428 for boat-angling. For spearfishing, the number of valid questionnaires (n = 31) was considered low, consequently, this fishing mode was not considered in the data analysis. Results on the economic contribution of this activity in Portugal will be made available as soon as possible. These results include socio-economic characterization of fishers and direct expenditures estimates.	
Romania			
Slovakia			
Slovenia			
Spain (Basque Country)	A postal survey was carried out during 2009 and 2010. The target population was the vessel owners and skippers of the recreational fleet, but shore anglers and spearfishers were not included in this study. The contact details for skippers could not be obtained because of confidentiality, so AZTI contacted recreational fisheries associations and federations in the Basque Country. Postal and face-to-face surveys were done with approximately 2000 surveys sent and 549 completed. More questionnaires were completed with face-to-face than in postal surveys. The name of the vessel, registration number and the home port were obtained from Basque Country administration	Direct expenditure for the same sample. The raising was made using the statistically significant variables, such as port, and length of the vessel and the category. The value of the catch was not used in the estimation of the total direct impact. The induced effect was calculated using the input-output tables of the Basque Country published by EUSTAT. The multipliers of the income, value-added, and employment were calculated. The direct impact was around 34 million €/year and the total impact including the induced effect was almost 54 million € and maintaining 624 FTE/year. No survey on WTP has been carried out.	Only covers recreational boat owners. Spearfishing and shore fishing is not included.

Country	Survey Methods (description of method, assumptions made, and applicable species)	Economic Value (direct, indirect, and induced), trip spend, and willingness to pay estimates	Magnitude and direction of bias
	<p>and additional vessel information including length, vessel and mooring were obtained from field sampling and google Earth. Three categories of vessels were defined: sailing, txipironeras (typical Basque vessel), and motor vessels. For the economic survey, the same methodology was used as described above.</p>		
Spain (Galicia)	<p>Online and face to face survey of 363 recreational fishers in 2017 from a total population of 60 000 recreational fishers. Recreational associations were involved in the survey dissemination.</p>	<p>Direct expenses were obtained, and when raised to total numbers (corrected by avidity classes, platform and other strata) it was estimated that per year recreational fishers spend 85.6 €M (CI95%=54.9–112.3 €M), while boat owners spend another 10.6 €M (CI95%=5.8–13.0 € M). Mean total individual annual expenses reported by the fishers were 1637 € (CI95%=1595–1871 €) per year. Boat anglers spent 15474 € (CI95%=12644–18026 €) to buy their boats, mostly in the second-hand market (61% of total). The mean annual boat-related expenses were 2902 € (CI95%=2 233–3 502 €) per boat (Pita <i>et al.</i>, 2018).</p>	<p>A relatively low number of interviews. Some problems derived from online interviews. However, avidity bias was corrected.</p>
Sweden	<p>National postal survey, approximately 22 000 questionnaires (in 2019) sent three times a year (recall time four months) to randomly selected individuals (permanent residents of Sweden found in the Swedish population register).</p>	<p>1.6 million Swedes (age 16–80) engaged in recreational fishing at least once during 2019. The number of days fished in marine and coastal waters was 4.3 million days in 2019. The total number of fishing days (marine and freshwater combined) was approximately 12.7 million days.</p> <p>Total expenditures for recreational fishing during 2019 was 10.6 billion SEK. Short-term expenditures amounted to 5.0 billion SEK, while long-term investments amounted to 5.6 billion SEK.</p>	
UK	<p>The economic value and social benefits of sea angling were estimated within Sea Angling 2012 to understand the importance of sea angling in England. This shows the pattern of direct spending by sea anglers and how this spending supports other economic activity in England through supply chains. We used the ONS household survey to estimate the total number of people who went sea angling in 2012, then ran a well-publicised online survey throughout 2012 to collect data on expenditure and social benefits from a representative sample of these anglers. Other surveys were carried out in face-to-face</p>	<p>Angler spend:</p> <ul style="list-style-type: none"> • Annual trip spend per angler - £761 • Annual spend on major items - £633 • Total annual spend per angler - £1394 <p>Direct spend in England:</p> <ul style="list-style-type: none"> • Total spend = £1.23 billion (£831 M excl. taxes and imports) 	<p>+</p>

Country	Survey Methods (description of method, assumptions made, and applicable species)	Economic Value (direct, indirect, and induced), trip spend, and willingness to pay estimates	Magnitude and direction of bias
	<p>interviews with sea anglers at five case study locations and supporting data were collected from angling businesses.</p> <p>In establishing the economic value of recreational sea angling, we considered the following elements:</p> <p>The total spending in the English economy supported by sea anglers and covering the more explicit items (i.e. rods, reels, etc.) and the less explicit items of spending (food, petrol, etc.).</p> <p>How far this total spending is on goods and services that are imported into the economy. For example, the UK is home to relatively few domestic firms that manufacture rods and reels, such that domestic spending on these goods tends to support foreign manufacturers, but with domestic firms perhaps benefiting as distributors of goods.</p> <p>How far this total spending on recreational sea angling, once discounted for imports, supports gross value added and employment in the English economy.</p> <p>How spending on recreation sea angling supports activity in other sectors. Here, for example, spending on accommodation might support employment in the hotel trade, but also jobs in the sectors that supply hotels.</p> <p>Data for estimating spend per angler were obtained from 2512 respondents to an online survey and from 340 face-to-face interviews at five case study locations (Weymouth, Deal, Liverpool, Northumberland and Lowestoft) where local businesses were also surveyed. The onsite survey locations included a variety of rural-coastal (Northumberland, Deal), mid-sized (Lowestoft and Weymouth) and city/urban locations (Liverpool). Site-based research was conducted throughout the period from March 2012 to February 2013. Site-based research also allowed the collection of data from some groups who were more likely to be underrepresented in the self-select online survey, such as occasional anglers and holidaymakers.</p> <p>The total annual spend in England was estimated by raising the mean spend per angler to the total number of sea anglers in England estimated from the Office of National Statistics Sur-</p>	<ul style="list-style-type: none"> • Supports over 10 000 FTEs • £358 million GVA <p>Total value (direct, indirect and induced spend):</p> <ul style="list-style-type: none"> • Total value = £2.10 billion • Supports over 23 000 FTEs • £978 million GVA <p>Average trip spend at case study sites:</p> <ul style="list-style-type: none"> • Deal = £46.2 • Liverpool = £43.7 • Lowestoft = £35.9 • Northumberland = £37.2 • Weymouth = £161.7 	

Country	Survey Methods (description of method, assumptions made, and applicable species)	Economic Value (direct, indirect, and induced), trip spend, and willingness to pay estimates	Magnitude and direction of bias
	<p>vey. All data were re-weighted using demographic and frequency-of-angling data from the surveys to reduce bias. An Input-Output framework was used to estimate the multiplier impacts of sea angling expenditure at the England level. This I-O framework enabled the effect of any spending or activity to be traced through the various supply chains, ultimately estimating indirect and induced-income effects. Average spend was also calculated for all respondents from the five case-study locations and showed spend was much higher at the charter boat location (Weymouth).</p> <p>The social benefits of sea angling were also assessed, with 47% of respondents said that ‘being outdoors and active’ was their main motivation for going sea angling, and 55% said it was to ‘relax and get away from things’. Sea angling contributes to health and well-being with 69% of sea anglers saying it is their main way of ‘experiencing nature’ and 70% saying that it is important to their quality of life. Better fish stocks were cited most often as the factor that would increase participation, although cost, time and family commitments were also important.</p> <p>For more information see Armstrong <i>et al.</i> (2013).</p>		