

# WORKSHOP ON RECREATIONAL FISHERIES IN STOCK ASSESSMENTS (WKRFSA)

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## WORKSHOP ON RECREATIONAL FISHERIES IN STOCK ASSESSMENTS (WKRFS)

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## i Executive summary

The Workshop on Recreational Fisheries in Stock Assessments (WKRFSA) aimed to establish a process for integrating recreational fisheries (RF) data into stock assessments. The workshop addressed three questions: identifying obstacles to RF inclusion, creating a decision tree for RF data inclusion and reconstruction, and establishing criteria based on data quality and catch quantity. It had three sections: assessing where RF data fits in the assessment cycle, schematizing RF data reconstruction, and discussing blockers to RF inclusion.

To prioritize stocks for RF data inclusion, a productivity-susceptibility analysis (PSA) by the WGRFS is ongoing. This PSA will provide a list of species within each ecoregion where RF could impact stock sustainability levels. When a risk is identified for a stock, RF data should be included in the data-call process for consideration in the benchmark.

Key blockers to RF inclusion were categorized into data issues, communication challenges, and resourcing problems. Data issues focused on quality, quantity, and consistency of the RF data. A need for better communication about RF data availability was outlined. Resourcing challenges included knowledge gaps within ICES stock roles, communication of RF-specific advice, and capacity needs for improved inclusion methods.

A flowchart-based framework for integrating RF data into the stock assessment process was developed, addressing survey errors, different catch levels, and reconstructing commonly missing RF data under different scenarios. Acknowledging data limitations, the framework proposed capturing RF exploitation levels in the assessment model or as a statement in the advice only.

The workshop addressed several of the blockers to inclusion of RF data into the assessment/advice cycle through identifying avenues for improved RF communication, devising methods within the framework for handling data quality, quantity, and consistency issues. However, the workshop was not able to resolve all the issues identified. Five key tasks for future development to resolve further blockers emerged: ICES supporting both stock assessment and RF communities to enhance capacity, considering a dedicated RF data coordinator role for each stock, improving communication between WGRFS and assessment WGs, compiling a priority list of species through PSA analysis, and ACOM providing standardized guidance for RF-specific advice.

## ii Expert group information

<b>Expert group name</b>	Workshop on Recreational Fisheries in Stock Assessment (WKRFSAs)
<b>Expert group cycle</b>	Annual
<b>Year cycle started</b>	2022
<b>Reporting year in cycle</b>	1/1
<b>Chairs</b>	Zachary Radford, UK Marina Scanu, Italy
<b>Meeting venue and dates</b>	3–5 July 2023, AZTI Mundaka, Spain (25 participants)

# 1 Background

## 1.1 DGMARE request and ACOM roadmap

The specific grant agreement between DGMARE and ICES lays down the content of the advisory deliverables provided by ICES and, recreational fisheries have been included in single-stock advice from ICES where possible.

The wording related to the inclusion of recreational fisheries catches has become more specific in the most recent DGMARE grant agreement:

**Where recreational fisheries take a significant part of the catches, the catch scenarios shall be calculated assuming that changes in fishing mortality are caused by the commercial fishery alone, the recreational fishery alone and a combination of the two. In these cases, the gears responsible for significant recreational catches should be identified, and when possible, some estimate of the magnitude or relative proportion of their catches should be also provided. In addition, in the light of available information, ICES will review and incorporate where possible, in its stock assessments recreational fisheries management measures and options agreed and/or implemented which are made known to ICES following a request for information by ICES and will comment on their contribution to reaching MSY objectives for the stocks concerned.**

The Advisory Committee discussed the many challenges related to the inclusion of recreational catches in stock assessments and asked WGRFS and WKRFSA with guidance from ACOM leadership and ICES Secretariat to develop a roadmap to guide the process. The report of WKRFSA will be used as a basis for drafting the roadmap.

## 1.2 Prioritization

Understanding the susceptibility of different species to recreational fishing (RF) pressure constitutes a crucial initial step, given the diverse array of species captured through RF, each subject to varying levels of exploitation. Additionally, while certain species might frequently be caught by RF, their level of exploitation might be small compared with that of the commercial fishery. To address this, the ICES Working Group on recreational fisheries surveys (WGRFS) has embarked on a project aimed at pinpointing species highly vulnerable to RF and highlighting priorities for both data collection and inclusion of RF in stock assessment, utilizing a productivity-susceptibility analysis (PSA) framework. This framework evaluates both a species' susceptibility to fishing pressure and its life-history characteristics, amalgamating them into a comprehensive vulnerability index (Patrick *et al.*, 2009). Moreover, recognizing potential data constraints within RF, the WGRFS approach incorporates an uncertainty score for each parameter, akin to the methodology proposed by Phillips *et al.* (2015). Both the vulnerability score and the uncertainty score collectively classify species into four categories: low priority (low vulnerability and uncertainty), medium priority (low vulnerability, high uncertainty), high priority for inclusion (high vulnerability, low uncertainty), and high priority for data collection (high vulnerability and uncertainty), as illustrated in Figure 1.1. These categorizations are determined for each ICES ecoregion.

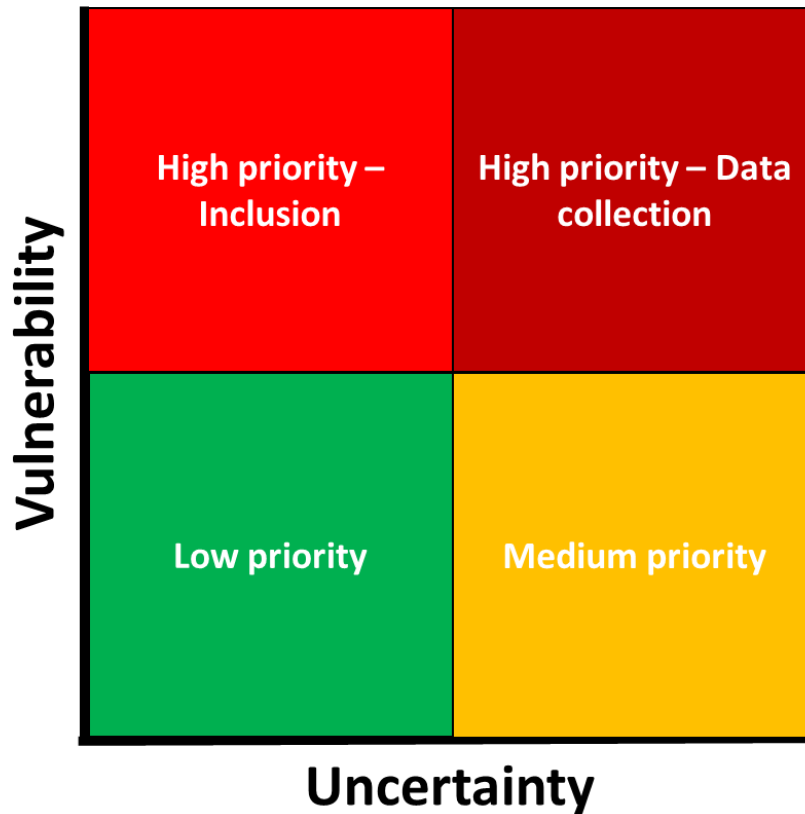


Figure 1.1. The proposed categories for the productivity susceptibility analysis being conducted by the ICES Working Group on recreational fisheries surveys. Scores will be provided per species and ICES ecoregion.

## 1.3 Examples of where recreational fisheries are included in the assessment process

### 1.3.1 Irish Sea cod

Irish sea cod stocks, as many other cod stocks, have been considerably declining over the past 30 years, with very strict cod recovery measures in place since 2000. This included zero catch advice for most of the years since, introduction of selectivity devices to avoid catches of cod and has also led to a strong decline in the whitefish / demersal fishing fleet. None of those measures led to a recovery of the stock and the stock by now is deemed to be not fishery controlled with fishing pressure hardly existent.

At the last benchmark it was considered to include the recreational fishery into the assessment; various options were explored: mentioning the recreational fishery in the advice sheet, adding the commercial catches (since 2017) to the total catches and applying the same selectivity as the commercial fleet or re-calculating the recreational catches within the model. It was decided on the second option. Recreational catches were about 1/3 of the commercial catches for the years and were hence an important addition, however not enough information was available for the selectivity pattern (length frequencies). As this is a highly depleted stock and recreational catches are only available for the years the stock has been under zero catch advice it is very problematic to understand the dynamics and it is also difficult to re-create catches back historically. Placing the sentences about the recreational fishery into the advice sheet could have considerable political implications and ICES needs to be treading carefully with their advice given this part needs to get serious input from policymakers.



### 1.3.2 Northern Shelf cod

The Northern Shelf cod stock consists of the previous North Sea (cod.27.47d20) and West of Scotland (cod.27.6a) cod stocks which, as of 2023, are assessed together using an assessment framework (multistock SAM) that explicitly models the dynamics of the three reproductively isolated substocks within (Northwestern, Southern and Viking). RF catches for Northern Shelf cod are provided by Belgium, Denmark, France, Germany, Netherlands, Norway, and the UK, covering the period 2009–2022 to varying extents. RF data for Northern Shelf cod is patchy and often has large confidence intervals. Furthermore, methods are not fully coordinated across countries and are subject to varying biases which in general are poorly understood.

A short workshop was held with recreational data collection and stock assessment experts in January 2021 to identify appropriate approaches for the former North Sea cod stock. It was clear that limitations with the existing RF data make it impossible to create a time-series of international recreational catches spanning the period of the assessment (from 1963 at the time) without extensive imputations, which would inevitably lead to an accumulation of biases related to survey design, implementation, and analysis (ICES, 2021a). The same conclusion was reached by the recent benchmark for Northern Shelf cod, which has an assessment starting in 1983 (ICES, 2023a). RF are therefore not included in the analytical stock assessment. Instead, a short time-series of RF is generated to estimate the magnitude of RF in relation to commercial catches, which is then reported annually in the WGNSSK report and advice. Briefly, this short time-series is constructed using the relative portion of each countries recreational catch compared to the Danish recreational catch, which is available every year from 2010. RF are currently estimated to account for 2.4–5.5% of the total removals of the Northern Shelf cod stock between 2010–2022.

### 1.3.3 Northern sea bass

Sea bass are an important target species for recreational fisheries (Armstrong *et al.*, 2013; K. Hyder *et al.*, 2020; Kieran Hyder *et al.*, 2021). Recreational removals (retained fish and those that die after release) for all countries exploiting the Northern stock were estimated to be in the region of 27% of the total commercial and recreational removals (K. Hyder *et al.*, 2018; Radford *et al.*, 2018). Recreational fisheries removals were included in the stock assessment and forecast (ICES, 2018) and were responsible for 489 tonnes of removals in 2021 (ICES, 2021b). This showed that recreational fisheries are an important component of fishing mortality for the Northern stock of sea bass.

The assessment model that covers the Northern stock (central and southern North Sea, Irish Sea, English Channel, Bristol Channel and Celtic Sea; ICES divisions 4.b-c, 7.a and 7.d-h) is treated as category 1 with a full analytical assessment and forecast (ICES, 2023b). The assessment is performed using the Stock Synthesis model (SS3). Six fishing fleets and three indices of abundance are included in the ICES assessment. The six fishing fleets are: UK bottom trawls, nets (UK OTB-nets); UK lines; UK midwater trawls (UK MWT); French fleets (combined); Other (other countries and other UK fleets combined); and recreational fisheries (combined). Commercial landings data are accessed by country and gear, and combined for the relevant fleets. Commercial discards are included for the UK bottom trawls and combined French fleets. Recreational removals are generated from surveys in France, Netherlands and the UK, from the landed component and released fish with post-release mortality of 5% for 2012. Recreational fishery removals were assumed to be constant prior to the introduction of management measures in 2015, while the impact of combinations of the MCRS, season length and bag limits on removals is estimated for 2015 onwards. Further data are needed from all countries with recreational fisheries to characterize the impact of management measures on recreational catches more effectively. A detailed short-term forecast is used to generate ICES catch advice for sea bass. It assumes that the

proportion of fishing mortality between fleets remains the same as in the last year of assessment for the intermediate and advice years.

Catch advice is provided for the combined commercial and recreational fisheries in order to not make any assumptions about how fishing opportunities should be partitioned between the sectors. Most fisheries legislation, including the CFP, encompasses the need to account for biological, social and economic factors in management decisions. This suggests that catches within safe biological limits should be allocated to parts of the fishery in a way that maximizes societal benefits and that this allocation should drive management measures. Hence, transparent and consistent approaches for explicit allocation of catches between recreational and commercial fisheries that account for social and economic benefits are needed in Europe. Some approaches have been developed using bioeconomic models (Tidbury *et al.*, 2021) and estimation of the social welfare generated through RF for sea bass (Cevenini *et al.*, 2023).

### 1.3.4 Western Baltic cod

The western Baltic cod stock has as many other cod stock declined a lot since the start of the catch time-series in the mid-1960s. From 1965 to the start of the 1980s the landings were varying between 45-55000 t, however since 2020 the commercial landings have been below 5000 t and the stock size has decreased to a historic low. There has been a recreational fishery for cod for many years in this area, but the relative contribution of the recreational catches became more important as the stock declined. Until 2007, the relative contribution of the recreational catches were below 15%, however in later years the contribution of the recreational catch was estimated to be between 50-70% of the total catch. Although the relative contribution of the recreational fishery has increased, the catch has been decreasing since 2017 due to the introduction of a bag limit and reduced resource availability. This indicates that the inclusion of recreational data for this stock also lead to a management regulation of the recreational catches. German recreational data have been available since 2013 and was included in the assessment at the benchmark in 2015 (ICES, 2013). In 2019, recreational catches from Sweden and Denmark were also included in the assessment as the main contributor to the recreational fishery for this stock (ICES, 2019a). The inclusion of the recreational data came after several workshops where the data quality and availability were discussed alongside how to reconstruct the historic time-series. Further, one of the important outputs from the workshops was an annual workflow including timelines to share recreational data to ensure meeting deadlines for the stock assessment.

### 1.3.5 Australian Examples

Australian fisheries occur in marine waters across most of its 34,000 km coastline, with many being multi-sector fisheries. Annual updates of commercial fisheries and aquaculture production are supported by ongoing national programs, while estimates of economic contributions from recreational fishing are only made periodically. In 2020/21, commercial fishing contributed 17,000 jobs and GVP above \$3 billion (ABARES, 2022), while recreational fishing contributed over 100,000 jobs and \$11 billion (Moore *et al.*, 2023). Given the catch, social and economic importance from RF, incorporating RF information into stock assessment and jurisdictional reporting of stock status is a need, but an ongoing challenge. Australian approaches for the adoption of recreational fishing data in stock assessments includes catch and effort data, CPUE, biological samples, and length and age compositions. Fisheries-dependent data from mandatory logbooks are used for most commercial and charter recreational fisheries. On the other hand, survey sampling may be only feasible way of collecting RF data, and RF licences providing sampling frames in some Australian states (NSW, Vic, Tasmania, WA). Statewide surveys are conducted in many states with estimates of harvest used for state reporting and stock assessments, as well as national

status reports being collated every 2–3 years since 2012 providing independent assessments of 148 Australian fish and invertebrate species (SAFS, 2020). These reports improve understanding of stock status to monitor sustainability and management success, particularly where evidence-based management measures and strategies are adopted, such as catch or effort limits and harvest control rules. Over time, there has been an increase in the number of species reported to cater for diverse interests among stakeholder groups, and a reduction in the proportion of species classified as 'undefined' by using data-limited assessment methodology, where possible.

In Western Australia, status reports are updated every year to reflect current reporting from commercial and charter fishing, and the most recent information from RF (Newman *et al.*, 2023). Harvest estimates are produced annually for only a few recreational fisheries, including Roe's abalone (*Haliotis roei*) and Western rock lobster (*Panulirus cygnus*), while harvest estimates are produced every 2–3 years for many other recreational fisheries, including demersal and near-shore scalefish. Roe's abalone is a single-species multi-sector fishery with restricted spatial and temporal access. This provides a complete spatial-temporal sampling frame for on-site and aerial-access surveys to estimate catch (Ryan *et al.*, 2016). The breeding stock is considered sustainable-adequate following recovery from historically low levels with stock indicators (harvest-size animals and spawning biomass) reaching above pre-2011 marine heatwave levels aided by a marine cold spell from 2016–2019 (Hart *et al.*, 2018). Increasing stock indicators halted in 2022 and there is ongoing monitoring of the impacts of an increase in summer sea surface temperature over recent years (*Western Australian Abalone Managed Fishery*, 2021). Western rock lobster is a single-species, multi-sector fishery occurring across large spatial and temporal scales. A species-specific licence provides a sampling frame for annual off-site surveys to estimate catch (Smallwood *et al.*, 2022). The breeding stock is considered sustainable-adequate with stock indicators (commercial and recreational catch rates, biomass and egg production) at record-high levels. An integrated population model indicates a continuation of fishing at similar TACs for the next five-years will result in similar levels of legal and spawning biomass, catch rates and harvest rates (de Lestang *et al.*, 2019).

The West Coast Demersal Scalefish Resource is a multispecies, multi-sector fishery resource occurring across large spatial and temporal scales. A Recreational Boat Fishing from a Boat licence provides a sampling frame for off-site RF surveys conducted every 2 to 3 years to estimate catch for stock assessments and resource allocation. Recreational catch data are included in stock assessments, reflecting the large proportion of overall catch attributed to recreational fishing and sector-specific harvest strategies. Catch estimates from periodic boat ramp and phone diary surveys (Ryan *et al.* 2022) were used for catch reconstruction to produce a time-series of recreational harvest. Catch reconstruction included: i) calculating recreational harvest (from conversion of retained catch by numbers to catch by weight, adjusting retained catch from boat ramp surveys to account for fishing that was out of scope from the survey design and adding a proportion of the released catch to account for additional mortality from released catches), ii) linear interpolation of recreational harvest between survey years, and iii) hindcasting recreational harvest from the first survey year using linear interpolation as a function of annual percentage change in Estimated Residential Population from the Australian Bureau of Statistics. Stock assessments are undertaken every 3 to 5 years to monitor stock status against a formal harvest strategy and recovery plan. RF catch and age compositions are used in Level 3 (catch curve/per recruit) and Level 5 (integrated model) assessments (Fairclough *et al.*, 2021). The most recent assessment in 2021 indicated that while management measures implemented between 2007 and 2010 have halted declines in stock indicators (relative spawning biomass) of key indicator species, snapper (*Chrysophrys auratus*) and West Australian dhufish (*Glaucosoma hebraicum*), there had been limited recovery. Catch information from each sector will continue to be monitored against recovery benchmarks, after these were further reduced by 50% in 2023.

There are a number of challenges for recognizing recreational fishing in stock assessments. Estimates of stock status are biased when total mortality from all sectors is not integrated into stock assessments, including landings from commercial, charter, recreational, customary, and other removals including post-release mortality and illegal fishing). Estimates of recreational harvest can improve reliability of stock assessments, particularly where RF accounts for a large proportion of the overall catch, or where RF targets different size classes from commercial fishing. Consideration also needs to be given to minimizing temporal and spatial differences in reporting to improve comparability, developing approaches for catch reconstruction, including uncertainty associated with catch estimates and developing approaches for recreational-only fisheries.

## 1.4 Where do recreational fisheries data fit into the ICES process?

Data collection and stock assessments in undertaken within the ICES auspice have been developing analytically over the past twenty plus years, to provide objective, robust advice. These have historically been developed to provide landings, and since development of the landings obligation, Total Allowable Catch (TAC) advice in tonnage per stock, for management of commercial fishing operations.

With the reduction in commercial catch and stock sizes of some stocks, it is becoming apparent that recreational removals (i.e. the kept + dead returns) may be approaching notable proportions – see Irish Sea and Baltic Sea Cod assessment sections. As recreational catch becomes better estimated in terms of catch methods and areas, fish numbers and tonnage, so the opportunity to incorporate this into existing stock assessments or develop new stock assessments increases. In order for this to be achieved successfully a number of issues need to be considered and resolved. These relate to:

- Fishing – Assessment – Advice cycle/process.
- Advice purpose.
- Stock definition.
- Data gathering.
- Data processing.
- Data inclusion into stock assessments.
- the stock assessment method and appropriate means of including recreational catch.

These are explored and discussed.

### 1.4.1 Fishing – Assessment – Advice cycle/process

ICES develop advice dependent upon a process of fishing, sampling, data preparation and submission by countries exploiting a stock, application of standardised and reviewed stock assessment models/methods, development and review of advice which is then used to set international fishing quotas, technical measures, and catch limits (Figure 1.2). This process has developed over the past two to three decades, with much of the quality control and standardisation elements being homed in during the past ten years. Data calls are issued by ICES, by region and stock and depending upon the employed stock assessment method and data requirements. Data calls are responded on, by pre-defined dates and to quality requirements by countries/jurisdictions exploiting each stock. Assessments are applied in ICES “Working Groups” who then draft Advice – allowable catch levels which are forecast to maintain a stock size (usually “Spawning Stock Size”, SSB) above estimated biomass reference points and “fishing pressure” (F) below estimated fishing pressure reference points, in order to comply with the “Precautionary Approach” and sustain the stock according to Maximum Sustainable Yield (MSY) or Precautionary Assessment

(PA) levels.). This process has developed over the past two to three decades, with much of the quality control and standardization elements being homed in during the past ten years. Data calls are issued by ICES, by region and stock and depending upon the employed stock assessment method and data requirements. Data calls are responded on, by predefined dates and to quality requirements by countries/jurisdictions exploiting each stock. Assessments are applied in ICES “Working Groups” who then draft Advice – allowable catch levels which are forecast to maintain a stock size (usually “Spawning Stock Size”, SSB) above estimated biomass reference points and “fishing pressure” (F) below estimated fishing pressure reference points, in order to comply with the “Precautionary Approach” and sustain the stock according to Maximum Sustainable Yield (MSY) or Precautionary Assessment (PA) levels.

For recreational removals to be incorporated into ICES assessments, the path for data to enter this system need to be considered and agreed upon. It would be appropriate to do so through the data call step, with appropriate data processing and quality steps/checks in place at the country/jurisdiction level.

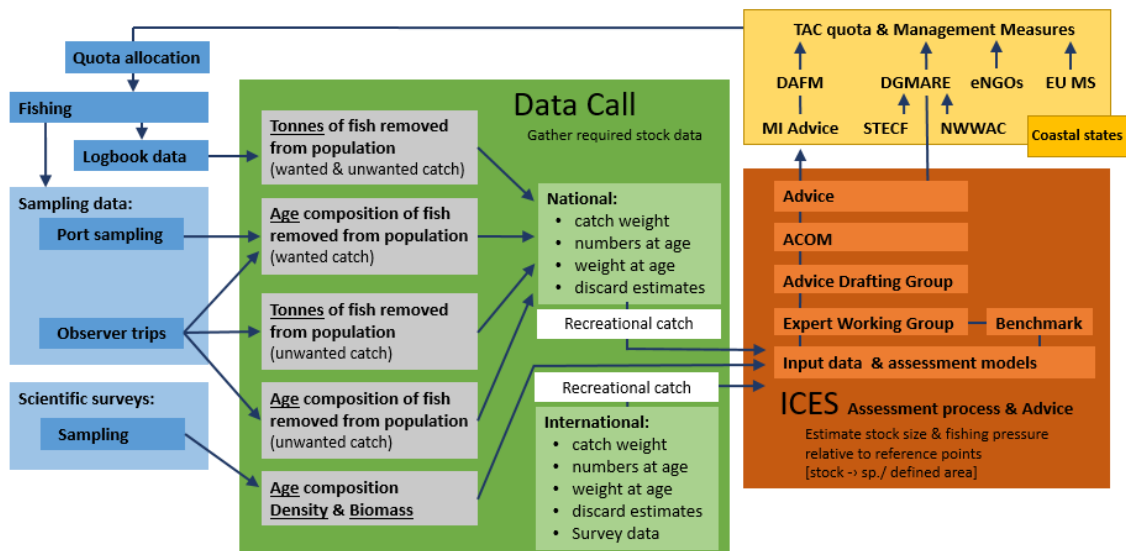


Figure 1.2. Schematic representation of the Fishing – Assessment – Advice cycle.

### 1.4.2 Advice purpose

Generally, for most stocks that ICES provides catch advice for, the exploitation of the “stock” is by recognized fishing sectors/gear types and is usually considered as commercial fishing. This has been appropriate, as data being included in assessments have in the main consisted of catch information from only commercial fishing activities, without inclusion of any recreational catch component. Given the potentially high removals by RF from some stocks, not including it as a source of mortality may impact the assessment and resulting advice by giving an erroneous biomass estimate and level of exploitation. Currently, in most cases recreational catch and associated mortality is not included in stock assessments, as historically the level of commercial catch far exceeded recreational catch, with commercial application being the focus of the assessment and advice. Where there is now evidence of notable recreational catch and reliable time-series, its inclusion in stock assessments is recommended to better estimate stock size, reference points and available catch within the ICES precautionary approach framework, unless there is evidence that it does not impact the stock.

### 1.4.3 Stock definition

A stock is considered as a species, with reproductive and spatial spread within a defined area and subject to a distinct fishery:

**“A part of a fish population usually with a particular migration pattern, specific spawning grounds, and subject to a distinct fishery. In theory, a Unit Stock comprises all the individuals of fish in an area, which are part of the same reproductive process. It is self-contained, with no emigration or immigration of individuals from or to the stock. On practical grounds, a fraction of the unit stock is considered a ‘stock’ for management purposes (or a management unit), as long as the results of the assessments and management remain close enough to what they would be on the unit stock.”**

Given that RF typically takes place closer to the shore than commercial fishing, connectivity of the targeted stock needs consideration. The biological properties of stocks can vary within stock units (e.g. different size classes present), but the individuals within the stock are still reproductively linked. In some rare cases, such as Norwegian coastal cod, there can be distinct ‘inshore’ and ‘offshore’ stocks, in cases where there are uncertainties around stock structure, these should be itemized in the stock issues list and addressed at a stock identification workshop. Results of such work should inform the validity of incorporating recreational catch into the stock assessment.

### 1.4.4 Data gathering

Single species, stock management advice is generally based on a uniform set of data. While all stock assessments are each specifically tuned to the nuances of the stock, its species distribution, spawning and recruitment, and fishing patterns, most consist of similar data including:

- Time-series of commercial catch in the form of total catch tonnage (comprising landings and discards) from commercial fleets.
- Time-series of standardized scientific surveys –one or a number of standardized scientific fishing surveys using net mesh smaller than commercial mesh sizes.
- Scientific sampling of commercial catch, both “landings” and “discard” portions. In the form of:
  - Multiple fish length and weight measurements of both catch components.
  - Collection of otoliths for aging.
  - Recording of discard portions relative to landings portions of the catch (usually in total weight per haul).
- Potentially a “commercial index fleet”, in a catch-per-unit-effort standardized form from a portion of the commercial catch fleets.
- Additional biological sampling, gathered to determine fish size and age at maturity, to separate Total-stock biomass and Spawning-stock biomass.

Figure 1.3 lays out a potential process of data gathering in line which is in line with the commercial process.

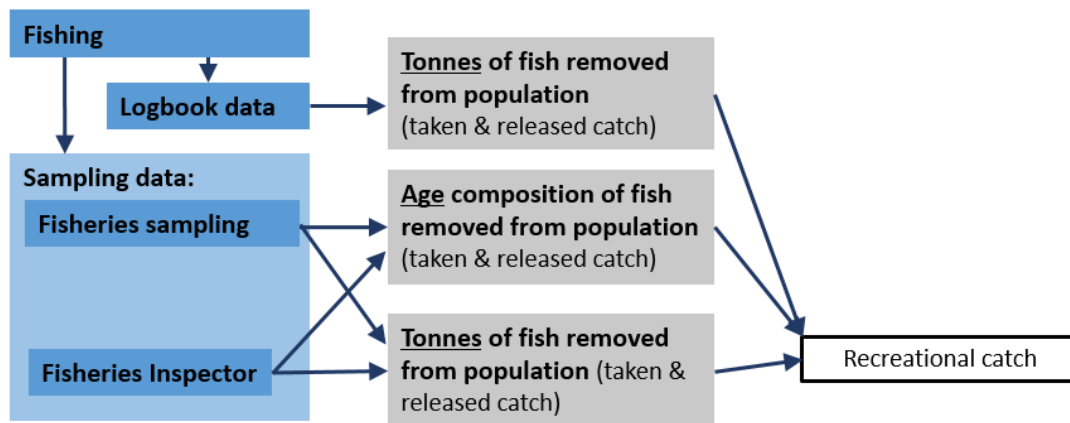


Figure 1.3. Schematic representation of possible recreational catch data gathering for processing.

### 1.4.5 Data processing

Processing of data are dependent upon the intended assessment method. For “category 1”, “fully analytical” assessments, which account for age and or length structure of the stock catch weights from commercial logbooks are translated into numbers of fish of each age class or length class in each year of the time-series (Figure 1.4). This is achieved through “raising” of the raw industry-reported landings data through iterative application of weight-to-length and length-to-age relationships derived from sampling (Figure 1.5). Discarding levels are accounted for through scientific observations of fishing practices at sea applied to fleets using different fishing techniques. Data processing is stock and year specific, depending upon national and international sampling levels across quarters of the year, spatially across the stock area and across different fishing gear types and net mesh sizes. Raising is often applied at a national level before international level owing to local knowledge and differences in fishing practices. Note that other necessary data series detailed in sections below are also derived through this process.

For recreational data to be incorporated into a category 1 assessments it is important that their processing is undertaken in comparable ways, however it is recognized that recreational fishing is not as monitored as commercial fishing across the North Atlantic with varying regulations and legislation across jurisdictions.

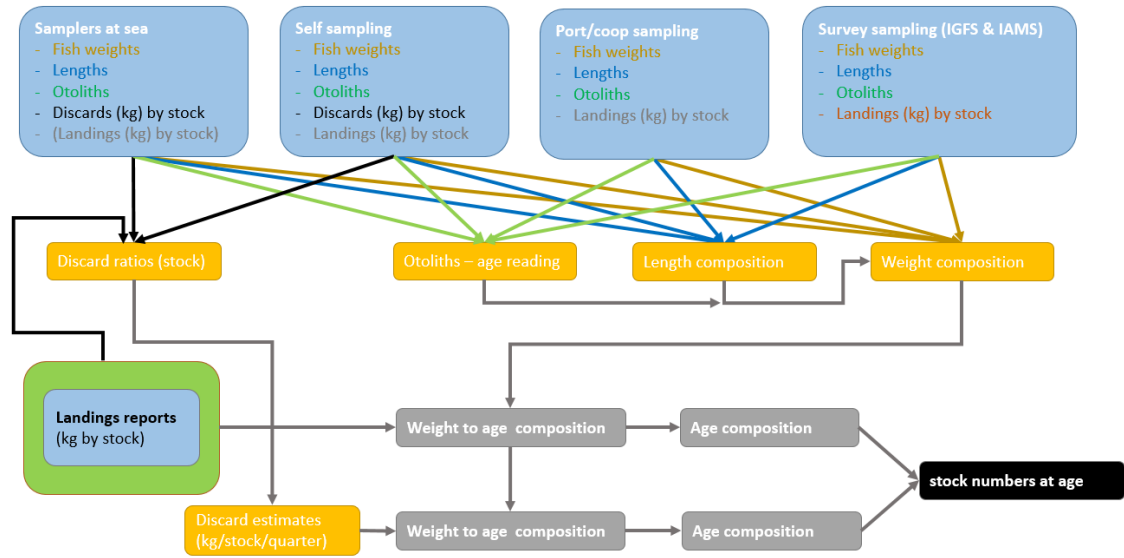


Figure 1.4. Schematic representation of data processing from sources through to stock numbers-at-age.

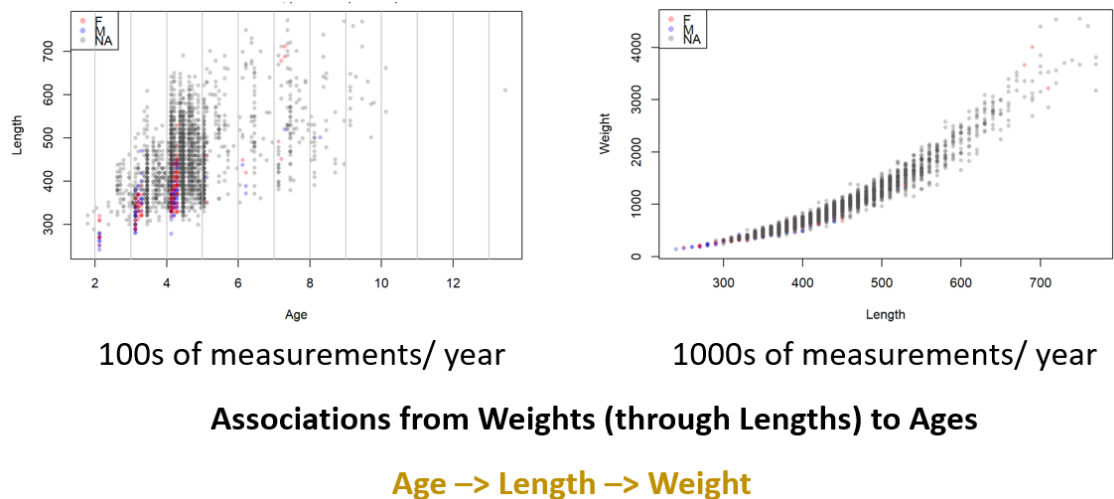


Figure 1.5. Schematic representation of length to age, and weight to length relationships of a stock derived from commercial sampling (at sea and ports) and scientific surveys, to facilitate translation of commercial logbook catch weights to numbers-at-age.

### 1.4.6 Data inclusion into stock assessments

The approach to including recreational catch into an ICES stock assessment needs to be processed through the ICES Stock assessment Benchmarking process. Where an assessment is flagged as requiring a Benchmark an ICES workshop will be organized, data call made, stock identification reviewed, data evaluation undertaken and model/stock assessment, and forecast evaluation with workshop members and review process. Benchmarks are coordinated through the ICES Benchmark Oversight Group, approved with consensus of the Advisory Committee and administered through the ICES secretariat.

For category 1 assessments either/or numbers of fish at specified annual age and length classes are utilized as the primary data input. Accompanying these data are data pertaining to average weights of fish at age and often landings/discard fractions:



- Total catch numbers-at-age “Stock number-at-age” – time-series.
- Catch mean weights at age – time-series.
- Landings mean weights at age – time-series.
- Discard mean weights at age – time-series.
- Stock mean weights at age – time-series
- Landing fraction (discard ratio) – time-series.

Further data:

- Independent, scientific survey numbers-at-age – time-series.
- Natural mortality-at-age, constant over time or time-series if appropriate/available.
- Maturity “ogive” by age – the proportion of each age class which has reached reproductive maturity.
- “F” before spawning – proportion of fishing mortality to occur prior to reaching spawning.
- “M” before spawning – proportion of fishing reaching maturity prior to spawning.
- Noting that these this list is a generalization and will differ slightly depending up on the stock assessment method being used.

The stock assessment method and appropriate means of including recreational catch.

Data gathering and submission for stock assessments needs to align with that of the commercial and survey derived data to be incorporated. This applies to timing within the “fishing-assessment-advice” yearly cycle and analytically to ensure data types/ classes/ measurements are comparable. Considering timing and process, the current system of ICES data calls, assessments, advice provision (Figure 1.2) gives a stable conceptual structure to achieve inclusion of recreational catch, with it falling into the data call, its gathering, processing and submission for inclusion in assessments could be routinely followed. Data processing prior to submission may differ nationally but should endeavour to supply like data.

Consideration needs to be given to how recreational catch data can be incorporated into a stock assessment in line with the model’s data requirements (summarized above). As data are generally in the form of numbers and averages at age, it would be most appropriate to include recreational catch in this manner along with commercially derived data.

Sampling should be undertaken on recreational catch to determine length/weight/age relationships. Reporting, monitoring, estimation programmes need to be designed and implemented to develop time-series of catch data. The means of translating these records into values at age needs to be determined and will depend on how catch data are recorded and reported, and associated sampling levels (by quarter, by area, by fishing technique), recorded and reported in catch numbers or weights.

It may be appropriate to use commercial sample derived data to apply in the raising process (weights-lengths-ages), however a fully considered programme should examine this before routine application. While it may be expected that fish caught by different means but from the same area will generally show similarities relationships between size (length and weight) and age (excepting any fishing-gear induced size selectivity), fish caught in different areas – coastal/inshore relative to deeper and/or more offshore areas – may show different growth and potentially fecundity rates.

Alternative approaches to include data could and should be considered. The assessment method “Stock Synthesis” (SS3) for instance allows for more than one time-series of catch data to be incorporated and this would be a sensible approach to develop and compare against other approaches in the Benchmark forum. Alternatively, recreational catch might be useful as a fisheries dependent indices.

Recreational catch dependence upon assessment method/type, and with consideration of the discussion above gives:

Current category 1 assessment methods – SAM, SS3, A4A, ASAP, other:

- Recreational catch-at-age added to commercial – recreational catch sampling specified age.
- Recreational catch-at-age added to commercial – commercial catch sampling specified age.
- Stand-alone time-series (SS3, SAM).
- Reference indices (tonnage).

Category 2: Surplus production models (e.g. SPiCT):

- Tonnage added to commercial catch time-series.
- Inclusion of survey data or catch data into the assessment survey indices.

Recreational fisheries data typically fits better into category 1 assessments as these model types are more likely to incorporate data-imputation methods within them (e.g. SS3), however, other data category assessments could still benefit from the inclusion of recreational fisheries data. Furthermore, recreational fisheries data could form the basis of the data available for highly data-limited stocks.

## 2 Schematics for inclusion of recreational fisheries data into the assessment process

### 2.1 Identifying issues

Before initiating any data collection, benchmarking, or other advisory procedures for a fish stock, it's essential to have a clear end-user need, often prompted by requirements from entities like the European Commission seeking advice, typically driven by ecological concerns. Once this necessity is established, the outcomes generated through the WGRFS PSA analysis should be scrutinized to ascertain the potential vulnerability of the species to RF. Furthermore, the PSA analysis results must have been consulted before commencing this entire process, ensuring that data collection efforts for the species are started if not already underway. In the event that recreational vulnerability is detected, it becomes imperative to include recreational data in the stock's list of issues. If advice has already been formulated, this inclusion should trigger a data call and benchmarking protocol. Conversely, if advice is not currently available for the stock, the groundwork for a novel assessment should commence. This sequence of steps is succinctly illustrated in the flowchart depicted in Figure 2.1.

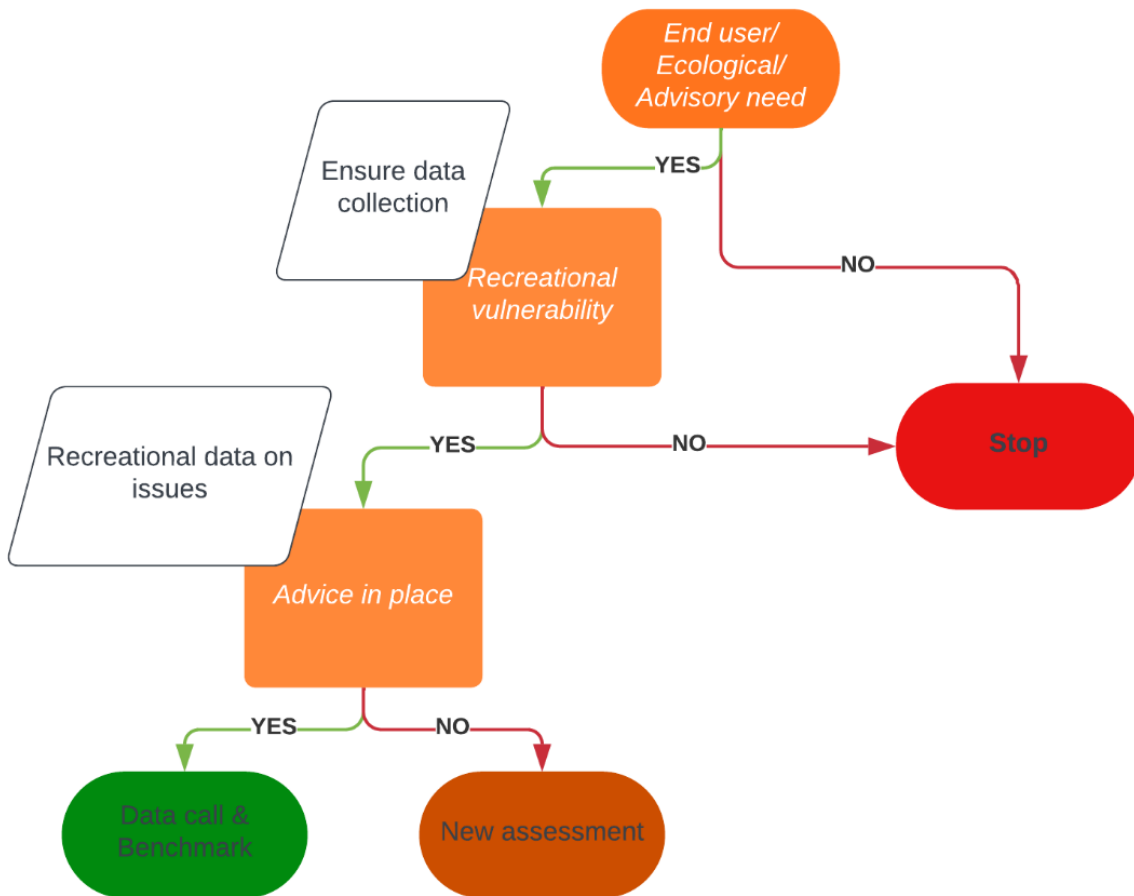


Figure 2.1. The initial steps for including recreational fisheries data into the ICES assessment and advisory process.

## 2.2 Benchmark preparation

Collecting and incorporating recreational fishery data in stock assessment can be very important, if the proportion of recreational catches is relatively large compared to commercial catches. However, no country has a yearly census of catch data from the recreational sector and biological sampling remains sparse. To help improve the evidence base, it may be necessary to prioritize some stocks for data collection, and lay out what data are required for stock assessment. This process needs to be started ahead of a benchmark so inclusion of recreational fisheries in the assessment can be considered, if they are not already in.

Below we describe the different steps of a decision tree, which is presented in Figure 2., on considering the inclusion of recreational data in a stock assessment during the benchmark process.

1. Evaluate the proportion of recreational removals compared to total catch. If it falls below *ca.* 5%, recreational removals are negligible and do not need to be considered further as part of the assessment, but should be highlighted on the advice sheet.
2. Consider if there is a time-series of recreational removals.
  - a) If there is not and one is required, consider options for reconstruction (section 3.3).
  - b) If it is not possible to reconstruct a time-series, it can be difficult to use the recreational data in an analytic stock assessment. However, since the proportion of recreational removals has been identified as non-negligible, this should be reported in the issue list and a recommendation should be given to the RCG on sampling. Further, it can be reported on in the advice sheet.
3. If a catch time-series is included, consider length data.
  - a) If lengths data do not cover the time-series, consider options for reconstruction (section 3.3). Existing length distributions can be used to test if it would be appropriate to borrow length distribution from other sources and extend the time-series, noting that the selectivity of the recreational fleets is however very likely to differ from commercial fleets.
  - b) If it is not possible to reconstruct a time-series of length data, it can be difficult to include the recreational data in the analytic assessment. However, the total removals can be presented on the advice sheet (e.g. catch table information, standard graphs). Further this should also lead to a recommendation in the issue list and for the RCGs.
4. For age data, the scenario is very similar as for length although ages are more rarely sampled in the recreational fishery and will often go through an ALK.
5. As an alternative dataset, and independent of the former, recreational data can be considered as indices of abundance. Recreational removals are usually collected as part of surveys and thus are provided as CPUE-type values that are then raised to get total catch. If these CPUEs are believed to reflect the stock dynamic, then they can be used as such in the assessment (by age or total weight). However, as with commercial fishing, targeting of species by recreational fishers would need to be considered here. As with commercial indices it needs to be evaluated if this would be appropriate as recreational fishers' effort could be dependent on a lot of other variables than the stock development (local regulations, weather etc.). In most stock assessment, 5 years are considered an absolute minimum amount of years to be included in an index.
  - a) Although this is an option, there will be significant challenge in using RF data in this way due to the plethora of factors influencing how many people go out and how much they catch.
6. As per benchmark practice, the model(s) should be tested with diagnostic tools, sensitivity analyses etc.

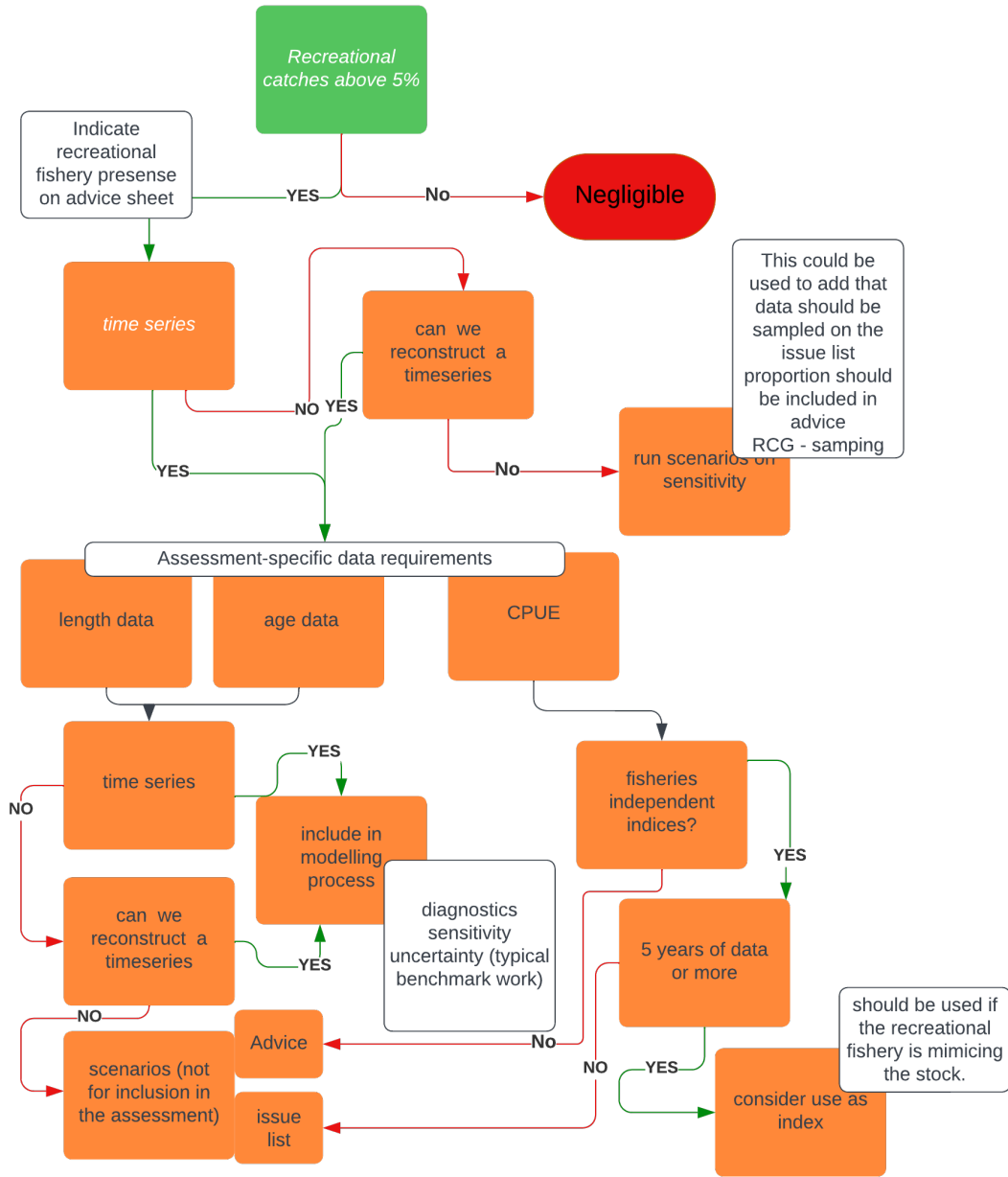


Figure 2.2. The benchmark preparation process for inclusion of recreational fisheries data.

## 2.3 Imputation of recreational data

### 2.3.1 Catch component

Due to challenges associated with gathering recreational release data through specific survey methods, some countries opt not to collect such information. In these instances, the procedure elucidated in Figure 2.3 should be employed to estimate these data. In essence, this approach entails aggregating data from all countries, either by employing an average return rate encompassing all countries or by soliciting expert opinions regarding release rates. Subsequently, the assessment model's responsiveness to these methodologies is assessed, and in cases of incongruence, an assessment relying solely on the retained portion of the catch within the model is conducted. If the data quality and the model responsiveness to recreational data prove satisfactory,

the information should be integrated into the modelling process. Conversely, if the criteria are not met, the data should only be utilized for indicating potential catches within the advisory documentation.

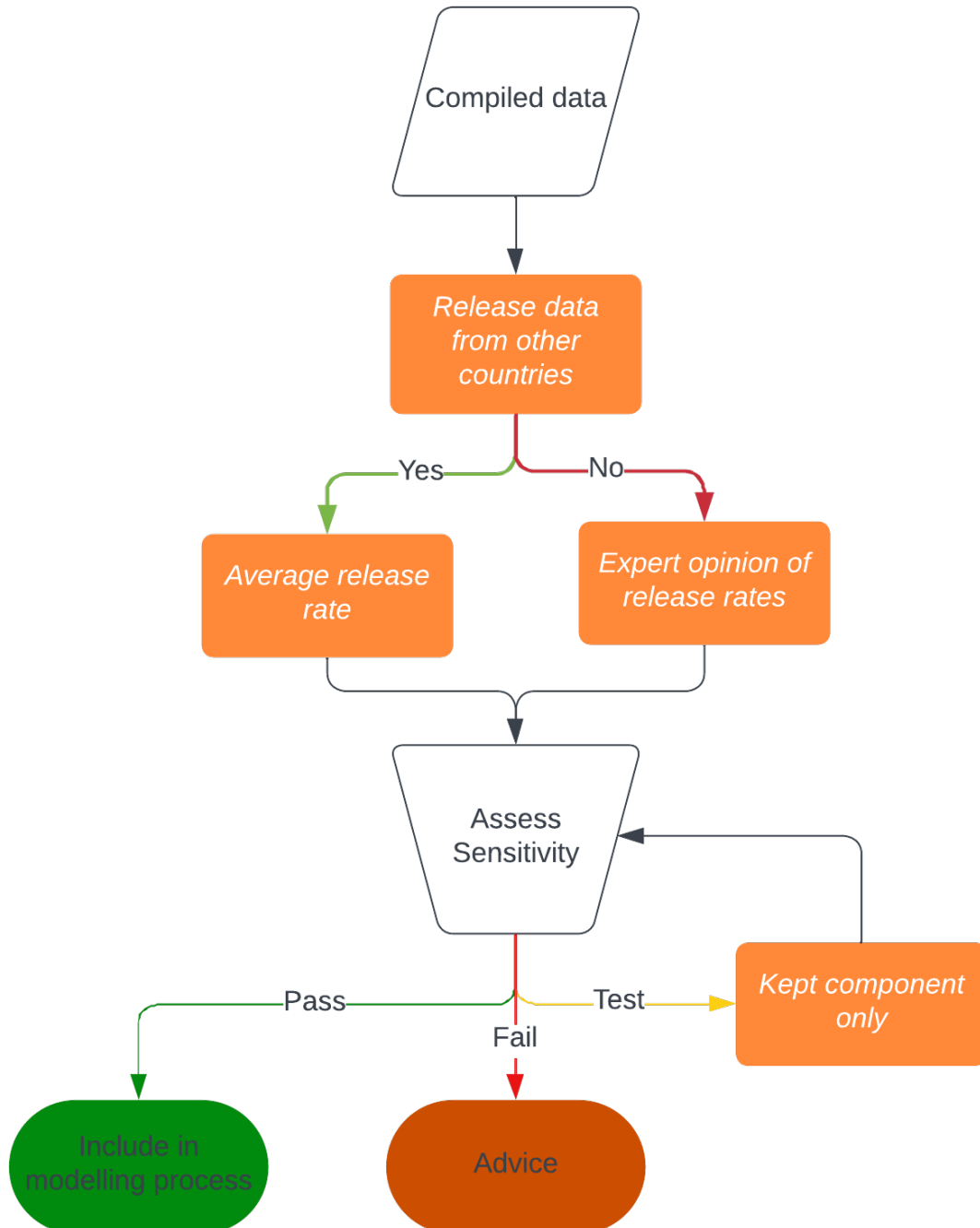


Figure 2.3. The process for imputing the returned component of recreational catches.

### 2.3.2 Length data

Length distributions, particularly for the released component of the catch, can be difficult to collect in recreational fisheries surveys, so are often missing. However, if the model requires these data, there are several options available to impute these data, which are summarized in Figure 2.4. If recreational catch length distributions are available from other countries, then these should be borrowed and used to calculate the number of fish at length. Similarly, if there is a similar commercial fishery to the recreational fisher (e.g. a rod and line fishery), then the length

distribution from this fishery could be used. If no length distributions can be borrowed then the data from other fisheries should be assessed to identify if a cohort signal exists, and if so a model-based solution may be possible to impute the length-distributions. All of these options should be assessed for robustness and model sensitivity prior to inclusion in the modelling process. If there are no options, or the solutions applied are not sufficient then the catches should be reported in the advisory sheet.

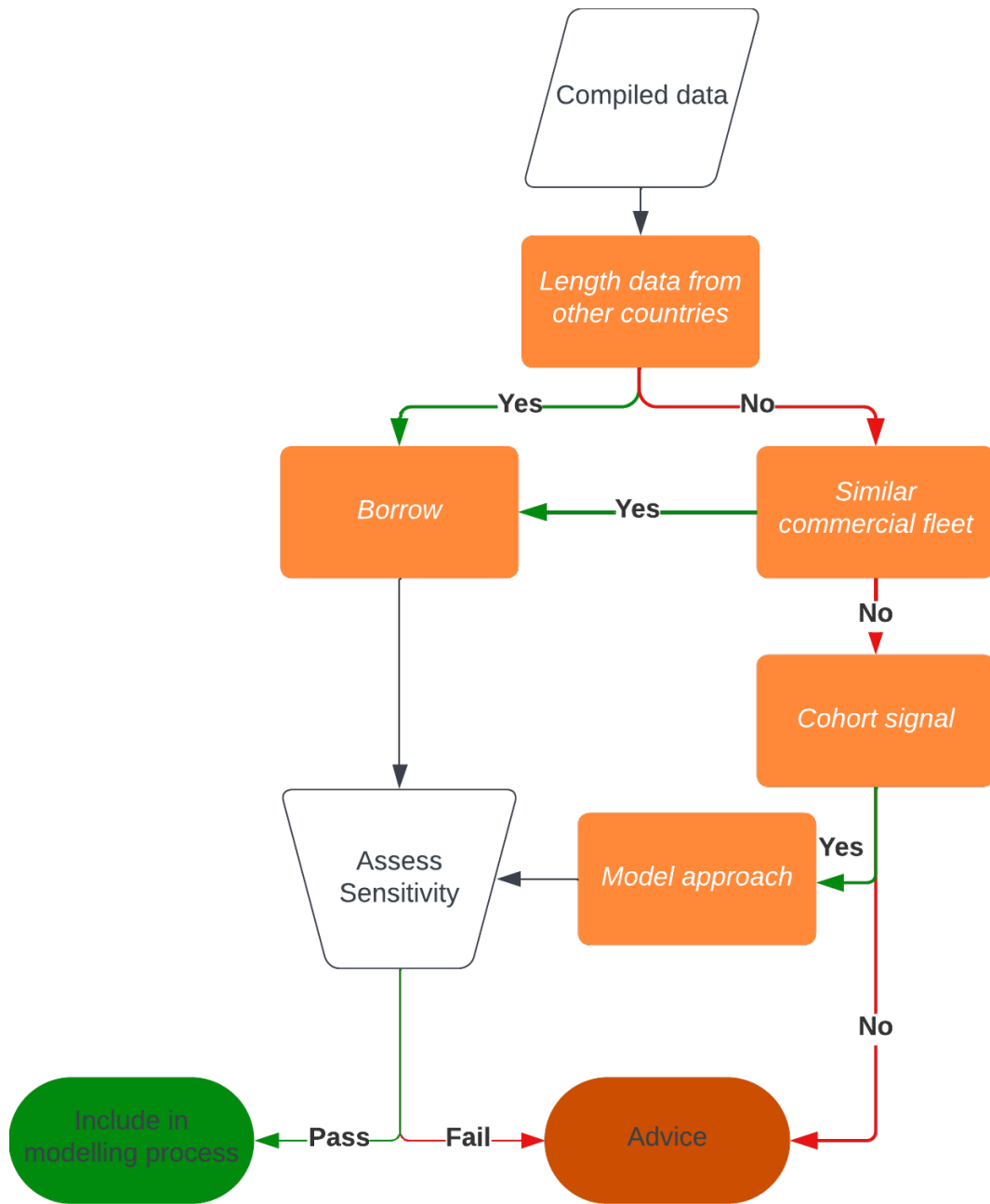


Figure 2.4. The process to impute length distributions for recreational fisheries data.

### 2.3.3 Post-release mortality

While harvest by recreational fisheries (RF) is acknowledged as a source of significant biomass removal, the lethal and sublethal impacts of catch-and-release (C&R) fishing are generally poorly understood. This hampers effective stock management by limiting the incorporation of accurate RF biomass removal into stock assessments and quota allocations. Even when post-release

survival rates are high, the cumulative post-release mortality (PRM), and thus total fishing mortality, of a fish stock can be high, for example, if it is a very small, slow-reproducing stock or recreational fishing effort is high and C&R is a common practice (Coggins *et al.*, 2007; Kerns *et al.*, 2012). In extreme cases, this can result in management measures (e.g. minimum landing sizes) losing their effectiveness and lead to overfishing of the stock, which can limit fishing opportunities in the long term (Coggins *et al.*, 2007; Hessenauer *et al.*, 2018; Kerns *et al.*, 2012). Furthermore, there may be changes in the size and age structure and genetic diversity of a stock, and even changes in a particular ecosystem (Lewin *et al.*, 2019). In addition to the potential lethal effects of C&R, a number of non-lethal effects also exist that may act on the released fish (Davie and Kopf, 2006; Wilson *et al.*, 2014). Examples of such non-lethal effects following C&R include physiological stress responses (Cooke *et al.*, 2013), behavioural changes, and reduced growth or reproductive success (Pinder *et al.*, 2017; Siepker *et al.*, 2006).

It is known that the impact on fishes subjected to C&R depends on many factors, including: fish biology and physiology, environment and context, fishing techniques, and the angler's behaviour, attitudes and practices. Since the last seminal reviews (ca 2005-2007 and 2010-2011 for freshwater fishes; Bartholomew and Bohnsack, 2005; Hühn *et al.*, 2011) of C&R impacts, interest in assessing the impact and factors associated with C&R has grown exponentially. Recent studies have expanded the list of species and factors assessed, as well as the experimental methods used to assess impacts. To address the lack of an up-to-date review of lethal and sublethal impacts of C&R in recreational fisheries, a project funded by the Centre for Environment, Fisheries, and Aquaculture Science (UK) has been recently launched. The proposed methodology for the project was presented to the WKRFSA for critique and input. The project encompasses two major studies. The first study will build on the methods of previous C&R literature assessments to undertake a global systematic review of trends and factors associated with lethal and sublethal impacts of C&R across taxa, gears, techniques, fisheries and environmental conditions. It will include peer-reviewed and grey literature using structured and reproducible database searches. Following this, it will undertake a quality assessment of C&R studies to date using the ICES WGMEDS critical review framework for discard studies (ICES, 2019b). This work is expected to provide the most comprehensive synthesis of C&R research to date, and will provide a much-needed database of quality-weighted PRM estimates for various species, fisheries and environments.

Using the quality-weighted database of PRM estimates compiled in the initial review, the second study intends to build a model for estimating PRM in data-limited fisheries and species. The model will incorporate the significant factors identified to influence C&R mortality by species, family or life-history traits. The outcome of this would be a user-friendly, open-access management tool through which several variables can be selected to evaluate the potential PRM associated with any C&R recreational fishery. The predicted mortality estimates will be bounded and weighted depending on the quality and quantity of the primary review data. Based on input from the WKRFSA meeting, it was agreed that this model could take the form of either a simple structured decision tree or perhaps a more complex model with better predictive power using a random forest or a Bayesian belief network, depending on the quality and extent of the data compiled from existing studies. This tool is intended to provide best available estimates of PRM associated with C&R in recreational fisheries, and thereby improve the ability of stock assessments to effectively account for the total biomass removal of recreational fishing in data-limited situations.



### 2.3.4 Age data

When the collection of RF data lacks otolith retrieval and/or reading, it might become necessary to reconstruct age matrices of the catches. This is particularly relevant to direct inclusion in stock assessments that employ age-structured models.

In cases where biometric features, primarily lengths, of the recreational removals or catches are available, there is a possibility of converting these lengths into ages. This conversion is typically carried out using the von Bertalanffy growth function, which describes the relationship between length and age. This approach is known as Age-length Keys (ALKs). However, to ensure the accuracy of the conversion factor and its alignment with the stock, certain conditions need to be met.

ALKs can be derived from data obtained through fisheries-dependent or fisheries-independent sources. For their reliable use in this context, it is important that these ALKs have been calculated from otolith readings of catches that spatially overlap with the RF activities. This alignment ensures that the RF removals and the conversion factor are both applied to the same stock, which is a reasonable assumption.

In summary, when otolith retrieval and reading are absent from RF data collection, the conversion of lengths into ages using ALKs can be a viable alternative, but it's crucial to ensure that the underlying conditions are met for accurate and consistent stock assessment.

### 2.3.5 Catch time-series

The availability of two options hinges on the stock assessment model employed. Certain models facilitate missing value imputation within the model itself, while others lack this feature. Consequently, this section is divided into the options accessible when within-model imputation is feasible and when it is not.

#### 2.3.5.1 Within model approaches

When within-model imputation options are available, two potential approaches can be considered: incorporating a truncated time-series and allowing missing value imputation within the model. However, if these options are not viable, the stock assessor should contemplate the possibility of applying a constant recreational fishing  $F$  with scaling or incorporating auxiliary data. As with any form of reconstruction, it's essential to rigorously assess the model's sensitivity to the underlying assumptions before determining whether the recreational fishing data should be integrated into the modelling or advisory procedures. A visual representation of this process can be found in the flowchart depicted in Figure 2.5.

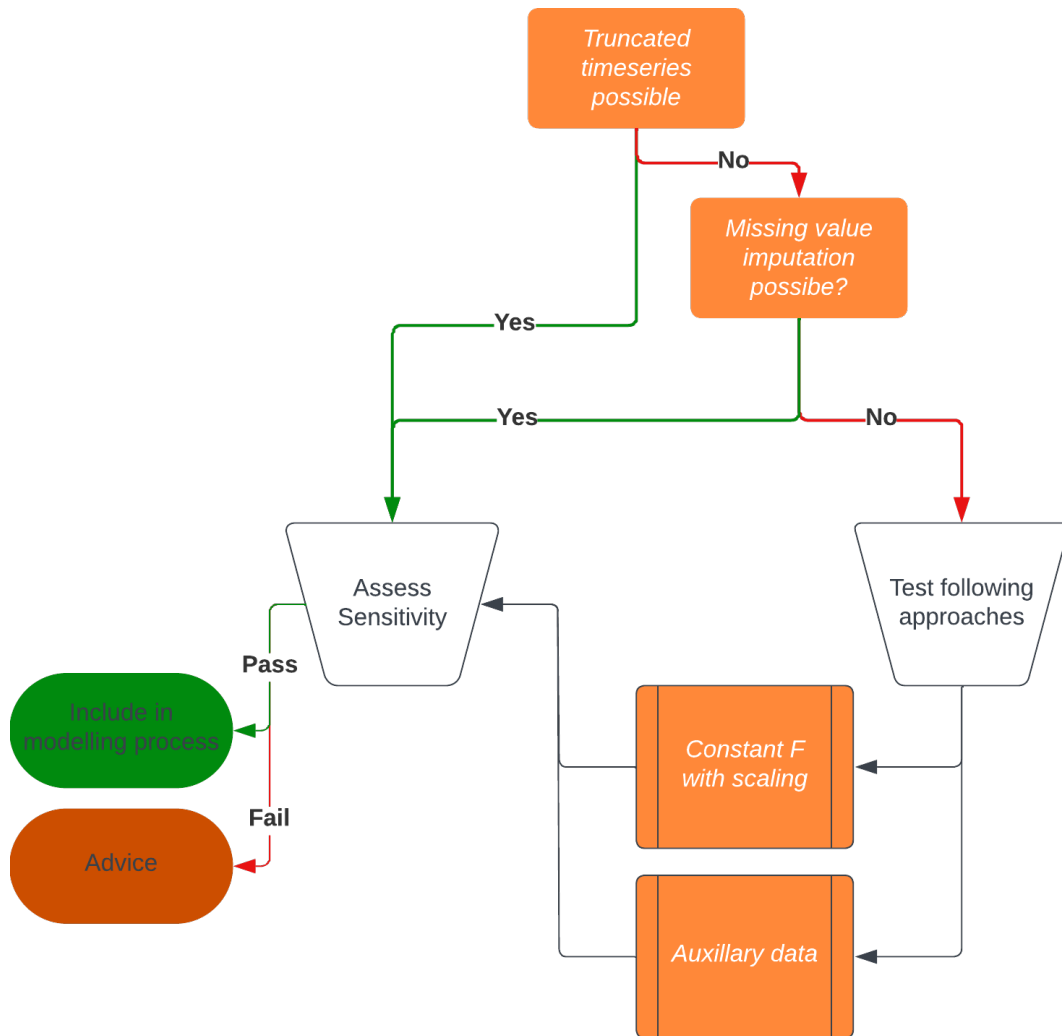


Figure 2.5. The missing catch time-series reconstruction methods when within-model approaches are available.

### 2.3.5.2 Outside the model

In cases where assessment models do not support within-model reconstruction, several alternatives are available, as outlined in Figure 2.6. The initial method to explore involves investigating whether a historical measure of effort or a proxy for catches can be utilized to reconstruct the missing catch data within the respective region. This could involve leveraging data such as license sales. In the absence of such data, historical catch per unit effort from other countries should be examined. The options for this approach vary based on the length of the time-series.

When only a single year of catches is available across all countries, employing a constant catch value or a constant catch value scaled proportionally to the stock size could be considered. Alternatively, if a continuous time-series has been collected in one country, but only limited years of data are available from other countries exploiting the stock, these catch data could serve as an index for reconstructing recreational catches over time. This involves estimating an average catch ratio in the country with a complete time-series compared to countries with shorter time-series, and applying this ratio to the remaining time-series. For an example, see the north sea cod benchmark (ICES, 2023a).

In cases where resources and expertise permit, a Bayesian-state-space 'JARA' model could be applied for data reconstruction. For 'patchy' time-series, linear interpolation and a JARA model are viable options for data reconstruction.

As with any form of data reconstruction, it is imperative to thoroughly assess the sensitivity of the assessment model to the reconstruction assumptions and uncertainties, as well as the quality of the data itself. This evaluation will aid in determining whether the reconstructed data should be integrated into the modelling process or exclusively included in the advisory capacity.

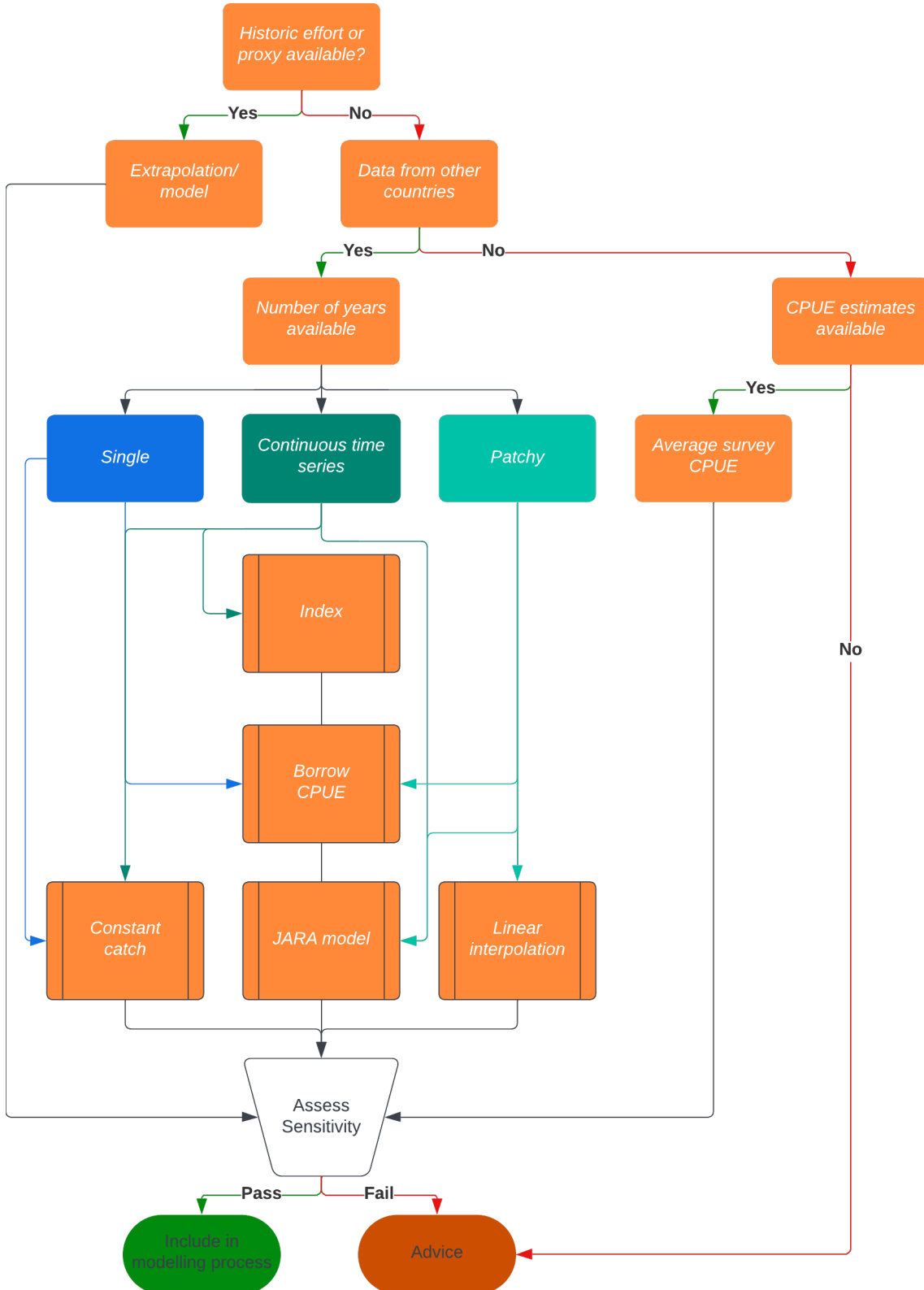


Figure 2.6. The process for reconstructing recreational removal estimates over time outside the model.

## 2.4 Assessment sensitivity

There are several diagnostics, sensitivity analyses, and considerations for including RF in stock assessments. The quality of RF data should be evaluated (e.g. checking for artefacts that may arise from the sampling or raising schemes, considering RF coverage across time and space) and accounted for in the assessment model where applicable (e.g. via increased error). Where possible, it would be ideal to conduct sensitivity analyses to different raising schemes, to determine the influence of decisions made during RF data processing on assessment outcomes.

Where an assessment already exists for a stock, a sensitivity to the inclusion of RF should be conducted and any stock summaries and diagnostics relevant to that assessment model compared to those from the existing assessment without RF. Where relevant, checks should consider model convergence, that diagnostics still meet any criteria for acceptance of the assessment, improvement or deterioration of diagnostics, and any changes to the perception of the stock.

When constructing a new assessment based on recreational data (e.g. for a stock that is currently unassessed), it may be necessary to obtain life-history parameters and biology from the recreational data or elsewhere. Where there is uncertainty in the biology of the species, sensitivity analysis should be conducted to understand the effects of this uncertainty on assessment outcomes. Any new assessment should meet the criteria for acceptance relevant to the modelling framework employed.

In both cases, the RF data needs to be considered in relation to any underlying assumptions of the model. For example, some models implicitly assume asymptotic selection which may or may not be appropriate. Depending on the assessment modelling framework, consideration may need to be given to how RF are included in the assessment (e.g. as a catch fleet or a CPUE index). Finally, and particularly for RF focused assessments, the objective of the assessment must be considered to determine an appropriate modelling framework (e.g. catch advice, stock status assessment or monitoring trends).

## 2.5 Recreational fishery focused assessments

Where RF is the primary pressure on a stock, it may be necessary to assess its status using only the data collected through this fishery.

In a data-rich scenario, i.e. where long time-series of removals and/or length–frequency distribution (LFD) and survey data are available, it is possible to proceed with standard stock assessment methods. In a data-limited scenario however, where short time-series of catches and/or LFDs are the only source of information, it may still be possible to obtain direct or indirect indications on the status of a stock.

For example, if LFDs representative of the RF activity are available, and life-history characteristics such as growth rates, maximum size and length at maturity, and length at first capture of the target species are known, several length-based methods could be applied (e.g. Froese *et al.*, 2018; Hordyk *et al.*, 2015). However, these approaches rely on many assumptions, so confidence in the approach and the relevance of the assumptions in the context of the data available should be assessed to ensure robustness. Further, in situations where data are limited, ICES technical guidance for harvest control rules and stock assessments for stocks in categories 2 and 3 and associated literature should be consulted (Fischer *et al.*, 2020, 2022)

In combination with formal models, empirical approaches can be pursued evaluate the health of fish stocks and determine appropriate management measures. They generally consist of the analysis of trends in time-series of different indicators (e.g. average length of catches, 95<sup>th</sup> percentile of largest individuals, analysis of CPUEs, etc.), with respect to threshold values. In addition, if

tagging activity results are available, and if they are coupled with models (e.g. Brownie model), empirical indicators could also provide biomass estimates.

## 2.6 Data quality

Three primary metrics warrant examination when assessing the quality of recreational survey data: survey bias, survey error, and the extent of reconstructed catches incorporated into the model (Figure 2.7). Foremost among these concerns for stock assessors is the presence of bias within the survey. Notably large positive or negative biases in estimates raise greater concerns than survey errors. Irrespective of survey errors and the proportion of reconstructed catches relative to the total, if the survey bias, as evaluated by WGRFS, is pronounced, it is advisable to limit the presentation of catches solely to the advisory sheet.

Likewise, in instances where recreational catch surveys lack robustness (e.g. elevated relative standard errors) or if the conducted reconstruction exhibits fragility (e.g. the proportion of total catch reconstructed surpasses 60% or relies on implausible assumptions), it is prudent to omit the catches from the modelling process. The focus should remain on maintaining rigor and accuracy in the assessment, considering these factors before determining the inclusion of such data.

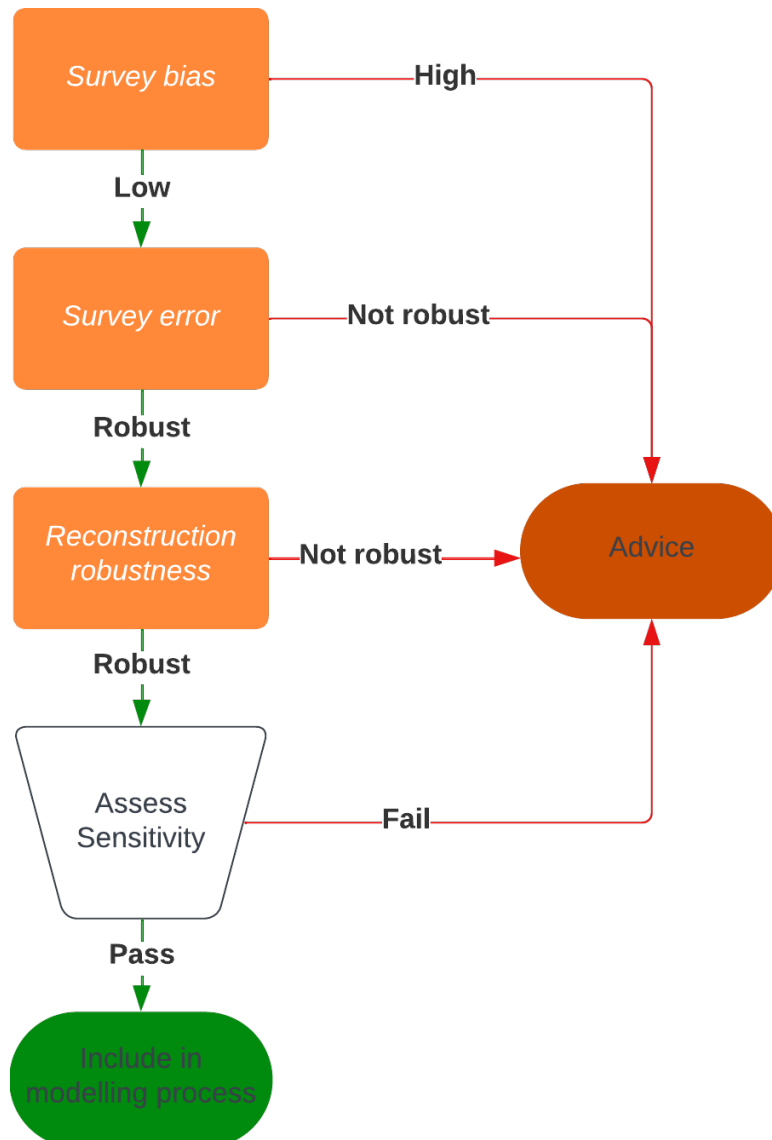


Figure 2.7. The process for assessing the quality of recreational fisheries data in the stock assessment process.

### 3 Reflecting on the key blockers to inclusion of recreational fishing data in stock assessments, where the workshop has and has not addressed the issues present

The issues preventing inclusion of RF data into stock assessments were split into four sections: challenges associated with inclusion; opportunities that inclusion of RF data provide; needs for inclusion of RF data; and next steps (see Figure 3.1 for all subjects captured within this discussion, and if they were addressed or not during the meeting). From the challenges put forward, four key themes were identified. The most cited challenges surrounded data collection, reflecting the often limited and varied data collection conducted both within and between stocks. For example, each nation may opt to conduct recreational catch surveys using a different survey method, making combining the catch estimates difficult. Furthermore, data essential to some stock assessment models, such as age and length data, are not collected for all or part of the catch. These data issues lead to the second challenge identified: data inclusion, whereby stock assessors are unsure as to how RF data can be used in the assessments as there are gaps in both space and time (missing countries and missing years). These issues mean that the opportunity to reliably include RF data in stock assessments is limited, as there is considerable resource required to process the data and make it compatible with stock assessments. This workshop helped address the challenges surrounding how to deal with different data collection methods and how to process the data for inclusion in assessments through provision of a framework for RSF data collectors and stock assessors to follow. While improving understanding of data issues and opportunities has been progressed through development of proposed frameworks during this meeting (Section 2) significant resourcing is needed to implement processes and develop approaches for inclusion in stock assessment and advice.

Despite the issues identified, there are opportunities available should RF data be included in stock assessments. One of the main improvements would be to the scientific advice ICES would be able to provide, as the additional source of fishing mortality would be accounted for in assessments, and recreational-specific TACs and management could be better informed. Furthermore, producing advice including RF would facilitate better communication around the importance of RF. Finally, as a recreational mortality can be analytically estimated, researchers could gain a better understanding of the social and economic value of RF. Within the workshop several opportunities were presented to aid the communication around RF data, such as giving a short presentation to WGCHAIRS on recreational fisheries. Furthermore, through the prioritization exercise underway by WGRFS described in Section 1.2, there is the opportunity to improve the knowledge of the type of stocks that would benefit from inclusion of RF data into the assessment process.

Whereas there were discussions on the opportunities for including RF advice in assessments, how the advice should be presented was outside the scope of this workshop. Thus, guidance from ACOM is required to outline how RF advice should appear in assessment advisory outputs. Furthermore, the opportunity to improve the social and economic understanding of RF was outside the scope of this workshop.

To overcome the challenges and reach the opportunities discussed, several requirements were identified. These included: better communication around RF data availability and how to use it; better data quality and transparency; more co-design of data-collection between stakeholders,

scientists, organizations and regional/international jurisdictions; where appropriate processes for allocation of TAC; and funding to develop the methods for inclusion of RF data and allocation of resources.

As described above, the need to improve communication was highlighted alongside some suggestions for approaches. Furthermore, means of partially resolving data-quality and transparency issues with RF data were addressed through the production of the framework presented in Section 2. Additional work is required however on a per-assessment basis, to addresses issues related to RF data-quality and transparency. Although TAC-allocation decisions and funding for conducting the work required to include RF data into the stock assessment process were discussed, this was considered outside the scope of the workshop. Finally, the need to co-design RF approaches with stakeholders was highlighted, but was again outside the scope of the workshop.

The next steps required to develop the opportunities and overcome the challenges associated with inclusion of RF data into the stock assessment process should be:

- development of a framework to aid stock assessors and recreational data collectors to include RSF data into the assessment process;
- create a method for prioritizing stocks to include recreational data;
- initiate better communication around the availability and how to include RF data;
- create a team within WGRFS to identify future RF data needs to achieve inclusion in the assessment process;
- allocate different responsibilities to working groups, for example preparation of RF data for stock assessments could be allocated to WGRFS.

The need to prioritize stocks for working up RSF data into assessments is currently being addressed by the WGRFS's PSA. Further, the present workshop presents an initial framework for incusing RF data into the assessment/advice cycle, including when to/not to include RF data and how to extrapolate data where appropriate. The workshop participants suggested that, due to the specialised nature of working with RF data, an additional responsibility similar to that of stock coordinator should be considered for recreational-specific data. Further work outside is required to build upon this workshop and the communication required to aid the inclusion of RF data into assessment processes as well as develop the future requirements (e.g. post-release mortality data).

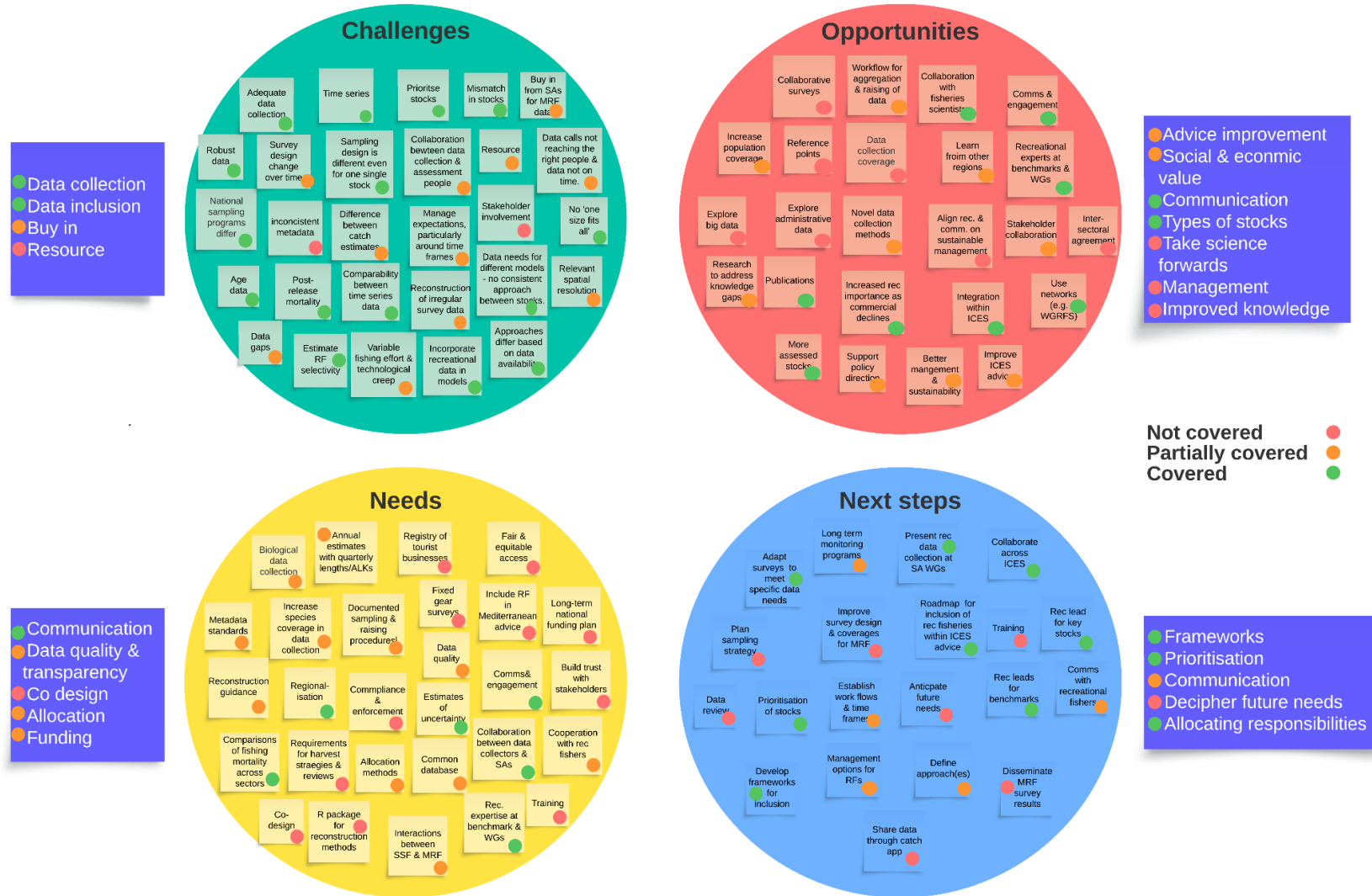


Figure 3.1. Challenges, opportunities, needs, and next steps for inclusion of RF in the assessment process. Sticky notes in the circles are the outcomes from the initial brainstorm, which were synthesised into common themes in the blue boxes. These were revisited at the end of the workshop to assessed which of the issues had been covered either fully or partially, or not covered at all.



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## Annex 2: Resolutions

**Approved at resolutions meeting on 9 November 2022**

**Moved from DSTSG to FRSG as suggested by ACOM**

### WKRFSA – Workshop on Recreational Fisheries in Stock Assessments

2022/2/FRSG51 The **Workshop on Recreational Fisheries in Stock Assessments** (WKRFSA), chaired by Zachary Radford\*, UK, and Martina Scanu\*, Italy, will be established and meet in Sukarrieta, Spain 3–5 July 2023 to:

- a) Identify key issues preventing the inclusion of recreational fisheries in advisory and stock assessment processes ([Science Plan codes](#): 5.1);
- b) Create a decision tree for the inclusion of recreational fisheries in the advisory and stock assessment processes ([Science Plan codes](#): 5.1 and 3.1);
- c) Develop agreed criteria for the inclusion of recreational data based on the data quality and the contribution of recreational fisheries to the total catch for a given stock ([Science Plan codes](#): 3.1).

ToRs b) and c) will consider the [Data Profiling](#) tool developed by ICES. WKRFSA will report by 18 August 2023 for the attention of SCICOM, ACOM, FRSG, and WGRFS.

### Supporting information

Priority	The activities of this workshop will aid the inclusion of recreational fisheries data into the stock assessments and advisory process. Currently, recreational fishing mortalities are not explicitly accounted for in many stock assessment processes nor are covered in ICES advice. This is becoming increasingly important due to the recognition of recreational fisheries impacts on specific stocks, increasing availability of recreational survey data, and increasing pressure from the angling community. As such, this workshop is considered both timely and to have a high priority.
Scientific justification	<p>Many countries are quantifying catches by marine recreational fisheries (MRF) as required under the EU-MAP. A review by Radford <i>et al.</i> (2018)<sup>1</sup> estimated that between 2 and 43% of total removals could be from MRF. However, only a small number of stocks have MRF data included in the assessment process (e.g. sea bass, western Baltic cod, North Sea, Irish Sea cod), generally due to issues with data availability, uncertain levels of recreational catch, and/or challenges with inclusion in the assessment methods. As a result, recreational fisheries mortality is not accounted for explicitly in many stock assessments. MRF survey data are increasingly available, providing an opportunity for better inclusion in stock assessment and advice.</p> <p>The Working Group on Recreational Fisheries Surveys (WGRFS) has started to develop approaches to prioritize stocks where recreational catches are important and should be included in stock assessments and advisory processes. There are many different approaches for inclusion in the advisory process (e.g. North Sea cod) or inclusion of data in assessment models (e.g. sea bass, western Baltic cod). Hence, a consistent and robust approach is needed that is co-developed by experts in recreational fisheries and stock assessment.</p>

<sup>1</sup> Radford, *et al.* (2018). The impact of marine recreational fishing on key fish stocks in European waters. PLoS ONE. 13. e0201666. 10.1371/journal.pone.0201666

	<p>To facilitate this a decision-tree will be developed covering the different approaches for inclusion in the advisory process and, where possible, in the stock assessment models. This should account for the importance of MRF relative to commercial fisheries and quality of the MRF data available.</p> <p>ToRs b) and c) will consider the data profiling tool developed by ICES<sup>2</sup>. Final inclusion of recreational catches in stock assessment should be considered and agreed at relevant benchmark processes.</p>
Resource requirements	The research and data collection programmes that will provide the main inputs to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible.
Participants	The workshop will be attended by 20–25 individuals from the ICES recreational fisheries, advisory, and stock assessment communities and, where relevant, academics and other stakeholders.
Secretariat facilities	None beyond sharepoint facilities and editorial support for the report.
Financial	No financial implications.
Linkages to advisory and science committees	ACOM, SCICOM.
Linkages to other groups	It is also very relevant to the WGRFS, FRSG, DSTSG, and most of the assessment working groups (e.g. WGCSE, WGNSSK, WGBIE, WGBFAS, AFWG).
Linkages to other organizations	The work of this group is closely aligned with similar work in GFCM.

<sup>2</sup> <https://www.ices.dk/data/tools/Pages/Data-profiler.aspx>

## Annex 3: Future tasks identified by WKRFSA

Five key tasks for future development to facilitate inclusion of RF data into stock assessments blockers emerged within the WKRFSA, which have been justified within the report text. Two of the tasks are for ICES as an organization to both provide support for building capacity for development of methods for developing inclusion of RF data in to stock assessments, and to consider adding an RF data coordinator to the stock roles due to the bespoke issues and knowledge around availability with RF data that are not compatible with the traditional stock data coordinator role.

Furthermore the WKRFSA identified and put forward two tasks to the WGRFS, the first being to contact and communicate with assessment working groups to outline the RF data available to ensure it is used and data calls are providing RF data. In addition, the WGRFS needs to produce a list of stocks to prioritize through the productivity-susceptibility analysis described in the report text.

The final task identified is for ACOM as a need for guidance and a standardized process for producing RF specific advice is required where the data are included in the stock assessment model (e.g. should a recreational TAC be produced, does the commercial and recreational F been to be separated or combined), and where RF removals are only included in the advice.