Report of the Working Group on Recreational Fisheries Surveys (WGRFS)

7 – 11 May 2012

Esporles, Spain

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Executive summary

The Planning Group on Recreational Fisheries Surveys (PGRFS) has been renamed Working Group on Recreational Fisheries Surveys (WGRFS). The inaugural meeting was hosted by IMEDEA, Esporles, Spain 7–11 May 2012.

A key objective for WGRFS is to supply recreational fishery data and estimates into the ICES stock assessment and advisory process, operating within the ICES Quality Assurance Framework and responding to the requirements of the EU Data Collection Framework (DCF) and other drivers. As such, WGRFS is a forum for the planning and coordination of recreational fisheries data collection and analysis, and for sharing knowledge and discussing new ideas. The WG builds extensively on experiences gained within and beyond the EU, and participants in 2012 came from most European member states (12), as well as, Norway, USA and Australia. Altogether 27 participants contributed to the meeting, including two representatives of European sea angling stakeholder groups.

The first part of the WGRFS meeting reviewed progress in implementing recreational fishery surveys within Europe, including results of existing survey series and the design of new ones. A group consensus was reached that the detailed national reports, including survey design and ongoing results, will be compiled in a stand–alone, annually updated report maintained on the WGRFS SharePoint site. The main WGRFS report will contain brief summaries of survey methods, coverage and catch estimates for key species, in tabular form (Section 4).

The WGRFS considered the future potential uses of recreational fishery survey data and how they impact data collection, in relation to a request from the European Commission for feedback on the restructuring and planning process for the new EU 2014–2020 Multi–annual Program (EU DCMAP) for Data Collection (Section 3.5). The WG noted the need for: agreement at a regional scale on end–user needs for recreational fishery data; the setting of precision targets at the overall stock level; documentation of bias in data collection and estimates; the recommendation of new species for which recreational removals have a significant impact on the resources; and flexibility to allow for differences between countries in the types of surveys that are appropriate or possible. The WG also highlighted the importance of collecting data for evaluating the economic and social value of recreational sea fishing. WGRFS made substantial progress this year in developing a scorecard system to evaluate the quality of recreational catch estimates, covering all stages from the design and implementation of national surveys through to the quality of the international combined estimates (Section 3.2). The scorecards will be tested on recreational data for Baltic cod and European sea bass prior to the benchmark assessments for these stocks later in 2012, and the outcomes will be reviewed at WGRFS 2013 where further development of the scorecard will take place.

Two experts invited to WGRFS provided a mini–review on catch and release mortality and associated methods, including containment experiments, mark–recapture studies and use of biotelemetry (Section 3.3). A comprehensive review on catch and release and the potential associated release mortality will be presented in a paper at the 2012 ICES ASC in Bergen, for which a preliminary abstract was provided to WGRFS (Annex 6).

A session of the WGRFS meeting explored the critical importance of ensuring the most effective engagement with stakeholders when setting up and running recreational fishery surveys. Experiences from the USA, Australia and UK were presented to highlight specific difficulties encountered and how they have been resolved through different processes of communication (Section 3.4).

1   Opening of the meeting

The WGRFS meeting took place from 7–11 May 2012, at IMEDEA laboratory in Esporles (Palma de Mallorca, Spain). The meeting participants are listed in Annex 1.

2   Adoption of the agenda

The agenda outlined in Annex 2 was amended to allow time for WGRFS to develop recommendations for the new EU DCMAP 2014–2020, which will replace the existing Data Collection Framework. Due to this additional work, the ToR *c) Provide a mini glossary on recreational fishing terminology* for the 2012 WGRFS meeting was deferred to the 2013 meeting.

3   Report of the 2012 Meeting

3.1   Terms of Reference (ToRs)

The ToRs for the 2012 WGRFS meeting were as follows:

a) Develop and implement a scorecard system (see for example: WKACCU – Workshop on Methods to Evaluate and Estimate the Accuracy and Bias) in order to evaluate country survey programs.

b) Provide a mini–review on catch and release mortality (with a method replicable for different species.

c) Provide a mini glossary on recreational fishing terminology.

d) Address relationships between scientists and stakeholders (recreational fisheries associations, commercial world, regulatory administrations in charge of recreational fishing).

e) Discuss the use of the data provided.

Terms of Reference (a), (b) and (e), plus the additional discussions on the new EU Map 2014–2020, were addressed through plenary sessions, whilst ToR (a) was completed through a mixture of plenaries and break–out groups. ToR (c) was deferred until the 2013 WGRFS meeting.

3.2   Scorecard for the Evaluation of the Quality of Recreational Fishing Data for Use in Stock Assessment (ToR a)

3.2.1   Purpose and scope of the scorecard

This Section addresses Term of Reference (a) for WGRFS 2012: *"Develop and implement a score card system (see for example: WKACCU – Workshop on Methods to Evaluate and Estimate the Accuracy and Bias) in order to evaluate country survey programs."* This ToR is to help bring recreational fishery data, where used by ICES in developing stock assessments and fishery management advice, within the ICES Quality Assurance (QA) Framework. It is anticipated that WGRFS will have a key role in delivering quality–assured recreational fishery data such as catch, harvest and/or releases in numbers

(or weight) to ICES assessment WGs, STECF or other stakeholders, and will use the proposed framework for documenting and archiving data quality.

The overall aim of this Section is to develop a logical, hierarchical framework for documenting the accuracy of recreational fishery catch estimates combined over countries for individual fish stocks, and for tracing the source and type of errors at each stage from the design and implementation of national surveys through to the compilation of international estimates.

Two components of accuracy are considered:

- Precision of estimates (e.g. Relative Standard Errors, RSE) related to sampling design and sampling intensity (numbers of Primary Sample Unit (PSU) sampled).
- Bias arising typically from incomplete coverage of the population, non–representative sample selection, tendency in respondent reply (e.g. overestimating effort), systematic errors in data recording etc.

The proposed QA scorecard framework for recreational fishery data includes documentation of precision, which is needed to explore how an agreed target precision for a stock could be achieved by adjusting the sampling intensity (number of PSUs) within individual national surveys. However the main aim of the framework is to evaluate the nature and source of bias, which in general is harder to quantify than precision. In recreational fishery data, bias can be more important than the precision (*cf.* Connelly and Brown, 1995; Tarrant *et al.*, 1993; Vaske *et al.*, 2003).

3.2.2 Types of bias

Bias can be ascribed to each of three stages in the process of estimating recreational fishery catch, harvest or release, i.e. *(i) survey design, (ii) implementation* and *(iii) analysis.*

Bias associated with *survey design* is related to the survey coverage and the methods for selecting primary sampling units. A bias could occur if certain segments of the fishery are unaccounted for (e.g. charter boats, shore fishing, private marinas, night–time fishing, tourists) in the total estimate. Moreover, the sample selection procedure can also lead to a bias if those recreational fishers or trips surveyed are not representative of the whole population or a stratum (e.g. more avid anglers are selected). Bias can also be generated through the process in which a subsample estimate is raised to an entire population estimate. An example could be if a subsample of fishers involved in a licensed fishery are sampled and then raised to the number of licenses issued without taking into account those fishing without a valid license, although this fraction can have an effect on the final catch estimate (Sparrevohn and Storr–Paulsen, 2012). In the special cases of census sampling, such as the Swedish Sound charter boat fishery, the *survey design* will not result in sampling bias if the census succeeds in fully covering the population.

Bias associated with the *implementation* phase is a failure to meet an intended survey design, leading to non–representative sampling of the population. It can be connected with the people conducting the survey and/or the people being sampled. For example, on–site surveys may fail to implement a randomized scheme and preferentially sample popular sites or anglers who are seen catching fish. Alternatively respondents in an off–site mail/telephone survey or an on–site survey, when asked to recall previous catches or effort, might have a predominant tendency towards over or underestimation, i.e. a recall bias. Examples of recall bias, where respondents have

generally overestimated their fishing effort when asked to recall fishing patterns for a longer period, are given by Tarrant *et al*. (1993); Connelly and Brown (1995) and Vaske *et al.* (2003). However, this is not always the case (Connelly and Brown, 2011), which exemplifies that anglers and recreational fishers in general are heterogeneous groups (Arlinghaus *et al.,* 2008; Johnston *et al.,* 2010). Among other biases that should be mentioned are digit preference where the respondent will have a tendency for rounding figures to 0 or 5, a tendency that typically will increase with increasing re-calling period (Huttenlocher *et al.,* 1990; Tarrant and Manfredo, 1993). Further, in surveys designed such that respondents are either recalling a catch or reporting it themselves, there is a risk that prestige bias (where fish size or numbers are exaggerated) will occur or deliberated false information are given.

Bias can also arise at the *analysis* stage. This can typically occur where the stratification schemes, sample probabilities and cluster sampling effects are not taken into account during the analysis. Incorrect calculation of weighting factors or inappropriate use of model–based estimators and statistical procedures may also contribute to bias. These biases can be difficult to trace as they will in most cases be a result of faulty analyses completed at a national level and hence not evident to WGRFS.

3.2.3   The scorecard approach

The bias in each of the processes will be evaluated using a scorecard system similar to the one initially developed in WKACCU (ICES, 2008). A drawback using a qualitative method such as a scorecard system is that combining different scorecard traffic colours into one measurement (e.g. another colour) is problematic. There are many steps leading to the total international catch estimates for a stock, as provided to a stock assessment working group. Such groups, and funders such as the Commission, are interested in a relatively high–level overview of data quality, particularly the precision, potential level and direction of bias, how quality has changed over time, and how quality varies between countries providing data. Scorecard entries at this level will however be the endpoint of many stages of design, implementation and analysis, through which bias will propagate. The scorecard system proposed by WGRFS will accordingly be a nested series of scorecards that identify precision and bias at each level, providing effectively a full audit trail of data quality.

The process of developing and testing this system will take time and will be reviewed in upcoming WGRFS meetings. An opportunity however arises in 2012 to trial aspects of the scorecard system at benchmark stock assessments of Baltic cod and European sea bass, both stocks with recreational fishery catch estimates (time-series for cod; one year for bass). WGRFS will also benefit from recommendations by the 2012 Workshop on Practical Implementation of Catch Sampling Schemes (WKPICS2), which will also consider how to develop the scorecard system further for commercial fishery sampling. These experiences will be reviewed at WGRFS 2013 and the scorecard system updated as appropriate based on the learning from the two case studies.

3.2.4   Overall structure of the scorecard system

To achieve the assessment of quality we propose a nested scheme with four levels (Figure 1):

1) **Stock:** The international combined estimate (a value) and component national (country) estimates of recreational catch, harvest and/or release of the stock. Entries are compiled by year and presented together with the Relative Standard Error (RSE) and the potential bias (scorecard colour).

2) **Country:** Estimate for an individual country (a value), presented in a similar format as for the Stock level but for each fishery "subpopulation" for which estimates are available (e.g. charter boats; shore fishing; fixed gears). Entries are annual recreational catch, harvest and/or release for each subpopulation sampled within a country. The subpopulation is defined in the survey and will in most cases – but not all – represent a fishing sector.

3) **Subpopulation:** The scorecard results (a colour) for the surveys of a subpopulation (e.g. effort, CPUE, catch or biology surveys – on–site and/or off–site) done at a national level. A description of each survey will be presented in a tabular form in order to provide an overview of potential gaps in the sampling (e.g. if a subpopulation of fishers are not sampled and hence are not included). Further, the numbers of Primary Sample Units (PSUs) will be given.

4) **Survey:** the *design*, *implementation* and *analysis* of each individual survey of a subpopulation is assessed according to an agreed set of criteria by each country expert rating the bias according to traffic light colours, where red, amber and green represent known substantial bias, unknown substantial bias and minimal bias respectively.

Stock – assessment for WG including catch, RSE, bias & gaps by subpopulation & year

Country – catch, RSE, bias for each subpopulation & year

Subpopulation – description, RSE, PSU, bias for each survey

Survey – design, implementation, analysis
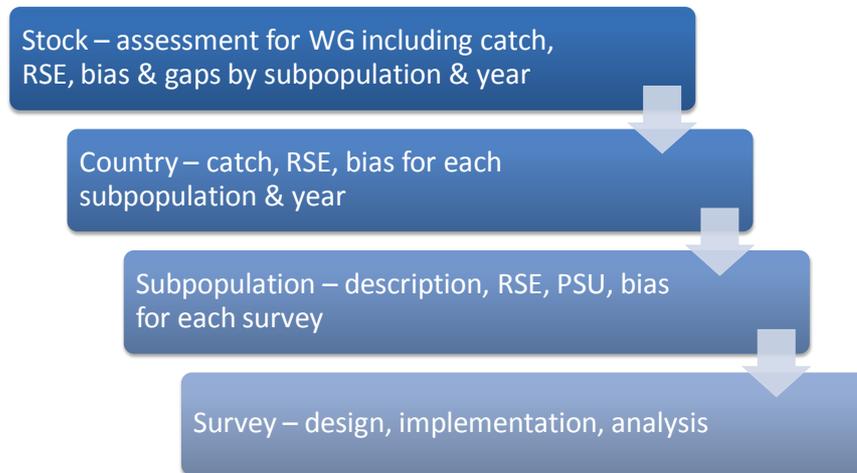
Figure 1: Nested schema for the assessment of recreational fishing data for stakeholder use such as in stock assessments.

3.2.5 Assessment of Quality at a Stock Level

At this level a Table will be produced which will be the primary output delivered to the end–users (Figure 2). The Table will be compiled by experts at the WGRFS, and may include catch, harvest or releases at a stock level estimated by year. It is important that these estimates will be delivered together with an assessment of the bias as a colour and notes describing the overall accuracy, the direction (is the estimate assumed to be over or under–estimated) of the overall bias and potential gaps in the in the value, where a gap typically will be a Section of fishers that are not sampled.

Year	A	B	C	D	E	...	Z	Total	Comments
			Country						
2000									
2001									
2002									
2003									
2004	Catch, RSE written as numbers								Gaps in data sets, overall accuracy
2005									
2006	Bias is represented by colours:								
2007		Known substantial bias							
2008		Potential for substantial bias							
2009		Minimal bias							
2010									
2011									
2012									

Figure 2: Example of Table provided and recommendations on the use of recreational fishing data on a particular stock to be used in stock assessment. Numerical Table entries are catch estimates and RSE, with cells coloured according to bias.

Examples of gaps could be if only catches from private boats and not charter boats are included in the survey. This Table will be accompanied by a paragraph wherein recommendations of how the data might be used in stock assessment are given, recommendation that will be up for discussion with the end–user, e.g. an assessment WG.

An example of a recommendation for the use of these data will also be provided. For example: **"WGRFS comments and recommendations: The main part (>90%) of the stock is expected to be harvest by country A and B, hence the lack of data from country C, D and E is assumed to have a lower impact on the estimate than the overall inaccuracy. Country A improved survey design in 2007, hence WGRFS recommends that earlier estimates are substantially down–weighted or omitted and replaced with average values for those years sampled after 2007".**

3.2.6   Assessment of Quality at a Country Level

Each cell in Figure 2 represents an estimate (a value) derived for each country in each year together with the RSE and the bias associated with this estimate. This represents the combination of a set of subpopulation assessments for each country. Each country will define subpopulations that are relevant, but these may vary between countries. The catch and harvest and associated RSE and bias will be assessed for each subpopulation in each year and captured in a Table (Figure 3). Examples of subpopulation could be: anglers, gillnetters, fykenetters. Other examples could be that anglers are divided into subpopulations such as shore anglers, charter boat anglers and private boat anglers.

	Subpopulations of recreational fishers								
Year	A1	A2	A3	A4	A5	...	A6	Total	Comments
2000									
2001									
2002									
2003									
2004		Catch, RSE written as numbers							Gaps in data sets, overall accuracy
2005									
2006		Bias is represented by colours:							
2007		▮	Known substantial bias						
2008		▮	Potential for substantial bias						
2009		▮	Minimal bias						
2010									
2011									
2012									

Figure 3: Example of Tableprovided for each country and year indicating the quality of recreational fishing data. Numerical Tableentries are catch estimates and RSE, with cells coloured according to bias.

3.2.7 Assessment of Quality at a Subpopulation Level

Each cell in the country level assessment represents either one or a set of surveys that could include measures of effort, CPUE, catch and biological data collection (Figure 4). These may be on–site or off–site surveys. At a subpopulation level a Tablewill be compiled by the country expert that includes all potential surveys within a particular subpopulation. A subpopulation is a statistical unit and will for many surveys be the same as a fishing sector, but due to the vast number of fishing methods and traditions throughout Europe it was decided to differentiate between sectors and subpopulations. Additional column can be added if more than one survey is available for each estimate. This Tablewill include a description of the survey, RSE and PSUs.

		Survey		
Dianostic	Effort	CPUE	Catch	Biological
Description of Survey		Type of survey		
RSE				N/A
Description of PSU		Description		
Number of PSUs		Number		
Design		▮	Known substantial bias	
Implementation		▮	Potential for substantial bias	
Analysis		▮	Minimal bias	
Comments				

Figure 4: Example of Table provided for each country, year and subpopulation indicating the quality of recreational fishing data. Cell entries for first 4 rows are mixture of text and numbers as indicated; final 3 rows are traffic lights colours only.

An important feature of this Table will be that the bias colour shown in the stock and country tables will be split into sources. This means that it will be possible to see if the bias is a result of a sub–optimal *survey design*, complications during *implementation* or a bias that is a result of problems during data *analysis*. WGRFS discussed the utility of metadata on numbers of PSUs as an indicator of relative precision. Although the value will be connected to the precision and not the bias it was agreed that a record of PSUs sampled will give an indication on the actual sample size but also will ensure that the PSU is clearly identified for each survey and hence it was decided to include it.

3.2.8 Assessment of Quality for Each Individual Survey

Each survey will undergo a traffic light scorecard evaluation on its *design*, *implementation* and *analysis* (Figure. 4). As with the WKACCU scorecard, this stage will involve answering a series of questions resulting in a set of answers that clearly indicate one of three outcomes: (i) known substantial bias (red); (ii) potential for substantial bias (amber); and (iii) minimal bias (green). In some cases the scorecard system will have to identify if a known bias at the *design* or *implementation* stage can be sufficiently mitigated at the analysis stage to reduce the severity of the bias.

Scorecard question: *Design*

The first series of questions will relate to the design of the survey and is based upon the deliberations of one breakout group formed during the 2012 WGRFS. The questions can be divided into two main groups, where the first group focuses on the population of fishers and the degree to which all important contributors to the total harvest, catch and/or release are identified and taken into account. The second group focuses on the sampling frame and how well it represents the identified population.

Scorecard question: *Implementation*

The score–sheet set up to cover *implementation* bias is based upon the outputs of two breakout groups formed during the WGRFS 2012. One dealt specifically with biases associated with the implementation of on–site surveys and the other group with off–site survey biases. Since there is a rather large overlap in the nature of the issues, independent of the sampling strategy, the recommendations from the two breakout groups have been merged into a single score–sheet. This means that questions that are not relevant to a given survey type will simply be assigned not applicable (N/A). Further, each potential bias outlined in the score–sheet has been assigned a direction of the bias (positive or negative) and a magnitude (minor, moderate or major).

The actual implementation of the survey will also be scrutinized. This will be achieved through both general and specific questions, intending to highlight known sources of bias. To serve as an example: *Let's imagine an onsite survey is set up correctly with the aim to interview a subsample of fishers while fishing. Hence tourist fishers are also covered. However the persons doing the interviews only speak the native language and are therefore unable to perform the interviews with tourists.* This bias can either be captured at a general level where it is asked: *"has the implementation of the survey been such that tourist fishing has been accounted for"* or by a more specific question such as *"did the clerks performing the interviews share a common language with the tourist"*.

Scorecard question: *Analysis*

No specific questions will be asked concerning the analysis biases. However, WGRFS will to the degree possible scrutinize the analytical methods used and if any miscalculations are encountered provide a colour. Further, notes on whether the survey estimation methods have been subject to peer or independent review and whether the survey has been fully documented/published will be given.

3.3 Catch–and–Release in marine recreational fisheries (ToR b)

The extent of Catch–and–Release (C &R) practices in marine recreational fisheries has been poorly documented in the past, but its importance for many marine fish stocks is increasingly recognized in recent years (Cooke and Cowx, 2004; Bartholomew and Bohnsack, 2005). C&R is the process of catching a fish using hook and line, and re-

leasing it alive to the waters where it was caught, assuming that the fish will survive (Arlinghaus *et al.*, 2007). Arlinghaus *et al.* (2007) classified three different types of C&R practice: (i) regulatory C&R, (ii) voluntary C&R and (iii) total C&R. Regulatory C&R refers to C&R as a response to management regulations, e.g. minimum landing sizes, bag limits or protected fish species. Voluntary C&R means that an angler releases a fish on a voluntary basis due to individual reasons. In a total C&R fishery all viable fish are released, both voluntarily and/or as a response to regulations (Arlinghaus, 2007; Arlinghaus *et al.*, 2007).

C&R angling has a long history in many countries and its practice has spread throughout the world over the last decades, which led to controversy and public debates in some countries (Aas *et al.*, 2002; Policansky, 2002; Arlinghaus, 2007). It has been indicated that the increased release rates in recreational fisheries are primarily a response to mandatory management regulations, and to a lesser extent, on a voluntary basis (Lucy and Studholme, 2002; Bartholomew and Bohnsack, 2005). Cooke and Cowx (2004) estimated, based on Canadian data, an annual global release rate of about 60 % or 19 million tons for recreational fisheries, corresponding to 30 billion released fish each year. While C&R has been thoroughly studied in marine and freshwater recreational fisheries in the US, Canada and Australia, and also in some freshwater fisheries in Europe, only very few peer–reviewed articles exist on C&R in marine recreational fisheries in Europe (e.g. Muoneke and Childress, 1994; Bartholomew and Bohnsack, 2005). Conspicuously, most marine C&R studies in Europe have been conducted with species from southern Europe and the Mediterranean Sea (e.g. Alós, 2008; Alós, 2009; Alós *et al.*, 2009a; Alós *et al.*, 2009b; Veiga *et al.*, 2011).

However, a literature review and mini–workshop during the WGRFS 2012 meeting revealed that C&R is also very common in other European marine fisheries, and that for several species (e.g. Baltic cod and European sea bass), a large proportion of the catch is released by anglers (ICES, 2011; van der Hammen and de Graaf, 2012; Ferter *et al.*, in press; Strehlow *et al.*, accepted). Unfortunately, these estimates are generally in grey literature, or only mentioned casually in published harvest studies. This is due to the fact that the main focus of marine recreational fisheries surveys is often to obtain harvest estimates, as resources to investigate C&R in marine fisheries are often limited (ICES, 2011). Since 2009 all European Union Member States (MS) are obligated to evaluate the recreational catches of Atlantic cod, European eel, Atlantic salmon, European sea bass and bluefin tuna (CEC 1224/2009). Therefore, it is important to notice that strictly speaking the Commission regulation instructs MS to monitor the marine recreational catches including releases, and not only the harvest or landings. Considering the importance of recreational catches and C&R practice for several marine fish stocks, there is a need for detailed investigations of (i) release rates and reasons for releases, (ii) mortality rates of released fish, and (ii) best practice in the design of surveys to estimate quantities released.

One of the aims of the WGRFS mini–workshop was to present methods, which are suitable to study immediate, short– (~24–72 h) and long–term (> 72 h) mortality of released fish (see Pollock and Pine, 2007 for more details). Therefore, three different designs of field studies to estimate C&R mortality (containment, mark–and–recapture and biotelemetry studies) were introduced, and C&R mortality studies from Norway and Germany, which are planned or have already started, were used as practical examples.

3.3.1 Containment studies

Containment or cage studies are a common and cost–effective approach to evaluate short–term mortality of released fish. Fish are caught and held in cages, pens or ponds and their survival and behavior is monitored for short time periods (Pollock and Pine, 2007). There are principally two approaches of containment studies, which can be used to study the effects of C&R. In the first approach a treatment group exposed to the C&R process and a control group are compared to estimate the absolute release mortality. For comparison the control group should be caught with low–impact methods (e.g. pots or seine), which ideally cause no significant fishing mortality. The second approach is the comparison of two or more different treatment groups, for example groups of fish caught with various hook types or in different depths.

There are several advantages of containment studies compared to other methods such as low costs and efforts, easy access and direct visual observation of the fish in short time intervals, as well as the potential control of the biotic and abiotic factors in the holding facilities. In addition, containment studies are a well accepted and frequently used method in the literature to evaluate short–term mortality of catch and release fishing (Bartholomew and Bohnsack, 2005; Pollock and Pine, 2007). However, potential disadvantages are the semi–natural conditions (e.g. no migration, non–natural forage and post–release predation), which may lead to an underestimation of the post–release mortality rate, no information about long–term and indirect effects of the C&R event, and potential negative effects of the captivity. Furthermore, the method is not suitable for all species due to limited space in the holding facilities, e.g. very large, pelagic or migratory species (Pollock and Pine, 2007; Donaldson *et al.*, 2008). A major challenge of a proper containment study design is the use of true replicates, and the avoidance of pseudoreplication. To avoid pseudoreplication, completely random or randomized block experimental designs based on replicated holding units should be used (Pollock and Pine, 2007).

3.3.2 Mark–and–recapture studies

A traditional method to study the long–term mortality of released fish is through mark–and–recapture studies, which have been widely used in recreational and commercial fisheries to assess the migration, growth and survival rates of fish. Fish are individually tagged with different external tags (e.g. t–bar anchor tags) after being caught and then released back into their natural habitats (ICES, 1965; Parker *et al.*, 1990). Again, ideally both a control and treatment fish would be tagged and released. By using recapture data from the fishery, low–resolution information of migration, growth and survival after the release event can be collected (Pollock and Pine, 2007). Advantages of mark–and–recapture studies are: easy application, relative low costs, the possibility to have large sample sizes, and the provision of long–term mortality data under natural environmental conditions. However, mark–and–recapture studies provide only very low resolution data compared to biotelemetry studies. A problem is the uncertainty in the calculation of the C&R mortality rate estimates due to underreporting of the recaptures and natural mortality. Consequently, to achieve a sufficient number of tag returns, a large quantity of fish has to be tagged (Pollock and Pine, 2007; Donaldson *et al.*, 2008).

3.3.3 Biotelemetry studies

One approach to enhance data resolution and quality of C&R studies is the combination of containment or mark–and–recapture experiments with a biotelemetry study (Pollock *et al.*, 2004; Donaldson *et al.*, 2008). Biotelemetry studies are used to investigate short– and long–term mortality, and their use for C&R studies has increased in recent years (Donaldson *et al.*, 2008). For telemetry studies, fish are tagged with either acoustic/radio tags or satellite pop–up tags and released into their natural habitats. An acoustic tag sends all available information (e.g. fish location and physical parameters) to a nearby receiver station after being implanted into the fish. At least one close–by receiver station is always necessary to receive data. In contrast a satellite pop–up tag is attached externally, and does not need a direct contact with a receiver station. Instead it pops up after a pre–defined period of time and sends its stored data via satellite link after reaching the surface (Block, 2005; Donaldson *et al.*, 2008).

A great advantage of telemetry studies is the provision of high–resolution data of migration patterns, predator avoidance, behavior and survival for a long time period after the release event. Thus, biotelemetry allows estimating the C&R mortality rates under natural conditions, including ecosystem interactions and indirect mortality due to intra– and interspecific competition. Besides, biotelemetry offers the collection of physiological, behavioural, energetic and environmental data (Donaldson *et al.*, 2008).

Disadvantages are the negative effects and potential mortality caused by the invasive tagging method for internal tags. It can be difficult to separate the effects of tagging from the impact of the C&R event (Bettoli and Osborne, 1998; Donaldson *et al.*, 2008). Additionally, the implantation procedure is complicated and time–consuming (3–10 min), and requires well–trained staff. In many cases fish have to be anaesthetized which may lead to additional stress and mortality (Donaldson *et al.*, 2008). Due to relatively large tag sizes, this method is not always suitable for small species or individuals. Furthermore, telemetry studies are very costly due to the high prices of the telemetric tags (ca. 500 EUR per acoustic tag and ca. 3000 EUR per satellite pop–up tag), which in most cases leads to relatively small sample sizes (Pollock and Pine, 2007).

The mini–workshop during the WGRFS 2012 meeting served as an open platform to get an overview of the practice of C&R among marine recreational anglers in Europe (i.e. release rates), and to collect existing data and knowledge of potential impacts (i.e. post–release mortalities) for different European marine species. To achieve more awareness of C&R practice by European marine anglers, the outcomes of the mini–workshop will be published in an internationally co–authored paper. The paper has also been submitted as oral presentation for the ICES Annual Science Conference 2012 in Bergen (Annex 6).

3.4 Stakeholder Involvement in Recreational Fishing Surveys (ToR d)

The collection of recreational fishing data is still a recent phenomenon in many European countries and there is no clear framework for application of the data for stock assessment or fishery management. Surveys are often complex, and the rigorous statistical designs needed to minimize bias are often counter–intuitive to recreational fishermen. The fishermen may themselves identify potential biases in data such as mean weights or catch rates where they do not match their own experience or those of others in the fishing community. These issues can all erode trust in the collection and use of the data, or even lead to non–cooperation in surveys. During the WGRFS 2012 meeting, a special session on stakeholder involvement was held to share and exploit some of the experiences made in some countries, including in the USA and Australia where there is a relatively long history of recreational surveys and experiences in working with stakeholders. Two stakeholders from European angling bodies were invited to contribute their views to the session.

WGRFS strongly emphasizes the need to engage stakeholders during survey design and implementation, to establish easily–understood communications on survey methods and how data are used, and to ensure that stakeholders do not feel left out of the recreational management process (*cf.* Ihde *et al.*, 2011). Three case studies were presented at WGRFS to illustrate this process: the Tasmanian Rock lobster fishery, the newly–designed sea angling surveys in the UK (England), and the long–established NOAA surveys in the USA. The Australian case study shows how stakeholders were engaged to build trust in the surveys as they came under increasing scrutiny following the establishment of separate recreational and commercial TACs, and how the debate was moved away from the validity of the surveys and on to the survey results and their use. The UK case study highlights the steps taken to involve stakeholders from the very first stages in setting up new surveys in 2012, in order to build trust and promote cooperation. Finally, the USA case study describes the approaches NOAA has taken to re–build confidence in recreational fishery estimates after the surveys had to be redesigned following a major review several years ago.

3.4.1 Tasmanian rock lobster fishery case study

Surveys of the Tasmanian recreational rock lobster fishery have been undertaken biennially since the mid–1990s. The earliest surveys were implemented to provide baseline information about the nature and scale of the fishery, which was found to be relatively minor when compared with the commercial fishery. Steady growth in recreational licence numbers, reductions in the commercial TAC, implementation of an explicit TAC for the recreational sector and inclusion of recreational catches into the stock assessment meant that the need for and scrutiny of the survey results has increased.

Stakeholders with an interest in the surveys include resource managers, stock assessment scientists, recreational and commercial fishers. Recognizing that resource managers and stock assessment scientists may have limited understanding of the survey design, attention was directed at engaging these groups via detailed briefings and reports relating to methodology, etc. This was important since uncertainties or misunderstandings regarding the survey method and validity of results were readily picked up and exploited by other stakeholders. By properly engaging managers and assessment scientists it has been possible to shift focus to the survey results themselves rather than whether the surveys are valid or biased.

Involving recreational and commercial stakeholders has been more challenging, with these groups motivated by differing drivers and tending to be selective about how they interpret survey results. Presentations and open discussions (noting that it can be difficult to explain statistical concepts in lay terms) with members of management advisory committees (which also provide an informal steering committee function) and major (peak) associations are the main ways in which these stakeholders groups have been engaged. The peak recreational body in Tasmania was also proactive and commissioned an independent expert review of the surveys. A key motivation for this review was to build general confidence in the surveys from within the recreational as well as commercial sectors. In practice, some elements from within the commercial sector have chosen to ignore the review's findings and discredit/ignore the surveys to pursue their own sectoral agendas.

In our case study, engagement of the resource managers and assessment scientists represented an important step forward as it shifted focus onto the implications of the survey results for the management of the fishery rather than the validity of the surveys. Engagement with the recreational sector over a number of years has also been important in gaining general acceptance and endorsement of the surveys – an observation supported by survey response rates that have remained exceptionally high (>90%) despite several significant management changes impacting the recreational sector.

3.4.2 The English Experience

Sea Angling 2012 is the largest survey of recreational sea angling activity, economic value and social benefits in England. On–site and off–site surveys are being carried out to estimate effort, catches, expenditure and social value, for scientific purposes as well as to ensure that the needs of sea anglers are represented as effectively as possible in future marine policy development. Sea angling in England has never been actively managed and there is no licence scheme, so the survey initially met with resistance from some groups who had concerns that the data would lead to restrictions such as bag limits and licences. Other sectors have asked why they should cooperate when previous exercises in working with the government have failed to yield any positive outcome (e.g. proposals to increase the minimum landing size of sea bass). The development of a communications policy has therefore been an integral part of Sea Angling 2012 from the start, to ensure that the methods and purpose of the surveys are clearly explained. This was split into two parts: a steering group comprising of the government, scientists and the angling community, and publicity material to inform anglers about the survey.

The steering group includes a broad range of stakeholders from different sectors of the angling community, businesses, media, scientists and policy-makers. It was set up to provide advice on survey methods and communications, to help develop credibility and trust, and to ensure that the data are of use to angling organizations to develop their own policies. This was done before data collection started to ensure that the experience of the angling community could help to shape the project. The group operates in an open manner with minutes published on the website and provides support in many aspects of the project (e.g. survey design, economic subcontractor selection). The experience of the steering group has been important in shaping the project and many changes have been made to the surveys as a result of steering group discussions. For example, the economic valuation planned was extended to

include assessment of the social benefits of angling on the advice of the steering group, and significant changes to both survey design and questions have also been made.

The second aspect of the communications plan was to provide factual and balanced information to anglers about the project. A website (http://www.seaangling2012.org.uk) was set up to inform the angling community about the project, and to host project updates and links to online surveys. The project team has provided articles in the angling media (Internet forums, magazines and radio), talks to local interest groups and flyers in local tackle shops. Flyers in tackle shops are important as a way of engaging with the many sea anglers that do not read Internet forums or magazines. The flyer is also handed to angers during on–site surveys and has helped dispel suspicions about the project. Tackle businesses have kindly provided high–quality tackle prizes and vouchers for quarterly prize draws available to people providing on–site or on–line interviews. Currently, the response rate during on–site surveys has been around 90%, with most non–responses being due to factors other than negative perceptions of the project.

Stakeholder engagement takes significant amounts of time and resource, but the English experience is that the benefits far outweigh the cost. It is important to engage as early as possible in the project and build trust through open discussions and transparent processes. The views of the angling community should be taken into account in the development and running of the project where practicable within the financial constraints. The angling community know far more about anglers and angling than scientists, and scientists know much more about scientific methods than the angling community. Working together leads to the experience and knowledge of all parties being incorporated in design and implementation of recreational angling surveys. This enhances the quality of the data collected leading to greater utility for scientists and the angling community alike.

3.4.3   The US experience: New communication methods

The traditional Marine Recreational Fisheries Statistics Survey (MRFSS) conducted by the National Marine Fisheries Service did not reflect the complex sampling design and contained some intercepts that were not obtained through probability sampling. To address this issue, several changes were made resulting in a new survey, the Marine Recreational Information Program (MRIP). In order to re-establish trust in the recreational fishery estimates and the data provided by NOAA Fishery new communication methods were applied. Thereby MRIP explicitly addresses head–on stakeholder concerns about the reliability and credibility of recreational fishing catch and effort estimates. On their new website http://www.countmyfish.noaa.gov/index.html they provide fact sheets, videos and background information. A communication team was established to provide expert advice in order to effectively communicate with the stakeholders. To improve communication videos were chosen as new communication method.

3.5 The use of recreational fishery data (ToR e)

WGRFS discussed the use of recreational fishery data in the context of the transition from the current EU Data Collection Framework to the new EU DCMAP 2014–2020. The WG considers that requirements to collect recreational fishery data should be based on agreement reached at a regional scale on end–user needs for recreational fishery data. Precision targets should be set at the overall stock level for combined international estimates, and bias in data collection and estimates should be documented. New species for which recreational removals have a significant impact on the resources should be included. Flexibility is needed to allow for differences between countries in the types of surveys that are appropriate or possible. The WG also highlights the importance of collecting data for evaluating the economic and social value of recreational sea fishing. These points are elaborated in more detail in the following Sections.

3.5.1 Provision of data

Numbers/weight – Annual estimates

The current DCF is overly prescriptive in requiring recreational catch data in weight per quarter. WGRFS advises that the specific details of survey schemes such as periodicity of estimates (e.g. annual, twice a year or quarterly) and type of data to collect (e.g. numbers, weight, length compositions) are agreed first at a regional level between countries. This process should be targeted to end–user needs and types of surveys involved with coordinating input from WGRFS. The WGRFS would alos like to highlight that respondent generally prefers to recall there catch in numbers and that converting recalled numbers to a weight estimated can be problematic if the correct average weight of a fish harvested is wither completely unknown or is subject to temporal and spatial variation (Sparrevohn *In press*).

3.5.2 Quality indicator

WGRFS emphasizes that there should not be a single precision target set for all countries individually but rather a single precision target for the overall catch, harvest or release of each stock. The required precision of national sampling schemes for shared stocks should be agreed on a regional level, with the overall aim to deliver a combined estimate to a sufficient level of quality. This could mean that countries with a very low share of the recreational catches of target stocks in a region could have correspondingly lower survey effort and precision requirements for delivery of required data. This is analogous to treating each national survey as a separate stratum within an international survey, and optimizing the survey effort between strata (countries) to achieve desired precision at regional level and efficient use of resources. Additional survey effort to meet specific national requirements should be included in the new DCMAP.

Further, WGRFS recommends that the description of the quality of the estimates should be extended to not only include precision but also bias. WGRFS has proposed a scorecard format (Section 3.2) to identify and document biases in recreational surveys.

3.5.3 Species

WGRFS understands that new species should be included in the new DCMAP according to the principle that (1) the recreational fishery has a potential important impact on the population dynamics or (2) it is of strong socio-economic importance. Examples that meet these criteria are:

- Sea trout (*Salmo trutta*) / Baltic Sea (criteria 1 & 2)
- European Lobster (*Homarus gammarus*) / North Sea, Kattegat, Skagerrak (criteria 1 & 2)
- Pollack (*Pollachius pollachius*) / Northeast Atlantic (criteria 1 & 2)

WGRFS would like to highlight that the decision–making process to include new species in the new DCMAP need to be dynamic and adaptive addressing the needs of multiple end–users. This could be achieved through regional groups (e.g. RCMs) and dialogue meetings between the Commission, national scientists, WGRFS and STECF perhaps on a supranational level (Baltic Sea – North Sea & Eastern Arctic – North Atlantic) and (Mediterranean & Black Sea).

3.5.4 Socio–economic data

It is estimated that there are 25 million anglers in Europe of which 8–10 million are recreational sea anglers (Pawson *et al.*, 2008). In addition, there is a large number of recreational fishers using passive gear – e.g. in the Baltic Sea, Denmark (29 222) and Germany (1642) – or spears.

WGRFS recommends including the collection of socio-economic data in the new DCF to assess the economic and social benefits of the recreational fishery and allow value judgements. The requirements (type of data, frequency of collection) specifying socio-economic data should be developed in a dedicated workshop including members of STECF and WGRFS.

3.5.5 Practicalities

Although the design of recreational fishery surveys can have much in common with commercial fishery sampling programs funded by the DCF, for example use of vessel list frames or lists of coastal access–points for sampling, there are also some major differences that can vary nationally and require different survey approaches. For example, a country may have no lists of individual fishermen as might be available from fishing licenses or other registries. Moreover, national confidentiality protection requirements may impede the use of address lists for survey purposes. In this case, nationwide population surveys are required (e.g. postal or telephone surveys) to estimate recreational fishing effort, catches and in some cases to recruit panels of fishermen to complete diaries. In some countries, on–site surveys may be feasible to estimate catch per unit of effort and collect length data directly from fishermen, whereas in other countries this may not be feasible or cost-effective. It is important that requirements for recreational fishery data collection in the new DCMAP recognizes the national peculiarities of recreational fisheries, and that the new DCMAP supports collaboration between countries within regions to ensure national datasets are collected in a way that they can be combined in a statistically valid way at a stock level and that the quality of the datasets can be compared objectively using guidelines established through WGRFS. The potential for task sharing to make best use of DCMAP funds should also be encouraged.

3.5.6 Funds bringing in outside experts

External experts from the US and Australia have played a fundamental and invaluable role in building up the scientific expertise in the field of recreational fisheries and survey designs in Europe. Ever since the inauguration of PGRFS, now WGRFS, considerable efforts were undertaken by the participating countries to permit external experts to participate in annual meetings. The availability of funds to bring in outside experts would be important to circumvent funding issues in future and maintain the collaborative work.

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4 International marine recreational sampling schemes

This Section includes a set of tables, which cover all species and areas the current DCF is requesting recreational data for (Legislative Basis: Council Regulation (EC) No 199/2008 & Commission Decision (2010/93/EU).

The first set of tables gives an overview of the current/most recent surveys countries have in place to estimate marine recreational catches.

The second set of tables gives an overview of the most recent harvest/release estimates for the relevant species.

The tables relate purely to surveys of recreational fishing, which can be defined as all forms of non–commercial fishing. In most countries recreational fishermen are prohibited to sell their catch (Pawson *et al.*, 2008).

Recreational fishing can be divided into two broad categories:

- Angling using rod & reel or handlines (this may include spearing of fish by divers, and hand–gathering of shellfish)
- Fishing with "passive" gears including nets, traps, pots & creels, and long–lines

The tables cover four major sea areas as defined by the current DCF:

- Baltic Sea (ICES Subdivisions 22–32)
- North Sea (ICES areas IIIa, IV and VIId) and Eastern Arctic (areas 1 & II)
- North Atlantic (ICES areas V–XIV and NAFO areas)
- Mediterranean Sea and Black Sea

4.1 Current/most recent marine recreational fishing surveys

4.1.1 Baltic Sea (ICES Subdivisions 22–32)

Table 1. Most recently carried out, ongoing and/or planned marine recreational fishing surveys in the sampling period 2011/2012.

Country	Cod	Eel	Salmon	Sharks	Comments
Denmark	A combined telephone and Internet survey was designed together with Statistic Denmark Two recall surveys, with their own questionnaires and group of respondents, were carried out. The first survey, the "licence list survey", specifically targeted that part of the Danish population 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 of fishers who fished without a valid licence and with how much effort they did so. In this survey, no questions concerning their harvest were asked.Data on average size of eel, cod and seatrout are obtained by a reference panel of 75 fishermen. No data on average size of catches angling is avaliable.	Sampled similar to cod.	Baltic salmon is mainly been angled during trolling. The harvest is not monitored but guestimated to be around 3000 individuals.	Catches of sharks by Danish recreational fishers are assumed to be insignificant	From 2010 and onwards the catches of seatrout is also beeing estimated
Estonia	Catch data are reported and stored in EFIS for passive gears	Catch data are reported and stored in EFIS for passive gears	Catch data (length and numbers) are reported and stored in EFIS for passive		For licensed recreational fishery with passive gears it is mandatory to report their

Country	Cod	Eel	Salmon	Sharks	Comments
			gears,.		catches (to EFIS) since 2005
Finland	Cod catch is 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 on the basis of local fishing licenses.		A nationwide biennal recreational fishing survey, all species and all gears included. A stratified sample about 6000 households. Response rate about 60% after max 3 contacts. A telephone interview for the non–respondents.
Germany	CPUE data from annual stratified random access point survey covering all access points along the Baltic coast. Effort estimates by postal survey from 2006/2007 will be replaced by effort data from on–site sampling. Length distributions from on–board sampling of charter vessels by survey agents and self–sampling from angling events, private boat, charter boat and trolling anglers. Length–mass key from commercial sampling for conversion to weight.	A telephone–diary survey to estimate eel harvests of the recreational passive gear fishery was implemented in August 2011 as a pilot study. The panel consists of 180 recreational passive gear fishermen of which 120 have been recruited from the Baltic Sea across 7 strata. Participants are recalled every 4 months to remind them to fill in the provided diary. The survey period ends 31. July 2012.	Derogation pending. The development of the recreational fishery for salmon will be observed.	Derogation requested, as there is no recreational fishery for sharks in German waters or from German vessels.	
Latvia	No sampling – low catches, derogation pending	Sampling on triennial basis in lakes and rivers – on–site survey	All river salmon catches have to be reported (low catches)		The catches taken in recreational fishery with commercial gears should be reported and added to

Country	Cod	Eel	Salmon	Sharks	Comments
					commercial catches.
Lithuania	Small commercial angling boats are licensed, for no. of trips and anglers could be obtained from census, direct interviews and questionnaires.	n. a.	n. a.(fisheries for salmon in rivers only – additional information to RCM)		All recreational fishermen are licensed
Poland	Pilot study planned for 2009/2010. No. of anglers will be from Maritime Office. CPUE data from on–site survey. Sampling also for discarded and retained catch. For 2010 was planned 6 trips. WKSMRF 2009 recommended increase no trips to collect CPUE data.	Significant only inland waters. Anglers are licensed and obligated to record catches in weight in special register. From 2010 obligated record more detailed data. Pilot study (on–site survey) in 2010 – also in marine?	n. a.		Importance of angling growth rapidly.
Sweden	National survey supported by regional studies (see comments).	n. a. (It is prohibited to fish for eel – additional information to RCM)	National survey, regional studies, other supporting studies including other sources (see comments)	n. a. (It is prohibited to fish for sharks – additional information to RCM)	A national biennal (more or less) recreational fishing survey, all species, sub–areas and all gears included. A stratified sample about 10 000 respondent aged between 16–75 years (the sample also includes respondents from a panel based on previous studies). Response rate about 60% after two phases – substracting fishers and non–fishers. Telephone interviews for the non–respondents used for weighting of final results. The national survey is

Country	Cod	Eel	Salmon	Sharks	Comments
					supported by smaller reginal studies, when needed. A regional suvey on cod has for example been performed the last two years in Öresund (2010 and 2011). The collection of data on recreational Salmon fishing is exhaustive and contains regional studies as well as collection of data from other sources (recreational fisher's logbooks etc.)

4.1.2 North Sea (ICES areas IIIa, IV and VIId) and Eastern Arctic (ICES areas I and II)

Table 2. Most recently carried out, ongoing and/or planned marine recreational fishing surveys in the sampling period 2011/2012.

Country	Cod	Eel	Sharks	Comments
Germany	According to a pilot study from 2004–2006, German recreational fishery cod catches in the North Sea have no impact on the stock. Annual cod catches from charter vessels amount to approximately 30 t. Other fishing techniques (e.g. boat angling, shore angling) as well as the recreational passive gear fishery have no further relevance concerning cod catches. A second pilot study was carried out in August 2011 to verify these findings. Preliminary results show that there	A telephone–diary–recall survey to estimate eel harvests of the recreational passive gear fishery was implemented in August 2011 as a pilot study. The panel consists of 180 recreational passive gear fishermen of which 60 have been recruited from the North Sea across 2 strata. Participants are recalled every 4 months to remind them to fill in the provided diary. The survey period ends 31. July 2012.	A pilot study was carried out in August 2011 to estimate recreational shark catches in the German North Sea. Preliminary findings show that recreational shark catches are marginal and have no impact on the stocks.	

Country	Cod	Eel	Sharks	Comments
	has been no change and that catches have even declined.			
Denmark	See under the Baltic table	See under the Baltic table	See under the Baltic table	See under the Baltic table
Sweden	National survey supported by regional studies (see comments).	n. a. (It is prohibited to fish for eel – additional information to RCM)	n. a. (It is prohibited to fish for sharks – additional information to RCM)	A national biennal (more or less) recreational fishing survey, all species, sub–areas and all gears included. A stratified sample about 10 000 respondent aged between 16–75 years (the sample also includes respondents from a panel based on previous studies). Response rate about 60% after two phases – substracting fishers and non–fishers. Telephone interviews for the non–respondents used for weighting of final results. The national survey is supported by smaller reginal studies, when needed. A regional suvey on cod has for example been performed the last two years in Öresund (2010 and 2011). The collection of data on recreational Salmon fishing is exhaustive and contains regional

Country	Cod	Eel	Sharks	Comments
				studies as well as collection of data from other sources (recreational fisher's logbooks etc.)
Norway	A rowing–creel survey is conducted in Southern Norway from April – August 2012 to: - Estimate the proportions of angling tourists vs. Norwegian recreational anglers targeting cod - Get a size frequency distribution of cod landed by recreational anglers - Estimate the CPUE for cod among Norwegian recreational anglers - Estimate the release proportion for cod catches			

Country	Cod	Eel	Sharks	Comments
UK Scotland				
United Kingdom (England)	A major survey programme commenced in England in 2012 called Sea Angling 2012 (www.seaangling2012.org.uk) the elements of the survey are as follows: • Monthly surveys of households, using face–to–face interviews, to estimate recreational sea angling effort (angler–days) by region and fishing mode. • On–site surveys of anglers at shore angling sites and private boat launching sites in nine regional strata in England, to estimate mean catch per unit of effort (CPUE), length compositions by species, angling effort and trip expenditure. • Sampling from a known population of sea angling charter vessels to estimate total effort and catches by species. • A separate survey of economic and social benefits of recreational sea angling involving on–line surveys and direct interviews at sites around the coast of	Marine recreational survey estimates as for cod	As for cod	First results due in 2013

Country	Cod	Eel	Sharks	Comments
	England. • Quarterly online catch surveys to collect additional information and to help interpret the other survey results.			
France				
Belgium				

Country	Cod	Eel	Sharks	Comments
Netherlands	In 2009 and in 2011 online screening (panel) surveys were carried out to estimate the total number of recreational fishermen in the Netherlands, resulting in approximately 640.000 marine recreational fishermen. In 2010 a monthly online diary survey was carried out to estimate the annual cod catches, which resulted in an estimate of approximately 360 tonnes of cod catches. Currently (2012) the online panel survey is carried out again, for which we expect to have the preliminary results at the beginning of 2013.	In 2009 and in 2011 online screening (panel) surveys were carried out to estimate the total number of recreational fishermen in the Netherlands, resulting in approximately 640.000 marine recreational fishermen and 1.5 million freshwater recreational fishermen. In 2010 a monthly online diary survey was carried out to estimate the annual cod catches, which resulted in an estimate between 55 and 115 tonnes of eel catches of which between 17 and 36 tonnes are caught in marine waters (North Sea). Currently (2012), the online panel survey is carried out again, for which we expect to have the preliminary results at the beginning of 2013.		Weight estimates are based on poor length estimates. Numbers are therefore more accurate then weights.

4.1.3 North Atlantic (ICES areas V–XIV and NAFO areas)

Table 3. Most recently carried out, ongoing and/or planned marine recreational fishing surveys in the sampling period 2011/2012.

Country	Sea bass	Salmon	Eel	Sharks	Comments
UK Scotland					

Country	Sea bass	Salmon	Eel	Sharks	Comments
United Kingdom (England)	A major survey programme commenced in England in 2012 called Sea Angling 2012 (www.seaangling2012.org.uk) the elements of the survey are as follows: • Monthly surveys of households, using face–to–face interviews, to estimate recreational sea angling effort (angler–days) by region and fishing mode. • On–site surveys of anglers at shore angling sites and private boat launching sites in nine regional strata in England, to estimate mean catch per unit of effort (CPUE), length compositions by species, angling effort and trip expenditure. • Sampling from a known population of sea angling charter vessels to estimate total effort and catches by species. • A separate survey of economic and social benefits of recreational sea angling involving on–line surveys and direct interviews at sites around the coast of England. • Quarterly online catch surveys to collect additional information and to help interpret the other survey results.	Recreational fishing for salmon is almost entirely in inland waters and is monitored by the Environment Agency.	Marine recreational survey estimates as for bass.	As for bass	First results due 2013.

Country	Sea bass	Salmon	Eel	Sharks	Comments
Ireland					
France					
Spain (Basque Country)	A DCF–funded pilot study has started in 2012 to estimate sea bass catches in the Basque Country recreational fishery. Telephone, mail and e–mail surveys are being carried out. Results will be available by the end of 2013.		A routinary glass eel sampling is carried out since 2004. Fishermen have to fill in a dairy logbook in order to obtain the fishing license. These logbooks are used to estimate total catches ad CPUEs. The results are presented in the WGEEL.		

Country	Sea bass	Salmon	Eel	Sharks	Comments
Portugal					

4.1.4   Mediterranean Sea and Black Sea

Table 4. Most recently carried out, ongoing and/or planned marine recreational fishing surveys in the sampling period 2011/2012.

Country	Bluefin tuna	Eel	Sharks	Comments
Spain	Reported to ICCAT collected by IEO.	Regional governments Valencia and Catalonia collect information provided to the DGFisheries.	Minimal catches.	No standard surveys performed in Balearic Islands. Only in the framework of research projects. No current sampling on 2012.
France				
Italy				
Greece				

4.2 Most recent harvest/release estimates for the relevant species

Harvest estimates are either provided in tons (t) or in numbers (#) the second figure indicates the year.

4.2.1 Baltic Sea (ICES Subdivisions 22–32)

Table 1. Most recent marine recreational harvest estimates – in tons (t) or numbers (#); figures in brackets indicate differing years – in the sampling period 2011/2012.

Country	Cod		Eel		Salmon		Sharks		Comments
	Harvest	Release	Harvest	Release	Harvest	Release	Harvest	Release	
Denmark	765.5	761749	45.3	23962	3000 ind.	N/A	N/A	N/A	Data on seatrout is also avaliable
Estonia									
Finland									
Germany	2 098 037 # 2340 t	760 818 # 227 t	–	–	n/a	n/a	n/a	n/a	Cod estimates are preliminary and based on the 2010 length distribution. Pilot survey for recreational eel catches initiated in August 2011 will end in July 2012 (1–year telephone–diary survey)
Latvia									
Lithuania									
Poland									
Sweden	205.6 t (2010)	74.3 t (2010)	n.a.	n.a.	57.3 t (2010)	28.1 t (2010)	n.a.	n.a.	National survey (ref.year 2010)

4.2.2 North Sea (ICES areas IIIa, IV and VIId) and Eastern Arctic (ICES areas I and II)

Table 2. Most recent marine recreational harvest estimates – in tons (t) or numbers (#); figures in brackets indicate differing years – in the sampling period 2011/2012.

Country	Cod		Eel		Sharks		Comments
	Harvest	Release	Harvest	Release	Harvest	Release	
Germany	30 t (2007)	–	t		50–100 # (2011)	–	Pilot survey for recreational eel catches initiated in August 2011 will end in July 2012 (1–year telephone–diary survey) Preliminary findings from a pilot study in 2011 show that recreational shark catches are marginal and have no impact on the stocks.
Denmark	537.4 t	280071	34.2 t	27034	N/A	N/A	Data on seatrout is also avaliable
Sweden	226.3 t (2010)	275.9 t (2010)	n.a.	n.a.	n.a.	n.a.	National survey (ref.year 2010)
Norway	1613 t (2009) 543.000 # (2009) (RSE 22%) Angling tourists only	66 % (SE 4%) of catches in Northern Norway 61% (SE 8%) of catches in Southern Norway	Eel is a protected species in Norway since 2010. No recreational harvest of this species is allowed.		Spiny dogfish is a protected species in Norway since 2011. No recreational harvest of this species is allowed		The harvest estimates for cod refer to landings in 445 registered tourist angling businesses (Vølstad *et al.*, 2011). The release estimates for cod are based on two study areas in Northern and Southern Norway, respectively (Ferter *et al.*, in press).

Country	Cod		Eel		Sharks		Comments
	Harvest	Release	Harvest	Release	Harvest	Release	
UK Scotland							
United Kingdom (England)	Available 2013	Available 2013	Available 2013	Available 2013	Available 2013	Available 2013	
France							
Belgium							
Netherlands	538.000 # 360 t	176.000 # 23 t	174.000 # marine 341.000 # fresh 17–36 t marine 37–78 t fresh	108.000 # marine 873.000 # fresh 24–26 t marine 137–150 t fresh			Numbers are more accurate than weights.

4.2.3 North Atlantic (ICES areas V–XIV and NAFO areas)

Table 3. Most recent marine recreational harvest estimates – in tons (t) or numbers (#); figures in brackets indicate differing years – in the sampling period 2011/2012.

Country	Sea bass		Salmon		Eel		Sharks		Comments
	Harvest	Release	Harvest	Release	Harvest	Release	Harvest	Release	
UK Scotland									
United Kingdom	Available 2013	Available 2013	No marine catches	No marine catches	Available 2013	Available 2013	Available 2013	Available 2013	
Ireland									
France									
Spain (Basque Country)					0.376 t (2011)				Reported eel catches correspond to glass eel A pilot survey for recreational sea bass catches has started in 2011 and will end in December 2012. Results will be ready by the end of the project.

Country	Sea bass		Salmon		Eel		Sharks		Comments
	Harvest	Release	Harvest	Release	Harvest	Release	Harvest	Release	
Portugal									

4.2.4 Mediterranean Sea and Black Sea

Table 4. Most recent marine recreational harvest/release estimates – in tons (t) or numbers (#); figures in brackets indicate differing years – in the sampling period 2011/2012.

Country	Bluefin tuna		Eel		Sharks		Comments
	Harvest	Release	Harvest	Release	Harvest	Release	
Spain							
France							

Country	Bluefin tuna		Eel		Sharks		Comments
	Harvest	Release	Harvest	Release	Harvest	Release	
Italy							
Greece							

Annex 1: List of participants

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Annex 2: Agenda

Monday 7th May: Start time 14:00.   Finish 18:00

14:00–14:30	Introduction, Icebreaker, ToRs
14:30–16:00	Country Report Updates & Improvements: new species, survey methods, etc. (10 min per country)
16:00–16:30	Coffee break
16:30–18:00	Country Report Updates & Improvements: new species, survey methods, etc. (10 min per country)

Tuesday 8th May: Start time 09:00 Finish 18:00

09:00–10:30	Presentation: Jon Helge Vølstad, Introduction to the WKACCU scorecard Discussion
10:30–12:00	Individual Break–out groups developing scorecards individual coffee break
12:00–13:00	Plenary: scorecards
13:00–15:00	Lunch
15:00–16:30	Individual Break–out groups developing scorecards
16:30–17:00	Coffee break
17:00–18:00	Plenary: scorecards

Wednesday 9th May: Start time 09:00   Finish 16:30

09:00–11:00	Plenary: scorecards Wrap up
11:00–11:30	Coffee break
11:30–13:00	Update New DCF (2014–2020)
13:00–15:00	Lunch
15:00–16:30	Mini Review: Keno Ferter and Simon Weltersbach, C&R Mortality Discussion
16:30	Social event

Thursday 10th May: Start time 09:00   Finish 17:00

09:00–10:00	Presentation: Jan Kappel (European Angler Alliance), Stakeholder involvement
10:00–11:00	Presentation: Dave van Voorhees, The US experience
11:00–11:30	Coffee break
11:30–12:30	Presentation: Jeremy Lyle, The Oz experience
12:30–13:00	Presentation: Harry Strehlow, Data use
13:00–15:00	Lunch
15:00–16:00	Presentation: New DCF
16:00–16:30	Coffee break
16:30–18:00	Writing recommendations New DCF (2014–2020)

Friday 11th May: Start time 09:00   Finish around lunchtime

09:00–10:00	Update & Revise WGRFS Recommendations
10:00–11:30	ToRs next meeting
11:30–12:00	Date & Venue COST Proposal, FP Project Theme sessions: ICES ASC & 7th WRFC

Annex 3: WGRFS terms of reference for the next meeting

The **Working Group on Recreational Fisheries Surveys** (WGRFS), chaired by Claus Reedz Sparrevohn, Denmark and Harry Vincent Strehlow, Germany, will meet in Esporles, Spain, 22–26 April 2013 to:

a) Produce a mini–glossary (definitions and terminology)

b) Review the available outcomes of the workshop on socio–economic data collection and requirements

c) Gap–analysis on the available data of recreational fisheries estimates according to species, region
Collaborative planning of harmonized survey application

d) Initiate a process developing a system that organizes the compilation of data on a stock level

e) Review the outcomes of the inclusion of recreational data in the benchmark assessments of western Baltic cod and Atlantic sea bass
Agree and update the dataseries for the next assessments (including quality indicators)

f) Review and update the scorecard based on the experience of implementing the scorecard on the assessed stocks

WGRFS will report by 1 June 2013 to the attention of ACOM.
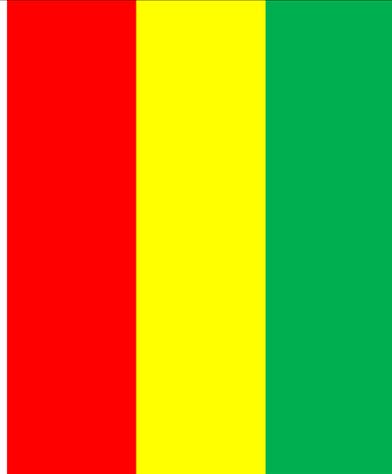
Supporting Information

Priority	High – Because recreational catches can be high for some stocks
Scientific justification	This work is required under the EC–ICES MoU that requests ICES to provide support for the Data Collection Framework (EC Reg. 199/2008 and EC Decision 2008/949/EC). WGRFS is the ICES forum for planning and co–ordination of marine recreational fishery data collection for stock assessment purposes. DG MARE should be a member of WGRFS to ensure proper coordination with the DCF activities. WGRFS shall develop and approve standards for best sampling practices within its remits and for marine recreational fisheries in the ICES area, in line with the ICES Quality Assurance Framework.
Resource requirements	Bringing in outside experts from the US and Australia has played a fundamental role in building up the scientifc expertise of WGRFS to meet its ToRs.
Participants	Co–Chairs, nationally nominated members and outside experts. The Group is normally attended by some 20–25 members and guests.
Secretariat facilities	Normal backstopping support in the organization of the group.
Financial	The avaliability of funds to bring in outside experts to maintain the collaborative work is vital.
Linkages to advisory committees	ACOM
Linkages to other committees or groups	WGBFAS, WGEEL

Linkages to other organizations	WECAFC/OSPESCA/CRFM/CFMC Working Group on Recreational Fisheries
	Many linkages to national angling associations, since WGRFS members estimate national marine recreational catches.

Annex 4: Recommendations

Recommendation	Adressed to
1. Structures and contents of recreational fishery data in the new DCMAP 2014–2020 should consider proposals by WGRFS 2012 (see WGRFS 2012 Section 3.5), including proposal for a workshop on collection of economic and social data.	DG MARE

Annex 5: Scorecard questions

Design (general)

- Was all sectors assessable during the actual survey
  - was there a clerk preference for interviewing certain types of fishery
  - did clerks avoid doing interview at certain times of the day
  - did the clerks avoid during interviews during bad weather conditions

Sparrevohn & Storr-Paulsen 2012

Did the inclusion of tourist fishing encounter problems
  - Was those clerks performing the interview able to communicate with the tourist anglers
  - Was there made a division between resident fishers that did not talk the national language and tourist

Lyle ?
Lyle ?

Did the inclusion of illegal fishing encounter any problems
  - Was there any preference from clerks not to engage with illegal fishers, e.g. due to threatening behavior
  - was there certain areas not attended due the suspicion of illegal fishery carried out there

- Incentives

Will fishers have an incentive to moderate their catch	+/-	moderate
Is illegal fishery covered or accounted for in other ways	+	moderate
Are there so many questions asked that the respondent might suffer "Questionnaire fatigue"	+/-	moderate
Can fishers that gives deliberately wrong replies identified and excluded	–	minor
In case of having a panel will those selected change their fishing pattern or activity	+	moderate
In case of having a panel will those that drop out create a bias	+/-	minor
Has there been quality check throughout all survey stages	+/-	moderate

Non-response

- has all non-response pathways been taken into account? Including: Lesser & Kalsbeek 1992

Non-response during the screening process e.g. for a panel of fishermen	+	major	Guideline: >70 % green; 30-70% Amber; <30 red
Those persons in a panel that are non-responses	+	major	Guideline: >70 % green; 30-70% Amber; <30 red
Interview non-response (those that is not participating in the interview)	+	major	Guideline: >70 % green; 30-70% Amber; <30 red
Question non-response (those that do not answer a specific question)	+	moderate	Guideline: >70 % green; 30-70% Amber; <30 red
coverage issues			Guideline: >70 % green; 30-70% Amber; <30 red

- is non-response accounted for

Is there a non-response follow up procedure	+	major	See Lesser & Kalsbeek 1992 for various methods
Is the majority of non-respondents refusals	–	major	
has there been weighting of non-responses by demographic (e.g. age)	+/-	minor	
has there been weighting of non-responses by geographic (e.g. distance to coast)	+/-	minor	

	Guiding Questions	High Bias		No Bias
A. Selection				
1. Non-probabilistic sampling	Has the design been thought through to maximize precision? Are there protocols in place and are they followed how to deal with subsamples (selection of individuals, times, boats, biological samples)? Applied throughout all survey stages? Are the right sites, times, respondents, biological samples sampled?	none	some	total
2. Quality control	Was the assignment completed?			
B. Non-response				
1. refusal	What is your refusal rate, e.g. according to spatial issues, fishing in MPAs or fishing for high value species? 2nd Step: Have you re-evaluated refusals? What about not completed assignments (unobserved sample bias)?	total	some	no
C. Catch				
1. Kept	verified by creel clerks yes/no all filleted don't show More confidence in kept component than release component. Control of 10% of the catch by direct observation for confirmation to increase confidence in the final estimate (increase quality of self-reported data).	no	partial	confirmed
1.1 Species identification	verified by creel clerks yes/no all filleted don't show Validation studies required			
1.2 Numbers	directly observed/self reported digit preference			
2. Releases	see above			
2.1 Species identification	see above			
2.2 Numbers	directly observed/self reported digit preference			
D. Effort				
1. Unit	How is fishing time defined? Are we using the same effort unit to link to our effort surveys?			
2. Modes	Classify into angling / non-angling (passive gear) Classification into sea-based / land-based methods Classification into fishing methods			
3. Targeting	Is the target species (gear type) clearly defined?			
4. Location	Was fishing area clearly defined (tickable map)?			
E. Biological				
1. Non-probabilistic sampling	Has the design been thought through to maximize precision? Are there protocols in place and are they followed how to deal with subsamples? selection of individuals, times, boats, biological samples	no	partial	confirmed
2. Kept				
2.1 Length	verified by creel clerks yes/no all filleted don't show Validation studies required Measurement unit			
2.2 Mass	measured by creel clerks yes/no all filleted don't show Digit preference Validation studies required			
2.3 Otolith/Scales				
2.4 Sex				
3. Released				
3.1 Length	see above			
3.2 Mass	see above			
3.3 Scales				
F. General				
1. Date				
2. Environment/weather	Are you using additional data to improve precision? Is activity linked to weather conditions?			

Annex 6: ASC Session C Preliminary Paper

ICES CM 2012/C (Oral presentation)

Marine recreational fisheries in Europe – does only harvest matter?

Keno Ferter, Marc Simon Weltersbach, Jon Helge Vølstad and Harry Vincent Strehlow (more to come)

The potential impact of marine recreational fisheries on fish stocks has largely been neglected until recent years in Europe. While the landings of European commercial fisheries in marine ecosystems have been assessed over decades, there has been relatively little effort to estimate marine recreational fisheries catches. However, since 2009 the European Union demands from their member states to monitor the catches of stocks subject to recovery plans by recreational fisheries. To do this in a reliable and systematic manner, an ICES Working Group has been established to develop common survey methods across Member States. As recreational fisheries are often regulated through minimum landing sizes and bag limits, anglers often release part of their catch. The survival rates of these releases are generally unknown, but are likely less than 100%, and hence will cause bias in estimates of the fishing mortality based on landed catches only. Post–release mortalities can vary significantly by species, and depend on many factors including water temperature, fishing depths and handling time. To get an overview of the practice of Catch–and–Release (C&R) among marine recreational anglers in Europe, the existing knowledge of C&R and its potential associated release mortality was collected during a workshop of the ICES Working Group. This meta–analysis revealed that large proportions of the catch are released in several European marine recreational fisheries, and that post–mortality of released fish may need to be accounted for in the estimated fishing mortality.

Keywords: European recreational fisheries, catch–and–release, post–release mortality, fishing mortality

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