

ICES WGRFS REPORT 2013

ICES ADVISORY COMMITTEE

ICES CM 2013/ACOM:23

Report of the ICES Working Group on Recreational Fisheries Surveys 2013 (WGRFS)

22–26 April 2013

Esporles, Spain



ICES

International Council for
the Exploration of the Sea

CIEM

Conseil International pour
l'Exploration de la Mer

International Council for the Exploration of the Sea Conseil International pour l'Exploration de la Mer

H. C. Andersens Boulevard 44–46
DK-1553 Copenhagen V
Denmark
Telephone (+45) 33 38 67 00
Telefax (+45) 33 93 42 15
www.ices.dk
info@ices.dk

Recommended format for purposes of citation:

ICES. 2013. Report of the ICES Working Group on Recreational Fisheries Surveys 2013 (WGRFS), 22-26 April 2013, Esporles, Spain. ICES CM 2013/ACOM:23. 49 pp.

For permission to reproduce material from this publication, please apply to the General Secretary.

The document is a report of an Expert Group under the auspices of the International Council for the Exploration of the Sea and does not necessarily represent the views of the Council.

© 2013 International Council for the Exploration of the Sea

Contents

Executive Summary	1
1 Background and Terms of Reference (ToRs)	3
2 Recreational Fishing Surveys Across Europe (ToR c)	3
3 Use of Recreational fishing Data in Stock Assessments (ToRs e)	4
3.1 Western Baltic Cod (SDs 22-24)	4
3.2 Atlantic Sea Bass	10
4 Assessing the Quality of Recreational Fishing Data (ToRs c, d, f)	17
4.1 Revised Guidelines for best practice in recreational sampling schemes	18
4.2 Condensed set of guiding questions	19
5 European Requirements for Recreational Fishing Surveys (ToR d)	21
5.1 Identifying end-user needs for recreational fishery data	22
5.2 Evaluation of end-user needs and the WGRFS role	22
5.3 Identifying the frequency and coverage of recreational fishery surveys	23
6 Glossary of Recreational Fishing Terms (ToR a)	25
Cited References	28
Annex 1: List of participants	29
Annex 2: Current/most recent marine recreational fishing surveys	31
A2.1. Baltic Sea (ICES Subdivisions 22-32)	31
A2.2. North Sea (ICES IIIa, IV and VIIId) & Eastern Arctic (ICES I and II)	34
A2.3. North Atlantic (ICES areas V-XIV and NAFO areas)	37
A2.4. Mediterranean Sea and Black Sea	38
Annex 3: Most recent harvest/release estimates for the relevant species	39
A3.1. Baltic Sea (ICES Subdivisions 22-32)	39
A3.2. North Sea (ICES IIIa, IV and VIIId) & Eastern Arctic (ICES I and II)	40
A3.3. North Atlantic (ICES areas V-XIV and NAFO areas)	41
A3.4. Mediterranean Sea and Black Sea	41
Annex 4: ToRs for WGRFS in 2014	42
Annex 5: Guidelines for best practice in recreational catch sampling schemes	43

Executive Summary

The ICES Working Group on Recreational Fishing Surveys (WGRFS) role is to provide recreational fishery data for stock assessment and advice, that satisfies the ICES Quality Assurance Framework and requirements of the EU Data Collection Framework (DCF). As such, the WGRFS is a forum for the planning and coordination of recreational fisheries data collection and analysis, for sharing knowledge, and discussing new ideas. In 2013, 17 scientists from 13 countries attended the meeting with the aim of sharing current national surveys methods and estimates, reviewing the use of recreational fishing data in stock assessments, developing a tool to assess the quality of recreational fishing surveys, providing guidance on the development of requirements for the Multi-Annual Data Collection Programme (DC-MAP), and production of agreed definitions for recreational fishing surveys.

WGRFS defined recreational fishing as *“the capture or attempted capture of living aquatic resources mainly for leisure and / or personal consumption. This covers active fishing methods including line, spear, and hand-gathering and passive fishing methods including nets, traps, pots, and set-lines”*. A glossary of recreational fishery was also produced to help common understanding and sharing of information (Section 6).

The WGRFS shared progress in implementing recreational fishing surveys across Europe, including results of existing surveys and the design of new ones (Section 2, Annexes 2 and 3). Significant discussion was had about the potential sources of bias and how to minimise future biases in the estimates produced.

WGRFS assessed the use of recreational fishing data in two ICES stock assessments (Section 3). Recreational fishery estimates from Germany were used for the first time in the assessment of the western Baltic cod leading to an increase in total removals and the precision of the assessment. In future, Danish and Swedish data will also be incorporated. For Atlantic sea bass, recreational fishery data was not included in the assessment due to the lack of time series data and differences between national survey methods. The data indicate that recreational fishery removals could be significant, so data should continue to be collected and included once available. The inclusion of recreational fishery data in assessments is expected to add to the accuracy of total abundance estimates in particular where area-specific assessments are developed. WGRFS advises to document recreational fishery estimates for those stocks where removals are significant until such times as the estimates can be incorporated in the assessment models.

The method to assess the quality of recreational catch estimates using a scorecard system developed by the WGRFS in 2012 was tested and further developed. Scorecard questions were developed to guide the evaluation process and help to operationalize this framework (Section 4). “Best practice” guidelines for recreational fishery sampling were also developed based on WKPCS2, covering the design, implementation and analysis of sampling schemes whilst also providing information on the existence and possible magnitude of biases (Annex 5). The conclusion from this exploratory work was that no single way to document data quality is suitable for all end users, and a “toolkit” of reporting systems is needed to provide different end users with the information they require.

Proposals for frequency and precision of recreational fishery surveys in the new DC-MAP were reviewed (Section 5). WGRFS continues to advise that requirements to collect recreational fishery data in DC-MAP should be driven by end-user needs.

WGRFS should be closely involved in this process, as it is the current Expert Group on recreational fishery surveys in Europe, and should have appropriate Terms of Reference to provide Regional Coordination Groups (RCG) with advice on how end-user requests for recreational fishery data can be addressed. WGRFS proposes that a fixed percentage threshold triggering a survey (percentage of total removals, by weight, attributable to recreational fisheries) is inflexible and not appropriate as a sole decision rule. Recreational fisheries for particular species may become more or less important over time, so there is need for time series data to show trends. Furthermore, in a situation of overfishing, recreational fisheries can still be exerting a significant fishing mortality locally even if the estimated total removals weight is below the designated threshold. In the case of fixed frequencies for conducting surveys, WGRFS is of the opinion that where possible, surveys should be conducted annually to preserve expertise, infrastructure and budgets. Multi-annual surveys should only be adopted where the impact on assessments and advice have been evaluated and deemed acceptable.

1 Background and Terms of Reference (ToRs)

The ICES Working Group on Recreational Fishing Surveys (WGRFS) meeting took place between the 22 and 26 April 2013, at the IMEDEA laboratory in Esporles, Mallorca. A total of 17 scientists from 13 countries contributed to the meeting, including Norway, USA and Australia, and was co-chaired by Harry V. Strehlow and Kieran Hyder (see Annex 1 for list of participants). The agenda was agreed and followed, although some changes were made to timings in order to complete discussions, and was as follows:

Day	Session
22 April 2013	<ul style="list-style-type: none"> • Introduction & ToRs • Review of recreational fishing surveys across Europe
23 April 2013	<ul style="list-style-type: none"> • Stakeholder participation in WGRFS • Use of Recreational Fishing Data in Stock Assessments • Post-release mortality estimation
24 April 2013	<ul style="list-style-type: none"> • Assessing quality of recreational fishing data
25 April 2013	<ul style="list-style-type: none"> • European requirements for recreational fishing surveys • Glossary of recreational fishing terms
26 April 2013	<ul style="list-style-type: none"> • Funding opportunities • ToRs for next meeting

The ToRs for the 2012 WGRFS meeting were as follows:

- a. Produce a mini-glossary (definitions and terminology)
- b. Review the outcomes of the workshop on socio-economic data collection and requirements
- c. Gap-analysis of the available data for recreational fisheries by species and 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 inclusion of recreational data in benchmark assessments of western Baltic cod and Atlantic sea bass. Agree and update the data-series 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.

ToRS (a) and (f), plus the discussions on stakeholder participation, post-release mortality estimation, and requirements for the new EU DC-MAP 2014-2020 were addressed through a mixture of plenary sessions and break-out groups. ToRs (c), (d) and (e) were addressed using case studies of the western Baltic cod and Atlantic sea bass as examples. It was not possible to complete ToR (b) as the workshop on socio-economics had not occurred before the working group.

2 Recreational Fishing Surveys Across Europe (ToR c)

Recreational fishing surveys are being done across Europe that cover all species and areas required under the DCF (EC 199/2008 & 2010/93/EU) and control regulations (EC 1224/2009).

The tables in Annex 3 provide an overview of the current/most recent surveys countries have in place to estimate marine recreational catches and Annex 4 gives the most

recent harvest/release estimates for the relevant species. The tables cover four major sea areas as defined by the current DCF:

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

Box 1: Definition of Recreational Fishery

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

These tables relate solely to surveys of recreational fishing as defined by the WGRFS (see Box 1). In most countries this can be defined as all forms of non-commercial fishing, except Norway where recreational fishermen are allowed to sell their catch (Pawson *et al.*, 2008).

3 Use of Recreational fishing Data in Stock Assessments (ToRs e)

To evaluate the appropriateness of data and methods to determine stock status for certain stocks benchmark assessments are conducted in regular time intervals. Furthermore reducing uncertainty in assessments is still a primary objective (*cf.* WKACCU, WKPRESISE, WPICS, etc.). One source of uncertainty (unaccounted mortality) is known removals by marine recreational fisheries, which have been monitored since 2004 (EC 1581/2004). Quantifying this uncertainty and integrating recreational fishery data into stock assessment are critical for the quality of the assessment. The inclusion of recreational fishery data will increase the accuracy and precision of abundance estimates particularly where area-specific assessments are developed.

In 2012/2013 marine recreational fishery data was assessed for the first time for use in two ICES stock assessments, western Baltic cod and Atlantic sea bass. The Benchmark Workshop on Baltic Multispecies assessment (WKBALT) met at ICES Headquarter in November 2012 and February 2013. The sea bass benchmark assessment (IBP-NEW) met at ICES Headquarter from 1-5 October 2012. In the following section we present these two stocks and describe the work that has been done.

3.1 Western Baltic Cod (SDs 22–24)

National marine recreational fisheries surveys showed that the recreational fishery removes considerable amounts of biomass from the western Baltic cod stock (ICES, 2010; 2011; 2012a; Sparrevohn and Storr-Paulsen, 2012; Strehlow *et al.*, 2012). Recreational harvest of western Baltic cod accounted for 25% of the total landings in 2010 (commercial landings + recreational harvest), where harvest refers to the number or biomass of all fish kept, excluding released fish and catch refers to the number or biomass of fish caught, divided into harvested and released/discarded fish (Pollock *et al.*, 1994). Due to the large impact of the marine recreational fishery, it was decided at the WBALT benchmark 2013 to use recreational fisheries data in the assessment. Data were available from Germany, Denmark and Sweden. The longest available time series of recreational fisheries including biological data is from Germany, so these data were included in the assessment. Danish and Swedish were not used in this assessment, but there are plans to include these data in future assessments.

The German marine recreational data collection program follows a multiannual multistage survey design (see Strehlow *et al.*, 2012). An off-site survey (mail-diary) is used to estimate effort. On-site, a stratified random sample of access points and days is

used to estimate catch rates (cpue). Length distributions of recreational catches are collected by onboard measurements of charter vessels trips. Other data sources were self-reported length samples from fishing events. Commercial/BITS length–weight relationships and age–length keys (ALK) were used for conversion of recreational catch numbers to biomass and length-at-age.

The German marine recreational fisheries data are grouped into sea-based (boat angling, charter boat angling, trolling) and land-based (shore angling, wading) fishing practices. Data are collected on a quarterly basis and grouped half yearly to reduce variance. Further stratification is by coastal states, SD, harvest and release in numbers.

Significant numbers of samples have been collected between 2004 and 2012. This includes 1126 mail diaries in the period 2004–2006, and 1844 site-days with 16,303 anglers interviewed. 381 length sampling trips have been done with 14,827 length measurements of harvested cod and 5,717 measurements of released or discarded cod.

Recreational data was compiled according to the following procedure. German recreational fisheries data for cod was available from 2005 until 2012. Recreational length distributions (SDs 22 and 24) were available from 2009 onwards. Releases were also sampled consistently from 2009. Using these data the average catch from 2005–2011 was used to extrapolate the years 1991 to 2004. To account for the historic development of marine recreational fishing in the former GDR after unification, recreational catches in Mecklenburg Western Pomerania were set at 20% in 1991 with a 20% annual increase until 1995. From 2009 to 2011 CANUM is estimated based on the respective recreational length distribution from each year. The ALK used for conversion are based on data from the Baltic International Trawl Survey (BITS) for the years 1991 to 2002 and on commercial sampling data from 2002 to 2011.

The amounts of dead recreational releases (discards) are estimated following two compilations methods:

1. Land-based releases are estimated assuming 100% mortality;
2. Sea-based releases are estimated applying 11.2% mortality based on a catch and release containment study from 2012 (Weltersbach and Strehlow, 2013).

The time-series of recreational harvest and release (dead) is presented in Figure 1. For the years 1970–1990, the catch numbers in recreational catch was set to be similar to 1991. The amount of recreational catch compared to commercial landings is presented in Figure 2; and commercial and recreational catch numbers-at-age are compared in Figure 3.

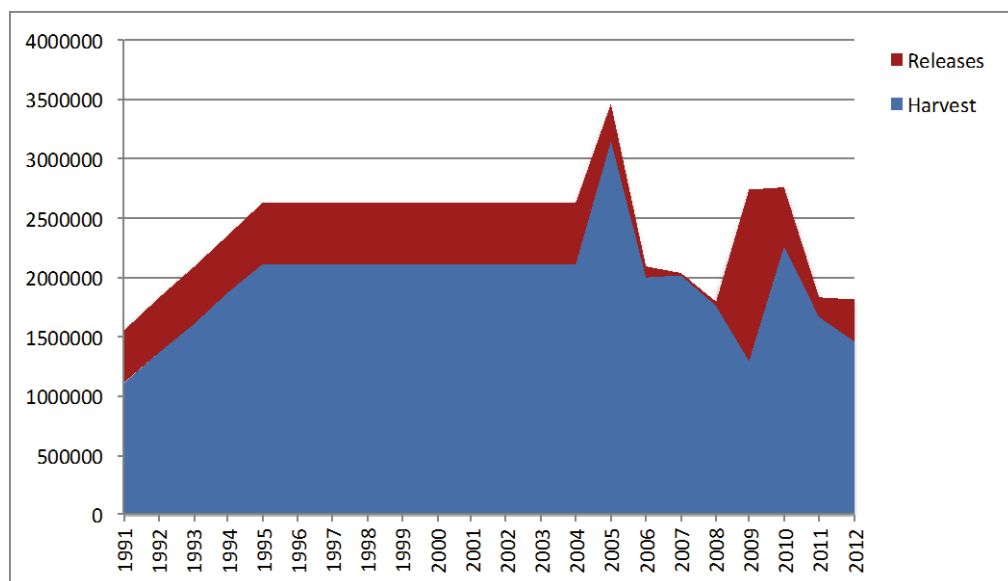


Figure 1: The estimated German recreational cod catches in numbers in the western Baltic from 1991 to 2012, divided into harvested and released (dead) cod.

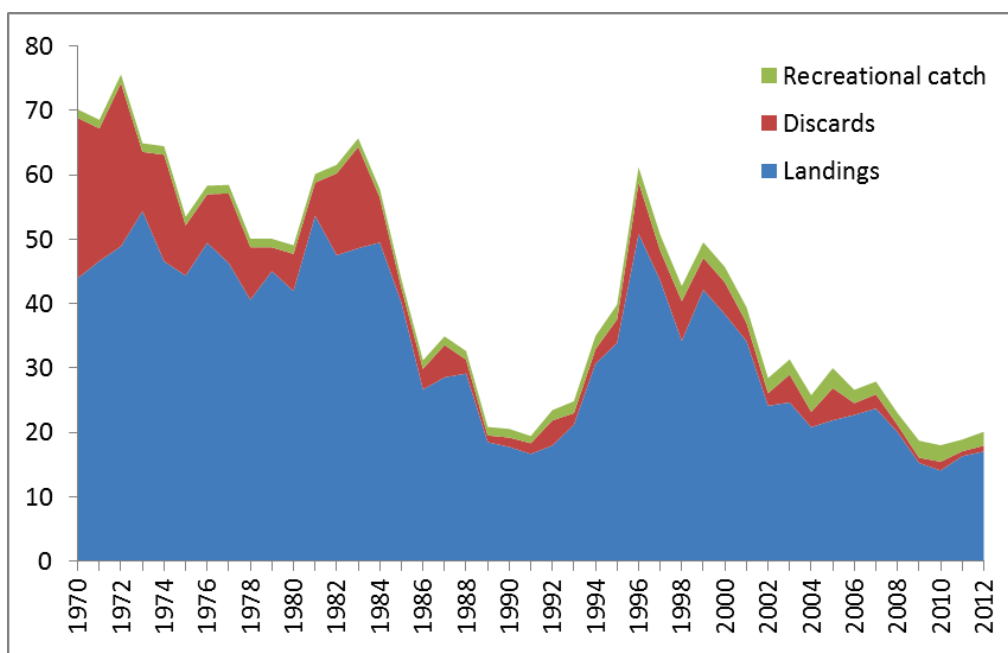


Figure 2: Commercial landings, commercial discards and recreational catch (ICES, 2013b).

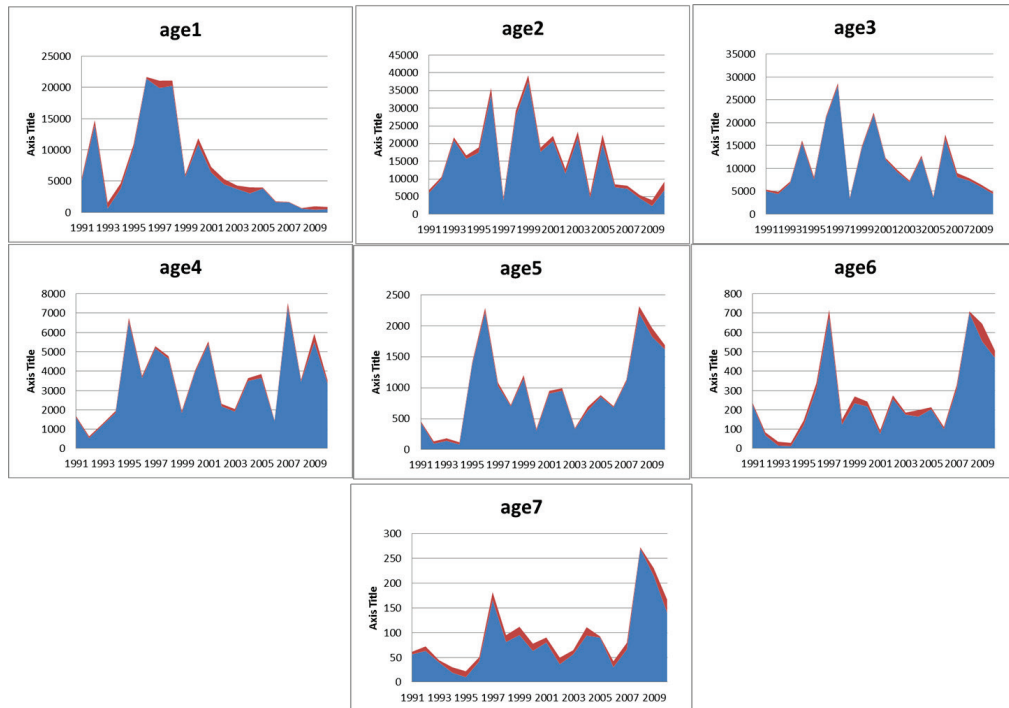


Figure 3: Catch numbers-at-age, separately for commercial (landings plus discards) shown in blue and recreational catches (harvest plus dead releases) shown in red (ICES, 2013a).

During the benchmark a number of changes were made to the assessment (ICES, 2013a), including:

- Combining BITS survey indices from Solea and Havfisker, and adding information for ages 4-6 from BITS Q1 and ages 4-5 from BITS Q4
- Revising maturity ogives
- Changing F_{bar} from 3-6 to 3-5
- Including recreational catches

A stochastic state-space model (SAM) (Nielsen, 2008; 2009; ICES WGMG rapport 2009) was used for assessment of cod in the western Baltic Sea. Figure 4 shows the differences in the estimates between the different runs.

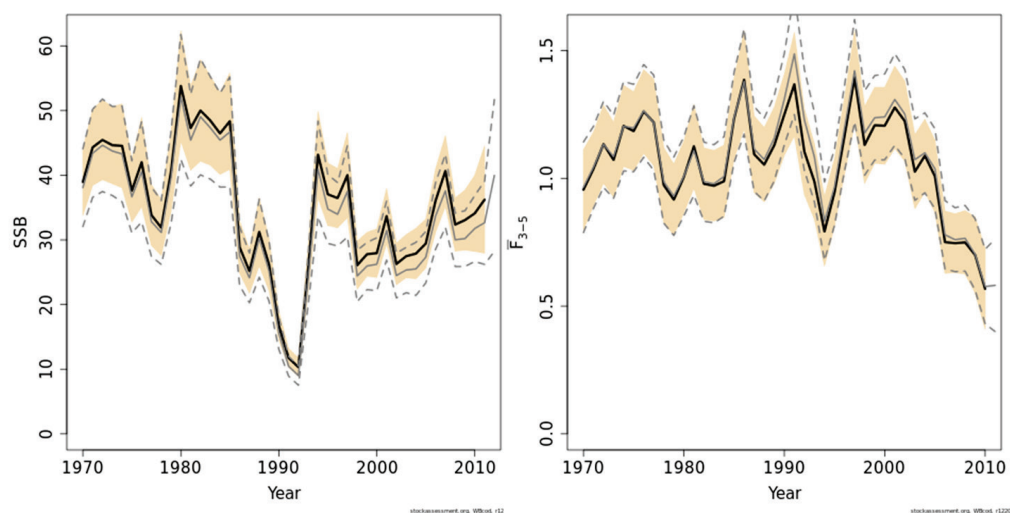


Figure 4: The run with new maturity and survey indices, but excluding recreational catch (grey line) compared to the run with new survey and maturity indices and adding recreational catch (black line; ICES, 2013a).

Reference points and management options

The previous biomass reference point was revised from $B_{pa}=23$ kt to $B_{pa}=36$ kt ($B_{lim} \cdot 1.4$). The increase was due to a new source of removals (recreational catch), which caused an overall increase in biomass estimates for the stock (Figure 4). The break point at 26 kt was considered a candidate for B_{lim} . $B_{MSYtrigger}$ was set equal to $B_{pa}=36$ kt. (ICES, 2013a). Table 1 shows the differences in the current and previous assessment.

Table 1: Differences in the 2011 estimates between the current and previous assessment of western Baltic cod (the numbers in parenthesis show confidence intervals; ICES, 2013b).

	Assessment 2012	Assessment 2013	Differences
Catch data	Including discards	Including discards, recreational catch	yes
Method	SAM	SAM	no
SAM results			
SSB ₍₂₀₁₁₎ (t)	33.5 kt (25.9-64.2)	SSB ₍₂₀₁₁₎ (t)	
Recruits Age 1 ₍₂₀₁₁₎ (mill)	36.9 kt (21.2- 60.3)	41.6 (29.2-59.2)	
Fbar (3-5) ₍₂₀₁₁₎	0.43	0.76 (0.61-0.95)	

As recreational catches were now included in the assessment, it was concluded that in the forecast, these need to be treated in a similar way as discards. Thus, the partial F due to recreational catch was separated from the F from commercial landings. The different management options are shown in Table 2. (ICES, 2013a). Danish marine recreational fishery data has been collected since 2009 (Sparrevohn and Storr-Paulsen, 2012). In 2010, Danish recreational fishermen were estimated to catch 1040 t of cod in the western Baltic, of which a large part (470 t) was taken in the Sound (SD 23). Danish and Swedish recreational data were not included in the assessment, but WGBFAS and WGRFS emphasized the need to incorporate these data in the future (see WKBALT & WGBFAS report 2013 for a full documentation of the western Baltic cod assessment - ICES, 2013a; b).

Table 2: Outlook table for 2014 for different management options (ICES, 2013b).

Basis: $F = F_{sq}(2013) = 0.7$; $SSB(2014) = 42.0$; $R_{age\ 1}(2013) = 54.7$ million; Commercial landings (2013)=18.8; Discards (2013)=0.8; Recreational catch (2013)= 2.4

Rationale	Total catch (kt)	Basis	F Total (2014)	F (Comm. Landings) (2014)	F (Recr. catch) (2014)	F (discard (2014)	Human consumption ¹⁾ (2014)	Comm. Landings (2014)	Discards ²⁾ (2014)	Recr. Catch ³⁾ (2014)	SSB (2015)	%SSB change ³⁾	% TAC change ⁴⁾
Management plan ⁵⁾	19.6	$F_{comm}=0.6$ (F3-6)	0.64	0.57	0.04	0.03	18.9	16.7	0.7	2.2	49.3	18	-6
	18.8	$F_{total} = 0.6$ (F 3-6)	0.6	0.54	0.03	0.03	18.1	16.0	0.7	2.1	50.2	20	-10
	20.2	$F_{land}=0.6$ (F3-6)	0.66	0.6	0.04	0.02	19.4	17.2	0.8	2.3	48.8	17	-3
	20.6	$F_{total}=0.6$ (F3-5)	0.6	0.54	0.03	0.03	19.9	17.6	0.7	2.3	48.3	15	-1
MSY framework	10.2	F_{MSY}	0.26	0.23	0.01	0.02	9.9	8.8	0.3	1.1	58.7	40	-51
MSY transition	13.2	$0.2 \cdot F_{2010} + 0.8 \cdot F_{MSY}$	0.35	0.31	0.02	0.02	12.8	11.3	0.4	1.5	55.6	32	-36
Zero catch	0	$F = 0$	0	0	0	0	0	0	0	0	69.1	65	-100
Other options	15.5	$F_{2013} \cdot 0.6$	0.42	0.38	0.02	0.02	15.0	13.3	0.5	1.7	53.3	27	-25
	17.6	-15% TAC change ($F_{2013} \cdot 0.7$)	0.49	0.44	0.02	0.03	17.0	15.0	0.6	2.0	51.2	22	-15
	19.6	$(F_{2013} \cdot 0.8)$	0.56	0.5	0.03	0.03	18.9	16.7	0.7	2.2	49.3	17	-5
	20.7	0%TAC change ($F_{2013} \cdot 0.87$)	0.61	0.54	0.03	0.04	20.0	17.7	0.7	2.3	48.1	15	0
	21.5	$F_{2013} \cdot 0.9$	0.63	0.57	0.03	0.03	20.7	18.3	0.8	2.4	47.5	13	3
	23.2	$F_{2013} \cdot 1.0$	0.7	0.63	0.04	0.03	23.2	19.8	0.8	2.6	45.8	9	12
	23.9	+15% TAC change ($F_{2013} \cdot 1.04$)	0.73	0.66	0.04	0.03	23.0	20.3	0.9	2.7	45.1	8	15
	25.0	$F_{2013} \cdot 1.1$	0.78	0.69	0.04	0.05	24.0	21.2	1.0	2.8	44.2	5	20
	29.6	$F_{2012} \cdot 1.4$	0.99	0.88	0.05	0.06	28.3	25.0	1.2	3.3	40.2	-4	41
	33.5	$F_{2012} \cdot 1.7$	1.2	1.07	0.06	0.07	32.1	28.3	1.4	3.8	36.7	-12	60

¹⁾ Human consumption landings are defined as commercial landings plus recreational catch. The latter includes mainly recreational harvest (landings) including releases where fish are considered to die (a small proportion compared to harvest)

²⁾ Recreational catch and discards are calculated assuming the same proportion of recreational catch and discards in total catch as observed in 2012

³⁾ SSB 2015 relative to SSB 2014.

⁴⁾ Human consumption landings 2014 relative to TAC 2013.

⁵⁾ Management plan options are provided for (i) setting the total F (3-6) to 0.6; (ii) only the commercial part of F (3-6) (commercial landings plus discards) to 0.6; and (iii) setting only the commercial landings part of F (3-6) to 0.6. This is due to different possible interpretations of the management plan. Additionally, an option with total F (3-5) at 0.6 is provided for comparison, as the F_{bar} was changed in this year's assessment. All the other options in the tables (besides those related to management plan target F) are calculated using F_{bar} (3-5)

3.2 Atlantic Sea Bass

WGRFS reviewed the outcomes of the recent benchmark assessment (ICES IBP-New 2012) of European sea bass (*Dicentrarchus labrax*) with particular reference to the input of recreational fishery catch estimates. Sea bass is a highly valued recreational fishery target in the UK, Ireland, France, Netherlands and Spain, and these countries have developed recreational fishery surveys particularly to meet the requirements of the EU Data Collection Framework. Unfortunately, the only survey estimates available to IBP-NEW were for France and Netherlands for 2010, and it was not possible to include this into the assessment model being developed. This report provides an overview of the assessment in relation to future use of recreational fishery survey estimates.

Stock units

Commercial fishery landings of sea bass occur continuously over the southern North Sea, Channel, Celtic Sea, Irish Sea, without clear geographic boundaries, and along the Biscay coast of France and Spain (Figure 5). There is no clear genetic differentiation into biological stock units, and bass tagged with electronic data storage tags can show extensive migrations between the North Sea and the English Channel (Figure 5d). The pragmatic view of IBP-New 2012 was to structure the baseline stock assessments into four units:

- Assessment area 1. Sea bass in ICES Areas IVbc, VIId, VIIe,h and VIIa,f&g (lack of clear genetic evidence; concentration of Area IV bass fisheries in the southern North Sea; seasonal movements of bass across ICES Divisions). This is a relatively data-rich area with data on fishery landings and length–age composition by fleet; discards estimates; growth and maturity parameters; juvenile surveys, fishery landings per unit effort (lpue) trends.
- Assessment area 2. Sea bass in Biscay (ICES Subarea VIIa,b). Available data are fishery landings, with length compositions from 2000; discards from 2009; some fishery lpue.
- Assessment area 3. Sea bass in VIIf and IXa (landings, effort).
- Assessment area 4. Sea bass in Irish coastal waters (VIa, VIIf, VIIj). Available data: Recreational fishery catch rates; no commercial fishery operating.

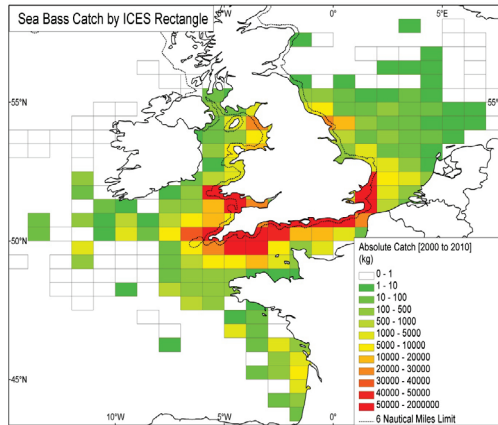
Fishery landings of sea bass are extremely small in Irish coastal waters of VIIa and VIIg and the stock assessment for assessment area 1 will not reflect the sea bass populations around the Irish coast, which may be more strongly affiliated to the population in area 4 off southern, western and Northern Ireland. Recreational shore and boat fisheries for sea bass are widespread along the coastal regions covered by the commercial fisheries

Commercial fishery landings time series

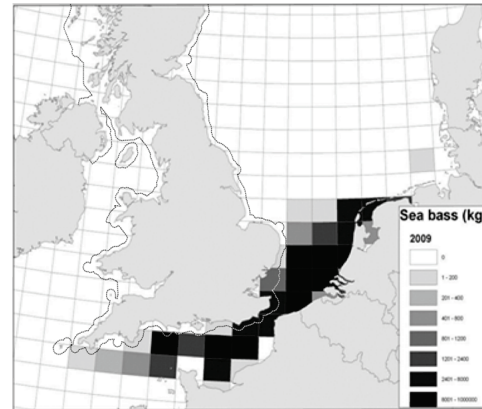
Total international fishery landings for sea bass, by area, have increased by around a factor of 4 since the 1980s, with a pronounced increase in the assessment area 1 (IV–VII) since the 1990s, levelling off during the mid 2000s (Figure 6). Recent landings from assessment area 1 have been around 4,000t. The increase has been recruitment driven following a strong 1989 year class and some strong year classes after that, and fisheries have expanded particularly in the North Sea. A period of ocean warming in the 1990s may have contributed to the northward expansion. Landings from assessment area 2 (Biscay VIIa,b) have been more stable. Landings for the area IV & VII

stock unit are given in Figure 7a, by fleet components used in the Stock Synthesis assessment model.

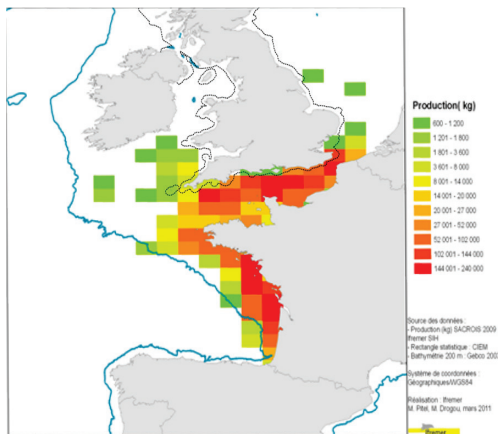
(a) UK 2000 – 2010



(c) Netherlands 2009



(b) France: 2009



(d) Movements of bass with electronic tags

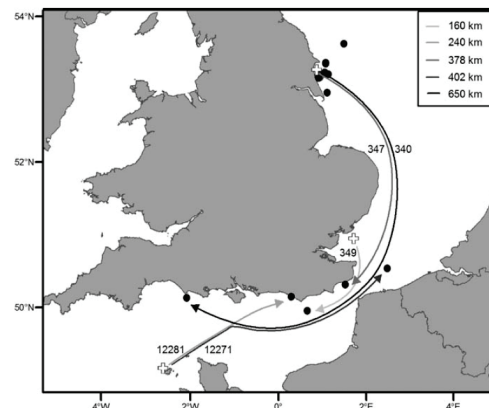


Figure 5: Distribution of commercial fishery landings of sea bass: (a) UK (aggregated over 2000-2010), (b) France, 2009; (c) Netherlands, 2009. Figure (d) shows the release and recapture positions of sea bass tagged with data-storage tags (Quayle *et al.*, 2009). Release positions shown by white crosses and recapture positions shown by black circles.

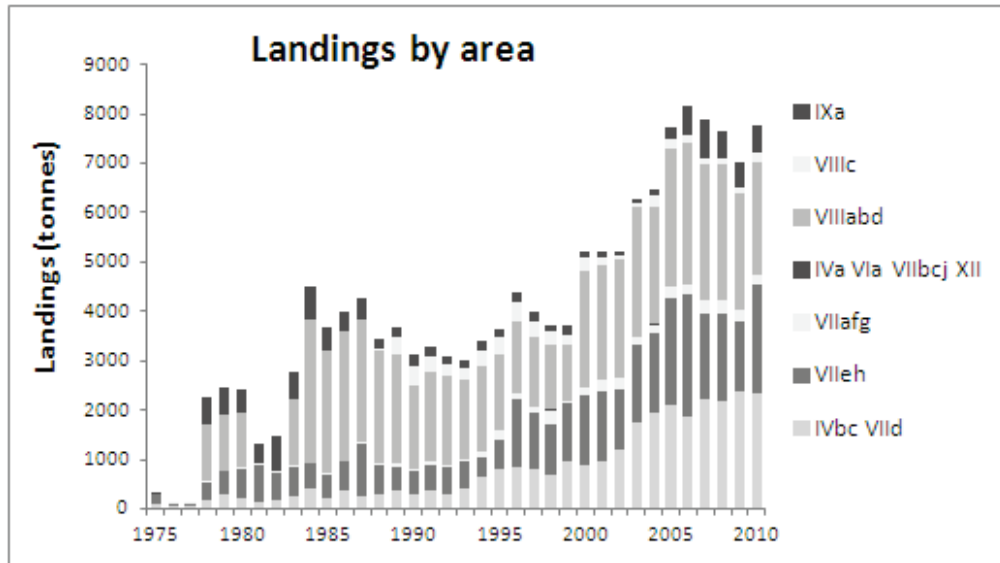


Figure 6: Official reported landings of sea bass by area (ICES database). Some national data in the 1980s are incomplete in this dataset.

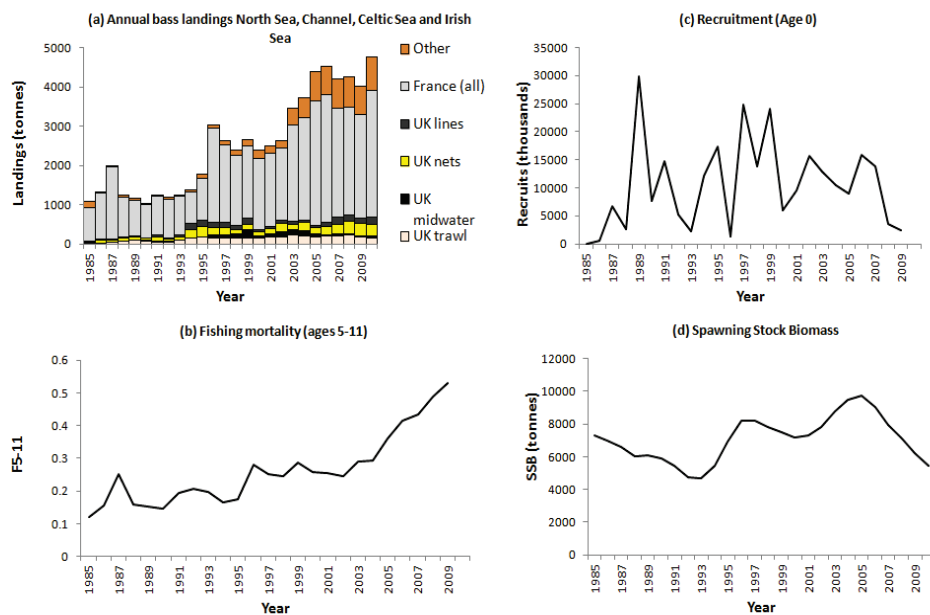


Figure 7: Results of 2012 benchmark assessment of sea bass in the North Sea, Channel, Celtic Sea and Irish Sea (IVbc, VIIa,d-h). (a) Landings series for the fleet units included separately in the assessment; (b)-(d) model estimates of fishing mortality, recruitment and spawning stock biomass.

Recreational fishery estimates

Recreational fishery survey data reviewed by IBP-New are described below.

France: a new study targeting sea bass was conducted between 2009 and 2011. Estimates of sea bass catches were obtained from a panel of 121 recreational fishermen recruited during a random digit dialling screening survey of 15000 households in the targeted districts. The estimated recreational catch of bass in the Bay of Biscay and in the Channel was 3170 t of which 2350 t was kept and 830 t released. The relative standard error of the estimate was 26% (revised from a figure of 51% given to IBP-

New). Around 60% of the recreational catch estimate was from Bay of Biscay. The main gears used, in order of total catch, were fishing rod with artificial lure, fishing rod with bait, handline, longline, net and spear fishing. Approximately 80% of the recreational catch was taken by sea angling (rod and line or handline); 2610 t total catch and 1840 t kept (29% release rate).

UK: a new survey programme based on a statistically sound survey design commenced in 2012 to estimate fishing effort, catches (kept and released) and fish sizes for shore based and boat angling in England. The survey does not cover other forms of recreational fishing. Results will be available late 2013.

Netherlands: a recent survey investigated the amount of sea bass caught by recreational fishers (van der Hammen and de Graaf, 2012; ICES, 2012). Estimates of sea bass catches were obtained from a panel of 1,043 recreational fishermen recruited during a telephone survey of 109,293 people. Preliminary estimates are that about 360 thousand individual sea bass were caught in 2010. Of these, 218 ± 130 (95% CI) thousands were retained, which is about 61%. In weight, 161 tonnes of sea bass were caught in total. Of this, 96 ± 60 (95% CI) tonnes were retained, which is 60%. These results are mainly applicable to Subarea IV.

Spain: a recreational boat fishing survey was performed in the Basque Country to estimate the total catch of the target species of this fishery in 2009. Sea bass catch data from 555 surveys were modelled with a two-step GLM, using type of boat and total boat length as covariables. The results were extrapolated to the total number of boats using an updated census. The estimated catch for sea bass in 2009 was 8.2 tons, with an associated standard error of 0.149 tons. This is an underestimate of recreational catches as it excludes shore fishing, which is the subject of a pilot study in 2012.

Ireland: the only time-series of recreational fishery data available to IBP-New 2012 was provided by stakeholders participating in the meeting. Cpue data were collected by the Cork Sea Angling Club (mainly shore anglers on the south coast of Ireland) from approximately ten angling competitions held each year. This series is within assessment area 4 (Irish coastal waters in VIa, VIIb, VIIj). Numbers of sea bass per angler-days declined rapidly from the mid-1960s for a decade, after which it stabilized for a further decade, before declining to its lowest level in the 1980s. Part of the decline in the 1960s was associated with the very strong 1959 year class. Some additional information on age compositions of anglers' bass catches was also provided.

Ireland has conducted recreational fishery surveys for the Data Collection Framework, though estimates were not provided to IBP-New.

Combined recreational fishery catch estimates in relation to commercial catches

To estimate fishery harvests (retained plus released fish dying), an estimate of hooking mortality is needed. The National Marine Fisheries Service in the US has in the past used an average hooking mortality of 9% for striped bass, estimated by Diodati and Richards, 1996. Striped bass are very similar to European sea bass in terms of morphology, habitats and angling methods. A literature review of hooking mortality for a range of species compiled by the Massachusetts Division of Marine Fisheries included a total of 40 different experiments by 16 different authors where striped bass hooking mortality was estimated over two or more days (Gary A. Nelson, Massachusetts Division of Marine Fisheries, pers. comm.) The mean hooking mortality rate was 0.19 (standard deviation 0.19). Direct experiments are needed on European sea bass to estimate hooking mortality for conditions and angling methods typical of European fisheries.

Table 3: French and Dutch combined estimates of recreational fishery removals for 2010 in areas IV and VII, including an assumed hooking mortality of 20% for released fish (RSE = relative standard error).

	All Areas IV-VIII			Areas IV and VII only				
	kept	released	RSE	Proportion in IV&VII	kept	released	hooking mortality	total removed
France 2010	2350	830	0.26	0.4	940	332	20%	1006
Netherlands 2010	96	65	0.31	1	96	65	20%	109
Total								1115

For assessment area 1 (IVbc, VIIa, d-h), these removals would represent 19% of a combined fishery removal of 5850 t in 2010 (1115 t recreational + 4736 t commercial), although this percentage will be imprecise due to the large RSEs for the recreational catch estimates (for France, the RSE for Areas IV and VII is 0.41 as only 40% of the catch estimate is for this area). The addition of recreational catches from the UK, Belgium and other countries would increase this percentage, but addition of commercial discards weights for all international fleets would reduce the percentage. Estimates of discards weights of sea bass in Areas IV and VII in 2010 for UK trawls and nets, and French fleets, are around 200 t. These figures exclude discards from other national fleets or UK fleets not sampled. Retained catches of sea bass by UK sea anglers were estimated in the late 1980s and early 1990s to be around 400 t per year (Dunn *et al.*, 1989; Dunn and Potten, 1994), although these estimates are of unknown accuracy. It is possible, therefore, that recreational fisheries could potentially account for around 20% of the fishing mortality in recent years in areas IV and VII. It is not possible to evaluate how the recreational fishing mortality rate may have altered over time, and how this would affect the fit of the assessment model, including initial depletion rate. Further work is needed on how to handle recreational data (recent estimates and missing historical data) in assessments and advice for sea bass.

For the Biscay area, the French recreational survey estimate of sea bass harvest for 2010 is 1,500 t, including 20% hooking mortality of releases. In comparison the commercial landings for VIIIa,b in 2010 were 2,258 t. Hence, recreational fishery harvests are around 40% of total harvest. This percentage would be greater after inclusion of Spanish recreational catch estimates.

Assessment trends from Stock Synthesis model: area IV&VII stock.

The stock assessment for bass in areas IV&VII is conducted using Stock Synthesis 3 (Methot, 2000) – a statistical model estimating population numbers and fishing mortality based on (for sea bass) fishery landings and length compositions, survey indices of abundance, growth parameters and input natural mortality values. A natural mortality value of $M=0.2$ was adopted based on a range of published methods linking M with growth, maturity and/or maximum observed age. The maximum observed age of around 30 years was from the 1980s, and will also have been affected by earlier commercial and recreational catches. Hence, a component of the M could represent recreational removals. The recreational fishery estimates cannot be included yet (only one year).

Most sensitivity runs with different model settings and inputs indicate a recruitment driven growth in biomass in the 1990s and early 2000s and a strong increasing trend in fishing mortality (Fig. 7). Recent year classes have been very weak, and combined with high fishing mortality, the decline in SSB is expected to continue.

Future handling of recreational fishery data in the assessment.

The assessment of sea bass has now moved into two regional ICES stock assessment working groups. The benchmark assessment of bass in IVbc and VIIa,d-h will be repeated as annual updates by the Working Group on the Celtic Seas Ecoregion (WGCSE) and the more southerly stocks in Biscay and Iberian waters are being handled by the Working Group on Hake, Monk and Megrim (WGHMM). The first of these meetings assessing sea bass are in May 2013.

WGRFS advises that WGCSE and WGHMM continue to document recreational fishery estimates until such time as the estimates can be incorporated in the analytical process following a future benchmark. Due to the large recreational fishery removals estimates, WGRFS emphasizes the need for the recreational fishery estimates to be evaluated against guidelines for best practice, and the potential for bias to be fully evaluated using the data quality reports being developed by the WG.

Table 4: Summary of recreational surveys providing data for sea bass in IVb-c, VIIa, VIId-h

Country	Years	ICES areas covered	Recreational fisheries covered	Type of survey	Effort estimates	CPUE estimates	Catch estimates	Length/age compositions	Gaps in data coverage? ¹
France	2011 & 2012	VIId,e,h	Shore, private boat, charter boat; angling & non-angling	Offsite	RDD survey	Telephone diary panel	CPUExeffort		
Netherlands	2010...	IVc		Offsite	RDD survey	Telephone diary panel	CPUExeffort		
UK (England)	2012 (in prep)	IVbc, VIIa,d,e,f,g	Shore & private boat angling	Offsite & onsite	Face-to-face stratified random population survey	Stratified random roving-creel survey	CPUExeffort		Non-angling gears excluded.
UK (England)	2012/13 (in prep)	IVbc, VIIa,d,e,f,g	Charter boat angling	Onsite	Stratified random survey using vessel list frame	Stratified random survey using vessel list frame	Stratified random survey using vessel list frame	Skipper diaries	No coverage of Wales
UK (NI)	2012	VIIa	Shore, private boat, charter boat	On-line survey		On-line survey			
Belgium									
Ireland									
Other....									

Table 5: Gaps in data coverage, and imputation procedures.

Country	Year	Recreational fisheries	Spatial gap	Imputation procedure, if applied	Temporal gap	Imputation procedure, if applied	Bias evaluation
France	2011 & 2012	Excludes under 15 years old & non-residents	No data collected	None	No data collected	None	Expected to be minor
UK	2012	Non-angling gears	No data collected	No estimates made	No data collected	No estimates made	Expected to be small component
UK	2012	Angling gears: shore, private & charter boats	No catch surveys in Wales	None	No catch surveys in Wales	None	Significant missing catch

4 Assessing the Quality of Recreational Fishing Data (ToRs c, d, f)

WGRFS 2013 addressed three Terms of Reference (c, d and f) related to documentation and quality evaluation of recreational fishery surveys from the initial survey design through to implementation and analysis, and the compilation of national estimates to give international estimates for stock assessment or other purposes. The work carried out on these ToRs built on the WGRFS 2012 proposals for data quality indicators, and taking into account more recent outcomes by the ICES Workshop on Practical Implementation of Statistical Sound Catch Sampling Programmes (WKPICS2 – ICES, 2012b) where guidelines for best practice in sampling designs were developed, and further development of data quality scorecards was carried out.

Methods of performing a gap analysis (ToR c) were discussed and some trial spreadsheets were developed, and a trial completion and modification of the scorecard format proposed by WGRFS 2012 was carried out (ToR f). The WKPICS “best practice” guidelines for commercial fishery sampling were modified to apply to recreational fisheries. Finally, a reporting system was developed based on USA surveys that provide a clear description of a sampling programme in similar format to the “best practice” guidelines whilst also providing information on the existence and possible magnitude of biases at each stage.

The conclusion by WGRFS of this exploratory work was that there is no single way to document data quality that is suitable for all end users, and that a “toolkit” of reporting systems is needed that will provide different end users with the type of information that they require (Fig. 8). The end users and their requirements could include:

1. National laboratories (for documenting and monitoring national schemes)
2. Regional Coordination Groups (overviews of sampling schemes extant within the region; identification of important gaps in data; developing recommendations for optimizing sampling across countries)
3. European Commission (evaluation if Member States are meeting DCF / DC-MAP requirements for delivery of data using statistically sound methods)
4. Stock assessment expert groups (data quality in terms of precision and bias of estimates being used for assessments).
5. WGRFS itself (monitoring the extent and effectiveness of recreational fishery surveys; basis for ongoing development of methods; responding to specific requests).

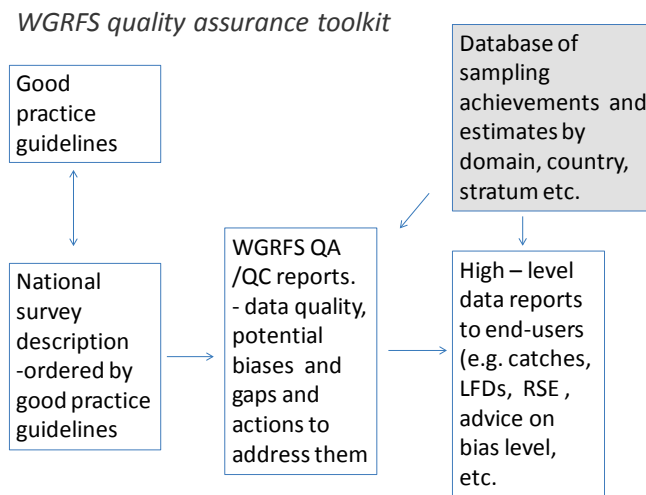


Figure 8. Toolkit of documentation formats for communicating recreational fishery survey data quality issues and metrics to different end users. (“Database of sampling achievements” may simply be an archive of tables or spreadsheets maintained by WGRFS, not necessarily a specific database).

The development of this toolkit is still a work-in-progress, and WGRFS was not able to provide final, agreed formats for these reports. The following sections document achievements in developing (1) best practice guidelines; (2) national survey descriptions and quality documentation in relation to best practice. Other quality report formats will be the subject of continuous development and practical trial by WGRFS.

4.1 Revised Guidelines for best practice in recreational sampling schemes

WKPICS2 (ICES 2012b) developed guidelines for “best practice” in the design, implementation and analysis of sampling schemes to estimate discards and size frequencies of commercial fishery catches. This was done at the request of the European Commission to provide a simple means of evaluating national sampling schemes against best practice. These guidelines were reviewed by WGRFS and adapted to be suitable for recreational fishery survey programmes.

Best practice can be defined as sampling designs, implementation and data analysis that lead to minimum bias and an accurate estimate of precision, and which make the most efficient use of sampling resources. For example, probability-based sampling with accurate control of the inclusion probabilities would be considered an example of best practice. However, if logistical, legal, and economic constraints dictate the use of a non-probability based scheme to select primary sampling units (for example legal requirements in the selection of a reference fleet), it is good practice if the selection is done in a way that ensures representative coverage of the target population and minimises bias, and if this can be demonstrated with suitable diagnostics. Bad practice would be an ad-hoc, non-probability based sampling scheme, particularly where there are no census data to show how representative the samples are of the population or to re-weight the samples during analysis.

Where bias is unavoidable, best practice requires collection of information that allows the form and level of bias to be investigated, and to develop mitigating measures where possible. For example, by recording all refusals (and the reasons) for non-supply of data by sampled charter boat skippers, and the characteristics of those vessels and their activities, there is a better possibility to evaluate the potential for bias.

In the fullest sense, best practice for national recreational fishery sampling schemes encompasses survey design, documentation of objectives, design and protocols, staff training, data collection and archiving, systems for monitoring sampling performance, and data analysis. Some of these aspects would require lengthy documentation, so WGRFS has followed the approach of WKPICS2 to restrict the guidelines mainly to aspects of design in the expectation that good practice for the other aspects of sampling schemes would be demonstrated by the availability of detailed national sampling protocols. Annex 5 provides draft “best practice” guidelines developed by WGRFS, which could be included in a repository with best practice for the new DC-MAP.

4.2 Condensed set of guiding questions

The following scorecard questions were developed to guide the evaluation process with the main aims to capture survey improvements and highlight key issues in national surveys. The magnitude of bias depends on the national characteristics of the marine recreational fishery.

DESIGN			
QUESTION		Answer	Comments (including Magnitude and Direction of Bias)
Target population	Are all sectors contribution to the total catch, harvest or release well-known and documented?	Yes / No / Unknown	
	Is there illegal/tourist fishery, which is not accounted for?	Yes / No / Unknown	
	Are there elements of the target population that are not accessible?	Yes / No / Unknown	
Target frame	Is the PSU identified and documented?	Yes / No / Unknown	
	Does the sampling frame fully cover the target population?	Yes / No / Unknown	
	Are there elements of the target population that are excluded from the frame (e.g. non-residents, private access sites)?	Yes / No / Unknown	
Stratification	Are the strata well defined, known in advance and stable?	Yes / No / Unknown	
	Is there an overstratification leading to excessive imputation?	Yes / No / Unknown	
Selection	Is sampling probability based (e.g. stratified random with spatial strata, PPS)?	Yes / No / Unknown	

IMPLEMENTATION			
QUESTION		Answer	Comments (including Magnitude and Direction of Bias)
Selection	Has the survey been designed to maximize precision?	Yes / No / Unknown	
	Are there protocols in place and have they been followed for subsamples (selection of individuals, times, boats, biological samples)?	Yes / No / Unknown	
	Are the right sites, times, respondents, biological data sampled?	Yes / No / Unknown	
	Is there a language barrier (tourist fishery)?	Yes / No / Unknown	
	Is there a preference not to engage with illegal fishers (e.g. threatening behavior)?	Yes / No / Unknown	
	Has the assignment been completed?	Yes / No / Unknown	
Nonresponse	Are response rates recorded and evaluated?	Yes / No / Unknown	
	Are refusal rates (e.g. according to spatial issues, fishing in MPAs or fishing for high value species) recorded and evaluated?	Yes / No / Unknown	
	Have you re-evaluated refusals?	Yes / No / Unknown	
	Have you accounted for not completed assignments (unobserved sample bias)?	Yes / No / Unknown	
Recall	Is the recall period appropriate?	Yes / No / Unknown	
	Does recall period match fishing season?	Yes / No / Unknown	
Effort	Is effort well defined (unit, fishing mode, target species, location) and related to CPUE measures?	Yes / No / Unknown	
	Is the concept of effort understood by respondents?	Yes / No / Unknown	
	Is it possible to record incorrect fishing areas?	Yes / No / Unknown	
Catch	Is catch verified by surveyors (e.g. all filleted, don't show)?	Yes / No / Unknown	
	Is species identification and naming reliable?	Yes / No / Unknown	
	Is there a clear division between fish kept and fish released?	Yes / No / Unknown	
	Are there any high-valued/threatened species taken in the fishery that might be unreported?	Yes / No / Unknown	
	Is there a digit preference in the reports?	Yes / No / Unknown	

ANALYSIS			
QUESTION		Answer	Comments (including Magnitude and Direction of Bias)
General	Does the estimation procedure follow the survey design?	Yes / No / Unknown	
	Has imputation been used to account for missing observations and, if so, is the procedure documented?	Yes / No / Unknown	
	Has the precision of estimates been calculated and, if yes, where are the documented?	Yes / No / Unknown	
	Has there been weighting to correct for nonresponses/avidity bias	Yes / No / Unknown	
	In panel surveys, have those selected changed their fishing pattern or activity?	Yes / No / Unknown	
	Is the bias caused by drop-outs and drop-ins in a panel corrected for?	Yes / No / Unknown	
WGRFS ASSESSMENT OF SURVEY			
WGRFS summary assessment of key bias and how the survey design could be improved to account for these biases in future. This will form the basis of any advice that is provided to end users on the quality of the estimates produced.			

5 European Requirements for Recreational Fishing Surveys (ToR d)

Following from the conclusions of its 2012 report, WGRFS 2013 continues to advise that requirements to collect recreational fishery data in the new Multi-Annual Data Collection programme (DC-MAP) should be driven by end-user needs. Flexibility is needed to include data for additional species or areas and to allow for differences between countries in the types of surveys that are appropriate or possible. WGRFS 2013 also continues to highlight the importance of collecting data for evaluating the economic and social value of recreational sea fishing.

The need for recreational fishery data, and how it should be collected, have been discussed by Regional Coordination Meetings in recent years, and by STECF Expert Working Groups dealing with the Data Collection Framework and the development of the DC-MAP. However, the topic has often been inadequately covered, particularly in comparison with commercial fishery data collection, and proposals have been made that in some cases appear unsupported by expert analysis to demonstrate the impacts on stock assessment and fishery management. This includes the proposal that recreational fishery surveys should only be included in DC-MAP if they are responsible for more than X% of total fishery harvests, or that the frequency of surveys could be reduced. WGRFS is of the opinion that decisions are required on a case-by-case basis, including consideration of recreational fishery impacts on local populations that may not be evident from fishery removals over large spatial scales.

More recently, STECF EWG 13-02 (March 2013) considered the classification of end-users, and the need for flexibility to include new data requirements, or modify or delete existing data requirements in the DC-MAP Master Reference Register, according to end-user needs. A process for evaluating such changes to data collection requirements, according to objective criteria, was developed. The EWG 13-02 considered that

Regional Coordination Groups, involving (where necessary) PGECON and Expert Groups, would be responsible for the evaluations.

WGRFS considered the EWG 13-02 draft text, and in the following section develops proposals for how end-user needs for recreational fishery surveys can be evaluated within DC-MAP, and how such surveys can be coordinated by the Regional Coordination Groups in collaboration with WGRFS.

5.1 Identifying end-user needs for recreational fishery data

WGRFS notes that there are many potential end users and uses for recreational fishery data. The specific data requirements (effort, catches, biological and economic data by species, areas, scales of data aggregation, and precision) may differ between end users. Examples of uses include:

- Catches and size/age compositions at stock level for input into ICES stock assessment models.
- Métier-type data required by Commission/STECF/ICES to evaluate fleet-based management (including recreational fishery métiers).
- Defining objectives and approaches for fishery management (e.g. how to manage resources shared by commercial and recreational fishers where objectives may be conflicting).
- Evaluation of economic value/impact and social benefits of different fishery sectors.
- Supporting the evaluation of local area impacts – for example the total recreational catch may be a small component of the total catch for a stock, but there may be larger impacts at local/national scales. There may also be specific national needs for data to manage the impacts.
- Input to development and operation of spatial management tools such as MCZs/MPAs.
- Monitoring changes in species diversity.

5.2 Evaluation of end-user needs and the WGRFS role

WGRFS advises that the decision process for including recreational fishery surveys in DC-MAP, and for designing and implementing the surveys, must take full account of the end-users' needs, and should be based around an objective set of criteria. STECF EWG 13-02 developed a set of objective criteria to be applied when deciding to add, change or delete data collection requirements in the DC-MAP Master Reference Register. A seven-step process of evaluation was proposed, addressing: *Need and Relevance; Impacts; Feasibility; Methods; Costs; Data quality; and End use*. WGRFS fully supports this proposal. The EWG 13-02 identified RCGs, PGECON and expert groups as responsible for the evaluations. WGRFS proposes that it should be involved in this process, as it is the Expert Group on recreational fishery surveys in Europe, and should have appropriate Terms of Reference to provide advice to RCGs on how any end-user requests for recreational fishery data can best be addressed.

The role of WGRFS in the regional coordination process should include:

- Providing expert advice to RCGs on how end-user needs for recreational fishery survey data can be addressed.

- Providing best practice guidelines, methodology, documentation, quality assurance reports and quality indicators for national and regional/stock aggregated data.
- Identifying gaps and issues to be addressed to improve data.

5.3 Identifying the frequency and coverage of recreational fishery surveys

End-users may specify the need for surveys, but the form and intensity of surveys will be constrained by available budget. Within Europe, commercial fishery landings are recorded exhaustively through logbooks or sales slips, apart from some small-scale fisheries where surveys are needed to estimate catches. Discards are typically estimated from at-sea observer schemes, required annually for Member States by the Data Collection Framework for métiers where discards account for 10% or more of the catches. Pilot studies have been conducted for métiers with low discard rates, to provide evidence to seek derogations to sample these fleets for discards. The need for recreational surveys could be viewed in the same context. WGRFS considers below some approaches that have been raised within the European fisheries community for deciding on the need for surveys.

Percentage of total removals as a threshold for triggering a survey

WGRFS proposes that a fixed percentage threshold (percentage of total removals, by weight, attributable to recreational fisheries) is inflexible and not appropriate as a sole decision rule. Recreational fisheries for particular species may become more or less important over time, and there is a need for time series data to show trends. Furthermore, in a situation of overfishing, recreational fisheries could still be exerting a significant fishing mortality even if the estimated total removals weight is below the designated threshold. This may occur particularly if the recreational fisheries have a large component of young fish with low average weight, where the numerical catch could be relatively large but the catch weight relatively small, for example in coastal or estuarine nursery areas. Heavily exploited stocks under recovery also need better evaluation of all sources of mortality, with sufficient precision.

Bearing in mind the need to achieve cost-effectiveness in fishery monitoring programmes, WGRFS recognises that large and expensive survey programmes are difficult to justify in sea areas where the overall recreational fishing effort and impacts are known to be very low and where estimates would have minimal effect on management decisions. An appropriate approach could be an adaptive survey design that maintains a core, low-level and relatively inexpensive annual monitoring when recreational fishing effort and catches are low, but can increase the sampling to improve precision should catches and fishing mortality increase. This would require survey designs that achieve consistency and minimal bias at different levels of sampling intensity. An adaptive survey design could also vary sampling effort on a spatial / national level, analogous to trawl survey optimisation where additional stations can be added to strata in a stratified random survey design, should abundance increase or decrease over time in particular stratum. A risk with this approach is that budgets and teams established to carry out low-level surveys may prove difficult to increase when required.

Fixed frequency of surveys at periods of years

Annual recreational fishery surveys are expensive, particularly where there is no exhaustive register of fishers or vessels and additional surveys are needed to estimate the population. This may drive a request to carry out surveys only at intervals of two

or more years to save costs. From a stock assessment perspective, this would necessitate an imputation of annual recreational fishery catches for years with no data, which could be achieved using statistical models assuming some persistent relationship between recreational catches and other fishery removals.

Several issues need to be considered before adopting surveys only at intervals of several years:

- Recreational fishery surveys are demanding in terms of expertise and infrastructure. Intermittent surveys could lead to loss of survey expertise, teams and budgets.
- There would be a need for stock assessment methods that can deal with intermittent catch data – e.g. statistical models /Bayesian approaches (as applied to Baltic salmon).
- Simulations (management strategy evaluations) would be needed to evaluate impact on assessments/management. For example, annual data at relatively low precision (from a low-intensity and inexpensive survey) may provide better information than intermittent higher-precision surveys. This may apply particularly where there is large inter-annual variability in fishing activities due to weather or other factors.
- If endangered / threatened species are caught in the fisheries, there may be a legislative requirement for annual data.
- Management plans may specify data requirements.
- There may be need for specific types of data for individual stocks e.g. sub-annual data for very seasonal fisheries; continuous monitoring of salmon recreational fisheries for specific purposes.

WGRFS is of the opinion that annual surveys would be optimal for many cases, and that in some cases they could better preserve expertise, infrastructure and budget of the surveys over time. However, the choice of frequency and design of the surveys depends on various criteria such as impacts of national recreational fisheries on stocks, conservation status of species caught, specific end user needs, and the number of species for which data are collected from the same survey. Multi-annual surveys could be adopted where the impact on assessments and advice have been evaluated and found acceptable. Methods for improving cost-benefit should be explored, where this can allow better-targeted and cheaper surveys to be carried out annually. A good example could be obtaining a comprehensive list frame of recreational fishers or charter vessels, for example through a register, to avoid the need for expensive population surveys by post, random digit dialing etc. If a population survey is unavoidable, consideration could be given to carrying this out at longer intervals than annual, and drawing from this population frame to apply an annual randomized telephone-diary type approach in the intervening years.

6 Glossary of Recreational Fishing Terms (ToR a)

These definitions have been taken from a number of sources including Wikipedia, national recreational fishing reports, ICES, and FAO, and were adapted for our purposes. The terms are defined in the context of recreational fishing and some terms may have slightly different (but analogous) meanings for commercial fishing and in fisheries science.

Term	Definition
Access point	Location where anglers are intercepted (e.g. for an on-site survey).
Active fishing	Fishing using line, spear, and hand-gathering.
Angling	Fishing with handlines, fishing rods and/or poles using baits and/or lures.
Avidity	The time spent fishing or frequency of fishing activity, measured as number of days on which fishing trips were made.
Bag limit	Maximum allowable number or total weight of individuals kept.
Best practice	Planning, organization, managerial and/or operational practices that have proven successful in particular circumstances in one or more regions and can have both specific and universal applicability.
Bycatch	Part of catch of a fishing unit taken incidentally in addition to the target species towards which fishing effort is directed.
Catch	Total number or weight of individuals caught during fishing operations.
Catch-and-release	The process of capturing a fish, usually by angling, and releasing it alive. Catch and-release ranges from legally required mandatory release of protected sizes and species to voluntary catch-and-release of fish that could have been retained.
Census	Sampling of every unit in the target population.
Charter Boat	A boat or vessel operating under charter for a price, time, etc. It is operated by a licensed captain and crew or individually and the participants are part of a pre-formed group of anglers. Thus, charters are often closed parties, but some countries include head and tour boats in this definition.
Commercial fisheries	Fisheries whose primary aim is to generate profit.
Complemented survey	Survey combining two or more contact methods (e.g. a telephone survey to estimate effort and an access survey to estimate catch rates).
CPUE	Catch (e.g. number or weight of fish) per some unit of fishing effort (e.g. per hour fishing).
Creel survey	Catch assessment survey undertaken to estimate the catches made by recreational fishermen, usually through a sampling program involving interviews and inspection of individual catches in the identified fishing and landing places (on-site).
Diary survey	Survey undertaken to estimate the effort and/or catches made by recreational fishermen by the mean of their diaries.
Discards	Portion of catch released, dead or alive.
Dwelling	Household or group of households related to the same place.
Fishing effort	A measure of resource use by fishers. Typical units of effort are number of trips, fishing time, and/or number of fishing gears used.
Fishing gear	Equipment used for fishing (e.g. hooks, traps, nets).
Frame	Complete set or list used to gain access to the target population for sampling (e.g. telephone directory for a RDD telephone survey).
Harvest	The part of the catch that is kept, not released.
Headboat	A boat operated by licensed captain usually carrying greater than seven anglers. Fees are paid on a per head (angler) basis. (see also tour boat)

Hours fished	The amount of time an angler actively fished in a mode with fishing gear in the water.
Intercept survey	Interviewing anglers and examining their catch upon completion of their fishing trip, or under certain circumstances, while they were still fishing.
License	Authorisation to fish in a particular place.
Mail survey	Data collected through questionnaires sent to recipients by post asking for information about previous fishing activity, catch, or expenses.
Measurement error	Is the difference between a measured value of quantity and its true value.
Minimum landing size	The MLS is the smallest length at which it is legal to keep or sell an individual.
Mortality	The loss of individuals from a stock due to predation, death from disease, and removals by fishing.
Multi-stage sampling	A sampling method in which the target population (e.g. recreational fishers, charter boats, shore fishermen) in principle first is divided into a number of groups or primary units from which samples can be drawn (sampling stage 1). Examples of first stage units (primary sampling units) are households, trips, and sites. The components in each primary sampling unit in the sample can then be sub-sampled in the secondary stages, and so on.
Non-residents	Someone that fishes in a particular area, but is excluded from the sampling frame for surveys in that area.
Non-response error	Bias in estimates caused by the difference between respondents and non-respondents arising when people refuse or are unable to answer a survey question.
Non-sampling error	Deviations from the true value that are not a function of the sample chosen, including various systematic errors and any random errors that are not due to sampling.
Offsite sampling	Intercepting respondents away from principal areas of activity, e.g. household.
Online survey	An online survey is a questionnaire that the target audience can complete over the Internet. Online surveys are usually created as web forms with a database to store the answers and statistical software to provide analytics. People are often encouraged to complete online surveys by an incentive such as being entered into a prize draw.
Onsite sampling	Intercepting respondents at principal areas of activity, e.g. fishing sites.
Passive fishing	Fishing with “passive” methods including nets, traps, pots, and set-lines.
Possession limit	The maximum number or weight of a particular type of fish you can possess in a specified area.
Prestige bias	Bias arising when surveyed anglers exaggerate the number and size of the fish they caught.
Primary Sampling Unit (PSU)	PSU refers to sampling units that are selected from the sampling frame in the first (primary) stage of a multi-stage sampling survey (hierarchical sampling).
Probability sampling	Sampling in which all possible samples have known probabilities of being drawn.
Random Digit Dialing (RDD)	RDD is a method for selecting people for involvement in telephone statistical surveys by generating telephone numbers at random.
Recall bias	Bias arising when anglers do not remember correctly events or experiences in the past.
Recreational fishing	Recreational fishing is the capture or attempted capture of living aquatic resources mainly for leisure and / or personal consumption. This covers active fishing methods including line, spear, and hand-gathering, and

	passive fishing methods including nets, traps, pots, and set-lines.
Refusals	Selected respondents that refuse to participate in surveys.
Removals	Individuals who have been definitely removed from the stock/population (harvest + dead discards/releases).
Rounding bias (also known as digit bias)	Bias arising because anglers round their catch or other data to numbers ending in 0 or 5.
Sampling frame	A sampling frame is the list of sampling units or device from which a sample is drawn. The sampling frame comprises all the primary sampling units and any stratification of these, and may be based on a vessel registry or list of ports.
Screening survey	A survey to identify the target population of recreational fishers and their fishing characteristics.
Secondary Sampling Unit (SSU)	SSU refers to the sampling unit selected from the primary sampling unit.
Simple random sampling	Selecting a subset of individuals/units from a frame where each individual/unit has the same probability of being selected.
STECF	The Scientific, Technical and Economic Committee for Fisheries advises the European Commission on biological, ecological, technical and economic factors affecting fisheries.
Stratification	Stratification is the process of dividing members of the population into homogeneous subgroups before sampling.
Survey	A survey is a method of gathering information from a number of individuals, known as a sample, in order to learn something about the larger population from which the sample is drawn.
Telescoping	Telescoping is when respondents report an event (either effort or catch) that happened outside of the period in question. An example is reporting of the capture of a trophy fish that happened outside of the survey recall period.
Tour boat	Boat offering fishing trips taking a number of recreational fishers that pay individually.
Wash up survey	The final part of the survey where the attitudes and awareness of recreational fishers to a variety of fisheries issues are measured.

Cited References

- Diodati, P. and R.A. Richards. 1996. Mortality of striped bass hooked and released in salt water. *Transactions of the American Fisheries Society*. 125: 300–307.
- Dunn, M., Potten, S., Radford, A. and Whitmarsh, D. 1989. An Economic Appraisal of the Fishery for Bass in England and Wales. Report to the Ministry of Agriculture, Fisheries and Food. University of Portsmouth. 217 pp.
- Dunn, M.R. and Potten, S. 1994. National Survey of Bass Angling: Report to the Ministry of Agriculture, Fisheries and Food. University of Portsmouth, Centre for the Economics and Management of Aquatic Resources. 45pp + appendices.
- ICES 2010. Report of the Planning Group on Recreational Fisheries Surveys (PGRFS), 7-11 June 2010, Bergen, Norway. ICES CM 2010/ACOM:34. 168 pp.
- ICES 2011. Report of the Planning Group on Recreational Fisheries Surveys (PGRFS), 2-6 May 2011, Esporles, Spain. ICES CM 2011/ACOM:23. 111 pp.
- ICES 2012a. Report of the Working Group on Recreational Fisheries Surveys (WGRFS), 7-11 May 2012, Esporles, Spain. ICES CM 2012/ACOM:23. 55 pp.
- ICES 2012b. Report of the second ICES Workshop on Practical Implementation of Statistical Sound Catch Sampling Programmes (WKPCS2). ICES CM 2012 / ACOM: 54
- ICES 2013a. Report of the Benchmark Workshop on Baltic Multispecies Assessments (WKBALT), 4–8 February 2013, Copenhagen, Denmark. ICES CM 2013/ACOM:43. 215 pp.
- ICES 2013b. Report of the Baltic Fisheries Assessment Working Group 2013 (WGBFAS), 12 - 19 April 2012, ICES Headquarters, Copenhagen. ICES CM 2012/ACOM:10. 859 pp.
- Methot, R.D. 2000. Technical Description of the Stock Synthesis Assessment Program. National Marine Fisheries Service, Seattle, WA. NOAA Tech Memo. NMFS-NWFSC-43: 46 pp.
- Nielsen, A. 2008. State-space assessment model for cod in the Kattegat. Working Document 7, ICES WGBFAS 2008.
- Nielsen, A. 2009. State-space fish stock assessment model as alternative to (semi-) deterministic approaches and stochastic models with a high number of parameters Working Document 14, ICES WKROUND.
- Pawson, M.G., Glenn, H., and Padua, G. 2008. The definition of marine recreational fishing in Europe. *Marine Policy*, 32: 339–350.
- Pollock, K.H., Jones, C.M. & Brown, T.L. 1994. Angler survey methods and their applications in fisheries management.
- Quayle, V.A., Righton, D., Hetherington, S. and Pickett, G. 2009. Observations of the Behaviour of European Sea bass (*Dicentrarchus labrax*) in the North Sea. In: J.L. Nielsen *et al.* (eds.), *Tagging and Tracking of Marine Animals with Electronic Devices, Reviews: Methods and Technologies in Fish Biology and Fisheries* 9, DOI 10.1007/978-1-4020-9640-2 7, C _ UK Crown 2009.
- Sparrevohn, C.R. & Storr-Paulsen, M. 2012. Using interview-based recall surveys to estimate cod *Gadus morhua* and eel *Anguilla anguilla* harvest in Danish recreational fishing. *ICES Journal of Marine Science: Journal du Conseil*, 69, 323–330.
- Strehlow, H.V., Schultz, N., Zimmermann, C. & Hammer, C. 2012. Cod catches taken by the German recreational fishery in the western Baltic Sea, 2005 - 2010: implications for stock assessment and management. *ICES Journal of Marine Science: Journal du Conseil*, 69, 1769–1780.
- Van der Hammen, T and de Graaf, M. 2012. Recreational fishery in the Netherlands: catch estimates of cod (*Gadus morhua*) and eel (*Anguilla anguilla*) in 2010. IMARES Wageningen UR, Report Number C014/12, 61 pp.
- Weltersbach, M.S. & Strehlow, H.V. 2013. Dead or Alive – Estimating post-release mortality of Atlantic cod in the recreational fishery. *ICES Journal of Marine Science*, 70: 864–872.

Annex 1: List of participants

Name	Address	Email
Pentti Moilanen	Finnish Games and Fisheries Research Inst. (FGFRI) P.O. Box 2 00791 Helsinki Finland	pentti.moilanen@rktl.fi
Mike Armstrong	Cefas Pakefield Road NR33 0HT Lowestoft Suffolk United Kingdom	mike.armstrong@cefas.co.uk
Manuel Bellanger	IFREMER 155 rue Jean-Jacques Rousseau, Technopolis 40 F-92138 Issy-les-Moulineaux France	Manuel.Bellanger@ifremer.fr
Ryszard Grzebielec	National Marine Fisheries Research Institute (MIR) ul. Kollataja 1 81-332 Gdynia Poland	ryszard.grzebielec@mir.gdynia.pl
Kieran Hyder	Cefas Pakefield Road NR33 0HT Lowestoft Suffolk United Kingdom	kieran.hyder@cefas.co.uk
Jeremy Lyle	Institute for Marine and Antarctic Studies - Taroona University of Tasmania Private Bag 49 Hobart TAS 7001 Australia	jeremy.lyle@utas.edu.au
Atis Minde	Latvian Resources Agency Daugaugrivass Riga, Latvia LV-1049 Latvia	atis.minde@bior.gov.lv
Beatriz Morales-Nin	Mediterranean Institute for Advanced Studies C/ Miquel Marquès 21 07190 Esporles Mallorca, Iles Balears Spain	beatriz@imedea.uib-csic.es
Estanis Mugerza	AZTI-Tecnalia AZTI Sukarrieta Txatxarramendi ugarte a z/g E-48395 Sukarrieta (Bizkaia) Spain	emugerza@azti.es
Hans Jakob Olesen	Technical University of Denmark National Institute of Aquatic Resources (DTU Aqua) Jaegersborg Allé 1 2920 Charlottenlund Denmark	hjo@aqua.dtu.dk
Vidar Øresland	Institute of Marine Research Swedish University of Agricultural Sciences Turistgatan 5 453 30 Lysekil, Sweden	vidar.oresland@slu.se

Krzysztof Radtke	National Marine Fisheries Research Institute (MIR) ul. Kollataja 1 81-332 Gdynia Poland	krzysztof.radtke@mir.gdynia.pl
Harry V. Strehlow Chair	Thünen Institut für Ostseefischerei (TI- OSF) Alter Hafen Süd 2 18069 Rostock Germany	harry.strehlow@vti.bund.de
David Turnbull	Marine Scotland Scottish Government 1B-South Victoria Quay Edinburgh EH6 6QQ UK Scotland	david.turnbull@scotland.gsi.gov.uk
Jon Helge Vølstad	Institute of Marine Research P.O. Box 1870 N-5817 Bergen Norway	jon.helge@imr.no
Dave van Voorhees	National Marine Fisheries Services (NOAA) 1315 East West Highway Silver Spring, MD, 20910 United States	dave.van.voorhees@noaa.gov
Marc Simon Weltersbach	Thünen Institut für Ostseefischerei (TI- OSF) Alter Hafen Süd 2 18069 Rostock Germany	simon.weltersbach@vti.bund.de

Annex 2: Current/most recent marine recreational fishing surveys

A2.1. Baltic Sea (ICES Subdivisions 22–32)

Table A2.1. Most recently carried out, ongoing and/or planned marine recreational fishing surveys in the sampling period 2012/2013.

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 and effort of fishers who fished without a valid licence. 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 are available.	Sampled similar to cod.	Baltic salmon is mainly caught by 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, the catch of seatrout has also been 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 gears.		Catch reporting has been mandatory since 2005 For licensed recreational fishery with passive gears.

Country	Cod	Eel	Salmon	Sharks	Comments
Finland	Cod catch known to be very low. Catch estimate by postal survey of the whole Finnish population (see comments).	Catch estimate by postal survey of the whole Finnish population (see comments).	Catch estimate by postal survey of the whole Finnish population (see comments). For Salmon rivers there is an additional postal survey conducted on the basis of local fishing licenses.		A nationwide biennial recreational fishing survey is done for all species and gears. A stratified sample of about 6000 households is done with response rates of around 60% after a maximum of 3 contacts. A telephone interview is done 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 a nationwide CATI-Bus telephone screening, followed by a 1-year telephone diary recall survey. 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-weight 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 called every 4 months to remind them to fill in the diary. The survey period ends 31 July 2012. Results will be available in 2013.	Derogation pending. A survey is planned for 2013/2014.	Derogation requested, as there is no recreational fishery for sharks in German waters or from German vessels.	In 2013 a seatrout survey (1-year diary recall survey) was initiated. During the spring season a bus route intercept survey was used to recruit diarists and collect biological samples (length, weight, scales, tissue samples). Alongside catch data, diarists are asked to collect biological samples themselves.
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 commercial catches.
Lithuania	Small commercial angling boats are licensed, for number of trips and anglers can 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

Country	Cod	Eel	Salmon	Sharks	Comments
Poland	Pilot study planned for 2009/2010. Number 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 biennial (more or less) recreational fishing survey (mail and telephone), including all species, sub-areas and all gears has been done. However, a new improved design will be implemented during 2013. The national survey is supported by a regional study on cod (tourboat fishing) that has been done for the last two years in the Sound between Sweden and Denmark (2011 and 2012). This continues in 2013. This is the most important area in Swedish waters for recreational fishing for cod. 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.).

A2.2. North Sea (ICES IIIa, IV and VIId) & Eastern Arctic (ICES I and II)

Table A2.2. Most recently carried out, ongoing and/or planned marine recreational fishing surveys in the sampling period 2012/2013.

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. Results show that there has been no change and that catches have even declined.	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. Results will be available in 2013.	A pilot study was carried out in August 2011 to estimate recreational shark catches in the German North Sea. Findings show that recreational shark catches are marginal and have no impact on the stocks.	
Denmark	See the Baltic (Table A2.1).	See the Baltic (Table A2.1).	See the Baltic (table A2.1).	See the Baltic (table A2.1).
Sweden	See the Baltic (table A2.1).	See the Baltic (table A2.1).	See the Baltic (table A2.1).	See the Baltic (table A2.1).
Norway	A rowing-creel survey is conducted in Southern Norway from April – August 2012 to: <ul style="list-style-type: none"> Estimate the proportions of angling tourists versus 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 			
UK (Scotland)				

Country	Cod	Eel	Sharks	Comments
UK (England)	<p>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:</p> <ul style="list-style-type: none"> • 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 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. 	Marine recreational survey estimates as for cod	As for cod	First results due in late 2013
France	A pilot study from 2010-2011 of French recreational cod catches in the North Sea showed no impact on the stock. In 2012, the French recreational cod catches in the North Sea were monitored through a national telephone and diary survey covering all species.	As for cod.	As for cod.	The National Survey covers cod, eel and sharks, but the marginal nature of these fisheries does not allow obtaining a reliable estimate of harvest for these species. The French recreational fisheries cod, eel, sharks and bluefin tuna catches have no (or low) impact on the stocks.
Belgium				

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 in 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 fresh water 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 in the beginning of 2013.		Weight estimates are based on poor length estimates. Numbers are therefore more accurate than weights.

A2.3. North Atlantic (ICES areas V–XIV and NAFO areas)

Table A2.3. Most recently carried out, ongoing and/or planned marine recreational fishing surveys in the sampling period 2012/2013.

Country	Sea bass	Salmon	Eel	Sharks	Comments
UK (Scotland)					
UK (England)	See North Sea (Table A2.2).	Recreational fishing for salmon is almost entirely in inland waters and is monitored by the Environment Agency.	See North Sea (Table A2.2).	See North Sea (Table A2.2).	See North Sea (Table A2.2).
Ireland					
France	See North Sea (Table A2.2).	n.a.	See North Sea (Table A2.2).	See North Sea (Table A2.2).	See North Sea (Table A2.2).
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 were presented in the WGEEL.		
Portugal					

A2.4. Mediterranean Sea and Black Sea

Table A2.4. Most recently carried out, ongoing and/or planned marine recreational fishing surveys in the sampling period 2012/2013.

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	See North Sea (Table A2.2).	See North Sea (Table A2.2).	See North Sea (Table A2.2).	See North Sea (Table A2.2).
Italy				
Greece				

Annex 3: 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.

A3.1. Baltic Sea (ICES Subdivisions 22–32)

Table A3.1. Most recent marine recreational harvest estimates – in tons (t) or numbers (#); figures in brackets indicate differing years – in the sampling period 2012/2013.

Country	Cod		Eel		Salmon		Sharks		Comments
	Harvest	Release	Harvest	Release	Harvest	Release	Harvest	Release	
Denmark	765.5 t	761,749 #	45.3 t	23,962 #	3,000 #	N/A	N/A	N/A	Data from 2011. Data on seatrout is also available
Estonia									
Finland									
Germany	2,479,569 # 3824 t	1,033,926 # 389 t			n/a	n/a	n/a	n/a	Eel catch estimates (recreational passive gear fishery) will be available in 2013
Latvia									
Lithuania									
Poland									
Sweden	85 t (2012)		n.a.	n.a.	57.3 t (2010)	28.1 t (2010)	n.a.	n.a.	Cod estimate from tour boat fishing in the Sound (2012). National survey (ref.year 2010)

A3.2. North Sea (ICES IIIa, IV and VIId) & Eastern Arctic (ICES I and II)

Table A3.2. Most recent marine recreational harvest estimates – in tons (t) or numbers (#); figures in brackets indicate differing years – in the sampling period 2012/2013.

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). 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	280,071 #	34.2 t	27,034 #	N/A	N/A	Data from 2011. Data on seatrout are also available
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 <i>et al.</i> , 2011). The release estimates for cod are based on two study areas in Northern and Southern Norway, respectively (Fertter <i>et al.</i> , in press).
UK (Scotland)							
UK (England)	Available 2013	Available 2013	Available 2013	Available 2013	Available 2013	Available 2013	
France							The National Survey covers cod, eel and sharks, but the marginal nature of these fisheries does not allow obtaining a reliable estimate of harvest for these species. The French recreational fisheries cod, eel, sharks and bluefin tuna catches have no (or low) impact on the stocks.
Belgium							
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.

A3.3. North Atlantic (ICES areas V–XIV and NAFO areas)

Table A3.3. Most recent marine recreational harvest estimates – in tons (t) or numbers (#); figures in brackets indicate differing years – in the sampling period 2012/2013.

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	3922 t (2012, provisional)	776 t (2012, provisional)							The National Survey covers cod, eel and sharks, but the marginal nature of these fisheries does not allow obtaining a reliable estimate of harvest for these species. The French recreational fisheries cod, eel, sharks and bluefin tuna catches have no (or low) impact on the stocks.
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.
Portugal									

A3.4. Mediterranean Sea and Black Sea

Table A3.4. Most recent marine recreational harvest/release estimates – in tons (t) or numbers (#); figures in brackets indicate differing years – in the sampling period 2012/2013.

Country	Bluefin tuna		Eel		Sharks		Comments
	Harvest	Release	Harvest	Release	Harvest	Release	
Spain							
France							The National Survey covers cod, eel and sharks, but the marginal nature of these fisheries does not allow obtaining a reliable estimate of harvest for these species. The French recreational fisheries cod, eel, sharks and bluefin tuna catches have no (or low) impact on the stocks.
Italy							
Greece							

Annex 4: ToRs for WGRFS in 2014

The next WGRFS meeting will take place from 2 – 6 June 2014 in Sukaretta, Spain. The ToRs for the meeting were split into multi-annual ToRs that will be addressed each year as they represent core outputs and specific ToRs for issues that will be addressed at this particular meeting. The ToRs are outlined below.

Multi-annual ToRs:

- a. Collate and evaluate national recreational catch (harvest & release) estimates. Evaluate the use of recreational catch estimates
- b. Assessing different survey designs (onsite, offsite) for improved data collection

Specific ToRs:

- c. Review and update the 'WGRFS Quality Assurance Toolkit (QAT)' based on the experience of filling in the spread sheets at country level
- d. Provide guidelines on effective communication with stakeholders (content, timing)
- e. Mini workshop: Reviewing and collecting the available information on socio-economic data in marine recreational fisheries (Country examples).
- f. Mini Review: Evaluate the role of post-release mortality estimates.

WGRFS will report by 1 July 2014 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 scientific 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 availability 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, WGBAST
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 5: Guidelines for best practice in recreational catch sampling schemes

Documentation of sampling design, performance of sampling and production of estimates			
Process that need to be described	Best practice	Comment	Bad practice
Target population	The target population needs to be identified and described. Access to the target population for sampling purposes need to be analysed and documented.	Examples: whole population of resident recreational fishers; fleet of charter boats.	
Primary sampling units (PSUs)	Choice of PSUs should be identified, justified and documented. PSUs could be trips, vessels*time or sites*time (harbours, access points, etc), households, dwellings; individual licensed anglers; residential phonebook listings; PSUs should be documented	If PSU is something else than households, dwellings, residents; trip, vessel or site the choice needs to be thoroughly explained.	
Sampling frame	The sampling frame (list of PSUs) should be a complete list of non-overlapping PSUs. The sampling frame should ideally cover the entire target population.	If it is not possible to cover the entire target population with the sampling frame it is good practice to clearly describe how large the excluded part of the population is and the reason for excluding it.	To exclude large parts of the target population in an ad-hoc way.
Stratification of the sampling frame	Strata should be well defined, known in advance and fairly stable. Clear definitions and justifications of strata should be available. One PSU can only be in one stratum. The minimum number of samples within a stratum is dependent on objective, PSU and variance and needs to be calculated. The number of samples within a stratum needs to be justified, in particular if it is below 10.	If the desired minimum number of samples per stratum is not analytically assessed, the choice needs to be justified and described. Care needs to be taken to avoid over-stratification.	To over-stratify (few or no samples in each strata) the sampling schemes. Over-stratification results in increased risk for bias, particularly for ratio estimates, and a need to impute data.
Distribution of sampling	The way sampling effort	If other methods,	

Documentation of sampling design, performance of sampling and production of estimates			
Process that need to be described	Best practice	Comment	Bad practice
effort	is distributed between strata needs to be described. In accordance with best practice, this can be based on analysis of variance or just distributed proportionally. The different sampling inclusion probabilities/weighting need to be documented.	such as expert judgment are used, this should be explained and justified.	
Sample selection procedure	In accordance with good practice, the selection of PSUs to sample should be done in a controlled way allowing for estimation of sampling inclusion probabilities for the different samples. In principal this mean that samples shall be chosen randomly (probability based sampling). Random sampling can be either simple random sampling or systematic random sampling. The selection procedure needs to be justified and described	If it is impossible to use probability-based sampling, the samples need to be thoroughly validated for how representative they are. This process need to be described. If a non-probability based sampling design is applied, this needs to be accounted for in the estimation process (e.g model based estimations). This needs to be thoroughly explained. For recreational fisheries (similar to small-scale fisheries) where there is no census information on the target population, the only way to sample in accordance with good practice is randomly.	Ad-hoc based sampling, without proper documentation to allow estimation of bias, where the sampling inclusion probabilities cannot be estimated.
Hierarchical structure in the sampling	All the levels in the hierarchical structure of the sampling scheme need to be documented. Sampling should be random at all levels. Sampling probabilities should be worked out at each level, and information for this needs to be collected (e.g number of fishers at a sampled shore site)		Failure to account for the different levels of sampling units in the design and estimation processes. (Risk for bias as well as hiding true variation)

Documentation of sampling design, performance of sampling and production of estimates			
Process that need to be described	Best practice	Comment	Bad practice
Protocol for selection of samples at lower sampling levels (SSU, etc.)	Such protocols should exist in a national repository		
System to monitor performance of sampling schemes - Quality Indicators	Non-response rates should be recorded. Precision of estimates (relative standard error) should be calculated, where relevant. Effective sample size (or appropriate proxy such as number of vessels or trips sampled) should be calculated and recorded.		
Documentation of raising/weighting procedure for national estimates	Data analysis methods should be fully documented, covering: (1) how the stratification and multi-stage sample selection is accounted for in the raising/weighting procedures; (2) ancillary information (for example from national census data; licence registries), that is used to adjust sample weights to correct for any imbalance in samples compared to the population; (3) methods of adjustment for missing data and non-responses.		
Validation/diagnostics	E.g., Independent checks of self-reported data and questionnaires.		