

ICES WGRFS REPORT 2016

ICES SSGIEOM COMMITTEE

ICES CM 2016/SSGIEOM:10

REF. ACOM, SCICOM

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

6–10 June 2016

Nea Peramos, Greece

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Recommended format for purposes of citation:

ICES. 2017. Report of the Working Group on Recreational Fisheries Surveys (WGRFS), 6–10 June 2016, Nea Peramos, Greece. ICES CM 2016/SSGIEOM:10. 76 pp.

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Executive Summary

The ICES Working Group on Recreational Fisheries Surveys (WGRFS) role is to summarise and quality assure recreational fishery data collected under the EU Data Collection Framework (DCF-EC 199/2008 and 2010/93/EU) and control regulations (EC 1224/2009), and provide advice for ICES on recreational fishing issues. In 2016, 25 scientists from 16 countries attended the WGRFS with the aim to: share and evaluate current national surveys; characterise and understand recreational fishing in the Mediterranean; assess spearfishing activity; investigate the potential for regionalization; provide feedback on EU-MAP proposals; and look at the inclusion of recreational data in stock assessments including post-release mortality and reconstruction of time-series. The term of reference and agenda for the working group are provided in Section 1.

WGRFS compiled and assessed the quality of recreational harvest and release data collected within Europe for use in stock assessment (Section 2). These are summarized by country for four major sea areas and species (European sea bass, cod, sharks, salmon, eels, and tuna) defined under DCF and control regulations. A summary of the experience of surveys in Australia was provided and the potential for the use of SmartPhone apps to augment traditional monitoring and develop novel scientific understanding was discussed. The potential of SmartPhone apps was felt to merit further investigation, especially comparisons between apps and traditional surveys.

Recreational fisheries in the Mediterranean are complex with multiplatform multi-species fisheries and there is a lack of data available to assess the participation, catch or value of these fisheries. As a result, a mini-workshop was held to understand the current state of understanding of marine recreational fisheries in the Mediterranean and make recommendations of how to address some of the challenges (Section 3). The challenges included: management conflicts between sectors, recognition of the diversity, issues with the regulatory frameworks, paucity of data, financial support, and stakeholder engagement. As a first step, the WGRFS felt that pilot studies are needed that provide baseline data for recreational fisheries, and should be done under the EU-MAP.

Recreational fishing surveys are difficult to conduct and methods are complex, so the quality and validity of surveys was investigated (Section 4). The quality of national recreational catch sampling schemes in Poland and the UK were evaluated using the WGRFS Quality Assessment Tool. Further the regional catch sampling approach for western Baltic cod was assessed focusing particularly on Denmark. The schemes for the Baltic and UK were adequate quality, but more work was required to make the Polish survey more robust.

The use of recreational fishing catches in stock assessment for Baltic cod and European sea bass was reviewed (Section 5). There is an urgent need to include Danish and Swedish recreational catches of western Baltic cod in the assessment. This includes exploratory stock assessment runs to test the effect of including all recreational data on spawning–stock biomass and fishing mortality. In the case of sea bass few time-series of recreational catches exist, so different methods for incorporation of recreational catches in stock assessment have been developed and the sensitivity of the assessment model to different approaches investigated. It is unlikely that a single methodology to reconstruct historical catches will work across all fisheries as both the data available and stock modelling approaches vary. However, it is very important time-series are collected for sea bass and that new methods for reconstructing time-

series of catches are developed to improve the accuracy of assessments of stocks with significant recreational components.

A WGRFS draft document was developed to provide recommendation for recreational cod data needs for monitoring the recreational fisheries in response to a request from the European Commission to ICES (Section 6). The main conclusions were that to arrive at reliable Baltic-wide estimates of the cod recreational fisheries the MS need to conduct recreational fishing surveys collecting annual numbers, weight, and length or age composition of catches and releases. The surveys need to cover the stock area and be agreed on at a regional level but MS may not need to apply the same survey methods. In order to avoid costly population surveys and conduct recreational fishing surveys, the most cost-effective approach is to have a licence system in place where licence holders can be contacted. Collection of multispecies data is preferable and generally easy to conduct within the same national survey programme. This draft document was used as the basis for the production of ICES advice through the Advice Drafting Group on Recreational Fishing published on 31 May 2016.

Recommendation for future surveys of recreational fishing under the EU Multiannual Plan (EU-MAP) were that thresholds on catches are removed from the EU-MAP, multispecies surveys are requested and that the list of species for the Mediterranean should include groupers, sea bass, *Diplodus sargus*, *Dentex dentex*, *Sparus aurata* and albacore.

1 Background and Terms of Reference (ToRs)

The ICES Working Group on Recreational Fishing Surveys (WGRFS) meeting took place between the 6 and 10 June 2016, at the Fisheries Research Institute in Nea Peramos, Greece. A total of 25 scientists from 16 countries contributed to the meeting and was 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
6 June 2016	Introduction and ToRs Country updates
7 June 2016	The Mediterranean day: Workshop on recreational fishing in the Mediterranean (synthesis of existing knowledge, gaps, challenges, & management)
8 June 2016	Survey requirements, methods & quality: EU-MAP requirements and quality of national survey programmes
9 June 2016	Use of Recreational Fishing Data in Stock Assessments: stock assessment updates and assessment of post-release mortality.
10 June 2016	Funding opportunities ToRs for next meeting

The ToRs for the 2016 WGRFS meeting were as follows:

Multiannual ToRs

- a) Collate and review national estimates of recreational catch, activity, and socio-economic values for candidate stocks, and identify significant data gaps in coverage and species.
- b) Evaluate the quality of national surveys using WGRFS quality assessment tool (QAT).
- c) Provide advice to ICES, Regional Coordination Groups, and European Commission on the availability of data, use of data in assessments, and design of future data collection programmes.
- d) Assess the validity of new survey designs for data collection, including the sampling efficiency, cost of delivery, and levels of accuracy and precision.

Specific ToRs

- e) Review updates of the EU MAP data requirements for recreational fishing effort, catches, and socio-economic aspects.
- f) Assess the magnitude of recreational catches using non-angling active methods including spearfishing, scuba diving and hand gathering.
- g) Develop examples of regional data collection programmes (e.g. species, areas, third countries) using two case studies Mediterranean and Atlantic.
- h) Recommend methods extrapolating post-release mortality across species and fisheries and identify significant data gaps.

- i) Review data collection methods in inland/transitional waters and identify potential synergies with marine recreational fisheries catch sampling schemes.
- j) Assess methods for the reconstruction of recreational fisheries time-series.

ToR (b) was addressed through a mixture of plenary sessions and break-out groups using the national sampling schemes of Poland and UK as case study examples. ToRs (a), (c), (d), (e), (f), (g), (h), (i) and (j) were addressed in individual sessions.

2 Recreational fishing surveys across Europe (ToRs a and d)

2.1 Results from the latest recreational sea fishing surveys

Recreational fishing surveys are carried out across Europe covering all species and areas required under the DCF (EC 199/2008 and 2010/93/EU) and control regulations (EC 1224/2009).

The tables in Annex 2 provide an overview of the current/most recent surveys countries have in place to estimate marine recreational catches and Annex 3 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 3.a, 4 and 7.d) and Eastern Arctic (Areas 1 and 2);
- North Atlantic (ICES Areas 5–14 and NAFO areas);
- Mediterranean Sea and Black Sea.

These tables relate solely to surveys of recreational fishing defined by WGRFS (ICES 2013a) as:

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

The table in Annex 4 provides an overview of economic evaluation of recreational sea fishing and Annex 5 provides information about new surveys that will be done over the coming year.

2.2 The Australian experience

In Australia telephone surveys represent the main approach for the collection of recreational fishery data at state-wide and national scales. In most instances these surveys employ a multiphase design involving a screening survey to identify fishers and a follow-up “phone-diary” survey in which fishing activity is monitored in detail. Both general population (household) and licence holder surveys have been undertaken, the former based on stratified random sampling of phone directories and the latter based on random sampling from licence databases. Particular attention has been given to understanding and, where feasible, adjusting for response bias through the use of profiling information and calibration against known population characteristics.

Declining response rates and increasing mobile-only phone ownership represented key challenges for the ongoing collection of recreational fishing data in Australia and globally. Although response rates in most Australian surveys remain very high by international standards (>80%), there has been a general downward trend over time, driven mainly by rising non-contact rates (potentially due to call ID screening) and lower diary uptake rates. Diary completion rates have, however, remained very high (~95%), attributed to a respondent-centric approach to the management of diarists. The increase in mobile ownership has greatest impact for the general population surveys whereas licence databases tend to include contact information (land-line and/or mobile) for the majority of licence-holders. To address the issue of under-coverage, there have been several independent (on-site) studies that have indicated no signifi-

cant differences in avidity profiles for listed and non-listed fishers. Demography (age) represents the primary difference between the two groups, suggesting that calibration against population census data will reduce this bias.

Where contact numbers are routinely provided in licence systems, sampling from licence databases represents an optimal approach to addressing the under-coverage problem. Unfortunately, most Australian licence systems include exemption categories (e.g. age based) and in order to address this hybrid-survey designs using a combination of general population/licence database sampling have been trialled. There has also been some preliminary progress with dual frame (landline/mobile) sampling although both approaches provide some challenges in terms of data analysis.

WGRFS proposes: further efforts should be made to assess the combination of general population and license database sampling (e.g. standard error). However, this is of lower priority than expansion of surveys to cover all fishing modes.

2.3 New approaches using Apps

Several SmartPhone applications (apps) that allow anglers and other recreational fishers (e.g. spear fishers) to record the details of their fishing trips and catches, have emerged during recent years. These apps vary greatly in content and purpose with apps that allow anglers to interact with each other, apps that give information about hot spot and/or apps that can provide the angler with a catch diary that is always close at hand. It is clear that these apps hold great potential to inform fisheries managers in a cost-effective way and provide scientific insight at a scale that would not be possible using tradition scientific data collection (Venturelli *et al.*, 2016). The numbers of people that own SmartPhones is growing rapidly across the globe, so if the potential is fully realised, well designed apps will provide huge high resolution datasets about a range of factors that add to the evidence base that underpins the management of fisheries (Cooke *et al.*, 2016; Gallagher *et al.*, 2016; Gutowsky *et al.*, 2013; Lorenzen *et al.*, 2016). In fact, in a recent review of the US recreational fishery programme, a recommendation was made to assess the potential for the use of apps in the programme (NAS, 2016)

Apps for recreational fisheries have proven successful in providing knowledge of angler distribution and spatial behaviour (Papenfuss *et al.*, 2015) and catch rates (Jiorle *et al.*, 2016). However, it is likely there is great potential for the further application of app data (Venturelli *et al.*, 2016), especially if methods to correct for the composition of the population using apps are developed (Jiorle *et al.*, 2016). Apps also provides opportunity to increase the interactions between the manager and the angler which, if used cleverly, can be a powerful tool to provide direct information about management in near real time. Final, but not least, well-designed and well-promoted apps can be used as a citizen science vector between the billions of recreational fishers that on a global scale visit waterbodies every day, and the scientists who monitor changes concerning local and global environmental problems such as distributions of invasive species or changes in important habitats such as spawning areas.

There are also challenges that need to be addressed with use of apps. The average app, fisheries related or not, has a retention rate of only 5% after 12 months, so clear innovative approaches are needed to overcome this. Moreover, anglers that download and contribute with data to the app are self-recruiting and therefore not randomly selected, which pose a challenge in terms of data bias and quality. There is a proliferation of apps providing services for anglers, all of which collect different sets

of data. There is significant efforts in developing apps and recruiting a user base, so it is not sensible to support a particular app. Instead, standards have been proposed that apps would need to adhere to for the data to be used for scientific purposes (Venturelli *et al.*, 2016). The Danish app, Fangstjournalen, developed by DTU Aqua could be consulted as an example of an app that meets such standards.

WGRFS proposes: assessing the potential of recreational fishery data collection through apps in collaboration with stakeholders (e.g. angling associations, angling clubs, etc.).

3 Recreational fisheries in the Mediterranean (ToRs f and g)

In the Mediterranean, the term “sport fishing” has been used widely in place of recreational fishing. Recreational fishing is understood to be a fishing activity that is performed for leisure and the sale of the catch is not permitted. Recreational fishing can be practised purely for leisure or as part of a competition that is then categorized as “sport fishing”. According to FAO, recreational fishing is a growing activity in several countries in the Mediterranean Sea (Cacaud, 2005). The increase of recreational fishing in the Mediterranean is attributed to the development of tourism in various regions and the increasing supply of charter fishing tours. However, limited national data exist on marine recreational fisheries to quantify the role and any associated trends of marine recreational fisheries in the Mediterranean.

Marine recreational fisheries in the Mediterranean may be categorized into amateur, tourism, and sport/competition, each having their own associated goals. However, here is a tendency to use indifferently or loosely the terms sport fishing and recreational fisheries in the literature as well as in legislation (Gaudin and De Young, 2007). The legislations must clearly define the terminology, the rules and procedures for each category. Further categorization may be by fishing type:

- *Pêche à Pied*: (scoop net, collect by hands, hands tools e.g. knives, harpoons).
- Shore-based (angling and nets e.g. castnets, beach-seines).
- Boat-based (passive gears e.g. gillnets, trammelnets, longlines, traps angling, e.g. bottom line, jigging, trolling, rod and line fishing).
- Underwater fishing (speargun harpoon, hand collection).

Recreational target species differ greatly between fishing types and regions throughout the Mediterranean. The available information on recreational catch composition is scarce but there is some evidence that the main target groups are sparids (e.g. *Diplodus sargus*, *Dentex dentex* and *Sparus aurata*), groupers, tunids, sea bass, mullets and cephalopods. Underwater fishing is the most selective activity among the different fishing types. Catch and release fishing is not yet a widespread practice in the Mediterranean recreational fishing culture (Gaudin and De Young, 2007). Few socio-economic studies on marine recreational fisheries in the Mediterranean are available (e.g. Gordoia *et al.*, 2004; Ünal *et al.*, 2010; Morales-Nin *et al.*, 2015; Tunca *et al.*, 2016) thus better understanding of the value of marine recreational fisheries in the Mediterranean is needed.

Although many Mediterranean countries have marine recreational fisheries regulations, very few have a compulsory licensing system and this generally does not cover all modes. Article 17 of the Council Regulation (EC) No 1967/2006 specifies:

- The use of towed nets, surrounding nets, purse-seines, boat dredges, mechanized dredges, gillnets, trammelnets and combined bottom-set nets shall be prohibited for leisure fisheries¹. The use of longlines for highly migratory species shall also be prohibited for leisure fisheries.

¹ "leisure fisheries" means fishing activities exploiting living aquatic resources for recreation or sport (Council Regulation (EC) No 1967/2006).

- Member States shall ensure that leisure fisheries are conducted in a manner compatible with the objectives and rules of this Regulation.
- Member States shall ensure that catches of marine organisms resulting from leisure fisheries are not sold. However, the sale of species caught in competitions may be authorized provided that the profits are donated to charity.
- Member States shall take measures both to record and to ensure separate collection of data on catches resulting from leisure fisheries in respect of the highly migratory species listed in Annex I to Regulation (EC) 973/2001 and occurring in the Mediterranean.
- Member States shall regulate underwater fishing with spear guns in particular to fulfil the obligations set out in Article 8(4).
- Member States shall inform the Commission of all measures adopted pursuant to this Article.

A mandatory, cheap, and affordable licence would be beneficial for a number of different reasons. A licence would provide information on marine recreational fishing effort and allow cost-efficient monitoring of the fishery. It would also help in the development of management regulation and build awareness among recreational fishers. Three groups of licences could be implemented in the Mediterranean corresponding to *shore-based*, *boat-based* and *underwater recreational fishing*. In some countries with mandatory licence system (e.g. Spain) a special authorization is also required to catch species under specific conservation measures. Few countries in the Mediterranean specify the licence period in their marine recreational fisheries regulation and it varies considerably between countries. To estimate fisher populations accurately, similar national licensing systems would be useful.

In general, recreational management measures in the Mediterranean countries are highly diverse, varying from many regulations to none depending on the country. This problem has recently been highlighted by MEDAC, who requested the EU and Member States establish a legal framework for recreational fisheries that encompasses rights and priorities, agents responsible for management, licensing requirements, and fees and regulations (MEDAC, 2016). In the Mediterranean, a minimum and common policy frame could be implemented: (a) regulating access to the resources (e.g. implementation of a licence system); (b) ensuring the pursuit of a leisure activity (prohibition of sales); (c) providing conservation measures (e.g. limitation of gear and tackle, daily bag limits, minimum sizes, prohibited species); and (d) establishing a monitoring and control system with specific sanctions measures (*cf.* Gaudin and De Young, 2007).

The conclusions of a SAC meeting regarding recreational fisheries in the GFCM area (GFCM, 2011) identified the following issues in the Mediterranean:

- Management conflicts and synergies between recreational, commercial fishermen, aquaculture and other aquatic resource users. This especially related to the interactions with commercial fisheries and aquaculture round use of space and exploitation of the same species.
- Lack of recognition of the multispecies/multi-gear nature of recreational fisheries.

- Inadequacy of the regulatory frameworks in some countries including: weak enforcement and penalties, and illegal fishing hidden under the umbrella of recreational fishing.
- Lack of robust scientific support and basic data on the status, exploitation patterns, socio-economic importance of recreational fisheries, and thus lack of information to manage and promote the sector in a sustainable manner.
- Need to test the reliability of the data used to determine exploitation patterns and direct expenditures collected using off-site methods in combination with on-site catch assessment surveys.
- Lack of financial support for monitoring, research and development of the recreational fisheries sector.
- Lack of knowledge, poor communication and dialogue between user groups and recreational fisheries interests. Lack of empathy of the needs and aspirations of each other and lack of finance and knowledge of integrated management of recreational fisheries.

WGRFS proposes that pilot studies of recreational fisheries are developed in the Mediterranean as part of the EU-MAP. This will provide baseline data on species and fisheries that are under pressure and the value of recreational fisheries. The management of recreational fisheries in the Mediterranean should be reviewed in light of these data and decisions made on how to proceed.

4 Assessing Quality of Different Survey Designs (ToRs b and c)

WGRFS 2016 addressed two Terms of References (b and c) related to assessing different survey designs (onsite, offsite) for improved data collection and reviewing and optimizing the WGRFS 'Quality Assurance Toolkit' (QAT) based on the experience of completing at country level. The "toolkit" was developed by ICES (2013a) to assess and document the quality of recreational fishery surveys and thus recreational catch estimates. The aim of this evaluation is to provide statements of quality of recreational data for end-users including stock assessment scientists, and identify potential improvements to survey design. This was done for UK and Poland. A regional sound catch sampling scheme was discussed focusing on the case of western Baltic cod and particularly Denmark.

4.1 Western Baltic cod

The subgroup was discussing the different possibilities of how to achieve statistically sound estimates of catches and effort for western Baltic cod from different types of methods while being as cost effective as possible.

Emphasis was on the Sound (ICES SD23) and the planned Danish combined on-site access point and charter boat survey was used as a case study and a platform for a more generic approach to on-site survey planning and design. The objective is to match and correct recreational fisheries catch data from the Danish recall survey in ICES SD 23 with validated on-site data for inclusion in the stock assessment for the western Baltic cod stock.

It was noted that the Danish catch estimates from recall surveys may be biased since more avid anglers are expected to volunteer and participate in such surveys (respondent bias) and by too long recall periods (recall bias). In addition, bias such as prestige bias, telescoping bias and digit bias are more frequent in recall surveys compared to onsite surveys. The catch estimates thus tend to be overestimates though it may follow the same trend over time as the 'true' catch values.

Several different types of possible on-site surveys were discussed. The design of the on-site surveys should allow for the estimates to be scaled up to population size (i.e. catches for the total number of fishers participating in the fishery either by inclusion of data from the recall survey or from the on-site survey itself). The number of samples should be increased where the variation is highest. The on-site surveys should be repeated on a regular basis.

WGRFS proposes that in order to reach statistically sound catch estimates the Danish survey needs to combine the recall survey from Statistics Denmark to estimate participation rate and effort and the on-site access-point intercept survey for cpue and catch data. Regional cooperation should be implemented where possible (e.g. collection of biological samples in ICES SD 23).

4.2 Poland

Polish recreational cod fishery data on catch composition and biological information is collected during on-board observer trips. Effort information (numbers of trips and number of anglers per trip by ICES subdivision and quarter) is provided by the Harbour Master Offices in the main harbours located on the Polish coast. The total recreational cod catch is obtained from the sampled mean weight of the anglers' total catch from observed trips in a given stratum and the known number of trips at the popula-

tion level. Additionally, in the years 2013, 2014 and 2015, 35, 23 and 28 interviews were conducted respectively during on-board observer trips. Charter boat selection is not fully random, and private boats (up to a few meters in length) are not covered by on-board sampling creating potential bias in the total catch estimate and biological information collected. Small harbours are not covered by data collection from Harbour Master Offices.

Sampling also does not cover angling from the shore. Eel, salmon, sea trout recreational fishery catch data are missing for marine recreational fishery as well as freshwater release figures. Freshwater harvest capture data are collected through mandatory catch reporting. There are no reliable effort and catch composition data available for spearfishing, but is considered to be minimal. Data collected under recreational fishery monitoring may be biased and are likely to represent an underestimate of the total recreational catch. For full details of the assessment of quality of the Polish survey programme see Annex 5.1.

WGRFS proposes that the Polish survey is likely to provide a significant underestimate of catches by recreational fisheries due to the number of modes not sampled. It is also not a randomised sampling scheme for the charter boats, so there may be biases in the estimates. It is recommended that a review of the design is carried out and the robustness of the charter boat estimates investigated before the numbers are used for stock assessment.

4.3 UK

The UK Sea Angling 2016 estimates participation, activity, catches and releases, and expenditure. It comprises of a national face to face survey to estimate the percentage of the UK population that participates in recreational sea fishing, demographics and the different fishing methods used, an online questionnaire survey which was used to recruit diarists, and a year-long diary survey which records fishing activity, avidity, fishing mode, catches, releases and fish measurements. Two recall surveys are also included to estimate catches in 2015 and annual expenditure. The diary survey began in January 2016 and will be completed in December 2016 and so not all of the data have been collected or analysed at the time of this assessment. The UK recreational fisheries survey for 2016 is underway, but the full analysis cannot start until data collection is complete. Full details of the assessment of quality of the UK survey programme see Annex 5.2.

WGRFS proposes that it cannot assess the quality of the catch estimates, but deems the design of the UK survey to be appropriate and fit-for-purpose.

5 Use of recreational fishing data in stock assessments (ToRs d, h and j)

5.1 Baltic cod

The 2015 ICES Benchmark Workshop on Baltic Cod Stocks evaluated the appropriateness of data and methods to determine stock status for the cod stocks in SD 22–24 (western) and SD 25–32 (eastern) (ICES, 2015b). Stock identification based on otolith shape analysis showed a high degree of stock mixing in SD 24, so the catch was split into two stocks with the eastern cod representing around 65% of the current total removals. The proportions of eastern and western cod in SD 24 was reconstructed back to the mid-1990s and landings at-age were obtained using the age structure from SD 22 (ICES, 2015b). A stochastic state-space model (SAM) is used to estimate trends and status.

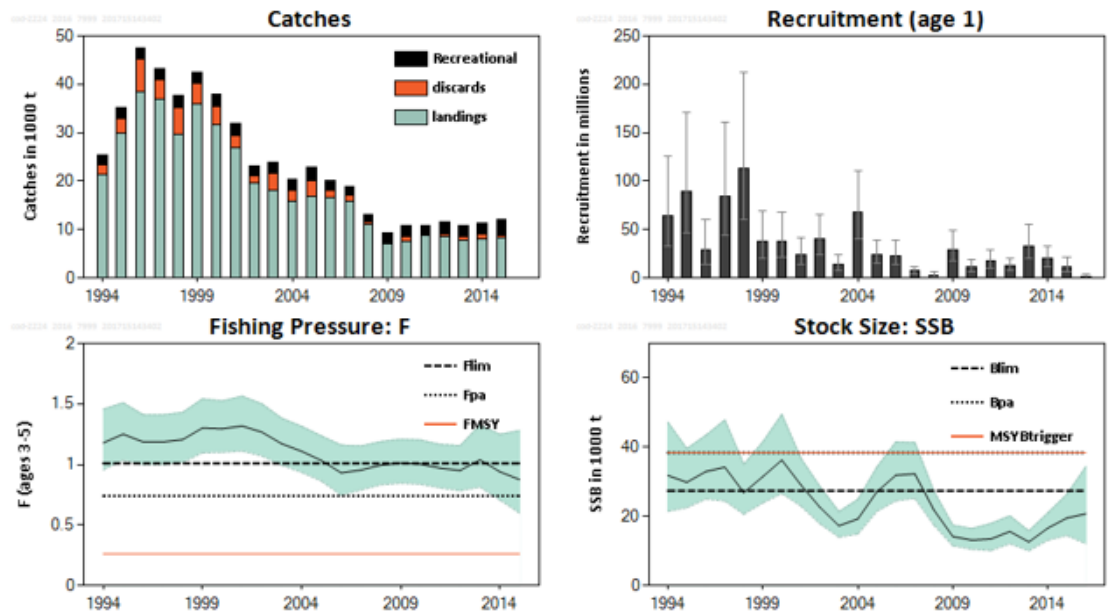


Figure 5.1.1. Cod in subdivisions 22–24 (western Baltic cod). Summary of stock assessment (weights in thousand tonnes). Recruitment, F, and SSB have confidence intervals (95%) in the plot. The EU landing obligation started in 2015; therefore, landings in 2015 include fish above and below the minimum conservation reference size (MCRS).

The spawning–stock biomass (SSB) has been below the limit reference point B_{lim} since 2008 (Figure 5.1.1), while fishing mortality (F) is above F_{MSY} and recruitment (R) has been low since 1999 (ICES, 2016f).

Commercial catches are mainly taken by trawlers and to a lesser degree by gillnetters in Subdivisions 22–24. There is a trawling ban in place for the largest part of Subdivision 23, i.e. gillnetters are taking the largest share of the commercial catches in this area. Overall catches are mainly Danish, German and Swedish. Since 2015 the EU landing obligation obliges the fishery to land all catches of cod making discarding an

illegal activity. In this context the minimum conservation reference size (MCRS) was reduced to ≥ 35 cm.

German recreational fisheries catch of western Baltic cod represented one quarter of the total catch in 2015 (ICES, 2016e). These catches are mainly taken by private and charter boats and to a small degree by land-based fishing methods. These catches were included in the assessment at the benchmark in 2013 (ICES, 2013b) and confirmed and updated in the 2015 benchmark (ICES, 2015b).

German marine recreational fisheries removals of western Baltic cod between 2005 and 2015 were provided for SD 22 and 24, and historical data were reconstructed for the period 1990 to 2004 for inclusion in the stock assessment (ICES, 2013b). Recreational cod catches taken in SD 22 and 24 by Germany were considered western Baltic cod and included in the assessment. Spatial analysis revealed that recreational catches by charter boat around the Island of Ruegen were close to shore in area 38G3. All catch-at-age data from 2009 onward were estimated using the recreational length distribution from SD 24 and age-length keys from German commercial data for SD 22. For a further description of the compilation method see ICES (2013b). Only German recreational catches are included in the 2016 assessment, so represent a large underestimation of recreational removals. The lack of Danish and Swedish recreational fishery removals add to the uncertainty of the assessment and it is unknown when these data will be included. Preliminary estimates of Danish and Swedish recreational catches in 2015 where 1250 t and 215 t respectively (ICES, 2016e).

ICES was requested to provide information on catch opportunities only for the commercial sector, this was implemented assuming a recreational catch of 2558 t in 2017, corresponding to the observed average of the last three years (ICES, 2016f). This gave a catch advice of 917 t total commercial catch in 2017 for western Baltic cod, corresponding to a quota reduction of 88%.

The council of ministers decided on catch limits for 2017 in the Baltic Sea reducing the total allowable catch for western Baltic cod by 56% and introducing bag limits for recreational fisheries of five cod per fisher and day and three cod per fisher and day during the spawning closure in February and March.

WGRFS proposes that there is an urgent need to include Danish and Swedish recreational catches of western Baltic cod in the assessment. This includes exploratory stock assessment runs to test the effect of including all recreational data on SSB and F. There is also a need to observe recreational fishing effort dynamics as response to the introduced management measures.

5.2 European sea bass

The trends and status of the sea bass stock in the North Sea, Channel, Celtic Sea and Irish Sea (ICES Areas 4.b,c and 7.a,d-h) have been estimated since 2012 using an integrated analytical assessment framework (Stock Synthesis 3). This was first developed for sea bass by ICES IBP-NEW in 2012 (ICES, 2012), then further developed by IBP-Bass in 2014 (ICES, 2014) and by IBP-Bass2 in 2016 (ICES, 2016a). The IBP-Bass2 assessment was carried forward to an update assessment in 2016 providing management advice for 2017 (ICES, 2016b).

Since 2014, ICES has used an assessment approach for sea bass that allows inclusion of an estimate of recreational fishery removals derived from surveys carried out in Europe over the period 2009–2013 (see Table 5.2.1, from surveys described by Armstrong *et al.*, 2013; Rocklin *et al.*, 2014; Van der Hammen and de Graaf, 2012; 2015).

Coverage by space and time of the different national surveys has not been fully aligned. The recent estimates of total recreational harvests of sea bass for France, Netherlands, England and Belgium (data supplied informally by Belgium) in Subareas 4 and 7 amounted to 1400–1500 t. With no direct knowledge of hooking mortality on sea bass, WGCSE previously reviewed studies on similar species such as striped bass in the USA, but did not include a value in the assessment along with estimates of released fish, and assumed the total recreational removals were approximately 1500 t in 2012. Discards in the commercial fisheries are around 5% by weight, mainly from trawls, and survival rates are also unknown.

The recreational harvests are large enough that their exclusion from the sea bass stock assessment will lead to an assumption that all the fishing mortality, F , as estimated from the age profile in the catch-at-age data, is due to commercial fishing. In reality, any management actions applied to the commercial fishery based on a forecast from an assessment excluding recreational fishery data would only affect part of the total F and would be less effective than intended because of the additional F due to recreational fishing.

ICES therefore considered it desirable to have the recreational fishery F represented in the assessment and forecast so that impacts of measures on either fishery can be evaluated. The method chosen made a major assumption that the recreational fishery F in all years of the assessment was the same as given by the estimated recreational harvest of 1500 t in 2012. This was considered more feasible and defensible than assuming the same harvest of 1500 t in all years, or the same proportion of total fishery harvest each year (e.g. 25% as in 2012) given the large changes in biomass and the growth of commercial fishing over time. Assuming a constant recreational F over time in the absence of direct estimates in each year is similar to the treatment of natural mortality in most stock assessments where a value is chosen, for example based on life-history traits, and is held constant over time.

It must be acknowledged that such an approach is very approximate and will not hold from 2016 onwards in future assessments if the very restrictive bag limits from 2016 onwards and the increase in minimum landing size from 36 cm to 42 cm since 2015 are effective in reducing recreational F . The very large increase in catch and release implied by these measures also means greater uncertainty in removals since 2015 caused by post-release mortality which is not currently accounted for in the assessment.

To implement the assessment approach, IBP-Bass in 2014 (ICES, 2014) developed a method in which a time-series of landings-at-age for recreational fisheries was estimated within the model conditional on the assumptions that: i) recreational F and selectivity has been constant over time; ii) selectivity-at-age of recreational retained catch mirrors that of the UK commercial linefish landings; and iii) that the international recreational landings in 2012 were 1500 t. The technical details of how this was achieved and then improved in IBP-Bass2, are described in the report of IBP-Bass2 (ICES, 2016a).

The implied time-series of recreational landings are shown in Figure 5.2.1 together with commercial landings (from ICES, 2016b). The estimates suggest that in the early 1980s the commercial and recreational landings were similar, but the growth of the commercial fisheries in the 1990s led to commercial fishing becoming the predominant source of F . The commercial fishery landings are based on official statistics, which may in some small-scale fisheries underestimate the true landings due to legal exemptions from reporting small individual landings.

The ICES assessment results (Figure 5.2.1) continue to show that total biomass and SSB are in decline due to a combination of progressively increasing commercial fishing mortality and an extended recent period of very poor recruitment from 2008 onwards. The trend of increasing F occurs against a backdrop of rapidly increasing commercial landings from the mid-1990s to mid-2000s, driven by the very strong 1989 year classes and a series of above-average recruitments formed during an extended period of warmer sea conditions that occurred from the late 1980s. Recruitment of the 2008–2012 year classes however appears very weak and is a large contributor to the expected continued decline in SSB towards the lowest previously observed value.

The ICES catch advice is based on a short-term forecast where the effect of catch options in 2017 on SSB in 2018 is explored (ICES, 2016c). The improved recruitment in 2013 will not have much effect on the forecasts until beyond 2017. It is however unknown how the current bag limits on recreational fisheries, the monthly catch limits on commercial fleets, and the increase in MLS to 42 cm, will impact how F may change in the recreational fisheries compared to commercial fisheries in future years. A time-series of recreational catch estimates up to the current time is urgently needed to allow future ICES stock assessment to accurately track changes in commercial and recreational F and abundance.

WGRFS proposes that there is an urgent need to develop an internationally coordinated time-series of estimates of sea bass recreational catches and releases with associated size composition data, to allow a more accurate estimate of the fishing mortality due to recreational fishing and any future changes due to management actions. There is also need for additional studies on post-release mortality.

Table 5.2.1. Estimates of annual recreational fishery catches of sea bass in France, Netherlands and UK (England) from surveys in recent years. RSE = relative standard error. An estimate of 60 t of removals by Belgium in 2013 was provided informally to WGCSE 2014. Estimates are by weight except for Netherlands where weight and numbers are given. (From ICES, WGCSE 2016b.)

(a) France			Kept	RSE	Released	RSE	Total	RSE	Release rate
2009-2011	NE Atlantic		2,343t		830t		3,173t	26%	26%
	ICES IV & VII		940t		332t		1,272t	>26%	26%
2011-2012	NE Atlantic		3,146t		776t		3,922t		20%

RSE was 26% for area VII and VIII combined; area VII represented 40% of total.
 ~ 80% by weight in 2009/11 was recreational sea angling

(b) Netherlands			Kept	RSE	Released	RSE	Total	RSE	Release rate
March 2010-Feb 2011	Southern North Sea	By number	234000	38%	131000	27%	365000	26%	64%
		By weight	138t	37%					
March 2012-Feb 2013	Southern North Sea	By number	335000	26%	332000	21%	667000	17%	50%
		By weight	229t	26%					

93% by weight in 2010/11 was recreational sea angling. 2012/13 figure is angling only

(c) England		Kept	RSE	Released	RSE	Total	RSE	Release rate
2012	ICES IVbc, VIIa,d,e,f	230- 440t		150-250t		380 - 690t	26-38%	36-39%

Survey covered only recreational sea angling
 Range of values is for different effort estimation procedures

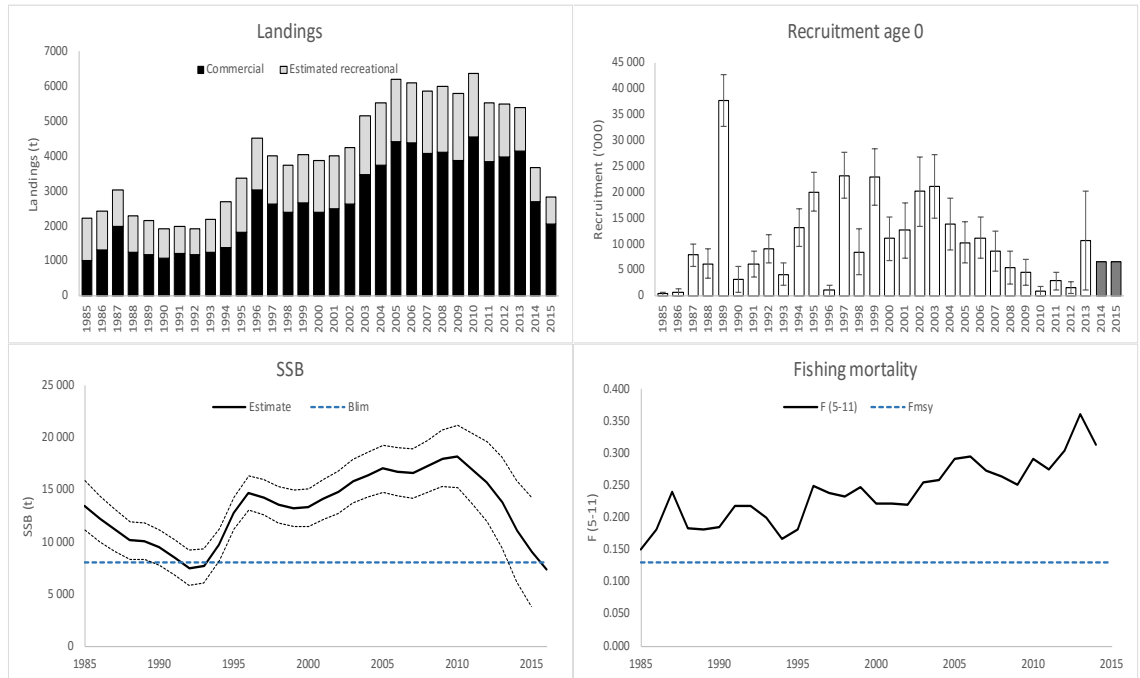


Figure 5.2.1. Time-series of landings, recruitment, spawning-stock biomass and fishing mortality of sea bass in ICES Areas 4.b,c and 7.a,d-h, from the update assessment carried out by ICES in 2016 (ICES, 2016b In prep). Note that the F_{MSY} was not presented in the ICES advice released in 2016, as it had not been reviewed by IBP-Bass2 and will be re-evaluated in the next full benchmark in 2017 (WKBass).

5.3 Post-release mortality

To obtain accurate estimates of fishing induced mortality, one should account for post-release mortalities which may occur because of catch-and-release (Kerns *et al.*, 2012). Several surveys have shown that marine recreational anglers release large proportions of their Atlantic cod, European sea bass, and European eel catches, both due to voluntary and regulatory catch-and-release practices (Sparrevohn and Storr-Paulsen, 2012; Strehlow *et al.*, 2012; Ferter *et al.*, 2013a; Ferter *et al.*, 2013b; van der Hammen *et al.*, 2016). For the German Baltic Sea, recreational fishery, post-release mortality of Atlantic cod has been included in the stock assessment since 2013 (Eero *et al.*, 2015).

Several post-release studies on Atlantic cod have been conducted covering a range of potential mortality factors including anatomical hooking location, water temperature, air exposure and capture depth (Weltersbach and Strehlow, 2013; Ferter *et al.*, 2015a; Ferter *et al.*, 2015b; Capizzano *et al.*, 2016). Bleeding and high water temperatures significantly increased post-release mortality of cod, while fish without substantial hooking injuries were found to have high survival potential. Bleeding and anatomical hooking location are dependent on the lure/bait and hook type used (Weltersbach and Strehlow, 2013; Capizzano *et al.*, 2016) which is why post-release mortality of cod can be expected to vary between fisheries. It is therefore not possible to determine a default post-release mortality which is valid for all recreational cod fisheries. The same applies for European eel and European sea bass. There are ongoing studies dealing with post-release mortality of these two species (Weltersbach *et al.*, 2016), investigating the impact of several factors.

A follow-up workshop was conducted during the 2016 year's working group meeting to review the information provided on recreational fishing practices in different European marine recreational fisheries, e.g. commonly used bait and lure types, capture depths and water temperature ranges. Based on expert knowledge, there seems to be a large variation between countries likely leading to different post-release mortality of cod, eel and sea bass in different countries. Together with future post-release mortality estimates, this information can be used to extrapolate experimental estimates to the different fisheries.

C&R is often considered as beneficial for fish stocks since it can potentially reduce fishing mortalities and at the same time maintain angling opportunities (Cooke *et al.*, 2006). However, its practice has also led to controversy and public debates in many countries (e.g. Aas *et al.*, 2002; Arlinghaus *et al.*, 2007; Cooke and Sneddon, 2007; Arlinghaus, 2008; Salmi and Ratamäki, 2011). When evaluating C&R practice, the focus is often on the lethal impacts (i.e. post-release mortality) only. However, sublethal impacts must also be considered, particularly when the aim is to evaluate C&R practice for a certain species from a fish welfare perspective. Sublethal impacts are for example increased levels of stress parameters, e.g. changes in glucose, lactate and cortisol levels after C&R (reviewed in Cooke *et al.*, 2013). Several studies have shown that extensive fighting time, long air exposure and improper handling can increase sublethal impacts (e.g. Ferguson and Tufts, 1992; Davis and Olla, 2001; Currey *et al.*, 2013; Danylchuk *et al.*, 2014). However, these negative impacts of C&R can be significantly reduced when anglers are educated on how to release the fish properly (Cooke and Suski, 2005; FAO, 2012).

WGRFS proposes collecting recreational fishery characteristics for certain target species to enable extrapolation between stocks and fisheries. This needs collaboration across Europe and between stakeholders (e.g. angling associations, angling clubs, etc.). Citizen science has good potential to contribute to the evidence base and fill existing data gaps. Furthermore, WGRFS proposes that sublethal impacts of C&R are investigated to develop best practice guidelines and to evaluate C&R regulations from a fish welfare perspective.

6 Recommendations for future surveys under EU-MAP (ToRs c, e and i)

6.1 ICES advice

ICES was asked by the European Commission to address the following questions:

- Which data on recreational cod fishing in the Baltic Sea are currently available to ICES?
- What are the ICES criteria for including data from the recreational cod fishery into the annual stock assessment, and what is the ICES definition of recreational fishery in this respect?
- Which recreational fisheries data, based on ICES criteria, should be collected by BALTFISH Member States in order to arrive at reliable Baltic-wide estimates of the cod recreational fisheries, bearing in mind:
 - The need to act in a cost-effective manner.
 - The need to account for differences in nature of cod recreational fishery across BALTFISH Member States.
 - The possibility for the data to be extrapolated by ICES for previous years.

These were discussed at the ICES WGBFAS and a draft document outlining the WGRFS position was produced. This response was used as the basis for the production of ICES advice through the Advice Drafting Group on Recreational Fishing that was published on 31 May 2016 http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2016/Special_Requests/EU_recreational_cod_data_in_the_Baltic_Sea.pdf.

A summary of the key points made in the advice is given below.

Recreational fishing are all non-commercial fishing activities exploiting living aquatic resources for recreation, tourism or sport (EU 1224/2009). In the Baltic Sea this covers active fishing methods including line and spear and passive fishing methods including nets, traps, pots, and set-lines (ICES, 2013a).

Current data gaps relate to the following:

- 1) No data: Individual BALTFISH Member States (MS) do not conduct recreational fisheries surveys and/or provide no data.
- 2) Temporal coverage: Available data stem from a pilot survey and/or surveys are conducted on an irregular basis.
- 3) Spatial coverage: Available data stem from a certain region only and do not cover the entire coastal waters of the MS.
- 4) Fishing methods/platforms not covered: Relevant fishing methods/platforms (e.g. charter boats, private boats, shore fishing) are not covered by recreational fisheries surveys.
- 5) Lack of type of data: Available data are in weight or numbers only (no catch composition data), making conversion to numbers-at-age problematic.

- 6) Data quality: Available data are of insufficient quality, e.g. not representative.

To fill these gaps and arrive at sound estimates of recreational fishing mortality the following approaches are required:

- 1) The MS need to conduct recreational fishing surveys to estimate volume (numbers, weight, and length or age composition) of catches and releases.
- 2) An annual frequency of data collection over a number of years is required to develop a time-series of recreational fishing mortality that includes both the retained and the released components of the catch.
- 3) Recreational fisheries surveys need to cover the spatial use patterns of the recreational fisheries.
- 4) Recreational fisheries surveys need to cover the relevant fishing methods/platforms to quantify all significant recreational mortality.
- 5) As a minimum the various surveys being conducted need to collect annual catch volume in numbers and biological data (size or age composition) for both caught and released components.
- 6) Sampling design needs to be probability based.

WGRFS proposes that in order to avoid costly population surveys and conduct recreational fishing surveys in the most cost-effective way, is by having a licence system in place where licence holders can be contacted. Data collection should be coordinated on a regional scale to ensure the necessary harmonization of survey coverage, compatibility of methods, and improvement of cost-effectiveness. Collection of multispecies data is preferable and generally easy to conduct within the same national survey programme.

6.2 EU perspective

DG MARE made a short presentation on recreational fisheries from the European Commission perspective. It was underlined that, although the new Common Fisheries Policy Regulation contains only one reference to recreational fisheries in the recitals, the issue is becoming increasingly topical. This is because in specific cases, catch estimates from recreational fishing are need to produce a reliable scientific stock assessment. The WGRFS was informed that, in the Commission proposal for a new Technical Measures framework, the provisions on prohibited fishing gears and methods and on minimum conservation reference sizes also apply to recreational fisheries, as recreational fisheries can have a significant impact on the state of the fish stocks. Regarding the question of the potential applicability of the landing obligation to recreational fisheries, further scientific work on survivability of releases from recreational fishermen might have to be undertaken in future. DG MARE representative also gave an update of the expected timing for the adoption of the EU MAP and of the template for MS workplans.

WGRFS proposes that there is regular contact between the EC and WGRFS to aid understanding and delivery of recreational fisheries requirements.

6.3 Marine recreational fisheries

The requirements for future marine recreational fisheries under the EU-MAP was drafted (STECF 2016) and updated after being reviewed by individual countries. This comprised two documents related to the EU-MAP (now published as EU 2016/1251) and the national workplans (now published as EU 2016/1701). The final text for the EU-MAP was due completed on the 10 June 2016 and the member states voted on the programme on 27 June 2016. EU adoption of the EU-MAP was aimed to be in July 2016, with the requirements for National Workplans based on the EU-MAP implemented from 2017. WGRFS discussions focused on the wording of the text, which changed after the meeting before this report. Thus, it does not make sense to provide the textual suggestions, instead response to the broad ideas are captured below.

The EU-MAP recommends that the weights and numbers of fish caught and release by recreational fishers be provided for a limited set of species (see Section 6.5). However, additional species may be requested based on end-user need (e.g. request from the RCG). Member States should also do pilot studies within two years of decision taking effect to demonstrate the proportion of the removals that are recreational. Thresholds for catch and biological data collection were proposed. A simple table for recreational surveys is included in national workplans that outline the survey types, species, drivers, and estimates that will be provided.

The WGRFS reviewed the text and provided suggestions for changes to the wording. The use of thresholds for catch sampling was not seen as a useful concept as there are no other métiers that are not sampled for catch regardless of the level of extraction, and the threshold has no basis in biology. Multispecies surveys were proposed as there is little additional effort in collecting and processing data for all species. It is important to have time-series for inclusion in stock assessments, so a new species request from an end-user could easily then be provided.

WGRFS proposes that thresholds on catches are removed from the EU-MAP and that multispecies surveys are requested. Updates to the EU-MAP text and national workplan tables were provided to the EC to improve the definition of requirements and ability to assess the compliance of national workplans.

6.4 Diadromous species

It is a DCF (EC 199/2008) requirement that recreational catches of salmon and eel are reported and the eel recovery plan (EC 1100/2007) includes statutory monitoring of recreational catches of eel. Hence, EU Member States (MS) are obliged to report their recreational catches (= harvest *and* releases) of eel and salmon in inland waters. However, the number of MS reporting recreational harvest in marine and especially inland waters is limited with even fewer reporting release rates (see Annex 6 in ICES, 2015a and Table 4.1 in ICES, 2016d). The requirement to report both harvest and releases of the diadromous species salmon, eel and seatrout in marine waters and freshwater in relevant ICES areas is reemphasized in the new EU-MAP (Table 6.4.1).

Table 6.4.1. Overview of the diadromous species for which recreational catches (harvest and releases) will need to be collected in both marine water and freshwater under the new EU-MAP.

	AREA	SPECIES
1	Baltic Sea (ICES Subdivisions 22–32)	Salmon, eels and seatrout (including in freshwater)
2	North Sea (ICES Areas 3.a, 4 and 7.d)	Salmon and eels (including in freshwater).
3	Eastern Arctic (ICES Areas 1 and 2)	Salmon and eels (including in freshwater).
4	North Atlantic (ICES Areas 5–14 and NAFO areas)	Salmon and eels (including in freshwater).
5	Mediterranean Sea	Eels (including in freshwater).

Although the harvest of eel and salmon by recreational fishers is banned in some MS, a catch-and-release fishery for diadromous species is still allowed in nearly all MS. Post-release mortality could potentially contribute significantly to overall anthropogenic mortality (e.g. fishing, mortality, hydropower, pumping stations) of diadromous species. As a result, it is important to estimate the amount of released diadromous fish and to determine the associated catch & release mortality of these species (see Section 5.3) to be able to quantify post-release mortality. An estimate of post-release mortality is required to manage these diadromous fish stock effectively.

WGRFS proposes reviewing national catch sampling schemes and ensure that recreational fishing surveys of diadromous species as listed in the EU-MAP cover a) the entire stock area (inland and marine waters), all platforms (e.g. boat, shore) and gears (e.g. angling, fykes) and most importantly c) cover both the harvest and released component of the catch.

6.5 Species sampled in the EU-MAP

The background to the EU-MAP is provided in Section 6.3. As the EU-MAP decision (EC 2016/1251) and national workplan (EC 2016/1701) have been agreed and published, only a short description of the discussions and the main points will be provided here. The list of species for recreational data collection in each region is shown in Table 6.5.1, but at the time of the meeting more species were included on the list for the Mediterranean.

The WGRFS felt that multispecies surveys should be recommended rather than specifying individual species or groups. This is because multispecies surveys are similar effort to single species surveys, only representing a small increase in the effort during analysis and reporting. Time-series of recreational catches are needed for inclusion in stock assessment, so it will be very difficult to generate time-series for new species unless multispecies annual surveys are routinely done.

The WGRFS reviewed the species list for each individual area. There was discussion about the inclusion of shellfish (especially lobster and crab) where recreational catches could be significant, but was not included due to the lack of an analytical assessment. The species lists were reasonable for all areas apart from the Mediterranean and Black Seas. The Mediterranean and Black Seas are challenging as these are multi-species multiplatform fisheries, where identification of individual species can be difficult. The WGRFS proposed that for the Mediterranean Sea groupers, sea bass, *Diplodus sargus*, *Dentex dentex* and *Sparus aurata* should be included in the list. Alba-

core is an important target species in the Mediterranean and should also be included if not covered by highly migratory species. These suggestions were not included in the final species list (Table 6.4.1). The WGRFS did not have sufficient representation from the Black Sea to be able to assess the relevant species for data collection. These suggestions were provided to the EC.

WGRFS proposes that where possible multispecies surveys should be done and that the list of species for the Mediterranean should include groupers, sea bass, *Diplodus sargus*, *Dentex dentex*, *Sparus aurata* and albacore. The WGRFS did not have the right expertise to assess the Black Sea requirements.

Table 6.4.1. List of species for which marine recreational catches (harvest and releases) need to be collected under the new EU-MAP (EC 2016/1251).

	Area	Species
1	Baltic Sea (ICES Subdivisions 22-32)	Salmon, eels and seatrout (including in fresh water) and cod.
2	North Sea (ICES areas IIIa, IV and VIId)	Salmon and eels (including in fresh water), Seabass, cod, pollack and elasmobranchs
3	Eastern Arctic (ICES areas I and II)	Salmon and eels (including in fresh water). Cod, pollack and elasmobranchs
4	North Atlantic (ICES areas V-XIV and NAFO areas)	Salmon and eels (including in fresh water). Seabass, cod, pollack, elasmobranchs and highly migratory ICCAT species.
5	Mediterranean Sea	Eels (including in fresh water), elasmobranchs and highly migratory ICCAT species.
6	Black Sea	Eels (including in fresh water), elasmobranchs and highly migratory ICCAT species

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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 2014–2015.

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 fishers. No data on average size of catches are available.	Sampled similar to cod.	Baltic salmon is mainly caught by trolling. The harvest is not monitored but guestimated e.g. from surveing the catches during the major trolling competitions in the Baltic. Catch is set to be around 3000 individuals including recreational fishing with longlines.	For 2014 respondents were asked about their catches of shark (only 2 respondents claimed to have caught sharks)	From 2010 catch of seatrout has also been estimated. From 2013 the annual licence list recall survey is webbased only. Catch estimates should therefore be interpreted with caution. No results are available in missing categories for the group of non-respondents as a consequence of the new approach. The data for 2014 is preliminary.

COUNTRY	COD	EEL	SALMON	SHARKS	COMMENTS
Estonia	Main catch of cod in recreational fisheries comes from passive gears. The data are reported and stored in Estonian Fisheries Information System (EFIS).	Catch data are reported and stored in Estonian Fisheries Information System (EFIS) for passive gears (gillnets, longlines). Eel is mainly caught in inland waters.	Catch comes from gillnets and rod fishing in rivers. For recreational fishermen it is obligatory to report these data, which is stored in Estonian Fisheries Information System (EFIS).	There is no recreational fishery for sharks in Estonia.	Catch reporting has been mandatory since 2005. The data are reported and stored in Estonian Fisheries Information System (EFIS) for passive gears (gillnets, longlines) and salmon and sea trout rod fishing in rivers. Latest hobby fishery survey was carried out in 2013 and was based on phone call approach. Next recreational fishery survey is planned to be carried out in 2016.
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 household-dwellings is done with response rates of around 40-45% after a maximum of 3 contacts. A telephone interview is done for a sample of the non-respondents. Harvested catch and released catch is measured separately by species.

COUNTRY	COD	EEL	SALMON	SHARKS	COMMENTS
Germany	<p>Cpue data from annual stratified random access point survey covering all access points along the Baltic coast.</p> <p>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.</p> <p>Length distributions from on-board sampling of charter vessels by survey agents.</p> <p>Length-weight key from commercial sampling for conversion to weight.</p>	<p>A telephone-diary survey to estimate eel harvests of the recreational passive gear fishery was implemented in 2011–2012 as a pilot study. The panel consisted of 180 recreational passive gear fishers of which 120 have been recruited from the Baltic Sea across 7 strata.</p> <p>Participants were called every 4 months to remind them to fill in the diary.</p>	<p>Derogation pending. A survey is planned for 2015.</p>	<p>Derogation requested, as there is no recreational fishery for sharks in German Baltic waters or from German vessels.</p>	<p>In 2014 a seatrout survey (1-year diary recall survey) was completed. 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 collected biological samples themselves.</p>
Latvia	<p>In 2012 a survey of the recreational cod fishery from fishing vessel was conducted. Catches were very low, more leisure than fishing trips.</p>	<p>Sampling on triennial basis in lakes and rivers - on-site survey. Available catch data from part of the recreational fishery (self consumption fishery) as well as from licenced fishery in several inland water bodies.</p>	<p>The same as for eel. The catches from self consumption have to be reported and are available. Licenced angling is allowed in three rivers and catches could be estimated from the returned licences.</p>	<p>There is no recreational shark fishery.</p>	<p>The catches taken in the recreational fishery with commercial gears (self consumption fishery) have to be reported and are added to the commercial catches.</p>
Lithuania	<p>Small commercial angling boats are licensed.. From 2013 Lithuania implemented a new system of data collection. Total number of charter vessels and boats engaged in recreational fishing can be obtained from daily reports of border police. The total catch and catch per boat is evaluated from the direct interviews.</p>	<p>Information on catch volumes can be obtained from the census, direct interviews and questionnaires only. Respondents selected by visiting known fishing spots where they come to fish from all parts of Lithuania.</p>	<p>All salmon catches have to be reported to the Ministry of Environment Protection but the number of reported fish is very low. An online survey, a face-to-face interview survey and a personal interview survey was implemented in 2015 as a pilot study to estimate recreational salmon catches.</p>	<p>There is no recreational fishery for sharks in Lithuanian waters or from Lithuanian boats.</p>	<p>All recreational fishers are licensed</p>

COUNTRY	COD	EEL	SALMON	SHARKS	COMMENTS
Poland		In 2015, 12 on-board observer trips were performed to collect biological data and 9 harbour masters offices were visited to collect data on number of angling trips and number of anglers onboard charter vessels.	The recreational eel fishery will be investigated within the framework of the Polish Eel Management Plan following Council Regulation 1100/2007 adopting the Eel Management Plan (EMP).	On the Polish coast the increasing popularity of salmon trolling is observed each year with a particular emphasis on years 2010-2015. Baltic salmon is mainly caught by trolling. Harvest has not yet been monitored.	

COUNTRY	COD	EEL	SALMON	SHARKS	COMMENTS
Sweden	National survey supported by regional studies (see comments).	It is prohibited to fish for eel - additional information to RCM.	National survey, regional studies (see comments).	It is prohibited to fish for sharks (additional information to RCM).	<p>A national biennial recreational fishing survey (mail and telephone), including all species, subareas and all gears has been done. However, a new improved design was implemented during 2013, but results are not yet available.</p> <p>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 (SD 23) between Sweden and Denmark (2011–2013) and continued in 2014. This is the most important area in Swedish waters for recreational cod fishing. The collection of data on recreational salmon fishing is exhaustive and contains regional studies. The regional studies are adapted to different catch areas and are based on postal surveys, gear inventories and catch reports on the web.</p> <p>Salmon catches by trolling boats is estimated from a survey directed to trolling anglers. Recreational catch with traps are estimated from gear counts.</p>

A2.2. North Sea (ICES 3.a, 4 and 7.d) and Eastern Arctic (ICES 1 and 2)

Table A2.2. Most recently carried out, ongoing and/or planned marine recreational fishing surveys in the sampling period 2014–2015.

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 2011–2012 as a pilot study. The panel consisted of 180 recreational passive gear fishers of which 60 were recruited from the North Sea across 2 strata. Participants were recalled every 4 months to remind them to fill in the provided diary.	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 negligible 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).

Country	Cod	Eel	Sharks	Comments
Norway	<p>A rowing-creel survey was conducted in Southern Norway from April–August 2012 to:</p> <ul style="list-style-type: none"> • Estimate the proportion of angling tourists vs. Norwegian recreational anglers targeting cod. • Get a size–frequency distribution of cod landed by recreational anglers. • Estimate the cpue for cod among Norwegian recreational anglers. • Estimate the release proportion for cod catches. 			
UK (Scotland)				

Country	Cod	Eel	Sharks	Comments
UK (England)	<p>A major survey programme (Sea Angling 2012) took place in England in 2012 and part of 2013. The survey components were:</p> <p>Monthly surveys of households, using face-to-face interviews, to estimate recreational sea angling effort (angler-days) by region and fishing mode</p> <p>On-site surveys of anglers at shore angling sites and private boat launching sites in nine regional strata in England, to estimate mean catch per unit of effort (cpue), length compositions by species, angling effort and trip expenditure</p> <p>Sampling from a known population of sea angling charter vessels to estimate total effort and catches by species</p> <p>A separate survey of economic and social benefits of recreational sea angling involving online surveys and direct interviews at sites around the coast of England</p> <p>Quarterly online catch surveys to collect additional information and to help interpret the other survey results</p>	<p>Marine recreational survey estimates as for cod</p>	<p>Marine recreational survey estimates as for cod</p>	<p>See Armstrong <i>et al.</i> (2013) for full details. Downloadable at: http://webarchive.nationalarchives.gov.uk/20140108121958/http://www.marinemanagement.org.uk/seaangling/index.htm</p>

Country	Cod	Eel	Sharks	Comments
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.

Country	Cod	Eel	Sharks	Comments
Belgium	<p>There is a study (2014–2015) to estimate the number of active recreational fishing vessels and fishing effort based on on-site observations. A protocol for assessing catches of cod and sea bass is under development. Interviews are ongoing to get insight into the total catches of cod and sea bass by sea-anglers. An earlier DCF funded pilot study (ILVO, 2007) concluded that cod catches by recreational fishers in the Belgian coastal waters could amount to 100–200 tons annually. A DCF-funded pilot study was carried out in 2013 and 2014 to estimate catches of sea bass, cod and some main species targeted by the recreational fisheries in Belgium. Mail, e-mail and online surveys were used and from the pilot study, for 2014 the catches for cod resulted in an estimate of 400 kg per person on annual basis. From the same pilot study, for sea bass the average total catch by recreational fisheries was estimated 172 kg per person. The different fishing techniques have been taking into account in the pilot study surveys.</p>			<p>In Belgium, there is no obligation to register recreational sea fishing. For recreational fishing in freshwater, a permit is obligatory. This results in additional challenges for gathering and analysing data on marine recreational fisheries for cod and sea bass.</p>

Country	Cod	Eel	Sharks	Comments
Netherlands	<p>The RECFISH programme consists of the following elements:</p> <ul style="list-style-type: none"> • Online Screening Survey (panel) to estimate the number of recreational fishers (marine and freshwater). Surveys were carried out in 2009, 2011 and 2013. In 2013 a parallel online and random digit dialling survey was done. • Online monthly Diary Survey to estimate the annual cod and eel catches. 12 month surveys were carried out in 2010, 2012 and the latest survey started in April 2014. • Onsite surveys to determine length frequency of landed (marine) species. 	As for cod.	As for cod, however the number of sharks in the logbooks is low, therefore the numbers are not very accurate.	Weight estimates can be based on the onsite survey or the logbook survey.

A2.3. North Atlantic (ICES Areas 5–14 and NAFO areas)

Table A2.3. Most recently carried out, ongoing and/or planned marine recreational fishing surveys in the sampling period 2014–2015.

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	Pilot study in 2011 found that median annual bass harvest by domestic shore anglers, the dominant angler category, was two fish per angler in 2010. Catch & release by this angler category was 79% of catch. No reliable estimate of bass angler numbers available for study. Charter angling boat catch (2007–2009) was negligible (no impact on stocks).	Recreational fishing (angling) is entirely in freshwater. Harvest permitted in freshwater where surplus over Conservation Limits exists. Carcass tagging scheme with mandatory reporting for anglers.	Eel is a protected species in Ireland since 2009. No fishing (commercial or angling) allowed in the Republic of Ireland. Various life stages being monitored annually (under EU Reg.1100/2007).	Negligible landings based on fisheries officers observations.	
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).

Country	Sea bass	Salmon	Eel	Sharks	Comments
Spain (Basque Country)	<p>A DCF-funded pilot study was carried out in 2012 to estimate sea bass recreational catches in the Basque Country. E mail, telephone, and post surveys were carried out and resulted in estimates of 129, 156, and 351 tonnes respectively (Zarauz <i>et al.</i>, 2015).</p> <p>A new survey was carried out in 2013 to estimate recreational catches in 2012 and 2013. The main species targeted by recreational fishers were included in the surveys apart from sea bass. These species were different depending on the fishing technique used (shore, boat, spear fishing). E mail, telephone, and post surveys were used. Three independent surveys were carried out. The three diferent sampling frames were the list of surface licences (for shore fishing), the list of spearfishing licences (for spear fishing) and the list of registered recreational vessels (for boat fishing). Contact information is complete for post , but incomplete for e-mail (14% aprox) and telephone (19% aproximately). Surveys were done in June 2013 and December 2013 (Ruiz <i>et al.</i>, 2015).</p>		<p>A routine glass eel sampling has been carried out since 2004. Fishers have to fill in a diary logbook in order to obtain a fishing license. These logbooks are used to estimate total catches and cpues and the results ae presented in WGEEL.</p>		
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 2014–2015.

COUNTRY	BLUEFIN TUNA	EEL	SHARKS	COMMENTS
Spain	Reported to ICCAT collected by IEO.	Regional governments Valencia and Catalonia collect information provided to the DGFisheries.	Negligible catches.	No standard surveys are performed. Only in the framework of research projects. No current sampling since 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	The fishery of tunas is practised only by professional fishers and is prohibited for recreational fishers by the Ministerial Decision 170317/162669	The recreational fishery of eel is prohibited in the application of the framework of regulation EU/1100/07.	The recreational fishery of various species of sharks is prohibited according regulation EC.53/2010.	There are no standard surveys performed in Greece and the few data that exists is from research projects.

Annex 3: Most recent harvest/release estimates for the relevant species

Harvest estimates are either provided in tonnes (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 tonnes (t) or numbers (#); figures in brackets indicate differing years, in the sampling period 2014–2015.

Country	Cod		Eel		Salmon		Sharks		Comments
	HARVEST	RELEASE	HARVEST	RELEASE	HARVEST	RELEASE	HARVEST	RELEASE	
Denmark	1,272 t (2015)	1,222,710 # (2015)	71.2 t (2015)	28,867 # (2015)	10,562 # (2015)	5,963 # (2015)	0	0	Harvest and release of Salmon based on only 37 and nine respondents respectively. Catches are in general likely to be overestimates due to response and recall bias. Estimates should therefore be interpreted with caution. Data are also available for seatrout.
Estonia	0.9 t (2014)	0 (2014)	0.005 t (2014)*		2.5 t (2014)				*Eel is mainly caught in inland waters, 0.53 t (2014)

Country	Cod		Eel		Salmon		Sharks		Comments
	HARVEST	RELEASE	HARVEST	RELEASE	HARVEST	RELEASE	HARVEST	RELEASE	
Finland	0 t (2014)	0 t (2014)	9 t (2014)	0 t (2014)	62 t (2014)	0 t (2014)			Data from the nationwide biennial recreational fishing survey.
Germany	2,430,020 # 2962 t	1,138,514 # 410 t	4034 # 1,5 t (2012)	1577 # 0,1 t (2012)					
Latvia	0.1 t (2012)	0 (2012–2014)	0.1 t (2013) 0.1 t (2014)	1 386 200 (2014)	2.2 t (2013) 2.2 t (2014)				
Lithuania	30 t (2015)		4,9 t (2015)		10 t (2015)	3 t (2015)			
Poland	857 t (2015)								
Sweden	142 t (2013)		NP	NC	7300 # (2013)				Cod estimates are from four boat fishing in the Sound (SD 23). Salmon estimates are based on regional surveys from coastal and offshore areas. Salmon catches from trolling survey that will be repeated in 2015. Recreational trap catches are only reported in the total catch in WGBAST report therefore not included here

A3.2. North Sea (ICES 3.a, 4 and 7.d) and Eastern Arctic (ICES 1 and 2)

Table A3.2. Most recent marine recreational harvest estimates, in tonnes (t) or numbers (#); figures in brackets indicate differing years, in the sampling period 2014–2015.

COUNTRY	COD		EEL		SHARKS		COMMENTS
	Harvest	Release	Harvest	Release	Harvest	Release	
Germany	30 t (2007)		16,858 # 4 t (2012)	5534 # 0,4 t (2012)	50–100 # (2011)		<p>Pilot survey for recreational eel catches initiated in August 2011 will end in July 2012 (1-year telephone-diary survey).</p> <p>Findings from a pilot study in 2011 show that recreational shark catches (mainly tope shark (<i>Galeorhinus galeus</i>)) are marginal and have no impact on the stocks.</p>
Denmark	777 t (2015)	346,170 # (2015)	23.8 t (2015)	73,068 # (2015)	201# (2015)		<p>Catch estimates of sharks based on only 2 respondents! Catches are in general likely to be overestimates due to response and recall bias. Estimates should therefore be interpreted with caution! Data on seatrout are also available.</p>
Sweden	226.3 t (2010)	275.9 t (2010)					National survey (ref. year 2010)

COUNTRY	COD		EEL		SHARKS		COMMENTS
	Harvest	Release	Harvest	Release	Harvest	Release	
Norway	Marine angling tourists ¹ : 1613 t (2009) 543 000 # (2009) (RSE 22%) Local Norwegian recreational fishery (all gear types, high potential for bias) ² : 23 040 t (2003)	Marine angling tourists Northern Norway ³ : 66% (SE 4%) (2010–2011) Marine angling tourists Southern Norway: 62% (SE 8%) (2010–2011) Norwegian Skagerrak recreationl fishery ⁴ : 55% (2012)	Eel is a protected species in Norway since 2010. No recreational harvest of this species is allowed. No recreational catch estimates are available.		Spiny dogfish, porbeagle, basking shark and silky shark are protected species. No targeted fishing is allowed. No recreational catch estimates are available for other shark species.		<ol style="list-style-type: none"> Vølstad <i>et al.</i> (2011) Hallenstvedt and Wulff (2004) Ferter <i>et al.</i> (2013a) Kleiven <i>et al.</i> (2012)
UK (Scotland)							
UK (England)	430–820 t 281,000# (RSE 30%) (2012)	50 t 201,000# (RSE 36%) (2012)	5,300# (RSE 140%) (2012)	32,000# (RSE 62%) (2012)	skates and rays: 41,000# (RSE 51%) smooth-hound (<i>Mustellus</i>): 4200# (RSE 42%) tope (<i>Galeorhinus</i>): 20# (RSE 92%) dogfish (all species): 46,000# (RSE 37%) (all 2012)	skates and rays: 39,000# (RSE 43%) smooth-hound (<i>Mustellus</i>): 190,000# (RSE 35%) tope (<i>Galeorhinus</i>): 6,800# (RSE 36%) dogfish (all species): 448,000# (RSE 30%) (all 2012)	These results cover the catches for the whole of England including North Sea, Channel, Celtic Sea and Irish Sea. The range of estimates for cod catches by weight represents different methods of estimating seasonal and annual shore and private boat effort. Catches by number for cod and other species are for the method that is likely to be most consistent with future surveys. See Armstrong <i>et al.</i> (2013) for full details.

COUNTRY	COD		EEL		SHARKS		COMMENTS
	Harvest	Release	Harvest	Release	Harvest	Release	
France							The National Survey also 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	100–200 t (2007)						These data result from a pilot study in 2007. A new study is ongoing to estimate the catches by sea-anglers.
Netherlands	690 000 (23)# 737(22) t	392 000 (23)#	313 000 (20) # fresh 41(20) t fresh 91 000 (32) # marine 18(39) t marine	517 000(14)# fresh 67 000 (40)# marine	0 (0) # 0 (0) t	15,000 (32) #	All data from 2012 and anglers only. Survey period from March 2012 to February 2013 with RSE in parentheses. Numbers are more accurate than weights. Data from van der Hammen and de Graaf (2013; 2015). Weights of retained cod are based on lengths measured in an on-site survey. Other weight estimates are based on lengths in the logbook survey. In the 2012 survey no length measures of released fish were collected. Therefore only numbers are available.

A3.3. North Atlantic (ICES Areas 5-14 and NAFO areas)

Table A3.3. Most recent marine recreational harvest estimates, in tonnes (t) or numbers (#); figures in brackets indicate differing years, in the sampling period 2014–2015.

	HARVEST	RELEASE	HARVEST	RELEASE	HARVEST	RELEASE	HARVEST	RELEASE	
UK (Scotland)									
UK (England)	230–440 t (2012)	150–250 t (2012)	No marine catches	No marine catches	5300# (RSE 140%)	32 000# (RSE 62%)	skates and rays: 41 000# (RSE 51%)	skates and rays: 39 000# (RSE 43%)	These results cover the catches for the whole of England including North Sea, Channel, Celtic Sea and Irish Sea. The range of estimates for bass catches by weight represents different methods of estimating seasonal and annual shore and private boat effort. Catches by number for bass and other species are for the method that is likely to be most consistent with future surveys. See Armstrong <i>et al.</i> (2013) for full details.
	243 000# (RSE 38%) (2012)	467 000# (RSE 43%)			(2012)	(2012)	smooth-hound (<i>Mustellus</i>): 4200# (RSE 42%) tope (<i>Galeorhinus</i>): 20#(RSE 92%) dogfish (all species): 46 000# (RSE 37%) (all 2012)	smooth-hound (<i>Mustellus</i>): 190 000# (RSE 35%) tope (<i>Galeorhinus</i>): 6800# (RSE 36%) dogfish (all species): 448 000# (RSE 30%) (all 2012)	
Ireland			No marine recreational catches	No marine recreational catches	No marine recreational catches	No marine recreational catches			see Table A 2.3.

France	3922 t (2012, provisional)	776 t(2012, provisional)		The National Survey also 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)	145 t [112-180] (2013)		1.5 t (2012–2013)	Reported eel catches correspond to glass eel.
Portugal				

A3.4. Mediterranean Sea and Black Sea

Table A3.4. Most recent marine recreational harvest/release estimates, in tonnes (t) or numbers (#); figures in brackets indicate differing years, in the sampling period 2014–2015.

Country	Bluefin tuna		Eel		Sharks		Comments
	Harvest	Release	Harvest	Release	Harvest	Release	
Spain							
France							The National Survey also 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: Economic information by country

Table A4.1. Most recent marine recreational economic information.

COUNTRY	SURVEY METHODS (DESCRIPTION OF METHOD, ASSUMPTIONS MADE, AND APPLICABLE SPECIES)	ECONOMIC VALUE (DIRECT, INDIRECT & INDUCED), TRIP SPEND, & WILLINGNESS TO PAY ESTIMATES	MAGNITUDE AND DIRECTION OF BIAS
Austria			
Belgium			
Bulgaria			
Croatia			
Cyprus			
Czech Republic			
Denmark	<p>1. Webpanel (1500 respondents (no tourism) Economic impact analysis (input/output) Jacobsen (2010), Ministry of Food, Agriculture and Fisheries of Denmark (2010) & Jensen <i>et al.</i> (2010).</p> <p>2. Tourism; Economic impact (input output). Unclear how number of tourists are found and how relative share of angling related economic activity is established (but see Jacobsen, 2010; Jensen <i>et al.</i>, 2010).</p> <p>3. CE analysis (DK angler= no distinction between marine and freshwater (Cowi, 2010), Webpanel 1500 respondents)</p> <p>4. Tourism (German webpanel, not distinction between marine and freshwater fishing) CE analysis, (Jensen <i>et al.</i>, 2010). (Table 6.1)</p>	<p>1. Economic impact: Total 388 536 824 Euro (2 900 000 000 DKR) Excluding taxes and leakages 147 376 037 Euro (1 100 000 000 DKR). An average angler spends 543 Euro (4051 DKR) per year, but specialized sea anglers (trolling fishermen) spend on average 3349 Euro (25 000 DKR).</p> <p>2. Economic impact from Tourism: Total 50 241 830 Euro (375 000 000 DKR), excluding taxes, leakages 33 896 488 Euro (253 000 000 DKR)</p> <p>3. CE Analysis: Average WTP is about 100 Euro (736 DKR) angler, but methodological very insecure estimate. Important WTP estimates (ranked from highest to lowest) 1) Nature component (beautiful scenery), 2) Water quality, 3) catch opportunity (numbers). Note that in a higher quality study (Toivonen 2000) WTP for Danish anglers was estimated to 82 Euros (616 DKR) in 1999/2000 prices.</p> <p>4. Tourism CE analysis: WTP -34 to 59 Euro (-255 to 444 DKR); positive WTP for increased catch opportunity, Increased size of fish, Beautiful surroundings and improved water-quality. Negative WTP if distance to fishing water is increased and/or if number of other anglers increase.</p>	

COUNTRY	SURVEY METHODS (DESCRIPTION OF METHOD, ASSUMPTIONS MADE, AND APPLICABLE SPECIES)	ECONOMIC VALUE (DIRECT, INDIRECT & INDUCED), TRIP SPEND, & WILLINGNESS TO PAY ESTIMATES	MAGNITUDE AND DIRECTION OF BIAS
Estonia			
Finland	<p>A number of surveys have been done in Nordic countries to evaluate the economic value of recreational fisheries including:</p> <p>Toivonen, A.-L., Appelblad, H., Bengtsson, B., Geertz-Hansen, P., Guðbergsson, G., Kristofersson, D., Kyrkjebø, H., Navrud, S., Roth, E., Tuunainen, P., Weissglas, G. In: TemaNord 6042000. 1–70</p> <p>Toivonen, A.-L. In: Pitcher, T. J., Hollingworth, C. (eds). Recreational Fisheries: Ecological, Economic and Social Evaluation. Blackwell Science.2002. p. 137-143</p> <p>A comparison of the economic effects of salmon fishing: commercial vs. recreational with input-output model (abstract in English) Lohenkalastuksen taloudellisten vaikutusten vertailua: lohen ammattikalastus Pohjanlahden maakunnissa ja vapaa-ajankalastus Torniojoella ja Simojoella. Storhammar E, Pakarinen T, Söderkultalahti P & Mäkinen T 2011. Riista- ja kalatalous – Tutkimuksia ja selvityksiä 13/2011. 35 p</p>	<p>http://www.rktl.fi/www/uploads/pdf/uudet%20julkaisut/tutk_selv_13_2011_web.pdf</p>	
France			
Germany	<p>In 2014 a nationwide telephone-diary survey with quarterly follow-ups was initiated contacting 50 000 households. This survey will produce estimates of anglers, effort and expenditures per category for the North and Baltic Sea. During the screening survey respondents were asked to provide a 12-month recall estimate of annual expenditures for recreational sea angling.</p>	<p>There are 195 000 sea anglers in Germany, with the majority (163 000) going angling in the Baltic Sea (unpublished data). Average annual expenditure was 736 € per angler.</p>	
Greece	<p>Have not been performed similar studies in Greece and has not been estimated the total value of the catches of recreational fisheries</p>	<p>No data exist</p>	
Hungary			

COUNTRY	SURVEY METHODS (DESCRIPTION OF METHOD, ASSUMPTIONS MADE, AND APPLICABLE SPECIES)	ECONOMIC VALUE (DIRECT, INDIRECT & INDUCED), TRIP SPEND, & WILLINGNESS TO PAY ESTIMATES	MAGNITUDE AND DIRECTION OF BIAS
Ireland	<p>'Socio-economic Study of Recreational Angling in Ireland' (TDI, 2013), commissioned by IFI, was based on sample size of 903 participants (692 face to face interviews, 211 online). Findings include an estimated 406,000 individuals (aged 15+) participated in recreational angling in 2012 (252 000 domestic, 113 000 overseas, 41 000 Northern Irish).</p> <p>http://www.fisheriesireland.ie/media/tdistudyonrecreationalangling.pdf.</p> <p>An omnibus survey was carried out in 2015 to estimate total domestic participation in angling (MB, 2015). Results indicate a total of 273 600 Irish individuals aged 15+ who consider themselves to be 'anglers'. Of these, approximately 4% consider themselves to be bass anglers (11 000) and a further 24% consider themselves to be sea anglers who target other sea species (65 600). Lower bound estimates for overseas anglers in 2014 are in the region of 132 000. These combined figures give a total value of angling in 2014 in the region of €836 million; of this approximately €71 million relates to bass angling and €158 million relates to angling for other sea species.</p> <p>A study, 'Economic Impact of Irish Angling Events' (based on sample of 314 anglers in 2013) (IFI, 2013) found that competitive anglers fish more often, stay for longer and spend more money than 'ordinary' anglers. The travel cost model was used to estimate consumer surplus in this study.</p>	<p>Estimated value of angling to Irish economy in 2012 of €755 million revised up to €836 million in 2014. Using the contingent valuation method, Irish anglers were asked their Willingness To Pay to preserve Ireland's natural fish stocks and the current quality of Irish angling - WTP estimates of €67 per angler per annum (2012) were estimated. Study of Irish angling events (festivals/competitions) estimates a much higher CS for participants using travel cost method; results indicated a CS of up to €252 per angler per day (see below).</p> <p>Per trip expenditure range of €858–€1027 per person for overseas anglers. Domestic anglers annual expenditure estimated at €1740.</p> <p>From the omnibus survey & an increase in overseas angling tourism the total value of angling in 2014 in the region of €836 million; of this approximately €71 million relates to bass angling and €158 million relates to angling for other sea species.</p> <p>Case study sea angling event with 124 participants was estimated to be worth nearly €200 000 to the host region in southwest Ireland. CS estimates of €252 per angler per day.</p>	
Italy			
Latvia	Value of landings in self consumption fishery	9762 EUR	
Lithuania	Have not been performed similar studies in Lithuania	No data on economic value, no economic-social surveys have been done.	
Luxembourg			
Malta			
Netherlands	Screening survey (50 000 households) followed by 12 month Diary Survey (2000 participants) (van der Hammen & de Graaf, 2013).	200 € per fisher per year, 341 € million (accommodation, travel, durable equipment, consumables, etc.)	

COUNTRY	SURVEY METHODS (DESCRIPTION OF METHOD, ASSUMPTIONS MADE, AND APPLICABLE SPECIES)	ECONOMIC VALUE (DIRECT, INDIRECT & INDUCED), TRIP SPEND, & WILLINGNESS TO PAY ESTIMATES	MAGNITUDE AND DIRECTION OF BIAS
Norway	Survey to 434 fishing tourism enterprises to compile data on fishing tourism season, capacity in number of beds and rental boats. Additional data on expenditure during a fishing tourism holiday in Norway as collected from 597 tourists (that had visited Norway to participate in tourist fishing the previous year).	Average daily expenditure by fishing tourists visiting Norway was 173 Euros and average length of stay 7,4 days (this implies that the total average expenditure on a fishing holiday in Norway is 1280 Euros). Total expenditure from fishing tourists that visiting the 434 enterprises in the year 2008 was 104 million Euros.	
Poland			
Portugal			
Romania			
Slovakia			
Slovenia			
Spain (Basque Country)	A postal survey was carried out during 2009 and 2010. The target population was the vessel owners and skippers of the recreational fleet, but shore anglers and spear fishers were not included in this study. The contact details for skippers could not be obtained because of confidentiality, so AZTI contacted recreational fisheries associations and federations in the Basque Country. Postal and face-to-face surveys were done with approximately 2000 surveys sent and 549 completed. More questionnaires were completed with face-to-face than postal surveys. The name of the vessel, registration number and the home port was obtained from Basque Country administration and additional vessel information including length, vessel and mooring was obtained from field sampling and google Earth. Three categories of vessels were defined: sailing, txipironeras (typical Basque vessel), and motor vessels. For the economic survey the same methodology was used as described above.	Direct expenditure for the same sample. The raising was made using the statistically significant variables, such as port, and length of vessel and the category. The value of the catch was not used in the estimation of the total direct impact. The induced effect was calculated using the input-output tables of the Basque Country published by EUSTAT. The multipliers of the income, value added and employment were calculated. The direct impact was around 34 million €/year and the total impact including the induced effect was almost 54 million €, and maintaining 624 FTE/year. No survey on WTP has been carried out.	Only covers recreational boat owners. Spear fishing and shore fishing is not included.
Sweden	National survey	1.6 million Swedes engaged in recreational fishing at least once during 2013. Total expenditures for recreational fishing during 2013 was 5.8 billion SEK.	

COUNTRY	SURVEY METHODS (DESCRIPTION OF METHOD, ASSUMPTIONS MADE, AND APPLICABLE SPECIES)	ECONOMIC VALUE (DIRECT, INDIRECT & INDUCED), TRIP SPEND, & WILLINGNESS TO PAY ESTIMATES	MAGNITUDE AND DIRECTION OF BIAS
UK	<p>The economic value and social benefits of sea angling were estimated within Sea Angling 2012 to understand the importance of sea angling in England. This shows the pattern of direct spending by sea anglers and how this spending supports other economic activity in England through supply chains. We used the ONS household survey to estimate the total number of people who went sea angling in 2012, then ran a well-publicised online survey throughout 2012 to collect data on expenditure and social benefits from a representative sample of these anglers. Other surveys were carried out in face-to-face interviews with sea anglers at five case study locations and supporting data were collected from angling businesses.</p> <p>In establishing the economic value of recreational sea angling, we considered the following elements:</p> <p>The total spending in the English economy supported by sea anglers and covering the more explicit items (i.e. rods, reels, etc.) and the less explicit items of spending (food, petrol, etc.).</p> <p>How far this total spending is on goods and services that are imported into the economy. For example, the UK as a whole is home to relatively few domestic firms that manufacture rods and reels, such that domestic spending on these goods tends to support foreign manufacturers, but with domestic firms perhaps benefiting as distributors of goods.</p> <p>How far this total spending on recreational sea angling, once discounted for imports, supports gross value added and employment in the English economy.</p> <p>How spending on recreation sea angling supports activity in other sectors. Here for example, spending on accommodation might support employment in the hotel trade, but also jobs in the sectors that supply hotels.</p> <p>Data for estimating spend per angler were obtained from 2512 respondents to an online survey and from 340 face-to-face interviews at five case study locations (Weymouth, Deal, Liverpool, Northumberland and Lowestoft) where local businesses were also surveyed. The onsite survey locations included a variety of rural-coastal (Northumberland, Deal), mid-sized (Lowestoft and Weymouth) and city/urban locations (Liverpool). Site based research was conducted throughout the period from March 2012 to February 2013. Site based research</p>	<p>Angler spend:</p> <ul style="list-style-type: none"> • Annual trip spend per angler - £761 • Annual spend on major items - £633 • Total annual spend per angler - £1,394 <p>Direct spend in England:</p> <ul style="list-style-type: none"> • Total spend = £1.23 billion (£831M excl. taxes & imports) • Supports over 10,000 FTEs • £358 million GVA <p>Total value (direct, indirect & induced spend):</p> <ul style="list-style-type: none"> • Total value = £2.10 billion • Supports over 23,000 FTEs • £978 million GVA <p>Average trip spend at case study sites:</p> <ul style="list-style-type: none"> • Deal = £46.2 • Liverpool = £43.7 • Lowestoft = 35.9 • Northumberland = £37.2 • Weymouth = £161.7 	+

COUNTRY	SURVEY METHODS (DESCRIPTION OF METHOD, ASSUMPTIONS MADE, AND APPLICABLE SPECIES)	ECONOMIC VALUE (DIRECT, INDIRECT & INDUCED), TRIP SPEND, & WILLINGNESS TO PAY ESTIMATES	MAGNITUDE AND DIRECTION OF BIAS
	<p>also allowed collection of data from some groups who were more likely to be underrepresented in the self-select online survey, such as occasional anglers and holidaymakers.</p> <p>The total annual spend in England was estimated by raising the mean spend per angler to the total number of sea anglers in England estimated from the Office of National Statistics Survey. All data were re-weighted using demographic and frequency-of-angling data from the surveys to reduce bias. An Input-Output framework was used to estimate the multiplier impacts of sea angling expenditure at the England level. This I-O framework enabled the effect of any spending or activity to be traced through the various supply chains, ultimately estimating indirect and induced-income effects. Average spend was also calculated for all respondents from the 5 case-study locations and showed spend was much higher at the charter boat location (Weymouth).</p> <p>The social benefits of sea angling were also assessed, with 47% of respondents said that 'being outdoors and active' was their main motivation for going sea angling, and 55% said it was to 'relax and get away from things'. Sea angling contributes to health and well-being with 69% of sea anglers saying it is their main way of 'experiencing nature' and 70% saying that it is important to their quality of life. Better fish stocks were cited most often as the factor that would increase participation, although cost, time and family commitments were also important.</p> <p>For more information see <i>Armstrong et al.(2013)</i>.</p>		

COUNTRY	SURVEY METHODS (DESCRIPTION OF METHOD, ASSUMPTIONS MADE, AND APPLICABLE SPECIES)	ECONOMIC VALUE (DIRECT, INDIRECT & INDUCED), TRIP SPEND, & WILLINGNESS TO PAY ESTIMATES	MAGNITUDE AND DIRECTION OF BIAS
US	<p>In 2011, the National Marine Fisheries Service (NMFS) conducted the National Marine Recreational Fishing Expenditure Survey. The survey collected information from anglers on expenditures related to marine recreational fishing. Marine recreational fishing was defined as fishing for finfish in the open ocean or any body of water that is marine or brackish for sport or pleasure. The survey is the second nationwide survey conducted by NMFS to gather marine recreational fishing expenditures across the United States. The first nationwide survey was in 2006. Prior to that year, three regional surveys were conducted starting in 1998 with the Northeast Region, the Southeast Region in 1999, and the Pacific Region in 2000 (Steinback and Gentner, 2001; Gentner, Price, and Steinback, 2001a; Gentner, Price, and Steinback, 2001b). The target population for the 2011 NES was marine recreational anglers, 16 years of age and older, who fished in all coastal states and in Puerto Rico during 2011. Puerto Rico was a new addition to the survey in 2011. In this survey, the level of fishing expenditures for these anglers was quantified within each coastal state and the US as a whole. The primary objectives of the national expenditure surveys are to collect trip expenditures for an angler's most recent marine recreational fishing trip and to collect annual expenditures on durable goods used for marine recreational fishing. Additional objectives include obtaining a profile of the most recent marine recreational fishing trip and collecting demographic information on marine recreational anglers. The survey data are then used to estimate the economic contributions of marine recreational fishing to a state's economy via a regional input-output model. In the states where the NFMS MRIP angler intercept survey was conducted, a total of 108 820 economic add-ons were attempted with anglers. 89 384 interviews were conducted with anglers who were 16 years old or older. Overall, 78 780 eligible respondents (72.0%) agreed to the economic add-on survey and 18 921 of those (24%) supplied contact information for a follow-up survey on their durable expenses. The MRIP intercept frame sample and the license frame samples in states without MRIP followed slightly different survey protocols. For the MRIP intercept frame, anglers who provided contact information were sent a follow-up survey either by mail or e-mail that asked about their expenditures on marine fishing- related durable goods in the prior 12 months. For the licence frame samples, anglers</p>	<p>Total angler expenditures : \$23 billion Trip expenditures: \$4.4 billion expenditures Durable goods expenditures: \$19 billion. By type of trip:</p> <ul style="list-style-type: none"> • For-hire expenditures: \$1 billion • Private boat expenditures: \$2 billion • Shore expenditures: \$1.5 billion. <p>Economic Contributions:</p> <ul style="list-style-type: none"> • 364 000 jobs • \$56 billion in output (sales impacts) • \$29 billion to GDP • \$18 billion in personal income. <p>Trip expenditures generated approximately 66 thousand jobs and durable expenses generated 298 thousand jobs.</p>	

COUNTRY	SURVEY METHODS (DESCRIPTION OF METHOD, ASSUMPTIONS MADE, AND APPLICABLE SPECIES)	ECONOMIC VALUE (DIRECT, INDIRECT & INDUCED), TRIP SPEND, & WILLINGNESS TO PAY ESTIMATES	MAGNITUDE AND DIRECTION OF BIAS
	<p>were sent a complete version of the survey by mail or e-mail that included questions on their most recent marine fishing trip and questions on their purchases of durable goods. The trip related questions on the mail survey gathered the same information that was obtained in the economic add-on to the APAIS. A total of 43 472 surveys were sent to anglers across the US either via e-mail or postal mail. About 5.8% of the total surveys sent out were returned as being undeliverable by the postal service. Approximately (34%) of the surveys (14 782) were completed either online or returned in the mail. Response rates were fairly consistent across states. See Lovell <i>et al.</i> (2013) for full details.</p> <p>Northeast US Recreational For-Hire (Charter and HeadBoats) Cost and Earnings and Economic Impacts</p> <p>Voluntary mail, telephone, and in-person surveys were designed to collect information on annual costs, returns, business structure, effort, demographics, and attitudinal data from for-hire vessel owners in the Northeast from January 2011 through July 2011. Surveys were completed by 281 vessel owners who provided data on 332 distinct for-hire vessels in the Northeast. In addition to providing a detailed overview of the operating structure of the “average” Northeast for-hire head boat and charter boat, input-output model were constructed to estimate the economic activity that for-hire businesses contribute to the Northeast’s economy as measured by total employment, labor income, and sales. Model results show that in 2010 the for-hire industry earned \$140.3 million in revenue, generated \$50.4 million in income to owners, hired captains, crew/mates, and office staff, and employed over 3,200 individuals. The multiplier effects of this activity were substantial. An additional \$193.7 million in sales, \$66.5 million in income, and 1,290 jobs in other Northeast businesses were supported by the for-hire industry through indirect and induced transactions. Service businesses (real estate, food services, marinas, repair shops, etc.), wholesale and retail trade businesses (sporting goods stores, bait shops, gas stations, etc.), and manufacturing businesses (fishing gear manufactures, fuel refineries, commercial fishermen [bait], etc.) were the enterprises most reliant on the for-hire fleet. Over 700 service sector jobs, 360 wholesale and retail trade jobs, and 63 manufacturing jobs were dependent upon the Northeast for-</p>	<p>Economic Impact</p> <ul style="list-style-type: none"> • \$334 million in output (sales impacts) • \$117 million in personal income • 7530 jobs 	

COUNTRY	SURVEY METHODS (DESCRIPTION OF METHOD, ASSUMPTIONS MADE, AND APPLICABLE SPECIES)	ECONOMIC VALUE (DIRECT, INDIRECT & INDUCED), TRIP SPEND, & WILLINGNESS TO PAY ESTIMATES	MAGNITUDE AND DIRECTION OF BIAS
	<p data-bbox="353 400 1093 491">hire fleet in 2010. In total, an estimated 4,500 jobs in the overall Northeast regional economy were supported by the active for-hire fleet in 2010. For full details see Steinbeck & Brinson (2013).</p> <p data-bbox="353 536 1104 560">An Assessment of Marine Recreational Fishing Values in Massachusetts</p> <p data-bbox="353 568 1160 1054">This study compared nonmarket values based on actual cash transactions to those estimated by inferring values from revealed behavior and from responses to hypothetical questions. The nonmarket good that served as the subject matter of the study was early season 2012 saltwater sportfishing permits in Massachusetts. Three separate samples of anglers were randomly sampled. The first consisted of 500 anglers who received a short survey that collected avidity and demographic information, accompanied by an actual cash offer to relinquish their fishing permit and give up their right to fish in Massachusetts waters for the remainder of 2012. The offers varied across anglers starting at \$15 (the permit cost \$10) and increased to \$500 in log-linear amounts. A second sample of 700 anglers was sent the same short survey and offered similar but hypothetical payments. Members of a third sample of 700 anglers received the same survey and were asked to indicate if they would be willing to pay the hypothetical price specified for their 2012 Massachusetts fishing permit. The distribution of hypothetical prices matched the amounts offered for the simulated market sample and the hypothetical willingness to sell sample.</p>	<p data-bbox="1189 539 1357 563">Economic Value</p> <ul data-bbox="1240 571 1733 703" style="list-style-type: none"> • Mean Economic Value per Angler • Hypothetical WTA Estimate = \$593 annually • Hypothetical WTP = \$80 annually • Actual WTA = \$317 annually 	

COUNTRY	SURVEY METHODS (DESCRIPTION OF METHOD, ASSUMPTIONS MADE, AND APPLICABLE SPECIES)	ECONOMIC VALUE (DIRECT, INDIRECT & INDUCED), TRIP SPEND, & WILLINGNESS TO PAY ESTIMATES	MAGNITUDE AND DIRECTION OF BIAS
	<p data-bbox="356 400 1162 451">State Preference Valuation Survey of Recreational Groundfish Fishermen in the Northeast US</p> <p data-bbox="356 467 1162 952">The stated preference conjoint survey was administered in conjunction with NMFS' Marine Recreational Information Program Survey (MRIP) along the coastal states of Maine through New Jersey during calendar year 2009. All anglers intercepted in Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, and New Jersey for the MRIP were asked to participate in a voluntary follow-up mail survey. Anglers that agreed to participate in the follow-up were sent mail questionnaires using a modified Dillman Tailored Design. A total of 4577 surveys were mailed out and 1491 completed mail surveys were returned for a response rate of 33%. However, this analysis focuses only on Gulf of Maine cod and haddock so surveys returned by anglers fishing in states south of Massachusetts were excluded. A total of 2039 surveys were mailed out in Maine, New Hampshire, and Massachusetts and 775 completed mail surveys were returned from those states for a response rate of 38%. Resulting survey data are being used in a bioeconomic to estimate changes in angler behaviour (effort and participation) and economic well-being from alternative possession and size limits.</p>	<p data-bbox="1193 400 2045 424">Total Annual Massachusetts Access Value</p> <ul data-bbox="1240 435 1704 528" style="list-style-type: none"> <li data-bbox="1240 435 1704 459">• Hypothetical WTA = \$91 million annually <li data-bbox="1240 467 1704 491">• Hypothetical WTP = \$12 million annually <li data-bbox="1240 499 1704 528">• Actual WTP = \$49 million annually 	

Annex 5: Quality assessment of national sampling schemes

A5.1. Poland

DESIGN CHARTE BOAT SURVEY ONLY COVERING MAIN PORTS		
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 No. Only charter boat surveys. Private boat and shore fishing missing. Spear fishing of minor importance. Eel, salmon, sea trout are missing (marine & freshwater releases only). Freshwater harvest captured through madatory catch reporting.
	Is there illegal/tourist fishery, which is not accounted for?	Yes / No / Unknown Licence required illegal component considered to be low. No, tourist fishers captured.
	Are there elements of the target population that are not accessible?	Yes / No / Unknown No
Target frame	Is the PSU identified and documented?	Yes / No / Unknown Yes, tour boat (marine)
	Does the sampling frame fully cover the target population?	Yes / No / Unknown No, shore fishing & private boat component not covered. Small harbours not covered.
	Are there elements of the target population that are excluded from the frame (e.g. non-residents, private access sites)?	Yes / No / Unknown No, but small harbours currently not covered.
Stratification	Are the strata well defined, known in advance and stable?	Yes / No / Unknown Yes, in terms of harbours (SD24, SD25 & SD26).
	Is there an overstratification leading to excessive imputation?	Yes / No / Unknown No
Selection	Is sampling probability based (e.g. stratified random with spatial strata, PPS)?	Yes / No / Unknown Yes
IMPLEMENTATION		
QUESTION	Answer	Comments (including Magnitude and Direction of Bias)
Selection	Has the survey been designed to maximize precision?	Yes / No / Unknown Unknown, inclusion probability of harbours equal.
	Are there protocols in place and have they been followed for subsamples (selection of individuals, times, boats, biological samples)?	Yes / No / Unknown NA
	Are the right sites, times, respondents, biological data sampled?	Yes / No / Unknown Probably, but harbours unweighted for number of boats.

	Is there a language barrier (tourist fishery)?	Yes / No / Unknown	No
	Is there a preference not to engage with illegal fishers (e.g. threatening behavior)?	Yes / No / Unknown	Not relevant, because onboard sampling only.
	Has the assignment been completed?	Yes / No / Unknown	Yes
Nonresponse	Are response rates recorded and evaluated?	Yes / No / Unknown	Yes, in general full response.
	Are refusal rates (e.g. according to spatial issues, fishing in MPAs or fishing for high value species) recorded and evaluated?	Yes / No / Unknown	NA
	Have you re-evaluated refusals?	Yes / No / Unknown	NA
	Have you accounted for not completed assignments (unobserved sample bias)?	Yes / No / Unknown	NA
Recall	Is the recall period appropriate?	Yes / No / Unknown	NA
	Does recall period match fishing season?	Yes / No / Unknown	NA
Effort	Is effort well defined (unit, fishing mode, target species, location) and related to cpue measures?	Yes / No / Unknown	No, possibility for bias due to different boat sizes and no stratification.
	Is the concept of effort understood by respondents?	Yes / No / Unknown	No, see above
	Is it possible to record incorrect fishing areas?	Yes / No / Unknown	Yes, one harbour located on Subdivision border. Harbour office does not record fishing area.
Catch	Is catch verified by surveyors (e.g. all filleted, don't show)?	Yes / No / Unknown	Yes
	Is species identification and naming reliable?	Yes / No / Unknown	Yes
	Is there a clear division between fish kept and fish released?	Yes / No / Unknown	Yes
	Are there any high-valued/threatened species taken in the fishery that might be unreported?	Yes / No / Unknown	No
	Is there a digit preference in the reports?	Yes / No / Unknown	No

ANALYSIS

QUESTION	Answer	Comments (including Magnitude and Direction of Bias)
Does the estimation procedure follow the survey design?	Yes / No / Unknown	Yes
Has imputation been used to account for missing observations and, if so, is the procedure documented?	Yes / No / Unknown	No
Has the precision of estimates been calculated and, if yes, where are the documented?	Yes / No / Unknown	Unknown to be followed up
Has there been weighting to correct for nonresponses/avidity bias	Yes / No / Unknown	NA

In panel surveys, have those selected changed their fishing pattern or activity?	Yes / No / Unknown	NA
Is the bias caused by drop-outs and drop-ins in a panel corrected for?	Yes / No / Unknown	NA

A5.2. UK

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 Well defined for angling, but other gears less well so due to low participation
	Is there illegal/tourist fishery, which is not accounted for?	Yes Covering resident fishers only.
	Are there elements of the target population that are not accessible?	No
Target frame	Is the PSU identified and documented?	Yes Individual anglers
	Does the sampling frame fully cover the target population?	Yes
	Are there elements of the target population that are excluded from the frame (e.g. non-residents, private access sites)?	Yes Non-resident tourists
Stratification	Are the strata well defined, known in advance and stable?	Yes Stratified by avidity and region
	Is there an overstratification leading to excessive imputation?	No Limited or no imputation required
Selection	Is sampling probability based (e.g. stratified random with spatial strata, PPS)?	Yes Sample at random from anglers by avidity and region.
IMPLEMENTATION		
QUESTION	Answer	Comments (including Magnitude and Direction of Bias)
Selection	Has the survey been designed to maximize precision?	Yes Survey was designed to maximise precision within available budget.
	Are there protocols in place and have they been followed for subsamples (selection of individuals, times, boats, biological samples)?	Yes Potocols for soampling of individual angler and also guidance for completion of diaries by individual anglers.
	Are the right sites, times, respondents, biological data sampled?	Yes Selection of anglers at random to complete diary including catch composition (lengths), but no information on biological relationships (e.g. length-weight)
	Is there a language barrier (tourist fishery)?	Yes We had to translate questionnaires into Welsh.
	Is there a preference not to engage with illegal fishers (e.g. threatening behavior)?	Yes Due to the diary survey, it is unlikely that illegal fishers will be covered in our estimates.
	Has the assignment been completed?	Yes Diarist have been selected and are submitting data.

Nonresponse	Are response rates recorded and evaluated?	Yes	Cefas track response rates and will be evaluated for diarists. No information on response rates for National Watersports Survey.
	Are refusal rates (e.g. according to spatial issues, fishing in MPAs or fishing for high value species) recorded and evaluated?	Yes	Where diarists drop out, the reason for this is documented. We know the population who have not signed up for diaries who said initially they would.
	Have you re-evaluated refusals?	No	We have not revisited the people who have not responded to the original surveys. We only have e-mail contacts and they have not responded.
	Have you accounted for not completed assignments (unobserved sample bias)?	Yes	Drop outs are being monitored and will be accounted for in the analysis.
Recall	Is the recall period appropriate?	Yes	This is a diary approach with monthly completion.
	Does recall period match fishing season?	Yes	Monthly diaries for the whole of the year.
Effort	Is effort well defined (unit, fishing mode, target species, location) and related to CPUE measures?	Yes	The individual trips of each are recorded including the number of hours fished.
	Is the concept of effort understood by respondents?	Unknown	Not asked if this is understood, but the concept of hours fished per day is easy to comprehend.
	Is it possible to record incorrect fishing areas?	Yes	It is possible to record incorrect areas as this is a diary, but we have a map interface to help individuals locate their spots.
Catch	Is catch verified by surveyors (e.g. all filleted, don't show)?	No	Diary based approach with no validation.
	Is species identification and naming reliable?	Yes	Created an identification guide for the main species, but generally the main species caught are easy to identify.
	Is there a clear division between fish kept and fish released?	Yes	Diarists record catches and releases separately.
	Are there any high-valued/threatened species taken in the fishery that might be unreported?	No	It is unlikely that anglers will not report fish caught.
	Is there a digit preference in the reports?	Unknown	It is possible, but more this can't be assessed until more diaries have been completed.
ANALYSIS			
	QUESTION	Answer	Comments (including Magnitude and Direction of Bias)
General	Does the estimation procedure follow the survey design?	Unknown	Survey in progress and analysis yet to be completed. Hence, all responses unknown at present.
	Has imputation been used to account for missing observations and, if so, is the procedure documented?	Unknown	However, it is envisaged that these issues will be considered.

Has the precision of estimates been calculated and, if yes, where are they documented?	Unknown	during the analysis phase.
Has there been weighting to correct for nonresponses/avidity bias	Unknown	
In panel surveys, have those selected changed their fishing pattern or activity?	Unknown	
Is the bias caused by drop-outs and drop-ins in a panel corrected for?	Unknown	

WGRFS ASSESSMENT OF SURVEY

The UK recreational fisheries survey for 2016 is underway, but the full analysis cannot start until data collection is complete. As a result, the WGRFS cannot assess the quality of the catch estimates, but deems the design to be appropriate and fit-for-purpose.

Annex 6: Multiannual ToRs for WGRFS (2017–2019)

The **Working Group on Recreational Fisheries Surveys (WGRFS)**, chaired by Harry V. Strehlow, Germany and Kieran Hyder, UK, will work on ToRs and generate deliverables as listed in the tables below.

	MEETING DATES	VENUE	REPORTING DETAILS	COMMENTS (CHANGE IN CHAIR, ETC.)
Year 2017	12–16 June	Azores, Portugal	Interim report by 1 September 2017 to SSGIEOM, SCICOM & ACOM	Harry Strehlow's 3 year term as chair ends
Year 2018	To be confirmed		Interim report by 1 September 2018 to SSGIEOM, SCICOM & ACOM	Kieran Hyder's 3 year term as chair ends
Year 2019	To be confirmed		Interim report by 1 September 2019 to SSGIEOM, SCICOM & ACOM	

ToR descriptors

TOR	DESCRIPTION	BACKGROUND	SCIENCE PLAN		EXPECTED DELIVERABLES
			TOPICS ADDRESSED	DURATION	
a	Collate and review quality of national estimates of recreational catch, activity, and socio-economic values for candidate stocks, and identify significant data gaps in coverage and species.	Advisory need and requests by other WGS.	27, 30	Regular activity in each year	Report in annex to interim report each year
b	Assess the validity of new survey designs for data collection, including the sampling efficiency, cost of delivery, and levels of accuracy and precision.	Scientific need for efficient evidence production & feed to other working groups	25, 26, 28, 31	Regular activity in each year	Report in annex to interim report each year

TOR	DESCRIPTION	BACKGROUND	SCIENCE PLAN		EXPECTED DELIVERABLES
			TOPICS ADDRESSED	DURATION	
c	Provide advice to ICES and European Commission on the availability of data, use of data in assessments, and design of future data collection programs as requested.	Advisory need & response to specific requests from the EC.	25, 26, 28, 31	Regular activity in each year, and response to ad hoc requests	Report in annex to interim report each year
d	Review and assess regional data collection programmes for the Regional Coordination Groups to deliver end-user needs and provide recommendations for additional data collection (e.g. species, areas, sectors, uses).	Advisory need & response to specific requests from the RCGs and ACs.	25, 26, 28, 31	Regular activity in each year	Report in annex to interim report each year

Summary of the Work Plan this can only be completed by the group

	<ol style="list-style-type: none"> Critically review the potential of novel survey methods to deliver recreational fisheries data (e.g. citizen science approaches using smartphone apps). Identify new post-release mortality estimates, potential sublethal effects, and reasonable extrapolations across species and fisheries for inclusion in stock assessments. Mini workshop on human dimension: reviewing and collecting available information on the compliance and response of recreational fishers to different management measures.
Year 1	4. Review the treatment of outliers in survey data analysis.
Year 2	To be reviewed and confirmed after the WGRFS 2017 meeting.
Year 3	To be reviewed and confirmed after the WGRFS 2017 meeting.

Supporting information

Priority	High – Because recreational catches can be high for some stocks
Resource requirements	Expertise on recreational fisheries surveys from areas outside Europe would be beneficial
Participants	The Group is normally attended by some 20–25 members and guests.
Secretariat facilities	Normal backstopping support in the organization of the group.
Financial	None
Linkages to ACOM and groups under ACOM	ACOM, WGBFAS, WGEEL, WGBAST, WGCSE, WGNSSK, WGBIE, WKMEDS, WKBASS, WGCATCH
Linkages to other committees or groups	SSGIEOM, SCICOM, STECF, EU Regional Coordination Groups, Advisory Councils
Linkages to other organizations	WECAFC/OSPESCA/CRFM/CFMC/MEDAC Working Group on Recreational Fisheries Many linkages to (inter)national angling associations, since WGRFS members estimate national marine recreational catches. Links to broader organisations with interests in angling and fisheries management including EIFACC and FAO.