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REF. SCICOM & ACOM

Report of the Working Group on Commercial Catches (WGCATCH)

7–11 November 2016

Oostende, Belgium



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Executive summary

The Working Group on Commercial Catches (WGCATCH), chaired by Hans Gerritsen, Ireland, and Nuno Prista, Sweden, met in Oostende, Belgium, 7–11 November 2016. The meeting was attended by 35 members from 21 institutes and 19 countries.

One of the main responsibilities of WGCATCH is to ensure the quality of commercial catch data, which underpins stock assessments and advice. In order to achieve this, the group documents sampling schemes, establishes best practice guidelines and provides advice on the uses of commercial fishery data. The group also evaluates how new data collection regulations, or management measures, may alter the way data needs to be collected and provides guidelines about biases and disruptions induced in time-series of commercial data.

This year the group addressed a broad range of subjects:

Commercial catch or landings per unit effort indices (CPUE/LPUE): The derivation of commercial CPUE/LPUE data series in the ICES community generally does not follow best practice. In many cases the data series are used as relative abundance indices to inform stock assessment and advice without standardisation to remove, as far as possible, temporal and spatial variation due to factors other than fish abundance. Additionally, procedures used to derive CPUE/LPUE indices are often poorly documented in ICES stock annexes and working documents. WGCATCH developed guidelines on what should be documented and considered when commercial fishery CPUE/LPUE indices are developed and used in stock assessment. A workshop on standardisation of CPUE/LPUE is proposed.

WGCATCH's documentation of national sampling designs: WGCATCH reviewed the new tables for completion by EU Member States to document their work programmes under the EU Multiannual Programme (EU-MAUP) for the collection, management and use of data in the fisheries and aquaculture sectors. The tables on sampling of commercial catches were reviewed to examine if they provide statistical indicators and descriptions that would allow WGCATCH to assess the statistical merits of the sampling programme and provide routine documentation of sampling schemes. WGCATCH found that while significant progress has been made towards documenting the sampling designs, some modifications will be necessary for them to be useful for routine documentation of sampling designs for WGCATCH purposes.

STECF FDI data call: The participation of the European Commission's Joint Research Centre (JRC) at the WGCATCH meeting provided an opportunity to communicate some concerns of the group over the use of the data held by JRC as a result of the 'Fishery Dependent Information' (FDI) data calls (formerly 'effort' data calls) issued by the Commission's Scientific, Technical and Economic Committee on Fisheries (STECF). The outcome of this discussion was a new data format for the data call which accounts for the limited resolution of sampling data.

Landing obligation: The group reviewed the impact of the landing obligation (LO) on sampling and on the quality of stock assessment data. The overall impression is that there is only partial compliance with the requirements. Data collection and estimation under the landing obligation could potentially be very problematic in terms of high refusals (biased estimates), observer effects on sampled trips and missing sampling some components of the landings (under MCRS). WGCATCH (2014) issued several recommendations of best practice in data logging and reporting under the landing obligation and proposed analyses to examine how the implementation of the

LO is affecting the sampling programmes and data collection. MS are advised to adopt them so that losses in data quality provided for assessment during the transition period are minimised.

Participation in the ICES advisory process: WGCATCH does not provide advice for fishery management but has the goal of actively contributing to the ICES stock assessment benchmark process and ensuring that the quality of commercial catch data is more widely considered in the assessment process. WGCATCH discussed the historical difficulties that expert groups dealing with catch sampling (WGCATCH and other related groups such as the Planning Group on Commercial Catches, Discards and Biological Sampling and the Planning Group on Data Needs for Assessments and Advice) have had when engaging with assessment EGs. WGCATCH concluded that preparing specific working documents on fishery data quality for assessment and/or benchmark meetings could be the most efficient way of increasing participation in the advisory process. A workshop to develop and test this approach is proposed by WGCATCH.

Small-Scale Fisheries data: WGCATCH drafted best practice guidelines for collection of transversal variables and biological data in small scale fleets. The usefulness of some new technologies such as remote electronic monitoring by CCTV and vessel position recording by AIS/GPS in monitoring SSF was also evaluated.

Protected Endangered and Threatened Species (PETS): WGCATCH concluded that there is need for joint work with the ICES Working Group on Bycatch of Protected Species (WGBYC) on the design of pilot studies to monitor incidental bycatch which are being planned under the EU MAUP and on estimation of incidental by-catches. Two joint WGCATCH/WGBYC workshops are proposed: one in 2018 on the design of dedicated sampling schemes on the monitoring of protected species and a second one in 2019 on the estimation of incidental bycatch rates and raising from sampled vessels to fleet level.

Regional Data Base (RDB): The ICES council has allocated 135.000 EUR on a two-year project to develop a new RDB which will hold national fishery sampling data and the information on sampling design and achievement needed to implement statistically-sound estimation methods. WGCATCH was requested to provide advice for this development by documenting and approving the estimation methods for incorporation in the RDB. WGCATCH decided on an intersessional workshop that will test the documentation of sampling designs and estimation methods and attempt to produce InterCatch-type estimates using the RDB format as a starting point.

Intersessional workshops for 2017: WGCATCH has identified intersessional Wks and training courses as the best means to ensure intersessional progress in areas of relevance for ACOM. The outcomes of these will be reviewed annually during the WGCATCH meeting. The following workshops and training courses are proposed for 2017: 1) Workshop on Sampling Design and Estimation of Commercial Catches (WKSDECC I), 2) Workshop on Optimization of Biological Sampling at Catch-Sample Level (WKBIOPTIM), 3) Workshop on methods for developing fishery-dependent indices of abundance for use in stock assessments (WKCPUE).

1 Administrative details

Working Group name: WORKING GROUP ON COMMERCIAL CATCHES (WGCATCH)

Year of Appointment within the current three-year cycle: 2014

Reporting year concluding the current three-year cycle: 2016

Chair(s)

Mike Armstrong, UK (2014)

Hans Gerritsen, Ireland (2014-16)

Nuno Prista, Portugal/Sweden (2015-)

Meeting venue(s) and dates

10–14 November 2014, Copenhagen, Denmark, (34 participants)

9–13 November 2015, Lisbon, Portugal, (30 participants)

7–11 November 2016, Oostende, Belgium, (35 participants)

2 Terms of Reference

WGCATCH 2014 Terms of Reference:

- 1) Develop the longer term work plan for WGCATCH;
- 2) Evaluate methods and develop guidelines for best practice in carrying out sampling of commercial fish catches on shore;
- 3) Provide advice on adapting sampling protocols to anticipated changes in management measures (e.g., discard ban) or technical advances in monitoring;
- 4) Provide advice to the RDB Steering Group on development of the RDB to support design-based data collection and estimates;
- 5) Evaluate responses to test applications of data quality assurance tables for on board and port sampling developed by WKPICS, SGPIDS and PGCCDBS, make improvements for further testing, and develop clear guidelines for completing and interpreting the tables.

WGCATCH 2015 Terms of Reference:

- a) Document current as well as best practices for data collection schemes to estimate catch, effort, catch composition, biological parameters, demographic characteristics and spatial mapping of activities of small-scale commercial fisheries (under-10m vessels) with particular focus on European fleets. Evaluate approaches to data collection by census, surveys or self-sampling.
- b) Further develop the work on sampling design and estimation through a detailed review of at least two contrasting case studies of commercial fishery sampling schemes, developed before the 2015 WGCATCH meeting, describing survey design, implementation, methods of data analysis, and derived estimates for end users with quality indicators (e.g., standard errors). The case studies should include examples of sampling of at sea and on shore.
- c) Develop examples of the use of a simulation modelling approach to investigate alternative survey designs and analysis methods for fishery sampling.

- d) Review emerging information and analyses from commercial fishery sampling schemes indicating the impact of the landings obligation legislation, or other legislation that could bias the data and estimates.
- e) Liaise inter-sessionally with PGDATA to develop a standardised survey approach for European countries to document historical changes in sampling design and availability of information on sampling achievements for commercial fisheries, and carry out a limited trial in 2015.
- f) Review progress in developing the ICES Cooperative Research Report on statistically sound sampling schemes for commercial fisheries, which will also act as a reference document for implementation of the EU-MAP and provide material for a planned text book.
- g) Review emerging statistical estimation procedures from ICES commercial fishery sampling schemes and comment on the implications for estimation in a regional context, in particular for the regional database to support the estimation procedures.
- h) Develop and maintain a reference list of key publications or other available resources dealing with design and implementation of fishery sampling schemes and associated data analysis, and annually review new publications of relevance to WGCATCH. This should also include studies examining relationship between precision achieved and cost of sampling, and relationships between data quality and quality of fishery management advice.
- i) Identify future research needs.
- j) Respond to recommendations to WGCATCH from ICES expert groups RCMs, liaison meetings or other groups.
- k) Develop the specific ToRs for the next WGCATCH meeting and a work plan identifying intersessional work that is needed, timelines and responsibilities.
- l) Ensure, where appropriate, that systems are in place to quality assure the products of WGCATCH.

WGCATCH 2016 Terms of Reference:

- a) Compile and evaluate approaches to estimate fishery-dependent CPUE and LPUE using case studies. Discuss conclusions of recent workshops and EGs that addressed effort-related issues.
- b) Review current and emerging sampling and estimation procedures of commercial catches, focusing on total catch, length and age distribution.
- c) Document recent changes in sampling design and data availability from commercial fisheries, particularly changes due to the introduction of the landings obligation and other legislation that can affect data collection and estimates.
- d) Liaise with other ICES groups (PGs, WG, WK, SSGIEOM) and research projects that deal directly with commercial catch data, and collaborate with PGDATA in the support to Benchmark process.
- e) Continue to document current as well as best practices for data collection schemes to estimate catch, effort, catch composition, biological parameters and spatial mapping of activities of small-scale commercial fisheries (under-10m vessels) with particular focus on European fleets. Evaluate approaches to data collection by census, surveys or self-sampling.
- f) Document current sampling and estimation practices for Protected, Endangered and Threatened Species (PETS) and rare fish species. Evaluate limitations of current data and communicate them to main end-users
- g) Review developments of the Regional Database (RDB) and exchange formats from a design-based sampling and estimation perspective.

- h) Foster regional cooperation on publications related to the work of WGCATCH.
- i) Develop and maintain a reference list of key publications and contacts dealing with design and implementation of fishery sampling schemes and associated data analysis.
- j) Respond to recommendations to WGCATCH from ICES expert groups RCMs, liaison meetings or other groups.
- k) Review the work of WGCATCH 2014–2016, identifying present and future research and training needs. Develop work plan for 2017–2019 and the ToRs for the next WGCATCH meeting, identifying intersessional work, timelines and responsibilities.
- l) Ensure, where appropriate, that systems are in place to quality assure the products of WGCATCH.

3 Summary of Work Plan

Details of annual work plans for 2014, 2015 and 2016 can be found in the reports of PGCCDBS 2014, WGCATCH 2014, and WGCATCH 2015.

4 Summary of Achievements of the WG during 3-year term

The most important goal of WGCATCH is to provide a forum for exchange of knowledge, ideas, and recent developments in sampling and estimation of commercial catches. Some of the outcomes of this forum are difficult to measure as they translate into changes of practices in sampling and estimation at national level that gradually have improved the quality of data used within ICES. An example of its success may be seen in the regional coordination project fishPi (MARE/2014/19), which had a large participation by WGCATCH members, and which was discussed in-depth during the WGCATCH meetings. Many of these participants had relatively little knowledge of statistically sound sampling design before attending WGCATCH and its predecessors (e.g., WKPICS1, 2 and 3; WKACCU, WKMERGE, PGCCDBS, SGPIDS etc.).

Other outcomes include documentation of sampling practices:

- Documentation of catch sampling practices in European countries (2014 report, section 3.2)
- Documentation of sampling practices for small scale fisheries (2015 report, section 2.3, annex 6)
- Documentation of length sampling at-sea and onshore in European countries (WKISCON2 report)
- Documentation of sampling and data logging practices for bycatches of protected, endangered and threatened species (PETS) and rare fish species (2016 report, section 5.7)

Guidelines and advice on best practice:

- Guidelines for designing a sampling survey (2014 report, section 3.4)
- Guidelines and best practice for sampling, data recording and estimation of commercial catches under the landing obligation, including advice on analysis to determine how the LO implementation is affecting the sampling programmes and data collection (2014 report, section 4.4; 2015 report, section 5; 2016 report, section 5.4)
- Guidelines for simulations of regional sampling designs (2015 report, section 4.5)

- Guidelines for best-practice in sampling of small-scale fisheries (2016 report, section 5.6 and Annex 11)
- Guidelines for documenting fishery-dependent LPUE/CPUE indices (2016 report, section 5.2.3)

Training courses and workshops

- Training courses design and analysis of statistically sound catch sampling programmes (2014, 2016)
- Workshop on implementation studies on concurrent length sampling (WKISCON2)
- A series of Wks proposed for 2017–2019 (2016 report, section 5.11)

Publications

- Peer reviewed publication providing a synthesis of the evolution of sampling design towards best practice, illustrated with a number of concise case studies (Planned for 2017).
- Peer reviewed publication on importance and data collection in Small Scale Fisheries (Planned for 2017–2018).
- Book on best practices for sampling commercial catches (currently planned for 2017–2019, editors: Mary Christman and Jon Vølstad)
- Repository of key resources; putting them into context with brief descriptions or review of each report, paper, book, website, software package etc. (This will be published online shortly, with a link from the WGCATCH page, www.ices.dk/community/groups/Pages/WGCATCH)

Contributions to conferences

- Several individual participations in Theme Session ASC 2016 G “The inshore challenge – management of recreational and commercial fisheries accounting for social benefits, economic value, and biological sustainability, and prioritising of marine data collection”
- Several individual participations in Theme Session ASC 2016 O “When is enough, enough?: Methods for optimising, evaluating, and prioritising of marine data collection”
- Group participation: Demanèche S., Armstrong M., Mugerza E., Adamowicz M., Carlshamre S., Clarke E. D., Dingsør G., Egekvist J., Fernandes A.C., Kavsars M., Nimmegeers S., Norkus D., Otterå H., Reis D., Rodriguez J., Saks L., Schembri S., Spegys M., Stoetera S., Vandemaele S., Vølstad J.H., Grygiel W., Gerritsen H. & N. Prista. 2016. “Small scale, big deal: Sampling catches from European small-scale fisheries”. ICES Annual Science Conference 2016, ICES CM 2016/G:258, 19-23 September 2016, Riga (Latvia)
- Zarauz L., Mugerza E., Armstrong M. 2016. Strengthening regional cooperation in small scale and recreational fisheries data collection (fishPi). ICES Annual Science Conference 2016, ICES CM 2016/G:208, 19-23 September 2016, Riga (Latvia)
- Grygiel, W., M. Adamowicz, I. Wójcik 2015. Monitoring rybacko-biologiczny na Bałtyku w wieloletniej praktyce Morskiego Instytutu Rybackiego–Państwowego Instytutu Badawczego (Gdynia). Poster nr 8 i opracowanie na Krajową konferencję naukową – Bałtyk 2015, pn. „Stan, trendy zmian oraz współczesne metody monitorowania środowiska Morza Bałtyckiego”. [Fisheries-biological monitoring in the Baltic Sea, in the long-standing practice of the NMFRI (Gdynia). Poster No. 8 and working paper at the National Scientific Conference - Baltic 2015, en-

titled: "The status, directions of changes and contemporary methods for monitoring the environment of the Baltic Sea."]. IO-PAS, Sopot, 14–16.10.2015, Editor - Inst. Ocean. PAS, Sopot, under editorial-ship of J. Dera & M. Ostrowska; 6 pp., CISBN 978-83-941037-1-2; (in Polish).

Datasets

- RDB: WGCATCH's repeated endorsement of the RDB as a fundamental tool for regional coordination of sampling and estimation has contributed to the progress in data submission that was observed in recent years.

Outreach:

- WGCATCH and WKPICS have had considerable success in changing the 'mind-set' of the EU Data Collection Framework (DCF 2009-2016); moving the focus from metier-based quota sampling to statistically sound sampling programmes in the Data Collection Multi-Annual Union programme (2017-19).
- WGCATCH 2016 and JRC developed a proposal for a new structure for the STECF data call on Fisheries Dependent Information. The new structure takes into account the design of the sampling data.
- WGCATCH indirectly participated in the EU project of regional sampling design fishPi (MARE/2014/19) by providing a forum for the presentation and in-depth discussion of the project results.

5 WGCATCH 2016 report

5.1 Introduction

It is vital for ICES and other end-users to have confidence in the fishery data underpinning stock assessments and advice on sustainable fishing, and understand their limitations. Many ICES expert groups use data on fishery catches to describe fishing activities, show the development of fisheries, and evaluate the effects of fisheries on stocks and ecosystems. Data from fisheries often form the primary basis for reconstructing historical populations and estimating fishing mortality. These data are often treated as exact in fish stock assessments; however the data are frequently estimated (e.g., discards) and have variable quality (e.g., reported landings may be inaccurate to varying extents over time). This can translate into inaccuracies in advice.

One of the main responsibilities of WGCATCH is to ensure the quality of commercial catch data. In order to achieve this, the group documents national fishery sampling schemes, establishes best practice guidelines, training courses and workshops on sampling and estimation procedures, and provides advice on the uses of commercial fishery data (e.g., estimating relative abundance indices based on fishery catch rates). The group also evaluates how new data collection regulations, or management measures (such as the landings obligation) may alter the way data needs to be collected and provides guidelines about biases and disruptions induced in time-series of commercial data.

5.1.1 Conduct of the meeting

The meeting was attended by 35 members from 21 institutes and 19 countries (**Annex 1** and **Figure 5.1.1.1**). Work was carried out inter-sessionally and, during the meeting, in subgroups and plenary.



Figure 5.1.1.1 Countries participating in WGCATCH in blue; ICES countries are outlined in red.

5.1.2 Agenda

The agenda of the meeting is given in **Figure 5.1.2.1** The meeting was conducted through presentations, discussions and analysis of questionnaires. Most ToRs were addressed in subgroups that reported in plenary sessions involving all participants. Report text completed at the meeting was reviewed in plenary and all participants were given the opportunity to comment on the final draft of the report after the meeting.

	Mon 07-Nov	Tue 08-Nov		Wed 09-Nov		Thu 10-Nov			Fri 11-Nov
9:00 - 11:00	start at 10:00 Introduce ToRs Finalise agenda	ToR A: LPUE - presentations		ToR B: Estimation - presentations	ToR E: Best practice SSF - Presentations, draft guidelines	ToR B: Plenary discussion on DCMAP recommendations/guidelines from WGCATCH			Group feedback Strategic planning for WGCATCH
break									
11:15 - 13:00	ToR g: RDB and StoX Tor H: Publications Allocate names to subgroups	ToR A: LPUE - presentations and discussion hake method	ToR E: Best practice SSF - Presentations, draft guidelines	ToR B: Estimation - presentations ans discussion	ToR E: Best practice SSF - Present guidelines Report writing	ToR F: PETS - presentations and analyse questionnaires	ToR C: Landing Obligation - Analyse LO questionnaire	Other subgroups if needed	Future ToRs New Chair Finish 13:00
break									
14:30 - 16:45	ToR d: Overview WKCOSTBEN, PGDATA, WGBIOP, SSGIEM	ToR A: LPUE - discussion, recommendations?	ToR E: Best practice SSF - Presentations, draft guidelines	ToR B: Estimation - Analyse DCMAP questionnaires	ToR E: Best practice SSF - Present guidelines	ToR F: PETS - presentations and analyse questionnaire	ToR C: Landing Obligation - Analyse LO	Other subgroups if needed	
break									
17:00 - 18:00	FutureToRs New co-chair Recommendations to WGCATCH Plan group dinner	ToR A: LPUE - Plenary discussion on findings and recommendations/guidelines from WGCATCH		Tor E feedback to plenary		Tor C & F: Findings and discussion			

Figure 5.1.2.1 Agenda of WGCATCH 2016 meeting.

5.1.3 Report structure

The report of WGCATCH 2016 is structured along the terms of reference.

5.2 ToR A – CPUE/LPUE indices

Compile and evaluate approaches to estimate fishery-dependent CPUE and LPUE using case studies. Discuss conclusions of recent workshops and EGs that addressed effort-related issues.

Chapter summary

The derivation of commercial CPUE/LPUE data series in the ICES community generally does not follow best practice. In many cases the data series are used as relative abundance indices to inform stock assessment and advice without standardisation to remove, as far as possible, temporal and spatial variation due to factors other than fish abundance. Additionally, procedures used to derive CPUE/LPUE indices are often poorly documented in ICES stock annexes and working documents. WGCATCH developed guidelines on what should be documented and considered when commercial fishery CPUE/LPUE indices are developed and used in stock assessment. A workshop on standardisation of CPUE/LPUE is proposed.

5.2.1 Background and outline

Fishery-dependent abundance indices derived from Catch-Per-Unit-Effort (CPUE) or Landings-Per-Unit-Effort (LPUE) are used in many stock assessments and national institutes. For some species where fishery-independent surveys do not provide reliable information, these indices can be the only source of information on stock trends. There is no design-base for fishery CPUE (i.e., the data are not collected according to a specific sampling design as is the case with fishery-independent surveys) and this can be the cause of significant bias in the perception of the trends. For example, changes in fishing gears, species targeting, discarding patterns, fleet structure, spatiotemporal activity and vessel power can occur at various time scales and lead to time series of LPUE or CPUE indices that do not adequately represent changes in fish abundance. Also, consideration needs to be given to how zero catches on individual trips or hauls should be treated as these have different meanings for trips that are within the habitat of the species, or are in other areas where there is zero or close to zero probability of catching the species at any level of abundance. Various methods are applied worldwide to deal with these problems, for example using species association data to exclude trips considered to have a very low probability of catching the species (Stephens and MacCall, 2004), and delta-lognormal models to provide relative abundance signal after factoring out the influence of area, season, vessel/gear characteristics etc.

The present ToR aimed to identify the extent of usage of CPUE/LPUE indices in ICES stock assessments, discuss the limitations and biases of those indices from a commercial catch perspective, and analyse the degree to which methods already available to standardise the data are being considered by the ICES community.

Prior to the meeting, WGCATCH chairs circulated an email requesting participants for presentations concerning LPUE/CPUE indexes. Additionally, three external experts with extensive previous work and/or responsibilities in the production of CPUE/LPUE indexes were invited to attend the WGCATCH meeting: Michael Pennington (NOR), Steve Holmes (JRC) and Mary Christman (USA). Overall, 7 presentations were discussed, one of them involving a direct request from the ICES Working Group for the Bay of Biscay and the Iberian Waters Ecoregion (WGBIE) to WGCATCH seeking advice on the quality of a CPUE index for the northern hake stock (hke-nrth) (see also **Section 5.9**). Discussions held during the meeting revealed the need to update previous guidelines for deriving and evaluating LPUE/CPUE indices for ICES benchmark assessments (ICES, 2015), and a subgroup was tasked with this work. A workshop was proposed

for final refinement of these guidelines and research and discussion of standardisation techniques and their use (see **Section 5.12**).

5.2.2 Presentations

- **Use of LPUE in ICES stock assessment WGs - Gerritsen H.**

The use of fishery dependent Landings-Per-Unit-Effort (LPUE) in 2015 ICES stock assessments was reviewed, with 201 stock annexes of pelagic and demersal stocks being examined.

Of the 30 pelagic stocks annexes, 21 did not mention LPUE data, 5 used raw LPUE data as supplementary information and 4 used LPUE in the assessment model, only one of these using standardised LPUE. Of the 171 demersal stocks annexes, 28% did not mention LPUE data, 45% used LPUE for supplementary information (in nearly all cases raw LPUE) and 26% used LPUE in the assessment model. From the latter, most used raw LPUE, 11 applied some sort of model to standardise the LPUE (GLM, GAM) and 3 used VMS data to spatially subset the data. None of the stocks annexes referred the use of the standard approaches applied in the USA (see presentation Mary Christman).

In summary, raw LPUE data are routinely used in ICES stock assessments, both as supplementary information and as indices of abundance in assessment models, particularly in what concerns demersal stocks. The use of raw LPUE data is not good practice as there is a high likelihood of bias and accepted methods exist that address at least some sources of bias.

- **VMS based CPUE data on a 0.05 degree resolution - Egekvist J.**

LPUE can be calculated and mapped on a high spatial resolution based on VMS data combined with logbooks/sales notes. The effort is then estimated from VMS data (rather than logbooks). Landings are distributed over VMS pings with fishing activity by fishing day recorded in the logbooks. This makes it possible to calculate a LPUE on a high spatial resolution. The LPUE can be standardized by, e.g., vessel power. It must be noted that in general VMS data are only available for vessels larger than 12 meters¹ since 2012 and larger than 15 meters before.

The logbook-based effort, calculated as Days at Sea or Fishing Days is correlated with the VMS based effort. Depending on the fishery/gear, the VMS based effort correlates best with different logbook based effort measurements.

The VMS based LPUE is used in practice in the Danish GUDP Vind project, where an online interactive tool has been developed for the fishermen to target sandeel and sprat fisheries and make them more efficient.

The ICES VMS/Logbook data call covering the years 2009-2015 contains information on fishing hours, kW*fishing hours, total weight and total value by year, month, c-square (0.05 degrees) and DCF métier level 6.

¹ Note that some 12-15m vessels are exempt from the obligation to carry VMS (Council Regulation 1224/2009 of 20 November, article 9)

- **Methodological aspects concern the CPUE estimation, based on the Polish commercial fisheries data** - Adamowicz M., Grygiel W. & E. Kuzebski

The presentation summarises data sources and methods for the CPUE and fishing effort calculations, based on the Polish commercial fisheries data from 2015 in the Baltic Sea. The data used for CPUE calculation (expressed in kg/fishing hours or kg/days at sea) is a report from the Polish Fisheries Monitoring Centre (FMC). The report contains catch data derived from the logbooks and monthly catch reports (MCRs) under the daily resolutions (applied for vessels <10-m length). At the beginning of a fishing effort calculation:

- The ICES statistical rectangle with the most fishing is accepted for further computations
- For each vessel-trip, the species dominated by weight is identified and considered as the target species,
- Vessel length categories are defined, because the CPUE may significantly differ across size of the vessels for some gear types.

CPUE is calculated separately for each species, month, gear type, vessel length category and rectangle (if needed). It is very important to take into account the target species of trips.

The following data problems have been identified: haul by haul catch information from the EU logbooks stored by the Polish FMC are not available, and is a lack of information about mesh size in MCRs from small vessels (<10-m).

- **Estimating CPUE for Single Species From Multispecies Datasets** - Mary Christman

In many instances data have been collected for development of single species abundance indices where the collection procedure is not species-specific. For example, sampling locations of bottom trawl surveys may be based on the need for data for a variety of species. As a result, the data for the species of interest for index development are often contaminated with excess zeroes, observations where the species was not observed. These extra zeroes are often due to sampling in habitat or seasons not in the distribution of the focal species. I discuss several methods for identifying those zeroes that are not part of the species distribution and which can be removed before analysis. Methods that identify observations to be removed are based on using independently obtained information on habitat, performing classification tree analyses, and using a multivariate technique developed by Stephens and MacCall (Fisheries Research 70 (2004) 299–310) that is based on co-occurrences of the focal species with other species also collected during the same sampling program. Once the observations that are determined to be inappropriate for the species of interest are removed from the dataset, analyses often proceed using model-based estimation methods. I describe one such method, a model where the CPUE is assumed to be distributed according to the Delta-lognormal distribution. This approach allows for the relevant excess zeroes to still be part of the dataset. . The presence or absence of a species is assumed to be due to a set of covariates that are usually not identically the same as the covariates that explain the observed non-zero CPUE values. The predicted values for each component (probability of a zero and the estimated CPUE when non-zero) are combined into a single predicted value for each combination of covariate values.

- **WKTRANSVALS 1&2, Standardized Effort Reporting & data bases JRC-ICES** - Holmes S.

An overview of the outcomes from the ad-hoc EU Data Collection Framework workshops on Transversal Variables (January 2015 and February 2016) was provided to WGCATCH. The workshops formulated a standard way of assigning two measures of fishing effort ('days at sea' and 'fishing days') across fishing gears and fishing areas for any given fishing trip scenario. An R package (fecR; <https://cran.r-project.org/web/packages/fecR/>) has been released that can implement the algorithms to calculate these measures of effort. The workshops considered the effort estimation for passive gears and polyvalent vessels, also small scale fisheries outside of the requirement to complete logbooks but it was clear further work was needed. The plenary on future work plans for WGCATCH confirmed work on small scale fisheries to 2019 so that this WG seems a good venue for future work on effort estimation. WGCATCH considers securing standardized effort reporting in these fleets is essential to ICES work. The transversal variables workshops had also considered an initiative to establish a common format for nationally held primary data. The aim is to facilitate a common approach to fulfilling ICES and STECF data calls utilising algorithms and packages such as the fecR package. Similar work has been conducted under the regional data base (RDB) steering committee.

- **Brief note on LPUE: Comparison of 5 years of ICES effort data with 5 years of the STECF data (calculated using the new effort algorithm)** - Prista N. & J. Rodriguez

A small demonstration was presented where graphs displaying 5-year landings data, effort data and raw landings-per-unit-effort (LPUE) data supplied to in a Working Document sent to an ICES Assessment Group were compared to similar graphs based on data that could potentially be extracted from the JRC database to answer a potential DG-MARE request on that fishery and stock. The exercise showed that for this particular case the conclusions taken from ICES data and JRC data would likely differ. The reasons for the differences were discussed, the most relevant being that different subsets of ports were used in the two analyses – the subset used by ICES resulting from analysis at national level and discussions at EG level that would hardly be replicated in a quick consultation to the JRC database. Overall, the demonstration highlighted that even if landings and effort data appear to be simple variables from which quick raw LPUE analyses can be carried out to inform assessment and management, the scientific analysis and discussions carried out within the ICES assessment framework still provide the best available knowledge and cannot be easily substituted by a quick consultations to database without substantial probability of erroneous conclusions.

- **Standardization of hake LPUE series of the Galician set-longline fleet in Subarea 7** - J. Castro, D. García, J.L. Cebrian and B. Patiño (presented by J. Rodríguez)

The ICES Working Group on Hake, Monk and Megrim (now WGBIE) identified a problem in the assessment of northern hake in relation to the scarce information on the abundance of large fish. The 2004 Benchmark Workshop on

Southern Megrin and Hake (WKSOUTH) tested the inclusion in the Stock Synthesis (SS3) model of Galician LPUEs from set-longline fleet targeting hake in ICES Subarea 7. This metier catches mainly adults. However, during WGBIE 2014, a serious inconsistency was detected when updating this LPUE time series, related to the assumption of the average fishing days by trip employed along the time series. The current working document provides the revision of this LPUE series by applying the actual number of fishing days by trip recorded in logbooks, which has varied greatly in the final part of the time series. The revised LPUE indices obtained were then tested in the assessment of northern hake stock. The difference in results between the assessments without LPUE and the assessment which includes the new LPUE series were minor. In the initial part of the time series the LPUE matched the abundance closely but in the last period the increase in the LPUE was much lower than the increase in the stock abundance.

5.2.3 Guidelines for documenting fishery-dependent LPUE/CPUE indices

PGDATA provided draft guidelines for the ICES benchmark evaluation process (Annex 4 of the PGDATA 2015 report; ICES 2015). These guidelines included a set of tasks that should be carried out when evaluating fishery dependent data, including CPUE/LPUE indices. Among those tasks were several references to documentation that should be produced and provided within the benchmark process. WGCATCH supports those guidelines and has updated them below (in **bold and red**). WGCATCH advises those interested in developing CPUE/LPUE indexes to consider the benefits of statistical methods of standardisation of data used widely in the US and elsewhere, such as data filtering using the Stephens and MacCall (2004) method followed by delta lognormal modelling (e.g., US Southeast Data, Assessment, and Review process; SEDAR, 2015) - or other standardisation approaches appropriate to the data. The “Report of the 2012 Meeting of the ICCAT Working Group on Stock Assessment Methods” (ICCAT, 2013) provides additional insight into “Generic methods for combining and standardizing multiple CPUE series” and “Protocols for the inclusion or use of CPUE series in assessment models”, the latter displaying a flowchart that aims to facilitate the appropriate application of CPUE to stock assessment models (see Figure 1 in ICAT, 2013).

Updated draft guidelines on fishery-dependent indices of fish abundance (p.65 of ICES, 2015)

Fishery dependent abundance indices continue to be used for some species, with or without fishery-independent data, and may be the only information available on stock trends for some data-limited stocks. Assessment and advisory groups need to understand the limits imposed by the quality and resolution of such data (see Appendix 1.6 and Annex 4 of the PGDATA 2015 report for more details on the limitations of such data; ICES 2015). Advice from the ICES Working Group on Fishing Technology and Fish Behaviour (WGFTFB) should be sought in evaluating the suitability of a fleet for providing abundance indices and for evaluating issues such as technology creep.

If fishery-dependent data are to be evaluated, consult the background documents listed in Annex 1 [of PGDATA 2015 report] and carry out the following tasks, collaborating where needed with WGFTFB:

- **Justify the need to use fisheries-dependent CPUE/LPUE data as there are many reasons for not including these data (see, e.g., SEDAR, 2015) such as**

changes in management regulations during the time series, changes in fisher's behaviour or use of technology, changes in discarding, inaccurate reporting of either landings/catches or effort or both, lack of appropriate effort measures (e.g., use days at sea but really need number of hauls or soak time). In cases where fisheries-independent data are insufficient and fisheries-dependent data are required to provide an index of abundance, a summary of the potential sources of bias and mitigation efforts should be included.

- Document **all data sources and** fishery CPUE/LPUE series evaluated, addressing target species, fleet sectors, fishing gears, coverage, and regulatory measures affecting fleet behaviour. Evaluate the suitability of each CPUE/LPUE fleet for the species being assessed, in terms of known aspects of the fisheries and fish behaviour in relation to gear design and fleet coverage.
- **Provide an exact definition of the fleet and fishery used including its size and spatial-coverage.** Describe **and justify** the methods for data selection (e.g., sub-setting of fishery trips according to vessel size, time, area, gear or species composition). Provide maps of coverage of the selected vessels in relation to the entire selected fishery (e.g., VMS), **detailing spatial distribution of the effort and landings over time.**
- Define and describe the available effort metrics (e.g., **fishing hours, days-at-sea, fishing days**, trips, number of hooks or nets, horsepower, soaking time, search time or any combinations of these), and evaluate which, if any, of the metrics are appropriate, and why. **Keep in mind that measures like "fishing days" can be ambiguous and differently interpreted by different data-providers.**
- Describe how zero catches from individual fishing trips using a particular gear are interpreted and handled in the analysis. Specifically: i) zero catch at a location where the species is expected to occur and be caught by the gear but is not caught due to random effects such as patchiness in distribution; ii) zero catch where fishing takes place in an area **with zero or very low probability of catching the species in any haul and at any level of overall abundance due to the nature of the habitat or other factors. How were these different types of zero catch treated in the analysis, and what are the implications in terms of potential for bias in the relative abundance trends?**
- Develop fishery CPUE/LPUE indices by appropriate strata (e.g., area, and fishery) and include measures of precision (**and the method used to estimate precision**) and assessment of bias; rank indices with regard to their suitability for use in assessment modelling. Describe methods of analysis of CPUE/LPUE data including any statistical modelling carried out.
- Evaluate **and account for** the potential for changes in catchability over time due to changes in vessels, fishing gear and methods (**including mesh-size**), **management regulations (e.g., landing obligation)**, or spatiotemporal activities. Document the methods and rationale for any factors used to correct for changes in fishing efficiency and feasible ranges for time-trends in efficiency. **Describe the statistical method used to standardize the series. Unless there is a very good justification to accept a raw LPUE index; an appropriate method to standardise the data should be applied.**
- **Describe the methods used for quality control, data cleaning (outliers; corrections to the catches or landings and effort data) and the development of the meta-data file describing the data used.**

- If developing a CPUE index including discards, evaluate the quality of the discards data for each year in the series, following the approaches outlined [by PGDATA] for developing time-series of fishery discards and landings. **Detailed information that should be given includes, for example, which age/length classes are most affected if discarding/slipping takes place, or if there is evidence that over-quota discarding is taking place.**
- For age-based CPUE/LPUE indices, evaluate the internal consistency of age compositions and correlations between fishery dependent CPUE/LPUE series and surveys.
- **Evaluate if there is a potential problem in the use of the CPUE/LPUE data in a stock assessment model due to lack of independence between the index series and the catch data used in the assessment, for example as can potentially happen if the annual CPUE index at age is effectively the total estimated catch at age divided by total annual effort. Similar residual error patterns could be present in both series for estimated values such as discards and length or age compositions which may be an issue if the assessment models treats the series as independent. If this is likely, the issue should be discussed with the stock assessment team well before the benchmark assessment meeting. Appropriate assessment methods that account for correlation among series should be used or identifying approaches for choosing among correlated competing series.**
- Where needed for exploring assessment models, evaluate the length or age selectivity of the CPUE/LPUE fleet as described above for fishery length and age compositions. Indicate the extent to which components of the age composition are mainly observed in the fishery dependent CPUE/LPUE and not in the scientific surveys.
- Recommend and tabulate fishery dependent datasets that are appropriate to use in the assessment, together with any quality indicators such as precision estimates or plausible alternative scenarios for catchability trends. **Include details on which method was used to provide a standard error estimate for the CPUE/LPUE time series.**

Other considerations

- **Include information on the existence of observer data available that could be used to build an index from or validate the catch and effort in the series and quantify technical creep.**
- **Try to verify if the landings per unit effort is proportional to the stock size. Harley et al. (2011) analysed a large number of LPUE indices and found in most of them evidence of hyperstability (LPUE remains high as abundance declines). Harley et al. suggest that where this non-linearity between LPUE and abundance is known, it should be accounted for in the assessment model. Alternatively, the reasons for the hyperstability need to be explored, documented and where possible incorporated into the index estimation.**
- **Where LPUE indices are used, the validity of the assumptions needs to be monitored every year, not just when the series is first introduced at a benchmark.**

5.2.4 Workshop on LPUE/CPUE indices

A workshop is proposed for refinement of the guidelines for documenting fishery-dependent LPUE/CPUE indices and discussion of new standardisation techniques (see **Section 5.12**).

5.2.5 References

Harley S. J., Myers R.A & A. Dunn (2011). "Is catch-per-unit-effort proportional to abundance?" *Canadian Journal of Fisheries and Aquatic Sciences* 58.9 (2001): 1760-1772.

ICCAT (2013). Report of the 2012 Meeting of the ICCAT Working group on Stock Assessment Methods. Vol. Sci. Pap. ICCAT, 69(3): 1354-1426.

ICES (2015). Report of the Working Group on Data Needs for Assessments and Advice (PGDATA 2015). 30 June–3 July 2015 Lysekil, Sweden.

SEDAR (2015). SEDAR Procedural Workshop 7: Data Best Practices. SEDAR, North Charleston SC. 151 pp. Available online at: <http://sedarweb.org/pw-07>.

Stephens, A. and MacCall, A. 2004. A multispecies approach to subsetting logbook data for purposes of estimating CPUE. *Fisheries Research* 70, 299 - 310.

5.3 ToR B – Sampling and estimation procedures

Review current and emerging sampling and estimation procedures of commercial catches, focusing on total catch, length and age distribution.

Chapter summary

WGCATCH reviewed the new tables for completion by EU Member States to document their work programmes under the EU Multiannual Programme (EU-MAUP) for the collection, management and use of data in the fisheries and aquaculture sectors. The tables on sampling of commercial catches were reviewed to examine if they provide statistical indicators and descriptions that would allow WGCATCH to assess the statistical merits of the sampling programme and provide routine documentation of sampling schemes. WGCATCH found that while significant progress has been made towards documenting the sampling designs, some modifications will be necessary for them to be useful for routine documentation of sampling designs for WGCATCH purposes.

The participation of the European Commission's Joint Research Centre (JRC) at the WGCATCH meeting provided an opportunity to communicate some concerns of the group with the use of the data held by JRC as a result of the 'Fishery Dependent Information' (FDI) data calls (formerly 'effort' data calls) issued by the Commission's Scientific, Technical and Economic Committee on Fisheries (STECF). The outcome of this discussion was a new data format for the data call which accounts for the limited resolution of sampling data.

5.3.1 Background and outline

WGCATCH builds on the work of previous EGs dealing with fishery data collection (e.g., WKPICS, SGPIDS, PGCCDBS) by being a forum for the discussion of commercial catch sampling and estimation and setting guidelines for best practice in at-sea and on-shore sampling of length and age compositions of landings and discards. In WGCATCH, the staff responsible for design of commercial fisheries sampling programmes, for data collection, for data estimation and for data provision to end-users (ICES EGs and others) regularly meet and build common knowledge on sampling and estimation issues defining guidelines that improve quality and optimizing results of sampling programmes targeting commercial catches of ICES stocks to ICES Assessment groups and other end-users (e.g., STECF).

The present ToR aimed at reviewing recent developments in sampling and estimation of commercial catches of ICES stocks. Additionally, taking advantage of the presence of a JRC representative, issues related to the quality of data provided by national institutes to STECF and the limits of their usage were discussed. Finally, a discussion was planned on the new EU-MAUP tables, their statistical soundness and the degree to which they could provide useful summaries of catch sampling activities of ICES stocks.

Prior to the meeting WGCATCH chairs circulated an email requesting WGCATCH participants for presentations of intersessional work carried out they might have carried out in sampling and estimation procedures. Additionally, a questionnaire was circulated that allowed participants to reflect on the new EU-MAUP tables. Participants were also requested to bring to the meeting an example of text box 4A of their EU-MAUP programmes. The final set-up for discussions involved 4 presentations presented in plenary and 3 additional presentations that were uploaded to the sharepoint to reduce time constraints. Discussions on the JRC data-call and EU-MAUP tables were held in plenary and in two subgroups. The discussions benefited from the presence at

the meeting of Mary Christman (USA) an invited participant with extensive expertise in sampling and estimation.

5.3.2 Presentations

- **Modelling length distribution by commercial size category to estimate species catch length composition for stock assessment** - Azevedo M., Silva, C. & J.H. Vølstad

In Europe, there is a requirement for fishery products of several species to be graded on the basis of size categories. In Portugal, fish are landed and sold at auction in boxes with fish of uniform size and labelled with the fish size category. In this study the length distribution by commercial size category is modelled using onshore biological sampling data. The annual catch length composition by species is estimated based on the modelled size-categories applied to the landings weight by size category for all year trips (“size category” raising approach) of two important Portuguese commercial species, hake (*Merluccius merluccius*) and horse-mackerel (*Trachurus trachurus*). The Portuguese annual landings length composition of these stocks is currently estimated by raising the length samples to trip landings, and then to port and region, by fleet and quarter (“trip” raising approach). Empirical validation of the size category methodology was performed using the Portuguese landings of Iberian hake which has a good annual sampling coverage of all landed categories showing that this approach, requiring much lower sampling effort, results in similar landings length composition. It is also shown for horse-mackerel, the case-study, that in the period 2013-2015 the variability of the mean length within size category is quite low as is the inter-annual variability by size category. Simulations were performed to investigate the effect of at-market sampling effort on the variability of horse-mackerel mean length by size category and to explore the effect of otoliths sample size on ageing of the species. Finally, an onshore sampling scheme is proposed, which reduces the number of current strata from 5 to 3 and the number of sampling units from 3 to 2, where PSU will be “auction x day” and SSU the “commercial size category”. We aim to test this new sampling scheme during 2017 for horse-mackerel to further validate its implementation in the future.

- **Do we really need a variance estimator? Empirical likelihood confidence intervals, case study the North Sea flatfish landings** – Wischniewski J.
- **Overview of the Dutch observer and self-sampling discard programme** - Chen C., Verkempynck R., Uhlmann S., Poos J.J. & E. van Helmond
- **Which species to sample? An objective method for the selection of species when sampling fish on a market** - Clarke L., Pout A., Sweeting S., Zeng F., Ritchie L., Clark P., Gault M. & C. Harriet
- **Evaluating regional designs for the on-shore sampling of North Sea demersal fisheries** –Pout A., Clarke L., Santos A.R., Elson J., Börjesson P., Christman M., Håkansson K.B., Paulsen M.S. (not presented, uploaded to sharepoint)
- **Statistical analysis of the sampling design: fishPi case study on the biological sampling of the European hake fishery** - Castro J., Prista N., Zarauz L., Rodriguez J., Azevedo M., Dubroca L., Pout A., Pereira J., Chen C., Gerritsen H., Elson J., Santos A.R., Börjesson P., Håkansson K.B. & S. Nimmegeers (not presented, uploaded to sharepoint)

- **Using statistical methods to improve regional catch sampling** - Håkansson K., Storr-Paulsen M., Clarke L. , Pout A. , Chen C. & E. van Helmond (not presented, uploaded to sharepoint)

5.3.3 STECF FDI datacall

The participation of JRC at the WGCATCH meeting provided an opportunity to communicate concerns WGCATCH participants have with the data provision and use of the data held by JRC as a result of STECF 'Fishery Dependent Information' (FDI) data calls, (formerly 'effort' data calls). These data calls include fishing effort, landings, discards and biological data.

Concerns with the present FDI data call

WGCATCH stresses the need to manage expectations of end-users. In particular, end-users need to understand the difference between census data and sampled data. Census data (landings volume and effort, both generally collected under the control regulation) can be disaggregated at any desired level as long as date/time variables and geographical coordinates are collected (as is the case of most electronic logbook schemes). Sampled data (discards and catch-at-age distributions) requires an estimation procedure that respects the sampling design. In the latter case, the estimates obtained may already be at the desired resolution level or still require further statistical calculations to yield estimates at the desired level (e.g., using domain estimation). Additionally, sampled data generally requires expert input to deal with unsampled strata (imputation) and potential bias in the sampled data. With sampled data different end-users and different sampling designs each require their own imputation and estimation procedures. Many person-hours are required to achieve the required estimation, imputation and bias analyses during the ICES stock assessment process and this cannot be done by relatively simple algorithms.

The STECF FDI data call requests sampled data at a métier level by quarter and asks for separate estimates to be made for fishing conducted under special conditions granted under the effort management plans. However, sampling programmes are primarily designed to provide information to stock assessments and are frequently carried out at disaggregation levels that vastly differ from those requested in the STECF FDI datacall. An example of how resources will limit the sampling coverage of multiple, more finely defined domains of interest within more coarsely defined sampling stratifications is provided in **Table 5.3.3.1**.

The far left columns of **Table 5.3.3.1** show the collection of vessels over which the MS considers it sensible to sample vessels. Domains similar to that shown in **Table 5.3.3.1** are contained in the national work plans for 2017-2019. The relevant categories in the current FDI data call are also listed in the table and the landings associated with those categories stated. Landings are census data so partitioning to these categories is possible. The far right hand column shows the number of trips sampled according to the categories in the FDI data call. There are several zeros; also very small numbers which creates the risk of biased data. The approach taken by the data-provider in this particular example was to estimate a discard rate of the broader domain data, then apply that discard rate to the landings of each FDI data call category. Similar practical decisions were reported by several WGCATCH participants that also reported estimating the data at a broad level of aggregation and then splitting them out across the quarters, vessel length class, mesh size, fishery and special conditions to meet the reporting level of the FDI datacall. However WGCATCH participants showed concerns that there was no standard approach to this and methods varied between countries, leading to lack of

transparency in calculations and potential errors in the combined data. In conclusion, it is not realistic for JRC to request highly disaggregated sampling data, then subject these data to simple imputation methods and aggregate them at arbitrary levels without considering the sampling design involved in data collection and expect a realistic answer.

WGCATCH proposal for future FDI datacalls

From the WGCATCH perspective it would be preferable to supply sampled data to STECF at a level that can be supported by the sampling design. If the data were required at a more specific level, the JRC would then develop a transparent routine to do this (e.g., if 20% of the landings of species X come from vessel length class Y then 20% of the age composition estimated over all vessel length classes could be allocated to vessel length class Y). The next FDI datacall in 2017 represents a very good opportunity to consider these changes as work has begun to define a new FDI data base that will replace the existing one once current effort management regimes are repealed and replaced by the regional multi annual plans under the revised CFP (Regulation (EU) No 1380/2013 of 11 December 2013). Additionally, a test of a new format of FDI data call is already being proposed by JRC for 2017 that makes these changes even more timely.

WGCATCH recommended to JRC that the current catch table in the FDI data call is split into a table for census data (control regulation) and tables for sampled data since the latter can only be provided at a much broader level of aggregation (e.g., broad gear types: large meshed trawl gears, smaller meshed beam trawls etc.; ICES divisions; annual data). The practical implementation of this approach would utilise the métier level 6 definitions (agreed at the RCMs and that define all MS métiers) and link them to member state defined sampling 'FISHERY ID'. The possibility of using two sampling FISHERY ID for each species would be provided, one for discards (total weights and biological data) and the other for landings biological data. If for a MS-species combination only one FISHERY ID is sufficient the two columns could be filled in using the same code. **Table 5.3.3.2** gives an illustrative example of the format of the census data table for landings. A FISHERY ID left blank indicates the métier was not sampled. The FISHERY ID is expected to include a definition of area(s) covered, using FAO naming hierarchy. **Table 5.3.3.2** illustrates why. For the same métier COD and FLE are sampled in schemes covering different areas. **Tables 5.3.3.3** and **5.3.3.4** show that part of each table for discard data and landings data that would correspond to **Table 5.3.3.2**

Additionally, WGCATCH recommended to JRC that numbers-at-length are requested in the FDI data call. The reason for the latter being that one of the main expected uses of the new FDI database is to help analyse whether the landing obligation has led to changes in the selectivity of fleets. WGCATCH considers that more information on this particular issue can be derived from numbers-at-length information than from numbers-at-age.

Both recommendations were taken on board by JRC and are incorporated in the draft FDI data call specification currently in preparation.

Table 5.3.3.1: Table displaying a group of vessels defined for sampling (for discards and age information) from a national work programme (far left column), the level of disaggregation in the STECF (FDI) data call and the number of samples available (right column). Source WGCATCH (unpublished).

OTB_DEF_70-99 or OTB_CRU_70-99												Vessel List	Sum of LANDINGS			
4												AREA				
OTB_DEF_70-99 or OTB_CRU_70-99												Domein				
OTTER 70-99, OTTER 80-89, OTTER 90-99												GEAR	STECF aggregated data			
u10m				o15m				o10t15m				VESSEL_LENGTH				
DEE{	CPart13C			DEEP	CPart13C			CPart13B			CPart13C		CPart13B		SPECON	STECF Data call
80-89	90-99	80-89	70-79	80-89	90-99	80-89	90-99	80-89	90-99	80-89	90-99	80-89	MESH_SIZE_RANGE			
													QUARTER	Landings (ton)		
4	3	4	3	4	3	4	3	4	3	4	3	4	1		82	
													2	56		
													3	64		
													4	103		
													1	20		
													2	7		
													3	23		
													4	16		
													1	66		
													2	27		
													3	62		
													4	64		
													1	53		
													2	75		
													3	84		
													4	51		
													1	49		
													2	49		
													3	31		
													4	79		
													1	217		
													2	517		
													3	833		
													4	339		
													1	41		
													2	5		
													3	51		
													4	87		
													1	41		
													2	22		
													3	55		
													4	5		
													3	0		
													4	0		
													1	0		
													2	0		
													1	0		
													2	7		
													1	7		
													2	2		
													3	6		
													4	6		
													3	1		
													4	0		
													Total			
														43		

* The observer programme does not split sampling by SPECON. To estimate for each SPECON the fraction of the landings is calculated and applied to raise the data.

Table 5.3.3.2 Proposed census data table for future FDI datacalls

FIELD	EXAMPLE
COUNTRY	SWE, SWE, SWE
YEAR	2015, 2015, 2015
QUARTER	1, 1, 1
VESSEL_LENGTH_CAT	12<18, 12<18, 12<18
GEAR	OTTER, OTTER, OTTER
MESH_SIZE_RANGE	>=105, >=105, >=105
DCF_METIER_LVL6	OTB_DEF_>105_1_120, OTB_DEF_>105_1_120, OTB_DEF_>105_1_120
FISHERY_ID_DIS	SWE_OTB_DEF_27.3D25-26-27-28-29, SWE_OTB_DEF_27.3D25-26-27-28-29, SWE_OTB_DEF_27.3D25-26-27-28-29
FISHERY_ID_LAN	SWE_OTB_DEF_27.3D25-26-27-28-29, NA, SWE_OTB_DEF_27.3D25-26
AREA	27.3.D25, 27.3.D25, 27.3.D25
SPECON	NONE, NONE, NONE
DEEP	NONE, NONE, NONE
FDF	NONE, NONE, NONE
SPECIES	COD, WHG, FLE
LANDINGS	53.6225, 0.2, 2.6877

Table 5.3.3.3 Proposed sampled data table (discards) for future FDI datacalls

FIELD	EXAMPLE, COMMENT
COUNTRY	SWE, SWE, SWE
YEAR	2015, 2015, 2015
FISHERY_ID_DIS	SWE_OTB_DEF_27.3D25-26-27-28-29, SWE_OTB_DEF_27.3D25-26-27-28-29, SWE_OTB_DEF_27.3D25-26-27-28-29
SPECIES	COD, WHG, FLE
DISCARDS	<i>Discard weight in tonnes</i>
NO_SAMPLE_DIS	<i>Number of discard samples taken</i>
NO_LEN_MEASURE_DIS	<i>Number of length measurements taken</i>
NO_AGE_MEASURE_DIS	<i>Number of age measurements taken</i>
MIN_AGE_DIS	<i>Minimum observed age</i>
MAX_AGE_DIS	<i>Maximum observed age</i>
AGE_0_NO_DIS	<i>Estimated number of fish age 0 discarded</i>
AGE_0_MEAN_WT_DIS	<i>Estimated mean weight of fish age 0 discarded</i>
AGE_0_MEAN_LEN_DIS	<i>Estimated mean length of fish age 0 discarded</i>
<i>Repeat for other ages</i>	

Table 5.3.3.4 Proposed sampled data table (landings) for future FDI datacalls

FIELD	EXAMPLE, COMMENT
COUNTRY	SWE, SWE, SWE
YEAR	2015, 2015, 2015
FISHERY_ID_DIS	SWE_OTB_DEF_27.3D25-26-27-28-29, NA, SWE_OTB_DEF_27.3D25-26
SPECIES	COD, WHG, FLE
LANDINGS	<i>Landings weight in tonnes</i>
NO_SAMPLE_LAN	<i>Number of landings samples taken</i>
NO_LEN_MEASURE_LAN	<i>Number of length measurements taken</i>
NO_AGE_MEASURE_LAN	<i>Number of age measurements taken</i>
MIN_AGE_DIS	<i>Minimum observed age</i>
MAX_AGE_DIS	<i>Maximum observed age</i>
AGE_0_NO_DIS	<i>Estimated number of fish age 0 landed</i>
AGE_0_MEAN_WT_DIS	<i>Estimated mean weight of fish age 0 landed</i>
AGE_0_MEAN_LEN_DIS	<i>Estimated mean length of fish age 0 landed</i>
<i>Repeat for other ages</i>	

5.3.4 EU MAUP

5.3.4.1 Introduction

The new EU multiannual Union Programme (EU MAUP) has made considerable progress towards statistically sound sampling. Specifically, two new important regulations were published that directly impact data collection of commercial fisheries in European Union waters:

- Commission implementing decision (EU) 2016/1251 of 12 July 2016 adopting a multiannual Union programme for the collection, management and use of data in the fisheries and aquaculture sectors for the period 2017-2019
- Commission implementing decision (EU) 2016/1701 of 19 August 2016 laying down the rules on the format for the submission of workplans for data collection in the fisheries and aquaculture sectors

These two legislative documents have the potential to significantly change biological data collection of landings and discards from European Union's commercial fisheries. As an example, where the previous data collection framework (2009-2016) focussed strongly on pre-specified national sampling targets for biological data and precision levels by métier (leading to quota-sampling and over-stratification), the new EU MAUP is now less prescriptive and puts emphasis in capturing the elements of statistically sound sampling programmes and decisions of data requirements being taken at regional level.

Having considered the importance of the new legislative documents WGCATCH analysed them with two specific objectives in mind:

- Review the progress achieved towards statistical sound sampling, discussing whether the new EU-MAUP tables provide the statistical indicators and descriptions that allow the statistical merits of the sampling programme to be

assessed. The main need for this review is related to statistically sound sampling having been a long term goal of WGCATCH and previous EGs such as PGCCDBS, WKMERGE, SGPIDS, WKPICS, amongst other

- Verify if the information (or part of thereof) contained in the work plans prepared annually by EU MS under Commission implementing decision (EU) 2016/1701 of 19 August 2016 could be used by WGCATCH to document historical changes in the sampling schemes of ICES stocks. That documentation is a long term WGCATCH objective [e.g., WGCATCH 2015] that is of significance for stock assessment benchmark working groups and other end users of commercial data. From a WGCATCH perspective, a collation of EU MAUP tables might, with slight adjustments, provide for that documentation and later be made available, routinely, in a centralised and user-friendly format that is accessible to the end-users of estimates.

Although WGCATCH set out to analyse this legislation it is important to state that there was no intention nor mandate to review or change the present format of the EU-MAUP tables. Rather, the motivation for analysing the tables stemmed directly from WGCATCH remit to ensure the documentation and quality of commercial catch sampling programmes and estimates used by ICES EGs, namely the assessment ones. Both of the latter are however intrinsically connected to the EU regulations and the criteria used to evaluate EU MS compliance (See WKPICS, PGCCDBS, etc.). It is this connection that justifies the objectives that WGCATCH set itself to achieve and the close collaboration that it established with RCM chairs on this matter.

5.3.4.2 General findings

WGCATCH welcomes the centrality that the concept of statistically sound sampling assumed in the new regulations. Significant progress was achieved with the latter that now allows probability-based sampling designs and estimation of commercial catches to be generalized across in EU waters, setting up explicit requirements for documentation and quality control of the data collected, and putting the focus on regional coordination of sampling plans. As a consequence of this regulation, MS are now strongly encouraged to move away from non-probabilistic quota sampling and métier-based sampling strata thus producing more accurate estimates to end-users.

However, there is room for continued improvement and a significant part of the realization of this progress in catch sampling will ultimately depend on

- a) The quality of the designs adopted (responsibility of the EU MS);
- b) The sampling effort allocated (shared responsibility of MS and the EU);
- c) The methodology used to evaluate the tables². Evaluation through STECF is likely to be inadequate. The tables need to draw out the pertinent statistical indicators and experts in sampling design need to evaluate the workplans;
- d) Adequate implementation and funding of the mechanisms for regional coordination (e.g., work done by the EU Regional Coordination Groups - RCGs).

² In the past it has been noticed that, e.g., evaluations based on quantitative criteria such as if a target number of fish sampled for biology has been achieved can, when associated to financial penalties induce MS to use non-probabilistic methods that lead to biased estimates (e.g., quota sampling).

WGCATCH also highlights that significant efficiency savings can be achieved by using RDB data and/or developing standard routines to provide the inputs for many of the tables.

5.3.4.3 Detailed findings

WGCATCH reviewed Tables 1A-F, 4A, 4B, 4C, 4D and 5A as well as text box 4A from Annex I of the Commission implementing decision (EU) 2016/1701 of 19 August 2016. This review was done through a compilation of the answers given by 11 countries to the questionnaires (**Annex 8**) and their discussion in subgroups and in plenary during the meeting. Responses to the questionnaires are available on the WGCATCH share-point and the detailed feedback for each of the tables in **Annex 9 of this report**.

5.4 ToR C – Landing obligation

Document recent changes in sampling design and data availability from commercial fisheries, particularly changes due to the introduction of the landings obligation and other legislation that can affect data collection and estimates.

Chapter summary

The group reviewed the impact of the landing obligation (LO) on sampling and on the quality of stock assessment data. The overall impression is that there is only partial compliance with the requirements. Data collection and estimation under the landing obligation could potentially be very problematic in terms of high refusals (biased estimates), observer effects on sampled trips and missing sampling some components of the landings (under MCRS). WGCATCH 2014 (ICES 2015) issued several recommendations of best practice in data logging and reporting under the landing obligation and proposed analyses to examine how the implementation of the LO is affecting the sampling programmes and data collection. MS are advised to adopt them so that losses in data quality provided for assessment during the transition period are minimised.

5.4.1 Background and outline

The introduction of the landing obligation (LO) provides a considerable challenge for data collection from commercial fisheries in ICES waters. The LO came into force in 2015 for the pelagic fisheries and cod fisheries in the Baltic Sea. In 2016, it was extended to some species in the demersal fisheries in the North East Atlantic affecting most of the European countries. The number of species and fleets subjected to the landing obligation is expected to continue increase until full implementation in 2019. Fisheries national institutes need to monitor the effects of the implementation of the landing obligation on sampling opportunities and adapt their sampling designs to meet the new challenges that sampling under the landing obligation poses.

The present ToR aimed to continue to compile information and evaluate the effect that the implementation of the LO has on commercial catch sampling and estimates provided to end-users. In doing this, it aimed at keep documenting and informing MS and/or staff yet-unfamiliar with the practical consequences of that legislation on how to meet the new challenges it poses and keep the quality of end-estimates available for assessment.

Prior to the meeting WGCATCH chairs identified a set of participants that took responsibility for two questionnaires to address the Tor. A first questionnaire was produced by RCM/NS and aimed to answer what are the practical issues and perceived concerns from MS relating to the current and pending sampling programmes, in relation to sampling, or not sampling, the new landed fraction ashore, changes in the quality of the data, control and sampling data and changes in the fishing behaviour (Questionnaire 1). A second questionnaire was sent to the subset of countries participating in cod fishery in the Baltic Sea aiming to assess the impact of the landing obligation on data submitted to the assessment working group WGBFAS 2016 in more detail (Questionnaire 2). Answers to both questionnaires were compiled and discussed during the WGCATCH meeting alongside results from one presentation.

5.4.2 Presentations

- **Lessons learned from discard ban 2015 in Denmark** - Storr-Paulsen M., Håkansson K. & J. Egekvist

5.4.3 Data collection under the landing obligation

5.4.4 Assessing the impacts of the LO, in relation to the sampling programme, **changes in the quality of the data and in the fishing behaviour (questionnaire 1)**

Summary of the results by region and conclusions taken from questionnaire 1 (**Annex 10**) are presented below.

5.4.4.1 Baltic Sea

In the Baltic Sea, the landing obligation was implemented in 2015, for the pelagic and cod trawl fisheries and salmon. Seven countries (Denmark, Germany, Estonia, Lithuania, Latvia, Sweden and Poland) fishing and collecting on-shore and off-shore commercial catch data responded to the questionnaire.

Onshore and at-sea sampling programme modifications - Overall, these MS sampling in the Baltic Sea have implemented modifications in their sampling sheets and databases. Sampling sheets and national databases were modified to accommodate the different components of the catch and landings (Landings >MCRS³, BMS⁴ landings, discards). The main change in sampling sheets and database was made in order to accommodate BMS landings category. Sampling programmes are in place to sample the new catch categories.

Impact on access to vessels and all components of the landings – Two of the seven countries with an at-sea sampling programme, reported an increase of refusal rates from the cod trawl fishery in the Baltic Sea. In fact, one country reported a 100% refusal rate from the cod fishery in 2016 so far. To respond to this, in the last quarter of 2016 a new system for at-sea sampling is being implemented and it will be mandatory for the randomly chosen vessels to accept observers. In relation to the onshore programme accessing all the landings components, most of the countries have difficulties on accessing the BMS landings, due to the low volume of BMS landings and/or the way this component is landed (in a communal container with landing from multiple vessels, or directly to transportation to other locations).

BMS data collection by control agencies - Countries have a range of answers; from no evidence to yes there is some evidence of BMS landings being recorded. The most common answer was that control agencies collect catch composition data at sea from some inspected trips (“last haul-data”). However, the sampling methods and data quality are still to be checked. No country in the Baltic is presently using CCTV for monitoring.

Impacts on data quality - Most countries have not yet tested their data for any changes in quality. Due to the nature of the pelagic fisheries (low discard rates), there is a sense that the data quality from those fisheries was not affected. However, for cod trawl fishery, two countries collected evidence that quality of the data collected by the control agencies (landings data: sales and logbook) were affected, due to the misreporting of BMS landings. Discard data used in cod stock assessment was derived from observer programmes, indicating that higher refusal rates will have an impact on the data quality.

³ Landings above the Minimum Conservation Reference Size (i.e. ‘normal’ landings)

⁴ Landings Below the Minimum Size

Impact on fishing behaviour - Most countries did not test for any change in the fishing behaviour. However, there is an impression that there is no change in the fishing behaviour due to the introduction of the landing obligation. It is currently perceived that this year is a transition period and the fishers are still adapting to the new regulation.

Analysis for observer effect - Two countries have performed spatial analyses to check the behaviour of demersal trawlers on observed trips compared to non-observed trips. The analyses did not show any significant change in behaviour when observers were present. No other analyses for observer effect were reported in the questionnaire.

5.4.4.2 North Sea and North Atlantic

In 2016, the landing obligation was implemented to the North Sea-East Arctic and North Atlantic and most of the MS were affected by the landing obligation. However, the species and fisheries affected are still limited and in some cases are under exemptions (*de minimis* or high survivability). Seven countries (Denmark, Ireland, Belgium, Estonia, Germany, UK – ENG and Spain) fishing and collecting on shore and at-sea commercial catch data in North Sea answered to the questionnaire.

On-shore and at-sea sampling programme modifications - MS sampling in the North Sea have changed and implemented the modifications in their sampling sheets and databases, when necessary. Sampling sheets and national databases were modified to accommodate the different components of the catch and landings (Landings >MCRS, BMS landings, discards). The main change in sampling sheets and database was made in order to accommodate BMS landings category. Sampling programmes are in place to sample the new catch categories.

Impact on access to vessels and all components of the landings - From the 7 countries with an at-sea sampling programme, only one reported a perceived increase of the refusal rates due to the landing obligation. However, there is a sense of general feel of distrust from the fishing industry. In relation to access all components of the landings, the BMS landings have been low and in most cases not easy to access or not visible to the sampler.

BMS data collection by control agencies - In most countries analysed (4 out of 6) the control agencies are recording BMS landings. The remaining countries are not aware if the control agencies can collect data on the new landing fraction.

Impact on data quality - The general perception is that the BMS fraction is not fully reported and accounted for in logbooks and sales notes. For discard estimates the increase in refusal rates will likely have an impact on the data quality. In addition, the complexity of the exemptions and confusion within the industry affects how observers might record the different components of the catch.

Impact on fishing behaviour - None of the MS noticed any change in fishing behaviour associated with the implementation of the landing obligation, nor observer effect. However, these were not tested or analysed.

5.4.4.3 Conclusions

WGCATCH should keep recording the progress and implementation of the landing obligation and document the challenges. Most of the MS have made changes in their databases and datasheets to record the different categories of discards and landings, including BMS. Main concern is in relation to the control data, where there is general perception that the BMS landings and logbook discards are not being fully reported. It is currently perceived that 2016 is a transition year for the demersal fisheries and that

these fisheries and the control agencies that inspect them may not be fully implementing the LO (they may be managing but not enforcing). Despite the systems being ready to accommodate the new catch and landings components, the sampling methods and data quality are still to be checked, in order to verify if all the catch components are being captured in the sampling programme. If there is evidence that one or more components are missed, national institutes should make the necessary changes in their sampling protocols to capture those comments. Control agencies are collecting data of catch composition by onboard sampling (“Last haul”-data). This data source is not yet fully investigated but could potentially add further information to increase the knowledge of catch estimation, by providing alternative or complementary catch data.

WGCATCH recommends that by the end of the first year of the landing obligation, Member Countries analyse the information on catches from vessels operator systems, registered buyers and sellers, logbooks and from independent scientific observations during the implementation phase of the landing obligation and carry out some of the analyses proposed by WGCATCH 2014 (ICES 2015) with the aim of supporting the estimation of unreported discards and BMS landings and identifying changes in fishing behaviour and discard patterns under the landing obligation. WGCATCH further recommends that Member Countries document the sampling and estimation procedures they use during the adaptation to the LO to keep the process transparent and possible to evaluate at a future occasion.

5.4.5 Assessing the impact of the landing obligation on data submitted to the assessment working group WGBFAS 2016 (questionnaire 2)

Seven countries answered the questionnaire 2 (**Annex 10**). The main findings for each catch category are summarized below, followed by general conclusions and recommendations.

5.4.5.1 BMS landings

The amount of cod BMS landings was reported to the assessment WG as a separate category by all countries except one, which included the BMS fraction in the discard category in InterCatch. The obligation to report the BMS fraction of the landings separately in the logbooks was not implemented in most countries in 2015 and the information was derived from sales slips and/or landing declarations. Two countries did not have a specific code for the BMS landings in any control data source and had to identify the fraction by the fate of catch reported in the sales notes. Three countries collected and reported biological data for the BMS landings, whereas two collected them both onshore and offshore and one only offshore.

5.4.5.2 Discards

Cod discards for active gears were estimated from onboard sampling programmes of five countries. One onboard sampling programme did not manage to get enough observed trips to estimate the discards from active gears in 2015 due to refusals by fishermen. One country did not estimate discards and assumed discards to not occur.

Passive gears were sampled for discards by four countries; two onboard, one by self-sampling and one by a combination of self-sampling and onboard sampling combined. The observer effect on discard rates has not been evaluated by any country. The general impression was that discarding was carried out to the same extent as earlier years on observed trips.

Discards were raised to fleet level by various ratio estimators; cod landings >MCRS; all cod landings; or total landing of all species. The country sampling only by self-sampling was not able to know what the fate of the BMS cod would have been, had it not been stored for sampling. In this case the entire BMS fraction (regardless of fate) was raised to fleet level and the reported BMS landings from the fleet was subtracted from the estimate to avoid “double counting”. It was also considered likely that not all BMS cod was brought to shore and the self-sampling programme will be extended to include onboard trips in late 2016.

5.4.5.3 Logbook registered discards

No country reported data for the InterCatch category “Logbook registered discards”.

5.4.5.4 Conclusions

The amount of BMS landings reported for cod in the Baltic Sea in 2015 was less than 1% of the total catch for the Eastern Baltic cod stock and even less for the Western Baltic stock, while the estimated discard rate was around 15% (WGBFAS 2016). According to preliminary data from one country, the BMS landings were even lower in 2016. The general impression from MS is that discarding behaviour had not changed from previous years in observed trips.

Although no obvious observer effect on discarding patterns was found in the Baltic 2015 it cannot be ruled out in the future. Measures should be taken to validate sampling schemes and if possible compare estimates to other data sources.

Discard allocations in InterCatch will be even more complex with the new catch categories. The catch category “Logbook registered discards” is particularly problematic, as the total discards in InterCatch are the sum of “Discards” and “Logbook registered discards”, while the discard allocation process only takes the ratio between “Landings” and “Discards” into account. **WGCATCH recommends to the ICES data centre and ICES secretariat that the category “Discards” should include all discards, regardless of if they are registered or not, and that “Logbook registered discard” should only be used for documentation purposes.**

The landing obligation had no or a very small impact on the assessment 2016, in the specific case of Baltic cod, since no analytical assessment was carried out for Eastern Baltic cod and no or little change in refusal rates and discarding behaviour was observed for Western Baltic cod. However, the data collection and estimation under the landing obligation could potentially be very problematic in terms of high refusals (biased estimates), observer effect on sampled trips, etc., which would have severe impact on the data quality.

5.4.6 Other topics discussed

Article 15.8 in the CFP (Regulation (EU) No 1380/2013 of 11 December 2013) allows catches of species that are subject to the landing obligation and that have been caught in excess of quota (or for which MS do not have a quota) to be deducted from the quota of the target species as long as this not exceed 9% of the quota of the target species and the non-target species is within safe biological limits. However, it is not clear in (at least some) MS how these catches will be officially reported under such interspecies flexibility. If e.g., a vessel targeting sprat gets an excess of herring and utilizes his sprat quota to land the herring, will it be reported as herring or sprat? WGCATCH stresses that reliable catch figures are a prerequisite for assessment of the stocks and that there

thereby is a strong need that catches are reported under the correct species. **WGCATCH recommends that Member Countries record catches of all species under the correct species code.**

5.4.7 References

ICES (2015). Report of the Working Group on Commercial Catches (WGCATCH 2014), 9-13 November 2015, Lisbon, Portugal. ICES CM 2015/SSGIEOM:34, 111 pp.

5.5 ToR D – Liaise with other ICES groups

Liaise with other ICES groups (PGs, WG, WK, SSGIEOM) and research projects that deal directly with commercial catch data, and collaborate with PGDATA in the support to Benchmark process.

Chapter summary

WGCATCH does not provide advice for fishery management but has the goal of actively contributing to the ICES stock assessment benchmark process and ensuring that the quality of commercial catch data is more widely considered in the assessment process. WGCATCH discussed the historical difficulties that expert groups dealing with catch sampling (WGCATCH and other related groups such as the Planning Group on Commercial Catches, Discards and Biological Sampling and the Planning Group on Data Needs for Assessments and Advice) have had to engage with assessment EGs. WGCATCH concluded that preparing specific working documents on fishery data quality for assessment and/or benchmark meetings could be the most efficient way of increasing participation in the advisory process. A workshop to develop and test this approach is proposed by WGCATCH.

5.5.1 Background and outline

Within the ICES structure, WGCATCH sits under the ICES Steering group on Integrated Ecosystem Observation and Monitoring (SSGIEOM) having direct relationships with other SSGIEOM EGs that deal directly with fishery data such as the Planning Group on Data Needs for Assessments and Advice (PGDATA), the Working Group on Biological parameters (WGBIOP), the Working Group on Recreational Fishery Surveys (WGRFS) and workshops developed by these EGs such as the Workshop on Cost Benefit of Data Collection in Support of Assessments and Advice (WKCOSTBEN). Furthermore as the ICES EG on commercial catches, WGCATCH should keep focus on research projects that deal with commercial catch data and can also spawn WGs of its own (e.g., WKISCON2) the results of which should be reviewed during its meeting. Furthermore, by pooling knowledge on Member Countries sampling programmes and estimation of commercial catches all across ICES waters, and statistical expertise on commercial catch sampling, WGCATCH has in its remit support to ICES EGs in commercial catch related issues allowing more informed decisions on, e.g., patterns in the data that may result from changes in sampling or estimation procedures. For that, WGCATCH meets inter-sessionally by video conference when requests from data compilation and benchmark groups arise and continues to foster the collaboration and information flow between data collection, estimation and data-provision, stock assessment and benchmark teams.

Prior to the meeting WGCATCH chairs requested from the chairs of SSGIEOM, PGDATA, WGBIOP and WKCOSTBEN presentations of their results. An additional presentation was requested from participants involved in the new research project based at the Institute of Marine Research in Norway on Reduced Uncertainty in Stock Assessments (REDUS).

5.5.2 Presentations

- **SSGIEOM** - Olav N
- **PGDATA** - Armstrong M. & M. Storr-Paulsen
- **WKCOSTBEN** - Armstrong M. & J.H. Vølstad
- **WGBIOP** - Clausen L.W., Vitale F. & P. Torres

- **Outcomes of letter to inter-benchmark and benchmark chairs** - Prista N. & H. Gerritsen

WGCATCH does not provide advice but has had as a goal its active participation in the benchmark process. Following decision of WGCATCH 2015, in February WGCATCH chairs sent an email to 2016 benchmark, inter-benchmark and data compilation chairs offering the WG availability to discuss and advise inter-sessionally on quality of commercial catch sampling input to assessment. The following content was included:

Dear benchmark, inter-benchmark and data compilation WK chairs,

We would like to make you aware of the existence of the Working Group on Commercial Catches (WGCATCH) and outline the support we can provide to your work.

At its last meeting, WGCATCH has decided to initiate a forum for discussion where end-users suspecting bias in commercial data can obtain an expert opinion and advice on the causes of observed patterns ([WGCATCH report 2015](#)). WGCATCH consists of experts in statistics, catch sampling design and parameter estimation of commercial catches. Many of these experts are involved in the design and implementation of sampling of commercial catches and may be able to provide insight into unexplained patterns in the assessment input data like step-changes or trends if these are due to bias in the sampling design.

If you are aware of any stocks that could benefit from our involvement, please contact us and we will attempt to address such issues intersessionally or at our meeting in November.

There was no response to this email so no discussion was held.

- **Reduced Uncertainty in Stock Assessments (REDUS)** - Vølstad J.H.

Reduced Uncertainty in Stock Assessments (REDUS) is new research project based at the Institute of Marine Research in Norway. REDUS aims to reduce the uncertainty in stock assessment and advice for our most important fish stocks. The REDUS project will use both a bottom-up approach (from observations through management) and a top-down (society's uncertainty requirements implications for observations). Thus REDUS will provide society with knowledge of how uncertainty affects stock assessment and hence quota advice, and complementary how much catches can increase if we reduce this uncertainty.

REDUS will provide a seamless and generic framework for uncertainty estimation and analysis that will allow for more optimal fisheries management (e.g., potential higher long-term quotas) and better prioritisation of fisheries monitoring and research. By coupling measures of survey and observational uncertainty with stock assessment models that account for uncertainty this provides the basis for harvest control rules and management strategy evaluation leading to providing statistically robust measures of uncertainty for quota advice and long-term harvest strategies alike. REDUS will build a generic Open Access toolbox founded on the StoX package and the S2D format that has a potential universal application in renewable marine resource management.

5.6 ToR E – Small-scale fisheries

Continue to document current as well as best practices for data collection schemes to estimate catch, effort, catch composition, biological parameters and spatial mapping of activities of small-scale commercial fisheries (under-10m vessels) with particular focus on European fleets. Evaluate approaches to data collection by census, surveys or self-sampling.

Chapter summary

WGCATCH drafted best practice guidelines for collection of transversal variables and biological data in small scale fleets. The usefulness of some new technologies such as remote electronic monitoring by CCTV and vessel position recording by AIS/GPS in monitoring SSF was also evaluated.

5.6.1 Background and outline

Small-scale fleets (SSF) are important components of many ICES fisheries and are receiving growing attention within the Common Fisheries Policy (CFP)-reform and Marine Spatial Planning (MSP) initiatives. Several recent works have highlighted the need to improve knowledge about small scale fisheries in order to secure their sustainable development (Chuenpagdee et al., 2006; Salas et al., 2007; Chuenpagdee R., 2011; Guyader et al., 2013; FAO, 2015).

Furthermore, the European Commission stressed the intention to provide support to the small scale sector under the reformed CFP and to promote small-scale coastal fishing activities (Regulation (EU) No 1380/2013 of 11 December 2013). The European Maritime and Fisheries Fund (EMFF) regulation (Regulation (EU) No 508/2014 of 15 May 2014) includes many references to the small-scale coastal fishing and as an example Article 25 could be mentioned: "With a view to promoting small-scale coastal fishing, Member States having a significant small-scale coastal fishing segment should attach, to their operational programmes, action plans for the development, competitiveness and sustainability of small-scale coastal fishing". More recently, the 2nd Workshop on Transversal Variables held from 22-26 February in Cyprus debated SSF effort definition and estimation but the complexity of the issue did not allow work to conclude during the meeting and it is uncertain if and when it might continue (Castro Ribeiro et al., 2016).

There is no single definition of small-scale fisheries, as any definition is linked to the end-user needs such as stock assessment, marine spatial planning, socio-economic studies, Marine Strategy Framework Directive (MSFD), Marine Protected Areas (MPA), management regulation texts, etc. WGCATCH adopted the view of the Data Collection Framework (DCF) Nantes workshop ("Common understanding and statistical methodologies to estimate/re-evaluate transversal data in small-scale fisheries") on small-scale fisheries (Anon., 2013) which refers to fleet segments by vessel length (LOA) ranges: <10m; 10m–12m and ≥12m. The under-10m fleet is considered as a separate fleet segment in relation to data collection because there is no obligation under the Control Regulation (Regulation (EU) No 1224/2009 of 20 November 2009 and Commission Implementing Regulation (EU) No 404/2011 of 8 April 2011) to supply EU log-books for those vessels (this applies to under-8m vessels in the Baltic). The LOA class 10–12 meters is retained as a separate fleet segment to ensure consistency in time-series and because they are not under Vessel Monitoring System (VMS) obligation under the Control Regulation (which is critical for mapping of fishing activities for marine spatial planning or other purposes needing data at specific spatial resolution). It should be also noted that many countries have put exemptions in VMS data requirement inside

the 12–15 meters fleet segment, so full VMS coverage of >12 m vessels cannot be assumed in many cases and the 12–15 meters fleet segment might also need to be retained for similar consideration of such cases.

WGCATCH 2015 made considerable progress in documenting the importance of SSF and how much they can contribute to landings and effort in some areas (ICES, 2016). The group concluded that SSF are important in nearly all countries but seemed to be trapped in a vicious cycle where due to incompleteness and lower quality of existing data on this component, systematic lower importance was assigned to it relative to larger scale fleets. Furthermore, WGCATCH 2015 highlighted the existence of both census and sampling approaches that quantify and characterize commercial catches from SSF, but also the inexistence of clear guidelines for the design, implementation and quality assurance of SSF data collection methods that reduce bias, increase precision and improve cost efficiency of their sampling. At the time, WGCATCH did not have the time to draw up such detailed guidelines for good sampling practices and proposed the continuity of the work inter-sessionally and during the 2016 meeting.

The subgroup of WGCATCH participants dealing with SSF kept worked inter-sessionally presenting its results to ICES ASC 2016 theme session G: “The inshore challenge: management of recreational and commercial fisheries accounting for social benefits, economic value, and biological sustainability”. Furthermore, it developed an initial draft of generic and specific guidelines on best practices for SSF data collection (transversal and biological data) that was brought for discussion during the 2016 meeting. During the meeting the subgroup also analysed two presentations and discussed new technologies used in monitoring these fisheries.

5.6.2 Summary of the presentations

- **Small scale, big deal: Sampling catches from European small-scale fisheries** - Demanèche S., Armstrong M., Mugerza E., Adamowicz M., Carlshamre S., Clarke E.D., Dingsør G., Egekvist J., Fernandes A.C., Kovsars M., Nimmegeers S., Norkus D., Otterå H., Reis D., Rodriguez J., Saks L., Schembri S., Spegys M., Stoetera S., Vandemaele S., Vølstad J.H., Grygiel W., Gerritsen H. & N. Prista

Small-scale fleets (SSF) are important components of many ICES fisheries and are receiving growing attention within the CFP-reform and Marine Spatial Planning initiatives. In order to assess the importance of SSF within Europe, WGCATCH 2015 compiled descriptions and data (effort, catch and value) of SSF fishing in EU waters, using 2012 as reference year and categorizing fleets by vessel length. The compiled information covered 17 countries describing a range of scenarios, spanning from the Baltic Sea to the Mediterranean. The <10m and 10–12m vessels were ranked highest in importance in nearly all countries in terms of number of vessels and employment. They were generally involved in multi-gear and multi-species fisheries developing seasonal or part-time activities into coastal areas with generally more sensitive habitats as nursery grounds or spawning aggregations. SSF were also found to be important for several fisheries in terms of effort, value and landings, and to represent a significant share of some TAC-quota or catches of regulated species, even though their landings may be under-reported. Group members also described the way SSF are sampled and estimated in their countries. The wide diversity in methodologies used to sample and estimate the impacts of SSF creates challenges to harmonize and standardize data quality indicators across

European countries. We put forward some best practice guidelines for sampling SSF and show that these will have to be adapted at regional level in order to encompass existing variability at fleet and fisheries level.

- **Regional cooperation in small scale and recreational fisheries data collection (fishPi)** - L. Zarauz, M. Armstrong, E. Mugerza, E. Andonegi, P. Börjesson, H. Mendes & A. Moreno

Regional coordination of small scale fisheries data collection programmes is needed to ensure that end users are supplied with the catch estimates or other data needed by them, at the required spatial resolution, temporal coverage, and quality. Coordination is a role for the lead scientists for the surveys in each country, the Regional Coordination Groups, and the ICES Working Group on Commercial Catches (as technical expert advisory groups).

For SSF, data collected under the Control Regulation via logbooks and sales notes are limited, and sampling is needed to improve the quality of collected information. The designs of SSF sampling programmes in a region do not necessarily have to be completely harmonised between countries. The most important attribute is that surveys have robust statistical designs to minimize bias and allow correct calculation of precision. Catch estimates from different surveys can then be combined. Information must be collected to allow evaluation of the potential for bias, e.g., non-response / refusals and incomplete coverage. The types of data needed from SSF should be defined by end-user needs to achieve Common Fisheries Policy goals as well as to support national inshore management.

SSF surveys can be complex and are statistically demanding. With multiple countries contributing to these estimates, a quality assurance framework for documenting and archiving data quality is required. Regional survey programmes should be subject to expert peer review before implementation and amended where necessary.

A distinction should be made between transversal variables collected through a census approach (Control Regulation or ad-hoc methods for SSF), and those transversal variables collected through sampling programmes designed for SSF. Further work will be needed to determine the needs and the design of such a regional database for these data.

5.6.3 Work carried out in 2016

WGCATCH 2016 work on SSF focused on:

- (i) Drafting best practice guidelines for data collection on SSF. This topic included:
 - a. Defining the estimates of core fishing activity variables needed for the SSF fishing sector (ex-transversal variables, capacity/gear information/fishing effort/landings per species in kg and in value) based on work done during previous meetings: DCF Nantes workshop on small-scale fisheries (Anon., 2013), WGCATCH 2015 (ICES, 2016), 2nd Workshop on Transversal Variables (Castro Ribeiro et al., 2016), 2016 fishPi research project (Anon., 2016) and on end users' needs.
 - b. Establishing best practice guidelines for SSF data collection of fishing activity variables, taking into account the WGCATCH 2015 conclusion

that SSF fishing activity variables have to be monitored differently by a census or a sampling approach adapted to the specific features of SSF vessels (multi-gears, multi-species fleet, high heterogeneity, high spatial distribution, seasonality and potential part-time activity, frequent direct sales, ...) (ICES, 2016).

- c. Drafting best practice guidelines for SSF data collection of biological data (length and age composition, discard rates estimates, catches of protected, endangered and threatened species) based on previous work carried out in particular during the ICES Workshop on Practical Implementation of Statistical Sound Catch Sampling Schemes series (ICES 2012, 2013, 2014) and discussing the specific issues of biological data collection in SSF.
 - (ii) Discussing the how modern/new technologies (Closed Circuit Television (CCTV), new apps for smartphone/tablets to collect fishery data, Automatic Identification System-AIS/GPS geolocalization tools to estimate geospatial effort, ...) can improve SSF data collection (namely in what concerns spatial mapping activity of vessels) based on a first review of different on-going projects known to WGCATCH members.

5.6.4 Best practice guidelines for data collection on Small Scale Fleets

The best practices guidelines for SSF data collection of fishing activity variables and biological data drafted by WGCATCH follow the structure presented in **Figure 5.6.4.1**. The most appropriate data collection methods and designs will depend primarily on the objectives of the scheme (i.e. what types, resolution, precision and quality of estimates - the domains of interest - are required by end users from the target population of vessels), and the practical aspects of collecting data (including available means to collect the data) in a reliable, statistically sound and cost-efficient way. Resolution may refer to spatiotemporal strata; gear types, etc. An important initial step is the pre-screening or frame survey of the fishery which provides information allowing the development and evaluation of data collection methods based on factors such as accessibility of vessels, fishing and landing patterns, part-time activity, gears used, target species etc.

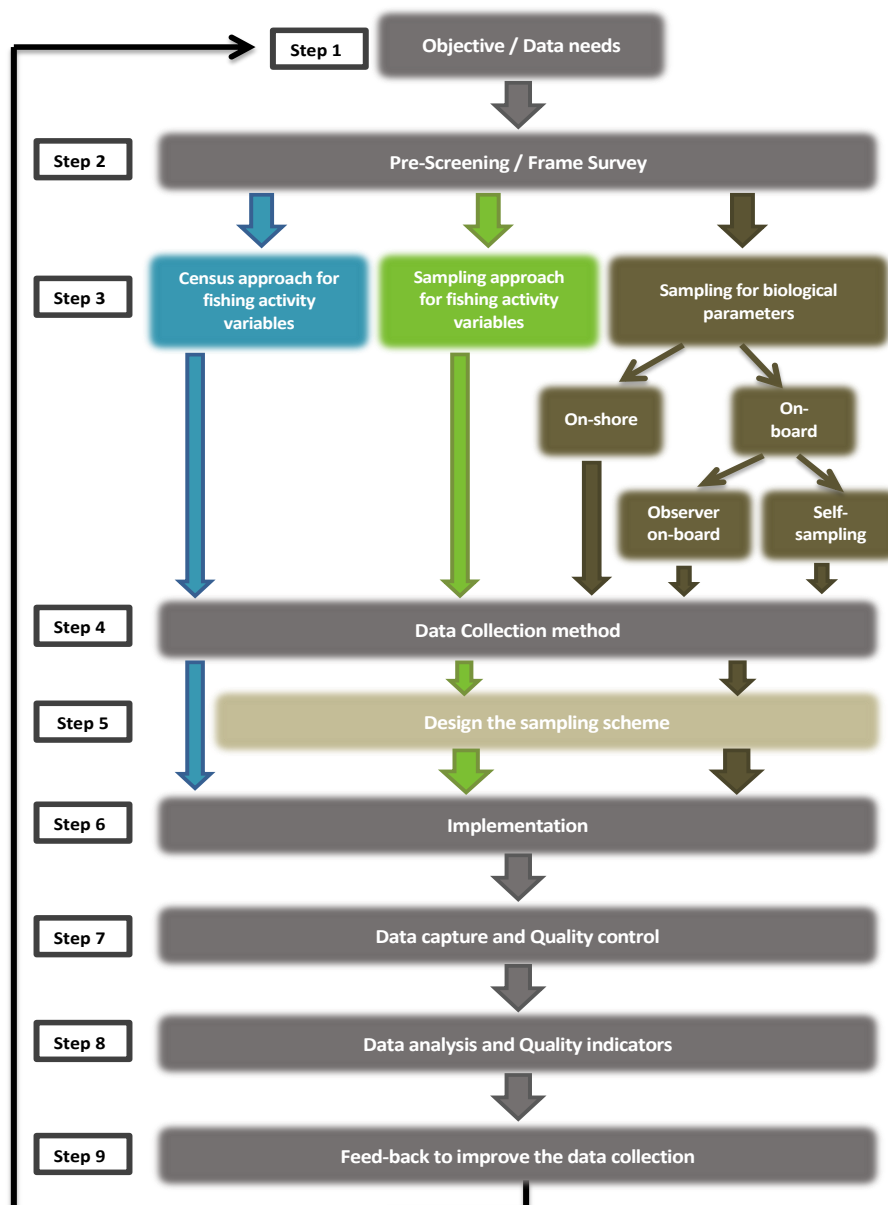


Figure 5.6.4.1. Diagram structure of SSF data collection best practices guidelines

5.6.4.1 Main end-users and end-user needs on SSF

The first step in setting up a data collection scheme is to identify the estimates and data effectively needed by end-users, i.e., to identify the target population and the types of estimates and their resolution (the “domains of interest”, such as estimates of landings or fishing effort by spatiotemporal strata; gear types etc.) and the level of precision that the data collection system is required to deliver and the types of data needed to make these estimates. The focus of WGCATCH is on the collection of data of relevance for stock assessment and fishery management including spatial controls. To identify the main end-user and their data and estimation needs, WGCATCH consulted the reports of DCF Nantes workshop on small-scale fisheries (Anon., 2013), fishPi research project (Anon., 2016) and 2nd Workshop on Transversal Variables (Castro Ribeiro et al., 2016) where this specific topic on SSF fishing activity data needs has been discussed.

A first (non-exhaustive) list of end-users and end-user needs is displayed in **Annex 11**.

5.6.4.2 Best practice guidelines for SSF data collection of fishing activity variables

The WGCATCH guidelines for the design, implementation and quality assurance of SSF data collection respecting fishing activity variables (including capacity, effort and landings estimates) are given in **Annex 11**.

5.6.4.3 Best practice guidelines for biological data collection on SSF

The WGCATCH guidelines for the design, implementation and quality assurance of biological data collection on SSF on-shore and/or on-board (including length and age composition, discard rates and catches of Protected, Endangered and Threatened Species) are given in **Annex 11**.

5.6.5 Role of modern/new technologies in improving SSF data collection

WGCATCH highlights that there are significant opportunities to improve Small Scale Fisheries (SSF) monitoring and data collection using technologies such as remote electronic monitoring (e.g., CCTV), new apps for smartphone/tablets to collect fishery data, AIS/GPS geolocalization tools, and other methods. The utility of such information should not be ignored and these technical instruments must be supported by helping the implementation of pilot or trial studies via an incentive approach. Member states should work together in the future for the extension/improvement of open source applications and development of tools to process such data.

In particular, new technologies constitute a good way to improve knowledge on spatial mapping activity of SSF which is a key issue receiving growing attention within the Common Fishery Policy (CFP) reform and Marine Spatial Planning initiatives in particular. New technologies could provide detailed information on effort with high spatial resolution which will be very useful to assess reliable fishing activity data (in particular fishing effort estimates as number of trips or fishing days of SSF vessels). New technologies constitute also a good opportunity for self-sampling programmes which could be the only way to collect data and calculate estimates for SSF discard rates or SSF Protected Endangered and Threatened Species (PETS) catches. More generally, WGCATCH concludes that new technologies constitute a way to improve SSF data collection. As a first input to this specific feature and to illustrate these aspects, WGCATCH provides this year an up-to-date review of the different technology projects that are being carried out in the ICES area, building up on work made during the DCF Nantes workshop on small-scale fisheries (Anon., 2013) where a very preliminary compilation is featured in chapter 7 of the final report which deals with the following ToR: *"input of modern techniques (CCTV, mobile phone apps or geolocalization data) to improve the estimated statistics"*.

During the Nantes workshop, three different programmes were presented and extensively described in the report:

- (i) France scientific project named RECOPECA was described (<http://archimer.ifremer.fr/doc/00024/13500/>). It consists in fitting a sample of voluntary fishing vessels with sensors recording data on fishing effort, catches and physical parameters.
- (ii) Denmark presented two other different systems (the Anchor Lab Black Box R100 and Archipelago Marine Research Ltd CCTV system).

In the following text, WGCATCH summarises additional developments and progress in countries that participated in WGCATCH 2016:

Marine Scotland and MASTS (Marine Alliance for Science and Technology Scotland) (Scotland)

As part of the project funded by the 2014/15 European Fisheries Fund 'Evidence Gathering in Support of Sustainable Scottish Inshore Fisheries', and managed by MASTS, Class B Automatic Identification System (AIS) (Vespermarine XB8000 transponder and associated GPS and VHF antenna) were installed in 274 inshore fishing vessels of 12 metre and under in June/July 2015. This represents approximately 18% of the 1524 <12 m fishing vessels registered in Scotland. The majority of the vessels (84%) are static gear operators that predominantly fish using creels. Mobile gear operators that utilise trawls and/or dredges comprise only 14% of the vessels. The majority of vessels (47%) operate on the East coast, followed by the West coast (22%), Outer Hebrides (16%), Shetland (14%) and East & North Coast (2%).

The feasibility of using AIS data as a tool for assessing aspects of the activity of inshore fishing vessels with a view to inform both fisheries management and marine spatial planning was the motivation for the project. It is important to note that there is currently no legal requirement for <12m vessels operating in Scottish coastal waters to carry Vessel Monitoring Systems or AIS. However, the project showed that AIS coverage around the Scottish coastline was extensive and that it was possible to easily harvest high resolution temporal and spatial activity data from AIS equipped vessels. With appropriate filters, these data can be used to provide information that can, in combination with other metrics, be used for fisheries management purposes and to provide valuable information to marine planners. Further research which will take place under the auspices of the recently funded EMFF project "Scottish Inshore Fisheries Integrated Data System (SIFIDS)" will refine the automated acquisition of temporal and spatial data from inshore vessels (not necessarily using AIS alone), together with operational and catch data. These data will be automatically uploaded to a centralised relational database for subsequent processing and analysis.

Marine institute (Ireland): Inshore VMS programme (I VMS) in Ireland:

A VMS programme for inshore vessels under twelve meters length overall was started in 2014 to improve data provision and enforcement tools for shellfish fisheries in Ireland. The aims of the programme are in relation to: (i) enforcement of fishery regulations (e.g., compliance with closed areas to protect sensitive habitats), (ii) food safety and traceability (tracking origin regarding classified production areas for bivalve molluscs) and (iii) fishing effort monitoring. In its first phase, the system has become mandatory for all vessels fishing razor-clams (*Ensis siliqua* and *Ensis arcuatus*) along the coast of the Republic of Ireland from July 2015.

The VMS device sends information (GPS coordinates, speed, course) every 5 minutes when the vessel is in motion and every hour in order to limit data volume and storage issues when it has been stopped for more than 30 minutes. The main difference between iVMS devices compared to standard VMS is the communication mode: in the case of iVMS information is sent through the terrestrial GPRS network (versus satellite transmission for VMS) and has therefore to be stored in an internal memory when the unit is out of range. The data, provided by the contracted companies who are managing and maintaining the pool of devices, are hosted by the companies and also by the Marine Institute. An interface to the devices allows vessel positions to be viewed in real time and retrospective reports and data downloads generated.

The programme is now in its operational phase with more than 90 vessels equipped. Intended future developments include (i) the combination of these high frequency VMS data with catch and landing data from various sources such as sales notes, shellfish gatherer documents (so called consignment data) or data from a Sentinel Vessel Programme (SVP, participating vessels under 12m in length provide logbook-like data

and biological and economic data on a voluntary basis) to produce razor-clam abundance indices or absolute abundance (catchability of the fishing gear is very high) at a high spatial resolution, (ii) the use of high resolution effort maps together with habitat maps for the purpose of habitat pressure and impact assessment and (iii) expansion of the programme to other dredging fleets.

DTU Aqua (Denmark):

DTU Aqua is working with AIS data in SSF. The objective is to merge the AIS data with the sales notes to finding the coverage of AIS and use it as spatial information on the SSF.

Department of Fisheries & Aquaculture (Malta):

In Malta, GPS is installed on fishing vessels from 5 m to 9 m, while VMS is installed on fishing vessels from 9 m and above with special fishing licences (e.g., lampuki FADs, lampara, surface longlines targeting tuna and swordfish, and beach and boat seines (tartarun)). Geospatial distribution and effort is analysed with the data obtained.

Thünen-Institute (Germany):

In the Baltic Sea, the Thünen Institute of Baltic Sea Fisheries (Germany) has recently started a 3-year project (STELLA) on alternative management approaches to minimize conflicts between gill net fisheries and unwanted bycatches (i.e. marine birds and mammals). Presently, effort data of the small-scale fleet are highly uncertain due to lack obligatory logbook entries. This severely hampers our understanding of the dynamics of the small-scale fisheries and leads to uncertain extrapolations of bycatch events.

During the STELLA project a smartphone application (app) will be developed for collection of better data on effort (time at sea, spatiotemporal distribution of fishing locations, length of nets, soaking time) and events of unwanted bycatches of gillnetters.

The app involves the use of smartphones with a GPS receiver. The app will be multi-lingual, multi-platform and supplied free of charge, however with minimum requirements for the type of smartphone. Development of the app will take place in cooperation with an enterprise. The suitability and feasibility of the app will be tested with German small-scale fishers and tests with Polish gillnet fishers are planned.

CEFAS (England):

Cefas has started a new project to develop an electronic tool which fishers can collect length samples from brown crab and lobster, as well as other shellfish species. The tools will be in the form of an android application and a set of bluetooth callipers. The application will allow the easy record of samples details and length measurements, with the data being subsequently sent to Cefas to be analysed.

Some local inshore fisheries conservation authorities, in England, are working in collaboration with Succorfish (<http://succorfish.com/fisheries>) to monitor and record the location of fishing activity by individual recreational lobster potting fishermen. The fishermen will be supplied with radio frequency identification tags that are attached to the individual pot. Currently, the use for this tool is for control and enforcement of the local bylaws, but it could also be used to estimate the effort and spatial distribution.

AZTI (Basque Country):

AZTI in cooperation with the Basque Government under a specific project with the SSF fleet installed AIS B devices in 65 vessels. An open source platform is also installed in

5 of them. The platform receives GPS data (time, position, speed and course) and sends it by GSM system to a private server in near real time, allowing a control of the inshore fishing effort. The system includes fuel consumption management plugging, which may detect skipper's behavioural changes on operational patterns during the steaming activity.

Additionally in 10 vessels a tablet is installed with a specific software application to collect information on catches.

The main objective of the project is to advice the Basque Government on the management of these fisheries under the inshore waters.

Fishmetrics (Azores):

Fishmetrics is an integrated and robust solution for fish size sampling. It addresses fish measurements for fish stock assessment and management, by proposing an integrated solution that i) automates fish data collection in fishing vessels and fish auctions, and ii) simplifies the fish measurement procedure by uploading the data to a remote database, where measurements can be taken at a later stage, not requiring physical access to fish. The system uses 3D motion information obtained with a 3D scanner to detect the presence of new fish boxes in conveyor belts or planar scales. Once a new box is identified, RGB and depth images are acquired, processed, and uploaded to a remote database (Maia et al., 2016) (**Figure 5.6.5.1**).

Fishmetrics uses portable or fixed hardware, a digital measurement system using computer vision and non-contact 3D metrologic solutions, and a back-end server which aggregates all sampling databases and automates all the required statistical analysis. Fish boxes images are automatically acquired, either at land or onboard of vessels (<http://fishmetrics.weebly.com>).

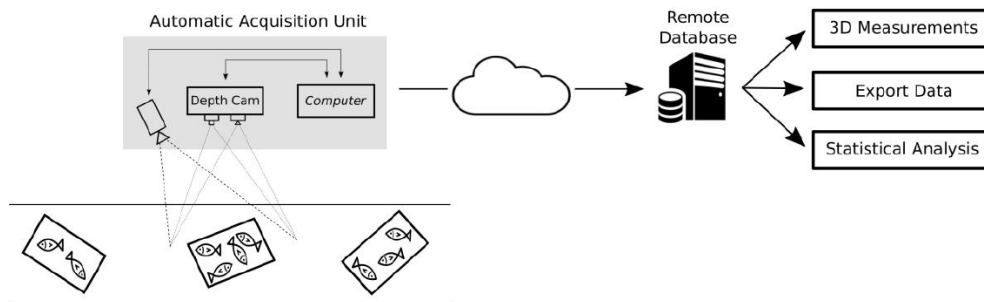


Figure 5.6.5.1 – FishMetrics system architecture.

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5.7 ToR F – Protected species

Document current sampling and estimation practices for Protected, Endangered and Threatened Species (PETS) and rare fish species. Evaluate limitations of current data and communicate them to main end-users

Chapter summary

WGCATCH concluded that there is need for joint work with the ICES Working Group on Bycatch of Protected Species (WGBYC) on the design of pilot studies to monitor incidental bycatch which are being planned under the EU MAUP and on estimation of incidental by-catches. Two joint WGCATCH/WGBYC workshops are proposed: one in 2018 on the design of dedicated sampling schemes on the monitoring of protected species and a second one in 2019 on the estimation of incidental bycatch rates and raising from sampled vessels to fleet level.

5.7.1 Background and outline

WGCATCH has a long-standing collaboration with WGBYC under which it has agreed to start routine documentation of sampling practices for Protected, Endangered and

Threatened Species (PETS) and rare fish species by means of a specific ToR. Such documentation will provide an annual check-point on whether Member Countries have implemented some of the best practices for PETS sampling previously proposed and a reference that allows the tracking of the evolution through time of PETS and rare species sampling methodologies applied at MS-level. At the WGCATCH 2015 meeting, members recognized the importance of recording bycatch of (Protected, Endangered and Threatened Species (PETS) during DCF-related sampling on board commercial fishing vessels and that in some cases this information was already being recorded but not necessarily logged into the national databases because their format does not account for these data. Following those discussions a questionnaire was devised to characterize the status quo of data collection of PETS under DCF-related commercial catch sampling programmes. Alongside this, WGCATCH participants involved in the sampling designs under DCF highlighted some concerns with regards to the degree of knowledge and expectations end-users might have on the quality of PETS data they were receiving. To address this concern, a general objective was stated to continue addressing the sampling and estimation of PETS as a routine ToR as a means to improve the communication with end-users on the current limitations in the sampling data available for these species and managing their expectations.

Previous to the meeting a questionnaire was circulated on participants alongside a request for presentations of work they may have carried out on PETS. Compilation of results from these questionnaires was carried out during the meeting followed by discussions in plenary. Two presentations were held on this topic.

5.7.2 Presentations

- **Cooperation WGCATCH and WGBYC - Couperus B.**
- **Rare and protected fish species in the Polish commercial catches, monitored by the institute observers in the Baltic Sea (2013-2015) – Grygiel W.**

The presentation was aimed on the sum up information about biodiversity of the southern Baltic ichthyofauna, based on an example of the Polish commercial catches in 2013-2015, inspected by the institute (NMFRI) scientific observers, with the special attention to the appearance of rare and under protection species. Observers collected the most of research materials during routine surveys on board of totally 104 commercial cutters and boats with length ranged from 6 to 40 m and main engine power ranged from 4 to 740 kW. Overall, 4147 fully valid fisheries data/samples were analysed.

Totally, 54 fish and lampreys species were recognised by observers in the Polish commercial catches (2013–2015) realised by boats with length of ≤ 11.99 m, small cutters with length of 12.0-20.0 m and large cutters with length of ≥ 21 m. Within the sum of recognised species, 8 - was classified as less numerous with seasonally appearances at several locations, 9 - as sporadically and somewhat locally appeared, 14 (25.9%) - as rare and locally appeared, 6 (11.1%) - as very rare and under the Polish protective regulations, 10 - as non-native (incl. 2 IAS). From 54 fish taxa, 22 (29.6%) is mentioned in the HELCOM (2013) Red-List Taxa, including 16 species marked as endangered, vulnerable and threatened and more 6 species as least concern. In 2013–2015, the percentage (by weight) of less numerous species with appearance at several locations fluctuated in a part of inspected the Polish commercial catches from 0.26 to 1.35 on average, and the mean share of sporadic and somewhat locally occurred species changed from 0.02 to 0.04. The mean share of rare species in the above-mentioned catches changed from 0.001 to 0.003%, and the percentage of very

rare species being under protection, ranged from 0.0015 to 0.0039. The most of rare and protected species was originated from catches conducted by boats with applied the set (anchored) gillnets and trap-nets, at 0-10 m depths range, in the southern part of the Gulf of Gdansk, mostly nearby the Vistula River mouth.

5.7.3 Importance of on board observations in the context of by-catch studies and development of regionally coordinated data collection programmes

The EU MAP requires that EU MS sample protected species. Additionally, ICES intends to include tables on incidental bycatches of protected species in its advice. These tables are to be prepared by WGBYC.

In the current situation WGBYC only has by-catch data from a limited number of small scale local studies and from data collected under the EU resolution 812/2004 and some of the previous DCF at-sea observer programmes. The 812/2004 EU resolution covers only cetaceans in a few specific métiers which are not always the ones where most bycatch is expected to occur. In this context, DCF at-sea observer programmes on commercial fisheries are an important supplementary source of information even if in most cases they are focused on sampling catches of commercial species (including discards) and consequently cannot focus exclusively on the collection of bycatch data. In addition dedicated surveys are too expensive for most MS (ICES, 2014, 2015) and long term monitoring of by-catch events on a larger scale (spatial and temporal) is required.

The potential of existing DCF-related catch sampling programmes to improve data collection on by-catches of PETS and other rare species has long been established. That objective has been realized under the new EU MAP that now includes provisions making mandatory the data collection on incidental by-catches of a large array of species protected under Union legislation and other international agreements (more details below). Although there is a desire to monitor a broad range of species, covering several taxa, an overarching design that adequately covers all taxa within the EU MAP is not realistic. When incorporating monitoring of PETS in the new EU MAP, the emphasis should therefore be on improving on board sampling protocols to ensure PETS by-catches are captured within the data recording system and to alter downstream data handling systems to ensure bycatch records of PETS are easily accessed by end users because it is not possible to convert those programmes into observation platforms for PETS and other by-catch without jeopardizing data collection on the main commercial stocks.

One approach to help address some of these issues may be to use data collected under the DCF/EU MAP or other sources to help identify “hot spots”, such as areas, seasons or métiers with relatively high bycatch rates of PETS. Based on initial assessments of the data at this larger scale, relevant MS or EU regional Coordination Groups (RCG's) may then need to carry out more focussed surveys to fully assess the scale and patterns of PETS bycatch in specific fisheries. This approach would require MS or RCG's to identify additional fisheries and/or species requiring sampling.

An important consideration is the extent to which the total bycatch of PETS species of interest is attributable to different types of fishery, such as large scale commercial fisheries, small scale and recreational fisheries. Obviously the relative importance of these components can vary considerably depending on the species concerned. Different end users also have differing and sometimes conflicting priorities. The amount and quality of data available from these three fishery components varies widely and strongly impacts how sampling can be designed and results analyzed. In all cases a detailed

knowledge of the different fisheries, and sampling methods appropriate for the different countries, needs to be built up at a regional scale to enable appropriate regional sampling designs and estimation methods to be developed.

As a first step to PETS regional coordination data collection programmes, substantial work needs to be carried out between main end users, data collectors and experts in sampling and estimation, under the umbrella of the RCGs, to: i) identify priorities on data needs and criteria; ii) identify additional national requirements for data to support national inshore management schemes, and find a trade-off between regional and national needs; iii) identify appropriate data collection methods for each country taking into account cost/benefits analysis and practical implementation considerations; and iv) develop standardised guidelines and protocols. This work will lead to a second phase of development where designs of regional data collection programme that cover needs identified in the first phase will be carried out. This should be fully documented and submitted to a consultation process with EGs such as WGBYC and WGCATCH and for peer review by experts in survey design. The process outlined implies considerable intersessional work between end-users and data providers, led by RCGs, and for which some funding and resources will be needed. Expertise and training is needed on data collection and analysis methods and sharing of expertise and skills across countries.

5.7.4 Status quo of by-catch sampling and data logging under DCF

A questionnaire on sampling practices and logging of PETS information into the databases was developed by WGBYC during the WGCATCH meeting to be completed by the MS separately before the 2016 meeting. The questionnaire was completed by 17 institutes. The results of the survey are presented in **Tables 5.7.4.1 and 5.7.4.2**. It appears that approximately about half of the institutes have already implemented the monitoring in of PETS (in common practise: rare species in the catches) in their sea going protocols, but that fewer have designed their databases to hold these data.

5.7.5 Requirements of the new EU MAP and future collaboration between WGCATCH and WGBYC on incidental by-catch issues.

The first paragraph of the text on incidental bycatch in the EU-MAP (EU 2016/1551, Ch III.3.a) can be interpreted as: to record incidental bycatches during existing at-sea observer trips or through self-reporting by fishers in a logbook scheme. The at-sea present sampling programmes are not designed in the first place to collect information on scarce specimens in the catch. The reason for this is that with incidental bycatch it is not known on beforehand what species will be caught - the list of protected species is several hundred with catches of most species likely being rare events in the fisheries -, the design of such programmes not being able to guarantee that the fleets selected for sampling include the most significant in terms of such types of incidental by-catch, and the very nature of work on board vessels that may make it impossible to carry out simultaneous data collection on larger by-catch and, e.g., otolith collection of discards. Consequently the protocol requires to indicate the percentage of the haul that has been checked on haul-level. For example: if possible an observer should inspect the catch when the codend is opened to check for large incidental bycatch and – even more important – he/she has to clearly indicate when that not done for whatever reason. Likewise, the part of the catch that effectively has been checked (for smaller specimens when sorting the catch and for longline- and gillnet fisheries) should also be clearly indicated.

The second paragraph can be interpreted as: if there are métiers of which the RCG's think that the planned methodology is not sufficient to monitor incidental bycatch, other methodologies should be used. In the National Workplans for the EU MAP Pilot Study 2 should be used by MS to plan a pilot scheme that - during the next three years - indicates possible métiers which should be studied by means of other methodologies than the routine commercial catch sampling schemes in the current EU MAP.

Plenary discussion during WGCATCH and questionnaire results indicated that many MS's have already adjusted or will be adjusting their sampling protocols to meet EU-MAP requirements and improve data collection on incidental by-catch. However it turned out that none of the adjusted protocols for the sampling of rare specimens have been mentioned in the National workplans, probably due to the lack of instruction in the text form to do so. **WGCATCH supports the adjustment of at-sea sampling protocols to improve data collection on incidental by-catch and recommends Member Countries that have not yet adjusted them to take steps to accomplish it.**

Additionally, several WGCATCH members of the group expressed their concern on the way data EU-MAP data on incidental bycatches obtained from commercial catch sampling programmes is being analyzed. For example, WGBYC states that the estimated Northeast Atlantic bycatch rate (all species combined) for towed gears under dedicated monitoring is three times greater ($6/187=0.03$) than the estimated bycatch rate from sampling schemes under the DCF ($6/1037=0.01$). In addition, the North Sea/Eastern Arctic and Northeast Atlantic combined bycatch rate estimated for static net gears under dedicated monitoring is also approximately three times greater ($34/732=0.05$) than that estimated under the DCF bycatch rate ($3/165=0.02$). According to the executive summary of WGBYC report for 2015 these discrepancies "continue to demonstrate that DCF sampling design and data collection protocols do not adequately capture protected species or other rare bycatch events". Several members of WGCATCH pointed out that, even if many DCF sampling design and data collection protocols do not adequately capture protected species, such conclusion should not necessarily be drawn as it assumes that results from directed and non-directed studies are directly comparable (e.g., sampling frames are the same, etc.). Furthermore, several WGCATCH members emphasised that little information is provided on how the referred national estimates of incidental bycatch data collected under the DCF were obtained and how they were pooled at regional level (e.g., were the observations from "static" and "towed" métiers and different countries pooled together? Were weighing factors applied and low sample sizes and biases in sampling considered?, etc.). Additionally some lack of clarity, and possible heterogeneity, was noted in the counter-part of the previous comparison (what were the sampling designs and estimation methods included in the category "directed studies"? how were the results of those studies pooled together?). Note that in stressing these aspects, WGCATCH members are not ignoring the responsibility they have in ensuring proper estimates of by-catch for the commercial fisheries sampled at-sea. Rather, they are highlighting that sampling and estimation of incidental by-catch are hot topics for research and data collection, prone to biases that are enhanced by the rare nature of many such by-catch events, and that consequently require more intense collaboration between EGs.

Based on the previous WGCATCH concluded that there is a pressing need for joint-work with WGBYC in the sampling design and estimation of incidental bycatch. A first step to achieve this, **WGCATCH recommends the organization in 2018 of a joint-workshop between WGCATCH and WGBYC dedicated to the design of interdisciplinary (e.g., DCF-related) and dedicated monitoring programmes and pilot studies for the monitoring of protected species and other incidental by-catch.** A second

workshop dedicated to the estimation of incidental bycatch will be considered for 2019 depending on the results of the first initiative.

5.7.6 References

ICES (2014). Report of the Working Group on Bycatch of Protected Species (WGBYC), 4–7 February 2014, Copenhagen, Denmark. ICES CM 2014/ACOM:28. 96 pp.

ICES (2015). Report of the Working Group on Bycatch of Protected Species (WGBYC), 2–6 February 2015, ICES Headquarters, Copenhagen, Denmark. ICES CM 2015/ACOM:26. 82 pp.

Table 5.7.4.1 Results of the questionnaire on the sampling of incidental bycatch of protected species in the on board sampling protocol.

	BEL	DEU	DNK	ESP_AZTI	EST	FRA	GBR_ENG	GRC	ESP_I	IRL	LTU	LVA	NLD	POL	PRT	PRT_AZ	SWE	#YES	#NO	#NA	no entry
Does the protocol contain instruction to record catch of other vertebrate species than fish (i.e. turtles, birds, dolphins, seals)?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	16	1	0	0
In gill nets - and hook-and-line fisheries: does the protocol instruct to indicate how much of the hauling process has been observed for (large) incidental bycatches which never came on board (because they fall out of the net)?	NA	Y	N	NA	N	Y	N	N	N	Y	N	N	Y	Y	Y	Y	NA	7	7	3	0
Does the protocol contain a check for rare specimens in the catch at opening of the codend or immediate removal during hauling in gill nets or hook-and-line?	N	?	N	N	Y	N	N	N	N	N	N	N	Y	Y	Y	Y	N	5	11	0	1
If Yes: is the observer instructed to indicate if the codend was not checked in a haul or at how much of the hauling process has been checked for immediate removal?	NA	?	-	Y	Y	-	NA	-	NA	-	N	-	Y	Y	N	Y	NA	5	2	4	6
Does the protocol instruct to check for rare specimens during sorting of the catch (i.e. at conveyor belt)?	N	Y	N	N	Y	Y	N	N	Y	Y	N	Y	Y	Y	N ^(b)	Y	N	9	8	0	0
If Yes: is the observer instructed to indicate how much of the sorting process has been checked on "haul level" (i.e. percentage)?	NA	Y	-	N	N	Y	NA	-	N	Y	N	Y	Y	Y	-	Y	NA	7	4	3	3
Does the protocol instruct to report specific handling or devices on board which may hide incidental bycatch?*	N	N	N	NA	N	N	Y	N	Y	N	N	NA	Y	Y	N	NA	N	4	10	3	0
If Yes: is the observer instructed to report what effect this has on the sampling at "haul level"?	NA	NA	-	NA		-	N	-	-	-	N	-	Y	Y	-	NA	NA	2	2	5	8
Does the protocol instruct to report of mitigation (i.e. Acoustic Deterrent Devices or "pingers")?	N	Y	N	NA	Y	Y	Y	N	N	N	N	NA	Y	N	N	NA	NA	5	8	4	0
If yes for ADD's: is there a check for proper working (i.e. Battery check)?	NA	N	-	NA	N	N	N	-	NA	-	N	-	N	N	N	NA	NA	0	8	4	4
In case of an incidental catch: is the observer instructed to indicate its state (dead and discarded, released alive, discarded in unknown state, collected for further research)?	N	Y	N	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	N	11	6	0	0

Table 5.7.4.1. Results of the questionnaire on the sampling of incidental bycatch of protected species with the question whether the national database is designed to enter this information.

	BEL	DEU	DNK	ESP_AZTI	EST	FRA	GBR_ENG	GRC	ESP_IEO	IRL	LTU	LVA	NLD	POL	PRT	PRT_AZ	SWE	#YES	#NO	#NA	no entry
Does the protocol contain instruction to record catch of other vertebrate species than fish (i.e. turtles, birds, dolphins, seals)?	Y	N	Yes	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N ^(a)	Y	N	13	4	0	0
In gill nets - and hook-and-line fisheries: does the protocol instruct to indicate how much of the hauling process has been observed for (large) incidental bycatches which never came on board (because they fall out of the net)?	NA	N	-	NA	N	Y	N	N	NA	Y	N	N	Y	NA	N ^(a)	Y	NA	4	7	5	1
Does the protocol contain a check for rare specimens in the catch at opening of the codend or immediate removal during hauling in gill nets or hook-and-line?	N	N	-	N	Y	N	N	N	NA	N	N	N	N	Y	N ^(a)	Y	N	3	12	1	1
If Yes: is the observer instructed to indicate if the codend was not checked in a haul or at how much of the hauling process has been checked for immediate removal?	NA	NA	-	Y	Y	-	NA	-	NA	-	N	-	N	Y	-	Y	-	4	2	4	7
Does the protocol instruct to check for rare specimens during sorting of the catch (i.e. at conveyor belt)?	N	N	-	N	Y	Y	NA	N	Y	Y	N	Y	Y	Y	N ^(a)	Y	Y	9	6	1	1
If Yes: is the observer instructed to indicate how much of the sorting process has been checked on "haul level" (i.e. percentage)?	NA	N	-	N	N	Y	NA	-	NA	Y	N	Y	N	Y	-	Y	-	5	5	3	4
Does the protocol instruct to report specific handling or devices on board which may hide incidental bycatch?*	N	N	-	NA	N	N	Y	N	Y (text field)	N	N	NA	N	Y	-	NA	Y	4	8	3	2
If Yes: is the observer instructed to report what effect this has on the sampling at "haul level"?	NA	NA	-	NA	-	-	N	-	-	-	N	-	N	Y	-	NA	-	1	3	4	9
Does the protocol instruct to report of mitigation (i.e. Acoustic Deterrent Devices or "pingers")?	N	N	-	NA	Y	Y	Y	N	NA	N	N	NA	N	N	-	NA	-	4	7	3	3
If yes for ADD's: is there a check for proper working (i.e. Battery check)?	NA	N	-	NA	N	N	N	-	NA	-	N	-	N	N	-	NA	-	0	7	4	6
In case of an incidental catch: is the observer instructed to indicate its state (dead and discarded, released alive, discarded in unknown state, collected for further research)?	N	N	-	Y	Y	Y	Y	N	Y (text field)	Y	N	N	N	NA	N ^(a)	Y	N	7	8	1	1

5.8 ToR G – RDB

Review developments of the Regional Database (RDB) and exchange formats from a design-based sampling and estimation perspective.

Chapter summary

The ICES council has allocated 135.000 EUR on a two-year project to develop a new RDB which will hold national fishery sampling data and the information on sampling design and achievement needed to implement statistically-sound estimation methods. WGCATCH was requested to provide advice for this development by documenting and approving the estimation methods for incorporation in the RDB. WGCATCH decided on an intersessional workshop that will test the documentation of sampling designs and estimation methods and attempt to produce InterCatch-type estimates using the RDB format as a starting point.

5.8.1 Background and outline

WGCATCH provides a forum to discuss ideas on exchange formats that aim to provide design-based estimates. The RDB is hosted at ICES and a main prerequisite for development of regional sampling programmes, for standardisation of data and a tool for ensuring transparency and quality assurance of input data for stock assessment and for other use for the management of the marine living resources by the EU and non-EU countries in the North Eastern Atlantic area (ICES, 2017). The ICES Data Centre is in charge of RDB maintenance and development. In WGCATCH 2015 other formats were presented that are also in development (e.g., Norwegian StoX / R-ECA software).

In the present Tor WGCATCH aimed to continue to monitor the development of the RDB and other formats and strengthen its interactions with the ICES Data Centre and SC-RDB that are coordinating the development of the RDB. The ultimate goal being to ensure that the final exchange formats and RDB development can hold data from the array of different possible probabilistic designs (WKPICS) and is able to estimate commercial catches in a statistically sound, standardized and transparent way that improves data quality to end-users and eases workload burden currently put on national data providers.

Previous to the meeting, WGCATCH chairs requested from the SC-RDB a presentation of the recent developments of the RDB and its future development plan.

5.8.2 Presentations

- **Data quality in fisheries science** – Dubroca L.
- **RDB developments** - Kjems-Nielsen H. (by skype)

The ICES Council has decided to use 135.000 EUR on a two-year project to develop a new RDB, which will hold national fishery sampling data and the information on sampling design and achievement needed to implement statistically-sound estimation methods. The new/updated exchange format will be based on the existing exchange format, but probably with an extra record type before TR, move of the CA record type to after the HL and with extra fields on all record types (based on the *fishpi* format). The change in the exchange format should first be in two years' time. WGCATCH is requested to evaluate estimation methods to be implemented in the new RDB. There is considerable expertise among WGCATCH members and contributors to *fishpi* and *redus*; and document current estimation methods based on the 'old' RDB format.

5.8.3 Future initiatives

WGCATCH plenary discussed what would be needed to meet ICES Data Centre request for approval of estimation method. Considering the significant workload of WGCATCH meetings that work would have to be developed intersessionally and only the final discussion had at WGCATCH meeting. Furthermore, it was highlighted that approval of generic estimation methods could not be easily achieved – documentation of historical sampling designs and estimation methods at stock level would first have to be performed and that an attempt would have to be carried out to develop scripts that could replicate present InterCatch estimates using the information of the RDB as a starting point. It was decided that a WK would be the best set-up for such intersessional work and that case-studies for potential stock for analysis would be sought among participants. The advantage of such format would be that, depending on the stock chosen, such workshop could also constitute a means of producing a WD to more actively engage in the advisory process (see **Section 5.12**).

5.8.4 References

ICES (2017). Report of the Steering Committee for the Regional Database FishFrame (SCRDB), 29 November – 1 December 2016, ICES Headquarters, Denmark. ICES CM 2016/ACOM:30, 35 pp.

5.9 ToR J – Response to recommendations to WGCATCH from ICES expert groups RCMs, liaison meetings or other groups

From: WGBIE

To: WGCATCH

Recommendation: A new commercial long line cpue has been proposed for northern hake and the EWG recommends that the methodology be reviewed and appropriateness for advice evaluated.

Response: WGCATCH dealt with this request under ToR a (see **Section 5.2 of this report**).

WGBIE provided a working document presented at WGBIE 2016, ICES, Copenhagen, Denmark, in May 2016 entitled “Standardization of hake LPUE series of the Galician set-longline fleet in Subarea 7” and authored by J. Castro, D. Garcia, J. L. Cebrian, and B. Patiño. This document was presented by J. Rodriguez at WGCATCH 2016, being summarised in **Section 4 of this report**. WGCATCH notes that the information provided in the working document, and in general in the stock annexes, is insufficient to evaluate the appropriateness of the fishery dependent index of abundance and can therefore only state that the proposed change appears to be a sensible one which will probably improve the quality of the estimate. WGCATCH also described the estimation techniques used in this working document and compared it to the estimation method used for the Norwegian longline CPUE series (see **Annex 7**). Finally, the group updated guidelines that outline the details that should be included in WD and the stock annexes of any stock that uses fishery-dependent indices (see **Section 5.2.3**).

From: WGHANSA

To: PGDATA; WGCATCH

Recommendation: The WGHANSA recommends that anchovy catches in the western part of Division 9a are sampled whenever an outburst of the population in the area is detected.

The WGHANSA considers each of the survey series directly assessing anchovy in Division 9a as an essential tool for the direct assessment of the population in their respective survey areas (subdivisions) and recommends their continuity in time, mainly in those series that are suffering of interruptions through its recent history.

The WGHANSA recommends the extension of the BIOMAN survey to the north to cover the potential area of sardine spawners in 8.a. This extension should be funded by DCMAP.

The WGHANSA recommends a pelagic survey to be carried out on an annual basis in autumn on the western Portuguese coast to provide information on the recruitment of small pelagics (particularly sardine and anchovy) in that region.

The WGHANSA recommends a pelagic survey to be carried out on an annual basis in spring in the English Channel (7.d, 7.e, 7.h) to provide information on the status of small pelagics (particularly sardine and anchovy) in that region.

Response: This is the same recommendation that was made to WGCATCH in 2015, the response then was “*The WGHANSA chair clarified that only the first sentence is relevant to WGCATCH and that the group did not expected a response from WGCATCH*”. WGCATCH further noted that:

- Countries should design sampling schemes that meet the end users’ needs in a cost-effective way. WGCATCH cannot specify which stocks are more important to be sampled.
- At present, WGCATCH is not in a position to evaluate whether the current sampling programmes are suitable to identify and sample these outbursts. . To achieve that more extensive and easy-to-access knowledge on data collection programmes, including sampling protocols and sampling effort would be necessary. The start of routine compilation of MS documentation on present and historical sampling designs and protocols (see **Section 5.11-5.12**) may in the medium term make such evaluations more possible.

From: WGBYC

To: WGCATCH

Recommendation: WGCATCH shall continue to implement the collection of data on incidental by-catch of Protected Species in the sampling protocols of national catch sampling schemes, including incorporation of appropriate fields in National databases, data processing, data validation and synchronization with the ICES Data Centre regional database (RDB).

Response: While WGCATCH does not *implement* data collection, the group will continue to address the issues of by-catch sampling and incentivize its members to collect data on incidental by-catch. The participation of WGBYC member Bram Couperus and the ToR on by-catches (ToR f) ensure that the needs for monitoring bycatch, including PETS, are considered when developing and implementing best practice in the sampling design of commercial fisheries. The two joint-workshops presently being proposed to WGBYC (see **Sections 5.7 and 5.12**) constitute additional important steps towards improved sampling and estimation of by-catch species.

From: PGDATA

To: WGCATCH; WGRFS

Recommendation: PGDATA suggest that WGCATCH and WGRFS further discuss workshops on sampling designs where countries / institute are encouraged to attend, especially if they have not started the process of implementing a sound sampling design. This WS will also provide additional staff training opportunities

Response: WGCATCH is considering three Wks for 2016 and, at least, two additional Wks for 2018-2019 (see **Section 5.11.3 and 5.12**). Three training courses on statistically sound catch sampling and estimations (intermediate level sampling, advanced sampling and catch estimation) are also planned for 2017-2019 period (see **Section 5.12**)

From: WGHANSA

To: WGCATCH; WGBIOP

Recommendation: The WGHANSA recommends that length distributions and biological parameters of catches are collected for sardine in Area 7 by countries operating in those waters.

Response: WGCATCH notes that:

- Countries should design sampling schemes that meet the end users' needs in a cost-effective way. WGCATCH cannot specify which stocks are more important to be sampled.
- At present, WGCATCH is not in a position to evaluate whether the current sampling programmes cover the mentioned biological data. To achieve that more extensive and easy-to-access knowledge on data collection programmes, including sampling protocols and sampling effort would be necessary. The start of routine compilation of MS documentation on present and historical sampling designs and protocols (see **Section 5.11-5.12**) may in the medium term make such evaluations more possible.

From: Liaison meeting 12. RCM NA 10.

To: WGCATCH

Recommendation: WGCATCH investigate suitable methods for estimating non Flag landing fractions.

Response: WGCATCH was not in a position to address this issue at the current meeting due to the short time period that spanned between the Liaison Meeting and its own meeting. WGCATCH recognizes the importance of the topic and will include it as ToR for 2017.

5.10 ToRs H, I, L (generic ToRs)

These ToRs are addressed through the general work of WGCATCH.

5.10.1 ToR H – Foster regional cooperation on publications related to the work of WGCATCH.

Members of the group are preparing two peer-reviewed papers, one on statistically sound catch sampling including sampling design classes of at-sea and onshore sampling schemes; and one on small-scale fisheries work carried out in 2015 and 2016.

5.10.2 ToR I – Develop and maintain a reference list of key publications and contacts dealing with design and implementation of fishery sampling schemes and associated data analysis.

The list of publications will be made available from a link on the WGCATCH website soon after the report is published.

5.10.3 ToR L – Ensure, where appropriate, that systems are in place to quality assure the products of WGCATCH.

The working group did not produce any data outputs, the main output from WGCATCH being the current report. All ToRs were fully discussed directly in plenary or in subgroups and then in plenary. The final draft of the report was provided to all WGCATCH members for scrutiny and error checking. WGCATCH chairs made every effort to ensure that the content of the report was accurate and reflects the opinions of the WG. Sufficient time was given to all participants for review of both report sections and the final draft.

Pending outputs like peer-reviewed publications and the repository of resources will also be scrutinised by WGCATCH members and chairs before publication.

5.11 ToR K – Review the work of WGCATCH 2014–2016, identifying present and future research and training needs. Develop work plan for 2017–2019 and the ToRs for the next WGCATCH meeting, identifying intersessional work, timelines and responsibilities.

5.11.1 Feedback session on WGCATCH 2014–2016 work

On the last day of the meeting, WGCATCH members were asked for their feedback on the conduct of the first three WGCATCH meetings (2014-2016). The feedback session involved splitting participants in subgroups and the subgroups providing feedback to plenary. WGCATCH chairs summarized the feedback into a set of main outcomes, the main outcomes being summarised below. They include some important considerations for the future chairs of WGCATCH to take into account for the planning of future meetings.

On the conduct of the meetings:

- Previous WGCATCH meetings have had too many major terms of reference; it would be better to choose one or two main subjects for a meeting and deal with them in detail. E.g., up to 3 days for a single ToR and deal with minor ToRs in a single day. Also, WGCATCH chairs have opted to always deal with all ToRs, this often resulted in a rushed approach. It may be better to postpone some ToRs if insufficient time is available.
- The selection of presentations has to be carefully considered; it may not be the best use of time to have presentations summarising work of other WG groups even if “Liaison with other groups” is a ToR; this information can be made available on the sharepoint and consulted by those interested. Also the duration of presentations may need to be managed more strictly and sufficient time for discussion needs to be available.
- It would be useful to make time available for strategic planning each year (not just every 3 years).
- Some people felt there was too much discussion in plenary and not enough time for actually doing work (WGCATCH is a working group; not a talking shop) and writing text. Others felt that there was too much discussion in subgroups and not enough discussion in plenary. The reason for such contrast may reside on “the number of participants per Member Country” [Member Countries that have 2 or 3 participants are more comfortable with work in subgroups] and “specific focus of each participant” [participants that are particularly interested in just one ToR preferring subgroup work]
- When subgroups are formed a chair and rapporteur are usually chosen, however during plenary discussions it has been the chairs of the Meeting itself that normally take notes. It might be beneficial to appoint a rapporteur for plenary sessions as well to ensure all the discussions can be included in the report because it is difficult to coordinate debate and take notes at the same time.
- When looking for new co-chairs, circulating an email asking for volunteers has been a good practice that ensured transparency. However, formal time to discuss co-chairs’ profiles should also be allocated in the meeting.
- WGCATCH meeting should remain on 2nd week of November

On subgroup work

Subgroups can be a good way to get all members involved, however:

- Sometimes discussions had in subgroup are repeated in plenary when that subgroup presents their findings. On the other hand, subgroups do need sufficient

time in plenary to discuss their finding so the whole group can come to agreement.

- WGCATCH has dealt with major ToRs in parallel through subgroups; this means that members cannot be involved in both subjects. It may be better to deal with one major ToR at a time. Within this subject it may still be useful to break into subgroups.

Intersessional work

Most ICES working groups and workshops struggle to get inter-sessional work done, because most members can only allocate time for the meeting itself, finding additional time between meetings is problematic. However, intersessional tasks can be achieved if:

- There is a clear task group defined as well as a task leader
- There is a motivation outside WGCATCH to do the work. E.g.,
 - An ICES ASC theme session where the work will be presented (e.g., SSF work presented at theme session G of ICES ASC 2016)
 - A peer-reviewed publication (e.g., SSF and design publication)
 - Intersessional work coincides with work being done for other projects (e.g., redus, fishPi);
 - Intersessional work coincides with work that is being done in national labs (e.g., design, estimation)
 - There is request for formal engagement of WGCATCH in a benchmark process
- Workshops can be good way to achieve results intersessionally. However, there is a need to avoid overlap/duplication with other ICES work. Also the number of the workshops needs to be limited and the number of participants for each of them needs to be considered to avoid excessive number of meetings.

5.11.2 Focus of WGCATCH in the next three years

The following topics outline the main focuses of WGCATCH activities for the period 2017-2019. The topics were put together intersessionally by co-chairs Nuno Prista, Hans Gerritsen and Ana Ribeiro Santos (incoming co-chair) based on their own views and feed-back obtained from participants during WGCATCH plenaries and the review of this report. SSGIEOM chair was also consulted in this process.

1. Sustain progress on statistically sound sampling and manage end-user expectations

WGCATCH 2014-2016 was the most recent of a long series of EGs that have addressed the quality of sampling of commercial catches in ICES waters [e.g., PGCCDBS 2002-2014, WKACCU 2008, WKPRECISE 2009, WKMERGE 2010, SGPIDS 2011-2013, WKPICS 2011-2013; [link to document repository](#)]. A consequence of their work has been the gradual adoption in national institutes of best practices in the sampling of commercial catches; and legislative changes that now clearly demand statistically sound sampling designs during the data collection of commercial fisheries; but also an increasing need to manage end-user expectation as to what statistically driven sampling programmes can be expected to deliver.

The recently approved EU multiannual Union Programmes (EU MAUP, Commission Implementing Decision (EU) 2016/1251 of 12 July 2016) represents considerable pro-

gress towards statistically sound sampling (see **Section 5.3.4 of this report**). The legislation is particularly important because it will significantly change biological data collection of landings and discards in ICES countries that are members of the EU. As an example, the previous data collection framework (2009-2016) focused on pre-specified national sampling targets and precision levels for biological data and used métier as strata. The new EU MAUP is now less prescriptive, putting emphasis in capturing the elements of statistically sound sampling programmes and leaving core decisions of data requirements and data collection to be taken at regional level. Such generalization of statistical sound sampling and regional coordination will improve accuracy and transparency of data received by end-users and are forecasted for 2018-2019 with most countries still carrying out previous sampling plans in 2017.

As more countries embrace the idea of statistically sampling and adapt their commercial sampling schemes, new aspects must be considered. On the one hand, there is a pressing need to compile historical information on how sampling was carried out before and the changes now implemented. On the other hand, end-user expectations need to be managed in what concerns the effective amount of sampling that will be achieved because such outcomes will be increasingly probabilistic – i.e., *it will no longer be possible to guarantee to end-users that X amount of cod otoliths from métier Y in subarea W will be aged by the end of the year* - rather, sampling designers will be expected to demonstrate, using simulations, that the sampling effort put in place *is expected* to yield X amount of cod otoliths to be sampled from métier Y in subarea W *with a certain level of confidence*. The correct calculation and communication of uncertainty around expected levels of sampling achievable from sampling designs will be fundamental to a) ensure that all commercial stocks receive the sampling coverage they need and b) maintain and improve the satisfaction of end-users with previous data-provision. To carry out the latter, increased statistical and programming competences will be needed at national level. Recent results from large scale simulations of regional sampling programmes (e.g., fishPi) indicate that some expertise is already available and scripts can be developed in the medium term that make that kind of statements feasible.

Over 2017–2019 WGCATCH will continue to ensure an adequate transition towards statistically sound sampling by providing guidance to member countries implementing it. The new legislative framework is a huge step forward but it does not by itself ensure that the quantity and quality of data collected meets end-user estimates and this monitoring should be intensified. Previous sampling designs must be documented alongside the changes now being implemented. Expectations of end-users from probabilistic sampling designs must be quantified with the dialogue between sampling designers and end-users being re-enforced, to achieve sampling programmes tuned to final objectives (and optimized, see below). Meanwhile, new needs for research and best practice will continue to come up (e.g., LM 2016 recently requested WGCATCH to analyse the sampling and estimation of national vessels in foreign landings: Anon. 2016). In its meetings, intersessional work and workshops, WGCATCH will continue to be the forum for continuous training and theoretical and practical debates of these issues.

2. Increase the focus on estimation

Over the last decade, relatively little attention has been put by ICES into the estimation of catch when compared to effort put into sampling practices. The main reason is reliable estimates can only be obtained using statistically sound sampling schemes. However, well-sampled data will only provide accurate estimates as long as adequate estimation techniques are being used to raise samples to the population of interest.

Recent discussions at WGCATCH and other EGs have increasingly highlighted that estimation techniques currently used by many countries to process commercial catch data may not be the most up-to-date and/or ignore sampling design and/or are far from transparent and standardized and involve significant levels of ad-hoc decisions. This situation is yet to be systematically analysed but, if confirmed, it may significantly influence the quality of catch data used in ICES assessments. Additionally, the increased regionalization of sampling suggested in the new EU-MAUP also implies a) regional estimation, i.e., increased inter-dependency and need for standardization across countries in what concerns estimation of several major stocks, and b) the use of more sophisticated techniques to obtain national level estimates (e.g., small domain estimation). Anecdotal evidence collected during WGCATCH meetings indicates that this area requires strong emphasis in the near future as many member countries may not yet be trained and capable to engage on such practices.

As the curator of quality of commercial catch data used by ICES, WGCATCH 2017-2019 will host a range of direct ToRs and promote training courses and Wks that address estimation issues. Furthermore, it will compile historical procedures and establish guidelines for future developments. Throughout its work plan WGCATCH will continue acting as a forum where approaches can be discussed and efforts coordinated on estimation practices that better meet end-user needs.

3. Collaborate in optimization of sampling in an increasingly multi-purpose context

Commercial catch data is a fundamental part of ICES work on the impacts of human activities in ecosystems and stock assessment, being used by dozens of EGs. Over the last decade, end-user demands for commercial catch data increased fast both inside and outside ICES. As an example, ICES has been requested to provide advice on a much larger number of stocks and ecosystem issues than in previous years. Where once only age of catches was the request, length and other biological parameters are increasingly being requested to satisfy new modelling alternatives. However, it is well known that national sampling effort cannot expand at the same rate, which creates a strong need for more efficient national sampling programmes, increased prioritization of objectives and increased management of end-users (national and international) expectations.

PGDATA developed a framework for overall optimization of data needed for assessment and initiated a series of WK with the aim of fleshing “out the operational details of a possible framework to prioritize allocation of sampling efforts within and among fishery-dependent and fishery-independent sampling schemes for collection of data for assessments (“cost-benefit framework”), and identify future steps in the process” (PGDATA 2016; draft agenda of WKCOSTBEN 2016). Because commercial catch data are a major input to assessment models, WGCATCH strongly endorses the framework of PGDATA and WKCOSTBEN series, with some of its members actively participating in both EGs. However, it has come to WGCATCH attention that some national institutes are developing simple statistical tools with the aim of quickly optimizing the quantity and quality of the data they routinely collect and eliminating, objectively, some absurdly evident cases of within-sample oversampling they have at hand (e.g., several hundreds of individuals from a single fish species measured from landings of single trip). WGCATCH welcomes such initiatives and considers them a positive reflection of the increasingly widespread consideration of cost-benefit work being carried out by PGDATA and WKCOSTBEN. However, WGCATCH considers important that, when such tools are developed, a) they provide for precautionary results, i.e., result in sampling levels that safe-guard data quality provided to end-users, b) they are

included in the PGDATA/WKCOSTBEN cost-benefit work, c) they are jointly developed and build from a common exchange format (the RDB exchange format) so they can be shared, compiled and scrutinized by the ICES community, namely WGCATCH when such tools are applicable to commercial catch data.

WGCATCH 2017-2019 aims to advise and coordinate current optimization efforts of commercial catch sampling being undertaken at national level, making sure that no sudden disruption to quality of data provision to end-users takes place as consequence of such independent optimization efforts. In doing this, WGCATCH 2017-2019 will maintain close collaboration with PGDATA and WKCOSTBEN, ensuring any optimization developments that concern commercial catch data are in agreement with the more holistic cost-benefit analysis framework being developed; and work closely with WGBIOP to identify and coordinate other address pressing needs for optimization of data collection on commercial catches that may come in the future.

4. A more active role in regionalization

Regional coordination of sampling and estimation is fundamental to the quantity and quality of commercial catch data used within ICES. Over the course of the last 3 years, significant advances were achieved in regional sampling designs, with increased training and expertise-sharing taking place in different kinds of collaborative efforts, including WGCATCH and the fishPi projects. These efforts have clearly demonstrated the importance of regionalisation on for accurate sampling and estimation of commercial catch data and need to be sustained and diversified over the course of the next 3 years.

Within the EU, RCMs (Regional Coordination Meetings) have been at the core of EU MS coordination in commercial catch data collection and data provision to end-users. Over the next 3 years their role will be transferred to RCGs (Regional Coordination Groups) and it is expected that RCGs will play a very significant role in the coordination of catch sampling activities at regional level. However, it must be emphasized that regional coordination of the sampling of ICES stocks is much broader geographically than RCGs because some ICES member countries belong to other geographical regions (e.g., US) or are not part of the EU, but represent significant shares of commercial catches of European stocks (e.g., Norway, Iceland, Russia). Furthermore, regionalization is a process that must continue independently of the political changes occurring at EU-level, particularly when it is undeniable that the European Union itself is undergoing significant changes, namely in membership.

WGCATCH 2016 participants have agreed that maintaining and enhancing the momentum achieved in regional coordination in 2017-2019 is crucial for data quality of ICES stocks. ICES, as scientific community, has more than 100 years of sustained history of cooperation and coordination in marine science. This history leads WGCATCH participants to perceive ICES in general, and WGCATCH in particular as a fundamental forum to discuss regionalization efforts in what concerns data collection and estimation of commercial catches and a place where guidelines and advice on regional sampling designs can be generated with a focus on science and advice that transcends political re-arrangements. In 2017-2019 WGCATCH will continue to provide a meeting place between ICES members, both EU and non-EU members, where knowledge transfer can take place and coordination of sampling and estimation activities can be openly discussed.

5. Following up and advising on the Landing Obligation and other legislative changes

Over the course of the last few years a few main regulations have been implemented which carry significant implications for data collection and data provision to ICES end-users, including the new EU-MAUP (see above), and Regulation (EU) No 1380/2013, that aims to progressively eliminate discards in all Union fisheries through the introduction of a landing obligation for catches of species subject to catch limits.

The implementation of landing obligation for commercial stocks has been phased-in for EU fleets since 1st January 2015 with full implementation expected for 1st of January 2019. Within this legislative effort, discard management plans have been produced that set the rules of the landing obligation in each of five marine regions: Mediterranean, South-western waters, North-western waters, North Sea and Baltic. The new discard management plans significantly impact the reporting and sampling of all components of commercial catches in European waters. As examples, misunderstanding and distrust by fishers of the differences between at-sea scientific observers and control officers has led to increased refusal rates in onboard sampling schemes of some countries; new commercial categories are being implemented to deal with fish under minimum conservation reference size (MCRS) that require adaptations in sampling design and sampling protocols and requires consideration by the stock assessment; *de minimis* and high survivability exceptions to the landing obligation are being set that change the definition of “discards” observed on-board; and several changes to quota management procedures (e.g., interspecies flexibility in quotas) and logbook formats are introducing changes in estimation that affect data provision to end-users.

WGCATCH has been actively involved in commenting the above mentioned legislations and advising member countries on best practice to maintain quality and quantity of sampling and estimation of commercial catches as they are implemented. This was achieved through routine ToRs with the group meetings acting as fora where difficulties and changes can be reported, advice for sampling and estimation obtained and recommendations on best practice or data quality issues can be issued to both national laboratories and end-users. In 2017–2019 WGCATCH shall continue this work, keeping track and documenting legislation helping member countries and end-users being ready for the full implementation of the landing obligation in 2019 and making sure any negative impacts from legislative changes are accounted for and minimized in due time.

6. Increasing expertise in the ICES community

Design, implementation and estimation of commercial catches programmes require extensive statistical and programming expertise at national level. PGCCDBS 2014 and WGCATCH 2014-2016 have acknowledged this and promoted continuous training in response to requests from both national institutes and RCMs. One such example were two training courses hosted at ICES HQ in 2014 and 2016 that provided 27 professionals from 16 countries with intermediate level competence in statistically sound sampling of commercial catches. Recent results from FishPI and discussions at WGCATCH have however highlighted that training and expertise are still deficient in many national institutes and this shortage is hampering a more active participation of those laboratories in regional coordination efforts.

In 2017–2019 WGCATCH will continue to support and recommend regular training of national staff in the field of sampling design and estimation of commercial catches. This training will be achieved primarily by means of new training courses proposed for 2017–2019 (see **Section 5.11.6**) but also by intersessional WKs dedicated to design and estimation of individual stocks (where new participants from national labs can be

more easily invited to join in, e.g., WKSDECC I: see **Section 5.11.5**) and the joint discussions regularly happening during WGCATCH meeting. The combination of these efforts is expected to provide national staff that cannot participate in WGCATCH meetings with the level of expertise required to improve data collection and provision at national and international level in a way that is coherent with WGCATCH guidelines, exponentiating progress towards a the generalized statistically sound sampling of all ICES stocks.

7. Increasing support to the ICES structure

WGCATCH is the main EG in matters of commercial catch sampling and estimation. As a consequence, it partners with ACOM, SCICOM, SSGIEOM, other EGs (e.g., PGDATA, WGBIOP, WGRFS, assessment WGs), the ICES secretariat and the ICES Data Centre in forming ICES policies, positions and guidelines, and identifying research and training needs that concern commercial catches. WGCATCH also articulates with RCMs/RCGs and Member States influencing data collection at national and international level. In 2014–2016, such collaboration was maintained through different types of initiatives, both internally driven by WGCATCH (e.g., by setting up specific ToRs, by requesting feedback from EGs during its meetings, suggesting joint-workshops, etc.) and externally-driven (e.g., by answering recommendations from other EGs, setting up specific ToRs requested by the LM, commenting on implications of legislative aspects, etc.) with variable degree of success.

In 2017-2019 WGCATCH will continue to increase its participation in ICES and the most important decision-making in catch related issues. This should be done by maintaining existing links with SSGIEOM, ACOM and SCICOM, and the RCMs and RDB, but also by increasing the visibility of its document repository and guidelines and developing the tools needed to make a more active and informed answering of information requests. The WG will also strive for a clarification of its role in the benchmark process and data-call process (see below) and collaborate in the review of the ICES strategic plan and science priorities ensuring that research needs in commercial catch sampling, estimation and data quality of commercial catches are included and will be addressed.

8. Strengthening the role of WGCATCH in the ICES advisory process

Within ICES, WGCATCH is the EG that deals with sampling design, estimation and quality of commercial catch data that enters assessment. Consequently, the WGCATCH is a key-participant in the defining new requests for commercial catch data, and should actively participate in the benchmark process to highlight potential issues with historical data (including changes in sampling design, implementation and/or estimation methods that may have impacted the quality of estimates used in assessment), strategies for bias and variance minimization, and research needs requiring future consideration. However, two recent examples indicate that WGCATCH's role is not fully perceived by the ICES community: in early 2016 WGCATCH circulated an email to benchmark chairs offering its expertise to analyze and discuss catch-related issues that could impact assessment and received no response (see **Section 5.5.2 of this report**); no timely consultation was held with WGCATCH during the preparation of a recent data-call requesting historical length data on commercial catches for use in data-limited assessment methods. Such reduced feed-back and consultation are not a new development: they fit into an already long tradition of difficulties in efficiently communicating quality aspects of commercial catch data to ICES assessment groups (e.g., PGCCDBS 2007). It is however a situation that requires addressing because the impacts

of the bias and precision of commercial catch data in assessment results may be significant.

In 2017–2019 WGCATCH aims to contribute more actively to the data calls and benchmark process by a) strengthening its role next to the ICES secretariat, SSGIEOM and ACOM, b) maintaining the openness and dialogue with benchmarks and assessment groups, and c) strengthening its own capabilities and internal tools to respond to recommendations and the benchmark process. Additionally, WGCATCH will be testing its own participation in the (re)definition of data calls (by, e.g., suggesting quality criteria for the frequency data (e.g., length, age) provided for assessment) and in the assessment process (by initiating workshops that feed their results to assessment EGs and the benchmark process by means of WD, e.g., WKSDECC I: see **Section 5.11.5**). Based on progress achieved, WGCATCH will work with ACOM, SSGIEOM and PGDATA in the development of a strategy for increasing consideration of uncertainty in commercial catches in ICES assessment models (e.g., including this need in the next Strategic Plan).

9. Meeting needs of RDB development

WGCATCH 2014-2016 has steadily been involved in the support of the RDB and advising its development, which considers as fundamental for ICES work and to improve the efficiency and transparency of data provision to end-users and a requirement of future regional sampling programs. The ICES Data Centre has recently been awarded with funding for the RDB development in the next 2 years (2017-2018). This funding will set in motion changes and adaptations, yielding a new RDB that encompasses statistically sound sampling data and estimation of commercial catches. Alongside with the changes in the exchange format and data content, the new RDB is also expected to estimate commercial catches and provide for “InterCatch-level” estimates that can be used for assessment and in the long term substitute InterCatch. WGCATCH 2017-2019 will continue to act as a forum for discussion of the RDB and its progress, being an active player in the developing of estimation methods, and advising the ICES SC-RDB as to the best way forward to include sample data and include up-to-date estimation routines in the new RDB. One means to achieve this will be by sponsoring WKS on sampling design and estimation. These workshops will not only compile historical sampling designs and estimation methods used at stock level, but also be planned to build on the RDB format (as opposed to national data formats) and produce R-scripts that estimate commercial data on ICES stocks (see **Section 5.11.4**).

10. Improving sampling and estimation of incidental catches of PETS and other rare species

The sampling and estimation of incidental catches of PETS and other rare species in commercial fisheries has been a long-term ICES concern and is now mandatory under the new EU MAUP. WGBYC is the ICES EG directly implicated in the data compilation and estimation of such rare events and impacts and has been collaborating closely with WGCATCH, since at-sea observations of commercial catch sampling programmes carried out under the former DCF are main data providers of such data. Consequently, by-catch of PETS and other rare species has been a routine ToR of WGCATCH 2015 and 2016 with recommendations being issued to MS to adapt their procedures so that routine sampling and logging of by-catch data from at-sea observations becomes a more widespread reality. Recent work by WGCATCH has however also highlighted substantial additional margin for collaboration between the two groups. As by-catch

issues were increasingly discussed, it has become apparent that the principles of statistically sound sampling may not be of widespread usage in some directed studies addressing by-catch. Furthermore, the sampling design of at-sea sampling observations under DCF appears not to be always considered in by-catch reporting (see **Section 5.7 of this report**). At the same time, it has been noted during correspondence with the chair of WGBYC that by-catch and rare event estimation has been significantly developed under WGBYC and that some of the techniques this EG may be using can be suitable for application to incidental catches of commercial fisheries other than PETS and rare species. WGCATCH participants are therefore increasingly interested in reinforcing collaboration between WGCATCH and WGBYC.

In 2017–2019 WGCATCH will maintain a ToR on incidental by-catches in order to keep focus on general by-catch issues and articulate WGBYC requests from commercial catch sampling programmes and continue to give guidance to national institutes on how to best sample incidental by-catch species. Furthermore, WGCATCH aims to extend its collaboration and knowledge-sharing with WGBYC by means of proposals for two joint workshops on incidental by-catch (see **Section 5.11.3**), one addressing the sampling of this catch component (to discuss sampling design and practical onboard protocol issues; planned for 2018) and one addressing estimation of incidental by-catch and other rare events (to share knowledge and competences on incidental by-catch estimation and the need to consider sampling design in the estimation process; planned for 2019, dependent on results of the first workshop).

11. Small scale fisheries

Small-scale fleets (SSF) are an important component of ICES coastal fisheries. In 2015 and 2016 WGCATCH compiled information on SSF that demonstrated the importance of SSF in ICES region and its data-deficiencies (WGCATCH 2015) and drafted guidelines on best practice to census and sample this component (WGCATCH 2016). The analyses demonstrated the importance of the SSF in nearly all countries and indicated that these fleets are likely fundamental to the quality of assessments of some ICES stocks. Furthermore, catches (landings and discards) and effort were determined to be the most important data to estimate for SSF. Guidelines to collect the latter (but also biological data from these fisheries) need to be somewhat diverse, incorporating various types of census and sampling approaches, depending on the reality of each Member States. However, like in larger fleets, there is need for standardization of data collection and provision, and regionalization and regional cooperation are key issues for the future. It is fundamental for the inclusion of SSF in the assessment that the definitions/concepts applied for the different SSF fishing data estimates are precisely documented and that regional databases allow both sampling and census data to be stored, distinguished and interpreted. The latter involve, amongst all, standardization of some definitions/concepts (see for example the WKTRANSVERSAL 2, where significant discussions were held and little consensus achieved in the definition of "fishing day" or a "day at sea" and how to calculate them and distribute them by area/gear, particularly in what concerns passive gears), and definition of regional data needs for data collection.

In 2017–2019 WGCATCH will continue to advise on current and best practices for SSF data collection, namely catch (landings+discards), effort, catch composition, biological parameters and spatial mapping of activities. Special focus will be given to the different situations and practical issues encountered by member countries while implementing the best practices already defined. A special focus will be put on the catch (land-

ings+discards) and effort estimates (issues of sampling intensity and regional sampling), the development of quality indicators and data quality check methodologies (e.g., completeness and representativeness of the estimates, good application of statistical sound sampling scheme, etc.), with attempts to standardize as much as possible the definitions and concepts used in data collection and reporting, i.e., concluding the discussions of WKTRANSVERSAL. Regionalization and regional cooperation are key issues for 2017–2019 period and WGCATCH will examine adjustments necessary to the RDB so that it can hold both census and sampling data of SSF landings and effort. Finally, new technologies (e.g., CCTV, new apps for smartphone/tablets, AIS/GPS geolocalization tools, etc.) provide a significant opportunity to improve SSF monitoring and data collection especially in addressing fishing effort and spatial mapping of fishing activities. WGCATCH will discuss results from those technologies and an array of different projects that directly or indirectly have collected data on SSF (e.g., PETS studies, MPA studies, etc) and may globally be used to attain better estimates.

12. WGCATCH: a forum for commercial catch issues

WGCATCH is *the* ICES forum for commercial catch issues. Discussions held in 2016 about the future of the WG confirmed that most participants saw WGCATCH as a meeting place where formally or informally they could seek collective advice on sampling, estimation and quality control issues related to commercial catches, share knowledge, planning future research and publications. This type of immaterial heritage from WGCATCH is hard to evidence in annual reports or deliverables even if, at the end of the day, it is perceived as the most important contribution to participants work.

In 2017–2019, WGCATCH will strive to maintain the right balance between its informality as a forum and the need to address ICES needs, keep intersessional and meeting work focused on specific issues, and produce deliverables that broaden the applicability of WGCATCH work outside the core group of participants. One means to achieve this will be to attempt a new way of documenting the informality of discussions, by means of regularly updated lists FAQs on the different issues of sampling, estimation and quality control.

5.11.3 WGCATCH work-plan for 2017–2019

See **Annex 3**.

5.11.4 WGCATCH ToRs and work-plan for next meeting

See **Annex 4**.

5.11.5 WGCATCH workshop proposals for 2017–2019

See **Annex 5**.

5.11.6 WGCATCH training plan for 2017–2019

In 2014 and 2016 ICES hosted the Training course on Design and Analysis of Statistically Sound Catch Sampling Programmes (23–27 June 2014, 12–16 September 2016). The courses were attended by 27 participants from 16 countries, including 3 non-ICES countries (see **Table 5.11.6.1**).

WGCATCH 2016 discussed the progress achieved in the two editions of the course and concluded that alongside WKPICS and SGPIDS series, these training courses have been an important in the training of a whole new generation of statisticians most of whom are presently working in sampling design of commercial catches in ICES waters. Furthermore, it is recognized that these training opportunities have led to substantial improvements in the quality of discussions on sampling design held at WGCATCH and other fora (e.g., RCMs, other EGs). Most importantly, the training acquired during these courses is expected to be improving the quality of data provided to end-users as a consequence of improved implementation of more statistically sound and rigorous sampling designs for commercial catches in ICES waters. Furthermore, it is recognized by participants from EU MS in WGCATCH that attendance of the training courses by their staff is now making it easier the planning of Multiannual Unions Programmes that meet the statistically sound sampling design requirements of the new legislation (see **Section 5.3.4**).

Table 5.11.6.1. Origin of participants in 2014 and 2016 ICES training courses in Design and Analysis of Statistically Sound Catch Sampling Programmes. (*) Non-ICES countries

	2014	2016	TOTAL
Belgium	2	1	3
Cyprus (*)		1	1
Denmark	2		2
Finland		1	1
Germany	1		1
Ireland		1	1
Norway		1	1
Poland	1		1
Portugal	1		1
Seychelles (*)		1	1
Sierra Leone (*)	1		1
Spain	3		3
Sweden	2	1	3
The Netherlands	1		1
United Kingdom	4	1	5
United States		1	1

WGCATCH considers the continuous training of scientists from ICES Member Countries by means of **intermediate-level sampling design and estimation courses** a fundamental part of its strategy to improve the quality of commercial catch data provided for assessment EGs and other end-users. Staff turnover at national institutes and laboratories, deficits in mathematical and statistical curricula of Fishery Biology and Marine Biology courses in many EU universities, and difficulties presently felt in securing the high-level salaries that required to attract top-notch statisticians to the field, concur to a perception that such training will for, some time longer, continue to be the most cost-efficient way to build-up expertise in fisheries statistics of commercial catches (but not only) in the ICES area. Recent endorsement of these courses by RCM Med 2015 (Anon., 2015) that stated that “The information on design-based sampling is scarce at Mediterranean and Black Sea level” and recommended MS to “improve their knowledge on the design-based sampling and other statistical sampling tools used in others EU re-

gions” by participating “in the EU Working Groups and Workshops relative to sampling designs and methods like WGCATCH”, and the increase focus being put into the sampling design of regional sampling plans indicate further potential for development of these courses.

As the pool of scientists with intermediate-level knowledge of sampling design enlarges, WGCATCH considers important to maintain their training, update it and make it progress to more statistically sophisticated areas by means of **advanced-level training courses**. Two of the training aspects that require attention are the fields of statistical estimation and simulation, aspects that can only be approached by more advanced-level courses. Training in such aspects is increasingly needed by WGCATCH for its estimation work in 2017-2019 (see **Section 5.3.4**) because it is widely recognized that while a statistically sound sampling design is a pre-requisite for unbiased estimates, the effort and money spent in designing and carrying out the sampling become useless if adequate and state-of-the-art estimation practices are not adopted. Furthermore, as statistically sound sampling designs are put in place, attention will also have to be given at defining best-practice for re-estimation of old-data that was likely collected with potentially biased sampling plans and to the incorporation of improved estimation methods in the new RDB (ICES, 2017).

Based on the previous and upon contacts with the instructors of the ICES training courses on statistically sound sampling (Jon Helge Vølstad, Norway, and Mary Christman, USA), WGCATCH carried out questionnaire on the training needs of its members⁵ and **decided on the following training courses for 2017-2019 (dates and venues to be defined)**:

- **An Intermediate-level training course in Design and Analysis of Statistically Sound Catch Sampling Programmes:** with content similar to the previous editions ([link](#)) and targetting national staff that is yet to acquire expertise in the field of sampling design and estimation;
- **An Advanced-level training course in Statistically Sound Sampling, Estimation and Simulation of Commercial Catches:** addressing more complex sampling designs, novel estimation methods and simulation (e.g., of larger scale sampling designs), targetting national staff that has attended previous editions of the intermediate level course or that has an already-strong background in statistics and programming.

5.11.7References

- Anon (2015). Report of the 2015 Regional Co-ordination Meeting Mediterranean and Black Sea, Large Pelagic Fisheries, 9 September – 11 September 2015, Rome, Italy.
- Anon (2016). Final Report of the 13th Liaison Meeting, 4 – 5 October 2016, DGMARE, Brussels, Belgium.
- ICES (2017). Report of the Steering Committee for the Regional Database FishFrame (SCRDB), 29 November – 1 December 2016, ICES Headquarters, Denmark. ICES CM 2016/ACOM:30, 35 pp.

[Link to ICES repository with ICES reports related to commercial catch data](#)

⁵ The questionnaire was responded by 11 countries and identified a minimum of 12 persons interested in the training at intermediate level and 10 persons interested in obtaining training at advanced level.

6 Cooperation

6.1 Cooperation with other WG

WGCATCH has a close working relation with its 'sister' groups WGBIOP and PGDATA. This cooperation includes:

- Joint proposals for workshops
- Development of joint questionnaires
- Frequent communication between the chairs on issues that are relevant for both groups
- Representation of WGCATCH members at WGBIOP and PGDATA meetings; these members can then give first-hand accounts of the developments in the other groups.

WGCATCH also closely cooperates with WGBYC on sampling and estimation practices for Protected, Endangered and Threatened Species (PETS). WGCATCH has a multi-annual ToR addressing this. Several WGCATCH members participate in the Working Group on Recreational Fishery Surveys (WGRFS) which has strong methodological links with small scale commercial fishery sampling.

6.2 Cooperation with Advisory structures

WGCATCH does not directly provide fishery management or other advice into the ICES advisory system, but supports it indirectly by providing technical and statistical advice on fishery data issues to stock assessment expert groups and other groups that use these data to develop advice. WGCATCH has answered four recommendations from assessment EGs. In addition, WGCATCH's routine documentation of sampling practices, its continued push for DCF/EUMAUP to require MS to implement statistically-sound sampling, and its recommendations for best practice in data collection and estimation, have all impacted favourably the quality of data used by ICES assessment EGs.

WGCATCH has the goal of actively participating in the ICES stock assessment benchmark process and ensuring that the quality of commercial catch data is more widely considered in the assessment process. WGCATCH discussed the historical difficulties that catch-related groups like WGCATCH but also PGCCDBS and PGDATA have had to engage with assessment EGs and concluded that preparing specific working documents on fishery data quality to assessment and/or benchmark meetings could be the most efficient way of increasing participation in the advisory process. A workshop to develop and test this approach is proposed by WGCATCH (see **Annex 5**).

6.3 Cooperation with other IGOs

WGCATCH closely follows the development of the RDB and has cooperated with the RDB steering group and RDB workshops.

WGCATCH members provided much of the expertise for the EU fishpi project (MARE/2014/19). The group has also closely followed the outcomes of the project.

In 2016 WGCATCH invited an expert from JRC, which resulted in a proposal for a new structure for the STECF data call on Fisheries Dependent Information.

7 Working Group self-evaluation and conclusions

The ICES Working group on Commercial Catches (WGCATCH) was appointed in 2014 and met annually between 2014 and 2016, being chaired by Mike Armstrong (2014), Hans Gerritsen (2014-16) and Nuno Prista (2015-). In each meeting between 30-35 participants took part, including members and invited experts. The participants of WGCATCH mostly consisted of people that carry out sampling design, estimation and data submission at national level. A smaller set of participants worked in data compilation at ICES level or participated directly in stock coordination and stock assessment, and an even smaller group of people could be qualified as experts in statistics. As a consequence, WGCATCH frequently resorted to external experts (e.g., Mary Christman, Mike Pennington) that helped the it delve into more statistically complex discussions and reviewed the quality of its outputs.

WGCATCH is vital for ICES and other end-users to have confidence in the fishery data under-pinning stock assessments and advice on sustainable fishing, and understand their limitations. Many ICES expert groups use data on fishery catches to describe fishing activities, show the development of fisheries, and evaluate the effects of fisheries on stocks and ecosystems. Data from fisheries often form the primary basis for reconstructing historical populations and estimating fishing mortality. These data are sometimes treated as exact in fish stock assessments; however the data are frequently estimated (e.g., discards, length and age composition) and have variable quality (e.g., reported landings may be inaccurate to varying extents over time). This can translate into inaccuracies in advice.

One of the main responsibilities of WGCATCH is to ensure the quality of commercial catch data. In order to achieve this, the group documents national fishery sampling schemes, establishes best practice, guidelines, training courses and workshops on sampling and estimation procedures, and provides advice on the uses of commercial fishery data (e.g. estimating relative abundance indices based on fishery catch rates). The group also evaluates how new data collection regulations, or management measures (such as the landings obligation) may alter the way data needs to be collected and provides guidelines about biases and disruptions induced in time-series of commercial data.

A copy of the full Working Group self-evaluation, including its main achievement and deliverables, is provided in **Annex 6 of this report**.

There are no formal conclusions of WGCATCH. Being an EG related to data collection under SSGIEOM, WGCATCH's work is ongoing in its constant addressing of both routine and new needs of the ICES community in areas such as the sampling design, estimation, optimization, data quality, data management and legislation of commercial catches, among other. Additionally, WGCATCH has an important role in providing a forum for exchange of knowledge, ideas, and recent developments in the area of commercial catches; without this forum the current training, research and coordination among Member Countries would likely stall and the quality of commercial catch data used by ICES assessment groups degrade over time.

Annex 1: List of participants

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Annex 2: Recommendations

RECOMMENDATION	ADRESSED TO
WGCATCH recommends that ICES benchmark assessment groups utilise the updated guidelines on development and reporting of fishery-dependent abundance indices given in Section 5.2.3 of the WGCATCH 2016 report.	ACOM, PGDATA
<p>Landing obligation: WGCATCH recommends that by the end of the first year of the landing obligation, MS analyse the information on catches from vessels operator systems, registered buyers and sellers, logbooks and from independent scientific observations during the implementation phase of the landing obligation and carry out some of the analyses proposed by WGCATCH (2014) with the aim of supporting the estimation of unreported discards and BMS landings and identifying changes in fishing behaviour and discard patterns under the landing obligation. WGCATCH further recommends that MS document the sampling- and estimation procedures they use during the adaptation to the LO to keep the process transparent and possible to evaluate at a future occasion. WGCATCH further recommends that when interspecies flexibility in quota applies (Article 15.8 in the CFP, Regulation (EU) No 1380/2013 of 11 December 2013), MS record and report catches of all species under the correct species code.</p> <p>Sampling of Small Scale Fisheries: WGCATCH recommends best practice guidelines for data collection on Small Scale Fleets described in Annex 11 are adopted by Member States.</p> <p>Sampling of incidental by-catches: WGCATCH recommends MS continue adapting their protocols for sampling onboard to better accommodate the collection of data on incidental by-catch, PETS and rare species</p>	RCMs/RCGs
WGCATCH recommends that comments and guidelines concerning EU-MAUP tables (see in Annex 9) are considered by DGMARE and MS.	DGMARE/STECF
WGCATCH recommends the organization in 2018 of a joint-workshop between WGCATCH and WGBYC dedicated to the design of interdisciplinary (e.g., DCF-related) and dedicated monitoring programmes and pilot studies for the monitoring of protected species and other incidental by-catch.	WGBYC, ACOM/SCICOM
WGCATCH recommends that in future ICES data calls, and in Intercatch, the category "Discards" includes all discards, regardless of they being registered or not, and that "Logbook registered discards" are used only for documentation purposes.	ICES Data Centre and ICES secretariat

Annex 3: WGCATCH resolution for multi-annual ToRs

A **Working Group on Commercial Catches (WGCATCH)**, chaired by Nuno Prista, Sweden, and Ana Ribeiro Santos (United Kingdom) will work on ToRs and generate deliverables as listed in the Table below.

	MEETING DATES	VENUE	REPORTING DETAILS	COMMENTS (CHANGE IN CHAIR, ETC.)
Year 2017	06-10 November	Kavala, Greece	Interim report by 15 January to SSGIEOM	Ana Ribeiro Santos (UK) is new co-chair for 2017-2019; Nuno Prista (SWE) ends 3-yr term as chair; new co-chair will be appointed
Year 2018	To be determined	To be determined	Interim report by (TBD) to SSGIEOM, SCICOM & ACOM	
Year 2019	To be determined	To be determined	Final report by (TBD) to SSGIEOM, SCICOM & ACOM	Ana Ribeiro Santos (UK) ends 3-yr term as co-chair; new chair will be appointed

ToR descriptors⁶

TOR	DESCRIPTION	BACKGROUND	SCIENCE PLAN TOPICS ADDRESSED	DURATION	EXPECTED DELIVERABLES
a	Review current and emerging statistical and technical developments in sampling, estimation and quality control of commercial catch data, focusing on total catches, length and age distributions and other biological parameters of ICES stocks	WGCATCH is the most recent of a long series of EGs that have addressed different aspects of sampling of commercial catches in ICES waters [e.g., WKACCU, WKMERGE, PGCCDBS, SGPIDS, and WKPICS], but less attention was put on estimation. The recast of DCF and implementation of EU-MAUP is intended to improve the quality of data collected. WGCATCH will provide guidance for monitoring the sampling levels and data quality, documentation of changes on sampling design and guidelines for estimation procedures. Guidelines also needed for development of the optimization methods for data collection that meet end-users needs and facilitate the multi-purpose and resource limited of the national insitutes. In 2016 a request to evaluate how foreign landings in national ports are being sampled was sent by LM 2016 to WGCATCH that will now be addressed.	25, 26, 27, 31	3 years	Documentation of sampling designs and estimation methods R-Scripts for within-sample optimization of length and age sampling Best practice guidelines for sampling national landings in foreign ports Best practice guidelines in data request and provision for frequency data Best practice guidelines for chosing methods and variables used to expand commercial sampling data Theme Session in ICES ASC Peer-reviewed publication on statistically sound sampling design

⁶ Avoid generic terms such as “Discuss” or “Consider”. Aim at drafting specific and clear ToR, the delivery of which can be assessed

					Book on best practices for sampling commercial catches
b	Review developments in sampling and estimation practices of catch, effort, length and age distributions and other biological parameters of small scale fisheries	SSF data is still highly biased(e.g., lack of coverage) and lacking on standardized concepts (e.g., fishing day, see WKTRANSVERSAL2, 2016) that jeopardize recognition of their significance and use in stock assessments. WGCATCH has previously compiled information on SSF and drafted best practice guidelines for data collection on these fisheries WG effort is now needed in a) monitoring the implementation of those guidelines and advise on regionalization of data collection, b) standardize reporting and RDB formats, c) define quality indicators for SSF sampling and census, d) improve knowledge-sharing on new data collection technologies useful for SSF.	25, 27, 28, 31	3 years	Best practice guidelines for standardized reporting of fishing effort Peer-reviewed publication on SSF
c	Review developments in sampling and estimation of incidental by-catch, including Protected, Endangered and Threatened Species (PETS) and other rare fish species	The sampling and estimation of incidental catches of PETS and other rare species in commercial fisheries has been a long-term ICES concern and is now mandatory under the new EU MAUP. WGBYC and WGCATCH have been collaborating to develop sampling protocols and design and estimation of rare events, to ensure that by-catch is properly sampled and estimated in DCF and EU-MAUP at-sea programmes.	25, 27, 28, 31	3 years	Report from WK on sampling of incidental by-catch (2018) Report from WK on estimation of incidental by-catch (2019) Theme Session in ICES ASC (2019)
d	Document and review changes in legislation that affect data collection and data quality and evaluate their impacts	The landing obligation has brought changes in reporting all catches and have implications on sampling of commercial catches. . Furthermore in 2017 the first EU-MAUP will be implemented and the pace of transition to statistically sound sampling is expected to increase. The complexity of these processes has been followed up closely by WGCATCH through routine ToRs with the group meetings acting as fora where difficulties and changes can be reported, advice for sampling and estimation obtained and	25, 27, 31	Routine ToR	Forum to discuss specific problems and find appropriate solutions and recommendations of best practice

		recommendations on best practice or data quality issues to both national laboratories and end-users.			
e	Review and suggest developments of the Regional Database (RDB) from a design-based sampling and estimation perspective	WGCATCH have been involved in the support of the RDB and advising its development. The development of the new RDB will encompass statistically sound sampling and estimation of commercial catches and can be used to provide data for assessment EGs. The ICES Data Centre and SC-RDB have requested WGCATCH to continue advising RDB development and ensuring the development encompasses statistically sound sampling schemes and proper methods of estimation.	25, 31	Routine ToR	Report to ICES Data Centre and SC-RDB.
f	Liaise with other ICES groups (e.g., WGBIOP, WGRFS, PGDATA and SSGIEOM), RCMs/RCGs, the LM and research projects	WGCATCH links with ACOM, SCICOM, SSGIEOM, EGs under SSGIEOM (e.g., PGDATA, WGBIOP) and the ICES secretariat to inform ICES policies and guidelines on quality and quantity of catch data. WGCATCH further links and obtains information from research projects that address sampling and estimation of commercial catches	25, 26, 27, 28, 30, 31	Routine ToR	Report liaison initiatives
g	Collaborate in the advisory process, informing assessment groups and benchmarks on commercial catch data issues.	The accuracy of commercial catch data is dependent on the quantity and quality of the sampling and estimation carried by at national level and stock coordination level. WGCATCH can advise on the quality of the time series used and suggesting improvements for sampling and estimation methods. Over 2017-2019, WGCATCH will phase-in a more active participation in the assessment and benchmark processes.	25, 26, 27, 30, 31	Routine ToR	Report relevant findings to benchmark steering group.

Summary of the Work Plan

Year 1	<p>ToR a)</p> <ul style="list-style-type: none"> • Draft templates for description of sampling schemes and estimation methods; test the templates in selected stock(s) (note: in separate WK: WKSDECC I) and review results at the meeting; • Compile information on the importance of foreign landings in national ports and discuss and draft best practice guidelines for their sampling and estimation at the meeting; • Produce R-script for within-sample optimization of length and age data (note: in separate WK: WKBIOPTIM) and review results at the meeting <p>ToR b)</p> <ul style="list-style-type: none"> • Intersessional work quality indicators and data quality checks using case-studies; Compilation information of the quality indicators used in different member countries; • Intersessional work on documentation of fishing effort definitions used in different member countries; discussion at the meeting; • Compile list of FAQs on implementation of best practice and guidelines on SSF data collection. <p>ToR c)</p> <ul style="list-style-type: none"> • Intersessional liaison with WGBYC and draft ToRs for a WK that addresses sampling of incidental by-catches and rare species; discussion of ToR proposal at the meeting. <p>Routine and generic ToRs that will be dealt with on a yearly basis by WGCATCH</p>
Year 2	<p>Topics planned to be addressed include: i) quality of length frequency data (under ToR a), ii) extension of historical documentation of sampling and estimation to additional stocks (under ToR a), iii) proposals for quality indicators and definitions of fishing effort (under ToR b), and iv) sampling of incidental by-catches and rare species (under ToR c).</p> <p>Routine and generic ToRs that will be dealt with on a yearly basis by WGCATCH</p>
Year 3	<p>Topics planned to be addressed include: i) choice of methods and variables used to expand commercial sampling data (under ToR a), ii) extension of historical documentation of sampling and estimation to additional stocks (under ToR a), iii) regional database requirements to hold and estimate SSF data (under ToR b), and iv) estimation of incidental by-catches and rare species (ToR c)</p> <p>Routine and generic ToRs that will be dealt with on a yearly basis by WGCATCH</p>

Supporting information

Priority	<p>WGCATCH supports the development and quality assurance of regional and national catch sampling schemes and estimation procedures that can provide reliable quality input data to stock assessment and advice, while making the most efficient use of sampling resources. As catch data are the main input data for most stock assessments and mixed fisheries modelling and an essential component of analysis of ecosystem effects of fisheries, especially with</p>
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	regard to the application of the Precautionary Approach, these activities are considered to have a very high priority.
Resource requirements	<p>The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible.</p> <p>WGCATCH builds extensively on experiences gained within PGCCDBS, WKACCU, WKPRECISE, WKMERGE, WKPICS, SGPIDS, WGRFS and previous WGCATCH work in period 2014-2016. European countries are encouraged to provide the WG with any requested documentation of their sampling programmes and manuals, estimation methods, quality assurance procedures, for review and feedback by the WG, and to ensure that their national members of WGCATCH have sufficient resources to conduct the necessary intersessional work to address the ToRs. 1-2 top-level experts in the area of statistically sound sampling and estimation will be invited to attend the meeting and review the quality of final outputs of WGCATCH.</p>
Participants	The Group is normally attended by some 30–40 participants, including members, invited guests and 1-2 external experts.
Secretariat facilities	None.
Financial	Member States may fund this through their EMFF programme. ICES funding (travel funds, per-diem) are required to ensure the participations of 1-2 external experts.
Linkages to ACOM and groups under ACOM	WGCATCH falls under the joint ACOM/SCICOM steering group on integrated ecosystem observation and monitoring (SSGIEOM), and supports the ICES advisory process by promoting improvements in quality of fishery data under-pinning stock-based and mixed fishery assessments, and ecosystem indicators related to fishery affects, and in developing data quality indicators and quality reports for use by assessment EGs and benchmark assessments.
Linkages to other committees or groups	There is a very close working relationship with all catch-related EGs and end-users including WGBIOP (in relation to collection of stock-based biological variables from fishery catches), PGDATA (in relation to data requirements of stock assessment EGs and benchmark assessment groups, optimization of catch sampling programmes and communication of quality information on commercial catch data), WGBYC (in relation to the sampling design and estimation of PETS and other incidental by-catches), RCM/RCGs and the Liaison Meeting (e.g., in relation to data requirements and regional sampling designs), the SC-RDB and the ICES Data Centre (in relation to RDB issues), STECF EWGs dealing with EU-MAP and other legislative changes that impact catch sampling and JRC (in relation to data provision from commercial catch sampling programmes).
Linkages to other organizations	The work of this group is closely aligned with similar work in FAO, GFCM, CECAF, NAFO/NEAFC and in the Census of Marine Life Programme.

Annex 4: WGCATCH proposal for terms of reference and work-plan for next meeting

The Working Group on Commercial Catches (WGCATCH), chaired by Ana Ribeiro Santos (United Kingdom) and Nuno Prista (Sweden), will meet in Kavala, Greece, from 6 November to 10 November 2017 to:

- a) Review current and emerging statistical and technical developments in sampling design, estimation, optimization and quality control of commercial catch data, focusing on total catches, length and age distributions and other biological parameters of ICES stocks.
 1. Discuss sampling and estimation methods, including results from intersessional Wks and training courses.
 2. Compile information and define best practice on sampling and estimation of national landings in foreign ports.
 3. Review templates for routine description of the national sampling designs and estimation methods.
- b) Review developments in sampling and estimation practices of catch, effort, length and age distributions and other biological parameters of small scale fisheries.
 1. Compile information on how different labs calculate effort for small scale fleets and passive gears
 2. Using case-studies develop a list of quality indicators for sampling and estimation of small scale fleets
 3. Compile information on the importance of new technologies for the monitoring of small scale fleets.
 4. Discuss the writing of a scientific manuscript that details the SSF work carried out by WGCATCH and draft a work-plan to accomplish that task.
- c) Review developments in sampling and estimation of incidental by-catch, including Protected, Endangered and Threatened Species (PETS) and rare fish species.

Routine ToRs

- a) Document and review changes in legislation that affect data collection and data quality and evaluate their impacts.
- b) Review and suggest developments of the Regional Database (RDB) from a design-based sampling and estimation perspective.
- c) Liaise with other ICES groups (e.g., WGBIOP, WGRFS, PGDATA and SSGIEOM), RCMs/RCGs, the LM and research projects that deal with commercial catch data
- d) Collaborate in the advisory process, liaising with assessment groups and benchmarks on commercial catch issues

Generic ToRs

- e) Identify research needs, amend work-plan and propose new workshops, training courses and study-groups, reviewing their outcomes

- f) Respond to recommendations to WGCATCH from ICES expert groups, RCM/RCGs, Liaison Meetings and other end-users of commercial catch data
- g) Ensure, where appropriate, that systems are in place to quality assure the products of WGCATCH

The WK should take place in 2017. Therefore it will need to be approved by ACOM early in 2017.

Workplan 2017

TARGET TOR	TASK	BY WHEN	BY WHOM
A	Refine ToRs and select Case-studies, chairs, dates and venues for WK(s) on sampling and estimation using RDB format	December 2016	Chairs
A	Produce templates for WGCATCH documentation of national sampling designs and estimation	February 2017	Chairs, Mary Christman, Jon Helge
A	Produce template of questionnaire on national landings in foreign ports and how they are sampled and estimated	February 2017	Chairs
A	Identify participants for intersessional review of templates and circulate;	March 2017	Chairs, sub-groups of participants
A	Produce final template and send to participants	April 2017	Chairs, Mary Christman, Jon Helge
A	Compile results	September 2017	Chairs
A	Request presentation of WKs results at 2017 meeting	September 2017	Chairs
B	Draft a questionnaire for documentation of fishing effort definitions used in different member countries and circulate	May 2017	Subgroup of participants
B	Draft and circulation of a questionnaire on quality indicators for SSF data collection used in different member countries and circulate	May 2017	Subgroup of participants
B	Compile questionnaires	September 2017	Subgroup of participants
B	Discuss results	Meeting 2017	Chairs, participants
B	Work on peer-review publication	Before and during Meeting 2017	Subgroup of participants
C	Draft ToRs of Joint WGBYC/WGCATCH WK on sampling of by-catch and pets (to be held in 2018). Select chairs, dates and venue.	April 2017	Chairs, Bram Couperus and Marjorie Lyssikatos (Chair of WGBYC)
C	Follow-up on WGBYC meeting	June 2017	Chairs, Bram Couperus and Marjorie Lyssikatos (Chair of WGBYC)
C	Discuss work-plan 2018-2019	Meeting 2017	Chairs, participants

Annex 5: WGCATCH proposals for Wks in 2017

Proposal: Workshop on Sampling Design and Estimation of Commercial Catches: Cod-Kat (WKSDECC I).

Workshop on Sampling Design and Estimation of Commercial Catches: Cod-Kat (WKSDECC I) chaired by Katja Ringdahl (Sweden) and Kirsten Håkansson (Denmark), will meet in ICES Headquarters, Copenhagen (Denmark), from 29 May to 02 June 2017, to:

- a) Document national sampling designs of commercial catches of cod-kat back to 2002, commenting on their statistical soundness and the quality of data they can deliver.
- b) Document national estimation methods of commercial catches of cod-kat back to 2002, commenting on their statistical soundness and the quality of estimates they deliver.
- c) Populate the latest version of RDB-exchange format and evaluate how well it fits data collection and estimation of commercial catches of the stocks, for input to the SC-RDB
- d) Develop R-script(s) that run on the latest version of RDB-exchange format and produce InterCatch estimates. Compare results from that script with estimates previously uploaded to InterCatch and evaluate differences.
- e) Produce a WD summarizing the findings, research needs and a roadmap for commonly agreed improvements in sampling and estimation that consider future needs of assessment of this stock.
- f) Present outcomes at the next WGCATCH meeting

WKSDECC I will report by 30 June 2017 to the attention of ACOM and SCICOM.

Supporting Information

Priority	This workshop is considered to have a high priority for documenting and evaluating the quality of past and current commercial data collection and estimates used by ICES assessments, and for the testing of the new exchange format and development of the estimation of the new RDB being developed by the ICES Data Centre.
Scientific justification	The documentation of current and historical national sampling designs has been pointed out and promoted by several ICES EGs (e.g., WGCATCH, PGCCDBS, WKPICS, SGPIDS) as a fundamental aspect of the transparency and quality of sampling and estimation of commercial catches routinely carried out by ICES member countries and delivered to ICES Assessment Groups. Furthermore it is an important first step for the regional coordination of sampling programmes and discussions on the improvement of the startistical soundness of the sampling programmes that will also ensure that, in the future, it will be possible to re-estimate historical data when new methods are developed and/or new end-users needs appear. Similar documentation of current and historical estimation practices is also fundamental for transparency and data quality but has received less attention, with many ICES stocks having estimation practices at present undocumented. This workshop will use cod-kat as a case-study for testing the historical documentation of

national sampling designs and estimation methods on the stock back to 2002 (ToR a-b), and discuss the quality of past data and a road-map for future improvements (ToR e). Cod-kat was selected as a case-study because it is a relatively simple fishery (only two major players, Sweden and Denmark) and the stock is currently being benchmarked having a need for re-estimation of historical commercial data at spatial domains that are different from the ones previously submitted to its assessment groups (WGBFAS).

The development of RDB is considered fundamental for ICES work and to improve the efficiency and transparency of data provision to end-users (e.g., WGCATCH 2015, 2016). It is also a requirement for future regional sampling programs designed to improve the quality of commercial data used in ICES assessments. The ICES Data Centre has recently been awarded funding for the RDB development that is setting in motion changes and adaptations and will ultimately yield a new RDB with a new exchange format that encompasses statistically sound sampling data and an estimation module capable of delivering improved "InterCatch-level" estimates as input to assessment. This workshop will use cod-kat as a case-study for testing the population of the RDB exchange format (ToR c) and the development of R scripts for the estimation module of the RDB (ToR d).

Resource requirements	Participants will be requested to document sampling designs and estimation methods ahead of the meeting using a specific format; and to bring to meeting a) historical commercial data on the stock (from 2002 onwards) stored in the latest RDB exchange format, b) historical intercatch estimates from that stock (from 2002 onwards). Member countries not participating in the meeting but with a significant share in the fishery will also be requested to provide similar data in similar formats. WGBFAS will be consulted to identify their future needs of commercial data for assessment purposes. 1-2 top-level external experts in the area of statistically sound sampling and estimation may be invited to attend the meeting and review the quality of final outputs. ICES funding may be requested to ensure their participation is possible.
Participants	The target attendance are participants from member countries involved in the fishery (including staff responsible for sampling design, estimation and data submission at national level and/or carrying out stock coordination and assessment at ICES level) and the ICES Data Centre. 8-10 participants are expected to attend, possibly some by webex. The final group of participants should ensure the level of expertise in statistically sound sampling, estimation, r-scripting, RDB development, and stock coordination/assessment needed to carry out the ToRs. 1-2 external experts may be invited to participate.
Secretariat facilities	Some secretarial support will be needed. Webex facilities may have to be provided. The WK should take place in 2017. Therefore it will need to be approved by ACOM early in 2017.
Financial	Member States may fund this through their EMFF programme. ICES funding (travel funds, per-diem) are required to ensure the participations of 1-2 external experts.
Linkages to advisory committees	ACOM and SCICOM
Linkages to other committees or groups	WGCATCH, WGBIOP, PGDATA, WGBFAS, SC-RDB
Linkages to other organizations	RCM/RCGs

Proposal: Workshop on Optimization of Biological Sampling at Sample Level (WKBIOPTIM)

The Workshop on Optimization of Biological Sampling at Sample Level (WKBIOPTIM), chaired by Ana Cláudia Fernandes (Portugal) and Julie Coad Davies (Denmark), will meet in Lisbon, Portugal, 20–22 June 2017, to:

- a) Discuss indicators of sample quality that can be used in communicating the need and effects of statistical optimization of sampling to end-users (e.g., effective sample size; variability in mean length, age frequency, number of modes in distributions, etc.);
- b) Carry out hands-on work on code for statistical optimization of biological samples based on the CS and CA exchange format of the RDB and sampling strategy used to obtain the data. Code should be general and applicable to samples from different commercial sampling programmes and surveys. Different sampling effort strategies (e.g., fixed number, number dependent on size-span of the sample) and sampling strategies (e.g., simple random, two-stage stratified sampling) should be considered
- c) Test the code developed in a set of case-studies and quantify effects, advantages and disadvantages of different options of statistical optimization at sample level in terms of cost and time-savings involved;
- d) Identify a road map for the discussion with end-users of optimization perspectives

Pre-WK work on scripts and quality indicators will be required.

WKBIOPTIM will report by (TBD) to the attention of ACOM and SCICOM.

Supporting Information

Priority	This workshop is considered to have a high priority for already established and new commercial fishery and survey sampling programmes developed under the MAUP. The expectation is that the time and costs that will be saved by the development and implementation of statistical optimization of the number of samples collected in commercial catch sampling and surveys will be fundamental to increase data provision on data on data-poor stocks and the environmental variables.
Scientific justification	Statistical sound sampling is a requirement of the new EU-MAUP that now specifies that “where data are to be collected by sampling, Member States shall use statistically sound designs” (COM IMPL DEC 2016/1701). One important component of a “statistically sound design” is that sampling effort is optimized and fit for purpose, i.e., that time and costs spent in sampling can be effectively justified in terms of quality of the information finally provided to end-users. Increasing demands to determine MSY reference points for an increasing number of stocks, including many data-poor stocks, and, at the same time, to collect additional environmental information (e.g., during surveys), make optimization of the number of length measurements, age and maturity estimation a priority since these tasks involve costs and time that when misspent limits the sample of other stocks and environmental variables. Economy-related fluctuations in the budgets available for sampling in some ICES countries endanger data

	<p>collection and further emphasise the need to secure national labs spent time and funds where they are are most needed.</p> <p>Recent WK and publications, including PGDATA and WKCOSTBEN, have pointed out to the likely existence of oversampling in lower stages of the sampling designs of some stocks, where an excessive number of individuals appears to be being sampled that does not accrude significant additional information to the very characterization of the sample itself, much less to data-provision to end-users after data is aggregated at higher levels. Evidence exists that cuts of over 50% in the number of lengths, ages and maturity data collected from some samples may be achievable without significantly change estimates obtained while saving precious time and resources.</p> <p>The WK aims to produce and test a set of R-scripts that can be used to identify appropriate sampling levels for biological samples of different stocks and surveys. Evaluation of the effects of statistical optimization at sample level requires the identification of indicators that characterize the main properties of the samples in terms of the information obtained on length, age and maturity (ToR a). Statistical optimization is carried out with R-scripts that simulate the effects of different sample sizes (e.g., fixed, dependent on number of size classes) and sampling strategies (e.g., random sample, stratified sampling) (ToR b). To ensure exchange of R code and future developments, exchange format CA/RDB will be used and code programmed in a general way. The advantages of statistical optimization at sample level require testing and demonstration (ToR c) and a roadmap for discussion with end-users of optimization perspectives (ToR d)</p>
Resource requirements	<p>The data collection programmes which provide the main input to this group are already underway, and resources are already committed. All EU countries have already available the datasets in the RDB/CA format required for analysis. The additional resource required is limited to the preparation of R-scripts, selection of case-studies, and attendance at the workshop. Participants are requested to bring to the WK, national examples of CA and CS table (e.g., their 2015 upload to RDB) for analysis during the WK.</p>
Participants	<p>WK should be composed of a) a subset of participants should be familiar with R-code to the level of “loop coding” and “function building”, b) a subset of participants experienced in age and reproduction analysis. In view of its relevance to the data collection within ICES, the EU-MAUP and regional sampling designs, the Workshop is expected to attract wide interest from those involved in WGCATCH and WGBIOP. Members of survey groups located under SSGIEOM are also among the probable participants as may national staff responsible for planning protocols for biological sampling.</p>
Secretariat facilities	<p>Some secretarial support will be needed. The WK should take place in 2017. Therefore it will need to be approved by ACOM early in 2017.</p>
Financial	<p>Member States may fund this through their EMFF programme..</p>
Linkages to advisory committees	<p>ACOM and SCICOM</p>
Linkages to other committees or groups	<p>WGCATCH, WGBIOP, PGDATA</p>
Linkages to other organizations	<p>RCMs</p>

Proposal: Workshop on methods for developing fishery-dependent indices of abundance for use in stock assessments (WKCPUE)

The Workshop on methods for developing fishery-dependent indices of abundance for use in stock assessments (WKCPUE), chaired by Jon Helge Vølstad (Norway) and Mary Christman (USA), will meet in (TBD), from (TBD) to (TBD) 2017 to:

- (a) Document statistical methods currently implemented worldwide (including ICES) for standardising fishing effort, filtering trip data and deriving abundance indices and associated measures of uncertainty in the index. Evaluate strengths and weaknesses of the different methods. Provide guidance on choice of methods given the characteristics of fisheries, the availability and quality of the data, the data source(s), units of abundance and effort, and the stock assessment model used by the ICES assessment Expert Groups (ICES EG) as well as models likely to be used in the near future.
- (b) Develop contrasting case studies from ICES EG to demonstrate the application and relative performance of a range of statistical modelling approaches and simpler methods. This should include some data-rich stocks which also have fishery-independent survey data known to accurately track stock abundance, and some data-limited stocks for which fishery-dependent abundance indices could provide the main source of information on stock trends.
- (c) Consider how catch/landings/discards and effort data from observer schemes can be included in the development of abundance indices.
- (d) Provide a list of published studies and links demonstrating applications of the methods documented by the workshop
- (e) Collate existing scripts and test data sets for running methods most likely to be useful for ICES assessment EGs, together with guidance on data formats and interpretation of model fit diagnostics.
- (f) Update and republish, if necessary, the PGDATA draft guidelines (further developed by WGCATCH 2016) that outline what should be documented and considered when CPUE/LPUE indices are to be used in stock assessment

The Workshop needs a targeted data call for catch and effort data for case study stocks.

WKCPUE will report by (TBD) for the attention of the ACOM, SCICOM, and WGCATCH.

Supporting Information

Priority	This workshop is considered to have a very high priority for improving the assessment of stocks with no or inadequate fishery-independent abundance indices.
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Scientific justification	International agreement to exploit all stocks at MSY means that a range of assessment methods is needed to determine MSY reference points and stock status relative to these, including for many data-limited stocks. The absence of reliable abundance indices for a stock is a major impediment for providing advice on stock status, and is an issue with many data limited stocks. Fishery-dependent indices have fallen out of favour in many stock assessments due to issues with data quality and concerns over changes in fishing efficiency, selectivity and discarding. At the same time some aspects of data quality are improving, for example availability of VMS data and lengthening series of observer data. The workshop will document and demonstrate advanced methods to filter data to remove trips with very low probability of catching the species of interest, and to standardise the remaining trip data using statistical models such as delta lognormal. Performance relative to simpler methods will be evaluated.
Resource requirements	The principal resource requirements are people with the statistical and data collection skills needed for the workshop. Historical data needed for the case study evaluations are already collected and must be made available. One additional top-level expert in the area of standardization and analysis of catch-per-unit-effort and survey statistics will be invited to attend the meeting and review the quality of final outputs.
Participants	To be arranged. Participants should have a good background in statistics and programming and having been (or being presently) directly involved in the design and implementation of CPUE time series.
Secretariat facilities	Some secretarial support will be needed. The WK should take place in 2017. Therefore it will need to be approved by ACOM early in 2017.
Financial	Member States may fund this through their EMFF programme.. ICES funding (travel funds, per-diem) are required to ensure the participations of co-chair Mary Christman and the additional external expert.
Linkages to advisory committees	ACOM and SCICOM
Linkages to other committees or groups	PGDATA, WGCATCH, stock assessment EGs.
Linkages to other organizations	Other RFMOs

Annex 6: Copy of Working Group self-evaluation

WORKING GROUP name

WORKING GROUP ON COMMERCIAL CATCHES (WGCATCH)

Year of appointment

2014

Chairs

Nuno Prista (2015-), Hans Gerritsen (2014-16), Mike Armstrong (2014)

Venues, dates and number of participants per meeting.

10–14 November 2014, Copenhagen, Denmark, 34 participants

9–13 November 2015, Lisbon, Portugal, 30 participants

7–11 November 2016, Oostende, Belgium, 35 participants

WG Evaluation

If applicable, please indicate the research priorities (and sub priorities) of the Science Plan to which the WG make a significant contribution.

WGCATCH addresses the following research priorities:

27. Identify knowledge and methodological monitoring gaps and develop strategies to fill these gaps

WGCATCH provides a forum for exchange of knowledge on sampling design and estimation of catch data. WGCATCH also initiates training courses on design and analysis of statistically sound catch sampling programmes and WGs on methodological issues (e.g., concurrent sampling).

31. Ensure the development of best practice through establishment of guidelines and quality standards for (a) surveys and other sampling and data collection systems; (b) external peer reviews of data collection programmes and © training and capacity building opportunities for monitoring activities

WGCATCH 2014-2016 provided guidelines and advice to Member Countries for best practice in:

- Sampling on shore to estimate length/age compositions of landings (building up on WKPICS work)
- Data collection in Small scale fisheries
- Simulations of regional sampling designs
- Sampling and estimation of commercial catches under the landing obligation (Building up on SGPIDS work)
- Documenting fishery-dependent LPUE/CPUE indices (building up on PGDATA work)

WGCATCH also reviewed the sampling practices in European countries, initiated training courses design and analysis of statistically sound catch sampling programmes and promoted a WK on concurrent sampling (WKISCON2).

The most important function of WGCATCH is to provide a forum for exchange of knowledge, ideas, and recent developments in sampling and estimation of commercial catches. Some of the outcomes of this forum are difficult to measure as they translate

into changes of practices in sampling and estimation at national level that gradually have improved the quality of data used within ICES. An example of its success may be seen in the regional coordination project fishPi (MARE/2014/19) which participants largely consisted of WGCATCH members and which developments were discussed in-depth during the WGCATCH meetings. Many of these participants had relatively little knowledge of statistically sound sampling design before attending WGCATCH and its predecessors (WKPICS etc).

Other outcomes include documentation of sampling practices:

- Documentation of catch sampling practices in European countries (2014 report, section 3.2)
- Documentation of sampling practices for small scale fisheries (2015 report, section 2.3, annex 6)
- Documentation of length sampling at-sea and onshore in European countries (WKISCON2 report)
- Documentation of sampling and data logging practices for bycatches of protected, endangered and threatened species (PETS) and rare fish species (2016 report, section 5.7)

Guidelines and advise of best practice:

- Guidelines for designing a sampling survey (2014 report, section 3.4)
- Guidelines and best practice for sampling, data recording and estimation of commercial catches under the landing obligation, including advice on analysis to determine how the LO implementation is affecting the sampling programmes and data collection (2014 report, section 4.4; 2015 report, section 5; 2016 report, section 5.4)
- Guidelines for simulations of regional sampling designs (2015 report, section 4.5)
- Guidelines for best-practice in sampling of small-scale fisheries (2016 report, section 5.6 and Annex 11)
- Guidelines for documenting fishery-dependent LPUE/CPUE indices (2016 report, section 5.2.3)

Training courses and workshops

- Training courses design and analysis of statistically sound catch sampling programmes (2014, 2016)
- Workshop on implementation studies on concurrent length sampling (WKISCON2)
- Series of new Wks proposed for 2017-2019 (2016 report, section 5.11)

Publications

- Peer reviewed publication providing a synthesis of the evolution of sampling design towards best practice, illustrated with a number of concise case studies (Planned for 2017).
- Peer reviewed publication on importance and data collection in Small Scale Fisheries (Planned for 2017-2018).
- Book/CRR on best practices for sampling commercial catches (Planned for 2017-2019, editors: Mary Christman and Jon Vølstad)

- Repository of key resources; putting them into context with brief descriptions or review of each report, paper, book, website, software package etc.

Contributions to conferences

- Several individual participations in Theme Session ASC 2016 G “The in-shore challenge – management of recreational and commercial fisheries accounting for social benefits, economic value, and biological sustainability, and prioritising of marine data collection”
- Several individual participations in Theme Session ASC 2016 O “When is enough, enough?: Methods for optimising, evaluating, and prioritising of marine data collection”
- Group participation: Demanèche S., Armstrong M., Mugerza E., Adamowicz M., Carlshamre S., Clarke E. D., Dingsør G., Egekvist J., Fernandes A.C., Kovsars M., Nimmegeers S., Norkus D., Otterå H., Reis D., Rodriguez J., Saks L., Schembri S., Spegys M., Stoetera S., Vandemaele S., Vølstad J.H., Grygiel W., Gerritsen H. & N. Prista. 2016. “Small scale, big deal: Sampling catches from European small-scale fisheries”. ICES Annual Science Conference 2016, ICES CM 2016/G:258, 19-23 September 2016, Riga (Latvia)
- Zarauz L., Mugerza E., Armstrong M. 2016. Strengthening regional cooperation in small scale and recreational fisheries data collection (FishPifishPi). ICES Annual Science Conference 2016, ICES CM 2016/G:208, 19-23 September 2016, Riga (Latvia)
- Grygiel, W., M. Adamowicz, I. Wójcik 2015. Monitoring rybacko-biologiczny na Bałtyku w wieloletniej praktyce Morskiego Instytutu Rybackiego-Państwowego Instytutu Badawczego (Gdynia). Poster nr 8 i opracowanie na Krajową konferencję naukową – Bałtyk 2015, pn. „Stan, trendy zmian oraz współczesne metody monitorowania środowiska Morza Bałtyckiego”. [Fisheries-biological monitoring in the Baltic Sea, in the long-standing practice of the NMFRI (Gdynia). Poster No. 8 and working paper at the National Scientific Conference - Baltic 2015, entitled: "The status, directions of changes and contemporary methods for monitoring the environment of the Baltic Sea."]. IO-PAS, Sopot, 14–16.10.2015, Editor - Inst. Ocean. PAS, Sopot, under editorial-ship of J. Dera & M. Ostrowska; 6 pp., CISBN 978-83-941037-1-2; (in Polish).

Datasets

- RDB: WGCATCH’s repeated endorsement of the RDB as a fundamental tool for regional coordination of sampling and estimation has contributed to the progress in data submission that was observed in recent years.

Outreach:

- WGCATCH and WKPICS have had considerable success in changing the ‘mindset’ of the EU Data Collection Framework (DCF 2009-2016); moving the focus from metier-based quota sampling to statistically sound sampling programmes in the Data Collection Multi-Annual Union programme (2017-19).
- WGCATCH and JRC developed a proposal for a new structure for the STECF data call on Fisheries Dependent Information. The new structure takes into account the design of the sampling data.

- WGCATCH indirectly participated in the EU project of regional sampling design fishPi (MARE/2014/19) by providing a forum for the presentation and in-depth discussion of the project results.

Has the WG contributed to Advisory needs? If so, please list when, to whom, and what was the essence of the advice.

Not directly. However, WGCATCH answered four recommendations from Assessment WGs; and WGCATCH's routine documentation of sampling practices, push for legislative measures that require statistically sound sampling, and establishing of best practice in data collection and estimation has impacted favourably the quality of data used by ICES Assessment Groups.

Please list any specific outreach activities of the WG outside the ICES network (unless listed in question 6). For example, EC projects directly emanating from the WG discussions, representation of the WG in meetings of outside organizations, contributions to other agencies' activities.

See question 6, outreach

Please indicate what difficulties, if any, have been encountered in achieving the workplan.

The main difficulties can be summarised as follows:

- Wide WGCATCH remit: Commercial catches issues span a wide variety of topics including, statistical aspects of sampling and estimation, implementation aspects of onshore and at-sea programmes, building of indexes (e.g., CPUE), analysis of legislative measures with impact in data collection, and advice on data quality assurance. This wide remit has frequently lead to many ToRs, implying the splitting of plenary in subgroups and significant intersessional work.
- Difficulties to carry out intersessional work: It has proven difficult to achieve intersessional work because most participants do not have sufficient time available for this. However, there were some situations where intersessional work did succeed. These were cases where there was a clearly defined task leader and task group and where there was an additional motivation (e.g., ASC theme sessions, papers resulting from the work, the work feeds in to other projects or work that is being done in national labs anyway). Workshops were also found to be a good way to achieve results intersessionally.

Future plans

Does the group think that a continuation of the WG beyond its current term is required? (If yes, please list the reasons)

Yes

It is vital for ICES and other end-users to have confidence in the fishery data underpinning stock assessments and advice on sustainable fishing, and understand their limitations. Many ICES expert groups use data on fishery catches to describe fishing activities, show the development of fisheries, and evaluate the effects of fisheries on stocks and ecosystems. Data from fisheries often form the primary basis for reconstructing historical populations and estimating fishing mortality. These data are often treated as exact in fish stock assessments; however the data are frequently

estimated (e.g., discards, length and age composition) and have variable quality (e.g., reported landings may be inaccurate to varying extents over time). This can translate into inaccuracies in advice.

One of the main responsibilities of WGCATCH is to ensure the quality of commercial catch data. In order to achieve this, the group documents national fishery sampling schemes, establishes best practice, guidelines, training courses and workshops on sampling and estimation procedures, and provides advice on the uses of commercial fishery data (e.g., estimating relative abundance indices based on fishery catch rates). The group also evaluates how new data collection regulations, or management measures (such as the landings obligation) may alter the way data needs to be collected and provides guidelines about biases and disruptions induced in time-series of commercial data.

All this work is ongoing and is likely to stall without the impetus that WGCATCH provides. Additionally, WGCATCH has an important role in providing a forum for exchange of knowledge, ideas, and recent developments; without this forum quality of catch data would degrade over time.

If you are not requesting an extension, does the group consider that a new WG is required to further develop the science previously addressed by the existing WG.

NA

What additional expertise would improve the ability of the new (or in case of renewal, existing) WG to fulfil its ToR?

The participants of WGCATCH mostly consist of people that carry out sampling design and estimation at national-level. A smaller set of participants work in data compilation at ICES level or participates directly in assessment groups. And an even smaller group of people would qualified themselves as experts in statistics. To improve its ability to fulfil its ToRs and more actively integrate the advisory process WGCATCH could benefit from:

- 2-3 additional participants with high level of statistical expertise
- 2-3 additional participants involved in the advisory process (e.g., Assessment group chairs)

To meet its needs in terms of statistical expertise part WGCATCH has been resorting to invited experts (e.g., Mary Christman, Mike Pennington). This situation is likely to continue in the future while ICES training in statistics is ongoing (See report 2016, section 5.11.6).

In what concerns the need for participants involved in the advisory process, the current shortage finds ground in historical difficulties of “sitting around at the same table” the “ICES data providers” and “ICES end-users”. Such difficulties have been repeatedly highlighted by other EGs (e.g., PGCCDBS, PGDATA) as the cause of the low consideration given to catch data quality within assessments. It therefore requires ACOM/SCICOM strategy to be solved.

Which conclusions/or knowledge acquired of the WG do you think should be used in the Advisory process, if not already used? (please be specific)

The group does not provide direct advice.

Annex 7: Some comments on estimating a cpue series based on commercial catch data

The working document “Standardization of hake LPUE series of the Galician set-longline fleet in Subarea 7 by J. Castro, D. Garcia, J. L. Cebrian, and B. Patiño” was made available to WGCATCH prior to the meeting and is available in WGCATCH website). To aid the discussion of this working document and improve response to WGBIE recommendation (see **Section 5.9**), WGCATCH chairs requested some comments on the methodology from Michael Pennington, an expert at IMR (Norway) with extensive career record in LPUE/CPUE analysis of both fishery dependent and fishery independent surveys. The text below describes the estimation techniques used in the longline LPUE working document as well as the estimation method used for the Norwegian longline CPUE series.

Some comments on estimating a cpue series based on commercial catch data

Michael Pennington

Institute of Marine Research

Bergen, Norway.

This note briefly describes the techniques currently used for estimating a cpue series for two fisheries. The first is the procedure used for estimating a cpue series for the Galician longline fishery for hake in Subarea 7. The second example is the method employed for estimating a cpue series for the longline fishery for ling in Norwegian waters.

1. The Galician longline fleet cpue series for hake

The Galician cpue series for hake in Subarea 7 is calculated as follows (Castro, et al., 2016)

$$R = \frac{\sum_{i=1}^N c_i}{\sum_{i=1}^N d_i} = \frac{\bar{c}}{\bar{d}}, \quad (1)$$

where R denotes for each year the average catch per trip divided by the average number of days per trip, c_i denotes the total catch from trip i , and d_i the number of days fish during trip i .

If it is assumed that

$$c_i = \beta d_i + \varepsilon_i, \quad (2)$$

where the (c_i, d_i) are a random sample from a superpopulation and ε_i is an error term independent of d_i (i.e. the expected total catch from a trip is proportional to the number of days fished), then the estimated standard error of \hat{R} is

$$se(\hat{R}) = \sqrt{\frac{\sum (c_i - \hat{R}d_i)^2}{\bar{d}^2 n(n-1)}}, \quad (3)$$

(for details, see Cochran, 1977, page 158).

The catch of hake is only a function of the length of a trip in days, which is a measure of applied effort (eq. 2). Therefore, it is rather easy to come up with a scenario where an estimated cpue series (eq. 1) would not track the actual abundance. For example, suppose the hake population was declining. Then if one segment of the fleet increased the number of days fished during each trip, keeping the catch more or less constant over time, while another segment reduced the number of days fished, then the estimated cpue would indicate wrongly that the abundance of hake was fairly constant.

2. The Norwegian longline cpue series for ling

The commercial catch of a particular species often depends on several factors in addition to the length of trips. For example, there is often a significant vessel effect, i.e. differences in catch composition and efficiency among vessels, which sets a lower bound for the precision of the estimates (Pennington and Helle, 2011).

One way to include more variables for estimating a commercial cpue series is to fit an appropriate generalized linear model (GLM) to the catch data (see, for example, McCulloch and Searle, 2001; Maunder and Punt, 2004; Venables and Dichmont, 2004).

For example, to estimate a cpue series for the population of ling in Norwegian waters, the average catch per hook for each set was related to year, month and vessel by the model (Helle, et. al., 2015)

$$y_{i,j,k,l} = c + \mu_i + \alpha_j + \beta_k + e_{i,j,k,l}, \quad (4)$$

where: $y_{i,j,k,l}$ is the average catch (kg) per hook in year i , month j for set l by vessel k ; c is a constant; μ_i is the year effect; α_j is the month effect; β_k is the vessel effect, and $e_{i,j,k,l}$ is the error term.

Since these data contained a large proportion of zeros, the GLM model (4) was combined with the delta method (Pennington, 1983; Stefánsson, 1996; Maunder and Punt, 2004). That is the estimator of the year effect, μ_i based on all the data is

$$\hat{\mu}_i = \frac{m}{n} \hat{\mu}'_i, \quad (5)$$

where m is the number of catches of ling greater than zero, n is the total number of sets and $\hat{\mu}'_i$ is the year effect based on model (4) using only the m positive catches. Finally, the estimated cpue series for ling is: $\hat{\mu}_i + (m/n)\hat{c}$, which is the adjusted year effect.

Now if the number of zeros is statistically independent of $\hat{\mu}'_i$ and the distribution of zeros is assumed to be binomial, then the variance estimator of $\hat{\mu}_i$ is given by (Pennington, 1983; 1996)

$$\text{var}(\hat{\mu}_i) = \frac{m(m-1)}{n(n-1)} \text{var}(\hat{\mu}'_i) + \frac{m(n-m)}{n^2(n-1)} (\hat{\mu}'_i)^2. \quad (6)$$

It should be noted that the Norwegian longline fleet has been rather homogenous over the last 15 years; however there have been some changes, such as different hook types and baiting machine upgrades, none of which appeared to affect the cpue estimates. For example, the greatest change was that the average number of hooks set per day has increased from 31 000 in 2001 to 37 000 in 2012, while the average catch versus the number of hooks set increased linearly, that is the average catch per hook did not depend on the number of hooks set (ICES, 2013).

As for estimating a cpue series based on model (2), there are many realistic scenarios for which cpue estimates based on model (4) would be misleading, but the examples would not be very transparent or easy to demonstrate briefly.

3. Discussion

As always, it should be emphasized that commercial catch data are typically observational data; that is, there was no scientific control on how or from where the data were collected. Therefore, the level of uncertainty associated with any conclusions based on observational data is often unknowable (see, for example, Rosenbaum, 2002) and consequently, one must usually hope and pray that a cpue series based on commercial data truly tracks abundance. An infamous example of a misleading cpue series based on commercial data was a cpue series for Newfoundland cod that incorrectly indicated that the abundance of the cod stock was increasing greatly. Advice based on this cpue series ultimately caused the collapse of the stock (see, e.g., Pennington and Strømme, 1998).

4. References

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Annex 8: Questionnaire on EU MAUP tables

Commission implementing decision (EU) 2016/1701 of 19 August 2016 provides the tables that structure the work plans for data collection for the period 2017-19. WGCATCH members were provided with the following questions regarding Tables 1A-F, 4A-D, 5A and text box 4A. The responses are available on the WGCATCH share-point.

- Do you think this table (or text box) is helpful to evaluate sampling schemes and estimation in the context of statistically sound sampling? (*) [Yes/No/Don't Know + comments]
- Could this table (or text box) be improved in order to better evaluate sampling schemes in the context of statistically sound sampling? (*) [Yes/No/Don't Know + suggest improvements]
- Was this table (or text box) easy to fill in? [Yes/No + suggest improvements]
- Was the table (or text box) filled in manually or automatically (R-script/database)? [Manual/Automatic]
- Approximate time spent filling the table (or text box) [person hours]

(*) consider this question both from the perspective of your own MS and from the perspective of those pooling tables to obtain a comprehensive overview on how ICES stocks are being sampled/estimated

(**) restrict your comments to concerns related to surveys of commercial catches

Annex 9: WGCATCH feedback on EU MAUP tables

The general findings are given in **Section 5.3.4** of the WGCATCH 2016 report. Below are the detailed conclusions for each of the tables. These conclusions result from analyses of the answers given to questionnaires and discussions held in subgroup and plenary.

Table 1A

Table 1A (Annex I of EU 2016/1701 of 19 August 2016) provides a list of the stocks that require sampling. There are thresholds in place that define whether a stock needs to be sampled. MS can also indicate that they will sample stocks that are below the thresholds.

Variable	Guidance
MS	Member State
Reference years	The three most recent years with data available.
Species	Given in Tables 1(A), 1(B) and 1(C) of the MAUP.
Region	Given in Table 5(C) of the MAUP (level II).
RFMO/RFO/IO	Organisation providing management/advice on the stock.
Area/Stock	Given in Tables 1(A), 1(B) and 1(C) of the MAUP.
Selected for sampling	Is the stock selected for sampling for at least 1 biological variable?
Average landings	Average landings for each stock over reference period.
EU TAC share	Percentage of MS share of the TAC (for TAC stocks only)
EU landings share	Percentage of MS share of the landings (for non-TAC stocks)
Threshold (Y/N)	Does the threshold apply?, (Chapter V of the MAUP)
Comments	Any further comment.

This is a useful table for documenting sampling designs as it gives a clear overview of the stocks that will be sampled. The following comments are issued:

- Because the thresholds are determined by the TAC share of each country for each stock, there is a problem with stocks that do not match the TAC area (e.g., the hake 3a, 4, 6, 7, 6ab stock, has four TAC areas (2a, 4; 3a,22-32; 6, 7, 15; 7abde). Issues like these will be interpreted differently by MS, resulting in inconsistencies. **WGCATCH recommends that this table is filled out centrally (by STECF) or regionally (by RCGs).**
- WGCATCH suggests that the share in EU landings per stock is more appropriate for determining thresholds than TAC shares or species*geographical_area combinations. While TAC shares have the advantage of “relative stability” this can be undermined by quota swaps and issues with spatial mismatches (see previous point).
- WGCATCH notes that some species groups reported in this table still require discrimination to genus and, preferably, species level (e.g., Elasmobranchs) so that what is effectively being evaluated for sampling is transparent and similarly reported across countries. **WGCATCH recommends such species groups are updated to the taxonomic level used in ICES stock assessments.**

- The stocks in this table do not match the stocks used by end-users in all cases. WGCATCH suggests that end-users (RDMO/RFO/IO) provide an updated the list of stocks.
- The table is focussed on landings (and TAC). WGCATCH suggests that it is not used by MS to determine which stocks to sample for discards. **WGCATCH recommends that MS sample all species discarded at least in what concerns length.**

Table 1B

Table 1B (Annex I of Commission implementing decision (EU) 2016/1701 of 19 August 2016) provides an overview of which biological variables (length, age, weight, etc.) will be sampled for each stock.

Variables in Table 1B

Variable	Guidance
MS, Species, Region, RFMO/RFO/IO, Area/Stock – as above	
Frequency	Frequency at which sampling will take place: monthly, quarterly etc.
Length	Years in which length will be sampled
Age	Years in which age will be sampled
Weight	Years in which weight will be sampled
Sex ratio	Years in which sex ratio will be sampled
Sexual maturity	Years in which sexual maturity will be sampled
Fecundity	Years in which length will be sampled
Comments	Any further comment.

This table is not directly related with statistically sound sampling but it provides a nice overview of the long term objectives of the MS with regards to the biological sampling of each stock.

Table 1C

Table 1C (Annex I of Commission Implementing Decision (EU) 2016/1701 of 19 August 2016) lists the planned number of individuals to be sampled for each year, stock and variable.

Variables in Table 1C

Name of the variable	Guidance
MS, Species, Region, RFMO/RFO/IO, Area/Stock – as above	
MS participating in sampling	If the sampled activity has been carried out according to a regionally coordinated programme, list participating MS
Sampling year	Year or years for planned objectives.
Variables	length, age, weight, sex ratio, sexual maturity and fecundity
Data sources	Surveys, commercial samples, market samples, discard samples
Planned minimum No of individuals to be measured at the national level	Member State shall state the total planned minimum number of fish to be measured at the national level. Use 'Comments' to briefly define the methodology used to obtain these values (e.g., previous sampling, simulation, etc.).

Planned minimum No of individuals to be measured at the regional level	Member State shall state the planned minimum number of fish to sample as part of a regionally coordinated scheme if one exists.
Comments	Any further comment.

WGCATCH did not come to a consensus on the usefulness of this table. On one hand, this table still promotes quota sampling, particularly if it will be used to evaluate the performance of each member state. On the other hand, it can be useful to provide an estimate of the expected number of individuals that will be sampled under a certain design and this could highlight important stocks that may end up with too low numbers of individuals sampled. However, WGCATCH notes that there are no guidelines on the minimum number of individuals that are required for stock assessment and if are ever to be set, they will be different from stock to stock.

- The planned numbers in this table should not be compared with the achieved numbers to evaluate the performance of a sampling plan - this would be bad practice and not in line with statistically sound sampling (see previous WGCATCH and WKPICS reports). **WGCATCH recommends the Commission considers planned number of individuals as merely indicative and does not use them to evaluate the quality of the sampling programmes.**
- WGCATCH notes that **numbers sampled in 2009-2015 are not adequate proxies for planned number of individuals in years ahead** because sampling designs will change to meet statistically sound sampling requirements.
- This table might be more relevant for evaluating a sampling design if the expected number of primary sampling units was given for each stock and each variable. (e.g., the expected number of trips or survey hauls on which variable X would be collected for stock Y). WGCATCH highlights that better information on the quality of data can be ensured by inclusion of a direct link between this table and the sampling scheme descriptions in Table 4A and Text Box 4A, eliminating the reference to numbers included in this table. "Data sources" would then be the individual surveys and sampling schemes (this would be the link). **WGCATCH recommends these changes in a future review of this table if it is secured that sampling designs and sampling protocols per stock are adequately described.**

Table 1F

Table 1F (Annex I of Commission implementing decision (EU) 2016/1701 of 19 August 2016) provides an overview of sampling for incidental by-catch of birds, mammals, reptiles and fish.

Variables in Table 1F

Variable	Guidance
MS, Species, Region, RFMO/RFO/IO, Area/Stock – as above	
Sampling period	Member State shall state the period for planned sampling.
Sampling period	The period for planned sampling (year range).
Sub-area/Fishing ground	Fishing ground of the mentioned species/stock.

Scheme	Sampling scheme: e.g., 'at markets', 'at sea' etc. Values shall match those in Table 4A and Table 4B of this Annex, unless directed schemes are in place.
Stratum ID code	Unique code to identify each stratum within the scheme.
Group of vulnerable species	Group of species, based on provision 3(a) of Chapter III of the MAUP.
Expected occurrence of recordings	Expected occurrence of recordings for individuals caught as incidental by-catch, including releases, in accordance with Table 1(D) of the MAUP. Fill in with (+/-) number or 'X'.
Comments	Any further comment.

This table is useful to WGCATCH because it provides an overview of incidental by-catch sampling. WGCATCH notes however that it does not directly match the progress made towards statistically sound sampling achieved in other tables and that statistically sound sampling designs should be implemented in all incidental by-catch studies, including pilot studies. **WGCATCH will be contacting WGBYC and propose a joint workshop in 2018 that addresses statistically sound sampling of incidental by-catches [see Section 5.7].** Additional comments from WGCATCH are:

- WGCATCH notes that this table only focuses on commercial sampling but could also include information from other types of surveys (e.g., research surveys). **WGCATCH suggests this is considered in a future update of these tables.**
- In what concerns commercial catch sampling, WGCATCH highlights that stratum ID is too detailed – sampling scheme would be enough. **WGCATCH recommends this change in a future update of this table.**
- WGCATCH also notes that the table provides information on whether incidental bycatches are recorded in each sampling scheme but there is no indication if the scheme is designed to sample these bycatches and how it is carried out (census? sampling? With what coverage?). In what concerns commercial sampling, the latter could be better achieved by adding information on incidental by-catch sampling in table 4A. **WGCATCH suggests this is considered in a future update of these tables.**

Table 2A

Table 2A (Annex I of Commission implementing decision (EU) 2016/1701 of 19 August 2016) provides an overview of fishing activity data by vessel length class. The table describes if the data collected under the control regulation is appropriate for scientific use, or additional data are collected to describe the fishing activity.

Variables in table 2A: Fishing activity data

Variable	Guidance
MS	Member State
Supra region	Given in Table 5(C) of the MAUP (level III).
Region	Given in Table 5(C) of the MAUP (level II).
Variable Group	Given in Table 4 of the MAUP.
Fishing technique	Given in table 5(B) of the MAUP.
Length class	Given in table 5(B) of the MAUP.
Metiers (level 6)	Given in table 2 of the MAUP.

Data collected under control regulation appropriate for scientific use (Y/N/I)	Y (yes), N (no) or I (insufficient)
Type of data collected under control regulation used to calculate the estimates	The type of data collected: logbooks, sales notes, VMS data, fishing forms etc.
Expected coverage of data collected under control regulation (% of fishing trips)	For each data source, the planned coverage percentage (fishing trips) should be estimated
Additional data collection (Y/N)	Y (yes) or N (no)
Data collection scheme	Data collection scheme: probability sampling survey, non-probability sampling survey, indirect survey, census survey, none etc.
Planned coverage of data collected under complementary data collection (% of fishing trips)	Planned coverage percentage (fishing trips).
Comments	Any further comments

The table is useful to highlight that the data collected under the control regulation does not fully cover, e.g., the small-scale fisheries. Member states can describe the coverage of the data collected under the control regulation and which additional sampling schemes they use to describe the small-scale fishery. However, discussions held in WGCATCH subgroup indicated that some member states may not have fully understood the intention and guidelines behind this table failing to fully describe the missing information on their small-scale fisheries.

Table 4A

Table 4A (Annex I of Commission Implementing Decision (EU) 2016/1701 of 19 August 2016) provides an overview of sampling plans for biological data

Variables in Table 4A

Variable	Guidance
MS, MS participating, Region, RFMO/RFO/IO, Sub-area/Fishing ground	As above
Scheme	Sampling scheme: e.g., 'at markets', 'at sea' etc. it shall be described in Text Box 4A of this Annex.
Stratum ID code	Unique code to identify each stratum within the scheme. Include strata with no coverage (i.e. no planned number of PSUs), in order to provide measurement on coverage of the sampling plan.
PSU type	Primary sampling unit (PSU) inside each stratum. PSU could be fishing trip, fishing vessel, port, fishing day, etc.
Catch fractions covered	Member State shall indicate which fraction of the catch is to be sampled. E.g., Catch, Landings, Discards
Species/Stocks covered for estimation of volume and length of catch fractions	Stocks covered by the sampling plan (e.g., all stocks in Tables 1ABC, or selected stocks, specify in 'Comments'.
Seasonality	Temporal stratification, e.g 'monthly', 'quarterly', 'annual', etc.
Reference years	Reference year(s) used for the expected PSUs
Average number of PSUs	Average number of PSUs sampled during reference years

Planned number of PSUs	Planned number of PSU to be sampled.
Comments	Any further comment.

This table is very useful because it ensures that MS describe their sampling with relevant statistical concepts. However, evaluation of a statistically sound sampling scheme cannot be performed exclusively with the information included in this table; a standardized version of text box 4A is crucial for a full interpretation.

- This table could include the sampling frame description from Table 4B, i.e., Tables 4A and 4B could be combined in only one table. Also, it would also be useful to have a column where you fill in if the sampling is part of a regional sampling scheme or not. **WGCATCH recommends these changes are considered in a future update of this table.**
- WGCATCH notes that coverage of PSUs is not always not a good index of coverage of the strata (e.g., when week is the PSU). **WGCATCH recommends that landings, fishing days and trips in the reference period are included as additional columns.** WGCATCH notes that this would make Table 4C redundant (see comments to table 4C)
- This table does not identify the study population. **WGCATCH recommends this is specified in Text Box 4A where the study population and sampling frame could be described, including coverage of the overall sampling plan in terms of psus, average landings, fishing days and trips in the reference period.**
- The number of PSUs are probably best given by sampling programme, rather than stratum, see comments on table 4B.
- **WGCATCH recommends this table could include indication of dedicated sampling programmes for incidental bycatches** (see comment in table 1F).

Table 4B

Table 4B (Annex I of Commission Implementing Decision (EU) 2016/1701 of 19 August 2016) provides additional detail on sampling plans for biological data

Variables in Table 4B

Variable	Guidance
MS, Stratum ID code – as above	
Stratum	Short description (free text) of the sampling strata (e.g., trawlers in the GSA 22; west coast purse-seiners; ports of the NW area, etc.).
Sampling frame description	Short description the sampling frame for each stratum (e.g., list of vessels in the GSA 22; list of purse-seiners in the west coast; list of ports in the NW area).
Method of PSU selection	Member State shall indicate the method(s) (free text) for the selection of the primary sampling unit (PSU).
Comments	Any further comment.

Tables 4A and 4B are reasonably useful for describing sampling programmes. However they would be more useful if the suggestions outlined next would be taken into account:

- Tables 4A and 4B could be combined in only one table. The description of the stratum should be moved to table 4A. The other fields can then be described at the level of the sampling programme. WGCATCH notes that the sampling frame and PSU selection are frequently (but not always) the same in all strata. **WGCATCH recommends these changes in a future update of this table.**

Table 4C

Table 4C (Annex I of Commission Implementing Decision (EU) 2016/1701 of 19 August 2016) provides data on the fisheries of the MS

Variables in Table 4C

Variable	Guidance
MS, Region, RFMO/RFO/IO, Sub-area/Fishing ground – as above	
Reference years	Year(s) to which the description of the fisheries refers.
Fleet Segment / metier	Metier (at level 6) as defined in Table 2 of the MAUP, or fleet segment, as defined in Table 5(B) of the MAUP.
Targeted species	Target species or species assemblage ('Demersal species', 'Small pelagic fish', etc.) as indicated in Table 2 of the MAUP
Average number of vessels	Average number of vessels active in this fleet segment/metier
Avg number of fishing trips	Average number of fishing trips in this fleet segment/metier
Av number of fishing days	Average number of fishing days in this fleet segment/metier
Average landings	Average total landings of this fleet segment/metier
Average landings in national ports	Average landings of this fleet segment/metier in national ports
Average landings in foreign ports	Average landings of this fleet segment/metier in foreign ports
Comments	Any further comment.

WGCATCH was unable to determine how this table could be useful in any way to describe and/or evaluate a sampling programme as there is no way to link between its information and Tables 4A-B.

- If the information on landings and effort is included in table 4A-B, this would make an explicit link to the sampling programmes that would allow the coverage of the programme to be evaluated (see comments to table 4A).
- WGCATCH notes that considerable efficiency savings could be achieved by obtaining these parameters directly from the RDB. The RCGs have initiated a subgroup where experts will develop and share code to develop data products from the RDB data. This group could develop routines to provide the data required. **WGCATCH recommends MS supply expertise and staff time for RDB data group work.**

Table 4D

Table 4D (Annex I of Commission Implementing Decision (EU) 2016/1701 of 19 August 2016) provides a summary of the characteristics of the landings into a MS.

Variables in Table 4D

Variable	Guidance
MS, Region, Sub-area/Fishing ground, Reference years – as above	
Landing locations(s)	The grouping/assemblage of landing locations (e.g., major ports, minor ports, ports, local ports, etc.), if available.
Average number of locations	Average number of landing locations by grouping/assemblage.
Average number of registered landings	Average number of registered landing operations. As the previous fields are optional, this field could refer the average number of total landings operations in the Member State.
Average landed tonnage	Average volume in live weight (tonnes)
Average landings of national fleet	Average volume in live weight landed by national fleet (into the MS??)
Average landings of foreign fleet	Average volume in live weight landed by foreign fleets into the MS
Comments	Any further comment.

This table contains valuable information on national and foreign landings in subsets of national ports. However, a) not all countries perform sampling using port groupings which may lead many countries to report “Landing location” as “all ports”, and b) frequently foreign landings cannot be split by fishing ground because this information is not available to the MS. These two aspects limit the table usefulness. Furthermore:

- In cases where sampling is carried out by port grouping it would be useful to have a column with sampling scheme and strata ID so that this table could be linked to table 4AB. When no such port groups exists, then that column could be left with “non-applicable”. **WGCATCH recommends these changes in a future update of this table.**
- When information on fishing ground is not available, MS should merge the cells and provide a total for foreign landings. **WGCATCH recommends this guideline is given to MS in a future update of this table.**
- Considerable efficiency savings could be achieved by obtaining these parameters directly from the RDB. The RCGs have initiated a subgroup where experts will develop and share code to develop data products from the RDB data. This group could develop routines to provide the data required. **WGCATCH recommends MS supply expertise and staff time for RDB data group work.**

Text box 4A

Text box 4A (Annex I of Commission implementing decision (EU) 2016/1701 of 19 August 2016) provides description of the sampling plans given in Tables 4A-B.

The sampling plans described according to Article 5 paragraph (3) of Commission implementing decision (EU) 2016/1701 of 19 August 2016, which reads: “Where data are to be collected by sampling, Member States shall use statistically sound designs that follow guidelines for good practice provided by the Commission, the International Council for the Exploration of the Sea (ICES), STECF or other expert bodies to the European Commission. The description of sampling schemes shall include, but not be limited to, the specification of the

purposes, design, expected execution difficulties (including non-response and refusals), data archiving, quality assurance procedures and analysis methods. This description shall also cover the definition of the sampling units, sampling frames and their coverage of the target population (including criteria used for coverage), stratification schemes and sample selection methods for primary, secondary and lower level sampling units. Where quantitative targets can be defined, they may be specified either directly by sample sizes or sampling rates, or by the definition of the levels of precision and of confidence to be achieved. For census data, Member States shall indicate if all segments are covered, which parts of the total population are missed and how these parts are estimated. The quality of sampling data shall be demonstrated using quality indicators related to precision and potential for bias, where appropriate."

WGCATCH considers this text box to be very useful to its work. However, comparisons made on Text Box 4A content and formats across MS indicated they have vastly different interpretations on what is required in this text box and how it should be reported. The latter situation greatly complicates the pooling of information and interpretations on what, how and when will be sampled that are fundamental to WGCATCH work (see **Section 5.3.4**). WGCATCH suggests that the structure of this text box should be more clearly defined, for example by providing headers (and descriptions or examples) following Article 5 paragraph (3):

- Guidelines followed (e.g., WKPICS3)
- Purpose of the sampling scheme
- Design of the sampling scheme
 - Definition of sampling units and sampling frames
 - Coverage
 - Stratification schemes
 - Sample selection methods for (PSU, SSU, etc.)
 - Sampling Targets
- Expected Difficulties (e.g., refusals)
- Data archiving
- Quality assurance procedures
- Analysis methods
- Census data
 - Segments covered / missing parts of the population
 - Estimation of missing parts
- Quality indicators

However, additional information to the above mentioned may also need to be included and word-count limits may have to be revised. To date, several groups have created templates to the reporting of sampling schemes, including WKRDB 2014, SGPIDS, WKPICS2, WGCATCH 2014. **WGCATCH will build on this previous work and analyse prior templates jointly with current examples of text box 4A of different MS to conclude on single template that most effectively captures the information needed to document a sampling scheme.** This work will take place intersessionally and involve testing in specific fisheries and stocks. The group has made the following suggestions so far:

- SSU type, sampling frame, and sampling effort in the whole sampling hierarchy should be specified (not only method of selection). **WGCATCH recommends that this information is included by MS in text box 4A.**

- WGCATCH notes that guidelines do not mention the need to include by-catch/PETS sampling in this text box. However, it would be useful to have that description. This should include information on type of by-catch screened (birds, etc), sampling frequency (e.g., all hauls? Some hauls?) and sample size (census/sample)? **WGCATCH recommends this information is included with associated description of the sampling design.**

Table 5A

Table 5A (Annex I of Commission implementing decision (EU) 2016/1701 of 19 August 2016) provides an overview of the quality assurance framework for biological data. The table highlights whether documentation in the data collection process (design, sampling implementation, data capture, data storage and data processing) exists and identifies where this documentation can be found.

Variable	Guidance
MS, MS participating in sampling, Sampling year/period, Region, RFMO/RFO/IO, Name of sampling scheme, Sampling frame – as above	
Is the sampling design documented?	Yes or No
Where can documentation on sampling design be found?	Link to website
Are non-responses and refusals recorded?	Yes or No
Are quality checks to validate detailed data documented?	Yes or No
Where can documentation on quality checks for data capture be found?	Link to website
In which national database are data stored?	Name of national database
In which international database(s) are data stored?	Name of international database(s)
Are processes to evaluate data accuracy (bias and precision) documented?	Yes or No
Where can documentation on processes to evaluate accuracy be found?	Yes, No, NA
Are the editing and imputation methods documented?	Yes or No
Where can documentation on editing and imputation be found?	Link to website
Comments	Any further comment.

This table is very useful. Appropriate documentation and quality control of the whole data collection process is required to provide accurate data to end-users highlighting important gaps. WGCATCH points out that full documentation of these aspects is a medium-term process that still may take 2-3yr to achieve.

- WGCATCH notes that Table 5A should also include protocols for incidental by-catch. **WGCATCH recommends this guideline is given to MS in a future update of this table.**

Annex 10: Landing Obligation Questionnaires

Questionnaire 1: Assess the impacts of the LO, in relation to the sampling programme, changes in the quality of the data and in the fishing behaviour - Results by region. Example shown for North Atlantic; separate sheets were circulated for the Baltic and the North Sea.

Monitoring the impact of the landing obligation on data collection

Country: Flag country		Past	Current	Pending
Landing obligation		2015	2016	2017
Species	Pelagic and Industrial	+ haddock, nephrops, hake, sole, whiting	+ plaice, megrim	
Gears		Fishery based	Fishery based	
Comments		List of vessels identified by threshold criteria. Exemptions and de-minimus	List of vessels identified by threshold criteria. Exemptions and de-minimus	
1	<i>Has the MS successfully adapted or implemented their onshore sampling programme?</i>			
	Modified sample sheets			
	Modified databases			
	Sampling procedures			
	If yes - how? If no - why not?			
2	<i>Has the MS successfully adapted or implemented their offshore sampling programme?</i>			
	Modified sample sheets			
	Modified databases			
	Sampling procedures			
	If yes - how? If no - why not?			
3	<i>Has there been issues getting access to vessels and all components of the catch and landings (incl. BMS landings)?</i>			
	Onshore			
	If yes - what? Percieved, anecdotal, measureable?			
	Offshore			
	If yes - what? Percieved, anecdotal, measureable?			
4	<i>Is there any evidence that your control agencies can collect data on the new landing fraction and additional data on discards?</i>			
	If yes - what? Percieved, anecdotal, measureable?			
	If no - why not?			
5	<i>Is there any evidence of an effect on the quality of data?</i>			
	Discard estimates			
	If yes - what? Percieved, anecdotal, measureable?			
	Control data - Landings data (logbook, sales notes)			
	If yes - what? Percieved, anecdotal, measureable?			
6	<i>Is there any evidence of a change in fishing behaviour? Technical (fishing gear, sorting processes) and tactical (fishing grounds and seasons)?</i>			
	If yes - what? Percieved, anecdotal, measureable?			
	If measureable - have you or will you need to account for this in your programme?			
7	<i>Is the MS doing any analysis for any observer effect</i>			
	If yes - what?			
8	<i>Please document experiences of sampling, or not sampling, the new landed fraction ashore</i>			

Questionnaire 2: Data collected and reported the first year of the landing obligation in the Baltic Sea

	Member State		
	Institute		
	Name of person filling the questionnaire		
	Species:		
		Active gears	Passive gears
BMS landings			
	Were BMS landings 2015 reported as a separate catch category to the assessment WGs?		
	<i>If yes:</i>		
	What data source/sources were used to quantify them? (e.g., Logbooks, sales notes, landing declarations, sampling, etc)		
	If BMS was quantified by sampling: a) how was it sampled; b) do you consider your sampling to have been representative?; c) what raising variable was used to produce final estimates?		
	Were BMS landings sampled for biological data (age/length)? If yes; a) were they sampled onshore or on-board (or both)? b) what raising variable was used to produce final estimates?		
	<i>If no:</i>		
	Were they reported in other catch categories or not reported?		
	Additional comments:		
Discards			
	Were discards estimated from 2015 sampling data?		
	<i>If yes:</i>		
	How was the sampling performed? (e.g., onboard, self-sampling, etc.)		
	Was there a likely observer effect on the discarding behaviour in sampled trips?		
	How was the observer effect accounted for (if so)?		
	What raising variable was used in the discard estimation (effort, cod landings >MCRS, all cod landings, total landings of all species, etc)		
	<i>If no:</i>		
	Why not?		
	Were discards estimated from some other data? If yes: what data were used?		
	If discards were not estimated, was it considered that no discarding had taken place?		
	Did you use the InterCatch category "logbook-registered discards"?		
	Additional comments:		

Annex 11: Best practice guidelines for data collection on Small Scale Fleets

Main end-users and end-user needs on SSF

Defining the end-users and end-users needs on SSF fishery data estimates constitutes the first step in setting up a data collection scheme. WGCATCH consulted different reports, where this specific topic has been discussed, to draw a proposal for a list of core SSF fishery data estimates needed.

The DCF Nantes workshop on small-scale fisheries (Anon., 2013) discussed different regulations actually implemented (CFP, Control Regulation, DCF Regulation, Management Plan in the Mediterranean Sea, Marine Strategy Framework Directive (MSFD), Natura 2000, Marine Protected Area (MPA), Water Directive, RFMO Regulations, Council Regulations (EC) 597/2014 and (EC) 812/2004 about incidental catches of cetaceans in fisheries, ASCOBANS agreement,...) and agreed on the need of SSF fishery data to meet such regulations requirements.

Recently, 2016 fishPi research project (EU MARE/2014/19: Anon., 2016) established a list of existing and potential end users of SSF fishery data presented in Table A11.1.

Table A11.1. Existing and potential end users of SSF fishery data.

End User	End user sub groups	Use of SSF data
ICES	ICES expert assessment WG	Need SSF data to produce quality assessment.
	WGCATCH	Documents national fishery sampling schemes, establishes best practice and guidelines on sampling and estimation procedures, and provides advice on other uses of fishery data.
	WGRFS	Planning and coordination of marine recreational fishery data collection for stock assessment purposes.
	PGDATA	To understand the quality of datasets and to use them as effectively as possible, and to employ objective ways to identify and prioritise data needs.
Other RMFO (ICCAT, NAFO, NEAFC, GFCM, IOTC, ...)	Expert assessment and ecosystem WG	Need SSF data to produce quality assessment.
European Commission	DGMARE & DG Environment	Implementation of MSFD; achievement of GES with good management of recreational as well as small scale fishery impacts. Implementation of (EC) 597/2014 and (EC) 812/2004, Birds Directive, Habitats Directive, achievement of the reformed CFP objective to promote small-scale coastal fishing activities, his development, competitiveness and sustainability.
	STECF	SSF data collection is required in the EU MAP.

End User	End user sub groups	Use of SSF data
International Organizations	FAO, OSPAR, ASCOBANS, ACAP, IWC...	Identifying threats, recommending action plans, implementation of different agreements
Regional Coordination Groups	RCGs for each region	Coordination and cost-effectiveness of fisheries data collection within regions (as included in EU-MAP). Finding the balance between regional and national data needs.
National Governments and regional fisheries authorities within countries		Developing policy positions on management that reflects the ecosystem aspects of sustainable development in coastal regions and spatial planning such as MCZs. Meeting international agreed responsibilities.
Scientific community in general.	Universities; Govt. departments; other Institutes	Scientists interested on small scale fisheries and their impact in the coastal ecosystems. Interactions with other uses of the sea.
		Data for publication.
Representative bodies for International and national commercial fisheries.	Commercial fishermen's organisations and federations.	Policy developments in relation to small scale fisheries and their impact in the coastal ecosystems. Interactions with other uses of the sea.
Recreational fisheries bodies	Recreational fishermen's organisations and federations (EAA, Angling Trust...)	Developing best practices.
Advisory Councils	e.g., North Western Waters AC; North Sea AC.....	Policy developments in relation to small scale fisheries and their impact in the coastal ecosystems. Interactions with other uses of the sea.
Marine NGOs	Birdlife international, WWF, GREENPEACE, OCEANA etc.	Policy developments in relation to small scale fisheries and their impact in the coastal ecosystems. Interactions with other uses of the sea.

The 2nd Workshop on Transversal Variables (Castro Ribeiro et al., 2016) also discussed this specific topic and agreed that it is essential to estimate the fishing activities of SSF in terms of annual fishing days, volume and value of catches as minimum requirements of data to answer these different end users' needs.

Following that, this workshop agreed on a list of transversal data (taking into account the DCF Nantes workshop proposal) to be collected for vessels without logbooks and adopted the view of DCF Nantes workshop considering that Regional Coordination Groups (RCGs) should be responsible, apart from the basic information (core set of variables) presented in the table, for the management of any additional list of fishing activity variables (number of pots, length of nets, ...) or any more detailed level of aggregation (spatial, technical or temporal). Indeed, this could require a regional approach associated with core end users' needs and the feasibility to collect such additional information should be assessed by RCGs considering the possible impact on data collection programmes.

The proposed list is presented hereafter in Table A11.2.

Table A11.2 Proposed list of transversal variables to be collected for vessels without logbooks requirement (LOA<10 meters):

HEADING	VARIABLE	UNIT	DESCRIPTION	COVERAGE	ACTIVITY SEGMENTATION	REFERENCE PERIOD
Capacity	Number of vessels	Number	Total number of vessels	Community Fishing Fleet Register	Fleet segment	
	GT	Number	Total GT of the vessels in the segment	Community Fishing Fleet Register	Fleet segment	
	kW	Number	Total kW of the vessels in the segment	Community Fishing Fleet Register	Fleet segment	
	Vessel Age	Number	Average AGE of the vessels in the segment	Community Fishing Fleet Register	Fleet segment	
Effort	Number of trips	Number		Active vessels	Fleet segment and gear (level 3)	Quarterly
	Days at sea	Day		Active vessels	Fleet segment and gear (level 3)	Quarterly
	Fishing days	Day		Active vessels	Fleet segment and gear (level 3)	Quarterly
	Number of vessels	Number		Active vessels	Fleet segment and gear (level 3)	Quarterly
Landings	Value of landings totals and per species	Euro	Value of landings total and per species	Active vessels	Fleet segment and gear (level 3)	Quarterly
	Live weight of landings	Tons	Live weight of landings in kg total and per species.	Active vessels	Fleet segment and gear (level 3)	Quarterly
	Prices by species	Euro/kg	Price per kg of species landed	Active vessels	Fleet segment and gear (level 3)	Quarterly

WGCATCH adopted the view of the Cyprus workshop and agreed on this first list of variables.

However, WGCATCH stresses the fact that to answer questions in its scope of activity (stock assessment and fishery management especially), estimates would be better obtained by gear type (level 4 of the DCMAP) which give possibility, for example, to distinguish set and drift nets as presented in **Annex 1 of these guidelines** (Table 2 of the Commission implementing decision (EU) 2016/1251 of 12 July 2016)).

Concerning gear dimension (total length of nets, total number of pots/traps and total number of hooks), WGCATCH stressed the fact also that these variables are of high importance, especially concerning passive gears, and encouraged countries to collect

such data although there are optional in DCMAP regulation for less than 10m vessels. This should particularly be addressed when countries implement a sampling approach to collect fishing activity variables, by including the collection of gear dimension data in their sampling protocols. This could be more difficult to implement in a census approach even if declarative forms could be designed to collect such information.

Guidelines on best practices for SSF fishing activity data collection

These following guidelines are proposed for data collection on SSF fishing activities based on similar good practice guidelines established for general commercial fishery sampling schemes by WKPICS (ICES, 2013b) and recreational fishery surveys by WGRFS (ICES 2013c).

Step 1: Objective/Data needs

The first step is to identify the types of estimates (domains of interest, landings, fishing effort, ... at the desired resolution such as spatiotemporal strata; gear types etc.) and the level of precision that the data collection system is required to deliver, and the types of data needed to calculate these estimates (see previous section).

Step 2: Pre-screening/Frame survey

The next step is to collect information on the target population of vessels including data on the access points on the coast where vessels can be sampled, and on the fishing activities of vessels. These data allow an evaluation of candidate data collection methods (choice between census and sampling approach) and for the sampling scheme to implement. Most of the time, the frame survey consist of a census-based approach in which data is collected at all access points along the coast for all fishing vessels and gears.

The aim is to extensively describe the vessels constituting the SSF fishing sector: (i) their fishing activity patterns (% of full-time, part-time or inactive vessels); (ii) their spatial/temporal patterns and dynamic of fishing and landing; (iii) target species and the gears they used including extent of polyvalency and seasonality, etc. (see example of France pre-screening survey, named as "Activity Calendar Survey" in **Annex 2 of these guidelines**). Identification of all possible landing sites, the numbers of vessels using these, and the daily, weekly and seasonal patterns of landing inside each site should be also surveyed especially to perform intercept surveys. The pre-screening survey also provides the opportunity for recording supplementary information useful for planning and implementation purposes such as, for example, fishing trip schedules pattern.

The pre-screening survey will constitute the general framework of the data collection. Based on it, a sampling frame must be clearly identified and fully documented (e.g., list frame of vessels or vessels x time period, or an area frame of landing sites). The primary sampling units of the frame should be clearly described. If the frame excludes part of the population for practical reasons (for example issues related with accessibility of the landings sites), this should be documented so that potential for bias can be evaluated.

The pre-screening survey should also identify existing data sources that are available, for example sales notes or any existing declarative forms; position data from AIS systems or geo-localization tools; etc.

Step 3: Census, sampling or a combination of the two?

The next step is to evaluate the most appropriate method for the data collection. The choice between census, sampling, or a combination of the two approaches to provide information on SSF fishing activity and catches (e.g., capacity/gear information/fishing effort/landings per species in kg and in value) will be done based on the information compiled in first step. The approach chosen will depend on (i) the objective (in particular the desired level of precision and desired resolution) of the SSF fishing activity data collection, (ii) the issues of cost efficiency, (iii) the available means to collect the data and (iv) the outcomes of the pre-screening survey (including the potential pre-existing data sources available).

The cost efficiency of census or sampling approaches to estimate SSF fishing activity variables has to consider all the costs linked with each procedure and has to be assessed case by case taking into account their specificities.

A census approach implies, among other things, costs for data inputs, data quality assurance and quality control (input error detection, reliability of self-reporting data, completeness of the information and other bias issues), data base development and data archiving, data processing and reporting. Statistical / programming costs are involved in development of calculation procedures of final estimates at any desired resolution (e.g., spatio-temporal strata, gear types, ...), with, *in theory*, a perfect result (no uncertainty).

A sampling approach implies, among other things, costs for designing, implementing and monitoring the programme (including acquisition of any auxiliary information needed for estimations), data base development and data archiving, quality assurance and quality control procedures, data processing and reporting. Statistical / programming costs are involved in development of estimation procedures including estimation of precision of final estimates through the application of sampling theory (where there is a sufficient number of samples to calculate the estimates at the different desired resolutions (e.g., spatio-temporal strata, gear types, ...)).

All the different factors linked with the approach chosen have to be taken into account before adopting a particular scheme. In some regions the use of declarative forms (manual or electronic) could be inappropriate whereas in other regions it could be the most efficient approach to use.

In conclusion, a sampling or a census approach could be developed to survey SSF. The two approaches imply different issues, assumptions and specificities implicating that best practices guidelines are specified for each of them in steps 4, 5 and 8 that take into account their particularities.

Step 4: Data Collection method

Sampling approach

Several types of sampling scheme are possible, for example:

- A catch sampling survey where the primary sampling unit (PSU) is a landing location on a day, and PSUs are sampled using a clustered random sampling scheme in order to interview skippers of vessels landing throughout the day

to collect data for that trip. The vessels trips are the secondary sampling units (SSU).

- Use of a known fishing fleet vessel register from which a list-frame of small-scale vessels is identified, and vessels are selected using a stratified random sampling scheme to collect data on their fishing activities and catches. This could be done by: i) direct interview for the last trip (PSU = vessel x day); ii) self-reporting of data for the full year using declarative forms (PSU = vessel); or iii) self-reporting of data for a shorter period using declarative forms (PSU = vessel x month for a monthly collection period). Option (ii) is equivalent to a reference fleet approach.

The data collection method should be identified.

If adapted declarative forms have to be used (random samples of vessels who self-report), they must be easy to complete, and capture the minimum sufficient data needed to calculate the required estimates (see census approach - step4 for more details). This could include e-adapted declarative forms, new smartphone applications and sales notes (if they are available).

Clear and easy-to-understand specific guidelines must be developed for fishermen to correctly complete the declarative forms (with some practical examples), or for trained survey staff completing interviews.

At this stage, it is important to develop an inventory of available resources in terms of budget, staff, data processing, analysis and any equipment costs such as electronic data capture tools, and any requirements that need to be met with regards to time schedule or accuracy of survey estimates.

It is critically important also to consult widely with fishermen in this process, to discuss the feasibility and practicalities of data collection and highlighted the benefits and objective of such data collection. A consideration is needed of incentives to encourage all the fishermen in the scheme to provide data and to ensure the data are as accurate as possible. An initial pilot study to trial data collection methods should be performed and the methods adapted where necessary.

Finally, other indicators as reliability of self-reported data expected, spatial distribution and seasonality, accessibility of the landings sites, etc. have to be taken into account to define the most adapted sampling scheme to survey SSF fishing activity variables. This should be assessed by region/gear/fleet as in some of them one type of sampling scheme could be inappropriate when, in other, it could be the more efficient approach to use.

Census approach

A census approach for SSF data collection method needs an adapted declarative form to collect fishing data (like logbooks for large scale fleets). Based on the 2015 WGCATCH overview of the SSF data collection schemes used in ICES area, the conclusion was that EU logbooks are not well adapted to the characteristics and special features of the SSF fleet. In particular multi-gears/multi-species fleet (polyvalency both between and within trips), importance of fixed gears (nets, pots, lines, on-shore fishing, ...), daily fishing trip schedules (sometimes two times in a day), ... when logbooks have been designed rather for active gears (especially trawlers) and several days fishing trips. Therefore, adapted declarative forms (named differently in each country as coastal log-books, coastal registers, monthly reports, monthly declarative forms, etc.) are preferred (see some examples in WGCATCH 2015 report and in **Annex 3 of these guidelines** presenting SSF data collection in used in Baltic Sea).

Adapted declarative forms must be easy to complete, and capture the minimum sufficient data needed to calculate the required estimates. This could include e-adapted forms, new smartphone applications.

Clear and easy-to-understand specific guidelines must be developed for fishermen to correctly complete the declarative forms (with some practical examples).

At this stage, the system in place to collect logbooks for large scale fleets (data capture software, data base) has to be taken into account also to insure cost efficiency.

Landings declaration and sales note data constitute, when they are available, another source of data to estimate SSF transversal data but are insufficient as they usually do not capture information on fishing effort, details of gears used, or fishing location. They have to be combined with additional data collection methods (census or survey).

Data on landings declarations and sales notes constitute also a useful source of information to improve estimates resulting from the analysis of the adapted SSF declarative forms on fishing activity, by cross-validation methods.

It is important to consider that the EU Control Regulation (Regulation (EU) 1224/2009 of 20 November 2009 and Commission Implementing Regulation (EU) 404/2011 of 8 April 2011) allows the possibility for fishermen to dispose of small landings without documentation. Communication with fishermen on the necessity to report all landings (including small landings) has to be considered in order to improve the estimates from adapted declarative forms. At this stage, it is important to develop an inventory of available resources in terms of budget, staff, data processing, analysis and any equipment costs such as electronic data capture tools, and any requirements that need to be met with regards to time schedule or accuracy of survey estimates.

It is also critically important to consult widely with fishermen in this process, to discuss the feasibility and practicalities of data collection and highlighted the benefits and objectives of such data collection. A consideration is needed of incentives to encourage all the fishermen in the scheme to provide data and to ensure the data are as accurate as possible. An initial pilot study to trial data collection methods should be performed and the methods adapted where necessary.

Step 5: Design the sampling scheme

Sampling approach

The choice of sampling frame and data collection method must be made before specifying a probability based sampling design and sample selection mechanism.

Extensive information on types of sampling designs for fisheries is given in the reports of WKMERGE (ICES, 2010), WKPICS 2011 – 2013 (ICES 2012b, 2013b, 2014), SGPIDS (ICES 2011, 2012a, 2013a), WGCATCH (ICES 2015, 2016) and WGRFS (ICES 2013c). These reports should be consulted to help design a scheme that meets the criteria for statistical soundness; criteria which could be found in the WKPICS2 guidelines for good practice and that has been adapted here for SSF' fishing activity data collection (see **Annex 4 of these guidelines**).

The need for pre-stratification of the PSUs in the sampling frame should be considered very carefully to ensure that it is really necessary (e.g., to address particular end user needs for specific domains of interest such as more precise estimates for particular regions). However, sufficient number of samples per stratum is necessary to provide robust estimates and to bring advantages by improving precision and cost-efficiency. The

method for selecting sampling units or PSUs such as vessels or "site x days" should be chosen to ensure that the samples are as representative as possible of the population.

An appropriate sample size can be determined based on the design itself and on any specified requirements for the spatio-temporal resolution and statistical precision of estimates, taking into account resources available for sampling.

If a reference fleet approach is used where a representative selection of vessels is made within a defined area, gear, target species or other strata and fishermen are asked to record data continuously throughout the year, it is better to stagger any replacement of vessels rather than changing them all at the same time. Several examples of inshore reference fleets can be found in literature from Norway (e.g., Pennington and Helle, 2011).

Census approach

This step 5 is not applicable to the census approach.

Step 6: Implementation

It is good practice to establish a system to monitor the performance of the data collection scheme, firstly to identify and if possible rectify problems emerging, secondly to allow an evaluation of the potential for bias if the problems cannot be rectified. This monitoring system should provide diagnostics on non-response or refusals to supply data (and reasons if known) and on inadequate coverage of the data collection scheme.

Where necessary, fishermen should be contacted at an early stage to try to improve the data collection.

Quality issues are also related to reliance on buyers and sellers documentation (confidence in self-reporting data). Statistical comparison of vessels data within fleets and métiers, could be a good way to identify outlier vessels, for which data must be checked. On-site or at-sea observations, by randomly selecting trips, can be made to validate self-reported data considering, on another hand, bearing in mind possible observer effects on quality of reported data.

Step 7: Data capture and Quality control

A national database is needed to compile SSF sampling and/or census data in a format that is compatible with any regional standards requirements (e.g., for uploading to the ICES-hosted Regional Data Base if adapted to take SSF data, and making use of existing codes for error trapping). To account for the requirements of sampling, the database should also include the input of variables needed for probability-based estimation in what will typically be a hierarchical cluster sampling design.

A quality assurance/quality control system should be implemented to identify and clean individual data errors (including input-error detection), for example using the R-codes for implementing range checks and other validation rules developed in the 2016 fishPi research project (EU MARE/2014/19: Anon. 2016), and to report on identified errors (including identification of outliers with statistical methods, ...). Good software for data capture (for example with allowable ranges for numerical fields) could limit these tasks.

Additional methods should be developed and implemented to provide diagnostics on data quality in completion of the annual data collection cycle. These may include methods used for within-year monitoring of the data collection in Step 6, including achieved

vs planned sampling; stratum coverage; non-response & refusal rates; information from on-site or at-sea data validation exercises or any other form of cross-validation for data available (could be position data from AIS systems or geo-localization tools, sales notes, existing declarative forms, ...), which could be a good means to improve the final estimates precision. For example, adapted declarative forms could be cross checked with sales note to strengthen the landings species composition.

Step 8: Data analysis and Quality indicators

Sampling approach

Data analysis should exactly follow the sampling design and sampling probabilities at each stage of sampling, as specified in the WKPICS 2012 guidelines which has been adapted here for SSF fishing activity data collection (**Annex 4 of these guidelines**; ICES 2013b).

Quality indicators should be provided related to: i) potential for bias and representativeness of the sample (direction and possible magnitude of bias, potential part of the fleet not represented in the sample), and ii) precision of estimates (e.g., standard errors or a proxy such as numbers of PSUs sampled). See Annex 3 of WKPICS 2013 for a detailed review (ICES 2014).

Quality issues depend also on the good use of adapted estimation procedure and on accurate information to calculate the sample probabilities. Therefore, methodologies to calculate the estimates have to be checked and reviewed regularly.

Statistical imputation or raking methods could be used, at this stage, to improve the estimates and their precisions.

A common technique for handling item non-response is imputation, whereby the missing values are filled in with a replacement/substituted values (e.g., last observation carried forward, imputing an assumed outcome, imputing the mean, imputing based on predicted values from a regression analysis, ...) to create a complete data set that can then be analysed with traditional analysis methods. Because missing data can create problems for analysing data (introduce a substantial amount of bias, make the handling and analysis of the data more arduous, and create reductions in efficiency), imputation is seen as a way to avoid pitfalls involved with deletion of cases that have missing values. Some imputation methods replace the missing data and account also for the fact that these were imputed with uncertainty (e.g., multiple imputation, simple imputation methods with adjustment to the standard error). A few of the well known attempts to deal with missing data include: hot deck and cold deck imputation; listwise and pairwise deletion; mean imputation; regression imputation; last observation carried forward; stochastic imputation; and multiple imputation (Cochran 1977; Higgins and Green, 2011). Raking (otherwise known as iterative proportional fitting sample balancing or 'raking ratio' estimation) is a method for adjusting the sampling weights of the sample data based on known population characteristics, so that its marginal totals match control totals on a specified set of variables. The difference may arise, for example, from sampling fluctuations, from non response, or because the sample design was not able to cover the entire target population. By adjusting these weights, the survey sample is essentially forced to resemble the population, therefore 'making' inference to the entire population is possible (Battaglia et al., 2009).

Census approach

WGCATCH considers that the assessment of the coverage/completeness of the estimates reached by the data collection is an issue that will require much attention when census approach is used to survey SSF. This is linked with the evaluation of potential for bias, especially if part of the fleet could not be surveyed. Diagnostics are needed on non-response or refusals to supply data and reasons if known.

Frame survey outcomes (in particular level of active/part-time and inactive vessels inside the SSF fishing sector) constitute a good input to evaluate potential bias. However, frame survey outcomes have to be updated regularly as it could be changed year to year. Cross-validation of data available (when different sources of data exist) constitutes also a good procedure to verify the completeness of the information received and to calculate quality indicators associated. Specific coverage' validation surveys could be also implemented.

WGCATCH stresses the fact that fishing fleet registers include SSF vessels and, as quality insurance, concludes that first step will be the calculation of the % of vessels covered by the declarative data available. WGCATCH advises a specific check on vessels without any information or with part-time information to verify the completeness of their data and assess the reality of their inactivity.

The aims of this analysis are the following: (i) define which part of the total fleet is surveyed or not, (ii) estimate the share of activity not covered by the declarative forms and (iii) constitute a basis to apply some statistical techniques to treat the non-respondents (statistical imputation or raking methods could be used, at this stage, to improve the estimates, see previous section) and then limit the potential bias of the estimates.

WGCATCH notes that some countries use annual preliminary survey (annual frame survey) to assess, among others things, the global inactivity of the vessels following which is particularly useful for checking the completeness/coverage of the declarative data collected and encouraged others to develop such approach.

Step 9: Feed-back to improve the data collection

The achievements and issues emerging from the data collection scheme should be summarised, and the design and implementation of the scheme modified where needed to rectify problems, improve data quality and cost efficiency. Feed-back and consultation with fishermen participating in the scheme is important to maintain their interest and contribution.

Guidelines on best practices for biological data collection on SSF

The sampling methods to collect SSF biological data (length and age composition, discards rates and catches of PETS) should be based on (i) statistically sound sampling scheme, (ii) cost-efficiency, (iii) available means, (iv) reliability, and (v) should be defined to meet the data resolution (spatial, technical or temporal) and the level of precision required.

Extensive detailed information on sampling design for biological data and related issues encountered is given in the reports of WKMERGE (ICES, 2010), WKPICS 2011 – 2013 (ICES 2012b, 2013b, 2014), SGPIDS (ICES 2011, 2012a, 2013a), WGCATCH (ICES 2015, 2016) and WGRFS (ICES 2013c). These reports should be consulted to help designing a sampling scheme that meets the criteria for statistical soundness. These criteria can be found in the WKPICS2 guidelines for good practices. Best practices guidelines addressed in these previous reports will not be repeated here (only the principal bullet points will be mentioned). SSF on-shore and on-board sampling programmes face the same issues as for large scale fleets. However, SSF biological data collection has also some specific issues related with their specific features (as high spatial distribution, heterogeneity, seasonality, part-time activity or frequent direct sales) which will be detailed here. These issues may represent other potential difficulty to survey SSF biological data.

Step 1: Objective/Data needs

As for fishing activity data, the first step is to identify the target population and the type of estimates (domains of interest, such as catch species composition, length and age compositions, maturity, sex ratio, discards rates, catches of PETS, ...), the resolution of the estimates (e.g., spatiotemporal strata; gear types etc.), the level of precision that the data collection system is required to deliver and the types of data needed for these estimates. Several types of sampling schemes can be performed to collect SSF biological data:

- An **on-shore sampling scheme** which includes:
 - (i) **Market sampling:** SSF landings may be sold directly to the public at the landing site, or sold at another auction than the corresponding landing site after transportation. Random sampling at markets/auctions may therefore not capture all SSF landings. Large scale fleets landings may also be sold at these auctions. Biological data to be recorded with this sampling scheme is the same as for large scale fleets and include species lengths and age compositions, landings and BMS composition of trip. Sampling should follow the best cost-effective sampling design considering that it may not be possible, for instance, to sample small but important landing sites for SSF where fish could be sold directly and not through markets. Some assumptions may have to be considered in these cases depending in what are biological variables to collect.
 - (ii) **Landing site surveys (inquiries to fishermen):** This sampling scheme allows potential for collecting data and biological samples from all landing sites for SSF that are included in the frame, irrespective of where the catch is sold. It strongly depends on cooperation from fishermen and a good compliance/relation between observer and fishermen should exist to obtain reliable data. Important information on SSF

biological data can be potentially obtained on discarded or BMS species compositions and weights, presence of PETS in trip besides landed species information, etc. It is also possible to ask for gears used, effort and spatial information from trip. Data on length and age distributions are difficult to obtain with this approach unless the fishers are intercepted during landing and can make their catch available for sampling. Cross validation procedures should be performed using census data when it exists or with sporadic onboard sampling when possible.

(iii) Purchase of samples: Species specific biological data like lengths, weights, sex-ratio, maturity and age can be obtained by purchasing independent samples from SSF, referring to lengths/age composition of landings (species specific/total); association to gear(s) used in trip. There are examples also of arrangements where fishers also bring samples of discarded catch ashore for sale to the fisheries laboratory (with suitable dispensations), from which information on discarded catch can also be obtained (see next section). Sample purchasing schemes need to follow sound statistical design principles to reduce bias. For logistic and administrative convenience, a sample of fishers may be recruited to provide catch samples at intervals in a similar manner to the use of a reference fleet, and in this case the sample needs to be picked in a way that is as representative as possible of all the fishers in each sampling stratum.

- **An at-sea (on-board) sampling scheme** which includes:
 - (i) Onboard sampling: This sampling scheme, where an observer goes onboard to sample trips, is potentially the most reliable way to obtain complete biological data concerning to species and lengths composition for catch, weights, discard rates, catches of PETS, along with fishing activity variables (fishing areas, effort, gears used, etc.). However, issues of safety and space for observers on small vessels (which could be linked with existing regulation) can lead to exclusion of many vessels from an observer sampling frame, and this can lead to bias if these vessels fish in areas with different size/age compositions of fish than the remaining larger vessels.
 - (ii) Self-sampling schemes (ICES, 2008): This type of sampling is an alternative option to record onboard biological data from SSF. Several approaches of self-sampling can be used but all of them should be designed according to a statistically sound sampling scheme so that sampled vessels are as representative as possible of the non-sampled vessels within strata. It should include validation procedures for data quality control, and cross-checking of data using adequate quality indicators (data obtained from sampled vessels using the same gears, operating in the same areas, landing in the same ports, etc.) to evaluate bias:
 - a. *“Onboard self-sampling”*: Fishermen themselves do the sampling of the catch (measures of fish by fractions ‘landed’, ‘BMS’ and ‘discarded’) onboard and record gear, effort and spatial related information. This approach requires training courses for fishermen to know what and how to record the information needed and again data quality evaluation and

- validation procedures. Sampling coverage must be routinely analysed to assess the effectiveness of the scheme.
- b. *“At-site self-sampling of discards”*: In the onboard catch sorting process, fishermen sort catches from hauls and keep discards to deliver them to an observer when arriving at port. This arrangement requires the good will of fishermen to cooperate, which may require additional incentives such as payments provided this does not lead to any incentive to bring non-representative samples ashore. Fixed-value samples of discarded fish seem to be the appropriate approach to get the most representative data. In this sampling scheme, biological data related to discards is collected in laboratory by biologists/observers/technicians. Information on landings species composition, weights and fishing activity variables should also be supplied by fishermen. One important issue in this type of self-sampling is how the discard fraction from catch is collected: random subsample of discards vs total discards? Are the samples collected from a single haul (or subset of hauls) according to a sample selection rule, or from the overall trip? Clearly understandable, written instructions must be given to fishermen on how to collect the samples. Data collected should be validated by cross-checking with species or lengths composition from e.g.. onboard sampling in other vessel trip operating with the same fishing gear in the same area.

The other steps to follow to conduct a biological data survey are summarised below, with a specific attention to SSF features which implies some specific issues (see previous ICES reports for more detail on best practices guidelines for biological data collection):

Step 2-3: Pre-screening/Frame survey and selection of the type of sampling scheme

The next step is the evaluation of candidate data collection method. The choice between on-board, on-shore sampling scheme or a combination of the two, to survey SSF biological data, will be done based on the outcomes of the pre-screening survey (see previous section), and on issues of cost efficiency, desired level of precision and the resolution needed. From there, the identification of the primary sampling unit (PSU); vessel/trip or site/day ; will be done.

At this stage, fishing activity variables estimates provide auxiliary data on fleet structure, activity and catches, which is valuable to implement the most appropriate sampling scheme. This is needed also for raising the biological sampling estimates for sampled trips to the fleet as a whole, within any defined sampling strata.

The choice between the different sampling scheme methods should take into account the potential existence of a fishing activity variables sampling scheme: biological data collection sampling scheme could then be easily linked with it if there is one (see previous section).

At this stage, identification of specific regulation issues linked to safety and space for observers on board, should also be taken into account in order to evaluate the possibility to develop or not an on-board sampling program. If not, it could mean high difficulties to assess the overall discard rate of SSF and the SSF catches of PETS, especially

when alternative method as self-sampling program (*as described above*) could not be put in place.

Step 4: Data Collection method

Stratification of the sampling frame: Information from pre-screening survey (see previous section) such as list of all landings sites (including large and small ports) and fishing activity data estimates (see previous section) such as fishing effort distribution, spatial and temporal distributions, evaluation of heterogeneity in landings composition and in landed weights from SSF between ports/regions, can be used to identify which strata should be considered to plan SSF biological sampling design. Stratification may be advantageous for delivering estimates that might be required for specific fleet segments or regions, but should clearly link with any strata used in surveys for estimating fleet activity and landings whilst avoiding under-sampling of any stratum. The minimum number of PSUs to be sampled within each strata should be defined.

Specific analysis on spatial distribution of SSF fishing vessels and their landing and sales sites should be done in the pre-screening survey to determine if SSF landing sites for this fleet are being covered by a general sampling scheme that includes both large scale fleets and SSF, constituting then a most cost-efficient sampling scheme for SSF. However an additional specific sampling scheme may be needed to target non-sampled ports where SSF fleets dispose of their catches directly and not through markets covered by the general sampling scheme, if this is a sufficiently large part of the SSF catch.

Step 5: Design the sampling scheme

Establish and describe criteria for sampling effort distribution. The most cost-efficient design for the main species caught throughout the frame could be to distribute sampling effort proportional to total landed weights/value or number of sales/trips in each port (see simulation examples in the fishPi project). However, needs for less common, more locally distributed species estimates should also be considered and may require a more complex optimisation scheme. Accessibility of observers to specific ports should also be considered when distributing sampling effort, with the decision *a priori* to include or not less accessible landings sites in the list of ports to visit. The screening survey should be used to evaluate how much of the catch of each species may be excluded in this way.

The next step is to identify a method for randomised selection of PSUs within each stratum. This is discussed in detail in previous ICES reports of WKPICS, WGCATCH, SGPIDS, which should be consulted.

The representativeness of the samples should be assess taking into account that for SSF, in some cases, fishing activity data are not exhaustively collected (needing alternative procedures as the one used for large scale fleets).

Steps 6-9: Implementation, Data capture and Quality control, Data analysis and Quality indicators, Feed-back to improve the data collection.

Note: see also previous section for fishing activity data collection as these steps are generic steps for data collection best practices

All these steps must be routinely assessed in order to try to overcome possible constraints relating with SSF biological data sampling which could be the consequence of

specific features of the SSF fishing sector. One important task is to well document the proposed sampling design in order to provide an efficient tool to evaluate its feasibility and consistency through time.

Step 10: Comparison of biological data from SSF and Large Scale Fleets

Based on the first results of the sampling scheme or previous data collection, a comparison between catch species composition and length and age compositions of SSF and large scale fleet landings in comparable gear/mesh/area/time groupings should be performed. This may suggest ways in which the sampling schemes for SSF and large scale fleet biological data could be optimised to improve cost-efficiency. For example if there is no significant effect of vessel size, the data from sampling at markets or by observers on larger vessels could be applied to catch estimates for vessels too small to take observers, or from small sites where SSF catches are sold direct to the public and not transported to markets. As always, potential for bias should be investigated and documented in relation to the savings in costs of sampling.

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Annex 1 of the guidelines: Fishing activity by region under DCMAP regulation

Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	LOA classes (m) (d)					
Activity	Gear classes	Gear groups	Gear type	Target assemblage (a)	Mesh size and other selective devices	< 10	10-<12	12-<18	18-<24	24-<40	40 & +
Fishing activity	Dredges	Dredges	Boat dredge [DRB]	Anadromous species (ANA) Catadromous species (CAT) Cephalopods (CEP) Crustaceans (CRU) Demersal species (DEF) Deep-Water species (DWS) Finfish (FIF) Freshwater species (no code) Miscellaneous (MIS) Mixed Cephalopod and Demersal (MCF) Mixed Crustaceans and Demersal (MCD) Mixed Deep-water species and Demersal (MDD) Mixed Pelagic and Demersal (MPD) Molluscs (MOL) Large Pelagic fish (LPF) Small Pelagic fish (SPF) Large Pelagic fish (LPF) and Small Pelagic fish (SPF)	(b)						
			Mechanised / Suction dredge [HMD]		(b)						
	Trawls	Bottom trawls	Bottom otter trawl [OTB]		(b)						
			Multi-rig otter trawl [OTT]		(b)						
			Bottom pair trawl [PTB]		(b)						
			Beam trawl [TBB]		(b)						
			Pelagic trawls		Midwater otter trawl [OTM]	(b)					
					Midwater pair trawl [PTM]	(b)					
		Hooks and Lines	Rods and Lines		Hand and Pole lines [LHP] [LHM]	(b)					
					Trolling lines [LTL]	(b)					
	Longlines		Drifting longlines [LLD]		(b)						

		Set longlines [LLS]	(b)						
Traps	Traps	Pots and Traps [FPO]	(b)						
		Fyke nets [FYK]	(b)						
		Stationary uncovered pound nets [FPN]	(b)						
		Fixed installations for fences and weirs (code needed)	(b)						
Nets	Nets	Trammel net [GTR]	(b)						
		Set gillnet [GNS]	(b)						
		Driftnet [GND]	(b)						
Seines	Surrounding nets	Purse seine [PS]	(b)						
		Lampara nets [LA]	(b)						
	Seines (c)	Fly shooting seine [SSC]	(b)						
		Anchored seine [SDN]	(b)						
		Pair seine [SPR]	(b)						
		Beach and boat seine [SB] [SV]	(b)						

	Other gear	Other gear	Glass eel fishing (no code)	Glass eel	(b)							
	Misc. (Specify)	Misc. (Specify)			(b)							
Other activity than fishing				Other activity than fishing								
Inactive				Inactive								

Footnotes:

- (a) according to existing coding in relevant Regulations
- (b) according to existing coding in relevant Regulations
- (c) with Fish Aggregating Devices (FADs)/in free schools
- (d) in the Mediterranean <6m and 6-12m

Annex 2 of the guidelines: Frame survey' example: "Activity Calendar Survey" used in France (SIH-Ifremer)

The reality of the activity of the French fleet is well assessed through the exhaustive "Activity Calendar Survey" (see figure below) applied every year in all regions on the basis of preliminary documentation provided by available declarative data (logbooks, monthly declarative forms, sales notes) and direct and indirect survey done by a set of observers. It covers the whole of the reference population and provides monthly activity schedules indicating the main fishing grounds and "métiers" operated by the vessels. It is to be noticed that this procedure has the benefit to provide the "métiers" as given by the fisherman himself throughout the year on an exhaustive basis and provide information on the part of fishing activity which is not included in available declarations.

FISHING FLEET ACTIVITY CENSUS Individual annual fishing calendar																														
Registration Code	Starting date	Ending date	Vessel name	District Name	Port Name	Loa	Tonnage	Power (kW)	Owner code and name	EU main gear code and subsidiary gear code	Year building																			
			Métier 1				Métier 2				Métier 3				Métier 4				Métier 5											
Month	Dis- lost	Port	Owner	Crew	DAS	FD	Métier	O	Area 1	R	Area 2	R	Métier	O	Area 1	R	Area 2	R	Métier	O	Area 1	R	Area 2	R	Métier	O	Area 1	R	Area 2	R
J																														
F																														
M																														
A																														
M																														
J																														
J																														
A																														
S																														
O																														
N																														
D																														

DAS = NB days at sea during the month / FD = NB fishing days / O = Origin of information (I = from interview, L = from Logbook analysis) R = Fishing range of operation :Lagoon, Inshore, Mixed, Offshore

Reliability of information	Activity Evolution	2006	2007	Panel	Owner data : address phone
<input type="checkbox"/> Direct	NB days at sea / year			Would you agree to participate another enquiry, belong to the Panel ? Yes <input type="checkbox"/> No <input type="checkbox"/>	
<input type="checkbox"/> Estimation	NB fishing days / year				
<input type="checkbox"/> Indirect	NB motor hours / year				

Métiers in logbooks or fishing forms : All Some (A) No

First selling : All through auction market Partly through auction (B) Totally out of auction

Whole landings = A + B

Species completely sold through auction market : / / / /
 Species completely sold out auction market : / / / /

Such survey provide input each year for the typological classifications of vessels (inactive/active vessels and classification by "métiers"), makes also possible the definition of sampling plans to structure the routine data collection program. It is a very useful tool to assess and check the completeness, reliability, accuracy and pertinence of declarative data available and sometimes to re-evaluated them. It constitutes, as well, the exhaustive basis to calibrate the estimates calculated on the basis of on-site survey sampling program and allow improving precision of them.

Annex 3 of the guidelines: Small-scale fishery data collection (Eastern Baltic)

Lithuania

In Lithuania coastal fishery with boats below 10 m is considered as SSF segment. Coastal area is subdivided into so called fishing bays (Figure 1). Licenses for fishery are fixed to certain fishing bay. For effort and landing data coastal logbooks are introduced by internal regulation. Fishermen are obliged to fill out logbooks as soon as fishing gears checked and catch picked up. Logbook contains information on (Figure 2):

1. No of fishing bay;
2. Name of the boat;
3. Gear type;
4. Mesh size or number of hooks;
5. Total length of gillnet or longline;
6. Soaking time (from - to);
7. Species composition in kg and individuals;
8. Information on purpose of catch, buyers, price, etc.

At the end of each month fishermen have to provide monthly report on fishery to authorities. Declaration contains summary of logbooks. Example of declarative form is presented in Figure 3.

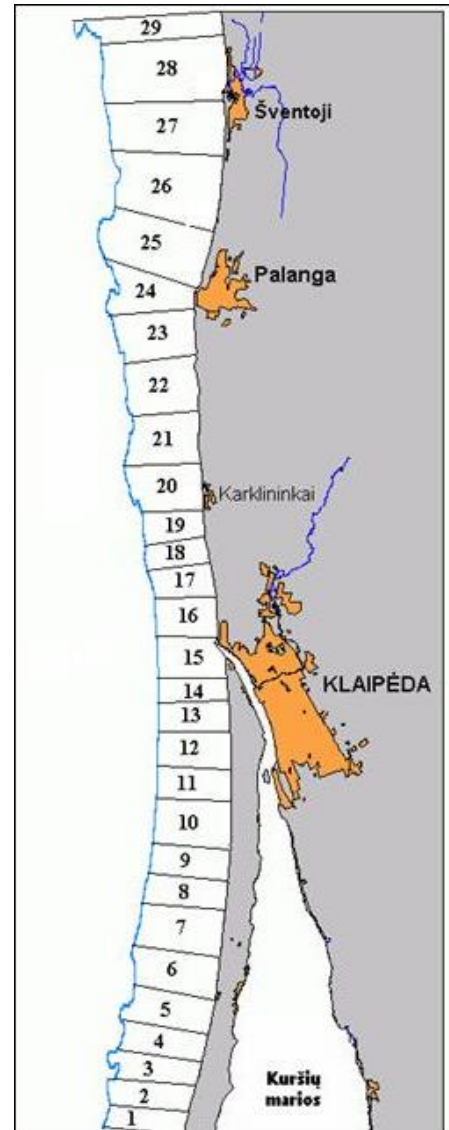


Figure 1. Mapping of fishing bays in Lithuanian coastal area

Figure 2. Example of coastal fishery logbook

Data	Žvejybos vieta (baro Nr.)	Žvejybos laivo pavadinimas ir registracijos Nr.	Žvejybos įrankiai				Žvejybos įrankių pastatymo laikas	Žvejybos įrankių tikrinimo data ir laikas	Sugautos žuvys (kg)					Duomenys apie žuvų pamojejimą (tam pareikšti reikiama patvirtuota dokumento Nr., data)	Realizuota žuvų kiekis (kg) (84 PYS)
			tipas	akių dydis (mm)	bendras ilgis (m)	kablukų skaičius (vnt.)			rūšis	apytikslis svoris	tikslus svoris	+	-		

Figure 3. Monthly declaration form

(įmonės/ ūkio pavadinimas)

MĖNESIO ŽVEJYBOS BALTIJOS JŪROS PRIEKRANTĖJE ATASKAITA Ž-2

Nr. _____ (data)

_____, _____ (sudarymo vieta)

Ataskaitos laikotarpis 20 _____ m. _____ mėn.

Garantuojamas gautų duomenų konfidencialumas

Pateikiama: iki mėnesio 10 dienos už praėjusį mėnesį.
 Žuvininkystės tarnybai prie Lietuvos Respublikos žemės ūkio ministerijos faksu (8 46) 257 745 arba paštu: Naujoji Uosto g. 8A, 92119 Klaipėda

Žvejybos laivo pavadinimas ir registracijos Nr.	Žvejybos vieta (baro Nr.)	Žuvų šikrovimo vieta	Žvejybos įrankiai				Žvejybos dienų skaičius	SUGAVIMAI, kg																							
			tipas	akių dydis (mm)	bendras ilgis (m)	kablukų, gaudyklų skaičius (vnt.)		M E N K Ė S	S T R I M E L E S	LAŠIŠA (vnt.)	(kg)	ŠLAKYS (vnt.)	(kg)	P L E K Š N Ė S	O T A I	S T I N T O S	K A R Š I A I	S T A R K I A I	E Š E R I A I	I Š V I S O											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24								
IŠ VISO:																															
								val.		min.																					

_____ (įmonės vadovo arba jo įgalioto asmens pareigų pavadinimas)
 (vardas ir pavardė) _____ (parašas)

Kiekvieno tipo įrankiais sužvejotų žuvų svoriai nurodomi atskirai, o sužvejotų statomaisiais tinklaisiais – ir atskirai pagal skirtingus tinklaičių akių dydžius: iki 24 mm, 45–49, 50–69, 70–90, per 90 mm.

Latvia

All Latvian coast line is divided by borders of districts (Figure 4). Spatial mapping of SSF distribution along coastal line is possible on districts border level.

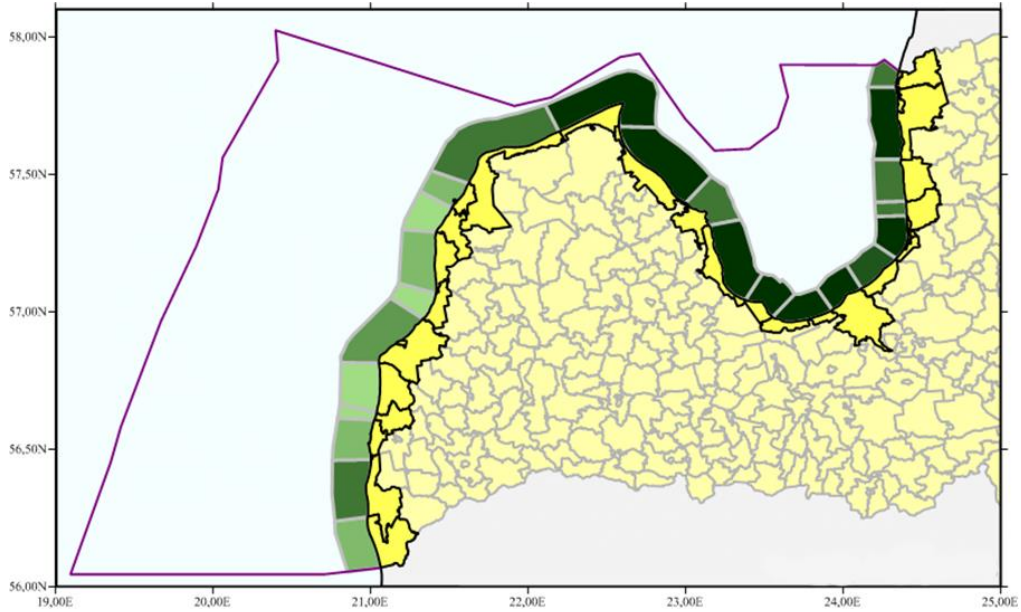


Figure 4. Borders of districts in Latvian coastal area

Each district has limited number of allowed fishing gears per year which are distributed between fishermen. Fisherman can work only in district where he has license. All fishermen are obliged to fill monthly reports (coastal logbooks) and send them to fishing control agency. Control agency perform monitoring of fishermen along all coastal area. The form of coastal logbook and rules about its filling are written in fishery rules of Latvia. Coastal logbook contains information (Figure 5) about:

- Coastal logbook number.
- Year, month.
- Fishing place.
- Baltic Sea or Gulf of Riga.
- District name.
- License owner.
- Company name.
- Registration number.
- Phone number.
- Allowed fishing gears according license.
- Information about fishing inspector.
- Signature of fishing inspector.
- Catch composition by species for each date for each fishing gear.
- Signature of fisherman.

PIEKRASTES ZVEJAS ŽURNĀLS NR 05/05

Aprīlis - Februāris
2013.gada _____ (mēnesis) _____ (mēnesis)
BALTĪJAS JŪRAS PIEKRASTE
(Izņemot jūras Rīgas jūras līci un Vēlēt līdzenumu, ja nepieciešams, jānorāda līdz Kokas raganam)

VENTSPILS
(pagasts, pašvaldība)
TĀRGALE
(ģimnāzija, skola)

Licences īpašnieks IK DAL
(ģimnāzija, skola)

(ģimnāzija, skola vai individuālā komersanta R.ģ. Nr., adrese, tālrunis)

Aizpildītais žurnāls nododams izsniedzējam līdz nākošā mēneša 6. datumam

Žurnālu izsniedza:
Jūras un iekšējo ūdeņu pārvaldes VENTSPILS kontroles sektors

g. Kalviņš
(inspektorģimnāzija, skola, tālrunis Nr.)

2013. gada 3. februāris

LICENCE
ZVEJAS ŽURNĀLS
RA-120

Izmantojamie zvejas rīki:

Nr. p.k.	Zvejas rīks	Skaits	Izmēri	Marķējums
1	ZIVJU TĪKLS	20	80-180mm	
2	Akmenplekstu tīkls	10	-240mm	
3	MENCA	966,95	kg	
4	LUCŪ MURDS	5		
5	Zivju āķi	100		

Paskaidrojumi:

- Izmantojamo zvejas rīku tabulā ieraksta licencē atļauto zvejas rīku nosaukumu (veidu) un to skaitu; izmēru ailē - līnuma acu izmēru, mirdiem - arī sētas garumu, vadam - arī atvērumu; marķējuma ailē - lietoto zvejas rīku marķējumu.
- Zvejas žurnālā tūlīt pēc zvejas norāda attiecīgajā datumā nozvejoto zivju daudzumu pa sugām, izmantoto zvejas rīku veidu, to skaitu, līnuma acs izmēru un dienu skaitu attiecīgajā zvejas reizē, kad minētais rīks izmantots zvejā.
- Vada zvejā ziņas par nozveju ieraksta katru zvejas dienu un norāda vada vilkšanas reizu skaitu dienā.
- Lašu, taimiņu un varavīksnes foreļu nozveju norāda pēc skaita (gabalos) un pēc svara (kilogramos) abpus šķērssvītrai (gab./kg).

Piezīmes.

- Informāciju par iezīmēto vai reto zivju, cūkdelfīnu un roņu noķeršanu, norādot to noķeršanas laiku, vietu un zvejas rīku, nodod licences izsniedzējam vai nosūta valsts aģentūrai „Latvijas Zivju resursu aģentūra” Daugavpils ielā 8, Rīgā, LV-1007 (tāl. 7617527).
- Zivs iezīmēšanas zīmītes nosūtītājs saņem informāciju par zivs iezīmēšanas un tās iespējamās migrācijas apstākļiem.

un datums	Izmantojamie zivju sugas nozveja (kg) (lašiem, taimiņiem - gab./kg) *											Kopā (kg) *	Zveja izmantotā kuģa reģ. numurs
	Nosaukums, skaits, līnuma acs izmērs	Zvejas dienu vai vada vilkšanas reizu skaits	Vilks	Laši	Taimiņi	Īste	Varavīks	Sīga	Zaļānā	Menca			
1. 02.14	Zivju tīkls 100-180mm	1	20	4/10	6/15	10	10					65	RA-120
2. 02.15	Zivju tīkls 140-180mm	1	40	8/04	17/50		10					124	
3. 02.16	Zivju tīkls 100-140mm 200-240mm	1	30	2/9	6/14		5	2	2	10		72	
4. 02.24	Zivju tīkls 200-240mm 100-140mm	1	50	7/30	21/50		5	2	2	10		149	
5. 02.25	Zivju tīkls 200-240mm 100-140mm	1	20	2/8	10/21							49	
6. 02.26	Zivju tīkls 200-240mm 100-140mm	1	20	20/70	24/62					10		162	
KOPĀ:			180	43/151	88/212	10	30	4	4	30		621	

* zivju sugas nosaukumu attiecīgajā ailē ieraksta zvejnieks
Atbildīgais par zveju *Ervinis Vilcziņš*
(vārds, uzvārds, paraksts)

Figure 5. Example of coastal fishery logbook

Estonia

Estonian Small Scale Fishery is regulated on the basis of issued fishing permits (historical fishing rights), which regulate the number of particular gears used. The number of different gears that can be used by SSF in Estonia is thus limited as historical fishing rights shares which are issued to individual fishers or companies and can be freely traded within Estonia. The number of allowed fishing gear (historical fishing rights) is regulated annually by the government of the Republic of Estonia. All landings have to be reported in logbooks which are issued together with historical fishing rights. Data on all landings of all fish species is recorded in logbooks and have to be reported monthly to the Ministry of Rural Affairs and stored in Estonian Fisheries Information System (since 2005). Estonian coastal log-books contain information about:

- Date of shooting and hauling (date of hauling was added in year 2015)
- Location of shooting and hauling
- Place of landing
- Gear type and count
- Total amount of catch by species in kg-s (number of individuals for salmonids)

Coastal log-books also contains the information about the owner of the permit, number of the permit, commercial register number, name of the fisherman and issuer of the permit (Figure 6).

COASTAL LOG-BOOK NR												PAGE NR			
Report month..... year 20.....				Owner of the permit				Frequency							
Number of the fishing permit.....				Commercial register number.....				48 h <input type="checkbox"/> 1 month <input type="checkbox"/>							
Date		Locati on	Landing site	Gear		Amount of fish by species									
Shooting	Hauling			Type	Nr	7	8	9	10	11	12	13	14	15	16
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
		Location	Landing site	Type	Nr	Amount of fish by species, gear and locations									
SUMMARY															

Comments:

Filled by the reporter:		Receiver (date of acceptance and signature of the receiver):	
Date of submission			
First and the last name of the filler			
Signature			
Registration Nr. of the vessel	Fisherman	Issuer of the permit	

Figure 6. An example of SSF logbook used by small fishing boats in Estonia.

Poland

Fishermen in Poland involved in the SSF when use the vessels with length ≥ 10 -m are obliged to use logbooks (the e-logbooks or the traditional paper logbooks) for reporting fish catches. Vessels < 10 -m by length, report their catches in the monthly catch reports (MCRs) under the daily resolution. It should be added that most of boats (< 10 m length) do not participate in the Baltic cod annual catch quota partition. However, if such size boats obtained cod annual catch quota is obliged reporting catches in a paper logbook. The example of MCR is presented in Figure 7. The key fields from the reports (MCRs), which are important for CPUE calculation are: vessel parameters, trip details, type of fishing gear used, fishing time, fishing locations, fish species composition (landings of given taxa) by weight. If in the given month the vessel not participated in fishing such information should be indicated in the MCR. Information about the mesh size in applied fish gear is not mentioned in MCRs from small vessels (< 10 -m). Moreover, in MCRs is a lack of detailed information about date and time of departure and arrive to a home-port. The VMS system is not applied on boats with length ≤ 11.99 -m.

WZÓR
MIESIĘCZNEGO RAPORTU POŁOWOWEGO

MIESIĘCZNY RAPORT POŁOWOWY Nr
statku rybackiego
za maj 2011 (miesiąc i rok)

Gatunki organizmów morskich wraz z ich kodami		Włók denny.....OTB Włók pelagiczny.....OTM Tuka pelagiczna.....FTM Tuka dema.....FTB Pławnice.....GND Mance, pety, wontony.....GNS Szuty haczykowe zakotwiczone.....LLS Szuty haczykowe dryfujące.....LLD Niewody dobrzeżne.....SDN Więcierze, żaki i inne pułapkowe.....FPO Narzędzia różne.....MIS	
Babkowate.....GPA	Losoń.....SAL	Szczupak.....FPI	
Belona.....GAR	Makrela.....MAC	Śledź.....HER	
Boleń.....ASU	Minog rzeczny.....LAR	Troć.....TRS	
Certa.....VIV	Mięsny.....FBU	Ukleja.....ALR	
Ciosa.....FSC	Okon.....FPE	Węgorzyc.....ELE	
Dorsz.....COD	Płoc.....FRO	Węgorzyc.....ELP	
Gładzica.....PLE	Pstrąg łącz.....TRR	Inne.....MZZ	
Jazgarz.....ACC	Sandacz.....FPF	morskie.....MZZ	
Karaś.....FCC	Sieja.....PLN	Inne.....FRF	
Karp.....FCP	Skarp.....TUR	słodkowodne.....FRF	
Krap.....ABK	Stomia.....FLE		
Leszcz.....FBM	Stynka.....SME		
Lin.....FTE	Sum.....SOM		

rodzaje narzędzi połowowych wraz z ich kodami

Data i godzina wyładunku	Czas połowów w godzinach	Rejon połowu kwadrat baltycki/morskie wody wewnętrzne*	Użyte narzędzia połowowe		Masa w kilogramach żywej wagi albo masa w kilogramach żywej wagi i liczba w sztukach gatunku złowionych organizmów morskich **						Gatunek złowionych organizmów morskich (KpD)		
			rodzaj (Kod)	liczba	ELE	FPE	FSC	FCC	FRO				
10.05.2011 10:00	2.4	W11-4	FPO	10	4	35	30	5	15				
14.05.2011 11:00	2.1	-11-	-11-	10	3	45	35	10	20				
16.05.2011 11:00	2.4	-11-	-11-	10	2	40	45	6	15				
21.05.2011 11:00	2.4	-11-	-11-	12	0	43	30	6	30				
16.05.2011 10:00	2.1	-11-	-11-	12	1	20	25	5	26				
11.05.2011 11:00	2.4	-11-	-11-	12	0	30	30	7	90				
14.05.2011 11:00	2.1	-11-	-11-	12	3	40	100	3	25				
17.05.2011 11:00	2.1	-11-	-11-	12	4	35	150	5	20				
21.05.2011 10:00	2.1	-11-	-11-	12	3	40	45	6	29				
23.05.2011 11:00	2.4	-11-	-11-	12	5	25	30	8	25				

Urząd Nr 84
5425
Poz. 780

10.06.2011

Figure 7. An example of MCR used by small fishing boats in Poland.

Logbooks and MCRs are submitted to the Polish Fisheries Monitoring Centre (FMC) in Gdynia (a part of the Fisheries Department under the Ministry of Maritime Economy and Inland Navigation in Warsaw). It should be mentioned that most of the vessels use the e-logbooks and information about each haul is registered and transferred to FMC every day of fishing activities and in the case when the catch information is registered in the traditional paper logbooks data are delivered to FMC 2-times per week. In logbook is registered sum of daily catches per species, type of fishing gear applied, mesh size in codend of given gear, statistical rectangle where fishing was realized, number of fishing operations, date and time of departure and arrive to a home-port. In a paper logbook is a lack of information about catch composition (by weight) from particular hauls.

Distribution of the Polish commercial fish catches, fishing effort and values of these landings in the southern Baltic, i.e. in areas where exploitation in 2014 was realized mostly by the SSF is presented in Figure 8.

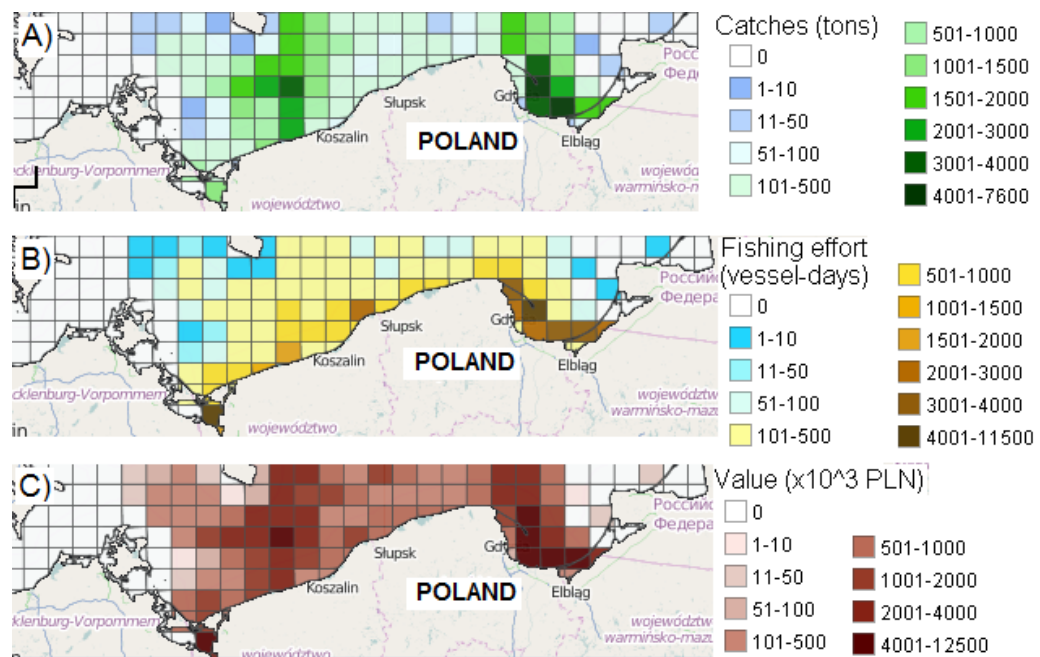


Figure 8. Distribution of the Polish commercial catches of all fishes (in tones; part A) in the southern Baltic and fishing effort (in the number of vessel-days; part B) and values of these landings (in the Polish currency; part C) in 2014, accordingly to the Polish fishing statistical rectangles (modified after Szymanek and Szura 2015).

Annex 4 of the guidelines: Best practices guidelines table for SSF' fishing activity data collection: Documentation of sampling design, performance of sampling and production of estimates.

Documentation of sampling design, performance of sampling and production of estimates			
Process that need to be described	Best practice	Comment	Bad practice
Target population	The target population needs to be identified and described. Access to the target population for sampling purposes need to be analysed and documented.	In the case of SSF, difficulties to get access to different landing sites are frequent (e.g. beaches, many islands etc. Elements that are not accessible should be documented. Knowledge of the structure is important for designing the sampling scheme.	
Primary sampling units (PSUs)	Choice of PSUs should be identified, justified and documented. PSUs could be trips, vessels*time or sites*time (harbours, markets, access points). Size of PSUs should be documented	If PSU is something else than trip, vessel or site the choice need to be thoroughly explained.	
Sampling frame	The sampling frame (list of PSUs) should be a complete list of non-overlapping PSUs. The sampling frame should ideally cover the entire target population.	If it is not possible to cover the entire target population with the sampling frame, it is good practice to clearly describe how large the excluded part of the population is and the reason for excluding it. In the case of SSF this could happen with some minor ports, inaccessible landings sites etc. If the sampling frame is a list of vessels, it is recommended to update this list (e.g. vessels living and entering the fleet)	To exclude large parts of the target population in an ad-hoc way.
Stratification of the sampling frame	Strata should be well defined, known in advance and fairly stable. Clear definitions and justifications of strata should be available. One PSU can only be in one stratum. The minimum number of samples within a stratum is dependent on objective, PSU and variance and needs to be calculated. The number of samples within a stratum needs to be justified, in particular if it is below 10.	If the desired minimum number of samples per stratum is not analytically assessed, the choice needs to be justified and described. Care needs to be taken to avoid over-stratification.	To over-stratify (few or no samples in each strata) the sampling schemes. Over-stratification results in increased risk for bias, particularly for ratio estimates, and a need to impute data.
Distribution of sampling effort	The way sampling effort is distributed between strata needs to be described. In accordance with best practice, this can be	If other methods, such as expert judgment are used, this should be explained and justified.	

	based on analysis of variance or just distributed proportionally. The different sampling inclusion probabilities/weighting need to be documented.		
Sample selection procedure	In accordance with good practice, the selection of PSUs to sample should be done in a controlled way allowing for estimation of sampling inclusion probabilities for the different samples. In principal this mean that samples shall be chosen randomly (probability based sampling). Random sampling can be either simple random sampling or systematic random sampling. The selection procedure needs to be justified and described	If it is impossible to use probability-based sampling, the samples need to be thoroughly validated for how representative they are. This process need to be described. If a non-probability based sampling design is applied, this needs to be accounted for in the estimation process (e.g. model based estimations). This needs to be thoroughly explained. For small-scale fisheries where there is no census information on the target population, the only way to sample in accordance with good practice is randomly.	Ad-hoc based sampling, without proper documentation to allow estimation of bias, where the sampling inclusion probabilities cannot be estimated.
Hierarchical structure in the sampling	All the levels in the hierarchical structure of the sampling scheme need to be documented. Sampling should be random at all levels. Sampling probabilities should be worked out at each level, and information for this needs to be collected (e.g number of boxes)		Failure to account for the different levels of sampling units in the design and estimation processes. (Risk for bias as well as hiding true variation)
Protocol for selection of samples at lower sampling levels (SSU, etc.)	Such protocols should exist in a national repository		
System to monitor performance of sampling schemes - Quality Indicators	Non-response rates should be recorded. Precision of estimates (relative standard error) should be calculated, where relevant. Effective sample size (or appropriate proxy such as number of vessels or trips sampled) should be calculated and recorded.	For SSF is quite frequent to contact skippers asking permission for sampling landings. This should be done randomly and non-response and refusal rates should be recorded. In at sea SSF observers' programmes refusal rates are quite common due to different reasons (i.e. safety reason). These refusal rates should be analysed). Self-sampling and interviews for gathering total catch, catch composition, effort could be an alternative. New and modern technologies (i.e. CCTV, smartphones apps etc.) adapted to these fisheries is another alternative.	

<p>Documentation of raising/weighting procedure for national estimates</p>	<p>Data analysis methods should be fully documented, covering: (1) how the multi-stage sample selection is accounted for in the raising/weighting procedures; (2) ancillary information (for example from fleet census data), that is used to adjust sample weights to correct for any imbalance in samples compared to the population; (3) methods of adjustment for missing data and non-responses.</p>	<p>For small-scale fleets with no fleet census data, the total fleet activity data have to be obtained from a separate fleet survey. (e.g. If there is a known register of vessels, the frame can be set up with vessel).</p>	
<p>Validation/Diagnostics</p>	<p>E.g., Independent checks of self-reported data and questionnaires; check trip reports with dealer reports.</p>	<p>Fisheries consultation and validation surveys should be recommended. Cross validation procedures should be performed using census data when it exists or with sporadic on-board sampling when possible. If self-sampling is the methodology used, training courses for fishermen to know what and how to record the information needed. Data quality evaluation, validation procedures, sampling coverage must be routinely analysed.</p>	