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Report of the Working Group on Commercial Catches (WGCATCH)

10–14 November 2014

ICES HQ, Copenhagen, Denmark

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

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Executive summary

The Working Group on Commercial Catches (WGCATCH), chaired by Mike Armstrong (UK) and Hans Gerritsen (Ireland), met in ICES HQ, Copenhagen, Denmark, 10–14 November 2014. The meeting was attended by 34 experts from 21 laboratories or organizations, covering 16 countries.

Currently, an important task for WGCATCH is to improve and review sampling survey designs for commercial fisheries, particularly those for estimating quantities and size or age compositions of landings and discards and providing data quality indicators. However, the scope of WGCATCH is broader than this, covering many other aspects of collection and analysis of data on fishing activities and catches. This will be end-user driven, and coordinated with the work of other ICES data EGs such as the Working Group on Biological Parameters (WGBIOP), the Planning Group on Data Needs for Assessments and Advice (PGDATA) and the Working Group on Recreational Fisheries Surveys (WGRFS) to ensure synergy and efficiency.

The report of the meeting commences with background information on the formation of WGCATCH and its overall role. The remainder of the report provides the outcomes for each of the Terms of Reference (ToRs) and responses to external requests, the proposed future work plan and the ToRs for the 2015 meeting.

The group formed two large subgroups to deal with the two major terms of reference which are the development of guidelines for carrying out sampling of catches on shore and the provision of advice on adapting sampling programmes to deal with the landing obligation.

In order to evaluate methods and develop guidelines for best practice in carrying out sampling of commercial sampling of commercial fish catches onshore, a questionnaire was circulated before the meeting. This questionnaire was structured around guidelines developed by the ICES Workshop on Practical Implementation of Statistically Sound Catch Sampling Programmes (WKPICS) for best practice at each stage of the sampling process, and asked for a description of current practices at each of these stages. Based on these questionnaires, common and specific problems were catalogued and potential solutions were identified. At the same time, the discussion of the questionnaires provided a form of peer-review of the sampling designs and identified where improvements could be made. WGCATCH provided guidelines for designing a sampling survey and summarized earlier guidelines provided by the 2010 Workshop on methods for merging métiers for fishery based sampling (WKMERGE)

The other main subject addressed by WGCATCH concerns the provision of advice on adapting sampling protocols to deal with the impact of the introduction of the landing obligation, which will alter discarding practices and result in additional categories of catch being landed. A second questionnaire was circulated before the meeting to allow the group to identify the fleets that will be affected and possible issues that are anticipated, as well as to propose solutions to adapt existing monitoring and sampling schemes and to quantify bias resulting from the introduction of this regulation. WGCATCH outlined a range of likely scenarios and the expected effects of these on fishery sampling programmes, and developed guidelines for adapting sampling schemes. The group also explored a range of analyses that could be conducted in order to quantify bias resulting from the introduction of the landing obligation. Finally a number of pilot studies/case studies were summarized, highlighting the practical issues involved.

The group provided advice on how the Regional Data Base (RDB) should be developed to support design-based data collection and estimates. This issue was also dealt with by the Workshop on the Regional Database WKRDB 2014-1 (27–31 October 2014, Aberdeen, UK), and WGCATCH reviewed and endorsed the findings of this workshop. WGCATCH had intended to review further test applications of quality assurance reports for fishery sampling developed by WKPICS, but it was not possible to test these further before this year's meeting. Some general comments on future development of quality indicators are given in the report. In relation to future work, WGCATCH drafted the Terms of Reference and intersession work plan for its 2015 meeting, and drafted the terms of reference for a proposed Workshop on Evaluating the Implementation and Statistical Aspects of Concurrent Length Sampling (WKISCON2). This workshop will evaluate the end-use and benefits of this form of sampling, in order to inform any decisions concerning its continued inclusion as a mandatory requirement in the new EU Multi Annual Programme (EU-MAP), the successor to the Data Collection Framework.

1 Introduction

1.1 Terms of Reference and work completed

This was the first meeting of WGCATCH. The final Terms of Reference were agreed by the 2014 meeting of the ICES Planning Group on Commercial Catches, Discards and Biological Sampling (PGCCDBS, ICES, 2014), and are as follows:

The Working Group on Commercial Catches (WGCATCH), chaired by Mike Armstrong (UK) and Hans Gerritsen (Ireland), will be established and will meet in ICES HQ, Denmark, ICES, 10–14 November 2014 to:

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 onboard and port sampling developed by WKPICS, SGPIDS and PGCCDBS, make improvements for further testing, and develop clear guidelines for completing and interpreting the tables.

The meeting was attended by 34 experts from 21 laboratories or organizations, covering 16 countries (Annex 1; Figure 1.1), and at intervals by the ICES Secretariat.

Figure 1.1. Countries participating in WGCATCH in blue.

WGCATCH also responded to recommendations or requests for advice from ICES Expert Groups, or external bodies such as the Regional Coordination Meetings (RCM) established by the European Commission to coordinate Member State (MS) activities under the Data Collection Framework (DCF).

The meeting comprised a mixture of plenary sessions involving all participants, and two large subgroups dealing with ToR 2 (shore sampling) and ToR 3 (effects of the landing obligation). The subgroups reported back in plenary each day. Report text completed at the meeting was reviewed in plenary, as were the proposed ToRs for the 2015 meeting of WGCATCH and the associated work plan. A number of presentations were given at the meeting, and a brief summary of each one is given in Annex 5.

1.2 Report content

The report of the meeting commences with background information on the formation of WGCATCH and its overall role. The remainder of the report provides the outcomes for each ToR and responses to external requests, the proposed future work plan and the ToRs for the 2015 meeting. These are draft ToRs and these may change depending on requests from end-users.

1.3 Background to formation of WGCATCH

During the 2013 PGCCDBS meeting (ICES, 2013a), members of the subgroup dealing with fleet-based fishery sampling proposed that their work would be better undertaken during a dedicated Working Group, which would allow more time to focus on its ToRs and develop its role to meet the changing demands for fishery data in coming years. This WG would also build on the comprehensive frameworks developed through the Study Group on Practical Implementation of Discard Sampling Plans (SGPIDS; ICES, 2013b) and the Workshop on Practical Implementation of Statistically Sound Catch Sampling Programmes (WKPICS; ICES, 2013c) and the earlier workshops on data collection and data quality evaluation WKACCU (ICES, 2008), WKPRECISE (ICES, 2009) and WKMERGE (ICES, 2010). A proposal for a Working Group on Commercial Catches (WGCATCH) was developed by PGCCDBS 2013 and the final ToRs were developed by PGCCDBS 2014 (ICES, 2014). The evolution of PGCCDBS into separate working groups is illustrated in Figure 1.2.

At roughly the same time, ICES revised its science and advisory strategies with increased focus on an ecosystem approach and benchmarking of the components of the assessment process. The system of Steering Groups, which oversee Expert Groups dealing with particular topics, was revised to improve the delivery of data and analysis into the benchmark process (Figure 1.3). The Steering Group on Integrated Ecosystem Observation and Monitoring (SSGIEOM) was altered to become a joint ACOM-SCICOM steering group including WGCATCH, the Working Group on Biological Parameters (WGBIOP), the Working Group on Recreational Fisheries Surveys (WGRFS) and the Planning Group on Data Needs for Assessments and Advice (PGDATA) within its remit. Some of the generic Terms of Reference for WGCATCH from 2015 onwards reflect the need for a joined-up approach to EG work within the Steering Group.

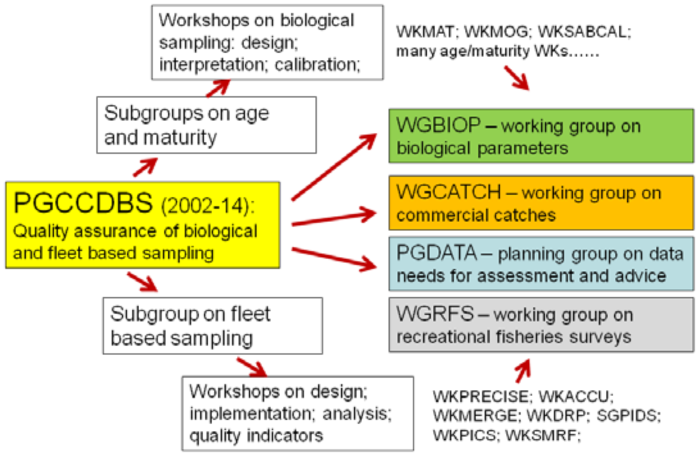


Figure 1.2. Evolution of the Planning Group on Commercial Catches, Discards and Biological Sampling (PGCCDBS) into separate working groups and planning groups.

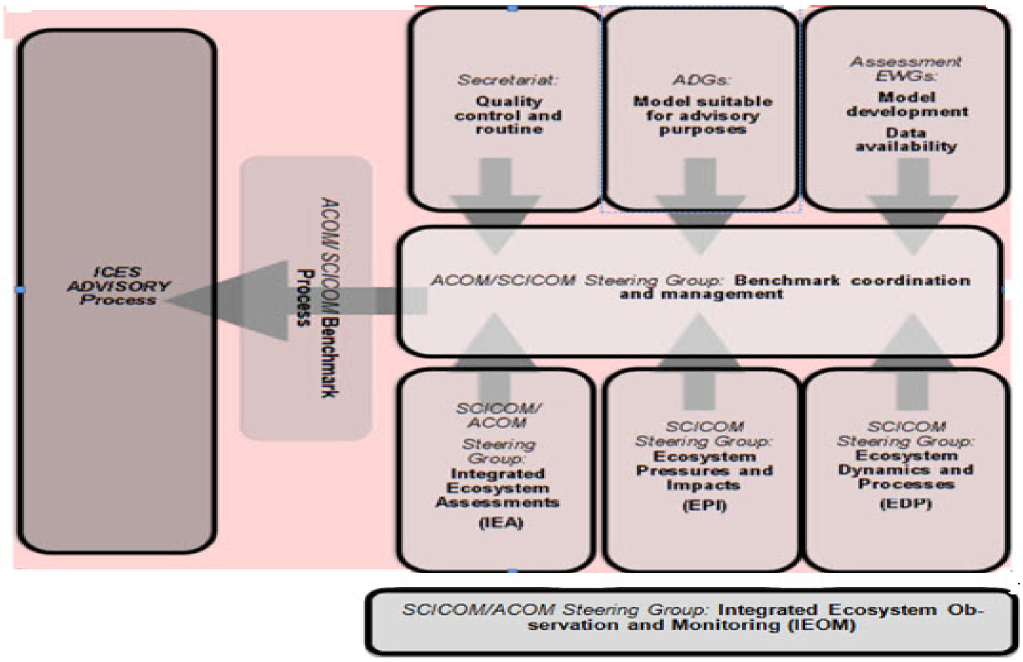


Figure 1.3. High level structure of the ICES advisory process showing linkages between steering groups, benchmarking process, ICES secretariat, advice drafting groups (ADG) and assessment expert working groups (EWGs). ACOM: Advisory Committee; SCICOM: Science Committee. WGCATCH falls under the Steering Group on Integrated Ecosystem Observation and Monitoring (SSGIEOM).

1.4 Scope of WGCATCH

WGCATCH exists primarily to support the ICES assessment and advisory process, and members are nominated by national ICES delegates. Additional experts from outside the ICES area can be invited – in 2014 this included an expert on statistical survey design from the USA and an expert on sampling of fisheries in Greece.

ICES provides advice to the European Commission through a Memorandum of Understanding (MoU), and the ICES Expert Groups on fishery and biological data collection (PGCCDBS, WGRFS, associated workshops or study groups such as WKPICS and SGPIDS, and the new groups WGCATCH, WGBIOP and PGDATA) are agreed as part of the MoU. This means that the work includes a focus on the needs for data and analysis to support implementation of the EU Common Fisheries Policy, although an important aspect is to draw on experience and advice from invited experts dealing with similar data collection in other parts of the World. As a Working Group, WGCATCH has a role to develop the science behind the study of commercial fisheries and their catches, as well as addressing implementation of existing methods.

Currently, an important task for WGCATCH is to improve and review sampling survey designs for commercial fisheries with a focus on estimates required by ICES stock assessment EGs and specified in the EU Data Collection Framework. In particular, this covers estimation of quantities of fish and invertebrates discarded, by stock and fishery, and estimates of size and age composition of retained and discarded catch components, together with data quality indicators such as relative standard errors (RSE). However, the scope of WGCATCH is broader than this, covering many other aspects of collection and analysis of data on fishing activities and catches. This will be end-user driven, and well-coordinated with the work of other data EGs such as WGBIOP, PGDATA and WGRFS to ensure synergy and efficiency.

2 ToR 1: Develop the longer term work plan for WGCATCH

The workplan and draft terms of reference for the next meeting are included in Annex 3.

3 ToR 2: Evaluate methods and develop guidelines for best practice in carrying out sampling of commercial fish catches on shore

3.1 Challenges posed for sampling catches on shore

Sampling of fishery catches at sea, using appropriate designs to ensure representative coverage within strata, remains the most direct way to quantify total catch compositions, proportions discarded, and size/age compositions of landings from individual trips. Many at-sea sampling programmes collect data on both the landed and discarded components, and allow the precise geographic locations of haul samples to be determined. The down-side is that observer sampling is expensive, which can severely limit the numbers of trips that can be sampled. This is problematic if end-users want estimates at high resolution of fleet métiers, areas and seasons.

In contrast, sampling of landings on shore can typically sample many more fishing trips for the same cost as an observer programme, although many of these trips are in clusters, reducing the effective sample size. It may be the only practical means of directly sampling very small vessels, unless self-sampling schemes are in place. Shore-based sampling sees only the landed component and almost always it is the landings of all hauls which may cover many days fishing over a wide area, which may cross stock boundaries. The landings offloaded ashore may already be sorted at sea into size categories, processed into fillets or already frozen, and it is possible that different parts of the landings of a vessel (e.g. fish and shellfish) may be disposed of separately and not available at the same at an auction site or other access point for sampling. The landings may be offloaded into lorries and transported to other auction sites or direct to a fish merchant, and many landings (especially of flag boats) may be transported overseas. Patterns of landings by different types and sizes of vessels may differ markedly. With the introduction of the landings obligation legislation, an additional category of unwanted (previously discarded) catch will come ashore, and the unwanted and wanted components will be processed differently at the point of landing, or landed at different sites.

Despite all the complexities and challenges of shore sampling, it remains a core part of marine fishery sampling programmes in most countries. In this Section of WGCATCH we explore in more detail the issues faced with sampling on shore in the different countries represented at the meeting, and how the sampling schemes have been adapted to these. Prior to the meeting, a questionnaire was circulated to all participants asking for details of the national shore sampling design, so that WGCATCH could collate how sampling has been adapted to specific national sampling scenarios and to highlight specific issues such as availability and presentation of the landings for sampling. These were presented in plenary, and experts on statistical sampling design provided valuable comments on the approaches being adopted and provided recommendations for improvement. The completed questionnaires are available in a separate Appendix to the WGCATCH report.

The ICES WKMERGE meeting (ICES, 2010) provided an overview of factors affecting the availability of landings to sample on shore, and how probability-based shore-based sampling schemes can be designed and implemented practically. The sections of the WKMERGE report specifically addressing shore sampling are reproduced in Annex 9.

3.2 Review of Sampling Designs

Questionnaires submitted by 16 MS were reviewed in detail. Several sessions were spent reviewing the sampling schemes presented to the meeting. The differing levels of expertise and differing interpretations of the questions in the questionnaires meant that it was a time-consuming process to achieve the same understanding of each sampling scheme, in particular, stratification and sampling unit selection methods, which are summarized in Table 3.2. WKPICS3 specified 4 design classes, according to how the PSUs are selected, which is summarized in Table 3.1, reproduced from the WKPICS3 report. An overview of each case study is provided in the text below.

The questionnaires included monitoring, quality indicators and summaries of raising procedures but it was not possible review this component within the time frame of the meeting. Raising procedures and national and regional estimation is a topic in itself and estimation will form part of the ToR for the next Working Group. However, such a ToR should look towards identifying statistically sound estimation methods, as opposed to reviewing current national “raising procedures” which might not have a statistical basis.

3.2.1 Basque Country

In the Basque Country, landing information is obtained from official sales notes and from the internal sales notes of private auctions (offshore fleet), which are considered more accurate. Logbooks are also available but they are not used to estimate length composition. Landings made by trawlers are sold in private auctions where only people with permits can enter. 90% of these landings are made on Sunday night. Purse-seines and artisanal fleet land in the ports and sell in public auctions. They land from Monday to Friday and at different hours of the day. The landings of each trip are sorted in boxes and organized in commercial size categories. The total weight of each commercial category is available for the sampler. Boxes are stored in towers.

The Basque Country presented a new sampling plan which will be implemented in 2015, although there are still some open questions which need to be defined. The plan is stratified and multistage, with ports fixed and the day being the primary sampling unit (PSU). PSUs are stratified by month and vessel sale events are the Secondary Sampling Units (SSU). The selection of PSE and SSU is quasi-random. Concurrent sampling is carried out and all available size categories are targeted. Box selection is ad hoc. The usage of concurrent sampling allows the quantification of species mixed in the same "commercial species". A representative sample of fish is measured. The group suggested the following issues for consideration in the sampling design: a) the definition of the different fleet lists as strata instead of subpopulations, b) the merging of monthly strata with the same sampling effort, c) the use of unequal probability to distribute sampling effort among months and ports, d) the performance of simulation exercises to explore simpler sampling designs, and e) the example of the Delaware River survey as a reference about how to sample the artisanal fleet.

3.2.2 Denmark

The Danish sampling design presented in this report is still under development. At the moment the PSU and selection thereof is in place – as well as the lower level of sampling units, but the appropriately SSU have not been found yet – Trip, box or maybe another unit. The program targets fish lengths and ages for 19 stocks and the design is a stratified multistage design with sale site being the PSU. The PSU are stratified by quarter and sale site and selected systematic in time. The selection of the

PSU is considered probabilistic, but since we exclude sites with few/small amount of sales we need to be aware of the potential bias this can cause. The proper unit for SSU needs to be settled and a proper method for the selection of species at the sites needs to be found.

3.2.3 France

In 2013, France has sampled more than 1400 sampling events in the continental and outermost islands harbours. The sampling frames are constructed with a combination of groups of ports, groups of métiers and large fishing areas, and the primary sampling unit (PSU) is the landing event. Visits to the markets are done following a systematic procedure, with a monthly sampling allocation. The landing events are mainly sampled concurrently for a predefined list of species of interest. When the concurrent sampling is impossible or when the totality of the landings is not available to samplers, another sampling frame is used where commercial categories of a given species are treated as PSUs. Moreover, in order to ensure sufficient samples for some key species, the overall sampling framework is completed with stock specific samples. A web service offers samplers and managers a tool for monitoring the field implementation of the sampling design throughout the year.

The way forward for France relates to two fields of the sampling protocol: (i) move to probabilistic sampling by considering including the day as a PSU and randomize the selection of days and (2) reduce the number of sampling strata (larger groups of ports, larger groups of métiers) and improve the randomness of the SSU selection. Another improvement will be the reduction of the stock specific sampling, by a better definition of the sampling frame to ensure the principal species/stocks are well covered.

3.2.4 Germany

In Germany most of the sampling is carried out by an observer-and self-sampling scheme. Germany has only implemented a shore sampling scheme for one fish stock in the Baltic. The target population is Western Baltic Spring-spawning Herring in the Baltic subdivisions 22 and 24. This stock is caught with pelagic trawls, gillnets and trapnets where pelagic trawlers are only landing into one processing factory and all other boats are landing into smaller ports representing the two sampling frames. Sampling effort is largely proportional to the amounts landed, both in space and time. 50 kg unsorted samples of the catch are taken every week either from the processing plant (1 sample on a Monday) or at 5 of the major ports (1 sample of each port). Samples from the ports are taken from a known group of fishers which is considered representative.

3.2.5 Greece

For the sampling design of Greece the fishing trip is considered as the PSU. The PSUs are stratified by geographical region, métier, vessel size and quarter and are selected proportionally and quasi randomly (proportion of vessels of each region/métier/length category and random selection of vessels from a given list/registry). The SSU is the sample (box) taken from the vessel's catch and is stratified by species. SSU selection is random. Concurrent sampling is carried out and all available size categories are targeted. TSU is fish length stratified by species. QSU is the biological variables of individual fish and is systematic (specific number of fish of each sex for every length class) and opportunistic (if not enough individuals in sample then purchase another sample or get sample from on board sampling). Problems of the sampling design arise from the large number of landing ports that are scattered all over the area (more than 17 000 km of coastline) and are not easy to be monitored, and the huge number of small vessels that could possibly change métiers between seasons (thus obliging us to constantly refresh the list of available for sampling vessels in each métier).

3.2.6 Ireland

The Irish sampling programme is under development and still incorporates some non-random and quota sampling. Separate sampling schemes exist for pelagic, demersal fish, *Nephrops* and inshore fisheries. The PSU in all schemes is the landing event. The sampling effort is weighted by the total landings in each port. Sampling events may be targeted at certain species (that are expected to be landed). The general guidelines are to sample 'little and often' to mitigate the bias that can result from quota sampling. Ireland is planning to formalize the randomness in the selection of landing events. Selection of species within each random event is a major challenge; the use of unequal sampling probabilities for species / stocks in each port will be explored (i.e. some species are only landed sporadically, while others are available at nearly all landings events).

3.2.7 Netherlands

The Dutch sampling design is stratified with sites*time being the PSU and fish box being the SSU when targeting fish. The PSUs are stratified by quarter and their selection is quasi-random. The SSUs are stratified by species and landing size category and their selection is quasi-random. Fish measurements by species are the TSU and their selection is random. The sampling design is the same for species which target is to obtain a length distribution or and age composition of the landed catch. Rare species, such are rays and skates are sampled opportunistically.

3.2.8 Lithuania

Lithuanian sampling strategy is based on the collection of data for 4 main species: cod, flounder, sprat, and herring. The sampling frames are vessel type (vessels using demersal trawl gear; vessels using pelagic trawl; vessels using passive gear and coastal fishery), the primary sampling unit is the landing day. Lithuania has only 1 port for fish landings and many other suitable (minor importance, however) sites for fish landings and sale (small vessels and boats engaged in coastal fishery use that sites). For each sampling frame we plan to visit port 1 day per month and sampling is performed for all métiers at visit. Before visiting the port, the sampler is able to check if landings are expected. This 'targeted' sampling is one of the main issues with the current sampling programme that needs to be addressed to move to a more statistically sound approach. Box and fish selection are random.

3.2.9 Poland

A quasi-opportunistic selection of marine fish (totally 12 Baltic stocks) sampling onshore is implemented in Poland. Access to the part of landed catches, realized by overall 835 vessels with different types and sizes, is through a list of 10 local first-sale centres located along a coast, however some cutters specialized in sprat fishery landed fish in foreign ports. The Polish scientific observers present on board of surveying vessels monitor this part of landings. Sporadically, fish sampling is also conducted based on materials from the fish processing company and warehouses. Approximately 70–85% total catches of salmonids are sampled under the self-sampling system.

The primary sampling unit is a trip of the operating vessels on a specified métier (=species), port and quarter. Generally, sampling is based on the preliminary agreements with vessel owners, managers of the companies and particular skippers or fishers that cooperate with Institute (NMFRI in Gdynia). Distribution of sampling of particular species over the year and selection of sampling is determined by intensity of the national fishing-quota utilization in given year.

3.2.10 Portugal

The Portuguese sampling design targeting fish lengths in 2014 is stratified multistage, with auction*day being the PSU and vessel landing events being the SSU. The PSUs are stratified by quarter and port and their selection is quasi-systematic. SSU selection is approximately random. Concurrent sampling is carried out and all size categories available at market are targeted. Concurrent sampling allows the quantification of species that have been mis-assigned to commercial species or are included in supra-specific commercial species. Box and fish selection are quasi-random. The overall sampling design is reasonably probabilistic but could be improved by, among other, a) considering the possibility of unequal probability sampling of ports, b) considering the effective advantage collected from sampling effort proportional to total landings, c) evaluate the effective need to evenly distribute sampling across weekdays, d) evaluating the effective need to sample 100 fish/size category.

3.2.11 Sweden

The Swedish onshore sampling scheme is based on a random, unequal probability sampling design. The sampling frame is a matrix of port clusters vs. days of the year. Port-cluster-days are selected at random with unequal probabilities based on the total landings and landing patterns the previous year. Selection at all lower sampling levels is carried out by simple random sampling. The presented sampling scheme has not yet been implemented, and a proper evaluation of the design needs to be carried out during 2015. One main issue is that it is a single species program designed for cod, and it is unclear how it will cope if more species need to be sampled. It is also unclear how the unequal inclusion probabilities will be treated in the estimation procedure.

3.2.12 UK – Northern Ireland

Three ports (Ardglass, Kilkeel, and Portavogie) comprise the bulk of Northern Irish commercial landings. Allocation of sampling effort is on an ad hoc basis. Sampling targets for each stratum are defined, based on recent landings. The sampler will check if landings are expected in a certain port before travelling. This 'targeted' sampling is one of the main issues with the current sampling programme that needs to be addressed to move to a more statistically sound approach. The PSU is a landing site on a specified day. The size of the PSU is related to the total landings into each port, ports with large volumes of landings are sampled more frequently than ports with small volumes of landings. PSU's are stratified by geographic areas, quarters and gear type. Fish markets are held at Kilkeel and Portavogie. Prawn trawlers land at Ardglass and catches are then shipped to Kilkeel market by road. For pelagic species, sampling targets are directly linked to the landings. The SSU is defined a vessel landing event and selected randomly. Landings from each gear type are sampled at random. The strategy for selecting individual landings of species to sample on a given day is guided by stock-based and concurrent sampling targets. For concurrent sampling a number of vessels are selected at the fish market and a length frequency is measured from every grade of species that has been landed by these vessels. Quota based sampling targets individual key species. Fish are sampled across the types of vessels that target these species, or take them as bycatch. The number of boxes of each category of target species that has been landed is counted and a length measure carried out from each landing selected.

3.2.13 UK – England

The UK – England are adopting a random probability based sampling design. What was presented to WGCATCH was a draft of the planned programme. It is a stratified multistage scheme with sampling frames for Demersal, Crustacean and Pelagic landings with auction/sale site*day being the PSU and vessel landing being the SSU. The PSU are stratified by Geographic region and quarter and broad gear groups to ensure the capture of landings from clearly unique seasonal fisheries for over 50 stocks. Each Geographic region is considered independently. The auction sites/ports are further stratified by port size, based on relative importance (sales and associated effort (voyages) with more sampling effort allocated to the more important ports. Depending on the class of port and the number of sampling trips required within that stratum the sampling effort is allocated systematically to the ports within each class across the quarter using biweekly periods. The overall sampling design is considered probabilistic falling into design class C.

Further consideration needs to be given to how to select the day within the bi-week period for a sampling trip. Each region and activity at access points needs to be analysed further to consider optimizing sampling effort. Within practical constraints it is better to provide strict instruction or method to select a sampling day rather than leave the day to the discretion of the observer. Vessel selection needs to be random where feasible. At the Tertiary level, if all species are not sampled from the landing (concurrent), a random or systematic process for selecting which commercial species to sample in a landing needs to be adopted.

3.2.14 UK Scotland

The Scottish demersal onshore sampling scheme is used to sample landings of demersal species for age and length. Fish are sampled in markets situated in three ports on the Scottish mainland and two in the Shetland isles. In all of these markets the handling of the catch is very similar. The design is a multistage stratified design. The design is stratified by market, and each market is visited approximately 3 weeks out of every 4 weeks. Visits are conducted by a team of two observers, the vessels selling their landings on a particular morning being selected using a random vessel selection form and sampled sequentially. On any particular visit as many vessels as are available and can be sampled in the time available will be sampled. The selection of the fish species is at the discretion of the observer. Total boxes and the number of boxes sampled are recorded for each sampled species. All the fish in one or more boxes are measures and one otolith collected for each cm length class. The selection of the box is at the discretion of the observer, and otoliths are taken from the first fish encountered in each cm length class.

3.2.15 Spain – IEO

IEO deploys different sampling schemes designated for selected *métiers* following the ranking system according to the DCF. Every sampling frame is constructed with a list of ports where days (PSU) are selected. The decision of which ports to include and the sampling effort allocated to every one of them is based on effort (trips) and landings (weight), considering geographical representation. The relationship between ports and fishing areas is used to accommodate ports as proxies to get more probabilistic random sampling. The sampling frame is stratified by quarter with a systematic monthly allocation of effort and an extra sampling effort allocation covering some seasonal fishing activities. Sampling is mainly done concurrently and all size categories available at market are considered. Improvement of the scheme could be done primarily through the establishment of unambiguous –and perfectly differentiated at port— fishing fleets (something we can only adjust *a posteriori* currently). Other considerations are the evaluation of random selection of PSUs and amelioration of the random selection of trips (SSUs)

Table 3.1. Design classes for at-sea and onshore commercial catch sampling specified in WKPICS3. The level of clustering of catches typically increases from scheme A to D. Schemes A and B are at-sea sampling programs, while C and D are onshore sampling. The primary sampling units may be subsampled in multiple stages, using simple random, stratified random, or systematics sampling.

Design class	Sampling frame of PSUs	Comment, example	Examples of stratification of PSUs	Case study
A	Vessels * time	Sample a number of trips across all vessels. In the analysis, trips are treated as PSUs. Sample a number of fishing operations across all vessels/trips; fishing operations are treated as PSUs (e.g. in at-sea self-sampling programs, or at-sea intercept surveys)	Vessel-characteristics (vessel length), time (quarter)	Netherlands case study Skagerrak regional case study Norway case study
B	Vessels	Select a group of vessels and sample trips over time from each vessel. Special case: If all vessels are sampled, each vessel is effectively a stratum.	Fleets (offshore/coastal), gear, target fishery	Norway case study
C	Sites*time	Random sample of site-days (e.g. buyer-days)	Quarter, market categories	Sweden case study
D	Sites	Sample a group of ports and sample vessel/trips over time from each port. Special case: If all ports are sampled, each port is effectively a stratum.	Geographic, quarter, effort, or landings at the sites Month	Scotland case study Spain case studies

Table 3.2

Country	Frame	Design class	1st SU	Stratification of 1st SU	Selection of 1st SU	2nd SU	Stratification of 2nd SU	Selection of 2nd SU	3rd SU	Stratification of 3rd SU	Selection of 3rd SU	4th SU	Stratification of 4th SU	Selection of 4th SU	5th SU	Stratification of 5th SU	Selection of 5th SU
Basque - Spain (planned)	Trawlers (3 lists)	D (special case)	Day	Month	Quasi Random (coordinated among fleets)	vessel sale event	-	Quasi random	Box	commercial species and commercial size category	First box in the tower	Fish (length)	Scientific species	Representative sample	-	-	-
Basque - Spain (planned)	Purseiners and artisanal	D (special case)	Day	Month	Quasi Random (coordinated among fleets)	Time window	-	Quasy Random (coordinated among fleets)	vessel sale event	-	Systematic	Box	commercial species and commercial size category	First box in the tower	Fish (length)	Scientific species	Representative sample
Denmark	Demersal – Case 1	D	Site	Each sales place, Quarter	Systematic in time	Trip	Area	Random	Box	Species, size category	Random	Fish (length)	-	Census	Fish (age)	-/Length	Census/ Random
Denmark	Demersal – Case 2	D	Site	Each Sales place, Quarter	Systematic in time	Box	Stock, size category	Random	Fish (length)	-	Census	Fish (age)	-/Length	Census/ Random			

Country	Frame	Design class	1st SU	Stratification of 1st SU	Selection of 1st SU	2nd SU	Stratification of 2nd SU	Selection of 2nd SU	3rd SU	Stratification of 3rd SU	Selection of 3rd SU	4th SU	Stratification of 4th SU	Selection of 4th SU	5th SU	Stratification of 5th SU	Selection of 5th SU
France	Group of ports	D	Landing event	Quarter and Fishery (group of métiers) and large fishing grounds	Opportunistic	Box	Commercial species, size category	Concurrent sampling with fixed list of species All size categories	Fish (length)	Scientific species	Census or subsample	Fish (age)	Subsample of length	Systematic (e.g. 1 age every 10 lengths)			
Germany	Group of ports	D	Ports	2 frames	Systematic by amount of landings	Group of vessels	Gear type	Systematic depending on fishing season	Unsorted subsample of 50kg			Individual fish		All in the sub sample			
Greece	Artisanal and Pelagic	A	Vessels * time	Region, métier, vessel size, quarter	Quasi random, proportional	Box	Commercial species	Concurrent	Fish (length)	Species	Census	Fish (biological variables)		Systematic (x number of individuals per sex per length class)			
Greece		B	Vessels														
Greece		C	Sites * time														

Country	Frame	Design class	1st SU	Stratification of 1st SU	Selection of 1st SU	2nd SU	Stratification of 2nd SU	Selection of 2nd SU	3rd SU	Stratification of 3rd SU	Selection of 3rd SU	4th SU	Stratification of 4th SU	Selection of 4th SU	5th SU	Stratification of 5th SU	Selection of 5th SU
Ireland	Group of ports	C	Sites * time	Fleet, area, quarter	Quasi random, proportional	Vessel* landing	Commercial species, size category	Quasi random	box	-	Quasi random	Fish (length and/or age)	-	Quasi random			
Netherlands	Group of ports	D	vessel landing event	quarter and port	Systematic in time	Box	Commercial species, size category	Random	Fish (length)	subsample	Random	Fish (age)	subsample	Random			
Lithuania	Demersal and Pelagic	Day	D	Quarter and Fishery (group of métiers)	Systematic in time	Species / ICES Subdivisions	Commercial species, size category	All size categories	Box	-	Random	Fish (length)	-	All in the sub sample	Fish (age)	Length group	Systematic
Poland	Demersal and Pelagic	C	Vessels	a trip of the operating vessels on a specified métier/quarter	Accordingly to the intensity of the national fishing-quota utilization in given year .	Area – the ICES Subdivisions	Stock	Random	Box	Species; size category – in the case of herring only	Random	Fish (length)	-/Length	Random	Fish (age)	-/Length	Census

Country	Frame	Design class	1st SU	Stratification of 1st SU	Selection of 1st SU	2nd SU	Stratification of 2nd SU	Selection of 2nd SU	3rd SU	Stratification of 3rd SU	Selection of 3rd SU	4th SU	Stratification of 4th SU	Selection of 4th SU	5th SU	Stratification of 5th SU	Selection of 5th SU
Portugal -2014	onshore	C	Auction* Day	Quarter Port	Quasi Systematic	vessel sale event	-	Quasi random	Box	commercial species and commercial size category	Quasi random	Fish (length)	Scientific species	Census or representative sample	-	-	-
Sweden	Matrix of port cluster vs.days	C	Port cluster x day	Quarter, Area	Random, unequal probability	Vessel landing	Fleet	Random	Box	Species, size category	Random	Fish (age)	-	Random			
UK England	Demersal	C	Sites * time	Geo-region, Gear group Quarter, Site class, Site, Day	Day is random within biweek period	Vessel* landing	Commercial species x Size category (sorted or unsorted)	Random	Box	-	Random	Fish (Sci. species, [sex], length)	-	All or systematic random if subsampled	Fish ([sex, maturity], age)	LengthGp	Systematic
UK England	Crustacean	C	Sites * time	Geo-region, Gear group Quarter, Site class, Site, Day	Day is random within biweek period	Vessel* landing	Commercial species x Size category (sorted or unsorted)	Random	Box	-	Random	Fish (Sci. species, [sex], length)	-	All or systematic random if subsampled	Fish ([sex, maturity], age)	LengthGp	Systematic

Country	Frame	Design class	1st SU	Stratification of 1st SU	Selection of 1st SU	2nd SU	Stratification of 2nd SU	Selection of 2nd SU	3rd SU	Stratification of 3rd SU	Selection of 3rd SU	4th SU	Stratification of 4th SU	Selection of 4th SU	5th SU	Stratification of 5th SU	Selection of 5th SU
UK (Northern Ireland)	Group of ports	D	Vessel landing	Geographic area, quater, gear type	Guided by stock-based and concurrent sampling targets.	Species	Commercial species, size category	All size categories	Box	subsample	random	Fish (length)	Length	Sysytematic (one from every grade)	Fish (age)	Sysytematic (one from every grade)	Ad hoc (carried out where possible)
UK Scotland	List of markets (demersal fish species)	C	Day	Market	Quasi-random	Vessel sale event	-	Random	Box	commercial species and commercial size category	Ad hoc	Fish (length)	-	Representative sample	Fish (age)	Fish length class	First fish measured in that length class
SP (IEO)	Ports	D	Days	Quarter	Varying between ports/fleets: from quasi random to quasi systematic and oportunistic	Trips		Random	Box	Commercial species, commercial size category	Concurrent sampling with species prioritization	Fish	Species				

3.3 General comments on the sampling designs presented to WGCATCH

The Working Group (WG) noted the complexity of many of the sampling designs, which result from attempting to achieve the current multiplicity of DCF requirements. These complex designs, without the accompanying identification of the estimation method, lead to possible over-stratification, difficulty of implementation, loss of control of sampling probabilities and difficulty in constructing an estimator. The difficulty of implementation of complex designs leads to the lack of true probabilistic sampling (e.g. opportunistic and haphazard) and an inappropriate use of simple random sampling assumptions in estimation. This in turn further complicates any possibility of constructing unbiased estimates with quantifiable precision. These issues are discussed in more detail below.

Simpler designs with fewer strata and in which probability can be controlled might get less precise estimates than a complex design but they reduce the risks of errors in implementation, and estimation will control bias and give the opportunity to understand bias. The design and implementation of sampling schemes has been discussed in many places in an ICES context (e.g. WKMERGE, WKPRECISE, SGPIDS, WKPICS) and there is a wealth of information in the reports of these working groups and references therein. The group recommend that anyone designing a sampling scheme should start with these reports as a first reference.

3.4 Guidelines for designing a sampling survey

As a result of the review of the sampling schemes presented to the WG, some guidelines highlighting key areas where it is important to follow a statistically sound approach are given below. These are then discussed in more detail in the following subsection.

The process of designing a survey begins with the identification of your objectives, which then drives the survey design and estimation methods that can be used given your resources. All parts of the population of interest should be surveyed and selection of sampling units should be probability-based.

1) **Objectives**

   Objectives must be identified in clear and concise terms before designing the survey.

2) **Design and estimation**

   The sampling design and associated estimation method intended to achieve the objective must be identified and considered together from the start. Note that complex designs lead to complex estimation methods and require an experienced survey statistician to oversee the process.

3) **Sampling frame**

   To avoid bias, the sampling frame should include all elements of the population, even if some elements are sampled with a very low effort.

4) **Stratification**

   Stratification should be avoided where possible except when there is evidence that the stratification will lead to improved estimation. (This can be tested with simulation studies.) The random selection of site (or fleet) and date together from a matrix (design class C) is usually more statistically efficient than first stratifying by site (or fleet) and then selecting visit dates (design class D).

5) **Probability-based sampling**

At each level in the hierarchy, samples should be selected using probability-based sampling. Failure to do so can result in bias which cannot be quantified and incorrect variance estimation. Systematic sampling can be used, but then the variance estimation needs to be adapted accordingly or variance will be underestimated.

6) **Simulation studies**

Simulation studies should be used to assess sampling schemes, for example using population data from previous years. The simplest simulations will allow you to estimate expected sample sizes for domains and to determine whether stratification is necessary to ensure domain coverage.

3.4.1 Further explanation and discussion of sampling guidelines

3.4.1.1 Survey objectives and multi-purpose sampling designs

Sampling designs should be set up to achieve specific objectives. If the requirements for the information to be obtained from sampling change, then the sampling design needs to be reassessed.

In general, requirements for estimates for a multiplicity of domains (e.g. combinations of areas, métiers and seasons) when combined with relatively low sample sizes as a result of relatively low funding levels, is likely to introduce complex survey designs, subjective sample selection and/or quota sampling in an attempt to ensure coverage of each domain. Interaction with end-users is required to discuss the cost implications of their requirements to avoid this.

The estimation of numbers or weights at age for landings and discards requires that ages are sampled directly from the landings and discards, and these estimates should ideally not be based on age–length keys, obtained from different surveys.

3.4.1.2 Complex sampling designs

It is theoretically possible to design highly complex sampling designs, for example with unequal probabilities at multiple stages, which can be very cost-efficient. However, an experienced survey statistician would be required to develop these complicated sampling designs. If you are not able to implement your unequal probability design correctly you will introduce bias in both the point estimates and variance estimates because the inclusion probabilities are wrong. (Modelling often assumes equal probabilities and models don't fix sampling mistakes.)

The sampling scheme should have a design which avoids empty strata. The domains for which estimates are required need to be specified such that sufficient sample sizes (in PSUs) are achieved given funding levels. If sample sizes are limited by logistical constraints, then the domains need to be modified. This can be an iterative process, using simulation studies to estimate expected sample sizes.

Sampling designs should be monitored and regularly assessed for efficiency (e.g. maximum precision given cost), possible sources of bias (e.g. due to coverage) etc. For estimates used in stock assessment and management one could consider whether the design captures all parts of the variation in the proportions-at-age fished from the stock.

If sampling designs and changes in sampling designs are carried out in accordance with statistical principles, the time-series is not jeopardized.

3.4.1.3 Potential bias with sampling frame under-coverage

Potential bias exists with sampling frames where some combinations of sites are removed from any possible sampling. Sampling frames should ideally include all sites. Sites of less interest can be grouped into a stratum which is sampled with low effort. This allows the use of these data subsequently to ensure the estimates are not biased. For guidance on how to organize the sites and then select site-days see the NOAA website for recreational fisheries listed in the references. As an example, a simple scheme to consider when you sample few sites is to take the most important sites as strata and sample them over time, and then group the other sites into one stratum, allocate a small number of samples to these sites and select units from the site*time matrix. A similar approach could be used for sampling days of the week with different effort.

3.4.1.4 Stratification

The over-stratification issues that arose with métiers can potentially still exist with the use of fleets; especially when combined with geographic and/or temporal stratification at the first level of the hierarchy. Combining this problem with limited sample sizes may lead to undersampling of some strata and consequently, potential loss of precision in the stratum-level estimates, which in turn influences the precision of the "domain" estimates which are often required. This over-stratification often leads to some strata being removed from the sampling frame which in turn leads to potential bias (see below).

Combining over-stratification with the need for multiple objectives, results in poor control of sampling probabilities for the individual objectives. (e.g. oversampling for cod because the design is stratified in order to sample a rare species).

It is preferable to have a sampling design with a small number of strata, with large PSU sample sizes, rather than many smaller strata with low PSU sample sizes. Unequal probability designs are a possible alternative to stratification but the analysis of data collected under such a scheme would require an experienced survey statistician. We endorse the use of broad stratification to control sampling probabilities as a simple, implementable approach to unequal probability designs. As an example, a simple scheme to consider when you sample few sites is to take the most important sites as strata and sample them over time, and then group the other sites into one stratum and select units from the site*time matrix and allocate a small number of samples to these sites.

It is also worth considering whether the stratification planned is actually necessary. Consider comparing the two approaches with a simulation study: the random selection of site (or fleet) and time together from a matrix (design class C) instead of first stratifying by site (or fleet) and then selecting visit dates (design class D). The former is usually the most statistically efficient.

An additional issue with sampling fisheries is the natural clustering inherent in the data. Hauls are clustered within trips, trips are clustered within sales events, fish are clustered within boxes. The clustering induced by sampling at ports or sales can dramatically reduce the precision obtainable (for example, in a Norwegian study, the effective sample size was reduced fivefold.) Thus for all designs, the design effect and effective sample size of the chosen sampling scheme should be monitored.

3.4.1.5 Potential bias with non-probabilistic sampling at all levels of the hierarchy

Even if all the sites are included in the sampling frame, if they are opportunistically picked over time (e.g. only sampling when landings or sales are over a particular level), this can be a cause of bias.

When decisions are left to the samplers for choices of days, ports or boxes there is a risk that they don't do it systematically or randomly. This means that there may be units within the stratum that have zero probability of being selected because the selection of units within the stratum is haphazard or opportunistic. Guidance should be given to the samplers as to how they can avoid potential bias. An example of this subjective sampling might be targeting some species without a prescribed plan for targeting the other species.

3.4.1.6 Sampling targets

Sampling targets for domains should be formulated as expected targets at the PSU level, achievable with the appropriate sampling design and current funding levels. This is because the natural clustering of the data means that the number of site-events and number of trips within sites are likely to effect the precision more than the number of fish measured or the number of ages taken at the site-events. In fact the effective sample size reduces as the correlation within clusters increases and the average number of samples taken within a cluster.

3.4.1.7 Time allocation/stratification

Because of the changing nature of fisheries throughout the year, it is very tempting to spread the samples evenly across the year, either through time stratification or systematic sampling. Time stratification is likely to lead to over-stratification of the sampling design, whereas systematic sampling will lead to underestimation of variance if it is not properly taken account of in variance estimation. Both techniques lead to the possible over-complication of the survey design, which could then require an experienced statistician to carry out analysis and estimation.

3.4.1.8 Allocation of sampling effort

Allocation of sampling effort to strata can be subjective as long as the sampling within strata is probabilistic. The reason we sample different locations at different time is to ensure we cover the variability of the population. Unless fisheries target their landings to particular ports, we are likely to sample a wider variety of landings if we go a port with more landings due to the variability of fishing practices.

If trips have similar landings overall, trips will be sampled with more or less equal probability if effort is allocated proportional to landings. However it is usually the case that fleets with smaller vessels fish closer to shore and land more frequently than fleets with larger vessels.

A key requirement of the sampling design is that the sampled landings achieve the coverage of the domains. This can be tested a priori with simulation studies.

3.4.1.9 Topics for future WGCATCH meetings

The following issues were raised in the discussions of sampling design and estimation but there was not time to discuss them properly. These would be useful topics for discussion at another WGCATCH meeting.

- Estimation of catch-at-age in complex design. For example, a comparison of design-based estimation of ages with the ALK approach.
- Sample size in domain estimation - simulations for identifying survey design and sample sizes to achieve the key objectives of the sampling programme.
- Different methods of design-based estimation. One topic to be considered is to address the current methodology used to estimate numbers-at-age for the sampling designs actually implemented.
- Model-based estimators.
- The selection of species – target species, species as domains, concurrent sampling (sampling all species for a particular trip).

4 ToR3: Provide advice on adapting sampling protocols to anticipated changes in management measures (e.g. discard ban) or technical advances in monitoring

The landing obligation (or discard ban) is part of the new CFP and will be implemented from the 1 January 2015 for pelagic and industrial fisheries in all areas and for fisheries for cod and salmon in the Baltic Sea. For other species subject to catch limits in the Baltic, the landing obligation has to be implemented by 2017 latest. In the North Sea, North Atlantic, Mediterranean and Black Sea the landing obligation for demersal species will gradually come into force covering an increasing number of stocks between 2016 and 2019. Note that the current legislation on discard plans to implement the landings obligation refer to stocks subject to "catch limits". In practice this will apply mainly to species subject to TACs but could also apply to non-TAC species where other forms of catch controls (e.g. vessel catch limits) are applied. For convenience, we refer to the application of the landings obligation to TAC species, but do not rule out its application to non-TAC species managed by catch limits.

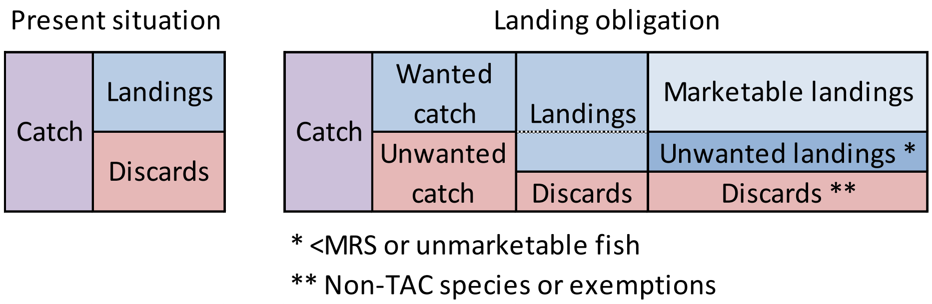
Historically, regulations and market forces motivated fishers to discard their catches, and if a vessel operator exhausted the quota for a species, they were legally required to discard any further catches of that species. In the reformed CFP, the European Commission is seeking to alter selectivity and fishing practices in a way that reduces unwanted catches and eliminates discards of species that have low post-release survival. It is intended to achieve this through a landing obligation that will apply to stocks subject to catch limits such as TACs, and all catches will count against quota. Fish under a minimum reference size cannot be sold for human consumption but these catches will have to be landed. However there are a number of exemptions, including: species with high survival; *de minimis* exemptions (difficult-to-avoid bycatch) and quota flexibility mechanisms (transferring of quota between species to avoid choke species). (See Annex 6, "Overview of the Landing obligation" for more details). Some of these exemptions may result in considerable discards.

Catch limits are intended to place a direct cap on fishing mortality by requiring all catches (not just landings) of a stock to be deducted from a vessel's quota, and once the catch limit for that stock is reached, the vessel must cease fishing activities catching that stock unless the aforementioned exemptions apply. The landing obligation constitutes a major shift in fisheries management with a clear policy objective to minimize unwanted catches and wasteful use of natural resources.

STECF and the RCMs have dealt with the implications of the landing obligation in some detail (see Annex 6 for an overview of the STECF discussions so far). WGCATCH will try to avoid overlap and focus on the implications for sampling only. For clarity, a number of concepts relating to the landing obligation will be defined here:

- **Minimum Reference Size** (MRS): Fish<MRS will not be allowed to be sold for human consumption. This makes them economically unattractive and should provide an incentive to avoid these fish.
- **Unwanted landings**: The portion of the catch that would formerly have been discarded but will now be landed. Unwanted landings can include TAC species that are below the MRS, unmarketable fish (e.g. damaged) and/or non-TAC species that were not sorted from the TAC species.

- **Unwanted catches**: The portion of the catch that would formerly have been discarded, so is the unwanted landings plus discards.



If the landing obligation will be implemented properly, institutes conducting biological sampling should have easier and more frequent access to the total catch (including the catch that was formerly discarded) than in the present situation, where typically only around 1% of trips are sampled at sea. However, WGCATCH foresees challenges for the fisheries data collection in relation to the implementation of the landing obligation. If the fishery-dependent data collection deteriorates, this will have consequences for the quality of stock assessments and management advice. Under the landing obligation, estimates of previously discarded fish could be quite different from if they had been sampled at sea. Moreover, it is expected that fishers will implement changes in selectivity to optimize their catch quota. Therefore, any marked differences in reported levels of unwanted catches compared with the recent estimates from sampling at sea could be due to several factors:

- Biases in estimation of catches (mainly discards) prior to implementation of the landing obligation;
- Low compliance with the landing obligation, including illegal, non-observed discarding;
- Changes in selectivity;
- Changes to the stock structure and composition of catches.

It will be essential to know which, if any, of these factors are operating. It is recommended that during the implementation phase, sufficient monitoring is in place to allow these factors to be evaluated and provide confidence in catch figures.

The landing obligation will affect sampling programmes in three broad areas:

- Logbooks and sales notes (census data);
- Sampling at sea;
- Sampling on shore.

The possible implications in each of these areas will be discussed in the following three sections (4.1, 4.2 and 4.3) and summarized in a table at the end of each section.

4.1 Logbooks and sales notes

It is important to realize that the quality of the data in official catch statistics (derived from logbooks and sales notes) are decisive for the quality of the input data for fish stock assessments as these data are used to derive weighting factors for raising estimates for the sampled trips to all trips by the fleet in any sampling stratum. Accurate documentation of catches is therefore a key element for the data collection-assessment-advisory process. In the EU, this documentation is currently regulated in the Control Regulation (1224/2009). In order to estimate and sample catches under a landing obligation, official catch statistics (e.g. logbooks, sales notes) should be expanded and restructured to allow fishers to separately record both the wanted and unwanted landings.

Under the landing obligation, landings (of non-industrial fisheries) will have different destinations. Marketable landings will be sold through auctions or direct sale to merchants or processors as at present. Unwanted landings may either be landed together with wanted landings but then transported to processing industries such as fishmeal plants, or separately offloaded at landing sites at or near these plants. Vessels under foreign flags may transport wanted landings to their home countries, while unwanted landings could be disposed of in the country of landing or elsewhere. This will have consequences for sampling catches on trip level and pose challenges for tracking different parts of the catch of the same trip. For sampling purposes, it is important that these different landings fractions can be tracked. To facilitate this, it would be beneficial to require the disposal of unwanted landings to be documented as part of the Registration of Buyers and Sellers schemes in each country.

There are currently some technical problems when using electronic logbooks to record discards, and changes may be needed to record unwanted landings (see pilot study, England). It is recommended that robust testing of the e-log system is conducted to ensure that vessel operators have the necessary tools to record their full catch including marketable landings, unwanted landings and discards.

At present the minimum EU requirement to record catches is by day. However, data on haul-by-haul basis may improve compliance of unwanted landings and discard information and enhance the opportunity to use logbook information for scientific purposes. Also, detailed registration on spatial and temporal level is required for certain scientific outputs, which require a finer resolution of data (e.g. discard atlas).

For the under-10 m sector, recording and monitoring full catches will be a challenge. Currently, no prior-notification of landing or the use of log sheets is required for these vessels. It is considered logistically difficult to produce accurate paperwork while at-sea and, with vessels working close inshore, not practical to give prior notification of landing. It is recommended that work be undertaken to determine how new self-reporting tools, independent at-sea observations and registered sales data and be integrated to deliver full documentation of catches in the under-10-metre fleet.

Recording of discards >50 kg in the logbooks is currently obligatory, but compliance is extremely low. Changing the regulation to include <50 kg discards is unlikely to improve this, implying that sampling schemes will continue to be necessary to estimate discards. This includes species that are allowed to be discarded due to expected high survival, as this will allow the results of discards survival studies to be applied to estimated discard numbers in order to estimate mortality associated with discarding.

Table 4.1.1 How will the logbooks / sales notes deal with unwanted catches?

Importance	Scenario	Consequences for sampling
Very high	Wanted and unwanted landings (and discards) should be recorded separately in official catch statistics.	Distinguishing wanted and unwanted landings is essential to ensure the continuity of the historic landings statistics, which form the backbone of many stock assessments. Sales notes data will allow more accurate tracking and quantification of the unwanted landings, especially if the logbook number is recorded in the sales notes.
High	Unwanted catches may be illegally discarded and therefore not recorded.	Illegal discarding can result in biased estimates of the unwanted catches (see also: Sampling at sea).
Medium	More detail on gear parameters in the logbooks would be useful.	Information on selectivity devices would be useful to analyse length distributions of the catches (e.g. to estimate unreported discards). Also information like the use of quad rigs is not currently recorded.
Medium	Improved catch statistics for <10 m vessels.	Improved catch statistics for <10 m vessels may result in significant improvements of catch data for some stocks.
Low	Haul by haul information (incl GPS position) would be useful.	This information will make comparisons between vessels much more reliable.
Low	Recording of all legal discards (including <50 kg).	Currently logbook data on discards is not accurately recorded and this is unlikely to change.

4.2 Sampling at sea

As a result of the implementation of the landing obligation some discarding becomes an illegal activity. Fish under the minimum reference size (MRS) must be landed and deducted from the fisher's quota. However, fish under MRS cannot be sold for human consumption, to gain economic profit. It might be the case that fishers are held responsible for processing these unwanted landings and consequently increase their operating costs. Also storage capacity on board will be limited, since all catch should be retained. This creates a strong incentive to keep on discarding. Subsequently, scientific observers on board are in the position to witness, and possibly record, illegal fishing activities. Although illegal activity can observed at present by observers, e.g. highgrading or misreported catches (area misreporting), the landing obligation will have a big impact and incentives to not comply will be stronger, especially in the first years after implementation. Therefore, WGCATCH expects an increase of refusal of observers on board, and increased observer effects (changed behaviour when observer on board, compared to the not sampled trips). These changes will reduce the amount of available data, increase bias and, consequently, have negative effects on accuracy of data. In the case of species and stocks that will not be subjected to landing obligation - such as TAC species that fall under exemptions (e.g. *de minimis*), non-TAC species, non-commercial species and protected, endangered or threatened species - high refusal rates and observer effects will make it impossible to accurately estimate discards.

In Section 4.5, WGCATCH suggests a number of approaches to quantify any biases that could result from the introduction of the landing obligation. In addition, the working group put forward two ideas for incentives to minimize refusal rates:

1) Incentives related to Certification (and related benefits), e.g. to obtain MSC certification, the refusal rate in a fishery should be below a certain level.

2) Requirement for members states to report refusal rates ("naming and shaming" principle), e.g. in annual national reports.

Some of the landings obligation pilot studies (e.g. England, see section 4.6) have highlighted that TAC species have to be sorted and stored separately as they are counted against the quota. This caused (in the pilot study) a large extra handling time on board. For the smaller vessels, storage of the extra boxes was a problem, both in respect to space but also as a safety issue for the crew members. Storing different species separately on board will be practically impossible for a large number of fisheries.

To date, several CCTV projects related to estimation of discards (both volume and length composition) have been carried out in Europe. One such project (http://www.farosproject.eu) combined CCTV data collection with image analysis software under a data transmission and storage network system. Such combination improves the efficiency of discards management, for example by providing markets with real-time information on catch volume and composition, and providing fishery managers with real-time data that supports implementation of control measures such as spatio-temporal closures. If adequately implemented, this method of monitoring could improve scientific data collection, for example by providing real-time georeferenced information of species abundance and length composition.

Table 4.2.1. How will unwanted catches be handled on board and how will skipper's behaviour change?

Importance	Scenario	Consequences for sampling
High	Refusal rates (access to sampling at sea) and observer effects might increase	1) Refusal rates need to be recorded (now and after the introduction of the landing obligation); this information is needed to identify if at-sea sampling programmes may be biased (or more biased than currently) 2) Potential sources of bias should be quantified, e.g. though comparing properties of refused and observed trips with unobserved trips by the same vessel or by different vessels in the same area (e.g. fishing locations, size composition of the reported catches etc.).
Medium	Unwanted landings might be stored on board without sorting by species.	Because these landings are counted against quota they will have to be quantified, either by the skipper or by fisheries authorities (or both). If these landings are subsampled, thorough mixing will be essential to avoid bias. Biological sampling may be able to 'piggyback' on sampling for quota management if this occurs.
Depends on the fishery	CCTV systems in the conveyor-belts that can be linked to software that automatically identifies and measure fish (e.g. Antelo *et al.*, 2011,	For certain fisheries, these systems might assist quantification of the catch.
Medium	Self-sampling of unwanted catch.	Fishers could take samples and store these samples under conditions that makes it possible to use these samples for biological sampling at a later stage

4.3 Sampling on shore

The landing locations and fate of the unwanted landings on shore is unclear and will remain so until the landing obligation actually comes into force. Furthermore, many countries are currently sampling on auctions where a large part of the landings can be encountered making the sampling schemes cost-effective. However the unwanted landings fraction may not be available at the fish auctions. This will have implications for onshore sampling designs and data collection protocols.

At present there is little clarity about how storage of unwanted landings on-board should be handled. If the fish are stored unrefrigerated, the sample may be decomposing at the time of sampling and concerns will include the ability to make correct species identification, the ability to estimate the demographic structure of the sampled catches, the estimates of sample numbers (depending on access point for sampling), the ability to measure fish and collect otoliths and even the ability to access samples at all (e.g. under health and safety regulations).

The most cost-effective way to deal with unwanted landings may be to dump them at sea (after landing). If this is done by a vessel that is not a registered fishing vessel, then this is presumably legal. This could affect access to these landings for sampling.

Table 4.3.1. How will unwanted landings be handled ashore?

Importance	Scenario	Consequences for sampling
Medium / high	Unwanted landings of a number of trips may be stored together.	If samplers cannot identify the trip from which the unwanted landings originate, it will be more difficult to estimate the total unwanted landings for the fleet.
Medium	Unwanted landings may be brought ashore at different times / locations from the wanted landings.	Providing sales notes for unwanted landings would help in this case. Samplers need access to the unwanted landings.
Medium	Recording of refusal rates (access to landings ashore)	Refusal rates need to be recorded (now and after the introduction of the landing obligation); this information is needed to identify if shore sampling programmes may be biased (or more biased than currently)
Medium	Unwanted landings stored on board without refrigeration.	Because these landings have no commercial value, skippers may not be willing to spend effort and money to refrigerate them. This could present problems for Access to samples (health and safety) Identification of species Estimates of weight, length, age.

4.4 Best practice / Guidelines for the near future

With the stepwise implementation of the landing obligation starting in 2015 there are many uncertainties how the implementation will affect the sampling programmes. WGCATCH proposes the following guidelines to assure the continuation of the individual sampling programmes and to prepare for adaptations needed for the new management regime:

1) Countries should continue their sea-sampling programmes with at least the same effort as before the implementation of the landing obligation.

Countries should record and document the accessibility to vessels (non-response rates) and demonstrate if this has changed with the implementation of the landing obligation.

Using a reference fleet might result in less bias if observer effects are significant. The reason is that vessels may change their behaviour for occasional observed trips but if they are continuously being monitored they are less likely to change behaviour.

Observers could sample the catch (rather than the landings and discards) if this reduces refusal rates.

2) If landings are sampled on shore, countries should sample all components of the landings including the unwanted landings. With the implementation of the landing obligation countries should be aware the landing sites accessible for sampling could differ for different parts of the landings, since unwanted landings would probably not be end up in auctions.

Countries should record and document the accessibility to sampling sites (non-response rates) and if this has changed with the implementation.

3) Countries should monitor and document if and how the landing pattern (e.g. sites) changes with the implementation of the landing obligation.

4) Sampling schemes should be designed and estimates produced in accordance with sound statistical principles. WGCATCH can be used as a platform to validate sampling designs and be beneficial in adopting sampling protocols.

5) Self-sampling programmes of the unwanted catch could be implemented in the situation that unwanted catch is inaccessible on shore or the quality of the unwanted catch is too poor to collect biological samples. Fishers could take samples on board and store these samples under conditions that makes it possible to use these samples for biological sampling at a later stage (Uhlmann *et al.*, 2012).

6) New or alternative methods (e.g. CCTV, self-sampling, comparisons of length frequencies between harbour and sea-sampling, modelling based on surveys) should be properly validated and evaluated and compared with the present estimates. Proper guidelines should be given for other countries to follow, were appropriate. WGCATCH can be used as a platform for this work.

7) Information should be analysed in real-time from vessel operator reporting systems, registered buyers and sellers, and from independent scientific observations (i.e. not just at the end of the year). These data should be cross-checked and analysed in the context of the forecast catch levels and quota availability. It is also recommended that an evaluation be undertaken to assess the extent to which the current observer programme can serve to validate self-reported catches and registered sales data. It is further recommended that consideration be given to how discrepancies between skipper-reported, independently observed and forecast catches be dealt with.

4.5 Proposed analysis

Subgroup discussions led to a list of proposed analyses that should be conducted by Member States. The analyses were divided into qualitative and quantitative sections and for each analysis is described the effectiveness and limitations of the data and data collection for those analyses. These analyses will support the estimation of unreported discards and identify changes of fishing behaviour and discard patterns under the landing obligation.

Proposed analyses are summarized in Table 4.5.1 and the data needed to carry out the proposed analyses are described in Table 4.5.2.

Table 4.5.1: Proposed analyses to be conducted by Member States

Data Analysis	Pros	Cons
Quantitative analysis		
Compare the LFD's of the landed fish from trips with and without observers from vessels using the same fishing grounds/gears **Observer vs. Onshore**	Will be able to detect if all length complements of species are being landed. Could be used to estimate unreported discards.	Need extensive observer data and a low non-response rate. Need to be able to access the wanted and unwanted landings.
Compare the market sizedcategories of the landings and calculate the ratio of trips with undersized fish (Figure 4.5.1). **Sale slips (non-observer trips)vs.sale slips (observer trips)** **Sale slips (non-observer trips)vs.Sale slips (CCTV vessels)** **Sale slips (non-observer trips)vs.Sale slips (non-observer trips)**	Data can be used to detect unreported discards.	It may be difficult to obtain sale slips for unwanted landings. Sales slips may not record logbook numbers making it difficult to link the data.
Compare species composition in logbooks for a fleet segment within a period and area with observer data and between vessels. **Logbookvs.Observer (Fleet and vessel level)** **Logbookvs.Logbook** **CCTV vs. non-CCTV (Logbook)**	Relatively easy to obtain information from logbooks. Data could be used to analyse if some fleet segments are missing species information related to discarding.	Lack of detailed gear information in logbooks. A very small number of observer coverage could skew the analysis.
Calculate the ratio of wanted and unwanted landings (by species) to total catch on either haul or trip level. **Logbook vs. Observer (Fleet and vessel level)** **Logbook vs. Logbook** **CCTV vs. non-CCTV (Logbook)**	Data can be used to give a more realistic catch estimate of stocks. A comparison can be made between observer programme results and logbook.	It will be difficult to obtain information by haul and species from the logbook.
Model discards through comparison of survey data with commercial data.	Allows for an alternative index of the catch.	Need high quality survey data and selection curves for all gear types used in the sample area.
Qualitative analysis		

Data Analysis	Pros	Cons
Logbook and VMS information on fishing operation positions could be used to analyse change in spatial patterns (Figure 4.5.2). **Logbookvs.Observer (Fleet and vessel level)** **CCTV vs. non-CCTV (Logbook)**	Gives an indication of changed behaviour when observers are present on a fishing trip.	Need a large amount of observer data to account for natural variation in fishing patterns. Haul by haul data currently not mandatory in logbooks of all member states. VMS only applicable to vessels above 12 m.
Compare the catch compositions in the historical observer data with the current variability of catch compositions. **Species composition** **Discard ratio**	Can analyse the effect of the discard ban on fishing patterns.	There will be a high variability over a time-series making it difficult to detect changes in discard behaviour.

Table 4.5.2: Input data needed for data analysis (*Haul by haul if possible)

Data source	Data Collected
Logbook*	Species composition
	Weights of catch/landings (divided into wanted landings, unwanted landings and discards)
	Fishing grounds
	Gear type
	Effort
VMS	Fishing grounds
	Behaviour patterns
	Behaviour of vessels that refuse observers
Observer sampling	LFD (catch)
	Fishing grounds
	Behaviour patterns
	Gear type
	Species composition
	Non response rates
	Effort
Onshore sampling	LFD (landings)
	Gear type
	Species composition
	Fishing grounds
	Sampling programs for unwanted landings
Sales slips	Commercial size categories
	Logbook ID
CCTV	Species composition
	LFD (catch)
	LFD (landings)
	Ratio of wanted and unwanted catches
	Recording of discard events
Scientific surveys	LFD
	Species composition
	Spatial distribution of the populations

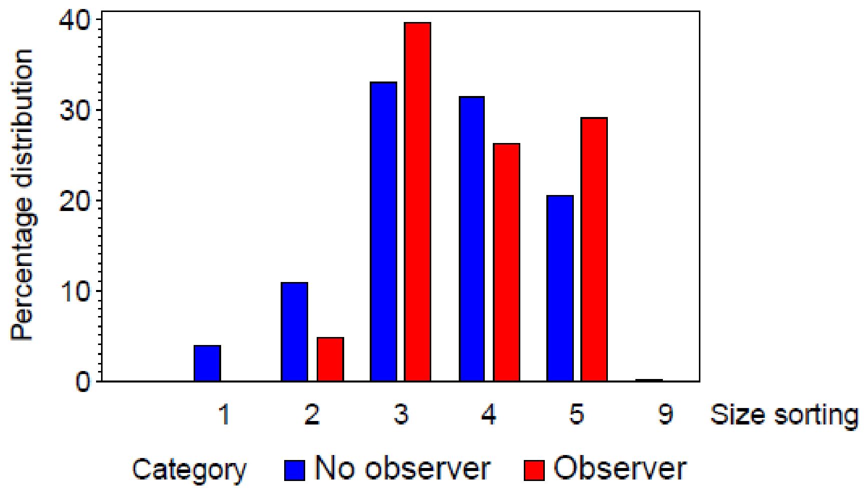


Figure 4.5.1: Relative difference in size sorting groups within the same fleet segments (Skagerrak) between observed and non-observed vessels. Sizing sorting group 1 = largest cod, sizing group 5 = smallest cod

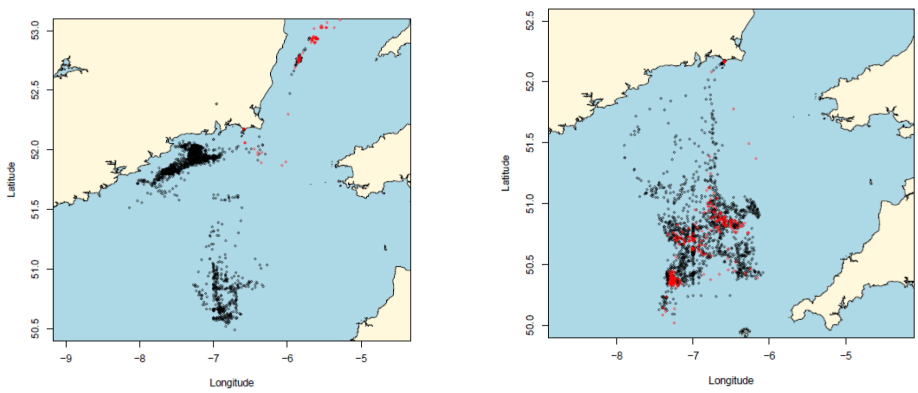


Figure 4.5.2: Comparison of VMS fishing activities of observed trips (red) and unobserved trips (black) by the same vessel. Left panel shows atypical behaviour and right panel shows regular behaviour. Note that atypical behaviour in itself does not necessarily mean that this is caused by the presence of an observer.

4.6 Landing obligation pilot studies / case studies

4.6.1 Ireland

BIM and the Marine Institute conducted trials during October and November 2014 to simulate the full introduction of the landings obligation. Vessels were required to retain and land the species specified in Article 15.1.C (ii) of EU regulation 1380/2013, namely cod, haddock, whiting, saithe, *Nephrops*, hake, common sole and plaice. Two fisheries were investigated i) the *Nephrops* fishery in the Celtic Sea (The Smalls) and ii) the mixed demersal gadoid fishery in the Celtic Sea.

The trials were split into two phases: Phase 1, where the vessels operated as normal i.e. no change in tactical behaviour or technical modifications to the gears and phase 2 where the skippers were presented with the results of the first phase and asked to choose from a range of existing mitigation tools and/or adjust their fishing behaviour and tactics and challenged to reduce the levels of unwanted catch as much as practically possible.

The vessels fished their monthly quota allocations as normal, but were required not to discard cod, haddock, whiting, saithe, Norway lobster, plaice, common sole and hake. They were permitted to continue fishing until the individual quotas for the target stock(s) had been taken or where any bycatch quota allocations have been exhausted (provided quota allocations for the target stock(s) remain) but were subject to continued monitoring of catches throughout the monthly quota management period using two onboard observers on each vessel. This provided full information on the catch retained and allowed for the assessment of different potential scenarios under the landings obligation. For example under conditions where some *de minimis* exemptions are foreseen, the data collected allows for a hindcast analysis to see at which point during the management period (Ireland operates a monthly quota allocation scheme) the vessel would have been choked under the particular scenario. Catches of all other TAC species were also fully documented during the trials, but discarding of undersize and over quota catches were permitted. In addition to facilitating the collection of biological (catch) data, vessels were also required to provide economic information to facilitate analysis of potential economic impacts of the landings obligation.

Key challenges were the requirements to land non-marketable undersize or over quota fish, cessation of fishing activity once the quota for the first individual TAC species is exhausted and costs associated with handling and disposal of non-marketable fish.

As the trials were only completed towards the end of 2014, the data are still being analysed and will be reported by February 2015. It is also intended to undertake further trials in different fisheries in 2015.

4.6.2 Scotland

In 2013, Marine Scotland conducted a fully documented landing obligation trial for all demersal species in the North Sea with the cooperation of a pair trawl team, randomly selected from 11 applicants. The vessels were awarded a quota uplift for a number of species in line with estimated of Scottish fleet discard rates and required to land all of their demersal catch. The scheme was intended to be a six month scheme (1 July–31 December 2013) during which the vessels would be required to land all of their North Sea demersal catch. However, the trial was concluded after 6 weeks at the request of the skippers.

During the six weeks of the landing obligation trial, the participating vessels predominately landed cod, haddock, whiting, saithe and hake (94% of the catch by volume and 93% of the catch by value). There was very little catch of other species, which consisted of (in order of decreasing tonnage): plaice, ling, catfish, anglerfish, lemon sole, pollack, megrim, halibut, dabs, witch, tusk, turbot and squid.

The main conclusions of the trial were as follows:

4.6.2.1 Choke species

This trial showed that there are likely to be significant challenges in operating under a landing obligation due to “choke species”, even where current quota levels are increased by current discard rates relevant to the specific fishing fleet, which in some cases are higher than the average EU estimated rates. The skipper reported that the cost of leasing quota approached, or exceeded, the price level for which the fish were sold, resulting in a projected financial loss once operating costs are taken into account for this species. It is not possible to predict how these situations might differ when the entire EU fleet is subject to a landing obligation and when the flexibilities become available.

4.6.2.2 Unwanted catch

The trial showed that it is possible to be very selective with regards to juveniles, with very little catch below Minimum Landing Size even when while targeting small haddock. Approximately 1% of the catch in this trial was juvenile fish. The terms and conditions of the trial required that this fish could not be sold for human consumption. Fish below Minimum Landing Size, damaged fish and fish otherwise unsellable were sold as bait to potters and creelers, and this market could possibly absorb considerable quantities of unwanted catch once the landing obligation comes into effect.
A report can be found at the following link:
http://www.gov.scot/Resource/0043/00438386.pdf

4.6.3 England

In 2012, Cefas conducted a landing obligation trial to provide information on the practical issues and challenges that implementing it would have in the English fisheries. The trial focused on how fishing practices, catch handling, storage and transport would change when the landings obligation is implemented. The trial demonstrated that the obligation to land all catches will result in significant changes at the vessel and port level, particularly in the amount of labour required to sort and weigh all species on board, and the logistical difficulties some ports will have to receive the previously discarded material. This project highlighted the need to know and understand how the landing obligation will affect the landing practices in the different ports and the need of adequate monitoring to ensure all catch components (human consumption, non-human consumption and discards) are recorded so the catch estimates are the most reliable. The trial generated recommendations which would be expected to facilitate the implementation of the landing obligation. These recommendations included:

1) Information on catches should be analysed in real-time from vessels operator systems, registered buyers and sellers, logbooks and from independent scientific observations during the implementation phase of the landing obligation;
2) Consideration should be given on how discrepancies between skipper reported and independently observed catch data should be dealt with;
3) Explore the feasibility of collecting species-specific sales data from non-human consumption markets, and the industries receiving this material to be included within the registered buyers and sellers system;
4) Robust testing of the e-log system to ensure that vessel operators have the necessary tools to record their full catch, including catches for human, non-human consumption and those released to back to sea;
5) Work should be undertaken to determine how the new self-reporting tools, independent at-sea observations and registered sales data can be integrated to deliver full documentation of catches. The report on *'The English Discard Ban Trial'* can be found here:

https://www.gov.uk/government/publications/final-report-the-english-discard-ban-trial.

Following this project, in 2013 Cefas initiated a five-year project to assist the fishers to make the transition to the landings obligation - ASSIST. This project mainly focuses on the operational studies to improve gear selectivity and develop and evaluate methods to fully document catches. One of the studies covered during this project is to investigate how remote electronic monitoring (REM) technology can be used to collect scientific fisheries data. The objectives of this study are: 1) determine the potential for biological and fisheries data be collected from REM equipped fishing vessels and how these data can be used in combination with observer offshore and onshore data to satisfy the requirements of the DCF; 2) assess the potential for skippers to generate discard estimates that can be utilized in the stock assessment process. It has been demonstrated that REM technology allows volumes of fish retained to be estimated, provide counts of most commercial species and some non-commercial species and can provide length frequency distributions using image analysis software and virtual calipers. It will be investigated how these data could be used to meet some of the DCF requirements which, at the trip level, include length frequency distributions for all commercial species, catches split into discards and retained, estimates of weight caught for each category (retained or discarded) caught. The results of this project showed strong correlations between the data generated from the REM equipment, and that generated by scientific observers and demonstrated the potential of use this technology as monitoring and enforcement tool. The report can be found here:

http://www.cefas.defra.gov.uk/media/524514/englandremcatchquotafinalreportjuly2011final_tc.pdf

The outcomes of these projects can be useful to the National institutes to predict and prepare how the monitoring and data collection will be affected, considering the different fates for the different landing components (human and non-human consumption) and potentially, how the data generated by different sources (CCTV, logbooks, sales slips, onshore and offshore observer and self-sampling) can be integrated and used for stock assessment and management advice.

4.6.4 Netherlands

In 2011, a catch quota pilot study started for cod in the Dutch bottom-trawl fishery in which EM (electronic monitoring/CCTV: video-based monitoring) was used as an audit system to review the consistency of reported cod catches under a catch-quota regime (an obligation to land all cod catches). This study evaluated the efficacy of EM for cod catches on vessels in a mixed bottom-trawl fishery and tested the hypothesis that cod catches are difficult to detect with video monitoring, specifically in catches with large volumes of bycatch. Eleven vessels joined the pilot study on a voluntary basis. Participants received a 30% increase in individual quota for cod and were also compensated with extra effort in days at sea. In return, all cod catches were counted against their cod quota. Based on this study it was concluded that distinguishing small numbers of cod in catches of mixed bottom-trawl fisheries is difficult because there is a low correlation between logbook and video data (Pearson r=0.17). Similar difficulties are expected in other mixed demersal trawl fisheries with large bycatch volumes, when similar-looking species are targeted. Limitations in the applicability of EM to control one of the most common types of fisheries in Europe will be a burden on the implementation of the European landing obligation. Improved protocols of catch handling on board and technical adaptations may reduce some of the limitations (van Helmond *et. al.*, 2014).

4.6.5 Denmark

Denmark has three ongoing pilot studies with respect to the landing obligation a) In the industrial fishery, b) in the Baltic cod fishery – handling the discard onboard and c) In a broad part of the human consumption fishery were the fishers' behaviour and gear selection is the main focus.

In the first pilot study a) the primary changes in the landing obligation for the industrial fishery is that all caught fish has to be landed no matter the present rules on species composition. Further the skipper has to endeavour, before the trip, that necessary quota are available for the expected species composition.

<u>The aim of the study is to</u>

- Gain experience with the landing obligation by letting a number of industrial vessels fishing under the same condition as will be mandatory in 2015.
- To give the Industry and the managers' knowledge of the challenges that will be part of an implementation of a landing obligation.
- To gain information on herring bycatch in the industrial fishery that can contribute to knowledge of how bycatch on herring can be regulated in a way to gain the largest profit for the industrial fishery.

In this study 11 vessels fishing sprat in the Baltic, Skagerrak and North Sea, 4 vessels fishing Norway pout are participating and 2 vessels conducting a combined Norway pout/sprat fishery are participating.

Requirement to vessels participating in the pilot study is that the slipping is not allowed, logbook has to be conducted on a haul by haul base and they are exempted for the rules on species composition.

In the second Danish pilot study b) The aim of the study was to investigate the practical challenges for the fisher to handle the catch onboard under a discard ban for the fisher as well as for the managers to get an overview on how to handle the quota control with a landing obligation in place. The Baltic was used as a case study area, as the discard ban will be put in place 1 of January 2015.

One of the outputs from the trial study was that fishers were not able to handle the large amount of non-target but TAC species, such as plaice, that should be sorted and landed as well. The extra sorting and handling time was so large that the fishers did not want to continue the pilot study. Although plaice will not be part of the landing obligation in 2015, it will be mandatory to bring plaice to land in 2017.

In the third pilot study c) The aim of the project is to investigate the possibilities to minimize the annual discard under a catch quota management system with a landing obligation by implementing the fishers' own suggestions to gear selection or/and to change behaviour by changing the fishing pattern in space and time and thereby optimize the value of the catch. This will be conducted with a full documented fishery (CCTV) and scientific observers. The project is divided in 2 phases the first is by conduction a questionnaires and the second face it to implement some of the suggestions by the fishers in a pilot fishery.

4.6.5.1 Questionnaires

In the first part of the project DTU Aqua's observers interview a large group of fishers on how the landing obligation will influence their quotas and fishing pattern and they were asked to come with suggestions to improvements and solutions.

4.6.5.2 Pilot fishery

In the pilot fishery selected vessels from different fleet segments and area try to reduce their discards by changing their gears and fishing pattern. Currently 14 vessels are participating:

1) Danish Seine fishery in Skagerrak, 2 vessels (start mid-September 2014)

2) Trawl fishery Skagerrak (*Nephrops*), 3 vessels (start mid-November 2014)

3) Trawl fishery in North Sea, 6 vessels (start mid-November 2014)

4) Trawl fishery Baltic (cod), 3 vessels (start 1 December 2014)

4.6.6 Norway

Norway has as a non-EU country already introduced a discard ban on cod and haddock in 1987, and has gradually extended this to 55 species or species groups at present. A key part of the success of the ban is that it does not stand alone but is part of a range of measures which are aimed at reducing the amount of unwanted catches. These measures include:

- The obligation to change fishing grounds e.g. when bycatch of undersized fish has been exceeded.
- Real-time closures, areas where the bycatch of undersized fish has been exceeded are temporarily closed.
- Tailoring of quota regulations, e.g. allocate quota to cover unavoidable bycatches.
- Gear restrictions, e.g. harmonizing minimum mesh sizes with permissible minimum catch size and the size of marketable fish.
- While unwanted catches can be sold for human consumption, fishers will not receive more than 20% of the value of these catches, creating an incentive to avoid them (in some fisheries this 20% rule was abandoned as it still provided too much of an incentive to catch these fish).

Discarding is an offence that may be difficult to detect. However, Norway has an extensive surveillance presence with 15 Coast guard inspection vessels conducting around 2000 inspections annually. This results in a number of detections each year and sanctions can be severe. Enforcement of the other measures to reduce discarding is more straightforward, e.g. the obligation to change fishing grounds can be enforced using haul-by-haul logbooks, VMS or other data.

Sampling of discards in Norway is done through a reference fleet and through comparing species composition and size at sea (conducted by the Reference fleet, Coast Guard and Directorate of Fisheries) with similar sampling of the landed catches. The Norwegian discard sampling program has been carried out through projects designed according to the specific characteristics of selected fisheries. Discards cannot be estimated for all fisheries all of the time, and if discards in a specific fishery turn out to be small, a fixed discard rate will be used for this fishery until it is checked again. On the other hand if the discard rate is high, then the discards in this fishery will be estimated each year.

A more detailed description on the Norwegian experience with sampling and estimation of bycatch under a discard ban is given in Annex 7.

4.7 Landing Obligation Questionnaire Summary

In order to address ToR 3 "*Provide advice on adapting sampling protocols to anticipated changes in management measures (e.g. discard ban) or technical advances in monitoring*", countries were asked to fill a questionnaire to answer which fisheries will be affected by the landing obligation. Participants were asked to provide information on observer programme coverage, what data should be collected and what analyses should be carried out to evaluate bias on fishing behaviours and discarding patterns. A summary of the results is presented in Annex 8 and the full questionnaires are available in a separate Appendix to this report.

Many of the findings from the questionnaires were used as a basis for the discussions in the subgroup and have been incorporated in the text of the preceding sections. An interesting result that has not been discussed in these sections is the number of vessels that are likely to be affected by the introduction of the landing obligation. Of the 29 903 vessels from participating countries, 9% are expected to be affected by 2015; 83% by 2016 and around 7% of vessels (mostly using pots and traps) are expected to remain unaffected.

5 ToR 4: Provide advice to the RDB Steering Group on development of the RDB to support design-based data collection and estimates

This ToR was dealt with by the fifth RDB workshop to develop the RDB data format for design based sampling and estimation (WKRDB 2014-1) which took place before the WGCATCH meeting. WGCATCH supports the findings of this workshop, a summary of which is given below. WGCATCH made the additional suggestion of including the sampling probability in the tables as an optional value. In this way, missing sampling probabilities can be calculated but if sampling probabilities are given, these values can be used to override the calculated value.

The fifth RDB workshop to develop the RDB data format for design based sampling and estimation (WKRDB 2014-1), with particular emphasis for onshore sampling, was chaired by Alastair Pout (UK- Scotland) Liz Clarke (UK- Scotland) and met in Aberdeen 27–31 October 2014 to:

a) Document, by means of case studies, the range of sampling protocols used to collect catch data on a variety of fish and shellfish sampled in a variety of situations across the regions, particularly those onshore, e.g. at landing port, markets, and at processors. These case-studies will identify the primary sampling unit (PSU) and all stages in the hierarchical cluster sampling involved.
b) Determine the extent to which these sampling protocols can be effectively recorded on the present RDB data format (csData tables), and as appropriate develop a revision of the data format.
c) Generate appropriate sample weights for the PSU using the sampling data recorded in the (revised) data format.
d) Following design based sampling principles (i.e. based on sampling frames of ports, markets or processors), consider the extent to which population estimates for a variety of domains can be effectively derived from the sample data, and post stratification weights, using the available landing and effort data in CL and CE format. Suggest revisions the the CL and CE data format accordingly.

One aim of this workshop (TOR B) was to modify the cs data structures used in the RDB, and inherited from FishFrame, to make it suitable for design based sampling and estimation. To this end a modified version of the cs data structure was constructed prior to the meeting incorporating all the suggested changes from previous meetings (WKRDB 2, WKPICS 2, SGPIDS 3). For clarity the modified sampling structure was termed the csRDB. This csRDB format included the addition of a new table, the se table, designed to record all pertinent information relating to the sampling event, and allowing the primary sampling unit (PSU) to be clearly identified. Following presentation of this in plenary a subgroup considered in more detail the revised format and new fields in the csRDB structure.

A second subgroup scrutinised documented case studies from 13 national sampling schemes presented to the workshop (TOR a). In each of these the stages in the multi-stage sampling were identified and the values used to determine the selection probabilities at each stage. This scrutiny identified a number of potential new variables and modifications that would be needed for the csRDB structure.

A third subgroup considered the translation of the existing cs data structure into the csRDB structure in the R statistical language and 4 national datasets successful populated the new csRDB data structure.

TOR d was addressed in part with a presentation and plenary discussion on a modified version of the cl and ce data structures and a proposed new exchange format that would incorporate the fields from both. This generated considerable discussion though it was concluded that any new structure and the role it was required to fulfil needed to be considered with greater clarity.

In addition TOR c and the estimation aspect of TOR d was demonstrated with the R survey package with a simulated dataset which was used to show the use of combined sampling probabilities to generate a sample weight, the ability of the package to estimate for domains and apply post stratification corrections.

The workshop came to a number of conclusions. It was felt that the csRDB sampling data structure was an important development but that it needs more work. Considerations of descriptive use and storage efficiency needed to be resolved, considerable work needs to be done in documenting and standardizing the existing fields and changes and in clarifying the code lists. It was felt that by far the best way to achieve this was through international cooperation; in particular members of the workshop found the hands-on approach focused the discussion and provided a way to make faster progress. The consensus was that more workshops like this would be the way to progress.

The extent to which fisheries estimation can be carried out using the R statistical language and specifically the package “survey” shows considerable potential but should be tested in rigorously within national institutes. Most of the people at the workshop were using R and this will continue both as a means of promoting collaboration, and developing the formats from the estimation. There is considerable potential and important implications in the use of the R statistical language as to how estimation is developed of the RDB.

6 ToR 5: Evaluate responses to test applications of data quality assurance tables for onboard and port sampling developed by WKPICS, SGPIDS and PGCCDBS, make improvements for further testing, and develop clear guidelines for completing and interpreting the tables

It was not possible to complete this ToR. The background to the ToR, the reasons for not being able to complete it, and future role of WGCATCH in developing data quality evaluation procedures, are outlined below.

A substantial investigation into the quality of fisheries sampling programmes, data and associated analysis has been conducted by the ICES Planning Group on Commercial Catches, Discards and Biological Sampling (PGCCDBS), in their role to promote the ICES Quality Assurance Framework for fishery and biological sampling (Nedreaas *et al.*, 2009), and by workshops and study groups established by PGCCDBS. In addition to establishing protocols and standards for fish ageing and maturity determination, the PGCCDBS and its workshops and study groups have covered topics such as sampling and estimation for maturity ogives (WKMAT: ICES 2007a; WKMOG: ICES 2008b), accuracy of sampling data (WKPRECISE: ICES 2009a; WKACCU: ICES 2008a), discard raising procedures (WKDRP: ICES 2007b); design of commercial fishery sampling schemes (WKMERGE: ICES 2010b; WKPICS: ICES 2011a, 2012c, 2013; SGPIDS: ICES 2011b, 2012a, 2013b) and recreational fishery surveys (WKSMRF: ICES 2009b; WGRFS: ICES 2012b, 2013a, 2014).

These ICES initiatives have had a progressive impact since the late 2000s in increasing the awareness within the ICES community of the need for statistically-sound sampling design rather than ad hoc methods, and have developed an important and well-documented body of knowledge of fishery sampling design, implementation and analysis. An important component of this has been the development of guidelines for best practice as well as proposals for ways in which the quality of sampling programmes and the data gathered from them can be documented for a range of end-users such as stock assessment scientists, regional coordination groups and the European Commission.

It has become clear through the various ICES expert groups on fishery and biological sampling that different end-users of the data need different types and detail of information of data quality, and that quality needs to be considered at the different stages of sampling design, implementation, archiving and extraction of data, and analysis of data. At each of these stages, there need to be documented guidelines and standards for best practice; quality evaluation procedures and tools; and performance measures utilizing quality indicators (Table 6.1). ICES PGCCDBS, WKACCU, WKPRECISE, WKPICS, SGPIDS and WGRFS have all considered ways in which data quality can be evaluated and presented. WKPICS and WGRFS have produced guidelines for good practice, and along with SGPIDS and PGCCDBS have tried to develop a range of “quality assurance tables” that try to encompass the quality of sampling design and implementation, drilling down to the level of individual national strata to examine diagnostics such as sampling levels in relation to total fleet activity, refusal rates, and how representative the sampled trips are of the fleets as a whole in each stratum. The next stage of quality assurance and quality control of data, once collected, has been considered by the Regional Coordination Meetings for the EU Data Collection Framework (e.g. RCM NS&EA, 2014), particularly in relation to their need to extract and use data from national and regional databases.

PGCCDBS (ICES, 2013) asked for practical testing of QA reports that had been developed by WKPICS and SGPIDS in 2012. WKPICS-2 (ICES, 2013) reviewed some test applications in the assessment of Baltic cod, where it was found that the QA tables (see Table 6.2) gave a good overview of the contributions of national landings and fleet strata to total landing and discards and how the sampling was balanced across the fleet strata. Where there were potential issues with sampling for a fleet, the contribution of that fleet to the total was clearly shown. The draft quality assurance reports were also tried out at the benchmark meeting for Baltic Dab and Flounder. PGCCDBS (2014) subsequently noted that due to other more pressing data issues there was little time for the assessment groups to properly consider the efficacy of these reports although there was general consensus that they would be useful. Anecdotally, among those not familiar with these reports there appeared to be little interest. Whether this was a result of there being little time for the groups to properly consider the meaning of the reports, or was indicative of the gap between the data collectors and stock assessors, was unclear. It was clear that further guidance would be required in how to complete and understand these reports, the relevance of the quality indicators, and their potential use. WKPICS3 had concluded that further trial applications were needed for at-sea and harbour sampling of other stocks, and suggested that this could be done prior to the next PGCCDBS 2014. This was not possible, but PGCCDBS (ICES 2014) identified trial stocks to be reviewed by WGCATCH in November 2014. Again, it was not possible to find the staff time and opportunity for these trials, and therefore the ToR (5) for WGCATCH to review the trials could not be completed.

Future role of WGCATCH in developing data quality evaluation procedures

A more promising opportunity now exists through the new ICES Planning Group on Data Needs for Assessments and Advice (PGDATA), which intends in 2015 to focus on establishing a framework for ICES benchmark assessments to document data quality and use the information directly or indirectly in the assessments, as well as providing transparency in how the quality of assessments and advice is influenced by the quality of component datasets. This will depend on developing systems for documenting data quality from the design to the analysis stage (Table 6.1) and providing quality qualitative and quantitative quality indicators. The fisheries-related data collection groups WGCATCH and WGRFS fall with PGDATA under the umbrella of the ICES Steering Group on Integrated Ecosystem Observation and Monitoring (SSGIEOM), which has quality assurance of data as a core objective. It is anticipated that all four groups will work collaboratively to promote quality assurance of data used by ICES, at all stages from collection to end use, and to develop the most appropriate systems for achieving this. This type of information will also be extremely useful for the DCF Regional Coordination Groups in developing balanced regional sampling schemes.

Table 6.1. Possible elements of quality evaluation of a fishery sampling programme (illustrative). Adapted from Armstrong (2014)

Programme stage	Existing guidelines and standards ("best practice")	Quality evaluation procedure	Performance measures	Possible Quality Indicators
Design of sampling scheme	e.g. WKPICS and WGRFS best practice guidelines; IBTS protocols etc.	Review of documentation on sampling design relative to quality standards	Indicators of bias potential due to design.	Score against quality standards, e.g. frame coverage, sample selection procedures etc.
Implementation of sampling scheme	e.g. WKPICS and WGRFS best practice guidelines; IBTS protocols etc.	Review of sampling outcomes – e.g. diagnostics of coverage, refusal rates, sample numbers and precision etc.	Indicators of extent of bias (e.g. low, medium, high, unknown); Indicators of precision.	Number of primary sampling units sampled in each sampling stratum; CV; frame coverage; refusal rates.
Data archiving and extraction	e.g. RCM North Sea and Eastern Arctic 2014 lists of data checks.	Review of documentation of QA/QC procedures relative to quality standards. e.g. use of electronic data capture; error traps etc.	Indicators of extent and effectiveness of QA/QC procedures.	Score against quality standards
Data analysis	e.g. WKPICS and WGRFS best practice guidelines; IBTS protocols; etc.	Review of documentation of estimation procedures relative to quality standards.	Indicators of extent of bias (e.g. low, medium, high, unknown)	Score against quality standards, e.g. analysis follows design

Table 6.1 Trial quality indicator table of Western Baltic cod (cod2224) for the sampling year 2012.

	AT-SEA-SAMPLING											
	Stock - Species - Area - Year (Cod 2224 2012)	**Total landings 2012: 16756 t (source: FishFrame, RCMBaltic 2013)**										
		Denmark		Germany		Sweden		Poland		Finland	Latvia	Estonia
		Design		Design		Design		Design				
		Implemention		Implemention		Implemention		Implemention				
	Importance: Contribution to stock landing	53%		27%		14%		5%		2%	<1	<1
	Sampling / design effect/diagnostic for randomness… (Description according to best practice)											
	Sampling design	probability based discard sampling		probability based catch sampling		Probability based discard sampling		probability based discard sampling				
	Primary sampling unit	Vessel* trips		Vessel		Trip		Vessel				
	Sampling frame	quartely vessel list		annual vessel list		Quarterly vessel list		annual vessel list				
	Periodicity	effort is following the fishery		1-2 samples/week during fishing seasons		difficult to quantify		--				
	Contact protocol	yes		Yes		Yes		Yes				
	Sampling manual available	yes (Danish)		under preparation		No		under preparation				
	...											
	Strata from the sampling frame	Fleet 1	Fleet 2	Fleet 1	Fleet 2	Fleet 1	Fleet 2	Fleet 1	Fleet 2	Fleet 1	Fleet 2	
		active gear (Trawler)	passive gear	active gear (Trawler)	passive gear	active gear (Trawler)	passive gear	active gear	passive	active gear	passive	
	Importance: Contribution to national landing	70%	30%	67%	33%	50%	50%	47%	53%	100%	100%	
	Mean discard rate of the fleet in the year	9%	assumed low	10%	4%	14%	2%	5%	1%			
	Importance: Contribution to national discards in fleet	100%	0%	84%	16%	93%	7%	71%	29%			
	Quality indicator											
1	Total number of vessels in the fleet*	151	199	58	887	40	101	44	69	1	3	
	Number of trips sampled onboard of vessels	34	0	28	32	4	40	1	2			
	Number of unique vessels sampled	15	0	15	17	4	19	1	1			
	Total number of trips conducted by the fleet	4686	11519	3891	22156	247	4043	275	565			
	Number of trips sampled where stock occurred in the discards	34	0	28	32	4	33	0	2			
	Number of trips sampled where stock occurred in the landings			28	32	4	39	1	2			
	Number of port samples	40	40					0	68			
	Age key quality indicator (e.g. Mean number of age samples per trip sampled from this fleet)	75	75	207	63	76	14	0%	0%			
2	Non-response rate	68%		45%	53%	75%	50%	0%	0%			
	Industry decline (refusal rate)	27%		9%	3%	23%	not determined	0%	0%			
3	Goodness of fit											
	Bias 1: Spatio-temporal coverage	tested and considered all right		tested and considered all right		Few trips achieved		sampling ICES rectangle 37G4	sampling ICES rectangle 37G4			
	Bias 2: Vessel selection	6% are having a to small vessel for observers to participate		smaller passive gear vessels rejected observers		High refusal rate		no problem	no problem			
	Bias 3: ...											
4	Precision levels of e.g. parameter a, b, ...											
	e.g. CV, variance, relative sampling error											
	e.g. Input data for XSA model:											
	maturity at age											
	stock weight											
	catch weight											
	catch at age											

7 Quality assurance of WGCATCH outputs

The working group did not produce any data outputs; the outputs of the group are this report and the appendix with the responses from the Questionnaires. All ToRs were fully discussed in subgroups and then in plenary. The final draft of the report was provided to all Working Group members for scrutiny and to check for errors. The Working Group chairs have made every effort to ensure that the content of the report is accurate and reflects the opinions of the Group.

8 Responses to recommendations to WGCATCH from other groups

Two recommendations were made to WGCATCH as part of the 2014 Liaison Meeting recommendations and agreements[1]. These are shown in Table 7.1, and responses are given below.

1) ICES WGCATCH (November 2014) explore sampling strategies which can be applied under the landing obligation management regime including sampling of the landing fraction of the catch which previously was discarded. LM recommends to MS to follow the guidelines provided by WGCATCH.

Proposed action: WGCATCH to address this additional task in the next meeting (2014).

WGCATCH response: This is covered under WGCATCH ToR 3.

2) ICES to set up a workshop proposal to see the implication to the stopping the concurrent sampling for those stocks and benefits concurrent sampling are providing or can provide considering the new and broader scopes of the revised DCF, such as the evaluation of impacts of fisheries on marine biological resources and on the ecosystem.

Proposed action: WGCATCH to consider this recommendation at WGCATCH 2014 meeting and prepare the resolutions of the requested workshop. The WK should take place in 2015. Therefore it will need to be presented / approved by ACOM December 2014.

WGCATCH response: Proposed Terms of Reference for a Workshop on Evaluation of Concurrent Sampling of Length in Commercial Catches (WKISCON2), and supporting information, were drawn up by WGCATCH and are given in Annex 4.

[1] Based on the draft report, 6 November 2014.

Table 7.1. Recommendations to WGCATCH from 2014 Liaison meeting.

LM 2. Implications of the landing obligation - Scientific data collection and at-sea sampling	
RCM NS&EA 2014 Recommendation 2	RCM NS&EA recommends that MS maintain scientific observer programmes and continue at-sea sampling schemes for the collection of scientific data for stock assessment and advice. Additionally that the role of scientific observer is not conflated with any monitoring role. Appropriate modifications to at-sea sampling protocols and recording should be devised for sampling the retained discard fraction.
Justification	Discarding will become illegal mostly, and this has the potential to disrupt the historical time-series of catches used in assessment models. Nevertheless, at-sea sampling needs to be maintained because discards at-sea will continue for various non TAC species and exemptions allowed under the landing obligation. Additionally the landing obligation will introduce a new category of retained discards and this fraction has to be sampled to obtain scientific data for the complete catch composition. Until such time as the feasibility of sampling this catch component onshore can be determined there is a need to maintain at-sea sampling. The RCM NS&EA underlines the importance of maintaining statistically sound sampling designs for the on-board observations, and the integrity of scientific observers.
Follow-up actions needed	Scientific institutions to prepare sampling protocols appropriate to at-sea sampling of the retained fraction and the extra faction (landing part for industrial purpose of fish under the minimum reference size) due to the landing obligations and modify their sampling protocol. MS & ICES to consider if modifications are needed for recording, storage and estimation processes (data exchange format, IT systems...)
Responsible persons for follow-up actions	Scientific institutions within MS
Time frame (Deadline)	Prior to the implementation of the landing obligation
LM comments	The LM fully support this recommendation and in addition that the **ICES WGCATCH (November 2014) explore sampling strategies which can be applied under the landing obligation management regime including sampling of the landing fraction of the catch which previously was discarded. LM recommends to MS to follow the guidelines provided by WGCATCH.**

Proposed action: WGCATCH to address this additional task in the next meeting (2014).

LM 9. Concurrent sampling	
RCM NA 2014 Recommendation 1.	The RCM NA recommends that a comprehensive evaluation of the utility of the data being collected with the concurrent sampling should be performed.
Justification	It is unclear whether the significant resource needed to carry out concurrent sampling provides benefits that outweigh the costs. Some ICES Working groups have benefited from concurrent sampling data collected however there is no empirical evidence to support this. In order to decide if concurrent sampling should continue, more feedback from end-users is required.
Follow-up actions needed	MS should carry out the evaluation on their own data collection schemes and report back to the RCM NA. **ICES to setup a workshop proposal to see the implication to the stopping the concurrent sampling for those stocks and benefits concurrent sampling are providing or can provide considering the new and broader scopes of the revised DCF, such as the evaluation of impacts of fisheries on marine biological resources and on the ecosystem.**
Responsible persons for follow-up actions	MS, RCM NA ICES
Time frame (Deadline)	MS: Intersession work with results reported to RCM NA 2015 ICES: Workshop to take place in 2015.
LM comments	The LM endorses this recommendation.

Proposed action: WGCATCH to consider this recommendation at WGCATCH 2014 meeting and prepare the resolutions of the requested workshop. The WK should take place in 2015. Therefore it will need to be presented / approved by ACOM December 2014.

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ICES 2012b. Report of the Working Group on Recreational Fisheries (WGRFS). ICES CM 2012/ACOM:23.

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Annex 2. Agenda

Starting time, Monday 10 November: Plenaries to commence 10h00 promptly (please arrive beforehand to get set up on Internet etc.)

Finishing time: Friday 14 November 12h30

Monday 10 November: 10:00 – 18:00

Item 1 Introductions and work plan for the meeting – what is the role of WGCATCH, where does it fit in with other Expert Groups in relation to ICES Advisory and Science Plans, and what we want to achieve at this meeting.

Item 2: Introduction to ToR 1 *(Develop the longer term work plan for WGCATCH*). Presentation of current work plan and plenary discussion of alterations / additions to go to ACOM / SciCOM for approval.

Item 3: Background to ToR 2 (*Evaluate methods and develop guidelines for best practice in carrying out sampling of commercial fish catches on shore*). Establish subgroup composition, tasks and outputs. PARTICIPANTS SHOULD COMPLETE THE QUESTIONNAIRE ON NATIONAL SHORE SAMPLING DESIGN, AVAILABLE IN THE SHAREPOINT FOLDER "**National shore sampling descriptions**" AND UPLOAD WITH COUNTRY NAME IN FILE NAME AS FAR IN ADVANCE OF MEETING AS POSSIBLE.

Item 4: Background to ToR 3 (*Provide advice on adapting sampling protocols to anticipated changes in management measures (e.g. discard ban) or technical advances in monitoring*). Establish subgroup composition, tasks and outputs. PARTICIPANTS SHOULD COMPLETE THE QUESTIONNAIRE ON NATIONAL PERSPECTIVES ON LANDINGS OBLIGATION, AVAILABLE IN THE SHAREPOINT FOLDER "**National information on landings obligation**" AND UPLOAD WITH COUNTRY NAME IN FILE NAME AS FAR IN ADVANCE OF MEETING AS POSSIBLE.

Item 5: Background to ToR 4 (*Provide advice to the RDB Steering Group on development of the RDB to support design-based data collection and estimates*). Establish subgroup composition, tasks and outputs.

Item 6: Background to ToR 5 (*Evaluate responses to test applications of data quality assurance tables for onboard and port sampling developed by WKPICS, SGPIDS and PGCCDBS, make improvements for further testing, and develop clear guidelines for completing and interpreting the tables.*). These test applications were not carried out; we will decide at WGCATCH if there is capacity at this meeting to do any further work at this stage. Chairs will review what has been done by previous ICES meetings and come with some proposals on what kind of framework is likely to be most useful to benchmark stock assessments and regional coordination for documenting current and historical data quality. This framework will be applied by the new Planning Group on Data Needs for Assessment and Advice (PGDATA) in 2015.

Item 7: Other requests to WGCATCH. This includes an RCM request for WGCATCH to review what STECF has said about the utility of concurrent sampling for length compositions, and recommend a Workshop if necessary – probably in 2015. This will be discussed and agreed in plenary.

Tuesday 11 November: 9:00 – 18:00

9:00: Plenary - Review subgroup tasks for the day

9:30: Work in subgroups

17:00: Plenary – Feedback from subgroups on progress

Wednesday 12 November: 9:00 – 18:00

9:00: Plenary - Review subgroup tasks for the day

9:30: Work in subgroups: commence text drafting

16:00 Plenary - Data quality indicators for catch data in stock assessments and regional coordination: suggestions from Chairs on the way forward.

17:00: Plenary – Feedback from subgroups on progress

Thursday 13 November: 9:00 – 18:00

9:00: Plenary - Review subgroup tasks for the day

9:30: Work in subgroups: develop final outputs and continue text drafting

15:00: Plenary – Feedback from subgroups on conclusions; review completed and ongoing text

Friday 14 November: 9:00 – 12:30

9:00: Plenary - Review tasks for the day

9:15: Work in subgroups to finalize text

11:00 Plenary - Review any remaining text not already agreed in plenary, and any changes from previous plenary feedback; ensure all files are in the correct place on SharePoint; identify any remaining post-meeting amendments to text needed.

12:00 Plenary - Overview of main conclusions to emphasize in Executive Summary of report; close meeting at 12:30

12:30 Phew!!

Annex 3. WGCATCH workplan and terms of reference for the next meeting

Initial workplan

The initial workplan was developed by PGCCSBS in 2014 (ICES CM 2014 / ACOM: 34)

Work plan for WGCATCH: 2014-2016.

2014: as defined by the proposed ToRs for 2014: i.e.

1) First meeting will agree the longer term work plan and skills needed
2) Evaluate methods and develop guidelines for best practice in carrying out sampling of commercial fish catches on shore (this has largely been completed for at-sea sampling by SGPIDS).
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 onboard and port sampling developed by WKPICS, SGPIDS and PGCCDBS, make improvements for further testing, and develop clear guidelines for completing and interpreting the tables.

In relation to the long-term plan, the required linkages and form of working relationships with end-users of WGCATCH products – e.g. RCMs; STECF; other ICES EGs - should be identified.

2015

A wide range of topics are possible for 2015 and 2016, and are listed below. These are in addition to any special requests to the WG. The topics should be prioritized by WGCATCH 2014.

- The group should evaluate methods and develop guidelines for best practice in carrying out sampling of commercial fish catches from small-scale fisheries. (This links closely with methods developed for recreational fisheries by WGRFS.)
- In relation to sampling design, WGCATCH should initiate a survey of the historical changes in sampling programmes in Europe. Of particular interest are changes related to the demands of the DCR and DCF, and expectations for the future DC-MAP. The motivation is that important historical information may otherwise be lost, and changes in characteristics and quality of time-series data need to be documented.
- To facilitate the goal of sampling optimization within and between countries, WGCATCH should begin to compile case studies where sampling design allows reliable estimation of precision, and examine the relationship between achieved precision and sampling effort and cost. Statistical approaches to optimize sampling to achieve multiple goals (e.g. achieve

desired precision for >X% of stocks or métiers) should be reviewed and case examples provided.

- The linkage and working relationships with end-users of WGCATCH products – e.g. RCMs; STECF; other ICES EGs - should be clearly established by 2015.
- Moving towards wider implementation of the discard ban, WGCATCH should begin to compile experiences from national trials of how the legislation affects shore based and at-sea sampling programmes, and data quality, and advise on how sampling programmes could be adapted.
- WGCATCH will continue to provide advice on how the regional databases should be structured to archive design-based survey data and permit analysis of the data according to design.
- The accuracy of reported landings data during various historical periods is often in doubt due to suspected or known misreporting, mixed-species catch reporting, dispensations from reporting small catches, and methods of recording landings where no logbooks are kept. Changes in legislation, e.g. introduction of Buyers and Sellers regulations, can cause step changes in accuracy. In some cases, scientists post-process official data or use surveys to try to improve the accuracy of the data. Often these are not well documented or reviewed. This is a potential topic to be addressed by WGCATCH, to review the extent of these problems and methods adopted, and advise on better approaches where needed. An initial survey would be needed to document the extent of the problem and methods adopted.
- Fishery-dependent abundance indices are still used in many stock assessments, and for some species where RV surveys cannot provide reliable information, may be the only source of information on stock trends. There is no design base for fishery cpue, and various methods are applied worldwide to get round this problem for example using species composition data (Stephens and MacCall 2004) to exclude trips considered to have a very low probability of catching the species, and delta-lognormal models to provide relative abundance signal after factoring out the influence of area, season, vessel/gear characteristics etc. There is scope for WGCATCH to work in collaboration with other ICES EGs such as WGFTFB (gear technology) and the Methods WG to evaluate these approaches using case studies in the ICES area, given that much of the work of WGCATCH on the underlying catch data are relevant. This includes how the catch and catch composition data are collected, and precision and biases in these over time.
- It has been an aspiration of WKPICS to produce a textbook on fishery sampling design. Whether or not this happens, PGCCDBS considers that there would be great value in publishing key findings of the WKPICS/SGPIDS/PGCCDBS/WGCATCH series in ICES Cooperative Research Reports (CRR) and peer-reviewed publications. Planning of these should commence in 2015:
    - CRR on optimization procedures and case-study application of sampling programme optimization;
    - CRR with synthesis of sampling design evolution towards best practice;
    - Peer-reviewed publication with sampling design/optimization case-studies from European waters.

2016

In 2016, WGCATCH should aim for completion of the agreed deliverables for the first three-year term, either as final products or well-defined achievements for topics that require longer-term work:

1) Detailed evaluation of onshore and small-scale fishery sampling design, implementation and analysis using case studies, and detailed guidelines for good practice;

2) Documentation of changes in sampling programmes in Europe;

3) Finalization of the "toolkit" of quality assurance reports for end-users of fishery sampling data, tested through stock assessment benchmarks and RCM meetings;

4) CRRs and peer reviewed papers (or plans in place) on sampling design and optimization;

5) Establishment of clear working relationships with end-users of WGCATCH products;

6) Clear guidelines on how the RDBs should be structured to accommodate design-based sampling and analysis;

7) Survey to compile extent of issues around accuracy of official landings data and national approaches to making corrections;

8) Review of methods adopted in Europe and elsewhere for developing fishery-dependent abundance indices, and associated filtering and other processing of fishery catch and effort data;

9) Submission of proposal for a theme session at the ASC 2017, following from and building on the very successful "What's the catch" theme session in 2013;

10) Work plan for next three years.

This is an extensive set of deliverables and some may be "work in progress" after three years, requiring a further term to address, or postponed to the next term.

Revisions to 3-year work plan by WGCATCH 2014

Term of reference	Task	By when	By whom
Small-scale fisheries mini-theme session	Seek contributions for a 3-h session (5 or 6 talks) including one or more external experts	January 2015	Chairs
	Review Nantes 2013 workshop and earlier studies for documentation of small-scale fisheries, and if not sufficient seek additional information from MS.	January 2015	Chairs
	Liaise with ICES secretariat on funding for any external experts, where needed	April 2015	Chairs
	Upload of presentations and summary for report, on sharepoint.	October 2015	Presenters
Case studies of sampling schemes	Circulate request to WGCATCH members specifying what is needed for the case studies, the required content and the format for documentation	January 2015	Chairs

	Prepare detailed working documents for each case study and upload on sharepoint for review by WGCATCH members in advance of meeting.	September 2015	Case study authors
c) Examples of simulation models	Identify case studies	January 2015	Chairs
	Prepare detailed working documents for each case study and upload on sharepoint	September 2015	Case study authors
d) Review implementation of landing obligation	Identify task leader(s) and contributors	March 2015	Chairs
	Develop a standardized questionnaire to collect specific information from MS, and circulate. Specifically identify responsible people in each lab. Online forum?	June 2015	
	Compile documentation from MS, summarize and upload report on Sharepoint.	October 2015	Task leaders
(e) Standardized approach to documenting changes in sampling schemes	Identify task leader (s).	December 2014	Chairs
	Develop a set of instructions / guidelines for MS to adopt; obtain feedback from WGCATCH members	Circulate draft by March 2015	Task leaders
	Liaise with PGDATA chairs to identify case examples (PGDATA to then issue the requests)	First PGDATA meeting in June 2015	Task leaders
(f) Develop CRR workplan	Identify report chapters, tasks, authors and timeline including availability of authors to work in 2015	January 2015	Chairs and contributors
	Submission to ICES Publications Committee to get approval for CRR	Just before ASC	Chairs
(g) RDB analysis	Identify task leader	Nov 2014	Chairs
	Prepare working document DESCRIBING estimation procedure		
(h) Compile literature	Liaise with secretariat to set up the repository; circulate request to WG members for material	End July 2015	Chairs
	WG members to provide pdfs, links, etc.	ongoing	WGCATCH members

Proposed terms of reference for the next meeting

The **Working Group on Commercial Catches** (WGCATCH), chaired by Hans Gerritsen (Ireland) and Nuno Prista (Portugal), will meet in Lisbon, Portugal, 9-13 November 2015 to address the following specific and generic terms of reference:

Specific ToRs:

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 landing obligation legislation, or other legislation that could bias the data and estimates.
e) Liaise intersessionally with PGDATA to develop a standardized 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.

Generic ToRs:

a) 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.

b) Identify future research needs.

c) Respond to recommendations to WGCATCH from ICES expert groups RCMs, liaison meetings or other groups.
d) Develop the specific ToRs for the next WGCATCH meeting and a work plan identifying intersessional work that is needed, timelines and responsibilities.
e) Ensure, where appropriate, that systems are in place to quality assure the products of WGCATCH.

WGCATCH will report by 4 December 2015 to the attention of ACOM.

Supporting information

Priority	WGCATCH supports the development and quality assurance of regional and national catch sampling schemes that can provide reliable 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 assessment and mixed fishery modelling, these activities are considered to have a very high priority.
Scientific justification	ToR (a): Small-scale commercial fisheries are defined as the fleet segment of vessels without a logbook obligation (<8m in the Baltic and <10 elsewhere in EU). WGCATCH and earlier groups have not focused specifically on data collection schemes for these fisheries, which pose particular challenges due to large numbers of vessels operating from many harbours, and lack of exhaustive data on activities and catches. Such fisheries can contribute to a significant amount of the landings in some areas. The DCF workshop: "Common understanding and statistical methodologies to estimate / re-evaluate transversal data in small-scale fisheries", Nantes (2013) noted that there is a there is a great heterogeneity in the landings and effort in the small-scale fishing sectors. The group suggested that ICES or STECF give advice on how to distinguish subpopulations within these sectors and how to optimize the precision and cost-efficiency of the data collection. In particular to evaluate the choice between census and sampling approaches and to provide guidelines for data collection. The Working Group on Recreational Fisheries Surveys (WGRFS) have addressed many issues concerning best practice of catch sampling that are relevant to small-scale fisheries. It is recommended that WGCATCH builds on this work and maintains close links with this group. It is proposed that WGCATCH organizes a mini-symposium within the 2015 meeting; and invite (external) experts to provide presentations. The outcomes of this symposium would be the basis of the documentation of best practice and could result in a peer-reviewed paper. ToR (b) WGCATCH 2014 and previous WKPICS and SGPIDS reports provided guidelines for best practice in sampling at sea to estimate discards and the length or age compositions of landings and discards, and sampling on shore to estimate length/age compositions of landings, and reviewed the sampling practices in European countries. More detailed national case studies are needed to demonstrate the performance of such schemes in practical applications covering different operational conditions and types of fishery. The studies should evaluate the components of total survey error (coverage error; non-response error; measurement error; processing error + sampling error). Methods for comparing and combining the estimates for retained fish from sampling at-sea and on shore should be explored. The case studies may be included in the planned Cooperative Research Report and text book on fishery sampling. ToR(c) WGCATCH 2014 identified the need for a simulation approach to evaluate the performance of competing survey designs, where there are different possible schemes for selecting primary and lower level sampling units. For example, if a random selection is made from all vessel landings at a market irrespective of métier or fleet segment, or if an

	attempt is made to sample a target or minimum number of landings per métier or segment. The simulations should explore bias and variance of estimates from the different schemes. Existing fleet and sampling datasets should be used as the source of information for setting up the simulated population of fishery catches to be sampled. ToR(d) WGCATCH 2014 provided guidelines for Member States to investigate the impact of the landing obligation on data quality, using data from sampling at sea and on shore together with VMS, remote electronic monitoring or other sources of information on fleet activities. Member States will be monitoring the initial implementation of the regulation for pelagic fisheries and some Baltic fisheries in 2015 and for other fisheries as they become included in future years. WGCATCH should compile and evaluate this information. ToR(e) National sampling schemes for commercial fisheries are moving towards statistically-sound designs, and this should result in a reduction in biases that may have varied historically if ad hoc, non-probability based schemes have been in place. Changes in sampling design may also have occurred at intervals in the past and there is a danger that this information could get lost. Documentation of such changes should be compiled for reference in assessment EG stock annexes, and may help in evaluating the utility or weighting of data for different historical periods, or interpreting historical performance of assessment models. This information is important input to the data compilation and evaluation stage of benchmark stock assessments. WGCATCH and PGDATA should liaise intersessionally to develop a pro-forma for documenting this information, and to identify some test cases relevant to a forthcoming benchmark assessment meeting. ToR(f) The European Commission has identified the need for clear sets of guidelines for Member States to sample commercial fisheries to provide the data that will be required by the EU-MAP. Most of the material needed for this is included in the series of reports of WKPICS, SGPIDS and WGCATCH, but there is a need to consolidate this and include clearly presented case studies. An approach is to include this in an ICES Cooperative Research Report, which would need to be agreed by the ICES Publications Committee in 2015. The content of this could form the basis for a future text book on the subject, which has been a long-term aspiration expressed by WKPICS. Work could commence before the next WGCATCH if resources are available. WGCATCH 2015 should continue to develop this publication. ToR(g) - (k) These ToRs address tasks that need to be completed each year, and include some requirements for EGs included in the Terms of Reference for the ICES Steering Group on Integrated Ecosystem Observation and Monitoring which is the parent SSG for WGCATCH.
Resource requirements	The WG builds extensively on experiences gained within PGCCDBS, WKACCU, WKPRECISE, WKMERGE, WKPICS, SGPIDS and WGRFS. European countries are encouraged to provide the WG with any requested documentation of their sampling programmes, updated manuals and protocols 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.
Participants	It is expected that WGCATCH will normally be attended by 30 - 40 members.

Secretariat facilities	None.
Financial	No financial implications.
Linkages to advisory committees	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 underpinning stock-based and mixed fishery assessments, and ecosystem indicators related to fishery impacts, and in developing data quality indicators and quality reports for use by assessment EGs and benchmark assessments.
Linkages to other committees or groups	WGCATCH links with WGBIOP in relation to collection of stock-based biological variables from sampling of fishery catches, and to PGDATA , stock assessment EGs and benchmark assessment groups by providing input on the data quality of commercial catches. WGCATCH also links closely with Regional Coordination Groups, the Regional Database Steering Group, STECF EWGs dealing with EU-MAP and the Liaison Meeting.
Linkages to other organizations	The outputs of WGCATCH will be of interest to FAO and RFMOs, and productive linkages may be established over time.

Annex 4. Proposed terms of reference for Workshop on evaluating the implementation and statistical aspects of concurrent length sampling (WKISCON2)

The Workshop on implementation studies on concurrent length sampling (WKISCON2), chaired by Nuno Prista (Portugal) and Liz Clarke (Scotland), will meet in Sukarrieta, Spain, 16–19 June 2015, to:

a) Identify the current use of concurrent length sampling data by end-users.
b) Review information on types and extent of concurrent sampling carried out on shore or at sea by Member States as part of national DCF programmes, the practical issues encountered, the additional costs involved, and the quality of concurrent length data from each source. Evaluate the difference in the data collected before and after implementation of concurrent sampling.
c) Identify the statistical arguments for concurrent sampling to characterize the length composition of species in mixed-species landings rather than the use of independent (non-concurrent) sampling for this purpose.
d) Identify any benefits concurrent sampling can provide considering the new and broader scopes of the revised DCF, such as the evaluation of impacts of fisheries on marine biological resources and on the ecosystem, and if these benefits can be achieved more cost-effectively from non-concurrent sampling of all species of interest.
e) Evaluate the implications of not carrying out existing concurrent sampling at-sea and/or on shore, in relation to costs and provision of fishery management advice.
An intersessional data request may be required for TOR b.

WKISCON2 will report by 3 July 2015 to the attention of ACOM and SCICOM.

Supporting Information

Priority	This workshop is considered to have a high priority for establishing commercial fishery sampling requirements under the EU-MAP and for ensuring the cost-effectiveness of data collection supporting mixed fishery models.
Scientific justification	The STECF Study Group on Research Needs (SGRN Revision of the Biological Data Requirements under the Data Collection Regulation, Brussels, 27 November – 1 December 2006) concluded that "In order to be able to fully appreciate and model the interactions between the different species taken by a métier, it is also essential to organize sampling in such a way that all species are sampled concurrently, actually meaning that all sampling for catch and length composition data are done simultaneously on all species in a vessel's catches or landings". This was considered easiest to do at sea, but may be required on shore. A requirement for concurrent sampling was included in the Data Collection Framework Decision 2008/949/EC. ICES carried out an evaluation of case studies in the Joint STECF/ICES workshop on implementation studies on concurrent length sampling (WKISCON: ICES CM 2008/ACOM:31), highlighting practical issues around concurrent sampling. Due to the future revision of the DCF as the EU-MAP, the RCM North Atlantic in 2014 recommended a comprehensive evaluation of the utility of the data being collected with the concurrent sampling. They noted that it is unclear whether the significant resource needed to carry out concurrent sampling provides benefits that outweigh the costs. Some ICES Working groups have benefited from concurrent sampling data collected however there is no empirical evidence

	to support this. In order to decide if concurrent sampling should continue, more feedback from end-users is required. This recommendation to the Liaison Meeting in 2014 led to a LM recommendation to ICES to set up a workshop proposal to see the implication to the stopping the concurrent sampling for those stocks and benefits concurrent sampling are providing or can provide considering the new and broader scopes of the revised DCF, such as the evaluation of impacts of fisheries on marine biological resources and on the ecosystem. LM proposed that WGCATCH 2014 should consider this recommendation and prepare the resolutions of the requested workshop. The WK should take place in 2015. Therefore it will need to be presented / approved by ACOM December 2014.
Resource requirements	The data collection programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required is limited to preparation and attendance at the workshop..
Participants	To be arranged
Secretariat facilities	Some secretarial support will be needed.
Financial	Member States may fund this through their EMFF programme..
Linkages to advisory committees	ACOM and SCICOM
Linkages to other committees or groups	WGCATCH.
Linkages to other organizations	RCMs

Annex 5. Recommendations

WGCATCH has no formal recommendations

Annex 6. Summary of presentations given at the meeting

Some design-based estimation – Liz Clarke

A brief overview of estimation methods comparing domain estimation with post-stratification for simulated datasets broadly based on the Scottish discard sampling programme was presented. The presentation also demonstrated the commands require to use the package "survey" in R to perform the estimation. The simulations considered a fleet of vessels for which an estimate of the total discards was required. The vessels were divided into three sampling strata (TR1, TR2 and TR3), and discard estimates where required for four domains; TR1 trawlers targeting demersal species but without cameras, FDF trawlers fitted with cameras – the so called "fully documented fisheries", TRN trawlers targeting *Nephrops* relatively close to the coast-line and TRO small trawlers targeting *Nephrops* at offshore fishing grounds. The TR1 and the FDF domains overlap the TR1 sampling pool, and the TRN and TRO domains overlap the TR2 sampling pool. The TR2 and TR3 sampling pools both contribute to the TRO domain.

A dataset with different discard rates was simulated and a population of 1000 trips created. The true values of the total discards by both sampling pool and domain where therefore known. This population was than sampled at random with a predetermined number of trips in each sampling pool being selected and estimates for the total discards, and its standard error, were generated using the Horvitz Thompson estimator functions in R survey. These demonstrated that unbiased estimates can be obtained for the original sampling pools, and for the domains, using samples from different sampling pools. The post-stratification of the sample, correcting for the known number of trips in each domain, was then demonstrated, to show how the variance of estimates was reduced with this method.

A framework for cost-efficient sampling to support stock assessment – Jon Helge Vølstad

Data quality reports and other indicators – Mike Armstrong

This presentation provided an overview of the development by PGCCDBS of the ICES Quality Assurance Framework for fishery and biological sampling, and the range of workshops and study groups that were formed by PGCCDBS to address aspects of the design of sampling schemes and the reporting of data quality. A range of systems for reporting data quality for different end-users, developed by these ICES groups, was briefly described, and the future development and use of these was discussed. See also Section 6 of this year's WGCATCH report.

Overview of the Landing obligation – Hans Gerritsen

A number of groups have been involved in identifying problems and finding solutions concerning the implementation of the landing obligation. The role of WGCATCH is limited to providing advice on adapting sampling protocols in relation to the landing obligation. However, in order to provide some context, a summary of the discussions by STECF that are relevant to WGCATCH is given below.

The landing obligation will apply to TAC species and all catches will count against quota. Fish under a minimum reference size cannot be sold for human consumption but these catches will have to be landed. However there are a number of exemptions, including: species with high survival; *de minimis* exemptions (difficult-to-avoid bycatch) and quota flexibility mechanisms (transferring of quota between species to avoid choke species).

The main tasks of monitoring the catch components that were formerly discarded involve: (1) quantifying discards allowed under the exemptions (and possibly illegal discards) and (2) monitoring of additional landings that cannot be sold for human consumption. This monitoring can take place through: remote Electronic Monitoring Systems (CCTV etc.); scientific observers (with no role in control and enforcement); control observers; at-sea inspection with patrol vessels and/or aircraft. For most fisheries, a combination of these monitoring practices will be necessary.

In addition to monitoring, additional requirements for documenting the catches may be required, these include: haul-by-haul documentation of the catches; mandatory reporting of all TAC discards (not just <50 kg); separate reporting of human-consumption landings and 'unwanted catches' (fish under the minimum reference size, damaged fish etc.); full logbooks for <10 m vessels.

It is anticipated that the presence of an observer on board may result in a change in behaviour. However, we may be able to quantify bias induced by observers by comparing length frequency distributions of trips from the same grounds with and without observers. Additionally, VMS data may be used to explore if skippers behave in a non-typical way when they have observers on board.

Presentation of France scenarios for monitoring under the new CFP

France is worried that the new CFP and the landing obligation will increase the bias of the at-sea observer programme to a level putting it at risk of being eventually uninformative and unusable. The at-sea observation is prone to two sources of bias, the deployment bias (observed trips not representative of actual fishing activity) and the observation bias (fishers behave differently when observer onboard). The illegal status of discards under the new CFP is likely to increase the observation bias (see also section 4 for further details), so France explored several scenarios to circumvent the threat of being unable to provide information for fisheries advice and poorly using public money. The scenarios include shifting to only market sampling, withdrawing part or all scientific observation to be replaced by the monitoring of reference fleets. At this stage, France is seeking for comments and ideas from other Member States and advice from relevant scientific groups, before taking a decision on the way forward.

Annex 7. Sampling and estimation of unreported bycatch under a discard ban – the Norway case

The introduction of a discard ban in Norway

Norway introduced a discard ban on cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*) in 1987 for both economic and ethical reasons (Anon, 1987). The hitherto best description of the Norwegian "discard ban package" is to be found in Gullestad *et al.*, (2014), and much of the following summary is copied from that paper. The very existence of the ban has been beneficial in changing the fishers' attitudes and discouraging the practice of discarding. The ban was gradually expanded to new species, and from 2009 an obligation to land all catches was introduced, albeit with certain exemptions Anon. (2008, 2014). It should be noted that the ban applies to dead or dying fish. Viable fish can be released back to the sea. The discard ban was preceded by a programme of real-time closures of fishing areas (RTCs) which evolved from 1984 and onwards. Areas can also be permanently closed year-round or seasonally, for all gear or specific gear, and for a variety of reasons – nursery areas, coral reefs, trawler-free zones to prevent conflicts between gear, lobster habitats, etc.

On 1 January 2009 the old Act relating to Seawater Fisheries was replaced by a new Marine Resources Act (Anon, 2008), and at the same time an obligation to land all catch of fish (discard ban) was made the general norm. The earlier Act related only to fisheries and focused mainly on the exploitation of commercial stocks, whereas the new Act applies to all living marine resources. After initial adjustments the following years, the discard ban comprises more than 55 species or species-groups by 2014 (Anon, 2014). Some further adjustments for species of low economic value could be expected in order to adapt the discard policy to some of the practical problems encountered by the fishing fleet and also discussed in WGCATCH.

Accompanying measures to facilitate the discard ban

A commonly asked question with regard to the Norwegian discard policy is how to handle all the 'illegal' catches that are now supposedly landed. Questions like this tend to overlook the combined set of measures that lie at the core of the policy. The discard ban, the obligation to change fishing ground, RTCs, the tailoring of quota regulations (e.g. allocation of quotas to that cannot avoid bycatches of TAC species), gear restrictions and minimum fish and mesh sizes, and the development of more selective gear – all these measures aim at reducing the amount of unwanted catches in the first place. The accompanying measures are discussed below.

Although there is no doubt that the extent of unwanted catches in Norwegian fisheries has been greatly reduced (e.g. Figure A7.1), it is a fact, supported by detected cases, that discarding still occurs. Sometimes it occurs deliberately and as a result of an intended and unlawful harvest strategy, but sometimes to dispose of an unintentional bycatch. As an incentive to land the unintended catch instead of discarding it, fishers may apply for compensation for the extra work of handling and landing the fish. The 'illegal' catches may be sold together with the rest of the catch and through ordinary market outlets. However, as all firsthand sales and all payments for fish are by law channelled through one of the six Norwegian fishers' sales organizations, the value of the "illegal" part of the catch is retained by the sales organization.

Nevertheless, 20% of the value of the 'illegal' catch may be paid to the fisher as compensation for any extra work. In purse-seine fisheries for mackerel, herring and capelin, this 20% rule was abandoned as it turned out to be too strong an incentive for vessels to exceed their quota by "filling up" on the last trip. The sales organizations are allowed to keep the confiscated 80% of the value, and use the money on their lawful duties related to fisheries control, which include the collection and revision of all data related to firsthand sales of fish in Norway. "Illegal" catches may also be ensiled and reduced to meal and oil, or used for animal feed. As such catches represent small and occasional volumes, there has been no direct effort triggered by discards to develop new markets. Over the years there have, however, been several initiatives to develop new fisheries and markets for hitherto underutilized species. Some of these species has historically been discarded as low value bycatch.

Historically, an important element when deciding on minimum mesh sizes in bottom trawl has been the objective of utilizing the growth potential of the individual fish, and letting each fish spawn at least once before it is caught (Hylen *et al.*, 2010). The minimum landing sizes of fish have often been set at levels where on average 75% of the fish below that size are expected to swim through the meshes, whereas 25% are captured (and discarded if the minimum landing size is enforced). The introduction of a discard ban led to a conceptual change with regard to the interpretation and function of permissible minimum sizes of fish. The minimum sizes of the fish that are actually fished have replaced the minimum landing sizes in technical regulations; for example, fishing sizes are crucial elements in the decision rules for RTCs. The focus on reduction of potential discards has also been an invitation to revisit – and if possible harmonize or improve – the connection between mesh sizes, allowed minimum fish sizes and the actual commercial minimum market sizes. For targeted fisheries, for example, there is no obvious reason why it should be legally permissible to take fish that are smaller than what is commercially accepted in the market. Hence, the option of increasing the minimum mesh size in trawls accordingly should be considered. For mixed fisheries the situation is, admittedly, more complex.

The prohibition to fish 'illegal' fish constitutes an obligation for fishers to change fishing ground when the fishing operations contravene the regulations. For instance, whenever bycatch limits or the permitted intermixture of undersized fish have been exceeded, the fishing operation on the fishing ground in question must cease and operations must move to an area where, to the best of the fishers' knowledge, it is probable that the catch composition is within the limits of the relevant regulations. It is not expedient within the Norwegian legal system to stipulate a fixed shift in depth or distance in nautical miles. If the logbook, satellite tracking or other sources of information reveal that more than one haul has been conducted in the same area without moving, the fisher will be subject to arrest/reporting to the police and may be fined for the offence. The catch in the relevant hauls is considered illegally caught, and its value confiscated by the prosecuting authority or the court in a decision separate from the fine. If illegal catch is mixed with legal catches on board the vessel, the entire catch may be considered illegal and its value confiscated. If the fisher has acted in compliance with the move-on provision, there is no offence. The value of the part of the catch that is in excess of permitted limits will, however, be subject to confiscation through an administrative decision by the Directorate of Fisheries. It should be noted that it is a crucial element of the anti-discard policy that fishing operations are recorded in logbooks on a haul by haul basis.

Different ways of regulating fisheries by means of quotas may provide different incentives with regard to discarding. As a consequence of the introduction of a discard ban, the government was forced to re-think its practices, not only for technical regulations, but also with regard to national quota regulations. It was important to ensure that the regulations were formulated to minimize possible incentives to discarding, such as quotas per trip or week. Weekly quotas face the fisher with a weekly temptation to discard excess catches in the last haul, whereas annual quotas limit that temptation to once a year. Another important measure was to allocate quotas to cover expected unavoidable bycatches in non-direct fisheries, before allocating remaining national quotas to vessels licensed to target the species in question.

The focus on the discard problem and in particular the regulations introduced to minimize the problem, have had a beneficial influence on the research and development of more selective fishing gear. The introduction of grid technology both in shrimp and cod trawls (compulsory north of 62°N from 1991 and 1997, respectively) are examples of this spin-off effect created first of all by the RTCs. The industry took an active part in this development when large areas were closed due to too large intermixtures of juveniles. With sorting grids still at a test stage, fishers could get an exemption to fish in closed areas, provided they used a sorting grid. To this end closures turned out to be far more effective and instrumental to innovation and implementation than years of traditional, publicly financed research on selectivity. The successful use of grids in the test phase paved the way for the agreement between Norway and Russia to make the use of grids compulsory throughout the Barents Sea.

Enforcement and sanctions of the discard ban

Discarding is an offence that may be difficult to detect. Nonetheless, enforcement of regulations concerning the obligation to land catches has high priority, and the Coast Guard and the Directorate of Fisheries do detect some cases each year. Presence and surveillance at sea by the Norwegian Coast Guard is extensive compared to most coastal states, with 15 inspection vessels conducting in the order of 2000 inspections annually. Presence and inspection at sea are the main tools for preventing and uncovering discarding.

When discarding is revealed, both the captain of the vessel and the owner may be fined. In extreme cases, for example if it is revealed that discarding is an integral part of the vessel's 'ordinary' production process, the fishing licence may be withdrawn for a period, and considerably higher fines are expected than for minor infractions. Over the years, the Coast Guard, in cooperation with the Public Prosecutor, has succeeded in learning how to collect evidence in discard cases in a way that will satisfy the Norwegian judicial system, so that it is possible to get convictions in a Court of Law. As a result, approximately half a dozen captains/companies are fined annually.

How to estimate discards under a discard ban?

Norway does neither operate an observer programme collecting scientific data at sea, nor a closed-circuit television (CCTV) programme to monitor potential discarding. However, scientific data, including some data on discards, are collected by the Institute of Marine Research through their Reference fleet (Anon, 2013), and by comparing species and size sampling at sea (conducted by the Reference fleet, Coast Guard and Directorate of Fisheries) with similar sampling of the landed catches.

The Norwegian discard sampling/estimation program has been very much project designed according to selected fisheries. The plan is to investigate the amount of discarding and/or unreported bycatches in different fisheries and to design the sampling and estimation procedures that best fit each fishery incl. how often the sampling and estimation have to be conducted. The current program includes the following fisheries:

Demersal fisheries

- Discards of juvenile fish in the Barents Sea shrimp fishery.
    - Direct sampling by personnel from the Directorate of Fisheries on board commercial shrimp trawlers, the Directorate's Surveillance service on board rented shrimp trawlers for the purpose, and the use of research survey data from the Institute of Marine Research using shrimp trawl. All these data are used in a model to estimate the discards. See example in Figure A7.2.
- Discards in the coastal fisheries with gillnets. Case study for gillnetters (<15 m) North of 62°N (ICES Subareas I and II)
    - Reference data collected at sea in each quarter of a year by IMR's Coastal Reference fleet in main fishing areas. Discards and size distribution of fish are reported daily by the Coastal reference fleet (self-sampling). Discards of various species per sales note and/or tonnes of targeted fish retained are calculated.
    - Comparisons of size distributions, at sea and at landing, per species per main fishing area per quarter of a year can also be used to calculate discard of fish.
- Discards in the bottom-trawl and autoline fisheries (the data have not yet been analysed)
    - Data from production reports (in kg or tonnes) are aggregated per species, and production size groups, per fleet (trawl or longline), per statistical area and quarter. Such data are assumed being equal to landings data (it is difficult to measure the fish when being landed from vessels that produce and freeze the fish at sea). These data are then compared with similar data collected at sea by the Reference fleet (self-sampling), Directorate of Fisheries or the Coast guard. The difference is interpreted as discards. In a pilot study, production reports in electronic format will be collected from 10 randomly selected trawlers and 5 autoliners that, seen from the VMS data, have fished in the respective areas.

Pelagic fisheries

- Quantification of unreported bycatch in the pelagic capelin fishery (pelagic trawl and purse-seine) in the Barents Sea – the results are also used to set aside a quota of cod for this bycatch purpose.
    - Reference data collected at sea by IMR's Reference fleet, the Directorate's surveillance service and the Coast guard raised to the total capelin catch. Stratified by two fishing gears and the main statistical fishing areas.
    - Alternative estimation procedure assuming that all bycatch are pumped on board the vessel at sea together with the target species (capelin) and sorted/sampled while landed at the industrial plant.

Industrial fisheries

- Quantification of unreported bycatch in the industrial fishery in the North Sea – the results are also used to set aside a quota of North Sea saithe and herring as bycatch in the industrial fishery.

- The industrial fisheries land their catches at 4-5 plants in Norway, and also in Denmark. Very often the total landing in tonnes is reported as the dominating species, only. When landing the catch a sophisticated grid system is used to get rid of most of the water content. A programmable sample draw is incorporated in this grid system to draw random samples from the whole landing. About 12% of the industrial landings (the goal is 20%) are currently sampled this way.

The Norwegian plan for quantifying discards may be summarized by saying that discards will most likely not be estimated for all fisheries at all time. Fisheries specific projects will be conducted to investigate the amount of discards in all fisheries, and if the discards turn out to be small, a fixed discards rate will be used for this fishery until it is checked again. On the other hand, if the discards rate is high then the fishery will be investigated and the amount of discards estimated every year.

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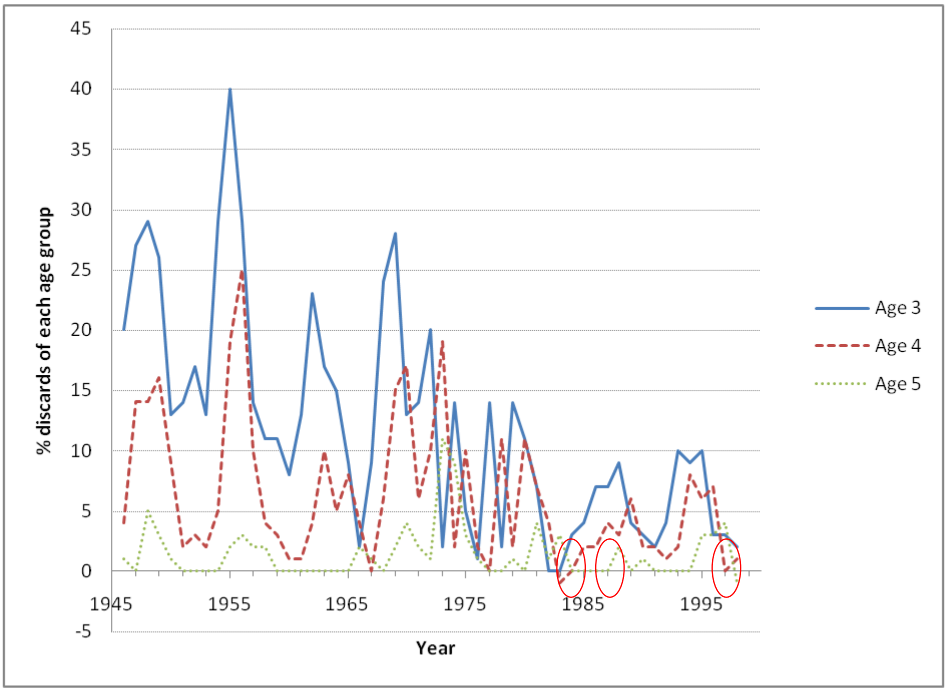

Figure A7.1. Discards in the commercial Norwegian trawl fishery for NEA cod, 1946-1998 (Dingsør 2001a,b). 1984: Temporarily closed areas introduced; 1987: Discard ban introduced; 1997: Sorting grid mandatory in the Barents Sea (55 mm).

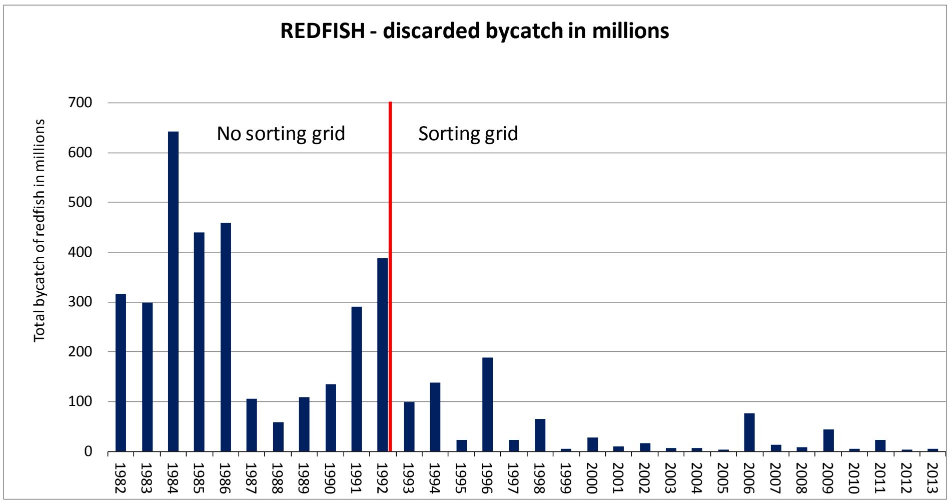

Figure A7.2. Discards of redfish (mostly *Sebastes mentella*) in the Norwegian shrimp trawl fishery in the Barents Sea.

Annex 8. Landing Obligation Questionnaire Summary

In order to address ToR 3 "*Provide advice on adapting sampling protocols to anticipated changes in management measures (e.g. discard ban) or technical advances in monitoring*", countries were asked to fill a questionnaire to answer which fisheries will be affected by the landing obligation. Participants were asked to provide information on observer programme coverage, what data should be collected and what analyses should be carried out to evaluate bias on fishing behaviours and discarding patterns. Sixteen countries participated this questionnaire: Portugal, Spain (Basque Country and Spain), Ireland, UK (Northern Ireland, England and Scotland), Belgium, Denmark, Sweden, Germany, Poland, Lithuania, Greece, The Netherlands and Scotland. Below is presented the summary of the answers for each question (Full details of the questionnaire is available in a separate Appendix to this report). The questions were:

- **Question 1** *"Which fisheries will be impacted by the landing obligation and how many VMS and non-VMS vessels in each?"*
- **Question 2** *"What percentage of each fleet currently has an observer on board and is this coverage intended to continue?"*
- **Question 3** **"***What percentage of vessels have CCTV to monitor catch composition and discarding?"*
- **Question 4** *"What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips with observers on board have different fishing behaviours and discarding patterns to vessels without observers."*
- **Question 5** *"What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips without observers on board have unreported discards of species or sizes of fish that must be landed under the landing obligation (> de minimis quantities)."*

Tables A8.1, A8.2 and A8.3 describe the fleets, by country that will be affected by the landing obligation in 2015, 2016 and 2019, respectively. According with the data provided by each country, 2616 vessels, from 14 MS, will be affected by the landing obligation, in 2015. The majority of vessels operate with pelagic fisheries (purse-seines and pelagic trawls), except for countries fishing in the Baltic, where all fisheries will be affected. This represents 9% of the total number of vessels (2616 out of 29 903). Most of the vessels affected are purse-seiners from Spain (445), Greece (251) and France (114). From the overall vessels affected by the discard ban in 2015, around half of them have VMS.

The fisheries for demersal fisheries will be affected by the landing obligation from the beginning of 2016. This covers the demersal fisheries in the North Sea and Western Waters (beam trawl, otter trawl, gillnets, trammelnets, longlines...). Table A8.2 summarizes the number of vessels that will be affected. 83% of the total number of vessels (24 931 out of 29 903 vessels) from the participating countries will be affected in 2016. However, only 17% (4294) of these vessels have VMS.

In 2019, only a small fraction of the vessels will remain to be affected by the landing obligation (Table A8.3). These are mainly the shrimp fisheries, from 3 MS (Belgium, The Netherlands and Germany). All together 399 vessels of which 381 VMS vessels and 18 non-VMS vessels will be affected. This represents 1% of the total number of vessels (399 out of 29 903).

The landing obligation will presumably not impact pot and trap fishing of 10 MS (Table A8.4). All together 1957 vessels of which 216 VMS vessels and 1741 non-VMS vessels will be affected. This represents 7% of the total number of vessels (1957 out of 29 903).

Only a few MS have vessels that have CCTV to monitor catch composition and discarding. Currently, vessels are not obliged to have these systems on board. Denmark has 32 vessels with CCTV (5% of the total number of vessels), UK (England) has 22 vessels (0.9%), Germany, 5 vessels (1%) and the Netherlands has 11 vessels (1%).

Overall, all countries have low observer coverage and do not cover all fleets. It should be noted that the observer coverage was expressed in different ways (kW days, number of vessels, number of trips, days…) or the sampling is conducted by the fishers (self-sampling). On average the sampling coverages are low and in most cases not all fleets are sampled on-board.

Table A8.1: Overview of the fleets that will be affected by the landing obligation in 2015.

year	2015		
Row Labels	**Gear**	**Sum of VMS**	**Sum of No VMS**
Denmark	gillnets (Baltic)	7	84
	OTM+PTM	91	4
	Sandeel	95	5
	bottom trawl (Baltic)/ seines (Baltic)	37	26
France	trawl small pelagic	114	16
Germany	industrial	2	0
	pelagic trawl	6	0
	trawl (Baltic)	70	100
Greece	purse seine	251	0
Ireland	pelagic trawl	27	0
Lithuania	gillnets (Baltic)	1	7
	otter trawl >=110 (Baltic)	22	0
	pelagic trawl	19	0
Poland	gillnets (Baltic)	33	345
	longline (Baltic)	2	17
	otter trawl (Baltic)	79	13
	pelagic trawl	76	0
	seine (Baltic)	0	1
Spain	purse seine	280	263
Spain (Basque Country)	purse seines	165	0
Sweden	gillnets	7	60
	gillnets and trammel nets (Baltic)	9	80
	longlines and hooks (Baltic)	3	20
	otter trawl>=105 (Baltic)	44	2
	pelagic trawl and seines	47	18
UK(England)	otter trawl<100	4	6
UK(Northern Ireland)	pelagic trawl	2	0
UK(Scotland)	pelagic trawl	23	0
The Netherlands	otter midwater trawl	33	0
Grand Total		**1549**	**1067**

Table A8.2: Overview of the fleets that will be affected by the landing obligation in 2016.

year	2016		
Row Labels	**Gear**	**Sum of VMS**	**Sum of No VMS**
Belgium	beam trawl >=120	8	0
	beam trawl 70-99	33	0
	dredges	1	0
	gillnets	1	0
	otter trawl >=100	1	0
	otter trawl 16-31	1	0
	otter trawl 70-99	8	0
	seines	3	0
	trammel nets	1	0
Denmark	bottom trawl<100	87	5
	bottom trawl>=100	38	13
	gillnets	44	61
	seines	21	0
France	beam trawl	58	17
	dredges	277	380
	gillnets	159	837
	longlines	34	490
	otter trawl<100 (Nep)	158	130
	otter trawl<100 (Whitefish)	471	358
	otter trawl>=100 (Whitefish)	168	22
	seines	11	0
Germany	beam trawl 70-99	6	0
	gillnets >=220	4	0
	gillnets 90-119	3	0
	otter trawl 70-99 (flatfish)	10	0
	otter trawl 70-99 (Nep)	7	0
	otter trawl 90-119	2	0
	otter trawl>=120 area I,II	4	0
	otter trawl>=120 area IV	11	0
	otter trawl>=130	4	0
	Scottish seine>=120	3	0
Greece	gill nets	8	3100
	longlines	41	4170
	otter trawl	292	0
	pots and traps	2	371
	trammel nets	16	6950
Ireland	beam trawl	13	0
	dredges	7	29
	gillnets	4	13
	longlines	0	5
	otter trawl<100	30	21
	otter trawl>=100	43	8
	seine	11	1
Lithuania	beam trawl	1	0
Grand Total		**2105**	**16981**

Table A8.2: Continued

year	2016		
Row Labels	Gear	Sum of VMS	Sum of No VMS
Spain	gillnet<60	1	300
	gillnet>60	82	751
	hand and pole line (LHM)	25	32
	longlines	128	1135
	otter trawl >=55 (DEF)	68	0
	otter trawl 100_119	13	0
	otter trawl 70-99	28	0
	pair trawl >=55		
	otter trawl >=55 (MCD)	134	9
Spain (Basque Country)	gillnets	13	35
	longlines	7	27
	otter trawl >=70	18	0
	pair bottom trawl>=55	4	0
	pair bottom trawl>=70	4	0
Sweden	demersal trawl and seines	94	30
	gillnets and trammel nets	2	11
	longlines and hooks	0	26
	pots and traps	1	42
UK(England)	beam	63	24
	dredges	85	107
	longlines	13	25
	netters	13	652
	otter trawl <100 (CRU)	101	62
	otter trawl <100 (DEM)	47	138
	otter trawl <100 (MOL)	12	2
	otter trawl >=100 (CRU)	7	1
	otter trawl >=100 (DEM)	30	47
	seine	10	7
UK(Northern Ireland)	dredges	38	23
	gillnets	3	4
	longlines	0	7
	otter trawl<100	100	45
	otter trawl>=100	6	0
	seine	1	0
UK(Scotland)	beam trawl	1	0
	dredges	60	30
	gillnets	9	0
	longlines	8	0
	otter trawl<100	120	85
	otter trawl>=100	170	0
	seine	15	0
The Netherlands	beam trawl	169	0
	dredges	3	0
	gillnets	188	0
	longlines	1	0
	otter trawl	121	0
	purse seine	14	0
	trammel nets	17	0
	gill/trammel nets	1	0
	Danish seine	3	0
	fyke	15	0
	handlines/pole-lines	80	0
	mechanical dredge	6	0
	scottish seine	35	0
	pair trawl	1	0
Grand Total		2188	3657

Table A8.3: Overview of the fleets that will be affected by the landing obligation in 2019.

year	2019		
Row Labels	**Gear**	**Sum of VMS**	**Sum of No VMS**
Belgium	beam trawl 16-31	19	0
Germany	beam trawl 16-31	173	18
Spain	otter trawl >=55 (MPD)		
The Netherlands	shrimp beam trawl	189	0
Grand Total		**381**	**18**

Table A8.4: Overview of the fleets that presumably will not be affected by the landing obligation.

year	not impacted		
Row Labels	**Gear**	**Sum of VMS**	**Sum of No VMS**
France	pots	51	600
Germany	pots	1	0
Ireland	pots	4	65
Poland	pots and traps	0	54
Spain (Basque Country)	pots	0	12
Sweden	pots and traps	1	6
UK(England)	pots	58	823
UK(Northern Ireland)	pots	3	111
UK(Scotland)	pots	9	70
The Netherlands	pots	89	0
Grand Total		**216**	**1741**

Question 4 and 5

For the questions 4 and 5, the answers among countries were similar, so it was decided to merge the overall answers, from both questions. Each participating country recommended a number of data analyses that should be carried out to identify different fishing behaviours and discarding patterns to vessels without observers and to identify the possible extent to which trips without observers on board have unreported discards. The proposed data analyses from questionnaires included:

1) Identify other vessels using the same fishing grounds to compare the species composition and LFD's of the landed fish from trips with and without observers.
2) Compare the fishing activities (location/catch composition/LFDs) of the observed trip with other trips by the same vessel to see if the observed trip was atypical.
3) Compare the variability of the catch compositions in the historical data with the current variability of catch compositions.

4) Potentially data collected from CCTV could be used to increase the coverage and compare catch composition.

5) Compare the size sorting distribution of the landing on observer trips v trips without observers.

6) Full CCTV coverage to assess *de minimis* quantities, where relevant

7) Compare the proportion of trips with reported (logbooks) undersized fish with undersized fish in the observer program.

8) Implement a self-sampling system of discards (Lithuanian example).

9) Compare previous years VMS patterns of the same vessels.

10) Use longer term CCTV information plus information from observers on CCTV vessels and compare this with the landed catch of vessels from the same fishing ground and the same period.

11) Quantify and access the component of fish sold under the minimum reference size (sorted by species).

12) Compare survey data with commercial data.

13) Compare composition of commercial size categories, from sales slips, between vessels to detect highgrading.

Annex 9. Extracts from WKMERGE report (ICES, 2010) relevant to shore sampling

The following text is extracted from the 2010 report of the ICES Workshop on Methods for Merging Métiers for Fishery Sampling, with some editing to focus it on shore sampling.

Activities of fishing vessels determining sampling access to catches

The ability to design a statistically robust sampling scheme depends critically on expert knowledge of how the temporal and spatial activities of fishing vessels determine when and where catches can be accessed for sampling, the fraction of the catches that are accessible, and any constraints that may limit the ability to sample the catches to the extent required. It is also important to know the quality and completeness of any data on fleet activities (e.g. records of gear type, mesh or area fished) that are required for raising sample data to the fleet level.

Aspects of fleet structure and dynamics relevant to the design of sampling schemes include:

1) *The segmentation of the fleet into clusters of vessels with similar dominant fishing methods* (e.g. beam trawlers, demersal otter trawlers and seiners; purse-seiners, shellfish dredgers, polyvalent etc.). This may also include segmentation by vessel LOA class (e.g. 10 m and under polyvalent vessels typical in small-scale fisheries). Vessels in different fleet segments are likely to have different fishing and landing patterns.

2) *The distribution of landing sites for each fleet segment*. Harbour facilities, markets and proximity to fishing grounds all affect the distribution of vessels of different fleet segments among home ports and landing sites. Large specialised vessels such as pelagic trawlers may be relatively few in number, operate from only a few ports and have few and lengthy trips, whereas small-scale fisheries may comprise thousands of small vessels landing daily at many small harbours. Larger-scale demersal fleet segments such as beam trawlers, otter trawlers, fixed netters, longliners etc. may also have different geographical patterns of landing among ports.

3) *The duration of individual trips within a fleet segment*. Small vessels at sea for a day or less will have a high probability of being accessible for sampling on shore on most days whereas large vessels at sea for several days or weeks will have a lower probability of being sampled on shore on any random day. This may require different sampling schemes for vessels with widely differing trip durations. Further stratification of vessels according to typical duration of trips, or vessel LOA classes if this is correlated with tip duration, may help.

4) *Temporal patterns in landing activities*. The days on which vessels land fish may be linked to the timing of fish markets, or to tidal states affecting the ability to fish. For example, fixed-nets may be shot primarily on neap tides, and the vessels may not be able to fish over spring tides.

5) *Daily landing patterns of different fleet segments or métiers*. It may seldom be the case that all types of vessels at a port land at the same time to the same market. There may be different markets, for example for *Nephrops* and for whitefish. There may even be cases where different components from a

single landing are split between different display or storage areas or bypass the market altogether and are transported directly to processors or retailers. This is a particular issue for concurrent sampling (see report of the ICES Workshop on Implementation Studies on Concurrent Length Sampling (WKISCON) – ICES, 2008).

6) *Spatial and temporal distribution of catches of individual species and stocks.* Species compositions of catches within a fleet segment may vary substantially between ports, due to the interaction between the spatial patterns of fishing and the spatial distribution of species. The same is true for different size or age classes of individual species. For example, discarding may have strong spatial and temporal trends, for example the smaller vessels in a fleet segment may operate closer inshore on nursery grounds.

7) *Variability of activities of vessels according to domains of interest (e.g. Level 6 métiers) within defined sampling frames and strata*. Landings of vessels within a fleet segment may represent trips by fishing ground (or finer spatial strata), gear type, target species or mesh sizes (i.e. métier level 5 or 6). The occurrence of such trips will vary spatially (between ports) and over time, and knowledge of this is essential to predicting how many trips by fishing ground and métier are likely to be delivered by a given intensity of sampling within each of the sampling frames and strata. If hauls within trips sampled at ports are known to have covered two or more fishing grounds or métiers, it is common practice to exclude such trips from sampling. If this becomes common, it is possible that the sampling scheme should be predominantly based on sampling at sea.

8) *Completeness of data recording at the fleet level*. A major problem can occur if sampling is stratified using variables such as gear codes, fishing ground and mesh size, but the fleet database used for raising has missing or inaccurate data on these variables. For example, it would be no use stratifying an observer scheme into different types of gillnets, which can be identified accurately at sea, if the fishers record all their trips using gillnets under a more general gillnet code. Unless the occurrence of sampling trips with different types of gillnet are in direct proportion to their occurrence in the fleet, the scheme will be biased because the sampling probabilities for the more detailed gillnet codes will be unknown.

The particular activities of fleet segments could lead to a requirement for them to have different sampling schemes and primary sampling units (PSUs). In this case, there would be a separate sampling frame for each fleet segment, as the sampling frame comprises all the primary sampling units and any stratification of these. (Currently, the Revised Standard Tables and Guidelines for completing DCF National Programmes, version 2009, imply that there would be a separate sampling frame for each fleet segment.). Some fleet segments may be sufficiently similar to fleet behaviour and accessibility for sampling to have the same PSUs and hence be included within the same sampling frame, although stratification by fleet segment may be advantageous. (See Section 5 of the WKMERGE report for a more detailed explanation of sampling frames and strata).

In the case of port sampling, if a sampling frame is defined as a list of access points for sampling clusters of vessels, trip duration can have an influence on the sampling design. Vessels at sea for several days or more may tend to land together at markets on specific days of the week, while small vessels may land and sell fish daily. If the selected PSUs represent a biased selection (e.g. if port visits coincide only with times when larger vessels with longer trips are landing, and exclude times when other vessels land), they represent only a subset of PSUs and are therefore a separate stratum and PSU definition (e.g. a separate stratum could be defined as all Friday markets in a quarter if there are fleet segments that land only on Fridays). In that case, a separate sampling stratum is necessary to cover all the other PSUs.

Defining the sampling frames and primary sampling units

The sampling frame is a list of all individuals or sampling units that can be selected independently with known probability by randomized sampling. The frame may represent the entire population of interest or may be incomplete because not all sampling units are accessible for sampling. In this case it is important to specify the characteristics of the study population (subset of the frame that can be accessed for sampling), and of the non-accessible subset, so that potential bias due to incomplete coverage can be assessed.

The elements (cells) in the sampling frames are the primary sampling units (PSUs) in the sampling plan. A PSU may be a vessel, vessel/trip, port/day, or market/day. The PSUs must completely populate the sampling frame in non-overlapping cells for all elements in the frame population to have a known probability of being sampled, and the sampled units can be given a correct weighting for estimating population values. Incomplete sampling coverage will cause bias if the non-accessible PSUs of the frame have different characteristics than in the sampled population. Examples of sampling frames for fishery sampling on shore are given below:

A complete list of access points for sampling

This area frame is an example of an "indirect" frame comprising a list of all ports, harbours or other landing sites that provide access to all landings by the target population of vessels (Figure A9.1). It is an "indirect" sampling frame because the numbers of vessels and trips are not necessarily known in advance. Rather, the landing sites provide access to clusters of trips by fishing vessels.

	Site 1	Site 2-5	Site 6	Site 7	Site 8-10	Site n
Day 1						
Day 2						
Day 3						
Day 4						
Day 5						
Day 6						
Day 7						
Day 8						
Day 9						
Day 10						
Day 11						
Day 12						
Day n						

Figure A9.1. Sampling frame comprising a list of locations providing access to clusters of fishing vessels. Primary sampling units in this example are sites or groups of sites on individual sampling days.

Area frames of this type are the *de-facto* sampling frames for most port sampling schemes. The PSUs will have a spatial component (an access point) and a temporal component (a period time over which a visit to the site takes place). The PSU could be a single landing site on a single day, or include a group of neighbouring landing sites and a period of more than one day for sampling these sites. The latter may be appropriate when the sampling sites are located in remote locations involving lengthy travelling time for sampling teams.

The list of PSUs must cover all the trips/landings in space and time in non-overlapping cells. The sampling frame (all the PSUs), and the number of PSUs in any stratification of the frame population, are therefore known and the PSUs can be sampled representatively using random or systematic sampling schemes with known probability. Each PSU represents a cluster of fishing trips that may either be sampled exhaustively, or subject to a further level of trip selection (subsampling) to obtain a representative sample of trips within the PSU. An example of an access point survey for a small-scale fishery in Mozambique is given in Section 6 and Annex 5.

A complete list of markets and days when the markets take place (i.e. a matrix of markets and days)

This could also be considered as a list frame that provides access to all catches handled by these markets over time if the markets are predictable. This could be the case if catches are transported directly from several landing sites to a single fish market.

Use of vessel list frames for port sampling

If accurate advance knowledge is available of the vessels due to land at different ports, and the timing of landings, a vessel list frame with random draws could be used to plan a representative sampling scheme based on advance selection of individual vessels to sample at a port or group of ports (*applicable more to small fleets, e.g. large vessels with relatively long trips*).

Selection of primary sampling units

The revised DCF Standard Tables and Guidelines (2009 version) require member States to indicate if the sampling schemes adopted for fleet-based biological sampling fall into one of the following three schemes:

A. Census

B. Probability based sampling (this includes systematic sample selection with a random element)

C. Non-probability based sampling

It would be rare to have census data in the absence of complete observer coverage, for example. Probability based sampling means that the probability of selecting a PSU for sampling is controlled and greater than zero. It does not imply that the sampling scheme needs to be fully randomized, as it would be possible (and possibly more feasible) to select sampling dates, for example, in a more systematic fashion within a stratum, provided this leads to representative (un-biased) sampling (Figure A9.2). Systematic sampling schemes (e.g. "bus route" sampling of shore sites), where appropriate, are likely to facilitate planning and be easier to implement than fully randomized schemes. Randomization would be appropriate to selecting vessels from a list or selecting landings to sample on a quayside during a sampling trip when all the landings are on display. During a port visit, systematic sampling (e.g. every second or third landing) would be a suitable approach if intercepting vessels landing at intervals during a day, without any advance knowledge of which vessels will be landing. It is good practice to randomize the first sample within a systematic scheme – for example if every fifth landing was to be sampled, the first sample should be a random selection of the first five samples.

Non-probability sampling applies to schemes where there is effectively no control over the sampling probabilities, and samples are selected on an opportunistic or ad hoc basis. Such schemes may produce misleading and biased estimates if treated as if they are probability based, although the bias may be reduced by the expedient of trying to ensure that sampling is spread out over time and space (*provided there is no systematic bias in selection of secondary or lower level sample units at the selected sites*). Model based estimators may be possible with non-probability based sampling, but cannot be expected to rescue a badly designed sampling programme.

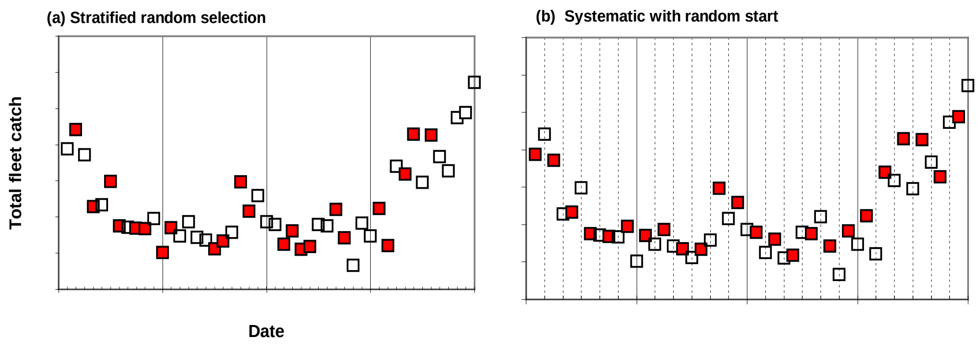

Figure A9.2. (a) Random sample of weeks to sample within quarterly strata; (b) Systematic selection of every second week. Filled squares are sampled weeks, open squares non-sampled weeks.

Procedures for selecting primary sampling units for shore sampling are described in the following section. Whatever schemes are chosen, a critical factor is the ability of the sampling staff (which may include contract staff) to easily interpret and correctly implement the sampling instructions. The ability to communicate sampling designs to technical staff or administrators also requires the terminology to be clearly explained: "random selection" may be misinterpreted as something inefficient and lacking in design, while "representative sampling" could be interpreted as a need to seek out catches that meet some preconceived notion of a typical catch composition or size frequency.

Selection of primary sampling units using an area frame for sampling on shore

An area frame should include all relevant attributes of the access sites for sampling to allow the definition of any stratification, or for assigning prior sampling probabilities to access points based on some measure of "size". Sampling schemes involving lists of sampling sites providing access to clusters of vessel trips may offer considerable challenges for designing robust sampling schemes due to issues such as timing and location of landings by different fleet sectors.

Key decisions affecting the sampling design are the definition of the PSUs and their stratification in the sampling frames. The PSUs will be defined as a landing site (or group of neighbouring sites) and a time window for the port visit, with all PSUs being non-overlapping area-time cells covering all landings in a frame or stratum.

Stratified random sampling of PSUs

Stratification is applied to the great majority of fishery sampling schemes. Defining strata as groups of ports of similar "size" would allow simple random selection of the

PSUs in each stratum, with a higher sampling probability in the strata with the largest ports. The example of the sampling scheme for small-scale fisheries in Mozambique (ICES 2010: WKMERGE report Section 6 and Annex 5) employs a stratification of sampling sites into "large", "medium" and "small", with a different probability of selecting PSUs (port x day) in each stratum. A theoretical example of such a scheme is shown in Figure A9.3. If the selected PSUs represent a biased selection (e.g. if port visits coincide only with times when larger vessels with longer trips are landing, and exclude times when other vessels land), they are representative of only a subset of PSUs. This could form a separate stratum (e.g. all Friday markets in a quarter). In that case, a separate sampling stratum is necessary to cover all the other PSUs.

Stratified systematic sampling with random component

The example of the sampling scheme for small-scale fisheries in Mozambique (ICES 2010: WKMERGE report Section 6 and Annex 5) uses a systematic lattice sampling scheme where the temporal strata are further subdivided into 1-week blocks. The PSUs (sampling site x day) are selected at random from all the PSUs in each 1-week period. This ensures good temporal coverage while retaining an element of randomization. This approach is also shown in the theoretical example in Figure A9.3.

Sampling with probability proportional to size (pps)

In pps sampling, the probability of visiting a particular port or cluster of ports in a stratum is adjusted according to an appropriate measure of size such as the expected total landings at the ports or harbours in each PSU, or the numbers of vessels or total effort etc. The disadvantage of pps sampling is the need for more complex statistical methods for computing the estimates, and the possibility that the auxiliary size variables from previous years' data may have changed in the sampling year, leading to reduced efficiency of the scheme. Sample selection using pps can also be applied within any strata.

Domains of interest within strata

The trips within a cluster may represent two or more domains of interest (e.g. métiers or fishing grounds). Provided the sampling is effectively random across all trips in the cluster, the occurrence of trips by domain should over time be equivalent to the occurrence in the fleet as a whole. Any requirement to sample a particular domain more intensively than another would require a means of accurately identifying the domain for all the trips in the cluster, at the time of sampling, and applying a higher probability of selecting trips of that domain. The danger of this approach is that the time required to sample those trips could result in the trips from some other domains having a zero probability of being selected, which could lead to some bias. A more subtle problem may occur if the rules for allocating trips to métiers in the census (logbook) data cannot easily be applied by the sampling team on site (e.g. if target assemblage is decided by catch value rather than catch weight). In this case the sampling probabilities may turn out different from those planned.

The proposals for sampling schemes given in WKMERGE (ICES, 2010) are intended for demonstrating the principles behind statistically robust fishery sampling schemes but should not be considered as exhaustive. Other unbiased approaches achieving the same goals are possible and may be more appropriate to particular national circumstances.

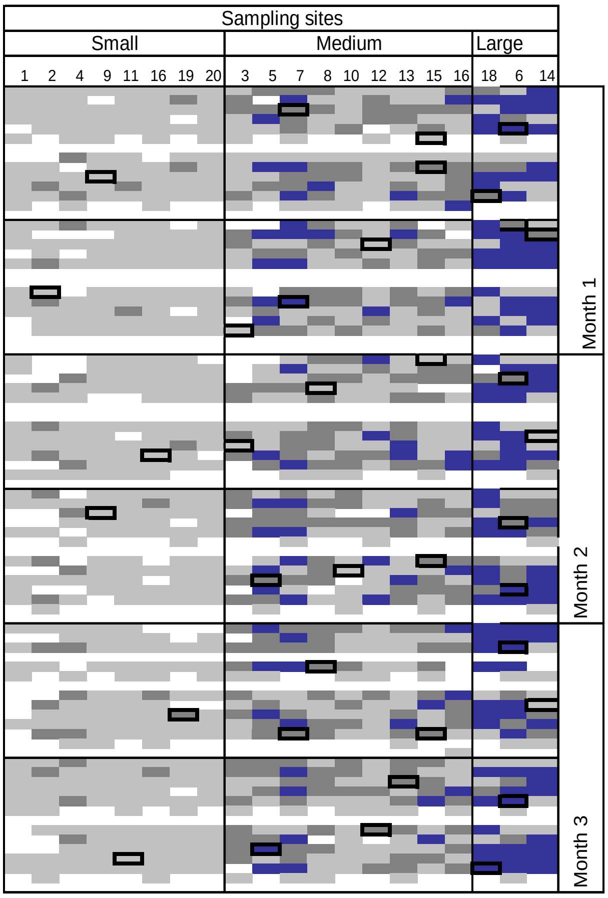

Figure A9.3. Representation of an area list frame used for port sampling ashore, with sampling sites along the top and sampling days down the side. The sampling sites are stratified in advance into those of "small", "medium" or "large" size (e.g. according to fleet size, quantities landed by species in a previous year). The daily landings are shaded to illustrate variability of the size variable (e.g. total landings, as known after the event; dark: large). The PSUs are defined as sampling site x day. Each PSU could comprise groups of neighbouring sampling sites that can be covered in an individual sampling trip. Each PSU comprises a cluster of vessels landings that may be sampled exhaustively or using a representative sample of fishing trips within the cluster. Frames of this type could represent an entire national fleet or represent fishing trips by geographic area or fleet segment Sampled PSUs and SSUs are outlined in bold. Sampling has been planned with one random PSU per 2-week time block for small ports (6 trips per quarter), three random PSUs per 2-week time block for medium ports (18 trips per quarter) and two per 2-week block in large ports (12 trips per quarter). In this Frame, sampling is with replacement (i.e. a sampling site could be visited more than once). Sampling without replacement is also possible.

Key features of good sampling schemes for shore based sampling

- Use robust statistical designs rather than ad hoc, opportunistic sampling;
- Use sampling frames that maximize the coverage of the target population;
- Fully document all non-accessible population elements and reasons for non-accessibility;
- Use stratification that is stable over time allowing controlled sample probabilities;
- Treat potentially unstable fleet components such as Level 6 métiers as domains;

- Avoid over-stratification – better to have representative, optimized sampling of fewer strata than to have undersampled and missing strata requiring imputation;
- Ensure that the variables for designing sampling strata are represented exhaustively in the fleet census data used for calculating raising factors;
- If domains cut across strata, ensure that accurate weights for raising the samples from the domains to the fleet level in each stratum can be obtained;
- Include systematic sampling (with random elements) where appropriate to improve temporal coverage and allow more efficient use of staff time;
- Use predominantly design-based sampling schemes even if planning to use model-based approaches;
- Avoid unequal probability methods such as probability-proportional-to-size if the correlation with the auxiliary variables is likely to be unstable over time;
- Ensure vessel list frames are updated immediately prior to the vessel selection period;
- Do not assume that a random selection of vessel PSUs from a list frame is equivalent to a random selection of trips within a stratum, if trip duration is skewed within the population of vessels in the stratum (e.g. more vessels with short trips);
- Ensure that sampling schemes are easy to interpret and implement, for example by contract staff with limited knowledge of sampling theory.

WKMERGE also made the following recommendations regarding imputation for missing data:

- Sampling programmes should be designed in a robust way avoiding over-stratification, minimising the risk of empty cells;
- Data users should be informed on the level of resolution of domains (métiers) for which robust data can be expected given the available resources for data collection;
- Automated imputation of missing data in databases should be avoided. If it is carried out, all imputed data must be clearly referenced in the database so that they can be excluded from any analyses, and the imputation methods clearly documented;
- Expert knowledge of the fisheries is needed when designing imputation methods for data analysis;
- Extreme caution should be taken in borrowing data from a métier sampled by one country to impute values for the same, but non-sampled, métier of another country. Different management measures operating in different countries exploiting the same stocks could lead to quite different catch compositions, for example different discard rates due to country-specific quota uptake, market forces, fish avoidance measures or other differences in activities in the same métier.

Annex 10. Appendix to the 2014 WGCATCH Report

Contents

Introduction

Prior to the meeting, the working group chairs circulated two questionnaires to the participants. The full responses of these questionnaires are included in this document.

The first questionnaire concerned shore-based sampling and was intended to evaluate methods and develop guidelines for best practice in carrying out sampling of commercial sampling of commercial fish catches on-shore. The questionnaire was structured around WKPICS2 guidelines for best practice at each stage of the sampling process and asked for a description of current practices at each of these stages. Based on these questionnaires, common and specific problems were catalogued and potential solutions were identified. At the same time, the discussion of the questionnaires provided a form of peer-review of the sampling designs and identified where improvements could be made.

The second questionnaire concerned the expected impact of the obligation to land all catches. This was intended to allow the group to identify the fleets that will be impacted and possible issues that are anticipated as well as solutions to adapt existing monitoring and sampling schemes and to quantify bias resulting from the introduction of this regulation.

Shore-based sampling design questionnaires

This table is based on guidelines for best practice in catch sampling schemes, drawn up by WKPICS2 (2012; Appendix 6). Please provide your answers in the *grey-blue boxes*. At this stage, appending the annexes is optional. See comments boxes for additional guidance on completing the table.

Member state:

Basque Country

Until now, sampling effort in the Basque Country was fixed at annual level based on previous DCF objectives and was allocated to metiers – ports - quarters proportionally to the total landings registered in previous years.

However, we are working on implementing probablity based sampling in 2015. This document reflect the sampling design that we plan to implement, but we have still some open questions which are shown in the text and will be solved with the practice.

Target population

Best practice

The target population needs to be identified and described. Access to the target population for sampling purposes need to be analysed and documented.

Comment

-

Bad practice

-

Member state sampling design

1) *The target population for DCF is all fish and shellfish species for which estimates of landed quantities are required by Commission Decision 2010/93/EU, taking account of any derogations granted.*

Primary sampling units (PSUs)

Best practice

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

Comment

If PSU is something else than trip, vessel or site the choice need to be thoroughly explained.

Bad practice

-

Member state sampling design

WKPICS design class D.

Ports are fixed and the PSU is the day.

Sampling frame

Best practice

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.

Comment

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.

Bad practice

To exclude large parts of the target population in an ad-hoc way.

Member state sampling design

The sampling frame is a matrix of ports vs days of the year.

A different sampling frame is defined for each of the subpopulation described above, as their activity is different in terms of landing ports and days of the wee. All sampling sites are included, and the sampling effort is proportional of the total landings registered on the previous year.

However, there are some elements which are not included in our sampling frame:

- *Only Spanish vessels and French vessels with Basque owners are sampled*
- *Weekdays with small total landings or small number of trips are excluded (at the level of subpopulation).*
- *Sometimes, part of the landings made by trawlers goes directly to a processing industry. If the sampler identify that whole trip is not available for sampling, the trip is not sampled.*
- *We also miss part of the landings for sampling when part of the trip is sold in two different auction locations (For example when trawlers go to area VI thay may sell part of the landings in Scotland).*

Stratification of the sampling frame

Best practice

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.

Comment

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.

Bad practice

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.

Member state sampling design

1) *For practical purposes, the target population is stratified into several fleets which are defined by mutually exclusive list of vessels. Each of these strata will have their own sampling design (sampling frame, PSU selection method, etc):*
   - A. *Offshore pair bottom trawlers*
   - B. *Offshore otter bottom trawlers*
   - C. *Litoral Pair bottom trawlers*

D. Purseiners

2) *For each sampling frame, the following strata are defined:*
   - i) *12 months of the year. Months with similar sampling effort can be merged as quarterly strata to avoid overstratification. If the sampling effort is different for some months, could they also be merged and considered as a quaterly strata with unequal probability? (open question to be solved)*
   - ii) *In the case or trawlers and purseiners (strata A, B, C & D) further strata are not defined.*
   - iii) *In the case of the artisanal fleet (subpopulation E), port size strata may be defined for large ports and small ports*
3) *An attempt is made to ensure each stratum has a minimum of port-sampling day-trips. Methods of allocating sampling effort between strata is given in next section.*

Distribution of sampling effort

Best practice

The way sampling effort is distributed between strata needs to be described. In accordance with best practice, this can be based on analysis of variance or just distributed proportionally.

The different sampling inclusion probabilities/weighting needs to be documented.

Comment

If other methods, such as expert judgment are used, this should be explained and justified.

Bad practice

-

Member state sampling design

1) *Sampling effort (number of trips to sample by stratum) is allocated according to information on fishing effort and catches in the previous year*
2) *In each stratum, sampling effort is distributed evenly.*

Sample selection procedure

Best practice

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 principle this means 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

Basque Country

Comment

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

Bad practice

Ad-hoc based sampling, without proper documentation to allow estimation of bias, where the sampling inclusion probabilities cannot be estimated.

Member state sampling design

1) *For offshore pair and otter bottom trawlers (strata A & B) sampling is done on mondays as 90% of landings are made this day.*
2) *For the rest of the fleet (strata C, D & E) a "trellis" sampling design is used. The dynamics of the different fleets are studied for each port, in order to identify the most important weekdays and include them in the matrix. Then, systematic sampling is used to evenly distribute sampling effort throughout the weeks and days of each quarter.*
3) *As there are multiple sampling frames (one for each fleet strata), and limited resources, the choice of weeks or days to sample ports in each stratum has to be coordinated across the different fleets. Although this results in a less systematic sampling of ports for each stratum, the planned sampling probabilities, and the principle of spreading the sampling across the year, are maintained.*

Hierarchical structure in the sampling

Best practice

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)

Comment

-

Bad practice

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)

Member state sampling design

WKPICS design class D.Ports are fixed. The hierarchy for sampling is as follows:

1) *Stratification on "Fleet x Quarter"*
   For trawlers (A, B & C):
   a) *PSU: selection of "day"*
   b) *SSU: selection of a "vessel sale event"*
      i) *(Stratify by "commercial species")*
      ii) *(Stratify by "commercial size category")*
         (i) *TSU: selection of a box*
            1. *(Stratify by "scientific species")*
               a. *QSU: selection of individual fish*

   For purseiners and artisanal fleet (strata D & E):
   1. *PSU: selection of "port x day"*
   2. *SSU: selection of " time window to sample"*
   3. *TSU: selection of a "vessel sale event"*
      iii) *(Stratify by "commercial species")*
      iv) *(Stratify by "commercial size category")*
         (i) *QSU: selection of a box*
            1. *(Stratify by "scientific species")*
               a. *FSU: selection of individual fish*

Protocol for selection of samples at lower sampling levels (SSU, etc.)

Best practice

Such protocols should exist in a national repository

Comment

-

Bad practice

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Member state sampling design

1) *Once in the auction, trips are selected randomly. Different strategies are designed to adapt the vessel selection to the landings dynamics of each fleet (strata).*
   a. *The selection of the vessels to sample for trawlers (A, B & C), is based on the list of landings vessels which is available the day before sampling. A random selection of the vessels from that list is performed.*
   b. *The selection of the vessels for the rest of the fleet (D & E) is made by dividing the time where the vessels are landing in different time windows. For example, the landing time can be divided as follows: 6-8, 8-10, 10-12, 12-14. The time to start the sampling is selected randomly among these intervals. The vessel is selected sistematicaly whithin the time window.*
2) *Concurrent sampling is performed, and thus all species in a trip are measured. In the case that all species cannot be sampled (limited time), the samplers have a list of the most important species to prioritize them.*
3) *All commercial categories are sampledfor each species*
4) *Boxes for each size category are stored in towers. Only accessible boxes are sampled.*

Basque Country

5) *Fish are sampled for length. A true random selection of fish in the boxes is not possible because fishes are carefully displayed for the auction, and we have to be very careful when manipulating them. A representatibe sample is taken. The rule of thumb is to sample for length a number of fishes enough to get a normal distribution.*

System to monitor performance of sampling schemes - Quality Indicators

Best practice

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.

Comment

-

Bad practice

-

Member state sampling design

The following systems are in place to monitor sampling performance and data quality:

1. *Probability-based sampling will be implemented in 2015*
2. *Non-response rates are recorded, for example if staff are refused access to landings to sample. These could be used to review potential bias and to improve on access to fisheries were consistent refusals are an issue.*
3. *The sampler ensures all the paperwork is in good order and completed to a high minimum standard. These data are entered onto the sampling database, which includes a range of error traps.*
4. *Once entered, the data and data integrity is checked by other member of staff. Any errors, outliers or unusual values are investigated and corrected.*

Documentation of raising/weighting procedure for national estimates

Best practice

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.

Comment

-
Bad practice
-
Member state sampling design *1) In 2015 probability based rasising factors will be incorporated for each stage. Untill now, the general procedure described below was followed to get the length compositions for main species:* *1) The data for each vessel trip sampled is linked with sales notes and logbooks.* *2) The length composition recorded from individual boxes sampled is raised to the total observed trip landing. The weight of the raised length frequency is calculated using length-weight parameters and can be raised to the reported landing weight in that trip.* *3) The raised length frequencies and landings weights are summed over all vessels of the target fleet sampled on that visit. The summed length compositions are then raised to the reported landed weight of all vessels of the fleet at stratum.* *4) Stratum raised length frequencies are then summed across strata to give the total length frequency for the fleet.* *5) This is repeated for all other post-strata (e.g. fleets or metiers)"* *2) Missing data may occur at several stages:* *i) Sometimes there are size categories in our sales notes which we didn't find in our sampling. In these cases, we use the nearest sampling data for that category (i.e. the day after or the day before).* *ii) If no sampling data is available for one strata, we use data from the nearest strata to fill it.*

Basque Country

Member state:

Belgium

Target population

Best practice

The target population needs to be identified and described. Access to the target population for sampling purposes need to be analysed and documented.

Comment

-

Bad practice

-

Member state sampling design

1) The target population for DCF is all commercial fish species for which estimates of landed quantities are required by Commission Decision 2010/93/EU, taking account of any derogations granted.

2) We only sample the landed catch at sea, as we don't know the exact fishing ground of the catch at the market. Currently the vessels in the on-board sampling program are selected on an ad hoc basis.

Primary sampling units (PSUs)

Best practice

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

Comment

If PSU is something else than trip, vessel or site the choice need to be thoroughly explained.

Bad practice

-

Member state sampling design

The PSU is a trip.

Sampling frame

Best practice

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.

Comment

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.

Bad practice

To exclude large parts of the target population in an ad-hoc way.

Member state sampling design

We have only one sampling frame for the sampling of demersal fisheries (12m-40m beam trawl vessels)

Stratification of the sampling frame

Best practice

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.

Comment

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.

Bad practice

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.

Member state sampling design

1) The following strata are defined for the sampling frame:

iv) 5 geographic areas (North Sea, Eastern English Channel, Celtic Sea, Irish Sea and Bay of Biscay)

v) 2 Vessel "size" strata: "Large" fleet segment (>221 kW) and "Small" fleet *segment (<221 kW) (North Sea)*

vi) 4 quarters of the year

The geographic areas are defined because of the boundaries of assessment and management areas.

Vessel size strata are defined because they have a different catch composition and the larger vessels don't have access to the 12 mile zone.

Quarterly strata are defined to allow the possibility of varying the sampling intensity according to seasonal fishing activity.

2) The overall sampling effort is largely constrained by the large refusal rate (limited work space on board,…)

Distribution of sampling effort

Best practice

The way sampling effort is distributed between strata needs to be described. In accordance with best practice, this can be based on analysis of variance or just distributed proportionally.

The different sampling inclusion probabilities/weighting needs to be documented.

Comment

If other methods, such as expert judgment are used, this should be explained and justified.

Bad practice

-

Member state sampling design

1) Sampling effort (number of trips to sample by stratum) is allocated according to information on the average fishing effort in the last 2 years.

2) For each stratum, the ratio of number of sampled trips to total number trips in the sampling stratum, is an indicator of the sampling inclusion probabilities. For the moment, the raising procedure for length frequency distributions is depending on the species (landings as auxiliary variable for sole and plaice and effort (hauls) as auxiliary variable for cod).

Sample selection procedure

Best practice

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 principle this means 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

Comment

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

Bad practice

Ad-hoc based sampling, without proper documentation to allow estimation of bias, where the sampling inclusion probabilities cannot be estimated.

Member state sampling design

Currently the vessels in the on-board sampling program are selected on an ad hoc basis.

Hierarchical structure in the sampling

Best practice

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)

Comment

-

Bad practice

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)

Member state sampling design

The hierarchy for sampling is as follows:

2) *Primary sampling unit: trip*
3) *Secondary unit: haul*
4) *Tertiary unit: sample weight*
5) *Fourth level: Individual fish*

Protocol for selection of samples at lower sampling levels

Belgium

(SSU, etc.)

Best practice

Such protocols should exist in a national repository

Comment

-

Bad practice

-

Member state sampling design

Every second haul is sampled by an observer so sampling takes place around the clock to reflect typical working conditions. The crew is sorting the marketable fish from the conveyor belt and they store this retained part of the catch in baskets for the observer to sample later on (different species in different baskets). In the meantime, the observer is taking care of the discarded fraction of the catch.

The observer sorts all the discarded species of commercial importance and determines the total weight in a haul for each species. For a selected set of species, the observer also takes length measurements. Usually, the length of all individual fish in the discarded part of the tow is measured. Only when a species is extremely abundant, a smaller representative subsample is measured. The ratio of the total weight and the subsample weight is used to estimate the total number of discards per cm-size class per species in the sampled tow. The retained part of the catch is treated in the same way as the discarded part of the catch (the landings are sorted into size categories at the market).

In each trip, otoliths from 3 fish per cm-size class per species per area, are collected for age estimations. For the discarded part of the catch, otoliths are being removed on board. For the retained part of the catch, otoliths are being removed on board (round fish species) or the whole fish is taken to the lab (flatfish). Otoliths are taken throughout the whole trip (several hauls) until the quota of otoliths is achieved.

System to monitor performance of sampling schemes - Quality Indicators

Best practice

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.

Comment

-

Bad practice

-

Member state sampling design

The following systems are in place to monitor sampling performance and data quality:

5. *The sampling design is statistically not robust (ad hoc).*
6. *Non-response rates are not recorded.*
7. *Monitoring spreadsheets are updated before departure and on return and these are used to provide a unique id for each trip and to track achievements. On return the sampler ensures all the paperwork is in good order and completed to a high minimum standard. These data are entered onto the sampling database, which includes a range of error traps.*
8. *Once entered, the data and data integrity is checked by another member of staff - following procedure. Any errors are investigated, corrected and recorded.*
9. *Summary reports (for each trip) provide overviews to identify outliers and extreme values in the data (raising factors; rare species and length ranges). Any unusual values are investigated.*

Documentation of raising/weighting procedure for national estimates

Best practice

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.

Comment

-

Bad practice

-

Member state sampling design

1) Fleet-raised length compositions are derived for all species, and where required, are included in the process of estimating age compositions based on sub-sampling for age. The raising procedure to calculate total length compositions for a fleet (metier or any other aggregation of trips) - which are post-strata - follows the hierarchy of sampling design, according to the sampling fraction at each stage. The general procedure is as follows:

6) *The national fleet activity database, which holds logbook or other sales data on individual landings, is accessed to locate the data for each vessel trip sampled. This may require searching surrounding dates and cross-matching other trip information (gear; mesh) collected by the sampler. The gear, mesh, area etc. are*

attached to the sample data in the data base.

7) *The length composition recorded from each haul sampled is raised to the total number of hauls in the trip using the documented raising factors (e.g. ratio of sampled weight over the total weight of the sampled haul and the ratio of the number of sampled hauls over to total number of hauls in the trip). The weight of the raised length frequency is calculated using length-weight parameters.*

8) *The raised length frequencies for all sampled PSUs in the stratum are summed, and then raised to the reported landed weight for the species for all landings of the fleet in the stratum.*

9) *This is repeated for all other post-strata (e.g. fleets or metiers).*

2) The procedure for calculating age compositions from aged sub samples of fish is currently based on a conventional age-length key approach. The quarterly sample numbers at age in each length class are combined over all other strata to construct an age-length key for each quarter which is then applied to the fleet-raised length compositions for the quarter.

3) Missing data may occur at several stages:

In certain quarters, the number of sampled trips is too law (often in the third quarter), therefore a yearly estimate is provided.

Member state:
Denmark
Target population
Best practice The target population needs to be identified and described. Access to the target population for sampling purposes need to be analysed and documented.
Comment -
Bad practice -
Member state sampling design
1) The target population for DCF is all fish and shellfish species for which estimates of landed quantities are required by Commission Decision 2010/93/EU, as detailed in the National Programme, taking account of any derogations granted. Denmark samples 19 stocks on shore. *2) On-shore access to the landed catch is through a list of sales sites divided in large and small sales places from which a systematic selection is made for sampling according to the procedures described below.*
Primary sampling units (PSUs)
Best practice 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
Comment If PSU is something else than trip, vessel or site the choice need to be thoroughly explained.
Bad practice -
Member state sampling design
The PSU is sales site * time (a day within 2-week periods).

For each quarter a list is made of the sites where 80% of the weight of the 19 stocks (species and area) are sold. The harbours are then ranked by 4 criteria for the stocks: landed weight, percentage of the stock sold, number of landings and a relative price to conduct the sampling in the harbour (travel costs and price of fish).

The five largest sales sites are appointed 3 trips by quarter the rest 1 trip by quarter. For practical reasons the samples need to be taken during one day within pre-defined 2-week periods.

Sampling frame

Best practice

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.

Comment

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.

Bad practice

To exclude large parts of the target population in an ad-hoc way.

Member state sampling design

The sampling frame is a matrix of ports vs time. We have 2 different sampling frames

- *i)* *Ports where demersal fisheries (under-10m and over-10m vessels) sell their landings and the fish are available for sampling.*
- *i)* *Ports where pelagic and industrial species (mainly mackerel, herring, sprat, sandeel and boar fish) are landed and are available for sampling. This includes a small number of specialised ports where pelagic fish are landed in high volume by large midwater trawlers, and other ports where these species are landed and sold by smaller vessels.*

The following sampling sites are excluded:

- *i)* *Small sales sites where landings are sold, but which collectively account for the 20% smallest parts of the landings of the 19 stocks.*

Stratification of the sampling frame

Best practice

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.

Comment

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.

Bad practice

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.

Member state sampling design

1) The following strata are defined for each sampling frame:

vii) Quarters
viii) 2 Port "size" strata: "Large" ports and "Small" ports.

Quarterly strata are defined to allow the possibility of varying the sampling intensity according to seasonal fishing activity although in practice a systematic sampling design is currently used for spreading the sampling evenly across the year.

Port size strata are defined to allow optimisation of the distribution of sampling effort to obtain greatest precision for as many species as possible

2) The overall sampling effort for all sampling frames and strata is largely constrained by the financial and staff resources made available by the government for this work – currently around XXX staff days are available for sampling on shore. This affects the number of strata that can be effectively sampled and the exclusion of some PSUs from the frame. An attempt is made to ensure each stratum has a minimum of 12 port-sampling day-trips. Methods of allocating sampling effort between strata is given in next section.

Distribution of sampling effort

Best practice

The way sampling effort is distributed between strata needs to be described. In accordance with best practice, this can be based on analysis of variance or just distributed proportionally.

The different sampling inclusion probabilities/weighting needs to be documented.

Comment

If other methods, such as expert judgment are used, this should be explained and justified.

Bad practice

-

Member state sampling design

Denmark

1) Sampling effort (number of trips to sample by stratum) is a fixed allocation. All large harbour sites are visited 3 times by quarter and small harbours are visited 1 per quarter.

Sample selection procedure

Best practice

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 principle this means 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

Comment

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

Bad practice

Ad-hoc based sampling, without proper documentation to allow estimation of bias, where the sampling inclusion probabilities cannot be estimated.

Member state sampling design

A systematic sampling scheme is adopted. A summary of the procedure is as follows:

- *i) An updated port list is compiled for each quarter, and the planned number of sampling visits per sales site is scheduled.*
- *ii) A systematic sampling design is used with predefined 14-days sampling blocks within which one sampling day is selected. The use 14-days period is due to practical reasons, as the observers/fishery control needs a flexible system.*

Hierarchical structure in the sampling

Best practice

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)

Comment

-

Bad practice

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)

Member state sampling design

1. Stratification by Quarter
    a. PSU: selection of day at sales site within 2-week period
        i. Stratify by stocks
            1. *SSU: selection of a vessel/trip during the sale event*
                a. Stratify by "commercial size category"
                    i. TSU: selection of a box
                        1. QSU: fish (length)
                            a. QSU: Selection of fish for age and weight (census or stratified by length) measurements
2. Data collected
    a. Length
    b. Age
    c. Weight
3. Purposes
    a. Stock assessment
    b. CANUM
    c. Length distribution

Protocol for selection of samples at lower sampling levels (SSU, etc.)

Best practice

Such protocols should exist in a national repository

Comment

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Bad practice

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Member state sampling design

i) The strategy for selecting individual landings on a given day is guided by stock-based sampling targets. The desired number of trips to sample varies between species, so that more landings on a day may be sampled for one species compared to an-

other.

ii) *The stocks are sampled by commercial category. In many cases it is the fishery control or the auction administration that selects the boxes for DTU Aqua. We need to get better insight and control of this step of the sampling procedure.*

iii) *Currently, otoliths are collected in a length-stratified design for all flatfish species. 2 otoliths are collected per 1cm length class from each box when sampling for length. This maintains the link between length and age sampling*

iv) *For all other species the sampling is directly towards the otoliths and no ALK are used.*

System to monitor performance of sampling schemes - Quality Indicators

Best practice

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.

Comment

-

Bad practice

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Member state sampling design

The following systems are in place to monitor sampling performance and data quality:

10. *Sampling achievements are summarised and monitored on an ongoing basis on a spreadsheet held in a shared drive, and through regular contacts with sampling staff, so that issues can be identified and resolved as early as possible.*
11. *Denmark is not reporting on non-response rate for harbour sampling – it has not been considered a problem as the fish are bought.*
12. *Data are entered into a sampling database.* Missing data on eg. ICES rectangle are looked up in the logbook database.

Documentation of raising/weighting procedure for national estimates

Best practice

Data analysis methods should be fully documented, covering: (1) how the multistage 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.
Comment -
Bad practice
-
Member state sampling design As the sampling design is under development, Denmark has not yet looked into the raising/weighting procedure. There is no need to describe the old procedure here.

Denmark

Member state:

Spain

Target population

Best practice

The target population needs to be identified and described. Access to the target population for sampling purposes need to be analysed and documented.

Comment

-

Bad practice

-

Member state sampling design

The target population for DCF is all fish and shellfish species for which estimates of landed quantities are required by Commission Decision 2010/93/EU, taking account of any derogations granted.

On-shore access to the landed catch is through a list frame of landing sites.

Primary sampling units (PSUs)

Best practice

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

Comment

If PSU is something else than trip, vessel or site the choice need to be thoroughly explained.

Bad practice

-

Member state sampling design

The PSU is day. Landing site are fixed (after effort/landings analysis for selection)

Sampling schemes are designed for every metier selected following ranking system as required by Commission Decision 2010/93/EU. Some metiers excluded, mostly targeting non DCF species.

Sampling frame

Best practice

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.

Comment

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.

Bad practice

To exclude large parts of the target population in an ad-hoc way.

Member state sampling design

Every sampling frame consists on a list of ports where days are picked.

The decision of which ports include is based both on :

- *effort (trips) and landings (weight) of the specific metier.*
- *geographical representation*

Each frame excludes minor ports and, only occasionally, other ports that present sampling difficulties.

Stratification of the sampling frame

Best practice

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.

Comment

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.

Bad practice

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.

Member state sampling design

Spain

The sampling frame is stratified by quarter.

Each stratum is sampled with a systematic monthly allocation procedure. The estimates for each stratum are combined into one estimate for the whole population.

After SSUs (trips), TSUs(boxes) are stratified by, where relevant, commercial species and commercial size categories.

Post stratification of the trips for estimation is done based on geographical areas (mutually exclusive and exhaustive). Geographical post-stratums are highly related to ports, but it is not always possible to know the geographical stratum of interest to which a SSU belongs until the sample is collected. Ports are then taken as proxies for fishing areas to get more probabilistic random sampling.

Selection of sampling days within the month is dictated by days of the week when there are markets, taking into account the time of the market. Usually there are differences between fleets for this.

Within a site/day the sampling is conducted by a sampling team (ranging from one to three people depending on the metier)

Trips/vessels are randomly selected. From each trip sampled, boxes are randomly selected, taking into account commercial size categories where relevant (usually depending on the species)

Distribution of sampling effort

Best practice

The way sampling effort is distributed between strata needs to be described. In accordance with best practice, this can be based on analysis of variance or just distributed proportionally.

The different sampling inclusion probabilities/weighting needs to be documented.

Comment

If other methods, such as expert judgment are used, this should be explained and justified.

Bad practice

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Member state sampling design

Allocation between ports of every sampling frame is based –not proportional— to the fishing effort and total landings: ports with larger volumes of landings and/or trips are sampled more frequently than ports with small volumes of landings/trips. This is adjusted according to geographical needs explained before and taking into account practical issues as specific problems to access the fleet in a port.

Sampling effort is allocated by stratum ensuring every stratum is sampled. A fix number of samples per stratum is systematically allocated and then specific adjustments are done based on fisheries pattern (e.g. seasonal fisheries) and/or biology specificities (e.g. extra-large fish *sizes could require larger coverage) usually answering end-users needs (e.g. ICES assessments groups).*

As sample size for the post-strata can't be exactly controlled relation between port and fishing effort/landings by geographical areas are taken into account to allocate sampling effort.

Sample selection procedure

Best practice

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 principle this means 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.

Comment

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

Bad practice

Ad-hoc based sampling, without proper documentation to allow estimation of bias, where the sampling inclusion probabilities cannot be estimated.

Member state sampling design

Randomly selection fish from boxes and trips landed.

Each sampling team choose the days to sample between the pertinent sampling frame and strata according to the days/times available. Trips are randomly selected.

The raising procedure for landing estimates and length compositions of each species does not incorporate sampling inclusion probabilities (but is based directly on the fishing effort in each stratum)

Hierarchical structure in the sampling

Best practice

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. num-

Spain

ber of boxes)

Comment

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Bad practice

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)

Member state sampling design

The hierarchy for sampling is as follows:

6) *Primary sampling unit: Days*
    a) *Stratification of PSU: Quarter*
7) *Secondary sampling unit: Trips*
8) *Tertiary sampling unit: Box*
    a) *Stratification of TSU: Commercial species, Commercial size categories*
9) *Quarter sampling unit: Fish*
    a) *Stratification of QSU: Species*
4. *Data collected?*
    Both Length and Weight
5. *Purposes*
    Size composition and landings estimation.

Protocol for selection of samples at lower sampling levels (SSU, etc.)

Best practice

Such protocols should exist in a national repository

Comment

-

Bad practice

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Member state sampling design

There is no formal way of randomising the sample selection. Randomness is established as first criteria selection for trips (SSUs), boxes (TSUs) and fish (QSUs).

System to monitor performance of sampling schemes - Quality Indicators

Best practice

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.

Comment

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Bad practice

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Member state sampling design

The following systems are in place to monitor sampling performance and data quality:

Monthly regular visits to the sampling teams during sampling operations are established to ensure homogeneity and good practices across the sampling network. This monitoring is done by IEO teams from three different centres grouping ports of the sampling frame around them.

Monthly reports are produced including by port and metier:

- *Sampling achievements.*
- *Quality considerations.*
- *Sampling problems.*
- *Port specificities related to sampling.*

Different types of data checks are established before and after data upload to the data base during all the process (data capture, data entry, post validation, data extractions and raisings)

Non-response rates are not quantitatively recorded. If, following monthly IEO visits to samplers, non-response were found to occur repeatedly the sampling would be analysed to be redirected to other major port for the fishery.

Documentation of raising/weighting procedure for national estimates

Best practice

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.

Comment

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Bad practice

Spain

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Member state sampling design *Metier raised lengths are estimated following hierarchy in sampling design.* *Sampled trips are identified through logbooks and sale notes (identificating fishing areas). This information is used for geographical post-estratification.* *The length composition recorded from individual boxes sampled is raised to the total observed trip landing. The weight of the raised length frequency is calculated using length-weight parameters and can be raised to the reported landing weight in that trip.* *The summed length compositions are then raised to the reported landed weight of all vessels of the fleet at stratum and/or post-stratums.* *Stratum raised length frequencies are then summed across strata to give the total length frequency.*

Member state:

France

Target population

Best practice

The target population needs to be identified and described. Access to the target population for sampling purposes need to be analysed and documented.

Comment

Bad practice

-

Member state sampling design

1) The target population for DCF is a list of species (G1 + some G2) for which estimates of length structure of landings are required by Commission Decision 2010/93/EU, taking account of any derogations granted.

2) On-shore access to the landed catch is through a list frame of group of landing sites and fisheries (groups of metiers and fishing areas) from which a systematic sampling is made according to the procedures described below.

Primary sampling units (PSUs)

Best practice

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

Comment

If PSU is something else than trip, vessel or site the choice need to be thoroughly explained.

Bad practice

-

Member state sampling design

The PSU is a landing event on a specified auction for a type of fisheries (group of metiers and fishing area) in a given quarter.

France

The size of the PSU is not taken into account (considered homogeneous within the strata).

Sampling frame

Best practice

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.

Comment

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.

Bad practice

To exclude large parts of the target population in an ad-hoc way.

Member state sampling design

The sampling frame is a matrix of groups of ports (neighbouring auctions), unambiguous fishing grounds and groups of metiers (e.g. all types of trawlers targeting demersal, all types of gillnetters targeting demersal,…) with a monthly sampling allocation scheme. There are 3 sampling designs

- *ii) Concurrent sampling with a list of species (G1 + some G2 depending on the port).*
- *iii) Commercial category sampling, when the total landings of the trips are not accessible to the sampler (depending on harbours)*
- *iv) Stock specific sampling for generating a predefined number of individuals sampled (seabass, saithe, sole Bay of biscaye, Nephrops, …)*

The following sampling sites are excluded:

- *ii) Small ports where the landings are sold, and which are accessible for sampling, but which collectively account for marginal% of the total landings.*
- *iii) Remaining small ports where the landings are sold, but which are remotely located and very difficult to access without a substantial increase in resources. These collectively account for marginal% of the total landings.*

Stratification of the sampling frame

Best practice

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.

Comment

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.

Bad practice

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.

Member state sampling design

1) The following strata are defined for each sampling frame:

ix) 4 quarters of the year

The sampled auctions are defined partly for logistic reasons, because of the geographic locations of local offices from which the sampling staff operate, and partly because of the boundaries of assessment and management areas.

Port size strata are defined to allow optimisation of the distribution of sampling effort to obtain greatest precision for as many species as possible

Quarterly strata are defined to allow the possibility of varying the sampling intensity according to seasonal fishing activity.

2) The overall sampling effort for all sampling frames and strata is largely constrained by the financial and staff resources made available by the institute for this work – currently around 2000 staff days are available for sampling on shore. This affects the number of strata that can be effectively sampled and the exclusion of some PSUs from the frame. Methods of allocating sampling effort between strata is given in next section.

Distribution of sampling effort

Best practice

The way sampling effort is distributed between strata needs to be described. In accordance with best practice, this can be based on analysis of variance or just distributed proportionally.

The different sampling inclusion probabilities/weighting needs to be documented.

Comment

If other methods, such as expert judgment are used, this should be explained and justified.

Bad practice

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Member state sampling design

1) Sampling effort (number of trips to sample by stratum) is allocated according to infor-

France

mation on fishing effort and catches several years before and in some cases using information on precision of estimates to conduct a statistical optimisation.

2) No sampling probabilities used. Raising by strata => analytical multistage estimation

Sample selection procedure

Best practice

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 principle this means 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

Comment

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

Bad practice

Ad-hoc based sampling, without proper documentation to allow estimation of bias, where the sampling inclusion probabilities cannot be estimated.

Member state sampling design

A systematic sampling scheme is adopted. A summary of the procedure is as follows:

iii) Each team (lab) has a list of frames to sample and a number of visits to the sampling sites per month. The team decides when and where to go at regular intervals, decides which day to sample per auction depending on the landing habits of the targeted vessels, in order to optimise the probability to sample the designated trips.

iv) Arriving in the auction, the team notes all the trips pertaining to the designated frame and choose one which contains sufficient species (from the list) and sufficient fish per species to sample.

Hierarchical structure in the sampling

Best practice

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)

Comment

-

Bad practice

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)

Member state sampling design

The hierarchy for sampling is as follow, within a group of ports and a quarter:

10) *Primary sampling unit: a landing event, stratified by fishery (group of metiers and fishing area)*
11) *Secondary unit: selection of a box, stratified by commercial species and size categories*
12) *Tertiary level: selection of individual fish, stratified by scientific species when relevant*

Protocol for selection of samples at lower sampling levels (SSU, etc.)

Best practice

Such protocols should exist in a national repository

Comment

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Bad practice

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Member state sampling design

v) *In the case of concurrent sampling, a list of species to sample exists for a given auction, so the team must sample all species from the list within the selected trip.*
vi) *For each species, all commercial categories must be sampled*
vii) *When a box of fish contains more than 50 individuals, the team may subsample the box, either by cutting the box by half (several times) or measuring one fish out of 2 (or more).*
viii) *In some locations, otoliths are collected in a length-stratified design. For a species, the Standard Operating Procedure specifies collecting 1 otolith per 1cm length class from each landing when sampling for length. This maintains the link between*

France

length and age sampling.

System to monitor performance of sampling schemes - Quality Indicators

Best practice

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.

Comment

-

Bad practice

-

Member state sampling design

The following systems are in place to monitor sampling performance and data quality:

13. *Sampling achievements are summarised and monitored on a web-based software (annex 1), and through regular contacts with sampling staff, so that issues can be identified and resolved as early as possible.*
14. *The samples are first validated by the team which has populated the samples into the database*
15. *The samples are further validated with a series of tools. Before using the data, the 2 validation processes are needed.*
16. *Summary reports provide overviews to identify outliers and extreme values in the data (raising factors; rare species and length ranges). These can be limited to a trip or all the data in a stratum and are carried out quarterly by an administrator. Any unusual values are investigated.*
17. *Numbers of PSUs (trips sampled) is documented as a proxy for effective sample size. Yearly reports of the sampling activity against fishing activity provide an indication of how representative the sampling is.*

Documentation of raising/weighting procedure for national estimates

Best practice

Data analysis methods should be fully documented, covering: (1) how the multistage 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.

Comment

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Bad practice

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Member state sampling design

1) Fleet-raised length compositions are derived for all species, and where required, are included in the process of estimating age compositions based on sub-sampling for age. The raising procedure to calculate total length compositions for a fleet (metier or any other aggregation of trips) - which are post-strata - follows the hierarchy of sampling design, according to the sampling fraction at each stage. The general procedure is as follows:

10) *The national fleet activity database, which holds logbook or other sales data on individual landings, is accessed to locate the data for each vessel trip sampled. This may require searching surrounding dates and cross-matching other trip information (gear; mesh; species composition) collected by the sampler. The gear, mesh, area etc. are attached to the sample data in the data base.*
11) *The length composition recorded from individual boxes sampled is raised to the total observed trip landing of the vessel using the documented raising factors (e.g. ratio of sampled weight to landed weight by commercial category). When the sampled weight is impossible, the weight of the raised length frequency is calculated using length-weight parameters and can be compared with the reported landing weight to look for discrepancies that should be investigated.*
12) *The raised length frequencies and landings weights are summed over all sampled trips (PSUs) of a stratum.*
13) *The raised length frequencies for all sampled PSUs in the stratum are summed, and then raised to the reported landed weight for the species for all landings of the fleet in the stratum.*
14) *Stratum raised length frequencies are then summed across strata to give the total length frequency for the fleet.*
15) *This is repeated for all other post-strata (e.g. fleets or metiers)".*

2) The procedure for calculating age compositions from aged sub samples of fish is currently based on a conventional age-length key approach. The quarterly sample numbers at age in each length class are combined over all other strata to construct an age-length key for each quarter which is then applied to the fleet-raised length compositions for the quarter. The form of aggregation of samples over sampled trips to construct the ALKs can vary from species to species

3) Missing data may occur at several stages:

iii) *Species landings were reported in a stratum, but no PSUs were sampled for that species in the stratum. If the stock is assessed internationally the stratum is left unsampled. If the stock is assessed nationally, strata are merged to allow the raising."*

France

Annex FR-1. Excerpt of the web-based tool to describe the sampling frame and monitor sampling.

MÉTIERS ÉCHANTILLONNÉS																EFFORT D'OBSERVATION EN NOMBRE DE MARÉES [(RÉALISÉ + ESTIMÉ) / PLANIFIÉ]												
Code ligne	Programme ou règlement rattachement	Société	Zones de pêche	Zone autre(s) info(s)	Quartiers maritimes	Autre(s) info(s)	MÉTIER Code DCF5	MÉTIER Maillage	MÉTIER Taille du navire	MÉTIER Autre	MÉTIER Libellé	MÉTIER Espèces cibles	Début	Fin	Stratégie d'échantillonnage	04 2014	05 2014	06 2014	07 2014	08 2014	09 2014	10 2014	11 2014	12 2014	01 2015	02 2015	03 2015	Total
Atlantique Nord																												
Golfe de Gascogne																												
2014_V0013	DCF_14	SINAY	VIIIa, VIIIb, VIIId, VIIIe		Concarneau		OTT_CRU OTB_CRU	70-99		côtiers	Chalutage de fond hauturier à langoustine	langoustine	01/2014	12/2014	Simultané : espèces G1	2 / 2	2 / 2	2 / 2	2 / 2	2 / 2	2 / 2	0 / 2	0 / 2	0 / 2				12 / 18 (-)
2014_V0014	DCF_14	SINAY	VIIIa, VIIIb, VIIId, VIIIe		Concarneau		OTT_CRU OTB_CRU	70-99		côtiers	Chalutage de fond hauturier à langoustine	langoustine	01/2014	12/2014	Stock spécifique	2 / 2	2 / 2	2 / 2	2 / 2	2 / 2	2 / 2	0 / 2	0 / 2	0 / 2				12 / 18 (-)
2014_V0016	DCF_14	IMA	VIIIa, VIIIb, VIIId, VIIIe		Arcachon		GTR_DEF GNS_DEF	40-49, 50-59, 60-79, 80-99, >=100		Hauturiers / côtiers	Fileyage	sole + poissons plats	01/2014	12/2014	Simultané : Toutes espèces commerciales	0 / 1	1 / 2	4 / 1	0 / 1	4 / 1	0 / 1	0 / 2	0 / 1	0 / 1				9 / 11 (-)
2014_V0119	DCF_14	IFREMER	VIIIa, VIIIb, VIIId, VIIIe		Bayonne		PTM_SPF OTM_SPF	16-32			Chalutage pélagique	Bar, maquereau	01/2014	12/2014	Simultané : Toutes espèces commerciales	1 / 0	0 / 0	2 / 0	1 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0				4 / 0 (-)
2014_V0121	DCF_14	IFREMER	VIIIa, VIIIb, VIIId, VIIIe	Utiliser cette ligne pour les quartiers de Lorient, Douardenez et Concarneau	Douarnenez		PS_SPF				Bolincheurs	Sardine, anchois	01/2014	12/2014	Simultané : Toutes espèces commerciales	0 / 1	0 / 0	2 / 1	0 / 1	0 / 0	7 / 1	1 / 1	0 / 0	0 / 0				10 / 5 (-)
2014_V0122	DCF_14	SINAY	VIIIa, VIIIb, VIIId, VIIIe		Guilvinec		PS_SPF				Senne tournante et lamparo à petits pélagiques	Sardine, anchois	01/2014	12/2014	Simultané : espèces G1	0 / 2	0 / 2	0 / 2	2 / 2	2 / 2	1 / 2	0 / 2	0 / 2	0 / 2				5 / 18 (-)
2014_V0123	DCF_14	IFREMER	VIIIa, VIIIb, VIIId, VIIIe		Bayonne		PS_SPF				Bolincheurs	Sardine, anchois	01/2014	12/2014	Simultané : Toutes espèces commerciales	0 / 1	0 / 1	1 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1				1 / 9 (-)
2014_V0124	DCF_14	IFREMER	VIIIa, VIIIb, VIIId, VIIIe		Brest		FPO_CRU				Caseyeurs à crustacés	Crustacés	01/2014	12/2014	Simultané : Toutes espèces commerciales	0 / 2	0 / 2	0 / 2	0 / 2	0 / 2	0 / 2	0 / 0	0 / 0	0 / 0				0 / 12 (-)

Member state:

Germany

Comment (TI-SF, Hamburg): In the North Sea and North Atlantic region sampling is only done by an on-board observer sampling scheme. No shore-based sampling is conducted. For the pelagic freezer trawler fleet sometimes samples are also taken by self-sampling of the fishery.

In the Baltic Sea, shore-based sampling is only conducted for the western Baltic spring spawning herring stock (WBSSH; SD22-24, Skagerrak/Kattegat (IIIa) FAO 27). The pelagic fishery for Baltic sprat is sampled using an onboard self-sampling programme by the fisheries.

The below text ONLY refers to the sampling of WBSSH in SD 22 and 24 by TI-OF, Rostock.

Target population

The target population for DCF is herring landed by German vessels in SD22 and SD24.

On-shore access to landed catch is through a list frame of landing sites which are sampled by a stratified, systematic sampling scheme.

Primary sampling units (PSUs)

The PSU is a landing site on an odd or even week during the fishing season.

The size of the port and the area where most landings are coming from are the basis for stratification of the PSU.

Sampling frame

Most landing come from the pelagic trawls, gillnets and trapnets (see Annex 1).

Frame 1: The only major landing site for trawlers landing herring is Neu-Mukran near Sassnitz (Rügen island). The processing factory is sampled once every second week during the fishing season.

Frame 2: Ports where the passive gear fisheries land their catches.

Stratification of the sampling frame

The following strata are defined:

1. *2 geographic areas (SD 22, SD 24)*
2. *Landing site for trawlers (only 1 major landing site, i.e. Neu-Mukran in SD 24) and landing sites for gillnetters within geographic area; the main fishing ground of gillnetters is the Greifswalder Bodden, south of Rügen island; 5 major landing sites around the bay are sampled once every second week during the fishing season since the foundation of the Thünen Institute of Baltic Sea Fisheries in Rostock (TI-OF)/Germany in 1992.*
3. *From the few ports where trapnets catches are landed, one sample per quarter is purchased.*

4. *4 quarters of a year (major quarters for fishing: 1 and 2, and less 4)*

Distribution of sampling effort

The sampling effort is largely proportional to the amounts landed, both in space and time. That is, most samples are taken in SD 24 (both active and passive gear) and a smaller amount is assigned to SD 22, considering also logistic and staff resources.

The same major landing sites of gillnetters are being sampled since 1992. The sampling design follows the main fishing season, which starts after disappearance of ice coverage. The length of the fishing season was restricted in the last years by the reduced quota allocations.

Sample selection procedure

We use a systematic random sampling scheme.

Active gear: Only 1 major port. Every second week. On Monday, the factory is contacted and a sample is ordered. An unsorted sample of the catch (50 kg of herring mixed with sprat etc) is taken by a factory worker at an arbitrary period during the landing procedure of an arbitrary vessel and kept cool. On Tuesday, the sample – together with data on the fishing trip - is picked up and processed in the laboratory of TI-OF in Rostock.

Passive – gillnet SD 24: Every other week, 5 of the major ports around the Greifswalder Bodden are systematically sampled (1 sample from each port). 50 kg of unsorted herring catch is purchased directly from the fisher at the time of landing the catch in the port. Samples are processed in the laboratory of TI-OF. These samples are usually purchased from known fishers and are considered representative for the catches from others fishers operating in the same fishing ground with the same mesh size. The variation between vessels in a given port is minor because in a given period of time, fishers from a given port usually use the same mesh size to target the optimum size range of herrings present in the fishing ground.

Passive – others: Considering logistics and limitations by staff and time, unsorted samples from gillnets or trapnets landed at other ports in SD 22 and SD 24 are purchased on a systematic basis (e.g. once per month or quarter). The objective is to ensure reasonable coverage of spatial and temporal variability. These samples are usually purchased from known fishers and are considered representative for the catches from others fishers operating in the same fishing ground with the same mesh size.

Hierarchical structure in the sampling

The hierarchy of sampling is as follows:
PSU: port in a week
SSU: gear type
TSU: our unsorted subsample from the vessel
FSU: individual fish

Protocol for selection of samples at lower sampling levels (SSU, etc.)

Member state sampling design

All biological information of the 50 kg unsorted herring sample is collected. First, this includes recording of the overall species composition. Second, herring is analysed. All individual total lengths (0.5 cm below) of herring (N ~250-500) are measured. The overall numbers and weights (in g) per length-class are determined. The sampling for age reading of herring is fixed at 5 individuals per length-class. Additionally, data about sex and maturity (8 number-scale corresponding to HEINCKE) are taken.

System to monitor performance of sampling schemes - Quality Indicators

All phone calls are documented in a special spreadsheet on a shared drive of the institute internal network.
The response rate is virtually 100% (determined during the past 2 years), both for active and passive gear samples. Therefore, non-response rates are no longer determined. This would, however, be possible using our telephone logs.
Routine quality checks of the data in the database include e.g. age-length keys, length-weight relationships etc.

Documentation of raising/weighting procedure for national estimates

The quarterly overall reported catches (tons) of herring are raised by gear, by quarter and subdivision. The raising procedure is based on length distributions, age-length keys and the mean weights at age. The results are summarised to produce quarterly estimates of numbers and mean weights at age (0-8+).

Presently, samples collected at the beginning of the fishing season (e.g. January) have the same weight as those collected during the peak fishing season (e.g. March). There may be significant differences in biological data between the start and end of a quarter which is presently not accounted for in our raising procedure.

Germany

Member state:

Greece

Target population

Best practice

The target population needs to be identified and described. Access to the target population for sampling purposes need to be analysed and documented.

Comment

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Bad practice

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Member state sampling design

1) The target population for DCF is a list of species (G1 and G2 group) for which estimates of landed quantities are required by Commission Decision 2010/93/EU Appendix VII as it is applied to the Mediterranean Sea.

2) The on-shore access to the landed catch for the purse seine fishery (vessels of 18-24m and 24-40m) is through the main landing ports or auction sites. For the small scale fishery since there is a huge number of landing-sites scattered all over the Greek coastline and the numerous island, the on-shore access to the landed catch is through a list frame of landing sites from which a stratified random selection is made for direct sampling on shore. For the bottom otter trawl fishery there is only on-board sampling.

Primary sampling units (PSUs)

Best practice

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

Comment

If PSU is something else than trip, vessel or site the choice need to be thoroughly explained.

Bad practice

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Member state sampling design

The PSU is the fishing trip (the recording of the landings of a fishing trip). Since the on-shore sampling refers to purse seine fishery and small scale fishery, the fishing trip usually lasts 1 day. The minimum coverage is 2 trips per month per metier per region.

Sampling frame

Best practice

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.

Comment

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.

Bad practice

To exclude large parts of the target population in an ad-hoc way.

Member state sampling design

The frame population is identical to the target one. The total number of trips to be sampled is defined proportionally to the effort (number of days at sea for each metier in every region).

Stratification of the sampling frame

Best practice

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.

Comment

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.

Bad practice

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.

Member state sampling design

1) *The following strata are defined*

i) *3 geographical areas (GSA 20-Ionian Sea, GSA 22-Aegean Sea, GSA23-*

Cretan Sea) divided to 12 regions

ii) 6 metiers (purse seines, gillnets, trammel nets, set long lines, drifting long lines, pots/traps)

iii) 4 quarters of the year

The geographic areas are defined because of the boundaries of assessment and management areas.

The regions are defined as clusters for stratified cluster sampling. Quarterly strata are defined to allow the detection of seasonal differences in the demographic structure and composition of the landings for different metiers

2) Methods of allocating sampling effort between strata are given in next section.

Distribution of sampling effort

Best practice

The way sampling effort is distributed between strata needs to be described. In accordance with best practice, this can be based on analysis of variance or just distributed proportionally.

The different sampling inclusion probabilities/weighting needs to be documented.

Comment

If other methods, such as expert judgment are used, this should be explained and justified.

Bad practice

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Member state sampling design

1) The total number of trips to be sampled is defined proportionally to the effort (number of days at sea for each metier in every region). The sampling design follows the main fishing season for every metier. In cases of métiers with high variability in the landings the number of trips to be sampled is further increased. The effort is allocated according to information on fishing effort and catches of the previous year.

2) No sampling probabilities used.

Sample selection procedure

Best practice

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 principle this means 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

Comment

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

Bad practice

Ad-hoc based sampling, without proper documentation to allow estimation of bias, where the sampling inclusion probabilities cannot be estimated.

Member state sampling design

A random sampling scheme is used
i) for purse seine fishery, the fishing trips in every region are distributed to the nine months of fishing activity (December to February is closed-season) according to fishing effort
ii) for pots-traps fishery, that is carried out only in some regions of GSA 22, the fishing trips are distributed in these regions for the 8 months of fishing activity (4 months closed-season) according to fishing effort
iii) for gillnet, trammel net, set long line, drifting long line fishery , the fishing trips in every region are distributed according to fishing season and fishing effort

Hierarchical structure in the sampling

Best practice

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)

Comment

-

Bad practice

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)

Member state sampling design

13) PSU: fishing trip

Greece

i) per region
ii) per metier
iii) vessel size (0-6m, 6-12m, 12-18m for small scale fishery, 18-24m and24-40m for purse seines)

iv) quarter

14) *SSU: Selection of a sub sample (box) from the vessel's catch and stratify by species*
15) *TSU: Individual fish length*
16) *QSU: Individual fish age*

Protocol for selection of samples at lower sampling levels (SSU, etc.)

Best practice

Such protocols should exist in a national repository

Comment

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Bad practice

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Member state sampling design

ix) *The overall landings composition and the total weight of every species are recorded. All commercial categories are sampled for each species. For a sub sample of 100 individuals per species the total individual length and the sample weight is measured. Information on biological variables (age, length, weight, sex, maturity) for the species that are required from 2010/93/EU Appendix VII, are taken by purchasing a sample per species in defined time intervals, both from the on-board and on-shore sampling.*

System to monitor performance of sampling schemes - Quality Indicators

Best practice

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.

Comment

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Bad practice

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Member state sampling design

The following systems are in place to monitor sampling performance and data quality:

18. *Sampling achievements are summarised and monitored on an ongoing basis on a spreadsheet and through regular contacts with sampling staff, so that issues can be identified and resolved as early as possible.*
19. *Monitoring spreadsheets are updated before departure and on return and these are used to provide a unique ID for each trip. On return the sampling team ensures all the paperwork is in good order and completed to a high minimum standard. These data are entered onto the sampling database, which includes a range of error traps.*
20. *Once the data are entered, their integrity is checked by a senior member of staff. Any errors are investigated, corrected and recorded.*
21. *Summary reports provide overviews to identify outliers and extreme values in the data (raising factors; rare species and length ranges). These can be limited to a trip or all the data in a stratum and are carried out quarterly by an administrator. Any unusual values are investigated.*
22. *Numbers of PSUs (trips sampled) is documented as a proxy for effective sample size. Yearly reports of the sampling activity against fishing activity provide an indication of how representative the sampling is.*

Documentation of raising/weighting procedure for national estimates

Best practice

Data analysis methods should be fully documented, covering: (1) how the multistage 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.

Comment

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Bad practice

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Member state sampling design

1) Fleet-raised length compositions are derived for the commercial species and included in the process of estimating age compositions based on sub-sampling for age. The raising procedure to calculate total length compositions for the fleet of each metier follows the hierarchy of sampling design, according to the sampling fraction at each stage. The general procedure *is as follows:*

16) *The length composition recorded from individual boxes sampled is raised to the total observed trip landing of the vessel using the documented raising factors (e.g. ratio of sampled weight to landed weight by commercial category).*
17) *The raised length frequencies and landings weights are summed over all sampled trips (PSUs) of a stratum.*
18) *The raised length frequencies for all sampled PSUs in the stratum are summed, and then raised to the reported landed weight for the species for all landings of the fleet in the stratum.*
19) *Stratum raised length frequencies are then summed across strata to give the total length frequency for the fleet.*
20) *This is repeated for all metiers.*

2) The procedure for calculating age compositions from aged sub samples of fish is currently based on a conventional age-length key approach. The quarterly sample numbers at age in each length class are combined over all other strata to construct an age-length key for each quarter which is then applied to the fleet-raised length compositions for the quarter. The form of aggregation of samples over sampled trips to construct the ALKs can vary from species to species

3) Missing data may occur at several stages:

iv) *Species landings were reported in a stratum, but no PSUs were sampled for that species in the stratum. In this case the strata are merged to allow the raising.*

Member state:

Ireland

Target population

Best practice

The target population needs to be identified and described. Access to the target population for sampling purposes need to be analysed and documented.

Comment

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Bad practice

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Member state sampling design

1) The target population for DCF is all fish and shellfish species for which estimates of landed quantities are required by Commission Decision 2010/93/EU, taking account of any derogations granted. (According to the National programme.)

2) On-shore access to the landed catch is through a list frame of landing sites from which a stratified selection is made on an ad-hoc basis for direct sampling on shore according to the procedures described below.

Primary sampling units (PSUs)

Best practice

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

Comment

If PSU is something else than trip, vessel or site the choice need to be thoroughly explained.

Bad practice

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Member state sampling design

The PSU is a landing site on a specified day

The size of the PSU is related to the total landings into each port, ports with large volumes *of landings are sampled more frequently than ports with small volumes of landings. For pelagic species, sampling targets are directly linked to the landings (x samples per tonnes landed).*

Sampling frame

Best practice

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.

Comment

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.

Bad practice

To exclude large parts of the target population in an ad-hoc way.

Member state sampling design

The sampling frame is a matrix of ports vs days of the year. Four main sampling frames are defined:

v) Ports / processors where pelagic landings are available for sampling.
vi) Ports / processors where demersal landings are available for sampling.
vii) Ports / processors where Nephrops landings are available for sampling.
viii) Ports / processors where inshore landings are available for sampling.

These sampling frames are not strictly independent; one sampling event (port-day) can include e.g. demersal and inshore samples.

No sampling sites are excluded per se, but:

iv) Many of the smaller ports are not sampled for practical reasons, however the landings in these ports are very minor. In 2013, 3% of the demersal landings and 3% of the pelagic landings took place in ports that were unsampled
v) Some landings are not available for sampling (e.g. if they are transported to other ports or abroad where auctions take place). However there are no ports where all of the landings are unavailable for sampling.

Stratification of the sampling frame

Best practice

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.

Comment

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.

Bad practice

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.

Member state sampling design

1) The following strata are defined for each sampling frame:

x) geographic areas (Ices divisions, mainly VIa, VIIabgj)
xi) 4 quarters of the year

The geographic areas are defined mainly because of the boundaries of assessment and management areas. Within geographic regions, species-specific sampling targets are set for each port (based on recent landings) but these are flexible to account for changes in landings patterns. Quarterly strata are defined to allow the possibility of varying the sampling intensity according to seasonal fishing activity; this is particularly relevant for seasonal pelagic fisheries.

2) The overall sampling effort for all sampling frames and strata is largely constrained by the financial and staff resources available – currently around 400 sampling days are available for sampling on shore (inshore, nephrops, pelagic and demersal). This affects the number of strata that can be effectively sampled and the exclusion of some PSUs from the frame. Methods of allocating sampling effort between strata are given in next section.

Distribution of sampling effort

Best practice

The way sampling effort is distributed between strata needs to be described. In accordance with best practice, this can be based on analysis of variance or just distributed proportionally.

The different sampling inclusion probabilities/weighting needs to be documented.

Comment

If other methods, such as expert judgment are used, this should be explained and justified.

Bad practice

-

Member state sampling design

Ireland

1) Sampling effort (number of trips to sample by stratum) is allocated between strata according to information on recent landings rather than using information on precision of estimates to conduct a statistical optimisation. The allocation of sampling effort is driven by species-specific sampling targets and with the aim to sample "little and often" (rather than quickly filling sampling quota from a small number of samples). Sampling effort is mainly driven by targets of age samples, the length samples are easier to obtain and follow from the combination of age sampling, concurrent (on-shore) sampling and at-sea sampling (length samples of the landings component of the catches taken at-sea by observers, are treated exactly in the same way as samples take ashore; therefore these at-sea samples are also included in the sampling effort).

2) For each stratum, the ratio of number of port x day sampling visits to total number of port x day combinations in the sampling stratum, is an indicator of the sampling inclusion probabilities. In practice, the raising procedure for length compositions of each species does not incorporate these probabilities but is based directly on the landings in each stratum

Sample selection procedure

Best practice

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 principle this means 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

Comment

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

Bad practice

Ad-hoc based sampling, without proper documentation to allow estimation of bias, where the sampling inclusion probabilities cannot be estimated.

Member state sampling design

Sampling targets for each stratum are defined, based on recent landings. These targets are filled on an ad-hoc basis, the sampler will check if landings are expected in a certain port before travelling. This 'targeted' sampling is one of the main issues with the current sampling programme that needs to be addressed to move to a more statistically sound approach.

Most samples are taken in the 'main' ports (where the local offices are) and secondary ports *(large ports without a local office) but smaller ports are also visited, on an ad-hoc basis.*

Hierarchical structure in the sampling

Best practice

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)

Comment

-

Bad practice

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)

Member state sampling design

The hierarchy for sampling is as follows:

17) *Primary sampling unit: A port on a day.*
18) *Second level: a vessel landing stratified by fishing area*
19) *Third level: species (or species group/commercial species)*
20) *Fourth level: a fish box stratified by commercial size categories (where relevant)*
21)
22) *Fifth level: an individual fish*

Where does species fit into this hierarchy? And what about the spatial and technical stratification?

Protocol for selection of samples at lower sampling levels (SSU, etc.)

Best practice

Such protocols should exist in a national repository

Comment

-

Bad practice

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Member state sampling design

x) *The presentation of the catches varies between ports and pelagic and demersal spe-*

cies, A Standard Operating Procedure exists for each of the major ports to give sampling staff guidance on how to access landings samples, however there is no formal way of randomising the sample selection.

xi) The strategy for selecting individual landings of demersal, pelagic or inshore species to sample on a given day is guided by stock-based and concurrent sampling targets. The desired number of trips to sample varies between species so more landings on a day may be sampled for one species compared to another. Concurrent sampling, where all species in a landing are measured, is carried out according to targets (x samples per stratum). The selection of the samples is determined to a large extent by the priority that is given to each species; if sampling levels are below target for species X, this species will be sampled first. If more than one vessel landed this species, sampling will be spread across the vessels where possible. Species for which age samples are collected are also given priority and any remaining time will be spent on collecting (concurrent) length samples.

xii) Currently, otoliths are collected using a quota system: sampling targets are set for each stock. The main ports for each stock are identified and sampling targets are distributed across the ports in proportion to recent landings. Targets are not strictly length-stratified but samplers do attempt to sample across the full length range available and aim to sample no more than 3 fish per size class in any single sampling event in order to spread out the sampling over the PSUs. Staff monitor the number of otolith samples and use adaptive strategies to achieve the stock targets.

System to monitor performance of sampling schemes - Quality Indicators

Best practice

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.

Comment

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Bad practice

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Member state sampling design

The following systems are in place to monitor sampling performance and data quality:

23. *Sampling achievements are summarised and monitored on an ongoing basis on a sample tracking system, which is checked before each port visit. Weekly meetings are held with sampling staff as well as mid-quarter reviews of sampling targets,*

24. *On return the sampler ensures all the paperwork is in good order and the data are entered onto the sampling database, which includes a range of error traps.*
25. *When age data are entered (after the otoliths are read) further checks for outliers are performed and investigated.*
26. *A rigorous QC system is in place for the age reading programme. All species have a primary and secondary reader and, in some cases, a trainee reader. A random subsample (20%) of age readings are cross checked by both readers, establishing cv's and % agreements. These interreader checks have a minimum threshold, in accordance with international best practice. Agreements lower than this threshold trigger a review process to investigate the source of the age reader disagreement. All Age Readers participate in relevant exchanges and workshops.*
27. *Before data are extracted for the assessment working groups, the data and data integrity is checked by the port samplers. Any errors are investigated, corrected and recorded.*
28. *Further checks are performed during the data extraction and raising procedure. Any errors are investigated, corrected and recorded. Strata with insufficient samples are merged at this stage*
29. *Non-response rates are not recorded, (for example if staff are refused access to landings to sample).*

Documentation of raising/weighting procedure for national estimates

Best practice

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.

Comment

-

Bad practice

-

Member state sampling design

1) Grade information is currently not included; samplers are requested to sample the grades representatively. The raising procedure also does not take the other levels of the hierarchy into account. Essentially the length samples within a stratum are simply combined (e.g. they receive equal weights). The ratio of the landings to sampled weights is used to raise the data to fleet level. Landings samples taken on-board by observers are also included and treated in the same way as port-based samples.

2) The procedure for calculating age compositions from aged sub samples of fish is currently based on a conventional age-length key approach. The quarterly sample numbers at age in *each length class are combined within each stratum to construct an age-length key for each quarter and area (although the areas might not always match the spatial sampling strata). The ALK is then applied to the fleet-raised length compositions for the quarter and area.*

3) Because the sampling design is somewhat over-stratified it is common to have insufficient length samples in a stratum. Depending on the stock and available data, samples from a number of strata will be combined: for slow-growing species, it may be acceptable to combine quarters; for others combining areas or gears may be a better option.

Gaps in ALKs can also occur, if they occur in the 'middle' of the ALK, these are filled in using a smoothing model. If they occur at the lower end, data from discard samples may be included, if the gaps occur at the higher end (larger, slower growing fish) data from other quarters can be included.

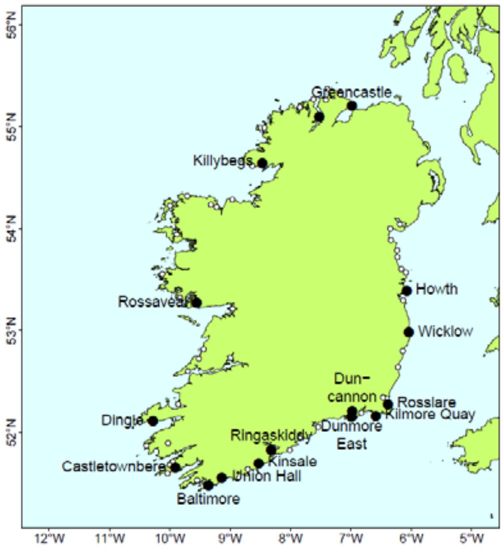
Annex IR-1. Description of sampling sites and how they are stratified, with map of location of the sites

Irish fishing ports

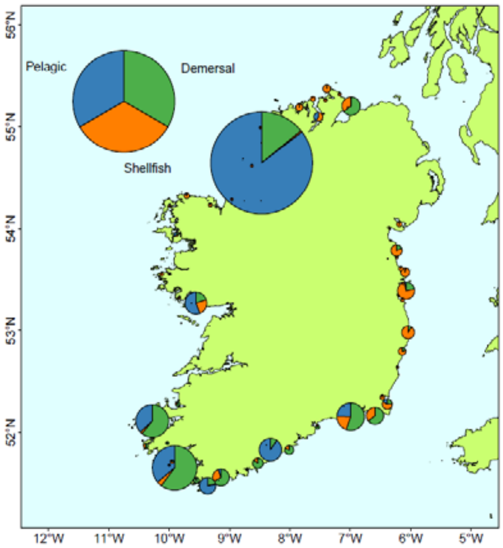
Fish are landed into numerous ports around the Irish coast and although each vessel is registered in a single port, they do not necessarily land their fish there. The main landings port for each vessel was determined by selecting the port where most landings events took place during 2008-12. Only vessels >10m with at least 50 landings events during the period 2008-12 were included.

Landings and vessels

Killybegs is by far the largest port in terms of the weight of fish landed (>100kt per year during 2008-12; including landings from foreign vessels). Pelagic species dominate in Killybegs but it is also the largest port for landings of demersal species. Killybegs is the main port for around 41 vessels. Castletownbere is the second-largest port in terms of landings (around 19kt per year; main port for around 53 vessels), followed by Dingle (10kt per year, 14 vessels). Demersal species dominate in these ports but pelagic species also account for around one third of the landings. Rossaveal is the main port in the west of Ireland (4kt per year, 31 vessels) and receives a mix of pelagic, demersal and shellfish species (The shellfish are nearly exclusively *Nephrops*). There are a large number of medium-sized ports along the south and east coast of Ireland, the largest of which is Dunmore East. The ports along the south coast receive a mix of pelagic, demersal and shellfish species while those on the east coast mainly deal with *Nephrops* landings.

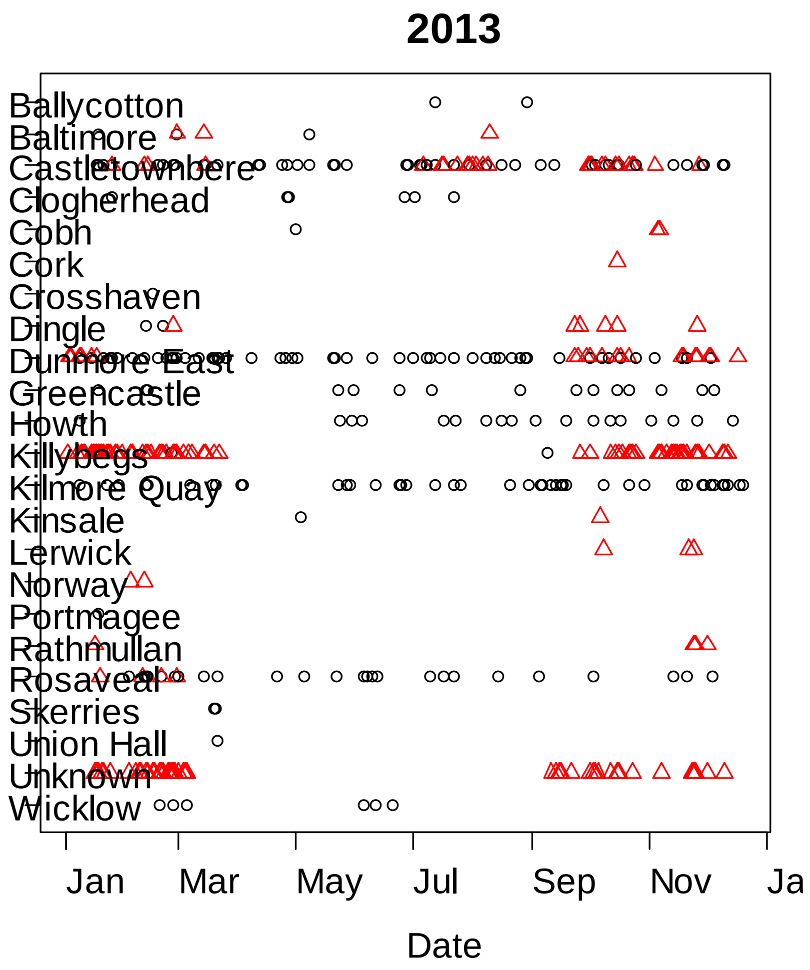


▲ The main Irish fishing ports (black dots). Minor ports are shown as white dots.

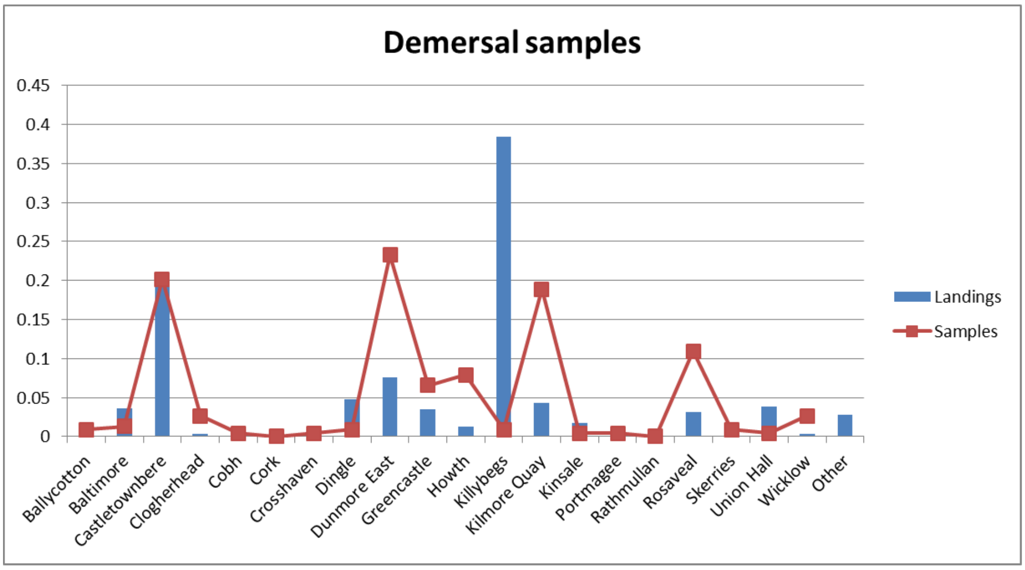


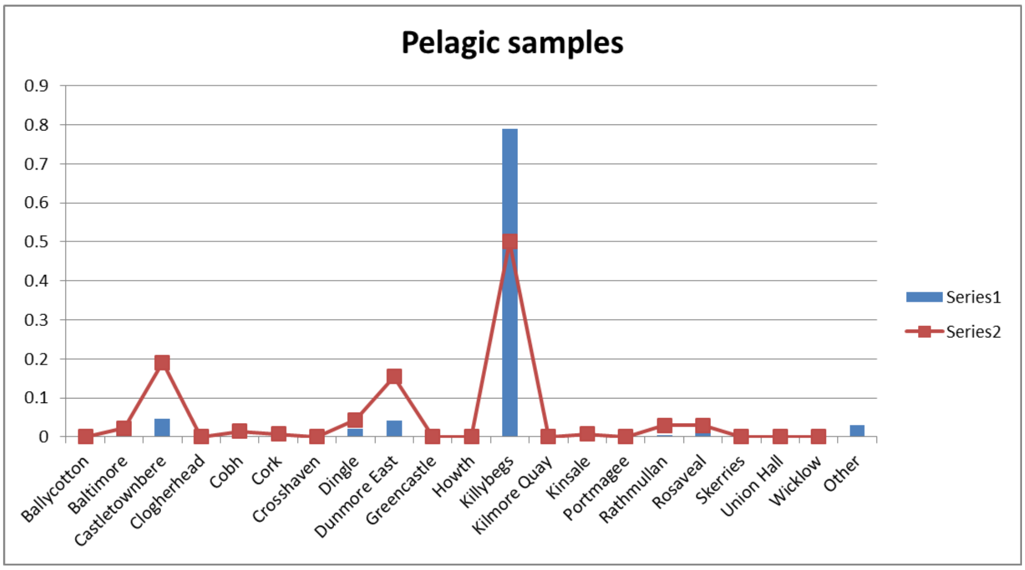
▲ Landings by port and species group; the size of the pie plots corresponds to the landings volume.

From: Gerritsen, H.D. and Lordan, C. 2014. Atlas of Commercial Fisheries Around Ireland, Marine Institute, Ireland. 59 pp.



Port sampling events by harbour and date in 2013 (pelagic red triangles and demersal black circles).





Demersal and pelagic landings by port (blue bars) and the number of sampling days (red line) both expressed as proportions.

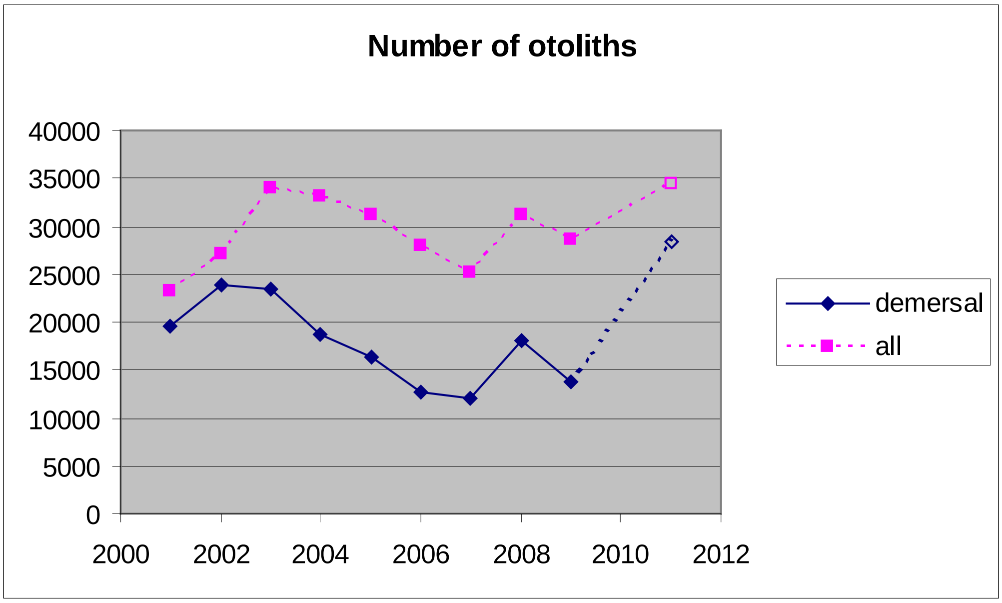
Ireland

Annex IR-2. Description of method for allocating sampling effort to strata

				Targets				
Species	**Area**	**Main sampling port**	**Other ports**	**Q1**	**Q2**	**Q3**	**Q4**	**Year**
Cod	VIa	Greencastle		Ad hoc1	Ad hoc1	Ad hoc1	Ad hoc1	1000
	VIb	Greencastle		0	0	0	0	0
	VIIa	Howth	Clogherhead	5002	5002	5002	5002	2000
	VIIb	Ros A Mhil		0	0	0	0	0
	VIIgj	Dunmore East	Wexford to Fenit	5002	5002	5002	5002	2000
Haddock	VIa	Greencastle		500	500	500	500	2000
	VIb	Greencastle		500	500	500	500	2000
	VIIa	Dunmore East	Howth, other east coast ports	500	500	500	500	2000
	VIIb	Ros A Mhil		100	500	100	100	500
	VIIg	Dunmore East	Wexford to Union Hall	300	300	300	300	1200
	VIIj	Castletownbere	Baltimore to Dingle	200	200	200	200	800
Hake	VI, VII	All ports		0	0	0	0	0
Megrim	VIa	Greencastle		2503	2503	2503	2503	1000
	VIb	Greencastle		2503	2503	2503	2503	1000
	VIIbgj	Kilmore Q, Castletb, Union H	Rosslare to Ros A Mhill	3003	300	300	300	1200
Monk (piscatorius)	VI	Greencastle		125	125	125	125	500
	VII	Castletownbere	All other ports	250	250	250	250	1000
Monk (budegassa)	VI, VII			0	0	0	0	0
Plaice	VIIa	Howth	Clogherhead to Dunmore East	2503	2503	2503	2503	1000
	VIIb	Ros A Mhil		0	0	0	0	0
	VIIg	Dunmore E, Kilmore Q	Other south coast ports	2503	2503	2503	2503	1000
	VIIj	Castletownbere	Portmagee, Dingle, Union H	2503	2503	2503	2503	1000
Sole	VIIa	Kilmore Quay	Clogherhead to Dunmore East	2503	2503	2503	2503	1000
	VIIb	Ros A Mhil		125	125	125	125	500
	VIIg	Kilmore Quay	Dunmore east and others	2503	2503	2503	2503	1000
	VIIj	Castletownbere	Dingle	2503	2503	2503	2503	1000
Whiting	VIa	Greencastle		350	350	350	350	1400

				Targets				
Species	**Area**	**Main sampling port**	**Other ports**	**Q1**	**Q2**	**Q3**	**Q4**	**Year**
	VIb	Greencastle		0	0	0	0	0
	VIIa	Dunmore East	East coast ports	Ad hoc	Ad-hoc	Ad-hoc	Ad-hoc	500
	VIIb	Ros A Mhil		Ad-hoc	Ad-hoc	Ad-hoc	Ad-hoc	500
	VIIgj	Dunmore East	Castletownbere, Kinsale etc	500	500	500	500	2000
Total demersal								28400
Footnotes:								
1) These should be sampled as a priority species on each trip to Greencastle								
2) All cod landed in ports from Wexford to Fenit can be considered to be from VIIgj, The VIIa cod are generally caught in the south of VIIa and biologically belong to the Celtic Sea stock								
3) Annual target of 1000, spread evenly over the quarters								

Ireland



Cod

VIa

- Cod landings are relatively minor. However the recovery plan for this stock is a major driver for fisheries advice. Therefore VIa cod should be sampled as a priority on all Greencastle sampling trips
- VIa cod are mainly landed in in Greencastle, at times also into Killybegs (but not auctioned there). There is no clear seasonal pattern in the landings

VIb

- VIb cod are not assessed. They are landed mainly during the first half of the year, particularly Q2.

VIIa

- The majority of the landings come in to Dunmore East, however, these are almost certainly caught in the south of VIIa and biologically part of the Celtic Sea stock. Therefore all cod landed in the south-west will be considered Celtic Sea cod and Howth is the main port for VIIa landings.
- The highest landings are usually in Q1

VIIb

- Insignificant cod landings, VIIbc cod are not assessed

VIIgj

- The highest landings are in Q1 and in some years, Q2.
- All cod landed in the south-west will be considered Celtic Sea cod

Haddock

VIa, VIb

- VIa and VIb haddock are landed in roughly equal numbers in Greencastle and Killybegs
- VIa haddock are landed throughout the year.
- VIb haddock are landed mainly during the first half of the year, particularly Q2.

VIIa

- In recent years the majority of the landings have come in to Dunmore East, before 2008, Howth was dominant.
- There is no clear seasonal pattern in the landings.

VIIb

- Most of the VIIb haddock are landed into Ros A Mhil
- VIIb haddock landings tend to be highest in Q1 and lowest in Q3
- VIIb haddock landings are a minor component of the VIIbk stock but they appear to have a different age structure to the rest of the stock.

VIIgj

- Most of the VIIj haddock are landed into Castletownbere
- The majority of the VIIg landings come in to Dunmore East.
- There is no clear seasonal pattern in the landings.

Hake

VI, VII

- Hake ageing is unresolved, a small number of otoliths will be taken on the groundfish survey, no port sampling will take place (for age!)
- The main ports taking hake landings are Greencastle, Dingle, Castletownbere and Dunmore east, smaller landings occur in Killybegs (some years), Ros A Mhil, Union Hall and other ports on the south coast.
- In recent years, the landings tend to peak in Q2
- The vast majority of the hake landed into Ireland is from foreign vessels landing into Killybegs and Castletownbere.

Megrim

VIa

- Greencastle takes most of the Megrim landings from VIa
- The landings tend to be lowest in Q1

VIb

- Killybegs and Greencastle get varying quantities of VIb megrim

VIIbgj

Ireland

- Most of the VIIb megrim are landed into Ros A Mhil
- Most of the VIIj megrim are landed into Castletownbere
- Most of the VIIg landings come in to Kilmore Quay.
- There is no clear seasonal pattern in the landings.

Monkfish

VIa, VIb

- Greencastle generally takes most of the Monkfish landings from VI, Killybegs and Castletownbere get varying quantities of Monkfish from VI.
- There is no clear seasonal pattern in the landings

VII

- Most landings are taken in Castletownbere
- The highest landings are usually in Q2

Plaice

VIIa

- VIIa plaice are landed in all ports from Clogherhead to Dunmore East. Howth used to take most of the landings but in 2008 and 2009 the landings were distributed evenly throughout east and southeast coast.
- There is no clear seasonal pattern in the landings.

VIIb

- Most of the VIIb plaice are landed into Ros A Mhil, followed by Achill (in recent years) and Killybegs
- There is no clear seasonal pattern in the landings.

VIIj

- Most of the VIIj plaice are landed into Castletownbere, but there are also significant landings in Dingle, Portmagee, Schull, Baltimore and Union Hall.
- Landings are generally highest in Q3 in Castletownbere and in Q1 in Portmagee end Dingle.

VIIg:.

- VIIg plaice are landed throughout the ports on the south coast, particularly Dunmore East, Kilmore Quay, Kinsale and Union Hall
- There is no clear seasonal pattern in the landings.

Sole

VIIa

- In recent years VIIa sole have been landed mainly in Wicklow, Howth, Arklow and Kilmore Quay. Before 2009, Rosslare and UK ports also took significant plaice landings.
- There is no clear seasonal pattern in the landings.

VIIb

- Most of the VIIb sole are landed into Ros A Mhil, followed by Killybegs and Fenit.
- There is no clear seasonal pattern in the landings.

VIIj

- Most of the VIIj sole are landed into Castletownbere, but there have also been significant landings into Dingle.
- Landings are generally highest in Q2 in Castletownbere and in Q1

VIIg:.

- VIIg plaice are landed throughout the ports on the south coast, particularly Kilmore Quay and Dunmore East.
- Landings are generally highest in Q1 and Q2

Whiting

VIa, VIb

- VIa whiting are mainly landed in Greencastle and in some years in Killybegs
- VIb whiting are mainly landed in Killybegs, landings are sporadic and implausible

VIIa

- Most of the VIIa whiting are landed into Dunmore East.
- There is no clear seasonal pattern in the landings.

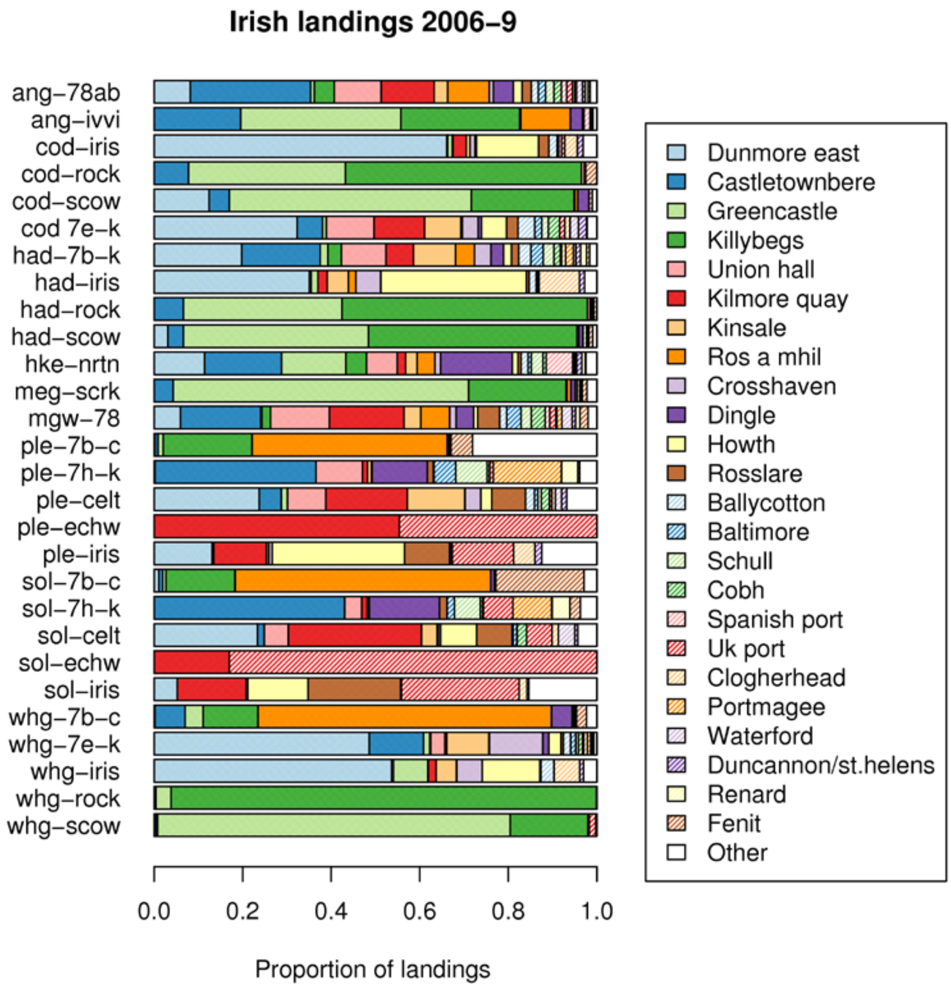
VIIb

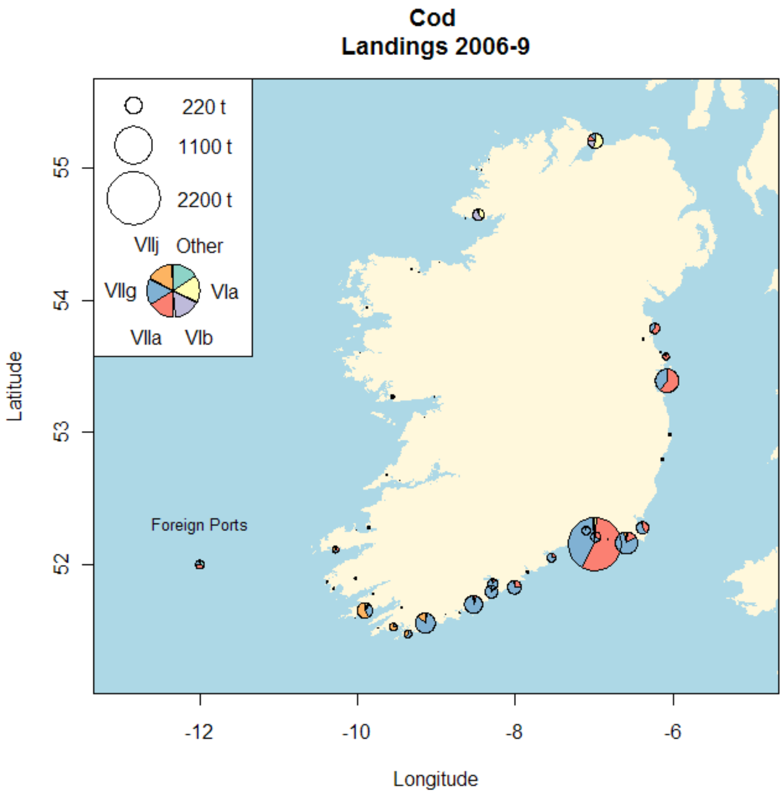
- Most of the VIIb whiting are landed into Ros A Mhil
- The vast majority of landings take place in Q1

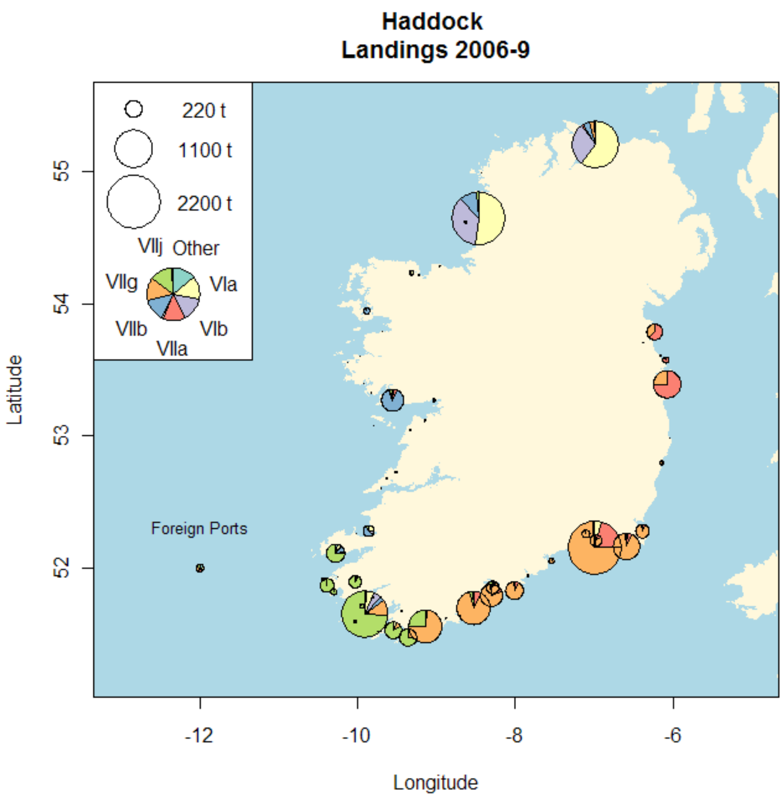
VIIgj

- The majority the VIIg of the landings come in to Dunmore East.
- Most of the VIIj haddock are landed into Castletownbere
- There is no clear seasonal pattern in the landings.
- The highest landings are generally in Q3.

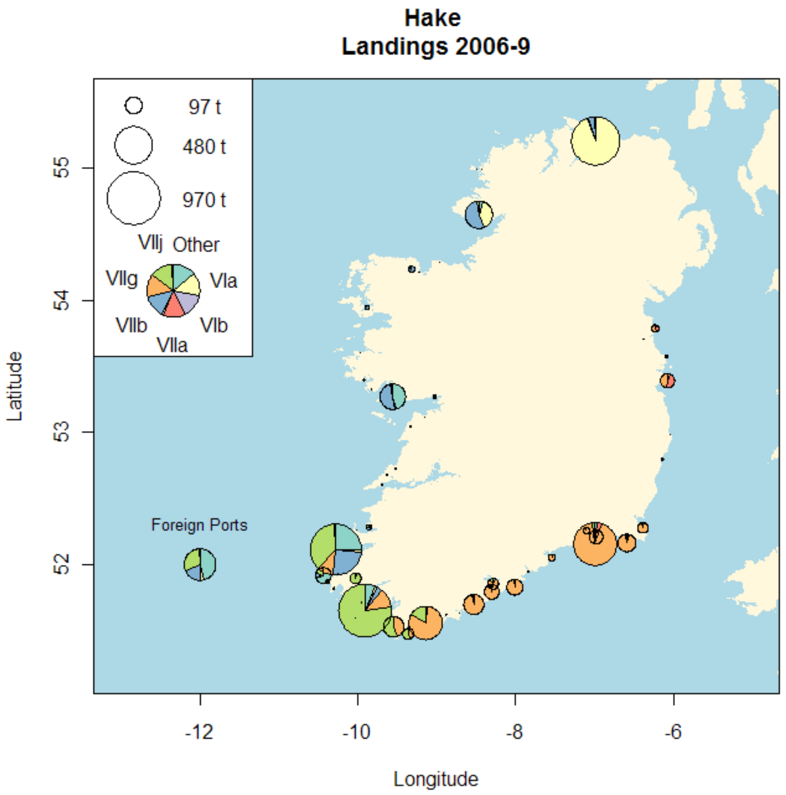
Ireland

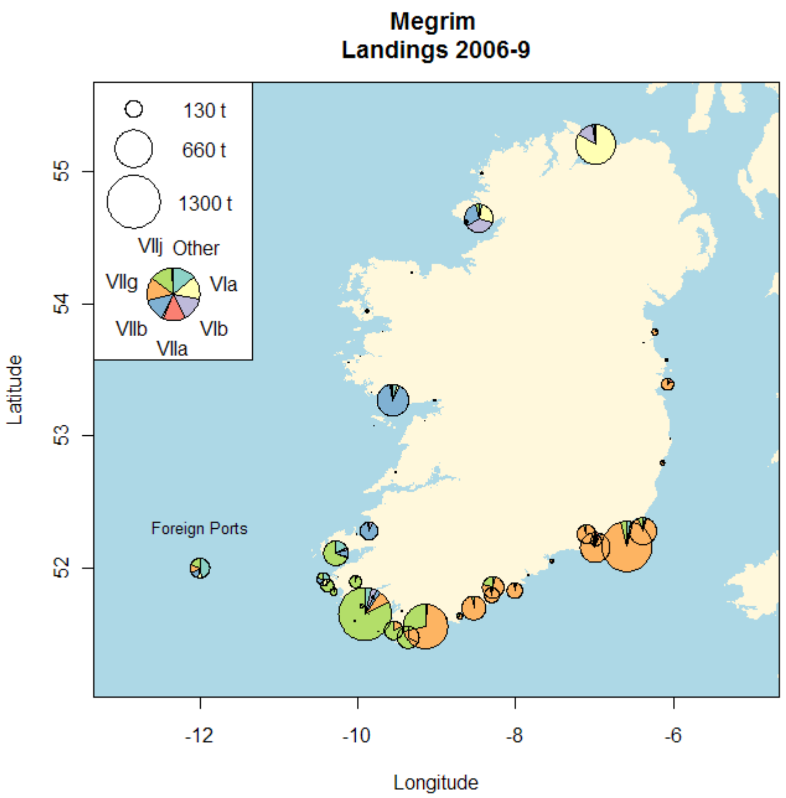

Irish landings 2006–9
ang–78ab
ang–ivvi
cod–iris
cod–rock
cod–scow
cod 7e–k
had–7b–k
had–iris
had–rock
had–scow
hke–nrtn
meg–scrk
mgw–78
ple–7b–c
ple–7h–k
ple–celt
ple–echw
ple–iris
sol–7b–c
sol–7h–k
sol–celt
sol–echw
sol–iris
whg–7b–c
whg–7e–k
whg–iris
whg–rock
whg–scow
0.0
0.2
0.4
0.6
0.8
1.0
Proportion of landings
Dunmore east
Castletownbere
Greencastle
Killybegs
Union hall
Kilmore quay
Kinsale
Ros a mhil
Crosshaven
Dingle
Howth
Rosslare
Ballycotton
Baltimore
Schull
Cobh
Spanish port
Uk port
Clogherhead
Portmagee
Waterford
Duncannon/st.helens
Renard
Fenit
Other

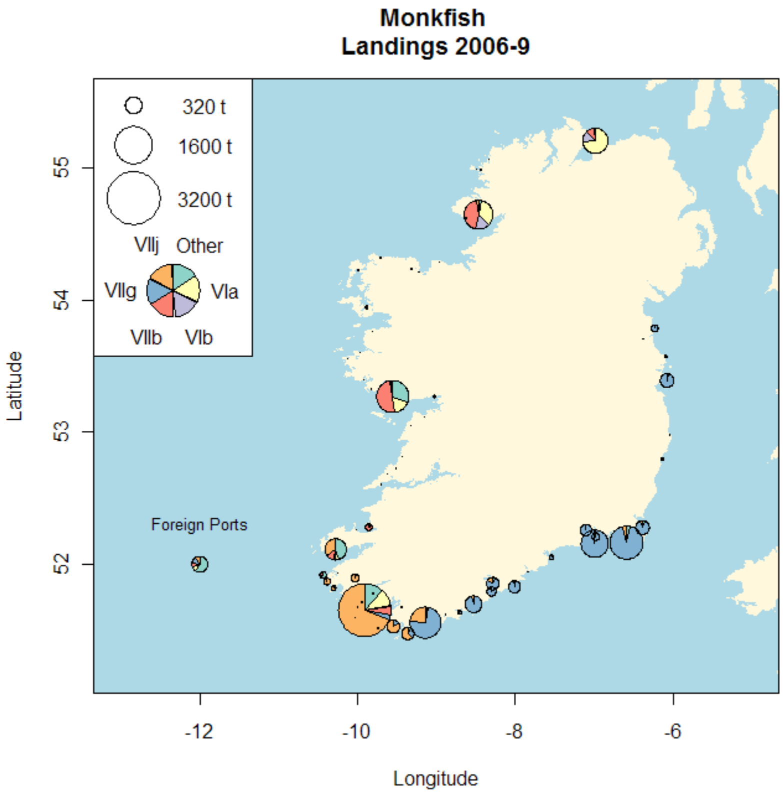

Cod
Landings 2006-9
220 t
1100 t
2200 t
VIIj
Other
VIIg
VIa
VIIa
VIb
Foreign Ports
Latitude
55
54
53
52
-12
-10
-8
-6
Longitude

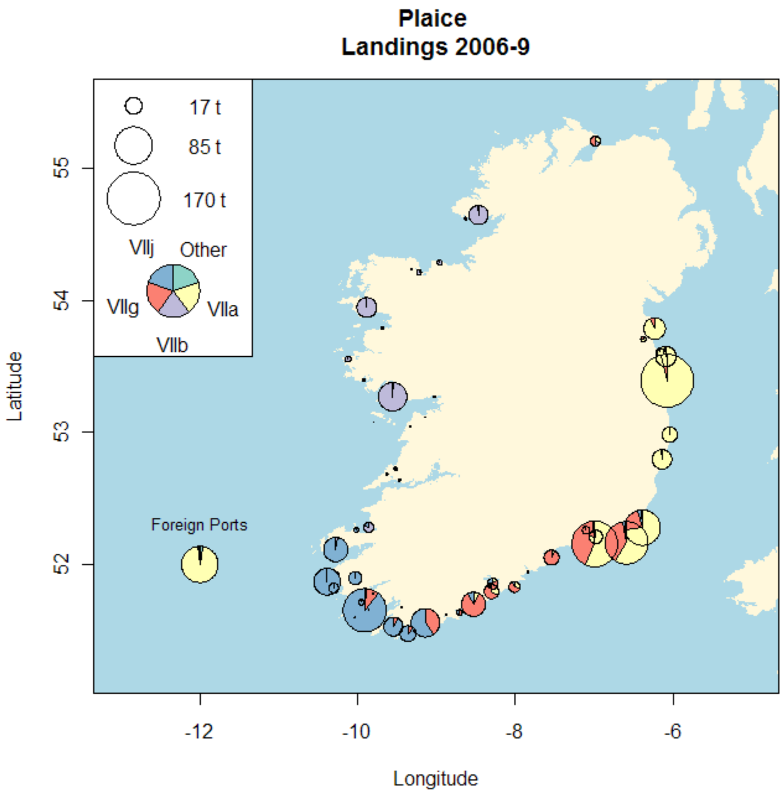

Haddock
Landings 2006-9
220 t
1100 t
2200 t
VIIj
Other
VIIg
VIa
VIIb
VIb
VIIa
Foreign Ports
Latitude
55
54
53
52
-12
-10
-8
-6
Longitude

Ireland

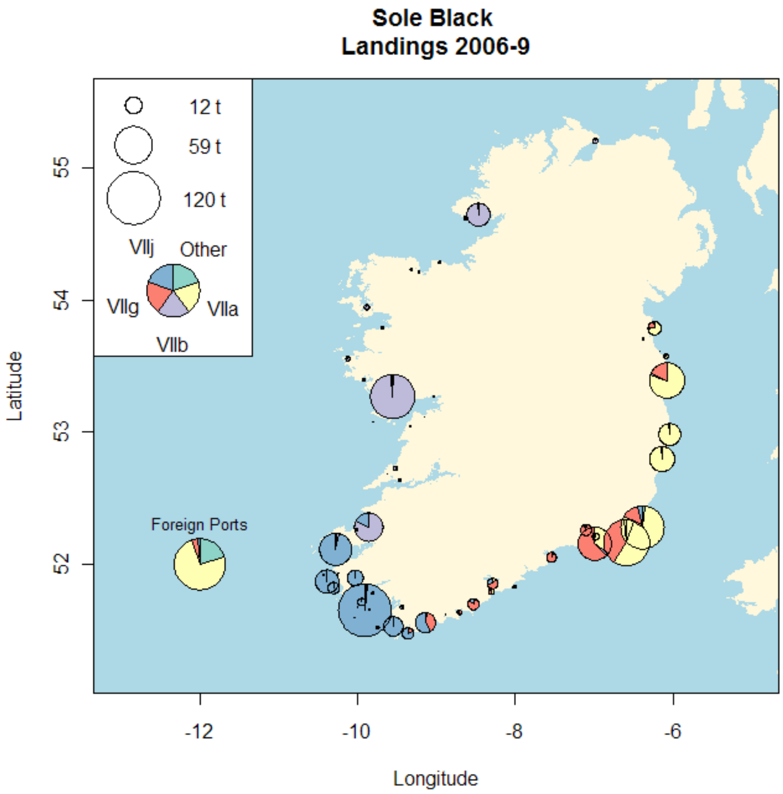

Hake
Landings 2006-9
97 t
480 t
970 t
VIIj Other
VIIg VIa
VIIb VIb
VIIa
Foreign Ports
Latitude
55
54
53
52
-12
-10
-8
-6
Longitude

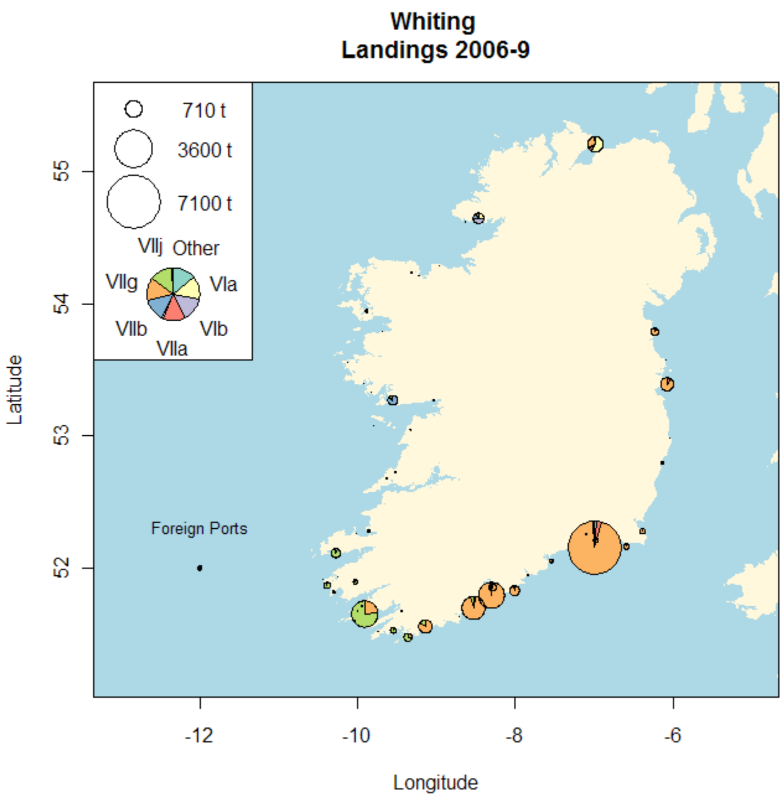

Megrim
Landings 2006-9
130 t
660 t
1300 t
VIIj Other
VIIg VIa
VIIb VIb
VIIa
Foreign Ports
Latitude
55
54
53
52
-12
-10
-8
-6
Longitude

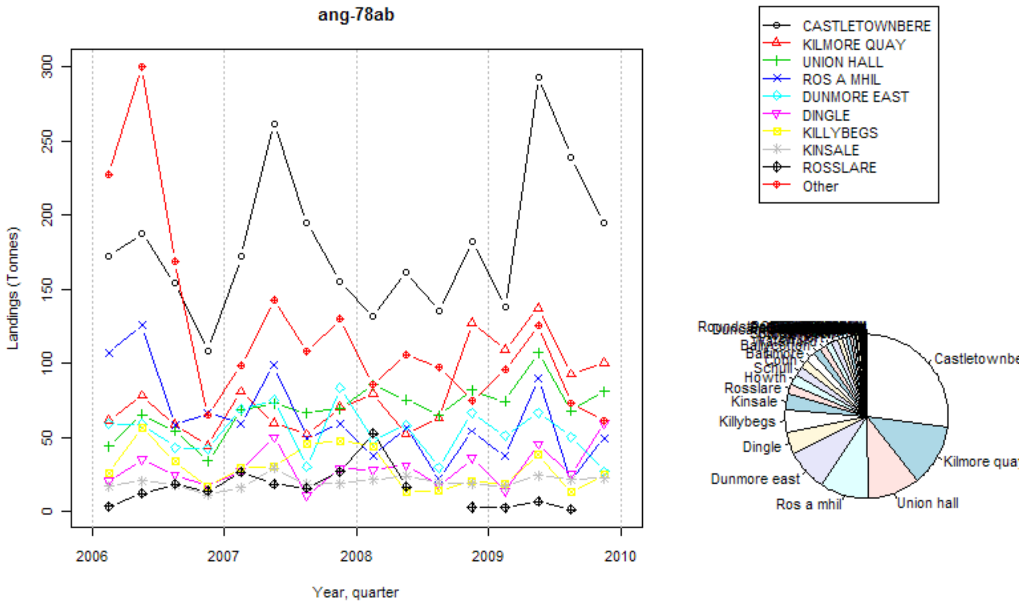

Monkfish
Landings 2006-9
320 t
1600 t
3200 t
VIIj
Other
VIIg
VIa
VIIb
VIb
Foreign Ports
Latitude
55
54
53
52
-12
-10
-8
-6
Longitude

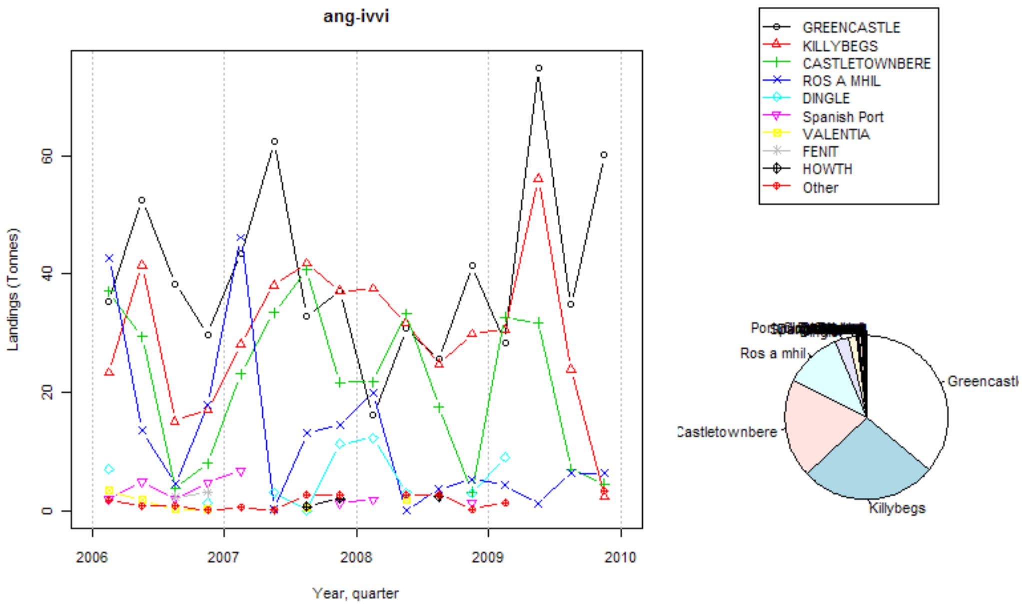

Plaice
Landings 2006-9
17 t
85 t
170 t
VIIj
Other
VIIg
VIIa
VIIb
Foreign Ports
Latitude
55
54
53
52
-12
-10
-8
-6
Longitude

Ireland

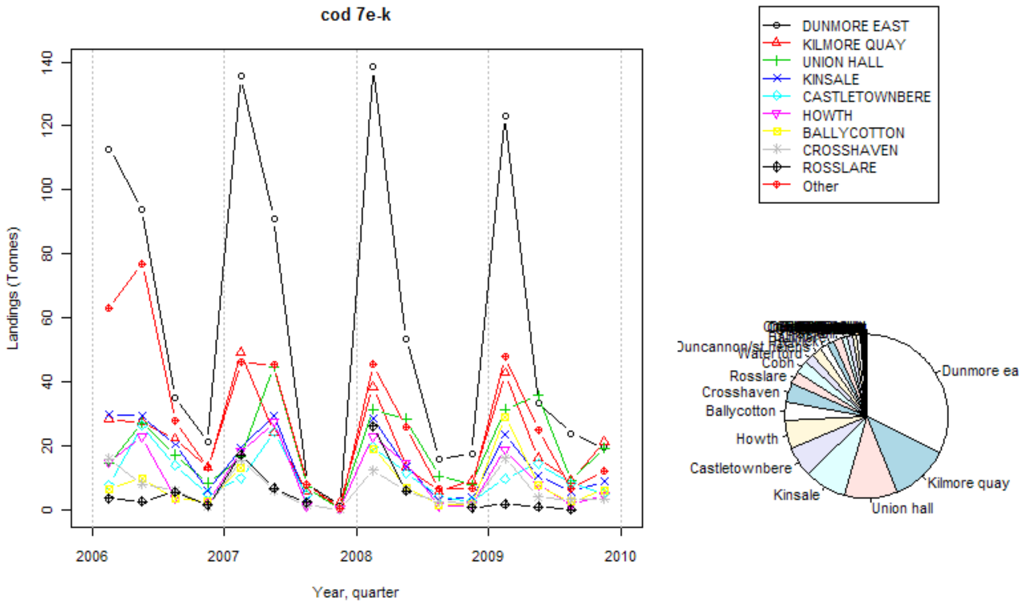

Sole Black
Landings 2006-9
12 t
59 t
120 t
VIIj
Other
VIIg
VIIa
VIIb
Foreign Ports
Latitude
55
54
53
52
-12
-10
-8
-6
Longitude

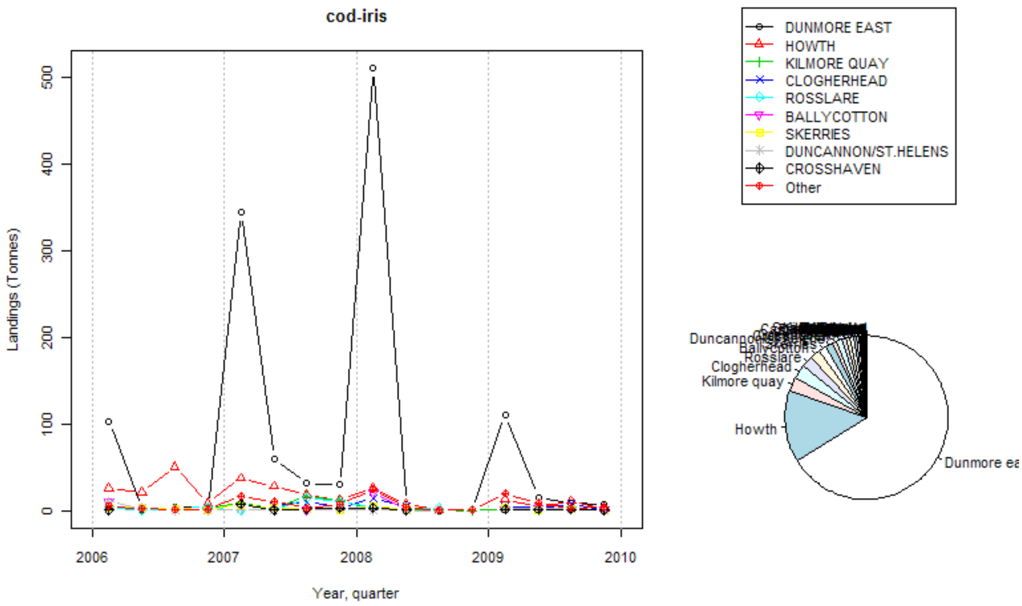

Whiting
Landings 2006-9
710 t
3600 t
7100 t
VIIj
Other
VIIg
VIa
VIIb
VIb
VIIa
Foreign Ports
Latitude
55
54
53
52
-12
-10
-8
-6
Longitude

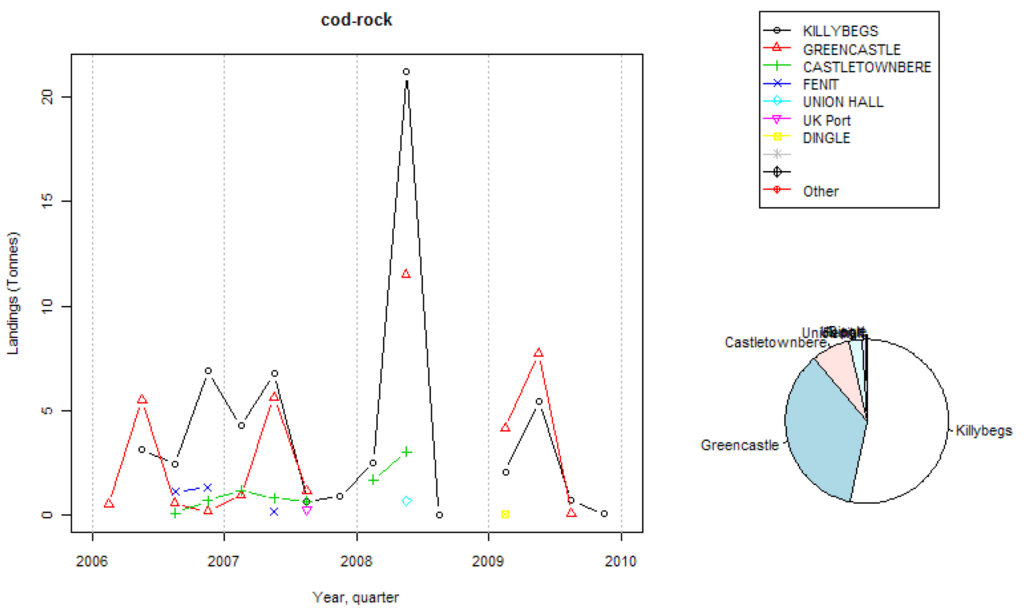

ang-78ab
Landings (Tonnes)
Year, quarter
2006
2007
2008
2009
2010
CASTLETOWNBERE
KILMORE QUAY
UNION HALL
ROS A MHIL
DUNMORE EAST
DINGLE
KILLYBEGS
KINSALE
ROSSLARE
Other
Castletownbe
Kilmore qua
Union hall
Ros a mhil
Dunmore east
Dingle
Killybegs
Kinsale
Rosslare
Howth

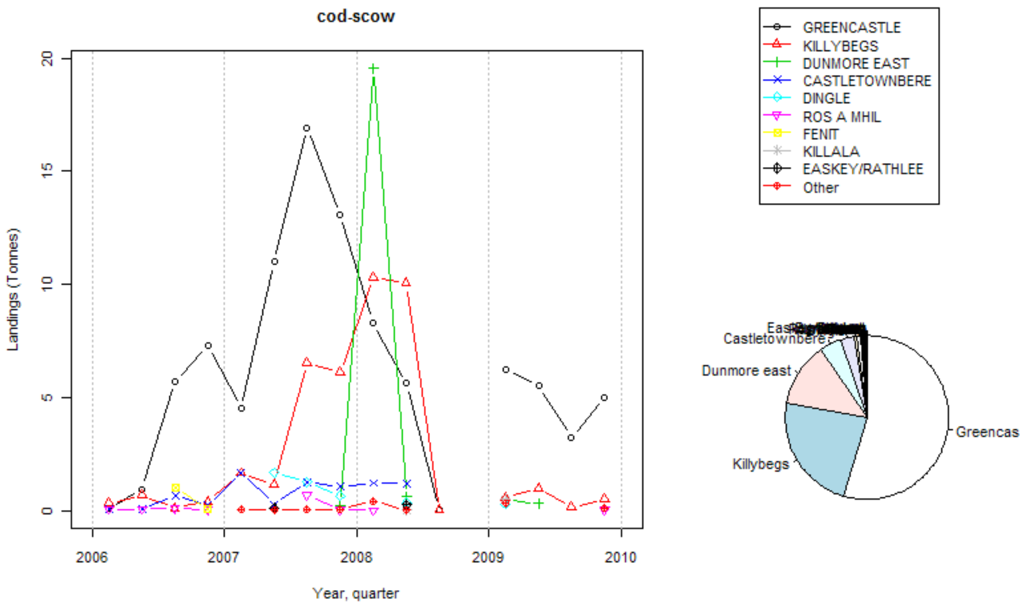

ang-ivvi
Landings (Tonnes)
Year, quarter
2006
2007
2008
2009
2010
GREENCASTLE
KILLYBEGS
CASTLETOWNBERE
ROS A MHIL
DINGLE
Spanish Port
VALENTIA
FENIT
HOWTH
Other
Greencastl
Killybegs
Castletownbere
Ros a mhil

Ireland

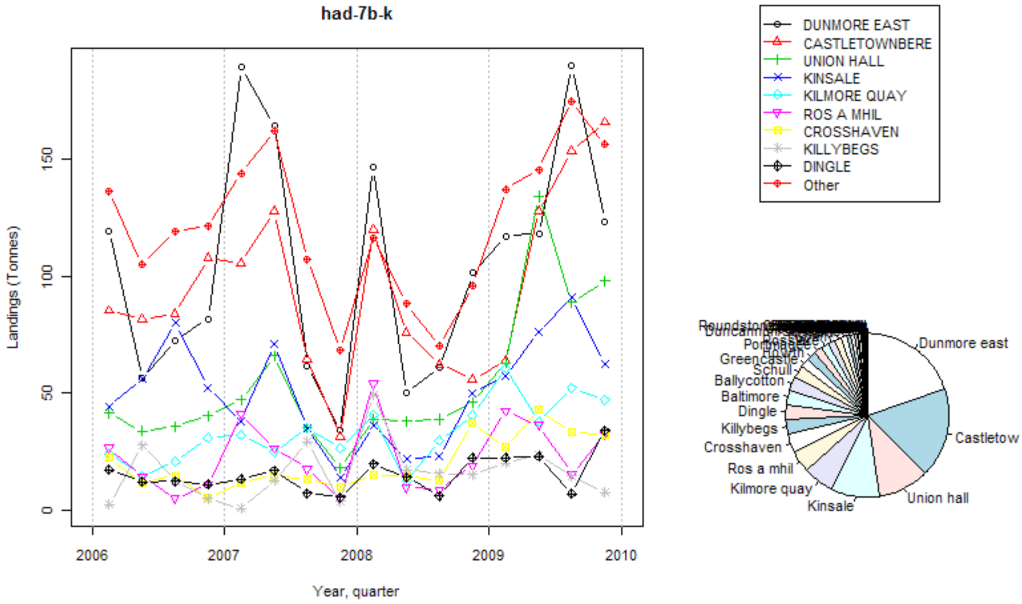

cod 7e-k
Landings (Tonnes)
0
20
40
60
80
100
120
140
2006
2007
2008
2009
2010
Year, quarter
DUNMORE EAST
KILMORE QUAY
UNION HALL
KINSALE
CASTLETOWNBERE
HOWTH
BALLYCOTTON
CROSSHAVEN
ROSSLARE
Other
Dunmore ea
Kilmore quay
Union hall
Kinsale
Castletownbere
Howth
Ballycotton
Crosshaven
Rosslare
Cobh
Waterford

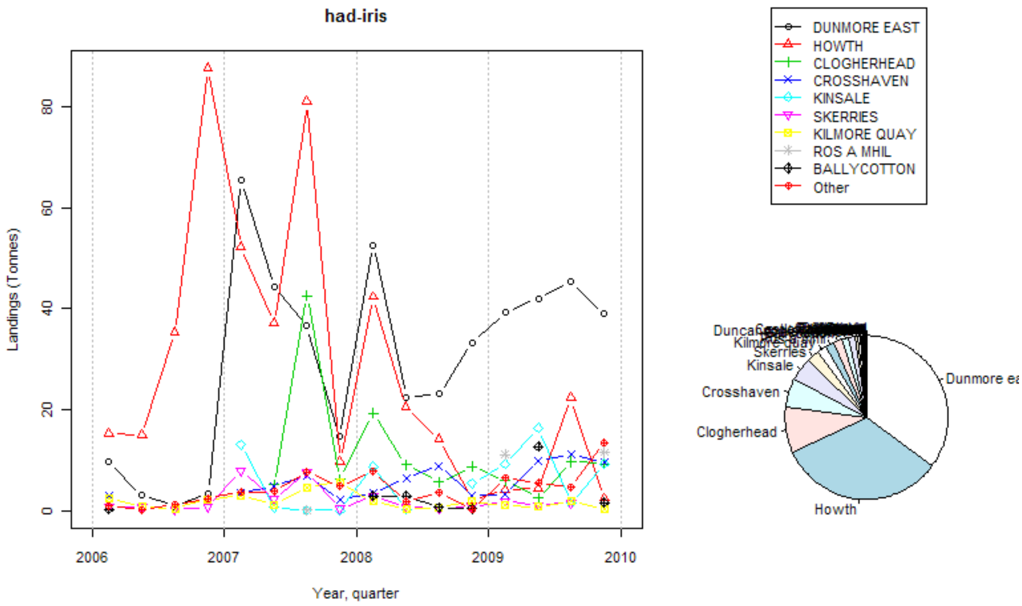

cod-iris
Landings (Tonnes)
0
100
200
300
400
500
2006
2007
2008
2009
2010
Year, quarter
DUNMORE EAST
HOWTH
KILMORE QUAY
CLOGHERHEAD
ROSSLARE
BALLYCOTTON
SKERRIES
DUNCANNON/ST.HELENS
CROSSHAVEN
Other
Dunmore ea
Howth
Kilmore quay
Clogherhead
Rosslare

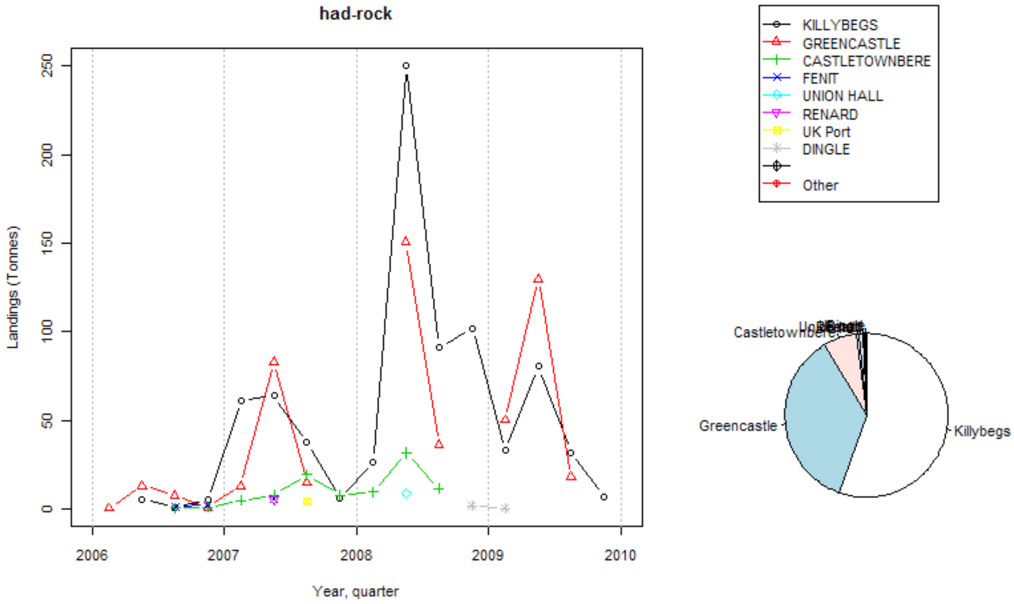

cod-rock
Landings (Tonnes)
0
5
10
15
20
2006
2007
2008
2009
2010
Year, quarter
KILLYBEGS
GREENCASTLE
CASTLETOWNBERE
FENIT
UNION HALL
UK Port
DINGLE
Other
Castletownbere
Greencastle
Killybegs

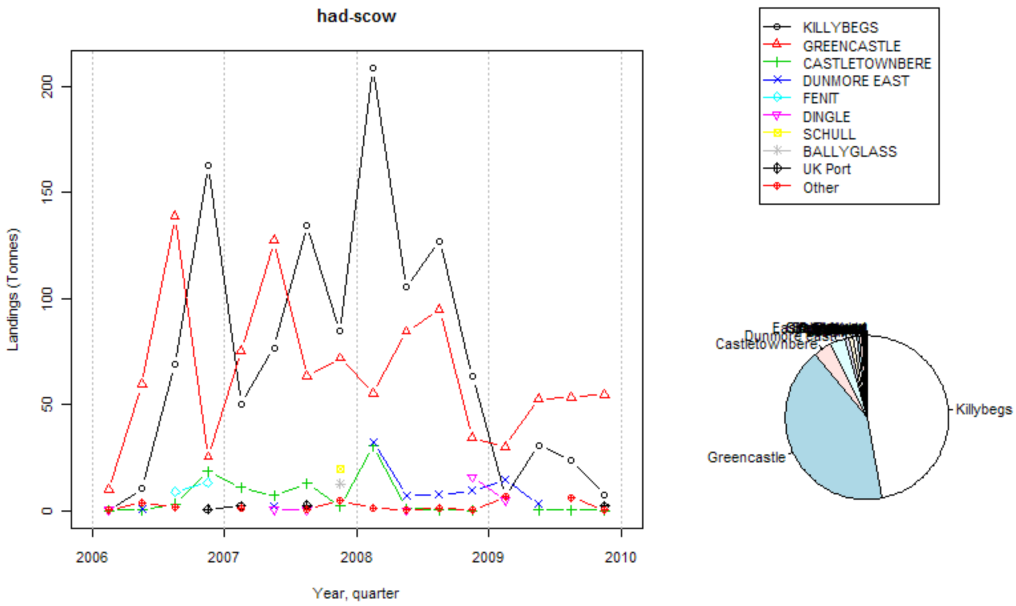

cod-scow
Landings (Tonnes)
0
5
10
15
20
2006
2007
2008
2009
2010
Year, quarter
GREENCASTLE
KILLYBEGS
DUNMORE EAST
CASTLETOWNBERE
DINGLE
ROS A MHIL
FENIT
KILLALA
EASKEY/RATHLEE
Other
Castletownbere
Dunmore east
Killybegs
Greencas

Ireland

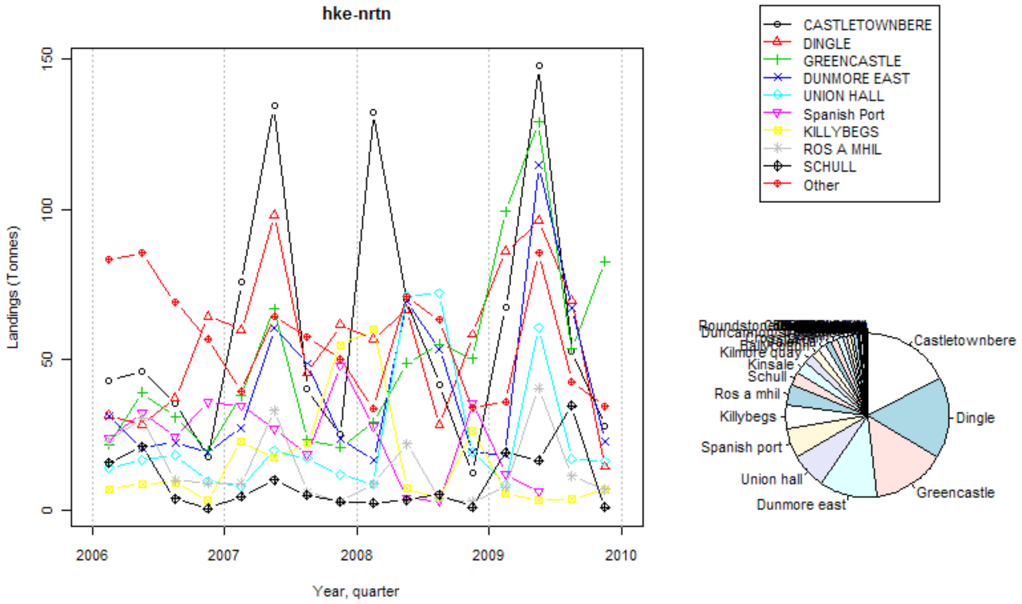

had-7b-k
Landings (Tonnes)
0
50
100
150
2006
2007
2008
2009
2010
Year, quarter
DUNMORE EAST
CASTLETOWNBERE
UNION HALL
KINSALE
KILMORE QUAY
ROS A MHIL
CROSSHAVEN
KILLYBEGS
DINGLE
Other
Dunmore east
Castletow
Union hall
Kinsale
Kilmore quay
Ros a mhil
Crosshaven
Killybegs
Dingle
Baltimore
Ballycotton
Schull
Greencastle

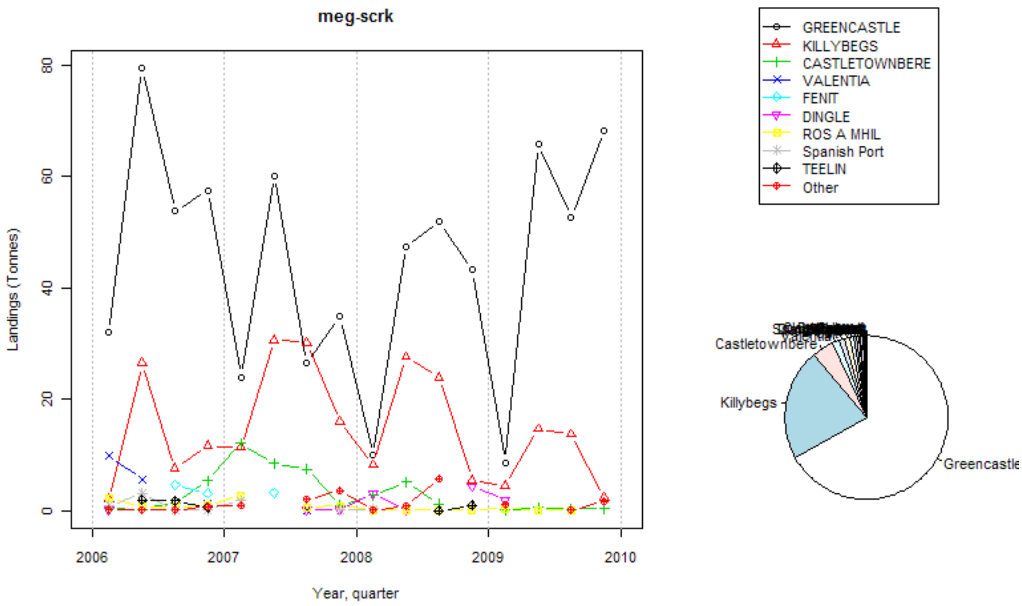

had-iris
Landings (Tonnes)
0
20
40
60
80
2006
2007
2008
2009
2010
Year, quarter
DUNMORE EAST
HOWTH
CLOGHERHEAD
CROSSHAVEN
KINSALE
SKERRIES
KILMORE QUAY
ROS A MHIL
BALLYCOTTON
Other
Dunmore ea
Howth
Clogherhead
Crosshaven
Kinsale
Skerries
Kilmore quay

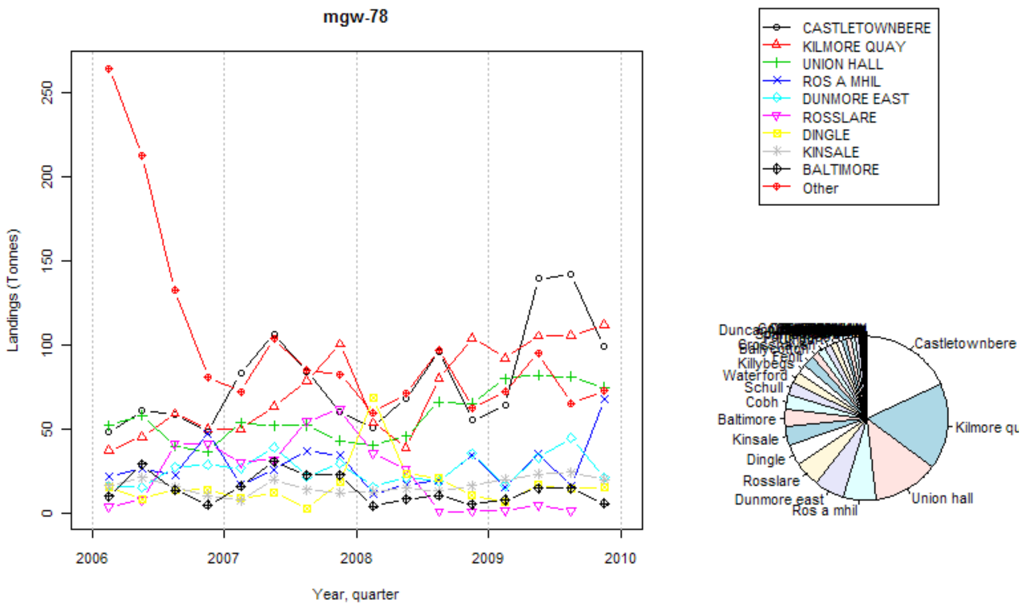

had-rock
Landings (Tonnes)
0
50
100
150
200
250
2006
2007
2008
2009
2010
Year, quarter
KILLYBEGS
GREENCASTLE
CASTLETOWNBERE
FENIT
UNION HALL
RENARD
UK Port
DINGLE
Other
Killybegs
Greencastle

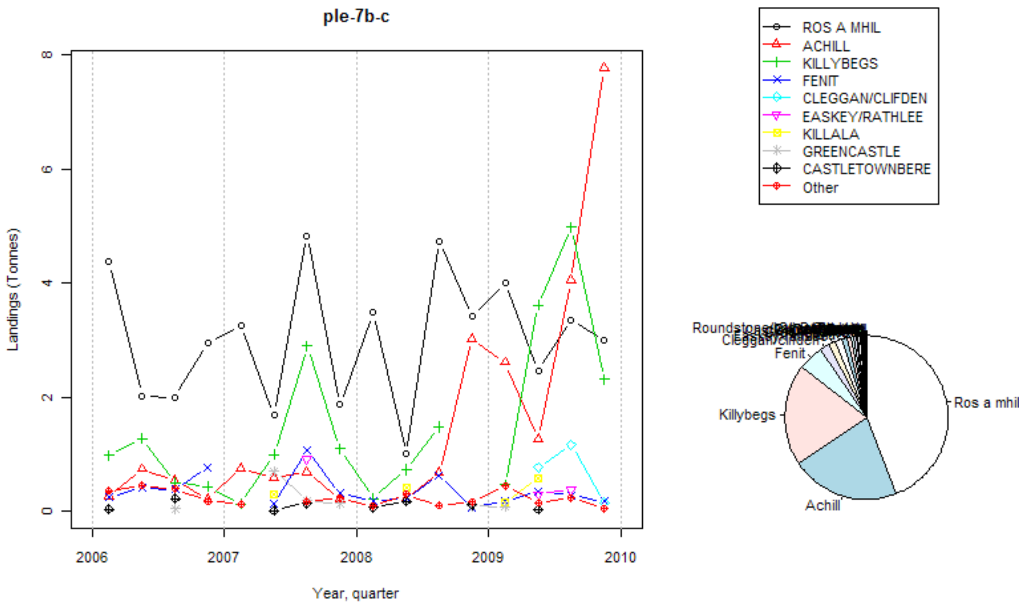

had-scow
Landings (Tonnes)
0
50
100
150
200
2006
2007
2008
2009
2010
Year, quarter
KILLYBEGS
GREENCASTLE
CASTLETOWNBERE
DUNMORE EAST
FENIT
DINGLE
SCHULL
BALLYGLASS
UK Port
Other
Killybegs
Greencastle

Ireland

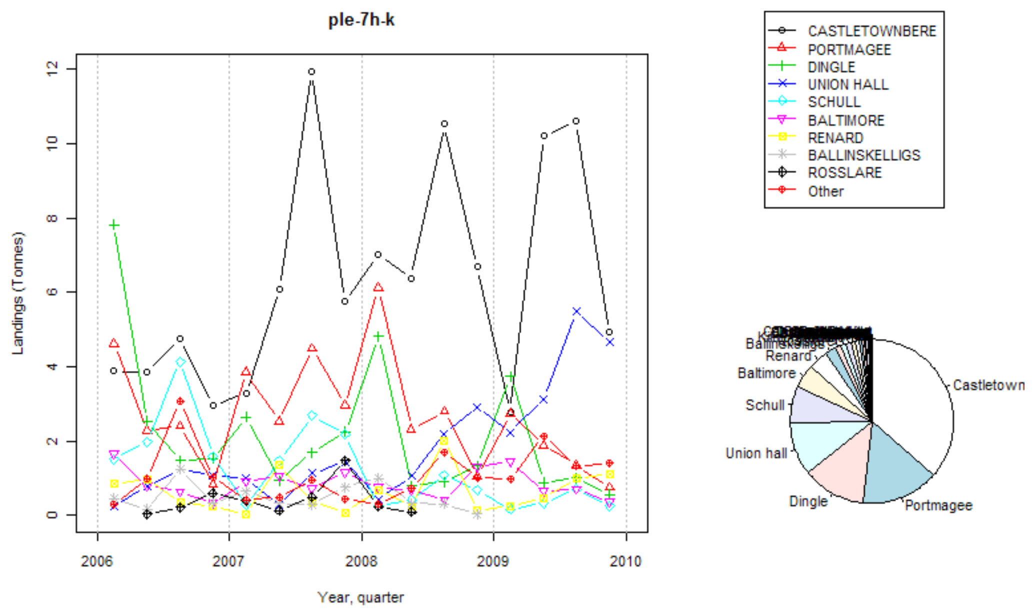

hke-nrtn
Landings (Tonnes)
0
50
100
150
2006
2007
2008
2009
2010
Year, quarter
CASTLETOWNBERE
DINGLE
GREENCASTLE
DUNMORE EAST
UNION HALL
Spanish Port
KILLYBEGS
ROS A MHIL
SCHULL
Other
Castletownbere
Dingle
Greencastle
Dunmore east
Union hall
Spanish port
Killybegs
Ros a mhil
Schull
Kinsale
Kilmore quay

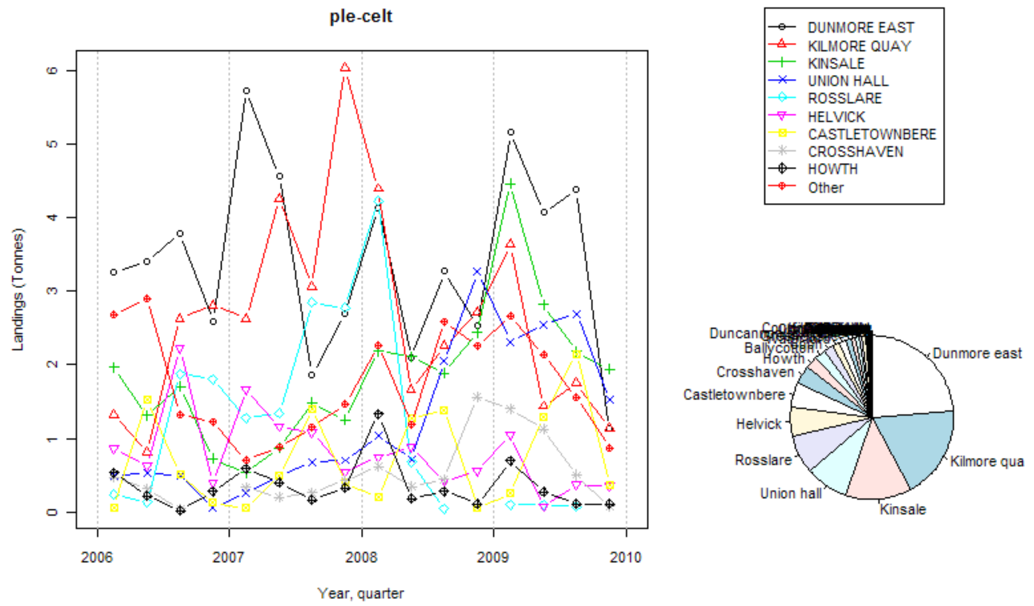

meg-scrk
Landings (Tonnes)
0
20
40
60
80
2006
2007
2008
2009
2010
Year, quarter
GREENCASTLE
KILLYBEGS
CASTLETOWNBERE
VALENTIA
FENIT
DINGLE
ROS A MHIL
Spanish Port
TEELIN
Other
Castletownbere
Killybegs
Greencastle

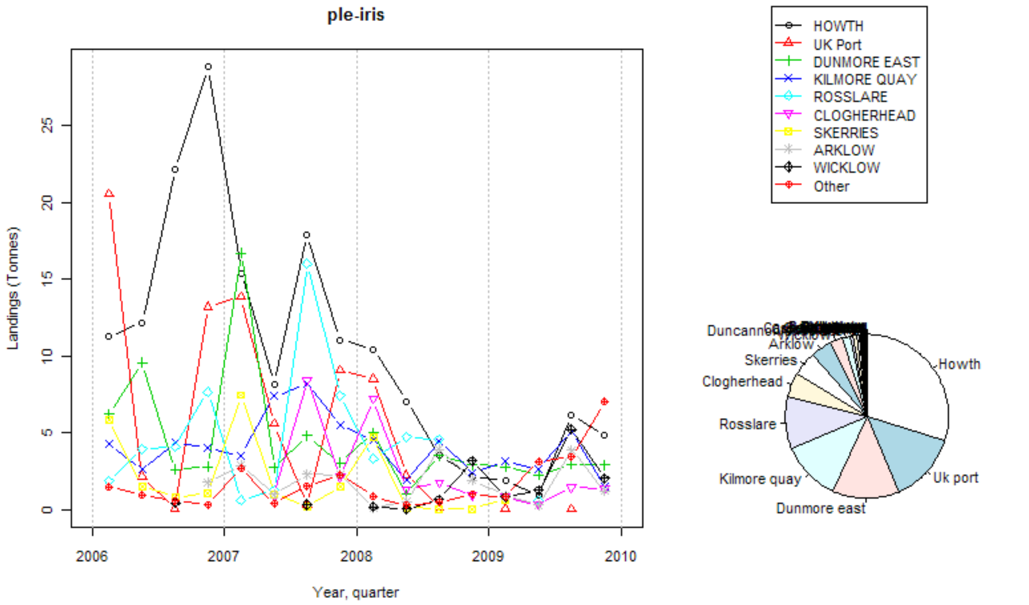

mgw-78
Landings (Tonnes)
0
50
100
150
200
250
2006
2007
2008
2009
2010
Year, quarter
CASTLETOWNBERE
KILMORE QUAY
UNION HALL
ROS A MHIL
DUNMORE EAST
ROSSLARE
DINGLE
KINSALE
BALTIMORE
Other
Castletownbere
Union hall
Ros a mhil
Dunmore east
Rosslare
Dingle
Kinsale
Baltimore
Cobh
Schull
Waterford
Killybegs
Fenit

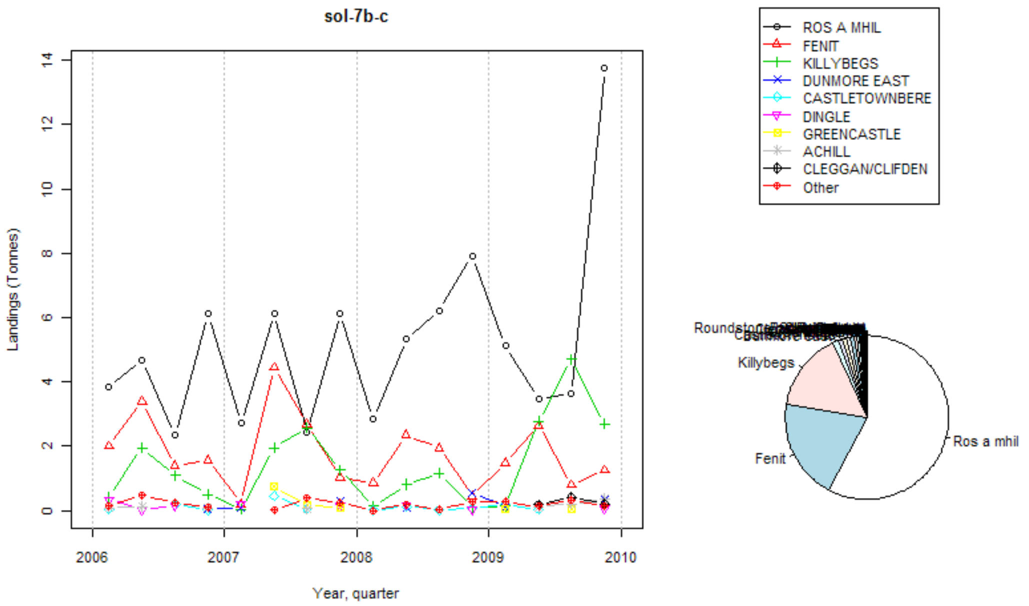

ple-7b-c
Landings (Tonnes)
0
2
4
6
8
2006
2007
2008
2009
2010
Year, quarter
ROS A MHIL
ACHILL
KILLYBEGS
FENIT
CLEGGAN/CLIFDEN
EASKEY/RATHLEE
KILLALA
GREENCASTLE
CASTLETOWNBERE
Other
Ros a mhil
Achill
Killybegs
Fenit

Ireland

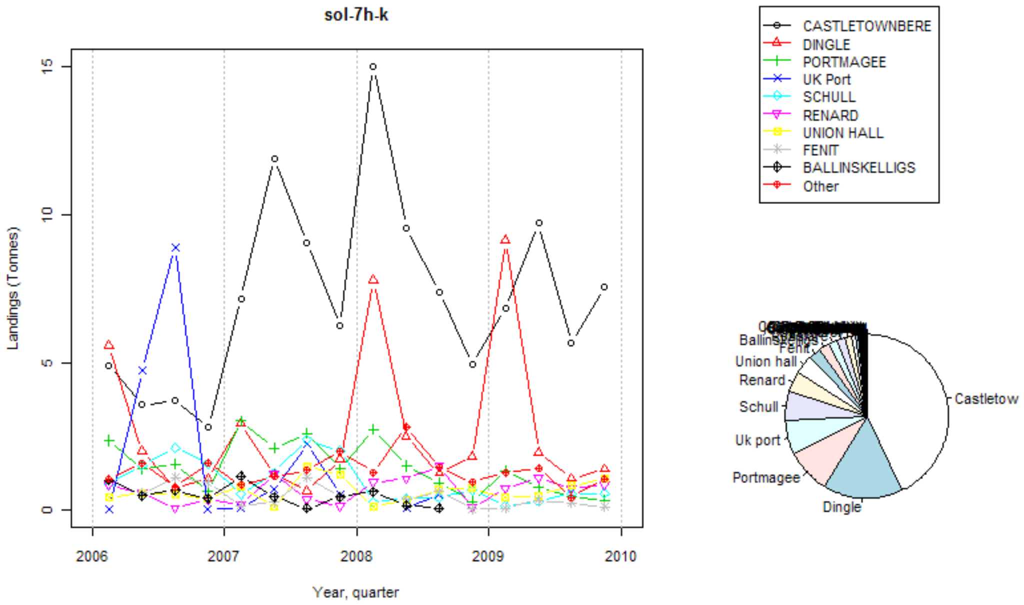

ple-7h-k
Landings (Tonnes)
0
2
4
6
8
10
12
2006
2007
2008
2009
2010
Year, quarter
CASTLETOWNBERE
PORTMAGEE
DINGLE
UNION HALL
SCHULL
BALTIMORE
RENARD
BALLINSKELLIGS
ROSSLARE
Other
Castletown
Portmagee
Dingle
Union hall
Schull
Baltimore
Renard

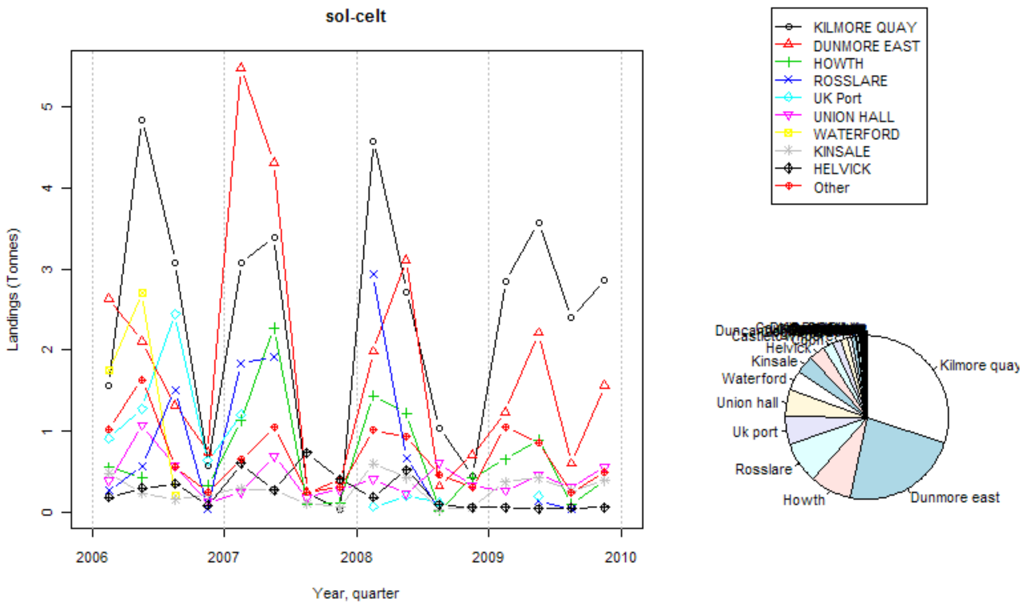

ple-celt
Landings (Tonnes)
0
1
2
3
4
5
6
2006
2007
2008
2009
2010
Year, quarter
DUNMORE EAST
KILMORE QUAY
KINSALE
UNION HALL
ROSSLARE
HELVICK
CASTLETOWNBERE
CROSSHAVEN
HOWTH
Other
Dunmore east
Kilmore qua
Kinsale
Union hall
Rosslare
Helvick
Castletownbere
Crosshaven
Howth

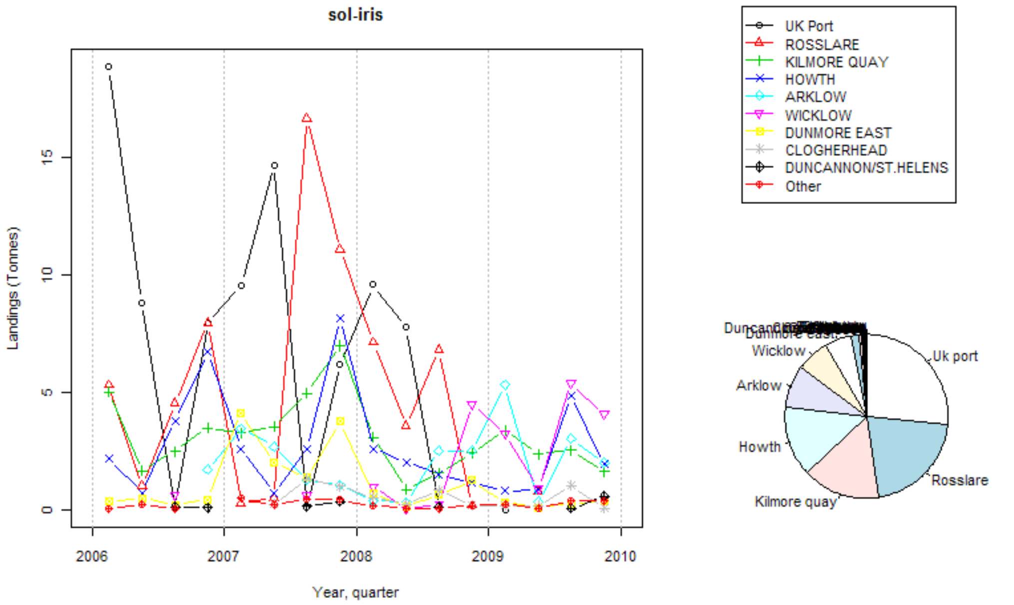

ple-iris
Landings (Tonnes)
0
5
10
15
20
25
2006
2007
2008
2009
2010
Year, quarter
HOWTH
UK Port
DUNMORE EAST
KILMORE QUAY
ROSSLARE
CLOGHERHEAD
SKERRIES
ARKLOW
WICKLOW
Other
Arklow
Skerries
Clogherhead
Rosslare
Kilmore quay
Dunmore east
Uk port
Howth

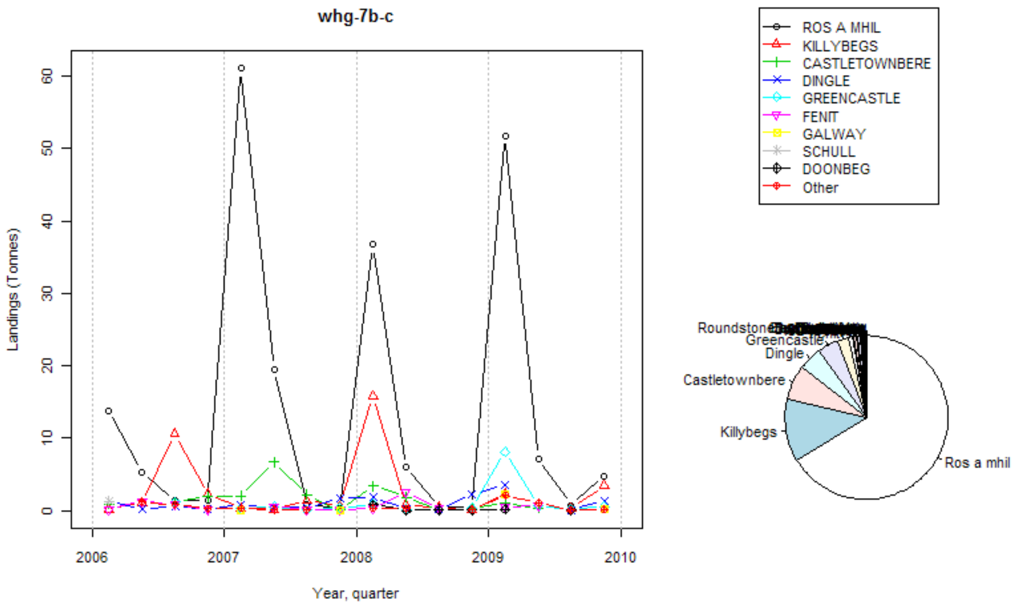

sol-7b-c
Landings (Tonnes)
0
2
4
6
8
10
12
14
2006
2007
2008
2009
2010
Year, quarter
ROS A MHIL
FENIT
KILLYBEGS
DUNMORE EAST
CASTLETOWNBERE
DINGLE
GREENCASTLE
ACHILL
CLEGGAN/CLIFDEN
Other
Killybegs
Fenit
Ros a mhil

Ireland

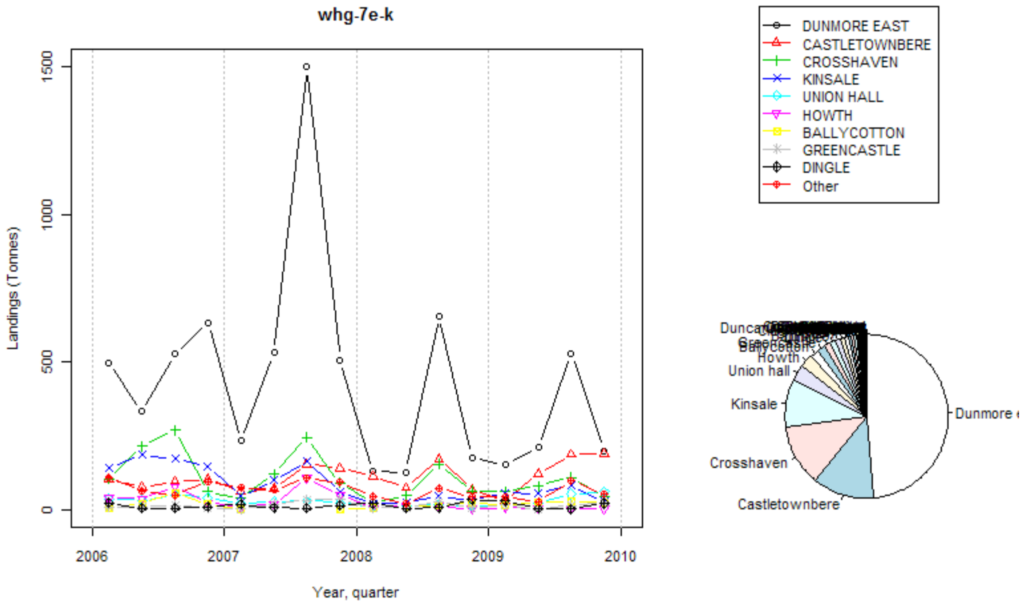

sol-7h-k
Landings (Tonnes)
Year, quarter
CASTLETOWNBERE
DINGLE
PORTMAGEE
UK Port
SCHULL
RENARD
UNION HALL
FENIT
BALLINSKELLIGS
Other
Castletow
Dingle
Portmagee
Uk port
Schull
Renard
Union hall
Fenit

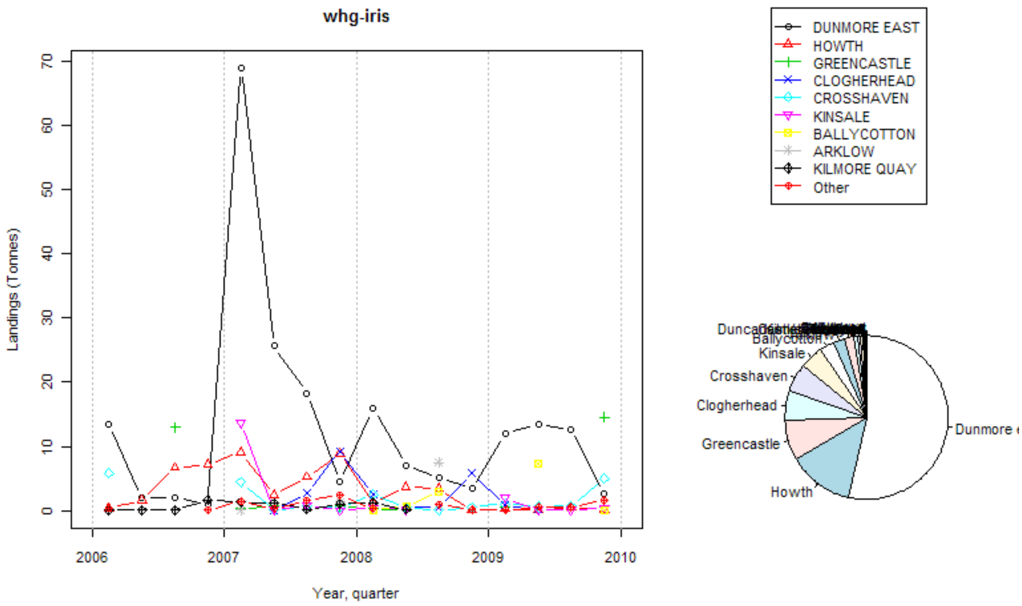

sol-celt
Landings (Tonnes)
Year, quarter
KILMORE QUAY
DUNMORE EAST
HOWTH
ROSSLARE
UK Port
UNION HALL
WATERFORD
KINSALE
HELVICK
Other
Kilmore quay
Dunmore east
Howth
Rosslare
Uk port
Union hall
Waterford
Kinsale
Helvick

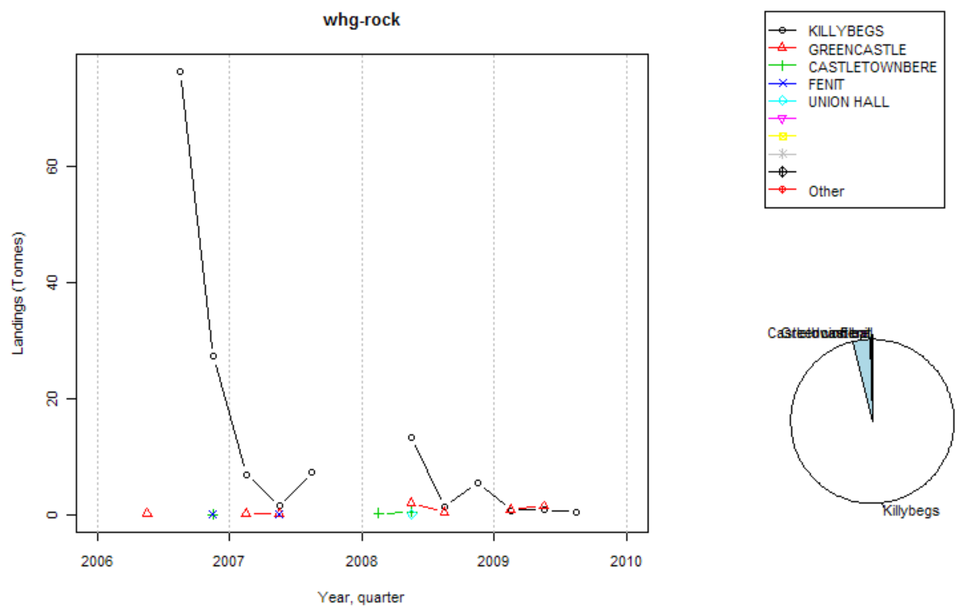

sol-iris
Landings (Tonnes)
0
5
10
15
2006
2007
2008
2009
2010
Year, quarter
UK Port
ROSSLARE
KILMORE QUAY
HOWTH
ARKLOW
WICKLOW
DUNMORE EAST
CLOGHERHEAD
DUNCANNON/ST.HELENS
Other
Wicklow
Arklow
Howth
Kilmore quay
Uk port
Rosslare

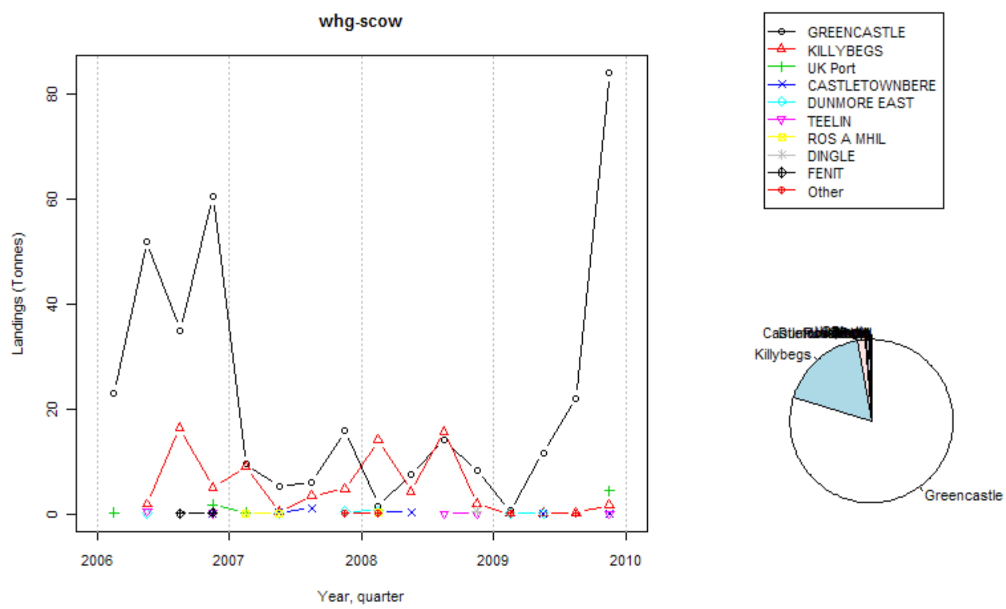

whg-7b-c
Landings (Tonnes)
0
10
20
30
40
50
60
2006
2007
2008
2009
2010
Year, quarter
ROS A MHIL
KILLYBEGS
CASTLETOWNBERE
DINGLE
GREENCASTLE
FENIT
GALWAY
SCHULL
DOONBEG
Other
Greencastle
Dingle
Castletownbere
Killybegs
Ros a mhil

Ireland


whg-7e-k
Landings (Tonnes)
0
500
1000
1500
2006
2007
2008
2009
2010
Year, quarter
DUNMORE EAST
CASTLETOWNBERE
CROSSHAVEN
KINSALE
UNION HALL
HOWTH
BALLYCOTTON
GREENCASTLE
DINGLE
Other
Howth
Union hall
Kinsale
Crosshaven
Castletownbere
Dunmore


whg-iris
Landings (Tonnes)
0
10
20
30
40
50
60
70
2006
2007
2008
2009
2010
Year, quarter
DUNMORE EAST
HOWTH
GREENCASTLE
CLOGHERHEAD
CROSSHAVEN
KINSALE
BALLYCOTTON
ARKLOW
KILMORE QUAY
Other
Ballycotton
Kinsale
Crosshaven
Clogherhead
Greencastle
Howth
Dunmore


whg-rock
Landings (Tonnes)
0
20
40
60
2006
2007
2008
2009
2010
Year, quarter
KILLYBEGS
GREENCASTLE
CASTLETOWNBERE
FENIT
UNION HALL
Other
Killybegs


whg-scow
Landings (Tonnes)
0
20
40
60
80
2006
2007
2008
2009
2010
Year, quarter
GREENCASTLE
KILLYBEGS
UK Port
CASTLETOWNBERE
DUNMORE EAST
TEELIN
ROS A MHIL
DINGLE
FENIT
Other
Killybegs
Greencastle

Ireland

Member state:

Lithuania

Target population

Best practice

The target population needs to be identified and described. Access to the target population for sampling purposes need to be analysed and documented.

Comment

-

Bad practice

-

Member state sampling design

1) The target population for DCF is all fish and shellfish species for which estimates of landed quantities are required by Commission Decision 2010/93/EU, taking account of any derogation granted.

2) On-shore access to the landed catch is through one landing site of 24- 40 m. vessel sizes and random selection from smaller vessels is made for direct sampling on shore according to the procedures described below

Primary sampling units (PSUs)

Best practice

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

Comment

If PSU is something else than trip, vessel or site the choice need to be thoroughly explained.

Bad practice

-

Member state sampling design

The PSU is a landing site on a specific day (usually whole fleet of 24-40 m segment operates together and lands fish within 1-2 days period in same place).

The size of the PSU is related to the total landings per quarter, and this is a basis for stratifying the PSUs by vessel type and gear type.

Sampling frame

Best practice

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.

Comment

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.

Bad practice

To exclude large parts of the target population in an ad-hoc way.

Member state sampling design

The sampling frame is a matrix of vessels type vs year quarter. Five sampling frames are defined:

ix) Vessels with demersal landings.
x) Vessels with pelagic landings.

The following sampling sites are excluded:

vi) Lithuanian flag vessels do not land in Lithuanian port
vii) Small landing sites where the landings are sold, but which are remotely located and very difficult to access. These collectively account for 1% of the total landings.

Stratification of the sampling frame

Best practice

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.

Comment

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.

Bad practice

Lithuania

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.

Member state sampling design

1) The following strata are defined for each sampling frame:

- *xii) Vessels over 24 m. using active gear*
- *xiii) Vessels over 24 m. using passive gear*
- *xiv) Vessels under 12 m. using passive gear (coastal zone)*
- *xv) 4 quarters of the year*

Quarterly strata are defined to allow the possibility of varying the sampling intensity according to seasonal fishing activity.

2) The overall sampling effort for all sampling frames and strata is largely constrained by the financial and staff resources made available by the government for this work. Also fleet behaviour also has impact on sampling availability (if vessels are operating and landing catches in other areas or ports). Currently around 90 staff days are available for sampling on shore. An attempt is made to ensure each stratum has a maximum of 30 port-sampling day-trips.

Distribution of sampling effort

Best practice

The way sampling effort is distributed between strata needs to be described. In accordance with best practice, this can be based on analysis of variance or just distributed proportionally.

The different sampling inclusion probabilities/weighting needs to be documented.

Comment

If other methods, such as expert judgment are used, this should be explained and justified.

Bad practice

-

Member state sampling design

1) *Sampling effort (number of trips to be sampled by stratum) is allocated according to information on fishing effort and catches in the previous year and following fleet operation in real time. Efforts for sampling are distributed proportionally between different types of landings.*
2) *The main aim of sampling on shore is to get data on length distribution of landings and collect representative samples for age distribution for all species per strata.*

Sample selection procedure

Best practice

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 principle this means 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

Comment

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

Bad practice

Ad-hoc based sampling, without proper documentation to allow estimation of bias, where the sampling inclusion probabilities cannot be estimated.

Member state sampling design

Sampling targets for each stratum are defined, based on recent landings. The sampler will check if landings are expected in a certain port before travelling. All samples are taken in the fishery port. Other landing sites (coastal area) are visited after prior communication with fishermen.

Hierarchical structure in the sampling

Best practice

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)

Comment

-

Bad practice

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)

Lithuania

Member state sampling design

The hierarchy for sampling is as follows:

23) *Primary sampling unit sampling day*
24) *Primary sampling unit: gear type.*
25) *Secondary unit: a vessel size.*
26) *Tertiary unit: boxes of fish (if the catch is segregated into commercial size categories), or commercial size categories*
27) *Fourth level: Individual fish (if no commercial size categories), or boxes (if there are size categories)*
28) *Fifth level: individual fish (if there are size categories)*

Protocol for selection of samples at lower sampling levels (SSU, etc.)

Best practice

Such protocols should exist in a national repository

Comment

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Bad practice

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Member state sampling design

xiii) *The presentation of the catches varies between gear types, vessel sizes and between fishing area. A Standard Operating Procedure exists to give sampling staff guidance on how to sample landings as representatively as possible for length and age composition or other biological material. Basics of sampling methodology are described in our nation technical reports.*

xiv) *The strategy for selecting individual landings of demersal or pelagic species to sample on a given day is guided by stock-based and concurrent sampling targets. The desired number of trips to sample varies between species so more landings on a day may be sampled for one species compared to another. Concurrent sampling, where all species in a landing are measured, is carried out according to targets (2-3 landings per visit).*

xv) *Currently, otoliths are collected in a length-stratified design. For a species, samplers do attempt to sample across the full length range available and aim to collect otoliths per 1 cm length class from each landing of demersal species, and per 0,5 cm from pelagic species.*

System to monitor performance of sampling schemes -

Quality Indicators

Best practice

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.

Comment

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Bad practice

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Member state sampling design

The following systems are in place to monitor sampling performance and data quality:

30. *Sampling achievements are summarised and monitored on an ongoing basis on a sample tracking system, and through regular contacts with sampling staff, so that issues can be identified and resolved as early as possible.*
31. *Non-response rates are not recorded, (for example if staff are refused access to landings for sample).*
32. *Monitoring spreadsheets are updated on return and these are used to provide a unique id for each trip and to track achievements. On return the sampler ensures all the paperwork is in good order and the data are entered onto the sampling database, which includes a range of error traps.*
33. *Data and data integrity is checked by data manager. Any errors are investigated, corrected and recorded. Further checks are performed during the data extraction and raising procedure. Any errors are investigated, corrected and recorded.*
34. *Numbers of PSUs (days sampled) is documented as a proxy for effective sample size. Quarterly reports of the sampling activity against fishing activity provide an indication of how representative the sampling is.*

Documentation of raising/weighting procedure for national estimates

Best practice

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.

Comment

Lithuania

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Bad practice

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Member state sampling design

1) Fleet-raised length compositions are derived for all species, and where required, are included in the process of estimating age compositions based on sub-sampling for age. The raising procedure to calculate total length compositions for a fleet (metier or any other aggregation of trips) - which are post-strata - follows the hierarchy of sampling design, according to the sampling fraction at each stage. The general procedure is as follows:

21) *The national fleet activity database, which holds logbook or other sales data on individual landings, is accessed to locate the data for each vessel trip sampled. This may require searching surrounding dates and cross-matching other trip information (gear; mesh; species composition) collected by the sampler. The gear, mesh, area etc. are attached to the sample data in the data base.*
22) *The length composition recorded from individual boxes sampled is raised to the total observed trip landing of the vessel using the documented raising factors (e.g. ratio of total number of boxes to number of sampled boxes). The weight of the raised length frequency is calculated using length-weight parameters and can be compared with the reported landing weight to look for discrepancies that should be investigated.*
23) *The raised length frequencies and landings weights are summed over all vessels of the target fleet sampled on that visit. The summed length compositions are then raised to the reported landed weight of all vessels of the fleet at that port on that sampling day. This represents the total raised length composition for the sampled PSU.*
24) *The raised length frequencies for all sampled PSUs in the stratum are summed, and then raised to the reported landed weight for the species for all landings of the fleet in the stratum.*
25) *Stratum raised length frequencies are then summed across strata to give the total length frequency for the fleet.*
26) *This is repeated for all other post-strata (e.g. fleets or metiers)".*

2) The procedure for calculating age compositions from aged sub samples of fish is currently based on a conventional age-length key approach. The quarterly sample numbers at age in each length class are combined over all other strata to construct an age-length key for each quarter which is then applied to the fleet-raised length compositions for the quarter. The form of aggregation of samples over sampled trips to construct the ALKs can vary from species to species

3) Missing data may occur at several stages:

- **v)** *Species landings were reported at a sampled PSU, but no trips containing the species were sampled. In this case, the PSU is ignored, and the stratum-raised length frequency is derived from PSUs with data for that species.*
- **vi)** *Species landings were reported in a stratum, but no PSUs were sampled for that species in the stratum. In this case, the landings for the sampled strata are raised to the total reported landings for all strata, including the non-sampled ones."*

Lithuania

Member state:

Netherlands

Target population

Best practice

The target population needs to be identified and described. Access to the target population for sampling purposes need to be analysed and documented.

Comment

-

Bad practice

-

Member state sampling design

1) The target population for DCF is all fish and shellfish species for which estimates of landed quantities are required by Commission Decision 2010/93/EU, taking account of any derogations granted in accordance with the National programme.

2) On-shore access to the landed catch is through a list frame of landing sites from which a selection is made based on their relative contribution of the landings for the species of interest

Primary sampling units (PSUs)

Best practice

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

Comment

If PSU is something else than trip, vessel or site the choice need to be thoroughly explained.

Bad practice

-

Member state sampling design

The PSU for demersal fisheries is landing event. However, during sampling the specific landings of a species are only sampled. Thus, we go out to take a defined number of samples of defined species, e.g. plaice Go to the auction and select a vessel landing plaice, willing to *let us sample. The intensity of the auction visits to a certain auction depend on their relative contribution to the total landings in earlier years.*

The PSU for pelagic fisheries is trip as fish from this fisheries is not auctioned. During a trip, trained crew members sample target species in each ICES subarea in each week. They collect a fixed amount of samples covering the entire length range of the catch of a certain species.

Sampling frame

Best practice

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.

Comment

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.

Bad practice

To exclude large parts of the target population in an ad-hoc way.

Member state sampling design

The sampling frame is a matrix of ports vs days of the year. Two sampling frames are defined:

- *xi) Ports where demersal fisheries land their catches and the fish are available for sampling. (1 port in the south is excluded for practical reasons. The total landings are relevant, but believed to be in line with similar ports in the region.)*
- *xii) A selection of pelagic vessels for on-board sampling. The samples are collected when vessels call port.*

Stratification of the sampling frame

Best practice

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.

Comment

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.

Bad practice

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.

Member state sampling design

1) The following strata are defined for each sampling frame:

xvi) Port (demersal) or vessel (pelagic)
xvii) 4 quarters of the year

For demersal fisheries, for each species a target number of samples (sample size depending on species) to be obtained throughout the year is specified based on a quarterly distribution by auction.

For pelagic fisheries, for each species a target number of samples to be obtained throughout the year by area is specified based on the expectation where the fleet might go. In practice, as sampling is done on board, the sampling follows the fleet and its fishery and targets may not always be met if the reference fleet does not fish in the area.

Distribution of sampling effort

Best practice

The way sampling effort is distributed between strata needs to be described. In accordance with best practice, this can be based on analysis of variance or just distributed proportionally.

The different sampling inclusion probabilities/weighting needs to be documented.

Comment

If other methods, such as expert judgment are used, this should be explained and justified.

Bad practice

-

Member state sampling design

Sampling effort (number samples by species by auction) is allocated according to information on landings in the previous year rather than using information on precision of estimates to conduct a statistical optimisation.

Sample selection procedure

Best practice

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 principle this means 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

Comment

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

Bad practice

Ad-hoc based sampling, without proper documentation to allow estimation of bias, where the sampling inclusion probabilities cannot be estimated.

Member state sampling design

The selection of auctions to sample is done a priori based on landings distribution of the previous years on s species by species basis. Sampling takes place on Monday and Friday, as these are auction days. At the auction, vessels are selected based on sampling opportunities (very limited time window between sorting and selling) for a certain species.

Hierarchical structure in the sampling

Best practice

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)

Comment

-

Bad practice

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)

Member state sampling design

The hierarchy for sampling for demersal fisheries:

29) Primary sampling unit: a given port on a given day.

30) *Secondary unit: a vessel landing having sample opportunity (categorised by target species for that market-visit (Rare species sampled opportunistically))*
31) *Tertiary unit: boxes (stratified by size categories if there are size categories)*
32) *Fourth level: individual fish*

The hierarchy for sampling for pelagic fisheries:

- *i) Primary sampling unit: A trip of a certain vessel*
- *ii) Secondary unit: area*
- *iii) Tertiary unit: week*
- *iv) Fourth level: species*
- *v) Fifth level: individual fish (no size categories)*

Protocol for selection of samples at lower sampling levels (SSU, etc.)

Best practice

Such protocols should exist in a national repository

Comment

-

Bad practice

-

Member state sampling design

For demersal fisheries:

Boxes are selected for each market category, if any

Individual (either for length measurements only or for aging as well) fish are selected randomly, up to the number of fish required for this species (by category if any)

For pelagic fisheries:

Boxes (appx 22kg) of frozen unsorted catches are brought ashore.

After defrosting a length distribution of the total box is obtained and forms the basis of a representative sample of 25 fish selected for age sampling.

System to monitor performance of sampling schemes - Quality Indicators

Best practice

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.

The Netherlands

Comment

-

Bad practice

-

Member state sampling design

The following systems are in place to monitor sampling performance and data quality:

35. *Sampling achievements are summarised and monitored on an ongoing basis in a spreadsheet held in a shared drive, and through regular contacts with sampling staff, so that issues can be identified and resolved as early as possible.*
36. *Once entered, the data and data integrity is checked by another member of staff - Any errors are investigated, corrected and recorded.*

Documentation of raising/weighting procedure for national estimates

Best practice

Data analysis methods should be fully documented, covering: (1) how the multistage 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.

Comment

-

Bad practice

-

Fleet-raised length and/or age compositions are derived for all species for which this is required. Otherwise raising is done by assessment area. The raising procedure to calculate total length or age compositions for a fleet (metier or any other aggregation of trips) in principle should follow the hierarchy of sampling design. The Netherlands is currently describing raising methods used in detail. These will be available early in 2015.

Annexes with detailed supporting information, names and location of sampling protocols.

Annex NL-2: Description of method for allocating sampling effort to strata

Example of allocation sampling effort for sole (length samples, age samples)

Bemonsteringsintensiteit 2014 (aantal monsters per jaar)						
Tong, Noordzee (IV)						
Type	Afslag	Kwartaal 1	Kwartaal 2	Kwartaal 3	Kwartaal 4	Totaal
Lengte-monsters	Den Helder	1	4	1	1	7
	IJmuiden	1	4	1	1	7
	Stellendam	1	4	1	1	7
	Harlingen	3	5	3	3	14
	Vlissingen	3	4	3	3	13
	Totaal	9	21	9	9	48
Leeftijds-monsters	Den Helder	1	4	3	3	11
	IJmuiden	2	5	3	3	13
	Stellendam	1	3	2	3	9
	Harlingen	3	6	6	5	20
	Vlissingen	2	4	3	2	11
	Totaal	9	22	17	16	64

The Netherlands

Member state/Country:

Norway

Target population

Best practice

The target population needs to be identified and described. Access to the target population for sampling purposes need to be analysed and documented.

Comment

-

Bad practice

-

Member state/Countryl sampling design

1) The target population is cod, haddock, saithe, and golden redfish for which estimates of landed catch north of 62 °N *in numbers-at-age, length, weight and other biological quantities are required as input for analytical stock assessments.*

2) On-shore access to the landed catch is through a list frame of landing sites which are accessed by boat according to a systematic design.

Primary sampling units (PSUs)

Best practice

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

Comment

If PSU is something else than trip, vessel or site the choice need to be thoroughly explained.

Bad practice

-

Member state/Country sampling design

In this survey the PSU is vessel and fishing trip. IMR staff contacts a stratified random sample of vessels operating in the statistical area around a port. IMR staff samples fish (length and age by species) from the randomly selected fishing trips when the fish is landed in the port (WKPICS3).

Sampling frame

Best practice

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.

Comment

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.

Bad practice

To exclude large parts of the target population in an ad-hoc way.

Member state/Country sampling design

The sampling frame is a matrix of ports vs days of the year. Three sampling frames are defined:

viii)

Stratification of the sampling frame

Best practice

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.

Comment

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.

Bad practice

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.

Member state sampling design

1) The following strata are defined for each sampling frame:

xviii) National Fisheries Statistical Areas (6 coastal; 1 oceanic) which can be aggre-

Norway

gated to ICES Statistical Areas.

xix) Gear (6).

xx) 4 quarters of the year

2) IMR staff samples fish (length and age by species) from the randomly selected fishing trips when the fish is landed in the port. For practical and funding reasons, trips cannot be selected from all combinations of regions, seasons and gears. In particular, samples are, mostly, taken from vessels operation in statistical areas near the coast. When a sample from a fishing trip is landed, the weight and length of each fish are recorded as well as the size of the catch taken during the trip. In this work we assume that we have a random sample of catches (fishing trips) from the population of catches (trips) in each of a set number of gear categories, in four quarters of the year, and in a set number of regions. We also assume that the fish were chosen randomly from each catch and ages were determined without error.

3) The overall sampling effort for all sampling frames and strata is largely constrained by the financial and staff resources made available by the government for this work This affects the number of strata that can be effectively sampled and the exclusion of some PSUs from the frame. The systematic survey from boat is complemented by samples of fishing trips conducted by the Directorate of Fisheries and locally contracted staff.

Distribution of sampling effort

Best practice

The way sampling effort is distributed between strata needs to be described. In accordance with best practice, this can be based on analysis of variance or just distributed proportionally.

The different sampling inclusion probabilities/weighting needs to be documented.

Comment

If other methods, such as expert judgment are used, this should be explained and justified.

Bad practice

-

Member state/Country sampling design

Sampling effort (number of trips to sample by stratum) is allocated the quarters according to information on seasonal fishing effort, and within a quarter according to information on active fishing vessels in the area surrounding the ports along the systematic track.

Sample selection procedure

Best practice

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 principle this means 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

Comment

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

Bad practice

Ad-hoc based sampling, without proper documentation to allow estimation of bias, where the sampling inclusion probabilities cannot be estimated.

Member state/Country sampling design

IMR staff samples fish when the fish is landed in the port (length and age by species) from a simple random sample of vessels/fishing trips within areas along the systematic cruise track of the survey vessel. Active fishing vessels that process the catch at sea are asked to set aside the catch from a fishing operation, which can be sampled by IMR staff when landed at the port.

Hierarchical structure in the sampling

Best practice

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)

Comment

-

Bad practice

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)

Member state/Country sampling design

The hierarchy for sampling is as follows:

33) *Primary sampling unit: Vessel/fishing trip .*

Norway

34) *Secondary unit: fishing operation.*
35) *Tertiary unit: individual fish (age, length, weight)*

Protocol for selection of samples at lower sampling levels (SSU, etc.)

Best practice

Such protocols should exist in a national repository

Comment

-

Bad practice

-

Member state/country sampling design

xvi) *Detailed protocol available from IMR*
xvii) *Currently, otoliths are collected from 30 randomly selected fish from each SSU. Also, Length, weight, sex, and maturity stage is recorded for each fish.*

System to monitor performance of sampling schemes - Quality Indicators

Best practice

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.

Comment

-

Bad practice

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Member state/Country sampling design

The following systems are in place to monitor sampling performance and data quality:

37. *Sampling achievements are monitored on an ongoing basis through regular contacts with sampling staff, so that issues can be identified and resolved as early as possible.*
38. *The sampling design is statistically robust based on diagnostics, given the logistical constraints, apart from poor coverage in Quarter 3 due to financial*

limitations.

39. *Non-response rates are currently not recorded routinely, but is considered to be minimal.*
40. *Onboard the survey vessel the sampler ensures all the paperwork is in good order and completed to a high minimum standard. These data are entered onto the sampling database while onboard, which includes a range of error traps. Age-readings are generally conducted onboard the ship by certified staff.*
41. *Once entered, the data and data integrity is checked through thorough diagnostics using the software ECA (ICES WKPICS3). Any errors are investigated, corrected and recorded.*
42. *Summary reports provide overviews to identify sampling coverage by area, quarter, and gear and tests for extreme values in the data (age-length-weight ranges).*
43. *Effective sample size has been estimated for mean length for selected species, as a proxy for quality of length-frequency data. Comparisons with data from the Reference Fleet and other platforms are used in diagnostics Quarterly reports of the sampling activity against fishing activity (landings per area, quarter, and gear) provide an indication of how representative the sampling is.*

Documentation of raising/weighting procedure for national estimates

Best practice

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.

Comment

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Bad practice

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Member state/Country

Based on ECA, and methods documented in several peer-reviewed papers.

Hirst, D., Storvik, G., Rognebakke, H., Aanes, S., and Vølstad, J.H. 2012. A modeling approach to the estimation of catch-at-age of commercial fish species. Canadian Journal of Fisheries and Aquatic Sciences 69: 1–13. doi:10.1139/CJFAS-2012-0075

Aanes, S. and J.H. Vølstad. In Review. Efficient statistical estimators and sampling strategies for estimating the age-composition of fish. Can. J. Fish. Aquar. Sci. (To appear)

Norway

Member state:

Poland

(concern the Baltic Sea) – description below was prepared by W. Grygiel and M. Adamowicz from the NMFRI in Gdynia

Target population

Best practice

The target population needs to be identified and described. Access to the target population for sampling purposes need to be analysed and documented.

Comment

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Bad practice

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Member state sampling design

1) The target population for DCF is all fish species for which estimates of landed quantities are required by Commission Decision 2010/93/EU, taking account of any derogation granted in accordance with the National Fisheries Data Sampling Programme. Totally, 12 Baltic fish stocks are sampled every year. Moreover, 3-5 fish stocks inhabited in the other seas are sampled too. In recent years totally, 835 vessels with different types and sizes, ranged from 12 to 30 m length, operated on the Baltic.

2) Random selection of marine fish sampling on shore, including sampling at fish-auction as well as random sampling directly at sea not exists in Poland. Instead of this, a quasi-opportunistic selection of sampling is implemented. On-shore access to the landed catch is through a list of 10 local first-sale centres moreover, directly from landing vessels in ports and harbours; sporadically fish sampling is also conducted based on materials from the fish processing company and warehouses. In the case of salmonids the self-sampling system is implemented. Sampling is based on the preliminary agreements with vessel owners, managers of the companies and particular skippers or fishermen, that cooperate with NMFRI (Gdynia). Generally, distribution of sampling of given species over the year is determined by national fishing-quota utilization.

Primary sampling units (PSUs)

Best practice

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

Comment

If PSU is something else than trip, vessel or site the choice need to be thoroughly explained.

Bad practice

-

Member state sampling design

The primary sampling unit is a trip of the operating vessels on a specified metier (=species), port and quarter. Landing-sizes from the previous year define the sampling probabilities for the group of vessels and ports.

Sampling frame

Best practice

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.

Comment

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.

Bad practice

To exclude large parts of the target population in an ad-hoc way.

Member state sampling design

The sampling frame is a list of Polish fishing vessels operating on the Baltic Sea. In many cases, fishes are already sold before they are landed accordingly to the agreements between the vessel owner and first-buyers. In this situation, when the vessel arrives to port, boxes are loaded into trucks directly from the vessel by attendance of the manager from the first-sale centre. Another example of complication in sampling design is when the manager collects landings from distant harbours and transfers it to the centre, and in this case, detailed information about fishing location is not accessible. One more important obstacle until recently was the lack of the agreement with the Ministry on the access to the fisheries administration database (Vessels' owners register, VMS, Logbooks data, First sale data). The agreement was signed on the end of October 2014. For the above-mentioned reasons samples are collected from c.a. 9% of the Polish fishery fleet.

Stratification of the sampling frame

Best practice

Strata should be well defined, known in advance and fairly stable. Clear definitions

Poland

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.

Comment

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.

Bad practice

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.

Member state sampling design

1) The following strata are defined for the sampling frame:

- *xxi) 3 ICES Sub-divisions very frequently covered by the Polish fleet and additionally, the ICES Sub-divisions where the Polish or joint-venture cutters are fishing for given species.*
- *xxii) Metier and vessel size category, which is comparable with the target species.*
- *xxiii) 4 quarters of the year.*
- *xxiv) In the case of Baltic sprat, stratification is also based on the purposes of the landed fish, i.e. separately for the human consumption and industrial (fishmeal production) purposes.*

The geographic areas of the sampling are defined according to the locations of the fish populations, which are corresponding with the stock size management units of given species. In the case of Baltic clupeids, geographic location of sampling is also determined by the main life-phases (spawning, feeding, wintering).

Metier and vessel size category defines the target species, e.g. in the case of sprat metier is OTM_SPF_16-31_0_0 and only the vessels with size over 19 m are involved in "sprat fishery", and in the case of herring metier is OTM_SPF_32-104_0_0.

Quarterly strata are defined to allow the possibility of varying the sampling intensity versus the seasonal fishing activity, however in the case of particular species it does not fully overlap with the main fishing seasons.

2) The sampling-scheme for a new year is prepared at autumn of the preceding year, accordingly to the landing size and fishing effort in three previous years of given metier (in the past it was acc. to species landing size and fishing effort), ICES Sub-division and quarter of the year.

Distribution of sampling effort

Best practice

The way sampling effort is distributed between strata needs to be described. In accordance with best practice, this can be based on analysis of variance or just distributed proportionally.

The different sampling inclusion probabilities/weighting needs to be documented.

Comment

If other methods, such as expert judgment are used, this should be explained and justified.

Bad practice

-

Member state sampling design

1) Sampling effort (number of trips to sample by stratum) is allocated according to information on landings and fishing effort in three previous years rather than using information on precision of estimates to conduct a statistical optimisation.

2) Neither sampling inclusion probabilities nor sampling weights are calculated, with the exception of Baltic cod (see a description below).

Sample selection procedure

Best practice

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 principle this means 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

Comment

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

Bad practice

Ad-hoc based sampling, without proper documentation to allow estimation of bias, where the sampling inclusion probabilities cannot be estimated.

Member state sampling design

Poland

The Polish on-shore sampling programme is rather based on ad-hoc selection of the vessel. Up to October 2014 there was no legal access to the ship-owners registry and getting access to particular landings was impossible, and samples are collected from a part of the Polish fleet that cooperate with the Institute. They are requested to storage one or two boxes of fish (depending on the species) from a particular area and métier, according to the current needs. Furthermore, since late 1990s the self-sampling program was introduced in the case of sea trout, salmon and whitefish fished in the coastal zone and open part of the Gdansk Basin. This program was based on the cooperation with selected believable fishermen, specialized in salmonids and whitefish fishing, who represented typical professional profile for that kind of the fishery. The fishers were trained and equipped with the relevant equipment. According to the contracts with Institute, they were obliged to collect data from their catches that included fish length and weight measurements, sex and maturity data and preserve scales for age reading. Approximately 70–85% of his total catch was sampled. The self-sampling program for the above-mentioned species is still kept.

Hierarchical structure in the sampling

Best practice

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)

Comment

-

Bad practice

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)

Member state sampling design

The hierarchy for sampling is as follows:

36) *Primary sampling unit: vessel-trip*
37) *Secondary unit: boxes of fish.*
38) *Third level: sub-sample only for clupeids for the length measurement purposes.*
39) *Fourth level: individual fish for the biological details analysis (ageing), however in the case of clupeids - fish selected for the biological analyses are taken from each length class occur in the measurement.*

Protocol for selection of samples at lower sampling levels (SSU, etc.)

Best practice

Such protocols should exist in a national repository

Comment

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Bad practice

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Member state sampling design

xviii) Vessel owners and managers of local first-sale centres that cooperate with NMFRI (Gdynia) are requested to leave to inspection one or two boxes of fish from landings of a needed trip.

xix) From 2005, in the case of clupeids firstly, fish are sorted out to sprat and herring and the next c.a. 2 and 5-7 kg of fish, respectively from the above-mentioned species are designated for the length measurements. For other commercial species, e.g. flounder, plaice, turbot and cod all the specimens from c.a. 60 kg/species are sampled for the length distribution.

xx) Within the biological analysis 3-5 cod otoliths, 5-7 flounder otoliths, 5-10 herring otoliths, and 10 sprat otoliths are collected from each length class, for the age determination.

System to monitor performance of sampling schemes - Quality Indicators

Best practice

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.

Comment

-

Bad practice

-

Member state sampling design

The following systems are in place to monitor sampling performance and data quality:

44. *Sampling achievements are summarised and monitored on an ongoing basis on a spreadsheet, and through regular contacts with sampling staff, so that issues can be identified and resolved as early as possible.*
45. *Monitoring spreadsheets are updated before departure and on return and these are used to provide a unique ID for each trip and to track achievements. On return, the observer ensures whether all the paper-*

work is in good order and completed to a high minimum standard. These data are entered into the sampling database with two stages of verification, which includes a range of error traps.

46. *Once entered, the data is cross-checked with official catch data delivered by the Fishing Monitoring Centre.*
47. *There are numbers of standard reports and figures in the national database showing outliers or lack of data.*

Documentation of raising/weighting procedure for national estimates

Best practice

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.

Comment

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Bad practice

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Member state sampling design

1) Fleet-raised length composition is derived for the main commercial species and included in the process of estimating age composition based on sub-sampling for age. The raising procedure in the routine work calculates total length compositions of given species according to the ICES Sub-division and quarter. In the case of Baltic cod, length distribution is determined separately for the commercial landings, discards and recreational marine angling. Raising factor is applied for cod length measurement from the level of single sample to the level of respective single landing. Cod ALKs were calculated separately for the commercial landings and discards. In some studies of Baltic sprat, the length distribution and ALKs were calculated separately for samples originated from industrial catches (fishmeal production) and from landings designated for human consumption.

The general procedure is as follows:

27) *The national fleet activity database, which holds logbook on individual landings, is accessed to locate the data for a group of trips from given area and metier. The gear, mesh-size, fishing area etc. are attached to the sample data in the database.*
28) *The length distribution recorded from individual boxes sampled is summarized in given quarter and ICES Sub-division. However, for Baltic cod, it is raised from the level of single sample to the level of respective single landing, and the next is summarized in give quarter, ICES Sub-division and fleet segment.*
29) *The sum of measured length frequencies of a particular species is raised to the*

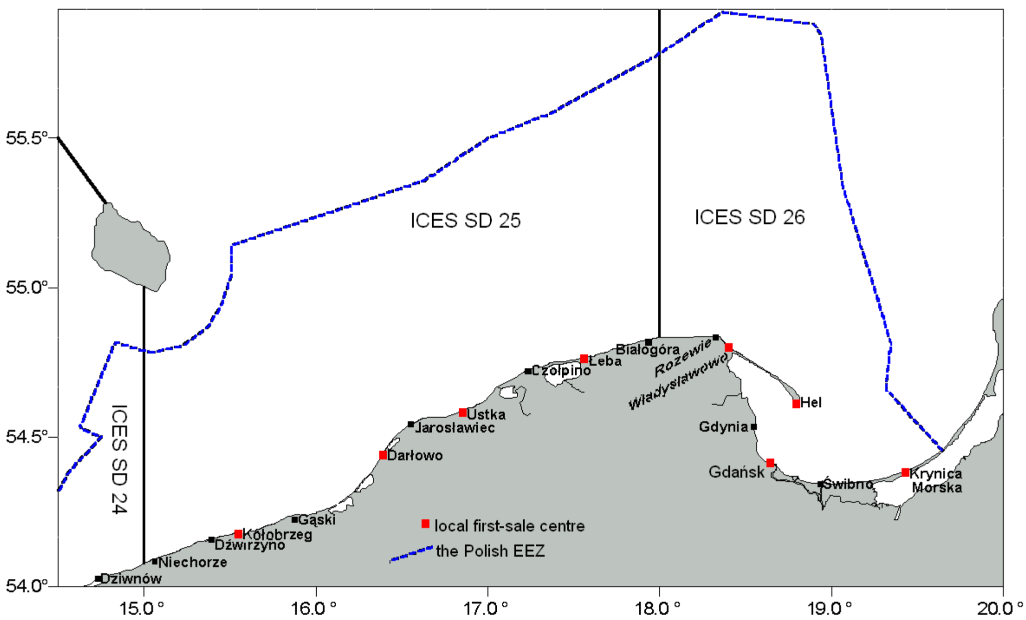
total Polish landings from given ICES Sub-division and quarter.

2) The procedure for calculating age composition from aged sub-samples of fish is based on a conventional age-length key approach. The quarterly sampled numbers at age in each length class are combined over all other strata to construct an age-length key for each quarter, which is then applied to the strata-raised length composition for the quarter. The form of aggregation of samples over sampled trips to construct the ALKs can vary from species to species.

3) Missing data may occur at several stages:

vii) *Species landings were reported in a stratum, but no PSUs were sampled for that species in the stratum. In this case, only landings data is registered.*

Annex PL-1: Description of sampling sites and how they are stratified, with map of location of the sites.



In the case of on-shore sampling programme in Poland, 10 local first-sale centres (figure above) determine the location of fish sampling. Moreover, sampling was accomplished also in ports and harbours. Very occasionally, fish samples were collected from the fish processing companies. Sampling sites are stratified by ICES Sub-divisions.

Annex PL-2: Description of method for allocating sampling effort to strata

Sampling effort (number of trips to sample by stratum) is allocated according to information on landings and fishing effort in three previous years. Principally, neither sampling inclusion probabilities nor sampling weights are calculated.

Annex PL-3. Procedure for selection of primary, secondary and lower sampling units.

The Polish on-shore sampling programme is rather based on ad-hoc selection of the vessel. Up to present days (Oct. 2014) there was no legal access to the ship-owners registry and getting access to particular landings is impossible, samples are collected from a part of the Polish fleet that cooperate with the Institute. They are requested to storage one or two boxes of fish (depending on the species) from a particular area and métier, according to the current needs. Managers of local first-sale centres, skippers and fishermen that cooperate with NMFRI (Gdynia) are also requested to leave fish sample from landings of a needed trip.

From 2005, in the case of clupeids firstly fish are sorted out to sprat and herring and the next c.a. 2 and 5-7 kg of fish, respectively from the above-mentioned species are designated for the length measurements. For other commercial species, e.g. flounder, place, turbot and cod all the specimens from c.a. 60 kg/species are sampled for the length distribution.

Within the biological analysis 3-5 cod otoliths, 5-7 flounder otoliths, 5-10 herring otoliths, 10 sprat otoliths are collected from each length class, for the age determination.

Annex PL-4: Quality assurance and quality control procedures in place

Data entered to the national database are verified in the two-stage validation process. Once when they are typed in, the wide range of checks are applied in order to avoid common errors and lack of data. Afterwards, user with particular rights, usually species expert, verifies data from more complex point of view. Moreover, number of standard reports and figures are available to evaluate the quality of the data. Up to now, length-age and length-weight relationships are visualised to show the outliers. There is also a report presenting the missing data in required fields.

Annex PL-5: Data analysis procedures, variance estimation and handling of missing values

Fleet-raised length composition is derived for the main commercial species and included in the process of estimating age composition based on sub-sampling for age. The raising procedure in the routine works calculates total length compositions of given species according to the ICES Sub-division and quarter In the case of Baltic cod, length distribution is determined separately for the commercial landings, discards and recreational marine angling. Raising factor is applied for cod length measurement from the level of single sample to the level of respective single landing, and the next is summarized in give quarter, ICES Sub-division and fleet segment. Cod ALKs were calculated separately for the commercial landings and discards. In some studies of Baltic sprat, the length distribution and ALKs were calculated separately for samples originated from industrial catches (fishmeal production) and from landings designated for human consumption. The procedure for calculating age composition from aged sub-samples of fish is based on a conventional age-length key approach. The quarterly sample numbers at age in each length class are combined over all other strata to construct an age-length key for each quarter, which is then applied to the strata-raised length composition for the quarter. The form of aggregation of samples over sampled trips to construct the ALKs can vary from species to species.

In the case of missing data only official landings data is registered.

Member state:

Portugal

Target population

Best practice

The target population needs to be identified and described. Access to the target population for sampling purposes need to be analysed and documented.

Comment

-

Bad practice

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Member state sampling design

1) The target population for DCF is all fish and shellfish species for which estimates of landed quantities are required by Commission Decision 2010/93/EU, taking account of any derogations granted, as specified by the National programme.

2) For practical purposes, the target population is considered divided into several major strata: fleets based on vessel lists.

3) The overall sampling design is common for all fleets. However, in practice each fleet can be considered as subject to its own sampling design with minor adaptations (e.g. week days).

Primary sampling units (PSUs)

Best practice

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

Comment

If PSU is something else than trip, vessel or site the choice need to be thoroughly explained.

Bad practice

-

Member state sampling design

*In each fleet, the PSU is a auction *day*

The size of the PSU is related to the total sales in that auction_event and day.

Sampling frame

Best practice

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.

Comment

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.

Bad practice

To exclude large parts of the target population in an ad-hoc way.

Member state sampling design

For each fleet, the sampling frame is a matrix of auctions*days of the year.

The following auctions are excluded:

- *i) Smaller auctions: Auctions that get allocated less than 12 trips a year across all fleets*
- *ii) Smaller auctions: Auctions that get allocated less than 1 trip in one quarter within a specific fleet.*

The following days are excluded:

- *i) All fleets: Weekends*
- *ii) At fleet level (some fleets only): Weekdays where total landings registered for the fleet are small.*

Stratification of the sampling frame

Best practice

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.

Comment

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.

Bad practice

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.

Member state sampling design

1) The following strata are defined for each sampling frame:

i) *Quarters*
ii) *Auctions (≈Ports)*

Quarterly strata are defined to allow the possibility of varying the sampling intensity according to seasonal fishing activity in each fleet. Port strata are defined based on the most important ports and logistic constrains.

Distribution of sampling effort

Best practice

The way sampling effort is distributed between strata needs to be described. In accordance with best practice, this can be based on analysis of variance or just distributed proportionally.

The different sampling inclusion probabilities/weighting needs to be documented.

Comment

If other methods, such as expert judgment are used, this should be explained and justified.

Bad practice

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Member state sampling design

1) Within each fleet total sampling effort is fixed based on previous DCF objectives and largely constrained by the financial and staff resources available and by the logistics involved in displacing observers to auctions.

*2) In each fleet, sampling effort (number of trips to sample) per auction*quarter is proportional to total landings registered in the previous year. If only 1 trip gets allocated to an auction*quarter then 2 trips are made. Statistical optimisation has not been performed.*

*3) In each port*quarter combination, sampling effort is distributed evenly through time.*

*4) The ratio between number of auction*day planned and total number of auction*day in the port*quarter combination is an indicator of the sampling inclusion probabilities.*

Sample selection procedure

Best practice

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 principle this means 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

Comment

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

Bad practice

Ad-hoc based sampling, without proper documentation to allow estimation of bias, where the sampling inclusion probabilities cannot be estimated.

Member state sampling design

1) Within fleet, systematic sampling is used to evenly distribute sampling effort throughout the weeks of each quarter. Visit days to each port are then coordinated across different fleets with observers being scheduled to do, e.g., X trips of one fleet1 and Y trips of fleet2 in a certain auction visit.
2) The total number of trips sampled at each day is set a priori. Trips are selected randomly from the list of vessels registered to be auctioned at the time of observer arrival.
3) Observers arrive close to the end of the vessel registration period.

Hierarchical structure in the sampling

Best practice

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)

Comment

-

Bad practice

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)

Member state sampling design

Portugal

The hierarchy for sampling is as follows:

i) Primary sampling level: A auction on a day
ii) Secondary level: a vessel_sale_event (~trip landing event)
iii) Tertiary level: commercial species (strata)
iv) Fourth level: commercial category (strata)
v) Fifth level: box
vi) Sixth level: scientific species
vii) Seventh level: individual fish
viii) Eighth level: individual fish length

Some variations may take place in specific auctions, e.g., when there is no list of commercial species and categories, observers create their own and sample them accordingly.

Protocol for selection of samples at lower sampling levels (SSU, etc.)

Best practice

Such protocols should exist in a national repository

Comment

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Bad practice

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Member state sampling design

i) Guidelines exists to give sampling staff guidance on how to sample landings as representatively as possible for length composition;
ii) vessel_sale_events are selected "randomly" from the list of vessels that have registered at the time of observer arrival (near complete SSU sampling frame);
iii) Observers aim to sample at least a box from all commercial categories of all commercial species present in the auction list of the selected vessel. If time is limiting, observers target group G1 and G2 species from the DCF.
*iv) On each commercial species*commercial category combination, observers measure fish from each scientific species in the box. In general, they aim to measure ~100 fish from each scientific species (they may measure half a box or two or more boxes depending on the numbers present).*

System to monitor performance of sampling schemes - Quality Indicators

Best practice

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.

Comment

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Bad practice

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Member state sampling design

The following systems are in place to monitor sampling performance and data quality:

i) *Weekly meetings are carried out to discuss and resolve sampling difficulties;*

ii) *Sampling achievements are monitored while ongoing using a spreadsheet held in a shared drive and by consulting database records;*

iii) *At the end of the year, an annual QCA is carried out on logged records. This QCA is carried out in R and identifies logging errors, reviews outliers, etc. For accountability, observers are asked to investigate and report on the correction of errors;*

iv) *Numbers of PSUs (port-days sampled) is documented as a proxy for effective sample size.*

v) *An automated R routine for QC is being developed to be implemented in 2015. The routine includes, among other, summaries of yearly, quarterly and monthly sampling levels, quantification of departures from sampling plan and motives of such departures, comparison between sampled trips and trips logged into the IPMA database, two sets of QCA outputs directed at stock coordinators (e.g., length frequencies per trip, summaries per auction) and sampling coordinators (e.g., size of vessels sampled, etc).*

Documentation of raising/weighting procedure for national estimates

Best practice

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.

Comment

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Bad practice

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Member state sampling design The length composition of landings at national level is estimated separately for trawl, purse-seine and multi-gear fleet segments. Quarterly estimates are obtained. Briefly, length composition of samples is raised to commercial_species*size_category and then to trip level; Then the several trips are combined within port and raised to port level (based on landings); Finally different ports are combined and raised to national level. More details on these procedures can be found in EGs reports dealing with individual stocks.

Portugal

Member state:

Sweden

The Swedish on shore sampling scheme is based on a random, unequal probability sampling design. The sampling frame is a matrix of port clusters *vs*. days of the year. Port-cluster-days are selected at random with unequal probabilities based on the total landings and landing patterns the previous year. Selection at all lower sampling levels is carried out by simple random sampling. The presented sampling scheme has not yet been implemented, and a proper evaluation of the design needs to be carried out during 2015. One main issue is that it is a single species program designed for cod, and it is unclear how it will cope if more species need to be sampled. It is also unclear how the unequal inclusion probabilities will be treated in the estimation procedure.

Target population

Best practice

The target population needs to be identified and described. Access to the target population for sampling purposes need to be analysed and documented.

Comment

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Bad practice

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Member state sampling design

1) The target population for DCF is all fish and shellfish species for which estimates of landed quantities are required by Commission Decision 2010/93/EU, taking account of any derogations granted. At present the Swedish on shore sampling scheme only covers the Baltic cod stocks.

2) On-shore access to the landed catch varies between sites. In some ports the landing is available for sampling, whereas in others the landings are more or less immediately transferred to trucks and transported abroad for processing. From most ports the landings are transported to one of a few processing sites / market sites where the fish can be sampled. The temporal pattern of landings also varies between ports, in some the landings are evenly distributed whereas in some, all fish is landed by the end of the week.

Primary sampling units (PSUs)

Best practice

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

Comment

If PSU is something else than trip, vessel or site the choice need to be thoroughly explained.

Bad practice

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Member state sampling design

The PSU is a cluster of ports on a specified day. The ports are clustered based on geographic proximity and sampling availability. In some clusters the landings are available at site, but from others the landings are directly transported to markets or processing factories, and need to be sampled in those locations. The sampling probability of a PSU is related to the total landings and landing patterns the previous year.

Sampling frame

Best practice

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.

Comment

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.

Bad practice

To exclude large parts of the target population in an ad-hoc way.

Member state sampling design

The sampling frame is a matrix of port clusters vs days of the year. Two sampling frames is defined:

xiii) Western Baltic: Port clusters where the demersal fleet landed cod from the western Baltic (subdivision 22-24) the previous year.

xiv) Eastern Baltic: Port clusters where the demersal fleet landed cod from the eastern Baltic (subdivision 25-32) the previous year.

The actual port clusters is partly overlapping between sampling frames, but the selection of PSUs from each sampling frame is independent and based on different sampling probabilities.

The following sampling sites are excluded from the sampling frames:

ix) Foreign ports and Swedish ports outside the Baltic area, that is in subdivision 20 and 21.

Sweden

x) Small ports, remotely located and/or difficult to access without a substantial increase in resources. These ports represent a limited fraction of the total landings from the eastern and western Baltic cod stock respectively

Stratification of the sampling frame

Best practice

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.

Comment

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.

Bad practice

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.

Member state sampling design

1) The following strata are defined for each sampling frame:

xxv) 4 quarters of the year

xxvi) 2 geographic strata are defined for the western Baltic; port clusters in the Sound area, and port clusters on the south coast. At present the eastern Baltic is confined within 1 stratum.

The ports in the south coast

Quarterly strata are defined to allow the possibility of varying the sampling intensity according to seasonal fishing activity and seasonal regulations. For example, in the eastern Baltic demersal fishery for cod is closed from July to August. This may be changed to 6 month periods.

The geographic strata of the western Baltic are defined partly for logistic reasons, trawling is not allowed in subdivision 23 and only landings from the passive fleet will be available for sampling in the Sound area, and partly because of possible changes in assessment and management areas, i.e., it is possible that cod in the Sound will be managed separately in the future.

Distribution of sampling effort

Best practice

The way sampling effort is distributed between strata needs to be described. In accordance with best practice, this can be based on analysis of variance or just distributed proportionally.

The different sampling inclusion probabilities/weighting needs to be documented.

Comment

If other methods, such as expert judgment are used, this should be explained and justified.

Bad practice

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Member state sampling design

1) At present, equal sampling effort (number of port-cluster-days sampled) is allocated to each stratum within sampling frames. As a result, more effort is allocated to the western Baltic than the eastern Baltic. Up till now we have had the opportunity to use the discard sampling program in the Sound for market sampling also. The present approach needs to be re-evaluated due to the upcoming landing obligation in 2015.

2) For each stratum, the ratio of the number of port-cluster-days sampled to the total number of port-cluster-days with landings could be used to calculate the inclusion probability needed for estimation. However, since the selection of PSUs to sample is based on sampling probabilities related to last year's landings it is unclear what the exact procedure will be. The estimation procedure for CANUM/WECA may also incorporate landings by weight at different stages as an auxiliary variable.

Sample selection procedure

Best practice

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 principle this means 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

Comment

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

Bad practice

Ad-hoc based sampling, without proper documentation to allow estimation of bias, where the sampling inclusion probabilities cannot be estimated.

Member state sampling design

A random, unequal probability-based sampling scheme is adopted (design class C; site x time).

A summary of the procedure is as follows:

- *v) An update list of port clusters is compiled for each sampling frame/strata.*
- *vi) A "trellis" sampling design is used with weekly sampling blocks. For a given sampling frame, the n samples are spread out evenly across the quarter. For example, if there are 16 visits planned to a stratum within a quarter there will be one sampling trip every week, and an additional sampling trip ever fourth week, with a random starting point.*
- *vii) The probability of sampling a specific port-cluster-day within a week is based on the landings in that port in the same quarter the previous year. For example, a port contributing 30 % of the landings in a stratum will be three times as likely to be selected as a port contributing 10% of the landings.*
- *viii) Following the selection of port-cluster, a day of the week for the sampling trip will be selected. The sampling probability for any given day will depend on the port-cluster selected in the previous step. For example, the sampling probability for a given day could be ⅕ if the landings are equally distributed over the week in that specific port-cluster, or ½ if landing only occur during two days by the end of the week. Unequal probabilities between days are also possible.*

Hierarchical structure in the sampling

Best practice

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)

Comment

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Bad practice

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)

Member state sampling design

The hierarchy for sampling is as follows:

a) Stratification on quarter and area

i) PSU: selection of port cluster x day

b) (Stratify by fleet)

ii) SSU: selection of a vessel landing

c) (Stratify by commercial size category)

iii) TSU: selection of a box

iv) QSU: selection of individual fish

Protocol for selection of samples at lower sampling levels (SSU, etc.)

Best practice

Such protocols should exist in a national repository

Comment

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Bad practice

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Member state sampling design

xxi) In advance of going to the sampling site the observers put together a list of vessels likely to land in the selected port cluster the actual day. The preliminary list is based on observer knowledge of previous landing patterns, through personal contact with fishermen and real –time VMS/AIS observations. At the sampling site the list is finalized and updated with the latest information available from fishermen, byers and the Fishery Monitoring Centre.

xxii) From the list of available vessel landings (including those vessels expected later that day) one landing within each fleet is selected by simple random sampling.

xxiii) From the selected landing a random box within each commercial size category is picked by simple random sampling. With few exceptions size category 3-5 will be present in the selected landing, whereas size category 1-2 are rare and frequently will not. These size categories will then be sampled opportunistically from other landings if available.

xxiv) Fish are sampled for age directly, that is, no length-stratified sampling occurs. In practice, 10-15 individuals are randomly selected from each box; the minimum number will be estimated from simulation. For the larger commercial categories, more than one box may be sampled to obtain the minimum number of individuals. Length, weight and otoliths are sampled from each selected fish.

System to monitor performance of sampling schemes -

Quality Indicators

Best practice

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.

Comment

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Bad practice

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Member state sampling design

The following systems are/will be used to monitor sampling performance and data quality:

48. *Sampling achievements are summarised and monitored on an ongoing basis with regular contacts with sampling staff, so that issues can be identified and resolved as early as possible.*
49. *Non-response rates will be recorded, for example if staff are refused access to landings to sample, or if vessels don't provide information about planned landing events and therefore don't appear on the list of available landings used to select landings at the sampling site.*
50. *Once entered, the data and data integrity is checked by other member of staff. Any entering errors are investigated, corrected and recorded.*
51. *At present the process to identify outliers and extreme values in the data are carried out on a yearly basis, concurrent with the raising procedure. In the future this will be done earlier on in the process to identify problems as soon as possible. The planned quality check should also include the following;*
52. *Landings in port clusters and/or at times not included in the sampling frames will be compared to those covered by the sampling frame with respect to spatial and temporal fishing pattern based on logbook data.*

Documentation of raising/weighting procedure for national estimates

Best practice

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.

Comment

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Bad practice

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Member state sampling design

1) *We sample for age directly and no separate sampling or raising of length distributions is carried out.*

2) *At present the number of fish within size categories and landing event is raised directly to total landings by quarter using a bootstrap procedure. This approach does not reflect the sampling design and will be modified to account for the hierarchy of sampling as follows:*

30) *The age and length composition recorded from individual fish sampled will be used to estimate the total landing using design-based inclusion probability according to the sampling fraction at each stage (port-cluster-day/vessel landing within fleet/box within size category/number of fish sampled within box).*

31) *The estimated age/length frequencies and landings weights are summed over all commercial categories and fleets within geographical strata, and then across strata to give the total numbers at age for the stock.*

32) *Census data from logbook and sales notes will be used to post-stratify the outcome from the design based estimation, and may also be used as an auxiliary variable within the estimation process.*

3) *Missing data may occur at several stages:*

i) *Commercial size categories 1 and 2 are very rare and will frequently not be available for sampling, not even opportunistically. In case of insufficient sample size for design-based estimation, CANUM and WECA for these size categories will also be estimated with alternative methods. The results with associated uncertainties will be presented separately.*

Sweden

Member state:

UK (Northern Ireland)

Target population

Best practice

The target population needs to be identified and described. Access to the target population for sampling purposes need to be analysed and documented.

Comment

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Bad practice

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Member state sampling design

1) The target population for DCF is all fish and shellfish species for which estimates of landed quantities are required by Commission Decision 2010/93/EU, taking account of any derogations granted.

2) On-shore access to the landed catch is through a list frame of landing sites from which selection is made on an ad-hoc basis for direct sampling on shore according to the procedures described below.

Primary sampling units (PSUs)

Best practice

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

Comment

If PSU is something else than trip, vessel or site the choice need to be thoroughly explained.

Bad practice

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Member state sampling design

The PSU is a landing site on a specified day

The size of the PSU is related to the total landings into each port, ports with large volumes *of landings are sampled more frequently than ports with small volumes of landings. For pelagics species, sampling targets are directly linked to the landings.*

Sampling frame

Best practice

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.

Comment

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.

Bad practice

To exclude large parts of the target population in an ad-hoc way.

Member state sampling design

The sampling frame is a matrix of ports vs days of the year. Four main sampling frames are defined:

- *xv) Ports / processors where pelagic landings are available for sampling.*
- *xvi) Ports / processors where demersal landings are available for sampling.*
- *xvii) Ports / processors where Nephrops landings are available for sampling.*
- *xviii) Ports / processors where inshore landings are available for sampling.*

These sampling frames are not strictly independent; one sampling event (port-day) can include e.g. demersal and pelagic samples.

No sampling sites are excluded per se, but:

- *xi) Smaller ports are not sampled for practical reasons, however the landings in these ports are very minor.*
- *xii) Some landings are not available for sampling (e.g. if they are transported to other ports or abroad where auctions take place). However there are no ports where all of the landings are unavailable for sampling.*

Stratification of the sampling frame

Best practice

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.

Comment

UK (Northern Ireland)

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.

Bad practice

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.

Member state sampling design

1) The following strata are defined for each sampling frame:

xxvii) geographic areas (Ices divisions, mainly VIIa, but also VIa,VIIfgj)
xxviii) 4 quarters of the year
xxix) 4 main gear types (OTB, OTM, SSC and PTM)

Distribution of sampling effort

Best practice

The way sampling effort is distributed between strata needs to be described. In accordance with best practice, this can be based on analysis of variance or just distributed proportionally.

The different sampling inclusion probabilities/weighting needs to be documented.

Comment

If other methods, such as expert judgment are used, this should be explained and justified.

Bad practice

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Member state sampling design

1) *Sampling effort (number of trips to sample by stratum) is allocated between strata according to information on recent landings rather than using information on precision of estimates to conduct a statistical optimisation. Allocation of sampling effort is on an ad-hoc basis.*

Sample selection procedure

Best practice

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 principle this means 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

Comment

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

Bad practice

Ad-hoc based sampling, without proper documentation to allow estimation of bias, where the sampling inclusion probabilities cannot be estimated.

Member state sampling design

Sampling targets for each stratum are defined, based on recent landings. The sampler will check if landings are expected in a certain port before travelling. This 'targeted' sampling is one of the main issues with the current sampling programme that needs to be addressed to move to a more statistically sound approach. Samples are taken in the three main ports (Ardglass, Kilkeel and Portavogie) with sampling occurring on an ad-hoc basis.

Hierarchical structure in the sampling

Best practice

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)

Comment

-

Bad practice

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)

Member state sampling design

The hierarchy for sampling is as follows:

i. *Primary sampling unit: A port on a day.*

UK (Northern Ireland)

ii. *Second level: a vessel landing.*
iii. *Third level: a species*
iv. *Fourth level: a commercial size categories (where relevant)*
v. *Fifth level: a fish box*
vi. *Sixth level: an individual fish*

Protocol for selection of samples at lower sampling levels (SSU, etc.)

Best practice

Such protocols should exist in a national repository

Comment

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Bad practice

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Member state sampling design

xxv) *A Standard Operating Procedure exists to give sampling staff guidance on how to access landings samples, however there is no formal way of randomising the sample selection.*

xxvi) *The strategy for selecting individual landings of species to sample on a given day is guided by stock-based and concurrent sampling targets. The desired number of trips to sample varies between species so more landings on a day may be sampled for one species compared to another. With concurrent sampling, a number of vessels are selected at a fish market and a length frequency is measured from every grade of every species that has been landed by these vessels.*

xxvii) *Sampling for otoliths is rarely possible at NI markets due to low volumes landed. If otoliths are collected from a fishing vessel, one pair of otoliths for each length class measured should be collected. This avoids clustering in the age data and helps to minimise bias when the data are raised to quarterly and annual landing periods by stock for each species.*

System to monitor performance of sampling schemes - Quality Indicators

Best practice

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.

Comment

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Bad practice

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Member state sampling design

The following systems are in place to monitor sampling performance and data quality:

53. *Sampling achievements are summarised and monitored on an ongoing basis on a sample tracking system, which is checked before each port visit. Weekly meetings are held with sampling staff and a weekly sampling progress report is compiled.*
54. *On return the sampler ensures all the paperwork is in good order and the data are entered onto the sampling database, which includes a range of error traps.*
55. *When age data are entered (after the otoliths are read) further checks for outliers are performed and investigated.*
56. *Before data are extracted for the assessment working groups, the data and data integrity is checked by the port samplers. Any errors are investigated, corrected and recorded.*
57. *Further checks are performed during the data extraction and raising procedure. Any error is investigated, corrected and recorded. Strata with insufficient samples are merged at this stage*
58. *Non-response rates are not recorded, (for example if staff are refused access to landings to sample).*

Documentation of raising/weighting procedure for national estimates

Best practice

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.

Comment

-

Bad practice

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Member state sampling design

1) The ratio of the landings to sampled weights is used to raise the data to fleet level. Land-

UK (Northern Ireland)

ings samples taken on-board by observers are also included and treated in the same way as port-based samples.

2) The procedure for calculating age compositions from aged sub samples of fish is currently based on a conventional age-length key approach. The quarterly sample numbers at age in each length class are combined within each stratum to construct an age-length key for each quarter and area (although the areas might not always match the spatial sampling strata). The ALK is then applied to the fleet-raised length compositions for the quarter and area.

3) Because the sampling design is somewhat over-stratified it is common to have insufficient length samples in a stratum. Depending on the stock and available data, samples from a number of strata will be combined: for slow-growing species, it may be acceptable to combine quarters; for others combining areas or gears may be a better option.

Gaps in ALKs can also occur, if they occur in the 'middle' of the ALK, these are filled in using a smoothing model. If they occur at the lower end, data from discard samples may be included, if the gaps occur at the higher end (larger, slower growing fish) data from other quarters can be included.

Annex UK/NI -1: Description of sampling sites and how they are stratified, with map of location of the sites.

Due to the changes in fishing activities the at-market sampling opportunities have deteriorated and effort has shifted to at-sea sampling. The on-shore sampling scheme uses area frames comprising all access points at the three main Northern Irish fishing ports of Kilkeel, Portavogie and Ardglass (Figure 1). Separate area frames and associated PSUs are established for some fleet segments with very restricted landing sites (e.g. large pelagic trawlers). The Primary Sampling Units for most fleet segments comprise sampling sites on a weekly basis. The sampling sites comprise the individual ports which are accessible. The primary sampling units for each area frame for on-shore sampling will be stratified as follows:

- By quarter

- By area (geographic strata linked to fishing grounds)

- By port

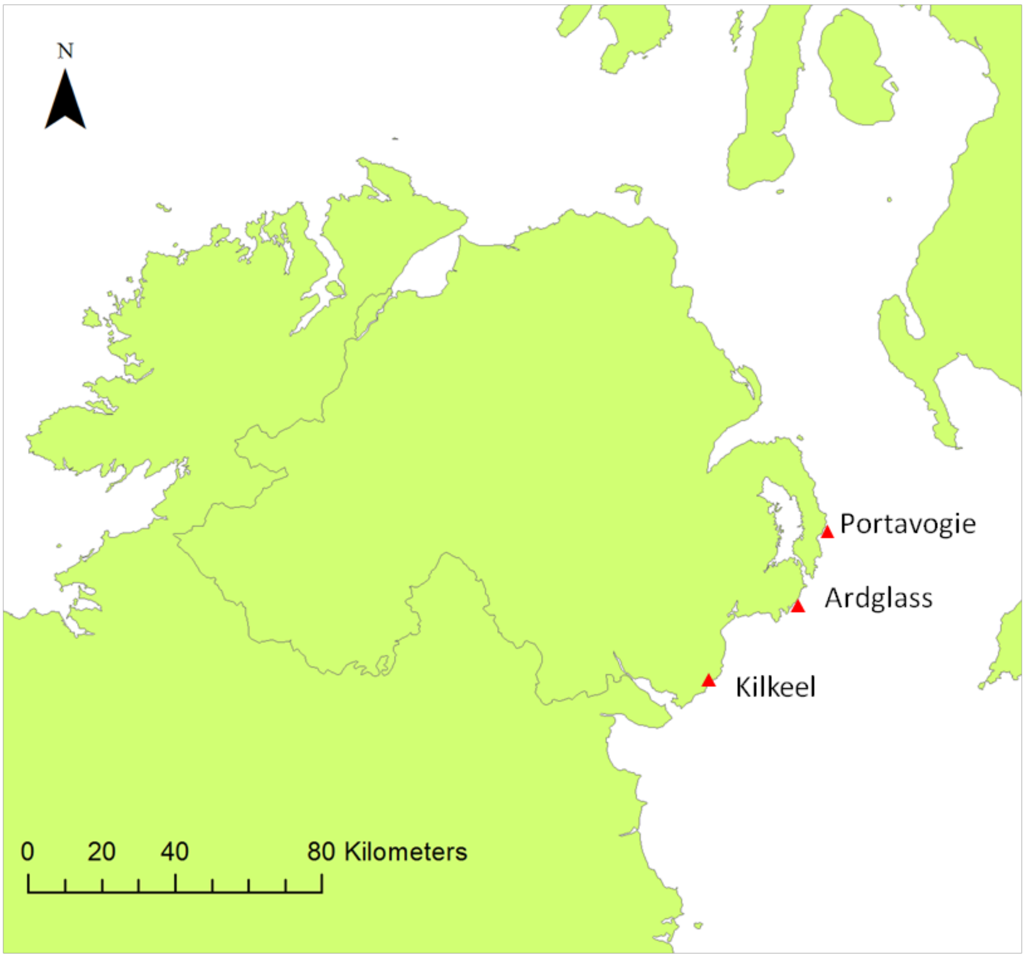

Figure 1: Northern Irish Fishing Ports

Summary of Northern Irish port visits in 2013:

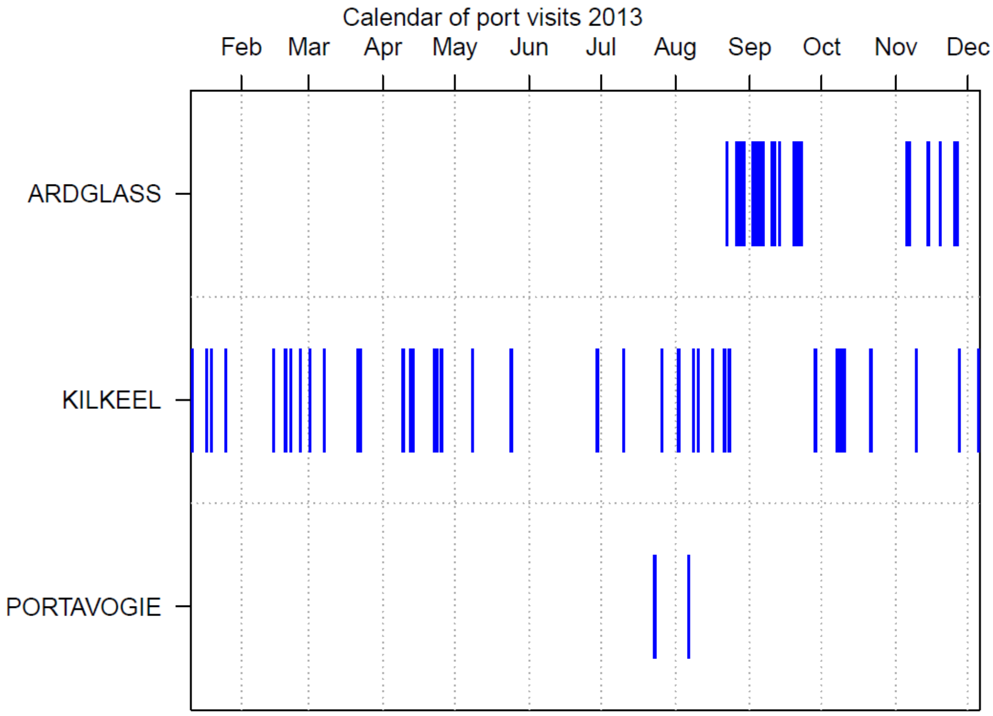

Figure 2: Port sampling events by harbour and date in 2013.

Table 1: Individual Port visits in 2013

Quarter	Number of port sampling events
1	12
2	9
3	28
4	14
Total	63

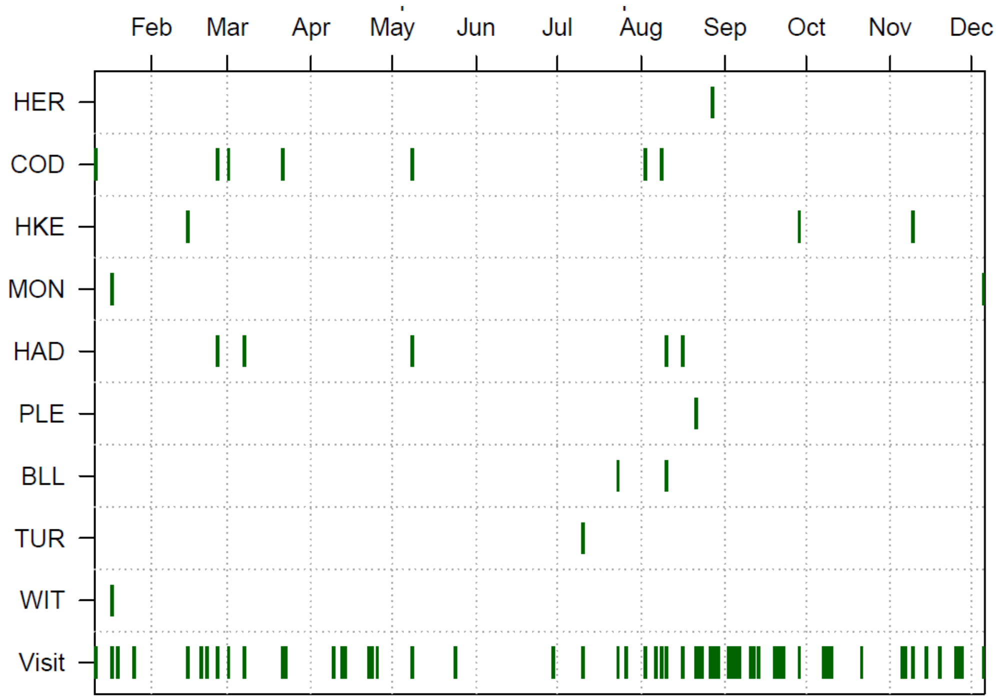

Figure 3: Calendar of species measured during port visits in 2013.

Table 2: Landings sampled for biological variables (COD = Cod, HAD = Haddock, WHG = Whiting, HER = Herring).

Species	Quarter	N Landings sampled
COD	1	9
HAD	1	6
WHG	1	1
COD	2	7
HAD	2	5
COD	3	11
HAD	3	2
HER	3	28
COD	4	1
HER	4	10

Annex UK/NI -2: Description of method for allocating sampling effort to strata

Three ports comprise the bulk of Northern Irish commericial landings. Allocation of sampling effort is on an ad hoc basis and largely dictated by staff resources available. Fish markets are held at Kilkeel and Portavogie. Kilkeel and Portavogie have prawn fleets and a small number of semi-pelagic vessels. Prawn trawlers land at Ardglass and catches are then shipped to Kilkeel market by road. Landings by larger trawlers mainly occur later in the week, typically Wednesdays and/or Fridays (Portavogie) and Thursdays and/or Fridays with an occasional Saturday market (Kilkeel). Ports are contacted prior to a market to confirm the market is taking place and expected commencement time. Figure 4 shows the breakdown of landings by port in 2013, the high levels of landings in Ardglass are mainly due to landings of herring which are processed at local factories.

Summary of Northern Irish landings in 2013:

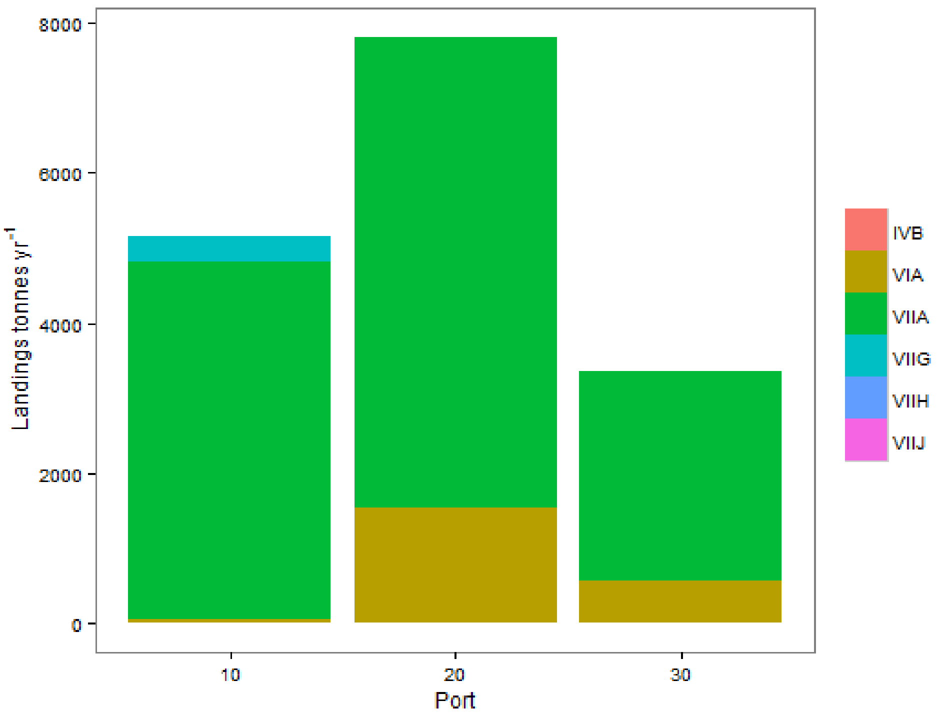

Figure 4: Total 2013 landings (tonnes yr^{-1}) for the 3 main Northern Irish ports (10 = Kilkeel, 20 = Ardglass, 30 = Portavogie) broken down by ICES rectangle (All landed species included).

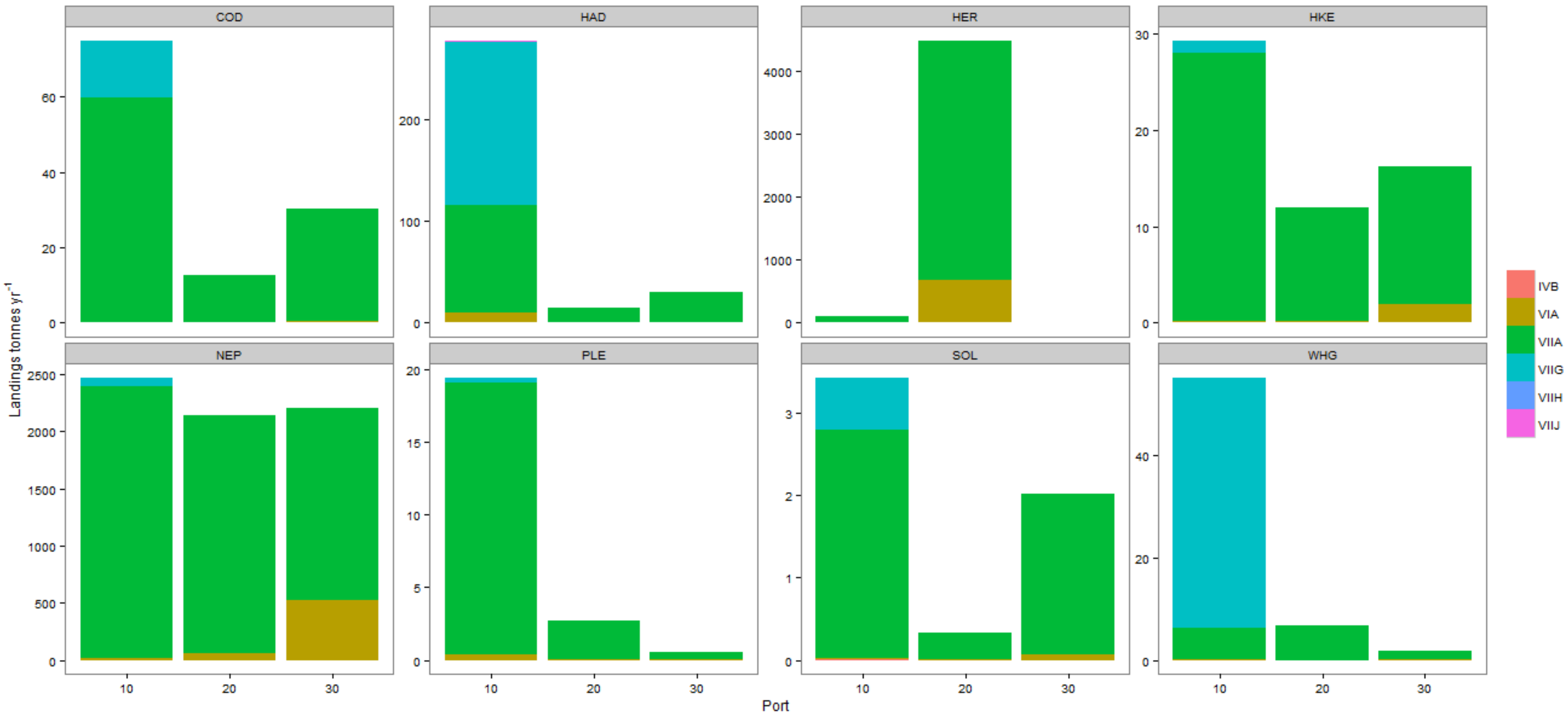

Figure 5: Total 2013 landings (tonnes yr-1) for the 3 main Northern Irish ports (10 = Kilkeel, 20 = Ardglass, 30 = Portavogie) broken down by ICES division for main commercial species (COD = Cod, HAD = Haddock, HER = Herring, HKE = Hake, NEP = Nephrops, PLE = European Plaice, SOL = Sole, WHG = Whiting.

Summary of main commercial species landings by ICES division:

Cod

VIIa

- The majority of the landings come in to Kilkeel.
- The lowest landings are usually in Q4. The highest landings are in Q3 with the exception of Ardglass where the highest landings are in Q2.

VIIg

- Landings from VIIg only came into Kilkeel the majority of which from Q1 and Q2.

VIa

- There were low levels of catch from VIa mainly into Portavogie.

Haddock

IVb, VIa, VIIh, VIIj

- There were low levels of catch from IVb, VIa, VIIh, VIIj into all three ports.

VIIa

- The majority of the VIIa landings came in to Kilkeel.
- The majority of the catch was landed in Q2 and Q3.

VIIg

- Landings from VIIg only came into Kilkeel the majority of which from Q1 and Q2.

Herring

VIIa

- The majority of herring landings came into Ardglass.
- Highest levels of catch were landed in Q3. There was some catch landed in Q4.

VIa

- There were low levels of catch from VIa.

Hake

VIIa

- The majority of the VIIa landings came in to Kilkeel.
- The majority of the catch was landed in Q1, Q2 and Q3. There were low levels of catch in Q4.

VIIg

- Landings from VIIg only came into Kilkeel the majority of which from Q2.

VIa

- There were low levels of catch from VIa mainly into Portavogie. Highest levels were during Q2.

Nephrops

VIIa

- Kilkeel had the highest landings followed by Ardglass and Portavogie.
- The majority of the catch was landed in Q1, Q2 and Q3 with the highest levels in Q3. There were low levels of catch landed in Q4.

VIa

- There were low levels of catch from VIa mainly into Portavogie. Highest levels were during Q2 followed by Q3.

IVb, VIIg, VIIh

- There were low levels of catch from IVb, VIIg and VIIh into Kilkeel. Highest levels were from VIIg mainly during Q2.

Plaice

VIIa

- The majority of the VIIa landings came in to Kilkeel. There were very lower levels of catch into Portavogie and Ardglass.
- The majority of the catch was landed in Q1, Q2 and Q3. There were low levels of catch in Q4.

VIa

- Most of the VIa plaice are landed into Kilkeel. There were very lower levels of catch into Portavogie and Ardglass.
- The highest levels of catch came into Kilkeel during Q4.

VIIg:

- Landings from VIIg only came into Kilkeel the majority of which from Q1 and Q2.

Sole

VIIa

- The highest landings of catch were into Kilkeel followed by Portavogie. There were low levels of catch into Ardglass.
- The majority of landings occurred in Q1, Q2 and Q3.

VIa, IVb, VIIh

- There were low levels of catch from VIa, IVb and VIIh . Catches from VIa mainly landed in Kilkeel and Portavogie during Q2 and Q3.

UK (Northern Ireland)

VIIg

- VIIg sole were landed only in Kilkeel mainly during Q1 and Q2.

Whiting

VIa,

- VIa whiting were mainly landed in Kilkeel during Q2 and Q4. There was low levels of catch landed during Q2 in Portavogie.

VIIa

- Most of the VIIa whiting were landed into Kilkeel and Ardglass with some into Portavogie.
- Catches into Kilkeel were landed mainly during Q3 with some in Q1 and Q2.
- Catches into Ardglass and Portavogie were mainly landed during Q4.

VIIg

- The majority the VIIg of the landings came in to Kilkeel. Catches were predominantly during Q2 and Q4 with lower levels during Q3.

Annex UK/NI -3: Procedure for selection of primary, secondary and lower sampling units

The Northern Irish on-shore sampling programme is carried out on an ad-hoc basis. Fish are landed onto the market either directly from boats or from lorries. Landings of cod, haddock and whiting will be graded into several size categories. Landings from each gear type (e.g. *Nephrops* single-rig, *Nephrops* twin-rig, semi-pelagic whitefish) are sampled at random. The strategy for selecting individual landings of species to sample on a given day is guided by stock-based and concurrent sampling targets.

Concurrent sampling

A number of vessels are selected at the fish market and a length frequency is measured from every grade of species that has been landed by these vessels.

Quota-Based Sampling

Individual key species are sampled across the types of vessels that target these species, or take them as by-catch. The number of boxes of each category of target species that has been landed is counted.

The quantity of each target species must be recorded accurately, and a length measure carried out from each landing selected. Sampling otoliths is rarely possible at Northern Irish markets due to low volumes landed and the short times that fish are on the market before sale and removal. If otoliths are collected from a fishing vessel, one pair of otoliths for each length class measured should be collected. This avoids clustering in the age data and helps to minimise bias when the data are raised to quarterly and annual landing periods by stock for each species. Each fish is weighed and measured before otoliths are removed.

Annex UK/NI -4: Quality assurance and quality control procedures in place

Data Input

Data are entered into a database and error checked prior to input. During input into the database, data is subject to a range of error checks and all outliers are investigated. A series of reports are generated by the database to evaluate the quality of inputted data.

Fish aging

Otolith data is only used for the purposes of fish stock assessment if they have been generated by or have been verified by a competent otolith reader (defined as someone who has read at least 5000 otoliths from that stock. Regular otolith or digitised otolith exchanges between at least two other laboratories take place each year.

Data extraction/Raising procedure

Outliers and potential typographic errors are investigated and corrected. All data analysis is fully documented and formulae are double checked to ensure they are correct.

Annex UK/NI -5: Data analysis procedures, variance estimation and handling of missing values

Stocks are assessed and managed within defined ICES rectangles. Data on Northern Irish landings are held by the Department of Agriculture and Rural Development (DARD) fisheries division. Port inspectors enter the vessel landings data at the Ports from the inspection of EC log books returns and auctioneers sales slips. Only data of landings from UK vessels landing in Northern Ireland and NI vessels into non-UK ports are used. Age compositions of Irish Sea stocks in Northern Ireland landings are obtained from a two-stage process. Biological data (length, weight, age, sex and maturity) are analysed to produce length-weight relationships and age-length keys (ALK) for each species by each quarter.

Length-frequency data from port onshore-sampling, fleet observer trips, and self-samplings are aggregated by quarter for different types of fishing gear where necessary. Average weights of fish in each length class are obtained using the quarterly length-weight relationship derived from biological data. The number of fish in each length class is multiplied by average weight in each length class to give an estimate of the total weight of fish. The aggregate sample weight is divided into quarterly catch tonnage for the appropriate gear type to give a raising factor. The aggregate sample length frequency is multiplied by the raising factor to give the total numbers in each length class. The quarterly ALK is applied to the raised length frequency to give the numbers landed or discarded at each age, and the mean length and weight at each age.

The total international catches at age of a species in a specified management unit are obtained by adding together the data from all the national fleets which have been sampled. Landings by fleets which haven't been sampled are assumed to have the same age composition as sampled fleets fishing in the same region. Stocks are assessed using Virtual Population Analysis (VPA). Independent assessments of stock size are derived from research vessel surveys. Data from research vessel surveys are used as a tuning information in stock assessment models.

Member state:

UK (England)

Target population

Best practice

The target population needs to be identified and described. Access to the target population for sampling purposes need to be analysed and documented.

Comment

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Bad practice

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Member state sampling design

1. *Target population for DCF is all fish and shellfish species landed into England for which estimates of length and/or age composition for the landed component of commercial catches are required by Commission Decision 2010/93/EU, taking account of any derogation granted.*
2. *Access to the population is through a list frame of fishing ports at which all or a defined proportion of the total landings are accessible at auctions, processors or other on-shore locations, and from which a stratified random selection of ports and days is made for sampling trips by Cefas staff.*

Primary sampling units (PSUs)

Best practice

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

Comment

If PSU is something else than trip, vessel or site the choice need to be thoroughly explained.

Bad practice

-

Member state sampling design

1. *WKPICS – design class C*
2. *The PSU is a port (or harbour or processor) on a day when landed catch is available.*

Landings into many small ports are transported to neighbouring larger ports where they can be sold by auction. A PSU is therefore a port where landings are available and implicitly includes all satellite ports from which catch is transported. Ports with auctions vary widely in size, from Lowestoft which deals with irregular infrequent landings from a dispersed fleet of under 10m vessels to Brixham which deals with regular large landings from a large fleet of over 10m vessels and a large fleet of inshore vessels.

3. *All landings into ports are documented exhaustively in the national fleet activity data base (FAD; Ifish2), by port of landing and port of sale based on EU logbooks and/or sales slips, with the exception of amounts less than 25kg per trip which can be disposed of without Buyers and Sellers documentation.*

Sampling frame

Best practice

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.

Comment

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.

Bad practice

To exclude large parts of the target population in an ad-hoc way.

Member state sampling design

The sampling frame is a frame comprising auction ports and ports of sale in England, and days of the year. Annex1 provides a map of sites in the sampling frame. Three sampling frames are defined:

- *xix) Ports where demersal fisheries land their catches and the fish are available for sampling. Landings from other ports are overlanded to these sites for sale.*
- *xx) Ports where shellfish (e.g. crabs; lobsters) are landed by vessels and the landings are available for sampling. Landings from other ports are overlanded to these sites for sale.*
- *xxi) Ports where pelagic species (mackerel, spratts and herring) are landed and are available for sampling. This includes a small number of specialised ports where pelagic fish are landed in high volume by large midwater trawlers, and other ports where these species are landed and sold by smaller vessels.*

The following sampling sites are excluded:

- *xiii) Remaining small ports where the landings are sold, but which are remotely located and very difficult to access without a substantial increase in resources.*

Stratification of the sampling frame

Best practice

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.

Comment

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.

Bad practice

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.

Member state sampling design

1) *The list of ports in each of the three sampling frames is stratified by:*
    1. *Quarter,*
    2. *Region (7 x strata) Lists of ports that map closely to ICES divisions, stock boundaries and fleet activities - 1Northeast, 2East, Southeast …..etc (details in Annex 1).*
    3. *3 x Port "size" classes based on the relative importance of that port within that region, described using an example in Annex 1.*
    4. *Gear group.*
        a. *E1 - Demersal trawlers, netters + liners*
        b. *E3 - Pelagic trawlers and seiners*
        c. *E4 - Shellfish pot & trap vessels*
        d. *E5 - Beam trawlers*
        e. *E6 - Mollusc dredgers*

    To cover the geographic range of fisheries and distribution of landings around England (& Wales) a regional approach is adopted to account for assessment areas.

2) *The stratification scheme is shown in Annex 1 together with an example of the number of fishing trips and total catches in a baseline year which would be used for allocating sampling effort.*

Distribution of sampling effort

Best practice

The way sampling effort is distributed between strata needs to be described. In accordance with best practice, this can be based on analysis of variance or just distributed proportionally.

The different sampling inclusion probabilities/weighting needs to be documented.

Comment

If other methods, such as expert judgment are used, this should be explained and justified.

Bad practice

-

Member state sampling design

1) *Sampling effort (number of trips to sample by stratum) is allocated according to information on fishing effort and catches in the previous year rather than using information on precision of estimates to conduct a statistical optimisation.*
2) *The overall sampling effort is largely constrained by the financial and staff resources made available by the UK government for this work – currently around 1080 staff days are available for port sampling (2014).*
3) *Effort is allocated to regions based on the expected stock composition of available landings within a stratum and expected achievements.*
4) *Based on the required effort in a stratum the number of sampling trips required are allocated to periods within the quarter systematically to ensure sampling is carried out throughout the quarter in an unbiased way.*
    a. *Major 1 ports will be sampled more frequently so the periods are biweekly blocks.*
    b. *Major 2 ports will be sampled less frequently so their periods are months.*

Each period is numbered for Biweekly periods, 1 to 6 and the 'starting point' is randomly selected. Then depending on the number of trips required these are distributed evenly across the period.

Sample selection procedure

Best practice

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 principle this means 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

Comment

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

UK (England)

Bad practice

Ad-hoc based sampling, without proper documentation to allow estimation of bias, where the sampling inclusion probabilities cannot be estimated.

Member state sampling design

A random, probability-based sampling scheme is adopted. A summary of the procedure is as follows:

ix) *An updated port list is compiled for each sampling frame and component stratum, and the planned number of sampling visits per frame and stratum is indicated according to planned sampling probabilities.*

x) *A "trellis" sampling design is used with bi-weekly sampling blocks. For a given stratum (e.g. large ports), the n annual samples are spread out evenly across the quarter. For example, if there are 26 visits planned to the large-port stratum within a geographic stratum, the ports are initially scheduled to be visited every second week. If there are 13 visits planned to small ports (half the sampling probability as large ports), these are spaced every 4 weeks. The order in which individual ports are sampled in a geographic stratum follows a "bus route" approach, moving more-or-less progressively along the coast, after randomising the first port at the start of the period.*

xi) *As there are multiple sampling frames (demersal, pelagic, shellfish), and limited resources, the choice of weeks or days to sample ports in each stratum has to be adapted for practical reasons. This can result in less systematic sampling of ports for each stratum, but the planned sampling probabilities, and the principle of spreading the sampling across the period, are maintained.*

Hierarchical structure in the sampling

Best practice

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)

Comment

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Bad practice

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)

Member state sampling design

The hierarchy for sampling is as follows:

vii. *Primary sampling unit: A port on a day.*

viii. *Secondary unit: a vessel landing.*

ix. Tertiary unit: boxes of fish (stratified by commercial size categories)

x. Fourth level: Individual fish (This can be subsampled to reduce sampling time but still ensure sufficient numbers are measured from within a box).

Protocol for selection of samples at lower sampling levels (SSU, etc.)

Best practice

Such protocols should exist in a national repository

Comment

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Bad practice

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Member state sampling design

xxviii) The presentation of the catches varies between ports, and between demersal, pelagic and shellfish landings. A Standard Operating Procedure exists to give sampling staff guidance on how to sample landings as representatively as possible for length and age composition or other biological material.

xxix) The strategy for selecting individual landings of demersal, pelagic or shellfish species to sample on a given day is guided by stock-based and concurrent sampling targets. The desired number of trips to sample varies between species so more landings on a day may be sampled for one species compared to another. Concurrent sampling, where all species in a landing are measured, is carried out according to targets (n landings per visit).

xxx) Currently, otoliths are collected in a length-stratified design. For a species, the Standard Operating Procedure specifies collecting from 1 to 3 otoliths per 1cm length class from each landing when sampling for length (the number is fixed per sample). This maintains the link between length and age sampling

System to monitor performance of sampling schemes - Quality Indicators

Best practice

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.

Comment

UK (England)

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Bad practice

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Member state sampling design

The following systems are in place to monitor sampling performance and data quality:

59. *Sampling achievements are summarised and monitored on an ongoing basis on a spreadsheet held in a shared drive, and through regular contacts with sampling staff, so that issues can be identified and resolved as early as possible.*
60. *The sampling design is statistically robust, using probability-based sampling.*
61. *Non-response rates, for example if staff are refused access to landings to sample, are currently not recorded. Currently scoping out a process for recording available trips not sampled and reasons. More difficult at major auction sites.*
62. *Monitoring spreadsheets are updated before departure and on return and these are used to provide a unique id for each trip and to track achievements.*
63. *Some data are logged on site using Electronic Data capture systems, avoiding transcription errors. If not, on return the sampler ensures all the paperwork is in good order and completed to a high minimum standard. These data are entered onto the sampling database, which includes a range of error traps.*
64. *Quarterly the data and data integrity is checked by another member of staff – with reference to control data. Any discrepancies are investigated, corrected when necessary and recorded.*
65. *Precision is currently estimated using COST tools, but numbers of PSUs (port-days) is documented as a proxy for effective sample size.*

Documentation of raising/weighting procedure for national estimates

Best practice

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.

Comment

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Bad practice

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Member state sampling design

1) Fleet-raised length compositions are derived for all species, and where required, are included in the process of estimating age compositions based on sub-sampling for age. The *raising procedure to calculate total length compositions for a fleet (metier or any other aggregation of trips) - which are post-strata should follow the hierarchy of sampling design, according to the sampling fraction at each stage. The general procedure should be as follows:*

33) *The national fleet activity database, which holds logbook or other sales data on individual landings, is accessed to locate the data for each vessel trip sampled. This may require searching surrounding dates and cross-matching other trip information (gear; mesh; species composition) collected by the sampler. The gear, mesh, area etc. are attached to the sample data in the data base.*
34) *The length composition recorded from individual boxes sampled is raised to the total observed trip landing of the vessel using the documented raising factors (e.g. ratio of total number of boxes to number of sampled boxes). The weight of the raised length frequency is calculated using length-weight parameters and can be compared with the reported landing weight to look for discrepancies that should be investigated.*
35) *The raised length frequencies and landings weights are summed over all vessels of the target fleet sampled on that visit. The summed length compositions are then raised to the reported landed weight of all vessels of the fleet at that port on that sampling day. This represents the total raised length composition for the sampled PSU (port – day).*
36) *The raised length frequencies for all sampled PSUs in the stratum are summed, and then raised to the reported landed weight for the species for all landings of the fleet in the stratum.*
37) *Stratum raised length frequencies are then summed across strata to give the total length frequency for the fleet.*
38) *This is repeated for all other post-strata (e.g. fleets or metiers)".*

In reality the current procedure differs from step iii) on. Samples for a stock from a port over a period (month or quarter) are summed and raised to port x quarter based on the landed weights. These raised samples are then summed and raised to the unsampled ports.

2) The procedure for calculating age compositions from aged sub samples of fish is currently based on a conventional age-length key approach. The quarterly sample numbers at age in each length class are combined over all other strata to construct an age-length key for each quarter which is then applied to the fleet-raised length compositions for the quarter. The form of aggregation of samples over sampled trips to construct the ALKs can vary from species to species

3) Missing data may occur at several stages:

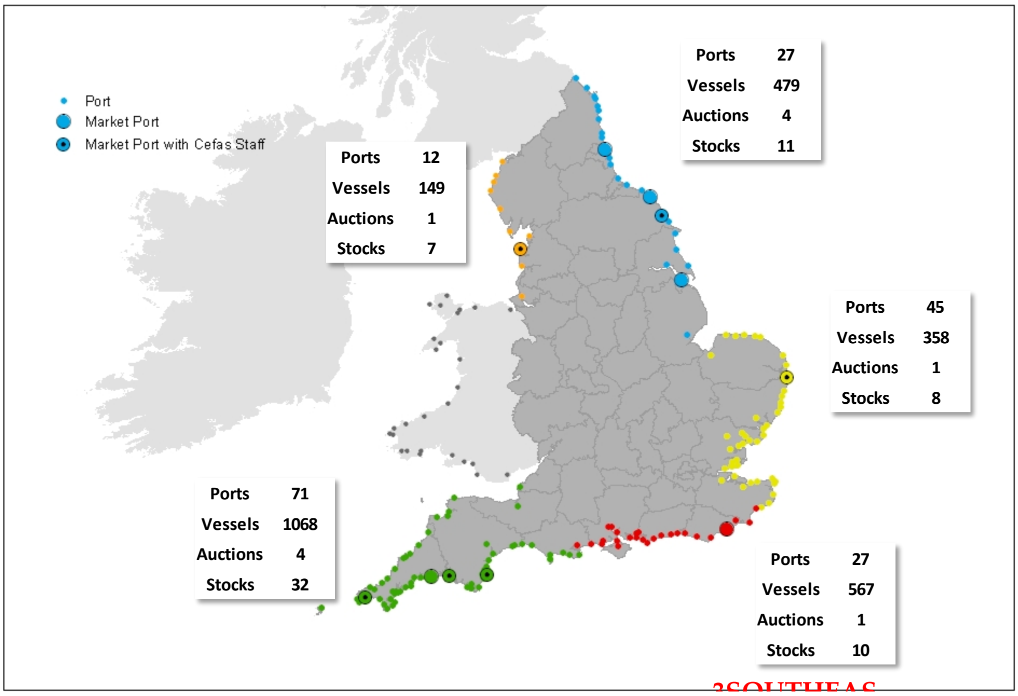
viii) *Species landings were reported at a sampled PSU, but no trips containing the species were sampled. In this case, the PSU is ignored, and the stratum-raised length frequency is derived from PSUs with data for that species.*

ix) *Species landings were reported in a stratum, but no PSUs were sampled for that species in the stratum. In this case, the landings for the sampled strata are raised to the total reported landings for all strata, including the non-sampled ones."*

UK (England)

Annex UK-1: Description of sampling sites and how they are stratified, with map of location of the sites.

Port group (used as a proxy for area (IV, VIId, VIIa etc):



Distribution of landings from areas into defined port groups:

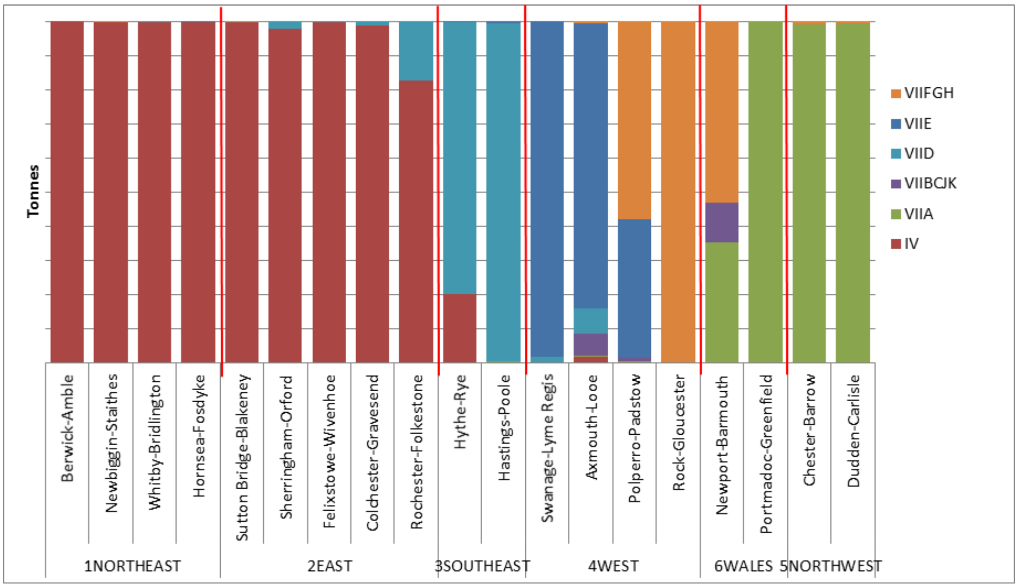


Table showing Regions and landings of the different species groups in 2012.

Regional Strata	CRU	DEM	PEL
1NORTHEAST	8272	4228	18
2EAST	1208	1044	655
3SOUTHEAST	948	2528	52
4WESTEAST	3527	8231	14648
4WESTWEST	3834	8761	4315
5NORTHWEST	458	442	0
6WALES	1206	1522	4
Grand Total	**19453**	**26756**	**19693**

Annex UK-2: Description of method for allocating sampling effort to strata

The Port Class is determined by ranking the ports based on sales data from the reference period within a geographical area by gear group:

Major1: The ports that account for the 1st 50% of the sales/effort.

Major2: The ports that account for the next 35% of the sales/effort.

Minor: The ports that account for the remaining 15%

If the number of active ports within a port group is < 10 then the Major1 ports are the top 75% by landings/sales/ trips and the next 15% are Major2 ports and the rest are Minor ports.

UK (England)

Example of Port classes

Key:

Major1	Up to 50%
Major2	Up to 85%
Minor	

DCFPort-Region	DCFSpe-cies	DCFGearType	PortClass	Port	Land-ings Tonnes	%
1NORTHEAST	DEM	E8 - Any gear	Major1	North Shields	1517.4	37.0
1NORTHEAST	DEM	E8 - Any gear	Major1	Grimsby	513.5	12.5
1NORTHEAST	DEM	E8 - Any gear	Major2	Amble	485.4	11.8
1NORTHEAST	DEM	E8 - Any gear	Major2	Blyth	455.6	11.1
1NORTHEAST	DEM	E8 - Any gear	Major2	Scarborough	393.2	9.6
1NORTHEAST	DEM	E8 - Any gear	Minor	Whitby	374.3	9.1
1NORTHEAST	DEM	E8 - Any gear	Minor	Hartlepool	282.7	6.9
1NORTHEAST	DEM	E8 - Any gear	Minor	Sunderland	61.7	1.5
1NORTHEAST	DEM	E8 - Any gear	Minor	….	….	….
2EAST	DEM	E8 - Any gear	Major1	Lowestoft	214.8	20.8
2EAST	DEM	E8 - Any gear	Major1	Ramsgate	170.5	16.5
2EAST	DEM	E8 - Any gear	Major1	West Mersea	124.1	12.0
2EAST	DEM	E8 - Any gear	Major2	Broadstairs	95.4	9.2
2EAST	DEM	E8 - Any gear	Major2	Folkestone	94.3	9.1

UK (England)

2EAST	DEM	E8 - Any gear	Major2	Brixham	51.9	5.0
2EAST	DEM	E8 - Any gear	Major2	Whitstable	48.4	4.7
2EAST	DEM	E8 - Any gear	Major2	Leigh-On-Sea	46.6	4.5
2EAST	DEM	E8 - Any gear	Major2	Orford	27.6	2.7
2EAST	DEM	E8 - Any gear	Minor	Newhaven	26.1	2.5
2EAST	DEM	E8 - Any gear	Minor	Rye	22.9	2.2
2EAST	DEM	E8 - Any gear	Minor	Queensborough	19.8	1.9
2EAST	DEM	E8 - Any gear	Minor	Felixstowe	17.2	1.7
2EAST	DEM	E8 - Any gear	Minor	Harwich	15.7	1.5
2EAST	DEM	E8 - Any gear	Minor	Walton-On-Naze	12.1	1.2
2EAST	DEM	E8 - Any gear	Minor	….	….	….
3SOUTHEAST	DEM	E8 - Any gear	Major1	Shoreham	543.9	21.7
3SOUTHEAST	DEM	E8 - Any gear	Major1	Rye	533.4	21.2
3SOUTHEAST	DEM	E8 - Any gear	Major2	Newhaven	496.3	19.8
3SOUTHEAST	DEM	E8 - Any gear	Major2	Eastbourne	192.2	7.7
3SOUTHEAST	DEM	E8 - Any gear	Major2	Poole	160.8	6.4
3SOUTHEAST	DEM	E8 - Any gear	Major2	Hastings	132.3	5.3
3SOUTHEAST	DEM	E8 - Any gear	Minor	Portsmouth	90.9	3.6
3SOUTHEAST	DEM	E8 - Any gear	Minor	Brixham	71.5	2.8
3SOUTHEAST	DEM	E8 - Any gear	Minor	Brighton	63.0	2.5
3SOUTHEAST	DEM	E8 - Any	Minor	Selsey	54.5	2.2

UK (England)

		gear				
3SOUTHEAST	DEM	E8 - Any gear	Minor	Plymouth	39.9	1.6
3SOUTHEAST	DEM	E8 - Any gear	Minor	Littlehampton	34.5	1.4
3SOUTHEAST	DEM	E8 - Any gear	Minor	Hythe	26.4	1.0
3SOUTHEAST	DEM	E8 - Any gear	Minor	….	….	….

Distribution of landings and trips across stratum in 2012 for Crustacean Sampling Frame

DCFPort-Region	DCFGearType	PortClass	Number Of Ports	Number Of Trips	Tonnes	% Port Region
1NORTHEAST	**E1 - Demersal trawlers, netters + liners**	Major1	1	3312	1740	22
		Major2	1	1871	449	6
		Minor	17	3171	412	5
	E4 - Shellfish pot & trap vessels	Major1	1	9125	2701	34
		Major2	4	10869	1664	21
		Minor	22	15411	1024	13
2EAST	**E4 - Shellfish pot & trap vessels**	Major1	1	603	117	10
		Major2	2	2739	144	12
		Minor	26	1248	58	5
3SOUTHEAST	**E4 - Shellfish pot & trap vessels**	Major1	2	1631	337	36
		Major2	2	5299	313	33
		Minor	24	3792	232	24
4WESTEAST	**E4 - Shellfish pot & trap vessels**	Major1	2	2938	1599	47
		Major2	3	4724	1098	32
		Minor	21	4461	598	17
4WESTWEST	**E4 - Shellfish pot & trap vessels**	Major1	2	3835	1604	42

		Major2	7	4638	1273	33
		Minor	31	3728	526	14
5NORTHWEST	**E4 - Shellfish pot & trap vessels**	Major1	1	62	2	0
		Major2	1	65	2	0
		Minor	3	12	0	0

Distribution of landings and trips across stratum in 2012 for Demersal Sampling Frame

DCFPort-Region	DCFGearType	PortClass	Number Of Ports	Number Of Trips	Tonnes	% Port Region
1NORTHEAST	**E1 - Demersal trawlers, netters + liners**	Major1	1	19564	1506	37
		Major2	4	18614	1783	44
		Minor	13	12506	682	17
2EAST	**E1 - Demersal trawlers, netters + liners**	Major1	3	8371	507	49
		Major2	6	7799	360	35
		Minor	36	3076	159	15
3SOUTHEAST	**E1 - Demersal trawlers, netters + liners**	Major1	6	35429	922	37
		Major2	6	35308	754	30
		Minor	26	19067	380	15
	E5 - Beam trawlers	Major1	3	3078	289	12
		Major2	1	494	54	2
		Minor	4	300	68	3
4WESTEAST	**E1 - Demersal trawlers, netters + liners**	Major1	1	41301	1517	19
		Major2	1	40750	1355	17
		Minor	26	27666	871	11
	E5 - Beam trawlers	Major1	1	14641	3120	38
		Minor	6	5031	744	9
4WESTWES	**E1 - Demersal trawlers, netters**	Major1	1	19510	2174	26

T	**+ liners**					
		Major2	4	11288	2137	26
		Minor	34	14875	811	10
	E5 - Beam trawlers	Major1	1	10286	2835	34
		Minor	4	124	312	4
5NORTHWEST	**E1 - Demersal trawlers, netters + liners**	Major1	1	2117	195	48
		Major2	1	2014	152	38
		Minor	7	886	39	10
6WALES	**E1 - Demersal trawlers, netters + liners**	Major1	1	969	171	36
		Major2	3	1950	129	27
		Minor	26	1219	81	17
	E5 - Beam trawlers	Major1	1	0	46	10
		Major2	1	321	42	9
		Minor	2	14	4	1

Distribution of landings and trips across stratum in 2012 for Pelagic Sampling Frame

DCFPort-Region	DCFGearType	PortClass	Number Of Ports	Number Of Trips	Tonnes	% Port Region
2EAST	**E1 - Demersal trawlers, netters + liners**	Major1	1	195	33	5
		Major2	2	136	47	7
		Minor	19	352	27	4
	E3 - Pelagic trawlers and seiners	Major1	1	61	311	47
		Major2	1	127	132	20
		Minor	4	4	104	16
4WESTEAST	**E1 - Demersal trawlers, netters + liners**	Major1	1	2261	858	6
		Major2	1	93	688	5
		Minor	20	5191	713	5

	E3 - Pelagic trawlers and seiners	Major1	1	125	7909	58
		Major2	1	354	2434	18
		Minor	4	154	1118	8
4WESTWEST	**E1 - Demersal trawlers, netters + liners**	Major1	1	3669	530	12
		Major2	2	940	393	9
		Minor	29	1826	217	5
	E3 - Pelagic trawlers and seiners	Major1	1	292	1598	38
		Major2	2	89	1145	27
		Minor	5	60	356	8

UK (England)

Member state:

UK (Scotland)

Target population

Best practice

The target population needs to be identified and described. Access to the target population for sampling purposes need to be analysed and documented.

Comment

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Bad practice

-

Member state sampling design

1) The target population for DCF is all fish and shellfish species for which estimates of landed quantities are required by Commission Decision 2010/93/EU, taking account of any derogations granted.

2) On-shore access to the landed catch is through a list frame of sales locations from which a stratified random selection is made for direct sampling on shore according to the procedures described below.

Primary sampling units (PSUs)

Best practice

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

Comment

If PSU is something else than trip, vessel or site the choice need to be thoroughly explained.

Bad practice

-

Member state sampling design

The PSU is an auction site on a specified day.

Sampling frame

Best practice

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.

Comment

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.

Bad practice

To exclude large parts of the target population in an ad-hoc way.

Member state sampling design

The sampling frame is a matrix of markets vs days of the year. Three sampling frames are defined:

- *i) Markets where demersal fisheries (under-10m and over-10m vessels) sell their catches and the fish are available for sampling.*
- *ii) Ports and processors where shellfish (e.g. crabs; lobsters) are landed by under-10m and over-10m vessels and the landings are available for sampling*
- *iii) Ports where pelagic species (mainly mackerel and herring) are landed and are available for sampling.*

The following sampling sites are excluded:

- *i) For demersal fisheries - small markets where the landings are sold, but which are remotely located and difficult to access without a substantial increase in resources. These collectively account for approx 20% of the total demersal landings.*
- *ii) The design for shellfish is under development so it is difficult to comment on this at this time.*
- *iii) No sites are excluded. Approximately 85% of trips by the pelagic fleet are sampled each year.*

Stratification of the sampling frame

Best practice

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.

Comment

If the desired minimum number of samples per stratum is not analytically as-

UK (Scotland)

sessed, the choice needs to be justified and described. Care needs to be taken to avoid over-stratification.

Bad practice

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.

Member state sampling design

1) The following strata are defined for each sampling frame:

- *i) 5 demersal markets/auctions.*
- *ii) The design for shellfish is under development so it is difficult to comment on this at this time.*
- *iii) No strata are defined.*

2) The overall demersal sampling effort is constrained by the financial and staff resources available within the lab. Currently around 36 staff weeks are available for demersal sampling on shore. The shellfish sampling scheme is under development, and the pelagic scheme is opportunistic, sampling all trips when logistics allow.

Distribution of sampling effort

Best practice

The way sampling effort is distributed between strata needs to be described. In accordance with best practice, this can be based on analysis of variance or just distributed proportionally.

The different sampling inclusion probabilities/weighting needs to be documented.

Comment

If other methods, such as expert judgment are used, this should be explained and justified.

Bad practice

-

Member state sampling design

1) Sampling effort (number of trips to sample by stratum) is allocated according to information on fishing effort and catches in previous years rather than using information on precision of estimates to conduct a statistical optimisation.

2) For each stratum, the ratio of number of market-day sampling visits to total number of market-day combinations in the sampling stratum is an indicator of the sampling inclusion probabilities at the PSU. The estimation procedure for length compositions of each species incorporates landings as an auxiliary variable

Sample selection procedure

Best practice

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 principle this means 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

Comment

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

Bad practice

Ad-hoc based sampling, without proper documentation to allow estimation of bias, where the sampling inclusion probabilities cannot be estimated.

Member state sampling design

An ad-hoc procedure is currently adopted. A summary of the procedure is as follows:

Markets are sampled approximately 3 weeks out of every 4 throughout the year. The weeks to sample markets are usually chosen for logistical reasons. The days chosen to sample each market is based on availability and the discretion of the observer.

Hierarchical structure in the sampling

Best practice

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)

Comment

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UK (Scotland)

Bad practice

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)

Member state sampling design

The hierarchy for sampling is as follows:

- *i) Primary sampling unit: A market on a day.*
- *ii) Secondary unit: a vessel landing.*
- *iii) Tertiary unit: boxes of fish within commercial size categories for a selected species*
- *iv) Fourth level: Individual fish sampled for length*
- *v) Fifth level: individual fish sampled for age (stratified by length)*

Protocol for selection of samples at lower sampling levels (SSU, etc.)

Best practice

Such protocols should exist in a national repository

Comment

-

Bad practice

-

Member state sampling design

- *i) The presentation of the catches is similar across markets. Vessel landings are selected at random from the available landings using a vessel selection form. The number of vessel landings sampled depends on the time available and the number of species sampled from each landing.*
- *ii) The choice of species to sample for a landing is at the discretion of the observer, and is based on many factors, including the time available and the species already sampled that day.*
- *iii) Currently, otoliths are collected in a length-stratified design. For a species, the Standard Operating Procedure specifies collecting 1 otolith per 1cm length class from each landing when sampling for length. This maintains the link between length and age sampling*

System to monitor performance of sampling schemes - Quality Indicators

Best practice

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.

Comment

-

Bad practice

-

Member state sampling design

The following systems are in place to monitor sampling performance and data quality:

1. *Sampling achievements are summarised and monitored on an ongoing basis on a spreadsheet held in a shared drive.*
2. *Non-response rates are recorded, for example if staff are refused access to landings to sample. These could be used to review potential bias and to improve on access to fisheries were consistent refusals are an issue. Currently these response rates are monitored internally by data managers and program managers and not published.*
3. *Monitoring spreadsheets are updated before departure and on return and these are used to provide a unique id for each trip and to track achievements. On return the sampler ensures all the paperwork is in good order and completed to a high minimum standard. These data are entered onto the sampling database, which includes a range of error traps.*
4. *Once entered, the data and data integrity is checked by another member of staff. Any errors are investigated, corrected and recorded.*
5. *Summary reports provide overviews to identify errors, and these are carried out monthly by an administrator. Any unusual values are investigated.*
6. *Summary reports provide overviews to identify errors, and outliers (length distributions by category, age-length plots, etc) are carried out annually by an administrator. Any unusual values are investigated.*
7. *Numbers of PSUs (port-days sampled) are documented as a proxy for effective sample size. Annual reports of sampling activity against fishing activity provide an indication of how sampling coverage.*

Documentation of raising/weighting procedure for national estimates

Best practice

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.

UK (Scotland)

Comment
-
Bad practice
-
Member state sampling design
1 & 2) Fleet-raised length, and where available, age, compositions are derived for major species. The estimation procedure to calculate total age or length compositions for a fleet-area-quarter combination – which are domains or post-strata – follows the hierarchy of sampling design below SSU level. A statistically sound estimation method following all levels of the hierarchy is in progress. The general procedure is as follows: *i) The national fleet activity database, which holds logbook or other sales data on individual landings, is accessed to locate the data for each vessel trip sampled. This may require searching surrounding dates and cross-matching other trip information (gear; mesh; species composition) collected by the sampler. The gear, mesh, area etc. are attached to the sample data in the data base.* *ii) The age or length composition recorded from individual boxes sampled is raised to the total observed trip landing of the vessel using the documented raising factors (e.g. ratio of total number of boxes to number of sampled boxes). The weight of the raised age or length frequency is calculated using length-weight parameters and can be compared with the reported landing weight to look for discrepancies that should be investigated.* *iii) The raised length frequencies for all sampled trips in the domain are summed, and then raised to the reported landed weight for the species for all landings of the fleet in the stratum.* *iv) This is repeated for all other domains.* 3) Domains are chosen in an attempt ensure there are no empty cells. If domains have not been sampled then age/length composition estimates are not reported for those domains. Non-responses are not adjusted for specifically, but all landings or trips for a domain are included in the estimation.

Landing Obligation Questionnaires

Request for information WGCATCH attendees
In order to address ToR 3) "*Provide advice on adapting sampling protocols to anticipated changes in management measures (e.g. discard ban) or technical advances in monitoring*", please provide your replies in the *grey-blue boxes*.

Member state:

Basque Country (Spain)

Which fisheries will be impacted by the landings obligation and how many VMS and non-VMS vessels in each?

Pelagic fisheries from 2015:

- *Purse seine targeting small pelagic species: 165 VMS vessels landing in basque ports (50 based in the BC) and no vessels without VMS*

Demersal fisheries from 2016:

- *Otter trawl >= 70mm (mixed demersal and mixed demersal an cephalopods): 18 VMS vessels, landing in basque ports (8 based in BC) and no vessels without VMS.*
- *Pair bottom trawl >= 70mm (hake): 4 VMS vessels, no vessels without VMS*
- *Pair bottom trawl >=55mm (hake,blue withing and mackerel): 4 VMS vessels, no vessels without VMS*
- *Longlines: 7 VMS vessels, 27 vessels without VMS*
- *Gillnets: 13 VMS vessels, 35 vessels without VMS*

Presumably not impacted:

- *Pots: 12 vessels without VMS*

Data for vessels <12m is available by trip but probably the information is incomplete.

What percentage of each fleet currently has an observer on board and is this coverage intended to continue?

- *Otter trawl >= 70mm: current coverage: 4.9%*
- *Pair trawl >= 70mm: current coverage: 4.4%*
- *Purse seine: current coverage: 0% (around 0.2 expected for 2015)*
- *Rest of the fleet is not covered by observers. For gillnets under 15LOA, a self-sampling programme has been carried out since 2009.*

At the moment the scientific observer programme is totally independent from enforcement and skippers take observers out on a voluntary basis. We expect that skippers may be more reluctant to accept observers once the landings obligation comes into force. We do not know yet how this will affect the scientific observer programme.

What percentage of vessels have CCTV to monitor catch composition and discard-

ing
None
What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips with observers on board have different fishing behaviours and discarding patterns to vessels without observers
Species composition, VMS data, length frequency distributions (LFD) of the catches / landings, *The data could be used to:* *1) Identify other vessels using the same fishing grounds to compare the species composition of the landed fish from trips with and without observers.* *2) Identify other vessels using the same fishing grounds to compare the LFDs of the landed fish from trips with and without observers.* *3) Compare the location of the fishing activities of the observed trip with other trips by the same vessel to see if the observed trip was atypical.*
What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips without observers on board have unreported discards of species or sizes of fish that must be landed under the landings obligation (> de minimis quantities).
Species composition, VMS data, length frequency distributions (LFD) of the catches / landings, *The data could be used to:* *1) Identify other vessels using the same fishing grounds to compare the species composition of the landed fish from trips with and without observers.* *2) Identify other vessels using the same fishing grounds to compare the LFDs of the landed fish from trips with and without observers.*

Member state:
Belgium
Which fisheries will be impacted by the landings obligation and how many VMS and non-VMS vessels in each?
Pelagic fisheries from 2015: • *no vessels* *Demersal fisheries from 2016:* • *Otter trawl 70-99mm (demersal fish): 8 VMS vessels* • *Otter trawl >= 100mm (demersal fish): 1 VMS vessels* • *Otter trawl 16-31mm (brown shrimp): 1 VMS vessels* • *Beam trawl 70-99mm (demersal fish): 33 VMS vessels* • *Beam trawl>= 120mm (demersal fish): 8 VMS vessels* • *Beam trawl 16-31mm (brown shrimp): 19 VMS vessels* • *Seine: 3 VMS vessels* • *Gillnets: 1 VMS vessel* • *Trammel nets: 1 VMS vessel* *Presumably not impacted:* • *Dredges: 1 VMS vessels* *Some vessels participate in more than one fishery; they were only counted for the dominant fishery.*
What percentage of each fleet currently has an observer on board and is this coverage intended to continue?
• *Otter trawl 70-99mm (demersal fish): 0%* • *Otter trawl >= 100mm (demersal fish): 0%* • *Otter trawl 16-31mm (brown shrimp): 0%* • *Beam trawl 70-99mm (demersal fish): 1%* • *Beam trawl>= 120mm (demersal fish): 0.2%* • *Beam trawl 16-31mm (brown shrimp): 0%* • *Seine: 0%* • *Gillnets: 0%* • *Trammel nets: 0%* *At the moment the scientific observer programme is totally independent from enforcement and skippers take observers out on a voluntary basis. We expect that skippers may be more reluctant to accept observers once the landings obligation comes into force. We do not know yet how this will affect the scientific observer programme.*
What percentage of vessels have CCTV to monitor catch composition and discarding
None

What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips with observers on board have different fishing behaviours and discarding patterns to vessels without observers
VMS data, length frequency distributions (LFD), weights of the catches / landings. *The data could be used to:* 4) *Identify other vessels using the same fishing grounds to compare the LFDs of the landed fish from trips with and without observers.* 5) *Compare the location of the fishing activities of the observed trip with other trips by the same vessel to see if the observed trip was atypical.*
What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips without observers on board have unreported discards of species or sizes of fish that must be landed under the landings obligation (> de minimis quantities).
VMS data, length frequency distributions (LFD), weights of the catches / landings. *The data could be used to:* 3) *Calculate the proportion of trips that are missing small fish that are landed by other vessels using the same fishing ground and gear. (Assuming that not all vessels are discarding illegally)*

Belgium

Member state:

Denmark

Which fisheries will be impacted by the landings obligation and how many VMS and non-VMS vessels in each?

Based on 2014 data. Vessels >= 12 m have VMS, smaller vessels counts as without VMS. There is only gear information on vessels with logbooks.

1 January 2015:

Fishery	Number of vessels with VMS	Number of vessels without VMS
Pelagic fishery (OTM, PTM)	91	4
Sandeel fishery (vessels landing more than 1 ton sandeel)	95	5

Cod fishery in the Baltic Sea (22-32). Vessels landing more than 50 kg cod

Fishery	Number of vessels with VMS	Number of vessels without VMS
Bottom trawl	31	25
Demersal seines	6	1
Gillnet	7	84

1 January 2016

North Sea fishery

Fishery	Number of vessels with VMS	Number of vessels without VMS
NS Bottom trawl < 100 mm (excluding sandeel fishery)	87	5
NS Bottom trawl >= 100mm	38	13
NS Demersal seines	21	0
NS Gillnet	44	61

What percentage of each fleet currently has an observer on board and is this coverage intended to continue?

- *Pelagic trawl: current coverage: 0%*
- *Otter trawl Baltic > 100mm: current coverage: 0.71%*
- *Otter trawl North Sea > 120mm: current coverage: 0.85%*

- *Otter trawl North Sea < 100mm: current coverage: 2.41%*
- *Otter trawl North Sea > 100mm< 119: current coverage: 0.65%*
- *Gillnetter North Sea and Skagerrak : current coverage: 1.34%*
- *Otter trawl shrimp<= 100mm: current coverage: 0.66%*
- *Seine: current coverage: 0.71%*
- *Beam trawl current coverage: 0.52%*

Presently the intention is to continue the observer program at the same level. At the moment the scientific observer programme is totally independent from enforcement and skippers take observers out on a voluntary basis. We expect that skippers may be more reluctant to accept observers once the landings obligation comes into force. We do not know yet how this will affect the scientific observer programme.

What percentage of vessels have CCTV to monitor catch composition and discarding

20 trawlers, 13 gillnetters, 5 Danish Seines, 1 longliner

What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips <u>with</u> observers on board have different fishing behaviours and discarding patterns to vessels without observers

VMS data, length frequency distributions (LFD) of the catches / landings.

The data could be used to:

6) *Identify other vessels using the same fishing grounds to compare the LFDs of the landed fish from trips with and without observers.*
7) *Compare the location of the fishing activities of the observed trip with other trips by the same vessel to see if the observed trip was atypical (VMS).*
8) *Compare the species composition in the catch*
9) *Compare the size sorting distribution of the landing on observer trips vs. trips without observer.*

What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips <u>without</u> observers on board have unreported discards of species or sizes of fish that must be landed under the landings obligation (> de minimis quantities).

VMS data, length frequency distributions (LFD) of the catches / landings.

The data could be used to:

4) *Calculate the proportion of trips that are missing small fish that are landed by other vessels using the same fishing ground and gear. (Assuming that not all vessels are discarding illegally)*

Member state:

Spain

Which fisheries will be impacted by the landings obligation and how many VMS and non-VMS vessels in each?

	METIER_DCF	*number of vessels*	*vessel with VMS*	*vessel without VMS (< 15m)*
Pelagic fisheries from 2015:	*PS_SPF_0_0_0*	*543*	*280*	*263*
Demersal fisheries from 2016:	*GNS_DEF_>=100_0_0*	*55*	*40*	*15*
	GNS_DEF_120-219_0_0	*4*	*4*	*0*
	GNS_DEF_40-59_0_0	*301*	*1*	*300*
	GNS_DEF_60-79_0_0	*762*	*32*	*730*
	GNS_DEF_80-99_0_0	*51*	*41*	*10*
	LHM_DEF_0_0_0	*57*	*25*	*32*
	LLS_DEF_0_0_0	*1263*	*128*	*1135*
	OTB_DEF_100-119_0_0	*13*	*13*	*0*
	OTB_DEF_70-99_0_0	*28*	*28*	*0*
	OTB_DEF_>=55_0_0	*68*	*68*	*0*
	OTB_MCD_>=55_0_0	*143*	*134*	*9*
	OTB_MPD_>=55_0_0	*59*	*59*	*0*

What percentage of each fleet currently has an observer on board and is this coverage intended to continue?

- *Gillnets GNS_DEF > 60mm: 0.04%*
- *OTB_ DEF_ >= 55_0_0: 0.8%*
- *OTB_MPD_ >= 55_0_0: 1.2%*
- *OTB_MCD_ >=55_0_0: 0.1%*
- *OTB_DEF_ >= 70-99_0_0: 1.9%*
- *OTB_DEF_ >= 100_0_0: 0.6%*
- *PTB_DEF_>= 55_0_0: 0.4%*

At the moment the scientific observer programme is totally independent from enforcement and skippers take observers out on a voluntary basis. We expect that skippers may be more reluctant to accept observers once the landings obligation comes into force. We do not know yet how this will affect the scientific observer programme.

Spain

What percentage of vessels have CCTV to monitor catch composition and discarding
None
What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips <u>with</u> observers on board have different fishing behaviours and discarding patterns to vessels without observers
Comparison of the retained catch on board with the landings in the habour is probably the best way to identify any possible bias due to the presence of an observer.
What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips <u>without</u> observers on board have unreported discards of species or sizes of fish that must be landed under the landings obligation (> de minimis quantities).
The comparison of size structure on board with that of the landings in the harbours from the same boats is probably the best way to identify trips without observers on board for species or sizes of fish that must be landed under the landings obligation. However this exercise would be costly due to the logistics involved. In addition, this action could blur the lines between a scientific observer programme and an enforcement programme which are at present totally independent and should remain so to ensure the comparison of the time series.

Member state:

France

Which fisheries will be impacted by the landings obligation and how many VMS and non-VMS vessels in each?

Pelagic fisheries from 2015:

- *Pelagic trawl (for small pelagics): 114 VMS vessels and 16 vessels without VMS*

Demersal fisheries from 2016:

- *Otter trawl < 100mm (nephrops): 158 VMS vessels, 130 vessels without VMS*
- *Otter trawl >= 100mm (whitefish): 168 VMS vessels, 22 vessels without VMS*
- *Otter trawl < 100mm (whitefish): 471 VMS vessels, 358 vessels without VMS*
- *Beam trawl: 58 VMS vessels and 17 vessels without VMS*
- *Seine: 11 VMS vessels and no vessel without VMS*
- *Dredges: 277 VMS vessels and 380 vessels without VMS*
- *Gillnets: 159 VMS vessel, 837 vessels without VMS*
- *Longlines: 34 VMS vessels, 490 vessels without VMS*

Presumably not impacted:

- *Pots: 51 VMS vessels and 600 vessels without VMS*

Data for vessels <10m is as available as larger vessels, since they have a monthly declarative form to fill and sales notes.

The database was filtered for vessels operating in the ICES area and vessels with less than 10 fishing trips in 2013 were considered to be inactive and not included in the count of the number of vessels.

Some vessels participate in more than one fishery; they were counted in each fishery when satisfying the condition of more than 10 trips in the given fishery.

What percentage of each fleet currently has an observer on board and is this coverage intended to continue?

- *Pelagic trawl targeting small pelagics : current coverage: 1 - 2% / area*
- *Otter trawl < 100mm targeting Nephrops: current coverage: 0.2%*
- *Otter trawl > 100mm targeting whitefish: current coverage: 4 - 15% / metier * area*
- *Otter trawl <100mm targeting whitefish : current coverage : 0.2 - 0.6% / Metier * area*
- *Gillnetters, current coverage : 0.3 – 1.3 / Metier * area*
- *Beam trawl, current coverage: 1%*
- *Seine, current coverage: 1.4%*
- *Dredges, current coverage : 0.4%*
- *Longlines : 0.1%*

At the moment the scientific observer programme is totally independent from enforcement and skippers take observers out on a voluntary basis. We expect that skippers may be more reluctant to accept observers or behave differently from their usual business when observers are onboard, once the landings obligation comes into force. We do not know yet how this will

affect the scientific observer programme.
What percentage of vessels have CCTV to monitor catch composition and discarding
None
What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips <u>with</u> observers on board have different fishing behaviours and discarding patterns to vessels without observers
Commercial categories distribution and ratio under and over reference size presented to the auction between observed and non observed vessels operating the same fishing grounds with the same gear *VMS data to evaluate if fishing grounds are identical when an observer is onboard or not* *LFDs of the catches / landings onboard and on-shore for identical fisheries* *Idea : maximise the number of observed trips on a very few fisheries and allocate all the observer work force on these?*
What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips <u>without</u> observers on board have unreported discards of species or sizes of fish that must be landed under the landings obligation (> de minimis quantities).
It is really important to quantify and access the component sold under the minimum reference size, and that this component is sorted by species

France

Member state:

Germany

Which fisheries will be impacted by the landings obligation and how many VMS and non-VMS vessels in each?

Pelagic fisheries from 2015:

- *Pelagic trawl in North Sea and North Atlantic: 6 VMS vessels and no vessels without VMS*
- *Industrial fisheries: 2 VMS vessels and no vessels without VMS*

Baltic fisheries for herring, sprat and cod from 2015:

- *~70 trawlers with VMS*
- *Several hundred vessels <15m without VMS (mostly passive gear, very few trawlers with <15 m loa); data for vessels <8m is available in aggregated form only*

Demersal fisheries from 2016:

- *Otter trawl >= 120mm (cod,saithe in I,II): 4 VMS vessels and no vessels without VMS*
- *Scottish Seine >= 120mm (haddock in IIIa): 3 VMS vessels and no vessels without VMS*
- *Gillnet 90-119mm (flatfish in IIIa): 3 VMS vessels and no vessels without VMS*
- *Otter trawl 90-119mm (nephrops in IIIa): 2 VMS vessels and no vessels without VMS*
- *Otter trawl 70-99mm (nephrops in IV): 7 VMS vessels and no vessels without VMS*
- *Otter trawl >= 120mm (gadoids in IV): 11 VMS vessels and no vessels without VMS*
- *Beam trawl 70-99mm (Flatfish in IV): 6 VMS vessels and no vessels without VMS*
- *Otter trawl 70-99mm (Flatfish in IV): 10 VMS vessels and no vessels without VMS*
- *Otter trawl >=130mm (Greenland halibut, redfish, cod in XIV and NAFO): 4 VMS vessels and no vessels without VMS*
- *Gillnets >=220mm (anglerfish): 4 VMS vessel and no vessels without VMS*

Later:

- *Beam trawl 16-31mm (Brown shrimp in IVb): 173 VMS vessels and ~18 vessels without VMS*

Possibly not impacted:

- *Pots (Deep Sea Red Crab): 1 VMS vessel*

Note: Some vessels participate in more than one fishery.

What percentage of each fleet currently has an observer on board and is this coverage intended to continue?

- *Pelagic trawl in North Sea and North Atlantic: ~9-10%*
- *Industrial fisheries: 0%*

- *Pelagic trawl in the Baltic: 0 % (self-sampling programme)*
- *Demersal trawl in the Baltic: <1%*
- *Gill net fisheries in the Baltic: <1%*
- *Other fisheries in the Baltic Sea: <1% - ~30%*
- *Otter trawl >= 120mm (cod,saithe in I,II): ~7%*
- *Scottish Seine >= 120mm (haddock in IIIa): 0%*
- *Gillnet 90-119mm (flatfish in IIIa): 0%*
- *Otter trawl 90-119mm (nephrops in IIIa): 0% (Derogation, sampled by DK)*
- *Otter trawl 70-99mm (nephrops in IV): 0% (Derogation, sampled by DK)*
- *Otter trawl >= 120mm (gadoids in IV): ~1.5%*
- *Beam trawl 70-99mm (Flatfish in IV): ~1.5%*
- *Otter trawl 70-99mm (Flatfish in IV): ~1.5%*
- *Otter trawl >=130mm (Greenland halibut, redfish, cod in XIV and NAFO): ~14%*
- *Gillnets >=220mm (anglerfish): 0%*
- *Beam trawl 16-31mm (Brown shrimp in IVb): ~0.05%*
- *Pots (Deep Sea Red Crab): 0%*

Calculations based on number of trips.

We are planning to continue the current scientific observer programme but we are expecting difficulties because the entanglement with enforcement after the landings obligation comes into force. It might be that the enforcement programme will take on the role of obtaining biological information which might be even more biased than presently.

What percentage of vessels have CCTV to monitor catch composition and discarding

1 pelagic freezer trawler, 2 otter trawler operating in the North Sea and Baltic Sea

What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips with observers on board have different fishing behaviours and discarding patterns to vessels without observers

compare LFD of catches sampled onboard the same vessels in previous years from the fishing ground

VMS data over time from the same vessel, i.e. comparison to previous years VMS patterns of the same vessel

Compare LFD of catches from vessels sampled at sea and vessels landing their catch from the same fishing ground and the same time period

Use longer-term information from CCTV vessels plus information from observers on CCTV vessel and compare this with landed catch of vessels from the same fishing ground and the same time period

What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips without observers on board have unreported discards of species or sizes of fish that must be landed under the landings obligation (> de minimis quantities).

determine discard of "cooperative vessels" at sea (i.e. with observers) and compare with discard amounts and LFD of vessels landing their catch from the same fishing ground and the same time period

Germany

Member state:
Greece
Which fisheries will be impacted by the landings obligation and how many VMS and non-VMS vessels in each?
Pelagic fisheries from 2015: • *Purse seine: 251 VMS vessels and no vessels without VMS* *Demersal fisheries from 2016:* • *Otter trawl (mixed demersal fish, crustaceans and cephalopods): 292 vessels all with VMS* • *Gillnets: 8 VMS vessel and 3100 without (95% of them <10m.)* • *Trammel nets: 16 VMS vessels and 6950 without (95% of them <10m.)* • *Longlines: 41 VMS vessels, 4170 vessels without (92% of them <10m.)* • *Pots/Traps: 2 VMS vessels, 371 vessels without (92% of them <10m.)* *These are data considering only vessels that were counted as active during 2013.* *Data for small scale fishery vessels are not very reliable because they only consist on the fishermen logbooks and sale books and they do not have a mandatory declarative form to fill.* *Some vessels participate in more than one fishery; they were only counted for the dominant fishery.*
What percentage of each fleet currently has an observer on board and is this coverage intended to continue?
We do not actually have observers on board. During the days that sampling at sea is taking place, the sampling team also serve as observers. That is why we don't use a percentage but actual days at sea. • *Otter trawl : 378 days* • *Purse Seine : 236 days* • *The rest of the fleet is not covered by observers* *There is no observer programme enforced and skippers take observers out as on board samplers. As long as on board sampling continues to take place, observing will also continue.*
What percentage of vessels have CCTV to monitor catch composition and discarding
None
What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips <u>with</u> observers on board have different fishing behaviours and discarding patterns to vessels without observers
VMS data, length frequency distributions (LFD) of the catches / landings. *The data could be used to:* 10) *Identify other vessels using the same fishing grounds to compare the LFDs of the*

landed fish from trips with and without observers. 11) *Compare the location of the fishing activities of the observed trip with other trips by the same vessel to see if the observed trip was atypical.*
What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips without observers on board have unreported discards of species or sizes of fish that must be landed under the landings obligation (> de minimis quantities).
VMS data, length frequency distributions (LFD) of the catches / landings.

Greece

Member state:

Ireland

Which fisheries will be impacted by the landings obligation and how many VMS and non-VMS vessels in each?

Pelagic fisheries from 2015:

- *Pelagic trawl: 27 VMS vessels and no vessels without VMS*

Demersal fisheries from 2016:

- *Otter trawl < 100mm (nephrops): 30 VMS vessels, 21 vessels without VMS and a large number of <10m vessels*
- *Otter trawl >= 100mm (whitefish): 43 VMS vessels, 8 vessels without VMS and perhaps some <10m vessels*
- *Beam trawl: 13 VMS vessels and no vessels without VMS*
- *Seine: 11 VMS vessels and 1 vessel without VMS*
- *Dredges: 7 VMS vessels, 29 vessels without VMS and a large number of <10m vessels*
- *Gillnets: 4 VMS vessel, 13 vessels without VMS and a large number of <10m vessels*
- *Longlines: no VMS vessels, 5 vessels without VMS*

Presumably not impacted:

- *Pots: 4 VMS vessels, 65 vessels without VMS and a large number of <10m vessels*

Data for vessels <10m is available in aggregated form only, no vessel specific information is available in the Irish logbooks database.

Vessels with less than 100h of fishing effort in 2013 were considered to be inactive and not included in the count of the number of vessels.

Some vessels participate in more than one fishery; they were only counted for the dominant fishery.

What percentage of each fleet currently has an observer on board and is this coverage intended to continue?

- *Pelagic trawl: current coverage: 1.2%*
- *Otter trawl < 100mm:: current coverage: 0.8%*
- *Otter trawl >= 100mm:: current coverage: 2.1%*
- *Beam trawl: current coverage: 1.5%*
- *Seine: : current coverage: 2.1%*
- *Dredges: 0.4%*

At the moment the scientific observer programme is totally independent from enforcement and skippers take observers out on a voluntary basis. We expect that skippers may be more reluctant to accept observers once the landings obligation comes into force. We do not know yet how this will affect the scientific observer programme.

What percentage of vessels have CCTV to monitor catch composition and discarding

None

What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips with observers on board have different fishing behaviours and discarding patterns to vessels without observers

VMS data, length frequency distributions (LFD) of the catches / landings.

The data could be used to:

12) *Identify other vessels using the same fishing grounds to compare the LFDs of the landed fish from trips with and without observers.*
13) *Compare the location of the fishing activities of the observed trip with other trips by the same vessel to see if the observed trip was atypical.*

What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips without observers on board have unreported discards of species or sizes of fish that must be landed under the landings obligation (> de minimis quantities).

VMS data, length frequency distributions (LFD) of the catches / landings.

The data could be used to:

5) *Calculate the proportion of trips that are missing small fish that are landed by other vessels using the same fishing ground and gear. (Assuming that not all vessels are discarding illegally)*

Member state:

Lithuania

Which fisheries will be impacted by the landings obligation and how many VMS and non-VMS vessels in each?

Pelagic fisheries from 2015:

- *Pelagic trawl: 19 VMS vessels (15 of 19 vessels participate in demersal fisheries as well)*

Demersal fisheries from 2015:

- *Otter trawl >= 110mm (cod in the Baltic Sea): 22 VMS vessels (15 of 22 vessels participate in pelagic fisheries as well)*
- *Gillnets: 1 VMS vessel, 7 vessels without VMS and a large number of <10m vessels*

Demersal fisheries from 2016:

- *Beam trawl: 1 VMS vessel and no vessels without VMS*

Presumably not impacted:

- *Pots: no VMS vessels, 9 of <10m vessels*

Data for vessels <8 m is available in aggregated form only, no vessel specific information is available in the Lithuanian logbooks database.

All vessels with overall length <10m participate in more than one fishery; they were only counted for the dominant fishery.

What percentage of each fleet currently has an observer on board and is this coverage intended to continue?

- *Pelagic trawl: current coverage: 0%*
- *Otter trawl >= 110mm: current coverage: 1%*
- *Gillnets: current coverage: 0%*
- *Beam trawl: current coverage: 0%*

We expect that the fishery control programme will replace scientific observer programme after the landings obligation comes into force. All fleet segments have limited capacity to carry observers on board and we expect that this obligation will facilitate data collection

What percentage of vessels have CCTV to monitor catch composition and discarding

None

What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips with observers on board have different fishing behaviours and discarding patterns to vessels without observers

VMS data, logbooks data of the catches / landings.

The data could be used to:

14) *We have implemented registration system of discards similar to logbooks (fishermen are obligated to register volumes of discarded fish by species). In order to check if records are realistic, we do regular inspections at sea (once per month) to perform analysis of discards on board.*
15) *Then we do recalculation of discards for all fleet and do comparison between data from logbooks and data gathered by scientists.*
16) *Comparison of minimum landing size at sea and landing places (to see if fish for sale has similar length structure at sea and auction).*

What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips without observers on board have unreported discards of species or sizes of fish that must be landed under the landings obligation (> de minimis quantities).

VMS data, length frequency distributions (LFD) of the catches / landings.

The data could be used to:

6) *Data of possible unreported landings are regularely are checked in harbours;*
7) *Length distribution also regularely have been analysing at landing places to check if minimum landing size is respected.*

Member state:	
The Netherlands	
Which fisheries will be impacted by the landings obligation and how many VMS and non-VMS vessels in each?	
Pelagic from 2015:	
Otter midwater trawls	33
Demersal from 2016:	
Beam trawls	169
Shrimp trawls	189
Boat dredges	3
Combined gill-trammel net	1
Danish seines	3
Fyke net	15
Gillnets	5
Gillnets (drifting)	1
Gillnets (standing)	182
Handlines and pole-lines (hand operated)	80
Long lines (set)	1
Mechanical (suction) dredge	6
Otter bottom trawls	121
Pair bottom trawls	1
Pots	89
Purse seiner	14
Scottish seines	35
Trammel nets	17
The table above shows the total number of vessels active per type of their main fishery. Vessels <10m do not sport VMS in general, there could possibly a few gillnetters, trammelnet-	

ters and potters not having VMS, unfortunately we don't have this information available.

What percentage of each fleet currently has an observer on board and is this coverage intended to continue?

- *Otter midwater trawls: current coverage: 15.0 % (based on trips)*
- *Beam trawls: current coverage: 2.8 % (based on kWdays)*
- *Scottish seines: current coverage: 3.4 % (based on D.A.S.)*
- *Otter bottom trawls: current coverage: 6.2 %(based on D.A.S.)*
- *Shrimp trawls: current coverage: < 0.1 % (based on D.A.S.)*

At the moment the scientific observer programme is totally independent from enforcement and skippers take observers out on a voluntary basis. We expect that skippers may be more reluctant to accept observers once the landings obligation comes into force. We do not know yet how this will affect the scientific observer programme.

What percentage of vessels have CCTV to monitor catch composition and discarding

Total 11 vessels: 6 Scottish Seiners, 17 % of total seine fleet, and 5 mixed bottom trawl (otter trawl and beam trawl), < 0.1 % of all otter trawlers and beam trawlers.

What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips with observers on board have different fishing behaviours and discarding patterns to vessels without observers

VMS data, length frequency distributions (LFD) of the catches / landings.

The data could be used to:

17) *Identify other vessels using the same fishing grounds to compare the LFDs of the landed fish from trips with and without observers.*
18) *Compare the location of the fishing activities of the observed trip with other trips by the same vessel to see if the observed trip was atypical.*
19) *Compare composition of market categories to detect highgrading.*
20)

What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips without observers on board have unreported discards of species or sizes of fish that must be landed under the landings obligation (> de minimis quantities).

VMS data, length frequency distributions (LFD) of the catches / landings.

The data could be used to:

8) *Calculate the proportion of trips that are missing small fish that are landed by other vessels using the same fishing ground and gear. (Assuming that not all vessels are discarding illegally)*

Member state:

Poland

(concern mainly the Baltic Sea) – description below was prepared by W. Grygiel and M. Adamowicz from the NMFRI in Gdynia

Which fisheries will be impacted by the landings obligation and how many VMS and non-VMS vessels in each?

Baltic pelagic fisheries from 2015:

- *Pelagic trawls: 76 VMS vessels and any vessels without VMS will be used.*

Baltic demersal fisheries from 2015:

- *Otter trawl: 79 VMS vessels and 13 vessels without VMS,*
- *Seine: none VMS vessels and 1 vessel without VMS,*
- *Gillnets: 33 VMS vessels and 345 vessels without VMS,*
- *Longlines: 2 VMS vessels and 17 vessels without VMS will be active.*

Presumably not impacted in the case of the Baltic Sea:

- *Traps: 54 vessels without VMS are active,*
- *large numbers (ca. 170) of small vessels with the length below 12 m, targeting species not mentioned in the landing obligation.*

In 2013, totally three long-distant factory vessels, owned by the private company, were fishing in NE-Atlantic and near the coast of Mauretania. At present time it is difficult to assess the impact of the landing obligation on the above-mentioned type of fishery.

All vessels that had any catches of the Baltic fish species listed in the landing obligation, registered in 2013, were considered active and included in the count of the number of vessels in the forthcoming years.

Some vessels from the Baltic fleet, participate in more than one type of fishery therefore, they were only counted for the dominant fishery.

What percentage of each fleet currently has an observer on board and is this coverage intended to continue?

- *Pelagic trawl: 25.0% (6)*
- *Otter trawl: 7.7% (9)*
- *Gillnets: 1.5% (8)*
- *Longlines: 8.6% (3)*
- *Pots: 4.2% (5)*

Note: the values above were counted as a proportion of the unique vessel external markings on board of which observers from NMFRI (Gdynia) were working to total numbers of active vessels, taken from the EU Fleet Register, used above-mentioned gear types.

It is predicted that almost the same coverage like in 2013 intend to be continued in 2015. Our intention is to implement the statistically sound catch sampling programme in the incoming years. The new programme will allow us to keep the sampling coverage at the demanded level.

What percentage of vessels have CCTV to monitor catch composition and discarding
None
What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips <u>with</u> observers on board have different fishing behaviours and discarding patterns to vessels without observers
VMS data, logbook data with a catch composition information (haul by haul if possible) *The data could be used to:* *21) Compare the information on registered catches with the catch composition observed by scientific-observers.* *22) Verify the fishing areas reported by fisherman with the data collected by observers.*
What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips <u>without</u> observers on board have unreported discards of species or sizes of fish that must be landed under the landings obligation (> de minimis quantities).
VMS data. *The data could be used to:* *9) Compare the catch composition and fish size groups obtained directly from landings with the results elaborated by observers from given area and gear type.*

Poland

Member state:

Portugal

Which fisheries will be impacted by the landings obligation and how many VMS and non-VMS vessels in each?

Pelagic fisheries from 2015:

- *None will be impacted*

Demersal fisheries from 2016:

- *To be decided. Discard plan currently being discussed*

For 2016 we do not know yet what fisheries and how landings obligation will affect the scientific observer programme because the details of discard plans for South Western Waters are still being worked out.

What percentage of each fleet currently has an observer on board and is this coverage intended to continue?

Estimates of fleet coverage for 2013 based on logbook data (OTB) and sales data (remaining fleets):

- *Otter trawl >= 55mm: current coverage: 13% (No. vessels); 0.37% (No. trips)*
- *Otter trawl >= 65mm (a): current coverage: 15% (No. vessels); 0.53% (No. trips)*
- *Purse seine >= 16mm (b): current coverage: 20% (No. vessels); 0.23% (No. trips)*
- *Deepwater longline (b): current coverage: 12% (No. vessels); 0.10% (No. trips)*
- *Beam trawl (b): current coverage: 30% (No. vessels); 0.90% (No. trips)*
- *Gillnets and trammel (b): current coverage: 2% (No. vessels); 0.02% (No. trips)*

1. *includes otter trawls licensed to operate with mesh size >=70 mm that target demersal fish species.*
2. *due to the multi-gear and multi-species nature of the vast majority of the Portuguese fishing fleet, the results are based on vessel lists generated at IPMA based on license data and catch data. Mutually independent vessel lists are generated for purse seiners targeting small pelagic fish, deepwater longliners targeting black scabbard fish, beam trawlers targeting crustaceans and gill/trammel netters targeting a variety of demersal species, amongst other fleets.*

At the moment the scientific observer programme is totally independent from enforcement and skippers take observers out on a voluntary basis. IPMA will continue onboard sampling for DCF purposes throughout 2015. We expect skippers to be more reluctant to accept observers once the landings obligation comes into force in EU countries and to start change their onboard practices when observers are present. We do not know yet how this will affect the scientific observer programme but we anticipate disruptions in our time-series of discards.

What percentage of vessels have CCTV to monitor catch composition and discarding

None

Positive tests were carried out in otter trawl under project FAROS (http://www.farosproject.eu/). The latter include real-time information gathering and processing of total weight, species and length composition of catch on a haul basis.

What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips <u>with</u> observers on board have different fishing behaviours and discarding patterns to vessels without observers

Full CCTV coverage would be the best solution to assess effect of observer presence. The FAROS system (http://www.farosproject.eu/) offers a possibility of real-time monitoring of species composition in different fishing grounds and across vessels.

If not possible, available CCTV data, VMS data, species composition, length frequency distributions (LFD) of the catches / landings and survey data can be pooled together to assess departures from expectations.

The data could be used to:

1) *Within vessel, compare CCTV, VMS, species and LFD records before and after observers are onboard to similar records of observed trip to see if the observed trip was atypical.*
2) *Identify other vessels using the same fishing grounds to compare the species composition and LFDs of the landed fish from trips with and without observers and survey data.*

What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips <u>without</u> observers on board have unreported discards of species or sizes of fish that must be landed under the landings obligation (> de minimis quantities).

Full CCTV coverage would be the best solution to assess de minimies quantities. The FAROS system (http://www.farosproject.eu/) offers a possibility of real-time monitoring of species composition in different fishing grounds and across vessels.

If not possible, available CCTV data, VMS data, species composition, length frequency distributions (LFD) of the catches / landings and survey data can be pooled together to assess departures from expectations.

The data could be used to:

a) *Calculate the proportion of trips that are missing small fish in landings to those of other vessels/surveys using the same fishing ground and gear. (Assuming that not all vessels are discarding illegally)*

Portugal

Member state:

Sweden

Which fisheries will be impacted by the landings obligation and how many VMS and non-VMS vessels in each?

Pelagic and industrial fisheries from 2015:

- *Pelagic trawls and seines: 47 VMS vessel, 18 vessels without VMS (>=10m LOA) and 2 vessels <10m.*
- *Gillnets: 7 VMS vessels, 60 vessels without VMS (>=10m) and 165 vessels <10m.*

Demersal fisheries in the Baltic from 2015:

- *Otter trawl >=105mm (cod): 44 VMS vessels and 2 vessels without VMS. No vessels <10m*
- *Gillnets/trammel nets: 9 VMS vessels, 80 vessels without VMS (>=10m) and 168 vessels <10m*
- *Longlines/hooks: 3 VMS vessels, 20 vessels without VMS (>=10m) and 35 vessels <10m.*

Presumably not impacted (derogation):

- *Pots and traps: 1 VMS vessel, 6 vessels without VMS (>=10m) and 235 vessels<10m.*

Demersal fisheries in Skagerrak, Kattegat and the North sea from 2016:

- *Demersal trawls and seines (all mesh sizes): 94 VMS vessels, 30 vessels without VMS (>=10m) and 17 vessels <10m.*
- *Gillnets/trammel nets: 2 VMS vessels, 11 vessels without VMS (>=10m) and 52 vessels <10m.*
- *Longlines/hooks: No VMS vessels, 26 vessels without VMS (>=10m) and 78 vessels <10m.*
- *Pots and traps: 1 VMS vessel, 42 vessels without VMS (>=10m) and 252 vessels <10m.*

Data for vessels <10m is available as monthly journals.

Vessels active in more than one fishery have been counted more than once.

What percentage of each fleet currently has an observer on board and is this coverage intended to continue?

Pelagic and industrial fisheries from 2015:

- *Pelagic trawls and seines: 0%*
- *Gillnets: 0.3%*

Demersal fisheries in the Baltic from 2015:

- *Otter trawl >=105mm (cod): 1%*
- *Gillnets/trammel nets: 0% (self sampling, discards sampled on shore)*

- *Longlines/hooks: 0% (self sampling, discards sampled on shore)*

Presumably not impacted (derogation):

- *Pots and traps: 0.15%*

Demersal fisheries in Skagerrak, Kattegat and the North sea from 2016:

- *Demersal trawls and seines: 0.5%*
- *Gillnets/trammel nets: 0%*
- *Longlines/hooks: 0%*
- *Pots and traps: 0.15%*

What percentage of vessels have CCTV to monitor catch composition and discarding

None

What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips with observers on board have different fishing behaviours and discarding patterns to vessels without observers

Length frequency distributions/distributions of catch categories between observed and non-observed trips

VMS data to compare locations of observed and non-observed trips

Non-response rates

What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips without observers on board have unreported discards of species or sizes of fish that must be landed under the landings obligation (> de minimis quantities).

Compare the proportion of trips with reported (logbooks) undersized fish with undersized fish in the observer program

Compare LFD between catches sampled at sea and catches sampled on shore (for the same gear and area)

A big problem will be access to vessels willing to take observers!

Member state:
UK (Northern Ireland)
Which fisheries will be impacted by the landings obligation and how many VMS and non-VMS vessels in each?
Pelagic fisheries from 2015: • *Pelagic trawl: 2 VMS vessels and no vessels without VMS* *Demersal fisheries from 2016:* • *Otter trawl < 100mm (*Nephrops*): 100 VMS vessels, 45 vessels without VMS* • *Otter trawl >= 100mm (whitefish): 6 VMS vessels, no vessels without VMS* • *Seine: 1 VMS vessel and no vessel without VMS* • *Dredges: 38 VMS vessels, 23 vessels without VMS* • *Gillnets: 3 VMS vessel, 4 vessels without VMS* • *Longlines: no VMS vessels, 7 vessels without VMS* *Presumably not impacted:* • *Pots: 3 VMS vessels, 111 vessels without VMS* *Some vessels participate in more than one fishery; they were only counted for the dominant fishery.*
What percentage of each fleet currently has an observer on board and is this coverage intended to continue?
• *Pelagic trawl: current coverage: 17%* • *Otter trawl < 100mm: current coverage: 2.9%* • *Otter trawl >= 100mm: current coverage: 59.1%* • *Dredges: current coverage: 0.8%* • *Seine: current coverage: 16.7%* • *Pots: current coverage: 1.0%* *At the moment the scientific observer programme is totally independent from enforcement and skippers take observers out on a voluntary basis. We expect that skippers may be more reluctant to accept observers once the landings obligation comes into force. We do not know yet how this will affect the scientific observer programme.*
What percentage of vessels have CCTV to monitor catch composition and discarding
None
What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips with observers on board have different fishing behaviours and discarding patterns to vessels without observers
VMS data, length frequency distributions (LFD) of the catches / landings. *The data could be used to:*

23) *Identify other vessels using the same fishing grounds to compare the LFDs of the landed fish from trips with and without observers.*
24) *Compare the location of the fishing activities of the observed trip with other trips by the same vessel to see if the observed trip was atypical.*

What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips without observers on board have unreported discards of species or sizes of fish that must be landed under the landings obligation (> de minimis quantities).

VMS data, length frequency distributions (LFD) of the catches / landings.

The data could be used to:

10) *Calculate the proportion of trips that are missing small fish that are landed by other vessels using the same fishing ground and gear. (Assuming that not all vessels are discarding illegally)*

Member state:

UK England

Which fisheries will be impacted by the landings obligation and how many VMS and non-VMS vessels in each?

Fisheries impacted by the discard ban:

Fisheries	Gear group	o10m	o7u10m	u7m	TOTAL	With VMS
Pelagics	OTTER.<100mm.PEL	4	4	2	**10**	**4**
Demersal	BEAM	72	12	3	**87**	**63**
	DREDGES	106	67	19	**192**	**85**
	LINES	5	91	310	**406**	**0**
	MIS	23	6	9	**38**	**13**
	NETTERS	23	274	368	**665**	**13**
	OTTER.<100mm.CRU	115	48		**163**	**101**
	OTTER.<100mm.DEM	68	106	11	**185**	**47**
	OTTER.<100mm.MOL	13		1	**14**	**12**
	OTTER.>= 100mm.CRU	7	1		**8**	**7**
	OTTER.>= 100mm.DEM	36	37	4	**77**	**30**
	POTS	152	418	311	**881**	**58**
	SEINE	12	2	3	**17**	**10**
TOTAL		**636**	**1066**	**1041**	**2743**	**443**

Presumably not impacted:

- *Pots: 881 vessels, 58 vessels with VMS.*

Some vessels participate in more than one fishery; they were only counted for the dominant fishery.

What percentage of each fleet currently has an observer on board and is this coverage intended to continue?

Gear groups	No Observer trips	Percentage
BEAM	32	1.3%
DREDGES	14	0.2%
LINES	1	0.0%
NETTERS	97	0.3%
OTTER.<100.CRU	28	0.8%
OTTER.<100.DEF	35	0.3%
OTTER.<100.MOL	10	0.8%
OTTER.>=100.CRU	1	0.5%
OTTER.>=100.DEF	19	0.6%
OTTER.>=100.MOL	1	0.3%
SEINE	1	0.2%

Cefas Observer programme the <7m fleet is not included in the target population. The percentage of coverage is based on the number of trips covered.and includes <7m fleet.

At the moment the scientific observer programme is totally independent from enforcement and skippers take observers out on a voluntary basis. We expect that skippers may be more reluctant to accept observers once the landings obligation comes into force. We do not know yet how this will affect the scientific observer programme.

The landing obligation may affect the diversity within the fleet and as a consequence it could change the factors we use to allocate the sampling effort.

UK (England)

What percentage of vessels have CCTV to monitor catch composition and discarding
In 2013, there were 22 (0.8%) otter trawlers vessels, mainly in the North Sea, with CCTV on-board.
What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips <u>with</u> observers on board have different fishing behaviours and discarding patterns to vessels without observers
Data needed: VMS, catch composition and length frequency, fishing practices (e.g gear used and fishing ground) 1. *Compare the "regular" fishing location and gear used by that vessel to see changes in fishing behaviour* 2. *Compare the catch composition and length frequency distributions (when using the same gear and fishing ground) between trips with observer and without observer* 3. *Compare the catch compositions of the retained fractions with the on-shore sampling data within the same fleet.*

What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips <u>without</u> observers on board have unreported discards of species or sizes of fish that must be landed under the landings obligation (> de minimis quantities).
Data needed: VMS, catch composition and length frequency, fishing practices (e.g gear and fishing ground), on-shore and off-shore historical data and CCTV data 11) *Compare the catch compositions and length frequency distributions of vessels with similar fishing behaviour (same metier and location)* 12) *Compare the catch compositions of the retained fractions with the on-shore sampling data within the same fleet.* 13) *Compare the variability of the catch compositions in the historical data with the current variability of catch compositions.* 14) *Potentially, data collected from CCTV to increase the coverage and compare catch composition.*

Member state:

UK (Scotland)

Which fisheries will be impacted by the landings obligation and how many VMS and non-VMS vessels in each?

Pelagic fisheries from 2015:

- *Pelagic trawl: 23 VMS vessels and no vessels without VMS*

Demersal fisheries from 2016:

- *Otter trawl < 100mm (nephrops): approx 120 VMS vessels, approx 85 vessels without VMS and approx 60 <10m vessels*
- *Otter trawl >= 100mm (whitefish): approx 170 VMS vessels*
- *Beam trawl: 1 VMS vessel*
- *Seine: 15 VMS vessels*
- *Dredges: approx 60 VMS vessels, approx 30 vessels without VMS and approx 20 <10m vessels*
- *Gillnets: 9 VMS vessels and 1 <10m vessel*
- *Longlines: 8 VMS vessels and approx 140 <10m vessels*

Presumably not impacted:

- *Pots: 9 VMS vessels, approx 70 vessels without VMS and approx 900 <10m vessels*

Data for vessels <10m is available in aggregated form only, no vessel specific information is available in the Irish logbooks database.

Vessels with less than 100h of fishing effort in 2013 were considered to be inactive and not included in the count of the number of vessels.

Some vessels participate in more than one fishery; they were only counted for the dominant fishery.

What percentage of each fleet currently has an observer on board and is this coverage intended to continue?

- *Pelagic trawl: current coverage: 0%*
- *Otter trawl < 100mm:: current coverage: 10-15%*
- *Otter trawl >= 100mm:: current coverage: 10-15%*
- *Beam trawl: current coverage: 0%*
- *Seine: current coverage: 10-15%*
- *Dredges: 0%*

At the moment the scientific observer programme is part of the same government organisation as enforcement. Skippers take observers out on a voluntary basis. We expect that skippers may be more reluctant to accept observers once the landings obligation comes into force. We do not know yet how this will affect the scientific observer programme.

What percentage of vessels have CCTV to monitor catch composition and discarding

- *Pelagic trawl: current coverage: 4%*

UK (Scotland)

- *Otter trawl < 100mm:: current coverage: <1%*
- *Otter trawl >= 100mm:: current coverage: 15%*
- *Beam trawl: current coverage: 0%*
- *Seine: current coverage: 0%*
- *Dredges: 0%*

What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips with observers on board have different fishing behaviours and discarding patterns to vessels without observers

VMS data, length frequency distributions (LFD) of the catches / landings.

The data could be used to:

25) *Identify other vessels using the same fishing grounds to compare the LFDs of the landed fish from trips with and without observers.*
26) *Compare the location of the fishing activities of the observed trip with other trips by the same vessel to see if the observed trip was atypical.*

What data should be collected, and what analyses should be carried out on these, to identify the possible extent to which trips without observers on board have unreported discards of species or sizes of fish that must be landed under the landings obligation (> de minimis quantities).

VMS data, length frequency distributions (LFD) of the catches / landings.

The data could be used to:

15) *Calculate the proportion of trips that are missing small fish that are landed by other vessels using the same fishing ground and gear. (Assuming that not all vessels are discarding illegally)*