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Report of the Study Group on Practical Implementation of Discard Sampling Plans (SGPIDS)

27 June – 1 July 2011

ICES Headquarters, Denmark

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

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

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Executive summary

The Study Group on Practical Implementation of Discard Sampling Plans (SGPIDS; chaired by Edwin van Helmond, The Netherlands) met 27 June – 1 July 2011 in Copenhagen, Denmark. Seventeen participants representing 11 countries were present at the meeting, including the outgoing chair, Simon Northridge, of ICES WGBYC (Working Group on Bycatch of Protected Species). SGPIDS was proposed by ICES PGCCDBS (2010) in response to a request from the Regional Coordination Meeting for the North Sea and Eastern Arctic (RCM NS&EA; 2010) to foster an exchange of experience and expertise between experts on discard sampling, planning and implementation of PGCCDBS recommendations and ultimately synchronize coordination and data collection procedures of discard sampling between countries.

To handle the exhaustive list of terms of reference the group split up into subgroups. These dealt with one term of reference each. Wherever necessary, the subgroups collected information about the existing discard sampling programmes by represented member state. This information was used to create an extensive overview of techniques and protocols used to sample discards onboard commercial vessels. Throughout the meeting all subgroups updated each other during plenary sessions.

The study group identified 21 different discard sampling programmes among the countries present, which were divided into two main types of discard sampling techniques: observer and self sampling (including self sampling with a reference fleet). Among observer programmes, differences in the procedures of selecting vessels and allocating sampling effort were identified. For example, nine out of 15 observer programmes use a quasi-random vessel selection method, based on a combination of opportunistic and co-operative criteria. The remaining six programmes use a fully random or otherwise systematic approach to select the vessels for monitoring. It was noted that only 25% of the programmes routinely record refusal rates. Six countries at SGPIDS conduct dedicated self-sampling schemes. Of these, 66% are validated (e.g. comparing biological data with matched or unmated observed trips and/or other independent sources). Vessel selection was a key source of potential bias for both sampling techniques. Sampling effort allocation was another major source of bias. Further, it was noted that legal conditions under which discard sampling is taking place, potentially harm the cooperation between industry and scientist in discard sampling programmes and, eventually jeopardize the quality of sampling programmes.

SGPIDS recognised the potential for more standardisation in sampling designs and this should start with a complete description (in English) of sampling designs of all current sampling programmes. SGPIDS created a detailed description, at all levels (i.e. sampling protocols, data processing, data storage procedures, co-operation with industry, observer training and safety procedures) for the 21 programmes. With the aim to standardize discard sampling across countries, it is important that bias and variability associated with their respective sampling programmes are investigated.

The Data Collection Framework (DCF) set out precision levels but did not include any requirements about bias. Bias is introduced to sampling schemes when samples are not representative of the population. In accordance with previous working and study groups (e.g. ICES WKEID, WKACCU), SGPIDS identified a number of potential sources of bias in discard data. There was a general agreement that improving the data quality by reducing bias should be prioritised over increasing precision levels.

1 Introduction

The results of discard sampling programmes play an increasing role in stock assessments and fisheries management. The quality of the discard data as well as uniformity of the data between countries play a vital role in the usability of this data. The Study Group on Practical Implementation of Discard Sampling plans (SGPIDS) is essential to allow standardisation and harmonisation of discard sampling plans and to provide a platform for the exchange of expertise on discard sampling practices for the next three years.

1.1 Supporting Information

Priority:	**Essential**
Scientific justification:	The coordination and planning of discards sampling is part of the tasks of PGCCDBS and more regionally of the Regional Co-ordination Meetings (RCMs). However, these groups lack expertise, scope and time to deal with the practical aspects of discard sampling. This meeting can build upon the outcome of WKDRP, WKEID, WKACCU and WKPRECISE with regard to the tools and methodology used to analyse discard data and their coverage, accuracy and precision. As discard sampling is often directly influenced by the legal framework in which it takes place, it is important to review the legal status of biological observers and the fisheries and areas they are sampling, e.g. demersal mixed fisheries in waters where discard bans for certain species apply.
Resource requirements:	Participants should bring descriptions of sampling procedures to the meeting.
Participants:	Scientists managing discard sampling schemes or projects, either under or outside DCF, within European waters.
Secretariat facilities:	Meeting facilities incl sharepoint and secretarial support
Financial:	None
Linkages to advisory committees:	ACOM
Linkages to other committees or groups:	PGCCDBS, RCMs, SGBYC, WGNSSK
Linkages to other organizations:	None

1.2 Terms of Reference

2010/2/ACOM49 A Study Group on Practical Implementation of Discard Sampling Plans [SGPIDS] (Chair: Edwin van Helmond, The Netherlands) will be established and take place at ICES HQ from 27 June to 1 July 2011, to:

a) describe different sampling techniques and identify the major sources of error associated with these techniques;

b) review the legal conditions under which discard sampling is taking place, i.e. under a discard ban;

c) identify which sampling techniques are the most appropriate to apply in various fisheries, including innovative sampling techniques;

d) describe sampling protocols aiming for standardisation of the collection of discard estimates;

e) propose standard data processing, quality checks and raising procedures; investigate innovative techniques for estimating discards;

f) collate an inventory of present data storage procedures of primary discard data and propose modifications which allow easy transfer to a common (regional) database;

g) investigate ways to improve co-operation with the fishing sector in collecting discard estimates;

h) describe present sampling and safety training procedures and, if needed, propose ways to improve those;

i) improve communication and data delivery to other study groups and working groups.

j) Identify elements of the EGs work that may help determine status for the 11 Descriptors set out in the Commission Decision (available at http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:232:0014:0024:EN:PDF;

k) Provide views on what good environmental status (GES) might be for those descriptors, including methods that could be used to determine status.

l) take note of and comment on the Report of the Workshop on the Science for area-based management: Coastal and Marine Spatial Planning in Practice (WKCMSP) http://www.ices.dk/reports/SSGHIE/2011/WKCMSP11.pdf

m) provide information that could be used in setting pressure indicators that would complement biodiversity indicators currently being developed by the Strategic Initiative on Biodiversity Advice and Science (SIBAS). Particular consideration should be given to assessing the impacts of very large renewable energy plans with a view to identifying/predicting potentially catastrophic outcomes.

n) identify spatially resolved data, for e.g. spawning grounds, fishery activity, habitats, etc.

1.3 Adoption of the agenda and terms of reference

The adopted agenda of the Study Group on Practical Implementation of Discard Sampling plans is presented in Annex 2 of this report.

Due to time constraints, considering the long list of terms of reference listed above, the additional terms of reference (j) to (n) (see below) were not addressed during this meeting.

Identification of the most appropriate sampling techniques applicable in various fisheries requires analysis of the collected information in the other terms of reference, mainly ToR (a) and (e). Because most of the information needed to address term of reference (c), was compiled during this meeting, there was a lack of time to report on this term of reference sufficiently. Also, the group indicates that terms of reference (c) is more in line with the identified terms of reference for next year's meeting (Annex 3). Therefore, the group recommends to move terms of reference (c) forward to the next SGPIDS meeting.

2 Discard sampling techniques by country and their major sources of error (ToR A)

2.1 Main sampling techniques

Several main sampling techniques were identified by SGPIDS (Table 1). These include: observer, self sampling and reference fleet procedures.

2.1.1 Observer programmes

In observer programmes, fishing trips are sampled by observers onboard commercial fishing vessel. Observers may be either dedicated (employed by the institutes) or contracted.

2.1.2 Self sampling programmes

In self sampling programmes, fishing trips are sampled by fishers themselves. This can either imply that fishers collect and retain a part of the catch or discard fraction and bring this ashore where the sample is analysed by research institute staff or that the fishers carry out the entire sampling themselves.

2.1.3 Reference fleet

A reference fleet is a pre-defined selection of vessels where the sampling is being carried out. The reference fleet is within the population of all active vessels within a given fleet. The actual sampling is usually carried out by the fishers themselves and in some cases by observers.

2.1.4 Onboard CCTV sampling

In recent years, several vessels in some of the EU Member States have been equipped with closed circuit video 'CCTV' cameras for catch monitoring including discards. The vessels are participating in pilot schemes for catch quota management and the cameras are intended to validate catches reported by the fishers. The cameras monitor several parts of the vessels including areas for lifting and sorting of the catch, conveyor belt, and hopper.

The sampling techniques can further be divided into subcategories for example depending on how the programmes are designed and how the observers are employed.

2.2 Sources of errors related to sampling techniques

The following most important sources of error (bias), associated with the different sampling techniques, were identified by SGPIDS (Table 1):

- Representativeness: is collected data representative of the sampled population?
- Evaluation of sampling frame: can the representativeness of the data be assessed?
- Data validation: can collected data be validated?

These are generic issues and apply to all discard sampling programmes and need to be accounted for among all the different sampling techniques. The degree of their relevance may be different among programmes and sampling techniques.

From an end-user's point of view; large variability in estimates deriving from the sampling programmes may also be considered as a sampling deficiency. It is however important to emphasise that large variability usually originates from variable populations and small sample sizes and that a precise estimate does not guarantee that the estimate is true. It may still be inaccurate, because the sampling was biased (see Annex 5). The use of coefficients of variation (CV) values as a single indicator of quality of discard data, as the presently required by the data collection regulation (CD 2010/93/EU) may therefore not be fully adequate.

2.3 General sources of potential bias associated with main sampling techniques

2.3.1 Observer programmes

Observer programmes are generally considered to have the potential to generate good-quality data. However, observers/staff employed on long-term contracts may develop ingrained working routines leading to a biased selection of vessels and/or sampling practices. Friendships between research staff, skippers and/or crew members can lead to biased working practices. The presence of observers may also lead to changes in behaviour of the crew. All these practices and situations can lead to a potential bias which may affect the accuracy of any discard estimates.

Contracting out observer work to private-sector companies may be cost effective, in some countries, and may increase sample sizes and obtain better spatio-temporal sampling coverage but may in turn lead to additional sources of bias. Contract observers may be influenced by the organisation that is employing them, they may be on short-term contracts, they may only have rudimentary training and lack of experience (see Section 8.1). The private-sector company may have other interests and business objectives than collecting accurate and scientifically-sound data. Care needs to be taken that the organisation or the individuals do not have a vested interest in (underreporting) discards.

2.3.2 Self-sampling programmes

Self-sampling programmes have the potential to generate relatively large amounts of data and increase the involvement of stakeholders in the data collection process. However, sharing an interest in discards, it may be in the interest of the self-sampler to show "good" data, in this case small discard amounts, because fishers. The incentive to deliver "good" data may also differ depending on the objective of the discard

sampling programme. It also needs to be acknowledged that sampling probably is not the most prioritised task on the vessel implying that sampling protocols need to be kept relatively simple. Feedback to the self-samplers is an important consideration to keep quality in sampling consistent over time. Validation of data is considered a key issue. Vessel selection may be another cause of bias, because self-sampling programmes usually run on a cooperative basis.

2.3.3 Reference fleets

A reference fleet provides favourable circumstances for the logistical aspects of sampling, because the same vessels are repeatedly sampled over time. The main consideration in relation to bias is however how these vessels are being selected. If the fishers carry out the sampling themselves, the same considerations may apply as for self-sampling schemes.

2.3.4 Onboard CCTV sampling

Fishing vessels equipped with CCTV cameras are a relatively new development in European waters. As with self-sampling, there is a potential to collect large amount of data. The objective of placing cameras onboard must be clear from the beginning: whether cameras are there to scientifically sample catches or rather to validate estimates in logbooks. The limitations of CCTV monitoring include that cameras do not cover the entire vessels, so the potential to cryptically discard still exists, that there can be problems to estimate total catch and species composition (in mixed fisheries) and that length measurements not always can be achieved. So far, CCTV cameras work well for identifying and quantifying cetacean and seabird bycatch. Vessel selection may also be an issue, as soon as CCTV cameras are put on vessels on a voluntary basis.

Detailed information about sampling designs and data quality checks procedures for the different sampling techniques was not accessible to the SGPIDS in a consolidated way from the relevant research authorities. To improve assessments of bias in different sampling programmes, SGPIDS therefore decided to make an inventory on sampling techniques used within the different sampling programmes at the various institutes. The inventory was done in a questionnaire and only included sampling programmes known to the participants and does not provide a pan-European overview. It should also be stressed that the inventory is only an overview and does not encompass all the details of the different sampling techniques. The questionnaire included questions on the basic design, existence of data quality check and validation procedures among self-sampling programmes, routines of assessing the representativeness of the sampled data, known bias but also on potential sources of bias and experienced problems. The intention was to identify common problems with the aim to address these in a thoroughly way during forthcoming meetings of SGPIDS. The results from the inventory are shown in Table 2.1 (sampling schemes). Tables 2.2 and 2.3 (sources of potential bias experienced problems)

Table 2.1. Results from an inventory of sampling designs, data quality check procedures and potential sources of bias by country.

		Sampling design						Quality checking procedures				Potential sources of bias and experienced problems			
Country	Segment	Sampling Technique	Validation study? Y/N	Primary sampling unit	Selection of vessels	Sampling frame and sampled population defined Y/N	Target number of primary sampling units	Exploratory analysis of primary data as a routine? Y/N	Refusal rate recorded? Y/N	Representativeness of sampled selection evaluated? Y/N	Quantified sources of bias	Potential sources of bias	Experienced practical constraints	Reference	Relevant metiers
NLD	Demersal	Observer		Trips	Opportunistic	No	10	Yes	No	No	vessel selection	samling effort allocation	weather	Overzee and Helmond, 2010	TBB_DEF, OTB_CRU
NLD	Demersal	Self-sampling	Yes	Trips	Reference	No	160	Yes	NA	No	vessel selection	haul selection		Overzee and Helmond, 2010	TBB_DEF, OTB_CRU, OTB_DEF
NLD	Pelagic	Observer		Trips	Opportunistic	No	12	Yes	Yes	No	vessel selection	observer effect	lack of space	Overzee and Helmond, 2010	PTM_SPF
NLD	Crustacean	Observer		Trips	Opportunistic	No	8	Yes	No	No	vessel selection	samling effort allocation	lack of space	Overzee and Helmond, 2010	TBB_CRU
SWE	Demersal, crustacean	Observer		Trips	Random	Yes	96	Yes	Yes	No	vessel selection	samling effort allocation, targets in the DCF drives sampling towards ad-hoc in th end of a sampling period	vessels in remote places, difficult to identify roboust sampling frames when vessels participate in several fisheries, bad weather and ice		OTB_DEF, OTB_CRU
SWE	Passive small scale	Self-sampling	No	Trips	Random	Yes	~40	Yes	Yes	No	vessel selection	no validation scheme	difficult to give fishermen enough info when choosing vessels randomly		GNS_DEF, LLS_DEF
UK_E	Demersal, crustacean	Observer		Vessels	Random	Yes	~200	Yes	Yes	Yes on an ad hoc basis	vessel selection in historical data	changes in vessel behaviour, differences between observers, the way the subsample is collected, non random haul selection	weather, travelling, single handled vessels, cost associated with random designs,	Enever, Grant & Revill (2008)	TBB_DEF, OTB_CRU, OTB_DEF, GNS_DEF

ESP_ATL	Demersal	Observer		Trips	Random	Yes	~12	Yes	No	mapping sampled hauls to compare with previous years Spatial info	vessel selection	Unknown changes in fishing techniques within vessels, observers effect, total discard estimation crew effect, lack of randomless during discard sampling collection,	weather,		OTB_DEF_100_119_0_0
ESP_ATL	Demersal	Observer		Trips	Cooperative	Yes	~120	Yes	No	mapping sampled hauls to compare with previous years Spatial info	vessel selection	between vessels fishing efficiency, observers effect, total discard estimation, discard fraction availability, lack of randomless during discard sampling collection,	fleet dynamics, mixture of univalent (trip:métier = 1:1) and polivalent vessels (more than 1 métier within trip), Vessel selection for onboard sampling in pair trawls, difficulties to match landing vessels with observer availability		OTB_DEF_>=55_0_0, OTB_DES_>=55_0_0, PTB_DEF_>=55_0_0, OTB_MPD_>=55_0_0
ESP_MED	Demersal	Observer		Trips	Cooperative	Yes	322		No	No	vessels selection	between vessels fishing efficiency, observers effect, total discard estimation, lack of randomless during discard sampling collection,	fleet dynamics, Unexpected change of métier during the trip,difficulties to match landing vessels with observer availability		OTB_DEF_>=55_0_0,OTB_DES_>=55_0_0,PTB_DEF_>=55_0_0,OTB_MPD_>=55_0_1

FR	All	Observer		Trips	Opportunistic	Yes	~1000	Yes	Yes	Yes on an ad hoc basis	None	vessel selection, species identification (inflate estimate of target spp), total discard estimate (all inflated by contracted observers), haul selection in some fisheries (last haul never sampled),	fleet dynamics, mixture of univalent (trip:métier = 1:1) and polivalent vessels (more than 1 métier within trip), inexperienced observers, refusals, weather, administrative authorization to take observer onboard		all
UK_S	Demersal, crustacean	Observer		Vessels	Random	Yes	86	Yes	Yes	No	None	estimation of total catch	lack of space, vessel engine trouble, bad weather, single handled vessels	Ken Coull	OTB_CRU (inshore and offshore), OTB_DEF
NOR	All	Self-sampling	Not on a routine basis	Vessels	Cooperative	No	NA	Yes	NA	No	None	selection of vessels, sampling effort allocation	weather		All
IRE	Demersal	Observer		Trips	Random/Cooperative/Random	Yes	271	No	NA	Only by VMS vs observer effort	None	selection of vessels,slippage estimation	Weather, vessel condition	Borges et al	ALL
IRE	Pelagic	Observer		Trips	Random/Cooperative/Random	Yes	38	No	NA	None	None	selection of vessels, catch estimation	Weather, vessel condition		ALL
IRE	Nephrops Self Sampling	Self-sampling	Yes	Trips	opportunistic/cooperative	Yes	15	Yes	NA	Yes	Yes(size distributions)	variation in onboard selection patterns over time	only works in fisheries with tailing		all

PT	Demersal	Observer		Trips	Systematic	Yes	~80	Yes	No	None	None	selection of vessels,	lack of space, security, bad weather, transportation and accomodation of observers, mixed metier trips		OTB_DEF, OTB_CRU; GTR_DEF, GNS_DEF, LLS_DWS
DK	Demersal, crustacean	Observer		Trips	Random	Yes	~200	Yes	Yes	Yes on an ad hoc basis	Vessel selection	observer effect, stockholm syndrome, species id, not enough knowlege of metiers before merging	logistics, legal conditions, bad weather, lack of space, uncooperative fishermen, changes targeted area and species assemblage		All demersal metier
DK	Demersal passsive gear	Self-sampling	Yes	Vessels	Cooperative		~50	Yes	NA	Yes on an ad hoc basis	None	unreliable data	logistics in the validation scheme		Gillnets
BE	Beams	Observer		Trips	Cooperative	No	~36	Yes	Not at the moment	Yes	None	selection of vessels, sampling effort allocation	space availability, unccoperative fishermen, obervers travelling		Beam
BE	Beams	Self-sampling	Yes	Trips	Cooperative	NA	~35	Yes	NA	Yes	None	various effort by different fishermen to sample	logistics in the validation scheme		Beam

2.4 Results; main sampling techniques

Sampling techniques were split into two main types, observer and self sampling (including self sampling within a reference fleet). None of the participating countries reported on a routine sampling programme involving CCTV cameras.

Observer sampling was further divided into two categories: i)where vessels were chosen quasi-random, using a combination of opportunistic and co-operative techniques, and one which vessels were chosen random or otherwise systematic, representing nine and six sampling programmes, respectively. Populations and sampling frames are systematically defined for the majority of the sampling programmes. Approximately, half of the sampling programmes are evaluated for representativeness in the sampled data through a number of methods, such as comparing VMS data with observer effort data and mapping hauls compared with previous years. Refusal rates are recorded routinely in 25% of the sampling programmes and exploratory data analysis is carried out for all sampling techniques.

Six countries at SGPIDS are running self-sampling schemes. These cover a range of both active and passive gears. Among these schemes, 66% are validated by appropriate studies. Trip is used as the primary sampling unit for 66% of the self sampling schemes and vessel is used for the remainder. The selection of these primary sampling units is mostly by co-operation (66%) but one self sampling scheme uses a reference fleet and another selects the primary sampling unit on a random basis. The sampling frame is predefined in 50% of the self sampling schemes. Moreover, the representativeness of the sampled selection is evaluated on 50% of the self sampling schemes. The refusal rate is recorded in only one of the self sampling schemes. All self-sampling schemes conduct Exploratory Data Analysis (EDA) on a routine basis.

2.5 Results; potential sources of bias and experienced problems

All potential bias and problems that were experienced along the way are described in Table 2.3. The table is not split into sampling techniques because many of the issues were common to all the techniques. The potential bias is split into issues relating to sampling design, vessel behaviour, the work of observers on board and the employment status and working practices of observers in general. Vessel selection was a source of potential bias and common to all of the sampling techniques. Sampling effort allocation and potential non- randomness in vessel selection in each metier was a potential source of bias.

Another potential source of bias lies with the observers themselves, including their onboard estimates of catch and discards and species identification. Observers on short-term contracts may exhibit varying degrees in their training and attendance to quality control and thoroughness of data collection. This problem applies in particular to observers contracted by private sector companies.

Sometimes the actual effort by fishers to adhere to sampling protocols in a self- sampling scheme may vary and therefore possibly introduce bias and generate unreliable data. The need to provide new fishers with enough detail to be able to competently carry out the protocols in the self sampling scheme was seen as a limiting factor. There are also problems and potential sources of bias related to sampling design. There is an inherent cost associated with random designs. There are difficulties in identifying robust sampling frames when vessels participate in several fisheries and also when trips qualify for several metiers within one trip. Trying to reach targets of sampled trips in the EU Member States National Programmes (EC 199/2008) may lead

to the original sampling design being compromised which may lead to bias. Targets at the metier level in the Data Collection Framework (DCF) may further be in conflict with robust statistically designed sampling frames. Some practical constraints that impede self-sampling schemes include bad weather, lack of available space on board and condition of the vessel.

Table 2.2. Summary of characteristics in sampling schemes included in the SGPIDS inventory.

Sampling technique		Number of sampling schemes	Population and sampling frame systematically defined?	Representativeness in sampled data routinely evaluated?	Are refusal rates recorded?	Exploratory Data Analysis?	Validation study?	Confirmed source of bias
Observer	Opportunistic / Cooperative / Quasi-random	9	Yes (56%) No (44%)	Yes (11%) No (56)% Yes on ad hoc basis (11%) Mapping sampled hauls to compare with previous years (11%) VMS vs observers (11%)	Yes (22%) No (78%)	Yes (100%)		Vessel selection (56%) None (44%)
Observer	Random / Systematic	6	Yes	No 50% Yes on ad hoc basis (33%) Mapping sampled hauls to compare with previous years (17%)	Yes (67%) No (33%)	Yes (100%)		Vessel selection (67%) None Quantified (33%)
Self Sampling	Reference (16%) Random (16%) Cooperative (66%)	6	Yes (50%) No (50%)	Yes (50%) No (50%)	NA (83%) Yes (17%)	Yes (100%)	Yes (66%) No (33%)	Vessel selection (33%) None Quantified (50%) Size distribution (17%)

Table 2.3. Potential sources of bias and experienced problems as expressed by the SGPIDS participants.

Potential Bias				Experienced problems	
Issues related to sampling design	**Issues related to vessel behaviour**	**Issues related to the work of observers onboard**	**Issues related to observers**	**Issues related to sampling design**	**Practical problems to implement sampling design**
Vessel selection	Observer effect	Total discard estimation	contracted observers (short contracts)	Cost associated with random designs	Weather and ice
Parts of the fleet do not cooperate in sampling		Slippage estimation	differences between observers	Difficulties to identify robust sampling frames when vessels participate in several fisheries	Lack of space onboard
Sampling effort allocation		Catch estimation	"Stockholm syndrome"	Mixture of univalent (trip:métier = 1:1) and polivalent vessels (more than 1 métier within trip)	Inexperienced observers
Not enough knowledge of metiers before merging		Discard fraction availability		Vessel selection for onboard sampling in pair trawls	Administrative authorization to take observer onboard
Vessels differ in fishing efficiency		Species identification		Difficulties to match landing vessels with observer availability	Vessel conditions (safety issues)
Lack of randomless during discard sampling collection (secondary sampling unit and sub samples)				Unexpected change of métier during the trip	Travelling and accommodation of observers
				Fleet dynamics	Vessels in remote places
				Refusals	Legal conditions
				Targets in DCF may lead sampling towards ad hoc based sampling in the end of the sampling periods	

3 Review of the legal conditions under which discard sampling is taking place, i.e. under a discard ban (ToR B)

There is a legal requirement for Member States to design and implement at-sea monitoring of commercial and recreational fisheries where necessary. This Study Group does not have the legal expertise to review the intricacies of the Data Collection Framework. Instead, the group had identified, the most important regulatory issues currently affecting the practical implications of discard sampling plans. These were:

1) The legal requirement for skippers to take with them scientific observers and participate in observer programmes

2) The implications for a discard ban and catch quota management systems

3) The requirement for estimates of precision and accuracy in the sample data and for the standardisation of sampling protocols across regions

4) The legal obligation for fishers to report discards

3.1 Requirement for fishers to accept scientific observers:

Council Regulation (EC) No 199/2008 of 25 February 2008 concerning the establishment of a Community framework for the collection, management and use of data in the fisheries sector and support for scientific advice regarding the Common Fisheries Policy Official Journal L 060 , 05/03/2008 P. 0001 - 0012

Article 11

3. The masters of Community fishing vessels shall accept on board samplers operating under the at-sea monitoring scheme and designated by the body in charge of the implementation of the national programme and cooperate with them in order to allow them to discharge their duties while on board Community fishing vessels.

4. The masters of Community fishing vessels may refuse to accept on board the samplers operating under the at-sea monitoring scheme only on the basis of an obvious lack of space on the vessel or for safety reasons in accordance with national legislation. In such cases, data shall be collected through a self-sampling programme, carried out by the crew of the Community fishing vessel, and designed and controlled by the body in charge of the implementation of the national programme.

The level of refusals by skippers to take observers is being monitored by several Member States and has been quantified by some. Moreover, the Ministries of some Member States have become aware of the reluctance by some fishers to participate in the national programmes and methods to increase their cooperation are being discussed. National laws are in place in some Member States making it illegal for fishers to refuse to take observers, and in doing so they risk receiving sanctions. Important considerations on this issue include, deploying observers onboard potentially hostile vessels and also the greater potential for observing fishing practice that is not representative of normal practice on these vessels.

Furthermore there are concerns by the coordinators of the national programmes that imposed sanctions could harm industry cooperation more generally. However, as Member States continue to improve the design of sampling programmes (including a random vessel selection) the refusal rates may increase. A potential consequence of

this is that institutes may receive fines for failure to meet data quality standards. It is therefore crucial to make every effort to engage with the industry and encourage their cooperation in the national programmes.

3.2 Implications for a discard ban and catch quota management systems

The introduction of a discard ban would require substantial changes in current legislation. A discard ban was trialled by two English vessels in a recent small scale scoping study. The vessels were instructed to land all fish caught during the trial. To enable the skippers to do this dispensations were required to allow:

i) the landing of fish under the legal minimum landing size (MLS)

ii) the landing of over quota fish, for which the skippers had insufficient quota

iii) the landing of species for which it is prohibited to retain (vulnerable species and quota exhausted)

iv) exemption from catch composition regulations

The dispensations stipulated that no fish below MLS or those for which there would otherwise be insufficient quota to land were to be sold nor could it be disposed of in such a way as to undermine the market. In summary a discard ban of this type was not compatible with the current technical conservation regulations and difficult to reconcile with the current quota system. It was observed that the landing of the entire catch would facilitate the enforcement of the ban on high-grading.

Since 1987 Norway have had a discard ban implemented. In the first years of the implementation the ban only concerned a few species such as cod, however in 2008, 15 species were included in the list and this was even further expanded in 2009. The discard ban indicates that all species on the list have to be landed and that Norway operates with a minimum catch size instead of landing size. Within a haul maximum 10% of the catch can be under the minimum catch size. If the proportion is higher than 10% the vessel has to move to another area. The fish below minimum catch size can be sold however to a price just covering the fisherman expenses for bringing the fish to port.

In the English study, all fish species were landed, therefore all sampling could have been performed once the vessels had landed the catch (in this instance both at-sea and shore-side sampling was conducted). Had this discard ban not applied to all fish species, at-sea sampling would have been required to capture data on all species in the catch. Those catches brought ashore that would otherwise have been discarded would need to be categorised as being a separate component of the landings.

If a discard ban is implemented it will have consequences for the cooperation between the industry and scientist in the observer programmes. As discarding would be illegal (for all or only some of the species) an observer could be reporting on potential illegal activity, this follows that it will be more difficult to be allowed on a trip and the fishers would have a large enticement to change behaviour when bringing observers. Under a discard ban the SGPIDS is concerned that on board observer programmes would not be regarded as scientific descriptive activity but would more pertain to control enforcement. This may cause a bias in sampling programmes and, eventually, could undermine the representativeness, and therefore the scientific quality, of the data.

3.3 Requirement for estimates of precision and accuracy in the sample data and for the standardisation of sampling protocols across regions

If there is a requirement, accuracy and precision of the estimates generated from the national sampling programmes need to be assessed, and also for sampling programmes to be standardised within regions:

Article 9

Sampling programmes

3. The protocols and the methods used for the establishment of national sampling programmes shall be given by Member States and shall be, as far as possible:

(a) stable over time;

(b) standardised within regions;

(c) in accordance with the quality standards established by the appropriate regional fisheries management organisations to which the Community is contracting party or observer and relevant international scientific bodies.

4. Accuracy and precision for the data collected shall be systematically estimated where required.

There is a need for greater emphasis on estimating data accuracy (bias) in conjunction with the precision estimates that are requested annually. However, there is general agreement that improving the data quality by reducing bias should be prioritised over increasing precision levels at the moment. Also recognised is the potential for more standardisation in sampling programme designs and this should start with a detailed description of the various sampling designs currently operating.

3.4 Legal obligation for fishers to report discards

COMMISSION IMPLEMENTING REGULATION (EU) No 404/2011 of 8 April 2011 concerning detailed rules for the implementation of Council Regulation (EC) No 1224/2009 establishing a Community control system for ensuring compliance with the rules of the Common Fisheries Policy

Annex VIII and Annex X. It is now mandatory to register discards in the logbooks if: "Discards of quantities of each species above 50 kg live weight equivalent shall be recorded. Discards of species taken for live bait purposes and which are recorded in the fishing logbook at section 15, shall also be recorded."

Discard information from fishers' logbooks could give scientists estimates of discard levels at a much higher resolution than the national observers programmes currently allow. However, it would be necessary to try and assess the quality of the discard data registered in the logbook. Comparisons between observer and skipper estimate could be made and observed trips could be compared with those not observed. Having to report discards could mean that the national observer programmes would contain an element of control enforcement which could create bias in the data.

4 Describe sampling protocols; aiming for standardisation of the collection of discard estimates (ToR D)

Sampling protocols are important in standardized onboard sampling and observer training. They are also an important tool in communicating to end-users the details of data collection and any bias that may exist in the final data. The main end-users of discard data are ICES WGs dealing with stock assessment and ecosystem indicators, the EU commission (through the DCF), the fishing industry and NGOs. End-users of discard estimates are generally interested in weights or numbers discarded per species, length frequencies and age structures of discarded species, and discard rates of the different fleets and species. Data is generally required per metier, on a quarterly basis, and from spatial strata (ICES area or division).

At present, all Member States seem to have developed onboard sampling protocols that they use to standardize discard data collection and train observers (in onboard observer programmes) or fishers (in onboard self-sampling programmes). However, these are generally not set up in a way that allows the direct comparison of the sampling methodologies used in each fishing trip across different metiers and from different Member States. This is mainly because they are frequently written only in each member-state's national language, but also, because they lack a common structure that facilitates comparison of their technical details.

A description of the main technical details of the Member States' onboard sampling protocols and an evaluation of the degree to each standardization has been achieved was the main task of SGPIDS' ToR d. Our approach to this ToR relied on an in-house survey of the onboard sampling protocols used by the different Member States. The survey was organized as a set of five tables of which three were based on the key output variables of the onboard sampling programmes (weights and numbers discarded, length frequency of discards, age structure of discards). The results were analyzed categorically and conclusions were drawn on the degree of standardization existing across the protocols and the way onboard sampling should move forward. Because SGPIDS tasks focused on discard sampling, the protocols used to collect information on the retained fraction of the catch were not analysed. We note however that in the vast majority of Member States the latter design is concurrent to the one used to sample discards.

4.1 Type of sampling protocols (Table 4.1)

Detailed métier- or fleet-specific protocols are required for comparisons of the methodologies to collect discard data and carry out standardized training of onboard observers. At present, all Member States present at the meeting had onboard sampling protocols and most were metier- or fleet-segment specific. However, most countries' protocols are only available in their own national language. Availability of the protocols in a national language eases communication with the observers and the national industry, and is particularly important in the case of self-sampling programmes. However, from a protocol standardization point of view, the use of national languages hinders international comparison of procedures and the communication of data collection procedures to end-users. We also found that most onboard sampling protocols were not available online. Online availability of onboard sampling protocol affords for quicker updates of the protocols and better observer training and recruitment. It is also fundamental to effective communication with scientists, industry and

the society in general. Increased efforts towards online publication of onboard protocols are therefore required.

Table 4.1. General details of Member States's onboard sampling protocols

Member-state	Protocols?	Métier or fleet segment specific?	Language	online?	Protocol contact
BE	Yes	Yes	NL	No	kelle.moreau@ilvo.vlaanderen.be; sofie.vandemaele@ilvo.vlaanderen.be
DK	Yes	Yes	DK	No	fh@aqua.dtu.dk
EN	Yes	Yes	EN	No	thomas.catchpole@cefas.co.uk
ES	Yes	No	ES	No	nelida.perez@vi.ieo.es; juan.santos@vi.ieo.es
FR	Yes	No	FR	Yes	Vincent.Badts@ifremer.fr
IRE	Yes	Yes	EN	No	sara-jane.moore@marine.ie
NL	Yes	Yes	NL	No	edwin.vanhelmond@wur.nl
NOR	Yes	Yes	NOR	No	kjell.nedreaas@imr.no
PT	Yes	Yes	PT (all), EN (some)	No	nmprista@ipimar.pt
SCO	Yes	Yes	EN	No	davisc@marlab.ac.uk
SWE	Yes	Yes	SWE	No	katja.ringdahl@slu.se

4.2 Weights and numbers discarded (Table 4.2)

Quarterly estimates of weights and/or numbers discarded per species are one of the goals of all onboard discard sampling programmes and a major objective established by the DCF. Our survey indicated that Member States routinely estimate quarterly discarded weights and numbers per species or, if required, have data available to do so (length frequency data and weight-length relationships). However, the two types of data are frequently not collected in all trips. We found this to happen mainly because of the time constraints of onboard sampling and the difficult logistics of sampling some fleets. A case study presenting the reasons why weights of discards are not directly sampled onboard Portuguese gill-net and trammel-net vessels was presented and discussed during the SGPIDS sessions (Prista et al., Annex 8). Additionally, we found that discard weights or numbers are generally collected at species level with both commercial and non-commercial species being sampled. Some Member States, however, only collect discard data for the fish species and the main commercial crustaceans and cephalopods. Discard data available at species level provides for a more holistic approach to discards and is a step forward in the direction of ecosystem approaches to fisheries management.

With respect to sampling designs, our survey indicated that Member States use a variety of methods to select the fishing operations (hauls or sets) that are sampled in

each trip. This variety includes census (all fishing operations are sampled), sampling (the selection of fishing operations to sample is based on a statistical design) and *ad-hoc* selection (the selection of fishing operations to sample is selected based on trip targets, generally set on minimum coverage). Albeit providing good coverage, *ad-hoc* choice of the fishing operations that will be sampled is likely to bias the final estimates. This happens when the sampled fishing operations are not representative of the full array of fishing operations carried out during the trip (e.g., when observers opt to sample only the fishing operations that take place during daytime or in a single area). In Member States that do not use *ad-hoc* selection, a census of all fishing operations seems to be considered the best alternative. However, a presentation made to SGPIDs (Santos *et al.*) suggested that within-trip variability in discards may not always be the main variance component of final discard estimates and so that censuses, albeit unbiased, could be an inefficient use of observer time. A systematic sampling design that still assures reasonable coverage of the fishing operations has been considered by some Member States as a suitable alternative, particularly because, random sampling of hauls is considered hard to implement consistently by less-statistically experienced observers.

At within-haul level most countries generally require observers to collect two or more boxes/baskets from the discards/catch. In many métiers the selection of the baskets is reportedly random but it was noted that, in the field, observers are most likely to assume "random sample" as synonym of "representative sample" than as the strict statistical randomization design the term implies. Consequently, a better means of stating representative is likely to be instructing observers to perform systematic sampling, e.g., by removing boxes from different parts of the discard/catch bulk. This sampling scheme carries the advantage of better accounting for the putative heterogeneity of species and length composition within the bulk sampled.

Finally, the choices of the primary (between hauls) and secondary level (within haul) raising variables are not unanimous among the surveyed countries. For example, as primary level raising factor some countries use fishing time while others use number of fishing operations. Similarly, as secondary level raising factor, most countries use total discard weight or volume but one uses retained catch as raising factor. The way total catch/discards are estimated appears to be a major difference between the member-state's protocols and should deserve in-depth study before full standardization can to be achieved. However, we note that the usefulness of using specific raising procedures depends on the type of relationship between auxiliary variables and the output variable and that this tends to be métier- and species- specific. Consequently, it may ultimately not be possible to fully standardize these procedures across all métiers, fleets and stocks. It was not clear from SGPIDS sessions whether or not these relationships have been thoroughly investigated by the Member States so we suggest that exploratory data analysis and simulation studies are carried out. This research should be coupled with estimates of uncertainty and quality indicators that provide end-users with an assessment on the quality of within-trip and within-haul estimates. It would be helpful if a comparative study of the different raising designs, made on a research vessel could be made available. Such study should also address the way total catch and total discards are estimated. In fact we note that most countries have their observers estimate discards and retained fractions of the catch separately, but some rely on skipper information or use direct proportion between discards and retained fractions of a sample to estimate total catch in the hauls. From the SGPIDS sessions it was not clear if these methodologies provide much different end-results or biases. A case-study from the Portuguese otter trawl fishery, where direct proportion

between discards and retained fractions in a catch sample is used to estimate total catch in each haul was presented (Prista *et al.*, Annex 8). This approach was reported as statistically more tractable than, e.g., estimates derived from skippers evaluation of total catch. However, in its current implementation it carries the disadvantage of requiring the observers to sort the catch and in feedback with fishers decide what are discards and what not. It was suggested this may confound high-grading practices. In-depth look into these and other putative sources of biases is required before a standardized protocol can be suggested.

Table 4.2. Sampling schemes for weights and number discarded

Member-state	Variable	Sampling scheme				Primary sampling						Secondary sampling						
		Type	Metier(s) or fleet segment(s)	Vessels	Species	Unit	Type of sampling	sampling unit selection	sampling unit raising	Source of raising variable	Sampling by	Unit	Type of sampling	sampling unit selection	sampling unit raising	Source of raising variable	Sampling by	who sorts the catch
BE	Weight discarded in trip	onboard	TBB_DEF	all	main commercial species	fishing operation	sampling	systematic (every 2)	Number of fishing operations	Observer	Observer	all discards	census	all units selected	---	---	Observer	Crew
BE	Weight discarded in trip	self-sampling	TBB_DEF	VIIf,g	cod	fishing operation	census	all units selected	---	---	Crew	all discards	census	all units selected	---	---	Crew	Crew
DK	Weight discarded in trip	onboard	all métiers in DCF	all	all fish species and mammals and seabirds	fishing operation	ad-hoc	1st fishing operation of the day	Number of fishing operations	Observer	Observer	basket(s) of discards	sampling	random	Total discard weight	Observer	Observer	Crew
DK	Weight discarded in trip	self-sampling	GNS	all	all fish species	fishing operation	census	all units selected	---	---	Crew	all discards	census	all units selected	---	---	Crew	Crew
EN	Number discarded in trip	onboard	all métiers in DCF	all	all fish species and commercial crustaceans and cephalops	fishing operation	ad-hoc	minimum 2/3 of fishing operations	Number of fishing operations	Observer	Observer	basket(s) of discards	sampling	random	Total discard volume	Observer	Observer	Crew
ES	Number discarded	onboard	OTB; PS	Mediterranean	DCF required species	fishing operation	census	all units selected	---	---	Observer	2 boxes of discards	sampling	random	Total discard weight	Crew	Observer	Crew

	in trip																	
ES	Number discarded in trip	onboard	GTR; LLS	Mediterranean	DCF required species	fishing operation	census	all units selected	---	---	Observer	2 boxes of discards	sampling	random	Total discard weight	Observer	Observer	Crew
ES	Number discarded in trip	onboard	OTB	Atlantic (long trips)	all species	fishing operation	sampling	systematic; day-night stratification	Number of fishing operations	Observer	Observer	1 box of discards	sampling	random	Total discard weight	Crew	Observer	crew
ES	Number discarded in trip	onboard	OTB	Atlantic (short trip)	all species	fishing operation	census	all units selected	---	---	Observer	1+ box(es) of discards	sampling	random	Total discard weight	Crew	Observer	Crew
ES	Number discarded in trip	onboard	PS	Atlantic	all species	fishing operation	census	all units selected	---	---	Observer	1 box of discards	sampling	random	Total discard weight	Crew	Observer	Crew
ES	Number discarded in trip	onboard	GNS	Atlantic	all species (some aggregated to higher taxa)	fishing operation	census	all units selected	---	---	Observer	---	---	---	---	---	---	Crew
FR	Both	onboard	all métiers in DCF	all	all species	fishing operation	sampling	random	Number of fishing operations	Observer	Observer	variable	sampling	random	adapted to sampling unit	Observer (when possible)	Observer	Crew
IRE	Both	onboard	Demersal fleet	all	all fish species	fishing operation	ad-hoc	minimum 3/4 of fishing operation	Total discarded weight	Observer	Observer	1 box of discards	sampling	random	Total discard weight	observer	Observer	Crew
IRE	Both	onboard	Pelagic fleet	all	all fish species	fishing opera-	census	all units selected	---	---	Observer	basket(s) of	sampling	random	Total discard	crew	Observer	Crew

						tion						discards			weight			
IRE	Weight discarded in trip	self-sampling	Nephrops	all	all fish and nephrops	fishing operation	ad-hoc	1 box of catch from 1 haul	Total landed weight of Nephrops	Crew	Crew	---	---	---	---	---	---	Crew
NL	Number discarded in trip	onboard	OTB_CRU; TBB_DEF;	all	all species	fishing operation	ad-hoc	minimum 1/4 of fishing operations	Fishing time	Observer	Observer	1 box of discards	sampling	random	Total discard volume	Observer	Observer	Crew
NL	Weight discarded in trip	onboard	TBB_CRU	all	all species	fishing operation	ad-hoc	minimum 1/4 of fishing operations	Fishing time	Observer	Observer	1 box of catch	sampling	random	Total catch volume	Observer	Observer	Sorting machine
NL	Number discarded in trip	self-sampling	OTB_DEF; OTB_CRU; TBB_DEF;	Reference fleet	all species	fishing operation	ad-hoc	2 hauls	Fishing time	Crew	Crew	2 boxes of discards	ad-hoc	ad-hoc	Total discard volume	Crew	Crew	Crew
NOR	Number discarded in trip	self-sampling	demersal fleet (High seas)	Reference fleet	all species	fishing operation	census	all units selected	---	---	Crew	segment	sampling	systematic	Number of segments	Crew	Crew	Crew
NOR	Number discarded in trip	self-sampling	demersal fleet (Coastal)	Reference fleet	all species	fishing operation	census	all units selected	---	---	Crew	segment	sampling	systematic	Number of segments	crew	Crew	Crew
PT	Both	onboard	OTB_CRU; OTB_DEF	all	all species	fishing operation	sampling	systematic (every 2); random start	Fishing time	Observer	Observer	3 boxes of catch	sampling	systematic	Total retained	Observer	Observer	Observer
PT	Number discarded	onboard	GTR_DEF; GNS_DEF; LLS_DWS	all	all species	fishing operation	census	all units selected	---	---	Observer	segment	sampling	systematic	Number of segments	Observer	Observer	Crew

	in trip																	
PT	Both	onboard	PS_SPF	all	all species	fishing operation	census	all units selected	---	---	Observer	0.5+ basket(s) of catch	sampling	random	Total discard weight	Crew	Observer	Observer
PT	Both	onboard	TBB_CRU	all	all species	fishing operation	census	all units selected	---	---	Observer	1+ baskets	sampling	random	Total discard weight	Observer	Observer	Crew
SCO	Number discarded in trip	onboard	OTB_DEF; OTT; PTB; OTB_CRU; SSC	all	all fish species and commercial crustaceans	fishing operation	census	all units selected	---	---	Observer	2+ basket(s) of discards	sampling	random	Total discard volume	Observer	Observer	Crew
SWE	Both	onboard	OTB_DEF; OTB_CRU	all	all fish species and commercial crustaceans and cephalops	fishing operation	ad-hoc	minimum 3 fishing operations	Number of fishing operations	Observer	Observer	3 boxes of discards	sampling	random	Total discard volume	Observer	Observer	Crew
SWE	Both	self-sampling	GNS+GTR+LLS	all	all fish species	fishing operation	census	all units selected	---	---	Crew	all discards	census	all units selected	---	---	Crew	Crew

4.3 Length frequency of discarded species (Table 4.3)

Length frequency of discards is collected in all onboard observer programmes. In general, onboard sampling for length frequency is performed for the same species and using the same sampling design and samples used to determine the species composition of the discarded fraction and to estimate the weights and numbers discarded per species. Only two countries reported to estimate these two outputs separately, i.e., to s independently sample the length frequency of each species of the discard fraction. Consequently, in most cases the estimates of weights/numbers and length frequency are not independent. One issue raised during the SGPIDS sessions was the question of whether or not the sample size collected in each haul for purposes of weight and number estimation was enough to adequately characterize the length frequency of the species discarded. It was unclear if that was so, but it was the general opinion that at present, the catch and discard samples allow the lengths of the main commercial species to be reasonably characterized.

4.4 Age-at-length of discarded species (Table 4.4)

Age-at-length of discards per species is an important variable for stock assessment. SGPIDS discussed the significance of this variable and the advantages and bias that could come from the use of survey-based and landings-based age-length keys as proxy to discard age-length key and reached no definitive conclusion. In general, the protocols of most countries instruct observers to perform age structure collection during onboard sampling of fishing trips, but not in all metiers. Furthermore, not all countries use this information to derive discard age length keys. Additionally, the collection of age structures and all subsequent processing in the laboratory is found very time consuming so Member States tend to collect age structure information only for the main target commercial fish species. In general, the onboard protocols set length-class based goals on the numbers of ageing structures the observers are expected to collect. A major difference identified across protocols was the aggregation level where these goals are set: some countries set goals at quarterly level, others at trip level and one at vessel level. A consequence of these different levels of aggregation is that information on the age structure of individual trips is not always available. Also, some bias may exist in quarterly level estimates if the ad-hoc selection of trips to sample cause age structures to be collected, e.g., in the first trips of each quarter. However, contrasted to trip goals, the quarterly goals carries an advantage: it sets maximum numbers on the age structures collected each quarter and thus significantly reduces, e.g., samples that have to be logged with databases, cross-checked for errors, and ultimately prepared and read.

Table 4.3. Sampling schemes for length frequency of discarded species

Member-state	Sampling scheme				Primary sampling						Secondary sampling					
	type	Metier(s)	Vessels	Species	Unit	Type of sampling	sampling unit selection	sampling unit raising	Source of raising variable	Sampling by	Unit	Type of sampling	sampling unit selection	sampling unit raising	Source of raising variable	Sampling by
BE	onboard	TBB_DEF	all	main commercial species	fishing operation	sampling	systematic (every 2)	Number of fishing operations	Observer	Observer	all discards	census	all	none	None	Observer
BE	self-sampling	TBB_DEF	VIIf,g	cod	fishing operation	sampling	systematic (every 2)	Number of fishing operations	Crew	crew	all discards	census	all units selected	---	---	Crew
DK	onboard	all métiers in DCF	all	all fish and mammals and sea-birds	fishing operation	ad-hoc	1st fishing operation of the day	Number of fishing operations	Observer	Observer	basket(s) of discards	sampling	random	Total discard weight	Observer	Observer
DK	self-sampling	GNS	reference fleet	all fish	fishing operation	census	all units selected	NA	NA	lengths at lab	all discards	census	all units selected	---	---	Crew
EN	onboard	all métiers in DCF	all	all fish and commercial crustaceans and cephalops	fishing operation	ad-hoc	min 2/3 of fishing operations	Number of fishing operations	Observer	Observer	basket(s) of discards	sampling	random	Total discard volume	Observer	Observer
ES	onboard	OTB	Atlantic (long trips)	all fish	fishing operation	sampling	systematic; day-night stratification	Number of fishing operations	Observer	Observer	1 box of discards	sampling	random	Total discard weight	Crew	Observer
ES	onboard	OTB	Atlantic (short trip)	all fish	fishing operation	census	all units selected	NA	NA	Observer	1+ box of discards	sampling	random	Total discard weight	Crew	Observer
ES	onboard	PS	atlantic	all fish	fishing operation	census	all units selected	NA	NA	Observer	1 box of discards	sampling	random	Total discard weight	Crew	Observer

ES	onboard	GNS	atlantic	all fish	fishing operation	census	all units selected	NA	NA	Observer	None	None	None	None	None	None
ES	onboard	OTB; PS	Mediterranean	DCF priorities	fishing operation	census	all units selected	NA	NA	Observer	2 box of discards	sampling	random	Total discard weight	Crew	Observer
ES	onboard	GTR; LLS	Mediterranean	DCF priorities	fishing operation	census	all units selected	NA	NA	Observer	2 box of discards	sampling	random	Total discard weight	Observer	Observer
FR	onboard	all métiers in DCF	all	all species	fishing operation	sampling	random	Number of fishing operations	Observer	Observer	variable	sampling	random	adapted to sampling unit	Observer (when possible)	observer
IRE	onboard	demersal fleet	all	all fish	fishing operation	ad-hoc	min 3/4 of fishing operation	Total discarded weight	observer	Observer	1 box of discards	sampling	random	Total discard weight	observer	Observer
IRE	onboard	pelagic fleet	all	all fish	fishing operation	census	all units selected	none	crew	Observer	basket(s) of discards	sampling	random	Total discard weight	crew	Observer
IRE	self-sampling	Nephrops	all	all fish and nephrops	trip	census	all units selected	Landed weight of Nephrops	crew	crew	1 box of catch	ad-hoc	random	Total landed weight of Nephrops	Crew	Crew
NL	onboard	OTB_CRU; TBB_DEF;	all	all fish	fishing operation	ad-hoc	min 1/4 of fishing operations	Effort	observer	Observer	1 box of discards	sampling	random	Total discard volume	Observer	Observer
NL	onboard	TBB_CRU	all	all fish	fishing operation	ad-hoc	min 1/4 of fishing operations	Effort	observer	Observer	1 box of catch	sampling	random	Total catch volume	Observer	Observer
NL	self-sampling	OTB_DEF; OTB_CRU; TBB_DEF;	reference fleet	all species	fishing operation	ad-hoc	2 hauls	Effort	crew	crew	2 box of discards	ad-hoc	ad-hoc	Total discard volume	Crew	Crew
NOR	self-sampling	demersal fleet (High seas)	reference fleet	all species	fishing operation	sampling	systematic (one per day)	Number fish operations	Crew	crew	segment	sampling	random	Total catch	Crew	Crew

NOR	self-sampling	demersal fleet (Coastal)	reference fleet	all species	fishing operation	sampling	systematic (two operations per week)	Number of fishing operations	Crew	crew	segment	sampling	random	Total catch	Crew	Crew
PT	onboard	OTB_CRU; OTB_DEF;	all	all species	fishing operation	sampling	systematic (every 2); toss coin to start	Effort	Crew	Observer	3 boxes of catch	sampling	systematic	Total retained	Observer	Observer
PT	onboard	GNS_DEF; GTR_DEF; LLS_DEF; LLS_DWS; FPO_MOL	all	all species	fishing operation	census	all units selected	NA	NA	Observer	segment	sampling	systematic (every 2)	Number of segments	Observer	Observer
PT	onboard	PS_SPF	all	all species	fishing operation	census	all units selected	---	---	Observer	1/2+ basket(s)	sampling	random	Total discard weight	Crew	Observer
PT	onboard	TBB_CRU	all	all species	fishing operation	census	all units selected	---	---	Observer	1+ baskets	sampling	random	Total discard weight	Observer	Observer
SCO	onboard	OTB_DEF; OTT; PTB; OTB_CRU; SSC	all	all fish species and commercial crustaceans	fishing operation	census	all units selected	---	---	Observer	2+ basket(s) of discards	sampling	random	Total discard volume	Observer	Observer
SWE	onboard	OTB_DEF; OTB_CRU	all	all fish and commercial crustaceans and cephalops	fishing operation	ad-hoc	min 3 of fishing operation	none	NA	Observer	3 box of discards	sampling	random	Total discard volume	Observer	Observer
SWE	self-sampling	GNS+GTR+LLS	all	all fish	fishing operation	census	all units selected	none	NA	Crew	all discards	census	all units selected	---	---	Crew

Table 4.4. Sampling schemes for age-at-length of discarded species

Member-state	Age at length of discards?	Sampling scheme				Primary sampling				ALK of discards?
		type	Metier(s)	Vessels	Species	Level	Sampling	Sampling goals	Sampling by	
BE	Yes	onboard	TBB_DEF	all	main commercial spp. required for stock assessments	Trip	ad-hoc	Targets per length class and geogr. area	Observer	Yes
BE	No	self-sampling	TBB_DEF	VIIf,g	none	---	---	---	---	---
DK	Yes	onboard	all	all	all commercial spp.	Quarter	ad-hoc	Targets per length class and geogr. area	Observer	Yes
DK	Yes	self-sampling	GNS	Reference fleet	all commercial spp.	Quarter	ad-hoc	Targets per length class and geogr. area	Observer	?
EN	Yes	onboard	all métiers in DCF	all	main commercial spp. required for stock assessments	Trip	ad-hoc	Targets per length class and geogr. area	Observer	Yes
ES	Yes	onboard	OTB	Atlantic (long trips)	main commercial spp. required for stock assessments	Year	ad-hoc	Targets per length class and geogr. area	Observer	No
ES	Yes	onboard	OTB	Atlantic (short trip)	main commercial spp. required for stock assessments	Year	ad-hoc	Targets per length class and geogr. area	Observer	No
ES	No	onboard	PS	Atlantic	none	---	---	---	---	---
ES	No	onboard	GNS	Atlantic	none	---	---	---	---	---
ES	No	onboard	OTB; PS	Mediterranean	none	---	---	---	---	---
ES	No	onboard	GTR; LLS	Mediterranean	none	---	---	---	---	---
FR	No	onboard	all métiers in DCF	all	none	---	---	---	---	---

IRE	Yes	onboard	demersal fleet	all	main commercial spp. required for stock assessments	Quarter	ad-hoc	Targets per length class and geogr. area	Observer	Yes
IRE	Yes	onboard	pelagic fleet	all	main commercial spp. required for stock assessments	Trip	ad-hoc	Targets per length class	Observer	Yes
IRE	No	self-sampling	Nephrops	all	none	---	---	---	---	---
NL	Yes	onboard	OTB_CRU; TBB_DEF;	all	plaice, dab, sole	Trip	ad-hoc	Targets per length class and geogr. area	Observer	Yes
NL	No	onboard	TBB_CRU	all	none					
NL	Yes	self-sampling	OTB_DEF; OTB_CRU; TBB_DEF;	Reference fleet	plaice, dab, sole, cod, whiting	Vessel	ad-hoc	Targets per length class and quarter	Observer	Yes
NOR	No	self-sampling	demersal fleet (High seas)	Reference fleet	none	---	---	---	---	---
NOR	No	self-sampling	demersal fleet (Coastal)	Reference fleet	none	---	---	---	---	---
PT	Yes	onboard	OTB_CRU + OTB_DEF;	all	main commercial spp. required for stock assessments	Quarter	ad-hoc	Targets per length class and geogr. area	Observer	Yes
PT	No	onboard	GNS_DEF; GTR_DEF; LLS_DEF; LLS_DWS; FPO_MOL	all	none	---	---	---	---	---
PT	No	onboard	PS_SPF	all	none	---	---	---	---	---
PT	No	onboard	TBB_CRU	all	none	---	---	---	---	---
SCO	Yes	onboard	OTB_DEF; OTT; PTB; OTB_CRU;	all	cod, haddock,	Trip	ad-hoc	Targets per length class	Observer	---

			SSC		withing, saithe					
SWE	Yes	onboard	OTB_DEF; OTB_CRU	all	main commercial spp. required for stock assessments	Trip	ad-hoc	Targets per length class	Observer	Yes
SWE	Yes	self-sampling	GNS+GTR+LLS	all	cod, flounder	Trip	ad-hoc	Targets per length class	Observer	Yes

4.5 Other outputs (Table 4.5)

Due to time constraints, SGPIDS could not address the full list of auxiliary variables and outputs that are provided by the each country's onboard sampling programme. A coarse survey of additional outputs indicated that the protocols of most Member States involved the collection of supplementary information on the retained catch, fishing effort, the technical details of the gears used, the geographical position of sampled and non-sampled hauls and a range of environmental variables (e.g., depth). These auxiliary data, are useful if, e.g., discard rates are to be standardized, or if sampling programmes are to be validated independently (e.g., with VMS data). Table 4.5. Auxiliary information collected in on board sampling protocols.

Member-state	Type	Metier(s)	Vessels	Type of sampling	Fishing effort info	Technical gear info	GPS info	Environmental info
BE	onboard	TBB_DEF	all	census	X	X	X	---
BE	self-sampling	TBB_DEF	all	census	X	X	X	---
DK	onboard	(em branco)	all	census	X	X	X	X
DK	self-sampling	(em branco)	all	census	X	X	X	---
EN	onboard	all	all	minimum 2/3 of fishing operations	X	X	X	X
ES	onboard	OTB	Atlantic (long trips)	50% of fishing operations	X	X	X	X
ES	onboard	OTB	Atlantic (short trip)	census	X	X	X	X
ES	onboard	PS	Atlantic	census	X	X	X	X
ES	onboard	GNS	Atlantic	census	X	X	X	X
ES	onboard	OTB; PS	Mediterranean	census	X	X	X	X
ES	onboard	GTR; LLS	Mediterranean	census	X	X	X	X
FR	onboard	all	all	census	X	X	X	---
IRE	onboard	demersal fleet	all	census	X	X	X	X
IRE	onboard	pelagic fleet	all	census	X	X	X	X
IRE	self-sampling	Nephrops	all	census	X	X	X	X
NL	onboard	OTB_CRU; TBB_DEF;	all	census	X	X	X	X
NL	onboard	TBB_CRU	all	census	X	X	X	X
NL	self-sampling	all	all	census	X	X	X	X
NOR	self-sampling	demersal fleet (High seas)	Reference fleet	---	---	---	---	---
NOR	self-sampling	demersal fleet (Coastal)	Reference fleet	---	---	---	---	---

Member-state	Type	Metier(s)	Vessels	Type of sampling	Fishing effort info	Technical gear info	GPS info	Environmental info
PT	onboard	all	all	census	X	X	X	X
SCO	onboard	OTB_DEF; OTT; PTB; OTB_CRU; SSC	all	census	X	X	X	X
SWE	onboard	OTB_DEF; OTB_CRU	all	census	X	X	X	X
SWE	self-sampling	GNS+GTR+LLS	all	census	X	X	X	X

4.6 Self-sampling programmes

Six Member States present at SGPIDS use self-sampling programmes to estimate discards. In some cases, these programmes are being developed as pilot-studies or target fisheries that are particularly difficult to sample with onboard observers (Table 4.2). Only one member-state was found to rely entirely on self-sampling program to estimate discards. The onboard protocols of most countries generally allow the estimation of weights or numbers, and lengths of discarded per species (Tables 4.2, 4.3). Only three Member States collect age structure information from self-sampling programmes (Table 4.4). In most cases, the skippers are requested to bring to shore a full discard sample, containing all species discarded, but cases exist where only commercial fish species are brought to shore. Within trip sampling protocol for species composition, weights and numbers is generally a census, because census is considered more practical for fishers to implement than other sampling schemes (Belgian self-sampling programme, Annex 9). However, with regards to length frequency, census, systematic and ad-hoc procedures are used depending on the member-state (Table 4.3). Three countries use self-sampling samples to construct age-at-length keys of some commercial fishes (Table 4.4). Most Member States require fishers to collect fishing effort, the technical details of gear, the geographical position and environmental data along with the discard data (Table 4.5).

4.7 Recommendations (ToR D)

The following recommendations arose from SGPIDS analysis to ToR d):

- In pursuit of increased standardization, it is important that Member States compile the main technical details of their sampling protocols in a common language (e.g., English). For stock assessment purposes and for better communication at national and international level, these technical details should also be made available in the languages of countries with whom they have shared stocks or common fishing grounds and should also be published online.
- In the technical compilation of the sampling protocols, aspects such as those referred to in table 4.1 to 4.5 should be routinely included, along with the list of métiers the protocols are applied to. Protocols that are too general (such that they have to be constantly adapted by on board observers when sampling a certain metier) should be avoided.
- From an ecosystem approach to fisheries management perspective, time series of discard data from a large array of species is important. It is recommended that Member States take steps towards a more holistic ap-

proach in their sampling trips. i.e. steps are taken towards estimating discards of all species. One way to achieve this without jeopardizing precision of final estimates is to establish sampling plans for non-commercial species that involve a lesser degree of sampling effort (e.g., collecting data of the non-commercial species in some of the hauls not sampled for commercial species).

- To ensure improved communication with the industry Member States should develop separate protocols for their self-sampling schemes. These should be simpler, shorter and more pictorial than the correspondent on-board sampling protocols.
- Member States should make efforts to support their sampling protocols on rigorous statistical analysis of the data collected to date. At within-trip level, it is important that bias and variability associated to ad hoc selection of fishing operation and boxes within-fishing operations is investigated and compared to the results obtained from systematic sampling and census sampling. Additional research is also due on the impact of different sampling techniques (box(es) of full catch vs. separate box(es) of retained and discards) and the raising variables used to raise box(es) to haul level and hauls to trip level.
- The issue of bias associated to the use of fully discard age-length key, mixed discard/retained age-length key or survey age-length key when estimating the age composition of discards was unresolved by SGPIDS. We suggest this subject is discussed at the next PGCCDBS meeting.
- Finally, it is recommended that greater attention is given to auxiliary variables, namely those that may help to standardize fishing effort (e.g., e.g., grid device information) and reduce the variability of final fleet level estimates (e.g., by post-stratification).

5 Proposals for standard data processing, quality checks and raising procedures; An investigation of innovative techniques for estimating discards (ToR E)

Discard sampling programmes entail a number of difficulties listed in previous sections that jeopardize the quality of the data produced and the uses they are intended for. This section first reviews the checks required to appraise the data quality; a second part examines how sampling designs and other issues affect raising procedures; a special section is devoted to estimating discards-at-age, which are required for stock assessment and raise particular issues. Due to time constraints the subjects 'data processing' and 'innovative sampling techniques were not addressed.

5.1 Quality checks

There are two different levels that should be applied to data checks :

1) Checks on the basic raw data gathered by the on board observer during the trip.

2) Checks on the aggregated sampling data from the collection of all trips in relation to the landing data and effort data applicable to the fleet and usually compiled from official logbook records or sales slips.

We envisage that type 1 checks occur before, or during entry into an institute's database, or once data has been entered into an institute's data base.

5.1.1 Internal integrity checks

Internal data integrity checks (termed "Type 1" checks) would include controls of the sampling process, and basic data checking routines such as:

- Do number of otoliths collected match number returned ?
- Is the vessel id correct?
- Are fish names in the correct format?
- Do numbers add up?
- Are latitude and longitude of haul positions correct?
- Is haul duration correct?
- Are the recorded statistical rectangles and ICES area compatible?
- Are raising ratios correct?
- Are there missing values?
- Outliers?
- Typing/transcription errors

Methods such as drop down boxes with finite lists of predefined options, automated range checks, etc can be used to support this process. Voice validation software, such that the numbers entered into a database are recited back to the individual entering the data can be used to reduce the incidence of errors in data entry and transcription from raw data sheets into electronic formats.

It is envisaged that most, if not all, institutes have some form of these internal integrity checks.

In addition to data integrity checks outlined above, a series of validation checks of onboard sampling practices can be envisaged. These could be targeted studies to es-

timate bias, or improve sampling practices, or optimise sampling effort practices on board vessels and could include such things as (see also ToR D, section 5):

- A study to determine if sampling every haul or a systematic sample of every other haul made a difference to the estimation of discard numbers or weights.
- An examination of the error associated in the estimating the weight of the catch as it was brought on board. This could perhaps be achieved by a second observer collecting all the discard fraction and estimating its weight or volume, independently of the first observer's estimate of the catch and the landed fraction.
- A comparison of otolith collection from all hauls, with otolith collection from a sub sample of hauls.
- A comparison of the observer sampling the catch, and separating the discard and landed fractions, and the observer sampling of the discard and landed fractions after sorting by the crew.

5.1.2 External validation checks

External validation checks (termed "Type 2"checks) is the process where the aggregated observer sampling trip records are checked against externally derived fleet level data.

This externally derived fleet level data will be in most cases log book records, auction sale records and VMS data, if available.

Comparisons between the sampling data and the logbook data can for instance be used to assess spatial-temporal coverage of the sampling, and look at the proportion of sampling effort in relation to the effort of the fleet.

Logbook data and auction sale records only relate to the landed fraction of the catch, and this needs to be kept in mind in any comparison of sampling designed to assess the discarded fraction of the catch.

Census data on trips are good descriptions of the target population (vessels) and their behaviour (trips). VMS data in particular provides a very good record of the spatio-temporal distribution of the target populations. These are the metrics against which discard sampling effort needs to be measured.

If it is possible to match the observer trip record to the external logbook record then discrepancies between the two can be quantified.

5.1.3 Special considerations for the different types of discard sampling

These are additional considerations that may be pertinent to particular types of sampling scheme.

5.1.3.1 Dedicated sampling schemes

Observers retained on long-term contracts may develop ingrained working practices leading to bias in selection of vessels. Friendships with skippers and crew members can lead to biased working practices, favoured treatment, payment in kind, good food, conditions on board proximity of the observer to the home port of a vessel. All these practices and situations can lead to potential bias in data collection.

Efforts to ensure that observers remain impartial and objective may include regular training, or retraining, the assessment of the performance of individual observers based on evaluation of vessel selection forms and in-depth quality check of their data, trips sampled by two observers who do not regularly work together.

5.1.3.2 Contracted observers

By contracted observers we mean observers that are not employees of the scientific institute that is the recipient of the data.

Contracting out observer work to other bodies may, in some countries, be a cost effective way to increase sample size and obtain better spatial-temporal sampling coverage. Contracted observers may also be appropriate for increasing the monitoring levels where particular fisheries are of interest, or where the importance of the fishery is disproportionate to its size. The logistics of covering seasonal or sporadic fisheries may be best met by employing contract observers. Monitoring the effects of new management measures may be more suited to additional contract staff, especially where there is a commitment to maintain observer coverage in conventional observer monitoring scheme.

Potential sources of error that may lead to biased data with contracted observers include:

- The observers may be influenced by the organisation that is employing them, they may be on short term contracts, they may have rudimentary training and lack experience and they may be young, or ex fishers or close to retirement age. The organisation contracted may be less established or may have specialities elsewhere.
- Observers hired on a short term basis usually may meet more difficulties with finding vessels agreeing to take them onboard than dedicated observers. Skippers are more confident in observers they know for a long time. On the one hand, this does not simplify cooperation with the industry. On the other hand, it is likely to reduce the bias in vessel selection, as dedicated observers tend to ask regularly to skippers they know are favourable to the programme and willing to take observers onboard.
- Care needs to be taken when employing contractors that the organisation or the individuals involved does not have a vested interest in discards.
- Written protocols are likely to be of particular importance, especially to cover events out-with the observers previous experience. Supporting tools for species identification (species guide) are also required.
- The communication links with contract observers operating in isolation, perhaps in remote or inaccessible areas may be limited, and hence support and direction may be limited.
- The data received may contain more errors and mistakes and it may have omissions and inconsistencies. In extreme cases it may be fabricated or doctored.
- The format data is returned may not be compatible with under that of the institute.

Some of these issues affecting data quality can be improved by providing observers and observer organizations with standardized protocols and tools. This requires a

rigorously structured approach by the coordinating scientific institute, including fully detailed standardized protocols, tools to monitor the realization of the sampling plan and communication methods to update the sampling plan when it cannot be realized owing to the fluidity of fishing activities. Training is a special issue with contracted observers. All these standardized and control tools are essential. This entails a certain cost, but as a result better control over procedure can be achieved.

In cases were observers are employed to monitor particular fisheries:

- The sampling design should be aimed to meet the needs of data collection in relation to the characteristics of the fishery. Data from such standalone sampling schemes cannot generally be absorbed into wider existing schemes – it is unlikely to be compatible with that of established schemes, and the data gathered are as a result not likely to be usable for other purposes.
- In cases where contracted observers are being used to bolster coverage in established schemes care needs to be exercised that increased observer coverage is compatible with the sampling stratification already in place. Sudden changes in data quality may result from mass influx of new observers to an existing sampling scheme.

In summary, the sequence of procedures to ensure data quality under a contracted observer sampling programme includes:

- Observer training is the most critical point, including safety and technical aspects (protocol, tools and software, species identification). Sessions need to be organized on a regular basis to ensure that newly hired observers receive the appropriate training.
- Written protocol and standardized observer record forms.
- Online monitoring of the realization of the sampling plan and the contacts with skippers (France developed a dedicated free software WAO, which is available in French and English).
- A specific software to enter the data into the data base, with multiple checks for internal consistency and levels within likely ranges.
- Procedure for data check and validation with back and forth controls between the observer, his/her supervisor, and the institute that stores the data. Compliance with the protocol as well as the data themselves need to be controlled.
- A centralised data base with checks for cross-consistency between data.
- Quality assessment of the data before they can be extracted from the data base.
- Regular audits of the organizations of observer societies.
- Payment conditional on quality of data and procedures, not just proportional to number of data lines filled.

5.1.3.3 Self sampling

In most of the self-sampling programmes, fishers are asked to collect samples that are returned to the scientific institute for further processing. But in some of the fisheries-science partnerships, fishers are collecting onboard discard data themselves.

Some of the considerations that should be kept in mind when running a self-sampling project are:

- The sampling protocol needs to be as simple as possible and the collection of the information should not be too time consuming.
- While self-sampling programmes usually reach a much higher coverage when it comes to getting data from a large number of vessels, there is needs to be control over the vessel selection, which may otherwise be highly biased, and may not correspond with a sampling stratum.
- Potential bias can arise from the motivation of demonstrating "good" or hiding "bad" discard practices.
- Data quality may be limited by insufficient fishers' training.

Therefore discard data collected by fishers should be validated by cross-check against discard data from a dedicated observer programme. The latter may be unmatched samples, or a matched observer sample – in which case the dedicated observer programme is used to check the work of the self-sampling scheme.

It is likely that stock assessors would be cautious about quality standards of not validated, self-sampled data put forward for stock assessment purposes. Hence, for scientific research and advice in general a trade-off between data quality and data quantity can be recognised.

SGPIDS note that discard self sampling may not necessarily be the best field for cooperation with the industry, especially when fishers collect and analyze discard data themselves; and unless there is an obligation by stakeholders (fishers and scientists) that unbiased quality discard data is required by both parties.

5.1.3.4 Reference fleet

A reference fleet is a group of vessels that have long term contractual (paid) arrangement with a scientific institute to collect data.

Most of the issues raised relating to self sampling apply to a reference fleet. A distinction may be that the long term relationship between vessels and scientific institutes allows better trust and more complex data to be gathered and more control over vessel selection

Any bias resulting from the opt-in nature of the vessels participating in a reference fleet will be a long term systematic feature of the data gathered.

5.1.3.5 Landed discards

In some situations a proportion of the landed fraction of the catch can be subsequently discarded, this we define as "landed discards". Examples would include some pelagic fisheries where the unsorted catch is stored in refrigerated sea water tanks in the vessels, and these tanks are unloaded at processors. The total retained catch is thus landed, and may or may not contain species or size classes that are discarded at the processor.

SGPIDS consider that there may be little or no bias if probability based sampling of vessels at landing locations is used, and there are none of the complications arising from observations being carried out at sea in the other settings. However, in pelagic fisheries (and some other) the major discard issues is slippage occurring at sea, which is difficult to sample; the discarding of a fraction of the retained catch is perhaps more akin to processor waste.

Most Member States do not regularly sample such landed discards as far as we are aware.

5.1.4 Raising procedures

5.1.4.1 A standard raising procedure?

The Community programme for the collection, management and use of data in the fisheries sector for the period 2011-2013 (European Union 2010) sets a number of requirements that dictate a standard raising procedure.

Variables: Sampling must be performed in order to evaluate the quarterly length distribution of species in the catches, and the quarterly volume of discards. Data shall be collected by metier referred to as level 6 of the matrix defined in Appendix IV (1 to 5) and for the stocks listed in Appendix VII. In order to optimise the sampling programmes, the metiers defined in Appendix IV (1 to 5) may be merged. When metiers or fleet segments are merged, statistical evidence shall be brought regarding the homogeneity of the combined strata. At national level, one metier defined at level 6 of the matrix in Appendix IV (1 to 5) may be further disaggregated into several more precise strata, i.e. distinguishing different target species.

Sampling strategy: the sampling unit shall be the fishing trip and the number of fishing trips to be sampled shall ensure good coverage of the metier;

Precision levels: (a) data related to quarterly estimates of discards length and age composition for Group 1 and Group 2 species must lead to a precision of level 1; (b) weight estimates of Group 1, 2 and 3 species must lead to a precision of level 1.

This implies that national programmes are expected to sample populations of trips grouped by metier and quarter. According to sampling theory the standard raising procedure within each stratum should be:

- Samples are raised to haul level based on sampled proportion.
- Sampled hauls are raised to trip level based on the proportion of hauls sampled.
- Sampled trips are raised to metier level based on the proportion of trips sampled.

5.1.4.2 Why it does not work

In the setting of the European fisheries and the Data Collection Framework, the situation may be complicated by a variety of issues. These issues have been listed by the Working Group on Discard Raising Procedures (ICES 2007); most have not been solved since this Working Group provided their conclusions. In brief:

- Total number of trips could be underestimated for various reasons depending on the source of information used (auction sales, logbooks…).
- Strata sampled in the onboard observer programme might be difficult to identify at the trip population level, the strata being identified in different manners depending on the source of information used.
- Trip durations might be quite variable within a metier, spanning e.g. from 1 to 10 days. This will automatically generate a high uncertainty in estimates. In addition, variable trip duration might generate a bias if the distribution of trip length within the sample does not reflect the distribution of trip length in the population. For example in Denmark a comparison on average length on observer trips with the average

length from the logbooks provided evidence that there were difference in several métiers. This can be solved by raising directly from hauls to métier by the proportion of hauls sampled relative to the total number of hauls of this metier in the quarter, provided the information is available. Whereas the estimate will be correct, the trip level must be taken into account when estim

-
- ating the associated variance (two-stage estimator, see ICES 2007), otherwise the latter would be underestimated. Another way of solving the variable trip duration is to raise sampled hauls to fishing days instead of trips, and then to metiers by total days fished. Here again special care must be taken when estimating the variance.
- Fishing operations of different metiers may be carried out during a single trip, so that i) a given trip is a sampling unit for several strata, and ii) the total number of trips for a given metier has to be corrected for these multi-métiers trips. This correction may be complicated depending on the information available from the log-books, which is not necessarily available for separate hauls.

5.1.4.3 Importance of the link with sampling design

Matching units and strata between discard data and raising variables may be complicated if the sampling strata are not perfectly aligned. This may often be the case as metiers tend to fluctuate in time depending on fishing opportunities and other constraints such as markets, fisheries regulations and weather. Sampling schemes are usually defined based on some former year activities, which may not reflect the sampled year activity in an appropriate manner. Therefore sampling programmes have to be quite flexible and allow for continuous adaptation to actual fleet activity. To overcome this, the Workshop on methods for merging métiers for fishery based sampling WKMERGE (ICES 2010) recommended to avoid the use of temporally dynamic metier as sampling strata. Rather, temporally stable strata such as sampling frames consisting of vessel lists should be used to provide sufficient data for the required metier, spatial and temporal strata. Unstable metiers should be treated as domains of interest rather than strata; estimates by metier may then be obtained using post stratification (ICES 2010). SGPIDS support this recommendation for onboard observer sampling.

For all these reasons, SGPIDS considers that there is clear evidence that there is no standard raising procedure for discard data. The raising procedure must follow from the sampling practices employed and these are dependent on the particular circumstances under which the sampling occurs. Among other things, different countries use different approaches to define metiers and potentially merge them into workable strata. Differences in stratification, variations in sampling protocols or schemes such as documented in sections 3 and 6 (ToRs a and d), as well as in the availability of raising variables, justify widely different raising procedures.

5.1.5 Precision and accuracy of estimates

5.1.5.1 Precision

To examine whether the precision requirements of the programme are met, discard estimates need to be accompanied by an appraisal of the uncertainty in the estimates – e.g., a confidence interval. It is now widely recognized that the assumption of a normal distribution for discarded numbers or weights does not hold. Therefore,

SGPIDS recommend the use non-parametric bootstrap methods (unless appropriate non-normal distributions can be fit to the data, and the corresponding analytical variance formula are available).

The ideal situation where the number of samples is dictated by the target precision and the level of stratification does generally not apply, and in particular, it does not apply to onboard discard sampling programmes. Generally resources available and other practical constraints limit the number of samples. WKMERGE pointed out that highly resolved strata such as level 6 métiers as set out by the DCF can lead to over-stratification. This in turn generates under-sampling or non-sampling of strata, and poor control over sampling probabilities (ICES 2010). As an example, a case study presented by Portugal at the 2011 PGCCDBS meeting has shown that up to 48 trips by quarter would be required to reach the required level of precision for two specific metiers set out in the DCF regulations (namely OTB_DEF_65_69_0_0_ and OTB_CRU_>=55_0_0). The actual number of trips targeted by the current sampling scheme is 12 (OTB_CRU) and 27 (OTB_DEF). The double requirement of precision level and fine-grained stratification in the DCF is not affordable by most Member States. As a result many Member States merge their strata, but statistical procedures for identifying metiers as homogeneous groups of fishing operations are not yet standardized (ICES 2010). This results in a lower level of standardization across programmes as each member state likely merge strata in different ways. Another issue arises from precision being required for numbers-at-length; however, different Member States might use different length class widths, and different length classes have different precisions. Thus precision levels are hardly comparable across species, metiers, and programmes. To improve standardization SGPIDS recommend to start from the resources available and the precision required to determine the number of strata. Furthermore, the number of trips to be sampled per stratum should be calculated based on an easy-to-calculate and comparable number such as total number or weight discarded by species.

5.1.5.2 Bias

SGPIDS note that the DCF sets out precision levels but does not include any requirement about bias. Bias happens when the samples are not representative of the population. Other sections of this report document a number of potential sources of bias in discard data, one of the most important of which is the selection bias introduced by most sampling programmes relying on a voluntary basis: only those skippers that are willing to take observers onboard are going to be sampled, and these may not be representative of the fishing and discarding practices of the whole fleet. Besides, even when there is no selection bias, the simple presence of an observer changes behaviours and generates a bias in estimates of catch and discards (Benoît and Allard 2009). For example, in the Danish cod trawl fishery the comparison of landings estimated from onboard sampling data versus logbooks provides indication for highgrading that did not happen when observers were onboard (Figure 5.1).

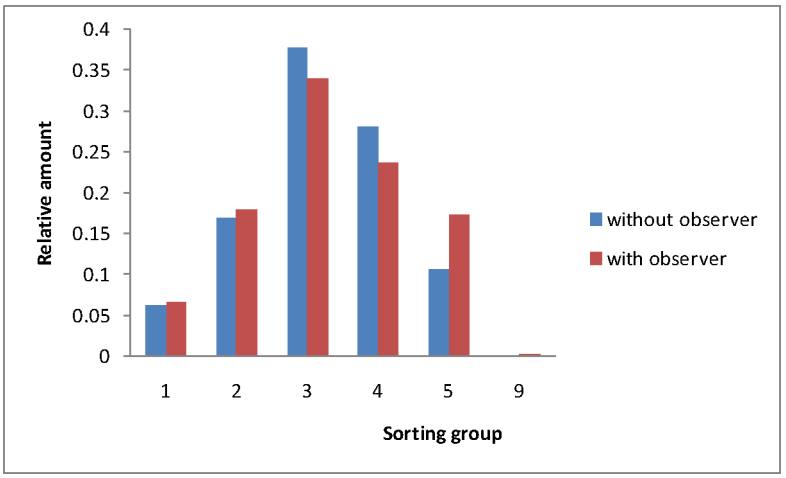

Figure 5.1. An example of comparison of cod between observer trips and same metier without observers on an annually basis by sorting groups. If there is a large difference between the amount of smaller fish (size group 5) with and without observers this can be an indication of high grading.

Some sources of bias can be mitigated, but others such as the observer bias are unavoidable. SGPIDS recommend that, as a first step, bias in estimates be appraised using methods such as comparison of landings estimates based on onboard observer sampling schemes versus other sources, or comparison of spatial cover (Figure 5.2).

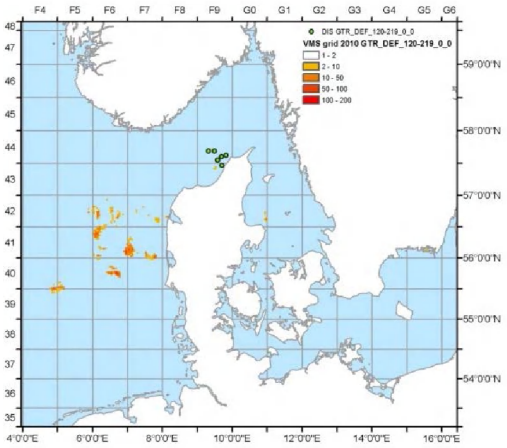

Figure 5.2. Danish VMS data from the métier GTR_DEF_120-219 in 2010. An example of poor spatial cover in the observer program where the green dots indicate a haul measured on observer trip and the orange scale the relative distribution of the fleet.

5.1.5.3 Sample size and sampled proportion

Provided the population of vessels or fishing trips in each stratum is sampled representatively at each stage in the sample selection process, estimates by strata may be obtained if the number of sampled trips within strata is sufficient. The necessity to calculate precision using non parametric bootstrapping however imposes a minimum number of samples required per stratum. What this minimum is, is not clear in the fisheries context. WKSCMFD (ICES 2004) used non parametric modified bootstrap algorithm for small sample sizes (Chan and Lee 2001) where n = 10 was used as the example. WKPRECISE noted that the required sample size is dependent on the precision levels required and that the number of samples increases more or less in proportion to the number of domains for which estimates are required. Domains in this

context being métier, or the temporal unit required for reporting. Basic simulations which assume a minimum of stochastic variation within the target population and no measurement error (appendix 1) suggest that a sample size of around 14 or more would be needed to obtain a valid 95% confidence interval on a bootstrap distribution of the sample mean. Experience of the type of data available to Member States from discard sampling schemes suggest that 10 replicates within a stratum would be considered a good samples size, and less than 5 is not unusual. For many scarce métiers or where there is an overriding requirement to raise data to a reporting level, such as the quarter, single sample observations are not uncommon. Aggregating such estimates to provide numbers at age or length at the reporting level underestimates the variation in the raised totals and leads to inappropriately narrow precision levels. Given these constraints post stratification involving the collapsing of strata to increase sample size is one way to ensure adequate sample replicates for bootstrap precision estimates. But it should be recognized that this comes at the price of not being able to thereafter disaggregate the raised data to provide estimates at finer temporal scales (such as the quarter) and for more highly resolved métier.

The inherent variability in discard data is a characteristic of the fisheries, the discarding practices during the sampling period, and the measurement error involved in sampling the discard portion of the catch. Variability is in most instances positively correlated with the size of the population being sampled, in the discard situation the number of trips. All other things being equal, greater sample size is required to estimate larger populations.

WKPRECISE (ICES 2009) and WKMERGE (ICES 2010) provided detailed recommendations to improve sampling designs and ensure a sufficient coverage within strata.

5.1.6 Auxiliary variables

To improve the accuracy and/or precision of discard estimates, auxiliary variables such as landings or effort e.g. time spent fishing may be used. This additional information will improve estimates when there is an established relationship between the selected auxiliary variable and discards; in the case of simple proportionality a ratio-estimator can be used; if the relationship is non-linear model-based estimates can still be developed (Rochet and Trenkel 2005). Also, some auxiliary variable may be more easily aligned with the onboard sampling scheme strata than the number of trips. It is essential that pilot studies be conducted for each fishery, and potentially each species within fisheries, to determine the most appropriate raising factors and auxiliary variables. For example, whereas discards of a target species may be proportional to the landings of this species, it might not be the case for bycatch species of which little amounts if any are landed.

Appropriate raising or auxiliary variables are those that are available – that is, that can be measured accurately on sampled trips, and for which data are collected in a consistent way for the whole metier. This may not be the case for landings nor for effort (ICES 2007).

5.1.7 Age-length keys and length-weight relationships

Generating estimates of numbers at age for the discarded fraction of the catch requires age samples, i.e. otoliths to be collected from fish, and the age determined.

All Member States present are measuring lengths of discarded fish. However a brief survey of those Member States present (Table 5.1) showed the extent to which the otoliths from the discarded fraction of the catch are collected, and the extent to which

they are pooled with other otoliths. Which age estimates are actually used in the construction of age length keys (ALKs) and what the spatial and temporal resolution of these ALKs is, how the ages are combined (i.e. as a weighted or unweighted sample), and which length frequencies are converted to numbers at age by the ALK is a poorly documented aspect of the raising process. However for estimating numbers at age for stock assessment working groups this is a critical stage.

Similar considerations apply to the use of weight length relationships. There was no opportunity to survey practices in the use of weights for participating Member States though some Member States weigh a sample of the catch on board, others weigh nothing and rely on weight length relationships, which in some instances date back 30 years. It was not apparent whether any member state weighs individual fish during at-sea sampling for discards.

Bias and error in the application of ALKs, and in the use of weight length relationships, is a poorly understood and rather neglected topic in the raising of data. These topics also have wider relevance as much of the same issues apply to the raising of landings data.

SGPIDS considers the construction and use of ALKs, and of weight length relationships, is an important issue that needs to be addressed possibly at some wider forum in the future. SGPIDS recommends PGCCDBS consider the most appropriate way to deal with the issue.

Table 5.1. Survey of the otolith collection and ALK construction for discard data.

Member state	Metier or Grouped metier to which ALKs applied	Oragin of otoliths used for discard age estimateion				Level at which ALK applied		Temporal scale	Spatial scale	ALK construction		
		Discard fish only	Discarded and landed fraction	Landed fraction only	Other	trip	stratum			weighted	unweighted	unknown
Ireland	Demersal	Yes	No	No	No		Yes	quarter	Ices Div		Yes	
	Pelagic	Yes	No	No	No	Yes		trip	Ices Div		Yes	
France	All				survey and landings		Yes	year, quarter	Ices Div / area			don't know
Scotland	Demersal	Yes	No	No	No	Yes		trip	Ices Div		Yes	
Belgium	Demersal		Yes				Yes	quarter	Ices Div		Yes	
Sweeden	All	Yes					Yes	quarterr	Ices div / area		Yes	
Denmark	All	Yes					Yes	quarter	Ices area	Yes		
Netherlands	all to be confirmed				discards landings and survey		Yes	quarter	Ices div			don't know
Portugal	All						Yes	quarter	Ices area			

6 An inventory of present data storage procedures of primary discard data and proposals for modifications which allow easy transfer to a common (regional) database (ToR F)

6.1 Regional Coordination Meetings (RCM's)

The need for common regional databases have been expressed by different Regional Coordination Meetings (RCM's) held under the Data Collection Framework (DCF) and by the "Regional scenarios and roadmap on Regional Database" meeting in 2010. Common regional databases have further gained support from STECF (PLEN-11-01) who consider that regional databases have a potential to decrease problems with data deficiencies through more centralised transmission processes and increase transparency on how data sets are compiled enabling assessment of quality.

In 2011 a road map on actions needed to enable implementation of common databases were set up by the interim steering group. It has also been identified that main need for a common database is for biological (including discard data) and transversal variables.

6.2 Council regulation 199/2008

EU Member States are in accordance with Council regulation 199/2008 obliged to store primary data collected under the Data Collection Framework (DCF) in computerised databases. The storage procedures as well as the variables stored may however differ between countries. A main reason for the variability in discard data storage procedures is the variability in sampling designs. How data is stored depends on how it is collected, and since different sampling programmes have different designs, data is stored in different ways.

This might cause problems in terms of transferring data to a regional (common) data base and also in the ability of the country to use, for example facilities for raising discard data in the common database.

6.3 inventory of the collection and storage of a range of discard data

In order to identify the main difficulties that countries may encounter when submitting discard data to a common data base: an inventory of the collection and storage of a range of discard data variables was carried out by SGPIDS. It was decided to use the variables from the COST/Fishframe format (Jansen et al, 2009) to make an inventory of possible problems.

A table containing all variables required in the COST/Fishframe format was set up and all the countries participating at the meeting was asked to fill out what variables they currently can deliver (Table 6.2). It was also assessed in more general terms how countries store discard data, if they currently have experience in and are able to use the COST/Fishframe format and, based on conclusions from the inventory, what the main problems are. The result from the inventory is shown in Table 6.1.

6.4 Main conclusions:

- All countries participating in the meeting store discard data in central databases.
- Most countries have some experience in using the COST/Fishframe format

- All countries are able to compile data in the format but in some cases with difficulties. Two main problems were identified:
    - Some sea sampling programmes do not collect weights of discards but use a length-weight relation and a raising factor based on volumes of discards. The COST/Fishframe format requires subsample weight and total weight of discards on a haul level. This can be calculated from length-weight relations but it is not done on a regular basis which makes compiling of the data very time consuming.
    - Some sampling designs require information on number of vessels by strata at the population level to raise the sampled data. This can presently not be done using the COST/Fishframe format since this information not is included in the effort and landings tables (CE and CL). This means that although discard data can be compiled, it cannot be used for raising in a common database.

Table 6.1. How countries store discard data.

Country	Is all discard data stored in a central data base? (Y/N)	Type of data base	Do you have experience with the COST/Fishframe format?	Is it possible to compile data in the COST/Fishframe format?			If yes, is it possible to get a data base generated report in the COST/Fishframe format?	If no, what are the main problems?
				CS	CE	CL		
Netherlands	Y	Oracle	Y	Y	Y	Y	Not yet	Weight by species are not measured. Weight by species are calculated by L-W relations.
Denmark	Y		Y	Y	Y	Y	Y	
Spain	Y	Oracle	Y	Y	Y	Y	Y	
England	Y	SQL	Y	Y	Y	Y	Not yet	No weights collected at sea, no column to enter RF based on proportion of volume sampled
Ireland	Y	Access front end for input but data stored in SQL	Y	Y	Y	Y	Y	
Sweden	Y	Oracle	Y	Y	Y	Y	Y	
Belgium	Y	Access	Y	Y	Y	Y	Y	
Norway	Y	SQL?	N	Y	Y	Y	N	
France	Y	Oracle	Y	Y	Y	Y	Y	
Scotland	Y		Y	Y	Y	Y	Y	No weights collected at sea, CE and CL table not on individual vessel level
Portugal	Y	Oracle	Limited	Y	Y	Y	Not yet	Time and experience are required to implement such interface. These and funds are lacking

Table 6.2. Variables required in the COST/Fishframe format.

					Is the parameter collected and on what level?										
					Country										
variable	description	requi	table	level	DNK	Spain	England	NL	Irela	SW	BEL	Norw	France	Scotland	Portugal
vslFlgCtry	Vessel Flag Country *	M	all		y	y	y	y	y	y	y	y	y	y	y
year	Year *	M	all		y	y	y	y	y	y	y	y	y	y	y
quarter	Quarter *	M	ce, cl		y	y	y	y	y	y	y	y	y	y	y
month	Month *	O	ce, cl		y	y	y	y	y	y	y	y	y	y	y
area	Area * (subdivision)	M	ce, cl, hh	haul	y	y	y	y	y	y	y	y	y	y	y
rect	Statistical Rectangle *	O	ce, cl, hh	haul	y	y(n)	y	y	y	y	CE,	y	y	y	y
foCatNat	Fishing activity category National *	O	ce, cl, hh	haul	y	y	y	y	y	y	y	y	y	y	(1)
foCatEu5	Fishing activity category European lvl 5 *	M	ce, cl, hh	haul	y	y	y	y	y	y	y	y	y	y	y
foCatEu6	Fishing activity category European lvl 6 *	O	ce, cl, hh	haul	y	y	y	y	y	y	y	y	y	y	y
trpNum	Number of trips	M	ce	fleet	y	y	y	y	y	y	y	y	y	y	not yet
foNum	Number of sets / hauls	O	ce, tr	trip, fle	y	y	not in CE	not in CE	y	y	y	y	not in CE	?	not yet
foDur	Fishing time / soaking time	O	ce, hh	haul	y	y	CE?	not in CE	y	y	y	y	y	n	not yet
effKwDays	kW-days	O	ce	fleet	y	y	y	y	y	y	n	y	y	y	not yet
effGtDays	GT-days	O	ce	fleet	y	y	y	y	y	y	n	y		y	not yet
daysAtSea	DaysAtSea	O	ce, tr	trip, fle	y	y	y	y	y	y	y	y	y	y	not yet
landCtry	Landing Country *	M	cl, tr, hh, sl, hl, ca		y	y	y	y	y	y	y	y		y	y
spp	Species *	M	cl, sl, hl, ca		y	y	y	y	y	y	y	y	y	y	y
landCat	Landing category * (human consumption	M	cl, sl, hl, ca		y	y	y	y	y	y	y	y	na	y	y
commCatScl	Size category scale *	O	cl, sl, hl, ca		y	y(n)	y	y	y	y	n	y	y	y	y
commCat	Commercial Size category *	O	cl, sl, hl, ca		y	y	y	y	y	y	n	y	y	y	y
unallocCatchWt	Unallocated catch weight	M	cl	fleet	y?		n	n	n	n	n	n	not yet	n	n
misRepCatchWt	Area misreported Catch weight	M	cl	fleet	y?		n	n	n	n	n	n	not yet	n	n
landWt	Official Landings weight	M	cl	fleet	y		y	y	y	y	y	y	y	y	y
landMult	Landings multiplier	O	cl	fleet	y			n	n	n	n	n	not yet	n	n
landValue	Official landings value	O	cl	fleet	y		y	n	y	y	n	y	y	y	y
sampType	Sampling type * (sea or market)	M	tr		y	y	y	y	y	y	y	y	y	y	y
proj	Project *	M	tr		y	y	y	y	y	y	y	y	y	y	y
trpCode	Trip code*	M	tr, hh, sl, hl, ca		y	y	y	y	y	y	y	y	y	y	y
vslLen	Vessel length	O	7) tr	trip	y	y	y	y	y	y	y	y	y	y	y
vslPwr	Vessel power	O	7) tr	trip	y	y	y	y	y	y	y	y	y	y	y
vslSize	Vessel size	O	7) tr	trip	y	y	y	y	y	y	y	y			y
vslType	Vessel type	M	6) tr	trip	y	y	y	y	y	y	y	y		n	y
vslId	Vessel Identifier (encrypted)	O	tr	trip	y	y	y	y	y	y	y	y	y	y	y
sampCtry	Sampling Country	M	tr	trip	y	y	y	y	y	y	y	y	y	y	y
sampMeth	Sampling method (observer or selfsampli	M	tr	trip	y	y	y	y	y	y	y	y	y	y	y
staNum	Station number *	M	tr, hh, sl, hl, ca		y	y	y	y	y	y	y	y	y	y	y
foVal	Fishing validity	O	9) hh	haul	y	y	y	y	y	y	y	y	y	y	y
aggLev	Aggregation level (haul or journey)	O	9) hh	(haul)	y	y	y	y	y	y	y	y	y	y	y
catReg	Catch registration	M	hh	haul	y		y		y	y	y	y	y	y	y
sppReg	Species registration	M	hh	haul	y		y	y	y	y	y	y	y	y	y
date	Date	M	hh	haul	y	y	y	y	y	y	trip	y	y	y	y
time	Time	O	hh	haul	y	y	y	y	y	y	y	y	y	y	y
latIni	Pos.Start.Lat.dec.	O	hh	haul	y	y	y	y	y	y	y	y	y	y	y
lonIni	Pos.Start.Lon.dec.	O	9) hh	haul	y	y	y	y	y	y	y	y	y	y	y
latFin	Pos.Stop.Lat.dec.	O	hh	haul	y	y	y	y	y	y	y	y	y	y	y
lonFin	Pos. Stop.Lon.dec.	O	hh	haul	y	y	y	y	y	y	y	y	y	y	y
foDep	Main fishing depth	O	hh	haul	y	y	n	y	y	y	n	y	n	n	y
waterDep	Main water depth	O	hh	haul	y	y	y	n	y	y	n	y		y	y
gear	Gear	O	9) hh	haul	y	y	y	y	y	y	y	y	y	y	y
meshSize	Mesh size	O	9) hh	haul	y	y	y	y	y	y	y	y	y	y	y
selDev	Selection device	O	9) hh	haul	y	y	y	n	y	y	n	y	y		y
meshSizeSelDev	Mesh size in selection device	O	hh	haul	y	y	y	n	y	y	n	y	n		(2)
catchCat	Catch category *	M	sl, hl, ca		y	y	y	y	y	y	y	y	y	y	y
subSampCat	Subsampling category *	O	sl, hl, ca		y	y	y	y	y	y	na	y	y	na	y
wt	Weight	M	sl	haul	y	y	n	n	y	y	y	n	y	n	y
subSampWt	SubSample weight	O	sl	sampl	y	y	n	n	y	y	y	y	y	n	y
lenCode	Length code	O	1) sl, ca		y	y	y	y	y	y	y	y	y	y	y
sex	Sex *	O	hl, ca		y	y	y	y	y	y	y	y	y	y	y
lenCls	Length class *	M	hl, ca		y	y	y	y	y	y	y	y	y	y	y
lenNum	No at length (not raised to whole catch)	M	hl	sampl	y	y	y	y	y	y	y	y	y	y	y
stock	Stock *	O	ca		y	y	y	n	y	y	n	y		y	y
age	Age *	M	ca		y	y	y	y	y	y	y	y	n (not disca	y	y
fishId	Single fish number (id) *	M	ca		y	y	y	y	y	y	y	y	n (not disca	y	y
plusGrp	Age Plus group	M	ca		y	y	y	y	y	y	n	y	n (not disca	y	y
otoWt	Otolith weight	O	ca		y	y			n	y?	n	y	n (not disca	n	(2)
otoSide	Otolith side	O	ca		y				n	n	n		n (not disca	n	(2)
indWt	Weight (individual)	O	ca		y	y	n	y	y	y	not c	y	n (not disca	n	y
matScale	Maturity scale	O	ca		y	y	y	y	y	y	n	y	n (not disca	y	y
matStage	Maturity stage	O	ca		y	y	y	y	y	y	n	y	n (not disca	y	y
table notes:															
(1) can be derived from European categories															
(2) not relevant at the moment, may be added when necessary															

7 Ways to improve co-operation with the fishing sector to collect discard information (case studies) (ToR G)

Discard sampling inherently requires fishers' cooperation to have data recorded during commercial fishing operations. Drawing upon experiences of sampling programme coordinators attending this meeting, a number of ways to improve cooperation with fishers have been identified. Several case studies illustrate the benefits of good working relationships. While all of them essentially help to build trust between cooperating partners, some demonstrate the risks that established working relationships can be jeopardized or even destroyed by management decisions, political, and/or public debate.

List of relevant ways to bridge the gap and improve cooperation between scientists and fishers:

- Communication/Feedback/Transparency
    - Research question(s): clearly define problems and objectives, highlight and explain possible differences in perception between involved parties
    - Data: explain data needs and exactly what the data are used for
    - Methods: strive for simplicity in sampling protocols (i.e. self-sampling) to minimize confusion risk and errors
    - Feedback and reporting
        - Joint meetings: these should be regular and focused on the investigated themes that interest fishers
        - Trip reports: these should be provided quickly after a trip, and contain easy to understand information, e.g. density maps, length frequencies for major species
        - Media output: popular articles in fishers literature (e.g. Fisheries News), social networking channels
- Fisheries-science partnerships
    - Self-sampling (see also WKSC 2008)
    - Joint surveys
- Incentives for fishers
    - Reimbursement for skippers (money, quota, extra days at sea, …)
    - Prizes/raffles
    - Involve fishers and their knowledge
- Incentives for observers: ensuring long staying, experienced observers facilitating contact with fishers
    - Observer employment status (contracted, sub-contracted, hired)
    - Reimbursement for observers

- Training (making sure observers are experienced in e.g. species identification, seaworthiness, on board practices, …)

- Commonality between observers and crew: aspects as personality, nationality, religion, employment background, gender, etc. can all potentially influence (facilitate or compromise) the working relations between fishers and observers. In this context, no standards should be set out for the initial selection of observers, but problems arising as a consequence of a lack of commonality between fishers and observers should be taken into account by discard programme coordinators.

- Maintain scientific integrity/reporting of data

  - confidential disclosure of violations to contractor/authority, so that data are excluded but the fishers are not publicly condemned

  - confidential treatment of data: no sharing of data collected on one vessel to crew of other vessel

7.1 Experiences and examples from Belgium

7.1.1 Communication/feedback/transparency

For many years, ILVO organises annual info-sessions for fishers (industry representatives, policy-makers, NGO's, press, … also welcome). Originally, these sessions were primarily set up to inform the involved parties of the new ICES advice for the major stocks relevant to Belgian fisheries, explain the trends in SSB, F, recruitment and landings in these stocks, and elaborate on the expectations regarding the TACs and national quota for the following year (also with STECF / EC Policy Paper rules in mind). In recent years, ILVO started using these meetings also as an opportunity to include other subjects that could/should interest fishers. Some of the questions that have been tackled in this way are: i) why do we want to know the age of fish, and how is the ageing done; ii) how can fishers help scientists to collect the necessary data to assess the state of the stocks; iii) what types of data are used for what purposes in stock assessments; iv) what is Maximum Sustainable Yield and why do we move from the precautionary approach to MSY-based advice. This initiative to provide and explain scientific information and concepts has been received very positively by the fishers and fishers organisations that were present at the info-sessions, and lead to a growing interest and trust, and an increasing presence of the sector year by year.

After the new scientific advice becomes publicly available on the ICES website, ILVO-scientists also use the monthly magazine of the Belgian fishers' association ("Rederscentrale") as a platform to publish a comprehensive overview of this advice and the potential TACs and quota in the following year for stocks of special relevance to Belgian fisheries. Also the extra questions that were elaborated on in the meetings described above can be subject of separate articles in the fishers' literature. Hereby, scientists focus on bringing informative (e.g. "The application of F_{msy} in the advices for 2011") and positive messages (e.g. "Large quotum of plaice expected for 2010").

In 2011, ILVO also started to be included in the lessons package of the Maritime Institute of Oostende, option Fisheries. This way, fishery scientists (both fishery biologists and gear scientists) focus on themes as 'Management of marine populations – why and how', 'Sustainability – what and why is this important', and try to make future fishers evolve towards a better understanding of these concepts (at least the ones that went to this school).

7.1.2 Fisheries–science partnerships

- Self-sampling: Belgium started its first self-sampling project in February 2010 on request of the fisher's association, primarily to investigate the impact of Belgian beam trawlers on the Celtic Sea cod stock. Therefore, ILVO developed a simple sampling protocol for this purpose and organises regular self-sampling training and info sessions for fishers (both in group as on individual request). Shortly after the start of the project, already more than 10 vessels joined the project voluntarily, illustrating the improved cooperation and trust between fishers and scientists, and the appreciation of fishers regarding the improved inclusion of their knowledge and experience in the data collection.
- ILVO pays attention to all requests for information and analysis that are being put forward by individual fishers/vessels and the Belgian fisher's association, and tries to answer all the questions that arise from that side (e.g. individual fisherman: "We notice more and more sea bass in our waters, but no quota have been set so far. Is this an upcoming thing, and what is the status of the assessments?; e.g. fisher's association: What is the effect of the Belgian beam trawl fishery on the recovery of the cod stock in VIId, and do we qualify for the <5%-rule?").

7.1.3 Incentives for observers

All (three) Belgian observers have fixed contracts with ILVO and benefit from interesting reimbursement schemes for time spent at sea. Several forms of training (see Table 9.1/Section 9) ensure that they can easily work along with the vessel crews. Additionally, some observers have backgrounds in the fishing industry, also making the gap between fishers and observers smaller.

Contact: **Kelle Moreau**(kelle.moreau@ilvo.vlaanderen.be)
Sofie Vandemaele (sofie.vandemaele@ilvo.vlaanderen.be)

7.2 Experiences and examples from Scotland

7.2.1 Grassroots contacts/commonality/communication

In Scotland commonality with fishers works very well. So, when for whatever reason an observer is liked by crew and/or the skipper, rigorous data recording is more likely to occur than in hostile environments where observers and crew may not get along well. This may explain why we have found that ex-fishers are welcomed with open arms. Face-to-face communication is preferred over unpersonal telephone calls. For example, many skippers and fishers are met while working on fish markets, just having a talk with them works wonders. Feedback is welcomed but needs to be in a format that is attractive and informative. For example, colourful maps about where discards were abundant are useful. Collaborative fishery and science projects are also a good opportunity to make contacts.

Contact: **Alastair Pout** (a.pout@marlab.ac.uk)
Peter Clark (p.clark@marlab.ac.uk)

7.3 Experiences and examples from The Netherlands

7.3.1 Communication/feedback/transparency

To carry out innovative research, staff at the Wageningen Institute for Marine Resources and Ecosystem Studies (IMARES) established and maintain good working relationships with the fishing sector. Both parties benefit from this approach by combining and exchanging their expertises within a research setting. There are several initiatives that encourage the cooperation with fishers and guide effective partnerships. These can range from chartering commercial vessels to the involvement of fishers 'in all stages of research' (Johnson and Densen, 2007).

There are also guidelines for IMARES staff with instructions and ideas on how to work together effectively (Quirijns *et al.*, 2009). Clear communication has been identified as a key element to that process. For example, this has been put into action in the dedicated observer discard monitoring project, where short trip reports are provided after all biological, technical and environmental data from an observed trip was audited. A summary output is routinely generated and sent to the skipper who took the observer onboard (Annex 6). The trip report includes a number of tables, length frequencies of key commercial discard species, and maps of haul positions (see Annex 6). SAS database extraction routines are used to create these outputs.

The "kenniskringen" (Dutch for "knowledge round tables") are another collaborative initiative, but not necassarily focussed on discards, (http://www.kenniskringvisserij.wur.nl/NL/ovr_kenniskringen/) this is a platform where representatives of research institutes, government agencies and industry from different sectors (demersal beam-trawl, gillnet, and shrimp fisheries) meet and share information. Small budgets are available to set up innovative research projects (some of which are related to discards) between reserachers and fishers within this network.

Contact: **Edwin van Helmond** (edwin.vanhelmond@wur.nl)
Sebastian Uhlmann (sebastian.uhlmann@wur.nl)

7.4 Experiences and examples from France

Skippers who are happy to be involved in the programme like to work on a long-term basis with permanent observers they know well and feel less confident in young, inexperienced observers hired by private sector companies. Dedicated observers are likely to facilitate cooperation more than hired observers.

As a first step towards improving cooperation in France we register refusals and their causes for each contact made by an observer. Refusal rates vary in time and between metiers, and range from 0 to 42%. A wide variety of reasons for not taking an observer onboard are put forward. It can be circumstantial, referring to weather, crew problems, or poor catch expected; it can be related to space onboard, security, and the administrative authorization to take "extra-personnel" onboard (some skippers would never request it). A variable part of refusals is ascribed to mistrust towards the programme, or the particular observer hiring private-sector company. The latter can be either permanent or likely to be revised depending on regulatory and social settings.

Crises regularly burst out with the result that no skipper would accept an observer onboard in a given port or wider area. Ad-hoc meetings for presenting the programme are organized on a case-by-case basis, and these generally help. Communication of the results of the programme and the various ways the data are used is very

important to build and maintain trusts from the fishers. They are interested in seeing what was discarded during the sampled trips, but also in more integrated results on the fleet or region level.

Contact: **Marie-Joëlle Rochet** (marie.joelle.rochet@ifremer.fr)

7.5 Experiences and examples from Spain

7.5.1 Reports

Disclosure reports are sent to fishers and fishers' associations at the end of each year since 2008. The discard information is presented at metier level, quantifying the discard problem and summarizing the discard species composition. The report aims to give the industry feedback with discard information obtained from the onboard Spanish Discard Sampling Programme (SDSP).

7.5.2 Media

A software included in a pendrive has been released last year to skippers who participate in the Spanish SDSP (Annex 10). The Software allows the user to obtain yearly discard information by metier of a set of common species in Spanish fisheries. The available information contains species biological parameters, estimated discarded/retained amounts, and spatial distribution plots. Effort was put into the development of intuitive and understandable maps and plots. It is expected that yearly updates of this first version will include: additional discard information, information about collaborative discard reduction projects between Spanish scientists, fishers and technicians. The main aim of this feedback is:

- To make fishers become users of SDSP information
- To create a platform to strengthen links between fishers and scientists by improving communication and collaboration
- To progressively introduce tools for future spatiotemporal fisheries management.

Illustrations see Annex 10.

7.5.3 Meetings

Meetings between fishers and scientists are carried out during the year aiming to solve situations that threaten the continuity of the program. For example, the industry has reacted negatively to the EU 2011 quota reduction of some Spanish target species (blue whiting, mackerel), affecting the Spanish Discards Sampling Program (SDSP) in terms of allowing observers to get onboard. Meetings will be carried out during the summer of 2011 to exchange views and concerns affecting the collaboration with fishers. This approach is also carried out in the Mediterranean by means of a yearly meeting with the aim of keeping the good communication achieved with fishers associations and ship owners.

7.5.4 Collaboratively funded projects

Some projects have been designed as collaborations of different stakeholders and are funded by the Spanish ministry/EU. The collaborative projects in course are seen as an opportunity to strengthen communication between scientists and fishers. Among others, the "Strategic Spanish Project relating to responsible fishing on discard

reduction (REDES)"is achieving good results in terms of communication with the industry.

REDES is a multidisciplinary project funded by the Spanish Science and Innovation Ministry and the EU, which began in 2009 to address the gaps identified in Spanish gear technology, i.e. gear selectivity. REDES involved fishers associations, ship-owners, technology industries, research institutes and university departments in a collaborative way. The project dealt with two Spanish métiers during 2010. A short description of the partnership is listed below:

- The fishing industry is represented by two of the main Spanish associations (ARVI and CEPESCA), linking the fleets that will have to face relevant discard reductions with the project.
- Other key industry partners in REDES are those companies having to deal with fishing gear and fishing technology. TECNOPESCA PYM and MAREXI are two Spanish SME´s in charge of the implementation of new ideas into specific products feasible for target fishing units.
- Five different public research institutions such as the Spanish Institute for Oceanography (IEO), the University of Vigo, the University of A Coruña, the CETMAR Foundation and the CEHIPAR Flume Tank collaborated in the R&D.

REDES was designed as an integrated project comprising the following sub-projects:

- SP1 - Analysis of the distribution, performance and factors influencing discarding in the selected fishing métiers
- SP2 - Design and construction of the selective fishing gears and devices. SP2 includes the so-called "Design Centre", a meeting point between fishers, technicians and scientists.
- SP3 - Simulation, testing and re-design of new fishing gears and devices.
- SP4 - Analysis of selectivity and the major effects expected from the introduction and use of selective fishing gears.
- SP5 - Project Office: Coordination, dissemination, contribution to standardization and technology transfer support.

During the SP2 "Design Centre" phase, several Workshops have been carried out with the industry. The main objective was to identify selectivity devices suitable for Spanish fisheries. During the meeting, discussions arose on the importance of discard sampling and taking discard information into account in the process of designing new selectivity and economically sustainable fishing gear. The fishers involved in the "Centre of Design" are now aware of the importance of keeping the discard sampling program ongoing.

Contacts: **Juan Santos** (juan.santos@vi.ieo.es)
Aida Carbonell (aida.carbonell@ba.ieo.es)

7.6 Experiences and examples from Ireland

7.6.1 Communication/feedback/transparency

In 2006, sampling levels decreased dramatically in the Irish discard sampling programme as a consequence of non-cooperation of the fishing industry. This was due to

a document in which it was perceived that confidential information on landings that was collected on board by observers was released to controlling authorities. At the time, this affected both at-sea and shore-based sampling. That experience highlighted some of the issues and frailties within the discard-sampling programme (Lordan *et al.*, 2011). Prior to this there had been a clear distinction between observers and control agencies where observers emphasized the difference between scientific and control agencies as well as the confidential nature of the scientific data collected. Since 2008, the Marine Institute has developed a code of conduct for staff and contractors, both of whom must explain how the data are to be used and the limits on confidentiality. Trust has been re-established and the discard sampling programme now has widespread industry cooperation.

In Ireland, there is a "Cruise Report" issued for every discard trip carried out (Annex 7). The Cruise Report gives details related specifically to the trip e.g., ICES division, number of hauls sampled, catch composition, catch length frequencies and information on discards weight and discard rates. Furthermore, there is a section that provides the fisher with information on stock assessment methodology and a section on fish ageing (Annex 7). The Cruise Report was designed to answer specific questions that fishers had always been asking Marine Institute staff, i.e. "what is stock assessment, why do you need to collect discard data, how old is that fish, and what did I catch on my trip, what did I land in my trip?". Real-time feedback to fishers provides an excellent opportunity to further improve co-operation with industry. (See Annex 6 for example)

7.6.2 Grassroots contacts/commonality/communication

A permanent presence in the ports is also of benefit for co-operation and relationships with fishers. The Marine Institute has six permanent staff members based in four of the main fishing ports around the country, Clogherhead, Ross a Mhil, Castletownbere and Dunmore East. Three of these are dedicated sea-going observers and regularly attend industry meetings and act as a liaison between fishers and scientists.

7.6.3 Fisheries–science partnerships

In Ireland, recently introduced legislation such as the Cod Long-term management plan has led to fishers demanding more discard-observer coverage in order to prove compliance with the plan. Vessels need to demonstrate that their cod catches are <1% of the total catch and having enhanced scientific observer coverage allows more data on catch to be collected and provides augmented information on cod catch compositions. Furthermore, there have been two industry led initiatives which involved cod-tagging surveys. The "Cape" project in ICES division VIa was instigated by local fishers who called for the closure of a traditional winter fishery for juvenile cod. Fishers defined an area to be closed to all fishing from October 2003 to February 2004 under national legislation and only those vessels involved in tagging operations were permitted to fish in that area. A similar project also occurred in the Celtic sea looking at migrations patterns of cod. Both projects were borne by collaborative initiatives and fishers were consulted regularly during their development and design. These provide concrete positive examples of the co-operation between fishers and scientists (Lordan et al., 2011).

7.6.4 Reports

Ireland is currently working on a "Discard Atlas". The aim of the Discard Atlas is to present a first attempt at auditing discards in Irish fisheries and propose some op-

tions to mitigate discards. The purpose is to present the scientific facts on discarding by the Irish demersal fleet. These scientific facts will inform the debate on how to significantly reduce discards in Ireland's demersal fisheries and are a key step on the road to sustainable fisheries. The information is presented in a highly visual format including maps of spatial discards and effort distribution and the language used is as non technical as possible. The target audience is scientists, managers, policy movers, industry, Non-Government Organisations (NGO's) and the general public.

Contacts: **Sara-Jane Moore** (sara-jane.moore@marine.ie)

7.7 Experiences and examples from Portugal

7.7.1 Communication/feedback/transparency

In 2008, IPIMAR/INRB, I.P. produced a report that was sent to all cooperative trawl vessels (Fernandes *et al.*, 2008). This report included a public acknowledgement of their cooperation and illustrated data on the frequency of occurrence of retained and discarded species (aggregated data, 2004-2005). The feedback was positive in some cases, but negative in others. Overall, two vessels reportedly left the program after the report was sent to them on basis of the report having provided a negative portrait of their fishing activity. From that time to present, IPIMAR/INRB, I.P. has reduced the information sent back to the fishers and only recently did the sending of a new report start being considered. The format and content of this report is currently being evaluated.

7.7.2 Fisheries–science partnerships

In the past, IPIMAR/INRB, I.P. has contracted a few vessels to carry out research activities at sea. The fact that specific vessels are sometimes chosen – the ones that present the most suitable work conditions for the research objectives – has been previously misunderstood by shipmasters that actively cooperate with the observer program. They complain on not having equal opportunity to access that extra funding opportunity. The solving of this misunderstanding has taken some energy (higher level contacts).

7.7.3 Incentives for fishers

In the beginning of the program, IPIMAR/INRB, I.P. distributed T-shirts to the skippers of the cooperative vessels. At the moment, pocket-knifes are being distributed. The pocket-knifes are given at the end of the trip as a gift. So far, skippers have reacted positively to this measure. Also, Last Christmas a postcard was also sent to the skippers and shipmasters of the cooperative vessels. This postcard included a thank you note on the cooperation given. This gesture seems to have strengthened the relationship with them.

7.7.4 Commonality between observers and crew

In Portugal we found female observers to be very successful in our observer program. They currently constitute ~65% of our observer team. Among the Portuguese fishers, female observers are well respected and their presence onboard generally makes fishers behave more friendly and helpful towards observer teams. This comes at the expense of sometimes teams avoiding smaller ships where WCs are not available or where sleeping quarters are common.

In Portugal we have not tried to employ ex-fishers as observers. However, all our observers have recently taken a fisher's licence and thus have been taught all the basics of fishing (navigation rules, knot tying, legislation, rowing, etc). One positive side effect of this course has been that the cultural gap between observers and fishers was substantially reduced. Observers are now more highly respected on board and fishers seem to have fun teaching them aspects of their own fishing activities.

Contacts: **Nuno Prista** (nmprista@ipimar.pt)

8 Description of present sampling and safety training procedures (ToR H)

Under the Data Collection Framework, Member States organize discard (among other) sampling programmes. Apart from differences in their designs, sampling- and safety-training procedures may differ between Member States and/or sampling programmes (i.e. dedicated observer versus self-sampling, Tables 8.1- 8.4). It should be noted that the success of a sampling programme (including the quality of data) builds on the quality of received training and safety instructions (McVea and Kennelly, 2007).

This inventory of sampling and safety training procedures by Member States is used to identify:

i. differences in observer recruitment, sampling, and safety training procedures
ii. identify common sampling and safety training problems and suggest ways to improve them

8.1 Differences in observer recruitment, sampling, and safety training procedures

8.1.1 Observer recruitment

Recruitment of observers is carried out by (government) research authorities employing observers either on full-time or short-term contracts, or exclusively by private sector companies. While recruitment by private sector companies may not necessarily affect the quality of sampling training procedures, because these are organized by research organizations responsible for the discard data collection. But responsibilities of ensuring sufficient safety training are typically handed over to the private sector companies. It was suggested that this may introduce safety risks (see section below).

Based on experiences of programme co-ordinators present at the meeting, recruitment by government research authorities may result in high turnover rates of observers due to short and/or fixed-term contracts. Whereas typically, programmes that employ full-time staff and or ex-fishers with long service records, benefit from their long-standing involvement, experience in species identification and relations with fishers.

8.1.2 Sampling and safety training

Information on sampling and safety training was provided by ten Member States. All observers receive some form of either at-sea or land-based training or both, whereby crew-member observers (i.e. in self-sampling programmes) receive far less training. The format and duration of such training components differed between Member States, the fisheries to be sampled, the observer type, and/or the experience level of the (trainee) observer. At-sea observer sampling training may be carried out onboard research or commercial vessels or both to train key elements of biological hands-on sampling. The duration of compulsory training varied between 3 and 32 days and 0 and 5 days for dedicated observers and crew-member observers (i.e. involved in self-sampling schemes), respectively. In several cases, the opportunity exists to receive a "refresher" training on a regular basis.

Where applicable, during practical sampling training, procedures of i) sample collection, and ii)species identification and measurement are being trained. Written manuals and in some cases audio-visual material or even exams are used to compliment training. Regular (informal) feedback, typically after data audits of, is provided in all cases.

For all observers some form of safety training is provided. It seems, however, that the number of safety training elements depends on national/federal laws and policies. Central to the safety training is a survival training course which in some cases also includes first aid and vessel-awareness training.

Typically, trips are sampled by at least one observer, in one case (in Sweden) it is mandatory to carry two observers onboard for the full duration of the sampling trip. In some cases (i.e. Dutch self-sampling programme), discards are being returned for analysis to shore-based laboratory facilities.

8.2 Identify common sampling and safety training problems with suggestions for improvement

The number and duration of sampling-training segments and their frequency of renewal were unmatched and far less intensive for crew-member than dedicated observers (Tables 8.1- 8.4). This may become an issue for those self-sampling programmes were crew-member observers collect detailed information other than "merely" retaining a subsample for subsequent analysis by trained scientific staff. None of the crew-member observers involved in self-sampling programmes received any additional safety training.

Representatives of SGPIDS recommend formalizing i) the recording of vessel safety assessments (e.g. "black lists"), ii) incidents where observers refused the boarding of vessels due to safety concerns, iii) and accident reports. This may be useful to quantify the proportion of unsuitable vessels for monitoring. It should be kept in mind that a lack of safety training and/or awareness by the crew may seriously compromise the safety of well-trained observers (McVea and Kennelly, 2007).

Another way of ensuring that health and safety standards are met, may be by monitoring the compliance of wearing personal safety gear (i.e. life jackets). This may be (informal) interview surveys of observers to report whether they actually wear their life jacket onboard.

Currently, EPIRBs (emergency position-indicating radio beacons) are compulsory for English, Irish and Scottish observers only. Considering that maritime safety can be greatly improved by wearing them, it should be considered to equip every sea-going observer with a regularly-serviced EPIRB, although these devices may be expensive.

Based on the inventory (Tables 8.1- 8.4), it is obvious that sampling and safety training schemes differ between programmes of Member States. To facilitate the standardization of discard sampling programmes (as addressed by ToR D, section 5), it may be also an option to standardize the training procedures across Member States. This approach is termed "cross training" and is practiced for some international observer programmes (McVea and Kennelly, 2007).

Table 8.1. List of the sampling and safety training elements, duration and renewal interval of dedicated observer discard monitoring programmes for Denmark (DK) and Sweden (SE).

	DK		SE	
	Full-time staff		**Full-time staff**	
	Duration	**Refresh**	**Duration**	**Refresh**
SAMPLING TRAINING				
Field training (onboard research vessels)	yes (9 days)	annual	yes	optional
Field training (onboard commercial vessel)	yes (6 days)	one off	yes	ongoing, 2 observers
Field training (land based)	yes (0.5 day)	ad-hoc	no	
Workshops (national)	no		no	
Workshops (international)	no		no	
Individual oral instructions	yes	ongoing	yes	ongoing
Exam (e.g. species identification)	no		no	
Written Manuals	yes	updated	yes	updated
Audio-visual manual (DVDs)	no		no	
Feedback after data audit	yes	ongoing	yes	ad-hoc
Other	no		no	
SAFETY TRAINING				
Survival training	3 days	annual	2 days	5 years
First aid	1 day	every three years	yes, included in survival course	
Vessel safety awareness course	3 days	annual	yes, included in survival course	
VHF training	yes	optional	no	
Fire fighting	3 days	annual	yes, included in survival course	
Medical exam (Y/N)	no		yes	?
EPIRB on board	no		no	
Personal safety equipment	yes	serviced	yes	
Lifejacket compliance	unknown		no	
Servicing equipment	yes	regular	yes	serviced
Manual handling course (i.e. lifting heavy gear)	no		no	
Emergency plan	yes	updated	no	
(Confidential) communication systems	no		no	
Audio-visual manual (DVDs)	yes	one off	no	
Risk assessment sign-off list	no		no	
Vessel safety assessment (by observer)	yes	updated	yes	ad-hoc
Safety officer	yes	full time	yes	full time
Safe-driving course	no		no	

Table 8.2. List of the sampling and safety training elements, duration and renewal interval of dedicated observer discard monitoring programmes for Great Britain and Wales (GBE/W), Ireland (IE), and Scotland.

	GBE/W		IE		IE		Scotland	
	Contracted/ full-time staff		Full-time staff		Con-tracted staff		Full-time staff	
	Duration	Refresh	Duration	Re-fresh	Duration	Refresh	Duration	Re-fresh
SAMPLING TRAINING								
Field training (onboard research vessels)	additional		no		no		yes (20 days)	one off
Field training (onboard commercial vessel)	yes (20 days)	annual	no		no		yes (8 days)	one off
Field training (land based)	yes	ad-hoc	3 days	annual	3 days	annual	yes (4 days)	one off
Workshops (national)	no		yes		yes		no	
Workshops (international)	no		no		no		no	
Individual oral instructions	yes	ongoing	yes	ongo-ing	yes	ongoing	yes	ongo-ing
Exam (e.g. species identification)	no		no		no		no	
Written Manuals	yes	updated	yes	up-dated	yes	updated	yes	up-dated
Audio-visual manual (DVDs)	no		no		no		no	
Feedback after data audit	yes	ongoing	yes	ongo-ing	yes	ongoing	yes	ongo-ing
Other	provisional permit, sign-off checklist						no	
SAFETY TRAINING								
Survival training	yes	5 years	1 day	3 years	yes	yes (con-tractor)	1 day	3 years
First aid	yes	one off	1 day	3 years	yes (con-tractor)	yes (con-tractor)	1 day	3 years
Vessel safety awareness course	yes	ad-hoc	1 day	3 years	yes (con-tractor)	yes (con-tractor)	1 day	one off
VHF training	yes	one off					0.5 day	op-tional
Fire fighting	yes	one off	1 days	3 years	yes (con-tractor)	yes (con-tractor)	1 day	one off
Medical exam (Y/N)	yes	2 years	yes	2 years	yes	yes (con-tractor)	no	
EPIRB on board	yes	regular	yes		yes		yes	
Personal safety equipment	yes	regular	yes		yes		yes	
Lifejacket compliance	yes	ongoing	yes		yes		yes	
Servicing equipment	yes	ongoing	yes		yes (con-tractor)		yes	
Manual handling course (i.e. lifting heavy gear)	yes	one off	yes		yes (con-tractor)		0.5 day	one off
Emergency plan	yes	updated	yes	yes	yes	yes	yes	?
(Confidential) communication systems	no		na		na		no	
Audio-visual manual (DVDs)	no		no		no		no	
Risk assessment sign-off list	yes	ongoing	yes	yes	yes	yes	yes	?
Vessel safety assessment (by observer)	yes	ad-hoc	yes	ad-hoc	yes	ad-hoc	yes	ad-hoc
Safety officer	yes	full time	yes	yes	yes	yes	yes	full time
Safe-driving course	yes	one off	No		no		yes	one off

Table 8.3. List of the sampling and safety training elements, duration and renewal interval of dedicated observer discard monitoring programmes for Spain (ES), France (FR), Portugal (PT).

	ES	FR		PT	
	Contracted (private sector)	**Contracted (private sector)**		**Full-time staff**	
	Duration	**Duration**	**Refresh**	**Duration**	**Refresh**
SAMPLING TRAINING					
Field training (onboard research vessels)	yes (Mediterranean only)	no		~15 days	annual
Field training (onboard commercial vessel)	3 days	no		~10 days	one off
Field training (land based)	yes (not all fisheries)	0.5 day	annual, but optional	yes	ad-hoc
Workshops (national)	no	8 days	annual, but optional	yes	ad-hoc
Workshops (international)	no	no		no	
Individual oral instructions	yes	yes	ongoing	yes	ongoing
Exam (e.g. species identification)	no	yes	annual	no	
Written Manuals	yes	yes	updated	yes	updated
Audio-visual manual (DVDs)	no	yes	one off	no	
Feedback after data audit	yes	yes	ongoing for each strip	yes	quaterly
Other	no	Additional training		no	
SAFETY TRAINING					
Survival training	not mandatory	3 days	one off, but optional refresher	80 hrs	one off
First aid	not mandatory	yes, incl. in survival course	one off, but optional refresher	yes, included in survival course	one off
Vessel safety awareness course	not mandatory	yes, incl. in survival course	one off, but optional refresher	yes, included in survival course	one off
VHF training	no	?	?	no	
Fire fighting	not mandatory	?	?	yes, included in survival course	one off
Medical exam (Y/N)	yes	no		yes	Every 2 years
EPIRB on board	no	no		no	
Personal safety equipment	yes	yes, incl. in survival course	ad-hoc	yes	regular
Lifejacket compliance	no	no		no	
Servicing equipment	no	?	?	yes	ad-hoc
Manual handling course (i.e. lifting heavy gear)	No	?	?	no	
Emergency plan	No	no		no	
(Confidential) communication systems	No	no		no	
Audio-visual manual (DVDs)	No	no		no	
Risk assessment sign-off list	No	no		no	
Vessel safety assessment (by observer)	Yes	no		no	ad-hoc
Safety officer	No	no		no	
Safe-driving course	No	no		no	

Table 8.4. List of the sampling and safety training elements, duration and renewal interval of dedicated observer discard monitoring programmes for Belgium (BE), and The Netherlands (NL).

	BE		NL	
	Full-time staff		**Full-time/ contracted staff**	
	Duration	**Refresh**	**Duration**	**Refresh**
SAMPLING TRAINING				
Field training (on-board research vessels)	10 days	annual	no	
Field training (on-board commercial vessel)	4-9 days	one off	5 days (for dem. fisheries)	one off
Field training (land based)	1 day	annual	1 day (for pelagic fisheries)	one off
Workshops (national)	no		no	
Workshops (international)	no		no	
Individual oral instructions	yes	ongoing	yes	ongoing
Exam (e.g. species identification)	no		yes	annual
Written Manuals	yes	annual	yes	annual
Audio-visual manual (DVDs)	no		no	
Feedback after data audit	no		yes	
Other	no		no	
SAFETY TRAINING				
Survival training	2 days	3 years	5 day	5 years (under 40-year olds)
First aid	yes, incl. in survival course	3 years	yes	?
Vessel safety awareness course	yes, incl. in survival course	3 years	yes, incl. in survival training	5 years (under 40-year olds)
VHF training	no		no	
Fire fighting	no		no	
Medical exam (Y/N)	yes	annual, optional	yes, incl. in survival course	5 years (under 40-year olds)
EPIRB on board	no		no	
Personal safety equipment	yes	?	yes	?
Lifejacket compliance	no		no	
Servicing equipment	yes	regular	yes	
Manual handling course (i.e. lifting heavy gear)	no		no	
Emergency plan	no		no	
(Confidential) communication systems	no		no	
Audio-visual manual (DVDs)	no		no	
Risk assessment sign-off list	no		no	
Vessel safety assessment (by observer)	yes	ad-hoc	yes	ad-hoc
Safety officer	yes	full time		
Safe-driving course	no		no	

Table 8.5. List of the sampling and safety training elements, duration and renewal interval of self-sampling discard monitoring programmes in Sweden (SE), Ireland (IE), The Netherlands (NL), and Belgium (BE).

	SE		IE		NL		BE	
	Duration	**Refresh**	**Duration**	**Refresh**	**Duration**	**Refresh**	**Duration**	**Refresh**
SAMPLING TRAINING								
Field training (onboard research vessels)	no		no		no		no	
Field training (onboard commercial vessel)	no		0.5 day	ongoing	5 days, optional	one off	no	
Field training (land based)	no		no		no		no	
Workshops (national)	no		no		yes	one off	0.5 day	one off
Workshops (international)	no		no		no		no	
Individual oral instructions	no		yes	ongoing	yes	ongoing	yes	ongoing
Exam (e.g. species identification)	no		no		na		no	
Written Manuals	yes	updated	yes	updated	yes		yes	annual
Audio-visual manual (DVDs)	no		no		yes	no	no	
Feedback after data audit	yes	ad-hoc	yes	ongoing	yes	ad-hoc	yes	half year
Other (e.g. media articles)	no				no		yes	ad-hoc
SAFETY TRAINING								
Survival training	na	na	na	na	na	na	na	na
First aid	na	na	na	na	na	na	na	na
Vessel safety awareness course	na	na	na	na	na	na	na	na
VHF training	na	na	na	na	na	na	na	na
Fire fighting	na	na	na	na	na	na	na	na
Medical exam (Y/N)	na	na	na	na	na	na	na	na
EPIRB on board	na	na	na	na	na	na	na	na
Personal safety equipment	na	na	na	na	na	na	na	na
Lifejacket compliance	na	na	na	na	na	na	na	na
Servicing equipment	na	na	na	na	na	na	na	na
Manual handling course (i.e. lifting heavy gear)	na	na	na	na	na	na	na	na
Emergency plan	na	na	na	na	na	na	na	na
(Confidential) communication systems	na	na	na	na	na	na	na	na
Audio-visual manual (DVDs)	na	na	na	na	na	na	na	na
Risk assessment sign-off list	na	na	na	na	na	na	na	na
Vessel safety assessment (by observer)	na	na	na	na	na	na	na	na
Safety officer	na	na	na	na	na	na	na	na
Safe-driving course	na	na	na	na	na	na	na	na

9 Recommendations to improve communication and data delivery to other study groups (ToR I)

There have been several problems in the communication between national data provider and end users in ICES study and working groups. We have categorized them into two main groups.

9.1 Data users:

- The requests may not be properly directed (requests may only be found in WG reports consequently national institutes have not been aware of the data needs).
- Many assessment groups do not actually use discard survey data. There can be many reasons for not using the data. The stock assessors may have low confidence in the quality and usefulness of discard data or are unaware of the data that is available.
- Sometimes the request is not specific enough making a response more difficult.
- Users, as assessment groups, do not always understand how the data are collected and are not familiar with the programme designs and sampled protocols.

9.2 Data provider:

- Data providers do not always know in what format data is needed for assessments (or other purposes).
- Data providers do not indicate the quality of the data delivered.
- Data providers work at a national level while stock coordinators operate on a stock level and little effort is made to standardize data across nations in the discard sampling, raising etc.
- Data requirements for the DCF are in terms of numbers of fish measured number of otoliths collected, precision levels on discard weight, by metier. The data requirements of the stock assessment working groups are in terms of numbers at age by year, by management area (some combination of ICES areas) and usually over the quarter. These two requirements are not necessarily compatible and lead to problems in the utility of the data.
- If discard data is not used, the motivation for sampling the data is decreasing and it feels like a waste of recourses.

9.3 Current procedures in data delivery to the assessment working groups;

Stock co-ordinators will generally seek discard survey data directly from the person responsible for discard data management in each relevant country. Data are usually provided as discards by weight and numbers at age by major gear category, and by quarter and by sub-division. Most of the raising process is therefore undertaken at the national level, because national discard data co-ordinators are best placed to understand the implications in differences in sampling methodologies and can therefore use the most appropriate raising procedures.

9.3.1 Problems with current process

This process is often reliant and having personal contacts between individuals working in the assessment groups and managing the data. However, in situations with new stock/data requirements, new staff, the requests can be often misdirected and sometimes not even requested at all (as stock assessor expects the involved nations are aware of the data normally delivered), but first noticed at the working group when data is missing.

At the moment all Member States are required to sample discard data. Sampling levels are delivered by metier in the national technical reports; however the compiled information of sampling level from an area or a metier is not accessible. The consequence of not delivering all of the available data to the assessment groups is that many assumptions have to be made in assessment process.

As there is no formal group with responsibility to handle catch data it is also difficult to ensure quality controls at an area/stock level and although the data quality can be assured for some metiers and areas this information is not always accessible.

9.3.2 Potential solutions

1) As one of the larger concerns from the assessment working groups is the quality issues of the discard data, this could, partly, be overcome by quality assurance framework (QAF) or score cards – as has been suggested by PGCCDBS 2011. WKACCU has listed all the data collection issues that could lead to bias or imprecision in a sampling scheme, and in theory each of these issues could be assessed against each national sampling scheme for each stock. However, it would be very difficult for any stock coordinator to then decide how to combine these scores across all countries to obtain an overall score card for the bias and precision of the overall discards estimates.

2) All discard survey data might be held centrally e.g. Fishframe where stock assessors could determine the extent of existing data and enable stock coordinators to use the data. In this way all nations would be responsible to upload annually national data and the stock coordinators/stock assessors would hold the responsibility to use the data.

3) Assessment groups and others interested in discard survey data could send their discard data requests to PGCCDBS. PGCCDBS would take responsibility to coordinate and delegate the requests. There are contact persons for each assessment group but there is currently no centralised list of discard programme managers. A list of national programme managers held by a working group would provide somewhere to send requests and also facilitate those requests being passed on the relevant people. PGCCDBS is not currently coordinating or passing on requests because there is no group to address this issue. Or process the data within workshops

4) Establish a group (SGPIDS or another new working group) to handle discard information on the same level as most surveys are coordinated on an annual basis by ICES working groups. This implies an annual process whereas assessment groups work throughout the year and it could be a lot of work for a small group of people as not all requests will be for data in the same format. The group should concentrate on;

- Run annual discard survey updates to collate all the data (raw or raised
- Agree on the 'score card' scores for each stock – agree on a composite assessment of how biased / imprecise the raised discard data might be
- Service requests from survey groups

5) Compilation of the national sampling level to total sampling level on metier by area would be a very beneficial information for all assessment groups to have asses to on a annual basis (RCM ?). This would show the amount of data available from the different nations and the working group would be able to address the relevant nations for further information.

10 References

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Annex 1: List of participants

Name	Address	Phone/Fax	Email
Aina Carbonell	Instituto Español de Oceanografía Centro Oceanográfico de Baleares P.O. Box 291 E-07015 Palma de Mallorca Spain		aina.carbonell@ba.ieo.es
Sofia Carlshamre	Swedish Board of Fisheries Institute of Marine Research, Lysekil P.O. Box 4 SE-453 21 Lysekil Sweden	Phone +46 52318772	sofia.carlshamre@fiskeriverket.se
Tom Catchpole	Centre for Environment, Fisheries and Aquaculture Science (CEFAS) Lowestoft Laboratory Pakefield Road NR33 0HT Lowestoft Suffolk United Kingdom		thomas.catchpole@cefas.co.uk
Peter Clark	Marine Scotland Science Marine Laboritory PO BOX 101 Victoria Road Aberdeen AB11 9DB Scotland		p.clark@marlab.ac.uk
Edwin van Helmond Chair	Wageningen IMARES P.O. Box 68 1970 AB IJmuiden Netherlands	Phone 0031 317487171	Edwin.vanHelmond@wur.nl
Sara-Jane Moore	Marine Institute Rinville Oranmore Co. Galway Ireland	Phone +353(0)91387200 Fax +353(0)91387201	sara-jane.moore@marine.ie
Kelle Moreau	Institute for Agricultural and Fisheries Research (ILVO) Ankerstraat 1 8400 Oostende Belgium	Phone +32 59 569830 Fax +32 59 330629	kelle.moreau@ilvo.vlaanderen.be
Simon Northridge	Scottish Oceans Institute University of St Andrews East Sands KY16 8LB St Andrews Fife, Scotland United Kingdom	Phone +44 1334 462654 Fax +44 1334 462632	spn1@st-andrews.ac.uk
Alastair Pout	Marine Scotland Science Marine Laboritory	Phone +44 1224 295507 Fax +44 1224 295533	A.Pout@marlab.ac.uk

	PO BOX 101 Victoria Road Aberdeen AB11 9DB Scotland		
Nuno Prista	INRB - IPIMAR Avenida de Brasilia 1449-006 Lisbon Portugal	Phone +351 213027132 Fax +351 213015948	nmprista@ipimar.pt
Juan Santos	Instituto Español de Oceanografía Centro Oceanográfico de Vigo P.O. Box 1552 36200 Vigo (Pontevedra) Spain		juan.santos@vi.ieo.es
Marie Storr-Paulsen	DTU Aqua - National Institute of Aquatic Resources Section for Fisheries Advice Charlottenlund Slot Jægersborg Alle 1 2920 Charlottenlund Denmark	Phone +45 3388 3442 Fax +45 3396 3333	msp@aqua.dtu.dk
Katja Ringdahl	Swedish Board of Fisheries Institute of Marine Research, Lysekil P.O. Box 4 453 21 Lysekil Sweden		katja.ringdahl@fiskeriverket.se
Marie-Joëlle Rochet	IFREMER Nantes Centre P.O. Box 21105 44311 Nantes Cédex 03 France	Phone +33 240 374121 Fax +33 240 374075	Marie.Joelle.Rochet@ifremer.fr
Sam Subbey	Institute of Marine Research P.O. Box 1870 Nordnes 5817 Bergen Norway	Phone +475523 5383 Fax +47 5523 8687	samuel.subbey@imr.no
Sebastian Uhlmann	Wageningen IMARES P.O. Box 68 1970 AB IJmuiden Netherlands	Phone +31 317 480 133 Fax +31 317487326	sebastian.uhlmann@wur.nl
Sofie Vandemaele	Institute for Agricultural and Fisheries Research (ILVO) Ankerstraat 1 8400 Oostende Belgium	Phone +32 59 569883 Fax +32 59 330629	sofie.vandemaele@ilvo.vlaanderen.be

Annex 2: Agenda

SGPIDS - Study Group on Practical Implementation of Discard Sampling plans
Agenda 27 June – 1 July2011

Monday (27/6)	12:30 – 13:30	Introduction: ToR's, agenda, define subgroups
	13:30 – 14:00	Break
	14:00 – 15:30	Presentations: Sebastian Uhlmann, Marie-JoeleRochet, Peter Clark
	15:30 – 17:30	Subgroups
Tuesday (28/6)	09:00 – 10:30	Presentations: Marie Storr-Paulsen, Katja Ringdahl, Juan Santos
	10:30 – 10:45	Break
	10:45 – 12:30	WGBYC: Simon Northridge
	12:00 – 13:00	Lunch
	13:00 – 16:30	Subgroups
	16:30 – 17:30	Plenary: discuss subgroup proceedings
Wednesday (29/6)	09:00 – 10:15	Plenary: discuss subgroup proceedings
	10:15 – 10:30	Break
	10:30 – 12:00	Subgroups
	12:00 – 13:00	Lunch
	13:00 – 15:00	Presentations: Nuno Prista, Alastair Pout
	15:00 – 17:00	Subgroups
	17:00 – 17:30	Plenary: discuss subgroup proceedings
Thursday (30/6)	09:00 – 09:30	Presentations: SofieVandermaele
	09:30 – 12:00	Subgroups
	12:00 – 13:00	Lunch
	13:00 – 16:00	Plenary: review draft report (part 1); ToR B,E,I
	16:00 – 17:30	Plenary: draft resolutions for next meeting
Friday (1/7)	09:00 – 12:00	Plenary: review draft report (part 2); ToR A,D,F,H
	12:00 – 13:00	Lunch
	13:00	End meeting

Annex 3: SGPIDS Terms of Reference for the next meeting

The **Study Group on Practical Implementation of Discard Sampling Plans** (SGPIDS), chaired by Edwin van Helmond, the Netherlands, will meet 25-29 June 2012 in ICES Headquarters, Copenhagen, Denmark to:

1) Develop and define quality standard levels for discard sampling programmes i.e. analysis of refusal rates, sampling coverage (spatial and temporal distribution), self-sampling validation procedures;

2) Identify appropriate on board sampling techniques; evaluate the effect of different on board sampling protocols (i.e. different usage of age-length-keys, sampling unsorted catch vs. landings and discard separately, sample size and raising procedures to haul level, usage of length-weight-relations, systematic sampling vs. census sampling, etc.);

3) Identify practical improvements to define sampling frames (i.e. based on effort/landings, etc.);

4) Develop statistically sound and practical tools to implement vessel selection procedures (including registration of refusal rates);

5) Develop standardize reporting of results of sampling designs (case studies: reports of discard results on a national level);

SGPIDS will report by xxxx to the attention of the XXXXX Committee.

Supporting Information

Priority	The quality of the discard data as well as uniformity of the data between countries plays a vital role in the usability of this data in research and stock assessment studies. The Study Group on Practical Implementation of Discard Sampling plans (SGPIDS) is essential to allow standardisation and harmonisation of discard sampling plans and to provide a platform for the exchange of expertise on discard sampling practices for the next three years. Consequently, these activities are considered to have a very high priority.

Scientific justification	Currently all Member States collect data of discard pratices under the Data Colletion Framework (DCF) of the European Commision. This DCF sets out precision levels by metier which need to be met by the different members states. Generally resources available and other practical constraints limit the number of samples and, conseqently, precision leversl are not met. SGPIDS notes that in order to meet the precision level requirements members states unwillingly bias their sampling programmes, i.e. to collect data ot the higest possible numbers of trips, institutes only collaborate with skippers who are willing to take observers on board. To examine whether the precision requirements of the programme are met, SGPIDS suggest a different approach. An approach with focus on the quality of the sampling programmes itself (representative sampling), rather then excessively increasing sampling levels just to meet (unrealistic) presision levels. In pursuit of standardized discard sampling between counties it is important that practical differences between programmes and possible improvements are identified. At within-trip level, it is important that bias and variability associated to different sampling protocols is investigated. Comparison of results of different methods used eventually lead to the most appropriated sampling protocols in discard sampling on board commercial vessels of various fisheries. Potential sources of bias within sampling programmes were identified during the first meeting of the study group. Bias in vessel selection and sampling effort allocation are reported to be common to all national sampling programmes. Providing the practical tools to define appropriate sampling frames, vessel selection procedures and reporting programme outputs will contribute to reduction of bias and ultimately standardize discard sampling programmes between Member States.
Resource requirements	Participants should bring descriptions of sampling procedures to the meeting. Reports of discard results on a national level. Additional resources required to undertake additional investigations regarding on board sampling techniques (i.e. age-length-keys, lengt-weight relations, discard data at haul level, ect.)
Participants	Scientists managing discard sampling schemes or projects, either under or outside DCF, within European waters.
Secretariat facilities	Meeting facilities incl sharepoint and secretarial support.
Financial	No financial implications.
Linkages to advisory committees	ACOM
Linkages to other committees or groups	PGCCDBS, RCMs, WGBYC, WKPICS1.
Linkages to other organizations	None.

Annex 4: Recommendations

Recommendation	Adressed to
1. For standardized discard sampling between countries/Member States it is fundamental that all countries/Member States are represented at the study group, or at least, all requested information by Member States is available to the group.	European Commission, RCMs
2.In pursuit of increased standardization, it is important that Member States summarize the main technical details of their discard sampling protocols in a common language (e.g. English) and make this available for other Member States (e.g. published online).	RCMs
3.The issue of bias associated to the use of fully discard age-length key, mixed discard/retained age-length key or survey age-length key when estimating the age composition of discards was unresolved by SGPIDS. We suggest this subject should be discussed by experts at the next PGCCDBS meeting.	PGCCDBS
4.It is recommended that greater attention is given to auxiliary variables, namely those that help to standardize fishing effort (e.g. grid device information) and reduce the variability of final fleet level estimates (e.g. post-stratification).	RCMs

Annex 5: A simple simulation to illustrate the issues bias, precision and sample size

A simple simulation of a small fleet and the sampling of vessels to illustrate the issues of bias, precision and sample size.

Assume we have a fleet of four vessels, and that these vessels typically have variable amounts of discards. On each trip the weight of discards is a random variable with a uniform distribution where the upper limit is 10, 20, 30, and 40 for the four vessels respectively and the lower limit is 0 for all 4 vessels. Each vessel does 30 trips. The resulting distribution of discarded weights from all 120 trips is shown below.

We wish to estimate the mean of this population.

Unbiased random sample

If a simple random sample of size n = 20 is taken from this trip distribution, then the best estimate of the population mean is the mean of these samples. A bootstrap with replacement gives the 95% confidence intervals of the sample mean.

In this example the population mean is 13.14 and the sample mean is 12.63 with 95% confidence intervals (8.66 to 16.82)

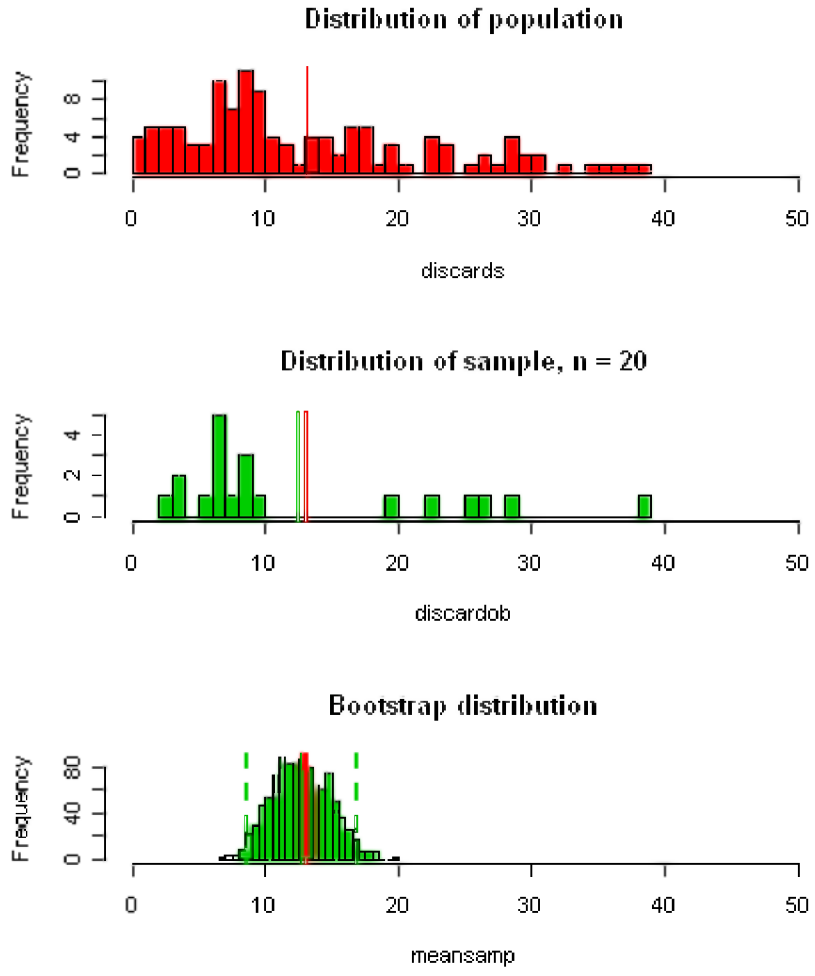


Figure Annex 5.1. Population distribution, sample distribution and bootstrap distribution when the sampling is unbiased and the sample size is large, $n = 20$.

Sample size

When the sample size decreases to 6 the confidence intervals of the bootstrap distribution increase, the precision of the estimate has decreased, but the sample mean is still unbiased.

Running the simulation 1000 times when the sample size is 20 we find that the proportion of simulations where the population mean falls within the 95% confidence interval is 0.956. Hence the 95% confidence intervals are a true reflection of the confidence interval of the sample mean. However when the sample size is 6 the proportion of the 1000 simulations where the population mean falls within the confidence interval of the sample mean has diminished to 0.849. The realised confidence interval from the bootstrap distribution is less than the true 95% confidence interval.

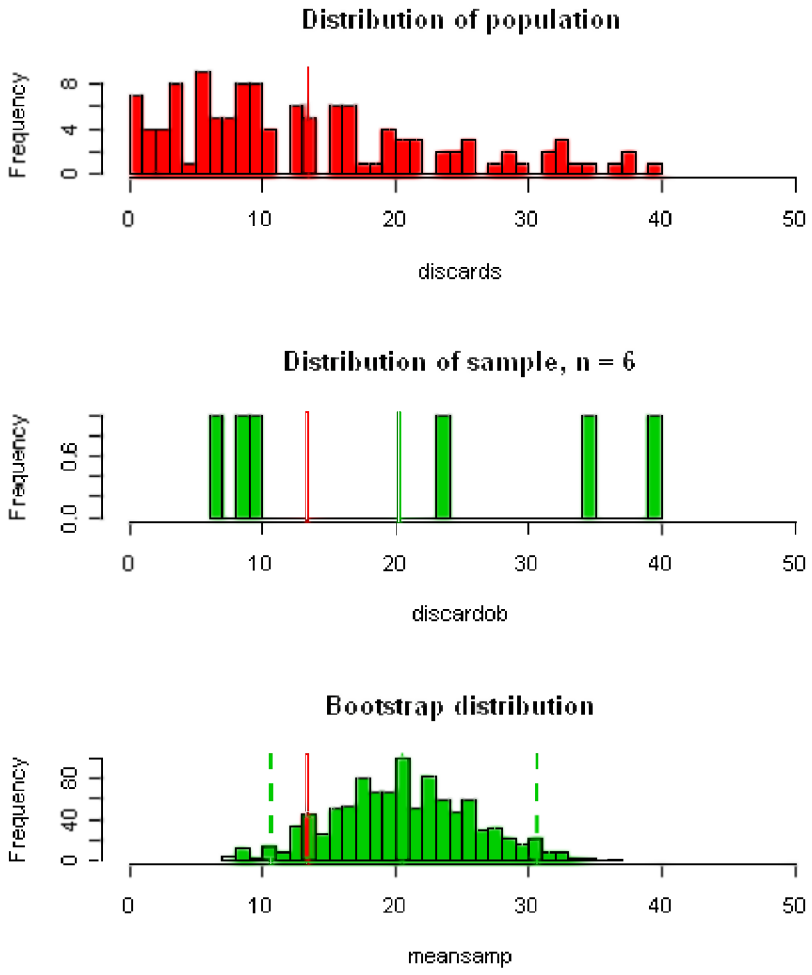


Figure Annex 5.2. Population distribution, sample distribution and bootstrap distribution when the sample size is small $n = 6$ but the selection is unbiased.

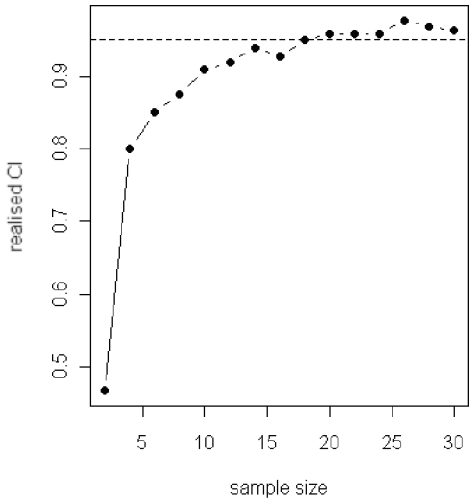


Figure Annex 5.3. The realised confidence interval from simulations with different sample sizes suggests that in this instance 14 samples need to be taken before for the 95% CI of the sample mean is correct.

Bias

Where we have samples from only 3 of the 4 vessels, (the vessel with the high discard rate is not sampled), despite obtaining 20 samples, the population mean of 13.09 falls outside the confidence interval of the sample mean, which is 9.09 with CI(6.46 – 12.45). The proportion of times the population mean falls out with the CI of the sample mean is 0.63. In other words on 37% of occasions the estimate and its confidence interval will not encompass the true mean of the population.

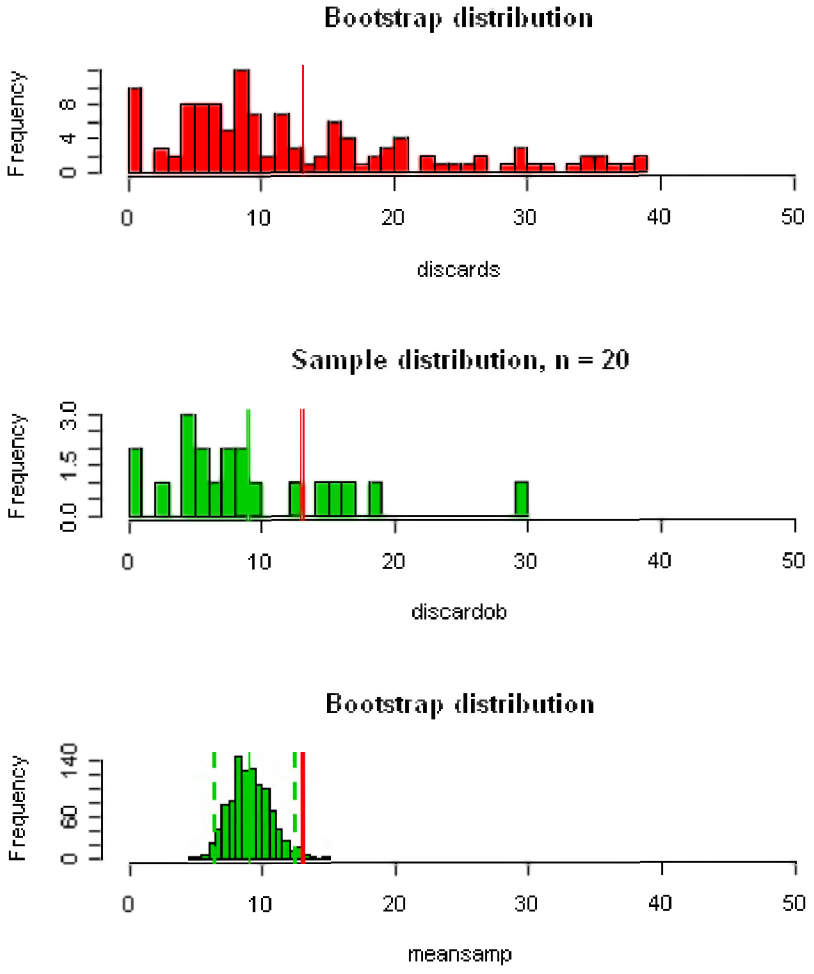


Figure Annex 5.4. Population distribution, sample distribution and bootstrap distribution when the sample size is large $n = 20$, but there is a biased sample from the available vessels.

Annex 6: Example of Dutch "letter for skipper" discard trip report

IMARES WAGENINGEN UR

For quality of life

[Vessel Owner]
[Address]

[Vessel name]

DATUM
21 september 2010

ONDERWERP
Aanbiedbrief rapport [of andere
titel van het product; tekst
hieronder navenant
aanpassen]

INTERNET
www.imares.wur.nl

CONTACTPERSOON
Naam

TELEFOON
+31 (0)317xxxxxx

E-MAIL
imares@wur.nl

Geachte meneer/mevrouw [XX],

Onlangs heeft [name observer] van IMARES meegevaren op uw schip met als doel gegevens te verzamelen over de vangsten en discards. Via deze brief wil ik u graag op de hoogte stellen van de voorlopige resultaten van het onderzoek dat met uw schip is uitgevoerd.

De algemene gegevens van de reis zijn samengevat in tabel 1. Van de [XX] trekken die gedurende de reis zijn gedaan, zijn [XX] trekken bemonsterd op discards en [XX] op aanvoer. De gemiddelde trekduur was [XX] uur en [XX] minuten. De visserij vond met name plaats in kwadranten [XX] en [XX] (figuur 1).

De totale aanvoer per soort van de reis is vastgesteld aan de hand van het logboek dat op de brug is ingevuld en aan de hand van afslaggegevens (tabel 2). De totale scholaanvoer was [XX] kg, de totale aanvoer van tong [XX] kg. Van de aanvoer is in totaal [XX] kg schol en [XX] kg tong bemonsterd.

Per lengtegroep en per visuur zijn de aantallen discards en aanlandingen berekend voor tong en schol (figuur 2). De totale hoeveelheid discards en aanlandingen per visuur staan in tabel 3 (aantallen) en tabel 4 (kg). Het percentage discards in aantal lag voor schol op [XX] % en voor tong op [XX] %. Het percentage discards in gewicht lag voor schol op [XX] % en voor tong op [XX] %. Tabel 5 geeft een overzicht van alle discards die zijn aangetroffen, uitgedrukt in aantallen per visuur.

Ik wil u hierbij nogmaals hartelijk bedanken voor de medewerking aan dit onderzoek. Wij zullen de gegevens met de uiterste discretie behandelen. Mocht u nog vragen hebben over de resultaten van het onderzoek dan zijn wij graag bereid die te beantwoorden.

Met vriendelijke groet,

Edwin van Helmond

Bijlagen:

A_4_5_2 V5

Wageningen UR (Wageningen University, Van Hall Larenstein University of Applied Sciences and various research institutes) is specialised in the domain of healthy food and living environment.

IMARES, part of Wageningen UR, is a leading, independent research institute that concentrates on research into strategic and applied marine ecology.

Tabel 1. Karakteristieken van de reis

NAME OF FORMER VARIABLE	PEM_CODE
schip	XXXXXX
datum vertrek	06/10/08 ()
datum aankomst	10/10/08 ()
visuren	73
gem_trek_duur_min	104
aantal_trekken	42
trekken_bemonsterd_discards	31
trekken_bemonsterd_landings	31
opstappers	Observer
maand	10
type_tuig	80cmKor12w
maaswijdte	80

Tabel 2. Aanvoer en bemonsterde aanvoer (kg)

soort	logboek	atslag	visis	bemonsterd gewicht
Griet	157	157		19.0
Kabeljauw	39	39		0.0
Nephrops	0	0		0.0
Schar	175	175		84.0
Schol	4666	4666		275.6
Tarbot	272	272		22.0
Tong	2612	2612		256.0
Varia	719	719		0.0
Wijting	0	0		0.0
	8640			

Tabel 3. Discards, landings en percentage discards per visuur (in aantallen)

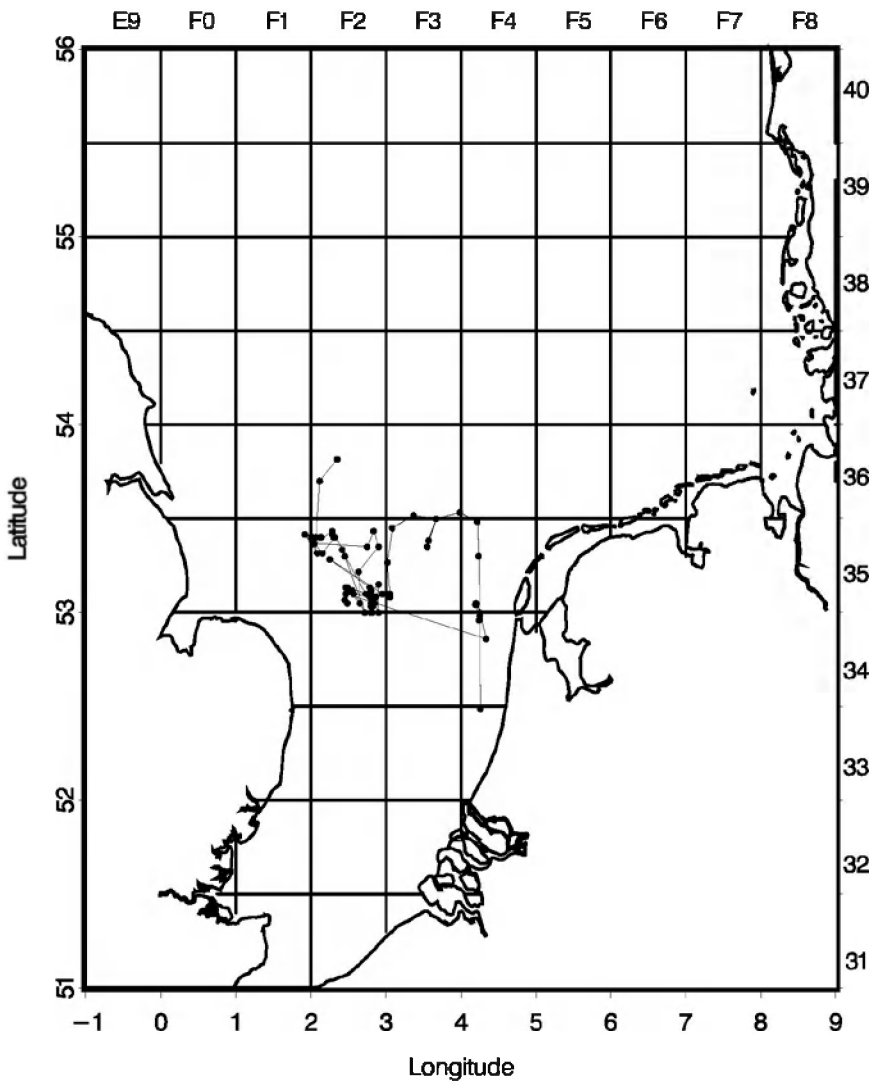
soort	landings	discards	% discards
Griet	3	1	28
Kabeljauw	onbekend	<1	
Nephrops	0	0	
Schar	12	602	98
Schol	173	744	81
Tarbot	2	4	74
Tong	135	26	16
Wijting	0	17	100

Tabel 4. Discards, landings en percentage discards per visuur (in gewichten)

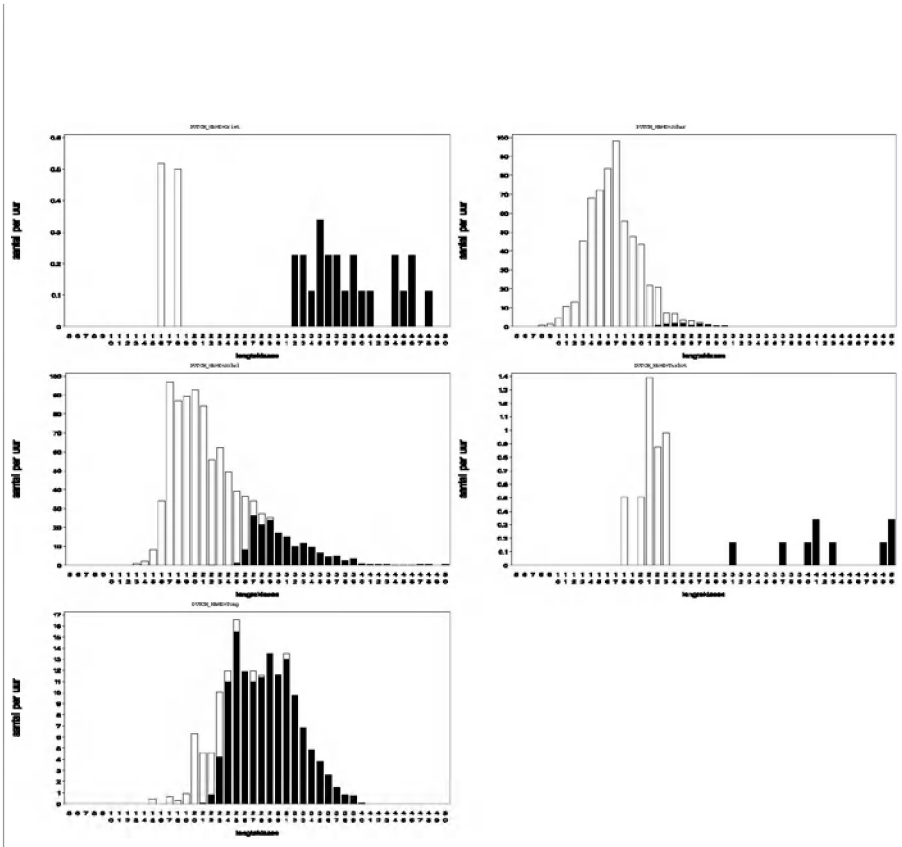
soort	landings	discards	% discards
Griet	2	<1	3
Kabeljauw	<1	<1	0
Nephrops	0	0	
Schar	2	31	93
Schol	64	60	48
Tarbot	4	<1	14
Tong	36	3	7
Wijting	0	<1	100

Tabel 5. Discards per visuur (in aantallen) voor alle vissoorten en benthos gevangen tijdens de reis, gesorteerd naar afnemende hoeveelheden.

DUTCH NAME	discards
Schol	744
Hartegels	679
Schar	602
Gewone zwemkrab	471
Zeester	439
Slangster	388
Pagurus sp.	136
Kamster	65
Schurftvis	46
Dwergtong	37
Tong	26
Kleine pieterman	26
Zeeegels	23
Wijting	17
Rode poon	16
Helmkrab	15
Fluwelen zeemuis	12
Grauwe poon	10
Noordzeekrab	8
Pitvis	7
Grote strandschelp	7
Harnasmannetje	7
Hondshaai	6
Mossel	5
Tarbot	4
Fluwelen zwemkrab	4
Blauwpootzwemkrab	3
Steenbolk	2
Heremietkreeft	2
Gedoornde Hartschelp	2
L. forbesi	2
Messchede	1
Zeedonderpad	1
Griet	1
Eledone	<1
Kabeljauw	<1
Nagelkrab	<1
Zandspiering	<1
Gevlekte rog	<1
Grote zeenaald	<1
Grondel	<1
Blonde rog	<1
Smelt	<1
Zeekat	<1
Zeeanemonen	<1
Dodemansduim	<1
Geep	<1



Figuur 1. Geografische weergave van de reis



Figuur 2. Aantal griet, schar, schol, tarbot en tong discards (□) en aanlandingen (■) per visuur.
Op de horizontale as staan de lengteklassen in centimeter van klein naar groot.
Op de verticale as staat het aantal vissen gediscard (wit) of aangeland (zwart) per visuur.

Annex 7: Example of Marine Institute Discard Sampling Cruise Report

Example of Marine Institute Discard Sampling Cruise Report

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CONTENTS

- Introduction
- Using Discard Data in Stock Assessment
- How old is that fish?
- Discard Trip Fishing and Sampling Details

Marine Institute
Fiúrai na Mara

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Introduction

The role of the Marine Institute, Fisheries Science Services (FSS) is to assess, research and advise on marine fisheries in order to ensure the sustainable exploitation of these resources. To achieve these tasks FSS conducts comprehensive stock monitoring programmes in waters around the Irish coast. Monitoring fish stock involves many diverse activities, for example sampling landings at fish markets and processors, conducting industry independent research surveys and analyses of logbook data which provide landings and effort statistics for the Irish industry as a whole.

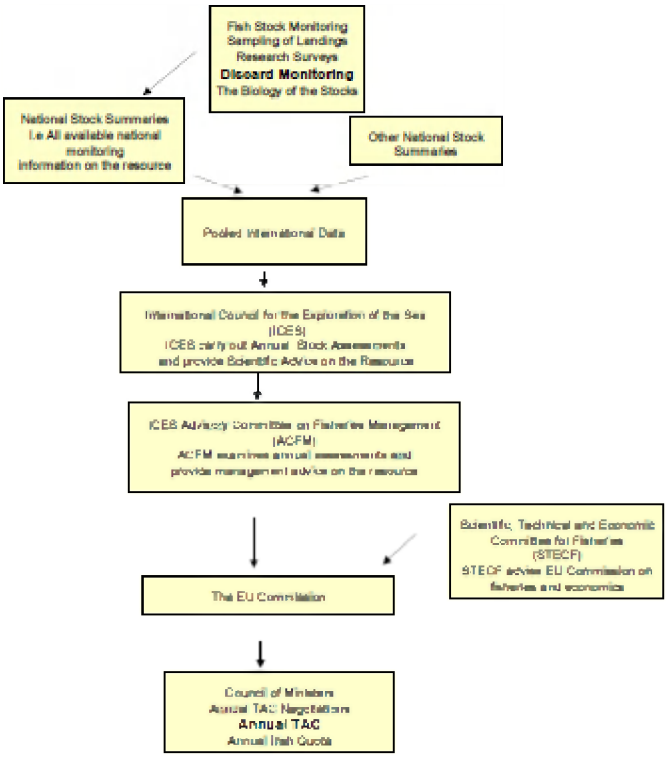
A very important part of the monitoring programme involves assessing discard rates at sea. Information on discarding is important to both fisheries scientists and fishermen alike. Firstly, knowledge of discard rates gives scientists better estimates of total fishing mortality. Secondly, knowledge of discard rates gives fishermen an indication of fishing grounds which have low levels of juvenile fish and hence will yield catches with low discard rates.

The importance of discarding data to stock assessments is widely recognised and discarding sampling by each member state is now mandatory under EU law (Data Collection Regulation 1639/2001 and 1543/2000).

Using Discard Data in Stock Assessment

The fish stock monitoring process involves collecting data on landings, discards, research surveys and the biology of the stock. The importance of discard data can not be overestimated. Including discarding data in scientific assessments helps to reduce the uncertainty in the assessments. These data are then used to reconstruct the historical development of the stock in the past and examine changes in the stock due to fishing. The next stage in the stock assessment process is to predict the future of the stock under a range of management options. Stock assessments provide the EU with information on the status of the various stocks and are the basis on which the annual Total Allowable Catches (TACs) are calculated (as outlined in the Figure1).

Figure 1. The Steps involved in the formulation of the annual TAC's



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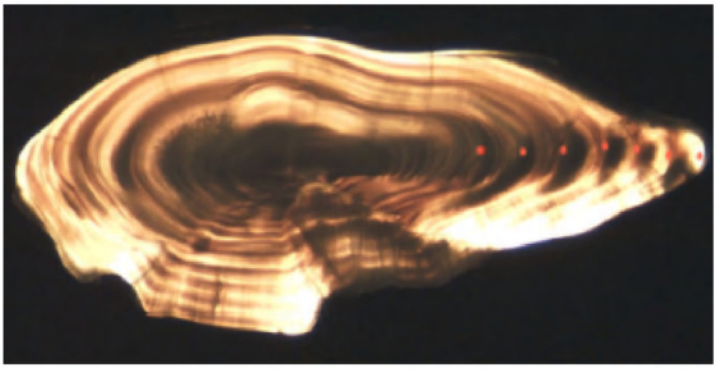
An important aspect of the stock assessment process is to examine changes in the stock on an annual basis and part of this involves the conversion of fish length to fish age. Differences in age at length of fish may vary for a large number of reasons e.g. a selective response to fishing pressure, environmental factors and food availability. The age profile of a stock gives an indication of how healthy that stock is. A healthy fish stock will have a broad range of ages present. If there are no young fish, then recruitment may have failed. This can lead to problems in the future if there are no young fish to replace the fish being taken from the stock through fishing activity. If there are no old fish, then the fish stock may be subject to overfishing. By determining the age of a large number of individual fish, using otoliths (bony structure present in the head of a fish), it is possible to build up a picture of the age structure of the whole population. This knowledge provides an indication of how the stock is coping with exploitation. Age data gives a good insight into the fish stock and is an important component in fish stock assessment. Figure 2. shows a cross section of a haddock otolith. The annual growth rings are shown by the red dots. Otoliths are read in the same way as the rings of a tree, with one ring representing one years growth.

Figure 2. Image of a 7 year old haddock otolith (60 cm in length). The annual growth rings (annuli) are indicated with red dots.



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How old is that fish?

Many fishermen are interested in the age of fish depending on their different lengths. The following plots show the average length for fish at different ages for eight of the most commercial fish species and how this relates to important parameters such as minimum landing size (MLS) and age at first maturity (Figure 3.) This graph can be interpreted by choosing the length on the left hand side, going across to the red curve and at that point dropping down to the age on the bottom axis. This gives an approximate age of the fish for any given length. For example the green arrows shows that a 50cm cod is approximately 2 years old.

Figure 3. Average length at each age for cod, haddock, and whiting.

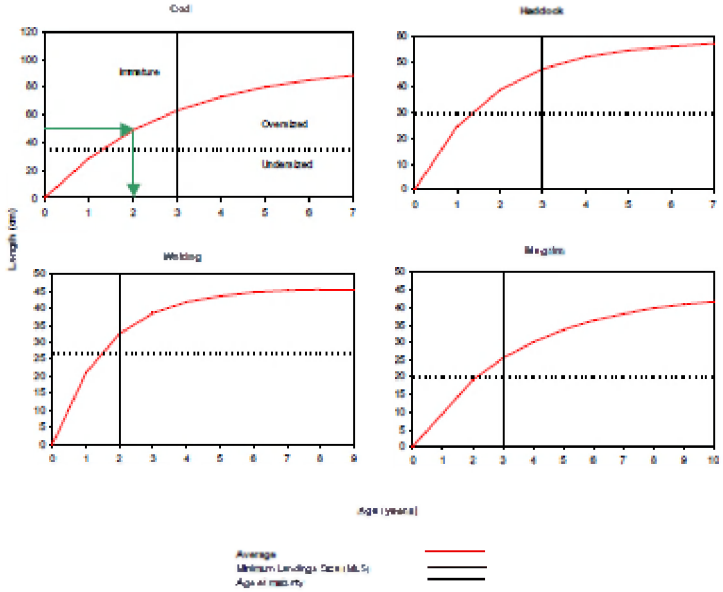
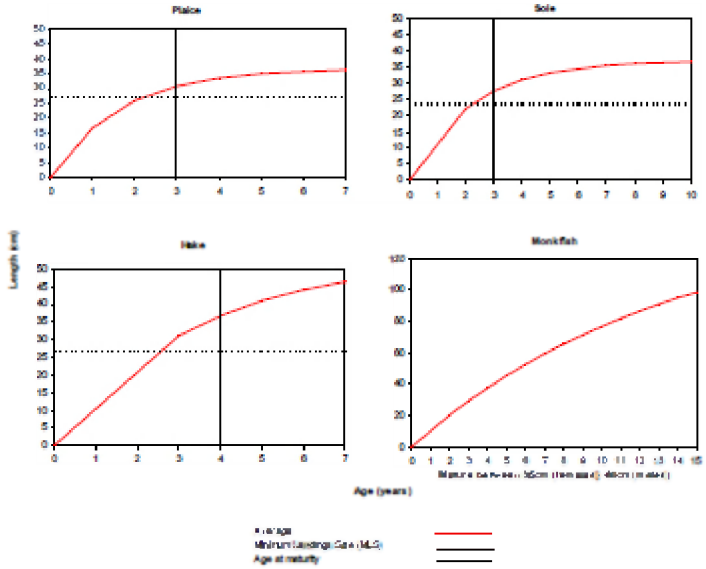


Figure 3 cont'd. Average length at each age for plaice, sole, hake and monkfish.



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Discard Trip Fishing and Sampling Details

This report relates to a fishing trip carried out between 23/01/2011 and 27/01/2011. Sampling was conducted by Tobi Rapp (FSS, Fisheries Assessment Technician). Trip details were as follows:

ICES Division	Gear Used	Hauls	Hauls Sampled
VIIg	Scottish seine (fly-dragging)	10	9

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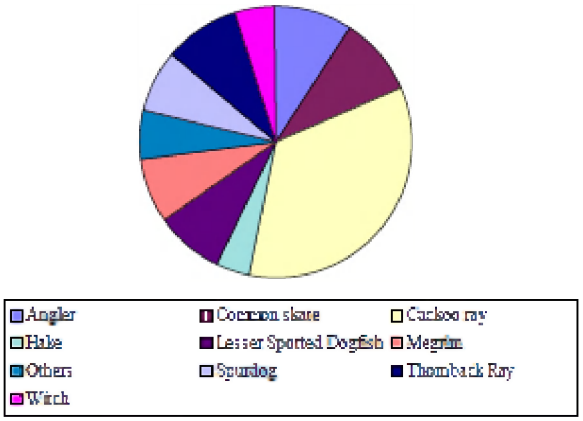
Figure 4. Specie: Catch Composition. Species less than 220 Kg are represented by Others.



"Others" component of Catch

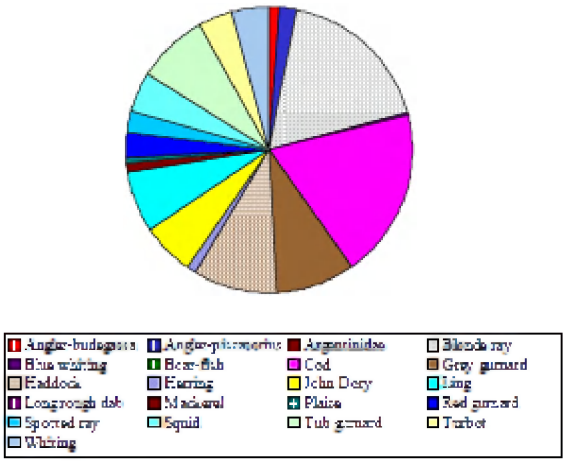


Figure 5. Catch weight per species

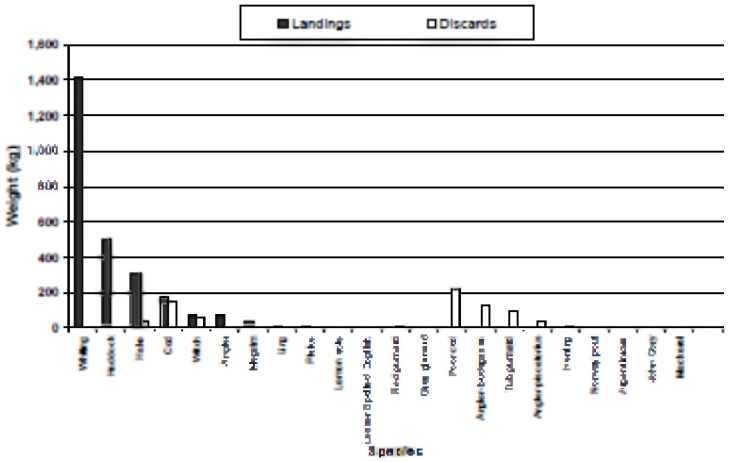


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Figure 6. Raised Length Distributions of Whiting caught during the trip.

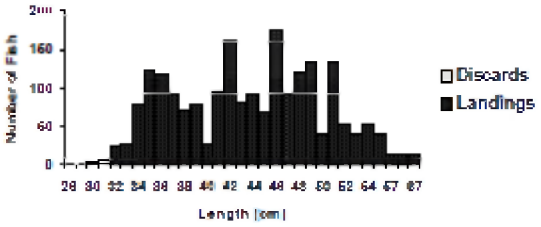
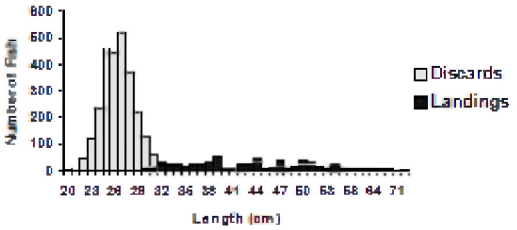


Figure 7. Raised Length Distributions of Haddock caught during the trip.



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Conclusions

During discard sampling on this fishing trip approximately 2634 Kg (~ 66 boxes) of commercial species were landed (including 0 Kg of Nephrops) and 716 Kg (~ 18 boxes) were discarded. Of these 716 Kg approximately 582 Kg (~ 14 boxes) were fish. The remainder was made up of non-fish discards eg. small prawns, squid, crabs etc.

Haddock dominated the total weight of fish discarded during the trip with 430 Kg. There was approximately 504.2 Kg of Haddock landed.

The discard rate for a given species refers to the weight of that species discarded as a percentage of the total catch of that species. Total catch is equal to the weight of both landings and discards.

Discard rate = Discards (kg) / Total catch (kg) X 100

Haddock had the highest discard rate (46.03%) during this trip. Of the Haddock caught approximately 504 Kg was landed and 430 Kg was discarded.

Acknowledgements

We wish to thank you and all of the crew for co-operating with this work. Without the help of the fishermen involved this sampling programme would not be possible. At-sea sampling of fishermen's catches provides the most reliable method of acquiring data on the quantity and species composition of discards. Collecting information on discards facilitates the re- construction of the whole catch for a particular species, the discarded part and the landed part. Without this, the data collected would be based solely on landings information from the commercial market. Size and age samples of discards permit the estimation of discard size age composition, which often differs considerably from that in the landings. The programme also provides an opportunity for mutual dialogue between fishermen and fisheries scientists.

Annex 8: Presentation of Portuguese onboard sampling protocols

Portuguese Onboard Sampling Protocols: Contribution to the Standartization of Bottom Otter Trawl and Set Gears

Prista N., Jardim E., Fernandes A.C.

ipimar Instituto de Investigação das Pescas e do Mar

inrb Instituto Nacional de Recursos Biológicos, I. P.

Outline

- Overview of the sampled *metiérs*
- Bottom otter trawl and Set Gear *métiers*
  - Sampling design
  - Onboard sampling protocol
  - Data collected and basic calculations
- Final comments and remarks

Métiers to sample (Division XIa)

Métier	Target assemblage	Examples of target Species / Group of species	Geographical area
DRB_MOL_30_0_0	Clams	*Ensis spp., Spisula solida, Donax spp., etc*	IXa
FPO_MOL_>=29_0_0	**Cephalopods**	***Octopus vulgaris* or fish (depending on type and size of trap)**	**IXa**
FYC_CAT_>=20_0_0	Catadromous fish	*Anguilla anguilla*	IXa
GNS_DEF_60-79_0_0	**Demersal fish**	***Trisopterus luscus***	**IXa - NW**
GNS_DEF_80-99_0_0	**Demersal fish**	***Pagellus acarne and other Sparidae***	**IXa**
GNS_DEF_>=100_0_0	**Demersal fish**	***Lophius spp, Merluccius merluccius, etc***	**IXa**
GTR_DEF_80_99_0	**Demersal fish**	***Sepia officinalis, Solea spp., Rajidae***	**IXa**
GTR_DEF_>=100_0_0	**Demersal fish**	***Lophius spp, Merluccius merluccius, etc***	**IXa**
LLD_LPF_0_0_0	Large Pelagic Fish	*Xiphias gladius*	IXa
LLS_DEF_0_0_0	**Demersal fish**	***Merluccius merluccius***	**IXa - S**
LLS_DWS_0_0_0	**Deep sea fish**	***Aphanopus carbo, Centroscymnus coelolepsis, Centrophorus spp***	**IXa - SW**
OTB_CRU_55-59_0_0	**Crustacean**	***Parapenaeus longirostris***	**IXa – SW, S**
OTB_CRU_>=70_0_0	**Crustacean**	***Nephrops norvegicus***	**IXa – SW, S**
OTB_DEF_65-69_0_0	**Demersal fish**	***Merluccius merluccius,Trachurus spp, Lophius spp***	**IXa**
PS_SPF_>=16_0_0	Small Pelagic fish	*Sardina pilchardus, trachurus spp, scomburs japonicus*	IXa
TBB_CRU_>=20_0_0	Crustacean	*Palaemonidae*	IXa - NW

Bottom Otter Trawl *métiers* (IXa)

Métier	Target assemblage	Examples of target Species / Group of species	Geographical area
DRB_MOL_30_0_0	Clams	*Ensis spp., Spisula solida, Donax spp., etc*	IXa
FPO_MOL_>=29_0_0	**Cephalopods**	***Octopus vulgaris* or fish (depending on type and size of trap)**	**IXa**
FYC_CAT_>=20_0_0	Catadromous fish	*Anguilla anguilla*	IXa
GNS_DEF_60-79_0_0	**Demersal fish**	***Trisopterus luscus***	**IXa - NW**
GNS_DEF_80-99_0_0	**Demersal fish**	***Pagellus acarne and other Sparidae***	**IXa**
GNS_DEF_>=100_0_0	**Demersal fish**	***Lophius spp, Merluccius merluccius, etc***	**IXa**
GTR_DEF_80_99_0	**Demersal fish**	***Sepia officinalis, Solea spp., Rajidae***	**IXa**
GTR_DEF_>=100_0_0	**Demersal fish**	***Lophius spp, Merluccius merluccius, etc***	**IXa**
LLD_LPF_0_0_0	Large Pelagic Fish	*Xiphias gladius*	IXa
LLS_DEF_0_0_0	**Demersal fish**	***Merluccius merluccius***	**IXa - S**
LLS_DWS_0_0_0	**Deep sea fish**	***Aphanopus carbo, Centroscymnus coelolepsis, Centrophorus spp***	**IXa - SW**
OTB_CRU_55-59_0_0	**Crustacean**	***Parapenaeus longirostris***	**IXa - SW**
OTB_CRU_>=70_0_0	**Crustacean**	***Nephrops norvegicus***	**IXa - SW**
OTB_DEF_65-69_0_0	**Demersal fish**	***Merluccius merluccius,Trachurus spp, Lophius spp***	**IXa**
PS_SPF_>=16_0_0	Small Pelagic fish	*Sardina pilchardus, trachurus spp, scomburs japonicus*	IXa
TBB_CRU_>=20_0_0	Crustacean	*Palaemonidae*	IXa - NW

Bottom Otter Trawl – Sampling Design

- Métiers:
  - OTB_CRU_55-59_0_0
  - OTB_CRU_>=70_0_0
  - OTB_DEF_65-69_0_0

  } merged: **OTB_CRU_>=55_0_0**
- Method: Quasi-random sampling
- Population: Fishing trips of all vessels
- Sampling frame: Fishing trips of all cooperative vessels
- Sample: Fishing trip
  - Trip duration: 2+ days in OTB_CRU; 1+ day in OTB_DEF

Bottom Otter Trawl – Sampling Design

- Strata:
  - Métier group
    - OTB_CRU_>=55_0_0
    - OTB_DEF_65_69_0_0
  - Quarters
    - previous year's fishing effort is used as a "guideline" in allocating sampling effort in space (NW, SW, S)
- Planned sampling effort: 27 trips (OTB_DEF); 12 trips (OTB_CRU)
- Observers: teams of 2 (now 1+)

Bottom Otter Trawl - Sampling Protocol

- Driven by priority levels (1-3)
- 4 tasks
  - Priority level 1 (forms OTB 01 to OTB 03)
    - **Task A)** characterization of the fishing trip and its hauls
  - Priority level 2 (form OTB 04)
    - **Task B)** characterization of the catch **in weight**
  - Priority level 3 (forms OTB 05 to OTB 10)
    - **Task C)** characterization of the catch in length
    - **Task D)** collection of biological samples

Bottom Otter Trawl – Onboard Routines

Shortened

- ***At departure:***
  1. Start filling out the *trip form* (OTB 01). **[task A]**
  2. Toss a coin and select hauls to sample (odd or even).
- ***In every haul:***
  3. Fill out the *haul form* upon inquiry to shipmaster (OTB 02). **[task A]**
  4. At the lower deck, determine weight of fish "retained". Fill out the *fish production form* (form OTB 03). **[task A]**
- ***In every haul selected for sampling:***
  5. Take a representative sample of catch (about three boxes of fish). **[task B,C,D]**
  6. Ask the crew what criteria they are using to sort the fish "retained" from the fish "discarded". **[task B,C,D]**
  7. Weight the sample of catch. Start filling out *sample form* (OTB 04) **[task B,C,D]**
  8. For each species present in the sample sort out the fraction "retained" from the fraction "discarded". **[task B,C,D]**
  9. Put aside the fraction "discarded" **[task B,C,D]**
  10. For each species in fraction "retained": **[task B,C,D]**
      - Weight and count each species and fill out *sample form* (OTB 04) **[task B,C,D]**
      - Measure the individuals and fill in the length measurements forms (OTB 05 to 09) **[task C,D]**
      - Check the *biological samples datasheet* for samples required. Put any required samples aside. Fill in the *biological samples form* (OTB 10). **[task D]**

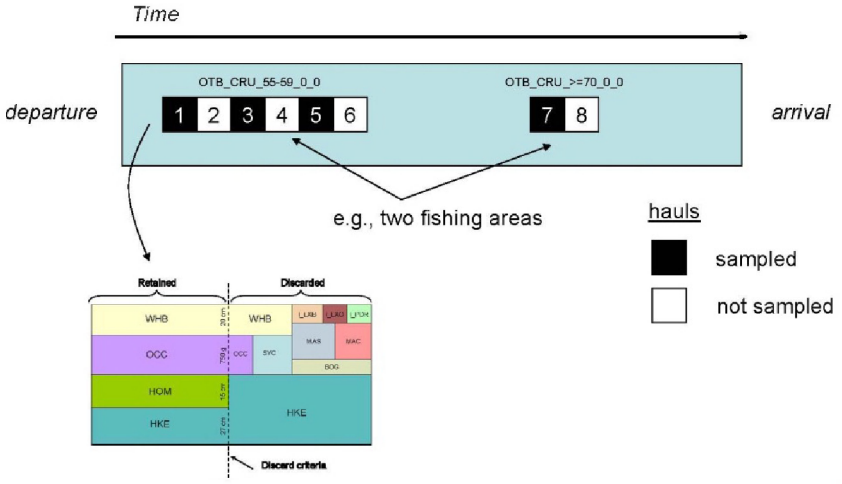
  11. Carry out step 10 in fraction "discarded" **[task B,C,D]**

Bulk of work

Time consuming

- ***At arrival:***
  12. Finish *trip form* (OTB 1) and check remaining data. **[task A]**

Bottom Otter Trawl – Fishing Trip e.g.



Bottom Otter Trawl – Data collected

Effort

Date and time of deployment and retrieval

Catch

Total catch (shipmaster)

Retained weight (per species)

Catch sample (discard + retained)

- number (per species)
- weight (per species)
- length frequency (per species)

Covariables

GPS, bottom type, depth, etc

Size of cod-end, type of footrope, etc

Shipmaster, target species, etc

Calculations

total discards $\frac{W_D}{W_R} = \frac{w_d}{w_r} \Leftrightarrow W_D = \frac{w_d}{w_r} \times W_R$

total catch $W_C = W_D + W_R$

total discards per species (x) $W_{D,x} = \frac{w_{d,x}}{w_r + w_d} \times W_C$

w_r – weight discarded (in sample)
w_d – weight retained (in sample)
W_D – weight discarded (total)
W_R – weight retained (total)
W_C – weight catch (total)

Set gear *métiers* (IXa)

Métier	Target assemblage	Examples of target Species / Group of species	Geographical area
DRB_MOL_30_0_0	Clams	*Ensis spp., Spisula solida, Donax spp., etc*	IXa
FPO_MOL_>=29_0_0	**Cephalopods**	***Octopus vulgaris* or fish (depending on type and size of trap)**	**IXa**
FYC_CAT_>=20_0_0	Catadromous fish	*Anguilla anguilla*	IXa
GNS_DEF_60-79_0_0	**Demersal fish**	***Trisopterus luscus***	**IXa - NW**
GNS_DEF_80-99_0_0	**Demersal fish**	***Pagellus acarne and other Sparidae***	**IXa**
GNS_DEF_>=100_0_0	**Demersal fish**	***Lophius spp, Merluccius merluccius, etc***	**IXa**
GTR_DEF_80_99_0	**Demersal fish**	***Sepia officinalis, Solea spp., Rajidae***	**IXa**
GTR_DEF_>=100_0_0	**Demersal fish**	***Lophius spp, Merluccius merluccius, etc***	**IXa**
LLD_LPF_0_0_0	Large Pelagic Fish	*Xiphias gladius*	IXa
LLS_DEF_0_0_0	**Demersal fish**	***Merluccius merluccius***	**IXa - S**
LLS_DWS_0_0_0	**Deep sea fish**	***Aphanopus carbo, Centroscymnus coelolepsis, Centrophorus spp***	**IXa - SW**
OTB_CRU_55-59_0_0	**Crustacean**	***Parapenaeus longirostris***	**IXa - SW**
OTB_CRU_>=70_0_0	**Crustacean**	***Nephrops norvegicus***	**IXa - SW**
OTB_DEF_65-69_0_0	**Demersal fish**	***Merluccius merluccius,Trachurus spp, Lophius spp***	**IXa**
PS_SPF_>=16_0_0	Small Pelagic fish	*Sardina pilchardus, trachurus spp, scomburs japonicus*	IXa
TBB_CRU_>=20_0_0	Crustacean	*Palaemonidae*	IXa - NW

Set gears – Sampling Design

- Métiers:
  - LLS_DWS_0_0_0
  - FPO_MOL_>=29_0_0
  - GNS_DEF_60-79_0_0
  - GNS_DEF_80-99_0_0
  - GNS_DEF_>=100_0_0
  - GTR_DEF_80_99_0
  - GTR_DEF_>=100_0_0
  - LLS_DEF_0_0_0

Mixed métiers

Merged: group **GNS_DEF+GTR_DEF**

specific region and season -> few vessels

Set gears – Sampling Design

- Method: Quasi-random sampling
- Population: Fishing trips of all vessels
- Sampling frame: Fishing trips of all cooperative vessels
- Sample: fishing trip (duration: ~1 day)
- Strata:
  - Métier group (GNS_DEF+GTR_DEF; LLS_DWS; LLS_DEF)
  - Quarters
    - previous year's fishing effort is not used as a "guideline" in allocating sampling effort in space (NW, SW, S) – evenly distributed
- Planned sampling effort: 12+12 trips (GNS_DEF+GTR_DEF); 12 trips (LLS_DWS);
- Observers: teams of 2 (now 1+)

Set gears - Sampling Protocol

- Driven by priority levels (1-3)
- 4 tasks
  - Priority level 1 (forms SET 01 to SET 03)
    - **Task A)** characterization of the fishing trip and its hauls
  - Priority level 2 (form SET 04)
    - **Task B)** characterization of the catch **in number**
  - Priority level 3 (forms SET 05 to SET 10)
    - **Task C)** characterization of the catch in length
    - **Task D)** collection of biological samples
- Difference to OTB: "Number" approach; trip structure: several sets per trip, segment within sets

Set Gears – Onboard Routines

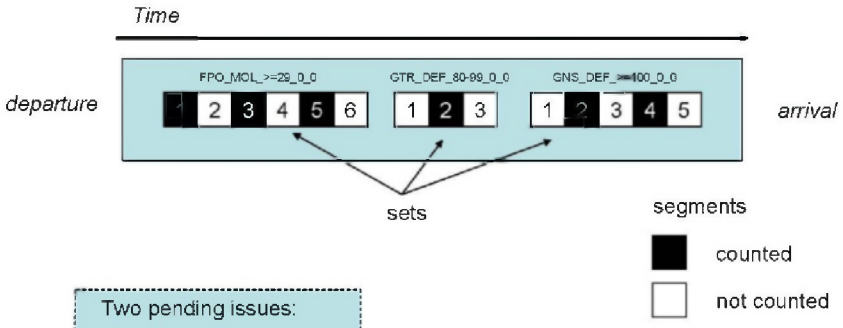
Shortened

- ***At departure and in every set (deployed and/or retrieved) :***
  1. Start filling out the *trip form* (SET 01). **[Task A]**
  2. Inquire the shipmaster about the gear characteristics and the set characteristics. Fill out the *set form* (SET 02a, 02b or 02c). **[Task A]**
- ***At the beginning of set retrieval:***
  3. toss a coin to select segments to count (odd or even). **[Task B, C, D]**
  4. Ask the crew to keep the fish "discarded" in separate boxes from the "fish retained" (discard and retained boxes, respectively). **[Task B, C, D]**
- ***During set retrieval (every segment selected for counting):***
  5. As the gear is being retrieved, count the specimens from each species and split them into the categories "retained" and "discarded". Fill out the *count form* (SET 04). **[Task B, C, D]**
- ***During set retrieval (segments <u>not</u> selected for counting):***
  6. Measure a representative sample of fish from each species "retained" and "discarded". Fill out the *length forms* (SET 05 to 09). When possible, weight each sample. **[Task C, D]**
  7. Check if Biological Samples are required. Put any required biological samples aside. Fill in the *biological samples form* (SET 10). **[task D]**
- ***At the end of set retrieval:***
  8. Determine the total weight of each species "retained" and fill out the *fish production form* (SET 3a, 3b or 3c). **[Task A]**
  9. Finish filling out the *set form* (SET 2) **[Task A]**
- ***At arrival:***
  10. Finish filling out the *trip form* (SET 1). **[Task A]**

Bulk of work

Time and space consuming

Set gears – Fishing Trip e.g.



Two pending issues:

- mixed *métiers*
- incomplete sets

Set gears – Data collected

Effort

Date and time of deployment and retrieval

Number of hooks, nets or traps

Catch

Total catch (shipmaster)

Retained weight (per species)

Catch counts (discard and retained)

number (per species)

Retained sample

length frequency (per species)

Discard sample

length frequency (per species)

Covariables

GPS, bottom type, depth, etc

Hook dimension, type of bait, size of nets, etc

Shipmaster, target species, etc

Calculations

total discards (in set) $N_D = n_d \times \frac{S_T}{S_n}$

total catch (in set) $N_C = (n_d + n_r) \times \frac{S_T}{S_n}$

total discards per species (*x, in set*) $N_{D,x} = n_{d,x} \times \frac{S_T}{S_n}$

length freq. discards per species (x, in set) $LF_{D,x} = N_{D,x} \times lf_{d,x}(\%)$

S_T – number of segments (total)
S_n – number of segments (counted)
N_r, n_r – number retained (total; counted)
N_d, n_d – number discarded (total; counted)
N_C – number caught (total)
$LF_{D,x}$ – length frequency discarded of spp x (total)
$lf_{d,x}(\%)$ – length frequency discarded of spp x (%, sampled)

Final comments and remarks

- Both protocols are
  - Catch approach -> Well-suited to ecosystem approach
  - Priorities -> easier training; improved standartization; easier to track statistical design
  - Unbounded estimates of Catch and Discards -> improved statistical properties
    - Drawback in trawl: sensitivity to errors (smaller samples) => must collect large sample => less hauls sampled; knife-edged approach to discard ogive
    - Drawback in set gears: weights require weight-length relationship -> possible cause of bias
- Open questions (need your feedback!)
  - raising procedures to fleet level (mixed métiers!)
  - Incomplete sets (can their information be useful?)

Annex 9: Belgian self-sampling programme

Belgian self-sampling programme: cod in VIIfg

On request and initiative of the Belgian fisheries sector, the Institute for Agricultural and Fisheries Research (ILVO), in close cooperation with the fisheries sector, started a self-sampling programme to identify the impact of the Belgian beam trawl fishery on the Celtic Sea (areas VIIf and VIIg) cod stock. Since February 2010, fishers of 10 commercial vessels are participating in the pilot project on a voluntary basis. The skippers and crew were trained by scientists of ILVO to follow a standard sampling protocol for collecting and recording data. Data are being collected from several levels:

- Trip/vessel-related data: vessel name, trip number, fishing gear used, departure and return time,.
- Haul-related data: number and date of haul, time and position of shooting and hauling, ICES statistical rectangle, normal haul (Yes/No+why), Lengths recorded (Yes/No), remarks…
- Weight-related data from all hauls: Total landing weights of sole, plaice, haddock and cod (gutted weight) and discard weights (life weight) of cod
- Length distributions from every second haul: length measurements of landed and discarded cod

In order to ensure that the data from the self-sampling programme reaches the required high quality standards, the self-sampling data are cross checked in two ways:

- Cod landings from the self-sampling programme will be compared to the cod landings recorded in the fish market.
- The weights, numbers and LFDs of the landed and discarded cod from the self-sampling programme will be compared to observer data of vessels fishing with similar spatial and temporal attributes.

In total, 37 trips were sampled by fishers in 2010. Based on the cross-checks mentioned above, there will be decided which trips can be accepted and validated. Further analyses on the validated data will be conducted.

Based on the first results, it seems that the Belgian self-sampling project allows a serious increase in spatial as well as temporal coverage and reduces the problems of very large raising factors based on scientific observer data only. Furthermore, the engagement of the industry in the collection of fisheries data is creating a better relationship between the scientists and fishers and we hope that this cooperation will improve the quality of the data available to scientists and ultimately to the stock assessment workshops.

Sofie Vandemaele[1], Els Torreele[1]

[1] Institute for Agricultural and Fisheries Research (ILVO), Ankerstraat 1, B-8400 Oostende, Belgium

E-mail: sofie.vandemaele@ilvo.vlaanderen.be

Annex 10: Spanish pendrive report

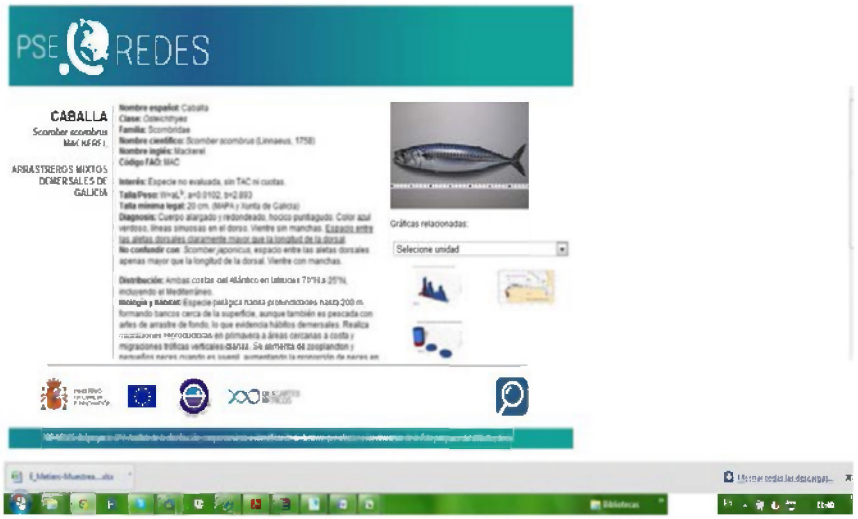


Figure Annex 10.1. Discard software guide interface.

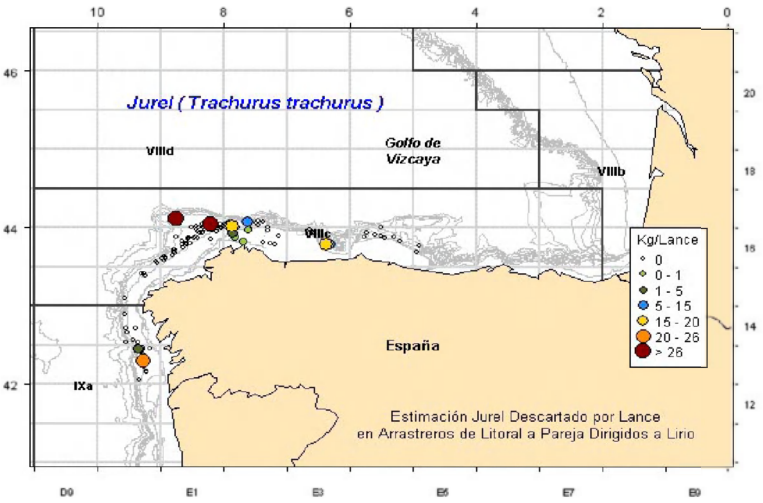


Figure Annex 10.1. Spatial information included in disclosure software.

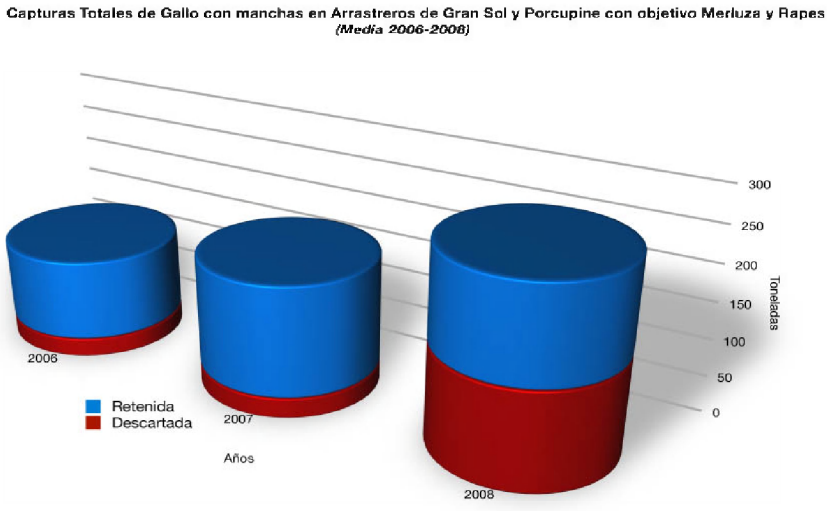


Figure Annex 10.2. Friendly looking plot of discard/landed fraction information included in the interactive software.