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SLU Aqua, Lysekil, Sweden

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Executive Summary

This workshop, chaired by Bram Couperus (the Netherlands) and Katja Ringdahl (Sweden) was held at SLU-Aqua, Lysekil, Sweden between 24–26 April 2018, with 10 participants from 7 countries.

Prior to the workshop, participants from each country were provided with a template to summarize information on their sampling schemes, Data Collection Framework (DCF) sea-sampling programmes, dedicated bycatch monitoring programmes and directed bycatch studies, in which bycatch data are obtained. These were collated into an inventory and developed further at the workshop.

The inventory describes when the different programmes/surveys started, what kind of monitoring it is, what the main objective of the programme is, where it takes place, what fishery it covers, the sampling design of the programme, sampling intensity and how data is stored, along with some expert judgement on the perceived importance of these fisheries compared to other fisheries in relation to the bycatch of birds, mammals, PET fish species, elasmobranchs and reptiles. The suggestion from WKPETSAMP is to fully populate this inventory with information on equivalent programmes from other countries and to update it on an annual basis, allowing for more complete future assessments on how data on bycatches are sampled throughout Europe. WKPETSAMP suggest that the ICES Working Group on Protected Species Bycatch (WGBYC) assumes the responsibility to manage the inventory.

WKPETSAMP compared the strengths and limitations between fish catch sampling programmes, dedicated bycatch monitoring programmes and directed bycatch studies. The UK was the only participating country running a dedicated bycatch monitoring programme. An important distinction between catch sampling / bycatch monitoring programmes and directed bycatch studies is that directed studies are usually limited in time and space which make them unsuitable for extrapolating results to areas beyond the immediate fishery of focus. Catch sampling and bycatch monitoring programmes have a larger spatial and temporal coverage meaning that extrapolation is appropriate, but may have high uncertainty due to monitoring intensity. Fish catch sampling programmes tend to focus on fisheries with large volumes of catch and/or fisheries were discards are considered high. This often coincides with fisheries of relevance for bycatches of protected fish species and elasmobranchs but with a lesser relevance for bycatches of birds, marine mammals and reptiles. Observers working in catch sampling programmes might not be specifically trained for typical bycatch monitoring tasks (e.g. they might not check for drop-outs or have difficulties with protected species identification). An additional limitation of catch sampling programmes for quantifying protected species bycatch was that observers may have to carry out multiple tasks on board and so may not be able to fully observe fishing operations for incidental bycatch (i.e. they may not be present in the right position at the right time), and generally do not record to what extent the haul was actually properly monitored for bycatch. A way forward might be to design robust multipurpose catch/bycatch sampling programmes in which observers focus on fish catch sampling on some hauls and on bycatch monitoring on others.

WKPETSAMP was also asked to attempt to identify the precision and accuracy required by end users. Work Package 3 (WP3) from the FishPi project has prepared an overview of these requirements and the workshop reviewed this work and concluded that end user needs are generally not clearly enough defined by the end users themselves. Another part of WKPETSAMP's remit was to develop criteria to evaluate if at-sea sampling programmes actually meet end user needs. It was proposed to carry out

risk assessments following the method developed in WKBYC (ICES, 2013), which was further developed within the FishPi project. Risk assessments were carried out within the FishPie project for most areas in the NE Atlantic, but not for the Baltic, Mediterranean or Black Sea. WKPETSAMP has recommended that WGBYC should be tasked with filling these gaps.

In addition WKPETSAMP was asked to define proper mechanism(s) for storage, maintenance and dissemination of the bycatch data generated from sampling programmes and directed studies. The outcome can be summarized as follows: (1) build routines into sampling (parts of) the entire haul and treat any rare item in the catch as an incidental bycatch, (2) provide observers with proper instructions and training, including protocols for identification and recording of rare catch items, (3) clear indication of species selection within sampling procedures so that real zeros can be distinguished from zeros arising through non-sampling, (4) adequate design of the national database(s) where catch and bycatch information is stored. WKPETSAMP were further given a presentation on the new data model for the Regional Database and Estimation System (RDBES) and an opportunity to provide feedback on fields needed to take requirements from bycatch studies into account. The Second Workshop on Practical Implementation of Statistical Sound Catch Sampling Programmes (WKPICS2 - ICES 2012) developed guidelines for best practice on the design and documentation of catch sampling programmes. The guidelines are generic and have high relevance for catch sampling programmes and studies providing data on incidental bycatch. WKPETSAMP developed a draft guidance for best practice on some of the issues that were discussed during the meeting, in particular in relation to training of observers, sampling protocols and data capture in the same format as the WKPICS2.

Opening of the meeting

The workshop started at SLU-Aqua, Swedish University of Agricultural Sciences in Lysekil, Sweden, on Tuesday, 24 April at 10:00 and closed on Thursday, 26 April at 16:00. 10 representatives from 7 countries attended the workshop (Annex 1).

1 Adoption of the agenda

The agenda of the meeting is included in Annex 2.

2 Inventory of existing sampling programmes (ToR a)

TOR A of WKPETSAMP was to compile an inventory of the various sampling programmes that provide information on incidental bycatch at the national level. These programmes include regular Data Collection Framework (DCF) at-sea sampling programmes as well as other national monitoring programmes and directed studies that focus on protected species bycatch.

A template for the inventory was designed and circulated prior to the workshop and was filled in by the participants. The template was then updated during the meeting in light of different problems, issues and misinterpretations that occurred when participants initially filled it in.

In the final document we have compiled information on at-sea data collection programmes from Germany, Greece, Iceland, Ireland, Netherlands, Spain (Basque county), Sweden and the United Kingdom. The inventory is found in Annex 5.

The programmes vary in methodology, from regular DCF sampling programmes, wide-scale bycatch monitoring programmes, self-sampling programmes, to direct studies on bycatch or interviews and surveys with fishermen. The inventory details when the different programmes/surveys started, what kind of monitoring is conducted, what the main objective of the programme is, spatial scale, what fisheries are covered, sampling protocols, sampling intensity, what data is recorded, along with some expert judgement on the perceived importance of monitored fisheries compared to other fisheries in relation to the bycatch of birds, marine mammals, PET fish species, elasmobranchs and marine reptiles.

The inventory will be forwarded to the Fish Pi2 (MARE/2016/22) project, and to the ICES Working Group on Protected Species Bycatch (WGBYC), to gather information on sampling programmes in other countries. It can also be forwarded to the Regional Coordination Groups (RCGs) for completion on DCF sea-sampling programmes in all EU countries.

The inventory provides an opportunity to get an overview of all programmes and studies collecting information on protected species bycatch. The existence of such an overview provides end users of the data, such as ICES WGBYC, the potential to assess what data should be available and to identify gaps to help further improve data collection efforts. It may also be useful to and inform expectations on where, for example, bycatch rates can be appropriately generated. This is of increasing importance as more focus is put on quantifying bycatches in fisheries in connection with sustainability accreditation schemes but also because of the broadening scope of the Common Fisheries Policy

(Council Regulation 1380/2013) within EU as it moves towards the proper implementation of the Ecosystem Approach.

However it is important that the inventory is managed and kept up to date in order to maximise its utility. **WKPETSAMP thereby recommend that WGBYC get the responsibility to gather and maintain an inventory of various sampling programmes providing data on protected species bycatch conducted by ICES countries.** This includes regular DCF at sea programmes, other national sea sampling programmes (including dedicated bycatch monitoring programmes) and directed studies that target protected species bycatch. This should be reflected in the future ToRs of WGBYC. The inventory can then be updated annually through a formal data call via ICES.

3 At-sea catch sampling programmes vs directed studies – comparison of designs, advantages and limitations (ToR b)

This section provides a comparison of various aspects of different types of at-sea data collection schemes, highlights common issues encountered in survey design, and describes relative strengths and limitations of each programme type. A short explanation is provided below to clarify what is meant by each programme type. The information provided here is based on data submitted by participants to the sampling inventory spreadsheet and through group discussion at the workshop.

Definitions:

1. **Catch sampling programmes** – wide spatial scale, long term programme (such as DCF) with sampling design (e.g. fishery selection) and on-deck sampling protocols optimized for quantifying commercial fish catches.
2. **Dedicated bycatch monitoring programmes** – wide spatial scale, long term programme (such as UK bycatch programme) with sampling design and on-deck sampling protocols optimized for quantifying protected species bycatch.
3. **Directed bycatch studies** – small spatial scale, short term research type studies designed to understand and possibly mitigate protected species bycatch in specific métiers/fisheries.

Catch sampling and dedicated bycatch monitoring programmes can encounter issues with vessel selection due to various constraints (unwilling skippers or owners, no legal obligation to carry observers, insufficient space for observers, vessels considered potentially unsafe etc.). These constraints mean it is frequently difficult to achieve true randomness within sampling plans which may have implications for the representativeness of the data due to introduced biases. The importance of such biases is by nature hard to determine, but could lead to significant estimation error, and may have consequences for data quality assurance and management advice. A considerable amount of work (ICES WGCATCH, WKPICS 1-3, SGPIDS) has been done over the last 10 years to improve the design and reduce bias in catch sampling programmes. The ambition is to move away from ad-hoc selection of vessels to be sampled, which was the prevailing situation in most countries before the onset of this work and to follow a hierarchical structure in the way vessels are chosen and trips sampled (e.g. vessel-trip-haul-sample-specimen). This work also includes guidance on how, for example, refusals to take observers on-board should be documented. WKPIC2 developed a best practice for the design of catch sampling programmes which is included in Annex 3. It is however unknown to what extent individual countries have implemented this work.

Directed studies do not tend to be affected by bias to the same degree because they are more focused spatio-temporally and the data are not typically used for extrapolation beyond the immediate area of interest. If such data were used to extrapolate to a wider level this will introduce potentially significant levels of bias.

Despite these issues, the absence of true randomness in large scale monitoring programmes should not be viewed as an excuse to disregard data or undermine data collection efforts because analytical techniques can be developed and results viewed in the appropriate context which can help compensate for uncertainties arising from a sub-optimal sampling design.

Catch sampling programmes and dedicated bycatch monitoring studies tend, due to budgetary constraints, to have relatively low sampling effort in relation to the effort within the monitored fishery (see column "sampling intensity" in the inventory of sampling programmes/studies, Annex 5). This has direct implications on the precision that can be expected in the results from sampling programmes.

Assuming that a sampling programme has a sufficient design, the level of precision around any calculated estimates (e.g. a bycatch rate) expected by end users is highly dependent on funding levels. Funding levels also have direct implications on the resolution at which estimates can be generated, for example, if the spatial sampling strata is the North Sea but funding is only sufficient for the collection of 10 samples, then end users should not expect results to be presented at the scale of statistical rectangle. End users should be aware that increasing precision or higher spatial resolution generally requires increased funding. Simulation studies (e.g. Northridge 2016) on how sampling levels and precision interact are a useful way of conceptualizing this issue.

WKPETSAMP discussed the strengths and limitations of catch sampling programmes, dedicated bycatch monitoring programmes and directed studies based on programmes put in the inventory by the participants. Notable is that the UK is the only of the participating countries that operates a dedicated bycatch monitoring programme alongside a DCF catch sampling programme. The conclusions from the discussions are summarized in Table 1.

Table 1. Strengths and limitations of catch sampling programmes, dedicated bycatch monitoring programmes and directed studies in the collection of bycatch data.

	Strengths	Limitations
Catch sampling programmes	• Already being conducted in all coastal EU member states. • Large spatial and temporal scale. • Well-funded through established mechanisms. • Generally target fisheries with high catches and mixed catch compositions so may already be suitably designed for assessing bycatch of protected fish and elasmobranch species.	• Sampling design may omit or undersample gears of high importance to some protected species bycatch. • Sampling protocols optimized for fish species are suboptimal for quantifying some protected species bycatch (e.g. mammals in net fisheries, birds in longlines) • Sampling intensity sometimes low, unlikely to observe rare event bycatches. • Non-commercial bycatches may be overlooked in existing sub-sampling procedures. • Observers not always trained in alternative sampling methodologies and species identification for protected species. • Sometimes difficult for observer to monitor bycatch in surveys with multiple objectives (i.e. the observer might be occupied with other duties when gear is being hauled) • Data recording practices and database storage facilities may not be able to deal with incidences of protected species bycatch.
Dedicated bycatch monitoring programmes	• Large spatial and temporal scale. • Generally target gear types with higher perceived risk of protected species bycatch (e.g. static nets/ midwater trawls for mammals, longlines for seabirds). • Observers are trained in sampling techniques and species identification of protected species.	• Sampling design may not be optimized for quantifying bycatch of some protected species (e.g. fish and elasmobranchs in demersal trawls). • Sampling protocols normally do not provide detailed information on commercial fish catch. Normally an estimate of retained and discarded catch is recorded but no fish measuring takes place.
Directed bycatch studies	• Small spatial and temporal scale – strength if this is the scale of interest • Generally target gear types / fisheries with known risk of protected species bycatch. • Observers are trained in sampling techniques and species identification of protected species	• Small spatial and temporal scale – results should not be extrapolated to a wider scale • Usually limited studies/projects difficult to follow development over time • Sampling design may not be optimized for quantifying bycatch of some protected species (e.g. fish and elasmobranchs in demersal trawls). • Sampling protocols normally do not provide detailed information on commercial fish catch. Normally an estimate of retained and discarded catch is recorded but no fish measuring takes place.

The situation in the UK provides a unique opportunity to compare results (i.e. mammal bycatch rates) from different data collection programme types because both dedicated bycatch monitoring and DCF fish catch monitoring programmes are conducted, and some of the same fisheries are monitored by both programmes but under different sampling protocols. A comparison was undertaken (Annex 4) which showed that the estimated bycatch rate for marine mammals differed by more than a degree of magnitude between the two programmes based on data from the same gear types (gillnets and tangle/trammel nets), areas and over the same time period. The data were stratified in an equivalent way for each dataset, and the UK draws the conclusion from the analysis that the observed differences in bycatch rates are likely largely driven by differences in on-board sampling protocols between the programmes. Large animals such as marine mammals often fall or are removed from the nets outside the vessel and if these occurrences are not checked for or recorded if seen within catch sampling programmes then significant differences in calculated bycatch rates can occur.

This comparison conducted by the UK shows that it might be naive to assume that it is possible to get reliable bycatch data, at least for marine mammals, from catch sampling programmes without proper adjustments to sampling protocols. A key question is if it is possible to alter the designs of the present at-sea sampling programmes to satisfy multiple objectives. This might imply revised sampling protocols and reallocation of sampling effort. Ideas such as keeping the "normal" fish sampling protocols for some hauls while the sampling of other hauls are dedicated to monitoring for bycatch of mammals and birds need to be investigated, and should be considered on a fishery by fishery basis. It is however important to acknowledge that sampling effort in the at-sea catch sampling programmes are already generally quite low. The amount of sampling effort needed to meet the different objectives for such a fully functional multi-purpose at-sea sampling programme need to be examined closely but could be calculated from existing data.

The development of multi-purpose at-sea sampling schemes requires expertise in statistics, sampling design, fisheries exploitation patterns and patterns of bycatch. This expertise might not always be present in all countries. Joint efforts are most likely needed. This could be done in cooperation between ICES WGBYC, ICES WGCATCH and the Regional Coordination Groups for Data Collection. In this context is it also important to realize that data are used at an international level. It is thereby important that at sea-sampling schemes are evaluated against agreed best practices for sampling design and sampling protocols.

4 Alternative methods to obtain data on bycatches (ToR b)

On-board observers are a relatively costly way to obtain data from fisheries which may still result in limited sampling effort (see inventory on sampling programmes). Observers also require space on-board the vessel (for work tasks or sleeping) which may be challenging on small vessels or on larger vessels that carry a full crew complement.

In some regions there is little existing reliable data available on the actual impact of fisheries on protected species populations, particularly related to the bycatch of seabirds and marine mammals in passive gears. This is mainly due to the very high numbers of vessels in these fisheries and the comparatively rare but very variable bycatch events, and low sampling levels which make a statistically reliable extrapolation difficult. Vessels using passive gears also tend to be relatively small. In Germany, for example, set net fisheries in the Baltic are mainly carried out by vessels below 12 m

length, thus without obligation to carry a Vessel Monitoring System (VMS), and a large number of vessels are smaller than 8 m length and therefore do not need to fill in logbooks (Oesterwind and Zimmermann, 2013) so accurate estimates of fishing effort are difficult to obtain. For vessels above 8 m that do fill in logbooks in the Baltic (and over 10m elsewhere) some important fields are not mandatory (e.g. length of nets, number of hooks for longlines, soaking times etc.), so it is not possible to calculate valid estimates of the true total fishing effort in these passive fleet segments. Implementing a representative sampling scheme with on-board observers is not practical or cost effective due to the high number of vessels and limited space on board to carry extra personnel.

To increase knowledge of bycatch in these types of fisheries other data collection methods can be utilized. Such methods are briefly discussed below.

Remote Electronic monitoring (REM)

Different methods of remote electronic monitoring, including Closed Circuit Television (CCTV), might be a cost-effective way to increase sampling effort. CCTV have been tested in different countries including Germany where the Thünen Institute of Baltic Sea Fisheries tested an REM system on three small vessels around the island of Rügen from March 2011 to December 2012 (Oesterwind and Zimmermann, 2013). Results show that REM is a practical method to document bycatch of seabirds and marine mammals reliably and much more extensively than would be possible with occasional monitoring by on-board observers. The amount of data collected is important for subsequent extrapolation: most protected species bycatch events are so rare that they can only be extrapolated in a statistically sound manner if the sampling is as extensive as possible. Only by this requirements like those set by the Multi Annual EU Program (DC-MAP) and Marine Strategy Framework Directive (MSFD), can be fulfilled.

Implementation of sampling schemes based on remote electronic monitoring does however require that such methods are generally accepted on a political level and by the industry.

Self–sampling

Self-sampling by industry through different apps or reporting logs might be considered. There is an obvious risk of bias as bycatches are usually considered as something negative by the industry so there is a risk of significant underreporting. Self-sampling schemes thereby need to be validated with REM and/or by observers. The generation of bycatch estimates also requires some knowledge of the level of fishing effort. Therefore self-sampling of fishing effort, because the quality of effort estimates from small scale fisheries using passive gears is poor in many cases, might be a promising way forward.

Questionnaire/ Interviews

Fishermen tend to have useful knowledge about when and where bycatches generally occur, particularly in their direct area of operation, and thus collectively can possess a significant amount of information over a much larger spatial scale. Questionnaires and interviews might be considered as a way to access and ultimately utilize this knowledge. The information might be difficult to use in quantitative assessments but could be incorporated as part of a screening procedure to highlight possible areas of particular interest when designing programmes or for validating outcomes from sampling programmes.

It is important that the international scientific community learn from experiences gained in individual countries on alternative ways to collect bycatch data. WGBYC has an important role to review results of alternative data collection efforts from different countries and disseminate the information and knowledge acquired.

5 Precision and accuracy needed by end users. What do we know? (ToR b)

End users and their use of bycatch data is described in FishPi (2015) Table 2. In general the end user needs are not clearly defined by the end users themselves. However an overall need to understand the level of bycatch mortality for different protected species has been expressed by many end users. One of the ToRs of WGBYC (an end user) includes evaluating the range of impacts of bycatch on protected species and the provision of associated precision levels (min/max).

The Baltic Marine Environment Protection Commission (HELCOM), also identified as an end user, has developed a number of fish and fishery related indicators including the HELCOM core indicator "Number of drowned mammals and water birds in fishing gear". To properly estimate that indicator there will be a need to monitor the bycatch of the mentioned taxa. In HELCOM (2018), it is expressed that it is necessary to develop monitoring programs in a way that the coefficient of variation is low because uncertainties of all estimated parameters, i.e. of abundance, bycatch rate and fishing effort add up to a considerable overall uncertainty which would make a thorough assessment difficult. The level of precision is not set, however the coefficient of variation (0.3) required by EU Regulation 812/2004 (European Commission 2004) is thought to be not possible to achieve in many cases.

Furthermore, in Article 12 (4) of the Habitats Directive it is laid down that "Member States shall establish a system to monitor the incidental capture and killing of the animal species listed in Annex IV (a).

Species to be monitored under protection programmes in the European Union or under international obligations are listed in the EU MAP Regulation (EU 2016/1251). However, it is the end users' responsibility to prioritise the protected species for which there is an immediate need for bycatch estimates and associated precision. The Regional Coordination Groups will be the bodies responsible for defining regional sampling objectives. To this end, the needs of the various end users and the feasibility of collecting the necessary information and any potential impacts on data collection programmes will need to be taken into account.

Table 2. From FishPi WP3. Relevant end users.

End User	End user subgroups	Use of by catch data
ICES	WGBYC (Working Group on Bycatch of Protected Species)	Collates and assesses information on bycatch monitoring and assessment for protected species, including mammals, birds, turtles, and rare fish.
	WGMME (Working Group on Marine Mammal Ecology)	Provides scientific advice in relation to marine mammals. examines any new information on population sizes, population/stock structure and management frameworks for marine mammals and assess how these can contribute to the regulatory requirements
	JWGBIRD (Joint OSPAR/HELCOM/ICES Working Group on Seabirds)	Requests for advice from OSPAR that, recently have featured the development of Ecology Quality Objectives (EcoQOs) and the development of common bird indicators under the EU's Marine Strategy Framework Directive
	ICES expert assessment WG	
	WGFTFB (Working Group on Fishing Technology and Fish Behaviour)	Studies measurements and observations relating to scientific and commercial fishing gears, design and statistical methods and operations, and fish behaviour in relation to fishing.
	ICES expert groups and steering groups dealing with integrated ecosystem assessment	
	WGCATCH (Working Group on Commercial Catches)	Documents national fishery sampling schemes, establishes best practice and guidelines on sampling and estimation procedures, and provides advice on other uses of fishery data.
	WGRFS (Working Group on Recreational Fisheries Surveys)	Planning and coordination of marine recreational fishery data collection for stock assessment purposes.
Other RMFO (ICCAT, NAFO, NEAFC…)	Expert assessment and ecosystem WG	
European Commission	DGMARE & DG Environment	Implementation of MSFD; achievement of GES with good management of recreational as well as commercial fishery impacts. Implementation of CE 812/2004, Birds Directive, Habitats Directive
	STECF	Inclusion of data collection in the EU MAP

International Organizations	FAO, OSPAR, ASCOBANS, ACAP, IWC, HELCOM	Identifying threats, recommending action plans, implementation of different agreements. For MSFD purposes The regional Sea conventions are one of the absolutely most important end user since they're the ones working with the indicators/indicator targets for D1 which are later implemented at national level.
Regional Coordination Groups	RCGs for each region	Coordination and cost-effectiveness of by catch data collection within regions (if included in EU-MAP)
National Governments and regional fisheries authorities within countries		Developing policy positions on management that reflects the ecosystem aspects of sustainable development in coastal regions and spatial planning such as MCZs. Meeting international agreed responsibilities
Scientific community in general.	Universities; Govt. departments; other Institutes	Scientists interested on by catch and ecosystem dynamics Data for publication
Representative bodies for International and national commercial fisheries.	Commercial fishermen's organisations and federations.	Policy developments in relation to interaction between commercial species and main predators;
Recreational fisheries bodies	Recreational fishermen's organisations and federations (EAA, Angling Trust…)	Developing best practices
Advisory Councils	e.g. North Western Waters AC; North Sea AC…..	Policy developments in relation to interaction between commercial species and main predators;
Marine NGOs	Birdlife international, WWF, GREENPEACE, OCEANA etc.	Policy developments in relation to interaction between commercial species and main predators;

6 Criteria to evaluate if at-sea sampling programmes meet end user needs (ToR b)

To set up criteria for evaluating if at-sea sampling programmes meet end user needs, a bycatch risk assessment for species in different areas and métiers needs to be carried out. The bycatch risk assessment should be correlated with the sampling coverage of monitored effort under the EU MAP or other studies monitoring bycatch. The method is described in the FishPi report Work Package 3 (WP3) and by WGBYC.

The first objective should be to identify those protected species with high bycatch rates by fishery/métier. Then, assess the sampling coverage of these fisheries under the EU-MAP at-sea sampling National programmes.

The approach of combining species abundance, bycatch rates, fishing effort and current monitoring levels by fishing grounds is a useful tool to identify the overall bycatch risk, highlight sampling needs and identify gaps or shortfalls in monitoring levels as a first

step. It would also identify which MS fisheries have the highest effort in different fishing grounds / métiers. This information is needed when allocating appropriate sampling levels between MS involved in these fisheries. In ICES WGBYC (2013) a methodology to estimate the bycatch risk of different groups of species, based on the métier, fishing effort and abundance in each different fishing region was developed. FishPi (2015) then combined this risk approach with the DCF sampling effort, to provide an index of which areas and fishing gears are most in need of additional sampling. High bycatch risk métiers and fishing grounds were identified in the North Sea and North Atlantic regions, considering different protected species or taxa.

The methodology followed can be found in the FishPi report under WP3 (Mugerza *et al.*, 2017) deliverable 3.1 section, and is summarized below in Figure 1.

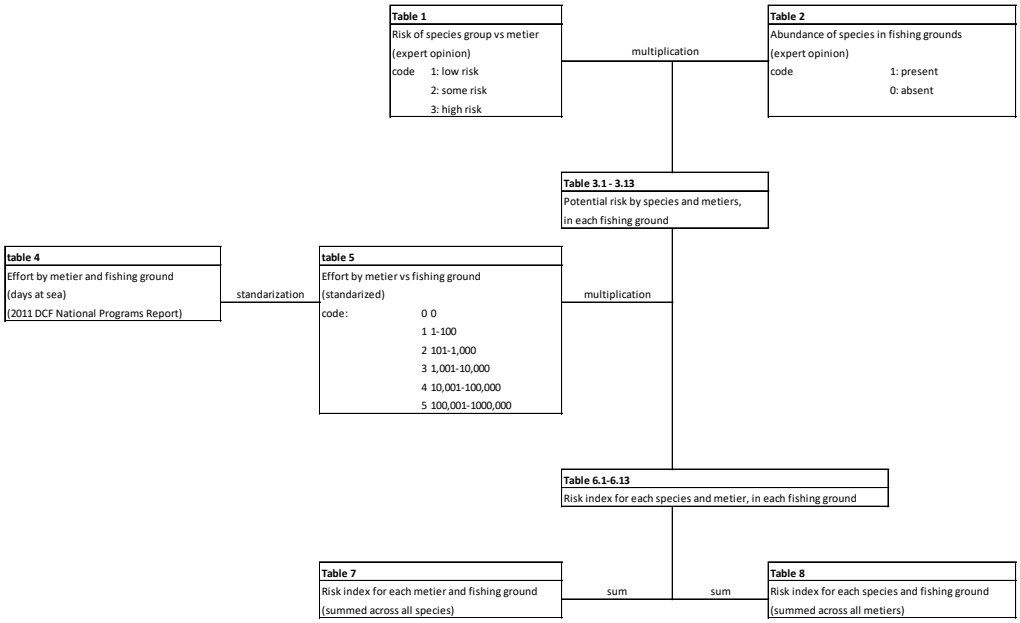


Figure 1. Risk based assessment methodology used in FishPi.

In order to check the relative distribution of monitoring effort under the EU-MAP against the risk by métier, the risk index by métier for different regions was combined with the planned effort in the EU MAP National programmes. This index provides an initial blueprint for determining which métiers in which regions require relatively more monitoring in order to improve estimates or understanding of bycatch across all protected species groups. An example of this index is shown in Table 3.

Table 3. Table from FishPi WP3. Relative DCF sampling effort subtracted from relative summed risk factors for each métier at different areas. Positive numbers (in green), indicate relative under sampling; negative numbers (in red) indicate relative over sampling. The header is the different areas included in the analysis.

	AZ	BB	CS	EA	FI	IB	IS	MA	NS	SK	WC	WI	WS
Boat dredge [DRB]	0	3	0	0	0	5	1	0	2	3	2	3	6
Bottom otter trawl [OTB]	0	-28	-36	-24	-50	-47	-32	-12	-39	-63	-29	-21	-57
Multi-rig otter trawl [OTT]	0	6	9	0	14	2	3	0	4	6	4	7	8
Bottom pair trawl [PTB]	0	-2	2	-4	14	-5	0	0	4	4	2	2	6
Beam trawl [TBB]	0	3	-10	0	0	4	8	0	-13	3	-16	2	3
Midwater otter trawl [OTM]	0	-4	6	-14	18	2	2	6	-1	6	4	-40	2
Pelagic pair trawl [PTM]	0	3	2	6	0	4	6	14	6	6	5	2	3
Hand and Pole lines [LHP] [LHM]	-29	3	5	0	0	5	2	0	3	5	4	3	2
Trolling lines [LTL]	0	4	0	0	0	0	0	0	0	0	3	0	0
Drifting longlines [LLD]	0	4	3	0	0	6	0	0	0	0	2	6	0
Set longlines [LLS]	-23	-2	8	7	0	5	4	0	5	5	7	11	10
Pots and Traps [FPO]	0	5	3	0	0	6	-25	19	6	2	6	3	-7
Fykenets [FYK]	0	5	0	0	0	0	0	0	2	3	0	0	0
Stationary uncovered poundnets [FPN]	0	0	0	0	0	0	0	0	0	0	0	0	0
Trammelnet [GTR]	0	-21	9	0	0	11	5	0	6	10	-5	8	5
Set gillnet [GNS]	35	10	-12	20	4	4	14	-27	-2	0	-5	7	13
Driftnet [GND]	0	9	4	0	0	0	0	0	9	4	7	0	0
Purse-seine [PS]	17	4	2	10	0	-3	3	0	3	2	3	2	2
Lampara nets [LA]	0	0	0	0	0	0	0	0	0	0	0	0	0
Fly shooting seine [SSC]	0	0	3	0	0	0	5	0	0	2	3	3	5
Anchored seine [SDN]	0	-3	0	0	0	0	3	0	3	0	2	0	0
Pair seine [SPR]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beach and boat seine [SB] [SV]	0	0	2	0	0	0	0	0	0	4	2	0	0
Glass eel fishing	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

WKPETSAMP recommend that WGBYC review this method and create tables for the areas which has not been done in the FishPi project (the Baltic, the Mediterranean and Black sea). The results from the tables created in FishPi WP3 showed many areas and many métiers where there is a need to increase the monitoring of bycatch of protected species. **Therefore there is a need for endusers to prioritize areas, métiers and species in need of monitoring. This task could be included in the ToR for WGBYC with help from other relevant ICES working groups such as WGBIRD, the Working Group on Marine Mammal Ecology (WGMME) and the Working Group on Elasmobranch Fishes (WGEF) etc**.

The method for how to prioritize between the species, métier and areas to be monitored should be agreed by WGBYC. An example of a methodology used on other species and in other areas is the Ecological Risk Assessment. An alternative method which can be used to determine which fisheries require most monitoring in order to most effectively minimise the uncertainty around the overall bycatch estimate is being developed by

the UK and is briefly described below. There may also be a need to use methods other than at-sea sampling programmes due to the high associated costs if high monitoring coverage is needed to meet end user defined precision requirements. It is recommended that WGBYC review alternative methods that might be used as an alternative to at-sea sampling by observers.

Development of a rational for monitoring protected species bycatch

Work has recently been carried out in the UK (Northridge, 2016) to develop a formal rationale for allocating sampling effort between métiers to reduce uncertainty in protected species bycatch estimation. Here we briefly describe the conceptual approach.

When bycatch of protected species is being considered, the risk assessment framework can be visualised as three elements as shown in Figure 2 below.

1. Resilience is usually taken to be a function of animal population abundance and the ability of the population to grow or recover.
2. Susceptibility is most usefully expressed in terms of a metier specific bycatch rate, but can be provided by expert solicitation and categorised in simple terms (e.g. Low-High).
3. Scale is generally considered to be known accurately through official fishing effort statistics and is usually expressed without uncertainty, though significant uncertainty can exist.

A species with low resilience and high susceptibility to bycatch in a large fishery is at risk of significant conservation impact, and conversely a species with high resilience and low levels of interaction in a small fishery is less at risk.

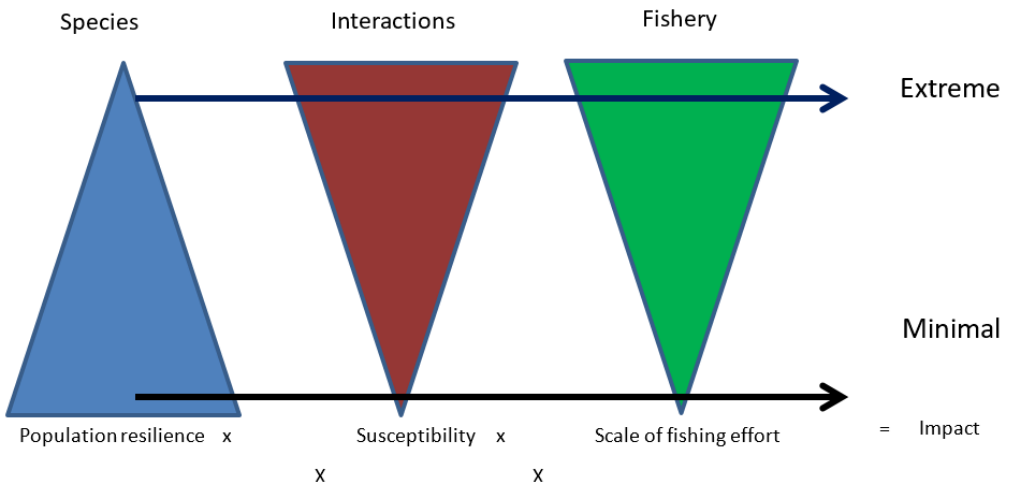


Figure 2. Three elements of the risk assessment framework.

An example is given in Table 4 to illustrate how sampling effort can be allocated between métiers. It is assumed that Species X has a maximum bycatch reference limit (resilience) of 1000 individuals. This limit is divided among four fisheries, pro-rated by effort in each fishery.

Table 4. Example of how sampling effort can be allocated between métiers. It is assumed that Species X has a maximum bycatch reference limit (resilience) of 1000 individuals. This limit is divided among four fisheries, pro-rated by effort in each fishery.

Fishery métier	Days at Sea	Days observed	No of animals observed	Upper Confidence Limit on bycatch estimate	Allocated bycatch reference limit	Difference between allocated limit and current estimate
A	3800	50	1	103	95	-8
B	31000	3000	15	248	775	527
C	200	30	0	23	5	-18
D	5000	10	0	1540	125	-1415
Summed	*40000*	*3090*	*16*	*1914*	*1000*	*-914*

In this example current sampling levels suggest the total bycatch of Species X (UCL) may exceed the reference limit overall by 914 animals, but most of this uncertainty comes from Fishery D, where only ten observation days have been carried out with no observed bycatch. The bycatch estimate for Fishery D lies between 0 and 1540 animals per year (high uncertainty), assuming bycatch events are binomially distributed. If an additional 20 days observations were made in fishery D (assuming no bycatches were observed) the upper confidence limit on the bycatch estimate falls to below 580 and to less than 1000 overall, below the allocated reference limit. An additional 20 days in fishery B would barely alter the UCL for that fishery and so would change the overall picture. Clearly allocating monitoring effort to fishery D is a more efficient way of improving precision around the overall bycatch estimate.

This approach helps determine which fisheries require most monitoring in order to most effectively minimise uncertainty. A more complex analysis is required where 2 or more species are considered with different bycatch reference limits and varying susceptibilities among the fisheries.

The importance of setting reference limits as yardsticks against which to compare current best estimates of the likely maximum bycatch should be clear. Such reference levels could be aligned with conservation targets (such as the 1.7% limit on small cetacean bycatch adopted by the Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS), but it is equally possible to use reference limits unrelated to estimates of sustainability. The way in which the reference limit is allocated between métiers is also important and can be based on fishing effort or other metrics such as landed catch weight or value of landings depending on what is most appropriate.

In times of restricted budgets it is important that attempts to implement ecosystem based fisheries management are directed in a rational way to meet different objectives. Already, within the UK, data from sampling schemes that were established to monitor commercial species discards are being used to address bycatch of protected species, while the sampling programme established to monitor cetacean bycatch has evolved and now covers all protected species. Within such data collection programmes, resources should be allocated in a way that best addresses management needs and reduces uncertainties. The approach briefly outlined here aims to provide a rationale for parsimonious sampling that will address the key uncertainty in bycatch risk assessment, that of susceptibility by métier.

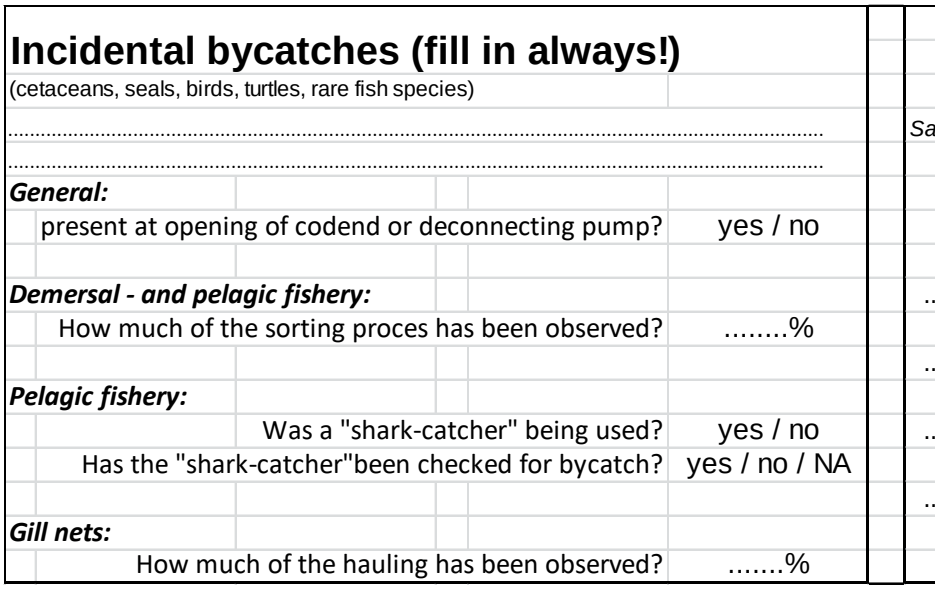
7 Mechanisms for storage, maintenance and dissemination of data originating from at-sea catch sampling programmes and directed studies (ToR c)

The term *incidental* bycatch indicates that the catch components that are being described are relatively rare. In practice this means that quantifying this part of the catch is not currently part of the routine work of a DCF fisheries observer. Properly quantifying incidental bycatch requires specifically trained observers and sampling protocols which should be readily available for at-sea observer programs.

Building routine

Although in many fisheries, an observer may not have to deal with occurrences of incidental bycatch very often, it is possible to build routine elements into the sampling protocol to ensure that if a bycatch occurs it will be noticed and recorded. For example this can be achieved by (1) instructing the observer to indicate on a haul-by-haul basis what part/s and portion of the fishing operation and catch sorting process has been checked for incidental bycatch items and (2) by treating any rare or unusual catch item as an incidental bycatch to avoid subjectivity in species selection. These aspects are described in more detail below.

1. Indicate what part of the catch has been observed "on haul level": It is important to collect this information so that in subsequent analyses true zero bycatch records can be distinguished from "zeros" arising from "no observer effort". This aspect of data collection should be included clearly in the sampling protocol and should be a high priority part of the forms that are filled out by the observer for each haul. The exact information that needs to be collected depends on the fishery / gear type and may contain information that is very specific for the local situation. For example some fisheries use specific alterations (e.g. shark catchers) in the trawl to avoid megafauna entering the fish pump, which can make it hard to detect bycatch. Figure 3 below shows a section of the Dutch DCF programme data collection form that has been adapted to ensure this type of information is routinely recorded.



Incidental bycatches (fill in always!)	
(cetaceans, seals, birds, turtles, rare fish species)	
.....	Sa
.....	
General:	
present at opening of codend or deconnecting pump?	yes / no
Demersal - and pelagic fishery:	..
How much of the sorting proces has been observed?	.....%
	..
Pelagic fishery:	
Was a "shark-catcher" being used?	yes / no
Has the "shark-catcher"been checked for bycatch?	yes / no / NA
	..
Gill nets:	
How much of the hauling has been observed?	.....%

Figure 3. Part of the field form used in Dutch at-sea catch sampling programs. Observers are expected to fill in this section for incidental bycatch for every haul.

Generally in DCF at-sea fisheries observer programmes there are three indicators that could be used to improve descriptions of the sampling effort on haul level: (1) the percentage of time the observer checked the sorting process for rare catch items, (2) the percentage of the actual hauling process that was properly checked for rare catch items, particularly relevant in line and net fisheries, where catches can fall or be removed from the net outside the vessel, (3) Was the observer suitably positioned to be able to see any bycatch of megafauna (e.g. in trawl gears was megafauna bycatch checked for at the opening of the cod-end). Within dedicated bycatch monitoring programmes or bycatch directed studies recording these aspects are less important because given the focus of the data collection one could assume that the observer dedicated close to 100% of their time in a way appropriate to quantifying bycatch.

These indicators can be used to flag the quality of the observer process or to directly apply a subsample factor to any rare catch item. For example: if an observer recorded a bycaught turtle falling out of the net during hauling of a gillnet while he/she properly observed 50% of the hauling process, the bycatch would be recorded with a haul subsample factor of 2.

***2. Treat each rare catch item as incidental bycatch*:** Because protected species bycatch events tend to be relatively rare it is important that observers are alert to the possibility of it occurring because missed events dramatically alter calculated bycatch rates. A way of shifting focus towards rare events is to consider any unusual catch in the same way, whether it is a protected species or not. For example, a single shad (or any other species) in a catch of 1 tonne of herrings, if noticed during the sorting process, can be recorded with a subsample factor of 1 (or 2 if only 50% of the sorting process was fully observed). The bulk herring catch is sampled in the normal way by taking a subsample of the catch for measurements etc. There is no need for the observer to check through the entire sorting process for a single specimen, but IF a shad (or other species) is observed within the bulk herring catch it is important to record it separately to the subsample details. Applying this routine should not add much extra work for observers in areas/fisheries with few species such as many midwater trawls fisheries. In very mixed fisheries this approach may be more problematic, and would require well-trained observers to ensure less common species are identified.

Making it a routine to record all "rare" specimens in the catch has also the advantage that the observer does not need to cross check extensive lists of protected species that need to be recorded.

Identification

The identification of rare species in the catch can often present problems because it is unlikely that any single observer is a fish, elasmobranch, bird, reptile and mammal specialist. Therefore, appropriate guides which also contain species that are uncommon in the area, should be made readily available. The protocol should contain clear instructions on what to do if a catch item cannot be identified to species (or taxa). This may include taking pictures for later identification or instructions to bring the specimen(s) to the lab (assuming any transport licenses are valid for protected species). The protocol should contain clear instructions on how to make sure that a specimen which was not fully identified and recorded on board, can be entered later in the national institutes database to ensure the record does not disappear.

For unidentified bycatch that could not be photographed or sampled for later identification, there should be an option to record by some taxonomic level (genus, family, order). Any species checklists carried on board should therefore always be hierarchical.

Species selection and other methods: EM, questionnaires, self-sampling, market sampling

Although the new DCF requires the sampling of all the species mentioned in Table D1 of EU Decision 1251/2016. In specific programs, trips or hauls, not all the species are sampled and this should be clearly described in the sampling design and protocol text.

Limited/restricted species selection methodologies are used in some commercial species sampling programmes but are also likely in alternative methodologies like Electronic Monitoring, questionnaires, fisher self-sampling etc. For example self-sampling of rare fish species by crews which collect specimens and bring them ashore for identification, will probably not contain marine reptiles, birds or marine mammals so this should be clearly stated in any protocols so that these types of data can be placed in an appropriate context.

Database

In relation to the provision of data to end users the at-sea recording of incidental bycatch becomes essentially pointless if the data are not entered into national databases and then subsequently submitted to the Regional Database and Estimation System (RDBES or RDB). Therefore national databases need to be designed appropriately to be able to hold the relevant information, including the option to enter information for all species from Table D1 in EU Decision 1251/2016, which provides a reference list of protected or vulnerable species.

Most institutes use a front end application to enter data so it is extremely important that such applications are modified accordingly, as many such applications use reference lists for selecting what species codes can be entered or not. For example if a reference list only contained fish species, data on other vertebrates (mammals, birds etc) will not be accepted by the database and such records may then for all intents and purposes become lost.

Data should be stored in such a way that permits export in a format compatible with the RDB. Data managers in national institute should be made aware of and follow the development of the RDBES steering group.

The latest version of the RDBES and associated documentation were presented during WKPETSAMP by Nuno Prista, a member of the group that supports ICES Data Centre in the development of the RDB data model. The presentation focused on the sampling hierarchies that most directly relate to at-sea sampling and in particular on the fields most relevant to records of incidental bycatch. These fields are in found in tables **Fishing Operation (FO)**, **Species Selection (SS)** and **Sample (SA)** and can be traced back to the variables identified in 2013 by SGPIDS 3 (ICES, 2013) which indicated in Table 5.1 of its report a set of core information that should be registered in national databases and be used in reporting incidental bycatch. Specifically, these variables were Date, Time, Geographical Position, Gear type level 6, and Mesh-size used at haul level, a check-box for sampling at haul level, species and number of specimens caught, and the presence/absence of pingers on the gear. All of these variables have been integrated into the latest version of the RDB data model with the exception of the presence/absence of pingers. Following the presentation, the member of RDBES data group requested WKPETSAMP to review the incorporation of these fields, checking if the present data model fulfils the present needs with regards to recording of incidental bycatch.

WKPETSAMP welcomed the presence in the RDBES data model of the variables previously suggested by SGPIDS 3 (ICES, 2013) and sees the move towards routinely population of these fields in future data calls as a step forward towards improving sampling protocols and registration of incidental bycatch in national databases. WKPETSAMP spent significant time discussing the need for the RDBES data model to allow a correct distinction of true zeros (no incidental bycatch) from missing values (situations where on-board protocols either do not carry out observations on incidental bycatch or do not ensure appropriate screening of the catch). Accurately distinguishing these types of records is vital for accurate estimation of bycatch rates because assuming missing values represent true zeros may lead to significantly biased (low) estimates of incidental bycatch.

In the RDBES data model, the distinction between these two situations when dealing with landings or discards quantified during DCF sampling is mostly addressed by means of species lists defined for each **CatchFraction**. The species lists are declared in the **SpeciesSelection** and indicate for each **CatchFraction** the list of species (e.g., all species, just fish species, fish and crustaceans) that are recorded during the sampling procedure. The association of these species lists to each **CatchFraction** allows some additional flexibility in the description of the sampling, e.g. for landings and discards it is possible to have two distinct lists. Such lists also permit the idea of multi-purpose at-sea sampling schemes in which some hauls might be primarily sampled for commercial species while others are sampled specifically for bycatch of mammals, birds or other protected species.

WKPETSAMP found the use of these lists promising with regard to the correct recording of incidental bycatches. However, it was noted that a substantial amount of bycatch, particularly megafauna, may be released or fall from the gear prior to the formation of the two more common **CatchFractions**, e.g. during net hauling operations or when trawl cod-ends are opened. Accordingly, WKPETSAMP recommends that the creation of additional **CatchFractions**: one for "slipped" catch (i.e. catch and bycatch that never came on board the vessel) and also pre-sorted catch (i.e. catch and bycatch that was hauled on-board (e.g. in the cod-end of a trawl) but that is quickly thrown overboard without entering what is typically considered the commercial catch sorting process of the haul. The creation of these two additional **CatchFractions** would enable not only the formation of different lists for different catch components but also the possibility of, during estimation, accounting for potentially different gear specific mortality rates (e.g., a dolphin that is released from a purse-seiner without ever being hauled on board is likely to have a better survivability than one that is hauled and released after a few minutes on deck). WKPETSAMP also welcomes the present existence in the **FishingOperation** table of two variables (**FopercCoverageHauling, FopercCoverageSorting)** that aim to provide an approximate percentage of the hauling operation and/or sorting operation effectively screened for bycatch. WKPETSAMP requests that a more general indicator of the certainty of observation of incidental bycatch in the haul/set is specified alongside an indicator of the quality of the observation

position the observer used within the vessel so that an informed judgment can be made about the likelihood of a bycatch being noticed if one occurred.

WKPETSAMP suggests that the following fields should be included in the new RDBES with reference to the section above on the sampling effort dedicated to catch items valid to the entire haul:

1. **Approximate % hauling operation actually observed (inc bycatch)**
2. **Approximate % sorting operation actually observed (inc bycatch)**
3. **Checkbox for slipped incidental bycatch**
4. **Checkbox to indicate whether megafauna could have been observed (was the observer in a position where he or she could observe e.g. drop outs)**

WGPETSAMP recommends WGBYC to review the four suggested data fields and further recommends the RDBES steering committee to implement these.

Since the sampling of protected species is now part of the DCF and in the future dedicated bycatch sampling or directed bycatch studies may also be initiated within the DCF programme it is important that the RDBES is designed appropriately to hold data that may originate from sampling protocols that differ from the current DCF methodology.

Finally, WKPETSAMP participants examined if some specific situations for sampling incidental bycatches could be clearly specified and interpreted in the RDBES. Given the lack of familiarity of participants with the recent RDBES data model and need to address other ToRs during the meeting, it was not possible to fully verify if the data model correctly encompasses these routines. Consequently, written descriptions of some hypothetical though conceivable situations were produced for future examination and consideration by the group in charge of RDBES development. WKPETSAMP produced 4 "realistic" examples for the RDBES steering committee to demonstrate what kind of information the RDBES should be able to hold. These examples are presented below.

Examples

Apart from the intended purpose to highlight which (additional) fields may be required in the RDBES, the descriptions also demonstrate that in cases of incidental bycatch, the collection of robust data requires skilled, well-trained observers who have to judge situations and make adequate decisions independently and promptly.

Grid trawl for pandalus (shrimps) example

General description: In the Swedish fisheries for *Pandalus borealis* with bottom trawls in Skagerrak using selection grids it is common that there are small gadoids like pout (*Trisopterus esmarkii*) in the catch. When the fishermen notice this they usually let the cod-end sink below the surface, the shrimps also sink but the gadoids float at the surface and are slipped from the trawl before the remaining catch is brought on board.

Observer information: Observers are not usually allowed to observe on the stern deck during the hauling operation due to safety concerns. Consequently, due to the layout of the vessel, it is often difficult to properly observe the whole hauling process.

Senario: The observer is trying to observe the hauling procedure to be able to detect and quantify slipped discards. Amongst the slipped fish there is a bird floating. The observer is not able to identify the species. The observer estimates how much discard

was released. The remaining catch is lifted aboard and emptied into to a container and sorted either by hand or by a sorting machine and the discards of fish, cephalopods and other invertebrates are then put in baskets of circa 30 kg. The observer notes the total number of discard baskets and three of them are sorted for catch compositions. All discard species are then sampled or further subsampled accordingly. Samples of different size categories of shrimp are also sampled and brought ashore to the lab for detailed measurements.

Comment WKPETSAMP: The observer can make an estimation of the amount of fish that has been slipped. There is no information on the composition of the slipped catch. The observed bird can be recorded as 1 bird (Aves sp.) with a subsample factor of 1.

Gillnet example

General description of the fishery: In Greece, gillnet fisheries are conducted by small vessels that often use power blocks for hauling the nets. The nets, which are usually 2–3 km long, are set overnight and hauled early in the morning. After hauling, the nets are kept on board and the vessel returns to harbour. The entire sorting process is carried out in port.

Observer information: During hauling, the observer is either in the bow or in the stern of the boat depending on the design of the vessel. If the observer is in the stern, they usually have a limited view of the hauling process and so are not often able to see or record an animal that falls from the net as it exits the water. Since sorting is being carried out on shore, the observer is able to census the entire catch that remains in the net.

Scenario: During hauling the observer is in the stern of the vessel and has a limited view of the hauling process. A sea turtle (*Carreta carreta or Chelonia mydas*) and a marine mammal (a pre-adult dolphin of the species *Tursiops truncatus)* is caught in the net. As soon as it reaches the power blocks it is forced out of and falls from the net. The observer has spotted the animal but they were not able to identify it to species level and, naturally, they were not able to weigh or measure it. Later, during the sorting process, specimens of *Alosa fallax* are found entangled in the net which the observer identifies, records and measures.

Comment WKPETSAMP: Assuming that the observer observed the whole hauling process (100%), the turtle and the bottlenose dolphin are recorded with a subsample factor 1. The specimens can be recorded as 1 turtle (Chelonioidea sp.) and 1 dolphin (Delphinidae sp.) being bycaught. Since the whole fish catch handling process has been observed in port the Alosa specimens would also have a subsampling factor of 1.

Pelagic trawl example

General description of the fishery: Dutch freezer trawlers sort the catch into different species and size grades and freeze the catch for human consumption in boxes of 22 kg. The catch is temporally stored in cooling tanks to be sorted and frozen later (hours–a day). While the cod-end is opened and/or connected to the pump at the stern deck, the catch is sorted and frozen on a lower factory deck. This process goes on continuously if there is catch in the cooling tanks and is essentially independent from the fishing process. As the catch is sorted, it is transported over a sorting machine on different lanes of a conveyor belt. Damaged, undersized fish and not marketable species are collected on a separate lane (this is the former discarded component but now is also frozen to be landed and destroyed ashore).

Observer information: The observer is not allowed on the stern deck for safety reasons. During the hauling process the observer has view of the stern deck from the bridge.

During processing, the observer takes a subsample (basket) from the total catch before the sorting machine and a sample of the offal fraction (basket or part of a basket). The processing time of one tank takes one hour, but the observer might not be present for the entire time it takes to process a tank.

Scenario: A catch from a pelagic freezer trawler is pumped on board into pre-storage cooling tanks. During the pumping process something blocks the opening to the pump. After removing the pump connector from the cod-end, the object appears to be a common dolphin (*Delphinus delphis*). The animal is hoisted over board by its tail. The pump is reconnected and pumping resumes. When pumping is over the observer observes the removing from the pump from the cod-end. Three cooling tanks of 30 tonnes each are filled with a mix of horse mackerel and mackerel. The observer estimates the offal fraction to be 2% of total catch. For 20 minutes, he observes the sorting process, a bird (Northern gannet, *Morus bassanus*) is removed from the sorting belt to be thrown overboard later. The observer later finds out that one of the three tanks is pumped overboard during the night.

Comment WKPETSAMP: The observer checked the opening of the cod-end. The total catch is 90 tonnes. 1 dolphin was bycaught. A fraction of 30 tonnes of the total catch was discarded: this fraction has the same species composition as the total catch sample. 1.2 tonnes (2% of the 60 tonnes) is offal fraction and has the same species composition as the offal sample. 1 Northern gannet with a subsample factor of 9 (120 minutes processing/20 minutes plus 1"virtually sorted" cooling tank 60 minutes/20 minutes) has been bycaught.

Purse seine example

General description of the fishery: The purse seiner freezes the herring on board for human consumption and packs it in boxes. The catch is pumped from the seine on board, and there is a sorting grid present at the end of the pump to prevent large objects from entering the sorting belt where the catch is sorted before processing.

Observer information: Observer is on board a purse seine vessel targeting herring. During the tightening of the seine, the observer is in the bridge for safety reasons, but can be present on the deck once the pumping begins. During processing, the observer takes a subsample from the total catch for species composition and measurements.

Scenario: When the crew starts to tighten the seine, an orca (*Orcinus orca*) is seen within the seine along with 2 white sided dolphins (*Lagenorhynchus acutus*). The crew immediately lower the seine again to get the orca and dolphins out, and the orca and 1 dolphin are seen leaving the seine according to the crew. Some of the catch escapes as well.

Comment WKPETSAMP: assuming that part of the fish catch does not survive this adventure, this may be interpreted as that an unknown part of the catch is discarded; the observer assumes that the killer whale and the dolphin do survive.

When the vessel is pumping the catch, a dolphin is observed coming through the pump, but stops on a sorting grid on deck before it reaches the sorting belt. The observer notices the dolphin when the crew is discarding it. It appears to be dead. He assumes that this is the dolphin that he noticed but which did not escape when the seine was lowered. As the vessel is getting full, another vessel from the same company comes along to help with the pumping, and only around 50% of the total catch was taken aboard the vessel that the observer was aboard.

Comment WKPETSAMP: assuming that the 50% of the catch that is taken over by the other vessel, does not contain any more dolphins, this is one bycaught specimen of white sided dolphin in the total catch.

Later, on the processing belt, a northern gannet is found dead along with the catch. A considerable catch of *Alosa alosa* was also noted, and in a 50 kg subsample, 5 kg were *Alosa alosa*.

Comment WKPETSAMP: this is one specimen of northern gannet in 50% of the catch or subsample factor 2, assuming that the observer was able to observe the whole processing of the catch on the vessel he was on. The Alosa alosa is sampled as normal in the subsample.

8 Preparation of guidelines for at-sea sampling programmes, suggestion for best practices and relevant parameters for PETS sampling (ToR d)

Best practice can be defined as sampling designs and protocols, implementation and data analysis that lead to minimum bias and an accurate estimate of precision, and which make the most efficient use of sampling resources. For example, probability-based sampling with accurate control of the inclusion probabilities would be considered an example of best practice. Bad practice would be an ad-hoc, non-probability based sampling scheme, particularly where there are no census data to show how representative the samples are of the population or to re-weight the samples during analysis. Where bias is unavoidable, best practice requires collection of information that allows the form and level of bias to be investigated, and to develop mitigating measures where possible. For example, recording all vessel refusals (and the reasons) in an on-board sampling scheme, and the characteristics of those vessels and their activities, provides the potential to evaluate any biases.

In the fullest sense, best practice for any kind of sampling schemes at sea encompasses survey design, documentation of objectives, sampling protocols, staff training, data collection and archiving, systems for monitoring sampling performance, and data analysis.

ICES WKPICS2 (2012) identified the different steps that need to be included when designing and implementing a regional data collection scheme to meet end user needs (illustrated in Figure 4). These steps are relevant for any kind of catch or bycatch sampling programme or dedicated study that is carried out to generate bycatch rates in fisheries. The most critical first stages are for the end users to clearly define the objectives and estimates required at a regional level to support fisheries management or conservation objectives, and an indication of minimum precision needed (steps 2 & 3). The subsequent steps 4–6 (type of data required; data collection methods and design, sampling intensity and allocation of sampling effort across countries and strata) cannot take place in an effective way without the information specified in step 3. The subsequent steps are the data collection, the handling of the data (e.g. archiving in databases), evaluation of data quality (quality indicators) and finally the data analysis to provide the required estimates and associated measures of uncertainty.

WKPICS2 emphasize that the evaluation of sampling schemes against benchmarks for good practice, and the monitoring of data quality using suitable indicators should be given considerable attention. The data analysis (step 9) may provide evidence of problems with data quality that may be traced back to individual sampling schemes to provide advice to programme managers which can lead to improvements in overall sampling design.

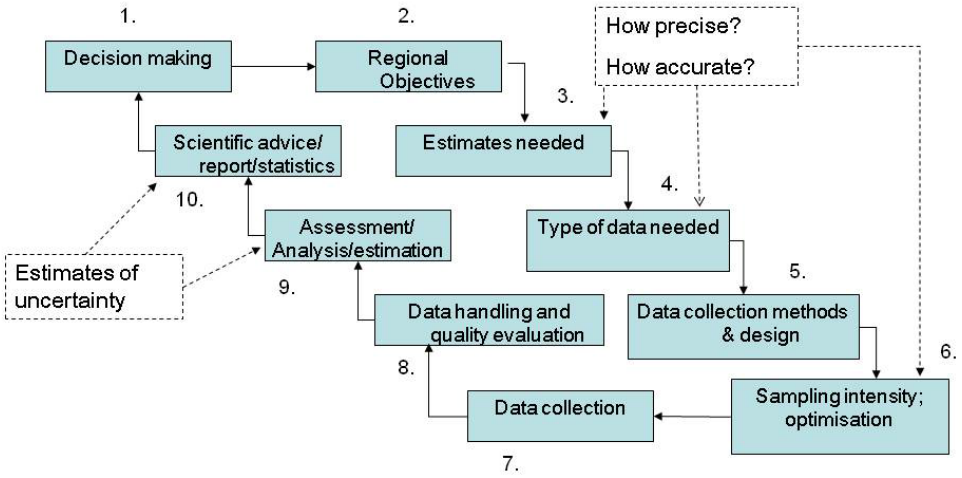


Figure 4. Stages in design and implementation of a data collection scheme providing data supporting assessments and management advice (from ICES WKPICS2, 2012).

WKPICS2 developed guidelines for "best practice" that apply to steps 5 to 8 in the schema shown in Figure 4. This covers the design, implementation and analysis stages of catch sampling schemes, assuming steps 3 & 4 are already defined. Some of these aspects would require lengthy documentation, so WKPICS2 restricted the guidelines mainly to aspects of design in the expectation that good practice for the other aspects of sampling schemes would be demonstrated by the availability of detailed national sampling protocols.

WKPETSAMP concludes that the guidelines for best practice developed by WKPICS are relevant for the design and implementation of all catch and bycatch sampling schemes and dedicated studies as they reflect the basic need to respect the statistical properties of a sampling programme/studies and the need for proper documentation. The guidelines developed by WKPICS2 are included in Annex 3.

WKPETSAMP do think that there is a need for a specific best practice in relation to the implementation of bycatch sampling programmes, in particular regarding sampling protocols, training of observers and data capture in relation to sampling of bycatches. WKPETSAMP thereby developed such a best practice based (Table 5) on the discussions during the week. This should be considered a draft and might be further elaborated by WGBYC and/or WGCATCH as required.

Table 5. Showing draft best practice for some key aspects of the implementation of bycatch sampling programmes.

Best practise in sampling schemes where by-catch is supposed to be monitored			
Process that need to be considered and described	**Best practise**	**Comment**	**Bad practises**
Sampling protocol – objective	The sampling protocol needs to be documented. It needs to be clear from the sampling protocol that monitoring of by-catches is an objective of the programme/study.		It is not good practise only to include sampling of the fish catch in the protocol if by-catches is an objective.
Sampling protocol – the possibility for the observer to observe by-catches	It needs to be clear from the sampling protocol if it is a priority for the observer to monitor the hauling process. It further needs to be clear how the observer should report if the hauling process can't be monitored or if only a part of the monitoring process is monitored.	By-caught megafauna might be discarded during the hauling operation. If the observer does not have the possibility to see this part of the fishing operation, by-catches might be underreported.	It is not good practise to assume that the observers are monitoring the hauling process as this is not always it possible.
Sampling protocol – species selection	It needs to be clear from the sampling protocol if the observer is assumed to sample all species caught or just species from a limited list. It needs to be clear from the sampling protocol how observers should handle subsamples and rare species.		If only a subset of species are sampled, it is not good practise if the lists are not properly defined and maintained allowing for proper analysis of data in the future.
Species identification	Observers get proper training in species identification for all species, including birds, mammals and reptiles on which they are assumed to make observations. Observers are provided with reference guides for species identification and cameras in the case rare species appear in the catches.		It is not good practise to send out observers that are only trained to identify fish species on trips where by-catch data are supposed to be obtained. Observers do further need to be provided with reference guides for species identification and cameras if by-catches of rare species are encountered.
Data capture	All species that a programme/study are supposed to monitor need to be able to be entered into the national database.	Most institutes use a front-end application to enter the data in the database, sometimes even on board. It is extremely important that it is possible to enter the collected information. This refers in particular to the possibility of entering rare species, as front-end applications often use reference lists.	It is not considered good practise if observer data can't be entered into a database.
Databases	It is good practise to store data in databases. Databases need to include information that is relevant for the by-catch species e.g. 1) how much of the hauling process that has been observed 2) if all species were observed or if a restricted list were used.	There is an obvious risk of losing data over time if data is not stored in databases. It is an obvious risk of misinterpreting data if information necessary for the by-catch estimates are impossible to enter in the database.	It is not considered good practise if data on by-catches and data relating to the sampling of those cannot be stored in the national databases.

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Annex 2: Agenda

Agenda Working Group on Bycatch of Protected Species (WGPETSAMP)

Lysekyl 24–26 April 2018

Monday 24 April

9:00 Installing your laptop and get connected with the network etc.

10:00 Welcome and routine business/household rules

10:30 Introduction, changes to the agenda

11:00 ToR 1: Develop an inventory of existing sampling programs

12:30 Lunch

13:30 Continue ToR 1

Wednesday 25 April

9:00 ToR 2: Comparison existing at-sea sampling programs to directed studies

12:30 Lunch

13:30 ToR 3: Define proper mechanism(s) for storage, maintenance and dissemination of both the PETS monitoring program inventory and monitoring data.

Thursday 26 April

9:00 ToR 4: Guidelines for at-sea sampling programs

12:30 Lunch

13:30 Prepare texts for the report

Annex 3: Guidelines for best practice in catch sampling schemes. From ICES WKPICS2 2012

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

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

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

Annex 4: A comparison of bycatch rates calculated from dedicated bycatch monitoring and fish catch monitoring (DCF) in the UK

The ICES Working Group on Protected Species Bycatch (WGBYC) has historically used data provided by EU member states (MS) through annual reports submitted under Council Regulation 812/2004 as the primary source of information for calculating cetacean bycatch rates. The 812/2204 Regulation required the implementation of dedicated bycatch monitoring programmes but due to cost constraints most MS used existing DCF at sea sampling programmes to collect data from the relevant métiers prescribed under the 812/2004 Regulation. Sampling design (in terms of metier selection) and on-deck sampling protocols under the DCF are optimised to quantify catches and discards of commercial species and there is generally a heavy focus on sampling of demersal towed gears which are not perceived to pose a significant threat to cetacean populations. Sampling of static nets and to a lesser extent midwater trawls, which have relatively higher impacts on cetaceans, is generally at a lower level because these métiers are not considered as significant in terms of commercial discard levels.

In the UK, a dedicated protected species bycatch monitoring programme has been run in parallel with the DCF monitoring programme, and in some cases the same fisheries are monitored by both programmes but by observers working under different on-deck sampling protocols. This situation provides an opportunity to compare bycatch rates to see if differences exist between programmes and to highlight where improvements can be made to ensure that catch sampling programmes can also provide useful information on which to base assessments of protected species bycatch.

In 2013, an initial comparison was undertaken which compared bycatch rates from static net fisheries in Subarea 7 over the three year period 2011 to 2013 because several of the same fisheries were monitored under both programmes and thus provide a reasonable basis for comparison. The result of that analysis, which did not stratify the data by specific net type and/or specific area, showed that the overall cetacean bycatch rate (0.025 animals per haul) in Subarea 7 calculated from dedicated monitoring was thirty-six times higher than the rate calculated using DCF observations (0.007 per haul) over the same period and broad area (Northridge *et al.*, 2014).

This initial finding (albeit based on a fairly crude comparison), and signals from the Commission that protected species bycatch monitoring may eventually be fully subsumed into the DCF, prompted a more detailed and widespread analysis which was carried out in 2015 and presented in Northridge *et al.*, 2015.

This second analysis was extended spatially to includes Subareas 4, 6, 7 & 8, used a longer time series (2005 to 2014), included seals as well as cetaceans and was stratified into two categories of broad net types (gill nets and tangle/trammel nets) and so provides a more robust assessment of potential differences in marine mammal bycatch rates calculated from data originating from the different data collection programmes.

Table 1 provides a summary of sampling levels, observed marine mammal bycatches under each programme and an initial comparison of overall bycatch rates calculated from the 10 year and 3 year data time series. We have used the same basic method of calculation for each dataset.

Table 1: Overall bycatch rates

Monitoring type	Obs Hauls 2005-2014	Obs Marine mammals 2005-2014	Mammals rate 2005-2014	Cetaceans Rate 2011-2013
Dedicated	7433	188	0.025	0.025
DCF	3142	6	0.0019	0.0007

The bycatch rate calculated from dedicated sampling was consistent over the two time periods at 0.025 animals per haul, despite seals and a much wider area being included in the 10 year dataset, whereas the rate calculated from DCF data is almost three times higher over the longer time period. This increase, which results from 3 mammal by-catch records from 2009/2010 in the DCF programme leads to a reduction in the overall difference between rates calculated from each programme, from thirty-six times higher in dedicated sampling over the 3 year period to thirteen times higher over the 10 year period.

We then stratified the full (dedicated and DCF) 10 year dataset by area (ICES division) and broad gear type (gill or tangle/trammel) and calculated the resulting "métier" specific bycatch rates. These are shown in figures 1 and 2.

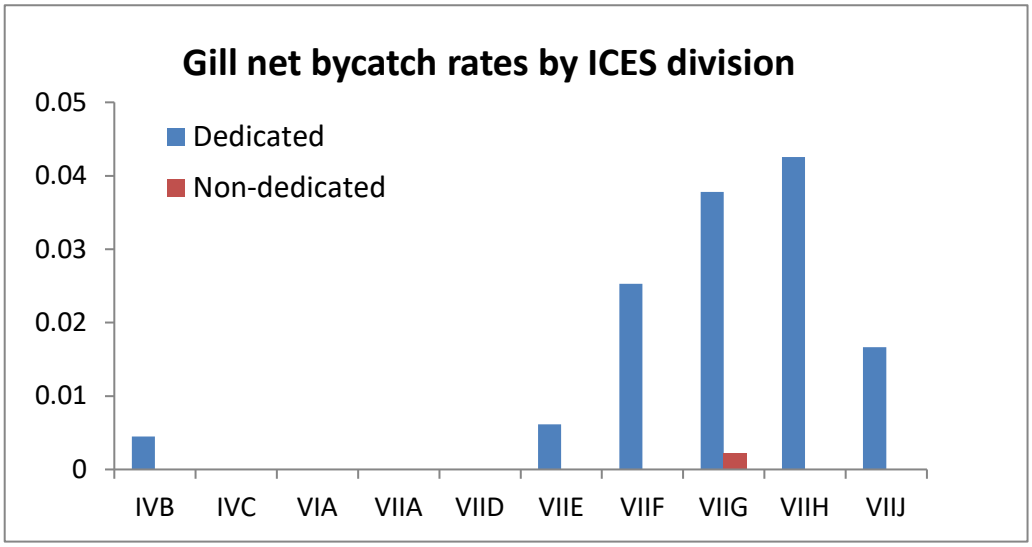

Figure 1: Gillnet bycatch rates calculated from dedicated and non-dedicated monitoring.

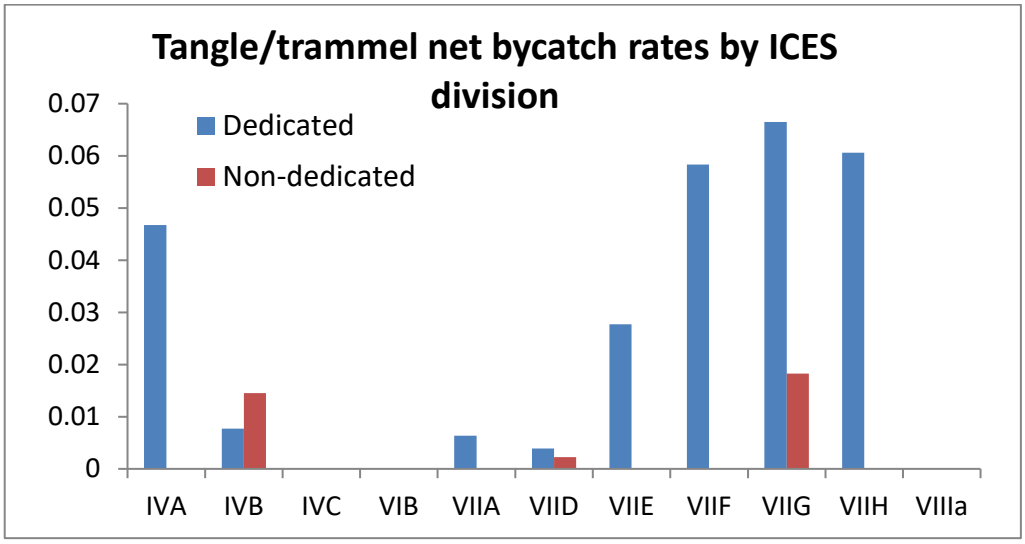

Figure 2: Tangle/trammel net bycatch rates calculated from dedicated and non-dedicated monitoring.

The data are stratified in an equivalent way for each dataset and there was sampling in the majority of métiers under each programme (though not always observed bycatches), so the resulting differences in bycatch rates are likely to be largely driven by differences in on-board sampling protocols. Large animals such as marine mammals often fall or are removed from the nets outside the vessel and if these occurrences are not checked for or recorded if seen within catch sampling programmes then significant differences in calculated bycatch rates can occur. Other factors such as vessel size which was not considered here, may also have an influence, particularly in divisions with coastal components, but less so in "offshore" divisions (e.g. 7 ghj) where only large UK netting vessels work. Nonetheless this analysis suggests that attempts to provide robust advice about fisheries impacts on marine mammals in particular (and potentially other PET species) would be significantly hampered if only data collected under the DCF in its current form was used.

This more comprehensive analysis was designed to see if differences exist between bycatch rates produced using the data collected under each programme. It is certainly not intended to undermine the general quality of data available from different programmes, because each programme is designed to provide information about impacts on different catch components. The remit of WGBYC had gradually changed over recent years to include other protected species including all marine mammals, seabirds, reptiles and protected fish and elasmobranchs. The vulnerability of these taxa varies between gear types and many of the smaller species may be effectively sampled using current sampling designs and protocols. However, the results indicate that sampling designs and associated sampling protocols may need to be adapted if monitoring programmes are to satisfactorily meet multiple objectives.

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Annex 5: Inventory of sampling programmes where bycatches are recorded

Table 1.a Inventory of sampling programmes where bycatches are recorded. In future, this inventory is intended to be placed in an online repository – ICES is currently working on a solution. In tables 1.b, 1.c, and 1.d on the following pages, more columns are presented – rows can be coupled according to the number in the column furthest to the left.

	Country	Year	Year the survey started	Type of monitoring	Main objective of monitoring scheme	Study area	Ecoregion	Target population
1	Germany	2017	2009	DCF- sea sampling programme	catch composition fish/crustacean species, bycatch of birds and mammals	German coastal area	North Sea	Beam trawl targeting brown shrimp in the German coastal area
2	Germany	2017	1995	DCF- sea sampling programme	catch composition fish species, bycatch of birds and mammals	4.,7d	North Sea	Trawlers targeting mackerel, herring in IV, VIId
3	Germany	2017	1995	DCF- sea sampling programme	catch composition fish/crustacean species, bycatch of birds and mammals	4, 3a	North Sea	Trawlers targeting gadoids in IV, IIIa
4	Germany	2017	1998	DCF- sea sampling programme	catch composition fish/crustacean species, bycatch of birds and mammals	4	North Sea	Beam trawl targeting flat fish in IV
5	Germany	2017	1998	DCF- sea sampling programme	catch composition fish/crustacean species, bycatch of birds and mammals	4	North Sea	OTB targeting plaice in IV
6	Germany	2017	1980	DCF- sea sampling programme	catch composition fish species, bycatch of birds and mammals	NAFO SA1-2	North Atlantic	OTB targeting Greenland halibut In NAFO SA1-2
7	Germany	2017	1995	DCF- sea sampling programme	catch composition fish species, bycatch of birds and mammals	6,7	North Atlantic	OTM targeting small pelagic species in VI, VIIbcjk, VIIe, VIIfgh, VIII, V-XIV, (IVa)

	Country	Year	Year the survey started	Type of monitoring	Main objective of monitoring scheme	Study area	Ecoregion	Target population
8	Germany	2017	1980	DCF- sea sampling programme	catch composition fish species, bycatch of birds and mammals	12,14	North Atlantic	OTB targeting Greenland halibut In XII, XIV, Va
9	Germany	2017	1995	DCF- sea sampling programme	catch composition fish species, bycatch of birds and mammals	12,14	North Atlantic	OTM targeting redfish in XII, XIV, Va
10	Germany	2017	1998	DCF- sea sampling programme	catch composition fish species, bycatch of birds and mammals	1,2	North Atlantic	Trawlers targeting cod, saithe in I, II
11	Germany	2017	1998	DCF- sea sampling programme	catch composition fish species, bycatch of birds and mammals	1,2	North Atlantic	Trawlers targeting herring in II (ASH)
12	Germany	2017	2009	DCF- sea sampling programme	catch composition fish species, bycatch of birds and mammals	German coastal area	Baltic Sea	demersal trawlers
13	Germany	2017	2009	DCF- sea sampling programme	catch composition fish species, bycatch of birds and mammals	German coastal area	Baltic Sea	demersal gillnetters and longliners
14	Germany	2009	2006	directed study	catch composition by-catch of birds	German coastal area	Baltic Sea	pelagic gillnetters
15	Germany	2009	2006	directed study	catch composition by-catch of birds	German coastal area	Baltic Sea	demersal gillnetters
16	Germany	2009	2006	directed study	catch composition by-catch of birds	German coastal area	Baltic Sea	longliners
17	Germany	2012	2011	directed study	catch composition by-catch of birds	German coastal area	Baltic Sea	demersal gillnetters
18	Germany	2012	2011	directed study	catch composition by-catch of birds	German coastal area	Baltic Sea	longliners

	Country	Year	Year the survey started	Type of monitoring	Main objective of monitoring scheme	Study area	Ecoregion	Target population
19	Greece	2017	2002	DCF- sea sampling programme	Catches/ discards of fish species/ Since 2017: Bycatch of birds, sea turtles and mammals	GSA20, GSA22, GSA23	Mediterranean Sea (Aegean Sea, Ionian Sea)	Trips of all Bottom otter trawls (OTB_DES_>=40_0_0) per GSA
20	Greece	2017	2002	DCF- sea sampling programme	Catches/ discards of fish species/ Since 2017: Bycatch of birds, sea turtles and mammals	GSA20, GSA22, GSA23	Mediterranean Sea (Aegean Sea, Ionian Sea)	Trips of all Purse seines (PS_SPF_>=14_0_0) per GSA
21	Greece	2017	2002	DCF- sea sampling programme	Catches/ discards of fish species/ Since 2017: Bycatch of birds, sea turtles and mammals	GSA22	Mediterranean Sea (Aegean Sea, Ionian Sea)	Trips of Pots and Traps (FPO_DEF_0_0_0), only in GSA 22
22	Greece	2017	2002	DCF- sea sampling programme	Catches/ discards of fish species/ Since 2017: Bycatch of birds, sea turtles and mammals	GSA20, GSA22, GSA23	Mediterranean Sea (Aegean Sea, Ionian Sea)	Trips of all Set gillnet (GNS_DEF_>=16_0_0) per GSA
23	Greece	2017	2002	DCF- sea sampling programme	Catches/ discards of fish species/ Since 2017: Bycatch of birds, sea turtles and mammals	GSA20, GSA22, GSA23	Mediterranean Sea (Aegean Sea, Ionian Sea)	Trips of all Trammel net (GTR_DEF_>=16_0_0) per GSA
24	Greece	2017	2002	DCF- sea sampling programme	Catches/ discards of fish species/ Since 2017: Bycatch of birds, sea turtles and mammals	GSA20, GSA22, GSA23	Mediterranean Sea (Aegean Sea, Ionian Sea)	Trips of Drifting longlines (LLD_LPF_0_0_0) per GSA
25	Greece	2017	2002	DCF- sea sampling programme	Catches/ discards of fish species/ Since 2017: Bycatch of birds,	GSA20, GSA22, GSA23	Mediterranean Sea (Aegean Sea, Ionian Sea)	Trips of Set longlines (LLS_DEF_0_0_0) per GSA

	Country	Year	Year the survey started	Type of monitoring	Main objective of monitoring scheme	Study area	Ecoregion	Target population
					sea turtles and mammals			
26	Greece	2017	2002	DCF- sea sampling programme	Catches/ discards of fish species/ Since 2017: Bycatch of birds, sea turtles and mammals	GSA20, GSA22	Mediterranean Sea (Aegean Sea, Ionian Sea)	Trips of Beach and boat seine (SB_SV_DEF_0_0_0) in GSAs 20 and 22
27	Iceland	2017	2014*	Icelandic fisheries monitoring program	Catch/Discards/gear regulations	5a	Iceland sea	Lumpsucker gillnet fishery
28	Iceland	2017	2013*	Directed study	Spawning stock of cod	5a	Iceland sea	Cod gillnet fishery in April
29	Iceland	2017	2014*	Icelandic fisheries monitoring program	Catch/Discards/gear regulations	5a	Iceland sea	Longline fishery
30	Iceland	2017	2014*	Icelandic fisheries monitoring program	Catch/Discards/gear regulations	5a	Iceland sea	Demersal trawl fishery
31	Iceland	2017	2014*	Icelandic fisheries monitoring program	Catch/Discards/gear regulations	5a	Iceland sea	Pelagic trawl/seine fishery
32	Iceland	2017	2014*	Icelandic fisheries monitoring program	Catch/Discards/gear regulations	5a	Iceland sea	Demersal gillnets
33	Iceland	2017	2014*	Icelandic fisheries monitoring program	Catch/Discards/gear regulations	5a	Iceland sea	Demersal seine
34	Ireland	2017	2013	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of fish species	6a	North Atlantic	Trips carried out by demersal/*nephrops* trawlers
35	Ireland	2017	2013	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of fish species	7a	North Atlantic	Trips carried out by demersal/*nephrops* trawlers
36	Ireland	2017	2013	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of fish species	7fgh	North Atlantic	Trips carried out by demersal/*nephrops* trawlers

	Country	Year	Year the survey started	Type of monitoring	Main objective of monitoring scheme	Study area	Ecoregion	Target population
37	Ireland	2017	2013	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of fish species	7fgh	North Atlantic	Trips carried out by demersal static gears, Gillnets/trammel
38	Ireland	2017	2013	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of fish species	7bcjk	North Atlantic	Trips carried out by demersal trawlers
39	Ireland	2017	2013	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of fish species	7bcjk	North Atlantic	Trips carried out by demersal static gears, Gillnets/trammel
40	Ireland	2017	2017	EMFF Enhanced By-Catch sampling programme	Bycatch of birds and mammals, catches/discards of fish species	7bcjk	North Atlantic	Trips carried out by demersal static gears, Gillnets/trammel
41	Ireland	2017	2013	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of fish species	6a	North Atlantic	Trips carried out by Pelagic trawlers
42	Ireland	2017	2013	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of fish species	7a	North Atlantic	Trips carried out by Pelagic trawlers
43	Ireland	2017	2013	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of fish species	7fgh	North Atlantic	Trips carried out by Pelagic trawlers
44	Ireland	2017	2013	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of fish species	7bcjk	North Atlantic	Trips carried out by Pelagic trawlers
45	Ireland	2017	2017	EMFF Enhanced By-Catch sampling programme	Bycatch of birds and mammals, catches/discards of fish species	6a, 7bcjk, 7fgh, 7a	North Atlantic	Trips carried out by Pelagic trawlers
46	Ireland	2017	2013	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of fish species	6a	North Atlantic	Trips carried out by Potters

	Country	Year	Year the survey started	Type of monitoring	Main objective of monitoring scheme	Study area	Ecoregion	Target population
47	Ireland	2017	2013	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of fish species	7a	North Atlantic	Trips carried out by Potters
48	Ireland	2017	2013	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of fish species	7fgh	North Atlantic	Trips carried out by Potters
49	Ireland	2017	2013	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of fish species	7bcjk	North Atlantic	Trips carried out by Potters
50	Ireland	2017	2013	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of fish species	ICES Area IV, VIId - North Sea ICES Area I,II -Eastern Arctic	North Sea Eastern Arctic	Trips carried out by Pelagic trawlers
51	Ireland	2017	2013	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of Whelks	7a	North Atlantic	Potters targeting Molluscs
52	Ireland	2017	2013	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of scallops, razors, cockles and fish species	7a	North Atlantic	Scallop dredgers
53	Ireland	2017	2013	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of scallops and fish species	7fgh	North Atlantic	Scallop dredgers
54	Netherlands	2017	2004	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of fish species	ICES 1-12	NE Atlantic	Trips carried out by Pelagic Trawlers

	Country	Year	Year the survey started	Type of monitoring	Main objective of monitoring scheme	Study area	Ecoregion	Target population
55	Netherlands	2017	2016	self-sampling	Discards of fish species	IV	North Sea	Trips carried out by Demersal trawlers
56	Netherlands	2017	2016	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of fish species	IV	North Sea	Trips carried out by vessel using passive gear
57	Netherlands	2017	2016	DCF- sea sampling programme	Bycatch of birds and mammals, catches/discards of fish species	IV	North Sea	Trips carried out by shrimp(crangon) beam trawlers
58	Netherlands	2008	2008	Directed study	Bycatch of mammals.	IV	North Sea	Trips carried uit by gill- and trammel net fishers
59	Netherlands	2017	2013	Directed study by Electronic Monitoring	Bycatch of harbour porpoises	IV	North Sea	Trips carried out by gill- and trammel net fishers
60	Spain (Basque Country)	2017	2017	DCF- sea sampling programme	Catches / discards of fish species	II	Norwegian and Barents seas	Trips carried out by demersal trawlers
61	Spain (Basque Country)	2017	2017	DCF- sea sampling programme	Catches / discards of fish species	VI	Celtic seas	Trips carried out by demersal trawlers
62	Spain (Basque Country)	2017	2017	DCF- sea sampling programme	Catches / discards of fish species	VIIIabd	Bay of Biscay	Trips carried out by demersal trawlers
63	Spain (Basque Country)	2017	2017	DCF- sea sampling programme	Catches / discards of fish species	VIIIabdc	Bay of Biscay and Iberian coast	Trips carried out by purse seiners
64	Spain (Basque Country)	2017	2017	Pilot study based on questionnaires to skippers	Seabirds bycatch	VIIIabdc	Bay of Biscay and Iberian coast	Trips carried out by the artisanal fleet

	Country	Year	Year the survey started	Type of monitoring	Main objective of monitoring scheme	Study area	Ecoregion	Target population
65	Spain (Basque Country)	2017	2017	Pilot study using new technologies	Catches / discards of fish species and PETS species	VIIIabdc	Bay of Biscay and Iberian coast	Trips carried out by the artisanal fleet
66	Sweden	2017	1997	DCF- sea sampling programme	Catches / discards of fish species	IIIaS	North Sea	Trips carried out by demersal trawlers
67	Sweden	2017	2008	DCF- sea sampling programme	Catches / discards of fish species	IIIaS	North Sea	Trips carried out by demersal trawlers using sorting grids
68	Sweden	2017	2002	DCF- sea sampling programme	Catches / discards of fish species	IIIaN	North Sea	Trips carried out by demersal trawlers
69	Sweden	2017	2005	DCF- sea sampling programme	Catches / discards of fish species	IIIaN	North Sea	Trips carried out by demersal trawlers using sorting grids
70	Sweden	2017	2008	DCF- sea sampling programme	Catches / discards of fish species	IIIa, IV	North Sea	Trips carried out by trawlers targeting *Pandalus*
71	Sweden	2017	2008	DCF- sea sampling programme	Catches / discards of fish species	IIIa	North Sea	Trips carried out by trawlers using sorting grids targeting *Pandalus*
72	Sweden	2017	1996	DCF- sea sampling programme	Catches / discards of fish species	SD 24-26	Baltic sea	Trips carried out by demersal trawlers
73	Sweden	2017	2017	Directed study	Bycatch of birds and mammals, catches/discards of fish species	SD 23-25	Baltic Sea	Trips carried out by gillnetters/longliners targeting primarely cod
74	UK	2016	1996	Habitats directive	Protected species bycatch	27.4, 27.6, 27.7	North Sea, Celtic Seas	Gillnetters
75	UK	2016	2013	812/2004 pilot studies	Cetacean bycatch	27.4, 27.7d-j	North Sea, Celtic Seas	Vessels requiring the use of ADDs under 812/2004

	Country	Year	Year the survey started	Type of monitoring	Main objective of monitoring scheme	Study area	Ecoregion	Target population
76	UK	2016	2005	812/2004 mandatory monitoring	Cetacean bycatch	27.6, 27.7, 27.8	Celtic Seas , Biscay	Midwater trawlers
77	UK	2016	2005	812/2004 mandatory monitoring	Cetacean bycatch	27.6a, 27.7ab, 27.8abc	Celtic Seas , Biscay	Gillnetters
78	UK	2016	2005	812/2004 pilot studies	Cetacean bycatch	27.6, 27.7, 27.8	Celtic Seas , Biscay	Midwater trawlers

Table 1.b Inventory of sampling programmes where bycatches are recorded. In future, this inventory is intended to be placed in an online repository – ICES is currently working on a solution. In tables 1.a, 1.c, and 1.d on the previous and following pages, more columns are presented – rows can be coupled according to the number in the column furthest to the left.

	Sampling frame	Primary sampling unit	Sampling hierarchy	Sampling selection methods for different levels in sampling hierarchy	Part(s) of the target population excluded from the sampling frame (e.g. vessels below a certain size, non-cooperative vessels, vessels with low fishing effort,…)	Sampling Intensity; Number of trips 2017	Sampling Intensity 2017; Proportion of trips covered by sampling	Temporal stratification
1	List of vessels	Fishing trips	trips	opportunistic randomised	-	7	0.10%	seasonal fishery
2	List of vessels	Fishing trips	trips	opportunistic randomised	-	5	12.00%	quarter
3	List of vessels	Fishing trips	trips	opportunistic randomised	-	5	1.90%	quarter
4	List of vessels	Fishing trips	trips	opportunistic randomised	-	4	1.00%	quarter
5	List of vessels	Fishing trips	trips	opportunistic randomised	-	1	3.40%	quarter
6	List of vessels	Fishing trips	trips	opportunistic randomised	-	0 from 4 trips all together in this metier in 2016	0.00%	seasonal fishery
7	List of vessels	Fishing trips	trips	opportunistic randomised	-	4	17.40%	seasonal fishery
8	List of vessels	Fishing trips	trips	opportunistic randomised	-	2	12.50%	seasonal fishery
9	List of vessels	Fishing trips	trips	opportunistic randomised	-	0 from 4 trips all together in this metier in 2016	0.00%	seasonal fishery
10	List of vessels	Fishing trips	trips	opportunistic randomised	-	1	33.00%	seasonal fishery
11	List of vessels	Fishing trips	trips	opportunistic randomised	-	1	33.00%	seasonal fishery
12	List of vessels	Fishing trips	trips	random draw from randomised list	target population involves all trawlers contributing to 90% of the total cod landings from SD2224 in the previous year	4	<1%	yearround

	Sampling frame	Primary sampling unit	Sampling hierarchy	Sampling selection methods for different levels in sampling hierarchy	Part(s) of the target population excluded from the sampling frame (e.g. vessels below a certain size, non-cooperative vessels, vessels with low fishing effort,…)	Sampling Intensity; Number of trips 2017	Sampling Intensity 2017; Proportion of trips covered by sampling	Temporal stratification
13	List of vessels	Fishing trips	trips	random draw from randomised list	target population involves all passive gear vessels contributing to the 60% of the total cod landings from SD2224 in the previous year	16	<1%	yearround
14	Six vessels each year, only conducted in April; fishing in part of German EEZ (waters off Mecklenburg-Vorpommerania)					0		yearround
15	Selected vessels; fishing in part of German EEZ (waters off Mecklenburg-Vorpommerania)					0		yearround
16	Selected vessels; fishing in part of German EEZ (waters off Mecklenburg-Vorpommerania)					0		yearround
17	Group of gillnetters operating from one port in Mecklenburg-Vorpommerania					0		yearround
18	Group of gillnetters operating from one port in Mecklenburg-Vorpommerania					0		yearround

	Sampling frame	Primary sampling unit	Sampling hierarchy	Sampling selection methods for different levels in sampling hierarchy	Part(s) of the target population excluded from the sampling frame (e.g. vessels below a certain size, non-cooperative vessels, vessels with low fishing effort,…)	Sampling Intensity; Number of trips 2017	Sampling Intensity 2017; Proportion of trips covered by sampling	Temporal stratification
19	Trips of all Bottom otter trawls (OTB_DES_>=40_0_0) per GSA for the reference year (2014)	Fishing trips	trips/ hauls	Random	Trips carried out by non-cooperative vessels, some vessels without shelter for observers	in process	in process (it is expected to be less than 1%)	quarter
20	Trips of all Purse seines (PS_SPF_>=14_0_0) per GSA for the reference year (2014)	Fishing trips	trips/ hauls	Random	Trips carried out by non-cooperative vessels, some vessels without shelter for observers	in process	in process (it is expected to be less than 1%)	quarter
21	Trips of Pots and Traps (FPO_DEF_0_0_0), only in GSA 22 for the reference year (2014)	Fishing trips	trips/ hauls	Random	Trips carried out by non-cooperative vessels, some very small vessels with no room for the observers	in process	in process (it is expected to be less than 1%)	quarter
22	Trips of all Set gillnet (GNS_DEF_>=16_0_0) per GSA for the reference year (2014)	Fishing trips	trips/ hauls	Random	Trips carried out by non-cooperative vessels, some very small vessels with no room for the observers	in process	in process (it is expected to be less than 1%)	quarter
23	Trips of all Trammel net (GTR_DEF_>=16_0_0) per GSA for the reference year (2014)	Fishing trips	trips/ hauls	Random	Trips carried out by non-cooperative vessels, some very small vessels with no room for the observers	in process	in process (it is expected to be less than 1%)	quarter
24	Trips of Drifting longlines (LLD_LPF_0_0_0) per GSA for the reference year (2014)	Fishing trips	trips/ hauls	Random	Trips carried out by non-cooperative vessels, some very small vessels with no room for the observers	in process	in process (it is expected to be less than 1%)	quarter
25	Trips of Set longlines (LLS_DEF_0_0_0) per GSA for the reference year (2014)	Fishing trips	trips/ hauls	Random	Trips carried out by non-cooperative vessels, some very small vessels with no room for the observers	in process	in process (it is expected to be less than 1%)	quarter

	Sampling frame	Primary sampling unit	Sampling hierarchy	Sampling selection methods for different levels in sampling hierarchy	Part(s) of the target population excluded from the sampling frame (e.g. vessels below a certain size, non-cooperative vessels, vessels with low fishing effort,…)	Sampling Intensity; Number of trips 2017	Sampling Intensity 2017; Proportion of trips covered by sampling	Temporal stratification
26	Trips of Beach and boat seine (SB_SV_DEF_0_0_0) in GSAs 20 and 22 for the reference year (2014)	Fishing trips	trips/ hauls	Random	Trips carried out by non-cooperative vessels	in process	in process (it is expected to be less than 1%)	quarter
27	All vessels with active fishing license	Fishing trips	Trips	Targeted	None	71	1.900%	Year
28	Six vessels each year, only conducted in April	Set	Set/net	Set stations/All	Other vessels	64	18.000%	Year
29	All vessels with active fishing license	Fishing trips	Trips/sets	Targeted/Ad-hoc	None	91	0.700%	Year
30	All vessels with active fishing license	Fishing trips	Trips/Hauls	Targeted/Ad-hoc	None	61	2.470%	Year
31	All vessels with active fishing license	Fishing trips	Trips/days	Targeted/Ad-hoc	None	25	6.200%	Year
32	All vessels with active fishing license	Fishing trips	Trips/days	Targeted/Ad-hoc	None	16	0.600%	Year
33	All vessels with active fishing license	Fishing trips	Trips/days	Targeted/Ad-hoc	None	26	0.800%	Year
34	All vessels with landings in this area	vessel x trip	trips/ hauls	vessel list/ad-hoc	Non-cooperative vessels	264	0.020%	Annual
35	All vessels with landings in this area	vessel x trip	trips/ hauls	vessel list/ad-hoc	Non-cooperative vessels	1306	0.000%	Annual
36	All vessels with landings in this area	vessel x trip	trips/ hauls	vessel list/ad-hoc	Non-cooperative vessels	3454	0.010%	Annual
37	All vessels with landings in this area	vessel x trip	trips/ hauls	vessel list/ad-hoc	Non-cooperative vessels	716	0.001%	Annual
38	All vessels with landings in this area	vessel x trip	trips/ hauls	vessel list/ad-hoc	Non-cooperative vessels	2804	0.001%	Annual

	Sampling frame	Primary sampling unit	Sampling hierarchy	Sampling selection methods for different levels in sampling hierarchy	Part(s) of the target population excluded from the sampling frame (e.g. vessels below a certain size, non-cooperative vessels, vessels with low fishing effort,…)	Sampling Intensity; Number of trips 2017	Sampling Intensity 2017; Proportion of trips covered by sampling	Temporal stratification
39	All vessels with landings in this area	vessel x trip	trips/ hauls	vessel list/ad-hoc	Non-cooperative vessels	388	0.005%	Annual
40	All vessels with landings in this area	vessel x trip	trips/ hauls	vessel list/ad-hoc	Non-cooperative vessels	388	0.150%	Annual
41	All vessels with landings in this area	vessel x trip	trips/ hauls	vessel list/ad-hoc	Non-cooperative vessels	188	0.010%	Annual
42	All vessels with landings in this area	vessel x trip	trips/ hauls	vessel list/ad-hoc	Non-cooperative vessels	165	0.040%	Annual
43	All vessels with landings in this area	vessel x trip	trips/ hauls	vessel list/ad-hoc	Non-cooperative vessels	217	0.020%	Annual
44	All vessels with landings in this area	vessel x trip	trips/ hauls	vessel list/ad-hoc	Non-cooperative vessels	429	0.007%	Annual
45	All vessels with landings of Sprat in this area	vessel x trip	trips/ hauls	ad-hoc	Non-cooperative vessels	232	0.006%	Annual
46	All vessels with landings in this area	vessel x trip	trips/ hauls	vessel list/ad-hoc	Non-cooperative vessels	5217	0.004%	Annual
47	All vessels with landings in this area	vessel x trip	trips/ hauls	vessel list/ad-hoc	Non-cooperative vessels	480	0.007%	Annual
48	All vessels with landings in this area	vessel x trip	trips/ hauls	vessel list/ad-hoc	Non-cooperative vessels	263	0.006%	Annual
49	All vessels with landings in this area	vessel x trip	trips/ hauls	vessel list/ad-hoc	Non-cooperative vessels	1987	0.005%	Annual
50	All vessels with landings in this area	Fishing trips	trips/ hauls	vessel list/ad-hoc	Non-cooperative vessels	72	0.006%	Annual
51	All vessels with landings in this area	Fishing trips	trips/ hauls	vessel list/ad-hoc	Non-cooperative vessels	2144	0.000%	Annual

	Sampling frame	Primary sampling unit	Sampling hierarchy	Sampling selection methods for different levels in sampling hierarchy	Part(s) of the target population excluded from the sampling frame (e.g. vessels below a certain size, non-cooperative vessels, vessels with low fishing effort,…)	Sampling Intensity; Number of trips 2017	Sampling Intensity 2017; Proportion of trips covered by sampling	Temporal stratification
52	All vessels with landings in this area	Fishing trips	trips/ hauls	vessel list/ad-hoc	Non-cooperative vessels	2485	0.000%	Annual
53	All vessels with landings in this area	Fishing trips	trips/ hauls	vessel list/ad-hoc	Non-cooperative vessels	98	0.001%	Annual
54	Vessel list of trawlers	Fishing trips	trips/hauls	Random/ad-hoc	All vessels are cooperating	12	10.000%	year
55	Reference fleet	Fishing trips	trips/hauls	Random from reference fleet	All vessels are cooperating	160	0.17%	year
56	Vessel list of passive gear	Fishing trips	trips	Random from vessellist	Not all vessels are cooperating	20	1.00%	year
57	Vessel list of shrimpers	Fishing trips	trips/hauls	Random from vessellist	Not all vessels are cooperating	8	0.10%	year
58	Group of gillnetters operating from one port	Fishing trips	trips	Ad hoc from a group of cooperating fishermen	Selection of vessels targeting cod and operating from one port in the period of February-May	48	62.30%	
59	Vessellist of gillnetters	Fishing trips	trips	Fishermen from different ports along the coast	Some fishermen were not willing to cooperate	1036	12.00%	quarter
60	Vessels registered as trawlers in the National fleet register	Fishing trips	trips/ hauls	Random	All vessels are included in the sampling frame	1	12.00%	quarter
61	Vessels registered as trawlers in the National fleet register	Fishing trips	trips/ hauls	Random	All vessels are included in the sampling frame	4	12.00%	quarter
62	Vessels registered as trawlers in the National fleet register	Fishing trips	trips/ hauls	Random	All vessels are included in the sampling frame	25	5.00%	quarter

	Sampling frame	Primary sampling unit	Sampling hierarchy	Sampling selection methods for different levels in sampling hierarchy	Part(s) of the target population excluded from the sampling frame (e.g. vessels below a certain size, non-cooperative vessels, vessels with low fishing effort,…)	Sampling Intensity; Number of trips 2017	Sampling Intensity 2017; Proportion of trips covered by sampling	Temporal stratification
63	Vessels registered as purse seiners in the National fleet register	Fishing trips	trips/ hauls	Random	All vessels are included in the sampling frame	22	0.68%	quarter
64	Vessels registered as minor gears (passive artisanal gears) in the National fleet register	Skippers from the artisanal fleet	trips/ hauls	Random	All vessels skippers are included in the sampling frame	40	57.00%	Year
65	Vessels registered as minor gears (passive artisanal gears) in the National fleet register	Fishing trips	trips/ hauls	Reference fleet	Rest of the vessels from the sampling frame	900	10.00%	Year
66	Trips performed the year before sampling (vessels weighted by no of trips)	Fishing trips	trips/ hauls	Random/ad-hoc	Trips carried out by vessels not participating in fishery the year before, wintertime some vessels without shelter for observers	13	0.85%	quarter
67	Trips performed the year before sampling (vessels weighted by no of trips)	Fishing trips	trips/ hauls	Random/ad-hoc	Trips carried out by vessels not participating in fishery the year before, wintertime some vessels without shelter for observers	11	0.99%	quarter
68	Trips performed the year before sampling (vessels weighted by no of trips)	Fishing trips	trips/ hauls	Random/ad-hoc	Trips carried out by vessels not participating in fishery the year before, wintertime some vessels without shelter for observers	11	0.65%	quarter

	Sampling frame	Primary sampling unit	Sampling hierarchy	Sampling selection methods for different levels in sampling hierarchy	Part(s) of the target population excluded from the sampling frame (e.g. vessels below a certain size, non-cooperative vessels, vessels with low fishing effort,…)	Sampling Intensity; Number of trips 2017	Sampling Intensity 2017; Proportion of trips covered by sampling	Temporal stratification
69	Trips performed the year before sampling (vessels weighted by no of trips)	Fishing trips	trips/ hauls	Random/ad-hoc	Trips carried out by vessels not participating in fishery the year before, wintertime some vessels without shelter for observers	13	0.39%	quarter
70	Trips performed the year before sampling (vessels weighted by no of trips)	Fishing trips	trips/ hauls	Random/ad-hoc	Trips carried out by vessels not participating in fishery the year before, wintertime some vessels without shelter for observers	9	1.32%	quarter
71	Trips performed the year before sampling (vessels weighted by no of trips)	Fishing trips	trips/ hauls	Random/ad-hoc	Trips carried out by vessels not participating in fishery the year before, wintertime some vessels without shelter for observers	14	0.69%	quarter
72	Trips performed the year before sampling (vessels weighted by no of trips)	Fishing trips	trips/ hauls	Random/ad-hoc	Trips carried out by vessels not participating in fishery the year before	8	1.07%	quarter
73	Trips performed the year before sampling (vessels weighted by no of trips)	Fishing trips	trips	Random	Trips from vessels that landed less than 500 kg cod the year before the sampling year. Trips from vessels not participating in the fishery the year before.	33	0.37%	quarter

	Sampling frame	Primary sampling unit	Sampling hierarchy	Sampling selection methods for different levels in sampling hierarchy	Part(s) of the target population excluded from the sampling frame (e.g. vessels below a certain size, non-cooperative vessels, vessels with low fishing effort,…)	Sampling Intensity; Number of trips 2017	Sampling Intensity 2017; Proportion of trips covered by sampling	Temporal stratification
74	<12m gillnetters	Vessels	Trips/hauls	True random where possible but rarely achieved due to multiple constraints. General combination of opportunistic, ad hoc, attempt to monitor multiple vessels within relevant strata where random not achievable.	observers permitted to refuse sailing due to safety concerns	166	0.58%	annual
75	>12m gillnetters	Vessels	Trips/hauls	True random where possible but rarely achieved due to multiple constraints. General combination of opportunistic, ad hoc, attempt to monitor multiple vessels within relevant strata where random not achievable.	observers permitted to refuse sailing due to safety concerns	10	n/a	annual
76	>15m midwater trawlers	Vessels	Trips/hauls	True random where possible but rarely achieved due to multiple constraints. General combination of opportunistic, ad hoc, attempt to monitor multiple vessels within relevant strata where random not achievable.	observers permitted to refuse sailing due to safety concerns	10	2%	seasonal

	Sampling frame	Primary sampling unit	Sampling hierarchy	Sampling selection methods for different levels in sampling hierarchy	Part(s) of the target population excluded from the sampling frame (e.g. vessels below a certain size, non-cooperative vessels, vessels with low fishing effort,…)	Sampling Intensity; Number of trips 2017	Sampling Intensity 2017; Proportion of trips covered by sampling	Temporal stratification
77	>15m gillnetters	Vessels	Trips/hauls	True random where possible but rarely achieved due to multiple constraints. General combination of opportunistic, ad hoc, attempt to monitor multiple vessels within relevant strata where random not achievable.	observers permitted to refuse sailing due to safety concerns	1	4.5%	annual
78	<15m midwater trawlers	Vessels	Trips/hauls	True random where possible but rarely achieved due to multiple constraints. General combination of opportunistic, ad hoc, attempt to monitor multiple vessels within relevant strata where random not achievable.	observers permitted to refuse sailing due to safety concerns	7	2.4%	seasonal

Table 1.c Inventory of sampling programmes where bycatches are recorded. In future, this inventory is intended to be placed in an online repository – ICES is currently working on a solution. In tables 1.a, 1.b, and 1.d on the previous and following pages, more columns are presented – rows can be coupled according to the number in the column furthest to the left.

	Other stratification	Observation method	Approximate size of subsample of fish	Species / groups of species identified	Species / groups of species registered in national database	Perceived importance of these fisheries compared to other fisheries catch of birds	Perceived importance of these fisheries compared to other fisheries catch of mammals
1		Observer observing on deck and when gear is hauled	variable, depending on catch	All fish species, all commercial crustaceans, since ca 2014 all birds and mammals	All fish species, all commercial crustaceans, since 2012 mammals	1	0
2		Observer observing on deck and when gear is hauled	variable, depending on catch	All fish species, all commercial crustaceans, since ca 2014 all birds and mammals	All fish species, all commercial crustaceans, since 2012 mammals	1	2
3		Observer observing on deck and when gear is hauled	variable, depending on catch	All fish species, all commercial crustaceans, since ca 2014 all birds and mammals	All fish species, all commercial crustaceans, since 2012 mammals	1	0
4		Observer observing on deck and when gear is hauled	variable, depending on catch	All fish species, all commercial crustaceans, since ca 2014 all birds and mammals	All fish species, all commercial crustaceans, since 2012 mammals	1	0
5		Observer observing on deck and when gear is hauled	variable, depending on catch	All fish species, all commercial crustaceans, since ca 2014 all birds and mammals	All fish species, all commercial crustaceans, since 2012 mammals	1	0
6		Observer observing on deck and when gear is hauled	variable, depending on catch	All fish species, all commercial crustaceans, since ca 2014 all birds and mammals	All fish species, all commercial crustaceans, since 2012 mammals	0	0

	Other stratification	Observation method	Approximate size of subsample of fish	Species / groups of species identified	Species / groups of species registered in national database	Perceived importance of these fisheries compared to other fisheries catch of birds	Perceived importance of these fisheries compared to other fisheries catch of mammals
7		Observer observing on deck and when gear is hauled	variable, depending on catch	All fish species, all commercial crustaceans, since ca 2014 all birds and mammals	All fish species, all commercial crustaceans, since 2012 mammals	1	2
8		Observer observing on deck and when gear is hauled	variable, depending on catch	All fish species, all commercial crustaceans, since ca 2014 all birds and mammals	All fish species, all commercial crustaceans, since 2012 mammals	0	0
9		Observer observing on deck and when gear is hauled	variable, depending on catch	All fish species, all commercial crustaceans, since ca 2014 all birds and mammals	All fish species, all commercial crustaceans, since 2012 mammals	0	0
10		Observer observing on deck and when gear is hauled	variable, depending on catch	All fish species, all commercial crustaceans, since ca 2014 all birds and mammals	All fish species, all commercial crustaceans, since 2012 mammals	0	1
11		Observer observing on deck and when gear is hauled	variable, depending on catch	All fish species, all commercial crustaceans, since ca 2014 all birds and mammals	All fish species, all commercial crustaceans, since 2012 mammals	1	2
12	quarter	Observer observing on deck and when gear is hauled	variable, depending on catch	All fish, birds and mammal species	All fish, birds and mammal species	1	1
13	quarter	Observer observing on deck and when gear is hauled	variable, depending on catch	All fish, birds and mammal species	All fish, birds and mammal species	4	4

	Other stratification	Observation method	Approximate size of subsample of fish	Species / groups of species identified	Species / groups of species registered in national database	Perceived importance of these fisheries compared to other fisheries catch of birds	Perceived importance of these fisheries compared to other fisheries catch of mammals
14	only part of German EEZ (off Mecklenburg Vorpommern)	Observer observing on deck and when gear is hauled; self-sampling		all birds		4	4
15	only part of German EEZ (off Mecklenburg Vorpommern)	Observer observing on deck and when gear is hauled; self-sampling		all birds		4	4
16	only part of German EEZ (off Mecklenburg Vorpommern)	Observer observing on deck and when gear is hauled; self-sampling		all birds		4	0
17	only part of German EEZ (off Mecklenburg Vorpommern)	CCTV		all birds and marine mammals		4	4
18	only part of German EEZ (off Mecklenburg Vorpommern)	CCTV		all birds and marine mammals		4	0
19	spatial stratification: 3 GSAs, 12 subareas	Observer observing on deck and when gear is hauled, Observers are instructed to photograph the whole haul and every PET species they record	Landings: 100% Discards: 1 box, but at least 10% of the total discards	All fish species, crustaceans, molluscs, birds, sea turtles and mammals	All fish species, crustaceans, molluscs, birds, sea turtles and mammals	0	0

	Other stratification	Observation method	Approximate size of subsample of fish	Species / groups of species identified	Species / groups of species registered in national database	Perceived importance of these fisheries compared to other fisheries catch of birds	Perceived importance of these fisheries compared to other fisheries catch of mammals
20	spatial stratification: 3 GSAs, 12 subareas	Observer observing on deck and when gear is hauled, Observers are instructed to photograph every PET species they record	100% of the catch	All fish species, crustaceans, molluscs, birds, sea turtles and mammals	All fish species, crustaceans, molluscs, birds, sea turtles and mammals	0	0
21	spatial stratification: 3 GSAs, 12 subareas	Observer observing on deck and when gear is hauled, Observers are instructed to photograph every PET species they record	100% of the catch	All fish species, crustaceans, molluscs, birds, sea turtles and mammals	All fish species, crustaceans, molluscs, birds, sea turtles and mammals	0	0
22	spatial stratification: 3 GSAs, 12 subareas	Observer observing on deck and when gear is hauled, Observers are instructed to photograph every PET species they record	100% of the catch	All fish species, crustaceans, molluscs, birds, sea turtles and mammals	All fish species, crustaceans, molluscs, birds, sea turtles and mammals	1	1
23	spatial stratification: 3 GSAs, 12 subareas	Observer observing on deck and when gear is hauled, Observers are instructed to photograph every PET species they record	100% of the catch	All fish species, crustaceans, molluscs, birds, sea turtles and mammals	All fish species, crustaceans, molluscs, birds, sea turtles and mammals	1	1
24	spatial stratification: 3 GSAs, 12 subareas	Observer observing on deck and when gear is hauled, Observers are instructed to photograph every PET species they record	100% of the catch	All fish species, crustaceans, molluscs, birds, sea turtles and mammals	All fish species, crustaceans, molluscs, birds, sea turtles and mammals	1	1

	Other stratification	Observation method	Approximate size of subsample of fish	Species / groups of species identified	Species / groups of species registered in national database	Perceived importance of these fisheries compared to other fisheries catch of birds	Perceived importance of these fisheries compared to other fisheries catch of mammals
25	spatial stratification: 3 GSAs, 12 subareas	Observer observing on deck and when gear is hauled, Observers are instructed to photograph every PET species they record	100% of the catch	All fish species, crustaceans, molluscs, birds, sea turtles and mammals	All fish species, crustaceans, molluscs, birds, sea turtles and mammals	1	1
26	spatial stratification: 3 GSAs, 12 subareas	Observer observing on deck and when gear is hauled, Observers are instructed to photograph every PET species they record	100% of the catch	All fish species, crustaceans, molluscs, birds, sea turtles and mammals	All fish species, crustaceans, molluscs, birds, sea turtles and mammals	0	0
27	Management area	Inspector observing on deck when gear is hauled	No subsampling	All commercial fish species, all birds and mammals	All commercial fish species, all birds and mammals	4	4
28	Statistical square	Technicians counting and measuring all catch	No subsampling	All fish species, all commercial crustaceans, all birds and mammals	All fish species, all commercial crustaceans, all birds and mammals	3	3
29		Inspector observing on deck when gear is hauled	100 fish of main species	All commercial fish species, all birds and mammals	All commercial fish species, all birds and mammals	2	0
30		Inspector observing on deck when gear is hauled	100 fish of main species	All commercial fish species, all birds and mammals	All commercial fish species, all birds and mammals	1	1

	Other stratification	Observation method	Approximate size of subsample of fish	Species / groups of species identified	Species / groups of species registered in national database	Perceived importance of these fisheries compared to other fisheries catch of birds	Perceived importance of these fisheries compared to other fisheries catch of mammals
31		Inspector observing on deck when gear is hauled	100 fish of main species	All commercial fish species, all birds and mammals	All commercial fish species, all birds and mammals	0	1
32		Inspector observing on deck when gear is hauled	100 fish of main species	All commercial fish species, all birds and mammals	All commercial fish species, all birds and mammals	3	3
33		Inspector observing on deck when gear is hauled	100 fish of main species	All commercial fish species, all birds and mammals	All commercial fish species, all birds and mammals	0	0
34		Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds reptiles and mammals	All fish species, all commercial crustaceans, all birds mammals and Reptiles	1	1
35		Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds reptiles and mammals	All fish species, all commercial crustaceans, all birds mammals and Reptiles	1	1
36		Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds reptiles and mammals	All fish species, all commercial crustaceans, all birds mammals and Reptiles	1	1
37		Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds reptiles and mammals	All fish species, all commercial crustaceans, all birds mammals and Reptiles	2	2

	Other stratification	Observation method	Approximate size of subsample of fish	Species / groups of species identified	Species / groups of species registered in national database	Perceived importance of these fisheries compared to other fisheries catch of birds	Perceived importance of these fisheries compared to other fisheries catch of mammals
38		Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds reptiles and mammals	All fish species, all commercial crustaceans, all birds mammals and Reptiles	1	1
39		Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds reptiles and mammals	All fish species, all commercial crustaceans, all birds mammals and Reptiles	2	2
40		Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds reptiles and mammals	All fish species, all commercial crustaceans, all birds mammals and Reptiles	2	2
41		Observer observing on deck and when gear is hauled		All fish species, all birds, mammals and reptiles	All fish species, all birds mammals and Reptiles	1	1
42		Observer observing on deck and when gear is hauled		All fish species, all birds, mammals and reptiles	All fish species, all birds mammals and Reptiles	1	1
43		Observer observing on deck and when gear is hauled		All fish species, all birds, mammals and reptiles	All fish species, all birds mammals and Reptiles	1	1
44		Observer observing on deck and when gear is hauled		All fish species, all birds, mammals and reptiles	All fish species, all birds mammals and Reptiles	1	1

	Other stratification	Observation method	Approximate size of subsample of fish	Species / groups of species identified	Species / groups of species registered in national database	Perceived importance of these fisheries compared to other fisheries catch of birds	Perceived importance of these fisheries compared to other fisheries catch of mammals
45		Observer observing on deck and when gear is hauled		All fish species, all birds, mammals and reptiles	All fish species, all birds mammals and Reptiles	1	2
46		Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds reptiles and mammals	All fish species, all commercial crustaceans, all birds mammals and Reptiles	1	1
47		Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds reptiles and mammals	All fish species, all commercial crustaceans, all birds mammals and Reptiles	1	1
48		Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds reptiles and mammals	All fish species, all commercial crustaceans, all birds mammals and Reptiles	1	1
49		Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds reptiles and mammals	All fish species, all commercial crustaceans, all birds mammals and Reptiles	1	1
50		Observer observing on deck and when gear is hauled		All fish species, all birds, mammals and reptiles	All fish species, all birds mammals and Reptiles	1	1
51	No at sea programme	Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds reptiles and mammals	All fish species, all commercial crustaceans, all birds mammals and Reptiles	1	1

	Other stratification	Observation method	Approximate size of subsample of fish	Species / groups of species identified	Species / groups of species registered in national database	Perceived importance of these fisheries compared to other fisheries catch of birds	Perceived importance of these fisheries compared to other fisheries catch of mammals
52	Only scallop trips targeted	Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds reptiles and mammals	All fish species, all commercial crustaceans, all birds mammals and Reptiles	1	1
53		Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds reptiles and mammals	All fish species, all commercial crustaceans, all birds mammals and Reptiles	1	1
54		Observer observing on deck and when gear is hauled; observer takes basket of the catch during sorting of the catch		All fish species, all birds, mammals and turtles	All fish species, all birds, mammals and turtles	1	1
55		Crew collects a fishing crate of discards in random hauls and transport to the lab		All fish species, crustaceans and benthos	All fish species, crustaceans and benthos	0	0
56		Observer takes record of the hauling process and indicates if part is missing		All fish species, all birds, mammals and turtles	All fish species, all birds, mammals and turtles	2	1
57		Observer observing on deck and when gear is hauled		All fish species, birds, mammals, crustaceans and benthos	All fish species, crustaceans and benthos	0	0
58		Observer takes record of the hauling process.		All mammal species	All mammal species	2	3

	Other stratification	Observation method	Approximate size of subsample of fish	Species / groups of species identified	Species / groups of species registered in national database	Perceived importance of these fisheries compared to other fisheries catch of birds	Perceived importance of these fisheries compared to other fisheries catch of mammals
59		Electronic Monitoring		Only harbour porpoises	Only harbour porpoises	2	1
60		Observer observing on deck and when gear is hauled	100 kg	All fish species, all commercial and no commercial invertebrates at different taxon level, all birds and mammals	All fish species, all commercial and no commercial invertebrates at different taxon level, all birds and mammals	1	1
61		Observer observing on deck and when gear is hauled	100 kg	All fish species, all commercial and no commercial invertebrates at different taxon level, all birds and mammals	All fish species, all commercial and no commercial invertebrates at different taxon level, all birds and mammals	1	0
62	Pair trawlers and Otter trawlers	Observer observing on deck and when gear is hauled	100 kg	All fish species, all commercial and no commercial invertebrates at different taxon level, all birds and mammals	All fish species, all commercial and no commercial invertebrates at different taxon level, all birds and mammals	1	1 for trawlers 2 for pair trawlers
63		Observer observing on deck and when gear is hauled	100 kg	All fish species, all commercial and no commercial invertebrates at different taxon level, all birds and mammals	All fish species, all commercial and no commercial invertebrates at different taxon level, all birds and mammals		
64		Questionnaires		seabirds and cetaceans	seabirds and cetaceans	2 for some gears (gillnets and longlines	0

	Other stratification	Observation method	Approximate size of subsample of fish	Species / groups of species identified	Species / groups of species registered in national database	Perceived importance of these fisheries compared to other fisheries catch of birds	Perceived importance of these fisheries compared to other fisheries catch of mammals
65		Self-sampling/reporting from Skippers		All fish species, all commercial and no commercial invertebrates at different taxon level, all birds and cetaceans	All fish species, all commercial and no commercial invertebrates at different taxon level, all birds and mammals	2 for some gears (gillnets and longlines	0
66		Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds and mammals	All fish species, all commercial crustaceans,	1	1
67		Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds and mammals	All fish species, all commercial crustaceans,	1	1
68		Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds and mammals	All fish species, all commercial crustaceans,	1	1
69		Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds and mammals	All fish species, all commercial crustaceans,	1	1
70		Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds and mammals	All fish species, all commercial crustaceans,	1	1
71		Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds and mammals	All fish species, all commercial crustaceans,	1	1

	Other stratification	Observation method	Approximate size of subsample of fish	Species / groups of species identified	Species / groups of species registered in national database	Perceived importance of these fisheries compared to other fisheries catch of birds	Perceived importance of these fisheries compared to other fisheries catch of mammals
72		Observer observing on deck and when gear is hauled		All fish species, all birds and mammals	All fish species,	1	1
73		Observer observing on deck and when gear is hauled		All fish species, all commercial crustaceans, all birds and mammals	All fish species, all commercial crustaceans, all birds and mammals	3	2
74	area, target species	on-board observer	n/a	all, protected species numbers, commercial/non-commercial species catch weight estimate	fish, mammals, seabirds, reptiles, crustaceans benthos.	2	3
75		on-board observer	n/a	all, protected species numbers, commercial/non-commercial species catch weight estimate	fish, mammals, seabirds, reptiles, crustaceans benthos.	1	3
76	area, target species	on-board observer	n/a	all, protected species numbers, commercial/non-commercial species catch weight estimate	fish, mammals, seabirds, reptiles, crustaceans benthos.	1	2
77		on-board observer	n/a	all, protected species numbers, commercial/non-commercial species catch weight estimate	fish, mammals, seabirds, reptiles, crustaceans benthos.	1	2

	Other stratification	Observation method	Approximate size of subsample of fish	Species / groups of species identified	Species / groups of species registered in national database	Perceived importance of these fisheries compared to other fisheries catch of birds	Perceived importance of these fisheries compared to other fisheries catch of mammals
78		on-board observer	n/a	all, protected species numbers, commercial/non-commercial species catch weight estimate	fish, mammals, seabirds, reptiles, crustaceans benthos.	1	1

Table 1.d Inventory of sampling programmes where bycatches are recorded. In future, this inventory is intended to be placed in an online repository – ICES is currently working on a solution. In tables 1.a, 1.b, and 1.c on the previous pages, more columns are presented – rows can be coupled according to the number in the column furthest to the left.

	Perceived importance of these fisheries compared to other fisheries catch of PET fish species	Perceived importance of these fisheries compared to other fisheries catch of elasmobranchs	Perceived importance of these fisheries compared to other fisheries catch of reptiles	Source: where can these data be found	End-user of PET data
1	2	1	0		national use, ICES WGBYC
2	1	1	0		national use, ICES WGBYC
3	1	1	0		national use, ICES WGBYC
4	1	1	0		national use, ICES WGBYC
5	1	1	0		national use, ICES WGBYC
6	1	1	0		national use, ICES WGBYC
7	1	1	0		national use, ICES WGBYC
8	1	1	0		national use, ICES WGBYC
9	1	1	0		national use, ICES WGBYC
10	1	1	0		national use, ICES WGBYC
11	1	1	0		national use, ICES WGBYC
12	1	1	0		national use, ICES WGBYC
13	4	1	0		national use, ICES WGBYC

	Perceived importance of these fisheries compared to other fisheries catch of PET fish species	Perceived importance of these fisheries compared to other fisheries catch of elasmobranchs	Perceived importance of these fisheries compared to other fisheries catch of reptiles	Source: where can these data be found	End-user of PET data
14	4	1	0	Bellebaum 2011: Untersuchung und Bewertung des Beifangs von Seevögeln durch die passive Meeresfischerei in der Ostsee. BfN-Skr. 295	national use
15	4	1	0	Bellebaum 2011: Untersuchung und Bewertung des Beifangs von Seevögeln durch die passive Meeresfischerei in der Ostsee. BfN-Skr. 295	national use
16		1	0	Bellebaum 2011: Untersuchung und Bewertung des Beifangs von Seevögeln durch die passive Meeresfischerei in der Ostsee. BfN-Skr. 295	national use
17	4	1	0	Oesterwind et al. 2012: Pilotstudie zur Dokumentation von Seevogel und Meeressäugerbeifängen in der Stellnetzfischerei der Fischereigenossenschaft Freest im Gebiet um Rügen. Zwischenbericht 2012.	national use
18		1	0	Oesterwind et al. 2012: Pilotstudie zur Dokumentation von Seevogel und Meeressäugerbeifängen in der Stellnetzfischerei der Fischereigenossenschaft Freest im Gebiet um Rügen. Zwischenbericht 2012.	national use
19	2	2	1		national use, GFCM
20	0	0	0		national use, GFCM
21	0	0	0		national use, GFCM
22	2	2	1		national use, GFCM
23	2	2	1		national use, GFCM
24	1	1	1		national use, GFCM
25	1	1	1		national use, GFCM
26	1	1	0		national use, GFCM
27	0	0	0		national use, ICES WGBYC

	Perceived importance of these fisheries compared to other fisheries catch of PET fish species	Perceived importance of these fisheries compared to other fisheries catch of elasmobranchs	Perceived importance of these fisheries compared to other fisheries catch of reptiles	Source: where can these data be found	End-user of PET data
28	1	1	0		national use, ICES WGBYC
29	1	1	0		national use, ICES WGBYC
30	1	1	0		national use, ICES WGBYC
31	1	1	0		national use, ICES WGBYC
32	1	1	0		national use, ICES WGBYC
33	1	1	0		national use, ICES WGBYC
34	1	1	NA		national use, ICES WGBYC
35	1	1	NA		national use, ICES WGBYC
36	1	1	NA		national use, ICES WGBYC
37	2	2	NA		national use, ICES WGBYC
38	1	1	NA		national use, ICES WGBYC
39	2	2	NA		national use, ICES WGBYC
40	2	2	NA		national use, ICES WGBYC
41	1	1	NA		national use, ICES WGBYC

	Perceived importance of these fisheries compared to other fisheries catch of PET fish species	Perceived importance of these fisheries compared to other fisheries catch of elasmobranchs	Perceived importance of these fisheries compared to other fisheries catch of reptiles	Source: where can these data be found	End-user of PET data
42	1	1	NA		national use, ICES WGBYC
43	1	1	NA		national use, ICES WGBYC
44	1	1	NA		national use, ICES WGBYC
45	1	1	NA		national use, ICES WGBYC
46	1	1	NA		national use, ICES WGBYC
47	1	1	NA		national use, ICES WGBYC
48	1	1	NA		national use, ICES WGBYC
49	1	1	NA		national use, ICES WGBYC
50	1	1	NA		national use, ICES WGBYC
51	1	1	NA		national use, ICES WGBYC
52	1	1	NA		national use, ICES WGBYC
53	1	1	NA		national use, ICES WGBYC
54	1	1	0		national use, ICES WGBYC
55	1	2	0		National use
56	1	1	0		national use, ICES WGBYC

	Perceived importance of these fisheries compared to other fisheries catch of PET fish species	Perceived importance of these fisheries compared to other fisheries catch of elasmobranchs	Perceived importance of these fisheries compared to other fisheries catch of reptiles	Source: where can these data be found	End-user of PET data
57	0	1	0		National use
58	1	1	0		National use
59	1	1	0		national use, ICES WGBYC
60	1	2	0		national use, ICES WGBYC
61	1	2	0		national use, ICES WGBYC
62	1 for trawlers 2 for pair trawlers	2	0		national use, ICES WGBYC
63			0		National use
64	2 for some gears (gillnets and longlines	1 for some gears (gillnets and longlines)	0		National use
65	2 for some gears (gillnets and longlines	1 for some gears (gillnets and longlines)	0		National use
66	2	2			national use, ICES WGBYC
67	1	1			national use, ICES WGBYC
68	3	3			national use, ICES WGBYC
69	1	2			national use, ICES WGBYC
70	3	3			national use, ICES WGBYC
71	1	1			national use, ICES WGBYC
72	1	1			national use, ICES WGBYC

	Perceived importance of these fisheries compared to other fisheries catch of PET fish species	Perceived importance of these fisheries compared to other fisheries catch of elasmobranchs	Perceived importance of these fisheries compared to other fisheries catch of reptiles	Source: where can these data be found	End-user of PET data
73	1	1			national use, ICES WGBYC
74	1	2	1		National government, EU Commission, ICES, Fishing Industry, Accreditation schemes, NGO's
75	1	3	1		National government, EU Commission, ICES, Fishing Industry, Accreditation schemes, NGO's
76	1	1	1		National government, EU Commission, ICES, Fishing Industry, Accreditation schemes, NGO's
77	1	2	1		National government, EU Commission, ICES, Fishing Industry, Accreditation schemes, NGO's
78	1	1	1		National government, EU Commission, ICES, Fishing Industry, Accreditation schemes, NGO's

Annex 6: Recommendations

RECOMMENDATION	ADRESSED TO
1. To review the suggested data fields for the Regional Database and Estimation System (RDBES) and further recommend to the RDBES steering committee to implement these.	WGBYC
2. To review the risk assessment method as applied by the Workshop on Bycatch of Cetaceans and other Protected Species in 2013 and further developed in the European funded FishPi project and carry similar risk assessments for the areas that have not been covered by the fishPi project so far (the Baltic, the Mediterranean and Black sea).	WGBYC
3. To gather and maintain an inventory of various programmes that include the sampling of protected, endangered and threatened species (PETS) conducted by ICES nations. This includes regular sampling at sea programmes under the Data Collection Framework (DCF), other national sea sampling programmes and studies that target PETS bycatch directly (various directed studies, small and large scale).	WGBYC