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Scientific, Technical and Economic Committee for Fisheries (STECF)

Landing obligation in EU fisheries (STECF-13-23)

This report was reviewed by the STECF during the 44TH plenary meeting held from 4 to 8 November 2013 in Brussels

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Landing obligation in EU fisheries (STECF-13-23)

THIS REPORT WAS REVIEWED DURING THE PLENARY MEETING HELD IN BRUSSELS, 4-8 NOVEMBER 2013

Background

Article 15 of the new CFP Basic Regulation (BR) recently agreed by the European Parliament and the Council, introduced a discard ban or landing obligation. This represents a fundamental shift in fisheries policy. The final text agreed by the Council and European Parliament includes a number of exemptions and flexibility tools that raise issues for implementation, catch forecasting, stock assessment and control and monitoring. The European Commission has requested STECF and ICES to consider these issues. At a scoping meeting involving STECF and the ICES Secretariat held during the summer plenary of STECF these issues were discussed and a draft work plan agreed between STECF and ICES of how to address them.

Request to the STECF

STECF is requested to review the report of the STECF Expert Working Group, evaluate the findings and make any appropriate comments and recommendations.

Observations of the STECF

The meeting of EWG 13-16 is the first of several intended STECF meetings addressing the issue of landing obligations for EU fishing fleets. The next meeting (EWG 13-17) is already planned for 26th-28th November 2013.

The EWG 13-16 report highlights that there are a number of interpretational issues relating to the *de minimis* exemptions described in Article 15 of the the basic regulation. It is unclear whether these exemptions are meant to apply at a MS level or can be cumulative across MSs. Similarly, it is unclear whether these exemptions should apply at the individual species level or for all species combined. Regarding inter-species quota flexibilities, it is unclear whether the so-called ‘donor’ quota was intended to be provided at the individual vessel level, at fleet level or at Member State or regional level and whether the donor quota is restricted to single or multiple species, as ’target-species’ is not defined.

The inter-species quota flexibility and the *de minimis* provisions can provide flexibility in the system to better adjust catch compositions to resemble fishing opportunities and increase both ecological and economic sustainability. However, depending on how the text in the regulation is interpreted, which and in which sequence these flexibilities are used the same provisions could be used to legally increase catches well in excess of desired or intended levels. STECF observes that the report identifies a number of important factors that will require careful consideration, if negative and unintended consequences are to be avoided.

STECF notes that any detailed rules that are made to implement the landings obligations will create several new restrictions, opportunities and incentives. Hence, before being finalised and agreed, STECF considers that proposed new rules should be carefully scrutinized to identify what business incentives they create for fishing-business owners and therefore what the responses of fishing-business operators are likely to be. In short, proposed new rules should be tested for unintended and undesired consequences.

STECF notes that the EWG 13-16 compiled an interesting and valuable spreadsheet comparing the time series of catch data held by ICES and STECF, which indicates that discrepancies between the two data sources has decreased in recent years. The report also proposes which data are the most appropriate to use for discard estimates.

STECF observes that EWG 13-16 addressed the important issue of control and enforcement in relation to the landing obligation, and that these aspects should be considered an important part of future discussions.

Conclusions of the STECF

Based on the findings in the report of the EWG 13-16, the STECF concludes that the EWG 13-16 report represents an important step in identifying and assessing some of the key issues associated with the landing obligations and will be an important aid for those developing and assessing regional management plans.

Noting that time to provide advice on the development and assessment of discard plans and regional management plans is limited (for the pelagic stocks and for salmon in the Baltic Sea, plans need to be submitted by June 2014) and many issues still need to be resolved, STECF concludes that the most important challenges to address include the following:

- Defining management units (e.g. stocks, areas, fisheries). As an example: the pelagic fisheries should apply the landing obligation from 2015 onwards, and can be approached in many different management units involving very different combinations of Member States and Advisory Councils. Discard plans could possibly be submitted for different combinations of area, species, stock, catching method, vessel type and other relevant aspects of the fishing activity.
- Dealing with third countries (e.g. Norway)
- Defining Minimum Conservation Reference Sizes (again with no clear objective, but with major implications for the marketing of the catch and the economics of catching businesses
- Develop the criteria to evaluate discard plans (Impact Assessment indicators)
- Outlining a process for developing discard plans
- The effect of exemptions and de-minims on control, enforcement and compliance levels

STECF concludes that the EWG 13-16 adequately addressed the majority of the Terms of Reference although further exploration of some highlighted issues is required especially in the context of developing regional discard plans. These will be addressed at the forthcoming expert group meeting (EWG 13- 17) to be held in Dublin from 26-28 November 2013.

STECF endorses the findings presented in the report of the EWG 13-17.

Expert Working Group EWG-13-16 report

Report to the STECF

EXPERT WORKING GROUP ON

Landing obligation in EU fisheries

(EWG-13-16)

Varese, Italy, 9-13 September 2013

1 EXECUTIVE SUMMARY

The introduction of the obligation to land all catches in the recent reform of the Common Fisheries Policy (CFP) represents a fundamental shift in the management approach to EU fisheries switching the focus from the regulation of landings to catches. The landing obligation included under Article 15 of the new CFP basic regulation prohibits the discarding of species subject to catch limits (i.e. TAC and quota species) as well as those subject to minimum size limits in the Mediterranean. It contains a number of exemptions namely species not covered by catch limits; species where high survivability can be demonstrated; prohibited species, limited volumes of permissible discards which can be triggered under certain conditions, the so called de minimis exemptions, as well as inter-species and inter-annual quota flexibility mechanisms.

Following joint STECF/ICES discussions on the landing obligation, a number of scientific and technical issues were identified as having significant implications for implementation of the landing obligation requiring further analysis. These were:

(i) survival;

(ii) de minimis and quota flexibility;

(iii) catch estimation;

(iv) horizontal control, monitoring and enforcement; and

(v) considerations and support for development of discard plans.

STECF noted that these raised important considerations for catch forecasting, stock assessment and control and monitoring. The expert group (EWG 13-16) was set up specifically to explore these issues with the intention to provide advice and guidance for the Commission, Member States and the industry to assist in the implementation of the landing obligation. As identified in the initial review carried out by STECF/ICES, several elements of Article 15 i.e. de minmis, survival and quota flexibilities are open to different interpretations and depending on how these elements are operationalised, could result in quite diverse and unintended consequences. The expert group considered these elements using worked examples and provided a range of outcomes depending on the different interpretations. Where appropriate the potential negative consequences on fish stocks of the mechanisms embedded in the regulation have been highlighted. In addition the EWG looked at STECF and ICES landings and discard data to begin a process for agreeing a single estimate of catch that will be necessary to establish catch quotas under the landing obligation. The group also considered control, enforcement and monitoring given they are key horizontal issues associated with the successful implementation of the landing obligation. The opinions of expert group are solely intended to provide guidance and support to those with responsibility for the formulation of regional discard plans and/or multiannual plans and not as a critique of the policy itself.

Survival issues: Research has shown that not all discards die. In some cases, the proportion of discarded fish that survive can be substantial, depending on the species, fishery and other technical, biological and environmental factors. Article 15 paragraph 2(b) of the regulation allows for the possibility of exemptions from the landing obligation for species for which "*scientific evidence demonstrates high survival rates*". Taking the first element of this –

"scientific evidence"- it is important that managers have guidance on protocols and methodologies that should be followed in order to ensure the results of such experiments are scientifically robust. Presently there are no such internationally agreed guidelines. EWG 13-16 therefore has provided guidance on best practice to undertake survival studies. This includes a detailed description of the methodological approaches available, their advantages and disadvantages and what factors need to be considered when undertaking such studies including sample sizes, selection and treatment of specimens and protocols for the various methods. In this regard EWG 13-16 has identified three methodologies for conducting survival experiments i.e. captive observations, vitality/reflex assessments and tagging/biotelemetry experiments. The intention is that this initial analysis will be followed up by an ICES expert group with the express intention of publishing guidelines for the conduct of discard survival studies.

Managers also require guidance on the second element of this provision – "high survival rates". EWG 13-16 was therefore asked provide an objective framework to identify what constitutes “high survival”. However, on the basis of the analysis carried out, EWG 13-16 concluded that the term “high survival” is somewhat subjective. From the perspective of waste minimisation, it could be viewed that the minimum level of survival that could be considered as high is where *true* survival (as opposed to experimentally *observed* survival) is greater than 50%. Put simply, any value less than this would result in a greater proportion of fish dying than those surviving and simply means that less of the resource is wasted (as dead fish) than is returned alive, to contribute to the stock biomass. However, defining a single value cannot be scientifically rationalised and therefore EWG 13-16 advises that assessing proposed exemptions on the basis of "high survival" need to be considered on a case-by-case basis taking account the specificities of the species and fisheries involved.

EWG 13-16 also looked at the potential impacts of exemptions for survival on fishing mortality, SSB and associated reference points. Obliging fishermen to land catches of fish that would otherwise have survived the discarding process could, in some specific cases, result in negative consequences for the stock, the rationale for excluding species meeting high survival criteria. This is because any surviving discarded fish contributes positively to the stock and landing those individuals therefore removes that benefit. This in effect increases fishing mortality. However, the potential impact is heavily dependent on a number of factors including the age structure of the discards; discard survival rates at age; natural mortality at age; the contribution discards make to the overall catch and; the overall status of the stock. The worked example show that where there is >50% survival across all age groups, then landings these fish would result in ~30% reduction is stock biomass (after 20 years) assuming no change in selectivity. Where discard survival is lower with younger age groups the effect is far less pronounced (~6%). The other example provided shows that in order to maintain catches within predefined targets e.g. Fmsy, then it would be necessary to reduce fishing opportunities in order to compensate for the contribution surviving discards had previously made to the stock. Furthermore, the choice to exempt a particular species is a “trade-off” between the stock benefits of the continued discarding of "high" survivors, which can be estimated through established forecasting models, and the potential removal of incentives to change exploitation pattern by allowing discarding. EWG 13-16 advises that such an evaluation should also consider the potential benefits for other stocks and the broader ecosystem that would arise from changes in exploitation pattern. EWG 13-16 considers that avoidance of unwanted catch should be the primary focus of such considerations and take precedence over the application of exemptions based on high survival. EWG 13-16 notes that in cases where exemptions are provided it will be necessary, to document the weight and age composition of discarded catches for accurate estimation of fishing mortality where discard survival rates are less than 100%.

De minimis and inter-species quota flexibility. These provisions are intended to provide some departure from the landing obligation and provide flexibility to account for unpredictable and unavoidable catches. EWG 13-16 considered them both individually and also considered there potential cumulative effects if used in tandem.

EWG 13-16 has identified that there are a many ways to interpret the wording of the de minimis exemption contained in Article 15(2c) of the regulation and this has substantial bearing on the potential impact of this exemption. EWG 13-16 identified many different interpretations around whether the de minimis should apply at an individual member state or across several states involved in a fishery or region and whether it should apply at the individual species level or for all species combined. At an operational level it could apply at an individual vessel, fleet, member state or regional (multi- state) level. This also implies that different operational approaches may be required (e.g from a catch monitoring and compliance perspective) depending on the interpretation and application. Given this, EWG13-16 considered the potential impacts of theoretical examples based on conservative and extreme applications of the rule to demonstrate the potential impacts. This analysis showed that under a single species ‘de minimis’ example where the 5% threshold included in the regulation is applied to only one target species, then the overall discard "allowance" is quite modest provided it is recorded accurately to ensure compliance. Conversely, if the 5% applies to the whole catch available to the fishery unit it can result in catches could substantially exceed advised levels for a chosen species.

The regulation contains two conditionalities for triggering the application of de minimis exemptions. These are defined as where "improvements in selectivity are considered to be very difficult" and where "disproportionate costs of handling unwanted catches do not represent more than a certain percentage”. These conditionalities were considered by EWG13-16 and a first attempt was made to provide some metrics that would allow assessment of whether individual cases would qualify for the exemption.

The first condition – "improvements in selectivity are considered to be very difficult” is subjective and EWG 13-16 interpreted as a technical restriction where gears cannot be improved to become more selective. Based on purely technical grounds there are numerous ways in which gears or fishing tactics could be used to avoid unwanted fish but at certain level, the changes in fishing practices are likely to lead to a significant reduction in their economic performance, either through lower catches and/or increased costs. EWG 13-16 concludes that it is more likely to be the economic implications of improving selectivity (lower revenues and or higher costs) rather than a technical issue that leads to ‘difficulty’. On this basis EWG 13-16 tested the ‘current revenue to break even revenue ratio economic balance indicator’, as currently used under the Balance and Capacity reporting requirements, as an appropriate indicator to use in this scenario. EWG 13-16 recognises that this has potential but requires further analysis and refinement before it can be considered an appropriate evaluation tool.

The second conditionality relates to “disproportionate costs of handing unwanted”. On first reading, it would appear that there is a requirement to identify what constitutes “disproportionate cost”. However, EWG 13-16 interpreted that disproportionate costs are simply assumed to be already occurring and that the key aspect of the regulation is how to define when the unwanted catch is “below a certain percentage of the total catch of that gear” how to set the “the percentage unwanted” and how this should be implemented in a discard plan. The general expectation is that this would be relatively low e.g. in line with the de minimis allowance itself. However, if the intention is for the de minimis (5%) to be an overall value that a Member State must not exceed (e.g. a MS specific discard cap), it appears that this gives some flexibility for a MS to apply the de minimis to any gear they choose regardless of the discard rate as long as they stay within their specific discard cap. The regulation leaves it up to the regional groups developing a specific plan to establish the appropriate values. EWG 13-16, points out that too high a percentage of unwanted catches might encourage the inappropriate use of de minimis and in practise might allow significant discarding to occur. If de minimus is implemented widely without sufficient supervision and thus a low probability of detecting continued discarding (<5%) conceptually there is a potential for fishers to use de minimus as a defence in a prosecution for failing to comply with the landing obligation

EWG113-16 also considered the inter-species quota flexibility provision contained in the regulation. It offers a way of transferring quota from a target species (donor) to a non-target species (recipient) although 'target species' is not defined. It appears that this mechanism was introduced to alleviate the problem of so-called "choke species". Through theoretical examples EWG 13-16 has demonstrated how used correctly it can provide economic benefits. As such it provides a tool for "balancing the books" by providing a means to cover catches of species for which a vessel may not have a quota entitlement. However, EWG 13-16 has also demonstrated that used speculatively to exchange the quota from a high volume/low value species to a low volume/high value species, it carries the risk of elevating fishing mortality on the recipient species. This is further enhanced if multiple transfers are made from different donor species to a single recipient species or if 'target species' is taken to mean a several species which are 'targeted' together, and a cumulative, single large transfer were to be made. Depending on the operational level, this provision may require additional data management development to manage quotas and, particularly if operated at the vessel level, implies sophisticated real-time management. Further, it is unclear whether transfer between stocks with different geographic range (e.g. transfer between Northern Hake and North Sea cod) could potentially result in member states gaining access to fishing areas that had they are currently excluded from. The regulation for inter-species quota flexibility also stipulates that the recipient non-target stock(s) must be within safe biological limits. For the provision to be of assistance in implementing the landing obligation, in what appears to be the intended way, a reasonable number of non-target/choke species need to meet the condition of within safe biological limits. However, by their very nature such stocks typically fall into the 'data-limited' category for which limit reference points have not been agreed. In practice, this will limit the scope for quota transfers to recipient species until such time as limit reference points (or suitable proxies are agreed) and that those stocks are shown to be within those limits.

Given the variation in plausible outcomes, EWG 13-16 advises that regional groups involved in the development of discard plans, should pay careful attention to their choice of interpretation of de minimis and the use of inter-species quota flexibility to ensure that no unintended consequences result. To this end it is important to note that Article 2 of the CFP basic regulation stipulates that the precautionary approach to fisheries management shall apply and that exploitation should be consistent with the achievement of maximum sustainable yield. Used irresponsibly, the de minimis rule would lead to overexploitation above MSY and in extreme cases have serious impacts on stock sustainability.

EWG 13-16 concludes that the use of these provisions would provide a useful means to allow continued fishing on so-called “choke species”. By applying the quota transfer it would be possible in some cases to adjust discard rate downward such that the de minimis would then apply and the fishery can continue. It is also clear, however, that the cumulative effects of de minimis and quota flexibility offers considerable scope to generate large catches of a species with the attendant risk that fishing mortality would rise. The order in which the provisions are applied (and multiple application of the provisions) also has a profound effect.

ICES and STECF catch estimates. Previous work has highlighted significant differences in catch (particularly discard) estimates contained in ICES (Intercatch) and the STECF effort databases. There is a clear need and desire to provide an agreed single estimate of catch given that the setting of future fishing opportunities will need to take account of previous discard levels. Both STECF and ICES receive data on landings and discards submitted by MS through both official channels and from scientists. The analysis carried out by EWG 13-16 is based on the assumption that MS have submitted accurate landing data and representative discard sample data. Official logbook data are another source of information on catch, however, one comparison of scientific estimates and log book declarations of total catch indicated that log books probably provide a gross underestimate of current discards. Based on the STECF data and ICES information, EWG 13-16 classified stocks into three groups:

(I) stocks where ICES indicates that discarding is considered negligible and STECF estimates that discarding is less than 10%;

(II) stocks for which detailed data on catch is available from both ICES and STECF and

(III) for which either ICES or STECF indicate that significant (>10%) discarding occurs and currently ICES does not present discard data in the advice sheets.

EWG 13-16 notes that for many pelagic species, discard estimates do not include catches that have been ‘slipped’, where the catch is retained by the gear and subsequently released without taking the gear on board. Studies have shown that survival is low and therefore failure to record these catches can result in a significant underestimation of fishing mortality.

For group (I) stocks, previous analyses have shown significant differences between ICES and STECF discard estimates. However, the analysis undertaken by EWG 13-16 shows that there is a general convergence in the ICES and STECF estimates and in the vast majority of cases, the differences are less than 10%. Consequently, the EWG 13-16 concluded that the ICES estimates should be considered the definitive estimates for the basis of assessments and catch forecasts. In such cases, as discards levels are low, future catch quotas will not be significantly greater than the corresponding landings quotas.

For group (II) stocks, where detailed catch and landings data are available, the EWG 13-16 concluded that the ICES estimates should be considered the definitive estimates for the basis of assessments and catch forecasts. For such stocks, future catch quotas are likely to be significantly higher than the corresponding landings quotas. For group (III) stocks, where there is evidence of significant discarding but ICES does not or is unable to provide catch advice, the EWG 13-16 was only able to provide a provisional evaluation on a stock by stock basis as to why there is a lack of overall catch value. Nevertheless, the provisional analysis gave some guidance on if and how catch advice could be provided in future. Collaboration between experts working within ICES and STECF may be required to address this further.

EWG 13-16 noted that for some stocks (eg Irish Sea cod; West of Scotland Cod) the target fishing mortality has been reduced considerably in an attempt to control catches. This has made landings very restrictive and has led to large-scale discarding of over-quota fish as catches well exceed allocated TACs. In such circumstances, EWG 13-16 advises that managers should carefully consider how to handle such stocks when moving from landings to catch quotas. If the catch quota allocated is derived from the total catches then there is a real danger of over exploitation. This issue probably requires further discussion between ICES and the Commission to agree on the basis for catch advice for such stocks.

There are other important considerations when deriving catch quotas to include estimates of discards. Typically, discard estimates are derived from relative small samples (trips) when compared to the overall fleet effort. This means that for many stocks, discard estimates are derived using high raising factors. This will inevitably lead to rather uncertain catch estimates and advice. Additionally, in cases where a very large proportion of the catches are discarded (e.g. plaice, dab), managers should consider if setting catch quotas which are multiples of the current landings is the appropriate management response for these stocks. In such circumstances, if the discard rate is seriously underestimated setting TACs could result in creating an unintended choke species. Conversely, if the discard rate is seriously overestimated such an approach could lead to unintended overexploitation. Further discussion is required on how best to set catch quotas for such stocks.

Issues relating to Control, monitoring and Enforcement (CME). The ability for Member States to control, monitor and enforce the landing obligation is key to successful implementation of the landing obligation. While these aspects are generally dealt with in other fora, they do have a direct bearing on and are inexorably linked to a number of key scientific, technical and economic issues, particularly relating to the provision of reliable catch statistics which are used as a core input into stock assessments and the provision of scientific advice. Therefore a number of control experts participated in EWG 13-16 specifically to deal with these issues. Much of the work of the control experts focussed on the utility of the current systems for documentation of landings and discards and whether changes were required in the current reporting procedures. It was concluded that the current system works reasonably well as a data capture system but the current scope requires broadening to improve resolution in terms of catch reporting, including potential issues with permitted tolerances between declared and actual landings; estimating quantities of legitimate discards; current levels of fleet coverage and availability of data at an operational level (e.g. haul-specific information). The expert group notes that the regulation provides a definition of catches which may be open to interpretation, particularly with regard to catches not taken onboard the vessel, but returned or ‘slipped’ back into the sea. It is considered important that for the provision of accurate catch information that such catches should be considered under the definition of discards in order to ensure adequate precision in estimates of fishing mortality.

It is important that catches of species not subject to the landings obligation are documented as such information is important for stock assessment and broader ecological studies. Under the current EU control regulation, it is mandatory for masters to record discards by species if they exceed 50kg. However, anecdotal information suggests that the reliability of the data is questionable and the 50kg threshold is too high to capture information for many species. A limited analysis, comparing reported discard estimates with those obtained by scientific observers showed significant discrepancies between the two, with the reported catch being only 0.06% of the weight recorded by the scientific observer. This shows that reliability of discard estimates derived from EU logbooks represents a gross underestimation when compared to scientific observer data and that reliance on such data for monitoring the volume of discards is insufficient and unadvisable.

The advantages and disadvantages of the relevant control tools in the context of the landings obligation and how they could contribute with compliance and the accurate reporting of catches were also considered. The review considered the use of remote electronic monitoring systems (REM) such as those CCTV type systems currently being piloted. The general view is that these systems can provide continuous coverage and highly resolved information, but their use in terms of assessment of catches is dependent on the nature of the fishery and species mix. Likewise control observers can provide continuous monitoring of fishing operations, and in particular act as a strong deterrent against illegal discarding, but deployment across entire fleets would be very expensive. At-sea control through the use of patrol vessels has the advantage in that the systems are well established and their presence acts as a strong deterrent, but coverage is discontinuous and can only verify catch documentation at time of boarding and in general is likely to have a low sensitivity to detect illegal discarding. At-sea inspection with aircraft, although expensive, can cover large areas in a relatively short period of time, and while coverage is discontinuous, aircraft are able to detect discarding, however where exemptions (de minimis, survival) are in place it cannot be ascertained whether the discards are legal or not for both types of at-sea inspection.

The effectiveness of the control activities outlined above can be enhanced by considering the risk of non-compliance, and then targeting appropriate control activities to verify compliance. Integrating information from the different sources can be used in a risk analysis framework, using pre-defined expected baselines, and using disparate data to detect potential outliers. Control can then be focussed on the 'outliers'.

The expert group considers that effective compliance requires a 'level playing field' in terms on monitoring, control and enforcement of the landings obligation and note that sanctions need to be proportionate not only to offence, but also to the risk of detection.

All exemptions from the landing obligation are a reason for legitimate discarding. As such their implementation will definitely add to the challenges faced in understanding of the incoming obligations by fishers, and in the work of control authorities in promoting and verifying compliance. Clarity for what the 'de minimis' provisions (and indeed all exemptions from the landing obligation) are therefore important in order to design appropriate CME systems.

It is important to note that there is a continued requirement for the collection of scientific data from commercial fishing trips. This could potentially lead to a situation where there are two types of observer, a control observer, who is empowered to enforce the landings obligation and the associated exemptions/flexibilities and scientific observers for the exclusive collection of biological data. In practice, carriage of the latter tends to be almost exclusively down to the goodwill of the master rather than any legal obligation. A future system with observers with very differing functions is likely to lead to confusion regarding roles and may undermine the current goodwill. EWG 13-16 is unable to state what the potential impacts may be on the current scientific observer programmes, but this may need further consideration as a move to the landings obligation may undermine the availability of data currently being collected by scientific observers and as such may have implications for national operational programmes. Regardless of whether the current observer programmes are untenable due to the above issues, there will be a need for a more fundamental review of both the scientific and control observer roles, moving towards dual functionality of 'science and compliance'.

Developing guidelines for discard management plans. The expert group was unable to fully address this term of reference as it was important to review and evaluate the constitute elements of discard plans individually in the first instance. However, EWG 13-16 made the following observations.

Discard plans are limited to a few restricted elements and can be considered as a "fall-back" position to the implementation of multi-annual management plans. Because of institutional issues between the European Parliament and the Council, the implementation of multiannual plans has been delayed. Therfore it is likely that discard plans will be the most likely method for implementing the landing obligation in the short term. The expert group identified a number of issues that need consideration in developing discard plans including:

- The definition of management units (regional areas) which may be particularly problematic for fisheries targeting highly migratory species;
- Issues with third countries e.g. Norway;
- The definition of Minimum Conservation Reference Sizes;
- The need for criteria for evaluating discard plans including Impact Assessment indicators and;
- Outlining a process for developing discard plans.

EWG 13-16 concluded that while important elements of the landings obligation were considered, and the current level of understanding has moved substantially as a result, there is a need for follow-up meetings to develop some of the issues identified above in more detail and in particular how these are to be incorporated and considered in the development of discard plans.

2 INTRODUCTION

Discarding has been an endemic problem in many EU fisheries for decades despite the availability of instruments and approaches such as technical and tactical measures to reduce unwanted by-catch. The successful deployment of such measures can have a positive long term effects on target species as they can lead to improvements in stocks over time which would lead to increasing quota. Despite these medium-term benefits, short term losses have tended to act as a barrier for individual business to improve exploitation patterns as they are likely to reduce the viability of some fishing businesses, even if subsidies or loans are provided to assist the businesses through a transitional period. As noted by STECF (2009) there is a lack of incentives to encourage the fishing sector to reduce discards as policy has tended to focus on the use of input measures to regulate selectivity rather than focussing on the outcome, a desired catch profile. Central to this problem is the lack of a cost associated with discarding at a business (vessel) level and a regulatory framework that has focussed on regulating landings rather than catch. This means that there is a stronger economic incentive to continue discarding and retain the maximum amount of marketable catch rather than optimise exploitation patterns. In addition, fishermen are compelled to discard in order to comply with regulations or because of a lack of marketing opportunities. This problem is most apparent in mixed fisheries where there is a mismatch between individual quota allocations and catch (landing) composition regulations.

Growing recognition of the discard problem has led to several initiatives to tackle this issue over the years. In its communication of 2002 (COM(2002)656) the European Commission highlighted a complex series of drivers that cause discards and identified a suite of measures that could be deployed to reduce discards. This communication focussed on the use of a range of gear modifications and operational changes to reduce discards. It also pointed to the utility of an outright ban on discards using Norway as an example. The report also articulated a number of aspects that required further consideration, particularly those relating to control and enforcement. In a further s communication to the European Parliament and European Council in 2007 (COM (2007) 136 Final)), the Commission attempted to re-invigorate the discussion on discards. This Communication outlined a new discard policy that had the objective of reducing unwanted by-catches and progressively eliminate discards in European fisheries "*by encouraging behaviour and technologies which avoid unwanted by-catches*". In order to promote such behavioural change, COM(2007) 136 Final identified the need for "*a progressive introduction of a discard ban*". This signalled a growing recognition that structures to incentivise the adoption of better exploitation patterns were required to discourage the catching unwanted fish in the first instance and a signalled move away from the regulation of landings towards the regulation of catch. In effect, introducing a cost associated with discards. However, due to political pressure this policy was ultimately shelved with no solution to the problem.

Following on from this in the Commission's green paper on the reform of the CFP (COM(2009)163 final) discarding was identified as one of the major shortcomings of the CFP and impossible to justify to fishermen or the public. Therefore the Commission undertook to introduce concrete measure to minimise discarding as part of the reform. Subsequently as a result of public pressure this translated into a proposal for a discard ban or obligation to land all catches included as part of the new CFP. The proposal set out a clear timetable for a discard ban and aimed to provide a driver to avoid unwanted catches and deliver a level playing field to change the fishing strategies of fishermen. The Commission proposal for an "Obligation to Land all Catches" covered a wide range of species subject to catch limits, specifying that these species "be brought and retained on board the fishing vessels and recorded and landed".

Following extensive negotiations between the European Council and The European Parliament the new CFP Basic Regulation (BR) with a revised version of the landings obligation was recently agreed by both institutions. The main provisions of the landings obligation are contained in article 15 of this regulation, together with several associated articles on how the landings obligation should be implemented reflecting the regionalised decision-making approach embedded in the reform of the CFP.

The introduction of the landings obligation signals a significant shift away from the current management approach which to date has focussed primarily on regulating landings towards a system of regulating catch. In addition, historic discard levels will be considered in the setting of future TACs, and this offers a significant benefit to fishing enterprises.

The final text agreed by the Council and European Parliament includes a number of exemptions and flexibility tools that raise issues for implementation, catch forecasting, stock assessment and control and monitoring.

During an initial scoping meeting involving STECF, the ICES Secretariat and the European Commission held during the summer plenary of STECF specific issues were identified that were considered important for further investigation. EWG 13-16 was set up specifically to address these issues and also provide support for the Commission, Member States and the industry to assist in the implementation of this new fisheries management approach. In general these can be loosely grouped into aspects concerning: (i) survival; (ii) De minimis and quota flexibility; (iii) catch estimation; (iv) control, monitoring and enforcement and (v) considerations and support for development of discard plans.

Survival

Article 15 paragraph 2(b) of the BR provides for an exemption from the landing obligation for the following:

"*species for which scientific evidence demonstrates high survival rates, taking into account the characteristics of the gear, of the fishing practices and of the ecosystem*;"

This raises three issues:

Demonstration: It is considered that Member States are likely to undertake survival studies to avail of this exemption. In the short-term based on previous STECF advice in 2012, which identified methodological and operational limitations in many earlier studies, there will be a requirement for the provision of guidelines or identification of best practice for undertaking discard-survival studies. In developing such guidelines consideration should also be given to providing a predefined list of species and fisheries that could be considered for exemption.

Definitions of high: There is currently no objective means to define 'high survival rates'. Therefore there is a need to develop an objective framework which will provide managers with a range of the likely impacts of different options depending on the definition used. There is a need to articulate what the impacts would be if a proportion of the landed catch that would have discarded might otherwise have survived and how this may affect estimates of fishing mortality, SSB and associated reference points.

Control and Enforcement Issues: There are risks associated with such a derogation to discard from a control and enforcement perspective. There are also implications for TAC setting procedures and monitoring of catch uptake that need to be considered.

De minimis Exemptions and Quota flexibility Tools

Article 15 paragraph 3(c) provides for a further exemption (*de minimis*) from the landing obligation as follows:

"*3(c) provisions for de minimis exemptions of up to 5% of total annual catches of all species subject to an obligation to land as set out in paragraph 1. The de minimis exemption shall apply in the following situations:*

i) where scientific evidence indicates that increases in selectivity are very difficult to achieve; or

ii) to avoid disproportionate costs of handling unwanted catches, for those fishing gears where unwanted catches per fishing gear do not represent more than a certain percentage, to be established in the plan, of total annual catch of that gear.

Catches under this provision shall not be counted against the relevant quotas, however, all such catches shall be fully recorded."

Two issues need further consideration:

Issues surrounding definitions of *de minimis*: It is unclear what is intended by the legislation and clarification is required on how this provision should be interpreted. The potential impacts of *de minimis* exemptions will vary considerably across species depending on how *de minimis* is applied in practice. A range of scenarios are possible and these should be illustrated by example.

Issues surrounding the conditionalities: The regulation allows for de minimis exemptions with two conditionalities (i.e. "improvements in selectivity are considered to be very difficult" or "to avoid disproportionate costs of handling unwanted catches"). There is no objective means to define what constitutes "very difficult" or "disproportionate costs of handling". Therefore there is a need (i) to identify appropriate metrics that can be applied and (ii) to identify appropriate threshold or trigger levels based on these metrics.

Article 15 paragraphs 4a and 4b provide for quota flexibility mechanisms through inter annual and inter species quota flexibility as follows:

"4a. As a derogation from the obligation to count catches against the relevant quotas in accordance with paragraph 1, catches of species that are subject to an obligation to land and that are caught in excess of quotas of the stocks in question, or catches of species in respect of which the Member State has no quota, may be deducted from the quota of the target species provided that they do not exceed 9 % of the quota of the target species. This provision shall only apply where the stock of the non-target species is within safe biological limits.

4b. For stocks subject to a landing obligation, Member States may use a year-toyear flexibility of up to 10% of their permitted landings. For this purpose, a Member State may allow landing of additional quantities of the stock that is subject to the landing obligation provided that such quantities do not exceed 10% of the quota allocated to that Member State. Article 105 of the Control Regulation shall apply."

Issues surrounding inter-species quota flexibility:

Similar to the de minimis exemption, it is unclear what is intended by the legislation. Depending on the implementation, the potential impacts will vary considerably across species.

Clauses 3c and 4a both involve flexibility that has the potential to increase catches of an individual species in excess of the TAC allocation. Both mechanisms should be considered together as the impacts could be cumulative.

Catch estimation

Article 16 paragraph 1 bis states the following:

"Article 16.1bis When a landing obligation for a fish stock is being introduced, fishing opportunities shall be set taking account of the change from setting fishing opportunities to reflect landings to setting fishing opportunities to reflect catches on the basis that for the first and subsequent years, discarding of that stock will no longer be allowed."

Provisional work has highlighted significant differences in catch (particularly discard) estimates contained in ICES (Intercatch) and the STECF effort databases. There is a clear need and desire from the Commission to provide an agreed single estimate of catch. STECF EWG 13-16 will evaluate the scale of the issue through a historic comparison of catch estimates, disaggregated into landings and discards, from the STECF and ICES data sources for advised TAC species. This will require the provision of catch data from both sources and will require resources for this to be undertaken. This would be best done through an *ad hoc* contract with the datasets prepared in time for the September STECF EWG meeting. EWG 13-16 will report on these differences and by example articulate why these differences occur.

Based on the results from the comparison between data sets, stocks/TACs will be categorised depending on the extent of discarding, availability and the utility of the information.

There will almost certainly be a need for a joint STECF-ICES follow up meeting (to be arranged) to resolve the issues and to progress towards an agreed methodology. This meeting could also consider the implications for assessments and catch advice.

This combination of meetings will be used to inform the European Commission on the extent of discard information and how this can be applied in the provision of catch advice.

Control, monitoring and enforcement

Recitals 48a and 49 of the BR set out the principles for control and enforcement in the CFP:

(1) "Recital (48a) In order to ensure compliance with the rules of the Common Fisheries Policy, effective system of control, inspection and enforcement, including the fight against IUU fishing activities, should be established.

(2) Recital (49) The use of modern, effective technologies should be promoted in the framework of the Union system for control, inspection, and enforcement. Member States and the Commission should have the possibility to conduct pilot projects on new control technologies and data management systems."

Specific to the landing obligation Article 15 paragraph 8 states:

"*Article 15.8 Member States shall ensure detailed and accurate documentation of all fishing trips and adequate capacity and means for the purpose of monitoring compliance with the obligation to land all catches, inter alia such means as observers, CCTV and other. In doing so, Member States shall respect the principle of efficiency and proportionality*."

The introduction of the landing obligation, signals a significant change from the current control system which has a high level of on-shore monitoring, to a system where at-sea monitoring and control will be required in order to monitor compliance. This raises the following issues that should be considered:

There is no definition of what constitutes "*detailed and accurate documentation*" nor is there a quantified definition of what constitutes "*adequate capacity and means*".

It is recognised that there is a legal requirement to record discards in EU logbooks currently, but there appears to be no evidence that the validity of the data actually recorded has been evaluated and some evidence to the contrary suggests the data quality is questionable. An evaluation of log-book estimates could be undertaken by comparing the estimates from observer programmes with the EU logbook data and would provide a useful insight into current documentation of catches.

There are a number of tools available to support the delivery of accurate catch and auxiliary (e.g. effort) data. Each tool has advantages and disadvantages in terms of the information they provide.

Exemptions (e.g. *de minimis* and survival) as well as inter-species quota flexibility have control and enforcement implications if not properly documented.

Currently, the discarded component of catches is monitored mainly for scientific purposes using DCF funded observer programmes. In this case observers are not authorised to enforce regulations. Typically, observer coverage is ~1% of total effort and therefore cannot be considered adequate for ensuring compliance. Given that not all species are covered by article 15, there will be a continued requirement for at-sea monitoring programmes but the role of scientific observers in respect of species that are covered is still unclear though it seems unlikely that observations of an illegal action can be exempt from reporting. Therefore there are a number of possible implications for current observer programmes, including vessel access and bias in catch estimates.

Support for the development of discard plans

Article 15 paragraph 3a provides for the development of regional discard plans as follows:

"*3a. Where no multiannual plan or no management plan in accordance with Article 18 of Regulation (EC) No 1967/2006 for the fishery in question is adopted, the Commission may adopt a specific discards plan on a temporary basis under the rules stipulated under Article 17. Member States may cooperate in accordance with Article 17 with a view to the Commission adopting a specific plan, for no more than a 3 year period, on the landing obligation and specifications in paragraph 3 (a)-(e), by means of delegated acts in accordance with the procedure in Article 55 or in the ordinary legislative procedure.*"

The supporting information and specific content of discard plans has not yet been defined. To assist Member States in formulating joint recommendations that will form the basis of the discard plans there is a need to develop guidelines. These should articulate the information and minimum acceptable standards for the elements of the discard plans:

- definition of fisheries and timelines for implementation.
- exemptions on the basis of high survivability;
- provisions for *de minimis* exemptions
- provisions on documentation of catches; fixing of minimum conservation reference sizes.

3 TERMS OF REFERENCE FOR EWG-13-16

Based on the outcome of the scoping meeting the terms of reference for EWG 13-16 are as follows:

1. Survival

1.1. Develop guidelines or identification of best practice for undertaking discard-survival studies.

1.2. Develop an objective framework to define high survivability which will provide managers with a range of the likely impacts of different options depending on the definition used.

1.3. Assess the impacts if a proportion of the landed catch that would have been discarded might otherwise have surivived and how this may affect estimates of fishing mortality, SSB and associated reference points.

1.4. If possible define a predefined list of species and fisheries that could be considered for exemption on high the basis of high survivability.

2. De minimis and Quota flexibility tool

2.1. Explore the potential impacts of de minimis exemptions and inter species quota flexibility provisions through worked examples assuming a range of different interpretations.

2.2. Identify appropriate metrics that could be applied to define the two conditionalities ((i.e. “improvements in selectivity are considered to be very difficult” or “to avoid disproportionate costs of handling unwanted catches”). Identify appropriate threshold or trigger levels based on these metrics.

2.3. Consider the potential cumulative impacts on the catches of individual species in excess of TAC allocations of de minimis and quota flexibility mechanisms.

3. Catch estimation

3.1. Evaluate the scale of differences in catch estimates used by ICES and STECF and identify the causes for these differences.

3.2. Categorise stocks/TACs depending on the availability and quality of discard data based on the analysis above.

4. **Control, monitoring and enforcement**

4.1. Define what constitutes "detailed and accurate documentation and "adequate capacity and means".

4.2. Provide an insight into the current documentation of catches by comparing the estimates from current scientific observer programmes with EU logbook data.

4.3. Describe the pros and cons of relevant control tools and describe how they can contribute to compliance with the landing obligation and the provision of detailed and accurate documentation of catches.

4.4. Consider the control and enforcement implications of exemptions for high survivability, de minimis and also inter-species quota flexibility.

4.5. Consider the implications for current "at-sea" monitoring programmes under the landing obligation.

5. **Development of Discard Plans**

5.1. Develop guidelines to assist Member States in formulating joint recommendations that will form the basis of regional discard plans.

It is acknowledged that there are a wide range of issues associated with the implementation of the landing obligation and EWG 13-16 may not be able to consider all of these terms of reference. Therefore this should be viewed as the first in a series of meetings. It should provide support through the development of principles and guidelines where appropriate and identify areas that require further work. It will be supported by complementary meetings/workshops convened by ICES.

4 ISSUES RELATING TO EXEMPTIONS BASED ON HIGH SURVIVAL

4.1 Guidelines and best practice for discard survival studies

4.1.1 Introduction - What is Discard Survival?

Before discussing the most appropriate methods for measuring the survival of discards, or indeed the utility of comparing different survival rates, it will be informative to consider what we mean by “Survival”.

The reciprocal of survival is death. When we measure the survival of organisms, after they have experienced a particular treatment, we are in fact measuring the number of individuals that died due to that treatment; as well as hopefully trying to explain why they died. More precisely, we usually measure mortality rates, which is the number of individuals that die over a defined period of time.

Species	Fishing Gear	Survival Estimates (%)					Reference
		Mean	Pooled	Median	Lower	Upper	
Gadus morhua	Handlines	-	74.3	-	61.4	100	Weltersbach & Strehlow 2013
Gadus morhua	Demersal longline	-	-	-	31.0	100.0	Milliken et al (2009)
Gadus morhua	Otter trawl	-	-	-	0.0	100.0	Carr et al. 1992
Gadus morhua	Jigging	-	-	-	42	68	Palsson et al. (2003)
Gadus morhua	Bottom trawl	-	-	-	0.0	63.7	Thurow & Bohl, 1976
Gadus morhua	Otter trawl	-	-	-	9.0	51.0	Robinson et al. 1993
Pleuronectes platessa	Shrimp beam trawl	-	-	-	68	100	Graham 1997
Pleuronectes platessa	Otter Trawl	-	-	-	0.0	54.1	van Beek et al. (1990) & 1989
Pleuronectes platessa	Beam Trawl	-	-	-	2.1	47.9	van Beek et al. (1990) & 1989
Pleuronectes platessa	Beam trawl	-	-	-	39	40	Kaiser & Spencer 1995
Pleuronectes platessa	Beam trawl	-	-	-	20.3	56.8	Revill et al 2013
Nephrops norvegicus	Crustacean trawl, simulated	-	-	-	58	75	Harris and Ulmestrand (2004)
Nephrops norvegicus	Crustacean trawl	-	-	-	30	79.3	Symonds and Simpson (1971)
Nephrops norvegicus	Crustacean trawl	-	-	-	12	60	Castro et al. (2003)
Nephrops norvegicus	Nephrops trawl	28.6	-	-	18.9	38.9	Wileman et al., 1999
Nephrops norvegicus	Nephrops trawl	-	-	-	16.5	38.9	Gueguen and Charuau, 1975
Nephrops norvegicus	Nephrops trawl	19-31	-	-	11	36	Charuau et al. 1982

Table 4.1.-1 Examples of discard survival estimates, by species & fishing gear.

A recent review of discard survival for STECF summarised experimentally derived estimates of discard survival rates with respect to species and fishery/métier (Revill, 2012)(See Table 4.1.-1 for examples). From this summary, we can see that some estimates of survival vary considerably – in extreme cases between 0 & 100%! This suggests that there may be little practical use for discard survival estimates in managing a fishery because either: the conditions leading to discard mortality vary so greatly, or the methods used to estimate them are grossly imprecise.

However, before trying to interpret different survival rates, it is important to remember that aggregated/hidden in these survival rates are the deaths of many individual fish (& other taxa). Understanding the processes that lead to the death of these individuals is key to how best we describe discard survival and, more importantly, learn how to improve it.

Every organism has critical biological systems that maintain its well being throughout its life. If any one of these systems permanently fails, the organism will die. For a fish, these systems include the cardio-vascular, respiratory and neurological systems; the loss of any one of which will rapidly kill the fish. There are other critical systems that if severely disrupted will significantly increase the likelihood of the fish dying, but maybe over a longer time period (i.e. hours to days), including: the osmoregulatory, metabolic, immunological, endocrinological and behavioural systems, for example. The failure of any these systems, or components of them, can happen for many different reasons, including: traumatic injury, disease, physiological disruption and senescence (aging). Furthermore, different individuals will have different capacities to endure disruption to these systems, depending upon various different factors, including, age, size, physical condition, sex, etc. Therefore what simply manifests as the death of an individual can have numerous possible causes, mechanisms and time frames by which it will happen.

Species	Fishing Gear	Test Effect	Survival Estimates (%)					Reference
			Mean	Pooled	Median	Lower	Upper	
Gadus morhua	**Jigging**	**Depth & Injuries**	**-**	**-**	**-**	**42**	**74**	**Palsson et al. (2003)**
Gadus morhua	Jigging	Deep	-	-	46	42	50	Palsson et al. (2003)
Gadus morhua	Jigging	Shallow	-	-	68	62	74	Palsson et al. (2003)
Gadus morhua	Jigging	Single Injury	-	-	73	-	-	Palsson et al. (2003)
Gadus morhua	Jigging	Multiple Injury	-	-	41	-	-	Palsson et al. (2003)
Gadus morhua	**Handlines**	**Season**	**-**	74.3	**-**	61.4	100	**Weltersbach & Strehlow 2013**
Gadus morhua	Handlines	April	-	100	-	-	-	Weltersbach & Strehlow 2013
Gadus morhua	Handlines	May	-	78.1	-	-	-	Weltersbach & Strehlow 2013
Gadus morhua	Handlines	June	-	57.7	-	-	-	Weltersbach & Strehlow 2013
Gadus morhua	Handlines	July	-	61.4	-	-	-	Weltersbach & Strehlow 2013
Pleuronectes platessa	**Beam trawl**	**Season**	**-**	**-**	**-**	**20.3**	**56.8**	**Revill et al 2013**
Pleuronectes platessa	Beam trawl	Feb	20.3	-	-	-	-	Revill et al 2013
Pleuronectes platessa	Beam trawl	Mar	25.6	-	-	-	-	Revill et al 2013
Pleuronectes platessa	Beam trawl	May	56.8	-	-	-	-	Revill et al 2013

Table 4.1-2 Examples of discard survival estimates (from Table 3.1.1), disaggregated with respect to key explanatory variables (i.e. Depth, degree of injury & season).

So is there any benefit to studying discard mortality (or survival)? As with any traumatic stressor, when discarding fish we can anticipate there is likely to be some level of commonality between the fatal mechanisms leading to the deaths of the different individual fish. Therefore, there are likely to be factors that can be correlated to the observed mortality. Davis (2002) reviewed an array of potential explanatory variables for discard mortality, which can be classified into three broad categories: biological (e.g. species, size, age, physical condition, occurrence of injuries), environmental (e.g. changes in: temperature, depth, light conditions) and operational (e.g. fishing method, catch size & composition, handling practices on deck, time exposed to air). These are discussed further in section 4.1.2 of this report. When examined in terms of key explanatory variables, it is clear that discard survival can be estimated with more precision and can be better understood (Table 4.1-2).

However, this could present a problem to fisheries managers because instead of simply asking “Can we discard this species?” it may be necessary to ask “when, where and under what conditions can we discard this species?”

There are three different experimental approaches that can used to estimate discard mortality:

Captive Observation: where the discarded subject is kept in captivity to determine whether it lives or dies;

Vitality Assessment: where the “vitality” of the subject to be discarded is scored relative to any array of indicators (e.g. activity, reflex responses and/or injuries) that have been correlated with a likelihood of survival; and

Tagging & Biotelemetry: where the subject to be discarded is tagged and either its behaviour/physiological status is monitored to determine its likelihood of survival, or survival estimates are derived from the number of returned tags.

These methods are described in more detail in section 4.1.3. The descriptions include the principles behind each method, the benefits and limitations of the different approaches, as well as an overview of the potential sources of error and bias. Before utilizing estimates of discard survival, in the context of fisheries management, consideration should be given to these limitations and potential sources of error. To aid the standardization and critical assessment of the techniques used to estimate discard survival, a framework for guidelines on the best practice for undertaking discard-survival studies is defined in section 4.1.3.

Finally, we propose a framework for undertaking survival studies (see section 4.1.4), which considers the advantages and disadvantages of each of these methods, with the aim of producing reliable and usable discard survival estimates in an efficient and timely way.

4.1.2 Potential Explanatory Variables

Introduction

When designing experiments to estimate discard survival, it is important to address the main factors influencing the stress, injury and hence mortality of discarded by-catch. Discarded organisms are subjected to considerable cumulative stress associated with the catching process, being brought to the surface, exposed to air and handling, thrown from the vessel and then sinking or swimming back to their habitats, all of which are likely to influence their subsequent survival (Davis, 2002; Broadhurst, 2006). Furthermore, the variability of these factors with respect to the fishery and environment in which the discarding practices takes place should also be carefully considered, to ensure that key parameters are not overlooked and estimates of discard survival biased. The following section provides a brief overview of these factors, and it is suggested that any future guidelines should expand on these notes, highlighting the potential for variation and interaction between variables.

Operational parameters

These parameters are related to how the fishing operation is carried out, the design of the gear and the composition of the catch.

- Fishing gear, netting materials, gear construction

The design of the fishing gear plays an important role in how the animals caught interact with the gear, with what components they come into contact and what the intensity of this contact is. The interaction starts with the stimulus of the gear such as tickler chains (Van Beeck et al, 1990; Kaiser and Spencer, 1995) and groundgear which can cause physical contact and possibly damage to the body (Chapman, 1981). In the path of the caught animals from the front part to the cod-end further physical contact can occur in which the characteristics of the netting material (stiffness, yarn surface, knot thickness) (Millner et al, 1993; Evans et al, 1994) are important (abrasion). Physical barriers in the net such as e.g. guiding panels can inflict extra damage.

- Tow duration, soaking time, herding

The longer fish are exposed to the fishing operation and fishing gear, the higher the potential effects are. They can lead to exhaustion and more intense physical damage. Also the herding effect that may lead to exhaustion of the fish can play a role (Robinson et al, 1993; de Veen, 1975; Berghahn, 1992; Colura and Bumguardner, 2001).

- Movement of fishing gear during capture

The way a fishing gear, be it a trawl or passive gear, moves during the fishing operation due to the nature of the seabed, depth range (Milliken et al, 2009; Benoit et al, 2013) or strong and changing currents affects the intensity of wounds, damage to the swimming bladder etc. Towing speed can have a strong effect on how sediment (sand grains) interacts with the fish body.

- Hauling speed

The speed of hauling affects how quickly dissolved gasses in the fish body expand and how the fish can cope with this physical change. Especially the swim bladder is sensitive to this effect.

- Catch composition & size / crowding density

The composition and the size of the catch (Robinson, 1993) determines how severe the interaction will be between the different animals in the catch (e.g. sea urchins, crabs...). It determines the pressure on and wounds to the fish bodies. . Also the crowding density of the catch prior to release (e.g. during slipping in purse seines) can strongly influence survival (Tenningen et al, 2012).

- Handling / sorting practices / treatment of catch

These parameters are related to how the catch is handled on board, from hauling the cod-end on board to the release of the discards to the sea.

- Hauling of fishing gear on board

The movement of the parts of the fishing gear containing the catch on board and the physical interaction with the hard parts of the vessel (weather conditions) and the time before emptying affect the health of the animals in the catch.

- Onto deck/ into hopper / into water / pumped / brailed

The path of the catch after removal from the fishing gear through the infrastructure on board can have a major effect on the survival of the fish (Berghahn, 1992). Whether the catch is released in a hopper with water, whether it is pumped, the speed of handling etc is determinant for the health of the animals in the catch.

- Exposure to air and light

Many species suffer from exposure to air and light (Chapman, 1984). The shorter the exposure the higher the chances for survival (Robinson et al, 1993; Hokensen and Ross, 1993, Evans et al, 1994, Barclay et al, 2012).

- Gaffing

Different methods exist to haul individual fish on board. Methods like gaffing wound the fish.

- Sorting time

Since exposure to air can affect survival (Castro et al 2003), a quick sorting of the catch is beneficial to the health of the fish.

- Vessel / crew effect

The design of the vessel and the skills of the crew affect how and how quickly the catch is handled.

- Return to sea

Discards can be temporarily stored on deck, can be released through a tube above or sub surface. This affects the exposure time to air and light and exposure to sea birds (Chapman, 1984).

Environmental

- Depth & depth Change

The negative effect of depth change on a species health status is mainly due to the rapid decrease of hydrostatic pressure. Fish with swim bladders inflating after capture die because of pressure changes during the capture process, while post-release mortality of other aquatic organisms (i.e. those without swim bladders) is more variable and sometimes can be low (Hislop and Hemmings, 1971; Palsson et al., 2003, Milliken et al., 2009, Revill, 2012). However, depth change effect may be relative small in relation to its indirect effects owing to the correlation of depth with other crucial environmental parameters such as light intensity, ambient water temperature or hypoxia (oxygen depletion - Kils et al., 1989).

- Weather / Sea-state

In the presence of strong currents or as sea conditions become rougher during the passage of storms, increased fish injury and mortality is to be expected for both towed- and fixed-gear fishing. Direct interaction with trawl and longline gear may result in scale loss, crushing, and hook damage (Neilson et al. 1989). Trawl selectivity may fluctuate with sea state (Kynoch et al. 1999). Hauling and landing of trawls and handling time on deck would be expected to take longer in rougher seas (Maeda and Minami 1976). For hooks & lines, increased strain and resulting injury in hooked fish is expected to occur with increased sea motion and bottom currents as gear is soaked and retrieved in a longer time period.

- Temperature change / thermocline / surface temperature

The effects of exposure to temperature changes (from ambient temperature at depth to surface/air temperature) are well known for freshwater and marine fishes, where physiological stress and deficits in behaviour have been commonly observed (Brett 1970; Fry 1971; Schreck et al. 1997; Davis et al. 2001). A series of experiments on marine fish (Barton and Iwama 1991; Muoneke and Childress 1994; Ross and Hokenson 1997) has documented species-specific differences in mortality. Furthermore, temperature change affects swimming performance and ability to maintain position in the net (Beamish 1966; He and Wardle 1988; Winger et al. 1999) causing fish to be injured more frequently.

- Salinity / halocline

Differences in salinity result in variation of osmotic pressure forcing aquatic species to regulate their body water contents through osmoregulation. Marine stenohaline species (e.g. *Nephrops*) may suffer haemodilution and rapid mass gaining, even after a brief exposure to non-preferred salinity ranges (Harris & Ulmestrand, 2004).

- Season

Time of year may affect the physical condition of fish to be discarded. Other more crucial parameters are usually 'masked' behind this variable, strongly correlated to it, such as: ambient temperature and spawning. Cicia et al. (2010) have demonstrated significant seasonal differences in mortality rates of skates captured between February and July, mostly due to surface temperature variation. Mediterranean swordfish also demonstrated lower vitality signals during post-spawning season compared to pre-spawning season, a finding attributed to the poor health condition of the spawners, related to exhaustion due to the recent high energy consuming reproductive activity (De Metrio et al., 2001; Damalas & Megalofonou, 2009).

- Light

Observations and measurement of fish behaviour under conditions of low light and darkness have been carried out both in the field and in the laboratory (Batty 1983; Olla and Davis 1990; Ryer and Olla 1998; Olla et al. 2000), confirming that its effect is species specific. Certain captured fish species in the net, under low light conditions, swam less, passed along the trawl faster, and did not orient to the long axis of the trawl resulting in more injury and mortality. On the other hand, bright surface light may cause dazzling and sensory blanking effects, reducing the animals' ability to make avoidance responses if released at sea (Pascoe, 1990). For some deep water species, short-term or permanent blindness may occur as well (Frank & Widder, 1994).

Biological

- Species

Significant variation in the survival rates of the different species discarded has been documented not only between studies but even within individual studies (Revill, 2012). Upon capture, individuals with hard parts (e.g., spines, shells, carapaces) mixed with more fragile species may induce greater injuries to soft-bodied individuals. Sedentary species and those lacking a gas bladder (e.g. flatfish, sharks and rays) or deciduous scales (scales that are easily shed e.g. herring or anchovies) have generally a higher likelihood of survival (Benoit et al., 2013). Several crustacean species (crabs, lobsters) and bivalve molluscs (scallops) are relatively robust and are likely to survive in large proportions when discarded (Mesnil, 1996). Large pelagic sharks is a group of species that has shown reasonably high survival rates (>90%), due to their robust nature, their ability to recover quickly from exhaustion and low probability of being attacked by larger predators (Megalofonou et al., 2005; McLoughlin & Eliason, 2008).

- Size

Size-specific mortality of discards, with smaller fish showing greater mortality (Neilson et al. 1989; Sangster et al. 1996; Milliken et al. 1999), is an important principle to consider, especially when target species are subjected to the process of “highgrading” in which smaller fish are discarded for economic reasons and larger fish are landed. Highgrading, disproportionally increases discard mortality. Increased sensitivity in smaller fish is attributed to fatigue from swimming down the nets and greater injury from abrasion passing through the net mesh (Suuronen et al. 1995, 1996c; Sangster et al. 1996). In addition, body core temperature increases faster in smaller fish (Davis et al. 2001; Davis and Olla 2001, 2002); an inverse relationship between the rate of body core temperature increase and fish size has been documented (Spigarelli et al. 1977).

- Condition

The probability of a fish surviving the traumatic event of capture has been documented to be related to its pre-released vitality status, or else put, its' condition upon arrival on deck (Benoit et al., 2012). However, condition of a specimens' health status is strongly correlated to other influential parameters, such as: species, size, season, and fishing depth.

- Swimbladder

In general species with organs that inflate after capture (e.g.: gas bladders, eyes) because of pressure changes become trapped near the surface after discarding and may experience complete mortality (Rummer & Bennett, 2005). The most frequently observed barotrauma (wound due to rapid change of hydrostatic pressure) is an overinflated or ruptured air bladder, with associated disruption to the abdominal organs. Species lacking swimbladder have a higher likelihood of survival (Benoit et al., 2013)

- Season – sexual maturity / feeding

Time of year may affect the physical condition of fish being discarded. Other more crucial parameters are usually 'masked' behind this variable, strongly correlated to it, such as: ambient temperature and spawning. Cicia et al. (2010) have demonstrated significant seasonal differences in mortality rates of skates captured between February and July, mostly due to surface temperature variation. Mediterranean swordfish also demonstrated lower vitality signals during post-spawning season compared to pre-spawning season, a finding attributed to the poor health condition of the spawners, related to exhaustion due to the recent high energy consuming reproductive activity (De Metrio et al., 2001; Damalas & Megalofonou, 2009).

- Predation – predator numbers / characteristic

Successful escapement from predators is dependent upon the initial responsiveness of the prey to a potential threat (Fuiman et al., 2006). If reflex responses are impaired (e.g. reduced swimming speed, loss of orientation), initial responsiveness would be negatively affected, as well as escapement in the event of a predator attack (Raby et al, 2013). Discarded fish become susceptible to predation, as a result of reflex impairment (Ryer, 2004). Predation rates of discarded fish depend also on variables, such as type of predators present, predator density, and predator avidity (Campbell, 2008). Vulnerability to predators is once again species- and size-specific, large predatory fish (e.g. large pelagic sharks) having a lower probability of facing predation.

4.1.3 Estimation Methods

4.1.3.1 Captive Observation Techniques

Captive Observation (1): Field Studies

This is a popular technique whereby discarded animals are transferred to underwater cages or aquarium tanks, instead of being returned (discarded) to the open sea. The animals are subsequently observed for a period of time to derive estimates of mortality. Typically the study animals will be sourced from commercial vessels operating under fully commercial fishing conditions. This method is commonly used to estimate short-term mortality under conditions which closely mimic commercial reality. Usually, short term mortality is estimated over several days, although ideally monitoring should continue until the discard induced mortality has abated.

Primary advantages of Field Studies

The primary and important advantage of this technique is that the animals under study are collected from authentic fishing conditions and have therefore been exposed to realistic and combined stressors associated with the capture and discarding process. For this reason the results from studies conducted in this manner are more likely to be trusted by the fishing industry.

Primary disadvantages of Field Studies

It may be difficult to control for some explanatory variables, if these are specifically being investigated. Captivity in tanks / cages may induce captivity stress and therefore requires careful use of appropriate controls.

Captive Observation (2): Laboratory Studies

Fish are held in aquaria under laboratory conditions and subjected to specific stressors and then subsequently monitored.

Primary advantages of Laboratory Studies

Laboratory based studies provides a controlled environment to investigate stressor effects upon fish under strictly controlled conditions. It is also easier in the laboratory to undertake detailed clinically invasive procedures, such as post mortems, undertake physiological investigations, etc.

Primary disadvantages of Laboratory Studies

The controlled conditions of the laboratory are far removed from commercial conditions and may therefore not be reflective of the commercial fishery. In addition fish can become acclimatised / habituated to the aquaria and potentially behave differently than “wild” fish. Captivity in tanks / cages may induce captivity stress and therefore requires careful use of appropriate controls.

Monitoring Protocols: Field and Laboratory Studies

The following protocols need to be properly accounted when conducting Captive Observation field studies:

- Treatment fish – The treatment fish (a.k.a. experimental fish) should be exposed to suitable stressors in a controlled or, at least measurable, way (see section 2.2). This may be in a laboratory or in commercial conditions on a fishing vessel. Following treatment, they are transferred to a containment facility (e.g. tank or sea-cage) for monitoring.
- Mortality – clearly defined characteristics of a “dead” subject must be established at an early stage (e.g. Onset of rigor mortis, lack of reflexes or response to stimuli, colour of gills, etc.). It can be difficult to identify if a fish is dead without such criteria.
- Observations – This will be a compromise between disturbing the fish, obtaining data and timely removal of dead specimens. Observations should be made not only on whether a specimen is alive or dead but should also look for signs of stress (these will vary for different species).
- Dead specimens - These must be removed as quickly as possible to lower the risk of disease. These can typically be removed by nets of one design of another (i.e. those used by aquarists or by anglers). In underwater cages diver or ROV’s may be deployed. Remote cameras can used to collect data on mortality rates (i.e. in deep submerged cages) but have are more limited in the data they can obtain, particularly if there are large numbers of mortalities.
- Frequency of Observations - Typically, monitoring every 24 hours should be undertaken although more frequent monitoring (e.g. every 12 hours) may be undertaken during the first 24 or 48 hours when more mortality might be expected. Monitoring at regular standard intervals (every 24 hour is suggested) is required to generate a cumulative mortality profile. In some experiments, where daily sampling of mortalities is particularly difficult or even impossible, only endpoint mortality has been monitored (e.g. Huse and Vold, 2010).
- Parameters to be measured on all fish (alive and dead) – typically these would be species, length and a score on a predetermined injury index. In addition there may be a requirement to determine age, weight, sexual maturity status, take blood for analysis or conduct post-mortems, although these latter parameters can only usually be obtained through destructive and invasive procedures.

- Duration of observations- This should be for as long as it takes for mortality rates to have levelled out or dropped to a low level. This may be days or weeks depending on species. However, in the real world, monitoring duration has to be a trade-off between the ideal scientific needs and more pragmatic considerations like available resources (sea time, budgets etc.).

Containment facilities

When constructing or designing facilities for observing live wild specimens over time in captivity, a variety of considerations need to be taken account of (See e,g, Broadhurst et al. 2006):

- The containment facilities must reflect the basic biological needs of the species subject to investigation. These needs will often be species specific, for example:

  Flatfish: Require a non-abrasive bottom surface area to rest on as opposed to large volumes (Van Beek et al. 1990)

  Pelagic schooling species: Require volumes large enough to maintain normal schooling behaviour (see e.g. Misund and Beltestad 2000)

  Scombrids: Require water flow (e.g. blue-fin tuna in aquaria)

  Nephrops and other aggressive species: Require to be isolated from each other (see e.g. Castro et al. 2003)

- Wild caught animals are likely to experience some degree of captivity stress. In order to minimize captivity stress the facilities must offer stable, sheltered conditions and be as representative as possible of their normal habitat. Parameters like temperature, salinity, oxygen, light level and water flow/exchange must be taken into consideration.

- The stocking density should not be too high so as to cause stress. Some guidance on determining acceptable density levels may be sought from the aquaculture industry, the hobby aquarist, historical survival studies, experienced researchers or public aquariums for example. Where there is no available guidance, it may be necessary to undertake controlled experiments to identify appropriate stocking densities prior to commencing the discard survival experiments.

- Predators such as sea birds, marine mammals, predatory fish and crustaceans should be absent from the facilities, as this causes unwanted removal of individuals and can induce additional stress. Where assessment of predation rates (e.g. seabird predation) is required for the full understanding of the survival rate, this should be undertaken in separate experiments.

- The construction materials used should be non-abrasive (e.g. knotless netting, particularly for bottom dwelling species and highly mobile species). Tanks should be constructed from non-toxic materials.

- Feeding during the confinement period may be considered, but it may often prove difficult to make wild specimens accept food in captivity. However, feeding/non feeding may be used as an indicator of the level of captivity stress.

Control Groups

The use of Controls

Ideally, it should be demonstrated that captivity is not contributing to the observed mortality. Therefore, good control groups are vital for the success and credibility of a survival experiment. Ideally the containment facilities and the methodology should inflict a low or negligible mortality on the study animals and therefore any observed mortality is due to the stressor(s) under investigation.

Control fish of the same species should ideally originate from the same population and location as the treatment fish, and should also be of a similar size and condition. Preferably, similar numbers of controls and treatment fish should be studies in the experiments but this may not always be logistically feasible so some compromise on this may be required. Control fish which are derived from other populations (i.e. captivity reared fish or captivity acclimatised fish) should be used with caution as they may exhibit different behaviour and react differently to captivity than the treatment fish.

To eliminate observer bias, the use of ‘blind controls’ (i.e. where the observer does not know which is test or the control fish) can be considered but this is not common practice.

Control fish should be kept under the identical conditions as the treatment fish whereby the only difference has been the initial stressors experienced by the treatment fish. It may not be practical to keep the control and treatment fish in the same tanks unless they can somehow be readily identified and differentiated by the observer.

Control fish might not be required in circumstances where survivability is high (for example see Revill et al, 2005) or for initial exploratory studies to obtain first crude (uncontrolled) estimates of discard mortality from a fishery.

Ethics and relevant legislation

It is important to keep in mind that experimental handling of animal may invoke some serious ethical questions, and survival experiments have to comply with national legislation on animal welfare.

Data Analysis

Modelling Binary data

Binary data results from trials in which there is only two outcomes, here, dead or alive, denoted 0 or 1. In modelling any data, it is often useful to think of the process we are observing. This leads to two different ways to consider the type of binary data arising from discard mortality studies.

Lets say we have a captive observation study where the discarded subjects are kept in captivity to determine whether they live or die. Observations are made every 24 hours, so that there is a sequence of 0's and 1's for each subject. We can consider either the total number alive on any day as a sum of trials, or we can consider, for each subject, a time step is a trial. The first has an interpretation of cumulative mortality while the other is conditional mortality.

These two interpretations lead to using logistic regression or using survival regression to analyse the data.

The use of logistic or survival regression

The difference between the approaches is illuminated by the statements that can be made from each: 90% of fish are dead after 10 days; as opposed to: if a fish survives the first 10 days after capture, it has a 90% chance of surviving the next 10 days. Since most of the covariates involved in discard mortality studies do not change over the study, both approaches are valid. However, f there was the need to investigate a covariate that varied over the course of the study, such as an environmental stressor, then the second approach is preferred. This is because time varying covariates do not necessarily relate to cumulative mortality at that time point.

Modelling considerations

Whether logistic or survival regression is used, the same principles hold. Explanatory variables can be included as linear or smooth terms. If the study consists of multiple sampling events where the sampling event has an impact on the observations then these variables should be included in the study.

The choice to include variables as random effects depends on whether inference is to be extrapolated out with the bounds of the study design. For example, if groups of observations come from a number of different hauls then in order to make predictions for "unobserved" hauls it is necessary to assume you know the distributional form of the haul to haul variability to make this leap. If, on the other hand, you have observations for a number of species but are only interested in those species, a standard fixed effect is appropriate. In the special case of survival regression, where individual subjects are modelled, it is often sensible to include subject as an autocorrelated random variable to account for the fact the some individuals may be consistently more robust than others, or have some subject specific feature not covered by the explanatory variables.

4.1.3.2 Vitality / Reflex Assessment

Measurement of fish welfare and stress has been hampered by a lack of real-time field methods that are easy and inexpensive to use (Morgan and Iwama 1997; Dawkins 2004; Huntingford et al. 2006). A direct and economically feasible approach to the problem is to visually assess fish status or measure characteristics of whole fish, such as reflex impairment. Two main categories of rapid assessment of the health status of a fish can be traced so far in fisheries science literature:

Vitality assessment.

Fish vitality is a visual impression of survival potential that is familiar to anyone who has handled fish (Davis, 2010). The condition or vitality of fish just prior to discarding has been shown to be a good predictor of mortality in both holding and tagging studies (e.g., Van Beek et al., 1990; Hueter and Manire, 1994; Richards et al., 1995). Vitality is assessed based on pre-defined 'vitality scores', (Table 4.1-3) shown to reflect the diverse conditions experienced by fish during the capture and discarding process (e.g., Richards et al., 1994; Benoît et al., 2010).

Vitality	Code	Description
Excellent	1	Vigorous body movement; no or minor[a] external injuries only
Good/fair	2	Weak body movement; responds to touching/prodding; minor[a] external injuries
Poor	3	No body movement but fish can move operculum; minor[a] or major[b] external injuries;
Moribund	4	No body or opercular movements (no response to touching or prodding)

Table 4.1-3: An example of "vitality scores" (from Benoit et al, 2010).

- RAMP (Reflex Action Mortality Predictors)

RAMP is based on behavioral reflexes, which are involuntary actions or responses to a stimulus (Berube et al. 2001). Reflex responses can be quantified as present or absent after stimulation by gravity, light, sound or touch in free swimming or restrained fish. A non-exhaustive list of commonly used reflexes studied in the RAMP method includes: resistance, mouth, operculum, gag, fin control, natural righting and evading (Barclay, 2012).

Utility of approach

Advantages

Firstly, these methods have been shown to correlate with short-term mortality estimates, unlike many physiological measures (Davis, 2010). They are relatively easy to apply in the field (e.g. on-board fishing vessels), where they can be conducted along with the usual activities of an observer without interfering with the normal activities of the crew. Finally, they are very cost-effective, provide results in a minimum of time, and are not compromised by captivity effects.

Disadvantages

These methods are proxies of potential fish mortality after release, and they cannot reliably estimate long-term mortality. It is acknowledged that they are species- and stressor-specific. For reflex impairment assessment consistent reflexes in control fish have to be established before applying the method which is also highly species-specific (Davis, 2010). The issue of observer bias is an important consideration and consistent results are likely to be related to the observer's experience and knowledge. Finally, there is a need for additional studies to relate 'vitality scores' to survival potential, i.e. establishing the RAMP curve.

Validity

Vitality assessment studies when combined with tagging studies, have proven that these methods may significantly overestimate mortality rates (Kaimmer & Trumble, 1998;0 Laptikhovsky, 2004)

Selection of Reference Stressor

Stressor types may be grouped as (i) physical, having an influence through exercise, pressure, temperature and water turbidity, (ii) ecological, which derive from social stress, predation and food availability, and (iii) chemical sources, resulting from changes in pH, O2, CO2 and xenobiotics (Davis, 2010). Stressors may be acute (short term) or chronic (long term) and their strength can range from mild to severe which can be gauged by the induced stress response and its outcomes (Barton 1997; Huntingford et al. 2006). Analysis and prediction of stress and mortality outcomes requires knowledge of stressors and their interactions, stress states and outcomes.

Since different stressor types (physical, ecological, chemical) may affect reflex responses in different ways, testing combinations of reflexes ensures that the effects of multiple stressor types are included in the calculated impairment index. Different stressor types should also be investigated depending on the 'operational system' under study: commercial fishing (trawling, netting, longlining), recreational fishing, aquaculture, transport or tagging for which stress and mortality is to be modeled.

The above methodology requires that a 'control' has to be set up by holding fish with minimum stress and test reflex responses both in free swimming and restrained fish to identify the reflexes that consistently respond to stimulation.

It should be underlined, that applicability of the method may be limited because measurements of certain stressors in the past have shown inconsistent responses to different types of fishing factors (e.g.: capture, handling, environmental factors, fish size) (Davis & Ottmar, 2006)

Selection of Reference Reflexes/Vitality Indicators

The decisive factors for selecting the appropriate reference reflex or vitality indicator are: (i) the species under study and (ii) its applicability in field studies. As a brief example 'Excellent' in large pelagic sharks is assessed through the presence of 'combative behaviour' (Megalofonou et al., 2005), while for summer flounder it is evaluated on the basis of 'minor scratches, no visible signs of mucus damage, minor scale loss' (Yergey et al., 2012)

It may not be practical to handle or have direct contact with some species when making vitality assessments. In such instances, free swimming observations and behaviour and reflexes may prove more practical (Davis, 2010). For example, deep sea species always pose considerable challenges when assessing mortality. Because of large pressure changes, they become trapped near the surface after discarding and may experience complete mortality (Rummer & Bennett, 2005). Some recently developed methods (NOAA Operation Deep Scope) allow for collection of deep sea creatures through a specialized benthic trap which can be deployed and retrieved through a submersible and assure constant ambient conditions (e.g. pressure, light, temperature) allowing for safe handling of specimens after capture.

Restrained vs free swimming

Reflex responses must be tested both in free swimming and restrained fish so that to identify the reflexes consistently responding to stimulation. Davis (2007) simulating fishing experiments in restrained fish on board fishing vessels to predict discard mortality and in caged free swimming fish to predict escapee mortality concluded that both approaches are feasible and advisable whenever mortality rate predictions are to be made.

Validation of Vitality/Reflex Scores vs Mortality

Reflex assessment (RAMP) requires that separate predictor curves should be derived and used for individual species through assay validation and fish stressor experiments (Davis and Ottmar 2006; Davis 2007). A graphical depiction of the necessary steps to validate the method is shown in Figure 4.1-1. Diagram of a template for validating reflex impairment as a research tool to measure stress and predict delayed and total mortality..

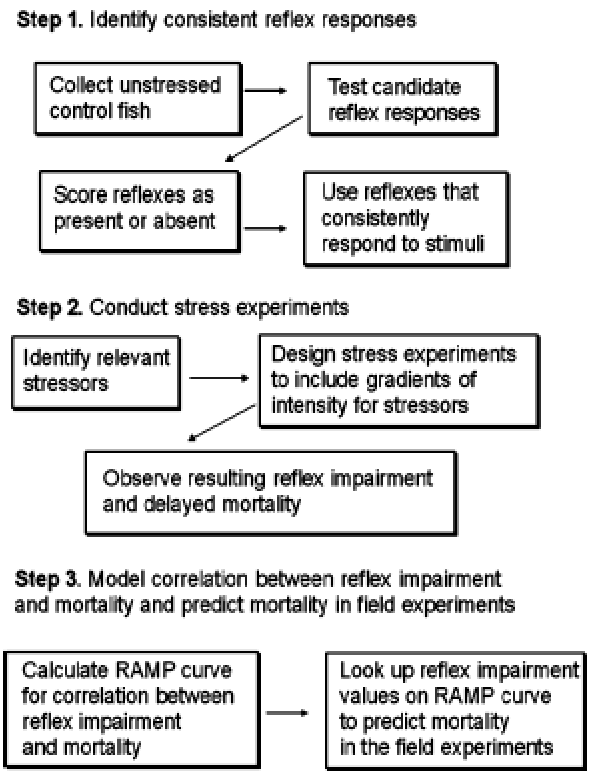


Figure 4.1-1. Diagram of a template for validating reflex impairment as a research tool to measure stress and predict delayed and total mortality.

Calibration with captive observation

The accuracy of the aforementioned methods can be calibrated by using fish confinement methods, which however depends on the degree to which the captive conditions reflect those experienced by discarded fish (Broadhurst et al., 2006). Captive conditions can induce mortality, if they represent an environment that would not otherwise be selected by the discarded fish (e.g., unrepresentative barometric pressure), or if holding densities induce stress or disease (Portz et al., 2006). Ideally, this mortality can be estimated using experimental controls, i.e., fish that were not subjected to capture and handling, but held in the same conditions. However, in practice, this is very difficult to implement (Broadhurst et al., 2006; Portz et al., 2006).

Finally, correlation between reflex impairment and mortality should be modeled using non-linear or logistic regression. The resulting models (typically depicted by sigmoid curves), can be 'fed' with measurements of reflex impairment of fish caught in the wild and predict sub-lethal stress and mortality in true operational conditions. However, expanding the results to wild fish and field fishing conditions would require identifying sets of reflexes that are consistently present in baseline wild fish and that are impaired by all relevant fishing stressors (Davis, 2007).

4.1.3.3 Tagging/Biotelemetry

A comprehensive review on tagging methods for stock assessment and research in fisheries has been conducted by Thorsteinsson et al (2002) and includes estimating survival rates.

Validity of approach

This approach is the only feasible method to provide estimates of long-term discard mortality. These studies can potentially quantify the increased levels of predation and long-term stress/injury induced mortality associated with the discarding process. There are two main methods; i) using traditional tags with control fish and ii) using data storage tags. With the traditional tags it is possible to calculate the long-term discard mortality rate with the use of control fish assuming that all other sources of mortality are equal or accounted for and there is equal chance of recapture for the treatment (discarded) and control specimens. This approach can also be used to determine the relative discard survival of specimens with different physical conditions and the relative survival rate of different fisheries.

The second method is to tag live discards with electronic data storage tags (DSTs) which provide detailed information on the activity for post-discarded individuals. On retrieval of the tags, stored data can be analysed to determine whether the individual survived or died (including predation). The proportion of tags indicating that the fish survived, gives a long-term discard survival estimate. Tags, currently available for this purpose include the ‘pop-off’ electronic DSTs. These tags record fine-scale behaviour, including swimming movements, depth & temperature measurements, prior to ‘popping-off’. The tags are recovered, either when the tagged fish is re-caught by commercial fishermen, or when the tag pops off the fish (dead or alive), drifts ashore, and is recovered by a member of the public. Previous pop-off tagging studies, on spurdog within the Celtic Sea (Righton et al., 2012), have demonstrated a 30% retrieval rate of the tags within 12 months of deployment. The restrictions associated with this approach are two-fold; the cost of the tags and the size of the fish onto which they can be attached, owing to technological constraints this is currently around ~30cm in length.

Prior to a tagging experiment being initiated it should be taken into account that there is a large variety of tags ranging from small CW tags suited for tiny fish to larger archival tags with the ability to measure and store large amounts of biological and environmental data. Similarly, the way information is deduced from the tag differs from one tag to another. Some will rely on recaptures whereas others are able to transfer data via satellites. The choice of tag should be made after a cost-benefit analysis of the individual method including the marking and recovery costs as well as the quality of data required.

Advantages

Tags are able to provide long-term estimates of discard survival as well as potential additional information about distribution, behaviour, growth rates, exploitation rates, mortality rates and stock identity. More sophisticated tags can be used to monitor the fish through the catch and discard process both with respect to physiology measurements of health factors and behaviour, although these will be chance events. For many larger species such as sharks and tuna the only feasible and practical approach for estimating discards associated survival and behaviour will be to use tags.

Disadvantages

When relying on tags for collecting scientific data in general is that any results from the study will not be apparent for a period after the release. Moreover, there is no guarantee of sufficient recaptures to make any robust conclusions. Studies using traditional tags can often suffer from low recapture rates, while more sophisticated tags can have higher returns but are more expensive. When using traditional tags, providing legitimate control groups is likely to be the largest challenge in conducting an experiment to estimate long-term survival. Using data storage tags will improve return rates (e,g,. 'pop off' tags) and negate the need for control fish, however, tagging induced mortality must be accounted for.. It should be noted, that for some species, tagging mortality rates may be so high as to make the approach unviable.

Tagging Protocols

Depending on the type of tag used and whether the tag is internal/invasive, different licenses might be required. Treatment and welfare of the fish during the tagging procedure should be subject to consideration as this period is critical for the post release survival and behaviour. During the actual tagging, handling time and stress should be minimized by maintaining high oxygen supply to the fish. Some species will need to be anaesthetized prior to tagging whereas others might not. During the actual release of the tagged fish attention toward minimizing post release mortality, e.g. by bird predation should be given.

Accounting for Tagging induced stressors

- Calibration with captive observation

Tagging induced mortality should be quantified either by using information from previous studies or through captive experiments for the control and treatment fish and the results should be applied to adjust the return rates for the two groups.

Analysis

- Experimental Design

For the method using traditional tags, the differences in return rates between the control and treatment (discard) groups can be used to calculate estimated long-term discard mortality rates. This assumes that the behaviour, growth and survival of tagged fish in the control group and untagged fish in the population are similar and all sources of mortality, other than discard mortality, are equal in the two groups. The treatment group should simulate the conditions under which commercial discarding occurs for the fishery under study. The experimental design must be carefully considered to ensure that it will meet the objectives of the project. For the method using data storage pop-off tags the geography of the study area and currents need to be considered to assess the probability of retrieving the tags.

- Accounting for biases

The identification of potential biases is a requirement to correctly interpret the results from tagging studies. Not all biases can be quantified and accounted for but should be discussed to determine confidence in the results. A tagging study to estimate discard survival estimates should consider:

- Non-representative geographical distribution of tagged releases (release errors). This relates to fish not being released in the areas in which discards are normally returned to the sea. It is important to conduct the tagging studies in the areas normally fished by the vessels involved in the fishery and where the discards occur.
- Non-representative conditions (release errors). The conditions under which normal discarding occurs should be replicated as accurately as possible and should cover the variability in conditions under which discarding occurs in the fishery of study. The handling of treatment groups should reflect that of the discarded fish and the handling of control fish should attempt to minimise any of the stresses of the capture and discard process.
- The fishery pattern (type, distribution, effort, etc.) in the release/recapture area may also influence the distribution of recaptures and thus bias results on migration or distribution. The main effect of changes in fishing pattern will be fluctuations in rate of returns of tagged specimens.
- Tagging induced mortality. If there is a difference in the tagging mortality between the control and treatment groups this will bias the estimate discard survival rate.
- Tag shedding (tag loss): This can be quantified by using combinations of different tag designs and through captive experiments, however, as long as both control and treatment groups or specamins surviving or dying have the same tags there will not be bias in the discard survival rate. The main impact of tag loss will be in the reduction in data generated by the study.
- Unequal level of industry support and awareness: Any differences between regions/countries in the level of industry support and awareness of a study could affect the level of return rate of recaptured fish. The main effect will be on having few data from which to make an estimate.
- Unequal detection of tags: This may occur when tags are less visible under certain conditions or when different sorting and handling practices are exhibited in the fishery. However, the control and treatment groups should be equally affected so this should not bias the discard survival rate. The main effect will be on having few data from which to make an estimate.

Incentive for returns

The incentives for returns may appeal more to some fishers than others and will reduce the available data from some areas/fisheries.

Estimating mortality from returns/observations

- The number of returns necessary for valid mortality estimates

Even if performed technically as well as possible, no tagging experiments could be regarded as successful unless accompanied by good reporting rates of recaptured tagged fish. In general, the higher the return rates the higher the confidence in the discard survival estimate. It is also possible to determine the *relative* effect of health status on long-term survival where this information is recorded and there are adequate recaptures. With the use of genuine control specimens it is possible to calculate the long-term discard survival rate assuming that all other sources of mortality are equal or accounted for and there is equal chance of recapture for the treatment and control specimens.

- Utilising telemetry data

Further to providing estimates of survival rates, telemetry data can be used to track the behaviour and activity levels of specimens that have undergone the catch and discard process. Telemetry data can also be used to re-enact a catch and discard event for individual fish when tagged specimens are caught and discarded during commercial fishing activity. This will likely occur only rarely and will be a chance event but has occurred and provides useful information.

- Assumptions associated with control fish to estimate a discard mortality rates

With the use of traditional tags there are numerous assumption associated with the use of control fish. A true control will enable the calculation of a long-term survival rate from the difference in return rate between the treatment and control. This assumes that the treatment and control specimens were identical in every way other than the treatment fish undergoing a capture and discard event. As with short terms experiments, various factors might negate this assumption including size and sex composition of the control specimens, differences in the location of origin of the two groups, differences in the condition between the two groups.

- Quality & Consistency of returns data

The use of reward schemes, such a direct payments or lottery draws can be used to incentivise return of the tags. Raising awareness of the programme for all those fishers and others that could recapture tagged specimens or locate the tags will help maximise the rate of returns. In the management of tagging programme the following should be considered to maximise returns of recaptured tags: adequate rewards for returning the tag; advertisements to further stimulate reporting; direct communication with local fishermen; regular information bulletins on the progress of the project; prompt response to persons returning or reporting tags; and anonymity for those reporting on recaptures. To ensure returns are maximised it is important to inform national institutes and organisations in all countries where recaptures might occur.

4.1.4 Framework for survival estimates

A framework for undertaking survival studies efficiently and producing reliable estimates is conceivable (figure Figure 4.1-2); after considering the benefits and limitations of the methods for estimating discard mortality (described in section 4.1.3). Here we distinguish between three generic time frames: immediate (straight after handling), short term (days to weeks) and long-term (> 1 month). However, future work on these guidelines should further clarify these definitions in context with both the time scales over which different factors affect mortality and the different methods estimate the subsequent discard survival.

Phase 1 – Immediate Mortality & Vitality Assessment

Vitality assessments (see section 4.1.3.2) could be used to identify species in a fishery that may have the potential to survive discarding. Where a large majority of individuals of a particular species demonstrated consistently high vitality scores, and there were very few examples of immediate mortality, this would indicate that that species may warrant further investigation to demonstrate its potential for short & long term survival, post-discarding. Using this approach, a large number of species could be assessed (quickly & inexpensively), over a wide range of conditions and for a variety of boats (& discarding practices) throughout the fishery.

However, this approach alone could not be used to justify an exemption to the Landings Obligation, as it provides no estimate of short or long term survival. Indirect/Proxy estimates of short-term mortality may be obtained using this approach, however, were the vitality/reflex score has been suitably validated with a short-term survival assessment (see phase 2).

Phase 2 – Short term mortality & Captive Observation

Reliable estimates of short-term mortality (days to weeks) can be obtained using captive observation (see section 4.1.3.1) either directly, by monitoring the survival of a sample of discarded fish, or indirectly, by validating a vitality/reflex score for a species using captive observation. A major advantage of the direct method is that specimens can be examined in detail to help determine the cause of death, which will provide important information on how to further improve the survival of discarded fish. The indirect method would allow a large number of estimates to be made for a wide range of explanatory variables, including fisher wide discarding practices, at relatively low cost. It is suggested that a combination of the two approaches would provide the most robust evidence of short-term mortality, as well as a thorough understanding of the factors influencing discard mortality. However, both approaches are unlikely to be able to account for long-term or *in situ* effects, such as predation and secondary infections.

It is feasible, that biotelemetry - where individual fish are tagged and monitored using various telemetric techniques – could also provide estimates of short-term mortality, and possibly accounting for predation mortality (see section 4.1.3.3). But it is thought that the costs associated with the tags and tracking of the individual fish will likely make this approach financially prohibitive for most species and fisheries; at least in terms of providing sufficient numbers of observations to give statistically valid estimates of short-term survival.

Reliable estimates of short-term discard mortality could be sufficient for fisheries managers to rationally assess whether there was sufficient justification for an exemption to the Landing Obligation for a particular species, within a specific fishery. This assessment should not be based upon the survival estimate alone, but also on due consideration of the uncertainty associated with the survival estimate, as well as the status of the stock, fishery and associated ecosystem (see section 4.3 for further discussion). Owing to the assumptions associated with this approach, it may be also be necessary to supplement this with long-term survival estimates, once they can be demonstrated.

Phase 3 – Long term mortality & Tagging

The most robust data on survival can be derived from long-term mortality estimates. It is recommended that conditional to the derogation permitting an exemption from the Landing Obligation and fulfilment of the requirement to 'demonstrate' high survival should be a requirement to monitor for the long-term survival of discarded fish from that fishery. The rational for this is that short-estimates of mortality are unlikely to have accounted for long-term or *in situ* effects, such as predation and secondary infections. Moreover, discarding practices are likely to vary from vessel-to-vessel/crew-to-crew and may not be maintained at the optimal standards to promote the highest survival of the discardees, as observed during the experiments used to make the initial short-term survival estimates.

The most practical approach for such long term monitoring is tagging (see section 4.1.3.3). This method requires considerable investment with respect to both time and money, and can be prone to errors and biases. However, when conducted properly this method has been demonstrated to produce reliable estimates of long-term discard mortality. Moreover, such a programme would provide valuable additional information on the stock, for example migratory behaviour, growth and natural mortality rates, that along with the long-term discard mortality estimates could be utilized in stock assessments and ecosystem management.

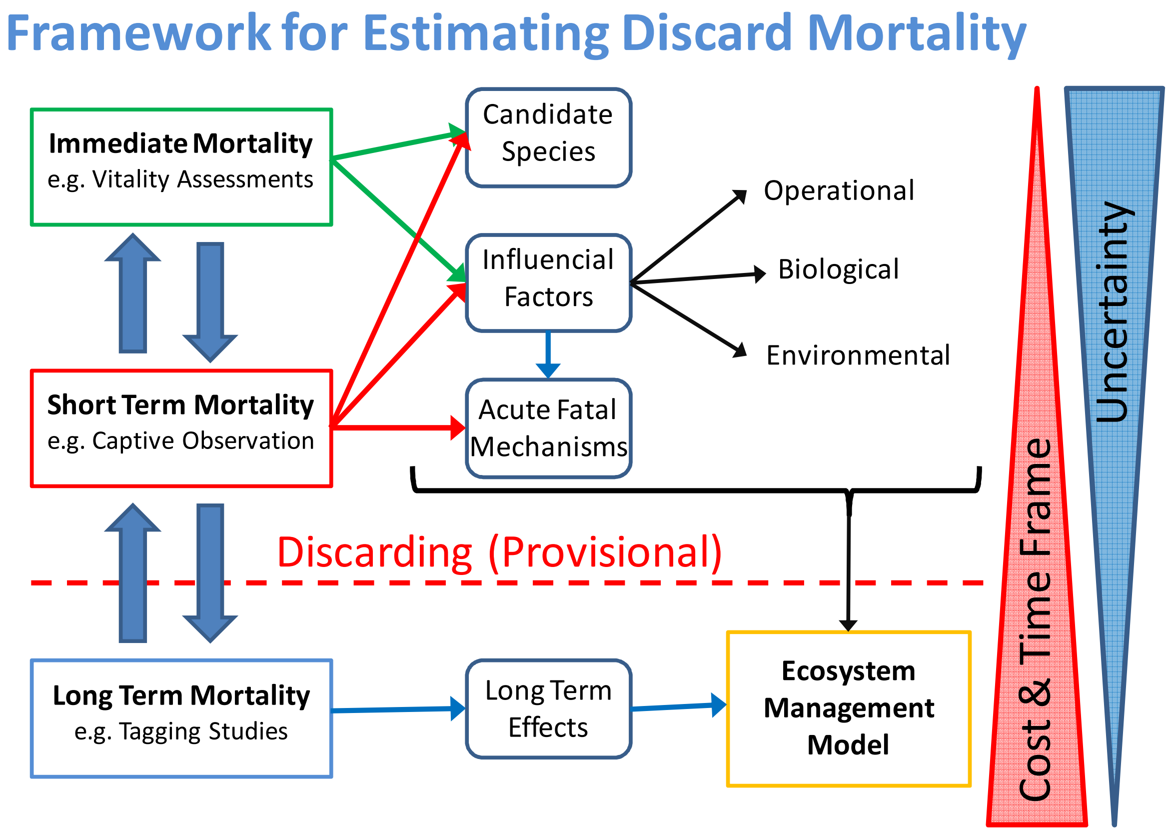


Figure 4.1-2 Framework for Estimating Discard Mortality

4.2 Objective framework for defining high survival

EWG 13-16 was asked to "Develop an objective framework to define high survivability which will provide managers with a range of the likely impacts of different options depending on the definition used." EWG 13-16 focussed largely on the question what constitutes "high survival" in context of the various objectives of the landings obligation listed in Article 2(4a) and supporting recitals (18) of the new CFP and the broader overarching environmental, sustainability and precautionary objectives (articles 2.1; 2.2; 2.3).

In addition, EWG 13-16 identified a number of “trade-off” factors that may need consideration when developing an objective framework for deciding on what constitutes “high survival”.

- *Article 4.2(a) gradually eliminate discards on a case-by-case basis and taking into account the best available scientific advice by avoiding and reducing as far as possible unwanted catches and gradually ensuring that catches are landed;*
- *Recital 18. “Measures are needed to reduce the current high levels of unwanted catches and gradually eliminate discards. Indeed, unwanted catches and discards constitute a substantial waste and affect negatively the sustainable exploitation of marine biological resources and marine ecosystems as well as the financial viability of fisheries.”*
- *Article 2.1. The Common Fisheries Policy shall ensure that fishing and aquaculture activities are environmentally sustainable in the long-term and are managed in a way that is consistent with the objectives of achieving economic, social and employment benefits, and of contributing to the availability of food supplies.*
- *Article 2.2. The Common Fisheries Policy shall apply the precautionary approach to fisheries management, and shall aim to ensure that exploitation of living marine biological resources restores and maintains populations of harvested species above levels which can produce the maximum sustainable yield.*
- *Article 2.3 The Common Fisheries Policy shall implement the ecosystem-based approach to fisheries management to ensure that negative impacts of fishing activities on the marine ecosystem are minimised, and shall endeavour to ensure that aquaculture and fisheries activities avoid the degradation of the marine environment.*

Based on the above, it is clear that the fundamental intentions of landings obligation (art 4.2(a)) is to reduce the current high levels of discards as they represent: (i) a waste of natural resources in the sense that fish are caught and killed for no apparent benefit or; (ii) that removing these fish without utilisation represents a waste in terms of future reproductive potential thereby negatively impacting on stock sustainability; (iii) a waste in the context of foregone future yield thereby negatively impact on the financial viability of fisheries sector and (iv) waste in terms of costs associated with onboard catch sorting.

However, the obligation to land all catches will result in the retention of fish that may previously have survived the discarding process. In such cases, it is conceivable this could compete with other management objectives, including the long-term sustainability of the stock [Art. 2(1)] and improving financial viability of the fishing sector as *any* surviving discard would previously have had a positive contribution to the stock. In practice, this will lead to an increase in fishing mortality and a reduction in stock biomass (see section 4.3) and if TACs are to be consistent with target reference points, then this may require a reduction in fishing opportunities to compensate for the loss in contribution the surviving discards had previously made to the stock, although the latter point will require further analysis as this will be dependent on how target reference points are defined.

The scale of any potential impact on stock productivity associated with the retention of surviving discards is heavily dependent on a number factors. These include the survival rate at age and the overall contribution discards make to the catch (discard rate). Moreover, the importance of fishing mortality (F) (including discards) relative to natural mortality (M) should also be considered. High natural mortality may reduce the expected benefits of letting surviving discards return to the sea.

However, the above observations and comments must be taken in context of the broader objectives of reducing waste and the elimination of discards and the explicit objective to incentivise the use of more selective harvesting/exploitation practices in order to minimise unwanted catch (Art. 14).

EWG 13-16 considers that permitting exemptions would limit incentives to improve exploitation pattern. This is likely to result in retention of the status quo i.e. no change in exploitation pattern pre and post introduction of the landings obligation, which would undermine the broader objectives of minimising unwanted waste and elimination of discards. EWG 13-16 therefore considers that the trigger point to permit exemptions based on high survival should be of sufficient magnitude to provide strong incentives to change fishing tactics and technical characteristics of fishing gears to improve selectivity and avoid maintenance of status quo practices.

Exemptions based on single species considerations could also undermine any positive benefits of reducing waste of other species that could be achieved through tactical and technical changes. However, the incentive to adopt technical changes in fishing gears should also consider the potential to introduce unaccounted mortality as this strategy is dependent on the assumption that these escaping fish survive. It has been demonstrated that some fish do die after escaping from fishing gears (eg. Suuronen, 2005; Breen, 2004; Breen et al, 2007; Ingolfsson et al, 2007), but in principle, the mortality associated with escaping are typically less, in number and magnitude, than those associated with discarding (e.g. Breen, 2004; Davis, 2004).

EWG 13-16 notes that the regulation specifies that any survival must be 'high' and EWG 13-16 considers that the use of this qualifier is important in that it may introduce lower limits on what can be considered as acceptable levels of high survival. In a numerical sense, it could be viewed that the minimum level of survival that could be considered as high is where *true* survival (as opposed to experimentally *observed* survival) is > 50%. Put simply, any value less than this would result in a greater proportion of fish dying than those surviving and simply means that less of the resource is wasted (as dead fish) than is returned alive, to contribute to the stock biomass.

The distinction between *true* and *observed* survival is important and those deciding on specific values should be aware that there are a number of factors that would require consideration. EWG 13-16 recognises there are practical and scientific limitations to the methods currently available for estimating discard mortality/survival. A summary of previous survival work shows that there can be considerable variation between and within experiments and the degree of variability is likely to be species-, fishery- and experiment-specific. Nonetheless, it is important to acknowledge such variation is inherent and in many cases, this may be due to ignoring specific factors such as age or length through the provision of age/length aggregated survival estimates. The potential effect of this is highlighted in section 3.3 which implies that the use of a single (age/length aggregated) result may not be totally appropriate. Therefore, due consideration should be given to the uncertainty associated with these estimates, when assessing their validity as evidence to justify .an exemption.

The uncertainties associated with experimentally derived estimates of mortality/survival arise from (i) potential biases and errors associated with experimental results and (ii) implementation issues. Experimental biases and errors can result from a number of sources. Typically, discard survival studies are based on short term captive observations (typically from hours to days) and there is emerging evidence that these may underestimate the magnitude of “true” mortality in the longer term (i.e. weeks to months)(see section 5.1.4.1). They often cannot replicate or consider other sources of mortality arising from inter alia, predation as a result of behavioural impairment; secondary diseases resulting from injuries and stress related immunosuppression associated with the capture process. Furthermore the experimental results may not be fully representative of normal fishing operations (see section 4.1.2 for further details) due to potential operational differences e.g. catch handling systems, tow duration etc between vessels in the same *metier*.

As a result, EWG 13-16 considers that a precautionary buffer may be required when considering survival estimates from short term captive experiments (*observed* survival) as the basis of permitting exemptions based on expectations of true or desired survival. In practical terms, this means that “short term” mortality estimates will need to be higher than the desired threshold in order to justify derogation. How much higher would be dependent upon a rational assessment of the estimates, its uncertainties and the nature and status of the fishery concerned. The methods for undertaking such a review still need to be developed and will require a more detailed evaluation of the relevant scientific literature and appropriate methods for addressing uncertainty in binomial data.

Conclusion

While EWG 13-16 has made inroads into the development of a framework to undertake survival studies, the selection of a value which constitutes “high survival” is subjective and is likely to be species- and fishery-specific. The choice of trigger will need to be based on “trade-offs” between the stock benefits of continued discarding and the potential removal of incentives to change exploitation pattern and how this contributes to the minimisation of waste and the elimination of discards. Such an evaluation also should consider the potential benefits for other stocks and the broader ecosystem that would arise from changes in exploitation pattern. If it is foreseen such changes would result in larger benefits than permitting continued discarding, then this should take precedence over the application of exemptions based on high survival. EWG 13-16 considers that avoidance of unwanted catch should be the primary focus of such considerations.

The choice of value or possible ranges considered in the context of article 15.2(b) will depend on which objective (e.g. avoidance of waste; improve stock sustainability; improve financial viability) has the highest priority. The “trade-offs” are a construct of the following points which may need consideration when deciding on the triggering exemptions based on high survival:

- the estimated survival rate & it associated uncertainty;
- the age stucture of the discards and their survival rate at age
- the relative importance of discards in the overall catch
- the relative importance of F (including discards) compared to M;
- the impact of the landing obligation on the stock;
- the potential for improving selectivity and handling practices; and
- the level of motivation for fishers to avoid unwanted catches.

4.3 Stock impacts of landings surviving discards

As noted above, retaining and landings individuals that would otherwise have survived the discarding process (surviving discards) will have some impact on the stock in that ***any*** survivor will have contributed positively to the stock biomass and will have lessened the potential impact the fishery has on the stock.

In the context of assessing the potential impact that the landings obligation may have, it is worth considering the situations pre and post introduction of the landings obligation. Presently, the total catch consists of fish that are either of commercial value landed or unwanted components which are discarded. In practice, for some species and fisheries, some of these survived the discarding process. Therefore, the fishing mortality for a fishery is the sum of landed fish and the discarded fish that died. This unwanted component could consist of commercially important species that were below the minimum landing size, of poor quality or for which the vessel had no quota, as well other species of no commercial value.

Following the implementation of the landing obligation, the components of the unwanted catch that may legally be discarded currently will change. It will be not be permitted to discard regulated species and therefore any fish that would otherwise have survived the discarding process will now contribute to the overall fishing mortality of the stock, in effect increasing fishing mortality. In practice, the impact on the assessed estimate of fishing mortality and stock biomass will largely be dependent on how discard are (or not) treated in the assessment. The following text is only pertinent to stocks that are subject to a full analytical assessment (i.e. estimates of fishing mortality and stock biomass are available) and not for data-limited stocks.

There are three groups of stocks where information about discard survival, either in the form of assumptions or empirical evidence, will influence the assessment of a stock and the setting of its TAC. Firstly, for few stocks, a discard survival factor is already formally included in the stock assessment process (typically *Nephrops* stocks). Secondly, many of the assessments within the EU area have discards included in the assessment that are assumed to have zero probability of survival. Thirdly, a number of stocks do not have discards included in the assessment either because discards are considered negligible or because accurate estimates are not available.

The first two scenarios are considered below through example. The third scenario has not been considered here due to time constraints. Two examples are used to illustrate the potential impacts of obliging fishermen to land catches. The first case explores a stock with very high discard rates and well documented evidence of survival but the assessment procedure assumes that none of the discard survives. Note that the discard survival proportions (0.5 – 0.9) are fictitious and are used purely for illustration.

The second case illustrates the potential impact on fishing opportunities where a portion of discards are known to survive, are explicitly used in the assessment on the assumption that under the landing obligation all of the catch must be retained and landed.

It is stressed that the examples are used only for illustrative purposes and the relative significance of landing "surviving discards" will be heavily dependent on a number of key factors including survival rates by age; contribution discards make to the overall catch and their age structure.

4.3.1 Example 1 - Plaice

This example is associated with a species which is subject to high levels of discards and where studies have demonstrated that a portion of those discarded has a probability of surviving. For illustration, the output from a recent plaice stock assessment is used. This provides a useful example for testing the implications of a landing obligation on a stock.

Deterministic stock projection was used to investigate the implications of the proportion of discards surviving on SSB and catch. The stock assessment itself was not altered to retrospectively account for discard survival, rather the question is asked: if a proportion of the fish that had previously been discarded survived, what are the implications of landing these individuals i.e. now removing them from the stock?

The stock was projected forward (for 20 years to reach a stable state) using:

- Numbers at age in the last year of the assessment
- Geometric mean annual recruitment
- Status quo fishing mortality at age (Fa) from the final year of the assessment
- Fishing mortality at age was disaggregated into landed and discarded components

$$F_a = F_{a,land} + F_{a,discard}$$

using the ratio of age-disaggregated discards D_a to catch C_a (discard rate) in the last year:

$$F_{a,discard} = \frac{D_a}{C_a} F_a, \quad F_{a,land} = \left(1 - \frac{D_a}{C_a}\right) F_a$$

The discard rate in the stock is high for young ages (e.g., 100% for age 1) and decreases for older ages (e.g., 70% of age 3 fish and 5% of age 6).

Fishing mortality of the discarded fish was further disaggregated into the proportion of the discard mortality that survives or dies:

$$F_{a,discard,survive} = p_{a,survive} F_{a,discard}$$

$$F_{a,discard,die} = (1 - p_{a,survive}) F_{a,discard}$$

where $p_{a,survive}$ is the proportion of discarded fish that survive, which can be age-specific or assumed constant across ages (expanded upon below). Note that $F_{a,discard,survive}$ is better termed the *survival rate* of discards rather than a mortality rate.

Under discarding, the fishing mortality relevant to the stock is:

$$F_a = F_{a,land} + F_{a,discard,die}$$

Under a landing obligation, the fishing mortality relevant to the stock is: $F_a = F_{a,land} + F_{a,discard,die} + F_{a,discard,survive}$

That is, under a landing obligation where a non-zero proportion of discards would have otherwise survived, fishing mortality increases.

4.3.1.1 Proportion of discards that survive:

Four discard survival scenarios were implemented:

- *Constant*: constant high discard survival proportions of 0.5, 0.7, and 0.9 applied across all ages.

- *Age-specific*: an age-specific discard survival ogive was constructed by extrapolating the fitted short-term (< 3 days) length-based discard mortality curve of Revill et al.(2013, Figure 3) to smaller lengths (Figure 4.3-1). To convert the length-based discard survival to age-based discard survival, age was converted to length via the von Bertalanffy function using the median parameters for European plaice in FishBase ($L_\infty = 56.1$ cm, $K = 0.1$ year^{-1}). Note that the survival proportion given by the ogive reaches only 0.5 for the oldest ages in the assessment (Figure 4.3-1) and that the discard survival proportion of age 1-4 fish is obtained from an extrapolation beyond the data of Revill et al. (2013).

We emphasize here that these are preliminary investigations based on approximations without detailed fleet-, species- or area-specific discard survival data. The results are not applicable for this stock and do not reflect expected survival rates and are only used to illustrate potential effects. Any detailed investigation should be conducted using the best possible data and information for a given stock and fishery by stock-specific experts.

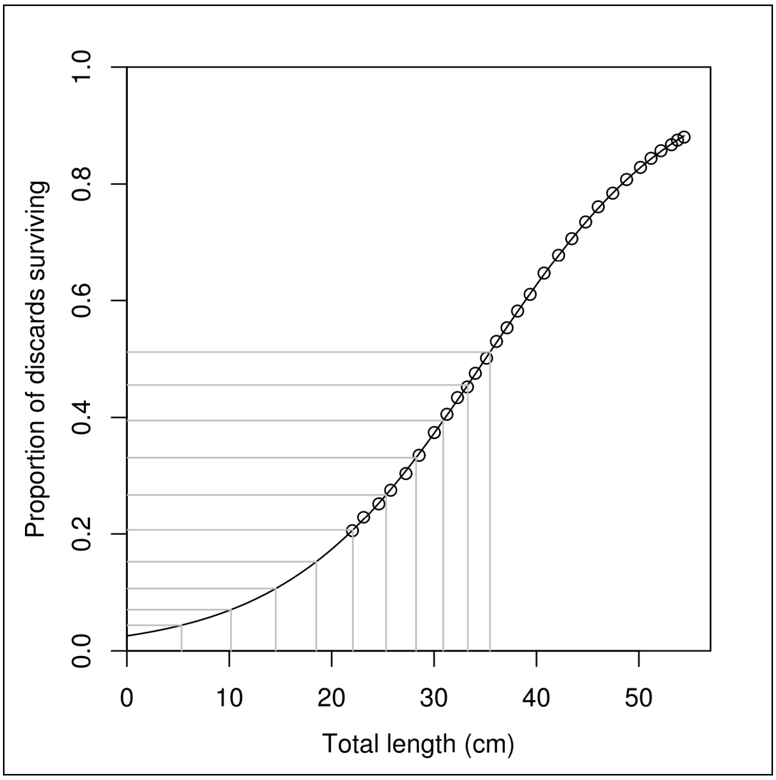


Figure 4.3-1. Proportion of discarded plaice surviving as a function of length. Points are from the fitted proportion dying curve of Revill et al. (2013, Figure 3, presented here as 1-proportion dying); the solid line is a logistic extrapolation of the points to smaller ages. Vertical grey lines are predicted length for ages 1-10; corresponding age-specific discard survival proportions are shown as horizontal grey lines.

4.3.2 Results

Assuming constant survival proportions of discarded plaice were: 0.5, 0.7 and 0.9 (much higher than observed and used only for illustrative purposes) and then landing them under a landing obligation results in dramatic effects on the stock and catches (Figure 4.3-2). For example, assuming the discard survival proportion was 0.5 and then implementing a landing obligation results in a 27% decline in SSB after 20 years (Figure 4.3-2). Percentage decreases in SSB are greater for the higher constant survival proportions implemented (Figure 4.3-2). For constant survival proportions, catches initially increase as previously discarded fish that survived are landed but ultimately catches decrease owing to a lower stock size (Figure 4.3-2).

Assuming age-specific (Figure 4.3-1) survival proportions results in less of an effect of a landing obligation on the spawning stock biomass and long-term yields (Figure 4.3-2, dashed lines). The spawning stock biomass decreases by 5.7% over 20 years. The reduced effect of a landing obligation in this scenario arises because the proportion of the most discarded age groups that survive is low (from extrapolation only 4.4% of age one and 7% of age two fish discarded are predicted to survive in the short-term, Figure 4.3-1) so landing them has less of an effect compared to a constant discard survival proportions across ages. A low survival proportion for young and highly discarded age classes implies that landing them has a lesser but non-negligible effect on the stock. A high proportion of these fish may be removed from the population either way.

As the low discard survival proportions are from an extrapolation, they must be viewed with caution. The only other available study with length-based discard mortalities for plaice (Berghahn et al. 1992) had high discard mortality proportions for small fish with ranges typically overlapping with the extrapolated values here but with generally lower mortality means. The shrimp beam trawl fisheries may have less impact than a fish beam trawl owing to different speeds and handling processes again highlighting the importance of fleet-specific information.

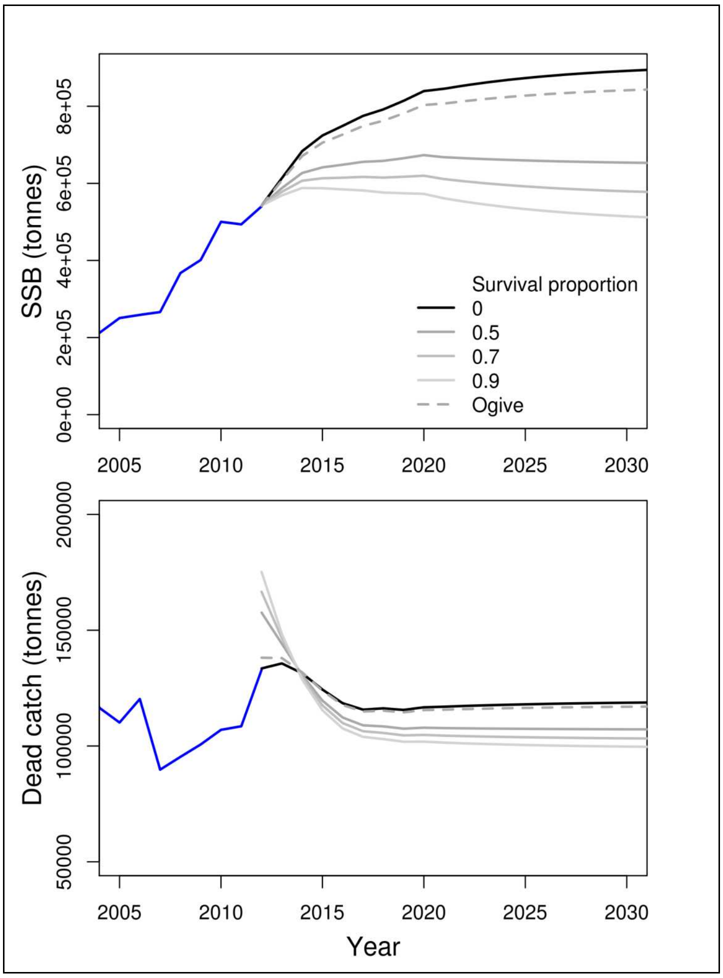


Figure 4.3-2. Effect of a landing obligation on the spawning stock biomass (top panel) and catch (bottom panel) of plaice under a range of hypothetical discard survival scenarios. Each line post-2012 in the top panel is interpreted as the resultant SSB assuming discards that previously survived at a given proportion are then landed.

The sub-group did not investigate the effect of a landing obligation on reference points as to do so would require re-fitting the assessment with retrospective assumptions regarding discard survival proportions. Such a task was considered beyond the scope of the present work but is highlighted for future investigation. Assuming fixed reference points, landing fish that previously survived can result in a decline in SSB (Figure 4.3-2), which may have important ramifications for stocks with biomasses close to their target and limit reference points.

4.3.3 Example 2 – Nephrops

We take a theoretical "*Nephrops*-like" example for illustrating the issue, because a number of features are already included in the current ICES advice for the *Nephrops* for which an assessment exist (typically an underwater TV survey measuring absolute abundance in terms of number of individuals). At present, the ICES advice is based on the following steps:

- Assume that abundance in the TAC year is equal to last observed abundance (no assumption on the stock dynamics in the intermediate year)
- Assume a dead discards ratio based on last observed data
- Assume a fixed discard survival rate of 25%
- Use a target dead Harvest Rate (Fmsy) to compute the number of dead removals for the TAC year
- Split these dead removals between landings and dead discards, add the estimate of surviving discards, and transform numbers into tonnes by applying a fixed mean weight for landings and discards respectively.

For example, assuming a population of 1000 individuals (or '000 individuals) with a target harvest rate of 10% give an overall target of 100 dead removals. Assuming a dead discards ratio of 30% gives a landings target of 70 individuals landed, 30 dead discards which corresponds to 40 discarded individuals – i.e. a de facto discards rate of 40/(70+40)= 36%.

Conversely, assuming an overall discards rate of 30% including survivors corresponds to a de facto dead discards rate of 24% [30*(1-0.25)/(70+30*(1-0.25))], which then allows for a higher landings target within the overall dead harvest rate target. In our example, landings become 70*[100/(70+30*(1-0.25))] = 75.6, i.e. an increase of the actual landings advice of 8%.

Now, in the case of a landings obligation without exemption, all discards are brought to shore and die, implying a survival rate of 0%. Our discards ratio of 30% corresponds to an equivalent dead discards ratio, and in order to stay within the established target harvest rate, the landings (or now Human Consumption share of the catch) stays at 70, i.e. 8% lower than the advice that was given assuming survival. Here we recall that landings opportunities may de facto raise up to the total removal target of 100 (as discards would now be landed and accounted for in the landings), but it is assumed that what was previously discarded would not be sold for human consumption, thus maintaining the same ratio of e.g. over and under MCRS.

Then the possible scenarios of impact assessment for that case are the following:

- The overall landings target for the fishery is reduced by 8%;
- The landings level and discards ratio are maintained to the same level, and the harvest rate is 8% higher than the (MSY) target

- Improvements of selection patterns are brought in the fishery, in order to maintain the high landings levels but reduce discards. In our example, the harvest rate should be reduced from 30% to 24% in order to maintain the landings at 75.6 individuals within the target HR of 10%.

4.3.4 Conclusion

These two examples illustrate the potential impact of the landings obligation on future levels of catches and biomass. As the metrics of fishing mortality, catches and biomass are directly linked to each other, any changes in either of these as part of the implementation of the landings obligation will have some impact on the two others. Landing some discards that would otherwise have survived negatively affects both the future fishing opportunities (to varying extent), and spawning stock biomass, and such negative impacts could create some incentives for fishing more selectively.

4.4 Predefined list of species and fisheries

Due to time constraints it was not possible to address this terms of reference. However, as noted by STECF (2012), the results from individual studies are highly variable and due to a lack of standardised experimental control, precludes identification of specific gears or fisheries. While no further analysis has been undertaken by EGW 13-16, the identification of factors affecting survival and methodological approaches available contained elsewhere in this report represents a significant advance in the development of standardised or best practice guidance for undertaking such experiments. However, until such time as the more detailed and comparable studied become available, EWG 13-16 reiterates the STECF (2012) advice that it is not possible to provide a reliable list specifying the survival rate of discards by species and by fishing gear.

5 ISSUES RELATING TO DE MINIMIS EXEMPTIONS AND QUOTA FLEXIBILITY

Background

This section of the report addresses issues associated with provisions in the basic regulation which are intended to provide some departure from the land-all policy to account for unpredictable or unavoidable catches. Two specific provisions are available a) the de minimis – a small discard proportion…..etc and b) the quota flexibility tool allowing some transfer of quotas to facilitate a 'balancing of the books'. EWG 13-16 addressed the following TORs:

1. Explore the potential impacts of de minimis exemptions and inter species quota flexibility provisions through worked examples assuming a range of different interpretations.
2. Identify appropriate metrics that could be applied to define the two conditionalities ((i.e. "improvements in selectivity are considered to be very difficult" or "to avoid disproportionate costs of handling unwanted catches"). Identify appropriate threshold or trigger levels based on these metrics.
3. Consider the potential cumulative impacts on the catches of individual species in excess of TAC allocations of de minimis and quota flexibility mechanisms.

The section deals first with the de minimis provision and the conditionalities associated with this. This is followed by discussion of the quota flexibility provision and finally a consideration of cumulative effects

The approach used was first to discuss the range of possible interpretations arising from the basic regulation and then to develop some worked examples using contrasting fishery scenarios to demonstrate the impacts of the different interpretations. EWG 13-16 notes that there are an almost infinite number of possible examples precluding a comprehensive analysis. EWG 13-16 instead worked on a series of contrasted cases, using artificial fishing units (to represent vessel, fleet or member state) and artificial species.

5.1 Potential Impacts of de minimis

The basic elements of the de minimis provision include the establishment of limits on the percentage of catches that can be discarded under certain conditions. These discards need to be recorded but do not count against quotas and are intended to offer a limited facility to assist in the continuity of fishing operations. The percentages of total catches concerned are relatively small and will be phased in over a transitional period, 7% for first two years then 6% for next two years and 5% thereafter

EWG 13-16 notes that there are a wide range of interpretations of what the wording of the de minimis provision actually meant. Particular problems are associated with the basic description '*…..up to 5% of total annual catches of all species subject to an obligation to land….*' . It is unclear whether this is meant to apply at a MS level or can be cumulative across all MS. Similarly the wording does not say whether this should apply at the individual species level or for all species combined. A further interpretation relates to the operational level at which the de minimis applies - ie individual vessel level or fleet level, or member state. Clearly, implementation at the individual vessel level /trip level implies a different operational approach, for example, from a control and monitoring perspective, compared to fleet or national level.

The regulation is also unclear about what should be taken to be 'total annual catches'. These could potentially be based on a retrospective "reference" year (or average), the previous year or be more forward-thinking, for example, from a catch forecast. In addition the timing of when the percentage is applied influences the quantity of discards permitted under the de minimis. Based on the available catch following quota allocation at the start of year, permitted discards could be quite different from those arising at end of year after swaps with other countries (either increasing or decreasing the available catch).

Taking these observations into account an example calculation is provided to illustrate the implications of fairly extreme interpretations. Table 5.1-1 provides information about a fishery unit which takes is allocated an overall quota of mixed species (150,000 t). One of these species has a catch quota (583 t) Under a single species 'de minimis' where the available 5% is only applied to the one species only, the discard allowance is quite modest (29 t), increasing the permissible catch from 583 to 613 tonnes. On the other hand if the interpretation takes the whole catch available to the fishery unit (150,000t) and applies this preferentially to the species in question, then the quantity becomes very large. A potential de minimis allocation of 7,500t (5% of 150, 000t) increases the permitted catch from 583 to 8083 tonnes.

Baseline catch quotas	
Total catch quota for all species available to management region/unit	150,000 t
Catch quota for de minimis species	583 t
Example (a) - de minimis applied to a single species	
5% de minimis allocation based on ***single*** species (5% of initial 583 t quota)	29 t
Total permissible catch with additional ***single-species*** de minimis allocation (583 t + 29 t)	612 t
Example (b) - de minimis applied across all species	
5% de minimis allocation to ***all*** species (5% of 150000 t quota)	7,500 t
Total permissible catch with additional ***multi-species*** de minimis allocation (583 t +7500 t)	8,083 t

Table 5.1-1De minimis examples showing 2 extreme cases where a) the 5% is applied only using a single species and b) the total available catch (all species) is used instead

EWG 13-16 considers that given the scope for such variation in outcomes, regional groups involved in the development of discard plans, should pay careful attention to their choice of interpretation of the de minimis provision. Circumstances which may result in unintended consequences and discard quantities higher than intended should not be allowed to develop. EWG 13-16 notes that Article 2 of the CFP basic regulation stipulates that the precautionary approach to fisheries management shall apply and that exploitation should be consistent with the achievement of maximum sustainable yield.

EWG 13-16 identified a plausible range of examples where the de minimis might apply (Table 5.2-1). This should not be considered an exhaustive list but may be helpful in providing some real world examples.

5.2 Triggering of de minimis conditionalities

Opportunities to utilise the de minimis condition only apply if certain conditions are met. The first of the two conditions requires that 'improvements in selectivity are considered to be very difficult'. EWG 13-16 was asked to consider appropriate metrics for this condition and spent some time identifying the key issues contributing to the ease or otherwise of achieving selectivity improvements

The conditionality stipulated in article 15.2.c.ii: "improvements in selectivity are considered to be very difficult" might firstly be interpreted as a technical restriction in that the gears cannot be improved to become more selective. EWG 13-16 considered that on purely technical grounds there were numerous ways in which gears or spatial distribution of fishing could be used to avoid unwanted fish.

The basic problem for fishermen in relation to selectivity, however, is that any change in fishing practices is likely to lead to a change in their economic performance, either by leading to lower revenues and or increased costs. This is particularly the case when applying more selective fishing gear to avoid by-catch. In several cases this may not only reduce unwanted catches, but it may also reduce wanted by-catch. So it is more likely to be the economic implications of improving selectivity (lower revenues and/or higher costs) rather than a technical issue that leads to 'difficulty'. The following cases can be distinguished:

- Fishermen may lose sellable catches if they switch to more selective fishing practices. STECF previously conducted an impact assessment for the *Nephrops* fishery in area VII and the flatfish fishery in the North Sea which involved improvements in selectivity and reduction of bycatch at least by 25%. The result was that the loss of sellable catch (species other than *Nephrops* or losses of flatfish) would be too large to be able to keep the vessels in business. (STECF 2008).
- If fishermen found it necessary to change fishing grounds on occasions when they experienced high by-catch rates of e.g. juveniles, this would result in additional costs as a result of increased steaming time and lost fishing opportunities. Furthermore, in fisheries with effort limitation, there could also be an issue associated with the cost of acquiring additional effort.
- Fishermen may find it necessary to switch to another fishing technique which may not only lead to the loss of sellable by-catch species but could also reduce the catch of the target species. Such a switch may, however, also have positive effects as it may lower fuel costs etc (e.g. static gear instead of towed gear). Therefore, an impact assessment or some evaluation of the costs and benefits of such a switch would be necessary before implementing the new gear type.

For practical illustration, Table 5.2-1 below provides some examples that are indicative of the sort of situations where a de minimis may be justified e.g. where technical solutions may be possible but the resultant loss in catches (i.e. revenue) would likely render the fisheries uneconomic. <u>It is important to note that this list is for illustrative purposes and is by no means exhaustive</u>. In many of these examples both conditions could be applied to justify a de minimis exemption.

Fishery	Problem	Very difficult increases in selectivity	Disproportionate costs
Pandalus	Bycatch of Norway Pout bycatch species has a similar size distribution to the target species	Increasing mesh size to improve selectivity for Norway Pout would result in high losses of Pandalus catch	Sorting Norway Pout from Pandalus would result in increased crew costs
Nephrops/Mixed demersal	Bycatch of pelagic and industrial species – large bulk catches make it difficult to sort out small quantities of target speceis		Sorting bycatch species from the target species and storing these on board results in increased crew costs
Industrial fisheries for Norway Pout	Bycatch of small gadoids – bycatch species has a similar size distribution to the target species		Sorting small gadoids from the target species results in increasing crew costs disproportionality
Industrial fisheries for sprat	Bycatch of gadoids – design of gear makes it very difficult to sort the target species from the non-target species	Sorting bycatch from the target species is very difficult in practice given the design of the trawls used in the fishery	The deck layout of the vessels makes it difficult to sort bycatch from the target species.
Pelagic fisheries	Bycatch of demersal species – design of gear makes it difficult to sort the target species from the non-target species	Sorting bycatch from the target species is very difficult in practice given the design of the trawls used in the fishery	The deck layout and storage systems of these vessels make it difficult to sort bycatch from the target species.
Pelagic fisheries	Limited carrying capacity on board – catches from the last haul exceed the remaining storage space on board		Vessels may have insufficient carrying capacity to take on board all of a catch. In these circumstances the vessel has no option but to discard such catches.
Gillnet/Trap/Longline fisheries	Depredation – catches are damaged by a range of predators	Mitigation measures to prevent damage are not available.	Requiring fishermen to store them separately, land them and count them against quota could be considered disproportionate given they have no value.

Table 5.2-1 Illustrative examples of where conditionalities associated with technical difficulty (art. 15.2.c.i) and disproportionate costs (art 15.2.c.ii) may trigger the use of the de minimis exemption. Note that this list is not definitive or exhaustive and is for illustration only.

These examples indicate that the most appropriate metric that should be applied is some kind of economic indicator. Drawing on the STECF work on balance indicators EWG 13-16 agreed that the 'current revenue to break even revenue ratio' was potentially an appropriate indicator to use in this scenario. The ratio shows how close the current revenue of a vessel or fleet is to the revenue required for the to break even from an economic point of view. If the ratio is greater than 1, then enough income is generated to cover operational costs and therefore break-even. If the ratio is less than 1, insufficient income is generated to cover operational costs and therefore the vessel or fleet is in a loss making situation indicating that the segment is unprofitable. If the ratio is negative, variable costs alone exceed current revenue, indicating that the more revenue is genertated, the greater the losses will be. Examples of the kind of output are shown in Table 5.2-2.

Current revenue / break even revenue ratio DCF economic data classifications 10% 5%	 decrease in current revenue increase in variable costs			
Costs and earnings	**Status quo**	**Scenario 1: increase in variable costs only**	**Scenario 2: decrease in current revenue only**	**Scenario 3: decrease in current revenue and increase in variable costs**
Landings revenue	£553,333	£553,333	£498,000	£498,000
Other revenue	£10,000	£10,000	£9,000	£9,000
Current revenue (CR)	**£563,333**	**£563,333**	**£507,000**	**£507,000**
Fuel cost	£172,333	£180,950	£172,333	£180,950
Crew cost	£193,333	£203,000	£193,333	£203,000
Repair and maintenance costs	£50,667	£53,200	£50,667	£53,200
Other variable costs	£11,667	£12,250	£11,667	£12,250
Fixed costs	£100,000	£100,000	£100,000	£100,000
Total operating costs	**£528,000**	**£549,400**	**£528,000**	**£549,400**
Gross Profit	£35,333	£13,933	-£21,000	-£42,400
Gross Profit Margin	**6%**	**2%**	**-4%**	**-8%**
Break even revenue (BER)	**£416,256**	**£494,441**	**£641,772**	**£880,208**
CR / BER ratio	**1.4**	**1.1**	**0.8**	**0.6**

Table 5.2-2 Current revenue, break even revenue examples for a series of three scenarios

The TOR 2 also requested guidance on the second condition related to "disproportionate costs". Following additional interpretation of article 15.2.c.ii, there was consensus that the ToR request to formulate an appropriate metric and thresholds for "disproportionate costs" was somewhat misleading. There is in fact no need to identify and justify what disproportionate costs would be, because the *full* wording in the article suggests that disproportionate costs of handing unwanted catch are simply assumed when the unwanted catch of a specific fishing gear is below a certain percentage of the total catch of that gear, and that the percentage threshold would be established in a discard plan. The key question appears to relate to 'the percentage unwanted' and the EWG gave some thought to this. The general expectation appeared to be that the percentage would be relatively low and one suggestion was for a figure in line with the de minimis allowance. It was, however, pointed out that the intention of the regulation was for the de minimis (5%) to be an overall value that a Member State was required to conform to, whereas this conditionality gave some flexibility for different gears to have different percentage discards.

EWG 13-16 considers that discussing and establishing appropriate values would be an important task for the regional groups developing discard plans. Too high a value might encourage the inappropriate use of de minimis and in practise allow significant discarding to occur.

The ToR also required EWG 13-16 to try to define targets and triggers so as to judge when the use of the de minimis condition was applicable. However, it was felt that this was not an appropriate task for the EWG to attempt. It is likely that appropriate target values, for example to apply in the case of the balance indicator discussed above, would be very variable depending on economic climate, circumstances, time of year, region etc. The process also requires considerable input from managers and again this seems to be a process that should be dealt in the development of discard plans.

5.3 Potential Impacts of the Quota flexibility tool

The basic provision of this tool allows inter-species transfers of quota between donor (target) and recipient (non-target) species. The tool allows for catches in excess of quotas or catches of species for which a participating unit in the fishery has no quota. The provision limits the transfer to 9% of the quota of the target species and there is a condition which stipulates that the recipient non-target species must be within safe biological limits.

Preliminary discussions by the subgroup quickly revealed that, as in the case of the de minimis tool, there was a wide range of possible interpretations of the wording describing the quota flexibility tool. It is unclear whether the ‘donor’ quota is provided at the individual vessel level, fleet level or at member state or regional level - the different interpretations imply a potential for very variable quantities of transfer. The available quota for transferring from donor species may also vary depending on the time of year since adjustments (through swaps etc) can take place. The regulation does not specify whether the available quota is determined at the start of the year or some subsequent point. An additional consideration is that inter-annual flexibility provision (not discussed in detail at this meeting) may elevate quota and generate larger quantities for transfer. It is also unclear from the wording what the intended purpose of the provision is. On the one hand it could be regarded as a provision for “balancing the books” – to take place once the catches of a non-target species have been taken. On the other hand the provision could be interpreted as a facility to be used speculatively, perhaps to open up opportunities for fishing on species where a quota was previously not available to a member state. The EWG also discussed the lack of clarity surrounding the meaning of target species. Depending on whether this is interpreted as singular (a species) or plural (group of species) produces very different quantities for transfer. Attempts to define ‘target species’ have been made on numerous occasions and while this is mainly straightforward in single species fisheries, it is far less clear in more complex mixed fisheries where a range a species may be equally important. Furthermore the criteria used to judge importance (either weight or value) could alter the relative importance of different species.

The range of interpretations lead to a number of observations and issues which EWG 13-16 considered to be important. The provision offers a way of transferring quota from low value/high volume species to low volume/high value species, this potentially provides helpful economic benefits but carries the risk of elevated mortality on the non-target species. The risk is enhanced if multiple transfers were to be made from a range of donors or if ‘target species’ is taken to mean a group and a single large transfer were to be made.

Quota flexibility also has a potential impact on current features of the European quota system. First of all the flexibility implies that resulting catches (particularly of the non-target species) could depart in unpredictable ways from the present relative stability. Secondly there is a potential unintended consequence arising from flexibility because of the diminished capacity for member states to swap quotas between themselves, if they have already transferred the quota to a different species. In effect the introduction of a new facility to help the implementation of the land-all policy leads to a hampering of an existing helpful one.

Depending on the operational level, the new provision may require additional data management development and, particularly if operated at the vessel level, implies a more sophisticated real-time accounting process. Further complications in this regard may arise where intermediate bodies, for example, producer organisations are involved in the negotiation and allocation of the transferred quotas. The EWG discussed at length the requirement for recipient (non-target) species to be within safe biological limits. However, by their very nature such stocks typically fall into the ‘data-limited’ category for which limit reference points have not been agreed. In practice, this will limit the scope for quota transfers to recipient species until such time as limit reference points (or suitable proxies are agreed) and that stocks are shown to be within those limits. By way of example, 14 of the 32 assessed ICES stocks are outside safe limits and a further 60 do not have and assessment or reference points (COM(2012) 278 Final). The regulation implies that there is presently limited scope for the flexibility to be applied and the EWG considered that early progress towards extending the number of species was required. It was also felt, in the absence of reference points based on metrics generated in the typical assessment framework, that the development of biomass and mortality reference point proxies should be treated as a matter of urgency. Discussions of discard plans within new regional bodies is likely to create renewed pressure for catch information and reference points that ICES and other advisory bodies will be expected to respond to.

By way of examples (Table 5.3-1 - Table 5.3-5), five case studies are examined which illustrate some of the potential benefits and difficulties associated with quota flexibility tool. The first two cases draw on typical features of a pelagic fishery, the second two consider situations which might be expected in the mixed demersal fishery of the North Sea and the final case an example more typical of the Bay of Biscay fisheries. It is important to note that the examples are illustrative and purposely present rather extreme situations.

	Before quota flexibility					Transfer	After quota flexibility			
	quota	landings	discards	catch	disc rate	9% from target quota	new landings	new discards	new catch	new disc rate
Target species	55000	50050	0	50050	0%	-4950	50050	0	50050	0.00%
Bycatch species	0	0	4950	4950	100%	4950	**4950**	**0**	**4950**	**0.00%**
Combined	*55000*	*50050*	*4950*	*55000*			*55000*	*0*	*55000*	

Table 5.3-1 Impacts on donor and recipient quota associated with quota-flexibility – case 1

In this example (Table 5.3-1), a target species with relatively large available quota is used to provide a 9% transfer to a bycatch species for which no quota is available. In this case, the transferred fish quantity exactly matches the expected discard amount so that the quota flexibility removes the discards. Combined catch is still the same and in a situation where the target species were of low value and the bycatch more valuable, there would an economic benefit in the process.

	Before quota flexibility					Transfer	After quota flexibility			
	quota	landings	discards	catch	disc rate	9% from target quota	new landings	new discards	new catch	new disc rate
Target species	55000	50050	0	50050	0%	-4950	50050	0	50050	0.00%
Bycatch species	5000	5000	5300	10300	51%	4950	**9950**	**350**	**10300**	**3.40%**
Combined	*60000*	*55050*	*5300*	*60350*			*60000*	*350*	*60350*	

Table 5.3-2 Impacts on donor and recipient quota associated with quota-flexibility – case 2

The second case (Table 5.3-2) is similar to the first with a substantial target species quota able to transfer a sizeable additional quota. Here, however, the bycatch species also has a (smaller) quota available which, in this case, is insufficient to cover the catch (made under present fishing conditions) and without quota flexibility this leads to about half the catch being discarded. By applying the 9% transfer, quite a large proportion of the expected discards can be eliminated, however, the transfer is not quite enough to render the fishery completely discard free. Just over 3% discards remain, but arguably, these could be dealt with by applying the de minimis condition (ie up to 5% discards allowed).

	Before quota flexibility					Transfer	After quota flexibility			
	quota	landings	discards	catch	disc rate	9% from target quota	new landings	new discards	new catch	new disc rate
Target species	15000	13650	0	13650	0%	-1350	13650	0	13650	0.00%
Bycatch species	350	350	233	583	40%	1350	**1700**	**0**	**1700**	**0.00%**
Combined	*15350*	*14000*	*233*	*14233*			*15350*	*0*	*15350*	

Table 5.3-3 Impacts on donor and recipient quota associated with quota-flexibility – case 3

The third example (Table 5.3-3) is more typical of a North Sea situation with a target species quota of around 15000 tonnes. In this example, a bycatch species is present with a relatively small quota and expected discards of about 40%. If the 9% transfer were made from the target species, the discards would be easily removed but now the new landings would imply a catch of the bycatch species about 3 times bigger than in the pre-transfer situation.

	Before quota flexibility					Transfer	After quota flexibility			
	quota	landings	discards	catch	disc rate	9% from target quota	new landings	new discards	new catch	new disc rate
Target species	15000	13650	0	13650	0%	-1350	13650	0	13650	0.00%
Bycatch species	30	30	150	180	83%	1350	**1380**	**0**	**1380**	**0.00%**
Combined	*15030*	*13680*	*150*	*13830*			*15030*	*0*	*15030*	

Table 5.3-4Impacts on donor and recipient quota associated with quota-flexibility – case 4

Case 4 (Table 5.3-4) demonstrates an even more extreme case where, under similar target species conditions, the bycatch species has a very low quota (eg a less prevalent flatfish species)and a high discard rate (>80%). The 9% transfer again easily removes the discard problem, but now the resultant catch (almost 1400 tonnes) is over 7 times what it would be without the quota transfer. Clearly, in cases 3 and 4 a more negative outcome emerges where there is increased risk that the potential for several fold catch increases could affect the sustainability of the stock.

	Before quota flexibility					Transfer	After quota flexibility			
	quota	landings	discards	catch	disc rate	9% from target quota	new landings	new discards	new catch	new disc rate
Target species	10	9.1	0	9.1	0%	-0.9	9.1	0	9.1	0.00%
Bycatch species	1000	1000	1000	2000	50%	0.9	**1000.9**	**999.1**	**2000**	**49.96%**
Combined	*1010*	*1009.1*	*1000*	*2009.1*			*1010*	*999.1*	*2009.1*	

Table 5.3-5Impacts on donor and recipient quota associated with quota-flexibility – case 5

In the final example (Table 5.3-5), more typical of mixed fisheries (eg Bay of Biscay) where there is no obvious, high volume, target species a different situation emerges. The low quota available for transfer does not provide a way of removing the large (in this case) discard quantity of the (perhaps low value) bycatch species. The outcome essentially changes nothing and the flexibility tool is unhelpful in this situation.

In all of these examples, the assumption is made that the expected discard component (removed by transfer) is of landable, marketable fish. In situations where the discards were of very small fish, below the minimum reference size, then the scope to reduce the discards would be less. It is clear that depending on the circumstances very different outcomes can arise from application of the quota flexibility tool.

In these examples, no information is given on the relative size of the bycatch species stocks, in some cases, the transfer amounts may well lead quite rapidly to much higher harvest rates, outside the bounds of sustainable exploitation. This would be exacerbated if several players all chose to transfer quota to the same bycatch species (for example a known choke species).

5.4 Potential cumulative effects of de minimis and quota flexibility

The EWG was asked to consider the scope for and impact of the combined use of the de minimis and the flexibility. There was only limited time to explore this thoroughly but a few observations can be made. Firstly, there are clearly opportunities for the careful use of these provisions to provide a helpful tool to achieve continued fishing opportunity. By applying the 9% transfer it would be possible in some cases to adjust discard rate downward such that the de minimis would then apply and the fishery could continue. It also clear, however, that the combined process offers considerable scope to generate large catches of a species with the attendant risk that fishing mortality would rise. The order in which the provisions are applied has a profound effect alongside the previous comments made. In practise it is likely to be difficult to evaluate in view of the low (5%) component of the combined provisions.

Error! Reference source not found. provides an example drawing on the earlier de minimis case and adding in scope for quota transfer. In this case, the relative change from applying the provisions ranges from just over 1 to over 16, illustrating that unexpected and quite large catches are possible. The risk here is an even larger fishing mortality than expected. Future discussions during the establishment of discard plans will need to guard against overly ambitious transfer schemes for many species and will need to show considerable restraint and common-sense in developing flexible plans which do not lead to excessive mortality.

Baseline catch quotas and status		
Total catch quota for all species available to management region/unit	150000	
target species	SP1	
target species quota	15000	
non-target species catch quota	SP3	
choke species (Risk)	High	
Within safe biological limits (current requirement)	yes	
Non-target species catch quota	583	
de minimis applied to a single species		
5% de minimis allocation based on ***single*** non-target species(SP3) (5% of initial 583 t quota)	29	Rel. Change
Total permissible catch of non-target species (SP3) with additional ***single-species*** de minimis allocation (583 t + 29 t)	612	1.05
de minimis applied across all species		
5% de minimis allocation to ***all*** species (5% of 150000 t quota)	7500	
Total permissible catch of non-target species (SP3) with additional ***multi-species*** de minimis allocation (583 t +7500 t)	8083	13.86
Inter-species flexibility		
9% inter-species quota flexibility allocation (9% of 15000 t target species quota (SP1))	1350	
Non-target species (SP3) catch + 9% inter-species quota flexibility (9% of 15000 t ((SP1))	1933	3.32
cumulative catch effects		
Non-target (SP3) quota + de minimis allocation based on ***single*** (SP3) species + 9% inter-species flexibility on target species (SP1)	1962	3.37
Non-target (SP3) quota + de minimis allocation based on **multi-**species + 9% inter-species flexibility on target species (SP1)	9433	16.18

Table 5.4-1Example showing the variable outcomes associated with cumulative effects of de minimis and quota flexibility

6 ISSUES RELATING TO CATCH ESTIMATION

6.1 Comparison and Categorisation of STECF and ICES catch estimates

A total of 85 stocks were identified by the Commission. These were selected to illustrate the issues for providing catch advice. Two short Ad Hoc contracts were placed to obtain data from ICES and JRC on landings and catch data on which to base catch advice. The available data on landings discards and catch were extracted from the STECF databases for all 86 stocks. In most cases the data could be identified correctly to stock level and extracted directly. In some cases the stock and area definitions were not unique and in this case the extraction was as close as possible to ICES stock definitions. Two types of data were obtained from ICES information on the basis of advice and the availability of discard data was obtained for all 86 stocks. In addition numerical data on catch landings and discards was obtained from the ICES advice sheets for the 23 stocks where this was available.

Both STECF and ICES receive data on landings and discards submitted by MS through both official channels and from scientists. The analysis carried out by EWG 13-16 is based on the assumption that MS have submitted accurate landing data and representative discard sample data. Official logbook data are another source of information on catch (see compliance section below), however, one comparison of scientific estimates and log book declarations of total catch indicated that log books probably provide a gross underestimate of current discards. As the date for commencing the landing obligation comes closer it is possible that additional discard data may be submitted making estimates of discarding rates more uncertain.

EWG 13-16 has used the discard ratio (DR= discards/catch) as the primary metric for comparison. This metric is useful particularly where there are small differences in the area the data represents (as sometimes necessarily STECF extraction cannot match ICES stock areas).In these cases differences in catch may come from not from estimating discards but landing allocation. Such a metric also relates directly to the estimate of catch from relatively well established landings data. Catch and catch advice are the primary variable of interest for this study

Overall the study focuses on what affects the magnitude of the catch not the precision of individual components. In examining the utility of the estimates for giving catch advice the group has used absolute % difference in DR as the main metric. This parameter is chosen because it is similar to the % change in catch that would occur if different approaches are used. So for example if discarding is very low but variable the DR will vary but the absolute difference in catch across methods or data sets will still be small. Only when discard rates are also large does catch estimation vary substantially when discard rates vary. The Group considers that this is the aspect that matters most for the estimation of catch and the provision of catch advice.

Based on the STECF data and ICES information the stocks were classified into three groups:-

Group I. Thirty four stocks which ICES indicates that discarding is considered negligible and STECF estimates that discarding is less than 10%.

Group II. Twenty three stocks for which detailed data on catch is available from both ICES and STECF

Group III. The remaining 28 stocks for which either ICES or STECF indicate that significant (>10%) discarding occurs and currently ICES does not present discard data in the advice sheets

The choice of the split at <10% of catch discarded is based on the perception that at such a magnitude the risk to management caused by misspecification of the discard rate could be regarded as negligible. In this evaluation STECF has assumed that MS submissions of discard data to STECF databases reflect current availability of discard data, and if zero or low rates are reported for an area and species these reflect low rates in the relevant fisheries and that no data is collected. The consideration for these three groups of stocks are discussed below.

6.1.1 Group I

Table 6.1-1shows the stocks in this group. The table shows the way ICES has considered discarding in the advice; the availability of detailed Intercatch data; and the discard rate obtained from STECF database. For these stocks 29 of the 34 have discard rates less than 5% for the remaining five with rates between 5 and 10% there is some uncertainty regarding raising from relatively few discard values in the STECF database.

Conclusions from comparison of Group I stocks.

ICES is expected to be able to provide catch advice for almost all of these stocks and if the discard element suffers from uncertainty the errors will be short term (a few years at most) and small provided subsequent catches are reported accurately through the landing delaration. The exceptions to this are some FU for *Nephrops* and some area advice for ling and argentine where additional discard data may be needed. Also, it must be underlined that the actual level of additional mortality within pelagic fisheries coming from slipping (the process of releasing the unwanted catches taken in the net before hauling onboard) is largely unknown, although this can be considered as a form of discarding (see section 7). The best advice is obtained by using a coherent analysis where assumptions in the assessment match the assumption in advice. Thus the group concluded that as all the differences are small the use of the ICES methods for catch estimation should be continued for all of these stocks.

Table 6.1-1Stocks in Group I (stocks with less than 10% discard in STECF databases), the table shows: the current basis of ICES advice regarding discards; the availability of detailed Intercatch data; the discard rate expressed as a % of the estimated catch; and the years when catch quota data is potentially required.

Stock	ICES Advice statement	In Assessment	ICES InterCatch data	STECF discard rate	Implementation Year
Anchovy-IXa	Assumed to be negligible	No	No	0%	2015
Anchovy-VIII	Assumed to be negligible	No	Yes	0%	2015
Anglerfish-IIIa_IV_VI	Assumed to be negligible	No	Yes	7%	2016-2019
Anglerfish-VIIb-k_VIIIa_b_d	Assumed to be negligible	No	No	3%	2016-2019
Anglerfish-VIIIc_IXa	Discard data available	No	Yes	0%	2016-2019
Argentine-Va	Discard not available	No	No	0%	2016-2019
Blue Whiting-I_II_III_IV_V_VI_VII_VIIIa_b_d_e_XII_XIV	Assumed to be negligible	No	Yes	1%	2015
Herring-25-29_32	Assumed to be negligible	No	Yes	0%	2015
Herring-28.1	Assumed to be negligible	No	Yes	0%	2015
Herring-30	Assumed to be negligible	No	Yes	1%	2015
Herring-31	Assumed to be negligible	No	Yes	1%	2015
Herring-Vb_VIaN_VIb	Assumed to be negligible (reported for demersal vessels)	No	Yes	0%	2015
Herring-VIaS_VIIb_c	Assumed to be negligible	No	Yes	0%	2015
Herring-VIIa	Assumed to be negligible	No	combined w VIIg,h,j,k	1%	2015
Herring-VIIg_h_j_k	Discard data available	Yes	combined w VIIa	1%	2015
Horse mackerel-IXa	Assumed to be negligible	No	Yes	1%	2015

Horse mackerel-Xa	Discard data available	Yes	No	0%	2015
Ling-IIIa_IV_VI_VII_VIII_IX_X_XII_XIV	Partial (underestimate)	No	No	9%	2016-2019
Ling-Va	No	No	No	0%	2016-2019
Ling-Vb	No	No	No	0%	2016-2019
Mackerel-VI_VII_VIIIa_VIIIb_VIIId_VIIIe_Vb_Iia_XII_XIV	Partial	Yes	Yes	5%	2015
Megrim-VIIIc_IXa	Discard data available	No	Yes	3%	2015
Nephrops-VI_Vb	Discard data available	Yes	several FU	0%	2016-2019
Nephrops-VII	Partial	Partially	several FU	0%	2016-2019
Norway Pout-VIa	No discards	No	No	1%	2016-2019
Plaice-VIIe	Discard data available	No	Yes	4%	2016-2019
Sole-VIIa	Discard data available	No	Yes	2%	2016-2019
Sole-VIId	Assumed to be negligible	No	Yes	2%	2016-2019
Sole-VIIe	Assumed to be negligible	No	Yes	0%	2016-2019
Sole-VIIf-g	Discard data available	No	Yes	3%	2016-2019
Sole-VIIh_j_k	No discards	No	Yes	2%	2016-2019
Sole-VIIIc_IXa	No discards	No	No	0%	2016-2019
Spurdog-Allareas	Partial	No	No	7%	2016-2019
Norway Pout-IV_IIIa	Assumed to be negligible	No	Yes	10%	2015

6.1.2 Group II

This group is based on the stocks for which ICES publishes discard data in its advice and data is available in the STECF database. For this group two evaluations were conducted. First all 23 stocks landings and discards were compared for catch years 2009 to 2012. Secondly several individual stocks from the North Sea were examined in detail to obtain greater understanding of the differences.

Table 6.1-2 documents the differences in discard rate obtained by comparing ICES discard data obtained from the ICES advice sheets and data extraction from the STECF databases.

The main reasons for discrepancies between STECF and ICES data can be summarized in the following.

- Different methods are used from ICES and STECF in order to raise discard estimates when no information is available from a Member State (see also more detailed discussion below).
- Several inconsistencies can be found in the management areas defined in the two datasets due to ICES practice of moving catch to better link area to stock and STECF area specification from DCF.
- For some stocks the ICES expert working groups are using official landings declarations considering this information as reliable to perform the assessment. In other cases the landings figures are raised based on the experts' knowledge of the stock by adding unallocated values to obtain the so called ICES landings level. These ICES figures are used to in the stock assessment process. STECF uses only official submitted landings but does not carry out stock assessment.
- Only EU Members States are obliged to submit data to STECF whereas Norway, Faros, Iceland and other countries provide data to ICES and can be a major contributor in some stock catches. Discarding rates are different for some of these countries that do not submit data to STECF.
- No Spanish data was submitted to STECF for years 2010 and 2011. For year 2012, Spanish discard information is only available for areas VIIIc and IXa. Some Spanish estimated values are included in the ICES dataset used for the assessment.
- No discard information was submitted from France to STECF for 2012 and therefore only raised discard estimated values are used. Furthermore, as written in the STECF report regarding French submissions in 2013 for year 2012 "Neither biological data (age data) nor discards data were provided. Discards data have been provided the years before for 2010 and 2011 but care is required in the use of these data to draw firm conclusions about catch composition."

One or more of the above inconsistencies may result in the discrepancies observed in the discard rates in Table 6.1-1 between the two datasets.

Figure 6.1-1 illustrates the estimated by stock by year. Figure 6.1-2 shows the same information aggregated over years expressed as the absolute difference in discard percentage points. From these graphs it can be seen that there is convergence over time and in 2012 all differences are below 20% and 16 out of 23 are below 10%. A discussion of differences greater than 10% is given below by stock.

Table 6.1-2 The differences in discard rate obtained by comparing ICES discard data obtained from the ICES advice sheets and data extraction from the STECF databases.

		2009			2010			2011			2012		
Stock	Area	RATE-STECF	RATE-ICES	DIFF-RATE	RATE-STECF	RATE-ICES	DIFF-RATE	RATE-STECF	RATE-ICES	DIFF-RATE	RATE-STECF	RATE-ICES	DIFF-RATE
Cod	VIa	74.13	69.84	4.29	81.51	58.41	23.1	88.14	78.63	9.51	85.92	71.45	14.47
Cod	VIIb-c_e-k_VIII_IX_X_CECAF	53.87			25.19			28.04	8.75	19.29	27.58	11.01	16.57
Cod	IV_VIId_IIIa	28.22	33.80	5.58	17.73	25.42	7.69	17.6	24.37	6.77	17.38	23.81	6.43
Cod	22-24	6.78	10.40	3.62	11.97	8.84	3.13	10.44	4.55	5.89	4.32	5.03	0.71
Cod	25-32	7.61	6.43	1.18	7.99	6.58	1.41	10.9	7.10	3.8	13.34		
Haddock	VIa	37.66	36.56	1.1	49.22	48.25	0.97	44.08	46.99	2.91	9.24	9.40	0.16
Haddock	VIb	40.7	32.48	8.22		8.25		7.49	7.39	0.1	3.31		
Haddock	VIIa	61.06			10.77	37.07	26.3	39.51	40.21	0.7	62.7	67.11	4.41
Haddock	VIIb-k_VIII_IX_X_CECAF	36.57	48.71	12.14	30.19	62.02	31.83	38.12	52.71	14.59	22.3	35.52	13.22
Haddock	IV_IIIa	23.23	24.33	1.1	25.1	25.90	0.8	26.41	24.84	1.57	11.91	12.00	0.09
Hake	IV_VI_VII_VIII_Vb_XII_XIV	2.51	10.27	7.76	22.27	6.41	15.86	8.9	7.27	1.63	4.6	7.43	2.83
Hake	VIIIc_IXa	17.08	13.24	3.84	18.85	9.31	9.54	30.41	10.24	20.17	22.1	12.36	9.74
Megrim	IVa_VI_Vb_XII_XIV	2.6	12.76	10.16	1.32	7.23	5.91	0.78	15.00	14.22	2.44	14.08	11.64
Megrim	VII_VIIIa_b_d	11.03	16.32	5.29	8.66	25.05	16.39	11.16	21.88	10.72	8.73	19.37	10.64
Plaice	VIIa	37.47	71.13	33.66	41.48	87.10	45.62	64.69	50.42	14.27	82.1	64.75	17.35
Plaice	VIIf-g	46.06	56.77	10.71	53.49	60.74	7.25	41.44	72.45	31.01	79.58	68.13	11.45
Plaice	IV	42.1	44.93	2.83	33.7	42.80	9.1	51.07	37.38	13.69	53.35	44.47	8.88

Salmon	32	11.08	11.31	0.23	11.85	11.67	0.18	10.17	9.64	0.53	8.65	10.03	1.38
Salmon	22-31	4.27	3.56	0.71	4.32	3.93	0.39	3.05	4.52	1.47	4.15	4.17	0.02
Whiting	VIa	62.63	46.20	16.43	74.92	74.42	0.5	57.21	59.58	2.37	78.11	69.90	8.21
Whiting	VIIa	98.24	94.93	3.31	63.83	89.52	25.69	88.83	94.06	5.23	92.71	96.55	3.84
Whiting	IIIa	86.05	30.76	55.29	91.43	54.25	37.18	92.25	87.55	4.7	62.56		
Whiting	IV_VIId	86.68	29.50	57.18	43.91	38.85	5.06	30.12	38.79	8.67	38.03	32.96	5.07

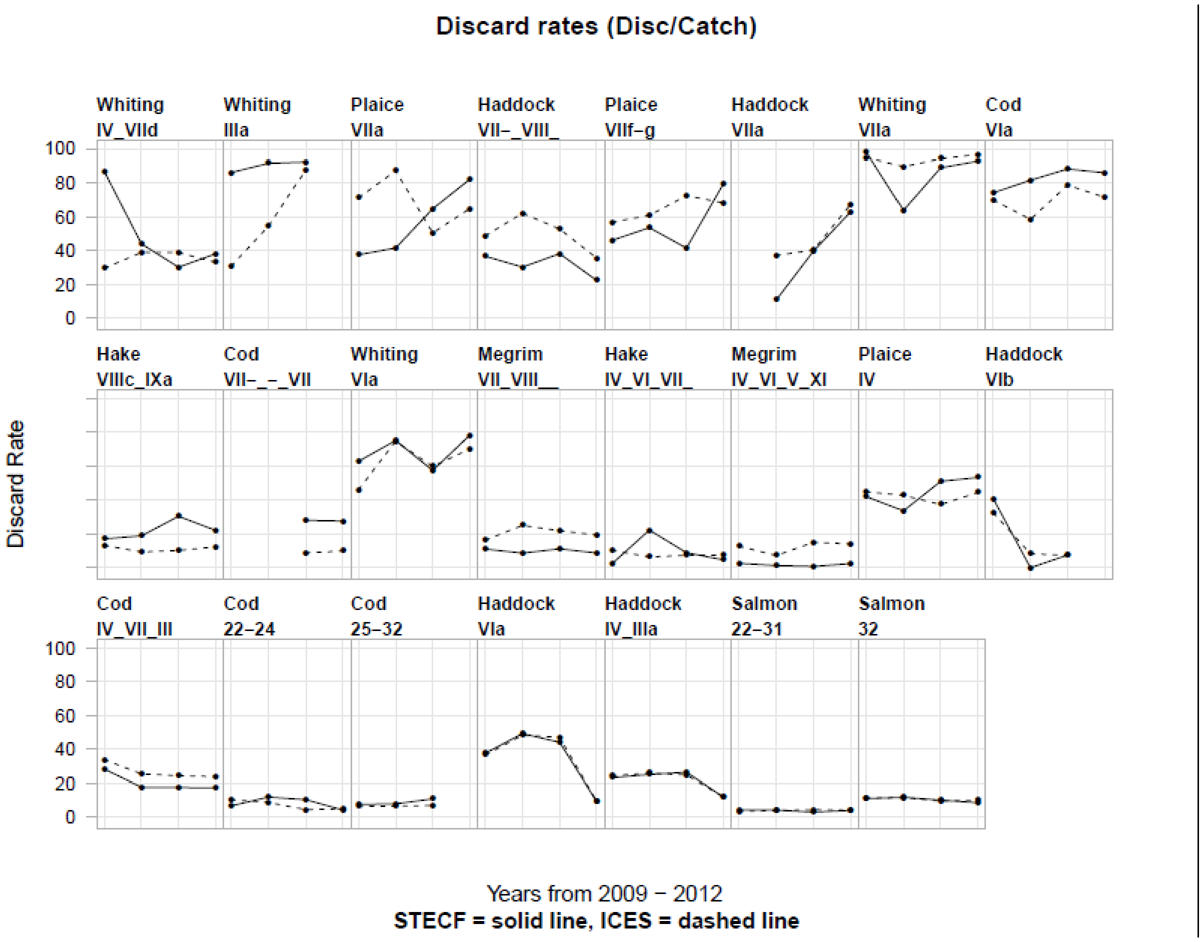


Figure 6.1-1 The discard rate (discard/catch) obtained from ICES advice sheets and data extraction from the STECF databases.

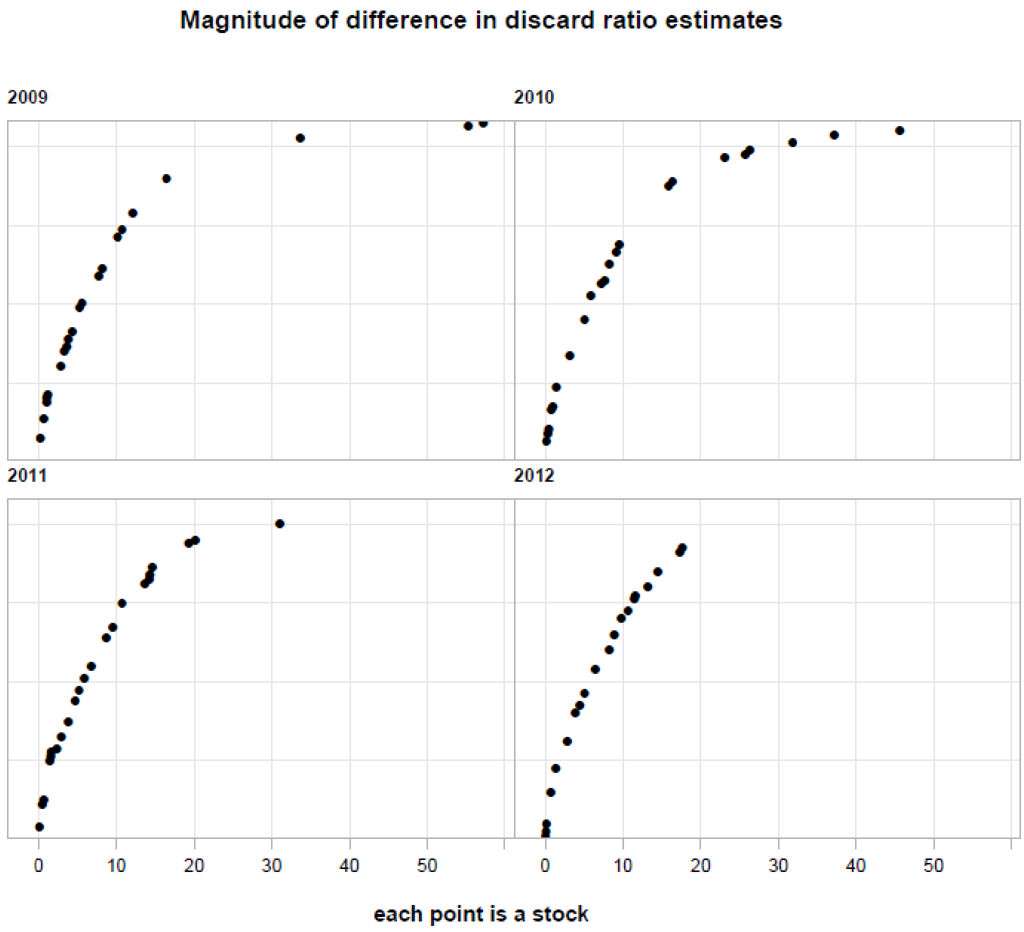


Figure 6.1-2 Absolute differences on discard rate for the 23 stocks obtained from ICES advice sheets and data extraction from the STECF databases. This shows that differences are reducing and by 2012 all differences are under 20% and 16 out of 23 are below 10%. See text for discussion of differences greater than 10%.

6.1.2.1 Stocks from group II with less than 10% difference between STECF-ICES discards ratio in all years:

The following eight stocks all appear to have discard estimation that is similar in both ICES and STECF data over all years from 2009 to 2012 and it is considered it should be possible to give catch advice. They are: Cod_IV_VIId_IIIa, Cod_22-24, Cod_25-32, Haddock_Via, Haddock_VIb, Haddock_IV_IIIa, Salmon_32, Salmon_22-31.

6.1.2.2 Stocks (seven) from group II have a difference of greater than 10% between STECF-ICES discards ratio in 2012:

Cod_VIa

The absolute difference between STECF-ICES discard ratio (DR) in 2012 is 14.47%. ICES Landings (2009-2012) are around double than those reported to STECF and the discards data is comparable.

The management areas between ICES and STECF for this stock are the same. However, Norway doesn't submit data to STECF (i.e. missing ~57 tones in 2012). The differences are because ICES reallocates landings between VIa and IVa due area misreporting. (in 2012 are 466 tonnes compared with official landings of 215.)

Conclusion: ICES provides catch advice for this stock but the estimates are uncertain and may remain so.

Cod_VIIe-k

The absolute difference between STECF-ICES discard ratio (DR) in 2012 is 16.57%. In addition, ICES Landings in 2011 higher than those reported to STECF and STECF discards are 2.5 times higher than ICES in 2011 and 3 times higher in 2012. ICES also reallocates landings taken in the southern part of VIIa (statistical rectangles 32E3 and 32E4) into VIIg as they are considered to be associated with the VIIe-k stock.
There is a difference in areas covered by the EU management units for this stock and the ICES stock areas. Also, France didn't submit any discards values for 2012 to STECF, hence only raised discard estimates are used in STECF resulting in a high number of discard weights. ICES Landings in 2011 included 1828 French highgrading tonnes (estimated from self-sampling programme).

Conclusion: ICES does not currently provide catch advice. There is uncertainty in the discard estimates data is available at ICES and in the STECF databases. ICES should evaluate available (including STECF data) discard data to assess its suitability to give catch advice.

Haddock_VIIb-k

The absolute difference between STECF-ICES discard ratio (DR) in 2012 is 13.22%. Landings are comparable between both data sets but ICES discards are 2-3 times higher than those reported to STECF for all years. ICES also reallocates landings taken in the southern part of VIIa (statistical rectangles 32E3 and 32E4) into VIIg as they are considered to be associated with the VIIb-k stock.

Regarding the discards, ICES Advice states that There is considerable uncertainty around the estimated discard numbers-at-age due to the diverse fishing (and discarding) practices and relatively low numbers of discard samples. However, the assessment appears to be relatively robust to the absolute levels of discards. For this stock there is also a difference in areas covered by the EU management units reported to STECF and the ICES stock areas. Difference in management areas and different raising methods used may account for the observed differences.

Conclusion: ICES provides catch advice. It is likely the real differences in DR are less than 10%

Megrim_IVa_VIa

The absolute difference between STECF-ICES discard ratio (DR) in 2012 is 11.64%. Landings are comparable between both data sets but ICES discards are much higher and not comparable with those from STECF (i.e. in 2012 the ICES discards are 6 times higher).

Regarding the discards, ICES Advice states that for 2012 due to paucity and absence of discard data, historical discards levels are assumed. For this stock there is also a difference in areas covered by the EU management units reported to STECF and the ICES stock areas. In addition, data from Norway is available to ICES but not reported to STECF. Differences in management areas and different raising methods used may account for the observed differences. Overall because discard rates are relatively low the uncertainty does not give rise to major differences in estimates of catch.

Conclusion: ICES already gives catch advice. Differences are just over 10% ICES could review available data to see if improvements can be made, though as discarding is a small proportion of the total catch advice is unlikely to change significantly.

Megrim_VII_VIII

The absolute difference between STECF-ICES discard ratio (DR) in 2012 is 10.64%. ICES discards from 2009-2012 are 2-5 times higher than those reported to STECF. Landings are higher in 2009-2011 in ICES data set and in 2012 in STECF data set.

Regarding the discards, ICES Advice states that 'an important contributor to the megrim catches, France, has not provided discard estimates in the last decade'. For this stock there is also a difference in areas covered by the EU management units reported to STECF and the ICES stock areas (i.e. VIIa is not included in ICES). In addition, ICES stock refers to the megrim species *Lepidorhombus whiffiagonis* whereas data reported to STECF refers to all megrim species *Lepidorhombus* spp. Also, France didn't submit discard data to STECF in 2012 and to ICES in the last decade and therefore raised discards may not be comparable due to differences in raising methods.

Differences in management areas and different raising methods used may account for the majority of the observed differences. Overall because discard rates are relatively low the uncertainty does not give rise to major differences in estimates of catch.

Conclusion: ICES data is reported to be partial. Differences are just over 10% ICES could review available data include that from STECF to see if improvements can be made, though as discarding is a small proportion of the total catch advice is unlikely to change significantly.

Plaice_VIIa

The absolute difference between STECF-ICES discard ratio (DR) in 2012 is 17.35%. Landings are comparable in both data sets with small unreported landings in ICES data. Discards values are not comparable between both data sets with STECF discards 2 times higher than ICES.

Regarding the discards, ICES Advice states that 'Discard information from Northern Irish and Irish *Nephrops* fleets became available for the first time this year (2013), enabling improved discard estimates for the most recent years (2010–2012). Because no time-series of this information was available to be incorporated in the assessment model, the previous discards computation was used. However, the new discard information was used to quantify the catch advice.' For 2012 data, two discards values sets were available in ICES Advice. If the most recent ICES discard figure is used for 2012 then the difference between the discard rates will be reduced to 12.2% making this estimation more consistent with STECF data.

Different discards raising methods used by ICES and STECF may account for the observed differences.

Conclusion: ICES provides catch advice. Differences are acceptable.

Plaice_VIIf-g

The absolute difference between STECF-ICES discard ratio (DR) in 2012 is 11.45%. Landings are comparable in both data sets. However ICES discards from 2011 are 4 times higher than those reported to STECF and STECF discards in 2012 are higher than those in ICES.
French discards are raised estimates resulting in high values which may not be representative. ICES used UK's discard estimates to raise French (a major contributor to the catch) and Northern Ireland discards.

Different discards raising methods used by ICES and STECF may account for the observed differences

Conclusion: ICES provides catch advice. Differences are acceptable.

6.1.2.3 All other Group 2 stocks (eight stocks) with >10% difference between STECF-ICES discards ratio for years prior to 2012:

Haddock_VIIa

The absolute difference between STECF-ICES discard ratio (DR) in 2010 is 26.3%. Discards in STECF for 2010 are significantly lower compared to the rest of STECF time series and to ICES in 2010.
The differences in discards raising methods used at STECF and ICES probably accounts for the inconsistencies in discard values in all years.

Difference in DR in the most recent year (2012) are below 10% indicating that differences in catch estimation are acceptably small

Conclusion: ICES provides catch advice. Differences are acceptable.

Hake_IV_VI_VII_VIII_Vb_XII_XIV

The absolute difference between STECF-ICES discard ratio (DR) in 2010 is 15.86%. ICES Landings are 2-3 times higher than those reported to STECF for all the years. More specifically, ICES discard values in 2010 are significantly higher than those reported to STECF.

There is a difference in areas covered by the EU management units for this stock and the ICES stock areas. ICES includes IIIa and doesn't include Vb, XII and XIV. In addition, ICES for 2011-2012 considers high unreported landings in the assessment whereas STECF deals only with official reported values.

Conclusion: Differences in DR in the most recent year (2012) are below 10% indicating that differences in catch estimation are acceptably small. Data may be partial, missing data issues need to be addressed.

Hake_VIIIc-IXa

The absolute difference between STECF-ICES discard ratio (DR) in 2011 is 20.17%. Landings and discards values are not comparable for years 2010-2011.

The main reason for this is the missing Spanish data from STECF data set since Spain has not provided these values for these years. Spain is the major fleet in these waters. However, ICES uses estimates of the Spanish landings and discards in the assessments.

Conclusion: Difference in DR in the most recent year (2012) are below 10% indicating that differences in catch estimation are acceptably small. Data may be partial, missing data issues need to be addressed.

Plaice_IV

The absolute difference between STECF-ICES discard ratio (DR) in 2011 is 13.69%. STECF discards in 2011-2012 area higher than those reported to ICES. Moreover, ICES discards in 2010 are 50% higher than those reported to STECF.

The differences in discards raising methods used at ICES and STECF probably accounts for the inconsistencies in discard values.

Difference in DR in the most recent year (2012) is below 10% indicating that differences in catch estimation are acceptably small

Conclusion: ICES provides catch advice. Differences are acceptable.

Whiting_VIa

The absolute difference between STECF-ICES discard ratio (DR) in 2009 is 16.43%. Landings are comparable between both data sets but STECF discards are higher than those estimated by ICES in years 2009 and 2012.

The differences in discards raising methods used at ICES and STECF in a high discarded stock probably accounts for the inconsistencies in discard values.

Difference in DR in the most recent year (2012) is below 10% indicating that differences in catch estimation are acceptably small

Conclusion: ICES provides catch advice. Discard rates are high and may lead to overall uncertain catch estimation. Differences between STECF and ICES are acceptable.

Whiting_VIIa

The absolute difference between STECF-ICES discard ratio (DR) in 2010 is 25.69%. Landings are comparable between both data sets but ICES discards in 2010 are 5 times higher than those reported to STECF in 2010.

The differences in discards raising methods used at ICES and STECF in a high discarded stock probably accounts for the inconsistencies in discard values. Moreover, discard figures from Northern Ireland where introduced to ICES in 2009 for the first time.

Difference in DR in the most recent year (2012) is below 10% indicating that differences in catch estimation are now acceptably small

Conclusion: ICES provides catch advice. Differences are acceptable.

Whiting_IIIa

The absolute difference between STECF-ICES discard ratio (DR) in 2009 is 55.29% and in 2010 is 37.18%. ICES landings are higher than those reported to STECF for all available years. However, ICES discards are significantly lower compared to STECF values for years 2009 and 2010 probably due to different raising methods. Moreover, Norway does not submit data to STECF but this data are available in ICES.

Difference in DR in the most recent year (2012) is below 10% indicating that differences in catch estimation are acceptably small

Conclusion: ICES provides catch advice. Discard rates are high and may lead to uncertain catch estimation Differences between STECF and ICES are acceptable.

Whiting_IV_VIId

The absolute difference between STECF-ICES discard ratio (DR) in 2009 is 57.18%. Landings are comparable between both data sets but STECF discards in 2009 are 15 times higher than those estimated by ICES. The high discard figure found in 2009 STECF data is deriving from high French discard figures due to the raising method of discard estimates followed.

Difference in DR in the most recent year (2012) is below 10% indicating that differences in catch estimation are acceptably small

Conclusion: ICES provides catch advice. Differences between STECF and ICES are acceptable.

Conclusions from comparison of group II stocks.

For the 23 stocks where detailed evaluations were carried out there is evidence of convergence of values between STECF and ICES catch estimates at stock level. There are a number of identified reasons why there will always be differences between the two analytical methods. They use different segmentation schemes and different approaches for raising segments without discard data. For 16 of the 23 stocks absolute discrepancies between the two discard rates are now under 10%. For the other 7 some of the reasons for differences have been identified. The group concluded that for all these stock the difference are now small and unlikely to contribute significantly to catch advice. The best advice is obtained by using a coherent analysis where assumptions in the assessment match the assumption in advice. EWG 13-16 concluded that the ICES estimates should be considered the definitive estimates for the basis of assessments and catch forecasts. In such cases, as discards levels are low, future catch quotas will not be significantly greater than the corresponding landings quotas.

6.1.3 Some differences between STECF and ICES type of approach, with a specific focus on the fishery-based raising as used in the North Sea.

The ICES WGNSSK/MIXFISH data call approach (which is about to be extended to other ICES areas and working groups) was initiated after that the MIXFISH group unsuccessfully tried to use the STECF data for their own purposes back in 2008-2009. The sum of catch and age distribution in the STECF data did not match sufficiently well the ICES stock level estimates, which prevented relevant analyses of partial F to be performed.

In 2013, ICES WGMIXFISH started a more precise comparison of the metrics coming from STECF and from ICES WGNSSK/WGMIXFISH for the North Sea stocks. The totals landed and effort employed by directly comparable categories should be the same between datasets, and indeed WGMIXFISH concluded that the issues were not important, although they might still occur due to differences in segmentation. But as expected, the largest differences between the data sets were found in the discard estimates (after raising).

Discard data is only sampled for a fraction of national fleets. The way the discard data is raised within a nation can be affected by the grouping of vessels implied by a fleet specific data call. Additionally, once the ‘raw’ data is supplied a working group has choices whether to assign (raise) a discard rate (and associated discards) to unsampled fleets and if so how. Assignment process for WGMIXFISH and STECF is different, as described below.

Differences could then result from different rules for assigning discards to metiers where discard data is missing in the working groups but it could also be an effect of countries submitting different discard estimates to various working groups.

Description of the differences in data collection and raising procedures

Differences in the data call

The Commission’s effort data call for STECF request data at a scale with is finer than the scale usually sampled by national institutes. The information is requested at a finer breakdown of mesh size, vessel length, and specific condition than the DCF métiers.

In contrast ICES WGNSSK/MIXFISH data call proceeded from a bottom-up ad-hoc approach where the individual institutes indicated their actual sampling strata, which often span over several closely related DCF level 6 metiers (e.g. OTB_DEF_70-99_0_0 and OTB_CRU_70-99_0_0, or OTB_DEF_100-119_0_0 and OTB_DEF_>=120_0_0). These actual strata (“supra métiers”) have formed the basis of the data call, allowing for both metiers which are largely common to all countries, and also to some country-specific strata (for ex OTB_CRU_70-99_2_35). This approach reduces the number of segments without discard information.

For the North Sea (area 4), there can be typically 3 - 4 times more strata for a country to fill in the STECF data call than in the ICES WGNSSK/WGMIXFISH data call.

Raising procedures

The principles for raising information (both discards ratio and age distribution) from sampled to unsampled strata differ between the two procedures.

In the STECF databases, the raising is entirely automatic, applying fixed procedures that have been unchanged for many years now. The raising is done at the lowest stratum level, i.e. area*quarter*gear*mesh size, where a country’s landings without discards (and/or age information) is raised by available discards ratio (/age distributions) from other countries within the same stratum. If there are no sampled strata available, then no raising is performed. This method is therefore fully objective and quick, but bears some risk for artefacts in the raising, where irrelevant or inconsistent discards ratio are used equally (for example if a country has closed a fishery in 4th quarter by quota exhaustion, higher discards ratio may apply to other countries which haven't been in the same situation).

In the ICES InterCatch database as used by the WGNSSK/WGMIXFISH for the North Sea, the raising is entirely manual and requires expert judgement. In 2013, a number of tools have been developed and applied to the 2012 data in order to screen and visualize the data available and help taking informed decision. Discards ratio by metier and country are plotted. The ICES WGs have applied consensus guidelines, with the basic principle that no unsampled metier should be left without a discards estimate (unless there is a good argument for doing so). This implies that if there are no sampled strata directly related to raise from, then a decision can be made to choose any other strata, or the average across all strata. Facilities have been developed in InterCatch in order to group sampled and unsampled strata, allowing quicker and more efficient work. This raising procedure avoids pitfalls of using irrelevant strata for raising métiers, and can better involve expert knowledge; but compared to STECF, this procedure is more demanding in time and expertise, is more subjective and more likely to evolve from year together with increased but also variable knowledge of the experts involved.

It cannot be said that either can be considered more or less appropriate than the other one, as both procedures bear different advantages and disadvantages as explained above.

Discards information by fleet for the main North Sea demersal stocks

The overall consistency at the stock level as shown in the analyses above can nevertheless hide major disparities when breaking down at the fleet-country level.

A brief illustration of this is given below (Table 6.1-3) with the example of 2012 whiting catch data in area 4 (nb in this example InterCatch DCF métiers have been allocated to the equivalent STECF categories in the best way for comparison purposes, for example OTB DEF >=120 0 0 is included in TR1)

ICES INTERCATCH

Gear	2012 landings	2012 Discards	2012 DR
BEAM	6	29	0.83
BT1	1	0	0.33
BT2	33	1372	0.98
GN1	7	7	0.49
GT1	3	2	0.40
LL1	2	1	0.33
oth	279	140	0.33
OTTER	294	146	0.33
TR1	7925	837	0.10
TR2	3815	3223	0.46
Grand Total	**12366**	**5757**	0.32

STECF

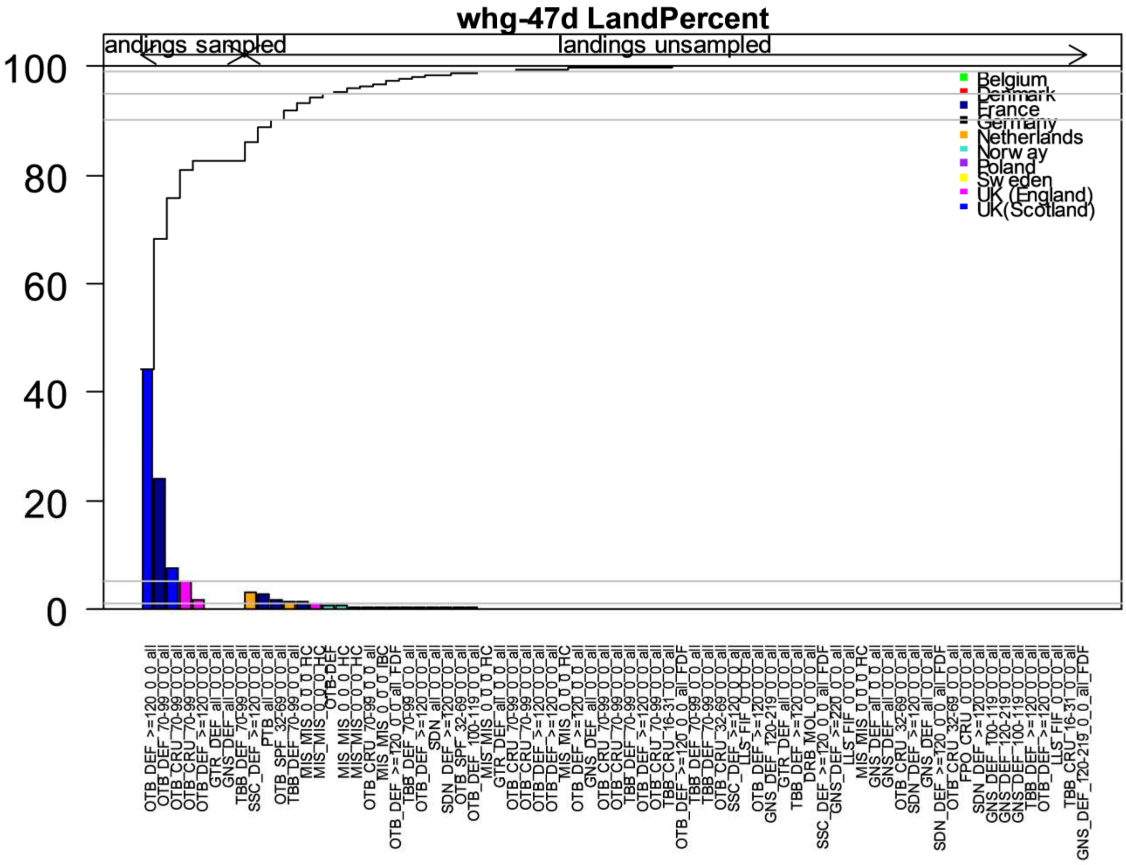
Gear	2012 landings	2012 Discards	2012 DR
BEAM	8	20	0.71
BT1	1		0.00
BT2	280	1657	0.86
DEM_SEINE	39		0.00
DREDGE	0		0.00
GN1	2	207	0.99
GT1	1	9	0.86
LL1	0		0.00
none	0		0.00
OTTER	58	1425	0.96
PEL_SEINE	1	0	0.07
PEL_TRAWL	339		0.00
POTS	0		0.00
TR1	7805	713	0.08
TR2	3474	4448	0.56
TR3	74		0.00
Grand Total	12083	8477	0.41

Table 6.1-3Comparison of ICES (InterCatch) and STECF landings and discards estimates for equivalent management units groupings for catches of whiting in the North Sea during 2012.

The total landings for the entire area are consistent, and the absolute difference in the estimated overall discards rate lie within 10%. Yet, the breakdown between gears differs, both with regards to landings and to discards. Ultimately, the overall picture is globally coherent in terms of the scale of landings and discards ratio for the main gears (TR1-TR2, which are likely to be sufficiently sampled, while discards and discards rate estimates are obviously more uncertain for the less important (and thus less sampled) gears for this stock

Certainly, it is clear that the best way to reduce uncertainty linked to the raising method is to reduce the amount of landings that are not sampled for discards information.

The ICES WGNSSK 2013 has produced a range of plots illustrating the importance of sampled vs. unsampled strata:



Figure

Figure 6.1-3 Sampled vs. unsampled landings strata for 2012 whiting in North Sea and Skagerrak (source: ICES WGNSSK 2013). The first group of bars shows landings (in % of total landings) for strata by metier (legend) and country (color) that have some discards information attached. The second group of bars illustrates the unsampled strata. The black line is the cumulative proportion, with grey lines showing the 90, 95 and 100% of total landings. For this stock, slightly more than 85% of landings have discard information attached.

The analysis presented in Figure 6.1-3 shows that for most of the main demersal stocks in the North Sea, landings are well covered by discards samplings, with fairly high landings proportions: above 80% for cod and whiting, and up to 95% for saithe, haddock or plaice in Skagerrak, but 70% for plaice in the English Channel.

Similarly, the STECF databases now include a quality control code (A, B or C) indicating the % of landings covered with discards information.

Conclusions from NS data

Such diagnostics are considered a very useful summary of the information available, and should hopefully be expanded to other stocks from other areas and ICES working groups and the use of intercatch generalized (or replaced by the regional Data Bases when these get fully operational). A high % coverage involving the DCF métiers gives confidence that differences between ICES and STECF discards estimates may not be too large, as only the marginal strata will have to be raised by one or another method. They also provide information to Member states wanting to develop discards atlas on which information is directly reliable as coming from the Member states own discards sampling program. The small number of métiers and fisheries not nationally covered cannot be expected to have a fully reliable and robust discards estimate, which ever source is used, but overall for the fisheries examined the results appear to capture the estimation of catch adequately for giving advice for the North Sea.

6.1.4 Group III

Four populations are identified by ICES as currently without discard data to give catch advice and by STECF as having some discard data available. For some of these stocks there may be a potential to move to catch advice. Seventeen populations are identified by ICES as currently with discard data but in most cases ICES does not currently use this data in assessments. For these populations STECF has some discard data available in the STECF databases. The group examined the data, and its variability preliminary analysis evaluated the potential to move to catch advice. It is not possible to draw general conclusions for this group and each stock is considered separately below.

Cod-VIIa (Implemented 2016-2019)

Currently ICES does not include discards in the assessment and does not advise on catches but rather that there should be no directed fishery. The WG report indicates that WKROUND 2012 collated recent discard information provided by Member States for the stock. In conclusion the current discard information is considered by the WG as representative of the information for the main fleets highlighting strong differences between national, quarterly and potentially regional discard rates as the national fleets tend to fish differing areas with differing gears. The WG should examine if the data are sufficiently precise to give catch advice. In some stocks in this situation the target F has been reduced considerably in an unsuccessful attempt to control catches by making landings more restrictive. Also the fraction of the catch that is discarded may have become very large. Managers might want to look at the suitability of the cod management plan provisions when moving from landings to catch quotas.

Conclusion: discussions with managers should be how it is intended to translate restrictive landings advice to catch quotas. Additional work will be required to establish what is needed to give catch advice.

Dab-22-32 (Implemented 2015-17)

ICES states that discards are known to take place, but the data are insufficient to estimate a discard proportion that could be applied to give catch advice; therefore total catches cannot be calculated. STECF reports discard data from Germany Denmark and Sweden at least for years 2009 to 2012. This data gives a range of discard rate (discard/catch) of 0.45 to 0.60. The ICES WG should evaluate available data including those from STECF and provide the best estimate of catch. (This stock will be benchmarked by ICES in January 2014)

Conclusion: discard rates of this magnitude need to be considered in catch advice. As the factors appear to be fairly consistent ICES should review available discard data, including that given to STECF and see if catch advice can be given and if not indicate what is needed in order to do so.

Dab-IV_IIIa (Implemented 2016-2019)

ICES states that discards are known to take place, but the data are insufficient to estimate a discard proportion that could be applied to give catch advice; therefore total catches cannot be calculated. STECF reports discard data from seven EU countries around the North Sea from 2003 to 2012 with overall discard rates of between 0.84 and 0.96 which implies very high catches relative to landings. The ICES WG should evaluate available data including those from STECF and provide the best estimate of catch. Managers might like to consider if setting catch quotas between 7 to 20 times the landings is the appropriate management response for this stock.

Conclusions: There will be considerable uncertainty in catch estimates for stocks with such high discard rates. ICES should review the available data and provide estimates of catch. The issues of such large multipliers should be discussed with managers both ICES and STECF might consider the way catch advice should be given under these situations.

Herring-IV_IIIa_VIId (Implemented 2015)

In 2013 ICES states that all catches are assumed to be landed. Discards have been reported in some years and ICES already provides catch advice. STECF reports very variable discard rates. There appear to be some rather high values which appear to be the result of automatic raising in areas with sparse or missing data. In the absence of information to the contrary the ICES EWG estimates appear to be the best basis for catch estimation for this stock. This stock could be included in the Group I stocks.

Conclusion: There appears to be sufficient data to allow ICES to provide catch advice.

Horse mackerel-IIa_IVa_VI_VIIa-c_VIIe-k_VIIIa_b_d_e (Implemented 2015)

ICES currently provides advice on landings for Western horse mackerel. ICES states that discards are underestimated, with discards data available for some of the main fleets. The STECF discard data suggests relatively low variable rates between 0 and 0.12 since 2009. The reported discard data may only partial reflect the extent of discarding. Currently discard estimates for fisheries on this stock appear to be unsuitable for estimating catch quotas. It may be necessary for additional data to be collected.

Conclusion: additional work may be required to establish what is needed to give catch advice.

Herring-IIIa_22-24 (Implemented 2015)

In 2013 ICES states that all catches are assumed to be landed. Discards are not included in the assessment and are considered to be low, but it s uncertain if there is a substantive catch slipping issue. STECF reports very variable discard rates. There appear to be some rather high values which appear to be the result of automatic raising in areas with sparse or missing data. In the absence of information to the contrary the ICES EWG estimates appear to be the best basis for catch estimation for this stock. This stock could be included in the Group I stocks.

Conclusion: There appears to be sufficient data to allow ICES to provide catch advice.

Horse mackerel-IVb_IVc_VIId (Implemented 2015)

ICES advice is based on ICES approach to data-limited stocks and is based on catch. Discards are known to occur some discards included in the assessment since 1997. STECF reports very variable discard rates. There appear to be some rather high values which appear to be the result of automatic raising in areas with sparse or missing data. In the absence of information to the contrary the ICES EWG estimates appear to be the best basis for catch estimation for this stock. This stock could be included in the group 1 stocks.

Conclusion: There appears to be sufficient data to allow ICES to provide catch advice.

Lemon sole-IV_IIIa_VIId (Implemented 2016-2019)

ICES states that discards are known to take place, but the data are insufficient to estimate a discard proportion that could be applied to give catch advice; therefore total catches cannot be calculated. STECF reports discard data from seven EU countries around the North Sea from 2003 to 2012 with overall discard rates of between 0.06 and 0. 33, though in recent years it has been more stable between 0.17 and 0.27. The major catches appear to be coming from fleets with discard data suggesting catch estimation may be possible.

Conclusion: ICES WG should evaluate the available data including those from STECF and evaluate if catch estimates can be obtained.

Ling-I_II (Implemented 2016-2019)

ICES states that Discard data are not available STECF reports discard data from only one country, Germany, giving an overall discard rate of   0.17 but with considerable variability of between 0.01 to 0.61 over the years 2009 to 2012. It may be that the uncertainty in the discard rate makes it difficult to give catch advice however, equally, the use of landings quotas to manage a fishery with such variable catches results in equally poor advice.   Collection of more data would be helpful.

Conclusion additional data on discarding is required to estimate catches for this stock

Argentine-I_II_IVV_VI_VII_VIII_IX_X_XII_XIV_IIIa_Vb (Implemented 2016-2019)

Based on the ICES approach for data limited stocks, ICES advised on catches in 2013 however, the 2013 advice sheet makes no clear distinction between landings and catch. The advice sheet notes that ‘Greater silver smelt can be a very significant discard species in the trawl fisheries of the continental slope of Subareas VI and VII, particularly at depths of 300–700 m.’ STECF reports very variable discard rates from five counties but the values may not be reliable. Currently there may not be sufficient data to estimate catch quotas for this species.

Conclusion additional data on discarding is required to estimate catches for this stock

***Nephrops*-IV** (1 January 2016)

According to ICES, discards estimates are available for some FUs but not for all of them. When data are available, discarding rates vary between FUs and are similar to STECF estimates for all FUs combined which vary from 5 to 13% over the last 3 years (2010-2012). Survival rates estimates are also available (25%). A summary of information available at the FU levels is presented below:

- FU5 : No data is currently available. The Dutch self-sampling programme may provide some discard estimates next year. ICES assumes discards rates to be similar to those from FU6 but they are neither used in the assessment nor used to provide catch advice.
- FU6 : Discard rates are available and are around 12% on average over the last 3 years (2010–2012). They are used to provide a catch advice. This figure includes discards expected to survive the discarding process assumed to be 15% of the total number discarded for this stock.

- FU7 : Discard rates are very low and are included in the catch advice (1% on average over the last 3 years (2010-2012)). This figure includes discards expected to survive the discarding process – assumed to be 25% of the total number discarded for this stock
- FU8 : Discard rates are around 13%, average of the last 3 years (2010–2012). They are included in the catch advice. This figure includes discards expected to survive the discarding process assumed to be 25% of the total number discarded for this stock.
- FU9: Discards rates are around 7% (the average of the last 3 years (2010–2012)). They are included in the catch advice. This figure includes discards expected to survive the discarding process assumed to be 25% of the total number discarded for this stock.
- FU10: No discard information is available. However, the landings for this FU are very low (around 50t).
- FU32: Discards are not used in the assessment. ICES does not provide catch advice. Some data is available from Danish fleets but is does not cover all quarters.
- FU33 : Discards are not used in the assessment. ICES does not provide catch advice. Some data is available from Danish fleets but it does not cover all quarters.
- FU34 : Discards are not used in the assessment. ICES does not provide catch advice. Some data is available in 2011 and 2012 from Scottish fleets.

Conclusion: The importance that discards data be available at FUs level needs to be stressed, as this is not currently the case in the current STECF databases. It is also important to note that ICES already provides catch advice for several FUs. ICES is encouraged to compile and/or collate discards data for those FUs for which no catch advice is currently provided.

Plaice -20 – 2016-2019

ICES states that discards are known to take place, and provided already a catch advice for 2014, applying a discard ratio of 12%. A benchmark is suggested for 2015. STECF reports discard data from Denmark, Sweden and Germany at least for years 2003 to 2012. This data gives a range of discard rate (discard/catch) of 0.08 to 0.25 and a value of 0.12 for 2012. Therefore the ICES and STECF estimates could be assumed to be almost identical now.

Conclusion: No additional actions should be undertaken and current protocol to derive catch advice could be maintained.

Plaice-21_22_23 – 2015-2017

Plaice-24_32 – 2015-2017

ICES states that discards are known to take place but the data are insufficient to estimate a discard proportion that could be applied to give catch advice; therefore, total catches cannot be calculated.

Discard estimates are available for recent years but are not used in the assessment and the advice yet. These stocks will be benchmarked in 2014 with the assumption that a catch advice will be available for 2015. Recent preliminary discard estimates are available in the ICES expert group report. For 2012 ICES estimates are 0.31 whereas STECF estimates are 0.33 and 0.66 for plaice-21_22_23 and plaice24_32 respectively. The STECF average ratio for both stocks over the period 2003-2012 is 0.43.

Conclusion: The current information and the planed benchmark suggest that ICES may be able to give a catch advice for 2015 consistence with the data available but this may be dependent on benchmark scheduling.

Plaice VIIb-c – 2016-2019

ICES states that based on the ICES approach for data limited stocks, that catches should be no more than 30 tonnes. The landings of plaice in VIIb-c are are very small in recent years (about 30t). Discards are a significant component of catch (~68%), with the available time-series extending from 2004 to 2012. Discards have exceeded landings since 2006, and the proportion that discards contribute to total catch has continued to increase in recent years. For 2012 ICES estimates are 0.68 whereas STECF estimates range from 0.33 to 0.70 with a value of 0.36 for 2012.

Conclusion: Although the ratio's from ICES and STECF differ somewhat, applying the ICES discard ratio appears not to be inconsistent with all the information available.

Plaice-VIId – 2016-2019

ICES states that discards are known to be high but cannot be quantified; therefore total catches cannot be calculated. This stock is scheduled for benchmarked in 2015 and discard estimates will be available in 2015 and most likely already in 2014. Preliminary discard rates are estimated around 30-35%.

Comparison between the ICES and STECF estimates for this stock would be rather meaningless as the STECF estimates for some gears have been derived using an automatic raising procedure that in those cases was not appropriate.

Conclusion: The current information and the planed benchmark suggest that ICES may be able to give a catch advice for 2016.

Plaice-VIIh_j_k – 2016-2019

ICES states that discards are known to take place but cannot be quantified; therefore total catches cannot be calculated. However recent preliminary discard estimates are available in the expert group report. In 2012 a significant part of the catches in VIIjk were discarded: 42% by numbers and 30% by weight. Some of the Comparison between the ICES and STECF estimates for this stock would be rather meaningless as the STECF estimates for some gears have been derived using an automatic raising procedure that in those cases was not appropriate.

Conclusion: The current information suggests that ICES will be able to give a catch advice for 2016.

Plaice-VIII_IXa- 2016-2019

ICES states that based on the ICES approach to data-limited stocks, that catches should decrease by 20% in relation to the last three years average. Due to the uncertainty in the landings data, ICES is not able to quantify the resulting catch. There is very little biological information available. Plaice was not recorded by either the Spanish or Portuguese discards observation programs. Discard information provided to STECF is minimal and highly uncertain.

Conclusion: Reliable information is needed to provide a catch advice for this stock.

Skates and Rays-IIIa_IV_VIId-e - 2016-2019

Discard information is available and could be provided in the future by ICES. However for the moment it is not expressed as an "overall discard rate" (percentage), but as length-frequency discarding figures for different species. The discarding patterns found that in general, the main commercial skate species were retained from 27–34 cm total length, and 50% retention occurred at 49–51 cm. Nearly all skates were retained at >60 cm total length. *Amblyraja radiata* was generally discarded across the entire length range (12–69 cm). STECF reports discard data from Denmark and Sweden only for the years 2003 to 2012. The range of discard rates for all skates and rays together vary between 0.36 and 0.82 with a value of 0.60 for 2012.

Conclusion: There will be considerable uncertainty in catch estimates for stocks with such high discard rates. ICES should review the available data and provide estimates of catch. The issues of such large multipliers should be discussed with managers both ICES and STECF might consider the way catch advice should be given under these situations.

Skates and Rays-VIa-b_VIIa-c_VIIe-k - 2016-2019

Discard information is available and could be provided in the future by ICES. However for the moment it is not expressed as an “overall discard rate” (percentage), but as length-frequency discarding figures. Although there may be widespread discarding of both skates (e.g. of small individuals and prohibited species, and if vessels have restrictive quota) and dogfishes, a proportion of these fish will survive in some fisheries. The discard rates provided by STECF range from 0.14 to 0.28.

Conclusion: The current information suggests that ICES will be able to give a catch advice for 2016.

Skates and Rays-VIII_IX - 2016-2019

Discard information is available for the main fleets (Basque OTB fleet in VIII, Spanish fleet in IXa and VIIIc, Portuguese OTB fleet in IXa and Deep-water longline Portuguese fleet). However, for the moment it is not expressed as an “overall discard rate” (percentage), but as frequency occurrence discarded numbers and/or volume. Therefore the overall discard rate remains unknown. The discard rates available to EGW-13-16 are considered unreliable.

Conclusion: it is unclear if ICES will be able to provide catch advice for 2016.

Skates and Rays-X_XII_XIV - 2016-2019

Some discard information is available by ICES. However, for the moment it is not expressed as an “overall discard rate” (percentage). According to ICES, depending on the species, discards may vary substantially. Information on discards from observers in the longline fishery from 2004 to 2010, as reported to the WGDEEP (Pinho and Canha, 2011) shows that for some species, such as deep-water sharks, the discards may be important. Actually, for species such as *Etmopterus* sp and *Centrophorus* sp all fishes are discarded. Other species frequently caught and discarded are *Dalatias licha*, *Deania* sp. and *Exancus griseus*. These changes are probably due to the management measures introduced, particularly the TAC/quotas, minimum size and fishing area restrictions that changed the fleet behaviour on targeting, Expanding the fishing areas to more offshore seamounts and deeper strata. Fisheries occurring outside the ICES area to the south of the Azores EEZ may be exploiting the same stocks as considered here. The discard rates available to EGW-13-16 are considered unreliable.

Conclusion: it is unclear if ICES will be able to provide catch advice for 2016.

Saithe-VII_VIII_IX_X_CECAF

There is currently no advice for this stock and as a consequence, until this is the case, there is no need for discards rate estimates for catch advice.

Saithe-IV_VI_IIIa (Implemented 2016-2019)

ICES advice is based on landings. ICES states that discards are known to take place but cannot be quantified, and therefore total catches cannot be calculated. Discards are not included in the assessment, information is available for some fleets. Some fisheries for saithe are considered to have rather low discarding while others report rather high discard rates. STECF reports discard rates of between 0.07 to 0. 24 over 2009 to 2012. Some of the STECF estimates appear to be incorrect and therefore no comparison should be done before the STECF discard information is verified. Such variability will lead to some uncertainty in catch predictions.

Conclusion: The STECF data uses common raising procedures which would not be correct for these fisheries. ICES has information in Intercatch and appears to have sufficient fleet data to raise the fleets separately. ICES should explore the estimation of a discard rate for the combined fishery with the aim of providing catch advice.

Sole-IIIa_22-24 (1 January 2015)

Discarding is considered low and therefore ICES assumes that all catches are landed. Danish discard sampling at sea is carried out within the EU programmes that began in 1995 in both Kattegat and Skagerrak. According to the ICES estimates available, discarding rate is around 3%. In recent years, STECF estimates the rate at a similar level: 5% on average over the period 2010-2012.

Conclusion: There appears to be sufficient data to allow ICES to provide catch advice.

Sole-IV (1 January 2016)

Although, according to ICES, discarding is known to take place, discards are not used in the assessment and no estimates are provided. STECF estimates over the period 2010-2012 range from 4 to 17%.

Conclusion: As discard rate appear to be low ICES should review available discard data, including that given to STECF and see if catch advice can be given and if not indicate what is needed in order to do so.

Sole-VIIIa_b (1 January 2016)

ICES assumes the discards to be negligible. They are not included in the assessment. ICES considers that they may have increased in recent years due to the development of high-grading. This issue will be addressed during a future benchmark (which still needs to be scheduled). STECF estimates over the period 2010-2012 range from 2 to 6%.

Conclusion: additional work will be required to establish what is needed to give catch advice. Available information suggests that discarding is low and may be negligible. It would appear appropriate for this to be considered at the benchmark.

Whiting-VIIe-k (Implemented 2016-2019)

ICES advice is based on landings. ICES states that it considers that discarding is known to take place but cannot be quantified; therefore, total catches cannot be calculated. STECF has discard data from 2003 with estimates of discard rates of 0.64 to 0.96, recent values are around 0.92. ICES states that there is a need for all countries to provide discard estimates of whiting raised to fleet level for inclusion in future assessments after a benchmark procedure. The fishery is dominated by two counties with only minor catches taken by other counties both of the major countries provide discard data to

STECF. While suitable data appears to be available in order to raise the vast majority of landings data to catch. The rather high discard factors seen in the STECF data suggest there will be considerable uncertainty in catch estimates can be obtained.

Conclusion: There will be considerable uncertainty in catch estimates for stocks with such high discard rates. ICES should review the available data and provide estimates of catch. The issues of such large multipliers should be discussed with managers, ICES and STECF to consider the way catch advice should be given under these situations.

Overall conclusions

For the 85 stocks evaluated 34 were initially identified as having low discard rates (DR <10%) and methods for calculating catches are already available or should not be difficult to carry out. Of these most of the pelagic stocks appear to already have catch advice or be suitable for catch estimation. Some *Nephrops* stocks are missing discard data at FU level. There is some uncertainty for argentine and ling stocks regarding the provision of suitable catch data, if needed for advice additional data may need to be collected. The STECF estimates for plaice VIIe are likely to be incorrect as a result of inappropriate automatic discard raising.

For the 23 stocks where detailed evaluations were carried out there is evidence of convergence of DR values between STECF and ICES catch estimates at stock. There are a number of identified reasons why there will always be differences between the two analytical methods. They use different segmentation schemes and different approaches for raising segments without discard data. For these stocks discard data used by ICES and STECF has become more coherent over the last few years. Differences in DR for the 23 stocks where ICES reports discard in the advice have reduced, 16 show the absolute differences in discard rate is less than 10% with the remaining 7 between 10 and 20%. There are however, considerable differences at fleet and area level for many species. Sometimes the absolute magnitude of discarding is uncertain although the effect of this is expected to give less than 10% impact on catch advice. Nevertheless evaluation at stock level appears to be coherent and give catch estimations that are well within the precision of current assessment methods. The expected status of catch advice for these stocks is given within the text on Group II

For the remaining 28 stocks the group has only been able to make preliminary evaluation stock by stock and gives a preliminary indication of expected possibilities in the section for Group III.

There are a number of stocks where ICES reports different landings for official figures, in others ICES uses models which give estimated landings that are different from reported figures. Under these circumstances it is expected that catch advice for these stocks will be based on the estimated landings raised to catches

Overall it is concluded that if estimates of catch are to be based on scientific estimates on submitted data, then ICES is best placed to provide estimates of catch that are coherent with the stock assessments and as such will be likely to be the best currently available basis for catch advice. To aid this process it would be helpful if JRC could make available extractions of discard estimates, landings and catch data from the STECF databases at the finest scale permitted. It is noted that the aggregated data by stock is already available and already helpful.

In some stocks discarding is occurring in response to restrictive landings quota, and management advice is currently given in terms of landings. In some stocks (eg Irish Sea cod) in this situation the target F has been reduced considerably in an unsuccessful attempt to control catches by making landings more restrictive. Managers should carefully consider the suitability of the management plan provisions when moving from landings to catch quotas.

For some stocks of species such as argentine or ling there is insufficient data available to calculate appropriate catches. Collection of additional data should be considered. These stocks are expected to be subject to landings obligation 2016-2019

For others such as some dab or flounder stocks discard rates are high >80%. High raising factors will inevitably lead to rather uncertain catch estimates and advice. In such cases where currently very large proportions of catch are discarded managers might like to consider if setting catch quotas with multipliers of >4 times the landings is the appropriate management response for these stocks. If the discard rate is seriously underestimated setting TACs could result in creating an unintended choke species.

6.2 Electronic annexes to section 6

Two electronic annexes to this report will be published on the meeting’s web site on:

http://stecf.jrc.ec.europa.eu/web/stecf/ewg1316

- Annex – EXCEL “Comparison rate’
- Annex – EXCEL ‘STECF data with rate’

7 ISSUES RELATING TO CONTROL MONITORING AND ENFORCEMENT

There are a number of control, monitoring and enforcement issues that will have significant influence on how successful the implementation of the landing obligation is. While some of these aspects are generally dealt with in other forum, they do have a direct bearing on and are inexorably linked to a number of key scientific, technical and economic issues, particularly relating to the provision of reliable catch statistics which are used as a core input into stock assessments and the provision of scientific advice. EWG 13-16 notes that bias in catch estimation has a direct and negative impact on the precision of stock assessments. EWG 13-16 considers that control, monitoring and compliace are horizontal issues that cut across a number of key elements in article 15, particularly with catch monitoring and control issues surrounding de minimis rules and exemptions on the basis of high survivability as well as monitoring of quota uptake taking account of quota flexibility mechanisms (inter-annual/inter-species).

EWG 13-16 considers that the successful implementation of a landings obligation will be heavily dependent on the degree of compliance leading to the accurate documentation of all catches. EWG 13-16 considers that an important element in this regard is the need to strive towards a level playing field through common requirements for all participants in a given fishery through regionalisation. EWG 13-16 considers that the uniformity of application is an essential element to buy-in by fishers, and hence compliance.

Definition of catch and discards

The CFP defines discard as*: catches that are returned to sea* (Art. 5(8a)). EWG 13-16 considers that the definition may be open to various interpretations that could potentially impact on how the landings obligation is monitored and controlled. In some fisheries at least, this could strongly influence what is actually monitored and recorded and therefore has the potential to bias estimates of fishery induced mortality. For example, it is not clear whether it is necessary that fish must be taken on board a vessel and subsequently dumped to constitute a 'discard' or whether the practice commonly known as slipping would be considered as discarding or not, as technically the fish have been retained (captured) by the gear, although not taken onboard. If slipping is excluded then this could significantly underestimate estimates of fishing mortality, particularly in pelagic fisheries, as studies indicate that the majority of fish do not survive this process (Tenningen, *et al*, 2012; Huse & Vold, 2010). This may have further significance in that article 15 stipulates that landing obligation applies, to all catches of fish subject to catch limits. As such, EWG 13-16 considers that there is a need for clarity in what is and is not subject to the landing obligation and that in the context of the landings obligation, slipping should also be considered as discarding.

7.1 **Definition of "detailed and accurate catch documentation"**

Documentation

Stock assessment and fisheries management are dependent on complete and accurate data of catch. EWG 13-16 considers that the current system of documentation (logbooks, landing declarations and transport declarations etc.) works reasonably well as a data capture system but the current scope needs to be expanded to improve resolution in terms of catch reporting (e.g. catches <50kg); inclusion of vessels not currently covered (e.g. under 10m) and; information at an individual operational level (e.g. haul). The challenges lie in verifying that the catch is accurately and fully reported in the system.

A number of issues in the current documentation system need to be considered so as to improve the effectiveness and efficacy of the system. The balance between the need for catch information and what constitutes a proportionate burden for the fishermen needs to be considered as follows.

- Currently a 10% discrepancy is allowed between logbook sheets and final landing declarations. This may impact on the level de minimis allocations, depending on how and when catches are estimated for the application of the de minimis (see section 5.1.)
- Specific challenges exist regarding estimating quantities of legitimate discards (e.g. for high-survival species/gear where fish are not brought on-board and non-TAC species discarded without any sorting/handling), as this adds a reporting burden on fishers.
- The existing exemptions around the reporting of discards (e.g. <50kg), and recording (e.g. for <10M vessels) detract from completeness of data.
- Haul by haul information and its transmission times. Individual haul data may be required to provide a sufficient level of resolution for verification of compliance.
- The time allowed for modification of logbooks during a fishing trip. A 24-hour limit on the editing of log-sheets and transmission of catch information when crossing the boundaries of relevant control areas would represent a substantial improvement in the confidence of reported data.

Handling of catch previously discarded

The handling and recording of catches that are currently discarded and under the landing obligation will have to be landed represents an increased burden on fisherman through increased sorting and storage on board. A balance needs to be found between what is practical to ask of fishermen and want is needed from a control perspective to improve verification of catch by the authorities. On the one hand this additional burden might encourage improvements in selectivity but on the other hand may create non-compliance if considered impractical by fishermen.

Animal by-product regulation

The Animal by-product (ABP) regulatory framework sets out health and hygiene conditions to ensure the animals or parts of animals that are not destined for human consumption are collected, stored, transported and processed to manage risk to public or animal health. The historical driver was the outbreak of Bovine spongiform encephalopathy (BSE), commonly known as mad cow disease, where it was clear that by-products not destined for direct human consumption can cause a problem if not managed appropriately, so the first ABP regulation 1774/2002 was put in place, and subsequently replaced by Council Regulation 1069 of 2009, and its implementing Commission Regulation 142 of 2011.

The ABP regulation include in their scope animals or parts of animals, including aquatic animals, which are excluded from human consumption by community legislation. There is an exemption for fish and parts of fish discarded at sea as part of normal fishing operations, which will remain relevant for legitimate discards (prohibited species and de minimis) as well as for products of evisceration. Fish under the MLS, which will now have to be landed for non-human consumption, therefore seem to be ABPs. If they are not visibly diseased, then the ABP regulation would seem to categorise these as Category 3 (the lowest risk ABP). The fishing vessel would remain primarily an establishment engaged in the production of food for human consumption, but its normal operations would also create some ABP, as is the case for many other food operations.

These rules could potentially increase the burden for fishermen substantially in terms of onboard handling and especially through increased and dedicated storage requirements. The regulation requires that from the point at which these are 'generated' or when the decision is made that they are not destined for human consumption (presumably at sorting of catch) then they should be identified as ABP and handled and stored so as to prevent cross-contamination of the food-stuff on-board. They should be stored in covered leak-proof containers marked 'Category 3 animal by-product, not for human consumption'. In addition ABP and food regulations would seem to preclude the use of re-useable containers (e.g. .plastic fish boxes or bulk-bins) which are used for ABP storage for subsequent storage of food products. Unprocessed Category 3 material must be stored chilled, frozen or ensiled, unless it can be processed within 24 hours of collection (so enters fishmeal plant processing line within 24 hours of catching.) Consignments of ABP would require collection by a registered ABP haulier (e.g. at the pier-side), who brings them to an approved ABP processing plant. Those consignments should be accompanied by a commercial document indicating the weight; and the food establishment generating the ABP (the fishing vessel) should have records to show the consignments of ABP collected.

7.2 Comparison of observer and logbook documentation of catch

Article 14.4 of EC regulation 1224/2009, "Community control system for ensuring compliance with the rules of the common fisheries policy" stipulates that "*Masters of Community fishing vessels shall also record in their fishing logbook all estimated discards above 50 kg of live-weight equivalent in volume for any species*".

In principle, this article could fulfil the legal obligation to document discards that are permitted under the de minimis and high survival exemptions and other species not covered by the regulation (see section 6.4). However, there are anecdotal indications that this article may not be fully adhered to in practice thereby undermining the utility of log-book self-reporting as a means of monitoring and recording legally permissible discards (e.g. de minimis and survival exemptions).

To explore this further, EWG 13-16 was asked to "*Provide an insight into the current documentation of catches by comparing the estimates from current scientific observer programmes with EU logbook data*". This is possible by comparing the current level of discard documentation specified under article 14.4 of EC regulation 1224/2009 from those trips where a scientific observer was present (Article 11.2 of EC regulation 199/2008 (establishment of a Community framework for the collection, management and use of data in the fisheries sector and support for scientific advice regarding the Common Fisheries Policy).

The ability of EWG 13-16 to fully address this ToR was hampered by having only a limited amount of data available to it. However, data was made available by one member state where direct comparisons between the two data sources had previously been made.

The results from this limited analysis highlight significant discrepancies between the two data sources. In those fisheries where direct comparisons of discard quantities can be made **1.35 tonnes** of discards was reported in logbooks whereas **2300 tonnes** was estimated from observer data in 2012. Logbook records of discards thus constituted **0.06**% of the amount estimated from scientific observer trips. The analysis also shows that discards were only reported in the EU Logbook for only 0.6% of the total number of recorded trips for that fleet segment and reported by only by 0.04% of vessels belonging to the particular segment.

This analysis, although limited shows that the reliability of discard estimates derived from EU logbooks represents a gross underestimation when compared to scientific observer data and that reliance on such data for monitoring the volume of discards associated with exempted species (de minimis/survival exemptions and non-regulated species) is insufficient and unadvisable. EWG 13-16 considers that a more detailed analysis is required to confirm this is the case across member states.

7.3 Evaluation of control tools and contribution to the landings obligation

EWG 13-16 addressed compliance with the landing obligation, available control tools and the requirement to document all catches under the following headings:

1. *System to promote compliance*
2. *Systems to verify compliance*
3. *Systems to deal with non-compliance*

1. System to promote compliance

General

Compliance of any management measure is dependent on numerous factors such as how well the legislation is understood by the industry, whether the management and control systems provide for a level playing field, and are operated with regard to proportionality, accountability, consistency and transparency. EWG 13-16 considers that there may be a need for better communication of the specific details of the landings obligation with the fishermen, outlining the precise details of the regulation and how these will potentially impact on their business and how the regulations are to be interpreted and controlled. In addition, it is crucial that the measure does not create any obstacles or perverse incentives for the fishermen to comply with the measure and that the system facilitates and incentivises compliance. It should be recognised that factors such as whether the fleet capacity and fishing opportunity are in line with the resource will have a large impact on the compliance and hence the burden on regulators in monitoring compliance.

Moving to a new system

In time, with a high level of compliance with the catch quota system, some pre-existing measures designed around the previous input-focussed system, could be considered for removal. For example, effort system, engine power limitations and technical measures could be revisited in the context that if catch is adequately controlled, the need for supplementary input type measures is questionable. This in turn would have the benefit of freeing up resources currently deployed to monitor and control these requirements and potentially allow for greater focus on the regulation of catches. EWG 13-16 considers that there will be a need to review other pertinent regulations to ensure compatibility with the obligation to land all catches and in particular those that conflict or generate negative incentives with the obligation to land all catches.

2. *Systems to verify compliance*

General

Verification of compliance is an obligation of the control authorities of the various Member States. Article 15.8 of the CFP stipulates that: "*Member states shall ensure detailed and accurate documentation of all fishing trips and adequate capacity and means for the purpose of monitoring and compliance with the obligation to land all catches, inter alia such means as* ***observers, CCTV and other****. In doing so, Member States shall respect the principle of efficiency and proportionality.*"

Whilst the regulation mentions *CCTV*, EWG 13-16 interpret this as referring to Remote Electronic Monitoring systems (REM-system) comprising CCTV, sensors and GPS. "*And other*" is interpreted as the article is being unrestrictive to the choice of enforcement tools. Verification of compliance with the landing obligation requires monitoring to be carried out at-sea where the discarding might take place. The enforcement tools currently available for at-sea monitoring include REM-system, control observers and at-sea monitoring with patrol vessels or aircraft. Other enforcement tools such as landings controls to check catch composition and risk analysis (cross-checks of documentation etc) can be used as a complement to the monitoring at sea but cannot alone be used to verify compliance.

Given the potential shift in emphasis in the tools required deal with the landinsg obligation from a control, monitoring and enforcement perspective, EWG 13-16 recognises that are initial setup costs, and on-going transmission/maintenance costs associated with enforcing the landing obligation. The costs should however be seen in the light of potential reduction in other control costs, e.g. effort control, engine power verifications etc.

The pros and cons of the different types of the enforcement tools will depend on for example gears, species and the areas where they are deployed. For that reason the enforcement system will differ amongst discard plans and for the fisheries within these. There are however some general advantages and disadvantages of the tools. The group is of the opinion that clear multi-annual plans and discard plans agreed across the regional group should include the measures and tools and hence drive towards measures which results in a level playing field in respect to the measures for monitoring compliance.

1. Remote Electronic Monitoring Systems (REM-systems)

The REM-system generally includes CCTV cameras, GPS and sensors on the gears. The GPS records detailed geographical positions, heading and speed and the sensors record information on when the components of fishing gear are in-use. The footage from the CCTV cameras can assist in verifying that the information recorded in the logbook is a complete and accurate representation of the actual catch and that no illegal discards are taking place. However, there are limitations and these and the overall pros and cons are dependent on the design and scale of the system, which in-turn is influenced by the size, scale and processing methods of the fishing vessel, the target species and gear type. These are articulated below.

	Pros	Cons
REM-systems	• Can provide continuous monitoring of fishing operations. • Determines where and when a fishing operation takes place. • Could be used to estimate the total catch and discards and species composition by haul, to be compared with the reported catch. • Allow retrospective examination and can be used in evidence. • Cost is low compared to other monitoring programmes. • Significant deterrent effect throughout the fishing trip. • Not intrusive to fishery operation.	• Verification of catches in multi-species fisheries and fisheries with large catches are difficult. • Considered by some fishermen to be invasive on privacy. • Would require consultation with European Data Protection Supervisor. • Pilot studies and experience from some types of fisheries are limited. • Substantial data management logistics required. • Uncertainty around use of such data in legal cases. • Requires trained controllers and significant time to analyse data. • Technical limitations e.g. component failure, maintenance. • Not suitable for all vessels, e.g. small vessels without power. • Can only be real-time with significant transmission cost.

2. Control observers

Within a control observer program, control observers are present on-board the fishing trip to observe what is caught, discarded, and registered during the trip. The role and status of the control observers may be different from scientific observers. This can depend on which elements of the catch are subject to regulatory controls (e.g. scientific observers record both regulated and unregulated catches) and due to the regulatory role of the control observer. There is a risk that illegal discarding and misreporting takes place on the trips where observers are not present. For this reason it may necessary that all trips are included in the observer programme if observer programmes form the core of the control system. Otherwise, detail is limited and can only be used in the risk analysis.

	Pros	Cons
Observers	• Can provide continuous monitoring of fishing operations. • Real-time information from the fishing activity. • Scientific sampling such as species and length composition can be carried out. • Strong deterrent effect to comply. • Veracity of the information in respect to species is high.	• Particularly costly enforcement method. • Some vessels are not able to take observers on board for safety and security reasons. • Requires training and experience. • Antagonistic working conditions. • Difficulties to cover all activities during the entire trip – can not provide absolute assurance. • Requires Council decision according to the control regulation (EC) 1224/2009. • Requires extensive management infrastructure. • Observers not efficient in all fisheries specifically factory vessels due to simultaneous activities.

3. At sea inspection with patrol vessels

At sea inspection with patrol vessels is used to detect and enforce regulations that require individuals to be ‘caught in the act’ and are the only effective measure against technical infringements such as the use of illegal fishing gears and vessels fishing within closed or restricted areas, although the advent of VMS has increased the deterrent against such activities. The system also benefits from having personnel who as well trained and have an indepth knowledge of fisheries regulations.

	Pros	Cons
At sea inspections with patrol vessels	• Infrastructure already in-place. • Presence of inspection vessels has a deterrent effect within a fishery, while present. • Can verify that the catch at the time of the boarding, including MLS fish retained on-board, is coherent with the logbook. • Can verify the compliance with selectivity measures e.g. gear-type at the time of boarding. • At sea inspection can be planned on more complete risk basis, as opposed to awaiting the landing. • Can be used to validate/refine risk assessment, close to real-time. • The observations can be used as comparison with the sales notes. • Can be less invasive/intrusive on fishermen than observers or cameras. • Possibility to contribute to support measures such as RTC and move-on provisions.	• Costly. • Discontinuous. Only covers a small part of the trip. • Only effective as deterrent when present in fishery. • Can only verify catch documentation at the time of boarding. • Difficult to conduct inspections unannounced. • Poor sensitivity to observe illegal discarding. • Interferes with fishing operation.

4. At sea inspection with aircraft

Like at-sea inspections with patrol vessels, inspections with aircraft can be used to detect fishing operations operating in restricted or closed areas and can cover large distances and operate in close cooperation with at-sea vessel patrols.

<table>
<tr><th></th><th>Pros</th><th>Cons</th></tr>
<tr><td>At-sea controls with aircraft</td><td>Infrastructure already in-place in some Member States.
Can cover large geographical areas.
Can detect discarding behaviour.
Aircraft can operate either overtly or covertly.
Can monitor without fisher being aware.
Visible aircraft have a deterrent effect while present.
Not intrusive to fishery operation.
Can be rapidly deployed.</td><td>Costly
Discontinuous. Only covers a small part of the trip.
Only effective as deterrent when present in fishery.
Robustness of the evidence (linking floating fish to a vessel).
Difficult identification of species discarded, with some exceptions for large pelagics.
Cannot reliably differentiate between illegal discarding and legitimate discarding, or discharge of other biological material.</td></tr>
</table>

Improving effectiveness of control measures through risk analysis

The effectiveness of the control activities outlined above can be enhanced by considering the risk of non-compliance, and then targeting appropriate control activities to verify compliance. For this reason control authorities generally have pre-existing systems for identifying risks through cross-checks of various data flows, ERS, VMS, landing declarations, sales notes tax audits etc. The need for such analysis is enhanced under the landing obligation. Implementation from continuous monitoring systems such as REM-systems or the deployment of control observers, will potentially be a vital source of information to establish a catch baseline against which catches of vessels operating in the same fisheries can be compared.

In a catch baseline analysis a baseline of catches expected in a specific fishery is estimated from data submitted (e.g. ERS data, inspections etc.). Vessels whose activities report catches different to this baseline may reasonably be regarded as posing a risk of non-compliance and thus prioritised for additional monitoring and control measures. This approach identifies outliers from the baseline assuming the baseline is one of compliance. The deterrent effect of continuous monitoring systems such as REM-systems or observers has the potential utility of increasing confidence in the baseline information generated. However non-uniform distribution of apparent control tools such as REM-system has potential to detract from confidence. It is also important to point out that the any suggestions of non-compliance as a result of a baseline reference analysis cannot be used as evidence and form the basis of sanctions. It could be used however if it indicates a general non-compliance activity across a larger range of vessels that further control measures might need consideration. Under this scenario fishers might be more mindful then to be compliant especially if 'peer' pressure could be brought to bear.

The subset of vessels to be included in the baseline could be chosen based on numerous conditions. Below are some examples:

- Baseline fleets (low-risk volunteer vessels)

- Voluntary take-up (opt-in by fishers)
- Rotating on periodic basis (uninstall and move to other vessels)
- Random subset of vessels (transparent random selection)
- High-risk vessels (where risk analysis indicates possibility of non-compliance)

The regional approach is an important component for properly applying the landing obligation Risk analysis traverses vessel nationality, and there is a need to work together in the risk analysis and evaluation of the fishing activities of the vessels acting in the same area with different flags.

In the risk analysis the potential infringement types should be considered when analysing risks. Regarding the landing obligation the below ones are examples of infringement types:

- Slipping of catches
- High-grading of TAC
- Discarding of fish below minimum reference sizes
- Discarding if inspection is anticipated
- Exceeding de minimis allowances
- Failure to log discards

3. Systems to deal with non-compliance

To ensure level playing field and encourage a culture of compliance, the discard plans should specifically consider and propose the appropriate penalties to be applied in case of non-compliance for all vessels in that fishery/region regardless of flag. The design of the sanctions could include:

- Common dissuasive sanctions and penalties etc.
- Increased control, e.g camera or observer
- Not allowed use a specific gear or required to use specific gear (e.g. larger mesh size)
- Deduct time
- Deduct quota
- Not allowed de minimis
- Not allowed inter-species transfer (9%)
- Removal of authorisation to fish

It may also be worth considering the scale of sanction relative to the risk of detection. Several studies have shown that the severity of sanction and the risk of detection has a main impact on compliance (e.g. Nielesen & Mathiesen, 2003) and that the level of sanction must be inversely proportional to the risk of detection e.g. the lower the risk of detection, the higher the sanction, while considering proportionality with the infringement. It is generally acknowledged that discard bans are difficult to enforces ((COM(2002) 656 Final) and therefore the risk of detection can be assumed to be low unless there is adequate observer or REM coverage (thought limited where it is permissible to discard part of the catch). As such, there appears reasonable argument that, depending of the severity of the offence, sanctions against illegal discarding will need to be at the upper end of the scale if they are to act as a sufficient deterrent.

7.4 Control and enforcement issues associated with De minimis and quota flexibility

All exemptions from the landing obligation are a reason for legitimate discarding. As such their implementation will definitely add to the challenges faced in understanding of the incoming obligations by fishers, and in the work of control authorities in promoting and verifying compliance. Clarity for what the ‘de minimis’ provisions (and indeed all exemptions from the landing obligation) do and don't allow is therefore important. Full details of the de minimis exemptions provisions are given in section 0. A potential range of interpretations for the calculation of de minimis exemptions are outlined in section 5.1 of this report and EWG 13-16 note that from a control perspective, there is an urgent need to gain clarity on how the regulation will be interpreted within discard management plans as this will have a significant bearing on the types of monitoring and control measures that will be required.

From a control perspective, the fact that catches discarded under the de minimis provisions do not count against quota creates a significant risk of non-compliance around de minimis, for example under-logging to protect access to the provision, or attempting to mask non-legitimate discards as de minimis. Similar concerns relate to potential exemptions associated with high survival (see section 4.2).

Maximal cap on de minimis

The maximal de minims allowance is expressed as a proportion of total annual catches. This creates an immediate problem trying to decide in advance how much of this exemption to allow, before the MS knows what the catch will be. The concept of catch includes all landings, including previous discards including <MLS so it will likely be difficult to estimate particularly in the early phases of implementation.

The wording of the cap mentions the denominator as catches of 'all species'. It is unclear from the wording if inter-species applicability might be allowable under de minimis. For example if MS/region decides that they would apply their de minimis provisions in a small number of species.

Measuring Discards

The regulation is clear that de minimis discards should be logged. However this creates practical difficulties. For example if a haul of pelagic fish, or a portion of a haul of fish is slipped before it is brought on-board then there will be real difficulty in estimating quantity discarded to any degree of accuracy. For demersal fish this would require fisherman to sort, box and then weigh the fish they intend to discard. Similarly, if discards are exempted due to high survival criteria, then obliging fishermen to sort and weigh catches could negatively impact on the survival probability of individual fish and could potentially conflict with the desire to return fish to the water as quickly as possible. Conversely, if a portion of the fish being discarded under the high survival criteria do not survive (i.e. survival <100%), failure to adequately monitor and record the volume of fish being discarded will also bias (under)-estimates of mortality.

7.5 Implications for current "at-sea" catch monitoring programmes

As discussed above, the introduction of the landings obligation has the potential for wide reaching consequences for the current approaches to monitoring and control, essentially moving from a predominately landings based system, to one where the monitoring and control of catches will be the main focus. Noted in section 7.3, EWG 13-16 considers that control observers may have a pivotal function in this context. This however, may have a number of implications for the current scientific at-sea sampling programme funder under the Data Collection Framework (article 11.2, EC regulation 199/2008).

Presently, scientific observers have no mandate for the control of fishing regulations, only to collect biological data which is used largely for stock assessment and ecosystem monitoring purposes. Although a legal requirement for masters to carry scientific observers, they can refuse carriage on grounds of safely and space availability (EC regulation 199/2009, art. 11.4). In practice however, the carriage of scientific observers has tended to rely extensively on the good will of masters rather than through any legal obligation or enforced means. However, if masters feel that, under the landings obligation, that scientific observers will have a dual function of collection of biological data *and* monitoring of compliance with the landings obligation or where the data being collated could be used in subsequent legal action, it is likely that the current ‘good will’ and critically, the level of observer coverage will be severely undermined. While this may be somewhat speculative, there have been circumstances where the carriage of observers has suffered from non-cooperation by parts of the fishing industry due to such concerns. Lordan *et al* (2011) reports a significant reduction in observer coverage in due to concerns that the data collated by scientific observers was to be used for control and ultimately prosecution purposes.

EWG 13-16 considers that there is a continued requirement for the collection of scientific data from commercial fishing trips as scientific observers not only collect data on regulated species, but also on catches of unregulated and unwanted species. This presents a challenge following the introduction of the landings obligation in that if business fail to comply with the landings obligation, then this may also result in refusal to carry scientific observers in that data collected could be used (perceived or otherwise) for enforcement purposes even though the observer has no regulatory mandate.

Clearly, there is a need for ongoing at-sea biological sampling of catches but this may be compromised due to the potential nd subsequent use of such data. While EWG 13-16 is unable to state what the potential impacts may be on the current scientific observer programmes, EWG 13-16 considers that this needs further consideration as conflicting objectives (perceived or otherwise) may undermine the availability of data currently being collected by scientific observers and also have implications for national operational programmes. If the current programme is untenable due to the above issues, then there may be a need for a more fundamental review of both the scientific and control observer roles, for example the need to go towards dual functionality of ‘science and compliance’. EWG 13-16 notes that this would represent a substantial shift in the current at-sea programmes and will also require a cultural shift in the relationship between industry and observer personnel.

8 ISSUES RELATING TO THE DEVELOPMENT OF DISCARD PLANS DEVELOPMENT OF GUIDELINES TO FACILITATE REGIONAL PLANS

STECF was unable to fully address the ToR on discard plans because all of the consituting elements needed to be fleshed out before, which left too little time to devote to the ToR on discard plans. However, the following text does provide with a general overview of discard plans that could form a basis for further developments in the future.

Discard plans are a new element that has been introduced in the Common Fisheries Policy. Although discard plans are not formally defined in the list of definitions (Art. 5) in the CFP, they are introduced in Article 15.3a:

"Where no multiannual plan or no management plan in accordance with Article 18 of Regulation (EC) No 1967/2006 for the fishery in question is adopted, the Commission may adopt a specific ***discards plan*** *on a temporary basis under the rules stipulated under Article 17. Member States may cooperate in accordance with Article 17 with a view to the Commission adopting a specific plan, for no more than a 3 year period, on the landing obligation and specifications in paragraph 3 (a)-(e), by means of delegated acts in accordance with the procedure in Article 55 or in the ordinary legislative procedure."*

Discard plans can be adopted by means of a delegated act through the Commission or through the normal legislative procedure (co-decision). The contents of a discard plan are described by listing paragraphs 3a-e which define the topics to be covered:

a) specific **provisions regarding fisheries or species** covered by the obligation to land all catches of regulated species as set out in paragraph 1 of this Article;
b) the specification of **exemptions to the landing obligation** for species mentioned in paragraph 2 point (b) of this Article; ["(b) species for which scientific evidence demonstrates high survival rates, taking into account the characteristics of the gear, of the fishing practices and of the ecosystem;"]
c) provisions for **de minimis exemptions** of up to 5% of total annual catches of all species subject to an obligation to land as set out in paragraph 1. The de minimis exemption shall apply in the following situations: where scientific evidence indicates that increases in selectivity are very difficult to achieve; or to avoid disproportionate costs of handling unwanted catches, for those fishing gears where unwanted catches per fishing gear do not represent more than a certain percentage, to be established in the plan, of total annual catch of that gear.
d) provisions on **documentation of catches**;
e) fixing of **minimum conservation reference sizes**, where appropriate, in accordance with paragraph 5. ["With the aim to ensure the protection of juveniles of marine organisms, minimum conservation reference sizes may be established."]"

If this list is interpreted as an exclusive list, this means that a number of other elements of Article 15 and of other articles (e.g. technical measures, effort regulation) cannot be part of a discard plan. Specifically, the quota flexibility derogation whereby "catches of species that are subject to an obligation to land and that are caught in excess of quotas of the stocks in question, or catches of species in respect of which the Member State has no quota, may be deducted from the quota of the target species provided that they do not exceed 9 % of the quota of the target species" (Art. 15.4a) does not apply to discard plans.

The procedure for developing discard plans is described in Article 17:

"Member States concerned shall cooperate with one another in formulating joint recommendations. They shall also consult the relevant Advisory Council(s). The Commission shall facilitate the cooperation between Member States, including, where necessary, ensuring that a scientific contribution can be obtained from relevant scientific bodies." So the Commission can decide on the delegated act based on a joint recommendation from the Member States concerned in consultation with the relevant Advisory Councils. There is no procedural description of the situation when third countries are involved and where the Commission has negotiation power on behalf of the European Union.

A first draft of a discard plan for the Baltic Sea has been drafted by the BaltFish consortium. Given the limited amount of time available in the Expert Working Group, it has not been possible to fully review the contents of the draft discard plan, but a quick perusal of the document showed that there may be a need for further specification of the plan in order to provide the scientific underpinning of derogations and to make the derogations more specific.

General issues

Discard plans are limited to a few issues only and can be considered as a fall-back position to the full management plan. Because the full management plans are not yet resolved between EP and Council, discard plans may in practice be the most likely method for implementing the landing obligation in the short term.

The EWG noted that the absence of a clear objective of the landing obligation also makes the definition of the objective of a discard plan problematic. If an impact assessment would be required for the adoption of a discard plan, the lack of objectives could provide a challenge in determining what the impact should be measured against. Yet, the EWG recommends that a discard plan should be accompanied by an impact assessment of some form, when submitted to the EC.

STECF has previously identified a procedure for Impact Assessments as follows (STECF, 2010[1])

Steps	Procedure	Timeline
1	EC: Drafting management plan, define options which shall be assessed In time to fit into a scoping meeting which was agreed in the STECF workplan (around one month ahead of the meeting the EC put this forward as part of the TOR for the meeting)	Month 1
2	Scoping Meeting with definition of the contents of the IA (with Managers, RACs, Scientists)	Month 2-3
3	STECF plenary meeting accepting the report on the scoping meeting	Month 4
4	Biological, economic simulations	Month 3-7
5	Impact assessment meeting	Month 7
6	STECF plenary meeting accepting the report (published a week after the meeting)	Month 8-9

[1] Scientific, Technical and Economic Committee for Fisheries (STECF) - Development of Protocols for Multi-annual Plan Impact Assessments (ed. Simmonds, E. J.). 2010. Publications Office of the European Union, Luxembourg, EUR 24368 EN, JRC58543, 50 pp.

For discard plans steps 3 and 6 may not be necessary if not part of the STECF work program.

In many cases the economic part of the impact assessment was very limited due to lack of data or availability of economists familiar with the data, models, etc. For an Impact Assessment for the discard plans economic arguments can be the reason for certain derogations. Therefore, the importance of the results will be higher and that may not mean a longer process but it could be.

The EWG discussed the possibility of using economists available within the fishing industry to prepare the impact assessment with an independent external review.

Important challenges to address:

- Defining management units (e.g. stocks, areas, fisheries). As an example: the pelagic fisheries should apply the landing obligation from 2015 onwards, can be approached in many different management units involving very different combinations of Member States and Advisory Councils. Fisheries could be divided by species, by type of vessels and fishing method, by area etc. All these approaches have implications for the way and the number of discard plans that need to be submitted.
- Dealing with third countries (e.g. Norway)
- Defining Minimum Conservation Reference Sizes (again with no clear objective, but with major implications for the marketing of the catch
- Develop the criteria to evaluate discard plans (Impact Assessment indicators)
- Outlining a process for developing discard plans.

The EWG recommends that an additional meeting be scheduled to work out these elements in more detail.

9 CONCLUSIONS

Survival

- Three main methodologies for conducting survival experiments were identified i.e. captive observations, vitality/reflex assessments and tagging/biotelemetry experiments. These are appropriate for measuring survival on differing temporal scales including immediate (straight after handling) – vitality/reflex; captive observations -short term (days to weeks) and; tagging/biotelemetry for long-term (> 1 month) assessment.

- While significant advances have been made in drawing up fundamental requirements for undertaking survival experiments using these methodologies, further development is required and this should be promoted through the formation of a dedicated ICES Expert Group tasked with the provision of an ICES manual on discard survival experiments.

- The definition of high survival in Article 15 is subjective and is likely to be species and fishery specific and dependent on the management objective. Results from short term experiments may underestimate true survival in the longer-term. Therefore care should be taking in interpreting the results of short-term survival experiments in terms of long-term stock benefits.

- Landing discards that would otherwise survive can have negative stock impacts. These impacts are largely dependent on age structure of discards, age specific survival and contribution discards make to the overall catch. Maintaining catches within desired levels may result in reduced fishing opportunities to compensate for loss in stock contribution.

- "Trade-offs" between expected stock benefits of continued discarding and removal of incentives to change exploitation pattern need to be considered. Avoiding unwanted capture in the first instance should have precedence over exemptions based on survival arguments.

De Minimis and Quota Flexibility

- There are many ways to interpret the working of the de minims exemptions in the regulation and this has substantial bearing on the potential impact of using this mechanism.

- It remains unclear is de minimis catch applies at a vessel, fleet, member state, regional level or whether it applies to one or more species. Depending on interpretation, the impacts could be minimal or could potentially result in catches that significantly exceed advised levels.

- Defining the first conditionality in the regulation - "very difficult"- in the context of improvements in selectivity to trigger de minimis exemptions is difficult as the term "very difficult" in itself is rather subjective. It may be better viewed from the point of economic difficulty rather than technical difficult. This allows for potential use of a ratio of current revenue/break even revenue indicator to be applied as an objective metric to prove this condition has been meant.

- Based on the interpretation of the wording in the regulation it may not be necessary to define "disproportionate costs of handling" (the second conditionality) as this is already assumed in the article. The key aspect of the conditionality is how to define when the unwanted catch is "below a certain percentage of the total catch of that gear"; how to set the "the percentage unwanted"; and how this should be implemented in a discard plan. This requires further exploration and consideration.

- Inter-species quota flexibility can be applied beneficially as a means of simply "balancing the books" by covering catches with low or no quota entitlements. However, it can also result in substantive unintended consequences if used speculatively for instance when used to exchange the quota from a high volume/low value species to a low volume/high value.

- The inter-species quota flexibility stipulates that the recipient non-target stock(s) must be within safe biological limits. Many stocks fall into the 'data-limited' category for which a) reference points and b) assessments are not available. In practice this will limit the scope (applicable species) until reference points or agreed proxies are made available.

- Inter-species quota flexibility could have serious impacts on stock sustainability and careful attention on how to this is applied in practice is needed to ensure that circumstances leading to unintended consequences are not allowed to develop. It is important to note the CFP basic regulation stipulates that the precautionary approach to fisheries management and that exploitation should be consistent MSY.

- The cumulative effects of de minimis and quota flexibility offers considerable scope to generate large catches of a species with the attendant risk that fishing mortality would rise. The order in which the provisions are applied (and multiple application of the provisions) has also a profound effect.

STECF and ICES Catch Comparisons

- Analysis of both STECF and ICES catch data for 85 stocks has led to the formation of three distinct groups: (I) stocks where ICES indicates that discarding is considered negligible and STECF estimates that discarding is less than 10% (34 stocks); (II) stocks for which detailed data on catch is available from both ICES and STECF (23 stocks); and (III) for which either ICES or STECF indicate that significant (>10%) discarding occurs and currently ICES does not present discard data in the advice sheets (28 stocks).

- For category I stocks, it is concluded that ICES should continue to provide catch estimates. For category II stocks, the evidence suggests that there is a general convergence in the estimates between ICES and ST ECF, which is typically less than 10% and that the ICES methods for the provision of catch advice should be continued. For category III stocks, it was only possible to provide a provisional evaluation on a stock by stock basis, but the provisional analysis give some guidance on how (and if) catch advice could be given in future.

- For some category II stocks (e.g. Irish Sea cod; West of Scotland cod) the target fishing mortality has been reduced considerably in an attempt to control catches. This has made landings very restrictive and has led to large-scale discarding of over-quota fish as catches well exceed allocated TACs. In such circumstances managers should carefully consider how to handle such stocks when moving from landings to catch quotas. If the catch quota allocated is derived from the total catches then there is a real danger of over exploitation.

- Discard estimates are derived from relative small samples (trips) when compared to the overall fleet effort. For many stocks, discard estimates are derived using high raising factors inevitably leading to rather uncertain catch estimates and advice.

- Where a very large proportion of catch are discarded (e.g. plaice, dab), managers should consider if setting catch quotas which are multiples of the current landings is the appropriate management response for these stocks. If the discard rate is seriously underestimated setting TACs could result in creating an unintended choke species and conversely, if seriously overestimated, could lead to unintended overexploitation.

Control, Monitoring and Enforcement

- The ability for Member States to control, monitor and enforce the landing obligation is key to successful implementation of the landing obligation and has a direct bearing on the provision of reliable catch statistics.

- The current system for documentation of landings works reasonably well as a data capture system but the current scope requires broadening to improve resolution in terms of catch reporting, including potential issues with permitted tolerances between declared and actual landings; estimating quantities of legitimate discards; current levels of fleet coverage and availability of data at an operational level (e.g. haul specific information).

- The definition of catches in the basic regulation is open to some interpretation with regard to catches not taken on board the vessel, but returned or 'slipped' back into the sea. It is considered important that for the provision of accurate catch information that such catches should be considered under the definition of discards in order to ensure adequate precision in estimates of fishing mortality.

- It is mandatory for masters to record discards by species if they exceed 50kg. However, anecdotal information suggests that the reliability of the data is questionable and the 50kg threshold is too high to capture information for many species. A limited analysis shows reported catch for one MS to be only 0.06% of the weight recorded by scientific observers. Reliance on such data for monitoring the volume of discards is insufficient and unadvisable.

- The effectiveness of the control activities (control observers, REM systems; at-sea patrols) can be enhanced by considering the risk of non-compliance, and then targeting appropriate control activities to verify compliance. Integrating information from the different sources can be used in a risk analysis framework, using pre-defined expected baselines, and using disparate data to detect potential outliers. Control can then be focussed on the 'outliers'.

- Effective compliance requires a 'level playing field' in terms on monitoring, control and enforcement of the landings obligation and note that sanctions need to be proportionate not only to offence, but also to the risk of detection.

- De minimis and survival exemptions from the landing obligation are a reason for legitimate discarding and as such complicate the understanding of the incoming obligations by fishers, and in the work of control authorities in promoting and verifying compliance.

- There is a continued requirement for the collection of scientific data from commercial fishing trips. This could lead to two types of observer - control and scientific observers. Dual functions may lead to confusion of roles by industry an may lead to impacts on scientific observer programmes due to access issues there will be a need for a more fundamental review of both the scientific and control observer roles, moving towards dual functionality with better linkage between 'science and compliance'.

Development of discard plans

- Discard plans are limited to a few restricted elements and can be considered as a "fall-back" position to the implementation of multi-annual management plans.

- A number of issues need consideration in developing discard management plans (i) Definition of management units (regional areas); (II) issues with third countries e.g. Norway; (III) defining Minimum Conservation Reference Sizes; (IV) need for criteria evaluate discard plans (Impact Assessment indicators) and; (V) outlining a process for developing discard management plans.

- Further work is needed to develop a template for such plans.

10 References

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11 EWG-13-16 LIST OF PARTICIPANTS

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12 List of Background Documents

Background documents are published on the meeting's web site on:

http://stecf.jrc.ec.europa.eu/web/stecf/ewg1316

List of background documents:

- EWG-13-16 – Doc 1 - Declarations of invited and JRC experts (see also section 12 of this report – List of participants)
- Annex – EXCEL "Comparison rate'
- Annex – EXCEL 'STECF data with rate'

European Commission

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Abstract

The Expert Working Group meeting of the Scientific, Technical and Economic Committee for Fisheries EWG-13-16 on Landing obligation in EU fisheries was held from 9-13 September 2013 in Varese, Italy. The report was reviewed and endorsed by the STECF during its plenary meeting held from 4 to 8 November 2013 in Brussels (Belgium).

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The Scientific, Technical and Economic Committee for Fisheries (STECF) has been established by the European Commission. The STECF is being consulted at regular intervals on matters pertaining to the conservation and management of living aquatic resources, including biological, economic, environmental, social and technical considerations.

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