Synthesis of the landing obligation measures and discard rates

EASME/EMFF/2018/011 Specific Contract Lot 1 No.2

EASME/EMFF/2018/011 Specific Contract Lot 2 No.4

Final Report

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European Climate, Infrastructure and Environment Executive Agency (CINEA)
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Term	Description
AC	Advisory Council
AIS	Automatic Identification System
ANOP	Association Nationale des Organisations de Producteurs
ASFA	Aquatic Sciences and Fisheries Abstracts
AWW	Atlantic Western Waters
BMS	Below Minimum Size
BS	Baltic Sea
CFP	Common Fisheries Policy
CINEA	European Climate, Infrastructure and Environment Executive Agency
CL	Consortium Lead
COM	European Commission
CQM	Catch Quota Management
DG MARE	Directorate-General for Maritime Affairs and Fisheries
EASME	Executive Agency for Small and Medium-sized Enterprises
EC	European Commission
EFCA	European Fisheries Control Agency
EM	Electronic Monitoring
EMFF	European Maritime and Fisheries Fund
ERS	Electronic Reporting System
EU	European Union
FDF	Fully Documented Fisheries
FDI	Fisheries Dependent Information
IFCA	Association of Inshore Fisheries and Conservation Authorities
ICES	International Council for the Exploration of the Sea
JDP	Joint Deployment Plan
LH	Last Haul
LO	Landing Obligation
MAP	Multi Annual Plan
MMO	Marine Management Organization
MLS	Minimum Landing Size
MSY	Maximum Sustainable Yield
NA	Not Applicable
NGO	Non-Governmental Organization
NS	North Sea
OR	Outermost Region
PO	Producer Organisations
REM	Remote Electronic Monitoring
SC	Specific Contract
SCL	Specific Contract Lead
STECF	Scientific, Technical and Economic Committee for Fisheries
VDS	Vessel Detection System
VMS	Vessel Monitoring System

EXECUTIVE SUMMARY

Article 15 of the reformed European Union (EU) Common Fisheries Policy (CFP) came into force on 1 January 2015. It introduced a phased implementation of a discard ban: a prohibition on discarding catch, generally described as the Landing Obligation (LO). The introduction of the LO was essentially a change from a 'landing' to a 'catch quota' system. In January 2019, the phased implementation was completed and the LO was fully implemented, covering all quota stocks in EU waters and those with Minimum Sizes in the Mediterranean. However, the transition towards a fully implemented catch quota regime has proved very challenging for some fisheries.

The ultimate objective of the landing obligation is to reduce the wasteful practice of discarding, to create incentive to fish more selectively and avoid unwanted catches. Member States undertook several initiatives and voluntary measures to facilitate the LO. Most were related to selective gear trials. Stakeholder interviews and questionnaires conducted in this study showed that the process for approving newly developed gear is long and severely delayed implementation of these measures. Avoidance (or 'move-on') rules were facilitated by voluntary agreements and helped to increase knowledge of areas with high discard levels in pelagic and demersal fisheries. These move-on rules, together with improvements in fishing gear selectivity, were considered the most effective in facilitating the implementation of the LO. Despite this, these technical measures were considered less viable from an economic point of view, as they require extra investments from vessel owners in new fishing gear and, also, the potential loss of efficiency in catching the most valuable target species. Other examples of measures taken to facilitate the LO were: adaption of national quota management to better fit the challenges the LO presented, initiatives to increase survivability, weekly catch limits and initiatives focused on improving accountability and quota alignment.

Consultation with stakeholders through interviews, questionnaires and online workshops pointed out that areal closures were classified as 'less effective', as were TAC removals and changes in Minimum Conservation Reference Size (MCRS). There was concern among some stakeholders that the removal of TACs as a management measure would be solely based on the desire to avoid choke species problems and, therefore, bypass the need to protect vulnerable stocks in mixed fisheries in the first place. As a result, removing TACs was thought to be un-precautionary, as it would have negative effect on sustainable management of stocks. When aiming to mitigate potential losses in fishing opportunities due to choke considerations, adaptions of national quota management to better fit LO challenges and quota swaps between Member States were the preferred options, followed by high survivability exemptions.

To be able to conduct a quantitative assessment of the potential effects of the LO, a comprehensive analysis on the fisheries dependent information (FDI) data base of the Joint Research Centre of the European Commission (JRC) was conducted. To facilitate the qualitative assessment of discard rates and measure the level of success of the LO across fisheries, species, areas and Member States, the consortium developed a dynamic application, 'ShinyApp'. The available data sets covered discard estimates for two separate periods: 2011 – 2014 and 2015 – 2019. National experts screened the data and developed look-up tables to conduct quality checks and harmonise data formats between data sets of the two periods. This work provided consistent information over the given period. The "ShinyApp" was also successfully linked to ICES stock assessment outputs to provide supplementary information, e.g., fisheries exploitation rates, stock states and trends, on observed discard rates. The connection of the app with the overview of certain fisheries' and species' exemptions also greatly facilitated the analysis of discard rates within the context of the LO. In addition, a method was developed that allowed for filtering the data so only fisheries with landings with a relatively high coverage of discard information were retained. This resulted in a much-reduced dataset that was used for analysis but could

also be interrogated in more detail using the app to understand discard trends for certain areas, fisheries and species.

The estimated discard rates did not show clear trends or patterns as a response to the implementation of the LO. The short time-series of available information in combination with the highly variable nature of discard data could explain this. This said, with the inclusion of more data, in the future, it may be possible to detect and explain changes in discard rates as a consequence of the implementation of the LO. There was also no distinction observed in discard rates between fisheries and species that have, or do not have, an exemption to the LO. As a result, differences in discard patterns owing to exemptions could not be established. It was also shown that there were difficulties in monitoring the impact of the different exemptions because of the high level of aggregation of information available in the STECF-FDI database. This is in contrast with the detailed specific criteria for fisheries and species under an exemption. These are based on information like combinations of implementation periods, explicit areas, fishing operations and vessel specifications. This issue should be considered when going forward in analysing this database to assess and evaluate LO or exemption effects.

Estimating the level of compliance was an important element in evaluating the implementation of the LO. To understand the reasons behind the viability or impracticability of some measures and subsequent compliance or non-compliance, the insights of national control authorities and other stakeholders (industry, NGOs, scientists) were collected. Stakeholders within all the areas of the study were consulted by means of in-person interviews, two e-workshops and an online survey. Currently, the main control measures used in EU waters are traditional at-sea inspections (i.e., patrol vessel) and dockside/auction inspection of the landings/e-logbooks. As these control measures only have a deterrent effect and do not allow for detecting illegal discarding, e.g. as it would never happen during sea inspections, the measures are not considered effective by most of the stakeholders within the current LO scheme. According to responding stakeholders, Remote Electronic Monitoring (REM) devices that incorporate on-board Closed-Circuit Television (CCTV) and sensors could be the best way forward to ensure effective monitoring and control. However, during workshops and interviews in this study, stakeholders from the industry were hesitant to encourage the use of REM, as use may lead to privacy issues, extra costs and feelings of distrust towards fishing operators. In terms of improving compliance, mainly to achieve improved registration of discards, there was a common agreement on the need to revise the ERS/e-logbook technology, for instance, by providing additional fields and increasing user-friendliness. In cases where logbooks were changed, the appropriate fields were not in place at the time of the start of LO implementation.

The list of fisheries and stocks covered by the LO implementation is rather straight forward to produce but getting an overview of the long list of exemptions was complex in both the Atlantic Western Waters (AWW) and the North Sea (NS). In addition, because detailed information on discard levels over a longer period of time were lacking it was complex to attain detailed specifications of exemptions, time of implementation, specific gears and areas, making it difficult to provide a general overview of the LO and an overall evaluation of its effects. Therefore, it was concluded that there was a lack of evidence for changes in discarding practices in the fisheries of the AWW, BS and NS as a result of the implementation of the LO. Nevertheless, it was noted, through consultations with stakeholders, that several adopted and implemented management measures potentially have an effect on fishing patterns and behaviour in avoiding catches below MCRS.

This study highlights the importance of maintaining scientific sampling programmes to understand changes in discard rates. It recommends that the data dissemination tool should be maintained so that further years of data on discard estimates can be incorporated and the app can be used as a quantitative assessment tool to measure success of the LO.

Survey results show that the majority of stakeholders (64% in the NS and BS areas and 72% in the AWW) believed that non-compliance to the LO implementation was occurring. The main reasons pointed out were the complex legislations, the fact that the LO is not accepted by the industry, the lack of efficient control tools at sea and the inadequacy of current control measures. According to some stakeholders, there is a substantial amount of extra work to be done on board as a result of the implementation of the LO, like separating wanted from unwanted catch and storing additional quantities of fish.

SYNTHÈSE

L'article 15 de la politique commune de la pêche (PCP) réformée de l'Union européenne (UE) est entré en vigueur le 1er janvier 2015 dans le but d'introduire une mise en œuvre échelonnée d'une interdiction totale des rejets, à savoir, une interdiction de rejeter les captures, plus largement connue comme l'obligation de débarquement (OD) qui consistait essentiellement à passer d'un système de « débarquement » à un système de « quotas de captures ». La mise en œuvre échelonnée s'est achevée en janvier 2019 par la mise en application totale de l'OD couvrant tous les stocks soumis à quotas dans les eaux de l'UE ainsi que ceux soumis à des tailles minimales en Méditerranée. Cependant, la transition vers un régime de quotas de captures s'est avérée très difficile pour certaines pêcheries.

L'obligation de débarquement vise principalement à réduire le gaspillage provoqué par les rejets, à encourager une pêche plus sélective et à éviter les captures indésirées. Dans ce contexte, les États membres ont entrepris plusieurs initiatives ainsi que des mesures volontaires facilitant l'application de l'OD et dont la plupart portaient sur des études relatives à l'utilisation d'engins de pêche sélectifs. Dans le cadre de la présente étude, les entretiens et les questionnaires menés auprès des parties prenantes ont montré que le processus d'approbation de nouveaux engins est long et qu'il a retardé de façon considérable la mise en œuvre de ces mesures. Des accords volontaires ont contribué à mettre en place des règles « d'évitement » (également appelées « move-on rules ») qui ont permis de mieux connaître les zones dont les taux de rejet sont élevés pour les pêcheries pélagiques et démersales. Ces règles d'évitement, associées aux améliorations de la sélectivité des engins de pêche, ont été considérées comme les moyens les plus efficaces pour faciliter la mise en œuvre de l'OD. Néanmoins, ces mesures techniques ont été estimées moins viables d'un point de vue économique du fait qu'elles nécessitent des investissements supplémentaires de la part des propriétaires des navires dans de nouveaux engins de pêche et représentent une perte potentielle d'efficacité dans les captures des espèces cibles les plus précieuses. D'autres dispositions ont été prises pour faciliter l'OD telles qu'une plus grande flexibilité dans la gestion des quotas nationaux pour que les États membres puissent mieux répondre aux défis présentés par l'OD, des initiatives visant à accroître le taux de survie, des limites de captures hebdomadaires ainsi que des initiatives axées sur l'amélioration de la responsabilité et de l'alignement des quotas.

La consultation des parties prenantes au moyen d'entretiens, de questionnaires et d'ateliers en ligne a indiqué que les fermetures par zone étaient « moins efficaces » car elles impliquaient la suppression des TAC (totaux admissibles de captures) en plus des changements dans les TMRC (tailles minimales de référence de conservation). Certaines parties prenantes craignaient que la suppression des TAC utilisée comme mesure de gestion ne soit fondée que sur le désir d'éviter des problèmes des stocks à quotas limitants et que, de ce fait, ne tienne pas compte du besoin prioritaire de protéger les stocks vulnérables dans les pêcheries mixtes. Par conséquent, la suppression des TAC a été considérée comme un manque de précaution puisqu'elle aurait eu un impact négatif sur la gestion durable des stocks. Ainsi, d'autres mesures correctives ont été privilégiées pour réduire les pertes potentielles de possibilités de pêche dues aux stocks à quotas limitants, à savoir une plus grande flexibilité dans la gestion des quotas nationaux pour permettre aux États membres de mieux répondre aux défis de l'OD, des échanges de quotas entre les États membres et des exemptions fondées sur le taux de survie élevé.

Les effets potentiels de l'OD ont été mesurés d'un point de vue quantitatif grâce à une analyse complète de l'information en fonction de la pêche (FDI) provenant de la base des données du Centre commun de recherche de la Commission européenne. Par ailleurs, afin de réaliser l'évaluation qualitative des taux de rejet et mesurer le niveau de réussite de l'OD selon les pêcheries, les espèces, les zones et les États membres, le consortium a développé une application dynamique « ShinyApp ». Les jeux de données disponibles

couvraient des estimations des rejets pour deux périodes distinctes : 2011 à 2014 et 2015 à 2019. Des experts nationaux ont analysé les données et développé des tables de correspondance afin d'effectuer des contrôles qualité et d'harmoniser les formats de données entre les différents jeux de données pour les deux périodes. Ce travail a permis d'obtenir des informations cohérentes sur la période donnée. La « ShinyApp » a également été reliée avec succès aux résultats des évaluations des stocks du CIEM pour obtenir des informations supplémentaires telles que les taux d'exploitation des pêcheries, l'état des stocks et les tendances des taux de rejet observés. La connexion de l'application avec l'aperçu des exemptions sur certaines pêcheries et espèces a également facilité l'analyse des taux de rejet dans le contexte de l'OD. De plus, une méthode a été développée pour filtrer les données de façon à ne retenir que les pêcheries dont le débarquement présentait une couverture relativement élevée d'informations sur les rejets. Le jeu de données ainsi obtenu étant beaucoup plus réduit a pu être analysé et interrogé en détail à l'aide de l'application pour comprendre les tendances de rejet pour certaines zones, pêcheries et espèces.

Les taux de rejet estimés ne montraient pas de tendances ni de modèles clairs suite à la mise en œuvre de l'OD, ce qui s'expliquait par les courtes séries temporelles d'informations disponibles ainsi que par la nature extrêmement variable des données sur les rejets. Ceci dit, en incluant plus de données, à l'avenir, il serait possible de détecter les changements dans les taux de rejet et de les relier à la mise en œuvre de l'OD. Aucune distinction n'a été observée dans les taux de rejet entre les pêcheries et les espèces selon qu'elles bénéficient ou non d'une exemption à l'obligation de débarquement. Par conséquent, il n'a pas été possible d'établir des différences entre les modèles de rejet liées aux exemptions. Des difficultés à suivre l'impact des différentes exemptions ont également été identifiées en raison de la forte agrégation des informations disponibles dans la base des données du CSTEP-FDI. Ceci contraste avec les critères détaillés spécifiques pour les pêcheries et les espèces bénéficiant d'exemptions. Ces critères sont basés sur des informations telles que des associations de périodes de mise en œuvre, des zones explicites, des opérations de pêche et des spécifications de navires. Cette question devrait être prise en compte lors d'une analyse plus approfondie de cette base de données afin d'évaluer les effets de l'OD ou des exemptions.

Un élément clé pour évaluer la mise en œuvre de l'OD était l'estimation du niveau de conformité. Pour comprendre les raisons de la viabilité ou de l'impraticabilité de certaines mesures et, par conséquent, de la conformité ou non-conformité, les opinions des autorités de contrôle nationales et d'autres parties prenantes (industrie, ONG, scientifiques) ont été recueillies. Les parties prenantes impliquées dans les différents domaines abordés par cette étude ont été consultées par le biais d'entretiens, de deux ateliers en ligne et d'une enquête en ligne. À l'heure actuelle, les mesures de contrôle principalement utilisées dans les eaux de l'UE sont les inspections traditionnelles en mer (par exemple par des navires de patrouille) et les inspections à quai/dans les criées des débarquements/journaux de pêche électroniques. La plupart des parties prenantes estiment que ces mesures de contrôle ne sont pas efficaces dans le schéma actuel de l'OD étant donné qu'elles ont un effet purement dissuasif et ne permettent pas de détecter, par exemple, les rejets illégaux qui ne se produiraient jamais lors des inspections en mer. Les parties prenantes ayant répondu à l'étude préconisent l'utilisation des dispositifs de surveillance électronique à distance (REM) incorporant des systèmes de CCTV (Closed-Circuit Television) à bord ainsi que des capteurs pour améliorer la surveillance et le contrôle. Cependant, lors des ateliers et des entretiens, les représentants du secteur hésitaient à encourager l'utilisation de la REM car cela pourrait soulever des problèmes liés au respect de la confidentialité, engendrer des coûts supplémentaires et créer un sentiment de méfiance à l'égard des opérateurs de pêche. Pour améliorer la conformité, et en particulier l'enregistrement des rejets, il existe un consensus sur le besoin de réviser les systèmes d'enregistrement et de communication électroniques des données (ERS) et le journal de pêche, par exemple, en ajoutant des champs supplémentaires et en simplifiant leur utilisation. Il a été noté que

lorsque les journaux de pêche avaient subi des modifications, les champs concernés n'étaient pas à jour au moment de la mise en œuvre de l'OD.

Obtenir la liste des pêcheries et des stocks couverts par la mise en œuvre de l'OD est assez facile, en revanche il a été complexe d'obtenir un aperçu de la longue liste d'exemptions dans les eaux de l'Atlantique nord-ouest et de la Mer du Nord. De plus, en raison du manque d'informations détaillées sur les taux de rejet pendant une longue période, il a été difficile d'obtenir des spécifications détaillées concernant les exemptions, le temps de mise en œuvre, les engins et les régions spécifiques et d'avoir une vue d'ensemble de l'OD ainsi qu'une évaluation générale de ses effets. Il a donc été conclu qu'il manquait de preuves de changement des pratiques de rejet dans les pêcheries de l'Atlantique nord-ouest, de la Mer Baltique et de la Mer du Nord suite à la mise en œuvre de l'OD. Néanmoins, lors des consultations avec les parties prenantes, il a été noté que plusieurs mesures de gestion adoptées auraient potentiellement un effet sur les modèles de pèche et sur les comportements à adopter pour éviter les captures sous les seuils des TMRC.

Cette étude met en évidence l'importance de maintenir des programmes scientifiques d'échantillonnage permettant de mieux comprendre les changements dans les taux de rejet et recommande de maintenir l'outil de diffusion des données pour pouvoir incorporer plusieurs années de données dans les estimations des rejets. L'application pourrait ainsi être utilisée comme un outil d'évaluation quantitative pour mesurer le succès de l'OD.

Les résultats de l'enquête ont montré que la majorité des parties prenantes (64% dans les régions de la Mer du Nord et de la Mer Baltique et 72% dans l'Atlantique nord-ouest) estimaient qu'il existait une non-conformité de la mise en œuvre de l'OD. Les principales raisons de cette non-conformité étaient des législations complexes, le fait que l'OD n'est pas acceptée par le secteur, le manque d'outils de contrôle efficaces en mer et l'inadéquation des mesures de contrôle actuelles. Selon certaines parties prenantes, la mise en œuvre de l'OD ajoute un travail considérable à bord des navires, comme la séparation des captures indésirées et le stockage de quantités supplémentaires de poisson.

1 INTRODUCTION

Article 15 of the reformed Common Fisheries Policy (CFP) of the European Union (EU) came into force on 1 January 2015 and introduced a phased implementation of a discard ban. This is generally described as the Landing Obligation (LO). In January 2019, the phased implementation was completed and the LO was fully implemented, covering all quota stocks in EU waters and those with minimum sizes in the Mediterranean.

Unwanted catches and discards constitute a substantial waste and negatively affect the sustainable exploitation of marine ecosystems, their resources and the financial viability of fisheries. With the LO, the CFP highlights the need for measures to reduce the levels of unwanted catches and to eliminate discards. The implementation of the LO is in essence therefore, a transfer from a landing quota system to a catch quota system. All fish caught should be landed and deducted from the available quota, including catches of juvenile and undersized fish below their MCRS that would have been discarded previously. The LO states that undersized fish cannot be directly used for human consumption. As a consequence, the economic return from fish below MCRS is generally much lower than from fish intended for the human consumption market.

Not being able to avoid catching one particular species results in a cap on fishing activity, whereby vessels are required to stop fishing when the quota for one stock or species has been exhausted, even if quotas for other species are still available. This cap on fishing activity is caused by the species with the most limiting available quota. It is commonly referred to as a 'choke event' or 'choke species'. Management anticipates that the potential of a choke event motivates fishers to change their fishing behaviour and practices so that unwanted catches, like undersized fish and quota-limited stocks, will be avoided. However, the transition towards a fully implemented catch quota regime is very challenging for some fisheries. Therefore, the CFP included several exemptions from the LO, which meant that rather than having to land all catches, some catch can still be discarded. These exemptions include species with high survival and fisheries that have disproportionate landing costs and proven difficulty of handling unwanted catches; as well as prohibited species; and species damaged by predators. Exemptions based on disproportionate landing costs and proven difficulty of handling, unwanted catches should not represent more than a certain percentage, in general less than 6 percent, of the total catch, the so called *de minimis*.

The main objective of this study is to assess and evaluate the implementation of the LO for fisheries of Member States for the Baltic Sea (BS), North Sea (NS) and Atlantic Western Waters (AWW) including the EU outermost regions (OR). To start a thorough evaluation of the LO, it is necessary to create a complete overview of implemented LO fisheries management measures by region and member state. This also covers initiatives undertaken to facilitate the implementation of the LO, such as development of monitoring technologies, catch avoidance strategies and quota regulation procedures. This results in a detailed summary of species and fisheries (country, gear and area) covered by the LO and its exemptions by implementation phase (year). This detailed and complete inventory of implemented measures and possible exemptions forms a solid basis for further assessment and evaluation of the LO. For this reason, these overviews of management measures are useful for consultations with stakeholders when evaluating the effectivity of the different management measures under the LO, during e-workshops and when developing interview guides and questionnaires.

To quantify and measure the success of the LO, a more analytical approach is needed in the second part of this study. After implementation, all catches of fish species affected by the LO should be landed. Therefore, one can expect changes in catch composition. Similarly, if effective measures to avoid unwanted catches are adopted (e.g., avoiding catches of juveniles or quota limited stocks) changes in gear selectivity and fishing patterns – will be detected. To be able to assess these potential effects, a comprehensive analysis on the fisheries dependent information (FDI) data base of the Joint Research

Centre of the European Commission (JRC) is conducted. Currently, the FDI data base is the only comprehensive source of catch information available that includes both landings and discard estimates for EU fisheries, covering the period 2011 – 2019. However, despite significant investments by Member States to populate the FDI data base, discard estimates are generated from relatively few samples. Discard sampling programmes often have limited coverage, which results in potential bias and high levels of uncertainty. Therefore, to check for biased and unrealistic discard estimates, prior to analysis, data needs to be screened by national fisheries data experts. The processes developed by these experts to detect inconsistencies in the data base are described in this study.

Comparisons between discard rates of the period prior to the LO implementation (before 2015) and the period throughout the LO implementation (2015–2019) potentially provide insight into how discard rates in EU fisheries have evolved as a consequence of the LO implementation. Because of the large amount of information covered and the wish to compare trends across species, fisheries, areas and gears, it is the aim to develop an online application within this study. Such an application could facilitate evaluation of management measures by creating a link with earlier compiled management measures overviews. In addition, an application provides the opportunity to evaluate the observed changes in discard rates with other sources of information. Discard rates can be highly variable in time and space as a consequence of changing economic, sociological, environmental and biological factors, making it difficult to directly define the effect of the LO implementation. To link observed changes of discard rates with stock and fisheries information of the International Council for the Exploration of the Sea (ICES) allows interpreting discard rates in a wider context, for example signals of strong recruitment, low catch rates, stock increase or decrease.

The objectives of the LO will only be met when fishers comply with the regulations. The level of compliance depends on the implementation of an effective control and enforcement system. Currently, this system is mainly based on four different legal acts: 1) the fisheries control regulation; 2) the regulation that establishes a European Fisheries Control Agency (EFCA); 3) the regulation establishing a system to combat illegal, unreported and unregulated fishing (IUU Regulation) and 4) the regulation on the Sustainable Management of the External Fishing Fleets (SMEF).

While fisheries' rules and control measures are agreed at EU level, Member States have a responsibility to adopt the necessary structures, measures and resources to ensure control, enforcement and inspection of all activities that fall under the scope of the CFP. This includes accurate and complete data recording, and submission within deadlines under Article 5(3) of Council Regulation (EC) No 1224/2009 (Control Regulation) and Article 109(2) of the Control Regulation. These articles support Article 15(13) of Regulation (EU) No 1380/2013 and are relevant in the context of ensuring control and enforcement of the LO and ensuring that all catches, including quantities discarded, are accurately documented. Member States also have an obligation to prevent, deter and eliminate illegal, unreported and unregulated (IUU) fishing (Article 1(2) of Council Regulation (EC) No 1005/2008) and to ensure that appropriate measures are systematically taken against those suspected of a breach of any of the rules of the CFP (Article 89 of the Control Regulation). Member States are empowered to carry out inspections by themselves. However, research has pointed out that joint efforts, through regional Joint-Deployment Plans (JDPs), make up a significant proportion of all inspections. JDPs were established for fisheries or areas that are considered a priority. These can be in EU waters (i.e., via EU specific control and inspection programmes) or international waters (i.e., via international control schemes) in collaboration with Member States and/or Regional Fisheries Management Organisations (RFMO). All JDPs involve multiple species and cover multi-annual activities and exist for the BS, NS and AWW. The LO presented a number of challenges for control authorities working towards ensuring its uniform and effective implementation across all Member States (Nuevo et al. 2019). For the purposes of monitoring compliance with the LO, Member States have an obligation to ensure that all

recorded data is accurate, complete and that all fishing trips are documented. In addition, Article 15 states that Multi-Annual Plans (MAPs), or in their absence temporary discard plans, should include details of the implementation of the LO including 'provisions on documentation of catches'. Accurate recording and reporting on all catches are essential for the monitoring and control of the use of the LO exemptions and flexibilities, e.g. exemptions for high survivability and *de minimis* (Karp et al. 2019, Nuevo et al. 2019). In the absence of effective control and enforcement, the Member States' ability to detect illegal discarding and to ensure the accurate documentation of catches is undermined and consequently jeopardising the sustainability objectives of the CFP. The main challenge associated with the enforcement of the LO is to control discarding at sea. The risks are difficult to mitigate by means of traditional control methods, such as inspections at sea. To evaluate the implemented control measures, including the methodologies and technologies used by control agencies and to explore the vulnerability to non-compliance for these measures, the different type of measures is identified and categorized during the third and final part of the study. Reasons for non-compliance are assessed and the possible consequences in terms of a successful implementation of the LO described. The practicality of implemented measures and the ability of the fishing sector to comply to measures are important evaluation topics. To understand how developments on exemptions, control measures, technologies, inspections and documentation schemes have responded to the new challenges during the implementation the LO input are gathered through consultation with authorities and stakeholders.

2 FISHERIES MANAGEMENT MEASURES AND INITIATIVES TO FACILITATE LO IMPLEMENTATION

The objective of this section is to identify and provide an overview of the implemented measures within delegated regulations and evaluate initiatives taken to facilitate the implementation of the LO. This last point includes identifying initiatives and LO related market measures highlighted in the interviews by local producer organisations (POs), advisory councils (ACs) and Member States' representatives.

2.1 Methods

A comprehensive review of existing documents was used to create an initial overview in combination with qualitative information gathered from interviews. The species and time frames of LO measures in the BS, NS, AWW and (when available) EU OR, were derived from Commission delegated acts and national measures implemented by the relevant Member States. Legal documents, STECF reports and implementation guidance sheets for fishers, provided by national fisheries control agencies, have been used as additional sources of information about LO measures (Annex 1.1).

Interviews with members of national and European fishery management and control agencies were supplemented by reviewing reports of pilot studies on catch quota management and Electronic Monitoring (EM) (e.g., within Denmark, Germany, the Netherlands and the United Kingdom[1]) and pilot studies on selectivity (e.g., Horizon 2020 project 'DiscardLess'). To collect feedback from stakeholders on preliminary overviews and outcomes, two e-workshops were held between 9–10 June 2020 for BS and NS stakeholders and on 17 June 2020 for the AWW and OR stakeholders. Annex 1.2 (BS and NS) and Annex 1.3 (AWW and OR) provide a summary of the main outcomes obtained from these e-workshops.

International reports, legal documents and specialized reports from ICES and STECF were searched for by accessing the websites of the ICES (https://www.ices.dk), STECF (https://stecf.jrc.ec.europa.eu/), DG MARE (https://ec.europa.eu/fisheries/) and Euro-Lex (https://eur-lex.europa.eu/). For the STECF, the following selection criteria where used: 'plenary meeting reports' and 'landing obligation'. For DG Mare: 'Policy -> Managing fisheries -> Discards'. Annex 1.4 (Table 1) provides an overview of the literature reviewed from these sites.

Peer-reviewed papers were identified using scientific citation search engines (e.g., Web of Science (WoS) and Google Scholar). The searches were limited to European studies conducted in the period 2014–2020 (March). Annex 1.4 (Table 2) provides the literature considered.

2.2 Collecting expert knowledge from interviews, workshop and data assembly templates

An interview guide was developed to highlight key management measures and assess the perceived success and feasibility of implemented or potential (for implementation) management measures (Annex 1.5). Interviews with national expert stakeholders representing the industry, ministries and NGOs were performed in accordance with the guide.

[1] Note that the United Kingdom was an EU member state at the time of the start of this study (February 2020).

Additionally, data assembly templates (Annex 1.6) were filled out to systematically assemble information from various sources and to create an overview of relevant management measures in relation to the LO by area, member state and fishery. For example, changes to MCRS were identified as a management measure relevant to LO for Germany, Denmark, Estonia, Finland, Latvia, Lithuania, Poland and Sweden, while TAC removal was identified as relevant to Belgium, Germany, Denmark, France, Sweden, the Netherlands and the United Kingdom. To compile the data assembly templates, information from interviews (with fisheries managers and POs), data obtained through literature (e.g., national and EC reports), expert knowledge (i.e., from scientists and policy makers) and reports on national LO pilot projects was used. As there was a substantial overlap in topics and persons to be interviewed, interviews were combined to provide information for all the objectives of this report.

Finally, in-depth assessments and consultations with experts and stakeholders were conducted via two e-workshops (from the BS and NS combined and the AWW and OR combined) and two online surveys. A detailed description of these methods employed are provided in the Annex 1.7.

2.3 Results

2.3.1 Overview of LO coverage by species, area, fishing gear and the time of implementation

Overviews of species, delegation regulations, year of implementation, gear class, gear, type of exemption, gear codes with exemption and ICES areas affected by the LO are presented in different tables: species affected by the LO are summarized in Table 1. Complete overviews by species and regions, including applied exemptions, can be found in Annexes 1.1. and 1.8.

Exemptions stated in the CFP of 2013 (Regulation (EU) No 1380/2013), article 15(4), are:

i) prohibited species;
ii) high survivability exemptions; and
iii) *de minimis* exemptions.
iv) fish that show damage caused by predators.[2].

It is important to note that the fourth point was added at a later date, as part of Regulation (EU) No 2015/812 Article 9, after the other points on the list. It is an overall exemption, as opposed to being specific like its counterparts.

[2] Citing Regulation (EU) No 2015/812: "Fish which have been damaged by predators such as fish-eating marine mammals, predatory fish or birds, can constitute a risk to humans, to pets and to other fish by virtue of pathogens and bacteria which might be transmitted by such predators. Consequently, the landing obligation should not apply to catches of such damaged fish, which should be immediately disposed of at sea."

Table 1: Overview of species subject to the landing obligation, species/area/year/gear combinations. (NWW= North Western waters; SWW= South Western Waters; NS= North Sea; BS= Baltic Sea; PTM = midwater pair trawls ; LHP= handlines and pole-lines; LHM = handlines and pole-lines (mechanized) ; LLS = set longlines ; LLD = drifting longlines; PS = purse seines ; OTM= midwater otter trawls; OTB = otter trawls; OTT = otter twin trawls ; PTB = pair trawls; TBN = Nephrops trawls; TBS = shrimp trawls; TBB = beam trawls; TB = bottom trawls (not specified); OT = otter trawls (not specified) ; PT = pair trawls (not specified) ; TX = other trawls (not specified) ; SSC = Scottish seines; SPR = pair seines; SDN = Danish seines; SX = seine nets (not specified); SV = boat or vessel seines; GNS = set gillnets (anchored); GN =gillnets (not specified); GND = driftnets ; GNC = encircling gillnets ; GTN = combined gillnets-trammel nets; GTR = trammel nets; GEN = gillnets and entangling nets (not specified); MIS = miscellaneous; FPO = pots; FIX = traps (not specified); FYK = fyke nets).

Species	First year	Area	Discard plans	Relevant gear codes
Albacore tuna (*Thunnus alalunga*)	2015	NWW, SWW	EU2014_1393, EU2018_0190, EU2014_1394, EU2018/0188	PTM
Alfonsinos (*Beryx spp.)*	2019	SWW	EU2018/2033	LHP, LHM, LLS, LLD
Anchovy (*Engraulis encrasicolus*)	2015	SWW	EU2014_1394 EU2018/0188	PS, OTM, OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV
Anglerfish (*Lophiidae*)	2018	SWW	EU2018/0044 EU2018/2033	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV, GNS, GN, GND, GNC, GTN, GTR and GEN
Any species not mentioned elsewhere in this table but subject to TAC	2019	NS	EU2014_1395 and EU2018_189 EU2018_2035, EU2019_2238	All
Any species not mentioned elsewhere in this table but subject to TAC or MCRS	2017	BS	EU2014_1396 and EU2018_306	All
Black scabbardfish (*Aphanopus carbo*)	2017	SWW	EU2017/2167	LLS
Blue whiting (*Micromesistius poutassou*)	2015	NS	EU2014_1395 and EU2018_189	OTM, PTM
Blue whiting (*Micromesistius poutassou*)	2019	NS	EU2018_2035, EU2019_2238	All
Blue whiting (Micromesistius poutassou)	2015	NWW SWW	EU2014_1393 EU2018_0190, EU2014_1394, EU2018/0188, EU2018/0044	OTM, PTM, OTT, OTB, PTB, OT, PT, TBN, TBS, TX, SSC, SPR, TB, SDN, SX, SV

Species	First year	Area	Discard plans	Relevant gear codes
Boarfish (*Capros aper*)	2015	NWW, SWW	EU2014_1393, EU2019/2239, EU2018/2033	OTM, PTM, OTT, OTB, PTB, OT, PT, TBN, TBS, TX, SSC, SPR, TB, SDN, SX, SV
Cod (*Gadus morhua*)	2015	BS	EU2014_1396 and EU2018_306	All
Cod (*Gadus morhua*)	2017	NS	EU2016_2250, EU2018_2035, EU2018_0045, EU2019_2238	All
Cod (*Gadus morhua*)	2019	NWW	EU2018/2034	OTB, OTT, OT, PTB, PT, SSC, SDN SPR, SX, SV, TBB, TBN, TBS, TB, TX
Common Sole (*Solea solea*)	2016	NS	EU2015_2440, EU2016_2250, EU2018_2035, EU2018_0045, EU2019_2238	All
Common Sole (*Solea solea*)	2016	NWW SWW	EU2015/2438, EU2016/2375, EU2018/0046, EU2018/2034, EU2019/2239, EU2015/2439, EU2016/2374, EU2018/2033, EU2019/2239	OTT, OTB, TBB, TBS, TBN, TB, PTB, OT, PT, TX, GN, GNS, GND, GNC, GTN, GTR, GEN, GNF
Great forkbeard (*Phycis blennoides*)	2019	SWW	EU2018/2033 EU2019/2239	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV, LHP, LHM, LLS, LLD
Greater silver smelt (*Argentina silus*)	2015	NS	EU2014_1395 and EU2018_189	OTM, PTM
Greater silver smelt (*Argentina silus*)	2020	NWW	EU2019/2239	OTT, OTB, TBS, TBN, TB, PTB, OT, PT, TX
Haddock (*Melanogrammus aeglefinus*)	2016	NS	EU2015_2440, EU2016_2250, EU2018_2035, EU2018_0045, EU2019_2238	All
Haddock (*Melanogrammus aeglefinus*)	2019	NWW	EU2018/2034 EU2019/2239	OTB, OTT, OT, PTB, PT, SSC, SDN SPR, SX, SV, TBB, TBN, TBS, TB, TX
Hake (*Merluccius merluccius*)	2016	NS	EU2015_2440, EU2016_2250, EU2018_2035, EU2018_0045, EU2019_2238	All
Hake (*Merluccius merluccius*)	2016	SWW	EU2015/2439, EU2016/2374, EU2018/0044, EU2019/2239	OTT, OTB, PTB, OT, PT, TBN, TBS, TX, SSC, SPR, TB, SDN, SX and SV
Herring (*Clupea harengus*)	2015	BS	EU2014_1396 and EU2018_306	All

Species	First year	Area	Discard plans	Relevant gear codes
Herring (*Clupea harengus*)	2015	NS	EU2014_1395 and EU2018_189	OTM, PTM, PS, OTB, PTB, GNS, GND, MIS
Herring (*Clupea harengus*)	2015	NWW	EU2014_1393 EU2018_0190	PS, GND
Horse mackerel (*Trachurus spp.*)	2015	NS	EU2014_1395 and EU2018_189	OTM, PTM, PS
Horse mackerel (Trachurus spp.)	2019	NS	EU2018_2035, EU2019_2238	All
Horse mackerel (*Trachurus spp.*)	2019	NWW SWW	EU2018/2034, EU2019/2239, EU2018/2033, EU2019/2239	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV, GNS, GND, GNC, GTR, GTN
Ling (*Molva molva*)	2019	NS	EU2018_2035, EU2019_2238	All
Mackerel (*Scomber scombrus*)	2015	NS	EU2014_1395 and EU2018_189	OTM, PTM, PS, OTB, PTB, GNS, GND, LLS, LHP, MIS
Mackerel (*Scomber scombrus*)	2019	NS	EU2018_2035, EU2019_2238	All
Mackerel (Scomber scombrus)	2015	NWW SWW	EU2014_1393 EU2018_0190	PS, OTM, OTB, OTT, OT, PTB, PT, SSC, SDN SPR, SX, SV, TBB, TBN, TBS, TB, TX, GNS, GND, GNC, GTR, GTN
Megrim (*Lepidorhombus spp.*)	2019	NWW SWW	EU2018/2033 EU2019/2239	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV, GNS, GND, GNC, GTR, GTN
North Deepwater Prawn (*Pandalus borealis*)	2016	NS	EU2015_2440, EU2016_2250, EU2018_2035, EU2018_0045, EU2019_2238	All
Norway lobster (*Nephrops norvegicus*)	2016	NS	EU2015_2440, EU2016_2250, EU2018_2035, EU2018_0045, EU2019_2238	All
Norway lobster (*Nephrops norvegicus*)	2016	NWW SWW	EU2015/2438, EU2016/2375, EU2018/0046, EU2018/2034, EU2019/2239, EU2015/2439, EU2016/2374, EU2018/0044, EU2018/2033, EU2019/2239	OTB, OTT, PTB, TBN, TBS, TB, OT, PT, TX, FPO, FIX, FYK
Norway Pout (*Trisopterus esmarkii*)	2019	NS	EU2018_2035, EU2019_2238	All
Norway Pout (*Trisopterus esmarkii*)	2015	NS	EU2014_1395 and EU2018_189	Any trawl < 32 mm, PS

Species	First year	Area	Discard plans	Relevant gear codes
Plaice (*Pleuronectes platessa*)	2017	BS	EU2014_1396 and EU2018_306	All
Plaice (*Pleuronectes platessa*)	2016	NS	EU2015_2440, EU2016_2250, EU2018_2035, EU2018_0045, EU2019_2238	All
Plaice (*Pleuronectes platessa*)	2019	NWW SWW	EU2018/2034 EU2019/2239	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV, GNS, GND, GNC, GTR, GTN
Pollack (*Pollachius pollachius*)	2019	NWW SWW	EU2018/2033	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV, GNS, GND, GNC, GTR, GTN
Red seabream (*Pagellus bogaraveo*)	2019	SWW	EU2018/2033	LLS, DWS, OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV
Saithe (*Pollachius virens*)	2016	NS	EU2015_2440, EU2016_2250, EU2018_2035, EU2018_0045, EU2019_2238	All
Salmon (*Salmo salar*)	2015	BS	EU2014_1396 and EU2018_306	All
Sand eel (*Ammodytes* spp.)	2015	NS	EU2014_1395 and EU2018_189	Any trawl < 32 mm, PS
Sand eel (*Ammodytes* spp.)	2019	NS	EU2018_2035, EU2019_2238	All
Skates and rays (*Rajiformes*)	2019	NS	EU2018_2035, EU2019_2238	All
Skates and rays (*Rajiformes*)	2019	NWW SWW	EU2018/2034 EU2019/2239 EU2018/2033	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV, GNS, GND, GNC, GTR, GTN
Sprat (*Sprattus sprattus*)	2015	BS	EU2014_1396 and EU2018_306	All
Sprat (*Sprattus sprattus*)	2015	NS	EU2014_1395 and EU2018_189	OTM, PTM, PS, MIS, ind. Trawl
Sprat (*Sprattus sprattus*)	2019	NS	EU2018_2035, EU2019_2238	All
Turbot (*Scophtalmus maximus*)	2019	NS	EU2018_2035, EU2019_2238	All
Whiting (*Merlangius merlangus*)	2015	NS	EU2014_1395 and EU2018_189	when caught by pelagic
Whiting (*Merlangius merlangus*)	2017	NS	EU2016_2250, EU2018_2035, EU2018_0045, EU2019_2238	All

Species	First year	Area	Discard plans	Relevant gear codes
Whiting (*Merlangius merlangus*)	2017	NS	EU2016_2250, EU2018_2035, EU2018_0045, EU2019_2238	All
Whiting (*Merlangius merlangus*)	2016	NWW SWW	EU2015/2438, EU2016/2375, EU2018/0046, EU2018/2034, EU2019/2239, EU2018/2033, EU2019/2239	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV, GNS, GND, GNC, GTR, GTN

2.3.2 Identification of relevant management measures

Table 2 provides a list of different types of management measures that have been identified as relevant for the implementation of the LO during a review of national and EU regulations, and interviews and recordings with relevant stakeholders. These interviews also revealed information about invested efforts, such as experimental studies, pilots and collaborations, conducted with national control agencies.

Table 2: List of identified management measures

N°	Management measure
1	Closed or temporarily closed areas/temporary stop on fishing activities
2	Avoidance/Moving-on rules/(near) Real-Time closures
3	Selective gear
4	High survivability exemptions
5	De minimis exemptions
6	Change of minimum landing/conservation reference size (MLS/MCRS)
7	Total Allowable Catch (TAC) removal
8	Quota management (e.g., swaps, Interspecies- and interannual quota flexibility mechanisms)
9	Catch Quota Management trials

Table 3 presents the management measures trialled or implemented in Member States. It provides an overview of the relevant legal regulations, including the measures and the 'relevant country'. This refers to the country where the management measure has been specified in a data assembly template. Note that the management measure may also be used by countries/Member States not listed in the 'relevant country' column, as countries are only recorded as the relevant management measure has been identified as trialled, implemented or used in relation with the LO. The measures are listed by overall measure category, with a short description of the measure type, legislation and/or scientific documentation and relevant countries.

The number of relevant countries identified in the table indicates the level of support or success of a particular management measure: 'avoidance/moving-on rules/(near) real-time closures' was the least frequently occurring measure among the relevant countries. Only three Member States (Denmark, the Netherlands and Sweden) trialled and implemented this management measure.

The CFP's Basic Regulation states in its recital 8 that management decisions in mixed fisheries should take into account the difficulty of fishing all stocks in a mixed fishery at MSY at the same time, in particular where scientific advice indicates that it is very difficult to avoid the phenomenon of "choke species" by increasing the selectivity of the fishing

gears used[3]. Additionally, article 9 of the CFP states that "MAPs may contain specific conservation objectives and measures based on the ecosystem approach in order to address the specific problems of mixed fisheries in relation to the achievement of the objectives set out in Article 2(2) for the mixture of stocks covered by the plan in cases where scientific advice indicates that increases in selectivity cannot be achieved. Where necessary, the MAP shall include specific alternative conservation measures, based on the ecosystem approach, for some of the stocks that it covers".[4]. Besides these recitals and provisions where the problem of choke species is recognized, it seems that problems with choke species due to bycatch of undersized fish or a lack of quota of bycatch species in pelagic fisheries have been frequently addressed by high survivability exemptions in recent years. Also, demersal fisheries fishing for flatfish species with bycatch of Nephrops and skates and rays used the high survivability exception to prevent choking situations.The *de minimis* exemption was indicated as a commonly used exemption for fisheries, especially for demersal fisheries dealing with choke situations. Stakeholders indicated that this measure was important, but information on the frequency of implementation on national levels was not available. Thirteen 'relevant countries' are identified in Table 3 for the *de minimis* exemption.

The changing of MCRS was identified as a relevant LO measure for fisheries targeting cod (*Gadus morhua*) in Germany, Denmark, Estonia, Finland, Latvia, Lithuania, Poland and Sweden.

TAC removal was identified as relevant for Belgium, France, Germany, Denmark, Sweden, the Netherlands and the United Kingdom.

Article 15 of the CFP set up flexibility mechanisms though which catches of species that are subject to the LO and caught in excess of quotas of the stocks in question, or catches of species of which the Member States have 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. Further, Member States may use a year-to-year flexibility of up to 10% of their permitted landings for stocks subject to the landing obligation. 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 Regulation (EC) No 1224/2009 shall apply. The 10% interannual quota flexibility was reportedly used by many Member States (i.e., Belgium, Denmark, Estonia, Finland, France, Germany, Latvia, the Netherlands, Spain and Portugal). By contrast, use of the 9% interspecies quota flexibility was less frequently reported. Denmark reported having used the 9% interspecies quota to align herring and sprat quota better in the BS, while Latvia used the interspecies flexibility to mitigate their zero TAC on plaice, by swapping some of their cod TAC to plaice. Based on these results, Member States seem to interpret interspecies quota flexibility as a last resort, only used when quota swapping with other Member States and interannual quota flexibility are insufficient in preventing choke situations for a given stock.

Catch quota management trials with EM were reported by a limited number of countries (Germany, Denmark, the Netherlands, Sweden and the United Kingdom).

[3] Proposal for a COUNCIL REGULATION fixing for 2021 the fishing opportunities for certain fish stocks and groups of fish stocks applicable in the Baltic Sea, and amending Regulation (EU) 2020/123 as regards certain fishing opportunities in other waters COM/2020/436 final.

[4] Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013 on the Common Fisheries Policy, amending Council Regulations (EC) No 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC.

Table 3: Management measures trialled or implemented in Member States (relevant countries: DE =Germany ; DK = Denmark; EE= Estonia; FI = Finland; LT = Lithuania; LV = Latvia; PL= Poland; SE = Sweden; UK = United Kingdom; SP = Spain; NL = the Netherlands; BE = Belgium; FR = France; PT = Portugal; IE = Ireland).

Management measure	Description/definition	Legal/Scientific Context	Relevant country
Closed or temporarily closed areas / temporary stop on fishing activities	Closing an area for fishing, temporarily or fully	Council Regulation (EU) 1380/2013; 2019/1241; 2020/123. European Commission (Press release) 2019. Commission approves emergency measures to protect eastern Baltic cod. Danish national regulation, "BEK nr 391 af 16/04/2010";	DE, DK, EE, FI, LT, LV, PL, SE, UK, SP
Avoidance/Moving-on rules / (near) Real-Time closures	Regulations for leaving a fishing area if certain bycatch criteria are hit	Commission Delegated Regulations (EU): 2018/2035; 2019/2201; 2019/1241; 2019/2238	DK, NL, SE
Selective gear	Increasing the selectivity of fishing gears through measures like, but not limited to, selective grids, sorting panels, increased mesh size, escape panels, or floats.	Commission Delegated Regulations (EU) 1396/2014; 2015/2440; 2016/2250; 2018/211; 2018/2035;2019/2238; 2019/2201; 2019/1241; 2020/123. Belgian national regulation, "23 DECEMBER 2019, Art. 5, Ministerieel besluit houdende tijdelijke aanvullende maatregelen voor het jaar 2020 tot het behoud van de visbestanden in zee"; Danish national regulation, "Vejledning om krav til bundtrawlredskaber, der skal anvendes i Kattegat, implementing (EU) 2020/123 artikel 15, stk.";	BE, DE, DK, EE, FI, FR, LT, LV, NL, PL, SE, UK, SP, PT
High survivability exemptions	CFP (art. 15(4b)) states that for "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", the LO shall not apply.	Council Regulation (EC) 1380/2013, (15); Commission Delegated Regulations (EU) 1395/2014; 1396/2014; 2015/2440; 2016/2250; 2018/189; 2018/2035; 2018/306; 2018/45; 2019/2238; 1393/2014; 1394/2014;2015/2438; 2015/2439;2016/2374; 2016/2375; 2017/2167; 2018/44; 2018/46;2018/188; 2018/2033; 2018/2034; 2019/2237; 2019/2239	BE, DE, DK, EE, FI, FR, LT, LV, NL, PL, SE, UK, IR, NL, BE, FR, SP, PT

Management measure	Description/definition	Legal/Scientific Context	Relevant country
De minimis exemptions	CFP (art. 15(4c)) allows for discards of up to 5 % of catches otherwise subject to the landing obligation under the de minimis exemptions. *de minimis* exemptions does not apply in the Baltic Sea	Council Regulation (EC) 1380/2013 (15). Commission Delegated Regulations (EU) 1395/2014; 2015/2440; 2016/2250; 2018/189; 2018/2035; 2018/45; 2019/2238; 1393/2014; No 1394/2014; 2015/2438; 2015/2439; 2016/2374; 2016/2375; 2017/2167; 2018/44; 2018/46; 2018/188; 2018/2033; 2018/2034; 2019/2237; 2019/2239.	BE, DE, DK, FR, NL, SE, UK, IE, NL, BE, FR, SP, PT
Change of minimum size (MCRS)	Reducing the minimum size allowed for landing to human consumption. In 2015, cod in the Baltic Sea. In 2016, (Norway lobster, 3a), 2017 (Norway lobster 3a, added tail measurement).	Commission Delegated Regulations (EU) 1396/2014; 2015/2440; 2016/2250.	DE, DK, EE, FI LT, LV, PL, SE
TAC removal	CFP (art. 15) states that the landing obligation apply to species with catch limits (TAC) or minimum size. Removal of TAC thereby remove the species from the landing obligation. This was used for dab and flounder in the North Sea in 2017	Council Regulation (EC) 1380/2013, (15); Communication from the Commission on the State of Play of the Common Fisheries Policy and Consultation on the Fishing Opportunities for 2018; ICES, EU request on a combined dab and flounder TAC and potential management measures besides catch limits	BE, DE, DK, FR, NL, SE, UK
Quota management	Adaptation in quota system. Quota swaps between countries. Quota swaps between vessels. Interspecies quota flexibility mechanisms of up to 9 %, CFP (art. 15 (8)), paragraph 8. Interannual quota flexibility of up to 10 %, CFP (art. 15 (9)).	Council Regulation (EC) 1380/2013, (15);	All Member States
Catch Quota Management trials with Electronic Monitoring	Council Regulation (EU) No. 219/2010 allow for 5 % of Member States' cod quota to be used as incentive for participation in Catch Quota Management trials supported by Fully Documented Fisheries using Electronic Monitoring with video as documentation of compliance.	Council Regulation (EC) 219/2010	DE, DK, NL, SE, UK

2.3.3 Evaluation of voluntary actions taken to facilitate the LO

Table 4 provides a detailed overview and evaluation of the voluntary actions identified in the study and the impact of the actions according to input derived from interview and workshop participants. The measures are listed by country, specific action, if there is a direct or indirect connection with the implementation of the LO and the impact/evaluation of those actions. For actions with an indirect connection, the relevance for the LO was identified at a later stage. For example, gear technology experiments set up to reduce bycatch for other research projects proved useful for the LO.

Table 4: Voluntary actions trialled or implemented in Member States.

Type	Country	Voluntary action	LO connection	Impact and evaluation
Avoidance/Moving-on rules	Denmark	Pelagic fishery stopped fishing for North Sea herring in first quarter	Direct	Avoid bycatch of mackerel. Since 2015.
	The Netherlands	Mapping discards in time and space, demersal	Direct	Avoidance of areas/times with high discards. Brunel et al., (2019) Report C015/19. Effect unknown.
	The Netherlands	Pelagic fishery has voluntary moving-on rules	Direct	Avoid undersized horse mackerel
Selective gear	Belgium The Netherlands	Light as deterrent/attractant	Direct	Selective measure. Still in trial phase
	Belgium Denmark Sweden Netherlands UK	New selective gears tested	Indirect	Slow approval process due to regulation obstacles and lack of uptake
	Spain France Ireland UK	New selective gears tested	Indirect	Slow approval process due to regulation obstacles and lack of uptake
High survivability exemptions	Denmark	Code of conduct for handling of rays	Direct	Higher survivability for discarded rays
	The Netherlands	High survivability exemption for plaice when vessels have Electronic Monitoring	Direct	In place on 6 vessels, soon 10 vessels. Challenging.
	The Netherlands	Self-imposed minimum landing size and weekly catch limit for skates, rays and turbot due to relatively small quota and high survivability exemption.	Direct	All skates, rays and turbot below self-imposed minimum landing size are discarded. Control is done by Producer Organisation
	Spain the Netherlands	Skate survivability tests	Direct	Higher survivability for discarded rays

Type	Country	Voluntary action	LO connection	Impact and evaluation
	UK			
	Spain	Code of conduct for handling of rays	Direct	Higher survivability for discarded rays
Catch Quota Management trials	The Netherlands	Pelagic trials with Electronic Monitoring	Direct	Planned but not started. Impact to be evaluated.
	Denmark	Free selection of gear when vessels have Electronic Monitoring (trial)	Direct	Positive results in the Baltic Sea and Kattegat (Mortensen et al., 2017)
	Spain	Trials with Electronic Monitoring on board scientific and commercial trawlers	Direct	Automatic estimates of discards by species to take real-time decisions. Avoidance of areas/times with high discards rates
Other	Denmark	New bycatch procedures at factory level	Direct	Better accountability of bycatches
	The Netherlands	Pelagic trial on processing of unwanted bycatch to manageable product	Direct	Not promising
	Denmark Sweden	Baltic pelagic developed new model to deduct sprat and herring quote	Indirect	Better alignment of catch at haul level with quota allocation

2.3.3.1 Avoidance/moving rules

Several Member States performed voluntary actions related to avoiding high bycatch areas in pelagic (Denmark, the Netherlands) and demersal (the Netherlands) fisheries that the stakeholders considered promising.

EM registration without video can potentially be used in the control and monitoring of fishing activity in closed areas designed to support the LO, but it has not been implemented so far. Denmark and Scotland have non-video EM implemented in certain mussel fisheries (blue mussels for Denmark, razor clam for Scotland). These systems register positional data at 10 second intervals and use sensors to record spatial and temporal distribution of fishing activities.

Several pelagic representatives stated that in addition to the voluntary measures regarding 'avoidance/moving on rules' listed in Table 4, pelagic vessels communicate among each other to avoid bycatch areas. Although such behaviour was the case before the LO, this is seen as a measure in line with the intention of the LO, which is to avoid unwanted catches as far as possible.

2.3.3.2 Selective gear

At a voluntary level, all Member States have conducted selectivity improvement trials. However, the potential benefits in terms of reducing unwanted catches are still not fully utilised. Two major reasons for the slow uptake were mentioned: 1) the lengthy and non-transparent process for getting new gear approved and 2) the lack of uptake of approved gear in the fishery. To get new gear approved, Member States have to submit a report to the STECF for evaluation. Although there is no established cooperation with STECF, the

same reports are also often presented in the ICES working groups on gear technology. There is no agreed protocol for what should be presented in these reports. Neither is there an available description of the evaluation process. The situation seems to differ from case to case (expert judgement) and there is no fast-tracking process to rapidly implement gear with proven benefits. Uptake by the fishing industry seems better when clear economic benefits are present, but when these benefits are smaller, there can be substantial delays. It should be noted, however, that the implementation of more selective gears as a result of legal requirements is mandatory.

2.3.3.3 High survivability exemptions

Spain, Portugal, the Netherlands, France and the United Kingdom conducted experiments in the AWW to assess the survivability of small pelagic fish, flatfish, Nephrops and rays' discards. All these experiments had a direct connection with the LO. Most studies were focused on obtaining scientific evidence of high survivability. Other experiments involved changes in MCRS and weekly catch limits for stocks with high survivability exemptions (the Netherlands).

2.3.3.4 Catch Quota Management Trials

Denmark, Germany, Sweden, the Netherlands and the United Kingdom trialled several Fully Documented Fishery (FDF) schemes. Fishing vessels were equipped with EM systems that allowed for video recording the catch prior to and/or in the initial years of the LO implementation. The first trials started in 2008 in Denmark, followed by the United Kingdom, Sweden, Germany and the Netherlands. While the trials began prior to the LO, focusing mainly on catch quota management, several of these experiments were relevant for the LO during the years 2013–2016. The Scottish catch quota management trial was the last to end in 2017. In 2019, the Netherlands started a new FDF trial, monitoring the four most commercially important flatfish species (sole, plaice, turbot and brill). The main objective is to develop a system that uses EM to automatically identify and register catch and discard fractions onboard. Denmark has plans to implement FDF in Kattegat in 2020–2022, with the aim to document and reduce the bycatch of cod.

Spain has carried out three pilot projects with the main objective being testing the reliability of EM equipment on-board commercial fishing vessels and determining whether this technology can be used to monitor and quantify catches. During the second phase of these pilot projects, a second step in the EM verification method was developed (called iOBSERVER). It allowed for full documentation of discards, biomass, size and discard rates.

2.4 Conclusions

While the list of fisheries and stocks covered by the LO implementation is rather straight forward to produce, getting an overview of the long list of exemptions is complex, in both the AWW and NS. The exemptions in the BS pertains to only three species, which is less than half of the species covered by TACs in the area. Similarly, less than half of species caught in pelagic fisheries in the NS are exempted, while the exemptions in the NS cover the 12 major demersal species under the LO in at least one fishery/gear type. In the AWW, a total of 23 species are covered by exemptions. Of these, 15 species are fished in NWW and 19 in SWW.

There were nine types of management measures trialled or discussed in connection with the implementation of the LO within the EU. Avoidance/moving-on rules/(near) real-time closures and electronic monitoring were trialled by three Member States while the remaining measures were trialled by at least seven Member States. There was general agreement among respondents that spatial and temporal avoidance measures and gear modifications were effective in reducing unwanted catches, whereas there was little agreement on the effectiveness of removing TACs and areal closures. When aiming to mitigate potential losses in fishing opportunities due to choke considerations, adaption of

national quota management to better fit LO challenges and quota swaps between Member States (specifically in relation to the LO challenges) were the preferred options followed by high survivability exemptions. Removal of TAC for stock and change of MCRS were least preferred adaptions. There was little agreement among respondents in the evaluation of areal closures, removal of TAC and change of MCRS. There was general agreement that high survivability exemptions, adaption of national quota management and quota swaps between Member States, vessels and years were effective. Respondents indicated that the removal of TACs would be based on a desire to avoid choke species problems rather than agreement that the TAC of a given stock was not necessary to obtain Maximum Sustainable Yield (MSY) of the stock in mixed fisheries. As a result, removing TACs was thought to be un-precautionary, as it could go against the sustainable management of the stocks.

Several Member States had voluntary actions related to selective gear development and trials. However, the stakeholders interviewed considered that the EU process to approve and use the developed gears creates delays in the implementation of these actions. Avoidance/moving on rules were facilitated by voluntary agreements and increased knowledge of high discard areas. Promising examples of adaption of national quota management to better fit LO challenges included initiatives to increase survivability, trials with MCRS and weekly catch limits for stocks with high survivability exemptions and initiatives focused on improving accountability and quota alignment.

3 EVALUATION OF THE LANDING OBLIGATION SUCCESS

The objective of this section is to compare the catch composition and discard pattern between the period prior to the LO implementation (before 2015) throughout the implementation period (2015–2018, depending on fisheries and area) and the full implementation in all sea basins (2015–2019, depending on fisheries and area), taking the implemented exemptions and management measures into consideration. This comparison provides an overview of how the EU fishing industry has adapted to the LO and whether the LO management measures have caused changes in catch composition, discard rates and fishing behaviour and practices.

3.1 Methods

3.1.1 Data availability, processing, harmonization and quality checks

This section focuses on using STECF-FDI data, which is the most comprehensive dataset for landings and discards estimates in EU fisheries. A data request was made to the Joint Research Centre (JRC), the Commission's science and knowledge service, with support from the European Commission (EC) and Member States to provide the consortium with data on landings and discards at the most disaggregated level, i.e., as provided by Member States when answering the annual STECF data call. The dataset has specific characteristics that need to be considered in the processing and analysis of the data, as outlined below.

Firstly, the dataset consists of census data (landings and effort) and sampled data (discard estimates and catch-at-age distributions). Data on landings is mostly obtained through logbooks. There are no technical complications for Member States to collect landings data to the level of disaggregation required for this project, as the data format requested corresponds to the scale of information in the European logbook (Data Collection Framework level 6). However, discard estimates are obtained by Member States through sampling programmes (e.g., observer programmes, self-sampling and reference fleets) and are rarely collected at the same disaggregation requested by the STECF-FDI data call.

The main objective of sampling programmes is to collect on-board catch data from commercial fishing vessels, with special attention to the discard component. In general, at-sea monitoring provides high quality data, though expensive and time-consuming to collect. Therefore, due to limited resources, these programmes generally have low sampling coverage of fishing effort and may not cover all fisheries in a member state. Importantly, most Member States' discard sampling programmes are not designed to provide data for the large number of combinations (e.g., year, areas, quarters, vessel length classes, fisheries and mesh-size ranges) requested by STECF-FDI data call. Most collect data at a broader scale than the combinations of variables requested by the STECF-FDI data call and therefore the same discard samples may be utilised across several records. Raising of these discard samples to the level required by the STECF-FDI data call is done at member state level and it is unlikely that all Member States use the same methods to fill potential data gaps for unsampled entities. It is therefore, possible that estimates of discards are not directly comparable between countries. Owing to the high level of detail and disaggregation requested in the STECF-FDI data call and the lack of precise data, corresponding estimates of discards are lacking for many records. Some country specific information on estimation and data compilation in response to the STECF-FDI data call can be found in the STECF-FDI report (STECF-20-10).

A key element in the process of scrutinizing this dataset is in identifying the information that is missing (no discard estimates submitted by the Member States) and then, where

information is present, analysing discard estimates that are marked zero to determine whether they are true (no discarding within a given fishery/ for a given species) or false zeros (no discard estimates available for a given fishery/ species). It is important to realize that a substantial part of the landings that are reported as a response to the STECF datacall are missing corresponding estimates of discards. The dataset that was made available to the consortium, discard estimates were available in 235 710 out of a total of 808 390 records of quota species.

Secondly, the format and level of data aggregation of the STECF data call that populates the STECF-FDI database changed in 2015. This resulted in the data being aggregated at different levels before (FDI-Classic) and after (FDI-New) 2015. In general, discard estimates are more aggregated across gears and areas in the FDI-Classic format compared to the FDI-new format. For example, metiers are not present in the FDI-Classic, which means that target species groups and selection devices cannot be specified for the analysis of discard rates before 2015. It is important therefore to harmonize the dataset over the years using the lowest common level of aggregation.

Additionally, when submitting data to the STECF-FDI database Member States can mark data as 'confidential'. This means that data on landings or estimates of discards might be so unique that catches of individual vessels may be revealed. The confidential data needs to be aggregated at a higher level before it is made public to avoid disclosure. However, the confidential marking is only used for data submitted for 2015 – 2019 and the majority of it (78% by number of records, 93% by landings) is classified as non-confidential.

In this study, data uploaded by Member States in request to the STECF-FDI data call was used. This was done to avoid any processing assumptions made by STECF/JRC. Furthermore, to ensure harmonisation across the two formats (before and after 2015, 'classic'' and 'new') datasets were aggregated to a lower degree than the publicly available FDI dataset. Figure 1 shows the harmonization and processing procedure followed.

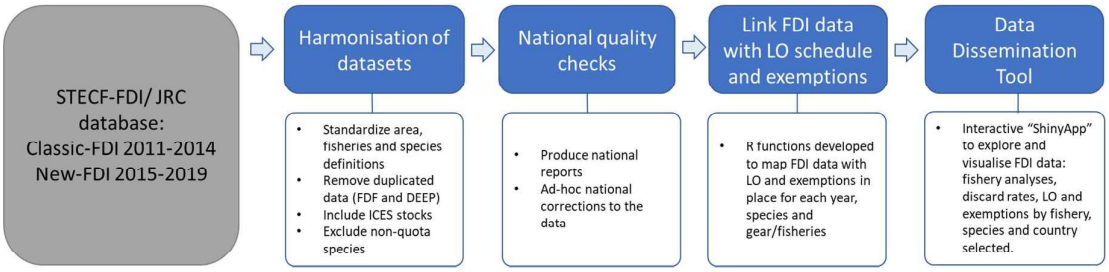


Figure 1: Flowchart of steps in harmonising and processing STECF-FDI data.

The result of the harmonisation of the data was a 'clean', consistent and quality checked dataset, that was used in the dissemination tool developed within the study. A scripted approach was used: a series of look-up tables to link datasets were developed (Table 5). To achieve consistency between the FDI-Classic and FDI-New datasets, the lowest (most disaggregated) common denominator was identified for fisheries and areas. The most disaggregated information (usually but not always the one available in the FDI-New dataset) was aggregated to match fisheries and areas in the other dataset. In some cases, fisheries were combined to create fisheries and area combinations that matched more appropriately to management regulations. A look-up table associates these 'new' areas to the areas used in the FDI-Classic and FDI-New datasets in a transparent way. The harmonisation also included removing double records. This was relevant for FDI-Classic, where entities relating to deep-water fisheries (DEEP) and FDF were removed. Non-TAC species were further removed from the dataset, as they are not covered by the LO. To do

this, species landings and discards data were linked to a database on quota species. TAC species under exemptions from the LO was kept in the dataset.

Furthermore, to supplement the discard information with stock assessment information, a link was created to match discard data to stock assessments undertaken by ICES. A look-up table on the conversion from species *x* area to stock was therefore created. All look-up tables were compiled and linked with an R (R Core Team, 2020) markdown script to allow for smooth transformations and continued addition of data as more becomes available.

Finally, the records that were outside the geographical scope of the study or that did not have a discard record were removed from the database. A total of 235 710 records were retained out of the initial 2 279 377 records (10%; Figure 2).

Table 5. Reference tables to harmonise the FDI-Classic and FDI-New datasets and supplement with additional information.

Table	Purpose
Area Lookup	Harmonise area definitions used by FDI-Classic and FDI-New, identify areas covered by analysis and group ICES subdivisions into regions.
BS and NS and AWW fishery lookups	Harmonise fishery definitions across FDI-Classic and FDI-New, rationalise fisheries with similar characteristics and group for analysis.
Stock relation	Identify whether an ICES stock assessment is available for a species in an area, provide link to ICES Stock Assessment Graphs database (https://www.ices.dk/data/assessment-tools/Pages/stock-assessment-graphs.aspx)
Quota species and area relation	Identify if a species is subject to quota across each area of the analysis.
FAO species codes	Provide link between species codes in the STECF database and common names.
Exemptions tables	Link introduction of LO and exemptions for different species and fisheries.

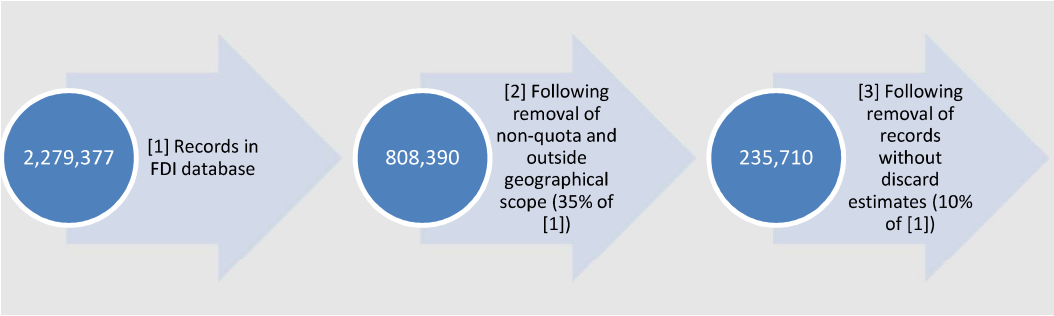


Figure 2. Filtering of records on landings reduced to remove those outside of scope or without discard estimates, for further analysis.

3.1.2 Linking the data with LO schedules and exemptions

A workshop was organised to double check results from the harmonization steps. An R markdown script (a 'country report') was developed to support this checking procedure and ensure consistency between data from Member States. The R-script summarised the information in the dataset on fisheries and areas that a given member state is active in. This information was then used by national experts to identify potential problems with the data. The experts were also asked to check if true (discard '0' observed in sampling programmes) and false zeros (discard '0' due to no sampling programme, which needed to be changed to 'NA' in the database) were labelled correctly. The checking procedure resulted in the development of country specific ad-hoc scripts to solve identified problems in the data. These included:

- species mislabelling, where different codes had been used across years;
- corrections where 'true zeros' for discards had been recorded as NA (Not Available) or NK (Not Known) for fisheries; and,
- corrections for FDF where discard estimates were provided from other sources than onboard sampling programmes.

These scripts were added to the above-mentioned R markdown script used to process the data.

The LO has been gradually implemented in the EU fisheries between 2015 and 2019. This means that the measures have been implemented in different years for different fisheries, species and areas and/or combinations thereof. A major focus on this implementation phase has been to identify and legally adopt different exemptions from the LO. These exemptions are mostly focussed on limited amounts of discards (so called *de minimis* exemptions), where individuals have a high chance of survival (high survivability exemptions) and those subject to predation mortality (predation exemptions). An indicator of the quality of any discard estimate and discard rate should preferably include assessment of the representativeness of trips observed in relation to the activities of the fleet, potential observer effects (sources of bias) and precision in the discard estimates derived from the sampled trips. It is not possible to do this kind of quality assessment for data provided by Member States to the STECF-FDI database, as the information needed to make this assessment is not provided and the processing of the sampled data to raised estimates occurs at member state level, prior to submission to the FDI.

To provide some indication of how well a fishery is sampled for a particular species, this study focused on the overall coverage of discard estimates; i.e., the percentage of the landings in a fishery that have discard estimates associated with them. This means the percentage of the number of records (same MS, species, fishery, quarter, mesh-size range, year, area, etc) or volume of landings in the STECF-FDI database that have a corresponding discard estimate associated to it, relative to the total for that fishery (more narrowly defined by gear, mesh size and year). A high proportion indicates that the species has discard estimates for the majority of its records, while a low proportion indicates that it does not. There is no objective way to define what 'good coverage is' and there is a trade-off in any threshold that defines 'good' coverage. The higher the threshold, the less data is included and that can provide information about discard rates.

3.1.3 Limitations

The lack of information on variance around the discard estimates, i.e. how much the discard rate varies between individual samples used for the estimation of the discard rate in a stratum, provided to the STECF-FDI database limits the possibility to make rigorous statistical analysis of the evolution in discard rates. Without knowledge of variance, it is for example, not possible to statistically detect a 5% decrease in a discard rate from one year to another. Such low understanding of variance also reduces the likelihood of

identifying correlations with LO measures. Qualitatively, changes that show a clear trend across several years may receive more attention than those without such clear trends. A full implementation of measures related to the LO is only present in the last year of data (2019). Therefore, the time-series is short for the period with full implementation and conclusions on effectiveness of measures need to be taken with a degree of caution.

Of the EU OR, discard data is not well covered under the data-call submitted to the STECF-FDI group. This makes it virtually impossible to make any assessment and comparison of the evolution of the discard rates before and after the implementation of the LO. The information available is predominantly for the Azores (ICES divisions 10 and 12), while information across both pre- and post-LO implementation datasets is not available for the Canary Islands (CECAF 34.1.2), Madeira or the French Outermost Regions (Guadeloupe, Mayotte, Martinique, French Guiana, Reunion Island and Comoros).

As areas with missing information could not be included in either qualitative or quantitative analysis, information has been used from different OR experts, including French and Portuguese experts. For French ORs, the main conclusion was that the LO is not clearly affecting activity because discard rates were low prior to LO implementation. In comparison, within the Azores, although discard rates prior to LO implementation was generally low, the LO is perceived as negatively impacting fisheries within the region (Fauconnet et al, 2019). This is due to the perceived already high selectivity of the fishing gears already used, the small scale of the fisheries making handling unwanted catch more challenging and the insularity and geographic dispersion of this OR making disposal of unwanted catch difficult, all of which greatly increase the complexity and subsequent costs of collecting and processing unwanted (and unmarketable) catch.

3.2 Results

3.2.1 The discard rates display dynamic app

Dissemination of discard information is available through a dedicated dynamic 'app' developed within the present project. A change in discard rate may be caused by changes in the spatial distribution of the fishery, or implementation of an exemption, or due to biological reasons such as high or low incoming recruitment to the fishery. Therefore, within this app, information on discard rates is contextualised with supplementary information on the spatial footprint of the fisheries, status, trends of exploited stocks and any LO derogations or exemptions that may be in place.

The app runs locally on a computer, once the open-source software R and RStudio (RStudio Team, 2020) are installed. Following setup (running an installation script, instructions provided in README.txt file), the user can explore the data through several pre-defined outputs. If desired, the tool can be run remotely, for example, by being hosted on a JRC server. Remote access would make the app accessible via a website with secure login to anyone with the required credentials and users would no longer need R software.

The dynamic component of the app consists of two parts:

1. A set of threshold limits that define the minimum coverage of data required to be displayed in the subsequent analysis.
2. Selection boxes that allow the user to identify information on:
    a. A particular geographical **area** of interest.
    b. A **species** of interest (limited to quota species).
    c. A **region** of interest (defined by common ICES sub-divisions across both datasets).
    d. **Countries** involved in the fisheries.
    e. The different **fisheries** available.

The selection boxes operate as a hierarchy, so that the user can only select fisheries that have a high enough discard data coverage (as determined by the threshold applied), dependent on species, region and countries selected. The specific information contained in each field of the app is explained in Table 6.

Table 6: Fields description of the app.

Field	Description
Dashboard:	This page provides the facility to change the threshold values. It also provides a data disclaimer, which highlights issues with the data that should be considered when interpreting the figures and values. The area, species, region, country, and fishery selection boxes are also available on this page (and all other pages).
Fishery analysis:	This page provides figures that highlight discard rates and associated information for each fishery and species selected. This includes: **Figure 1:** An interactive figure that shows a time series of discard trends for each fishery, with a solid black line showing the overall rate and coloured lines for each country selected. The data for each record contributing to the discard rate is shown in points that are proportional in size to the discards in that record. The shape of the point will differ depending on whether an exemption is in place for that record. The figure is interactive, and you can hover the cursor over any data point, as well and turn on and off data to visualise only certain features as well as directly download the figure to your computer. **Figure 2**: This figure shows the data coverage for the fishery, (i) in terms of the proportion of landings for that fishery for all species that have an associated discard estimate – this demonstrates how well the fishery is covered by a discard estimate overall, and (ii) in terms of the proportion of landings of its selected species. These are valuable because they show how well: (i) the fishery is covered by a discard estimate overall and (ii) the discard estimate of species for that fishery. **Figure 3**: This figure shows available information on the spatial landings' distribution for the selected area, species, countries and fisheries. These are divided into two figures: one showing the spatial distribution of landings *prior* to the introduction of the LO and one *following* the introduction of the LO. **Figure 4**: This figure shows the difference in distribution of landings between prior and post implementation of the LO. **Figure 5**: This figure shows any available information on the stock caught by the fishery by directly linking to available data from the ICES stock assessment. The figure shows the recruitment, fishing mortality and spawning stock biomass trends for the stocks, where available.
Discard trends	This page provides a synthesis of the trends for each species and fishery in terms of the changes in discard rates since implementation of the LO. **Figure 1**: This figure shows the percentage change in discard rates since implementation of the LO. Trends are highlighted as a visual aid, with decreases of > 5% shown in green, increases of 5% show in red and changes between -5% and +5% shown in yellow.

Field	Description
	Figure 2: This figure shows the number of species for each fishery that have either increasing, decreasing or showing no change in trend.
Discard trends– Exemptions	This page provides a synthesis of the trends for discard rates under exemptions (high survivability, *de minimis* and predation) and not under exemptions. **Figures 1 and 2**: These figures present the same information as in the discard trends tab (described above) but disaggregated between those fisheries and species under LO exemption or not under LO exemption.
Discard trends– species	This page provides a synthesis of species discard rates across all areas for fisheries with adequate data coverage for each area. **Figure 1:** The overall discard trends (and those of the main fisheries) for different species (selectable) across multiple areas.

A technical annex (Annex 1.9) and examples of the app (Annex 1.10[5]) is provided to demonstrate how the end-user could extract information on fisheries and discard rates.

At the dashboard, users are presented with three filters that apply different thresholds for data to be included in the analysis and outputs (Figure 3). Two of the filters are based on available discard estimates in relation to landings. If the filters are set to 0%, then all fisheries (with catches of the chosen species in the chosen area) where any kind of discard estimate is associated to a landing will be included. If the filter is set to 100%, only fisheries with all landed weight associated to discard estimates will appear. This allows users to select datasets that are more comprehensive, but in which estimates of discards for some fisheries are sparser than if a more complete dataset is used. The first filter is dependent on the landing weight of the species chosen while the second is based on landings of all species. The default setting for both these filters is 30% (an arbitrary threshold). The third filter gives users the possibility to focus the analysis on the main fisheries by targeting a given species in an area by removing fisheries that contribute less to the landings. If the filter is set to 5%, fisheries that cumulatively land less than 5% are removed from analysis. The default setting for this filter is 0%.

[5] This annex is not available due to limitations of the format of the report and is not made public

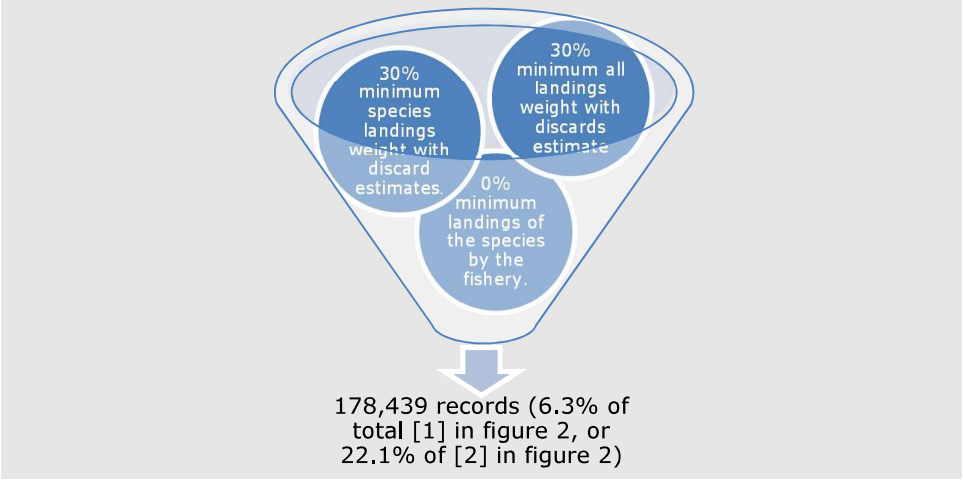


Figure 3. Data coverage threshold filters applied using the default values.

As such, the end-user can ultimately decide, with help of the data dissemination tool, the minimum degree of coverage of discard estimates in fisheries to be included in outputs viewed within the app. To guide users, the coverage of data for a fishery in each year is provided in heat maps allowing for qualitative evaluation of the robustness of the generated discard rates. The coverage indicators operate at the overall fishery level. Therefore, the discard rates at this level are likely be more robust than at the level of individual Member States contributing to these rates, where coverage may be lower than the overall coverage.

Summaries of the overall change in discard rate before and after the LO by fisheries and species are also available in the app (discard trends in the menu). Within this analysis, discard rates for species and fisheries are compared between the period before and after the introduction of the LO.

3.2.2 Overview of the discard rates by fishery, before, during and after the fully implemented LO

Detailed information on yearly evolution of discard trends by species, area and fishery is available in the dynamic app, developed within the project. An example (discard rates of North Sea cod) of the standard graphs in the output from the app is shown in Annex 1.11. The app gives the user the possibility to study species, areas and fisheries of interest in detail. The dataset underlying the app includes data on a large number of species, fisheries and area. The overall discard trend, expressed as the difference between the average trend in years before and after the introduction of the LO, is shown by region, fishery and species in Figure 4 – Figure 7 (for BS and NS) and Figure 8 – Figure 14 (for the AWW). Green colours indicate a decrease in discard rate of > 5%, red indicate an increase in discard rate of > 5% and yellow between -5% and +5%.

Fisheries in the BS and NS were grouped into regional analysis of discard trends by fisheries and species. The regional analysis includes the NS, the Kattegat-Skagerrak area, western BS, eastern BS and northern BS. For the fisheries in the northern BS, discard estimates were sparse. Hence, no fisheries appear in the analysis after application of the default setting of the filters.

No region shows a uniform and clear pattern of decreases in discard ratios after the introduction of the LO. Instead, there is variability between trends for different fisheries, species and combination thereof. This variability likely reflects the complex interactions

between management measures, stock status and fishers' behaviour and the variability in discard estimates coming from sampling programmes.

The pattern in discard trends for some fisheries differs between the NS and Kattegat-Skagerrak area. Discard trends are decreasing for most species in the Nephrops fishery (Dem_70-99_TR2) in Kattegat-Skagerrak, while the opposite response is shown for NS fisheries.

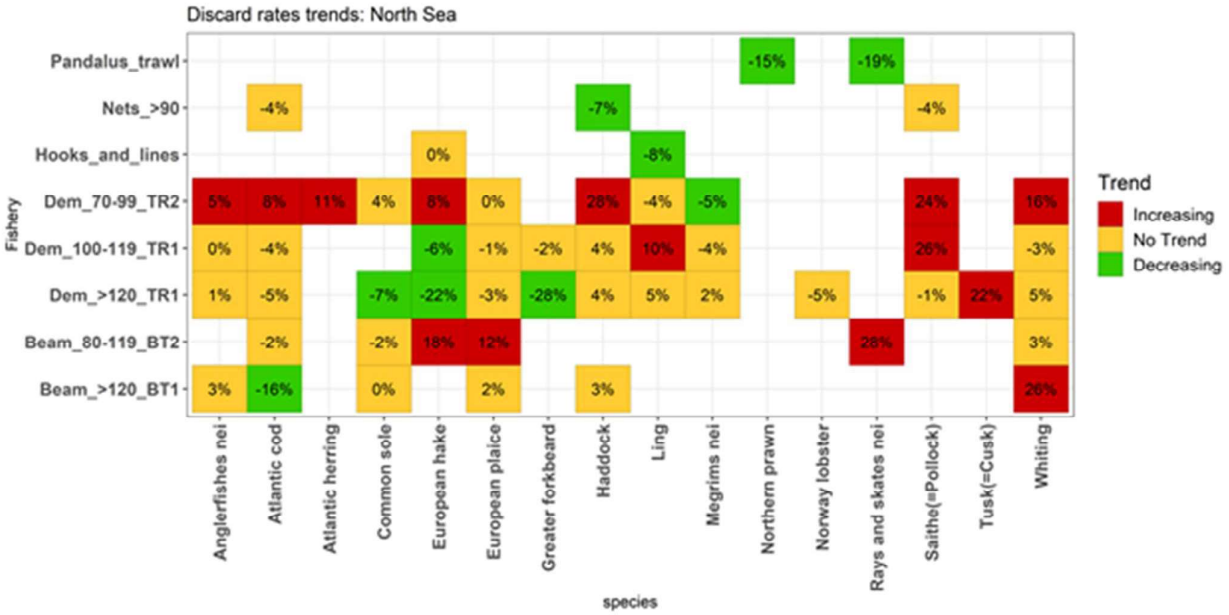


Figure 4. Change in discard rates from before and after implementation of the LO for the NS (ICES division 4).

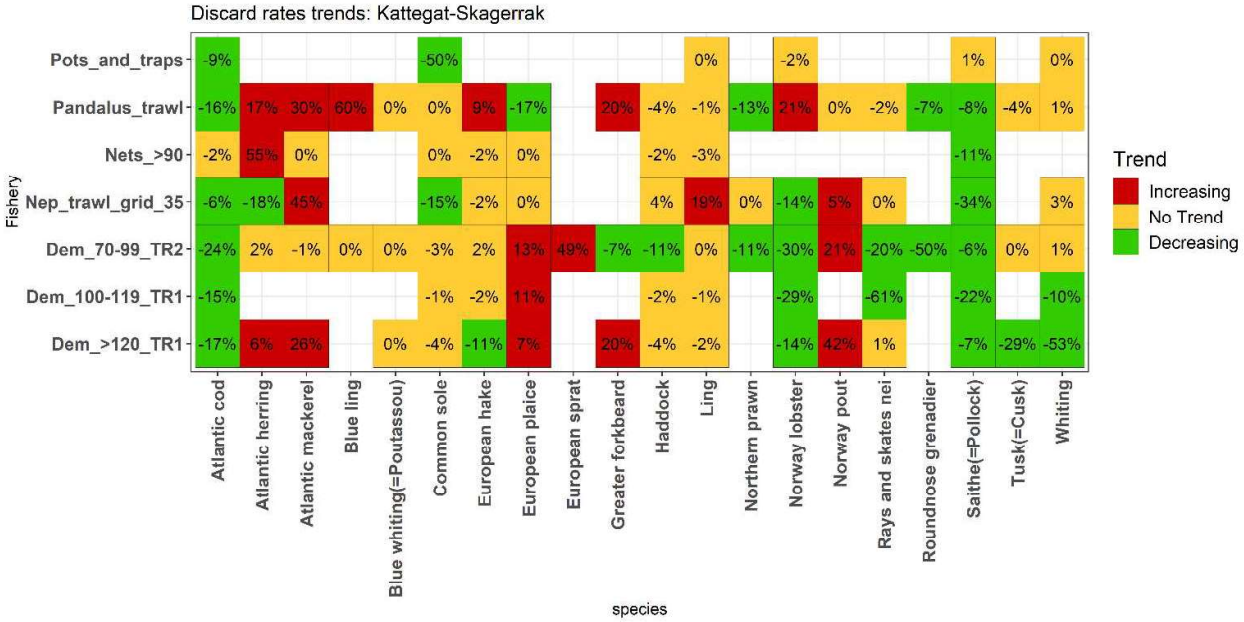


Figure 5. Change in discard rates from before and after implementation of the LO for the Kattegat and Skagerrak (ICES subdivision 3a).

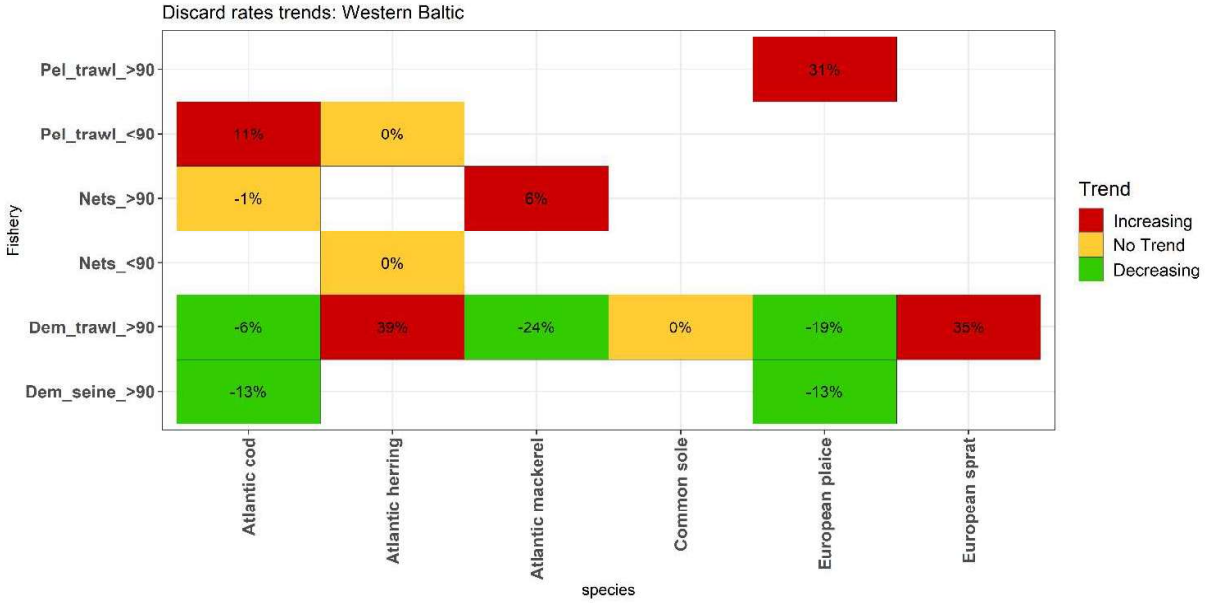


Figure 6. Change in discard rates from before and after implementation of the LO for the western Baltic (ICES subdivision 3d SD 22-24).

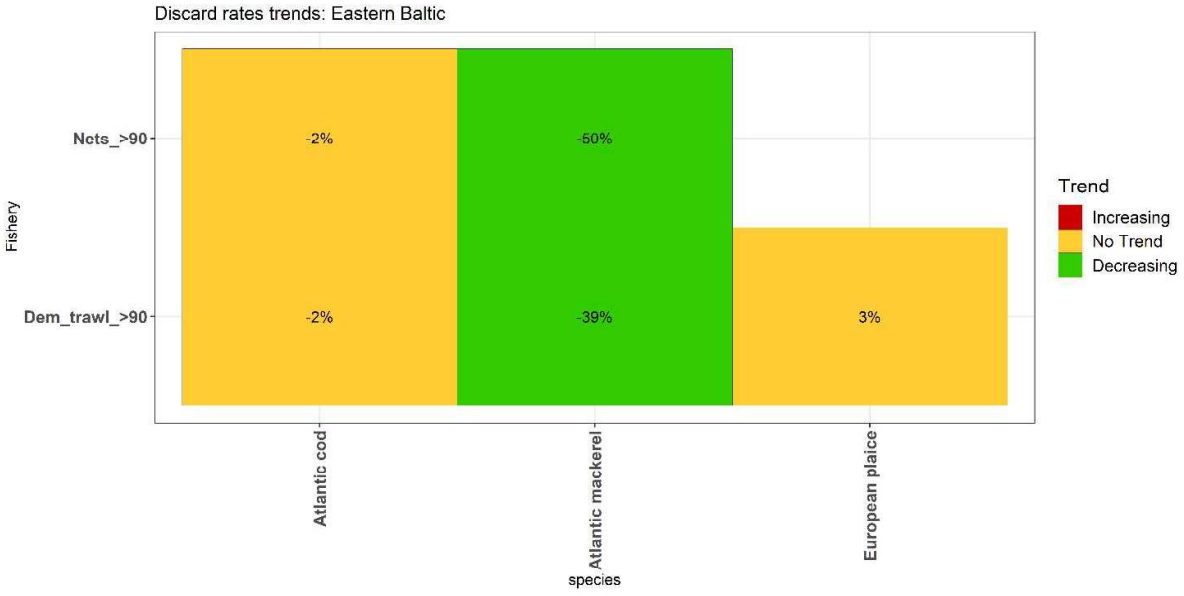


Figure 7. Change in discard rates from before and after implementation of the LO for the Eastern BS (ICES subdivision 3d SD 25-29 and 32).

Fisheries in the AWW and OR were grouped for regional analysis, which included (from north to south): Faroes grounds, West of Scotland and Rockall, the Irish Sea, the Celtic Sea, the English Channel, the Bay of Biscay and Iberian waters. Further details within

these areas can be viewed on the app. Fisheries and species meeting the available data threshold criteria within each region are presented in Figure 8 – Figure 14.

No single region was subject to a uniform pattern in changes in discard rates. Each region shows variation among fisheries and species with some increasing discard rates, some decreasing and some unchanged. The different trends highlighted in colour and the mix of colours for each region demonstrate the inherent complexity in seeking to understand causes for changes in discard patterns.

Examples of where a fishery has seen decreases in discard rates across multiple species can be seen by green boxes across rows in the figures. This includes demersal seine fisheries with mesh >= 120 mm West of Scotland and Rockall (Figure 9), demersal trawl fisheries with 70-99 mm mesh in the Irish Sea (Figure 10), beam trawl fisheries using mesh of 100-119 mm in the Celtic Sea (Figure 11), demersal trawl fisheries using mesh of 100-119 mm in the English Channel (Figure 12) demersal trawl fisheries using mesh of 70-99 mm in the Bay of Biscay (Figure 13) and gillnets targeting demersal fish with mesh of 80-99 mm in Iberian waters (Figure 14).

Few fisheries have seen increases in discard rates across many species, but some have either unchanged or increased rates including beam trawl fisheries using 70-99 mm in the Irish Sea (Figure 10), demersal trawl fisheries using >=120 mm in the Celtic Sea (Figure 11), demersal trawl fisheries using 70-99 mm in the English Channel (Figure 12), Beam trawl fisheries using 70-99 mm in the Bay of Biscay (Figure 13) and Otter trawl fisheries targeting mixed crustacean and demersal species using >=55 mm in Iberian waters (Figure 14).

Examples of where species have seen decreases in discard rates across fisheries can be seen by reading green areas across columns in each figure. Examples include megrims and cod in West of Scotland and Rockall (Figure 9), cod in the Irish Sea (Figure 10), plaice and hake in the Celtic Sea (Figure 11), cod and pollack in the English Channel (Figure 12), mackerel, seabream and horse mackerel in the Bay of Biscay (Figure 13) and mackerel in Iberian waters (Figure 14). Examples of where discard rates have been increasing for species across fisheries include haddock in the Celtic Sea (Figure 11), whiting in the English Channel (Figure 12), whiting in the Bay of Biscay (Figure 13) and nephrops in Iberian waters (Figure 14).

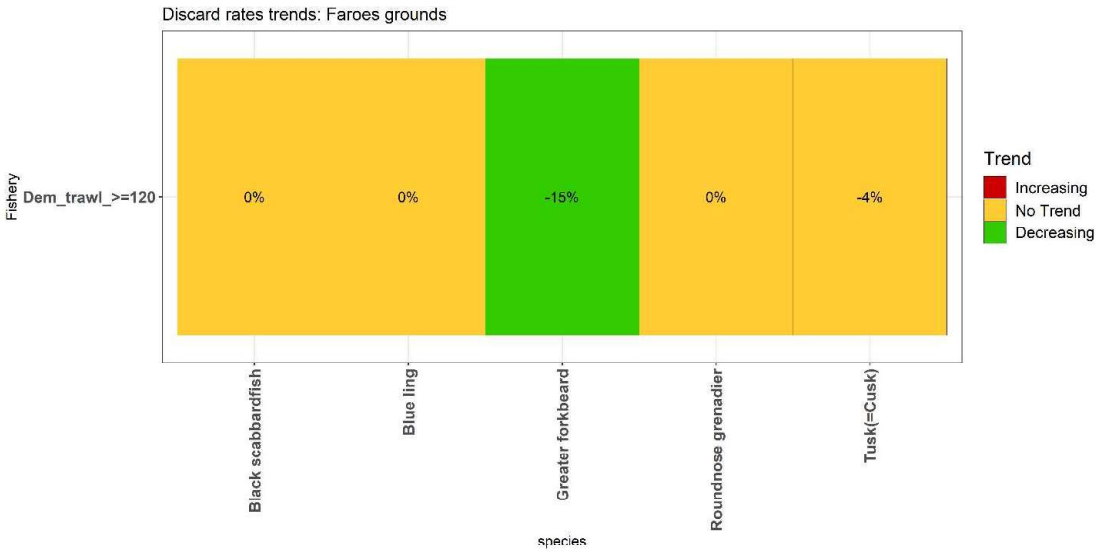


Figure 8. Change in discard rates from before and after implementation of the LO for Faroes grounds (ICES subdivision 5b).

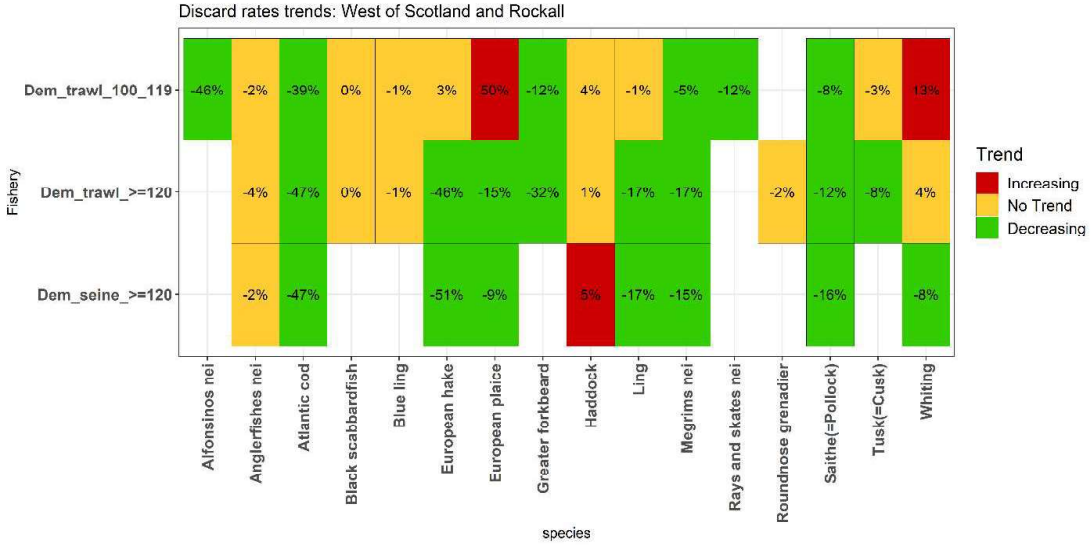


Figure 9. Change in discard rates from before and after implementation of the LO for West of Scotland and Rockall (ICES subdivisions 6a and 6b).

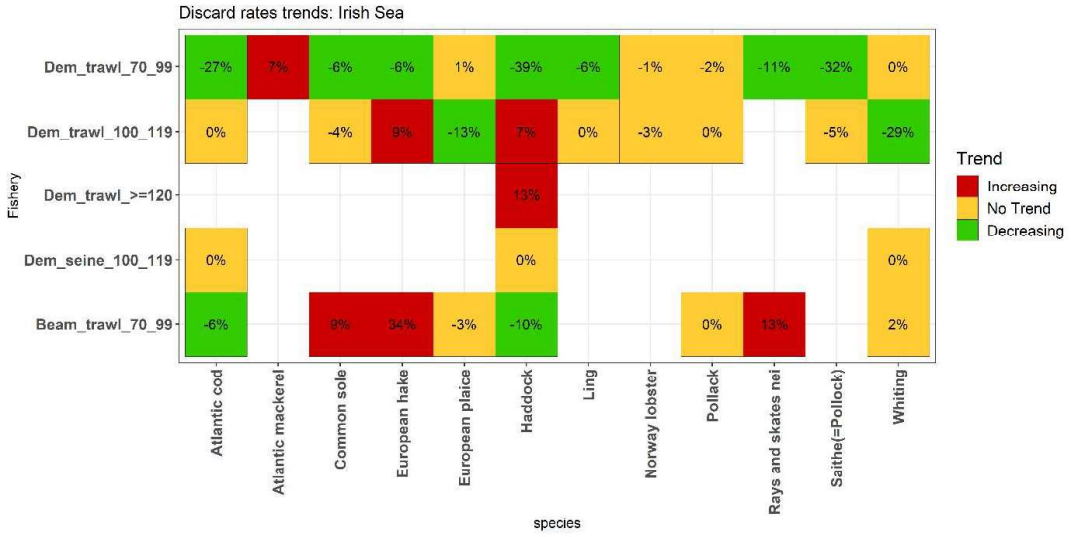


Figure 10. Change in discard rates from before and after implementation of the LO for the Irish Sea (ICES subdivisions 7a).

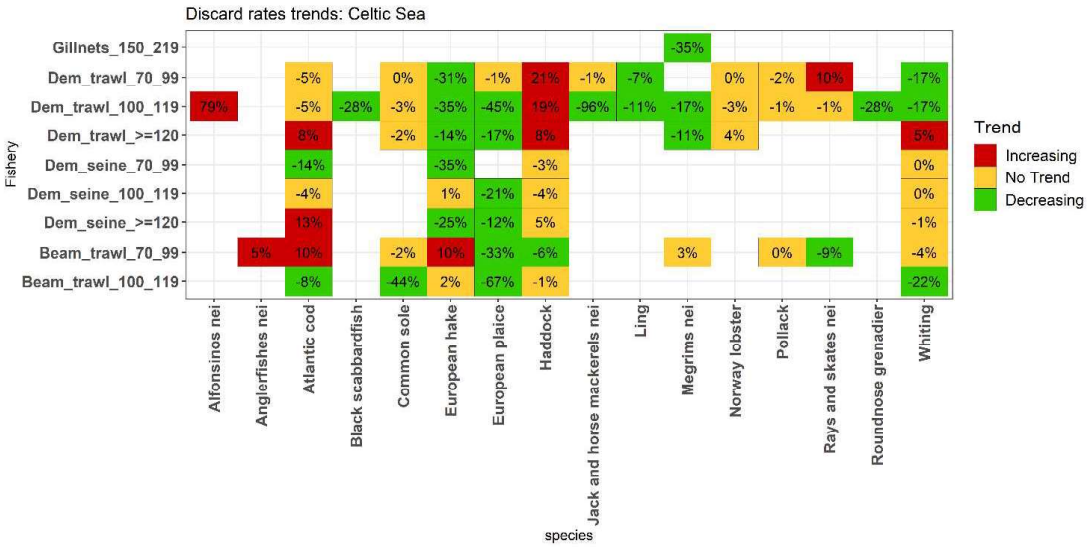


Figure 11. Change in discard rates from before and after implementation of the LO for the Celtic Sea (ICES subdivisions 7bc, e-k).

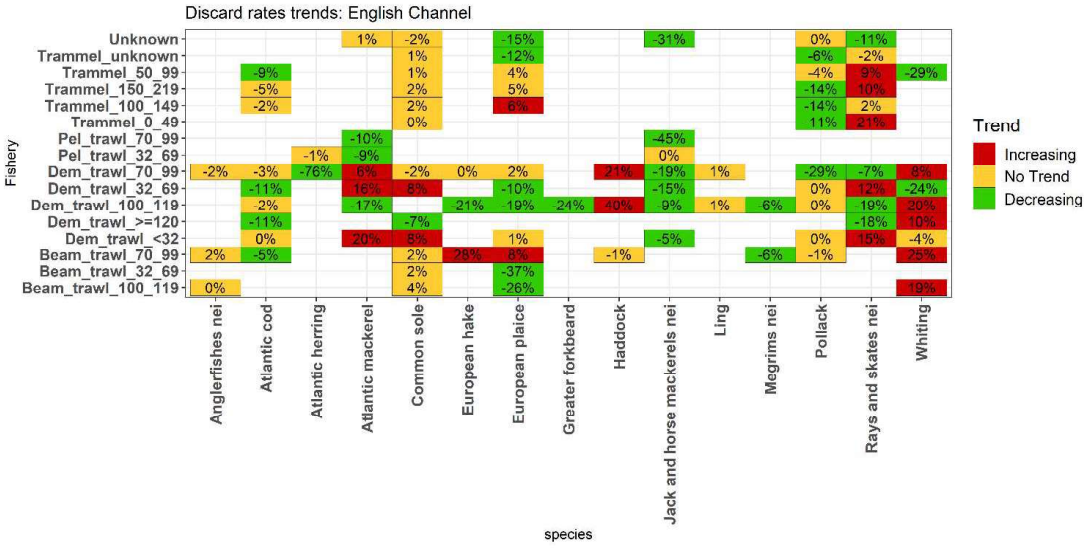


Figure 12. Change in discard rates from before and after implementation of the LO for the English Channel (ICES subdivisions 7d and 7e).

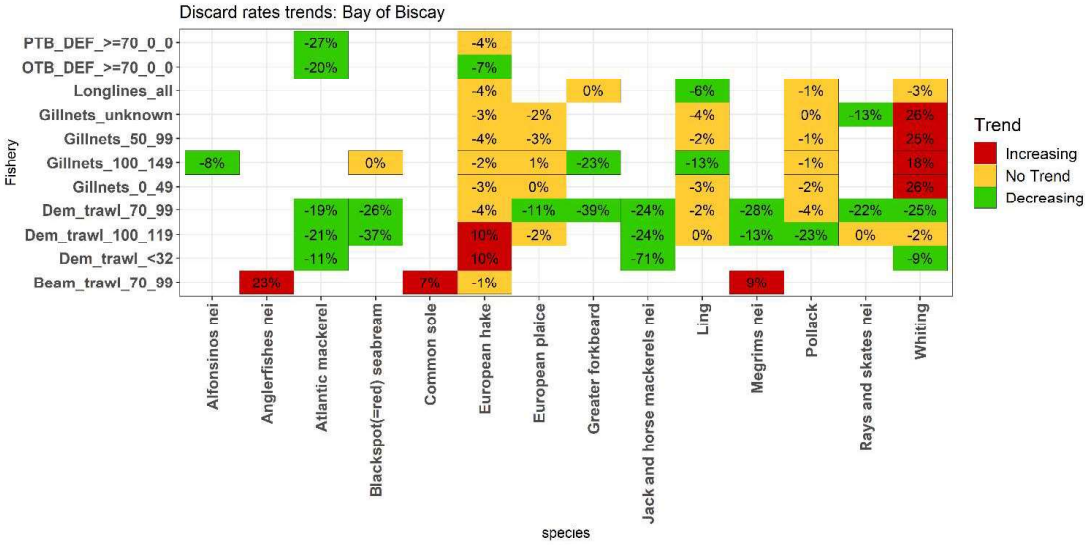


Figure 13. Change in discard rates from before and after implementation of the LO for the Bay of Biscay (ICES subdivisions 8abde).

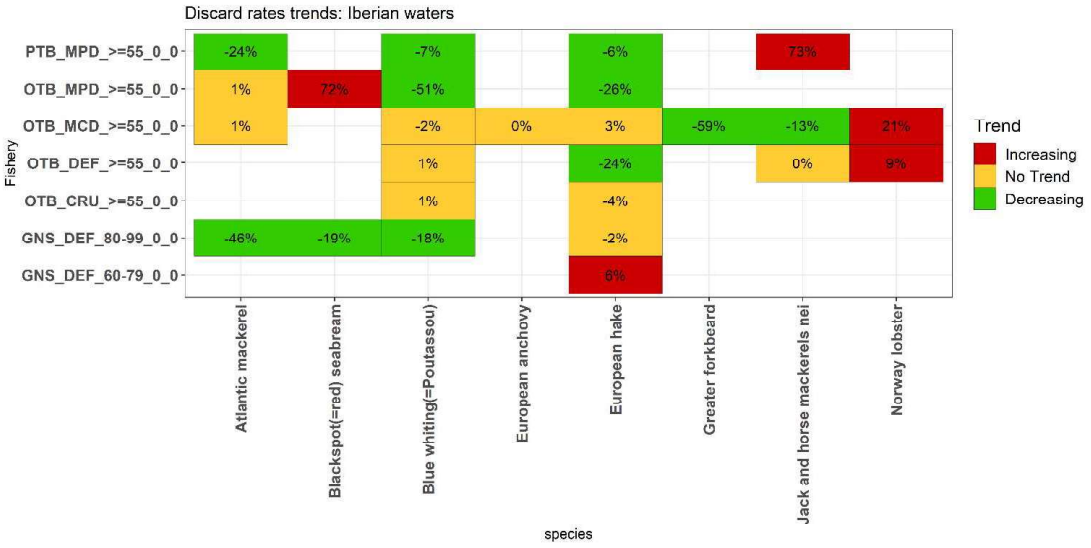


Figure 14. Change in discard rates from before and after implementation of the LO for Iberian Waters (ICES subdivisions 8c and 9ab).

3.2.3 Qualitative evaluation of the impact of the implemented management measures to the discard patterns and discard rates

A range of management measures have been introduced in order to facilitate the implementation of the LO. An additional objective of the analysis performed in this section has been to evaluate the many exemptions from the LO and to compare discard patterns in fisheries with and without exemptions. An increasing number of exemptions from the LO have been adopted since 2015, many of them in the NS (including ICES area 3a; Skagerrak-Kattegat). For most records, successful linkages could be established between the FDI data and the exemptions (Table 7). STECF-FDI data does not hold information of individual vessels, fishing trips or operations. Accordingly, exemptions based on vessel-specific conditions (e.g., engine power and trip/haul specific conditions, including haul duration and water depth) cannot be distinguished in the data. Additionally, STECF-FDI

data is aggregated on a quarterly level and does not hold monthly data. Therefore, exemptions that apply to specific months cannot be identified, unless the months correspond to whole quarters. The exemptions that could not be identified by region are shown in Table 7.

Table 7. Exemptions from the LO that could not be linked to FDI data for BS and NS areas.

Exemption description	Exemption type	Years in place	Reason for not being identified in FDI data
Pelagic species in purse seines in the NS with a condition for "point of retrieval" (level of closure of the seine) and an electronic recording and monitoring system.	Survivability	2015 onwards	Specific details of individual vessels and fishing operations is not reflected in the FDI data
Mackerel, horse mackerel, herring and whiting in pelagic trawls in 4b and 4c, south of 54 degrees north.	*De minimis*	2015 onwards	Spatial criteria that do not correspond to ICES areas.
Sole in area 4c, fished with bottom trawls with 80-99mm mesh size. The exemption applies only to catches of sole caught within six nautical miles from the coast, outside identified spawning areas, by vessels with engine power less than 180 kW. In addition, the water depth should be less than 15 m and the maximum length of the haul can be 1.5 h	Survivability	2017 onwards	Specific details of individual vessels and fishing operations is not reflected in the FDI data
Plaice in bottom trawls >120mm mesh size in area 3a and 4, November to April.	Survivability	2019 onwards	Months cannot be distinguished in the data and the time criteria does not align with quarters.
Nephrops in Functional units 6, 8 and 9 fished by bottom trawls with >80 mm mesh size and equipped with a netgrid selectivity device, from October to March	Survivability	2018 onwards	Nephrops functional units were not included in the FDI data format until the data submission in 2020. The data for this project was, except for the data year 2019, based on the submission made in 2019

The number of combinations of species and fisheries in the NS area that were subject to an exemption and where it was possible to link to the data, ranged from nine combinations in 2016 to 52 combinations in 2019. Corresponding figures for the BS ranged from two in 2016 to three in 2019. The proportion of landings originating from fisheries carried out under an exemption have increased during the implementation phase of the LO (Figure 15). The *de minimis* exemptions were more dominant during the initial phase of the LO, while exemptions based on high survivability have been implemented for an increasing part of the catches during recent years. This is likely related to the time needed to receive the scientific support for high survivability.

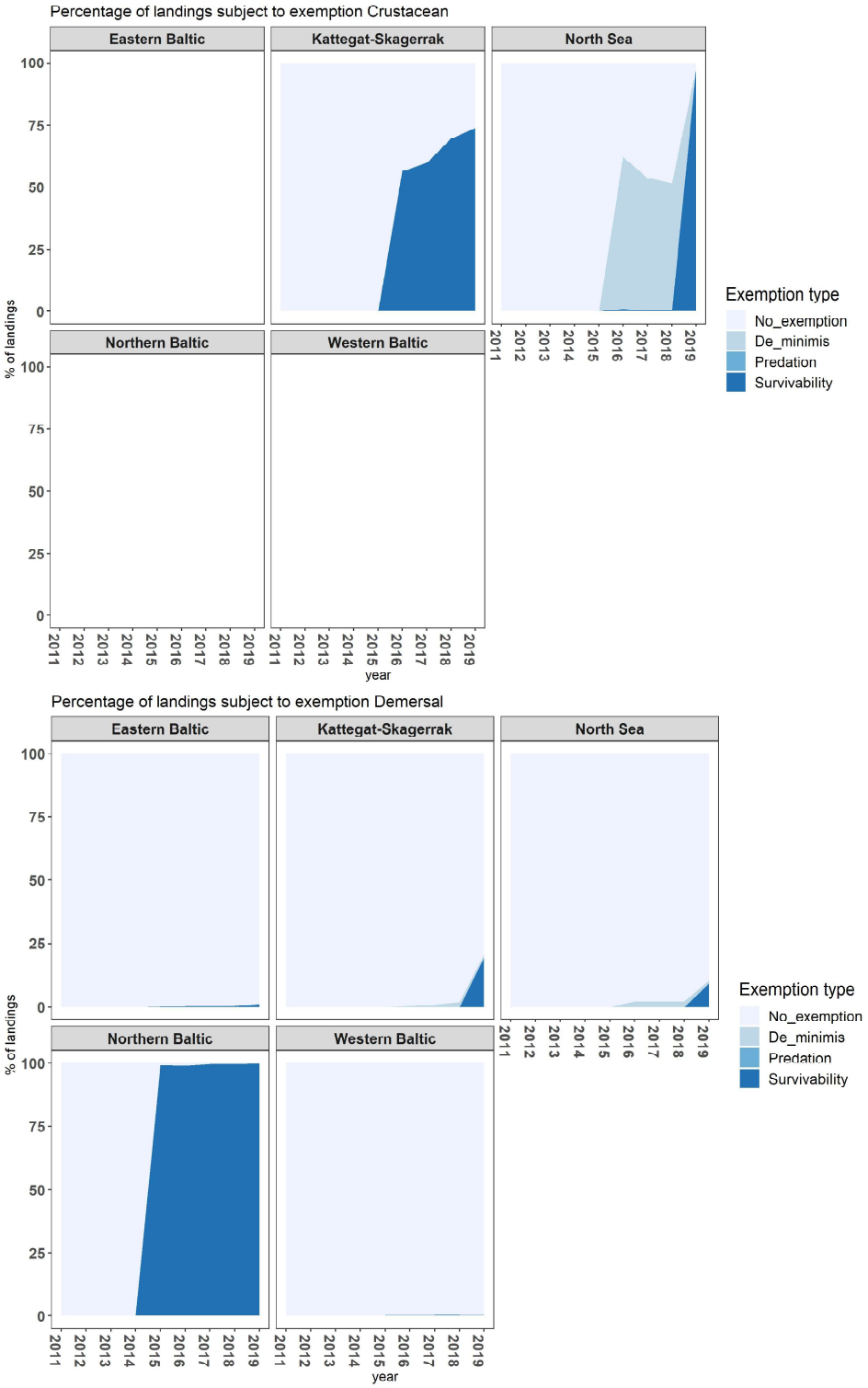


Figure 15. The proportion of overall landings of each species group (demersal, crustacean and anadromous) that is subject to a LO exemption in each of the supra-areas for the BS and NS.

It is uncertain if all Member States were able to identify all specific selectivity devices correctly in the national data on landings, as is required for some exemptions. It is therefore possible that some parts of a fishery met the criteria for an exemption, but this

was not reflected in the submitted data. Furthermore, discard sampling programmes do not always correspond to the same level of aggregation as exemptions or other management measures. Discard sampling programmes are generally designed for sampling of broad groups of gears, mesh sizes and vessel lengths. Therefore, if an exemption is only in place for parts of a sampled fishery, it may not be possible to estimate the discard rate specifically for the exempted part.

Until 2019, the implementation of the LO was phased in NWW and SWW, to progressively include species and fisheries only when a group of vessels met a specified catch composition and catch threshold. However, before 2019 the STECF-FDI data does not distinguish vessels under LO or not, with discard estimates and rates including all vessels in a fishery. Therefore, between 2015 and 2018 it is not possible to determine the impact of policy change on discard rates. In 2019, where all quota stocks were subject to the LO, one would have expected the impact of LO to be more visible.

For the AWW, the principle used to link the yearly exemptions with STECF-FDI data was different than for the BS and NS. While in the BS and NS, exemptions with a high level of detail and specificity were not linked with STECF-FDI data, in the AWW all exemptions were linked with the STECF-FDI data, even if all criteria were not available. This implies that for the fisheries with exemptions and a high level of specificity[6], discard estimates and rates include vessels covered and not covered by the exemption in the AWW. The FDI data does not have the level of detail necessary to get the exemption-specific catch, which makes it difficult to know whether discards were exempt from the LO or not. Table 8 summarises the fisheries and species for which it was not possible to have a complete match between the exemption specificity and the STECF-FDI data, precluding any interpretation of available discard rates for those species and gear combinations.

Within the AWW, for the NWW six exemptions were identified where it was not possible to have a complete match with FDI data due to specificity of the exemption. For the SWW, all exemptions were defined at a higher level and it was possible to have a complete match with FDI data. Similarly, for the AWW, the current national sampling programmes have low level coverage, cover broader fisheries and gear definitions and are not designed to collect data at that level of specificity. Therefore, for this region, discard estimates based on the sampling programmes may be imprecise or may not be representative of the true level of discards for the fleets under each exemption.

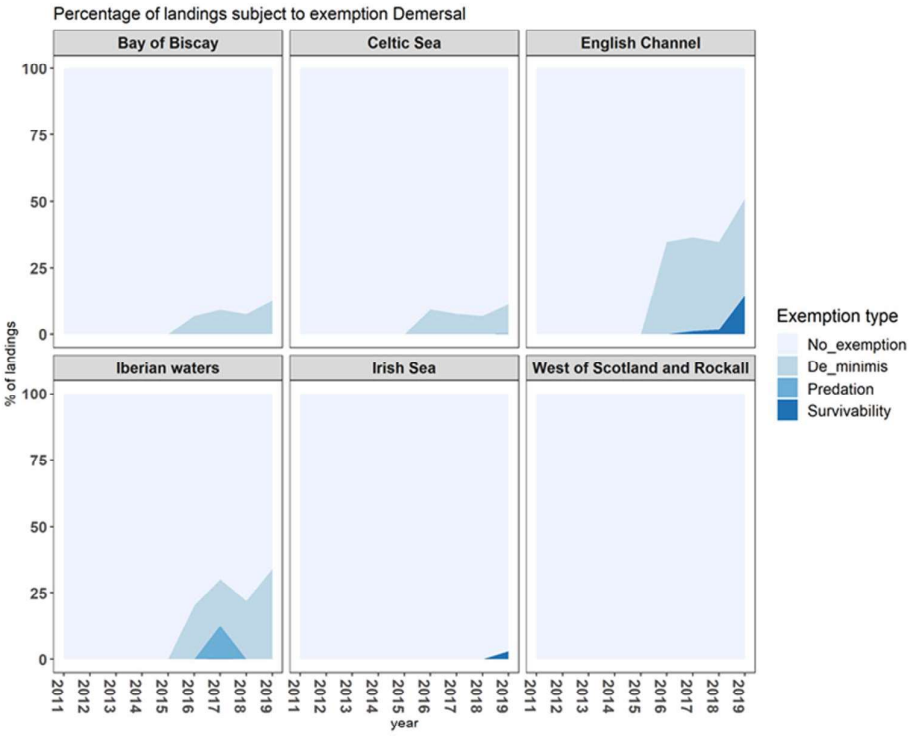
It can be assumed that all discards observed with associated high survivability exemptions were compliant with the LO. However, it cannot be determined whether discards associated with the *de minimis* exemptions were compliant. Because there is a cap on the total *de minimis* amount (proportion of catch that can be discarded), only discards up to this quantity are compliant with the regulation. With no officially reported information (e.g., logbooks) on the uptake of the *de minimis* quantities, it cannot be determined when the cap is reached for each fishery and therefore when discarding should stop.

[6] For example, beam trawls with engine power max 211kW, max vessel length 24m, within 12 miles of the shore, with haul duration <=1:30h, using flip-up rope or benthic release panel.

Table 8. List of species and fleets that were exempt from LO and the specificity of the exemption did not allow a complete match with the STECF-FDI data in the AWW.

Region	Exemption description	Type of exemption	Year	Reason for incomplete match
NWW – Pelagic	Mackerel and herring caught with purse seines, in 6, with conditions for "point of retrieval" and 80 % closure	Survivability	2015	Specific details of individual vessels and fishing operations is not reflected in the FDI data
NWW	Common sole caught by otter trawlers in 7d, within 6nm, under 10m vessels, with engine power of 180Kw, fishing in waters with depth of 15m (EU 2016/2375, art.2.1b)	Survivability	2017	Specific details of individual vessels and fishing operations is not reflected in the FDI data
NWW	Common sole caught by TBB, 80-119, with increased selectivity such large mesh extension, in 7d, e, f, g and h (EU 2016/2375, art.3.g)	*De minimis*	2017 onwards	No information on selectivity devices
NWW	Common sole caught by otter trawlers in 7d, within 6nm, under 10m vessels, with engine power of 221Kw, fishing in waters with depth of 30m and tow durations less than 1:30 hours (EU 2018/46, art.4.1b)	Survivability	2018 onwards	Specific details of individual vessels and fishing operations is not reflected in the FDI data
NWW	Norway lobster caught with bottom trawls with selective gears in 7 (EU 2018/2034, art.3.1c)	Survivability	2019 onwards	No information on selectivity devices
NWW	Norway lobster caught with bottom trawls with selective gears in 6a (EU 2018/2034, art.3.1d	Survivability	2019 onwards	No information on selectivity devices
NWW	Plaice caught by BT2, in 7a-k, maximum engine power greater than 221KW, within 12 nm, and tow durations less than 1:30 hours	Survivability	2019 onwards	Specific details of individual vessels and fishing operations is not reflected in the FDI data

There are differences in the percentage of landings subject to derogation depending on the species group, exemption type and area. For example, no or very few demersal fish landings are subject to exemption in the West of Scotland and Rockall and the Irish Sea. In comparison, over 25% of the demersal fish landings are subject to exemption in the English Channel and Iberian waters, while *de minimis*, high survivability and predation exemptions are much less frequently used in the Celtic Sea and Bay of Biscay. Conversely, most pelagic landings are subject to the *de minimis* exemptions in the Celtic Sea and West of Scotland and Rockall, with fewer exemptions in other areas and none in the Irish Sea. A large proportion of the crustacean landings (principally Nephrops) are subject to exemption, with nearly all landings in the West of Scotland and Rockall, the Irish Sea, Celtic Sea and English Channel and around 25% in Iberian waters subject to a high survivability exemption in the most recent year (Figure 16).



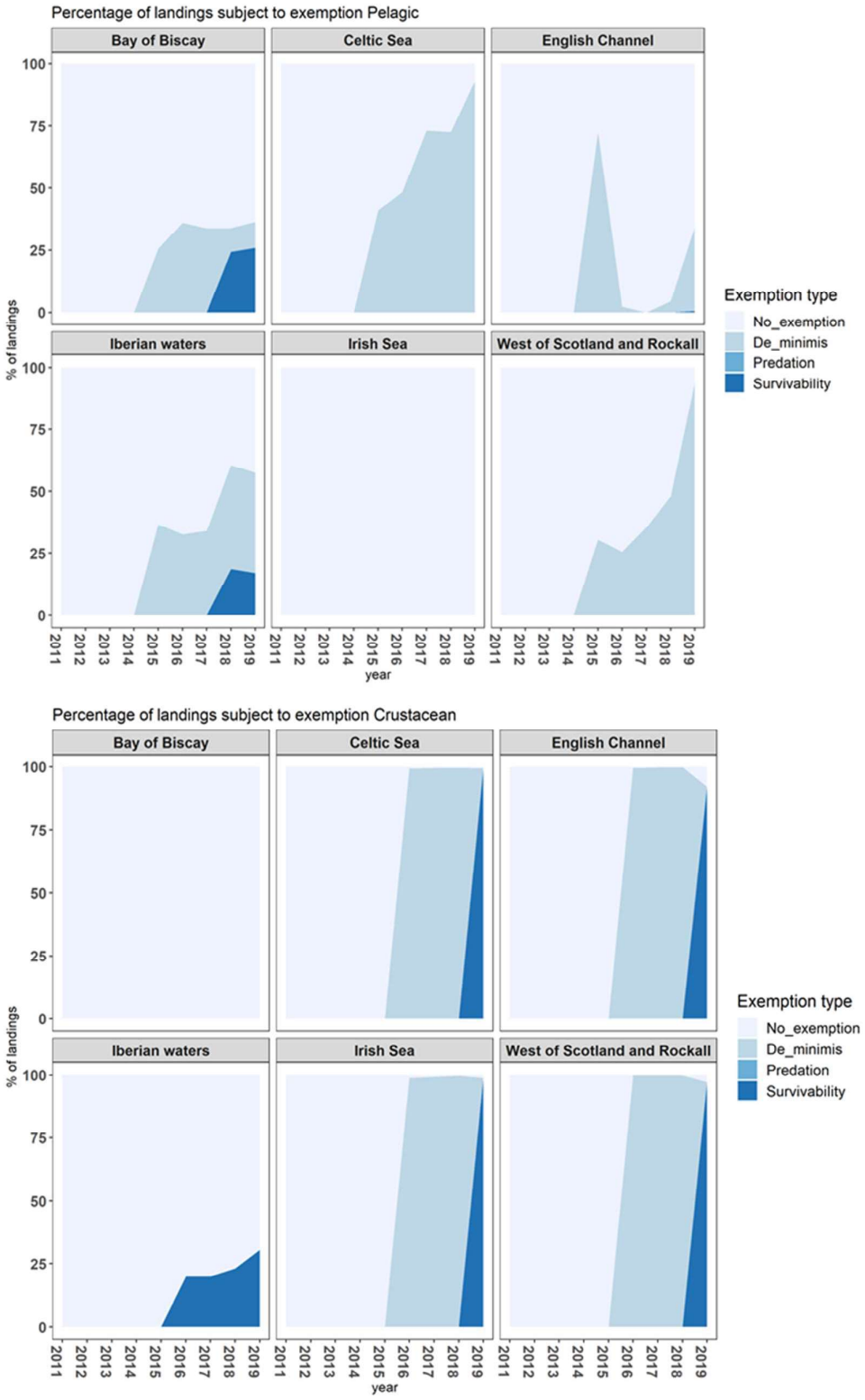


Figure 16. The proportion of overall landings of each species group (demersal, pelagic, crustacean) that is subject to a LO exemption in each of the supra-areas for the NWW and SWW.

3.2.3.1 Discard trends in fisheries with and without exemptions from the LO

Trends in discard rates were compared for fisheries and species with and without exemptions from the LO. The comparison was done in a similar as the generic analysis of trends in discard rates. Only fisheries and species that had discard estimates associated with at least 30% of the total landings in the fishery (of all species) and at least 30% of the landings of an individual species, were included in the plots. An average discard rate for each species and fishery was calculated for the years before the introduction of the LO and compared to the average rate after the LO introduction. It should be noted that, since the LO was not implemented at the same time for all species and fisheries, the compared discard rates are not calculated for the same number of years for all species.

The results from the NS and Kattegat-Skagerrak areas are shown in Figure 17 and Figure 18. No similar figures are shown from the BS as very few exemptions are present in this area. In addition, discard estimates in the BS were too sparse to include in analysis. The figures show the number of species in a fishery that have an increasing, stable, or decreasing trend in discard rate under the LO in relation to the years before. The left panel shows fisheries without any exemption in place and the right panel shows fisheries that have either a survivability – or a *de minimis* exemption. The threshold for categorizing the trends was set to 5%, i.e., if the average discard rate for a species in a fishery was more than 5% higher or lower under the LO than for the years before it was considered increasing or decreasing, respectively.

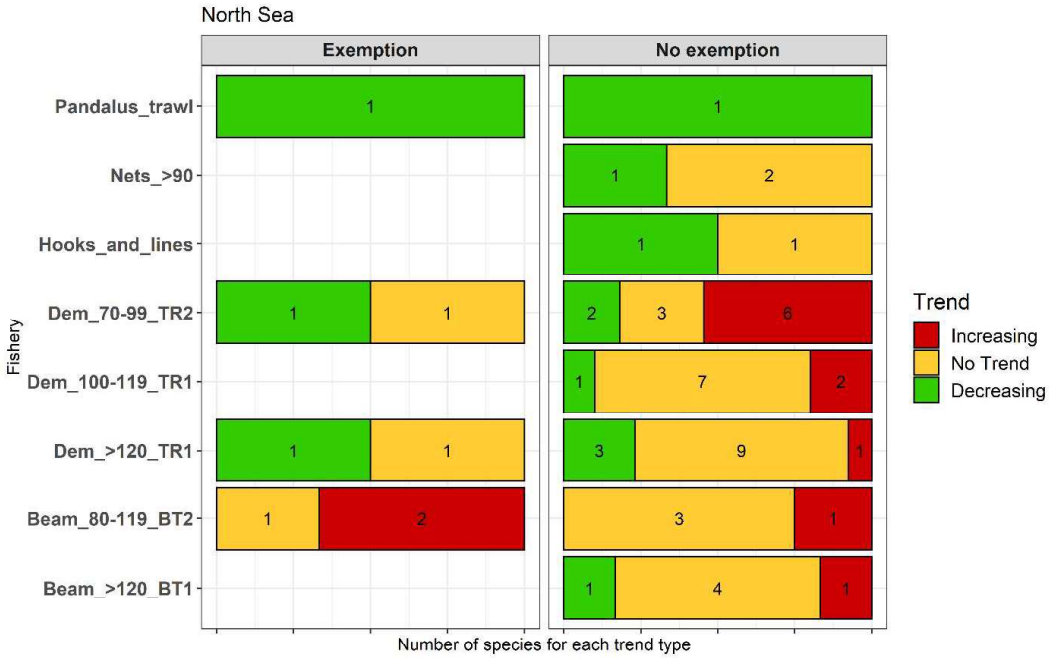


Figure 17. The number of species with increasing, decreasing and no trend in discard rates by fishery in the NS. Left panel shows fisheries and species with different exemptions from LO. Right panel shows fisheries and species with different no exemptions from LO. Colours indicate difference in average yearly trend before introduction of LO compared to average yearly trend after introduction of LO. n= number of species. Fisheries and/or species where available discard estimates are sparse (< 30% of corresponding landings) have been removed.

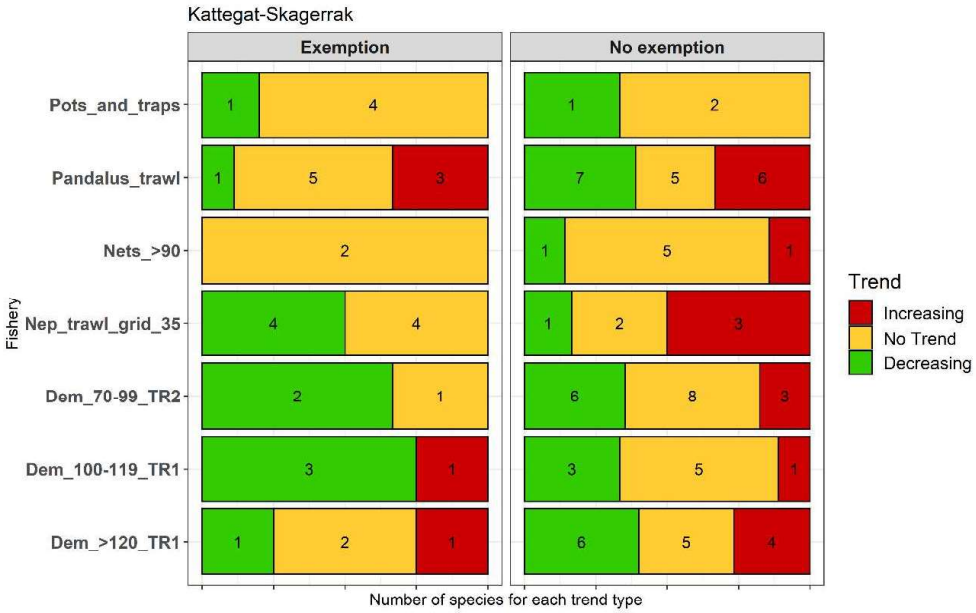


Figure 18. The number of species with increasing, decreasing and no trend in discard rates by fishery in the Kattegat-Skagerrak area. Left panel shows fisheries and species with different exemptions from LO. Right panel shows fisheries and species with different no exemptions from LO. Colours indicate difference in average yearly trend before introduction of LO compared to average yearly trend after introduction of LO. n= number of species. Fisheries and/or species where available discard estimates are sparse (< 30% of corresponding landings) have been removed.

In the AWW area, ORs, Faroes grounds and the West of Scotland and Rockall are not presented because they have no fisheries with exemptions with sufficient discard data coverage for analysis. For the other areas (Irish Sea, Celtic Sea, English Channel, Bay of Biscay, Iberian waters), the number of stocks with increasing, decreasing and stable discard rates by exemption and no exemption are provided in Figure 19 –Figure 23. For the areas that do have available data, there are few patterns that are clear with regard to differences between discard trends for species that are and are not subject to exemptions. In the Celtic Sea, the demersal seine fisheries (70–99 mm, 100–119 mm and >120mm) all show increasing or stable discard rates under species for which there are exemptions and decreasing or stable discard rates for species without exemptions (Figure 20). However, this is only relevant to a few species. All other areas and fisheries have a mix of increasing, decreasing and stable trends across species and exemptions (Figure 19, Figure 21 – Figure 23).

Figure 19. The number of species with increasing, decreasing and no trend in discard rates by fishery in the Irish Sea. Left panel shows fisheries and species with different exemptions from LO. Right panel shows fisheries and species with different no exemptions from LO. Colours indicate difference in average yearly trend before introduction of LO compared to average yearly trend after introduction of LO. n= number of species. Fisheries and/or species where available discard estimates are sparse (< 30% of corresponding landings) have been removed.

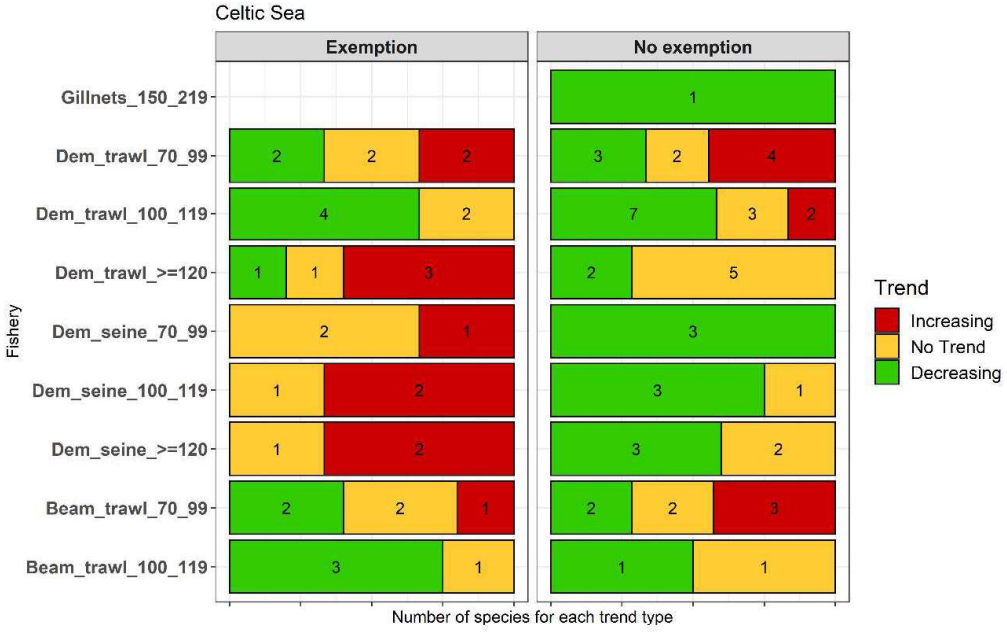


Figure 20. The number of species with increasing, decreasing and no trend in discard rates by fishery in the Celtic Sea. Left panel shows fisheries and species with different exemptions from LO. Right panel shows fisheries and species with different no exemptions from LO. Colours indicate difference in average yearly trend before introduction of LO compared to average yearly trend after introduction of LO. n= number of species. Fisheries and/or species where available discard estimates are sparse (< 30% of corresponding landings) have been removed.

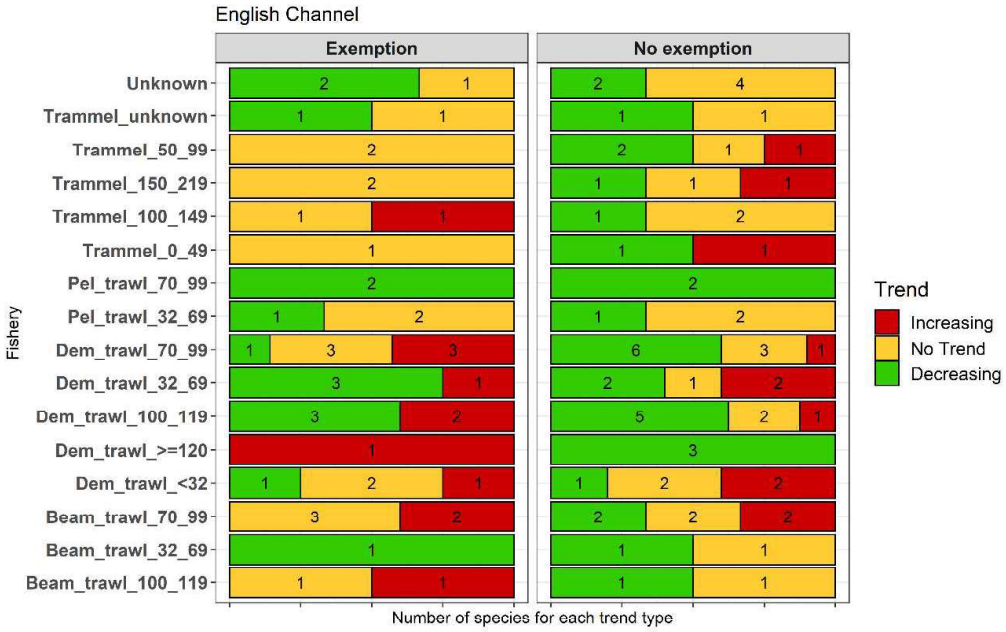


Figure 21. The number of species with increasing, decreasing and no trend in discard rates by fishery in the English Channel. Left panel shows fisheries and species with different exemptions from LO. Right panel shows fisheries and species with different no exemptions from LO. Colours indicate difference in average yearly trend before introduction of LO compared to average yearly trend after introduction of LO. n= number of species. Fisheries and/or species where available discard estimates are sparse (< 30% of corresponding landings) have been removed.

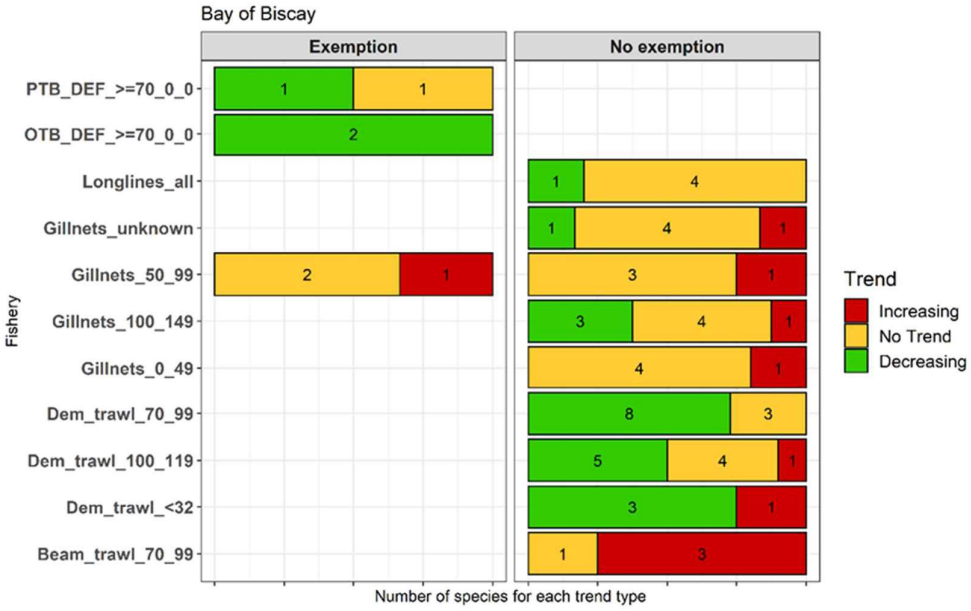


Figure 22. The number of species with increasing, decreasing and no trend in discard rates by fishery in the Bay of Biscay. Left panel shows fisheries and species with different exemptions from LO. Right panel shows fisheries and species with different no exemptions from LO. Colours indicate difference in average yearly trend before introduction of LO compared to average yearly trend after introduction of LO. n= number of species. Fisheries and/or species where available discard estimates are sparse (< 30% of corresponding landings) have been removed.

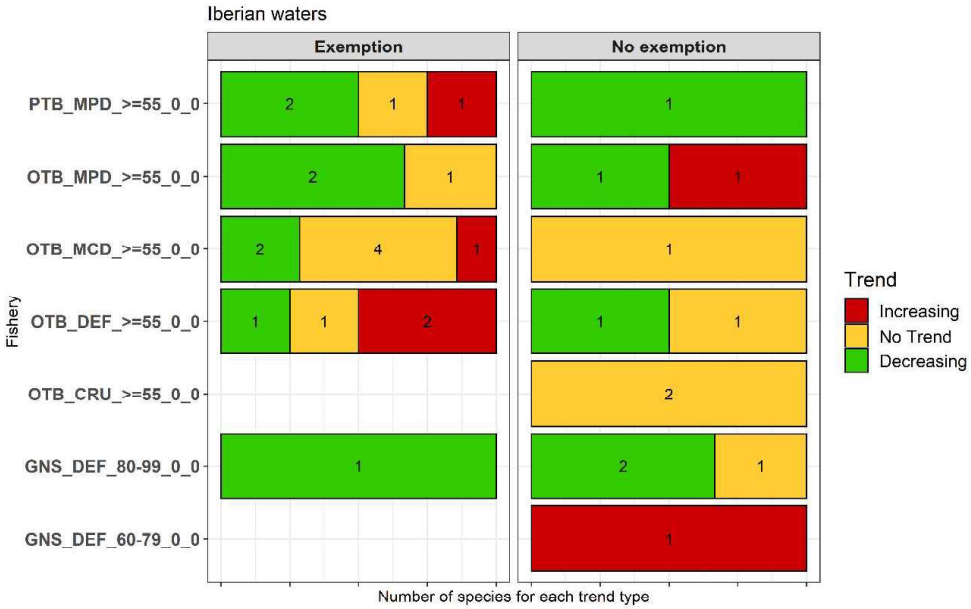


Figure 23. The number of species with increasing, decreasing and no trend in discard rates by fishery in the Iberian waters. Left panel shows fisheries and species with different exemptions from LO. Right panel shows fisheries and species with different no exemptions from LO. Colours indicate difference in average yearly trend before introduction of LO compared to average yearly trend after introduction of LO. n= number of species. Fisheries and/or species where available discard estimates are sparse (< 30% of corresponding landings) have been removed.

3.3 Conclusions

The study developed tools and methods for cleaning, filtering and displaying discard information in the STECF-FDI database. This includes an interactive app (ShinyApp) that allows end users to interrogate discard rates in a dynamic way that synthesises available information. The tool has the potential to become an effective way to monitor and view data on discard rates generated under the FDI process and summarise changes since introduction of the LO and in relation to the regulatory exemptions. The app contains detailed information on individual fisheries, species and data on discard rates.

Overall trends in discard patterns were presented based on data extracted from the app. From the analysis of the results, it can be concluded that the discard rates based on STECF-FDI data and analysed in this study did not show clear trends or patterns as a result of the full implementation of the LO. The short time-series of available information could explain this. Therefore, it was considered that there is a lack of evidence of changes in discarding practice in the fisheries and that discarding is still taking place outside of the LO restrictions.

Discard rates are influenced by a wide range of factors. These factors can be human (e.g., market, size or quota), technical measures (e.g., increased gear selectivity), closed areas with a high proportion of juvenile fish, changes in MCRS, or of a biological nature, such as changes in abundance and distribution following high or low recruitment. Due to this complexity and the limited time series of the datasets used (only one year with the full application of the LO), it has been impossible to draw conclusions on the cause and effect regarding changes in discard rates for different species and fisheries.

No apparent correlation was found between the number of species with discard rates that are increasing, decreasing and stable and the availability of derogations.

There is currently no other source of evidence to evaluate the potential changes in the fishing practices and catch compositions that are in response to the implementation of the LO, other than scientific sampling programmes.

4 CONTROL AND ENFORCEMENT

The objective of this section is to identify and categorize control measures, methodologies and technologies to assess compliance with LO and explore their vulnerability to non-compliance for Member States with fishing activities.

4.1 Background

4.1.1 Legal requirements

The need to monitor and regulate unwanted catches at sea, which is a key requirement for the successful implementation of the LO, is particularly challenging because of the large number of vessels and trips that need to be monitored and the remoteness of vessels at sea (James et al. 2019). Member States have essential roles and duties upon which the success of the LO depends. More specifically, Member States have a responsibility to adopt the necessary structures, measures and resources to ensure control, enforcement and inspection of all activities that fall under the scope of the CFP (Article 5(3) of Council Regulation (EC) No 1224/2009 (Control Regulation). In addition, Member States are obliged to ensure that all data recorded in accordance with the Control Regulation is accurate, complete and submitted within deadlines (Article 109(2) of the Control Regulation). These articles support Article 15(13) of Regulation (EU) No 1380/2013 and are relevant in the context of ensuring control and enforcement of the LO and ensuring that all catches, including quantities discarded, are accurately documented. Member States also have an obligation to ensure the effectiveness of the 'Community' system to prevent, deter and eliminate illegal, unreported and unregulated (IUU) fishing (Article 1(2) of Council Regulation (EC) No 1005/2008) and to ensure that appropriate measures are systematically taken against those suspected of a breach of any of the rules of the CFP (Article 89 of the Control Regulation). However, in its STECF-PLEN-14-02 report, STECF also highlighted that provisions relating to the documentation of catches will need to be increased following the implementation of the LO to comply with the full catch accounting required by Article 15(1) of the CFP basic regulation.

4.1.2 Compliance evaluations

According to STECF's EWG 13-17 *'the evidence thus far indicates that the current mandatory recording of discards in logbooks is unreliable and represents a gross underestimate of actual discards*'. The underreporting of discards was confirmed by compliance evaluations carried out by EFCA during two evaluation periods (2015-2017 for mackerel fisheries and 2016-2017 for North Sea and North Western Waters fisheries). The results from these evaluations suggested that non-compliance with the LO appears to have been widespread during the evaluation periods.

EFCA pointed out that the evaluations were complicated mainly by 1) the lack of reference data available[7] and 2) the complexities of the provisions under the discard plans exemptions. Based on the outcomes of these evaluations, EFCA concluded that:

1. the collection of reliable reference data is essential for an effective compliance evaluation exercise.

[7] Reference data refers here on using reference fleets, which consist of fishing vessels where the crew is trained to conduct self-sampling according to a specific protocol and/or contract with a fisheries institute.

2. the introduction of REM systems could be instrumental both for collection of reference data and for efficient control and enforcement of the LO, as traditional control tools have proven to be inefficient in control and monitoring the LO. REM systems could be implemented a monitoring tool instrumental for improving the reference data available and on the other side as a control tool for effective enforcing the LO.
3. As an alternative for the collection of reference data, an increase of effort on LH inspections should be promoted.

4.1.3 Identification of the risks and challenges associated with the LO and the consequences for failing to ensure its success

The introduction of the LO presented a number of challenges for control authorities working towards ensuring its uniform and effective implementation across all Member States (Nuevo et al. 2019). The main risks and challenges associated with the LO are to ensure control of discarding at sea, to ensure the detailed and accurate documentation of all fishing trips and to ensure that the conditions and thresholds associated with high survivability and *de minimis* exemptions are enforced. These risks are difficult to mitigate by means of traditional controls such as inspections at sea. One of the key challenges, therefore, is the need for new regulatory and enforcement mechanisms, as the focus of monitoring and control shifts from landing activities to activities at sea (Catchpole et al. 2017). This shift requires that fishing and discarding practices around the vessel are 100% monitored during fishing in order to detect what is caught and whether there is discarding (Catchpole et al. 2017).

The numerous exemptions built into the various discard plans complicate controllability (Nuevo et al. 2019, Borgers and Penas Lado 2019, Rihan et al. 2019). Traditional control and monitoring tools (Table 9) can meet this need to control the LO efficiently only to a limited extent (Catchpole et al. 2017).

A key condition for member states in agreeing to the LO at the time of the CFP negotiations was the possibility for TAC adjustments contained in Article 16(2) of the CFP (Savina, 2019,). These TACs adjustments (top-ups) have contributed since 2015 to greater fishing opportunities based on the argument that these will support the implementation of the LO (Borges 2021). The consequences of failing to efficiently control the LO would jeopardise the objectives of the CFP by leading to significant overfishing. This risk is especially relevant in light of the TAC top-ups that were allocated.

4.2 Methods

Before engaging with stakeholders and experts, a desktop study was conducted to gather the relevant background literature and legislation. In-depth assessments and consultations of experts and stakeholders were performed via various methods. These included oral interviews, an e-workshop and an online questionnaire (Annexes 1.2, 1.3 and 1.7). The online questionnaire consisted of 28 questions, including closed- and open-ended questions. It was sent to all participants of the two e-workshops. To broaden the range of disciplines covered, other eligible experts were identified and addressed as well. In total, the link to the full survey was emailed to 179 stakeholders in total (NGOs, scientific institutes, EU institutions, consultancy, governments/ministries). The survey was also forwarded by some respondents to other experts in their own network.

4.2.1 Results

4.2.2 Identification of the main control measures currently applied by Member States.

Table 9 provides an overview and description of the traditional monitoring and control measures that have been trialled or implemented in different Member States. In most Member States, fishing activities are monitored during at-sea inspections by inspectors from the fisheries ministries, in combination with dockside/fish auction surveillance. The use of electronic (e-) logbooks, or 'Electronic Reporting System' (ERS) is vital to monitor fishing activities and facilitate compliance as it allows the electronic registration of fisheries data.

Data on the position and activity of fishing vessels is provided by the satellite-based Vessel Monitoring System (VMS), which is required by EU law for vessels over 12 metres in length[8].

Besides VMS, two other satellite-based or radio-based systems, i.e., the Automatic Identification System (AIS) and Vessel Detection System (VDS) are used for monitoring and control purposes[5]. Other existing monitoring methods, such as aerial vessel surveillance, FDF, REM and market inspections have been trialled or implemented in some Member States.

Table 9: Overview of monitoring and control tools trialled or implemented at different levels in EU fisheries.

Method	Description
At sea inspections (patrol vessel surveillance)	Patrol vessels/boarding boats with on-the-spot observers conducting inspections of the e-logbooks.
Inspections of the landings/dockside monitoring	Inspection of the landings and crosscheck with logbooks/official documents at the fish docks/auctions/harbours.
Electronic Reporting System (ERS, "e-logbook)	The electronic reporting system (ERS) is used to record, report, process, store and send fisheries data (catch, landing, sales and transhipment). The key element is the electronic logbook where the master of a fishing vessel keeps a record of fishing operations. The record is then sent to the national authorities, which store the information in a secure database.
Vessel Monitoring System (VMS)	The vessel monitoring system (VMS) is a satellite-based system providing data at regular intervals on the location, course and speed of vessels (compulsory for vessels over 12 metres in length). Member States may apply exemptions for vessels between 12 and 15 metres under specific conditions. No tracking is required for vessels below 12 metres.
Automatic Identification System (AIS)	The Automatic Identification System (AIS) is an autonomous and continuous vessel identification and monitoring system used for maritime safety and security which allows vessels to electronically exchange with other nearby ships and authorities ashore the vessel identification data, position, course and speed.

[8] The Commission Implementing Regulation (EU) No 404/2011 of 8 April 2011 laying down detailed rules for the implementation of Council Regulation (EC) No 1224/2009 establishing a Community control system for ensuring compliance with the rules of the Common Fisheries Policy

Method	Description
Vessel Detection System (VDS)	Vessel Detection System (VDS) is a satellite-based technology (satellite imaging of sea areas) which may help to locate and identify fishing vessels at sea. The basic function of VDS is to allow the identification of vessels and the detection of their positions at sea.
Aerial vessel surveillance	Using aircrafts/drones for aerial surveillance. These are mainly used to overfly vessels and determine if they are fishing in an area where fishing is prohibited. Aerial surveillance has also been used in an attempt to control discarding at sea.
Remote electronic monitoring (REM)	Remote electronic monitoring (REM) includes the installation of cameras and sensors on board of fishing vessels to monitor catches. Closed-circuit television (CCTV) cameras can record footage of fish catching and processing. Sensors can be very useful in highlighting potential non-compliance (especially in pelagic fisheries) and events of interest in other fisheries (such as when gear is retrieved). Sensors serve to facilitate the reviewing of large volumes of REM footage by indicating potential non-compliances and high-risk events.
Market inspections	Officials verifying items of the CFP related to cold stores, gross and retail markets, restaurants, or any other premises where fish is stored and/or sold after landing has taken place.

Currently, there are no certified at-sea control observers in EU fisheries, in contrast with various Canadian and United States of America (US) fisheries (Brooke 2012, Porter 2010) (Box 1).

Box 1. Certified at-sea control observers EU fisheries.

Inspecting observers are usually present for the full duration of a trip. The mandates of these observer programmes vary from being focused on scientific data collection to being compliance monitoring schemes, although most observer programme mandates include elements of both (Ewell et al. 2020). However, there are various issues related to the costs, safety and logistical issues associated with at-sea control observers (James et al. 2019). The Canadian programmes started under co-funding arrangements and eventually moved to 100% industry funding while the US (West Coast) programmes are co-funded by the government and the fishing industry (van Helmond et al. 2020). In these cases, the fishing industry has the (shared) (financial) responsibility for monitoring fishing activities. This is in contrast to the EU fisheries, where control is entirely the responsibility of the member state.

4.2.2.1 LO monitoring and data collection measures

Besides the measures presented in the Table 9, the Last Haul (LH) programme and gramme and grade size analyses, have been organized in the framework of EFCA's JDPs to monitor the implementation of the LO. These control monitoring programmes aim to evaluate compliance with the LO, to compile catch composition data for use in a risk management strategy and to provide information on where and when discards are expected in a particular fishery (Nuevo et al. 2019, Valentinsson et al. 2019) (Box 2).

Box 2. Last haul (LH) programs.

The LH program consists of inspections at sea, with catch data being collected by member states inspectors (Nuevo et al. 2019). The catch composition of the last observed haul of the inspected vessel is recorded in terms of live weight per species and quantities above or and below the MCRS. Data is recorded on a template form, which is then submitted to the EFCA for compilation and analysis. The EFCA also uses gramme and grade size data collections in respect of the corresponding JDPs in the AWW and the NS. Gramme size inspections involves the weighing of individual fish onboard, with the cooperation of the industry and an analysis of the gramme size distribution (catch composition) afterwards. The EFCA has developed a methodology for risk assessment, identification of risk levels and coordination of control activities with member states. Due to the impossibility of conducting comprehensive control and surveillance activities, the risk approach arises as one of the main tools for addressing non-compliance with the LO.

To determine the discard levels, various countries have experimented with either 'reference fleets' (e.g., Norway, Bjørkan 2011, Mangi et al. 2015) or self-sampling (e.g., the Netherlands, Kraan et al. 2013, Uhlmann et al., 2011).

A technique with control potential, but currently used as a data collection program, is fully documented fisheries (FDF). FDF is a form of documentation of fishing activities either with REM by means of cameras and sensors or with observers. At the e-workshops, stakeholders elaborated on the FDF scheme as applied in Dutch fisheries in the framework of the LO exemption for plaice (*Pleuronectes platessa*). Within this programme, between 6-10 vessels have participated and have had cameras installed. Haul data and videos are delivered to the fisheries institute (WMR) to check/audit the results. To improve this type of data gathering in the future, WMR is currently working on machine learning software that will allow for an automatic registration of fish species, under various conditions (e.g., overlapping fish on the conveyor belt). To evaluate the potential of automated FDF data collection, similar research projects in other Member States have been undertaken, for instance in Belgium, where the VISIM I project has succeeded in automatically recognizing plaice and sole (*Solea solea*), and automatically registering fish lengths with high accuracy. It should be noted that these projects are not for control and enforcement intended purposes at the moment, but rather as data collection programs supporting scientific advice.

While FDF programmes have mainly been used to collect scientific data in the EU (e.g., for stock assessments or specific scientific projects, to complement DCF trips), there are ongoing discussions regarding the use of reference fleets for compliance purposes. During the subgroup discussions of the e-workshop organized in this study, some stakeholders (particularly NGOs) argued that advanced monitoring tools might increase the incentive for compliance, because of the constructive role that they can play in fisheries science (i.e., improving stock assessments). According to EFCA, reference fleets are good for general indications of non-compliance but are not sufficient to prove non-compliance at individual vessel level and therefore, are not an effective control and enforcement tool and are unlikely to promote compliance. While camera technologies can be promising for gathering more accurate data for inclusion in stock assessments and advice, other stakeholders stressed that cameras should not be used to see if fishers comply. While many large fishing vessels are equipped with CCTV systems for safety reasons, the majority of the fishers still consider camera surveillance as an intrusion into their private workspace and as tool that a government, which mistrusts them, will use against them (Baker et al. 2013, Mangi et al. 2013, Plet□Hansen et al., 2017, van Helmond et al. 2020). As previous studies showed, there is a strong perception of intrusion on the fishers' privacy

(van Helmond et al. 2020). Mangi et al. (2013) pointed out that a large proportion of the fishing industry is not supportive in using EM for this reason. During the e-workshop discussion of this study an NGO representative argued that using EM as a data collection tool might increase the incentive for compliance and may help improve stock assessments in the future. Data collection through the EM could be promoted and used to change the often negative views on EM into something more positive by the constructive role it can play in fisheries.

The numerous exemptions and flexibilities in place, such as for example, the *de minimis* and high-survivability exemptions, interspecies and interannual flexibilities, amongst others may add a layer of complexity to control and surveillance of the LO. Exemption measures have been devised essentially to mitigate potential choke situations and are regarded as necessary and widely accepted by the industry. Discards must not surpass the ceiling established for the stock in question. Improvement in selectivity and the avoidance and reducing, as far as possible, of unwanted catches are primary objectives of the LO and the *de minimis* and high survivability exemptions are intended to facilitate fishers in cases where improvements in selectivity are not feasible and where flexibility options are not sufficient.

While on-board observers could evaluate the levels of discards, they have the drawback of being expensive and not generally feasible (e.g. on board space limitations, scalability). Other alternatives, such as REM devices incorporating CCTV, are therefore currently being considered. The STECF 17-01 report noted that while new control tools such as CCTV and REM have been tested in several countries, there is little evidence of them being used and there is no mandatory basis of their use. In terms of the cost-effectiveness of EM programs, van Helmond et al. (2020) reported that, in most cases, EM proved to be a cost-effective reliable alternative for human observation after assessing EM programs in Canada and the US.

According to some experts, for the purpose of continuous monitoring, REM (incorporating CCTV) offers the most cost effective means[9], (Bartholomew et al. 2018, Course 2015 WWF report). Contrary to this, the UK government reported that fitting REM equipment on all vessels in the main segment of the demersal fleet (vessels over 15 metres) would be prohibitively expensive due to the high costs to government of analysing the electronic records and purchasing the necessary equipment[10]. Costs can vary greatly depending on factors such as the number of analysts, equipped vessels and observers, but also on the type of data to be generated from the system (basic compliance with the LO, catch estimates, and/or scientific biological data) (Dinsdale 2013, Catchpole et al. 2017). Similarly, an independent study warned that science monitoring and analysis resources could become overwhelmed by it (Needle et al. 2015). Catchpole et al. (2017) also notes that although the capital cost of purchasing and running the REM system could be met by Member State governments, it is possible that it could be funded through the structural funding programmes such as the European Maritime and Fisheries Fund (EMFF). One of the major issues regarding the analysis of REM video data is the duration of the video audits (Bergsonn et al. 2017). This issue could be solved by machine learning techniques, which would not require additional hardware, reduce the number of staff and decrease audit time even further (Bergsonn et al. 2017). More development is needed before this can be achieved in practice, but breakthroughs are expected in the near future, as many

[9] "European Union Committee Fisheries: implementation and enforcement of the EU landing obligation", 26th Report of Session 2017-19 - published 8 February 2019 – House of Lords Paper 276

[10] Defra, Consultation on the Implementation of the demersal landing obligation inEngland, 2015, January 2015.

research institutes and private companies are currently developing machine learning algorithms.

Another key aspect is that exemptions have to be properly registered in the logbook. It should be noted that the software supporting the electronic logbook differs from one country to another and the competent authorities need to approve the software in each case before it can be used. For example, Client Earth's report that the implementation of a new e-logbook software encompassing LO provisions was delayed in France, where its implementation had to wait until 2017.[11]

4.2.2.2 Facilitation of the LO implementation

Full adaptation of the e-logbook software to the new needs of the LO is needed to facilitate the LO implementation, particularly concerning reporting of exemptions. According to the legislation, all Member States are obliged to have the facility to record discards as "DIM" and "DIS" (Annex X R.404/2011[12]). To accommodate this, the e-logbooks have been modified to report discards under the exemptions. *De minimis* exemptions are assigned to vessels individually, and an individual quota system is in place. Data is submitted from the vessels to the administration where the *de minimis* uptake is monitored. The degree of use of the *de minimis* exemption is reported from the administration to the vessel and, once the exemption is exhausted, all fish must be landed. Member States also have a duty to ensure that the thresholds and conditions associated with the de minimis and high survivability exemptions, as outlined in the discard plans, are controlled, enforced and respected (Article 49b of the Control Regulation).

Full adaptation by Member States of the e-logbooks to the needs of the LO is still in progress, with most vessels below 12 metres still using paper logbooks. Given the difficulties to collect census information, some administrations employ statistics to cross-check logbooks to identify vessels that are underreporting in comparison to similar vessels, as is the case of France where interviewees referred to this approach.

Quota management frameworks that facilitate the implementation of the LO are being employed by diverse Member States (see Section 2 of this report). On the basis of these dispositions, Member States have employed a large variety of mechanisms, including interspecies and interannual flexibilities. These latter mechanisms seem particularly employed in countries where individual allocation systems are in place, for example in Spain, while less employed in others such as, for example, in Portugal. Management of these quota flexibilities requires a system of information exchange between the boat and the fisheries administration.

The e-logbook allows skippers to declare the catch and transfer this information to the fisheries administration in real time, while for paper logbooks this process is lengthier. Quota consumption is estimated by the administration and communicated to the skipper. Amongst the countries, Spain, the Netherlands, and United Kingdom have well-established individual quota management systems which allow transference of quotas between vessels. According to some interviewees, this system greatly contributes to overcome choke situations. By contrast, Ireland does not operate individual quota schemes and thus exchanges between boats are restricted. Nonetheless, a system called 'quota balancing' is in place for pelagic and demersal stocks subject to the LO. This consists in future deductions from the individual catch limit for those vessels exceeding its catch limit for a

[11] The control of the Landing Obligation, ClientEarth, October 2019.
[12] Commission Implementing Regulation (EU) No 404/2011 of 8 April 2011 laying down detailed rules for the implementation of Council Regulation (EC) No 1224/2009 establishing a Community control system for ensuring compliance with the rules of the Common Fisheries Policy

given stock within a given period. Thus, as seen, the diverse countries concerned employ different approaches to facilitate the implementation of the LO.

Fish below MCRS and not subject to exemptions must be landed and cannot be traded for direct human consumption (Regulation 1380/2013, Article 15.11). Full documentation of these catch either discarded under the *de minimis* umbrella or kept on board, has to be declared in the logbooks, landing declarations, transhipment declarations, sales notes, take-over declarations and transport documents. Good observer coverage on land is also required to prevent trading of these fish for direct human consumption. On land, trading of fishes below MCRS is likely one of the most common infractions (depending on the region), while at sea, infractions predominantly involve undersize fish found onboard and not been declared in the logbook. As the EFCA compliance evaluation reports point out, illegal and undocumented discarding are widespread, and currently not controlled due to the dependence by Member States on ineffective traditional controls.

4.2.3 Evaluation of the management measures in place

4.2.3.1 Management Measures

In **Question 4 (Q.4)**, respondents were requested to assess the various LO management measures in terms of avoiding and reducing unwanted catches and thereby eliminating discards for their respective country. The measures were: area closures, temporal-spatial avoidance measures/moving-on regulations/real-time closure zones, new selective gears and gear modifications, and removal of TAC for stocks. Respondents could also specify an additional management measure below the 'other' field.

In the BS and NS area, in general, 60% of all respondents (answering this specific question) considered these management measures as effective[13]. New, selective gears were considered the most effective, gathering 85% of the responses. 30% of respondents considered this highly effective. Only 5% considered this measure as ineffective. Avoidance measures (i.e., temporal-spatial avoidance measures/moving-on regulations/ Real-Time closure zones) were considered as effective by 65% of the respondents. The measure 'area closures' was ranked third, considered effective by 50% of the respondents. In the final place, the removal of the TAC was assessed as effective by 40% of the respondents (Figure 24).

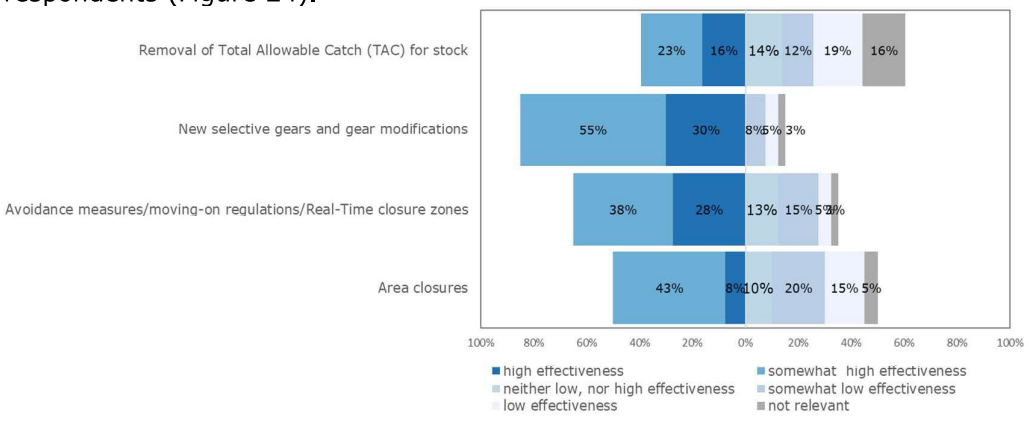


Figure 24: BS and NS. Results for Q.4: "Please assess the following LO management measures for their effectiveness in avoiding unwanted catches and thereby reducing (potential) discards for the fisheries of your country".

[13] Calculated by using the mean of the percentages 'somewhat high effectiveness' and 'high effectiveness' for all four listed management measures.

In the AWW area, 35% of respondents considered all management measures listed as effective to some degree (Figure 25). Selective gear was considered the most effective in its category, gathering around 70% of the responses, with notably, 15% of respondents considering this as highly effective. None of the respondents considered it ineffective. Avoidance measures have been in place for a long time before the LO and they have been either continued or modified to reduce unwanted catches. These measures were considered as effective by 46% of the respondents. 8% of respondents branded them as being of low effectivity. Similarly, TAC removal was considered as an effective measure by 46 % of the respondents, 19% of them regarded this measure as low effective. Finally, area closures were regarded as effective by only 35% of the respondents. The perception of the degree of effectiveness differs greatly with the management measure. 69% of respondents recognised that to increase fishing gears selectivity is at least somehow effective (Figure 25).

This result is consistent with the literature (Prellezo et al. 2018), where it was found that selective gear and gear modifications are regarded as effective to reduce unwanted catches to a certain extent and may let marketable fish to escape. This is likely why 27% considered this having neither low nor high effectiveness. The perception of effectiveness is less clear for other management measures, such as avoidance measures and TAC removal, where opinions are dispersed. Traditional area closures were not regarded as effective, with 42% of the respondents considering them as having low effectiveness. Notably, 27% of the respondents did not know the measure, which may be indicate that it is not even recognised as part of the LO toolbox (Figure 25).

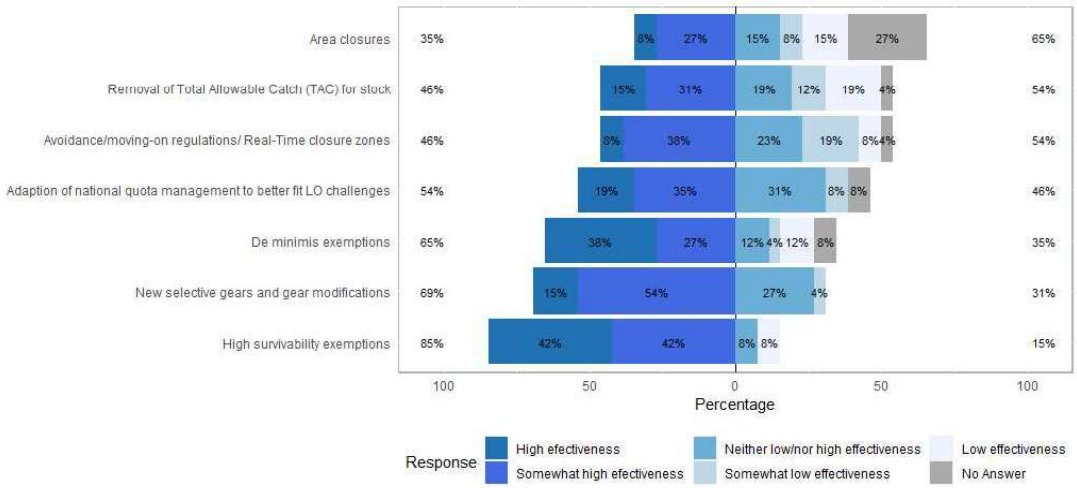


Figure 25: AWW. Results for Q.4: "Please assess the following LO management measures for their effectiveness in avoiding unwanted catches and thereby reducing (potential) discards for the fisheries of your country". Responses provided by 26 respondents.

Q.5 asked about management measures able to counteract a potential loss in fishing opportunities due to choke situations.

In the BS and NS, the most popular answers were: 'quota swaps between the Member States (specifically in relation to the LO challenges)', and 'adaptation of the national quota management to better fit LO challenges' (Figure 26). Quota swaps between vessels or quota pools within a member state were also assessed as effective measures to counteract choke effects. Removal of the TAC for stocks was regarded as the least effective (of the measures listed). There were no stakeholders that selected the 'I don't know' option for this question. 11 respondents used the 'other' field to elaborate (Annex 1.11 – Table A3).

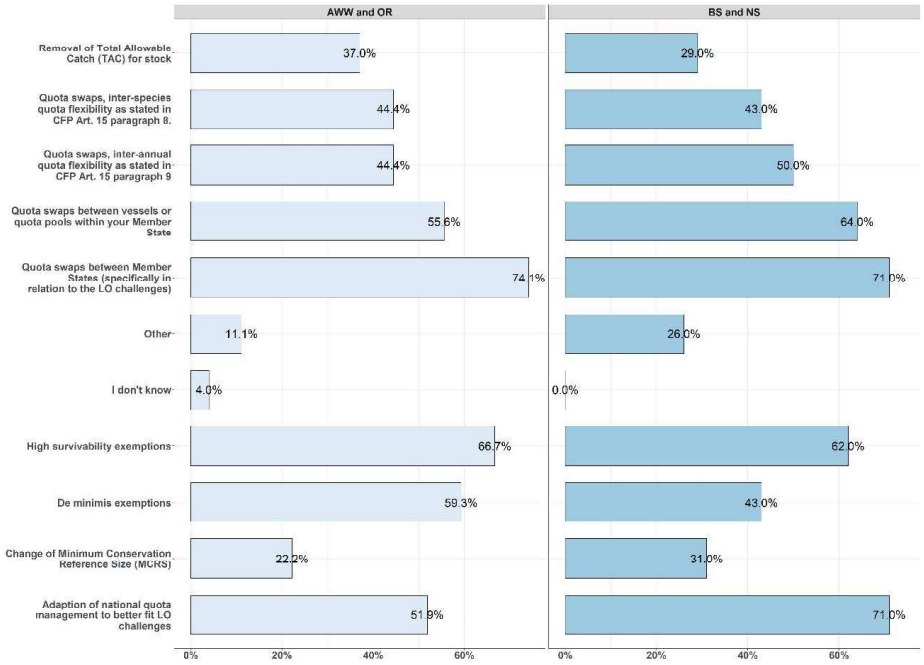


Figure 26: All areas. Results for Q.5: "What should be done with unwanted catches to mitigate a potential loss in fishing opportunities due to choke considerations?"

Quota swaps between Member States were regarded as more effective in addressing this issue in the AWW. The high survivability exemption was the second measure considered as effective to counteract this. The *de minimis* exemption and quota swaps among vessels were also regarded as highly effective. Removal of TAC and change in the MCRS was regarded as the least effective (Figure 26).

In **Q.6**, stakeholders were asked to rank LO management measures in terms of economic feasibility (i.e., maintaining a profitable fishery) for the fisheries of the different countries.

In the BS and NS, the most economically effective measure, according to the respondents, was the 'adaptation of national quota management to better fit the LO challenges' (71%). Temporal-spatial avoidance mechanisms were selected as somewhat economically viable (49%), followed by inter-annual quota flexibilities/quota swaps (44%). Area closures were considered as the least economically feasible (27%) (Figure 27).

In the 'other' field, two respondents indicated that economic feasibility depends on the specific circumstances that apply and, hence, varies case-by-case (Annex 1.11 – Table A4).

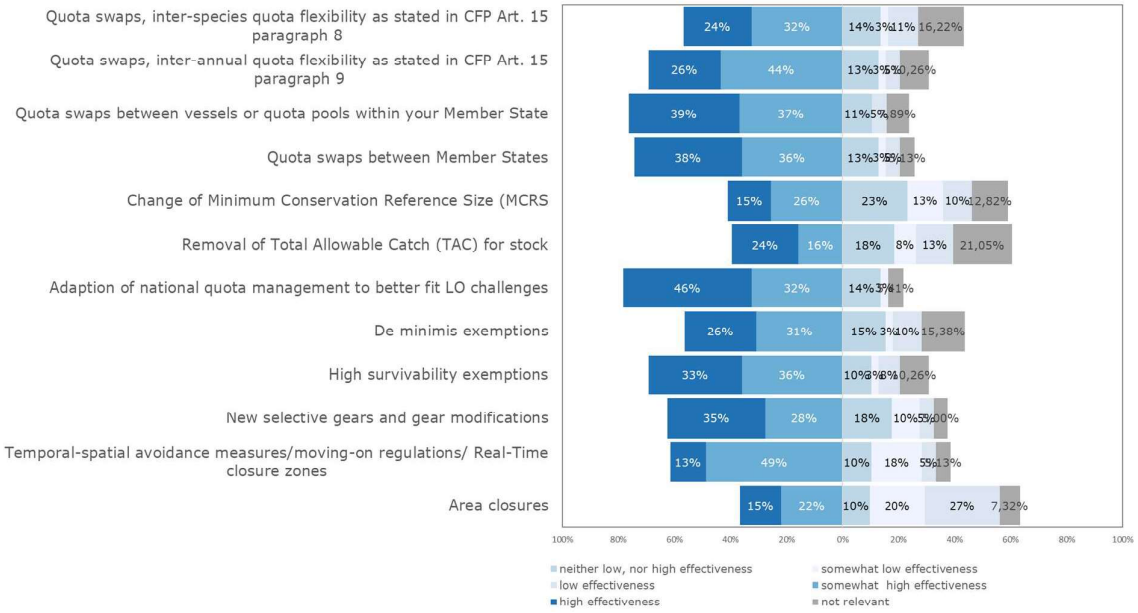


Figure 27: BS and NS. Results for Q 6: "Please assess the following LO management measures based on how well the measure could be implemented in terms of their economic feasibility".

In the AWW, the high survivability and *de minimis* exemptions were regarded as the most economically feasible. These measures were thought to be lower cost and yield better results – by 79% and 73% of the audience respectively. Management measures based on the TAC and quota system were also considered as highly economically viable. Quota swaps among countries, for example, was considered as a viable measure by respondents (70%). Removal of the TACs was also found as a viable measure by 65%, although 17% considered this unviable. A variety of measures based on quotas, such as interspecies flexibilities, quota swaps and quota-based management were also regarded as economically viable solutions by 57% of the respondents in each category (Figure 28).

Finally, in the AWW, technical means such as avoidance rules, fishing gear improvements, changes in MCRS and area closures were considered less economically viable by the respondents. Avoidance rules and fishing gear modifications were regarded as the most effective in this by 39% and 30% of the responses, respectively. Higher consumption of fuel to avoid certain areas where the occurrence of unwanted fish is high, or the investments necessary to improve selectivity were some of the reasons commented by the respondents. By contrast, regulatory solutions to avoid unwanted catches and quota-based measures seem to provide more economically viable solutions to avoid choke situations.

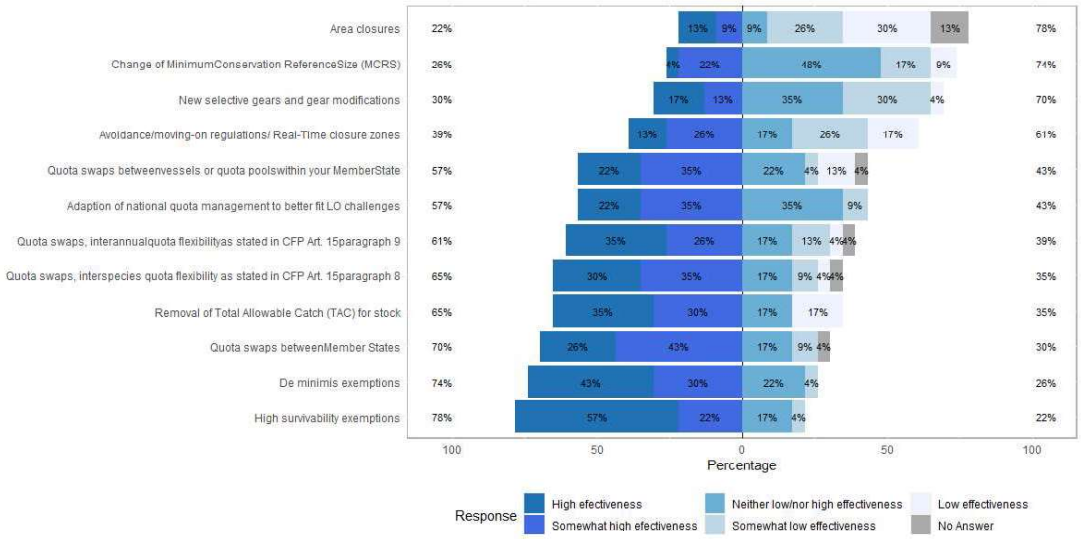


Figure 28: AWW. Results for Q 6.: "Please assess the following LO management measures based on how well the measure could be implemented in terms of their economic feasibility". Responses provided by 23 respondents.

4.2.3.2 Control measures and compliance

In **Q.7**, respondents were asked if the LO regulations were being complied with (Yes/No)? (Figure 29). In the BS and NS, 39 respondents answered this question, in 23 instances, this question was skipped. Most stakeholders (64%) that answered the question did not believe the LO regulation was being complied with.

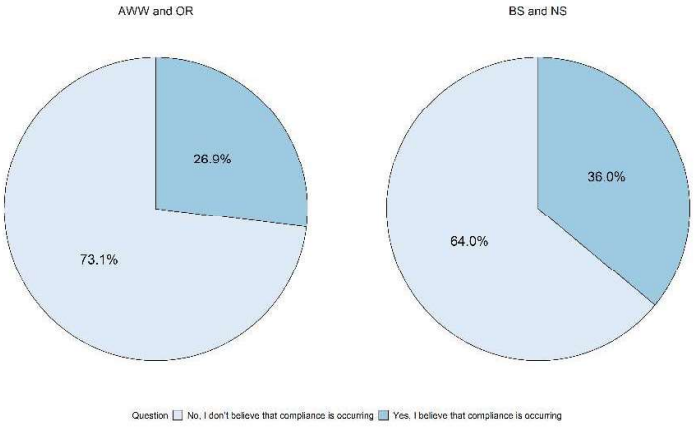


Figure 29: All areas. Results for Q.7: "Is the LO regulation being complied with? Compliance meaning conforming to the requirements of the LO legislation".

73% of the respondents who replied stated that non-compliance occurs in the AWW fisheries, while 27% of them thought that compliance takes place in the AWW fisheries. It should be noted that 13% of the respondents did not reply to this question (Figure 29). Annex 1.1 and Table A14 shows the structure of replies for this question by Member State and type of stakeholder.

For the people who selected 'no' as an answer, a follow-up question (**Q.8**) appeared, which inquired about the reasons for non-compliance. Here, respondents had the option to select multiple answer options. The most popular one in the BS and NS areas was 'the drivers of non-compliance are too strong and illegal discarding occurs in order to avoid having to record and land unwanted catches' (Figure 30). Many stakeholders indicated that 'the

legislation was too complex/vague' or 'that the complexity and multitude of Commission Delegated Regulation' were drivers of non-compliance.

The 'other' option was selected by 14 respondents in the BS and NS, where they elaborated on other reasons for non-compliance (Annex 1.11 – Table A5). Various respondents attributed non-compliance due to a lack of efficient control at sea and inadequate control tools (e.g., REM, Annex 1.11 – Table A5). Additionally, some stakeholders mentioned the negative perception and lack of acceptance of the LO by the fishing sector.

In the AWW, the complexity of the regulation was deemed as the main reason for non-compliance. 11 responses include this factor as the main reason for non-compliance. The second main reason for non-compliance was lack of space onboard (for storing unwanted catch) and the third cited the administrative burden. Six responses considered that the regulation is not possible to be controlled in practice. Other reasons, such as lack of crew for work onboard and poor communication of the LO regulations, were deemed less relevant. Responses seem to indicate that the regulatory framework is the main reason for non-compliance. The complexity of legislation and the administrative procedures seem to create legal insecurity, as well as lengthy and obtuse operative procedures, particularly in the reporting phase (Figure 30).

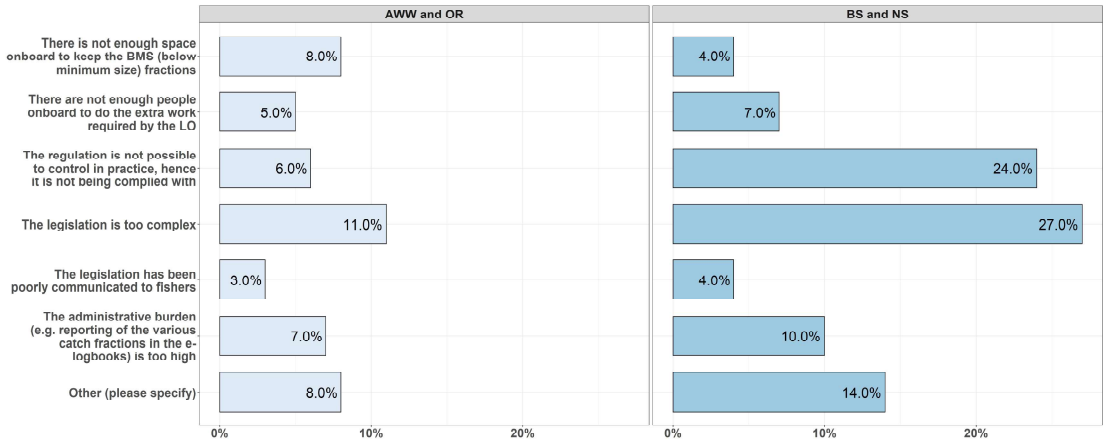


Figure 30: All areas. Please identify why non-compliance is occurring. Multiple-choices questions. See Annex 1.11 for full quotes.

Table A10 (Annex 1.11) provides the responses provided by the AWW stakeholders under the category 'others' in **Q.9**. Within this response, most respondents pointed to different factors that caused non-compliance. These included the complexity of the rules and declaration of catches, difficulties with handling fish on board and an inability to put fish on the market. In the other hand, more than 40% of the responses considered that there was a lack of effective control and monitoring, and that enhancement of these, facilitated by new technologies, should be put in place.

In **Q.9**, stakeholders were asked to write down what the 'extra work' onboard exactly entails (see answer option: "There are not enough people onboard to do the extra work required by the LO" in Q. 8). According to some stakeholders, the extra work required by the LO consists mainly of storing the additional quantities of fish (Annex 1.11 – Table A5). For the AWW area, the general consensus was that the extra work consisted in the deployment of people and time to sort and store the additional volumes of fish. Written answers for this question are presented in Table A11 of Annex 1.11.

For **Q.10**, we inquired about 'the main aspects of non-compliance associated with the LO'. Multiple boxes could be selected for this question. For most stakeholders of the BS and NS, the main aspects of non-compliance were the failure to bring and retain catches on

board (i.e., illegal discarding) and the failure to record all catches (including quantities discarded, Figure 31). Stakeholders remarked that the lack of accurate catch documentation is especially concerning, as data for stock assessments and future scientific advice could be undermined, therefore also undermining the purpose of the LO and the CFP to ensure sustainable fisheries (See Annex 1.11 – Table A15).

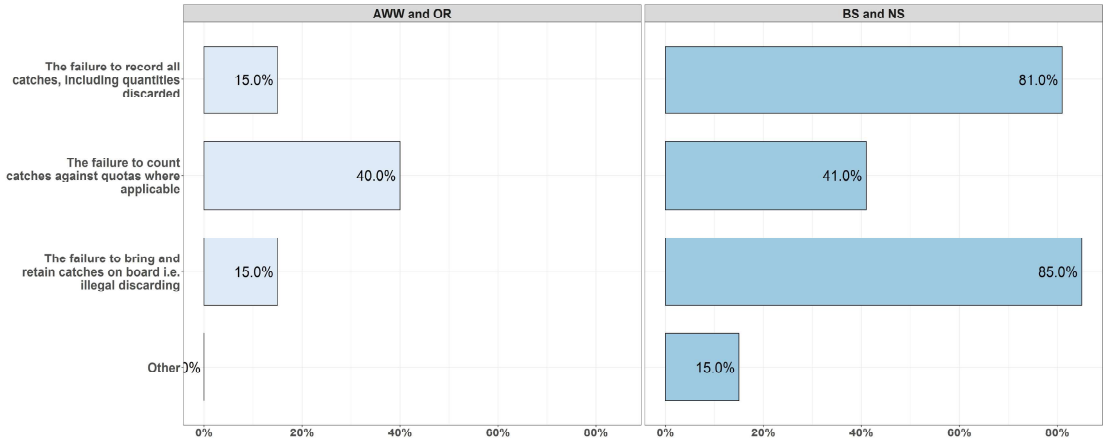


Figure 31: All areas. Percentage of responses (y-axis) and answer options (x-axis) for Q.10 ("What are the main aspects of non-compliance associated with the LO?")

Q.10 aimed to evaluate aspects that are deemed to impede compliance with the LO. The failure to count catches against quotas was deemed as the most important reason for discarding. This failure may be due to the inability to know the level of quota uptake in real time, which may lead to discarding to prevent surpassing quotas. Improvements on information technologies linked to e-logbooks may contribute to solve this situation. Notably, the failure to retain catches on board and to record them were deemed as equally important by respondents. In the first case, illegal discarding may occur due to strong economic drivers such as the impossibility to sell fish for direct human consumption i.e. fish below MCRS, or to find markets for low valued fish.

Additionally, stakeholders were asked whether traditional controls (e.g., inspections at sea, inspections at landing, aerial surveillance and data analysis) were adequate to ensure control and enforcement of the LO (**Q.11**, Figure 32). Most stakeholders in the BS and NS area (~56%) believed that they are not appropriately designed.

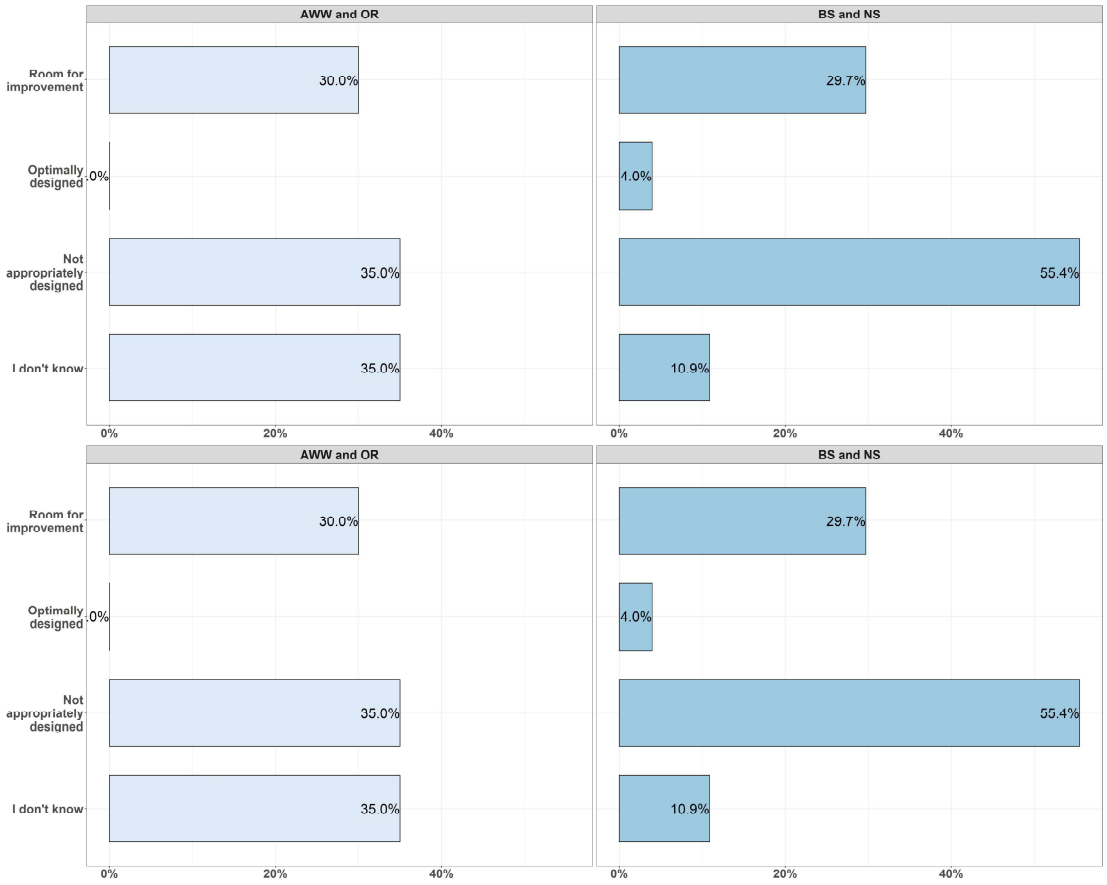


Figure 32: All areas. Percentage of responses (x-axis) and answer options (y-axis) to Q.11 ("Are traditional controls such as inspections at sea, inspections at landing, aerial surveillance and data analysis adequate for countries to ensure control and enforcement of the LO?").

In the AWW, none of the 17 respondents considered that these means are optimally designed to suit the needs of the LO, while 35% considered that the design is not appropriate and around 30% that there was still room for improvement. It is noteworthy that more than a third of respondents did not know if these traditional tools are suitable for the requirements of the LO. It is evident that traditional tools are regarded as ineffective in the current context of the LO and there is even a low awareness on the role that traditional control measures play in the framework of the LO.

Stakeholders were asked to write down measures that should be introduced by countries to ensure control and enforcement of the LO (**Q.12**, Annex 1.11 – Table A7). The majority of the answers (25 in total) pointed to the use of video recording, REM with CCTV, on board the vessel. Larger budgets for control bodies, more frequent controls and the harmonization of control measures over different countries and vessels were also proposed by stakeholders to address this issue.

Stakeholders were subsequently asked whether e-logbooks are appropriately designed to comply with LO measures (**Q.13,** Figure 33). Most of the respondents of the BS and NS areas (60%) believed that there was room for improvement. 10% of the stakeholders considered them 'not appropriately designed'.

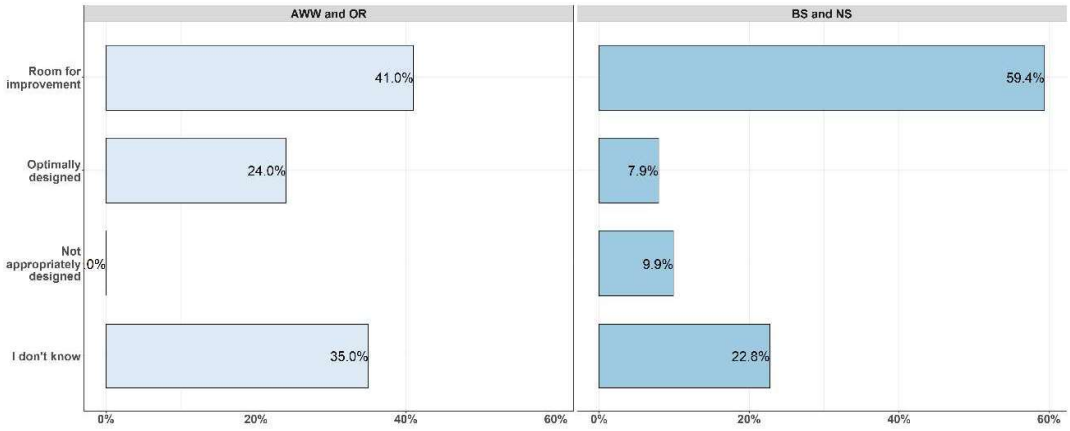


Figure 33: All areas. Percentage of responses (x-axis) and answer options (y-axis) to Q. 13 ("To what extent are the e-logbooks currently used by fishers appropriately designed to comply with a specific LO management measures").

In the AWW, all 17 respondents considered that logbooks were appropriately designed, while more than 24% deemed e-logbooks 'optimally designed'. However, there was still a high percentage of the respondents (41%) that thought there was still room for improvement. It is remarkable that the electronic version is considered well designed by a large part of the audience. This is likely because these tools are adapted to the LO's requirements. This is also consistent to what Member States have reported to the EC when describing the progress in the implementation of the LO.

Q.14 was an open question, aimed at gathering ideas to improve the e-logbooks (Annex 1.11 –Table A7). There were 28 responses from the stakeholders (Annex 1.11 –Table A7). Concrete suggestions on how to improve the current state of the e-logbooks are listed below.

- The addition of separate fields for the different kinds of discards. Adding in extra fields will allow for a better registration of the different types of exemptions (below minimum size (BMS), predator damage). Related to this, users need to be able to register the use of specific gear adjustments/technical modifications gears that were employed during the trip.
- Make the e-logbooks more automated (digitize where currently absent), improve its user-friendliness and operational simplicity, e.g., by automatic flagging of fields that were left blank.

Other suggestions included the coupling of the e-logbook with other types of technology/control tools, such as video, weighing scales and mechanical doors. One stakeholder noted that logbooks should be made mandatory for all vessels to ensure an equal playing field, irrespective of vessel length. Stakeholders also suggested that providing more guidance on how to correctly report in the logbooks would be beneficial (e.g., by built-in reminders and drop-down menu tabs to avoid typing errors).

This last suggestion links to **Q.15**, the question: 'have vessel owners, operators and markets/retail outlets been informed sufficiently over the years about changes in LO regulation, including the provisions of the discard plans, by the respective authorities?' In the BS and NS area, more than 40% of the stakeholders considered the information provided by respective authorities 'moderate', while 26 % perceived it as 'adequate'. Other stakeholders did not know the answer to the question (26%) or found the information provided to be 'not at all' sufficient (6%). In the AWW, 47% of the respondents considered that the degree of information was moderate, while almost 30% considered this as adequate. Almost a third did not know if actors were informed. This share may also include

those that are not satisfied with the degree of information. However, in general, the AWW stakeholders acknowledged the degree of information about the LO was positive.

Q.16 aimed to assess whether vessel owners and crew have been informed and trained sufficiently, over the years by authorities on how to accurately report and fill in the e-logbooks under the LO regulations (Figure 34). Many stakeholders did not know the answer to this question (32%).

In the BS and NS, around 24% of the respondents believed that the amount of information/training that vessels owners and crews received was moderate, while 16% assessed it as 'minimal'. Only few stakeholders opted for the extremes of the answer options. These were 'not at all' (3%) and 'optimally informed' (8%).

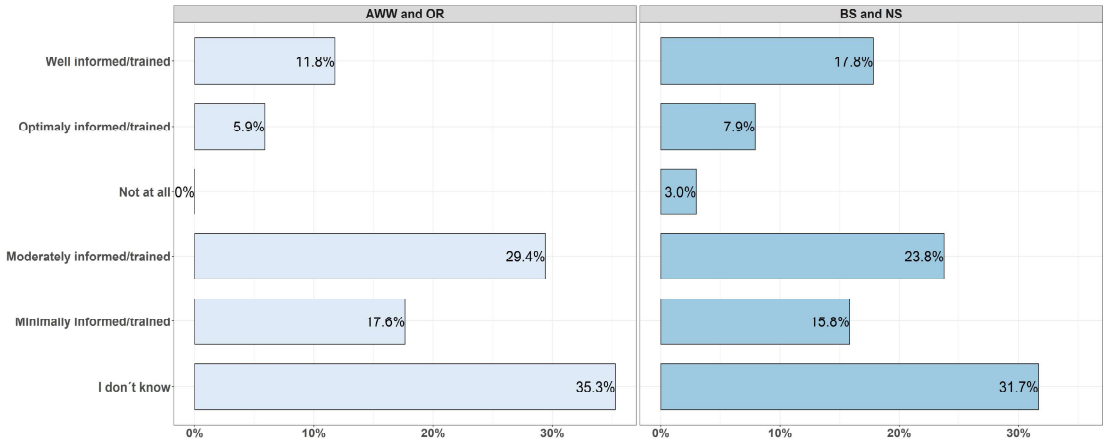


Figure 34: All areas. Percentage of responses (x-axis) and answer options (y-axis) to Q.16 ("Have vessel owners and crews been informed/trained sufficiently over the years by authorities on how to accurately report and fill in the e-logbooks under the LO regulations?").

In the AWW, 65% of the respondents considered that information was provided and notably, 30% of the respondents considered that they were moderately informed about the procedures for reporting. Around 17% considered that they were well informed and even optimally informed. However, there were people who considered that information was poor in the same proportion. Thus, there were divided opinions concerning the information available on this issue. It is worth noting that more than a third were not aware of this information process. But this may also reflect the composition of the survey's audience which comprises people that are neither engaged in management nor in the fishing activity.

To learn how vessel owners were informed of LO regulations by respective authorities, **Q.17** provided various answer choices. Again, respondents could choose multiple options. According to the majority of stakeholders, information was provided electronically (websites, newsletters, emails) (Table 10), while face-to-face activities were the second most common means of learning information. Information during the productive process seems to have been used as a communication channel less frequently by authorities. The degree of knowledge about the way these activities took place seems quite high. Other types of information that were mentioned by stakeholders (below 'other') were specific PO-related initiatives, such as guides for fishers and meetings with the industry, where the complex legal framework was translated into comprehensive content.

Table 10: All areas. Answer choices and responses provided by 40 stakeholders that answered Q.17.

Answer Choices	AWW and OR	BS and NS
Electronically: via websites, newsletters, emails	15	29
During inspections on board, on the docks or at the auctions	14	14
I don't know	2	11
Via workshops, trainings	7	10
Other (please specify)	2	5
None of the above	0	0

The consequences[14] of non-compliance were discussed in **Q.18**. In the BS and NS, infringements mostly result in sanctions (ranked first) or to penalty points, warnings and additional information provided by control officers on how to comply to the regulation (all ranked second). Next in rank was the answer 'catch or effort restrictions'.

In the AWW, warnings were deemed as the most appropriate means for authorities to address infringements by the fishing sector. Enforcement mechanisms such as catch and effort restrictions and sanctions were also considered as appropriate. Additional information was the fourth most recommended action. A broad categorisation of these consequences into: (i) warning and information; and (ii) properly called enforcement actions were granted equal importance by the respondents. Notably, a large part of the responses indicated that respondents were not aware of the consequences of non-compliance or that it was difficult for them to assume a position concerning this sensitive topic.

4.2.4 Funding and regulatory process

To obtain more information on economic means (financial resources) of Member States and the fishing industry to adapt to the LO, questions 19-21 were asked.

The majority of the stakeholders in the BS and NS areas, believed that these financial resources were available to the Member States ("economic means present", **Q.19**). However, for vessel owners, most stakeholders (43%) judged that financial means were "somewhat" present (**Q.20**). However, this funding for vessel owners was according to 25% of the stakeholders not easily accessible for vessel owners (**Q.22**, Figure 35). A part of the respondents did not know the answer to this question (20%) or selected the 'neutral' answer choice (neither disagree, nor agree, 20%).

[14] Here the term consequence is applied to comprise a wide range of actions conducted by the control authorities which range from warning and additional information and sanctions.

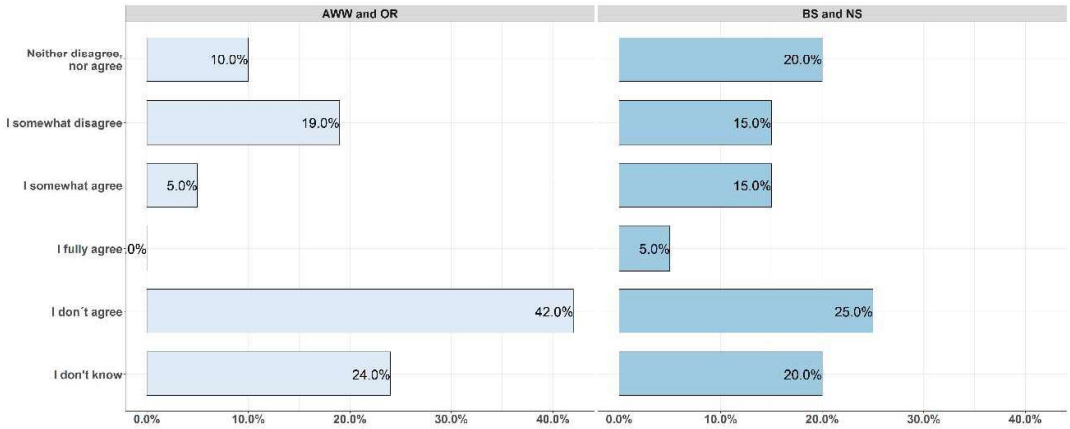


Figure 35: All areas. Results for Q.22 ("Funding for improvements on board and LO adaptions is easy to access by vessel owners").

In the AWW area, about 61% of respondents did not agree that funding was easy to access (Figure 35). Around 5% considered that it was easy to access. Around 9.5% neither agreed nor disagreed, while more than 22% were not aware of the topic. It is notable that there was a tension between the perception of the availability of funding and its accessibility. In Q.21, 14% thought that funding was sufficient, but in Q.22, only 5% viewed it as easily accessible. This seems related to administrative requirements and processes to access EU funding. Studies at the Member States level on the general implementation of the EMFF have found out that access to financing is restricted due to heavy regulatory and administrative processes (AZTI and INXENIA, 2019). A comprehensive analysis of the access mechanisms for the fishing sector to funding in the context of the LO is outside the scope of the present work.

To further investigate the responses on available financial means, we asked stakeholders if they agreed that funding for improvements on board and LO adaptions was sufficient (**Q.21**). Most respondents scored this positively, agreeing somewhat (25%) or fully (23%) with this statement. Around 18% thought funding for improvements on board (to adapt to the LO) was insufficient. Funds for certain onboard investments that are relevant for the LO are accessible via the EMFF. This fund introduced beneficial measures, including the provision of financial support to improve data collection, monitoring, and enforcement. Additionally, as Article 45 of Regulation No 508/1024[15] specifies, the EMFF should support on board improvements that aim to improve safety and working conditions. More than 30% of the stakeholders did not agree with the statement that "the regulatory process to make improvements on board and adapt to the LO (within the respondent's country) is easy to understand" (Question 23). In the AWW area, almost 81% of the respondents found these processes difficult, although to different degrees. In comparison, approximately 10% of respondents thought that this administrative process was easy to understand. Evidence at national level suggests that funding of private actions within the EMFF is subject to complex regulatory and administrative processes which are hard to deal with, particularly for small operators, hardening access to funding (AZTI and INXENIA, 2019). This could explain why a large share of stakeholders considered that the regulatory process is not easy to understand (**Q.23**, Figure 36).

[15] REGULATION (EU) No 508/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCILof 15 May 2014on the European Maritime and Fisheries Fund

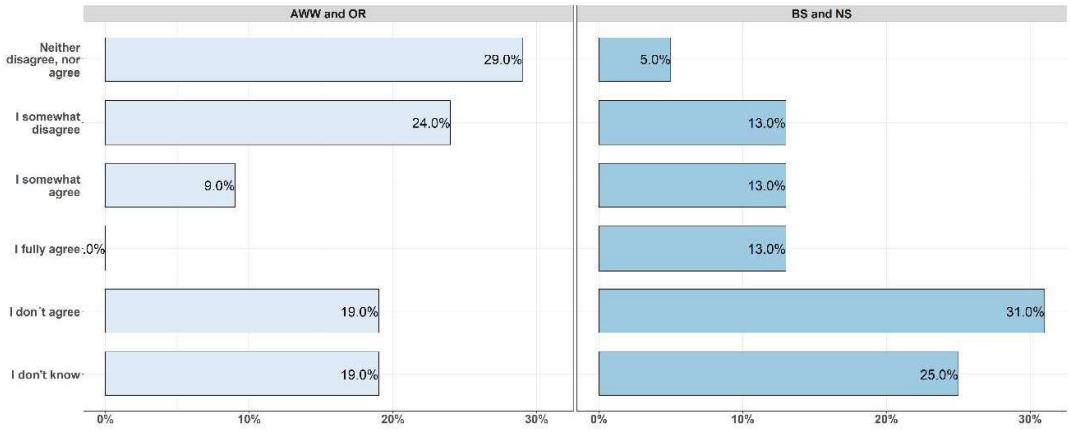


Figure 36: All areas. Answer choices (y-axis) and % responses (x-axis) provided by stakeholders who answered Q. 23: "The regulatory process to make improvements on board and adapt to the LO is easy within your country to understand".

Concerning economic means at the disposition of the AWW Member States, 43% of respondents thought that these resources were present (Figure 37). It is noteworthy that out of those replying positively, around 26% considered that economic means were very much present for addressing the LO challenge. By contrast, around 17% of the respondents considered that no sufficient economic means were present. 39% of the respondents were not aware of the availability of these resources.

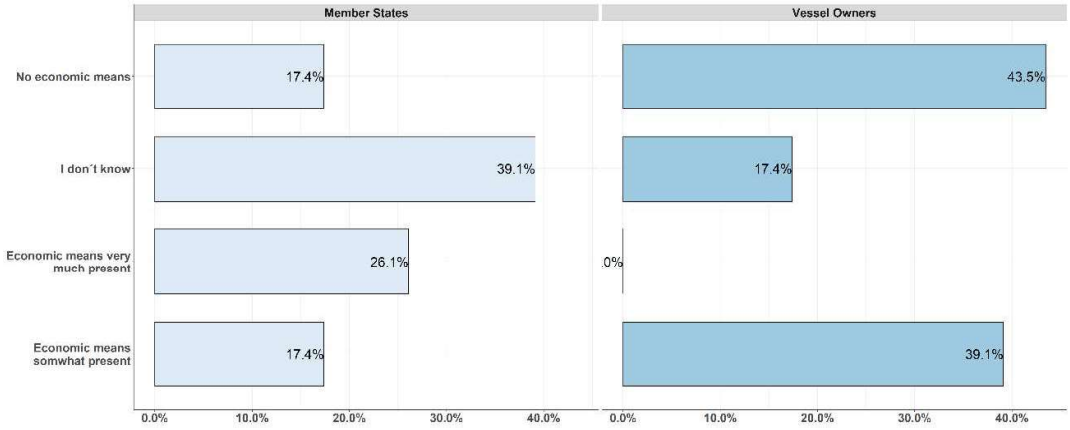


Figure 37: AWW. Member States (left panel) and vessel owners (right panel) have the economic means (i.e., financial resources) to adapt to the LO? Percentage of responses (x-axis) and answer options (y-axis). Responses provided by 23 respondents.

Q.20 asked about the economic means of fishing operators to address the LO implementation. More than 43% of the respondents considered that vessel owners did not have the economic means to address this process. Around 39% replied that these means were somewhat present. None of the participants considered that these means were very present. 17% of respondents decided to ignore this topic (Figure 37). It appears that the majority of respondents thought that fishing operators were not economically able to carry out this process with their own resources.

Q.21 asked about the sufficiency of funding for improvements on board and adaptation to the LO process (Figure 38). More than 54% of the respondents considered that funding was insufficient to different degrees. By contrast, around 14% agreed that this was sufficient. Nearly 23% of respondents did not know about this factor. In general, stakeholders seem to consider funding insufficient. Funding is available under the EMFF

umbrella for improvements on board and gear selectivity. The lack of knowledge about this topic may reflect that the audience encompasses actors who are less acquainted with the day-to-day problems of the fishing activity.

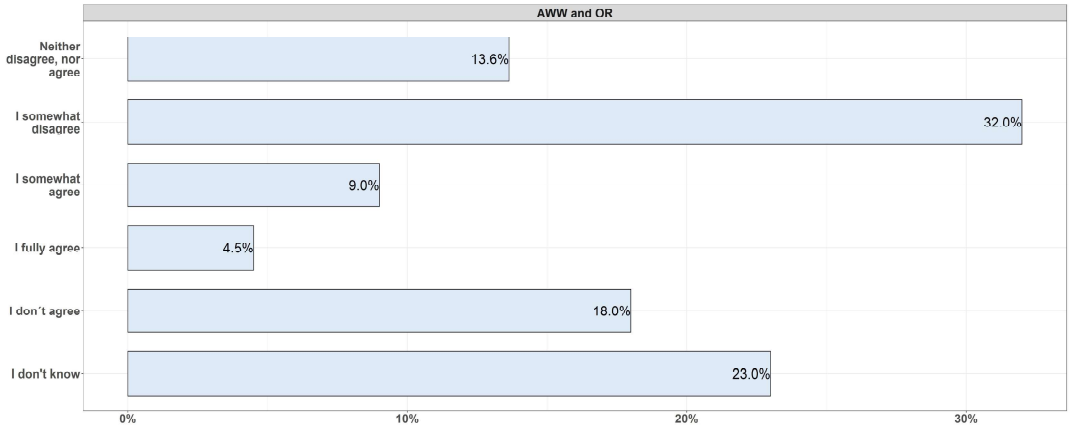


Figure 38: AWW. Percentage of responses (x-axis) and answer options (y-axis). Funding for improvements on board and LO adaptions is sufficient? Responses provided by 22 respondents.

4.2.5 Tools to improve control and enforcement

In the BS and NS, REM tools incorporating CCTV, cameras and sensors, were perceived as appropriate tools for control by most stakeholders (**Q.24**, "I fully agree", 44%). 27% of the stakeholders (26% of which were stakeholders from the fishing industry) did not agree with this statement (Figure 39).

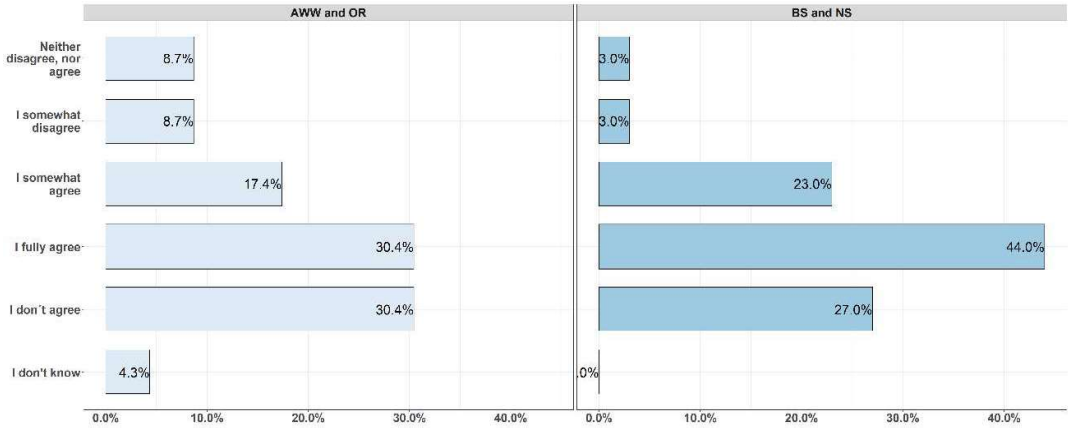


Figure 39: All areas. Percentage of responses (x-axis) and answer options (y-axis) to Q. 24: "Do you REM tools CCTV cameras and sensors (possibly supplemented by artificial intelligence analysis), are appropriate for control?".

In the AWW, most respondents also believed that REM would be effective as a control measure of the LO (**Q. 25**, "I fully agree" = 44%). These were mainly stakeholders belonging to NGOs (21%) and EU institutions (10%), and to a minor extent industry, science/academia and governments. 26% of the stakeholders, all belonging to the fishing industry, did not think REM would be effective to ensure control and enforcement of the

LO at sea (Figure 40). 50% of the stakeholders did not believe that REM should be applied on a risk basis[16] as opposed to 35% who does (**Q. 26**).

The people who selected "yes" could elaborate on how non-equipped REM vessels could be controlled at sea (see Annex 1.11 – Table A6). The majority of the stakeholders proposed controlling non-equipped REM vessels with traditional control measures (e.g., inspections at sea and last-haul analysis). The final question of this section asked respondents "how can CCTV for control purposes onboard be made acceptable for vessel owners and operators?" (**Q. 27***).* The written answers to this open question are presented in Table A7 (Annex 1.11). Respondents provided various options on how CCTV could be made acceptable. Responses included the implementation of CCTV systems on a risk basis (e.g., checking 10% of the recordings), the EU funding covering costs of installation/maintenance of the CCTV systems, giving ownership of the data to the fishing industry (e.g., certification schemes), providing benefits (e.g., quota uplift, free choice of gear) and exemptions to the LO for those who voluntary participate.

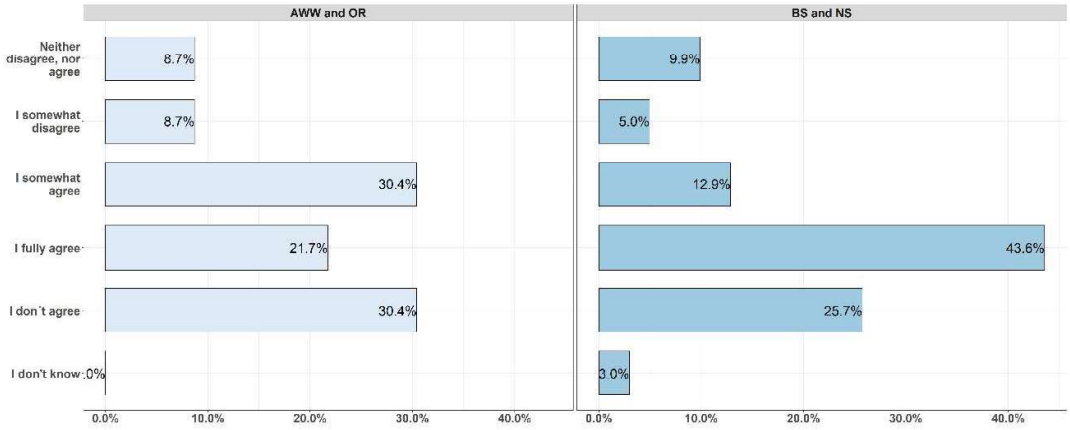


Figure 40: All areas. Percentage of responses (x-axis) and answer options (y-axis) to Q. 25: "Do you think the introduction of REM would be an effective control measure to enable countries to ensure control and enforcement of the LO at sea?".

The same set of questions were presented to the AWW as for BS and NS areas about tools to improve control and enforcement. Almost 48% of the AWW area respondents considered that these tools are appropriate for control, with more than 30% of respondents fully agreeing with this statement. By contrast, almost 40% of the respondents did not agree with this statement. It seems that positions towards this topic are polarised with few people maintaining a neutral position. Noteworthy that this control option is relatively familiar to the audience.

In **Q.25**, more than 50% of the participants replied that REM technologies would be effective tools for countries to ensure control and enforcement (Figure 40). Patterns identified in **Q.24** are also observed here. Opinions are again polarised, but it is evident that the use of these technologies is perceived as effective for control by the majority of respondents.

In **Q.26**, respondents were asked about the application of REM technologies on a risk basis. They were asked to apply these exclusively to the segments of the fleet that bear most of the risk of non-compliance (Figure 41). More than 45% of the respondents in the AWW area considered this as a viable option. Still, a high proportion were not in favour of

[16] Selection of vessel data and video footage to be reviewed based on non-compliance risk-analysis of the vessels/trips/fishing operations.

this idea. Many respondents were not aware of this topic. Those who selected 'yes' were requested to elaborate on how non-equipped REM vessels could be controlled at sea. There was only one response to this question (see Annex 1.11, Table A12).

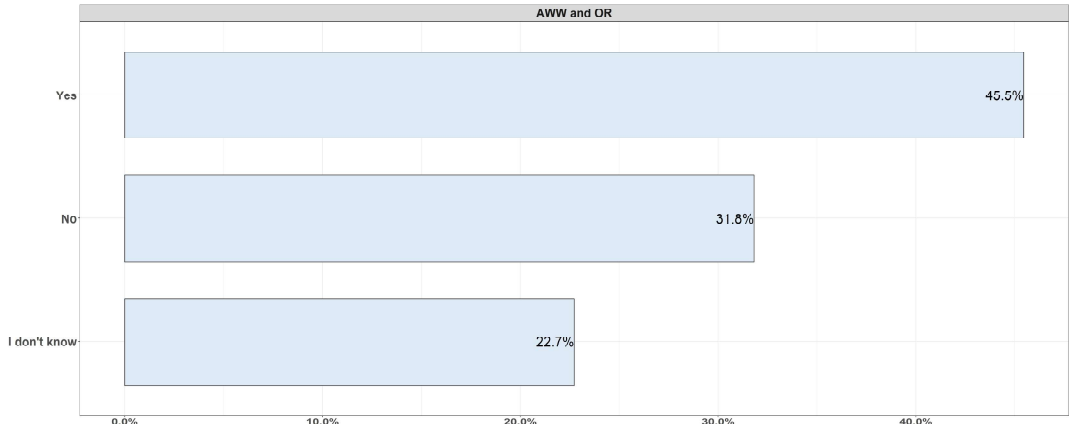


Figure 41:AWW. Percentage of responses (x-axis) and answer options (y-axis) to Q. 26: Should REM technologies be applied on a risk basis? Responses provided by 22 respondents.

The final question of this section asked respondents how onboard CCTV, intended for control, could be made acceptable for vessel owners and operators. **(Q.27).** The written answers to this open question are presented in Table A13 (Annex 1.11).

4.2.6 Oral interview results

While the focus of the interview guide was mainly on LO management measures, there were a couple of questions that touched on control issues and compliance. These questions and their respective summaries are listed in Table A8 (Annex 1.11). Respondents of both areas confirmed the findings presented above that LO exemptions are mainly being monitored by traditional means, namely by control officers that check logbook entries at sea and ports. Some stakeholders of the BS and NS indicated that they have knowledge of LH inspections occurring, but only to a limited extent. It was observed by certain stakeholders that LH inspections cannot always provide the 'true picture' as every haul is different. New technologies, such as REM with CCTV, lead to dividing positions amongst stakeholders (Table A9, Annex 1.11). Finally, it was noted by various respondents that fishers are experiencing difficulties with the administrative burden and complexity of the current LO regulation, resulting in continued discarding and misreporting of catch fractions. The main problem behind this seems to be the fact that the majority of the fishing industry does not agree with the rationale behind the LO (i.e., the fact that undersized fish cannot be thrown back into the sea and have to be landed)

4.3 Conclusions

As one of the cornerstones of the 2013 reform of the CFP, the LO emerged as a paramount challenge for the EU, Member States, and the fishing sector. The implementation of the LO encompasses a complex regulatory framework which attempts to address the needs of the regulation itself, while diminishing social and economic concerns derived from the implementation. Flexibilities and exemptions are provided to smoothen the implementation and the regulatory framework is subject to permanent revision in terms of the Multi Annual Plans (MAPs) and discard plans. Compliance with the rules is essential for LO success, but as the evidence indicates this is not always possible due to reasons such as economic viability, legal insecurity, required investments, lengthy development of technical solutions and the inability to exert a comprehensive control of such a large and diverse fishing fleet.

Currently, traditional methods of monitoring, which include dockside and fish market checking; the use of aircrafts (including drones) to fly over fishing vessels; patrol vessels to carry out inspections at sea; vessel monitoring systems (VMS) using satellite positional data to plot the speed and location of vessels; observers on board vessels to record catches and other scientific data; and self-reported data (E-log, paper logbooks, sale notes, landing declarations), can meet this need only to a limited extent.

One of the shortcomings of onboard inspections is that these only provide a snapshot of compliance at the time of monitoring. As these control measures only have a deterrent effect and do not allow for detecting illegal discarding, e.g. as it would never happen during sea inspections, the measures are not considered effective by most of the stakeholders within the current LO scheme. A shift from traditional methods to other technologies like REM will be required to exert continuous monitoring and control. In the EU, the use of REM techniques for monitoring and control purposes has been trialled by various member states but has not been rolled out on a large scale. The limited number of European studies addressing the issue of REM implementation have divided opinions concerning the cost of installing, maintaining, and analysing the data coming from these devices, and their legal and social implications.

Member States authorities are continuously installing new and diverse measures to facilitate LO implementation. Examples include improving the selectivity of the fishing gear under support of EMFF funding, the adaptation of the e-logbooks to the needs of the LO, and the implementation of quota regimes that may better fit the diverse features of the LO intended to avoid choke situations, amongst others.

In addition to a desktop study, the present study approached around 150 stakeholders operating in the NS, BS, and AWW to learn about the practical implementation of the LO and of the reasons underpinning compliance/non-compliance with the LO. The general response to the online survey and to the questions themselves was relatively high. Additionally, the survey succeeded in obtaining sufficient responses from the different stakeholders involved (industry, NGO, ministries, and science).

Most of the respondents indicated that certain levels of non-compliance are occurring. There are multiple reasons for this. Three of the most important reasons for discarding is the obligation to land, store and record unwanted catches. In turn, the complex legislation, consisting in numerous Delegated Regulations, and the associated administrative process, lead to legal insecurity and non-compliance as well. The fear to conduct uncomprehensive reporting and be penalised for the use of logbooks not yet fully adapted to the LO are factors that may underpin underreporting. The lack of effective control at sea and the inadequacy of current control tools also appeared as reasons for non-compliance. The fact that the LO is not seen as legitimate and hence not accepted within the fishing industry is also a substantial negative issue. The high amount of extra work to be done on board because of the LO arise also as a reason for non-compliance.

According to stakeholders, traditional control measures such as inspections at sea and at port and means to facilitate monitoring such as traditional logbooks were regarded as ineffective in the current LO scenario. They seem not suitable to the new exigencies of the LO scheme. Notably, e-logbooks were perceived as effective tools to facilitate the implementation of the LO, although respondents considered that improvements on these technologies are still a work in progress and there is much to do, e.g., to modify the logbooks to the reporting needs of the LO, clearly distinguishing between the diverse exemptions. Participation of the sector in further development of the tools will be essential.

Concerning information/training received, respondents evaluated positively the amount of information and the means employed to inform about the features of the LO to fishing

operators. There have been various regional workshops for national inspectors, as well as national initiatives, to provide information on LO compliance and enforcement.

There were divided opinions about the appropriate consequences of non-compliance for operators in the case infringements are detected. Sanctions and penalisation in one hand, and warnings and information in the other, are almost equally regarded as appropriate means for authorities to react to non-compliance.

In general, stakeholders considered that sufficient EMFF funding for vessel owners is in place for countries to adapt to the LO. In contrast, funding available for fishing operators is regarded as insufficient. The difficulty with the availability of funding for operators might be accessibility to these funds rather than the availability *per se*, as it was expressed by respondents when asked about the regulatory framework to make improvements onboard.

A large share of the audience (45%) considered that REM tools, incorporating CCTV and sensors, as the best means to ensure control. Others considered that the use of REM technologies can contribute to the long-term sustainability of the resources, whilst ensuring level playing amongst the fleets. Nonetheless, a large part of the stakeholders did not find this technology effective and rose many concerns regarding crew's privacy, companies' know-how, and costs of the system that should not be borne by the vessel owners, as can be observed from the open answers gathered in the survey. For some other actors REM should be applied only on a risk basis.

5 GENERAL CONCLUSIONS

The main objective of this study is to **assess and evaluate the implementation of the LO for fisheries of Member States for the Baltic Sea, North Sea and Atlantic Western Waters including the Outermost Regions**. It was, therefore, necessary to create a complete overview of implemented LO fisheries management measures by region and member state and include the initiatives undertaken to facilitate the implementation of the LO, such as development of monitoring technologies, catch avoidance strategies and quota regulation procedures.

While the list of fisheries and stocks covered by the LO implementation was rather straight forward to produce, **getting an overview of the long list of exemptions is complex, in both the AWW and NS areas.** Additionally, nine different voluntary actions trialled or implemented by the EU Member States to facilitate the LO were identified, with the **general agreement among respondents that spatial and temporal avoidance measures and gear modifications were the most effective in reducing unwanted catches**, whereas there **was little agreement on the effectiveness of removing TACs and area closures**.

When aiming to mitigate **potential losses in fishing opportunities due to choke** considerations, **adaption of national quota management** to better fit LO challenges and **quota swaps** between Member States and high survivability exemptions were the preferred options.

Several EU Member States had voluntary actions related to selective gear development and trials, but **the process to approve and use the developed gear was considered to delay the realisation of the benefits** of these actions.

To quantify and measure the success of the LO, a more analytical approach was required, therefore, tools and methods for cleaning, filtering and displaying discard information in the STECF-FDI database were developed. It is concluded that **there is a lack of evidence of changes in discarding practice in the fisheries and that discarding is still taking place outside of the LO restrictions**. This was also highlighted by the stakeholders interviewed. The main reasons identified by them for this were**, the complex legislation, numerous Commission Delegated Regulations and the substantial amount of work to be done on board** because of the LO. It was also identified how **improved logbooks and training could contribute to alleviating this problem**.

It is further concluded that **no apparent correlation is found between the number of species with discard rates that are increasing, decreasing and stable and the availability of derogations**.

This study highlights the **importance of maintaining scientific sampling programmes to understand changes in discard rates**. It is recommended that the data dissemination app developed in this study should be maintained so that further years of data on discard estimates can be incorporated and the app can be used as a quantitative assessment tool to measure success of the LO.

As the third objective of the study, to understand how developments on exemptions, control measures, technologies, inspections and documentation schemes have responded to the new challenges during the implementation, the LO input were gathered through consultation with authorities and stakeholders.

The main traditional control measures used in EU waters are **at-sea inspections (patrol vessel surveillance inspections) and dockside/auction inspections of the landings/e-logbooks**. A common critique concerning these conventional measures is the

shortcoming of **at-sea inspections, with these only providing a snapshot of compliance at the time of monitoring**.

The main risks and challenges associated with the LO are to ensure control of discarding at sea, to ensure the detailed and accurate documentation of all fishing trips and to ensure that the conditions and thresholds associated with high survivability and de minimis exemptions are enforced. **Failure to ensure control and enforcement of the LO will not only risk the failure of this core element of the CFP but may lead to significant overfishing.** Although, in the species with exemption TAC deductions (top-downs) take place the overall balance is that generous TAC top-ups (TACs increase) were allocated during the transition phase, increasing the chances of this overfishing to occur (Borges, 2021) .

The LO encompasses a series of management measures that have diverse degrees of effectiveness. The **general perception of the LO management measures was positive according to stakeholders. Removal of TAC, new selective gears, avoidance and area closures, were perceived as somewhat/highly effective for avoiding unwanted catches.** It was also found differences among the areas of the study. **Stakeholders from the BS and NS areas were most in favour of changes in quota systems and quota swaps and least in favour of area closures while in the AWW area**, **stakeholders considered** legal measures based on granting more flexibilities to fishing operations like **exemptions and diverse flexibilities based on the TAC and quota systems as more effective for reducing discards**.

Respondents indicated that the removal of TACs would be based on a desire to avoid choke species problems rather than that the TAC of a given stock was not necessary to obtain Maximum Sustainable Yield (MSY) of the stock in mixed fisheries. As a result, **removing TACs was thought to be un-precautionary**, as it could go against the sustainable management of the stocks.

Traditional control measures, such as **inspections at-sea and in-port and traditional logbooks are regarded as ineffective in the current LO scenario.** They are considered unsuitable for the new exigencies of the LO scheme. Notably, **e-logbooks were perceived as effective tools for control**.

In terms of the consequences of non-compliance for operators in the case infringements are detected, **sanctions, penalisation on one hand and warnings and information on the other are almost equally regarded as appropriate means for authorities to react to non-compliance.**

Within the context of adaptability to the LO, **stakeholders in the BS and NS areas described that sufficient funding for vessel owners was in place for Member States to support their national fisheries**. The main difficulty with funding was accessibility rather than availability. By contrast, **the funding available for fishing operators seems insufficient according to stakeholders from the AWW area**.

REM devices were perceived as effective for control and could contribute to the long-term sustainability of the resources, whilst ensuring a level playing field amongst the fleets. By contrast, **privacy concerns among the crews** were raised in the e-workshops and in the responses to the questionnaire from the AWW area (23% of the respondents commented on that), including that know-how by the skippers and crews would be exposed. Furthermore, high costs associated with the investment in the device and the installation and maintenance of it, would emerge, which should not be paid by the vessel owners. **Others thought REM should be applied only on a risk basis**, for vessels with higher risk of non-compliance.

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7 LIST OF ANNEXES

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[17] This annex is not available due to limitations of the format of the report and is not made public

ANNEX 1.1 OVERVIEW OF THE EXEMPTIONS

Table A1 Pelagic fisheries

Species	Gear Class	Period of exemption	Delegated Act	Gear code	ICES area
High survivability					
Mackerel (*Scomber scombrus*)	Purse Seine	2015-2020	EU2014_1395 EU2014_1393 EU2018_0189 EU2018_0190	PS	3a, 4, 5b, 6, 7
		2019-2020	EU2018_0190	GND	7e-f
Herring (*Clupea harengus*)		2015-2020	EU2014_1395 EU2014_1393 EU2018_0189 EU2018_0190	PS	3a, 4, 5b, 6, 7
		2019-2020	EU2018_0190	GND	7e-f
De minimis					
Mackerel (*Scomber scombrus*)	Pelagic trawl	2015-2019	EU2014_1395 EU2014_1393 EU2018_0189 EU2018_0190	OTM	4b, 4c, 7d
		2020	EU2018_0189 EU2018_0190	OTM	4b, 4c, 6
Horse mackerel (*Trachurus ssp*.)		2015-2019	EU2014_1395 EU2014_1393 EU2018_0189 EU2018_0190	OTM	4b, 4c, 7d
		2020	EU2018_0189 EU2018_0190	OTM	4b, 4c, 6
Herring (*Clupea harengus*)		2015-2019	EU2014_1395 EU2014_1393 EU2018_0189 EU2018_0190	OTM	4b, 4c, 7d 4b, 4d, 7d
		2020	EU2018_0189 EU2018_0190	OTM	4b, 4c, 6, 7
Blue whiting (*Micromesistius poutassou*)		2015-2020	EU2014_1395 EU2018_0189	OTM	3a, 4
		2015-2017 2018-2020	EU2014_1393 EU2018_0190	PTM	7 5b, 6, 7
Albacore tuna (*Thunnus alalunga*)		2015-2017 2018-2020	EU2014_1393 EU2018_0190	OTM PTM	7

Boarfish (*Capros aper*)		2015-2016	EU2014_1393	OTM	6, 7
Whiting (*Merlangius Merlangus*)		2015-2020	EU2014_1395 EU2018_0189	OTM PTM	4
		2018-2019	EU2018_0190	OTM	7d
		2019 2020 2021	EU2018_0190 EU2018_2034 EU2019_2239	OTM PTM	6, 7, 7b-k
High survivability					
Anchovy (Engraulis encrasicolus), mackerel (Scomber scombrus), jack mackerel and horse mackerel (Trachurus spp.)	Purse seine	2015_2020	EU2014/1394	PS	8, 9, 10, CECAF 34.1.1., 34.1.2. and 34.2
			EU2018/0188		
Herring (Clupea harengus)		2015_2020	EU2014/1393	PS	5b, 6, 7
			EU2018/0190		
Mackerel (Scomber scombrus)		2015_2017	EU2014/1393	PS	5b, 6, 7
		2018_2020	EU2018/0190	PS	5b, 6, 7
Herring (Clupea harengus)	Gillnet	2019_2020	EU2018/0190	GND	7e-f
Mackerel (Scomber scombrus)		2019_2020	EU2018/0190	GND	7e-f
De minimis					
Anchovy (Engraulis encrasicolus)	Purse seine	2015-2017	EU2014/1394	PS, OTM	8, 9, 10, CECAF 34.1.1., 34.1.1. and 34.2
Mackerel (Scomber scombrus) and horse mackerel (Trachurus spp.)		2015-2020	EU2014/1394 EU2018/0188	PS	8, 9, 10, CECAF 34.1.1., 34.1.1. and 34.2
Albacore tuna (Thunnus alalunga)	Pelagic trawl	2015-2020	EU2014/1393 EU2014/1394 EU2018/0190 EU2018/0188	PTM	7, 8
Anchovy (Engraulis encrasicolus), mackerel (Scomber scombrus) and horse mackerel (Trachurus spp.)		2018-2020	EU2018/0188	OTM	8

Blue whiting (Micromesistius poutassou)		2015-2017	EU2014/1393 EU2014/1394 EU2018/0190 EU2018/0188	OTM, PTM	5b, 6, 7, 8
Boarfish (Capros aper)		2015-2016	EU2014/1393	OTM	6, 7
Mackerel (Scomber scombrus), horse mackerel (Trachurus ssp.) and herring (Clupea harengus)		2015-2016	EU2014/1393	OTM	7d
		2018-2020	EU2018/0190	OTM	6, 7d
Whiting (Merlangius merlangus)		2019-2021	EU2018/2034 EU2019/2239	OTM, PTM	7b-7k
Anchovy (Engraulis encrasicolus)	Bottom trawling	2019-2020	EU2018/2033 EU2019/2239	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV	8, 9
Blue whiting (Micromesistius poutassou)		2018-2020	EU2018/0044	OTT, OTB, PTB, OT, PT, TBN, TBS, TX, SSC, SPR, TB, SDN, SX, SV	8c, 9a
Boarfish (Capros aper)		2019-2020	EU2018/2033 EU2019/2239	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR,	7b-c, 7f-k, 8, 9

				SDN, SX, SV	
Mackerel (Scomber scombrus)		2019-2020	EU2018/2034 EU2018/2033 EU2019/2239	OTB, OTT, OT, PTB, PT, SSC, SDN SPR, SX, SV, TBB, TBN, TBS, TB, TX	6, 7b-7k, 8, 9
Whiting (Merlangius merlangus)		2016-2021	EU2015/2438 EU2018/2034 EU2018/0046 EU2018/2033 EU2019/2239	OTB, OTT, OT, PTB, PT, SSC, SDN, SPR, SX, SV, TBN, TBS, TB, TX, BT2	7b-7k, 8, 9
Horse mackerel (Trachurus spp.)		2019-2020	EU2018/2034 EU2019/2239 EU2018/2033	OTB, OTT, OT, PTB, PT, SSC, SDN SPR, SX, SV, TBB, TBN, TBS, TB, TX	6, 7b-7k, 8, 9
	Nets	2019-2020	EU2018/2033	GNS, GND, GNC, GTR, GTN	8, 9, 10, CECAF 34.1.1., 34.1.2. and 34.2

Mackerel (Scomber scombrus)	Nets	2019	EU2018/2033	GNS, GND, GNC, GTR, GTN	8, 9, 10, CECAF 34.1.1., 34.1.2. and 34.2
		2020	EU2019/2239	GNS, GND, GNC, GTR, GTN	8, 9, 10, CECAF 34.1.1., 34.1.2. and 34.2
Whiting (Merlangius merlangus)	Nets	2019	EU2018/2033	GNS, GND, GNC, GTR, GTN	8, 9
		2020	EU2019/2239	GNS, GND, GNC, GTR, GTN	8, 9

Table A2. Demersal fisheries

Species	Gear Class	Period of exemption	Delegated Act	Gear code	ICES area
High survivability					
Norway lobster (*Nephrops norvegicus*)		2016-2018	EU2015_2440 EU2016_2250 EU2018_0045	FPO	3a, 4
		2019-2021	EU2018_2035 EU2019_2238	FPO, FYK	2a, 3a, 4
		2020-2021	EU2018_2035	OTB, OTT, TBN	2a, 3a, 4
		2016-2019	EU2015_2440 EU2016_2250 EU2018_0045 EU2018_2035	OTB, TBN	3ª
		2018-2019	EU2018_0045 EU2018_2035	OTB, TBN	4
		2019	EU2018_2035	OTB, TBN	2ª
Cod (*Gadus morhua*)		2015-2021	EU2014_1396 EU2018_0306	FPO, FYK, FPN	3b,3c,3d

		2018-2021	EU2018_0045 EU2018_2035 EU2019_2238	FPO, FYK	3a, 4
Common Sole (*Solea solea*)		2016	EU2015_2440 EU2018_0190	OTB, TBN	3ª
		2017-2021 2018-2021	EU2018_0045 EU2018_2035 EU2019_2238	FPO,FYK	3ª, 4
		2017-2021	EU2016_2250 EU2018_0045 EU2018_2035 EU2019_2238	OTB	4c
Haddock (*Melanogrammus aeglefinus*)		2018-2021	EU2018_0045 EU2018_2035 EU2019_2238	FPO,FYK	3a, 4
Hake (*Merluccius merluccius*)		2018-2021	EU2018_0045 EU2018_2035 EU2019_2238	FPO,FYK	3a, 4
North Deepwater Prawn (*Pandalus borealis*)		2019-2021	EU2018_2035 EU2019_2238	FPO,FYK	3a, 4
Plaice (*Pleuronectes platessa*)		2018-2020	EU2018_0306	FPO, FYK, FPN	3b,3c,3d

		2018-2021	EU2018_0045 EU2018_2035 EU2019_2238	FPO,FYK	3a, 4
		2019-2021	EU2018_2035 EU2019_2238	BT2	2a, 4
			EU2018_2035 EU2019_2238	GNS, GTR, GTN, GEN, OTB, PTB, SDN	3a, 4
Saithe (*Pollachius virens*)		2018-2021	EU2018_0045 EU2018_2035 EU2019_2238	FPO,FYK	3a, 4
Salmon (*Salmo salar*)		2015-2020	EU2014_1396 EU2018_0211	FPO, FYK, FPN	3b,3c,3d
Skates and rays		2019-2021	EU2018_2035 EU2019_2238	All	2a, 3a, 4
Turbot (*Scophtalmus maximus*)		2020-2021 2020	EU2019_2238 EU2019_2238	FPO, FYK TBB	3a, 4 4
Whiting (*Merlangius merlangus*)		2018-2021	EU2018_0045 EU2018_2035 EU2019_2238	FPO, FYK	3a, 4 4

De minimis					
Norway lobster (*Nephrops norvegicus*)		2016-2018	EU2015_2440 EU2016_2550 EU2018_0045	OTB, TBN, OTT, TB	2a, 4
		2019-2021	EU2018_2035 EU2019_2238	TBN, TB	4b, 4c
Cod (*Gadus morhua*)		2018-2019	EU2018_0045	OTB, TBN	3ª
		2018-2021	EU2018_0045 EU2018_2035 EU2019_2238	OTB, OTT, SDN, SSC	4c (4 in 2019)
		2020-2021	EU2018_2035 EU2019_2238	OTB, OTT, TBN	3ª
		2020-2021	EU2019_2238	TBN, TB	4b, 4c
Common Sole (*Solea solea*)		2016-2021	EU2015_2440 EU2016_2550 EU2018_0045 EU2019_2338	GN, GNS, GND, GNC, GTN, GTR, GEN, GNF	2a, 3a, 4
				OTB, TBN, OTT(2	

		2016-2021	EU2015_2440 EU2016_2550 EU2018_0045 EU2019_2338	020-2021) TBB	3ª
		2016-2021	EU2015_2440 EU2016_2550 EU2018_0045 EU2018_2035 EU2019_2338	TBN	4
		2019-2021	EU2018_2035 EU2019_2338	TB	4b, 4c
		2020-2021	EU2019_2338		4b, 4c
Haddock (*Melanogrammus aeglefinus*)		2016	EU2015_2440	TBN	3a
		2016-2021	EU2015_2440 EU2016_2550 EU2018_0045 EU2018_2035 EU2019_2338 EU2016_2550	OTB	3a

		2017-2021	EU2018_0045 EU2018_2035 EU2019_2338	OTT	3a
			EU2018_2035		
		2019	EU2019_2338	TBB	4b, 4c
		2020-2021		TBN, TB	3a, 4b, 4c
Hake (*Merluccius merluccius*)		2019-2021	EU2018_2035 EU2019_2338	OTB, TBN	3a, 4b, 4c
		2020-2021	EU2019_2338	OTT	3a
		2019	EU2018_2035	TBB	4b, 4c
		2020-2021	EU2019_2338	TB	4b, 4c
Horse mackerel (*Trachurus* spp.)		2019-2021	EU2018_2035 EU2019_2338	OTT, PTB, TBB (TR2, BT2)	4
Ling (*Molva molva*)		2019	EU2018_2035	OTB, OTT, PTB	4

		2020-2021	EU2019_2338	LLS	
Mackerel (*Scomber scombrus*)		2019-2021	EU2018_2035 EU2019_2338	OTB, OTT, PTB, TBB (TR2, BT2)	4
North Deepwater Prawn (*Pandalus borealis*)		2019	EU2018_2035	TBN, TBB	4b, 4c
		2020-2021	EU2019_2338	TBN, TB	
Plaice (*Pleuronectes platessa*)		2018	EU2018_0045	OTB	3a, 4
		2019-2021	EU2018_2035 EU2019_2338	OTB, OTT, BT	3ª
		2019-2021	EU2018_2035 EU2019_2338	TBN, TB	4b, 4c
Saithe (*Pollachius virens*)		2018-2019	EU2018_0045 EU2018_2035	OTN, TBN	3ª
		2020-2021	EU2018_2035 EU2019_2338	OTB, OTT, TBN	3a
		2019-2021	EU2018_2035 EU2019_2338	TBN, TB	4b, 4c
Sprat (*Sprattus sprattus*), Blue whiting (*Micromesistius poutassou*), Norway Pout (*Trisopterus*		2020-2021	EU2019_2338	OTB, OTM, OTT, PTB,	3a, 4

esmarkii), Sand eel (*Ammodytes* spp.)				PTM, SDN, SPR, SSC, TB, TBN	
Whiting (*Merlangius merlangus*)		2017	EU2016_2550	FPO	3ª
		2017	EU2016_2550	OTB	3a
		2018-2021	EU2018_0045 EU2018_2035 EU2019_2338	OTB, TBN	3a
		2020-2021	EU2019_2338	OTT, PTB	3a
		2018	EU2018_0045	OTB, OTT, SDN, SSC, TBN	4c
		2019	EU2018_2035	OTB, OTT, SDN, SCC, TBN	4
		2019	EU2018_2035	TBB, TBN, TB	4b, 4c

		2019	EU2018_2035	TB	4
		2020-2021	EU2019_2338	OTB, OTT, SDN, SCC	4b, 4c
		2020	EU2019_2338	TBN	4
		2021	EU2019_2338	OTB, OTT, SDN, SCC	4b, 4c
		2021	EU2019_2338		4c

Table A3

Species	Gear Class	Period of exemption	Delegated Act	Gear code	ICES area
High survivability					
Common sole (Solea solea)	Bottom trawling	2017-2019	EU2016/2375 EU2018/0046 EU2019/2239	OTT, OTB, TBS, TBN, TB, PTB, OT, PT, TX	7d
		2020_2021		OTT, OTB, TBS, TBN, TB, PTB,	7d

				OT, PT, TX	
Norway lobster (Nephrops norvegicus)		2016-2018	EU2015/2439 EU2016/2374 EU2018/0044	OTB, OTT, PTB, TBN, TBS, TB, OT, PT and TX	8, 9
		2019	EU2018/2034	OTB, SSC, OTT, PTB, SDN, SPR, TBN, TBS, OTM, PTM, TB, SX, SV, OT, PT, TX	6a, 7
		2019	EU2018/2033	OTB, OTT, PTB, TBN, TBS, TB, OT, PT and TX	8, 9
		2020_2021	EU2019/2239	OTT, OTB, TBS, TBN, TB, PTB, OT, PT, TX	6a, 7
		2020_2021	EU2019/2239	OTB, OTT, PTB, TBN, TBS, TB,	8, 9

				OT, PT and TX	
Plaice (Pleuronectes platessa)		2019	EU2018/2034	OTT, OTB, TBS, TBN, TB, PTB, OT, PT, TX	7d-g
		2019	EU2018/2034	TBB	7
		2020	EU2019/2239	TBB	7 (7a-7k)
		2020_2021	EU2019/2239	OTT, OTB, TBS, TBN, TB, PTB, OT, PT, TX	7d-g
		2020_2021	EU2019/2239	SDN	7d
Skates and rays (Rajiformes)		2019	EU2018/2034	OTB, SSC, OTT, PTB, SDN, SPR, TBN, TBS, OTM, PTM, TB, SX, SV, OT, PT, TX	6, 7
		2019	EU2018/2033	OTB, SSC, OTT, PTB, SDN, SPR, TBN, TBS, OTM, PTM, TB, SX, SV,	8, 9

				OT, PT, TX	
		2020	EU2019/2239	OTB, SSC, OTT, PTB, SDN, SPR, TBN, TBS, OTM, PTM, TB, SX, SV, OT, PT, TX	6, 7, 8, 9
Red seabream (Pagellus bogaraveo)	Longlines	2017	EU2017/2167	LLS, DWS	9
		2019	EU2018/2033	LLS, DWS	9a
		2020_2021	EU2019/2239	LLS, DWS	9a
Plaice (Pleuronectes platessa)	Nets	2019	EU2018/2034	GTR, GTN, GEN, GN	7d-g
		2020_2021	EU2019/2239	GTR, GTN, GEN, GN	7d-g
Skates and rays (Rajiformes)	Nets	2019	EU2018/2034	GNS, GN, GND, GNC, GTN, GTR, GEN	6, 7
		2019	EU2018/2033	GNS, GN, GND, GNC, GTN, GTR, GEN	8, 9
		2020	EU2019/2239	GNS, GN, GND, GNC,	6, 7, 8, 9

				GTN, GTR, GEN	
Norway lobster (Nephrops norvegicus)	Traps	2016	EU2015/2438	FPO, FIX, FYK	6, 7
		2017	EU2016/2375	FPO, FIX, FYK	6, 7
		2018	EU2018/0046	FPO, FIX, FYK	6, 7
		2019	EU2018/2034	FPO, FIX, FYK	6, 7
		2020_2021	EU2019/2239	FPO, FIX, FYK	6, 7
De minimis					
Cod (Gadus morhua)	Bottom trawling	2019	EU2018/2034	OTB, OTT, OT, PTB, PT, SSC, SDN SPR, SX, SV, TBB, TBN, TBS, TB, TX	7b-c, 7e-k
Common Sole (Solea solea)		2016-2018	EU2015/2438 EU2016/2375 EU2018/0046 EU2018/2034	TBB	7d-g
		2016	EU2015/2439 EU2016/2374	OTB, OTT, PTB, TBN, TBS, TB, OT, PT, TX and TBB	8a, 8b
		2019		TBB	7d-h

		2019	EU2018/2033	OTB, OTT, PTB, TBN, TBS, TB, OT, PT, TX and TBB	8a, 8b
		2020_2021	EU2019/2239	TBB	7a, 7d-h
		2020_2021	EU2019/2239	OTB, OTT, PTB, TBN, TBS, TB, OT, PT, TX and TBB	8a, 8b
Great forkbeard (Phycis blennoides)		2019	EU2018/2033	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV	9a
Greater silver smelt (Argentina silus)		2020	EU2019/2239	OTT, OTB, TBS, TBN, TB, PTB, OT, PT, TX	5b, 6
Haddock (Melanogrammus aeglefinus)		2019	EU2018/2034	OTB, OTT, OT, PTB, PT, SSC, SDN SPR, SX,	7b-c, 7e-k

				SV, TBB, TBN, TBS, TB, TX	
		2020	EU2019/2239	OTB, OTT, OT, PTB, PT, SSC, SDN SPR, SX, SV, TBB, TBN, TBS, TB, TX	6a, 7b-c, 7e-k
Hake (Merluccius merluccius)		2016-2020	EU2015/2439 EU2016/2374 EU2018/0044 EU2018/2033 EU2019/2239	OTT, OTB, PTB, OT, PT, TBN, TBS, TX, SSC, SPR, TB, SDN, SX and SV	8, 9
Megrim (Lepidorhombus spp.)		2020	EU2019/2239 EU2018/2033	OTT, OTB, TBS, TBN, TB, PTB, OT, PT, TX, BT2	7, 8, 9
Norway lobster (Nephrops norvegicus)		2016-2018	EU2015/2438 EU2016/2375 EU2018/0046	OTB, OTT, OT, PTB, PT, SSC, SDN,	6a, 7

				SPR, SX, SV, TBN, TBS, TB, TX	
Plaice (Pleuronectes platessa)		2019-2020	EU2018/2033	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV	8, 9
Pollack (Pollachius pollachius)		2019	EU2018/2033	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV	8, 9
		2020	EU2019/2239	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV	8, 9
Red seabream (Pagellus bogaraveo)		2019	EU2018/2033	OTB, OTT, PTB, TBN, TBS, TBB,	9a

				OT, PT, TX, SSC, SPR, SDN, SX, SV	
Sole (Solea spp.)		2019	EU2018/2033	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV	9a
Alfonsinos (Beryx spp.)	Longlines	2019	EU2018/2033	LHP, LHM, LLS, LLD	10
		2020_2021	EU2019/2239	LHP, LHM, LLS, LLD	10
Great forkbeard (Phycis blennoides)		2019	EU2018/2033	LHP, LHM, LLS, LLD	10
		2020_2021	EU2019/2239	LHP, LHM, LLS, LLD	10
Anglerfish (Lophiidae)	Nets	2018	EU2018/0044	GNS, GN, GND, GNC, GTN, GTR and GEN	8a, 8b-e, 9a
		2019	EU2018/2033	GNS, GND, GNC, GTR, GTN	8, 9
		2020	EU2019/2239	GNS, GND,	8, 9

				GNC, GTR, GTN	
Common Sole (Solea solea)		2016-2021	EU2015/2439 EU2018/0046 EU2018/2034 EU2018/2033 EU2015/2438 EU2019/2239	GN, GNS, GND, GNC, GTN, GTR, GEN, GNF	7d-h, 8a, 8b
Megrim (Lepidorhombus spp.)		2019-2020	EU2018/2033 EU2019/2239	GNS, GND, GNC, GTR, GTN	8, 9
Plaice (Pleuronectes platessa)		2019-2020	EU2018/2033	GNS, GND, GNC, GTR, GTN	8, 9
Pollack (Pollachius pollachius)		2019-2020	EU2018/2033 EU2019/2239	GNS, GND, GNC, GTR, GTN	8, 9
Norway lobster (Nephrops norvegicus)	Traps	2016-2018	EU2015/2438 EU2016/2375 EU2018/0046	FPO, FIX, FYK	6, 7
Black scabbardfish (Aphanopus carbo)	Longlines	2017	EU2017/2167	LLS, DWS	8, 9, 10, CECAF 34.1.2.

Annex 1.2

Summary of the online workshop on the Landing Obligation management and control measures in the Baltic and North Seas – 9 & 10 June 2020

Authors: Floor Quirijns, Noémi Van Bogaert and Kristian Schreiber Plet-Hansen

Consortium: Wageningen Marine Research (WMR), Wageningen Economic Research (WEcR), MRAG Limited Europe; MRAG Limited; Centre for Environment, Fisheries and Aquaculture Science (Cefas); Research institute for Agriculture, Fisheries and Food (ILVO), Johann Heinrich von Thünen-Institute: Federal Research Institute of Rural Areas, Forestry and Fisheries (TI), Technical University of Denmark (DTU), National Marine Fisheries Research Institute (NMFRI), Swedish University of Agricultural Sciences (SLU) and Institute of Food Safety, Animal Health and Environment (BIOR)

Background information

This workshop was part of the EASME/EMFF/2018/1.3.2.4 – Lot 1 – SC02 study project "Synthesis of the landing obligation measures and discard rates", carried out by a consortium consisting of scientific institutes from 8 countries in the Baltic and North Seas region. The consortium is contracted by the European Commission's Executive Agency for Small- and Medium-Sized Enterprises (EASME), on behalf of the Directorate General for Maritime Affairs and Fisheries (DG MARE). In total, there was a participation of 42 stakeholders from governments, fisheries organizations (pelagic and demersal), NGOs, control authorities and fisheries scientists.

Day 1

The workshop was initiated by Floor Quirijns (WMR) welcoming participants, followed by a short introduction by Evelien Ranshuysen (DG MARE) on the purpose of the study 'Synthesis of the landing obligation measures and discard rates'. The study should result in an improved understanding of the management measures that were put in place for the implementation of the LO and to evaluate whether these measures contributed to reducing discards, as the objective of the landing obligation is to eliminate discards by avoiding and reducing unwanted catches and by ensuring that catches are landed.

After the introduction, two presentations by the consortium followed on the progress of the work. Kristian Schreiber Plet-Hansen (DTU Aqua) presented the work on the identification of fisheries and species covered by the LO; management measures; and voluntary actions taken to facilitate the LO (slides in Annex I). Noémi Van Bogaert (ILVO) presented the consortium's work so far on definition and characterization of control measures in place; evaluation of those measures; and how input from authorities and stakeholders are gathered (slides in Annex II).

A plenary discussion was held, in which the main topics were:

• It is important to realize that there are synergistic effects between measures, i.e. measures can influence the wider incentive for the use of selective gears. Exemptions that allow more selective gear in closed areas may speed up the use of certain gear.

• A question was asked on whether there are examples of self-sampling for control purposes in the EU. In the Netherlands a self-sampling project has been ongoing since almost two decades: used for scientific purposes (stock assessments), but not for control purposes. When self-sampling would be a

part of a Fully Documented Fisheries (FDF), it might be used for control purposes. There currently is an experiment in the Netherlands with an FDF scheme to improve data on catch, discards and landings. At the moment this system is still too complex, time consuming and expensive. For it to work, more automated techniques (e.g. image analyses) need to be applied.

• Feasibility of having a reference fleet using EM techniques: depends on the fishery. In a mixed demersal fishery, a reference fleet can give an indication of what happens in the fleet, but cannot be representative. There is too much variation in catches and unwanted bycatch in time and space.

• How Article 17[1] is used in various member states. In the Netherlands the TAC for a species is split up in a part for wanted and a part for unwanted catch. The proportions are based on information in the ICES advice: from the unwanted catch part all quantities that fall under the de minimis and high survivability exemptions are deducted. The remaining part of the unwanted catch is used as a 'top up', or extra quota. The ITQs (quota allocated to individual vessels) are only based on the TAC for wanted catch. The top-up quota is managed on a national scale: if the fishery has been selective, there will be a remaining share. That remaining share could in future be applied to compensate fishers that use selective fishing methods, whom would get additional quota they could use to increase their share of wanted catch. Additional information on this can be provided if other participants are interested[2].

• How de minimis is a complicated measure: not only because of exemption specifications in the discard plans (such as the de minimis exemption for sole caught in fishery for Northern prawn, which is based on a combined limit for 10 species out of the annual TAC for a range of 12 species), but also because the percentage is set on an EU level, even though there are huge differences in discards percentages between MS/fleets.

• National control officers experience difficulties in checking logbooks/landings/sales data during the inspection of fishing vessels that are active in several EU waters. How can control officers effectively inspect catch fractions of vessels that land their fish in foreign harbours and are consequently transported to other countries? There seems to be a lack of data exchange and cooperation between MS in this respect.

Day 2

Day 2 was initiated with a presentation on the outcome of a short, online (not representative) multiple-choice survey after which participants split into one of the 3 subgroups. What follows here, is a summary of the conversations in each of the subgroups.

Subgroup 1 discussed a number of the LO management measures and how these measures impacted different fisheries of the member states involved. It was noted that it was easier for member states to go for the trials/scientific justification necessary for the high survival or de minimis exemptions, than to conduct lengthy selectivity trials. Efforts should be made to simplify the legal framework (Technical measures regulations), to allow fishermen to test innovative gear more easily. Additionally, member states could benefit from collaborations with each other and regionalization of exemptions (e.g. sharing

[1] Regulation (EU) No 1380/2013 of the European Parliament and the Council of 11 December 2013 on the Common Fisheries Policy, Article 17 - Criteria for the allocation of fishing opportunities by Member States

[2] The additional information can be requested via one of the workshop organizers: floor.quirijns@wur.nl.

resources, conducting research together). For fishermen and control officers, regionalization of exemptions would imply a less complex legislation and potentially better compliance.

Subgroup 2 exchanged ideas on possibilities for improving selectivity, which are not yet put into practice. The group mainly focused on factors that limit the implementation of new selective gear, such as a lengthy process that is required to get from “a good idea” to an implemented gear. There have been many trials on improving fishing selectivity, but often they do not result in more selective gears being used in the fishing fleet. This is mainly due to the complexity of the steps that need to be taken successfully, ranging from developing the idea into a gear adjustment and testing it; getting support from colleagues in the fishery, from the government and NGOs; getting scientific evidence for the functioning of the new gear; having it evaluated by STECF; getting international support; to making sure that the new gear fits the regulations.

Subgroup 3 discussed the control measures for the LO. The group agreed that singling out one control measure is not a solution, but that a combination of measures is key. All participants representing the industry, three out of four NGO participants and a ministry representative argued that top-down application of more control must be avoided if not complemented by the implementation of incentives e.g. free gear selection, access to closed areas or exemptions for the LO. An NGO representative argued that using electronic monitoring (EM) as a data collection tool might increase the incentive for compliance and may help improve stock assessments. Data collection through the EM could be promoted and used to change the often negative views on EM into something more positive by the constructive role it can play in fisheries.

In a final plenary session the subgroups reported back the above conclusions to the other participants.

General workshop conclusions

One of the outcomes of the workshop was a shared understanding between ministries, industry and NGOs that the landing obligation suffers from a “branding” issue, in the sense that the regulation tends to be phrased negatively, be it for compliance levels, for feasibility or for purpose of the regulation. This has created an environment around the landing obligation that fosters non-constructive solutions and a general lack of understanding, especially among fishermen. Emphasizing why the LO is meaningful and phrasing challenges and solutions more positively, while acknowledging issues, is important to support mutual understanding and promote a more positive environment around the LO.

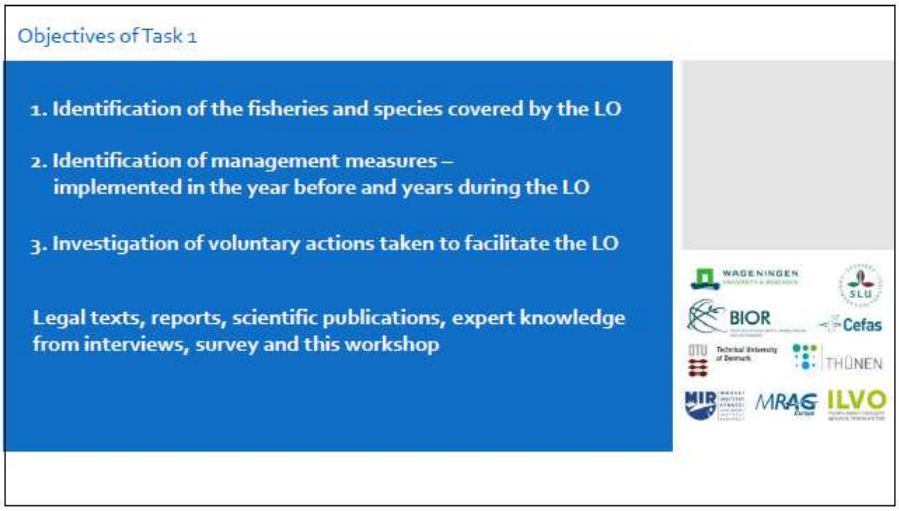
Implementation of more selective fishing gear did not occur as much as desired. The complex and lengthy process to get new gears tested, supported and approved, both nationally and on a European level, does not encourage the industry to work along that path. It would be helpful if the process of developing and implementing selective gear would be made easier.

Several participants from ministries, industry and NGO’s shared the opinion that while new monitoring tools can be useful to shift the culture of compliance with the landing obligation in a more positive direction, it is vital that such tools are not implemented in a top-down approach on its own. Rather, more advanced monitoring tools should be introduced together with benefits such as the option of free gear selection, specific landing obligation exemptions, access to otherwise closed areas or sustainability certifications. Particularly NGO’s stated that it is important to implement more advanced monitoring tools – such as electronic monitoring with video like the current Dutch FDF trial or electronic monitoring

without video as the Danish and Scottish mussel dredge BlackBox systems – in a manner where it is emphasized that these measures mainly function as data collection tools to better manage the fisheries to the benefit of all, rather than introducing such tools as purely control measures.

A representative from the Commission remarked that the LO will not be a success until effective control and enforcement measures are introduced. There are too many incentives for non-compliance because of for example choke situations or having to land low-value catches which cannot be sold for human consumption. Only with effective control, enforcement and inspection will the landing obligation be respected.

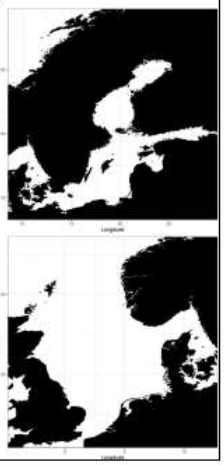
Annex I – slides from the presentation by Kristian Schreiber Plet-Hansen



1. Identification of the fisheries and species covered by the LO – Pelagic

Main pelagic species –
Herring, sprat, mackerel, horse mackerel, blue whiting, Norway pout

Exemptions:
High survivability (herring, mackerel; pelagic purse sein, certain conditions)
de minimis (herring, mackerel, horse mackerel, whiting (1%); certain pelagic trawlers
Predator damage (apply to all)



1. Identification of the fisheries and species covered by the LO

Exemptions:

High survivability:
Species with scientific evidence of high survival rates after being discarded can have an exemption from the obligation to be landed

de minimis:
where scientific evidence indicates that increases in selectivity are very difficult to achieve

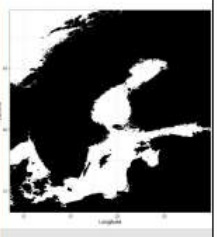
OR

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 a plan, of total annual catch of that gear

1. Identification of the fisheries and species covered by the LO – Baltic

Main species –
Cod, plaice, salmon, herring, sprat

Exemptions:
High survivability (cod, salmon, plaice in trap-nets, creels/pots, fyke-nets and pound net)
Predator damage (apply to all)



1. Identification of the fisheries and species covered by the LO – North Sea, Skagerrak, Kattegat

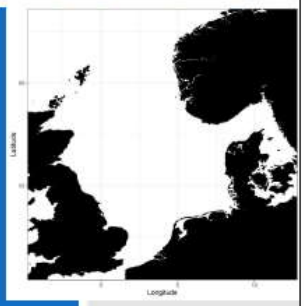
Main species –
Cod, haddock, whiting, hake, saithe, plaice, common sole, Norway lobster, Northern deepwater prawn, turbot, ling

Exemptions:

High survivability
(i) if caught in pots, traps or creels
(ii) Plaice in Danish seine
(iii) Plaice and Norway lobster in trawls or bottom trawls, certain conditions
(iv) Turbot in beam trawls
(v) Common sole in trawls, certain conditions
(vi) Skates and rays

de minimis
Between 1-7%, some combined, some for specific stock, some for longline, some for gillnet, some for beam trawls, some for trawls and seines
53 for 2020 if counting by species and area

Predator damage (apply to all)



Objectives of Task 1

1. Identification of the fisheries and species covered by the LO

2. **Identification of management measures – implemented in the year before and years during the LO**

3. Investigation of voluntary actions taken to facilitate the LO

2. Management measures in place or tried? - Baltic

Yes

Closed or temporarily closed areas

Avoidance/Moving-on rules (PL)

Selective gear

High survivability (3)

Interannual quota flexibility

Interspecies quota flexibility (DK herring, LT plaice)

Change of MCRS (Cod)

New prohibited species (Cod)

Adapting national quota system (SW, PL)

No

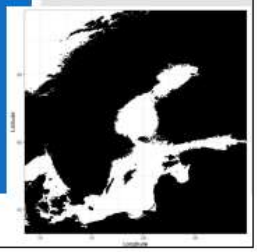
de minimis

TAC removal

Catch Quota Management trial (not since 2013)

Methods

- Interviews/questionnaires
- Literature search



2. Management measures in place or tried? – North Sea and Skagerrak/Kattegat

Yes

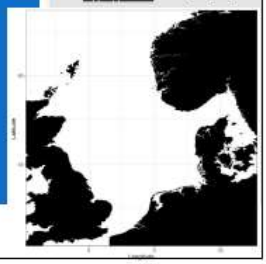
- Closed or temporarily closed areas
- Avoidance/Moving-on rules (Northern Prawn)
- Selective gear
- High survivability (26)
- de minimis (58)
- Interannual quota flexibility
- TAC removal (dab and flounder, North Sea)
- Change of MCRS (Norway lobster, Skagerrak/Kattegat)
- Catch Quota Management trial (ended in 2017)
- Adapting national quota system (NL, SW)

No

- Interspecies quota flexibility (possible but done?)
- New prohibited species

Methods

- Interviews/questionnaires
- Literature search

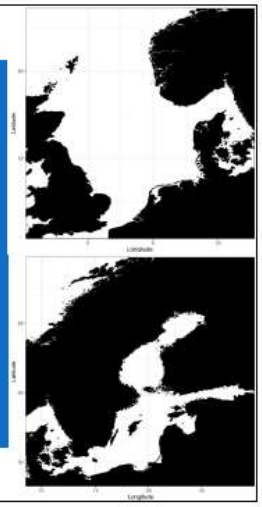


Objectives of Task 1

1. Identification of the fisheries and species covered by the LO
2. Identification of management measures – implemented in the year before and years during the LO
3. **Investigation of voluntary actions taken to facilitate the LO**

3. Voluntary actions

- DK pelagic stopped fishing for North Sea herring in the first quarter since 2015 to avoid bycatches of mackerel
- Pelagic communicate between vessels on bycatch areas
- Baltic pelagic developed model to deduct sprat and herring quota at the same time to align better with catches at the haul level with quota availability
- New bycatch procedures at the factory level
- Testing new selective gear types – both pelagic and demersal. But needs to be approved
- Catch quota management trials with EM in demersal fisheries (Denmark, Germany, Netherlands, Sweden, UK)
- Free gear trials with EM in demersal fisheries (Denmark)
- Plaice high survivability exemption when vessel has EM (Netherlands)
- Code of conduct for handling of rays
- MSC certifications



4. Gathering inputs from authorities and stakeholders

So:

What have we missed (management and voluntary actions)?

What measures work well?

What doesn't work well or isn't used?

Others?

Methods

- Interviews
- E-workshop
- Questionnaire

Annex II – slides from the presentation by Noémi Van Bogaert

Landing obligation control and enforcement measures collected by Lot1 consortium

Task 3

E-workshop June 9 2020

Noémi Van Bogaert

ILVO

Objectives of Task 3

1. Define and characterize the control measures in place

2. Evaluate measures in place

3. Gathering inputs from authorities and stakeholders

1. Define and characterize the control measures in place

Legal setting

Common Fisheries Policy (CFP)

- Fisheries Control Regulation
  Council Regulation (EC) No 1224/2009
- Regulation establishing EFCA
  Council Regulation (EC) No 768/2005
- IUU Regulation
  Council Regulation (EC) No 1005/2008
- SMEF
  Regulation (EU) No 1017/2403 of the European Parliament and of the Council

Key issues: Complexity; Enforcement; Control measures for new provisions; Fisheries data

Art. 25a para.1 (proposal)

"Member States shall ensure **effective control of the landing obligation**. For this purpose a minimum percentage of fishing vessels fishing for species subject to the landing obligation and flying their flag established in accordance with paragraph 2, shall be **equipped with continuously recording Closed-Circuit Television** (CCTV) systems incorporating data storage."

→ Commission's *proposal to revise the fisheries control system 2018/0193* (ongoing)

1. Define and characterize the control measures in place

Control measures used by **all/most** MS

Inspections of the Electronic Reporting System (ERS, "e-logbook")

Inspections of the landings/dockside monitoring

At sea inspections (patrol vessel surveillance)

Satellite systems

Vessel Monitoring System (VMS)

Automatic Identification System (AIS)

Vessel Detection System (VDS)

Methods

- Systematic literature review

1. Define and characterize the control measures in place

Control measures used/trialed by **some** MS

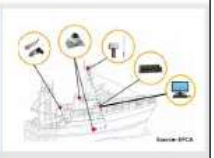
Market inspections

Remote electronic monitoring (REM)

Aerial vessel surveillance

Reference fleets/self-sampling

Fully-documented fisheries (FDF)



JDP (EFCA):

Last haul (LH) inspections

Gramme/grade size

JDP campaigns

2. Evaluate measures in place

Executive summaries of evaluation of Compliance with the Landing Obligation (EFCA, 2020)

- For North Sea Demersal species (cod, plaice, sole) (2016-2017)
- North Western Waters haddock, hake and whiting (2016 – 2017)
- Mackerel in North Sea and North Western Waters (2015-2017)

Compliance benchmarking criteria:

Compliance Level	Estimates of illegal discards	Benchmark Icon
High	< 5%	
Medium	≥ 5% and < 15%	
Low	≥ 15%	

Conclusion:

"As traditional control tools have proven to be inefficient in control and monitoring the LO, the introduction of REM systems could be instrumental both for collection of reference data and for efficient control and enforcement of the LO."

2. Evaluate measures in place

Step 1:
Data assembly

Data assembly templates per country

Step 2:
Data analyses

Country & Fisheries level

Step 3:
Presentation of results

Fisheries level

Methods

- Interviews/questionnaires
- Semi-quantitative scoring

1: Not enforced
2: Partially enforced
3: Fully enforced

3. Gathering inputs from authorities and stakeholders

Task 1

- What have we missed (management and voluntary actions)?
- What measures work well?
- What doesn't work well or isn't used?
- Potentially other LO management implications?

Task 2

- Other control measures that we missed?
- Which control methods could be more effective?
- Other suggestions?

Methods

- Interviews
- E-workshop
- Questionnaire

Annex 1.3

Report of the online workshop on the Landing Obligation management and control measures in the Western Waters – 17 June 2020

Summary prepared by Martin Aranda (AZTI), Julio Valeiras (IEO), Eoghan Kelly (MI), Sara-Jane Moore (MI) Jonathan White (MI), Eva Velasco (IEO) and Raúl Prellezo (AZTI)

Consortium: MRAG, MRAG Europe, AZTI, IEO, CEFAS, MI, DTU Aqua, WUR

Attendees:

Type of stakeholder	Number of attendees		Region/country
Morning session			
EU administration	2		EU
Industry	14		ES, UK, FR, IR, NL
Conservationist NGO	2		UK
Administration	2		ES, IR
Research	8		ES, IR, UK, FR
Total	28		
Language-based afternoon session			
	Spanish	English	Region/country
EU administration		1	EU
Industry	7	9	ES, IR, FR
Conservationist NGO		2	UK
Administration	1	1	ES, IR
Research	4	4	ES, IR, UK, FR, NL
Total	12	17	

Background information

This workshop is a milestone of the EASME/EMFF/2018/1. 3. 2. 4 – Lot 1 – SC02 study project "*Synthesis of the landing obligation measures and discard rates*", carried out by a consortium consisting of scientific institutes from 6 countries in the Western Waters region. The consortium is contracted by the European Commission's Executive Agency for Small and Medium-Sized Enterprises (EASME), on behalf of the Directorate General for Maritime Affairs and Fisheries (DG MARE). In total, there was a participation of 26 stakeholders from governments, fisheries organizations (inshore and demersal), NGOs, control authorities and fisheries scientists from diverse countries with interest on European Western waters fisheries, including attendees from Ireland, France, Spain, Portugal, Denmark and UK. The workshop was organised in two sessions within the same day, encompassing a morning session for the presentation on the progress of the study and preliminary findings, and an afternoon session were the main topics concerning the Landing Obligation (LO) implementations were debated by the stakeholders. In the afternoon session, the stakeholders were divided by language of preference. The session in Spanish was led by Julio Valeiras (IEO) and the session in English by Jonathan White (MI).

1. Morning session

Raul Prellezo (AZTI) welcomed participants to this event and was followed by a short introduction by Evelien Ranshuysen (DG MARE) on the purpose of the study "Synthesis of the landing obligation measures and discard rates". The study should result in an improved understanding of the management measures that were put in place for the implementation of the LO and to evaluate whether these measures contributed to reducing discards, as the objective of the landing obligation is to eliminate discards by avoiding and reducing unwanted catches and by ensuring that all catches are landed.

After the introductory presentations, two presentations on management measures (Task 1) and control, enforcement, and compliance (Task 3) were made by Julio Valeiras (IEO) and Martin Aranda (AZTI) respectively (see slides in the Appendix).

A plenary discussion followed the task presentations and participants revised the outcomes of the presentations, in particular the mapping of the exceptions applied in the diverse fisheries in Task 1.

Queries were made concerning the cost effectiveness of the implementation of the Remote Electronic Monitoring (REM) and particularly Close Circuit TV (CCTV). It was suggested that the cost of implementing **CCTV could be cheaper than implementing a conventional observers program large enough to ensure compliance with the LO**, although the process of a mandatory implementation may face industry opposition and may be costly from a legal perspective. Additionally, there are other costs associated with these new technologies that are not usually discussed but that can make this implementation costly and time demanding such as the **development of the software to analyse the data collected by these devices and the validation of these analyses** by scientists. There were other opinions on the potential use of cameras to ensure the quality of the data besides its potential for control and surveillance. Concerning costs of cameras an estimation made by WWF was referred, which places this cost in a range between EUR 3,200 to EUR 5,200 per year per vessel, encompassing hardware and analysis.

There was a reflection that the main problem of the LO is the complexity of the implementation itself, with a very complex set of regulations, exemptions, flexibilities, quota management, etc. So, at this stage it is **worthless to point at a specific segment of the fleet**. The project team points out the difficulties of the LO owing to the almost 300 exemptions, which have changed regularly since the implementation of the Common Fisheries Policy, for different fisheries and periods (annual / triennial). In task 1, the work of collecting all the documents was very laborious, which indicates that the normative is complex, and difficult to comply with by sectors of the fishing industry faced with multiple pieces of evolving legislation.

Concerning the **incentives** deployed by the management system there were **positive elements such as the funds deployed by the EMFF to work throughout the whole value chain by funding innovation in processing and marketing of unwanted fish**. Concerning this, trials on new products are being made in different countries, although the literature reviewed in the project indicates that stakeholders have concerns regarding investments in installation of processing capacities, since a viable production requires a steady raw material supply, and further, unwanted fish should not be landed in future under a full implementation of the LO.

A point was raised regarding the distinction between **the discard ban and LO, which are not the same**. The issue of discards reduction is addressed elsewhere in the EU with many studies about selectivity. But the LO is a big problem for the industry and requires other measures to be

mitigated. There was a question put to STECF on how trials conducted by scientist are evaluated. This was regarded as important for the industry to understand the process.

A final question invited a reflection of what has been done in the framework of the LO and what will be done in the future.

In the framework of the present study, in the next few days an online survey will be conducted to fill in gaps that may have been left unresolved.

2. Afternoon sessions

The session started with a presentation by Julio Valeiras (IEO) (Spanish) and Jonathan White (MI) (English) on the aims of the afternoon session and a list of open questions to be discussed amongst the participants.

1. How the management measures have performed from 2014?
2. Have these been effective to achieve the original objectives of LO?
3. Which measures were the best?
4. Which measures did not work?
5. Which management measures would you propose for a successful implementation of the LO?
6. Which other management measures are potentially useful for the implementation of LO?

a. Session in Spanish:

Management measures:

The participants commented that the introduction of the **LO was rushed and did not balance all objectives of the CFP**. The researchers opined that the enforcement has not been smooth and the goal of decreasing mortality has been diluted. The process has been built year by year and the exemptions too. There has been no vision of *métier* but of important species. There is no strategic vision and the administrations and industry have been reactive to soften the impact. The objective should not only be to comply with the law, but to continue to fish sustainably.

Industry representatives wonder what the LO's goal is: a discard ban or a landing obligation. Whether it is to fulfil an obligation or to find solutions to mitigate discards. The initial LO has not focused on the objectives, has not assessed the economic or social consequences. Imposition has been carried out without reflection with stakeholders. After 5 years, it would be important to carry out some study of the benefits obtained at the environmental and sustainability level to see if they have worked.

Impact assessments have lacked from the start of the process. In addition, repeated consultation from the Advisory Councils (ACs) were not clarified. The agreements have been made "*in extremis*" since 2013. Some measures may work effectively but do not solve the problem of discards. There are also concerns with regards to the management system itself which is based on TACs and quotas. **The delegated acts refer to quotas not to *métiers***. TACs and quotas blocks all possibilities of solving discards. Swaps have allowed to overcome TACs constrains, but this is not enough. Measures are totally limited by the “Principle of Relative Stability” for countries that have some zero quotas. Discards reduction is not possible if there are zero quotas for a significant part of the species. Although this does not pose a problem for some countries for some others such as Spain this becomes a difficult problem to overcome.

Administrations are continuously learning. It has been very difficult to establish and coordinate measures. There have been delays in the publication of national regulations. The LO and the

TACs and quotas system are very difficult to align and the delegated acts refer to populations / species. Funding for research has been very limited and it is very difficult to renew the scientific information every year since research takes time. The requirement of the EC that does not want to make the renewals every 3 years, impedes having the necessary time for the coordinated work of all the stakeholders.

The **administrative process takes a long time** from the Council of Ministers to the national implementation. The risk of choke species seems to be the main problem to be addressed. There is evidence that the process of introduction of new measures is lengthy. **The exemptions work well for some fisheries, for example static fishing gear but not for others**. There are fisheries in which *de minimis* exemptions have not been allowed, these are few species and in small quantities, but they create problems on board. For example, the bottom longline sector was not too impacted by the LO. For this fishery, *de minimis* were not approved. Flexibility measures in this fishery reduced overall effort on the target species, although the same has not happened in other fisheries.

There is a need for more studies on selectivity and **use of unwanted fish**, but it is evident that funding cannot satisfy all needs. **Improvements on selectivity** are required and an evaluation of its effectiveness for the fishers has to be conducted to use them. The administration has become fixated on commercial trawling species because they produce problems that already existed. Scientists have been more concerned that the devices were highly selective even though the sector could not or would not like to adopt them.

It is viewed that in the future the system needs to be **proactive and not reactive** and to establish a long-term strategy. But there are certain urgent needs like the renewal of some exceptions.

Ongoing and potential incentives:

Concerns were conveyed on the "penalisation" imposed to fleet sectors that are more selective to provide quota flexibilities to others that are less selective. This occurs since a part of the quota is reserved to solve the discard rates of non-selective fisheries. Flexibility measures are complex, difficult to implement and need revision (benchmarks need to be conducted). The measures are blocked by the quota system and the "Relative stability" which limits the fishing possibilities of some fleets (by Art. 14), as a consequence of 9 or 10 species for which they have no quota available.

There is much work to be conducted on selectivity and markets for unwanted fish, but there is a need to **focus on *métiers* where more risk of non-compliance exists**. Concerning sector initiatives, the "Choke mitigation tool" was proposed, which is a framework that enables the identification of issues, gaps and priority actions on selectivity, survivability, and economic and social impacts. Many tools were proposed by the ACs, such as selectivity studies, *de minimis*, survival, TAC and quotas. In all countries, research has been carried out on fishing activities, but a lot of testing is still required before launching new designs. In turn, inconsistencies occur with the official technical measures applied in the different fishing grounds (which are complex and different by fishery, area, country, type of boat, target species, etc.).

It is recognised that **collaboration between the scientists and the fishing sector on technical and scientific topics is fluent and relevant**, but technical transference to fishers of technical improvements **is not timely**. The possibility that captains can carry out tests with selective gears in their own way is discussed, after the relevant selectivity trials with researchers on board. There are even some legal considerations impeding skippers to try their own technical measures,

which may not be consistent with the technical regulation in force. New measures have to pass a **complex administrative process**, including STECF, before they may become part of the applied legislation.

It is considered that there should be more trials on selectivity. As an example, a selectivity device that was put into force to avoid unwanted species in NWW. Thanks to this the mini quota for this species was not employed. The EU is provided funding and financing projects but results need to be more visible. There is also a need to revise the normative concerning the obligation to land fish below MCRS. The industry believes that species outside the TACs and quotas system should not enter into this system in the future because it would make compliance with the LO harder. The main problem is the choke species, since the exemptions have to be renewed every year, greatly complicating the process. Pro-activeness is needed for setting up long-term strategies but considering current needs. Other measures must be studied: removal from the regime of species with no quota or small percentages or removal of the minimum sizes for species with low percentage of catch.

It is a need to develop a compliance spirit. It will be advisable to have a debate on measures to strengthen this spirit, to deploy incentives to reward the good practices with aid or some extra quotas and flexibilities and reinforce communication and training. For example, inspectors conducting control activities on board should also inform and educate skippers concerning their obligations under the LO.

Control measures:

REM technologies seem viable solutions at first sight and emerge as an alternative to costly observers' programs. Nevertheless, their use in control and surveillance are still under development, in particular the algorithms to interpret the data, which then need to be validated. Funding is being devoted for such developments. It seems that the **REM could work better with pelagics rather than in demersal fisheries**, where their application would be much more complex. REM, and particularly CCTV, is being applied by fishers for purposes other than control and require many man-hours to observe the recordings. Should the systems become mandatory, they should be used for double purposes: control and surveillance, and science. Level-playing conditions in control are required for all fleets. CCTV has a legal aspect that implies a serious responsibility for the fishing master, since he withstands the burden of proof. This is particularly problematic in MS where fishing infractions follow criminal procedures. In addition, it was commented that **traditional control means should be prioritized, improved, and applied on a level-playing basis instead of opting for technical means, which are not fully mature** such as REM and particularly the CCTV approach.

Finally, it was agreed that it is necessary to keep separated data collection for control purposes and for scientific purposes. Although there is a clear divide between the two, it is **complicated to establish a clear distinction between the use of data for scientific purposes and control**. It is of key importance to count on good data to justify the quota needs the sector requires.

b. Session in English:

Regulatory and institutional adaptations:

It was raised that the obligation is to land unwanted catch but there are no facilities on land to deal with it. **There is no economic gain from the unwanted catch**. Research is ongoing for potential uses of unwanted catch. Regulation needs to be fine-tuned and improved. It is frustrating from an industry perspective that closures, etc., only apply to certain vessels and it is difficult to convince PO members that management is working. Management do not want to incentivise catching undersize fish. Institutional frameworks have not dealt well with <MCRS issue. Adaptation needs to be conducted by relevant departments.

Fishers do not want to land juvenile fish as there is no value and it negatively impacts the stock. Basically, if there is no incentive to take up vessel space for <MCRS then it is hard for them to comply with the LO. It takes around two days to break even on a fishing trip and the objective is to maximise the load of saleable fish. Regulations and work on selectivity should provide a short-term incentive to land <MCRS, while also working on other areas to reduce catching. It was pointed out that there is a mismatch between size at maturity and MCRS. **In some countries, smaller fish are a desired catch**.

Concerning things to change in the LO implementation, **public relations and communication were poor during the setup of the regulation**. The LO was poorly implemented with a top-down approach, ignoring fisheries complexity.

Flexibility and incentives:

With regards to the pros and cons of flexibilities and incentives such as *de minimis*, fishers do not want to fill boats with unmarketable fish. Quota swaps help when quotas are exhausted, Spain got 6% of other member state's quota to allow them to continue fishing after the implementation of the LO. **Mixed fish advice must be considered on top of single species advice**.

Exemptions are common and difficult to monitor and make it hard to know if TAC is being met or exceeded. This complexity is also added to by incentives to improve selectivity or get an exemption. Incentives are available in the form of funding, usually to improve selectivity through trials or get an exemption for example through survivability trials.

In addition, similarity should be considered between incentives in the Common Agriculture Policy (CAP) for the CFP, for example sheep farmers to graze land, comparable to the aims of Marine Protected Areas (MPA). To get stocks to MSY, fishers should be compensated to stay in business. MS manage their EMFF spending independently to differing degrees of success, and division of funds across MS needs to be considerate to the marine area each MS manages.

Selectivity:

Industry support a science and evidence based approach using trials, and **are willing to adapt and change and participate in trials**. There is a lot of research that can be applied[1]. Some Member States' reports to the STECF, to Evaluation of Member States' Annual Reports on the Landing Obligation (for 2019) for DG MARE, contain good information on selectivity trials while

[1] For example, SMARTFISH: http://smartfishh2020.eu/

there is little information from others. A better approach might be the use of **real time measures and avoidance measures**. NWW is one of the few regions where progress is being made on selectivity improvement.

Good results of trials are difficult with changing parameters such as size classes, etc. A bottom up approach was suggested, where fishers are given more flexibility to develop trials/ tools/ management measures. Such an approach would require a robust framework to work within and funding. Some sectors of the fishing industry have undertaken a lot of work with selectivity, following this work however, they may then be restricted for catch owing to quota allocations. There needs to be consideration of more flexibility on quota. There is limited funding and limited resources for trials. Even if money is spent by industry and innovations were to be made, funding may be denied under the EMFF as measures may not be compatible with EU regulations. It was stated **how important avoidance was for fishers. Their knowledge comes into play.** It is important not to end up in choke scenarios set by the quotas so avoidance is very important for selectivity.

Control Measures:

It was commented that cameras are the best way to monitor to get good/ improved data and not necessarily for control. A question was raised of who would monitor footage and provide resources. Many vessels could be fitted with CCTV cameras, with footage recorded to a hard drive and sent, with accompanying data to authorities to see in real time. **Random sampling** could be set up where 1/10 or 1/5 cameras could record what is being caught. Currently there is <1% observer coverage, which could be increased to 10% coverage, being in addition a good source of independent data. This would help in improving compliance with regulations.

It is important to distinguish between compliance and scientific data. Coverage in UK is <1% observer coverage. It should be noted that a **voluntary scheme** may be expected to lead to a bias and a lack of representative data. **The technology is not yet sophisticated enough** for artificial intelligence, however technology should not be a barrier. Even so most people would not like cameras monitoring them 24 hours per fishing day. The CCTV idea needs trial and error and a real drive for it to be developed, data could be stored and analysed in the future.

An idea was raised of **setting aside quota and giving it to boats to do trials on this**. There is industry willingness for this. However, industry would not be in favour of cameras recoding all day long. A point was discussed on the **unviability of covering 85,000 vessels instead a risk-based approach may be more appropriate**, looking at *métiers* with high risk of unwanted catches. The CCTV approach could be used to enhanced monitoring. It was mentioned that there needs to be a chain of evidence to prosecute vessels that are accused of non-compliance. It was also commented that log sheets are difficult to interrogate. There is little information on EU log sheets on what devices are being used on vessels, only mesh sizes used in the codend are available. Scientific data relies on logbook data and now on reports of unwanted catches and BMS landings. It is not easy for fishermen to complete; it is not easy for scientists either as they need good quality data. Logbooks need to include fields detailing specific selectivity devices being used.

Conclusions:

Participants in the workshop tended to agree that the LO is a **complex institutional and regulatory process, encompassing many regulations, exemptions and flexibilities**, amongst others. These are hard to understand by the industry and complex to implement and enforce for Member States. Although the **elimination of discards is accepted and regarded as necessary**, the obligation to land unwanted fish faces problems that make this **economically unviable for the industry at least at this stage**. There is agreement that scientists, managers, and industry are putting **substantial effort to improve selectivity** with intensive use of technical and economic means and positive results are being yielded. But it is recognised that there is still much to do, and **more trials and funding are needed**. There are concerns, however, that the implementation of these improvements in the field is not timely and have to face a long administrative and technical process before being used. There are some technical devices with good results but with loss of target species. It is not clear to fishers how they may be compensated for this economic loss, which discourage them to apply these measures. **The industry seems to have practical solutions but they cannot be put in place if they are not in line with the current regulatory framework**. Thus, some sort of flexibility is required to allow fishers to employ its **empirical knowledge** and come up with viable solutions to reduce unwanted catches. It would be important to make visible the industry's intention to improve. It is necessary to incentivize the implementation of the selectivity results on fishing vessels: investments, profit-based results, compensation with financing and quotas.

REM is a promising tool that may greatly help in control for improving the levels of compliance. These technologies could also be used to improve the quality of the data, which is regarded as essential to evaluate the state of the resources. The CCTVs in particular are perceived as advantageous for a number of reasons although **the costs of implementing them goes beyond a simple installation of the devices on board which could be affordable**, but the development of methodologies and software for analysis could be costly and lengthy. This besides the many legal and social difficulties that a mandatory use of CCTV brings about. Improvement of traditional control means are needed, until the REM methodologies are mature. In any case, a risk-based approach is required and *métiers* having higher risk should be prioritised.

Compliance with the LO goes beyond strict control, it requires deployment of incentives and communication to build a compliance spirit within the fishing sectors. Control must be carried out in a way that fosters compliance and encourages good fishing practices. So far, the management system has provided means to counteract the problems arising since the introduction of the LO, such as exemptions, flexibilities and uplifts amongst others, which have worked relatively well depending on the fishery in question. **Funding is available under the EMFF for improvements onboard, and even for processing and in trade of unwanted fish, being the degree of use different from country to country**. Still efforts are required to find means to **improve the compliance spirit and actions should be conducted to trigger debate on this matter**.

Countries have made an enormous effort to advance and adapt to the LO. It is necessary to continue the coordinated work of administration, industry, and scientists. Problems must be addressed comprehensively, evaluating what has been already done over the years, working *métier* by *métier*. One could recover measures that already exist and look at what others have done. The general objective must be that the fishing activity continues to be profitable in compliance with the regulations. To achieve the goals of reducing mortality from discards, it is very important that the sector is involved at all times.

ANNEX 1.4 – LITERATURE SEARCH OUTPUTS

Table A1: Search terms applied in institutional literature search

Institution, search date and sites	Relevant documents
STECF, 24. March 2020 https://stecf.jrc.ec.europa.eu/reports/plenary	STECF. (2013). Scientific, Technical and Economic Committee for Fisheries (STECF) – 43rd Plenary Meeting Report (PLEN-13-02). Publications Office of the European Union, Luxembourg, EUR 26904(JRC 83565), 120 pp. https://doi.org/10.2788/96228 STECF. (2014a). Scientific, Technical and Economic Committee for Fisheries (STECF) – 45th Plenary Meeting Report (PLEN-14-01). Publications Office of the European Union, Luxembourg, EUR 26616(JRC 89783), 86 pp. https://doi.org/10.2788/15586 STECF. (2014b). Scientific, Technical and Economic Committee for Fisheries (STECF) – 46th Plenary Meeting Report (PLEN-14-02). Publications Office of the European Union, Luxembourg, EUR 2810 E(JRC 91540), 117 pp. https://doi.org/10.2788/11931X STECF. (2015a). Scientific, Technical and Economic Committee for Fisheries (STECF) – 48th Plenary Meeting Report (PLEN-15-01). Publications Office of the European Union, Luxembourg, EUR 27220(JRC 95802), 75 pp. https://doi.org/10.2788/878866 STECF. (2015b). Scientific, Technical and Economic Committee for Fisheries (STECF) – 49th Plenary Meeting Report (PLEN-15-02). Publications Office of the European Union, Luxembourg, EUR 27404(JRC 97003), 127 pp. https://doi.org/10.2788/878866 STECF. (2015c). Scientific, Technical and Economic Committee for Fisheries (STECF) – 50th Plenary Meeting Report (PLEN-15-03). Publications Office of the European Union, Luxembourg, EUR 27602(JRC 98672), 90 pp. https://doi.org/10.2760/088784 STECF. (2016a). Scientific, Technical and Economic Committee for Fisheries (STECF) – Evaluation of the landing obligation joint recommendations (STECF-16-10). Publications Office of the European Union, Luxembourg, EUR 27758. https://doi.org/doi:10.2788/59074 STECF. (2016b). Scientific, Technical and Economic Committee for Fisheries (STECF) – Special request for evaluating Baltic cod additional measures (STECF-16-23). Publications Office of the European Union, Luxembourg, EUR 27758. https://doi.org/10.2788/638914 STECF. (2017). Scientific, Technical and Economic Committee for Fisheries (STECF) – 55th Plenary Meeting Report (PLEN-17-02). Publications Office of the European Union, Luxembourg, EUR 28359. https://doi.org/10.2760/53335 STECF. (2018a). Scientific, Technical and Economic Committee for Fisheries (STECF) – 57th Plenary Meeting Report (PLEN-18-01). Publications Office of the European Union, Luxembourg, JRC111800. https://doi.org/10.2760/088784 STECF. (2018b). Scientific, Technical and Economic Committee for Fisheries (STECF) – 58th Plenary Meeting Report (PLEN-18-02). Publications Office of the European Union, Luxembourg, JR112730. https://doi.org/10.2760/74942 STECF. (2018c). Scientific, Technical and Economic Committee for Fisheries (STECF) – 59th Plenary Meeting Report (PLEN-18-03). Publications Office of the European Union, Luxembourg, JRC114701. https://doi.org/10.2760/335280 STECF. (2019a). Scientific, Technical and Economic Committee for Fisheries (STECF) – 61st Plenary Meeting Report (PLEN-19-02).

	Publications Office of the European Union, Luxembourg, JRC117461. https://doi.org/10.2760/31279 STECF. (2019b). Scientific, Technical and Economic Committee for Fisheries (STECF) – 62nd Plenary Meeting Report (PLEN-19-03). Publications Office of the European Union, Luxembourg, JRC118961. https://doi.org/10.2760/1597
STECF, 24. March 2020 https://stecf.jrc.ec.europa.eu/reports/discards	STECF. (2013). Scientific, Technical and Economic Committee for Fisheries (STECF) – Landing obligation in EU fisheries (STECF-13-23). Publications Office of the European Union, Luxembourg, EUR 26330, 115. https://doi.org/10.2788/37460 STECF. (2014a). Scientific, Technical and Economic Committee for Fisheries (STECF) – Landing Obligation in EU Fisheries - part II (STECF-14-01). Publications Office of the European Union, Luxembourg, EUR 26551, 67. https://doi.org/10.2788/26264 STECF. (2014b). Scientific, Technical and Economic Committee for Fisheries (STECF) – Landing Obligations in EU Fisheries - part 3 (STECF-14-06). In Publications Office of the European Union, Luxembourg. https://doi.org/10.2788/53393 STECF. (2014c). Scientific, Technical and Economic Committee for Fisheries (STECF) – Landing Obligations in EU Fisheries - part 4 (STECF-14-19). Publications Office of the European Union, Luxembourg, EUR 26943, 96 pp. https://doi.org/10.2788/63715 STECF. (2015a). Scientific, Technical and Economic Committee for Fisheries (STECF) – Landing Obligation - Part 5 (demersal species for NWW, SWW and North Sea) (STECF-15-10). Publications Office of the European Union, Luxembourg, EUR 27407, 62 pp. https://doi.org/10.2788/692447 STECF. (2015b). Scientific, Technical and Economic Committee for Fisheries (STECF) – TAC adjustments for stocks subject to the landing obligation (STECF-15-17). In Publications Office of the European Union, Luxembourg. https://doi.org/10.2788/561762 STECF. (2016a). Reports of the Scientific, Technical and Economic Committee for Fisheries (STECF) - Minimum conservation size for Red Seabream (Pagellus bogaraveo) (STECF-16-09). Publications Office of the European Union, Luxembourg, EUR 27758, 16 pp. https://doi.org/10.2788/0643 STECF. (2016b). Reports of the Scientific, Technical and Economic Committee for Fisheries (STECF) – Merging of the BT1 and BT2 gear categories in the North Sea (STECF-16-02). Publications Office of the European Union, Luxembourg, EUR 27758, 10 pp. https://doi.org/10.2788/638914 STECF. (2016c). Scientific, Technical and Economic Committee for Fisheries (STECF) – Evaluation of the landing obligation joint recommendations (STECF-16-10). Publications Office of the European Union, Luxembourg, EUR 27758. https://doi.org/doi:10.2788/59074 STECF. (2016d). Scientific, Technical and Economic Committee for Fisheries (STECF) – Methodology and data requirements for reporting on the Landing Obligation (STECF-16-13). Publications Office of the European Union, Luxembourg, EUR 27758. https://doi.org/10.2788/984496 STECF. (2017). Scientific, Technical and Economic Committee for Fisheries (STECF) – Evaluation of the landing obligation joint recommendations (STECF-17-08). Publications Office of the European Union, Luxembourg, JRC107574. https://doi.org/10.2760/149272 STECF. (2018a). Scientific, Technical and Economic Committee for Fisheries (STECF) – Data and information requested by the Commission to support the preparation of proposals for fishing opportunities in 2018

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Table A2: Search terms applied for peer-reviewed literature search.

Search term	Identified results
"Landing Obligation" AND "electronic monitoring" AND "fully documented fisheries" AND "catch quota management" AND "discard ban" AND "fisheries management" AND "European Fisheries Control Agency"	Run date: 6. March 2020 **1 result, of which the potentially relevant studies are:**
	James, K. M., Campbell, N., Vigarsson, J. R., Vilas, C., Plet-Hansen, K. S.,Borges, L., et al. (2019). "Tools and technologies for the monitoring, control and surveillance of unwanted catches," in The European Landing Obligation: Reducing Discards in Complex Multi-Species and Multi-Jurisdictional Fisheries, eds S. Uhlmann, C. Ulrich, and S. Kennelly (Cambridge: Springer).
"Landing Obligation" AND "electronic monitoring" AND "fully documented fisheries" AND "catch quota management" AND "discard ban" AND "fisheries management"	Run date: 6. March 2020 **20 results, of which the potentially relevant studies not already listed above are listed:**
	Borges, L., Cocas, L., and Nolde Nielsen, K. 2016. Discard ban and balanced harvest: a contradiction? ICES Journal of Marine Science, 73: 1632–1639. Calderwood, J., Robert, M., Pawlowski, L., Vermard, Y., Radford, Z., Catchpole, T. L., and Reid, D. G. 2019. Hotspot mapping in the Celtic Sea: An interactive tool using multinational data to optimise fishing practices. Marine Policy: 103511. Elsevier Ltd. https://doi.org/10.1016/j.marpol.2019.103511. Matias da Veiga Malta, T. A. 2019. Industry-led fishing gear development under the new European Union Common Fisheries Policy. Technical University of Denmark. Mortensen, L. O., Ulrich, C., Eliasen, S., and Olesen, H. J. 2017. Reducing discards without reducing profit: Free gear choice in a Danish result-based management trial. ICES Journal of Marine Science, 74: 1469–1479. Mortensen, L. O., Ulrich, C., Hansen, J., and Hald, R. 2018. Identifying choke species challenges for an individual demersal trawler in the North Sea , lessons from conversations and data analysis. Marine Policy, 87: 1–11. Elsevier Ltd. https://doi.org/10.1016/j.marpol.2017.09.031. Msomphora, M. R. 2016. Stakeholder Involvement in the Governance of Fisheries in Europe - With perspectives of the result-based mangement. The Arctic University of Norway. 62 pp. Suuronen, P., and Gilman, E. 2019. Monitoring and managing fisheries discards: New technologies and approaches. Marine Policy: 103554. Elsevier Ltd. https://doi.org/10.1016/j.marpol.2019.103554. Ulrich, C., Olesen, H. J., Bergsson, H., Egekvist, J., Håkansson, K. B., Dalskov, J., Kindt-Larsen, L., et al. 2015. Discarding of cod in the Danish Fully Documented Fisheries trials. ICES Journal of Marine Science, 72: 1848–1860.

	Ulrich, C. 2018. Research for PECH Committee - Landing Obligation and Choke Species in Multispecies and Mixed Fisheries - the North sea. van Helmond, A. T. M., Chen, C., Trapman, B. K., Kraan, M., and Poos, J. J. 2016. Changes in fishing behaviour of two fleets under fully documented catch quota management: Same rules, different outcomes. Marine Policy, 67: 118–129. Elsevier.
"Landing Obligation" AND "discard ban" AND "fisheries management"	Run dates: 9. March 2020 & 12-13 March 2020 **306 results, of which the potentially relevant studies not already listed above are listed:**
	Alternativa, B. (2018). Shedding light on alternative shrimp fishing : development of shrimp pots with a focus on selection, attraction and behaviour. Anbleyth-Evans, J. W., & Williams, C. (2018). Fishing for Justice: England's Inshore Fisheries' Social Movements and Fixed Quota Allocation. Human Geography, 11(1), 28–43. https://doi.org/10.1177/194277861801100103 Barros, L. F. (2017). Promoting species separation in trawl gears by using rigid grids and light systems Promoting species separation in trawl gears by using rigid grids and. Batsleer, J., Rijnsdorp, A. D., Hamon, K. G., van Overzee, H. M. J., & Poos, J. J. (2016). Mixed fisheries management: Is the ban on discarding likely to promote more selective and fuel efficient fishing in the Dutch flatfish fishery? Fisheries Research, Vol. 174, pp. 118–128. https://doi.org/10.1016/j.fishres.2015.09.006 Baudron, A. R., & Fernandes, P. G. (2015). Adverse consequences of stock recovery: European hake, a new "choke" species under a discard ban? Fish and Fisheries, 16(4), 563–575. https://doi.org/10.1111/faf.12079 Bird, C., Bendall, V., Ellis, J., & Catchpole, T. (2018). Health and vitality of discarded skates and rays. Bohman, B. (2019). Regulatory control of adaptive fisheries: Reflections on the implementation of the landing obligation in the EU common fisheries policy. Marine Policy, Vol. 110. https://doi.org/10.1016/j.marpol.2019.103557 Borda, I. S. (2014). Approach to the 2014 discard ban in the EU Common Fisheries Policy and trials with bycatch reducing trawl techniques. Ixai Salvo Borda. The Arcticc University of Norway. Borges, L. (2015). The evolution of a discard policy in Europe. Fish and Fisheries, 16, 534–540. https://doi.org/10.1111/faf.12062 Borges, L., & Penas Lado, E. (2019). Discards in the Common Fisheries Policy: The Evolution of the Policy. In S. S. Uhlmann, C. Ulrich, & S. J. Kennelly (Eds.), The European Landing Obligation - reducing discards in complex, multi-species and multi-jurisdictional fisheries (pp. 27–47). Dordrecht: Springer International Publishing AG, part of Springer Nature. Brookhuis, N. (2015). Swimming against the current? An exploration of the conditions for a successful implementation of the landing obligation in fisheries policy. Brunel, T., & Steins, N. A. (n.d.). Potential approaches to use the range of values for Fmsy in mixed fisheries management Potential approaches to use the range of values for Fmsy in mixed fisheries management. Calderwood, J., & Reid, D. G. (2019). Quota exhaustion and discarding: How Ireland's monthly quota system has a limited relationship with discarding patterns in the commercial fishing fleet. ICES Journal of Marine Science, 76(1), 244–254. https://doi.org/10.1093/icesjms/fsy158

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Annex 1.5

Interview guide

Anonymized ID: _____

Organisation: _____

Type of fishery stakeholder (admin/PO/manager):_____

Title: _____

Thank you for your cooperation!

A1. What management measures have been implemented in this region in the period 2014-2020?

Please go over each management measure, one by one, and provide a yes/no answer including more details in case the answer is "yes" (i.e. year of implementation, description of the measure etc.)

Could be management or policy measures such as:

- Closed areas
- Temporarily closed areas / (near) Real-Time closures / temporary stop on fishing activities
- Avoidance/Moving-on rules
- Selective gear
    1. Minimum mesh size
    2. Maximum twine thickness
    3. Selective devices like sorting grids or square mesh panels in demersal trawl fisheries
    4. Sieve-panel or catch reduction devices (BRDs)
    5. Beam size and number of dredges in beam trawl and dredge fisheries
    6. Net height/length in gillnet
    7. Maximum number of nets or hooks
    8. Hanging ratio in gillnet fisheries
    9. Increased selectivity in traps/pots e.g. escape gap dimensions or modifications to increase species/size selectivity
    10. Lights
    11. Others?
- High survivability exemptions
- *De minimis* exemptions
- Quota swaps
    1. Between member states
    2. Between vessels within member state
    3. For what species?
- Interstock flexibility (species quota swap)
- Change in quota management
    1. What are the current quota management systems?
    2. Are there species-specific differences?
    3. Has this been the same from 2014 to now?

- Change of minimum landing size (or rather Minimum Conservation Reference Size compared to MLS since MLS became MCRS. The case for Baltic cod from 38 cm to 35 cm in 2015 but others?
- Removal of TAC to avoid LO for the stocks? The case for dab and flounder in the North Sea in early 2017 but others?
- Last Haul ("last observed haul"-approach)
- Interspecies and inter annual quota flexibility mechanisms
- Others?

A2. What operational solutions / management measures mentioned above (A1) have been tried in this region in the period 2014-2020?

In addition to the above listed this could be:

- Trials on electronic monitoring (e.g. Germany, Denmark, Netherlands, England, Scotland, (Sweden))
- Voluntary vessels measures (e.g. water-filled hopper or water provisions during sorting process to increase survivability, increase mesh size, ensilage of BMS-catches, etc.)
- Others?

B. Of these, which were tested or implemented specifically due to the landing obligation?

_____

C. Of the management measures and operational solutions we have talked about, are there any which were tested or implemented as ecosystem measures? For instance: closed areas to protect seabed from fishing pressure.

_____

D. What are/were/could be operational solutions (e.g. technical fix in fishing operations, escape panels, lights as deterrents/attractants to remove unwanted fish, potential change of mesh size) from pilot studies or trials that could be more efficient than management measures when facing the LO, in your view?

D1: How have the management measures impacted different fleet segments / fisheries? E.g. Less risk of chokes? Decreased income? Increased handling time?

D2: How have the operational solutions or trials impacted different fleet segments / fisheries?

D3: Has there been a difference in adoption/compliance between different fleet segments/fisheries in terms of adopting management measures? If so please describe

D4: Has there been a difference in adoption/compliance between different fleet segments/fisheries in terms of adopting operational solutions? If so please describe

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E1: What are the main obstacles in the implementation of these management measures*?

E2: What are the main obstacles in the implementation of these operational solutions*?

***(e.g. lack of data, models or appropriate scientific understanding, or where the solutions would be incompatible with entrenched legislation (e.g. relative stability) or due to level playing field among actors (essentially that management and control measures are equal enough between member states to ensure fair competition in the industry regardless of nationality)**

F1: Which management measures were successful and/or have been adopted by the fishing fleet and do you have an estimate of how large the uptake is?

F2: Which operational solutions/trials were successful and/or have been adopted by the fishing fleet and do you have an estimate of how large the uptake is?

G. **Do you know of any voluntary initiatives taken by local producer organisations (POs) or advisory councils (ACs) to facilitate the landing obligation? Including market measures.**

H. **Do you have an overview of to what extent the implemented management measures are complied with?**

I. **Do you know on what basis exemptions from the LO have been implemented for the area/fisheries you represent? This could for instance be due to unavoidable mixed catches, survivability, disproportionate costs for handling and sorting the catch, lack of funding for investments/adaptations**

J. **How are exemptions monitored by controlling offices in your country?**

K. **What other challenges (outside of the Landing Obligation) can you identify as of major concern to different fleet segments/fisheries?**

ANNEX 1.6 – DATA ASSEMBLY TEMPLATE

Blank Template

Discard Plan: [insert name] (e.g. EU Landing Obligation)				
Member State: [insert name]				
General management measure: [insert a management measure listed in Table 1]				
Geographical scope	EU ☐	Regional ☐	National ☐	Other ☐
Nature of the obligation	Mandatory/voluntary			
Decision making level	EU/Regional/MS/sector (self-imposed)			
Field of application	At sea/at port/			
Regulatory framework	EU regulation:		National regulation:	
Responsible for enforcing	MS/other			
Specific measure	Date of implementation	Control/monitoring/enforcement measure	Outcome	Scores
[Introduce the specific measure e.g. selectivity devices]	[Insert date of implementation]	[Insert enforcement measure: e.g. logbook/inspection at sea/at port/aerial surveillance]	[Mention the fisheries in which these measures have been implemented]	1: Not enforced 2: Partially enforced 3: Fully enforced
[Introduce the specific measure]	[Insert date of implementation]	[Insert enforcement measure: e.g. logbook/inspection at sea/at port/aerial surveillance]	[Mention the fisheries in which these measures have been implemented]	1: Not enforced 2: Partially enforced 3: Fully enforced
Reasons for the fulfilment/or not of the objectives				
[Mention what regulatory and institutional factors have impeded/facilitated the degree of fulfilment of the objectives] [Mention what factors strictly inherent to the fishing activity (i.e. extractive, at port, distribution) have impeded or facilitated the degree of fulfilment of the objectives] [Mention if there has been a need to adapt/remove/create regulatory and institutional frameworks] [Mention if incentives have been provided to promote voluntary measures] [Describe if there is any overlap of competences at national level e.g. national/provincial; fisheries authorities/other authorities][Describe any other factor]				

ANNEX 1.7: Methods

The methods applied in Task 3 are:

1. a desk study (literature review, data collection);
2. In-depth assessment and consultation with experts and stakeholders via different tools: oral interviews, an e-workshop, an online survey.

Each of these methods are described under separate headings below.

Desk study

For the desk study, a five-step approach for systematic reviewing (Khan et al. 2003) was used. First, the main review questions were identified:

3. What are the control management measures currently in force?
4. What are their characteristics and advantages/disadvantages?
5. Which ones are broadly implemented, and which ones are not?

Relevant primary and grey literature publications were identified using a two-stage approach. In the first stage studies were identified using scientific citation search engines (e.g., Web of Science (WoS), Google Scholar). A list of search terms was used to identify the literature, including "wild cards" (e.g., discards*). We limited our focus to European studies conducted in the period 2014-2020 (February/March). Valorisation of bycatch products, ecological assessments and "high survival" studies were not included. The results of this search are listed in Table A3 (Annex 2). Relevant literature was exchanged between Tasks 1 and Tasks 3. The second stage was an extended literature search: examining the selected articles to identify other sources of relevant information/data from the reference lists of those articles (Annex 2, Table A4). Besides A1-publications, a search was conducted for reports and other relevant documents published by different (inter)national organisations (e.g. EFCA, ICES, EC) and Member States (Annex 2, Table A5). Various European project outputs (e.g., H2020 Discardless[1], H2020 Minouw[2]) were consulted as well.

In a next step, the quality of the studies was assessed via content screening of the selected papers and a final list of publications was made. Lastly, relevant info was summarized and main findings were synthesized and interpreted.

[1] www.discardless.eu
[2] www.minouw-project.eu

Oral interviews

For Task 1 and Task 3, a joint interview guide with 18 open questions was drafted with the aim of interviewing stakeholders (MS ministries, fishing industry and NGOs) on LO management measures. This interview guide was employed by the consortium (Denmark, France, Germany, Ireland the Netherlands, Belgium, Latvia, Poland, Portugal, Spain, Sweden, UK and the Outermost Regions of Portugal and Spain). A minimum of two interviews was demanded per country. Each of the partners delivered written transcripts with anonymous responses.

E-workshop

Two e-workshops, for both "Baltic Sea and North Sea" (BS&NS) and "Atlantic Western Waters" (AWW), were organized for Task 1 and Task 3 combined:

- *"The Landing Obligation management and control measures in the Baltic and North Seas" on the 9 and 10 June 2020 (Lot1).*
- *"The Landing Obligation management and control measures in the Atlantic WW " took place on the 17 of June 2020 (Lot 2).*

A summary of the respective e-workshops was sent to all stakeholders and provided as an Annex (both Lots). During the first day of the workshop two presentations were given on the topic of LO management measures and commonly employed control technologies in EU fisheries. During the second day of the workshop, stakeholders were split over three subgroups. Discussions in both e-workshops related to the topic of control and enforcement mainly revolved around the general lack of compliance to the LO and the future use of electronic monitoring to improve compliance. Feedback from the participants was used as a basis for the online survey (Task 3.3).

Online survey

To complement information gathered via the literature study, an online survey was developed in Survey Monkey©. Survey questions were drafted in close collaboration with scientists from both Lots involved in Task 1.2. This questionnaire listed 28 questions, including closed- and open-ended questions. The questionnaire was sent to all participants of the e-workshop.

To broaden the range of disciplines covered other eligible experts of AWW, North Sea and Baltic sea fisheries were identified and addressed as well. In total, the link to the full survey was emailed to 179 stakeholders in total (115 in Lot 1 and 64 for

Lot 2, NGO's, scientific institutes, EU institutions, consultancy, governments/ministries). The survey was also forwarded by some respondents to other experts in their own network. The survey was accessible for respondents between October 26 and November 20, 2020. The estimated time needed to fill in the survey was 15 minutes.

The first part of the survey (**Questions 1-3**) aimed to sketch the stakeholder profiles. **Questions number 4, 5 and 6** focussed on LO management measures (e.g., gear modifications, move-on rules, removal of TACs and area closures) and mainly delivered input for Section 2 of the main report. The other responses to each of the questions in the survey relate to the following overarching topics: management measures, control measures and compliance, funding and regulatory process and Remote Electronic Monitoring (REM). The main outcomes of the literature review that was conducted under Section 5 of the main report will be discussed jointly with survey, e-workshop and interview outcomes below in the general discussion.

Response rate and stakeholders' profile

In total, 94 respondents answered the questionnaire, 62 for NS&BS and 32 for AWW. The average response rate to the survey, defined as the number of responses received divided by the number of surveys sent out, could not be calculated as the invitation link to the survey was forwarded by multiple stakeholders. Hence, the number of stakeholders that received the survey is unknown. However, the response rate per question could be calculated (Annex 3.2- Table A1). The response rate per question (in percentage) was calculated by dividing the number of respondents answering a specific question to the total number of respondents taking part in the study (i.e., 62 and 32). The response rate varied between 11-100%, with an average of 60.77% (Annex 3.2-Table A2) for NS&BS and 14-100%, with the same average for AWW (Annex 3.2– Table A10).

In the first part of the questionnaire, respondents were asked to indicate the field of their professional activity (**Question 1**), the country where they work (**Question 2**) and the geographical areas where they are active (**Question 3**). The geographical distribution of the respondents covered the NS, the BS, the AWW and to a minor extent the Mediterranean, outermost regions and other regions (e.g., global, all EU waters). For the NS&BS Table 1 shows the percentage of

respondents for each professional category and country where they conduct their activities. Most respondents indicated to be professionally active in industry (37%), followed by NGO's (23%), ministries (15%) and scientific institutions (14.5%). For the AWW, Table 2 provides the structure of the responses by country and professional field. 37% of the respondents were located in Spain, 23% in France, followed by UK with almost 17% of the respondents, other countries were below 10%. Most respondents indicated to belong to industry (60%), followed by research (20%), NGO's (10%) or consultancy firms (6.7%).

The geographical distribution of the respondents covered the AWW and to a minor extent the Mediterranean, Outermost Regions, and other regions (e.g., North Sea).

Table 1: Percentage (%) respondents per country and professional field (EU offices/institutions, Ministry/government, Industry, NGO, science, other) for BS&NS. In the field "Other", respondents could indicate additional answer options besides the ones provided. Countries are abbreviated: BE = Belgium, DE = Denmark, FR = France, GE = Germany, NO = Norway, PO = Poland, SW= Sweden, NE = the Netherlands, UK = United Kingdom.

Field/Country	BE	DE	FR	GE	NO	PO	SW	NE	UK	Other	Total
EU offices	4.84						1.61				**6.45**
Ministry	3.23	3.23				3.23	1.61	3.23			**14.52**
Industry	1.61	17.74		1.61		6.45	1.61	4.84	1.61	1.61	**37.10**
NGO	3.23	3.23		3.23			3.23	1.61	4.84	3.23	**22.58**
Research & academia	4.84		1.61	1.61	1.61	1.61	1.61	1.61			**14.52**
Other		1.61					1.61	1.61			**4.84**
Totals	**17.74**	**25.81**	**1.61**	**6.45**	**1.61**	**11.29**	**11.29**	**12.90**	**6.45**	**4.84**	

Table 2: Percentage (%) respondents per country and professional field (EU offices/institutions, Ministry/government, Industry, NGO, science, other) the AWW. Countries are abbreviated: FR = France, IR – Ireland, BE = Belgium, PT = Portugal, SP = Spain, UK = United Kingdom.

Field/Country	FR	IR	BE	PT	SP	UK	Total
Consultancy				3.33%	3.33%		**6.66%**
EU agency/body			3.33%				**3.33%**
Ministry							
Industry	20.00%	3.33%	3.33%		23.33%	10,00%	**59.99%**
NGO	3.33%	3.33%			3.33%		**9.99%**
Research & academia				6.67%	6.67%	6,67%	**20.01%**
Totals	**23.33%**	**6.66%**	**6.66%**	**10.00%**	**33.66%**	**16.67%**	

ANNEX 1.8 – SPECIES AND GEARS COVERED BY THE LO FROM 2015 TO 2020 IN THE BALTIC AND NORTH SEAS AND ATLANTIC WESTERN WATERS

Baltic Sea

Table A1 - Overview of Baltic Sea species with first year of species becoming subject to the landing obligation, the relevant discard plans, gear codes, exemptions from the landing obligation in place, gear codes for exemption and ICES area for exemption.

Species	First year	Discard plans	Relevant gear codes	Type of LO exemption	Gear code LO exemption	ICES area with LO exemption
Cod (*Gadus morhua*)	2015	Delegated regulation (EU) No 1396/2014 and 2018/306	All	High survivability	FPO, FYK, FPN	3b,3c,3d
Salmon (*Salmo salar*)	2015	Delegated regulation (EU) No 1396/2014 and 2018/306	All	High survivability	FPO, FYK, FPN	3b,3c,3d
Herring (*Clupea harengus*)	2015	Delegated regulation (EU) No 1396/2014 and 2018/306	All	None	None	None
Sprat (*Sprattus sprattus*)	2015	Delegated regulation (EU) No 1396/2014 and 2018/306	All	None	None	None
Plaice (*Pleuronectes platessa*)	2017	Delegated regulation (EU) No 1396/2014 and 2018/306	All	High survivability (from 2018)	FPO, FYK, FPN	3b,3c,3d
All other species with TAC or MCRS	2017	REGULATION (EU) No 1380/2013 and 2018/306	All	None	None	None

North Sea pelagic fisheries/species

Table A2 - Overview of pelagic species in the North Sea region with first year of species becoming subject to the landing obligation, the relevant discard plans, gear codes, exemptions from the landing obligation in place, gear codes for exemption and ICES area for exemption.

Species	First year	Discard plans	Relevant gear codes	Type of LO exemption	Gear code LO exemption	ICES area with LO exemption
Herring (*Clupea harengus*)	2015	Delegated regulation (EU) 1395/2014 and 2018/189	OTM, PTM, PS, OTB, PTB, GNS, GND, MIS	High survivability and de minimis (1% from 2019)	PS; OTM, PTM	3a, 4
Blue whiting (*Micromesistius poutassou*)	2015	Delegated regulation (EU) 1395/2014 and 2018/189	OTM, PTM	None	None	3a, 4
Greater silver smelt (*Argentina silus*)	2015	Delegated regulation (EU) 1395/2014 and 2018/189	OTM, PTM	None	None	4
Horse mackerel (*Trachurus spp.*)	2015	Delegated regulation (EU) 1395/2014 and 2018/189	OTM, PTM, PS	De minimis (1% from 2019)	OTM, PTM	4b, 4c
Mackerel (*Scomber scombrus*)	2015	Delegated regulation (EU) 1395/2014 and 2018/189	OTM, PTM, PS, OTB, PTB, GNS, GND,LLS, LHP, MIS	High survivability and de minimis (1% from 2019)	PS	3a, 4
Sprat (*Sprattus sprattus*)	2015	Delegated regulation (EU) 1395/2014, 2017/1393 and 2018/189	OTM, PTM, PS, MIS, ind. Trawl	None	None	3a, 4
Norway Pout (*Trisopterus esmarkii*)	2015	Delegated regulation (EU) 1395/2014 and 2018/189	Any trawl < 32 mm, PS	None	None	3a, 4
Sand eel (*Ammodytes spp.*)	2015	Delegated regulation (EU) 1395/2014	Any trawl < 32 mm, PS	None	None	3a, 4

		and 2018/189				
Whiting (*Merlangius merlangus*)	2015	Delegated regulation (EU) 1395/2014 and 2018/189	when caught by pelagic	De minimis (1% from 2019)	OTM, PTM	4
Any pelagic quota species	2019	Delegated regulation (EU) 2018/2035	All	High survivability	FPO/FYK	3a, 4
Any pelagic quota species	2019	Delegated regulation (EU) 2018/2035 and 2019/2238	All	De minimis (7% combined from 2019. 6% planned for 2021)	TBN, TB	4b, 4c

North Sea demersal fisheries/species

Table A3 - Overview of demersal species in the North Sea region with first year of species becoming subject to the landing obligation, the relevant discard plans, gear codes, exemptions from the landing obligation in place, gear codes for exemption and ICES area for exemption. Exemptions altered or removed before 2020 are not shown.

Species	First year	Discard plans	Relevant gear codes	Type of LO exemption	Gear code LO exemption	ICES area with LO exemption
Cod (*Gadus morhua*)	2017	Delegated regulation (EU) 2016/2250, 2018/2035, 2018/45, 2019/2238	All	Survivability exemption; de minimis (4-6% by 2021 depending)	FPO/FYK, OTB, OTT, SDN, SCC, TBN	3a, 4
Haddock (*Melanogrammus aeglefinus*)	2016	Delegated regulation (EU) 2015/2440, 2016/2250, 2018/2035, 2018/45, 2019/2238	All	Survivability exemption; de minimis (4-6% by 2021 depending)	FPO/FYK, OTB, OTT, SDN, SCC, TBN	3a, 4
Whiting (*Merlangius merlangus*)	2017	Delegated regulation (EU) 2016/2250, 2018/2035, 2018/45, 2019/2238	All	Survivability exemption; de minimis (4-6% by 2021 depending)	FPO/FYK, OTB, OTT, SDN, SCC, TBN	3a, 4
Saithe (*Pollachius virens*)	2016	Delegated regulation (EU) 2015/2440, 2016/2250, 2018/2035, 2018/45, 2019/2238	All	Survivability exemption; de minimis (4-6% by 2021 depending)	FPO/FYK, OTB, OTT, SDN, SCC, TBN	3a, 4
Hake (*Merluccius merluccius*)	2016	Delegated regulation (EU) 2015/2440, 2016/2250, 2018/2035, 2018/45, 2019/2238	All	Survivability exemption; de minimis (4-6% by 2021 depending)	FPO/FYK, OTB, OTT, TBN, TB	3a, 4
Norway lobster (*Nephrops norvegicus*)	2016	Delegated regulation (EU) 2015/2440, 2016/2250, 2018/2035, 2018/45, 2019/2238	All	Survivability exemption; de minimis (6% by 2021 depending)	FPO/FYK, OTB, OTT, TBN, TB	2a, 3a, 4

North Deepwater Prawn (*Pandalus borealis*)(PRA)	2016	Delegated regulation (EU) 2015/2440, 2016/2250, 2018/2035, 2018/45, 2019/2238	All	Survivability exemption; de minimis (6% by 2021 depending)	FPO/FYK, TBN, TB	3a, 4
Common Sole (*Solea solea*)	2016	Delegated regulation (EU) 2015/2440, 2016/2250, 2018/2035, 2018/45, 2019/2238	All	Survivability exemption, De minimis (from 3-6% combined by 2021)	FPO/FYK, OTB, OTT, TBB, GN, GNS, GND, GNC, GTN, GTR, GEN, GNF	2a, 3a, 4
Plaice (*Pleuronectes platessa*)	2016	Delegated regulation (EU) 2016/2250, 2018/2035, 2018/45, 2019/2238	All	Survivability exemption, De minimis (from 3-6% combined by 2021)	FPO/FYK, SDN, OTB, PTB, GNS, GTR, GTN, GEN, BT2, TBN, TB	2a, 3a, 4
Turbot (*Scophtalmus maximus*)	2019	Delegated regulation (EU) 2018/2035, 2019/2238	All	Survivability exemption (from 2020)	FPO/FYK, TBB	3a, 4
Skates and rays	2019	Delegated regulation (EU) 2018/2035, 2019/2238	All	Survivability exemption	All	2a, 3a, 4
Horse mackerel (*Trachurus spp.*)	2019	Delegated regulation (EU) 2018/2035, 2019/2238	All	De minimis (6% combined from 2021)	OTB, OTT, PTB, TBB (TR2, BT2)	4
Mackerel (*Scomber scombrus*)	2019	Delegated regulation (EU) 2018/2035, 2019/2238	All	De minimis (6% combined from 2021)	OTB, OTT, PTB, TBB (TR2, BT2)	4
Sprat (*Sprattus sprattus*)	2019	Delegated regulation (EU) 2018/2035, 2019/2238	All	de minimis (1% from 2020)	OTB, OTM, OTT, PTB, PTM, SDN, SPR, SSC, TB, TBN)	3a, 4
Blue whiting (*Micromesistius poutassou*)	2019	Delegated regulation (EU) 2018/2035, 2019/2238	All	de minimis (1% from 2020)	OTB, OTM, OTT, PTB, PTM, SDN, SPR, SSC, TB, TBN)	3a, 4
Norway Pout (*Trisopterus esmarkii*)	2019	Delegated regulation (EU) 2018/2035, 2019/2238	All	de minimis (1% from 2020)	OTB, OTM, OTT, PTB, PTM, SDN, SPR, SSC, TB, TBN)	3a, 4

Sand eel (*Ammodytes spp.*)	2019	Delegated regulation (EU) 2018/2035, 2019/2238	All	de minimis (1% from 2020)	OTB, OTM, OTT, PTB, PTM, SDN, SPR, SSC, TB, TBN)	3a, 4
Ling (*Molva molva*)	2019	Delegated regulation (EU) 2018/2035, 2019/2238	All	De minimis (3%)	LLS	4
Other quota species, including pelagic	2019	Delegated regulation (EU) 2018/2035, 2019/2238	All	Survivability exemption, De minimis (6% combined from 2021)	FPO/FYK, TBN, TB	3a, 4

Atlantic Western waters pelagic fisheries/species

Table A4 - Overview of pelagic species in the AWW region with first year of species becoming subject to the landing obligation, the relevant discard plans, gear codes, exemptions from the landing obligation in place, gear codes for exemption and ICES area for exemption.

Species	First year	Discard plans	Relevant gear codes	Type of LO exemption	Gear code LO exemption	ICES area with LO exemption
Albacore tuna (*Thunnus alalunga*)	2015	EU2014_1393 EU2018_0190 EU2014_1394 EU2018/0188	PTM	De minimis (5-7%)	PTM	7, 8
Anchovy (*Engraulis encrasicolus*)	2015	EU2014_1394 EU2018/0188	All	Survivability exemption; de minimis (1-7%)	PS, OTM, OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV	8, 9, 10, CECAF 34.1.1., 34.1.2. and 34.2
Blue whiting (*Micromesistius poutassou*)	2015	EU2014_1393 EU2018_0190 EU2014_1394 EU2018/0188 EU2018/0044	All	De minimis (5-7%)	OTM, PTM, OTT, OTB, PTB, OT, PT, TBN, TBS, TX, SSC, SPR, TB, SDN, SX, SV	5b, 6, 7, 8, 9a
Boarfish (*Capros aper*)	2015	EU2014_1393 EU2019/2239 EU2018/2033	All	De minimis (0.5-7%)	OTM, PTM, OTT, OTB, PTB, OT, PT, TBN, TBS, TX, SSC, SPR, TB, SDN, SX, SV	6, 7, 8, 9
Herring (*Clupea harengus*)	2015	EU2014_1393 EU2018_0190	All	Survivability exemption	PS, GND	5b, 6, 7
Horse mackerel	2019	EU2018/2034 EU2019/22	All	De minimis (3-7%)	OTB, OTT, PTB, TBN, TBS, TBB,	6, 7b-7k, 8, 9, 10, CECAF

(*Trachurus spp.*)		39 EU2018/2033 EU2019/2239			OT, PT, TX, SSC, SPR, SDN, SX, SV, GNS, GND, GNC, GTR, GTN	34.1.1., 34.1.2. and 34.2
Mackerel (*Scomber scombrus*)	2015	EU2014_1393 EU2018_0190	All	Survivability exemption; de minimis (1-7%)	PS, OTM, OTB, OTT, OT, PTB, PT, SSC, SDN SPR, SX, SV, TBB, TBN, TBS, TB, TX, GNS, GND, GNC, GTR, GTN	5b, 6, 7, 8, 9, 10, CECAF 34.1.1., 34.1.1. and 34.2
Whiting (*Merlangius merlangus*)	2016	EU2015/2438 EU2016/2375 EU2018/0046 EU2018/2034 EU2019/2239 EU2018/2033 EU2019/2239	All	De minimis (4-7%)	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV, GNS, GND, GNC, GTR, GTN	7b-7k, 8, 9

Western waters demersal fisheries/species

Table A5 - Overview of demersal species in the AWW region with first year of species becoming subject to the landing obligation, the relevant discard plans, gear codes, exemptions from the landing obligation in place, gear codes for exemption and ICES area for exemption. Exemptions altered or removed before 2020 are not shown.

Species	First year	Discard plans	Relevant gear codes	Type of LO exemption	Gear code LO exemption	ICES area with LO exemption
Alfonsinos (*Beryx spp.*)	2019	EU2018/2033	LL	De minimis (5%)	LHP, LHM, LLS, LLD	10
Anglerfish (*Lophiidae*)	2018	EU2018/0044 EU2018/2033	All	De minimis (4-7%)	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV, GNS, GN, GND, GNC, GTN, GTR and GEN	8,9
Black scabbardfish (*Aphanopus carbo*)	2017	EU2017/2167	All	Predation	LLS, DWS	8, 9, 10, CECAF 34.1.2.
Cod (*Gadus morhua*)	2019	EU2018/2034	All	De minimis (7%)	OTB, OTT, OT, PTB, PT, SSC, SDN SPR, SX, SV, TBB, TBN, TBS, TB, TX	7b, 7c, 7e-7k
Common Sole (*Solea solea*)	2016	EU2015/2438 EU2016/2375 EU2018/0046 EU2018/2034 EU2019/2239 EU2015/2439 EU2016/2374 EU2018/2033	All	Survivability exemption; de minimis (3-7%)	OTT, OTB, TBB, TBS, TBN, TB, PTB, OT, PT, TX, GN, GNS, GND, GNC, GTN, GTR, GEN, GNF	7d-7h, 8a, 8b, 9a

		EU2019/2239				
Great forkbeard (*Phycis blennoides*)	2019	EU2018/2033 EU2019/2239	All	De minimis (3-7%)	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV, LHP, LHM, LLS, LLD	9a, 10
Greater silver smelt (*Argentina silus*)	2020	EU2019/2239	All	De minimis (0.6%)	OTT, OTB, TBS, TBN, TB, PTB, OT, PT, TX	5b, 6
Haddock (*Melanogrammus aeglefinus*)	2019	EU2018/2034 EU2019/2239	All	De minimis (3-7%)	OTB, OTT, OT, PTB, PT, SSC, SDN SPR, SX, SV, TBB, TBN, TBS, TB, TX	6a, 7b, 7c, 7e-7k
Hake (*Merluccius merluccius*)	2016	EU2015/2439 EU2016/2374 EU2018/0044 EU2019/2239	All	De minimis (5-7%)	OTT, OTB, PTB, OT, PT, TBN, TBS, TX, SSC, SPR, TB, SDN, SX and SV	8, 9
Megrim (*Lepidorhombus spp.*)	2019	EU2018/2033 EU2019/2239	All	De minimis (3-5%)	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV, GNS, GND, GNC, GTR, GTN	7, 8, 9
Norway lobster (*Nephrops norvegicus*)	2016	EU2015/2438 EU2016/2375 EU2018/0046 EU2018/2034 EU2019/2239 EU2015/2439	All	Survivability exemption	OTB, OTT, PTB, TBN, TBS, TB, OT, PT, TX, FPO, FIX, FYK	6, 7, 8, 9

		EU2016/2374 EU2018/0044 EU2018/2033 EU2019/2239				
Plaice (*Pleuronectes platessa*)	2019	EU2018/2034 EU2019/2239	All	Survivability exemption; de minimis (3-5%)	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV, GNS, GND, GNC, GTR, GTN	7, 8, 9
Pollack (*Pollachius pollachius*)	2019	EU2018/2033	All	De minimis (2-5%)	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV, GNS, GND, GNC, GTR, GTN	8, 9
Red seabream (*Pagellus bogaraveo*)	2019	EU2018/2033	All	Survivability exemption; de minimis (7%)	LLS, DWS, OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV	9
Skates and rays (*Rajiformes*)	2019	EU2018/2034 EU2019/2239 EU2018/2033	All	Survivability exemption	OTB, OTT, PTB, TBN, TBS, TBB, OT, PT, TX, SSC, SPR, SDN, SX, SV, GNS, GND, GNC, GTR, GTN	6, 7, 8, 9

ANNEX 1.9 FISHERY ANALYSIS PLOTS IN THE SHINY APP

This fishery analysis page provides figures that highlight discard rates and associated information for each fishery and species selected. The figures show discard rates by fishery over the time series, discard coverage for the fisheries and species, spatial distribution of landings prior and post the introduction of the landing obligation and ICES stock assessment information (if available for the species).

Only fisheries that meet the criteria set in the threshold filters on the Dashboard page are shown. The filters allow the user to set thresholds for discard coverage and contribution to total landings by the fisheries, in order to filter out fisheries with discard rates based on very little information or fisheries that are of less importance for the landings of the species.

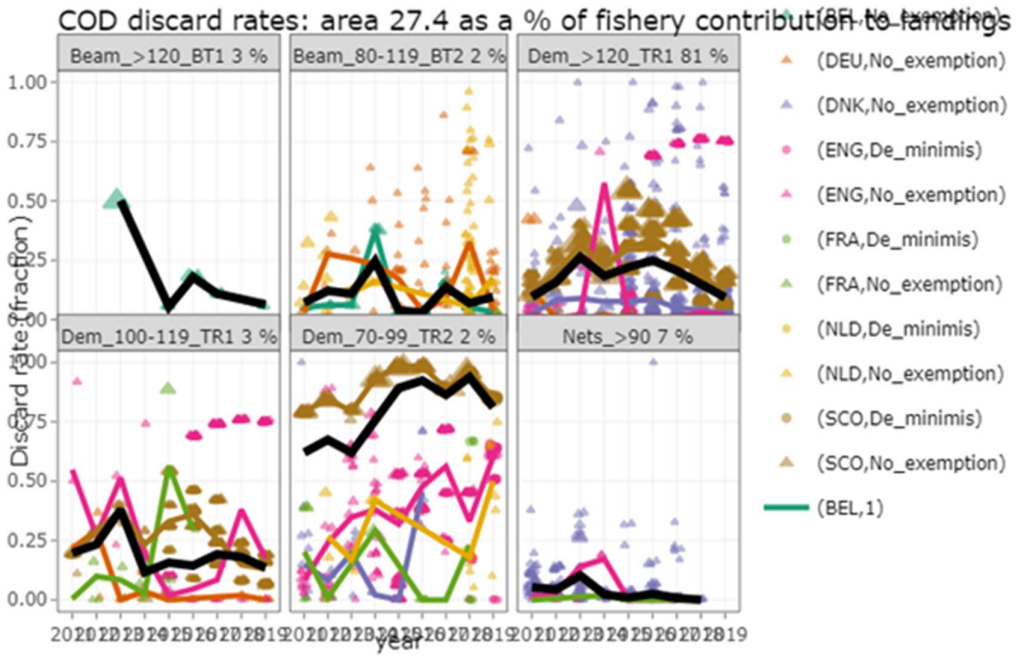

Figure A1; Discard rates.

Figure A1 shows a time series with overall discard rate (black line), discard rate by country (coloured lines) and discard rate of each individual data entry by country and exemption type (different shape of the data points). The size of the individual data points is proportional to the amount of discards of the data point. Each panel shows one fishery. The percentage shown in the header of the plots reflects the proportion of landings of the selected species taken by each fishery. The figure is interactive, and you can hover the cursor over any data point, as well and turn on and off data to visualise only certain features as well as directly download the figure to your computer.

The overall discard rate reflects the ratio between the sum of all discard entries (across countries) and the sum of all landings and discard entries (total discards/(total landings+total discards)) of the species. This means that countries with large catches have more influence on the overall discard rate than countries with smaller catches.

It is important to know that discard data is based on National sampling programmes that do generally not support the fine level of aggregation requested by the STECF FDI data call. Discards are usually estimated on a more aggregated level and then partitioned into individual data entries, in order to meet the requirements of the more disaggregated data format. This means that individual discard data points in Fig A1 do not reflect true variability between or within strata, but should be viewed merely as an illustration of the diversity in the submitted data. Depending on the method used to partition the discard estimates between smaller data entries, some data points in the plot may have the same discard rate since they were derived from the same discard estimate, but they may also appear to have different rates even if they are still derived from the same estimate. Therefore, care should be taken when interpreting individual data point in Figure A1. The (sometimes) increased number of data points from 2015 onwards in Figure A1 is an effect of a change in the requested data format and does not reflect increased sampling intensity.

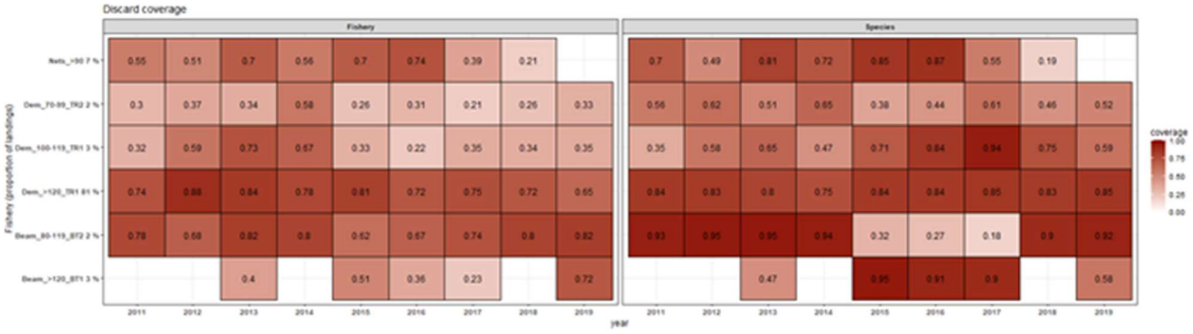

Figure A2; Discard coverage

Figure A2 shows the proportion of landings (in weight) that have a matching discard estimate. The left panel shows the proportion of landings of all species in the fishery covered by discard estimates. This panel gives an idea of how well the fishery has been sampled in general for discards. The right panel shows the proportion of landings of the selected species that has an associated discard estimate. This plot reflects the settings of filter 1 and 2 on the Dashboard page in the ShinyApp; if filter 1 is set to 40 %, only fisheries with an average discard coverage (across years) in the right panel of this plot will be shown in all the plots of the Fishery analysis page in the ShinyApp. The same goes for filter 2 and the left panel.

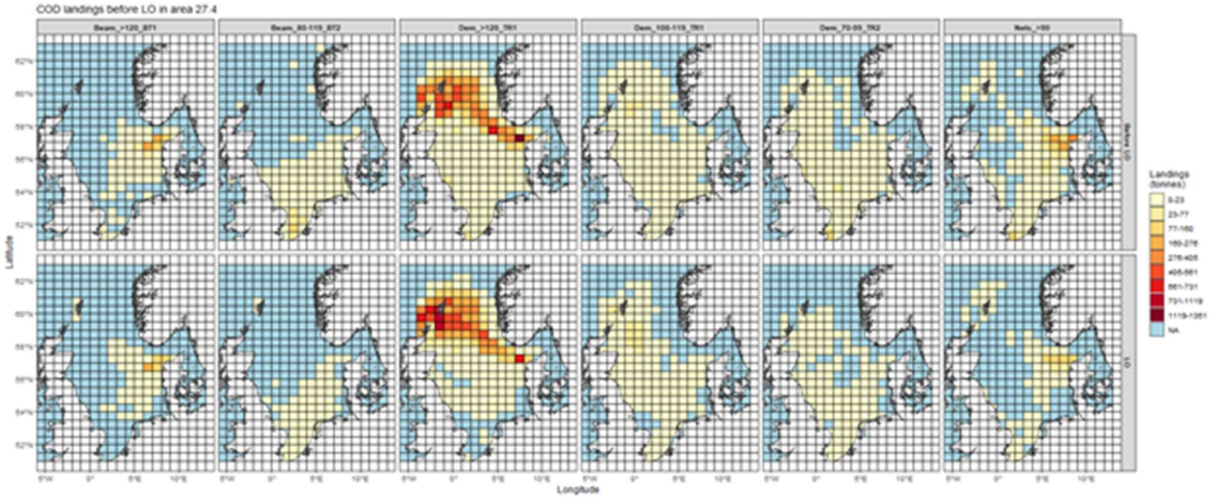

Figure A3; Spatial distribution of landings.

Figure A3 shows the sum of landings of the selected species by fishery and ICES rectangle, both for the years before (top panels) and after (bottom panels) the introduction of the landing obligation. Since the year of the landing obligation introduction varies between species and fisheries, the panels do not always reflect the same number of years across fisheries.

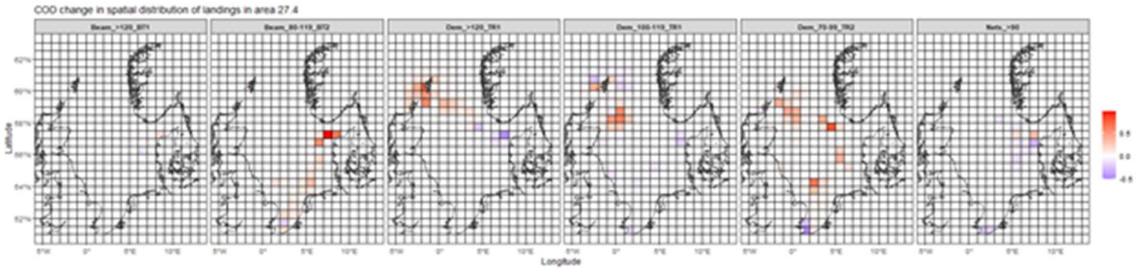

Figure A4; Change in spatial distribution of landings.

Figure A4 shows the relative change in landings of the selected species between the time periods prior and post implementation of the landing obligation, by ICES rectangle. The landings are standardized within each time period before the change is calculated.

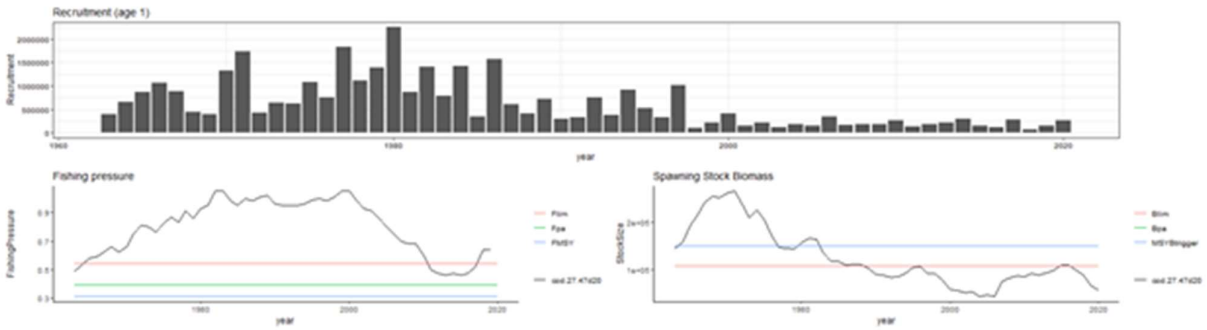

Figure A5; ICES stock assessment information.

Figure A5 shows the recruitment, fishing pressure and spawning stock biomass as provided by ICES stock assessment working groups. Since discard rates are strongly influenced by the size structure and abundance of the stocks, this holds important information when interpreting changes in discard rates. Especially recruitment is an important factor in regard to discards; if recruitment goes down, the proportion of small fish in the stock will decrease and discard rates will likely also decrease.

ANNEX 1.11

Table A1 Response rate (%) per question for the stakeholders of the North Sea and Baltic Sea. Answered = number of respondents that answered the question. Skipped = number of respondents that skipped the question.

Question Number	Answered	Skipped	Response rate (%)
1	62	0	100
2	61	1	98.39
3	62	0	100
4	43	19	69.36
5	42	20	67.74
6	41	21	66.13
7	39	23	62.90
8	28	34	45.16
9	7	55	11.29
10	27	35	43.55
11	27	35	43.55
12	25	37	40.32
13	40	22	64.52
14	28	34	45.16
15	35	27	56.45
16	38	24	61.29
17	40	22	64.52
18	40	22	64.52
19	40	22	64.52
20	40	22	64.52
21	40	22	64.52
22	40	22	64.52
23	40	22	64.52
24	39	23	62.90
25	39	23	62.90
26	40	22	64.52
27	37	25	59.68
28	15	47	24.19

Table A2 Written answers provided by stakeholders (North Sea and Baltic Sea) below answer option "Other" for Question 5.

N0	Quotes
1	*"Exemptions need to be based on sound scientific evidence and their use effectively monitored and all discards documented. In light of poor compliance as widely recognised exemptions represent risky loopholes. TAC removal only addresses choke issues cosmetically without any benefit for the stocks but on the contrary removes a direct way of controlling fishing mortality. MCRS should only be changed where this is in line with the biology of the stock, i.e. reflecting the maturity of the stock. Out of the options specified any quota related options are preferable."*
2	*"As the priority should lay on avoidance of unwanted catches."*
3	*"Charging scheme linked to landing over quota fish."*
4	*"Varies case by case. These LO management measures can have an effectiveness, but you can't say anything in general terms - it all depends on the specific circumstances."*
5	*"It all depends on the specific conditions."*
6	*"All have the potential, again depending on specifics."*
7	*"Remove MCRS."*
8	*"Increasing selectivity (through different measures) to not catch those unwanted catches in the first place."*
9	*"Subsidies for gear innovations and responsive fisheries management when innovative gears are ready for use."*
10	*"Unwanted catches should be avoided in the first place. That is an objective of the CFP."*
11	*"Criteria for national quota swaps to avoid quota hoarding for target species only".*

Table A3 Written answers provided by stakeholders (North Sea and Baltic Sea) below answer option "Other" for Question 6.

N0	Quotes
1	*See comments on other questions re: why options like TAC removal and exemptions are risky. Interannual and interspecies flexibility similarly pose risks biologically since they mean that additional quota beyond the scientific advice for a stock could be added, jeopardising sustainability.*
2	*Only answered to measures, that comply with the overarching goals of the CFP*
3	*Where "not relevant" was ticked: I do not consider these as long term economically sustainable solutions. Obviously, there is a certain, though unsustainable short term effectiveness with profitability of the fleet*
4	*A more ecosystem-based management system and more efficient control at sea would be a more holistic approach for the long term economic and ecosystem health.*
5	*Varies case by case. These LO management measures can have an effectiveness, but you can't say anything in general terms - it all depends on the specific circumstances.*
6	*It all depends on the specific conditions.*
7	*Silly question. The all have potential but it depends on the actual stock, fishery, area, situation. For bureaucrats and scientists it may be interesting to think in boxes, but this is not so for practical people*
8	*Marketing incentives: e.g. establishing discard avoidance champions and publicising them*

Table A4 Written answers provided by stakeholders (North Sea and Baltic Sea) below answer option "Other" for Question 8.

N0	Quotes
1	*"The key challenge is that the incentive to continue discarding (e.g. to avoid choking / not being able to fully exhaust one's quota portfolio) are too strong, while the risk of detection and punishment for non-compliance is too high due to the lack of proper, comprehensive control/monitoring/enforcement (e.g. through REM). Without reliable control measures being rolled out across the fleet, non-compliance will remain an issue. The prevalence of exemptions and flexibilities (including also the margin of tolerance, or thresholds re: reporting based on vessel size) make the rules more complex, and make it even harder to detect whether any discards are legal (e.g. falling under an exemption) or not."*
2	*"There is very little acceptance of the policy in the first place. It is perceived as a perverse and contradictory piece of legislation: to avoid discards by bringing them ashore and killing them all. Fishers run a business and will try to dodge costs at all costs, especially if the risk of sanctions and means of surveillance are almost non-existent."*
3	*"Enforcement is completely inadequate as long as Remote Electronic Monitoring is not structurally introduced in the fleet."*
4	*"No effective control measures at sea, no sufficient observer coverage, too many exemptions."*
5	*"There is basically no at sea control in place and no sanctions or penalties exist."*
6	*"Economic reasons."*
7	*"Mostly in cases where an increase in selectivity is difficult to reach (but doable if with more effort), it is easier for the fishermen to throw the unwanted catches back into the sea (discarding) - also because they know it is difficult to control and enforce."*
8	*"Not enough official controls."*
9	*"Control is too difficult and economic incentives remain to discard (due to choke species and high grading). Fishers do not see the legitimacy of the measures and do not buy in to them. (complexity of measures, specially cumulated to other regulations, does not help either)"*
10	*"Control measures are inadequate. Need onboard observers or electronic monitoring."*
11	*"When innovative more selective gears are invented there is not enough stimulants to use it (SepNep, pulse fishery) in terms of regulations and enforcement. And secondly, the landing obligation is not seen as legitimate in the fishing sector and the rules are often not logical or contradictory to what they want to achieve."*
12	*"The fishing industry has not bought into the landing obligation and many operators don't see any point to it. It is highly unrealistic to expect voluntary compliance and without effective control and enforcement compliance will never be achieved."*
13	*"No REM used onboard."*
14	*"Ineffective control, difficulty to control discard at sea."*

Table A5 Written answers provided by stakeholders (North Sea and Baltic Sea) below Question 9.

N0	Quotes
1	*"This argument could be turned around - what does it take to free up tasks of the crew? Could the sorting process become more automated, what are the innovations and investments it would take?".*
2	*"Processing and storing additional volumes of fish".*
3	*"Sorting the catch".*
4	*"If LO is implemented without exemption, each vessel needs abt 3 extra crew (seeVisNed/WR reports on best practices etc)."*
5	*"Selecting all the discards from the conveyor belt is very much work which does not generate any income and which comes on top of the hard work of fishing."*
6	*Separation wanted/unwanted catches takes time and money"*

Table A6 Written answers provided by stakeholders (North Sea and Baltic Sea) that answered "Yes" to Question 26.

N0	Quotes
1	*"Increasing the number of inspections on fishing grounds together with last haul inspections."*
2	*"Continued use of conventional measures (observers, last-haul analysis...)."*
3	*"It should cover all segments, however if it is a questions between only risk basis or no REM, then of course risk basis would be the most obvious to start with."*
4	*"REM should be tied to a license and seafood certification. low risk vessels could be controlled at sea by drones, aircraft and other traditional means."*
5	*"Real time AIS monitoring, observers, machine species identification on board."*
6	*"All vessels should be equipped, but image-check is on a risk basis: vessels don't know if and when they are checked."*
7	*"With inspector."*
8	*"All vessels should comply to REM not to be tempted in the way that vessels are modified for not to use the REM."*
9	*"I think REM should be operated by the fisheries; not by the control authorities."*
10	*"Seagoing inspections."*
11	*"Yes, at first takes time to put on REM. But risk based by fishery, not by vessel."*
12	*"Vessels in low impact fleets (in terms of discards and catch volumes) may not need to be controlled at sea."*
13	*"As in the past."*
14	*"REM equipped vessels should be used as a source of reference data to compare the catches of non-REM equipped vessels. Non-REM equipped vessels with significantly different catch profiles should be elevated in risk status and equipped with REM."*
15	*"Observer program, last haul."*
16	*"Via traditional control measures."*

Table A7 References made regarding open questions in the Questionnaire for stakeholders of the North Sea and Baltic Sea.

Question N^0	Question	Total N^0 responses	Quotes
12	What measures should be introduced by countries to ensure control and enforcement of the LO?	25	*"REM rolled across the fleet is the most cost-effective and robust tool."* *"To use 21st century technology - sensor scanners, cameras, drones. the same technology that could also be used to improve the transparency of the business operations, not just for sustainable seafood certification schemes - to document responsible seafood production with traceable and validated data."* *"Electronic monitoring"* *"Compulsory remote electronic monitoring, jointly with e-log and VMS/AIS on ALL vessels, depending on operating distance from shore"* *"electronic monitoring"* *"E-Logbooks for all vessels to record all catches,VMS/AIS/ Green box also on board of vessels <12m, REM with CTTV on board of vessel having high risk non-compliance with the LO regarding to EFCA risk assessment"* *"Mandatory Remote Electronic Monitoring (cameras on board) for the fishing licence to be valid, added to the already existing measures"* *"REM"* *"Incentivised Catch quota management With CCTV; lower quotas for those that want to stay out of this arrangement"* *"A fundamental discussion is needed to determine whether the LO can be implemented by fishers and is enforceable by control agencies - a discussion on REM potential is also possible but this is not the be all end all solution to the challenges of the LO."* *"More frequent controls"* *"Harmonizing control strategies between MS"* *"REM"* *"A combination of management measures: the use of modern innovative control tools (sensor data, CCTV as an REM tool, artificial intelligence); more bottom up and result orientated - like the Canadian halibut fisheries in British Colombia (fishers were given X amount of years to get to 100% catch accountability, they opted for CCTV/REM after long process); instead of a sanctioning system, a reward system for the fishers that comply and can show this."* *"Control and enforcement measures should go hand in hand together with implementation measures (such as real time closures, temporal and spatial measures) - as a measures 'package' to avoid catching unwanted catches. "* *"They should at least double their manpower "* *"More cooperation and incentives for the fishers. Stakeholder work,e.g. workshops with fishers, NGO and consumers "* *"Electronic monitoring"*

14	What could be done to improve the logbooks?	28	*"REM + more active use of art 17 in national quota allocation to low-discard fleets/vessels"* *"More of the traditional controls as mentioned above and greater budget for the controlling agencies to do more of these controls and generate more relevant knowledge."* *"Additional incentives?"* *"Technical measures for fishing gears to improve the selectivity"* *"For MS to fulfill their obligations to ENSURE control and enforcement of the LO some form of continuous monitoring during fishing activities at sea is needed. Remote electronic monitoring (REM) incorporating CCTV, sensors and artificial intelligence data review is the best means to do so."* *"REM"* *"CCTV, remote control"* *"Remote Electronic monitoring (REM)"* *"Reporting of catch damaged by predators leaves some room for improvement. However, most cases of catches damaged by seals occur in small scale fisheries but nevertheless e-logbook should be ready for this type of reporting. "* *"This probably depends on the MS, but the resolution re: types of exemptions is too low, making it difficult/impossible to allocate discards to a specific exemption or account them against the respective exemption allowance to make sure the overall exemption allowance is not exceeded."* *"Explanation to Question 7.: Compliance is relative, there is sufficient data of not compliance of LO in DK waters so the question should have 3 potential answers. "* *"Mandatory REM will improve the accuracy towards reality, more control at sea, right now control at sea is below 10%. Countries should be audited on how countries complied with LO, putting pressure on the countries for better control and sanctions, so countries should report back on compliance of LO on annual basis and not every 6yrs or whatever the control reports are requested."* *"More involvement with the fishing industry in order to achieve a workable (minimum administrative burden) and correct registration"* *"To install technology that allows to register unwanted catches (weighing scales and mechanical doors). To add extra fields that allow registration of sub-gear types, otherwise it will be impossible to disentangle later on whether a modified, more selective gear actually did have the desired effect of reducing discards, if that information was not registered anywhere, or even worse pooled within the umbrella classification of a conventional gear type."* *"Make the log book easier for the fishermen to fill in - e.g. automatic "flags" if they forget to fill in something or miss to send harbour reports etc. Today such mistakes may lead to*

sanctions, but boost often they are not done to try to "cheat" - but only by mistake by tired persons."
"Connect with additional control tools such as video."
"Digitize where this has not yet happened, make them mandatory irrespective of vessel length"
"No idea yet"
"It is not really the design but how it is used, properly or not."
"The need for registering, if discards are due to deminimis or other law is unnecessary as long as it is registered. The other task is for the control."
"e-Logbook must be used to document fishery and not to criminalize fishermen"
"Not necessary to mention in the log book on which ground the fish has been discarded. It just has to be fit for purpose"
"It's foolish that you can write whether or not you have discard due to deminimis or due to other regulation - it doesn't matter why you discard, it just matters that they do"
"It does not make sense that you can write whether or not you have discard to deminimis or other regulation. "
"Design them to fit the practicalities on board, and the purpose of getting information on actual catch. Not the academic "need" for information or desire to find something to punish the fishermen for."
"There are so many exemptions that it is almost impossible to improve the logbooks. Better to simplify the regulations."
"Especially for the logging of the exemptions a solution should be found "
"It is not the logbook, but the compliance to fill in the logbook"
"Reduce specifications of recording. No reason for stating under which rule a fish is discarded. That may be done as a follow up control based on area and fishing gear. Logbook should be more clear on the specific gear in use including the panels"
"Making them as automated and user friendly as possible, not only technically, but also using communication techniques or others, such as behavioural science"
"They need to be streamlined within the country - central system that can be updated automatically via internet. They need to encompass more details"
"Operational simplicity "
"Access simplicity"
"I don't know."
"The obligation to record discards pre-dates the LO by several years so, in principle, this is nothing new. However, the requirement to record information associated with the pelagic high-survivability exemptions (point of retrieval and sampling results) in electronic fishing logbooks hasn't been developed by any Member State."
"More guidance during filling of logbook (built-in reminders about prohibited species, legal discards, etc.)"
"Separate input fields for the different kinds of discards (BMS, predator damage)"

27	How can CCTV for control purposes on-board be made acceptable for vessel owners and operators?	37	*"The costs of installation, servicing and maintenance of the CCTV systems should be partially covered by the administration (EU funds)."* *"They are exploiting a common resource and need to accept that this comes with a bigger responsibility; it is also in the sector's own interest to be able to demonstrate/evidence 'good' behaviour, i.e. compliance with the rules, e.g. in order to receive/keep sustainability certification; there are also important advantages re: data collection which in turn could help improve stock assessment and the scientific basis of TACs; privacy concerns need to and can be addressed through sensible positioning of cameras and handling of the footage."* *"Through ultimatums, i.e. " if you can show that you do not have any bycatch or below xx then you may fish there/ get extra quota, if you cannot show compliance with LO (throuhg REM), you cannot fish.."* *"REM does not only means CCTV so other alternatives should be investigated"* *"By automating the process - no human eyes on the catch, by doing spot checks only (i.e., checking 10% of recordings), by giving ownership to the data (e.g. benefits also seafood certification schemes), by coupling license/costs to its use, by coupling price at provision rate of high quality, accurate data and operations."* *"Difficult, since the fishermen do not see the point of the cameras. What are the cameras supposed to see?"* *"It is a licence to produce. If they have nothing to hide, they should have no reservations. Privacy issues can be overcome technically. "* *"Stakeholder process, strict rules on privacy rights, incentives"* *"Results-based management: less rules for those who comply. Those who refuse EM have their quota top up automatically deduced of suspected discards"* *"See example in Spain and US"* *"It should be a mandatory piece as technical measures so far has not had enough positive impact on the fish stock and its recruitment nor on the ecosystem rehabilitation for fish stocks rebuilding capacity. Fish is a common property, no one owns the fish. Therefor the member states should have the courage to implement REM on their MS vessels as a part of the rights to fish. The voluntary act has already been tried out for many years and the result is fairly low. The measures are strongly needed both for the ecosystems and its fish stock as for the viability of economics in the future of the EU Fisheries sector."* *"Through consultation and effective rapid trial with both owners and operators".* *"Incentivize voluntary arrangement; those that opt out receive Lower quota (e.g cf. Catch quota management) "* *"Legal requirement"* *"If they are exempted from ex. the LO, logbook requirements and have free choice of gear. Data will be logged and all can be controlled, so should still have the data on fisheries on this basis to ensure the aim of the management."* *"Incentives as an exemption from the LO and freedom with regards to fishing measures."*

"If on a voluntary basis with Incentives such as free selection, no LO etc."
"Exception from LO might be an idea"
"If incentives are introduced such as free choice of gear etc."
"If benefits are offered. Fishing is a business and if benefits for the business are larger than reluctance then REM will be accepted"
"By convincing fishermen that it is for their transparency in the face of authorities as they complain they are"
"Vessel owners in control of CCTV systems."
"It has to be mandatory for all fishing vessels fishing in EU waters"
"It is also a mentality shift. in this a quote of the UK House of lords hearing on the landing obligation in 2019 is striking in my opinion 'Similar like the 70 m/h speed limit. You cannot deploy inspectors everywhere. It requires a cultural shift between government, regulator and the industry: a partnership"
"Not at all"
"If other rules do not apply. No need for technical regulations, logbook recordings or prior notifications. "
"If it brings an advantage to them, for example having to report less on discards or not at all"
"Quota uplift. Ease - or rather almost abolishment - of technical regulation. That is, making the fishers accountable for their catch but in return they are free to choose how to catch it."
"Exemptions from the LO (high survivability or deminimis)"
"They can be offered easier rules / less regulation"
"Extra bonus quota allocated "
"Bonus quota allocated"
"The rules that are controlled with CCTV should be seen as legitimate and feasible. "
"Starting with a small pilot project to understand all the aspects. This will take time! Offer some (financial, quota...) incentives"
"If the CCTV is appropriate for the protection purpose"
"It should be explained to the industry that it is in the fishing industry's best long term interests to ensure the success of the LO. Without effective control and enforcement the LO will fail and widespread, illegal, unreported discarding will continue. This will result in overfishing and will jeopardize the socio-economic objective of the CFP. Effective control and enforcement of the LO will level the playing field between MS and operators alike, meaning that compliant fishermen won't have to compete unfairly with those that choose to infringe the rules intended to safeguard their future fishing opportunities. REM has been proven by Member State trials, and internationally, as the only realistic means to control the landing obligation."
"Incentives in the form of extra quota allocation, increased area access. Careful with relaxing gear restrictions before proof of concept of CCTV system."
"By awarding the vessel owners and operators in some way for installing CCTV"

28	Feel free to leave any comments on this survey and / or additional remarks in relation to the questions and / or the topic of the LO here.	15	*"This is a very useful initiative - I just felt that some of the questions were a bit leading, e.g. re: options like TAC removal in the context of catch avoidance when really such options should not really be considered since they provide zero incentive to avoid unwanted catches, but just cosmetically 'fix' the problem."* *"Highlighting other advantages of REM for fishers is important. With REM fishers can actually document where their fishing grounds are - in relations to discussion on Marine Spatial Planning. Currently there is not documentation of fishing activities of 2/3 of all DK fishers, as those vessels are below 12 m. So in the light of e.g. future windfarm plans, fishers might have difficulties to show what are importance fishing grounds and they are weak on the negotiation tables with energy producers etc.."* *"No other comments"* *"I find the question on economic viability very limited in its usability, as short vs. long-term effects need to weighed, would only suggest to use it together with same question on ecologic sustainability "* *"There has to be a real game change within the Fisheries both on the gear improvement to be less harming to ocean habitats and to reduce non target species through selectivity. An even tighter cooperation between managing bodies, scientists and fishing industry is needed to solve some of those unwanted and destructive things still ongoing today. The hardest Changes for humans are to rethink and use a new mind set for more long-term measures. Maybe some real information Campaigns can help."* *"Questionnaire surveys that only offer the opportunity to choose among given answers are in general a total waste of time and only adds to the impression of ""system failure"" and the lack of will (or ability) to understand the complexity of the subject. I was requested by my superiors to answer and would have reclined if not ordered to do so. "* *"This is amongst the worst and most simplistic I have come across so far (and I've seen a lot)"* *"Some questions on funding is out of my knowledge therefore I had to choose "I do not know"* *"Question 7 was impossible to answer because there are different fisheries within a country. In some fisheries the LO works quite well in others it does not work very well. The answers are now drawn into one direction."* *"I feel the objective of the landing obligation is sometimes forgotten - to reduce the catches of unwanted catches (by increasing selectivity) instead focusing on the compliance and control of landing all catches; as well as the fact that the co-legislators (The Council, the European Parliament and the Commission) have 'installed' the landing obligation in the CFP with the latest reform. Commitment is sometimes not seen clearly. There has been a lot of collaboration between the different stakeholders throughout the phasing in of the landing obligation, and although still challenging - much more is known. I feel sometimes a reset needs to happen of thoughts and mentality to really work towards the objective of the landing obligation: to reduce the catches of unwanted*

	catches (not to be interpreted as a comment for deletion of the landing obligation - but instead to go further)” *“The LO is not workable and not enforceable. It is simplified wishful thing if authorities go ahead with just enforcement without looking at the 'workability' Both at choke situations as well as in mixed fishery (the sole/plaice dilemma) Glad to discuss this in further detail wvisser@visned.nl We need to make the move from LO to (verifiable correct) Information Obligation”* *"The process for getting new gears approved is too slow. There is a need to make more uniform exemptions from the LO. If plaice has a high survivability exemption in the North Sea, it should have it in the Baltic too"* *“ Strictly Pelagic segment fully complies with the LO. “* *"Enforcement of rules that are not seen as legitimate through camera's on board will further alienate fishermen from EU fisheries management. Fisheries management should become more flexible to adapt quicker to new selective gears or undesirable use of fishing gears. Fishermen should be involved more in managing stocks and the marine environment, they are the first to observe changes at sea but currently there is not enough trust in the authorities to share these experiences. fishermen are scared that their information will be used against them."* *“The LO will never work without effective control and enforcement. There are too many powerful drivers for non-compliance. All credible indications point towards widespread non-compliance across all sea basins. Unless effective controls are introduced the LO will fail and undocumented discarding will continue. This will lead to the failure of one of the core pillars of the reformed CFP, further overfishing and reductions in future fishing opportunities.”* *“”No comments”*

Table A8 Overview of interview questions and summarized feedback relevant for Task 3 for the NS&BS and the AWW. A1, D3, H, J refer to questions from interview guide.

Geographical area	Question	Feedback (summarized)
North Sea and Baltic Sea (NS&BS)	A1. What management measures have been implemented in this region in the period 2014-2020? E.g. Last Haul (LH) inspection program?	It was commented by various respondents that the Last Haul program is not really a "management measure" but instead an inspection program organized by EFCA. Most respondents indicated having knowledge of a limited number of LH inspections that had taken place onboard of vessels of their respective MS, but did not have a good overview of how and when LH inspections occurred exactly. It was also noted that LH inspections are difficult to plan ahead and carry out logistically. LH inspections cannot always provide the "true picture", or are a "piece of circumstantial evidence", as one haul can be very different from another.
	D3. Has there been a difference in adoption/compliance between different fleet segments/fisheries in terms of adopting management measures? If so please describe.	Most respondents answered "No" to this question, indicating that the adoption of LO measures and compliance happened similarly for different segments and fisheries. Some respondents argued that there may be differences for small-scaled, coastal fisheries.
	H. Do you have an overview of to what extent the implemented management measures are complied with?	Some reluctance in answering this question was observed (blank answers, or "no comments", see transcripts – Annex 4). Two respondents answered that the LO was fully complied with regarding the use of certain (selective) gears. Various respondents reported that fishers are experiencing difficulties with the administrative burden and complexity of the current LO regulation, resulting in continued discarding and misreporting of catch fractions. The main problem behind this seems to be the fact that the majority of the fishing industry does not agree with the rationale behind the LO.
	J. How are exemptions monitored by controlling offices in your country?	Most respondents answered that exemptions are being monitored by control officers that check logbook entries at sea and ports
Atlantic WW (AWW)	A1. What management measures have been implemented in this region in the period 2014-2020?	Exemptions are the predominant management measures put in place for facilitating implementation of the LO. Other management measures employed include flexibilities in quota management.

	D3. Has there been a difference in adoption/compliance between different fleet segments/fisheries in terms of adopting management measures? If so please describe.	Respondents commented that the success of the LO implementation varies on a case by case basis due to the nature of the different fisheries, being more difficult to adopt in fisheries encompassing trawling and mixed fisheries. Concerning operational means, a diversity of selectivity and avoidance means are in place and they have been applied according to the needs of the fishery in question.
	H. Do you have an overview of to what extent the implemented management measures are complied with?	Some reluctance in answering this question was observed (blank answers, see transcripts – Annex 4). This was a difficult question to answer for stakeholders and no one provided a figure on the extent of compliance. Some respondents commented that the complexity of the regulatory framework is a heavy burden for the sector. Exemptions can provide some alleviation, but these are only temporal means. Choke situations are very common, and this hardens compliance with the LO. Underreporting of catches may happen when a quota is close to zero. Other facts leading to non-compliance are the impossibility to trade fish below MCRS for human consumption and the lack of a market for unwanted fish.
	J. How are exemptions monitored by controlling offices in your country?	Most respondents answered that exemptions are being monitored by control officers that check logbook entries at sea and ports. Hence, traditional means are predominantly employed within the LO. REM with CCTV seems to offer a reliable option to monitor discards and discourage this practice. There are divided positions concerning CCTV and is a challenge from the legal and social point of view, while it appears to be less expensive than other means e.g., observers onboard. There is still much research to do on the methods to analyse the data gathered by these devices.

Table A9 Response rate (%) per question for the stakeholders of the AWW. Answered = number of respondents that answered the question. Skipped = number of respondents that skipped the question.

Question Number	Answered	Skipped	Response rate (%)
1	32	0	100
2	32	0	100
3	31	1	96,88
4	26	6	81,25
5	27	5	84,38
6	23	9	71,88
7	26	6	81,25
8	17	15	53,13
9	6	26	18,75
10	16	16	50,00
11	17	15	53,13
12	11	21	34,38
13	17	15	53,13
14	8	22	25,00
15	17	15	53,13
16	17	15	53,13
17	17	15	53,13
18	17	15	53,13
19	23	9	71,88
20	23	9	71,88
21	22	10	68,75
22	21	11	65,63
23	21	11	65,63
24	23	9	71,88
25	23	9	71,88
26	22	10	68,75
27	18	14	56,25
28	13	19	40,63

Table A10 Written answers provided by stakeholders of the AWW (Lot 2) below answer option "Other (please specify)" for Question 8

N0	Quotes
1	"The implementation on board is difficult: understanding of the exemptions (what can or not be rejected depending on the area), declaration on the paper-logbooks (not enough space, small boxes …). Also there is a danger to keep the catch (high quantity of small pelagics which can be higher than the maximal load authorized on the vessel for example)"
2	"Fish markets are not ready to receive and accommodate the BMS fraction of the catch; some fishers are still having training on the correct use of the new logbook format created to accommodate BMS fractions"
3	"Contrary to their obligations under EU law, Member States have not adopted the necessary measures to ENSURE control and enforcement of the LO at sea. REM supplemented by sensors and artificial intelligence reviewing systems could be used to control the LO. In the absence of effective control and enforcement measures, the LO will never be respected"
4	"If space on board is occupied by unintended species, commercial fishing would become unprofitable in some/most cases, thus leading to serious economic consequences. Also, the placing of new species in the market is not an easy task. Consumers also have to be educated on the different healthy species available to them"
5	"There is no control nor penalties"
6	"There is no monitoring at sea"
7	"The implementation is difficult to apprehend so the LO is partially applied. Because of this complexity, the LO is not well accepted by the industry"

Table A11 Written answers provided by stakeholders below answer option "There are not enough people onboard to do the extra work required by the LO for Question 9

N⁰	*Quotes*
1	*"The LO causes additional time per fishing trip to sort the catches so this time isn't available to fix the gears, rest, ... Also, this is additional handling for the landing"*
2	*"In small scale fisheries there are few people onboard, a lot of work and sometimes bad weather conditions"*
3	*"Bureaucracy and bigger quantities of fish to handle may put work on board at risk"*
4	*"The EODE project made a survey about the extra work" https://www.comitedespeches-hautsdefrance.fr/nos-actions/gestion-de-ressource/eode/*
5	*"Extra work in sorting/storing catches in accordance to regulations"*

Table A12 Written answers provided by stakeholders (AWW) that answered "Yes" to Question 26.

N0	Quotes
1	*CCTV equipped vessels should be used as a source of reference catch data for comparison to non-CCTV equipped vessels. Non-CCTV equipped vessels that show significant different catch profiles should be equipped with REM systems.*

Table A13 References made regarding open questions in the Questionnaire for stakeholders of the AWW

Question N^0	Question	Total N^0 responses	Quotes
12	What measures should be introduced by countries to ensure control and enforcement of the LO?	6	*"Observers onboard, encourage fishermen's commitment"* *"Remote electronic monitoring (REM) tools incorporating CCTV systems, sensors and artificial intelligence reviewing systems. Protocols for data exchange between coastal and flag MS should be established. REM has been proven to be capable of controlling and enforcing the LO in MS trials and is being increasingly used in other fisheries around the world"* *"Increase controls and include new tehcnologies for an effective LO"* *"Measures should be introduced for data collection and better scientific knowledge"* *"REM and more control"* *"Either 100% observer or alternative such as REM"*
14	What could be done to improve the logbooks?	6	*"Simplify them"* *"A new logbook format was developed to accommodate BMS and I think some fishers are still having training on its correct use"* *"Some MS don't have the capacity to record "DIM" and "DIS" in the LB. No code to distinguish between predator damaged and high-survivability species in most MS"* *"Adequate them to all the casuistic to be found on board"* *"More involvement with the fishing industry in order to achieve a workable (minimum administrative burden) and correct registration"* *"Specific entries for exemptions"*
27	How can CCTV for control purposes on-board be made acceptable for vessel owners and operators?	13	*"Be sure that privacy of the crew is respected, that the costs of the equipment and the treatment of data isn't the responsibility of vessels and that the efficacy of CCTV is proven before any other consideration".* *"Counting on the fishermen's opinion in the decision- making"* *"CCTV cameras would be acceptable in certain fisheries only on a risk basis because there are other means sufficiently effective. Cameras would not need to be mandatory in fisheries in comparison to other public labours and activities".* *"At first, it can't be acceptable, in the same way that they would not be acceptable in any job...It's a matter of privacy..."* *"It should be explained to them (fishers) that ensuring control and enforcement of the LO, and upholding the objective of the CFP, is in their own long-term interests. REM will level the playing field between operators that wish to respect the rules (allegedly the majority) with operators that choose to infringe the rules and operate at an unfair competitive advantage".* *"Know-how and personal data protected above all"* *"An incentive to start using CCTV could be though: scientific quota, non-stop of fisheries during certain times of the year as they became full documented fisheries..."* *"REM does not only mean CCTV so other alternatives should be investigated"*

28	Feel free to leave any comments on this survey and / or additional remarks in relation to the questions and / or the topic of the LO here.	8	*"It is likely to be difficult to convince industry while LO itself is not proved to be an efficient policy to attain a real sustainability of the resources in single and mixed fisheries, while keeping economic and social sustainability. At the moment, it is about wishing to control something that cannot be put 100% in practice without undermining article 16 of the CFP (loss of fishing opportunities)"* *"Equal rules for everyone"* *"You are not allowed to fish if you don't have a camera, you will have more at sea inspection, traceability of products for certification, optimise fishing strategies and crews* *"We have to make sure that privacy of the crew is respected, and that the efficacy of REM is proven. Moreover, the cost of the equipment (and date collection) should not be the vessel's responsibility"* *"Non-intrusive monitoring, initially"* *"Change the law so that vessels don't discard to avoid chocking. CCTV can be overcome by vessels, it is not foolproof"* *"For a better quality of stock evaluation (which was the main aim of the landing obligation at the beginning), we need a full documentation of the catches and not an obligation to land all these catches. The reality of the LO on the field is that it's too complex, the exemptions are too limited by gears / meshsize / area and in time. For a better implementation, we need simplification. I didn't answer many questions because I don't think we can choose just 1 answer from 1 to 5. There are so many different cases between species / area / gears that we can always find an example where it works and another where it doesn't. We can't find one solution that fits all cases but high survivability and de minimis exemptions are fundamental to help implement the LO. The problem of the LO is the intricacy of the rules and it's not the money available to conform to them that can change it"* *"LO has been approved under political pressure, and as a bleaching effect on the image of fishing. There are no evaluations of the impacts that it supposes nor the affectation on the stocks or the economy of the sector. With the LO a complete revolution should be inititited to redifine its objectives."* *"Without effective control and enforcement the LO will not be respected and it will fail. There are too many strong drivers for non-compliance to expect voluntary compliance. REM incorporating CCTV systems is the ONLY means to control the LO at sea. MS that fail to ensure control and enforcement of the LO should be held to account"* *"The most important issue is the sensibilisation of the industry in relation to the ecosistem (it includes LO) and of cour the full implementation of the regulation by the Authorities"* *"More funds should be foreseen for scientific purposes both on scientific and commercial boats"* *"I think the survey is very technical and many questions require an important knowledge of the sector and the situation of the fleet and the owners, which is not bad, but makes a bit difficult to answer some questions"* *"The goal of the LO is not to land everything but to lead to a full documentation of the all the catches. The LO as it is now, is really complex so we need to work on how it can be simplified so all fishermen can fully understand this regulation. This should be priority so the LO can be fully implemented and efficient. On another topic, the survey format is not the most adequate as there are many cases and we should qualify each case based on the context and where it happened so it's sometimes difficult to choose one answer that fits all"* *"Lack of enforcement"* .

Table A14 Written answers provided by stakeholders (North Sea and Baltic Sea) below Question 10.

N0	Quotes
1	I think all of these apply - the most concerning part is the lack of reliable comprehensive catch documentation since this deteriorates the data which go into stock assessments, ultimately undermining the scientific advice upon which TACs should be based. One key issue that does not seem to be sufficiently acknowledged and addressed is that TACs are now set based on catch rather than landings advice, with catch-based TACs being in many cases (and on average) substantially bigger than landings-based TACs (as was the case before 2015). Fishers basically receive extra quota to allow them to land what they would have previously discarded - but at the same time compliance remains poor. This means that the shift to catch-based TACs leads to potentially substantial catches beyond scientific advice, as long as compliance remains low. This undermines the whole purpose of the LO and the ambition of the CFP to ensure sustainable EU fisheries.
2	*To dodge costs at all costs when running a business. The low acceptance of the scientific justification for this legislation in the first place. A paradigm shift is needed to turn fishers into environmental stewards and custodians of the sea, and not exploiters for money.*
3	*don't know enough about current practices*
4	*The non acceptance of this legislation by fishermen, as they believe they kill their future by killing small fish*

Table A15: AWW. Respondents' perceptions about compliance by country and sector (30 respondents).

	Sector	No, I don't believe that compliance is occurring (%)	Yes, I believe that compliance is occurring (%)	No answer
Belgium	EU agency	3.33		
	Industry	3.33		
France	Industry	20.00		
	NGO			3.33
Ireland	Industry	3.33		
	NGO	3.33		
Portugal	Consultancy	3.33		
	Research & academia	3.33	3.33	
Spain	Consultancy	3.33		
	Industry	6.67	13.33	3.33
	NGO	3.33		
	Research & academia	3.33	3.33	
UK	Industry	3.33	3.33	3.33
	Research & academia	3.33		
Total		63.33%	23.33%	13.33%

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