Validation of selected sustainability indicators and underlying methodologies for the revision of the EU marketing standards for fisheries products

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Scientific, Technical and Economic Committee for Fisheries (STECF) - Validation of selected sustainability indicators and underlying methodologies for the revision of the EU marketing standards for fisheries products (STECF-22-12)

Edited by Fabio Grati & Jean-Noël Druon

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CONTENTS

Abstract

Commission Decision of 25 February 2016 setting up a Scientific, Technical and Economic Committee for Fisheries, C(2016) 1084, OJ C 74, 26.2.2016, p. 4–10. The Commission may consult the group on any matter relating to marine and fisheries biology, fishing gear technology, fisheries economics, fisheries governance, ecosystem effects of fisheries, aquaculture or similar disciplines. This report is from the EWG 22-12 on "Validation of selected sustainability indicators and underlying methodologies for the revision of the EU marketing standards for fisheries products", which met in Brussels from 5th to 9th September 2022.

SCIENTIFIC, TECHNICAL AND ECONOMIC COMMITTEE FOR FISHERIES (STECF) - Validation of selected sustainability indicators and underlying methodologies for the revision of the EU marketing standards for fisheries products (STECF-22-12)

Request to the STECF

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

STECF comments[1]

EWG 22-12 met in Brussels, from 5-9th of September 2022. The EWG was attended by 22 experts including 4 STECF members along with 1 JRC expert, 2 from DG MARE and 2 observes, who attended the plenary sessions of the EWG. STECF acknowledges that the EWG addressed all of the TORs, noting that further work is needed in this area.

EWG 22-12 is a follow-up of the 2020 EWG 20-05 "*Criteria and indicators that could contribute to incorporating sustainability aspects in the marketing standards under the CMO*", which explored and proposed transparent methods of measuring and communicating some sustainability aspects of fisheries and aquaculture products along the supply chain, based on scientifically sound, simple and verifiable criteria and indicators. EWG 22-12 focused on fisheries, while EWG 22-13, which focused on aquaculture also as a follow-up of EWG 20-05, ran in parallel with EWG 22-12.

EWG 22-12 had the objective to assess and complement the findings of two *ad hoc* contracted expert teams which defined specific indicators and grading for two environmental criteria, respectively (i) impact on the targeted stocks (fishing pressure) and (ii) impact on the seabed. These two criteria were identified by the Commission as key sustainability aspects for fishery products for a potential first stage of the revision of the marketing standards, based on the findings of EWG 20-05. EWG 22-12 also discussed and defined an approach for a third environmental criterion, (iii) impact on sensitive species (understood to be species whose conservation status, including its habitat, distribution, and population size or population condition is adversely affected by pressures arising from human activities, including fishing activities; EWG 22-12 p15.). This criterium was also identified as a priority by DGMARE but, contrary to the two first criteria, no simple quantitative approach already exists, and an operational indicator still needs to be developed.

STECF notes that in relation to the approach proposed by EWG 20-05 (see table 1 below – see explanation and product description in EWG 20-05 report), EWG 22-12 has thus sensibly progressed on three out of the 8 identified indicators, and, more specifically, operationalised the first two (fishing pressure and impact on the seabed), using the 'two systems approach'.

STECF recalls that this 'two systems approach' with two levels of scoring (System 1 and System 2) was developed by EWG 20-05. The rationale behind defining two systems is that data availability differs widely between different fishery and aquaculture products. System 1 uses basic information that is universally available for all types of fishery products, both domestic and imported. System 2 is based on additional information, that is more accurate but that may not necessarily be available for all products. System 2 would allow producers to obtain a more specific, and, in cases, a higher sustainability score. This potentially provides an incentive to producers to share more extensive production information to meet the data requirements of System 2.

[1] Ernesto Jardim did not participate in the discussions on this TOR due to a potential conflict of interest with his current employment. The details are contained in his Declaration of Interest Form.

Table 1. Example of scoring for three contrasted theoretical fishery products placed on the EU market (see products characteristics in the text)

Dimension	Criteria	Product 1	Product 2	Product 3
Environment	Fishing pressure	A	D	A+
	Fisheries management	A	No score	A
	Impact on ETP and sensitive species	A	No score	B
	Unwanted landings and discards	B	D	A
	Impacts on the seabed	D	E	A+
	Impact on marine food webs	B	No score	A
	Carbon footprint	C	E	A+
	Waste and pollution	A+	D	A
Social	Working condition (production)	A+	C	B
Final score		**A or B**	**D or E**	**A+**

Table 1 is extracted from EWG 20-05. The three circles highlight the sustainability criteria investigated in EWG 22-12. The dashed circle suggests that the indicators for the criteria are still under development.

STECF notes that the preparatory work implemented by the two *ad hoc* contracts groups facilitated the work of EWG 22-12 and allowed the EWG to progress further on their findings.

Concerning the current status of the indicators, STECF notes that the indicator on the impact on the seabed has been fully implemented. Indeed, EWG 22-12 provided an updated version of the excel file (control panel in Annex 1) developed by the ad hoc contract supporting the EWG including the revision of gear and habitat scores.

Concerning the indicator on fishing pressure, STECF notes that EWG 22-12 has provided an updated and adjusted version of the decision tree that was drafted in the ad hoc contract. However, the excel file provided by the ad hoc contract still needs to be implemented with the new rules/thresholds identified by EWG 22-12.

This indicator on fishing pressure aims to assess the biological status of the exploited stock based on fishing pressure, biomass or vulnerability of the species. A database with 1393 species for System 1 and 246 for system 2 and an associated online platform for computation has been produced by the ad hoc contract. However, the extended approach proposed by the EWG 22-12 would require gathering additional data (F_{MSY} B_{lim} or their agreed proxies in additional RFMOs) and reshaping the computing calculation in accordance with the extended approach. An evaluation of the coverage as well as a test of the new ranking limits would also be necessary.

STECF notes that regarding the indicator for sensitive species, the EWG found that defining and operationalising this indicator was more complex than for the other two indicators. To progress on this third indicator, EWG 22-12 investigated the feasibility and relevance of defining a sensitive species indicator either a) by gear and sub-area only, based on expert knowledge and intensive literature review, and b) using a risk-based approach in the form of productivity-susceptibility analysis (PSA). The EWG concludes that both approaches are able to provide a rough indicator, but with a likely high proportion of false positives due to lack of precise catch data such as precise data on the gear used and the area of capture: i.e., the methods may give a low score if a global risk of negative impact on sensitive species has been identified for a certain fishery, even if

incidental catches do not actually occur. STECF notes thus that the methodology for a criterion for sensitive species needs additional operationalisation and further development.

STECF notes that EWG 22-12 has tested an overall scoring/grading system for the three indicators together. The scoring of the systems 1 and 2 was applied to *Clupea harengus* (Atlantic herring) caught with Midwater otter trawls (OTM) in the Baltic Sea. This combination of species/area/gear was chosen as an example because Herring in Area FAO 27 is among the cases for which the EWG subgroup on sensitive species was able to compute the indicator for the two scoring systems (1 and 2) (Table 17 of the EWG report). For the other two indicators the EWG used the control panel for the seabed and one stock assessment from the Baltic (available online) for the fishing pressure.

STECF observes that this test is very insightful in illustrating the strengths and weaknesses of the two scoring systems, especially in difference of score between System 1 and System 2. System 1 score in this case is clearly lower than the score under System 2.

STECF notes that the two-systems approach creates a valuable option for producers to demonstrate increased levels of sustainability in production. Data under System 1 is widely available whereas System 2 is more case specific and can be much more detailed. In particular, under System 2 additional information on: a) the precise fishing area would improve the indicator on fishing pressure; b) the precise fishing gear would improve the indicator on the impact on the seabed; c) the precise fishing area and gear would improve the indicator on sensitive species. As such, System 2 is expected to act as an incentive to a) supply more information but also b) to adopt more sustainable practices.

STECF notes that the way to compute a single sustainability score, combining several variables into a single score, is still to be agreed upon. The challenge will be to interpret the actual score on a single product, e.g., (i) if it scores green for one criterion, orange for a second and red of a third then what should the final score be? And (ii) if the scores were red for the first criterion, green for the second and orange for the third, would that result in a different final score (i.e., are the separate criterion weighted)?

STECF is aware that different initiatives already exist or are in experimentation in the market in which multiple criteria are reflected on the product, including a final overall sustainability score. However, STECF notes that there are several ways by which this can be achieved and operationalising this will, in the current system, require some additional dedicated work to reach a robust consensus.

STECF observes that the alignment of different scores is not only relevant between different fish products from capture fisheries but a sustainability score of a wild caught fish should be comparable to a sustainability score of fish products from aquaculture. Moreover, STECF understands, the European Commission aims to have a scoring system that will allow direct comparison with other products in the wider market of animal proteins. For example, chicken and fish are substitute products in the perception of consumers. In such a case it is of prime importance that the sustainability label on chicken is comparable to that on fish. STECF notes this is sensible but in practice challenging to achieve.

STECF observes that EWG 22-12 considered that, as the fishing pressure and seabed impact indicators are closer to implementation, compared to the indicator on sensitive species, it may be possible to start using these indicators even though there may be a risk that producers and consumers may be confused by additional indicators coming on stream at a later date along. STECF notes that this is a serious concern.

In addition, STECF notes that, with the indicators for fishing pressure and impact on the seabed being operational, it is important that the communication on the indicators, especially with the fish producers is timely, credible and salient, (hence available on time, trustworthy and relevant) in order to ensure that the designed approach will be technically feasible (especially system 2 which requested additional data) and sufficiently accepted and implemented along the supply chain's stakeholders.

STECF advises, in order to make the scoring system operational, it would be appropriate to develop a simple tool that when a fish producer enters data on species, area and gear, it returns a simple score on the sustainability criteria.

STECF notes that, especially in those cases where producers seek to move from System 1 to System 2, information may not be readily available to them. This may lead to a situation where a geographical spread may occur, between areas with high and low levels of data availability. This may prohibit producers moving from System 1 to System 2, which may result in price differences between products. Those under System 2 are more likely to obtain a price-premium or better market access, compared to products under System 1 which are likely to be relatively cheaper. This may entice consumers to opt for the cheaper, yet less sustainable, alternative.

STECF conclusions

STECF concludes that EWG 22-12 has covered the ToRs and commented and progressed on the information provided under the two *ad hoc* contracts. STECF endorses the report.

STECF concludes that the indicators for fishing pressure and impact on the seabed have been sufficiently developed and operationalised to allow testing this system on a larger number of sea food products including products from outside the EU. STECF concludes that the current database for the indicators can be further expanded (as EWG 22-12 proposed a new decision tree and highlighted that the list of species does not cover all the seafood products currently marketed in Europe) with data on fishing pressure. It is suggested to issue an *ad hoc* contract to carry out this task.

STECF concludes that there is a need for harmonisation between the different possible scoring systems. Suggestions have already been made on the continuity of scoring between Systems 1 and 2 within fisheries products. However, there is also a need to align the scoring for all fish products, be it from fisheries or aquaculture. Moreover, the scoring of fish products should ultimately be in line with the sustainability scores of other animal products such as chicken and beef, noting this will be challenging to achieve.

STECF concludes that further work is required on the sensitive species indicator. Based on the discussions, and the difficulty to operationalise it as described in the EWG 22-12 report, STECF cannot firmly concludes whether actual development and operationalisation of this indicator is actually feasible. In order to progress this discussion, it is advised to issue an *ad hoc* contract (similar to the two issued in preparation of EWG 22-12) using the possible options for a sensitive species indicator, as discussed by EWG 22-12, and to test the candidate indicators with relevant case studies.

STECF suggests convening a follow-up EWG, to progress the application and integration of the work performed in the various *ad hoc* contracts. This EWG should also discuss the next steps in the process of operationalising and expanding the set of indicators, considering the options proposed by EWG 20-05 and other wider societal developments of sustainability indicators on consumer products. In particular, STECF notes the need to consider PEF (product environmental footprint) indicators coming from Life Cycle Analysis.

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[1] - Information on STECF members' affiliations is displayed for information only. In any case, Members of the STECF shall act independently. In the context of the STECF work, the committee members do not represent the institutions/bodies they are affiliated to in their daily jobs. STECF members also declare at each meeting of the STECF and of its Expert Working Groups any specific interest which might be considered prejudicial to their independence in relation to specific items on the agenda. These declarations are displayed on the public meeting's website if experts explicitly authorized the JRC to do so in accordance with EU legislation on the protection of personnel data. For more information: http://stecf.jrc.ec.europa.eu/adm-declarations

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REPORT TO THE STECF

EXPERT WORKING GROUP ON
Validation of selected sustainability indicators and underlying methodologies for the revision of the EU marketing standards for fisheries products
(STECF-22-12)

Brussels, 05-09 September 2022

This report does not necessarily reflect the view of the STECF and the European Commission and in no way anticipates the Commission's future policy in this area

1 INTRODUCTION

1.1 Terms of References for EWG 22-12

Background provided by the Commission

One of the measures established under the common market organisation (CMO) are regulatory marketing standards for fishery products. The current marketing standards[2] lay down uniform quality characteristics for certain fishery products sold in the EU, whatever their origin. The 2019 evaluation[3] of the marketing standards framework concluded that the current standards do not sufficiently contribute to supply the market with sustainable products. Consequently, the revision of the marketing standards is included as an initiative under the Farm to Fork Strategy for a fair, healthy and environmentally friendly food system[4].

In May 2021 the Scientific, Technical and Economic Committee for Fisheries (STECF) released a report on "Criteria and indicators to incorporate sustainability aspects for seafood products in the marketing standards under the Common Market Organisation"[5] (STECF 20-05). This report proposes transparent methods of measuring and communicating along the supply chain some sustainability aspects of FAPs, based on scientifically sound, simple and verifiable criteria and indicators. Among the eight criteria suggested by the STECF report, three have been identified by the Commission as key sustainability hotspots for a potential first stage of the revision of the marketing standards: (i) fishing pressure (impact on the targeted stock), (ii) impact on the seabed and (iii) impact on sensitive species.

Based on STECF 20-05, two separate expert teams have defined specific indicators for criteria (i) and (ii) above and developed a methodology for the grading of each of these indicators. An indicator for criterion (iii) still needs to be developed.

The Commission would like to engage a STECF EWG to assess and potentially complement the findings of the two *ad hoc* expert teams mentioned above. For that purpose, the STECF EWG will be able to build on the preparatory work of the two previous *ad hoc* expert teams. This preparatory work consists of a report and an Excel database for the sustainability criteria (i) fishing pressure and (ii) impact on the seabed.

The EWG should also discuss and define an approach for establishing an indicator for (iii) the impact on sensitive species.

Specific objectives

- Assess and validate the findings of the work-streams (i) and (ii) mentioned above
- Complement or propose adjustments to the proposed methodologies, if needed.
- Kick-off a process to develop an indicator on the impact on sensitive species.

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[2] Council Regulation (EC) No 2406/96 of 26 November 1996 laying down common marketing standards for certain fishery products, OJ L 334, 23.12.1996, p. 1–15
Council Regulation (EEC) No 1536/92 of 9 June 1992 laying down common marketing standards for preserved tuna and bonito, OJ L 163, 17.6.1992, p. 1–4.
Council Regulation (EEC) No 2136/89 of 21 June 1989 laying down common marketing standards for preserved sardines and trade descriptions for preserved sardines and sardine-type products, OJ L 212, 22.7.1989, p. 79–81.
[3] Seafood markets (europa.eu)
[4] Communication from the Commission to the EP and Council - Farm to Fork Strategy
[5] EN (europa.eu)

Tasks

Task 1: Assess and validate the findings of work-streams (i) and (ii)

The EWG should review the reports and data output of the two expert teams that proposed indicators and underlying methods for fishing pressure and impact on the seabed. This should include a high-level assessment of the resulting gradings for each indicator across various key fisheries products. The EWG should also review the methodology to update these grading and assess the reproducibility over time.

On that basis, the EWG should validate the proposed indicator and underlying methodology or identify potential shortcomings.

Task 2: Complement or propose adjustments to the proposed methodologies

In case shortcomings have been identified in the previous task for one or several indicators, the EWG should make concrete technical suggestions, how these shortcomings could be resolved. This concerns in particular the indicator on fishing pressure, which is limited by the number of stocks with individual stock assessment by ICES etc. In that context, the EWG should make a comparison of complementary grading methods for non-assessed stocks, in particular:

- the 'system 1' approach suggested by STECF 20-05
- an alternative system 1 approach suggested by the *ad hoc* expert team in their report
- a proposed approach for LCA-based fisheries assessments[6], and
- any other methodology that the EWG may identify.

The EWG should identify a preferred methodology and describe how that methodology would consolidate within the overall grading and its consequences in term of comparability and incentives.

Task 3: Kick-off a process to develop an indicator on the impact on sensitive species

The EWG should discuss and define a possible process for establishing an indicator on the impact on sensitive species. Subsequent to the EWG, an *ad hoc* team of four experts would be set up to develop the indicator on that basis.

For this task, the report STECF 20-02 on the review of technical measures could serve as a useful basis. The work of the *ad hoc* expert teams (i) on fishing pressure and (ii) on seabed impact should also be taken into account. The EWG should identify available sources of data which could be used to develop the indicator.

1.2 Outcomes of the STECF EWG 20-05

As a first step, the EWG 20-05 analysed what could be done in terms of sustainability scoring with the information only currently available on all fish products placed in the EU markets. In practice, this implies that only data which are mandatory under the consumer information provisions of the CMO regulation will be considered in this first scoring system referred as system 1 (Table 1). The EWG 20-05 pointed out that this information is currently only available for fresh and chilled products. Therefore, no rating system can be put in place for processed products, until the legislation imposes the same consumer information rules, thus making available what appears to be the minimum information required for any assessment of the product durability.

Risk-based approaches were used intensively under system 1. Such approaches provide for each category of fishery product a risk-based assessment of sustainability criteria that could be considered on the basis of mandatory information only. Such a rating should be understood as a probability for the product to meet the criteria, this probability being defined on average for all products of the same category regardless of its own specific characteristics.

[6] Hélias A, Langlois J, Fréon P. (2018) Fisheries in life cycle assessment: Operational factors for biotic resources depletion. Fish and Fisheries.

The current CM0 Regulation (n°1379/2013) specifies in its Article 35 that all "fishery products marketed within the Union, irrespective of their origin or of their marketing method, may be offered for sale to the final consumer or to a mass caterer only if appropriate marking or labelling indicates:

• The commercial designation of the species and its scientific name.

• The area where the product was caught, according to the 14 ICES divisions in the NEA (FAO area 27), to the 4 FAO sub-areas in the Mediterranean Sea and to the 17 remaining FAO statistical areas otherwise.

• The category of fishing gear used in capture fisheries, as laid down in Annex 3 of the Regulation, i.e. using 7 main fishing gear categories: seines, trawls, gillnets and similar nets, surrounding nets and lift nets, hooks and lines, dredges, pots and traps."

It should be noted that, according to article 39 of the CMO Regulation, additional voluntary information may be mentioned all along the supply chain and then provided to consumers. This especially includes more detailed information on the type of fishing gear, as listed in Annex 3 of the regulation (28 categories). More geographical details on the fishing area can also be added.

The EWG 20-05 noted that the FAO statistical areas are not necessarily matching with the areas covered by the competent RFMOs. This implies that some species can be declared on the label as taken in a given FAO area that is larger than the management RFMO area, resulting in a useless information for the sustainability assessment. This is for instance the case for non-tuna products from the Indian Ocean, where the South Indian Ocean Fisheries Agreement (SOFIA) is covering the southern part of FAO areas 51 and 57. Probably more importantly, some FAO statistical areas are not covered by any RFMO, as it is the case in some parts of the Pacific and tropical Atlantic. However, in some areas, even if they are not formally recognized as RFMOs, regional bodies can be identified that are in charge to assess stocks and coordinate fisheries management.

The EWG 20-05 suggested an additional analysis should be conducted to identify which part of the fish products imported on the EU market is coming from areas related to a given RFMOs or assimilated body in charge of fisheries management coordination. This point was developed with reference to system 2 and the establishment of a reference list of assessed stocks (Table 1).

Table 1. Definitions of systems 1 and 2.

System 1	Based only on data which are mandatory (art. 35 CMO Regulation) under the consumer information provisions of the CMO Regulation (i.e., species, capture area, gear category)
System 2	Based on additional voluntary information (art. 39 of the CMO Regulation) provided by producers (e.g., more detailed information on the type of fishing gear, details on the flag State of the vessel that caught those products, etc.).

A scoring system based only on the mandatory information would currently be very imprecise exhibiting several limits that need to be clearly identified and that are analysed in more details in the following paragraphs. Thus, the main goal of analysing system 1 was to assess its capabilities using mandatory information, as well as to evaluate the limits of such a system.

At the same time, this simple and coarse system has a major advantage as it could be applied to all fishery products, including those for which no direct information is available. System 1 therefore could be the basis used at least for fishery products for which no voluntary and verifiable information is provided by stakeholders along the supply chain. This also justifies identifying and detailing what can be done, even if little, under system 1.

The EWG 20-05 selected eight sustainability criteria based on their importance as recognized priorities in terms of sustainability, and their current applicability at the scale of a given product placed on the EU market: 1) Fishing pressure; 2) Fisheries management; 3) Impact on Endangered, Threatened, and Protected (ETP) and sensitive species; 4) Unwanted landings and discards; 5)

Impacts on the seabed; 6) Impact on marine food webs; 7) Carbon footprint; 8) Waste and pollution.

For six criteria, the EWG 20-05 was able to identify a scoring risk-based approach based only on the mandatory information currently available for all fresh and chilled fish products, according to the CMO regulation (i.e. the species, fishing gear type and fishing area). The EWG 20-05 stressed that such a risk-based approach, referred to as System 1, would provide coarse scores and should not be implemented until a test phase has been completed to assess the scoring feasibility, reliability and consistency of each criterion.

More importantly, the possibility of switching from this simple System 1 to the more robust System 2 should be offered to all producers and importers as soon as they provide additional well-defined and verifiable voluntary information. This additional information should allow their products to be rated on the basis of the more reliable System 2, which gives them the possibility to distinguish themselves from a more generalized rating of their product type, if justified.

The EWG 20-05 considered that the coexistence of the two rating systems is a powerful incentive for all players in the fishing industry to make efforts to collect and provide the additional information needed to better assess the sustainability of their products.

Among the eight sustainability criteria listed above, DG MARE identified i) Fishing pressure, ii) Impact on the seabed, and iii) Impact on ETP and sensitive species as key topics for developing a first scoring system. Therefore, based on the output of EWG 20-05, two separate expert teams have further investigated specific indicators for Fishing pressure and Impact on the seabed and developed a methodology for the grading of each of these indicators. An indicator for the Impact on ETP and sensitive species still needs to be developed.

1.2.1 Fishing pressure

This first selected criterion of fishery product aims at assessing to what extent the current fishing pressure exerted on the related stock is able to achieve the objective of Fmsy management for this particular stock. In other words, this criterion refers to the ex-post assessment of sustainability at the scale of each fish stock, as based on single- species assessment methods. Such a criterion must evidently be supplemented by other indicators dedicated to the ecosystem impacts of fisheries and to other aspects of fisheries management.

System 1

Many fish stocks are distributed on areas that are much smaller than the FAO statistical areas. Even in the case of European waters, limits of some stock do not match the ICES divisions, while several independent stocks of the same species can be present in a given division. This is for instance the case for many plaice or Nephrops stocks. Therefore, for a large part of products placed on the EU market, mostly but not exclusively the imported ones, mandatory information does not allow to link the product to a given stock. As a consequence, assessing, even roughly, the fishing impact on the originating stock of the product is impossible and neither the current or recent status of this stock. However, in an attempt to evaluate the usefulness of the mandatory information, two indicators could be built, that will be discussed later:

1) A simple risk-based approach might consider the percentage of fish stocks by FAO statistical area that is outside the biologically sustainable limits as an indicator of the probability for a given product to originate from an overexploited stock according to its fishing area. It should be noted that FAO assessments are provided at the statistical area only (i.e. not at a finer scale) and are based on a percentage expressed in number of stocks, across all species confounded and regardless of their size and landings. Consequently, the percentage of unsustainably fished stocks is not really a probability of unsustainability at the product level. These assessments that are updated every two years highlight however important contrasts between these very large FAO areas in terms of fishing pressure and mean stock status. In the EU area, the FAO ranking suggests that the Mediterranean and Black Sea is the worst area worldwide with about 63% unsustainably fished

stocks, while the North-East Atlantic (NEA) is better evaluated with 22% of unsustainably fished stocks. In European waters, it would be possible to use more precise estimates based on ICES, GFCM and STECF assessments, which are synthetized at a finer scale (by ICES divisions in the NEA and by basin in the Mediterranean Sea) in the annual STECF report of the CFP monitoring. This synthesis is however based on a different methodological approach with different indicators than in the FAO synthesis. It leads for instance to more pessimistic diagnosis at the global scale (about 90% and 39% of overfished stocks in the Mediterranean Sea and NEA respectively, STECF 2020). Thus, mixing the two systems might be confusing and considered as unfair between domestic and imported products. Theoretically, a more precise system could also be considered by crossing FAO areas and major groups of species, as defined in the FAO FIRMS database (http://firms.fao.org/firms/summaries/ in). However, an analysis of this database suggests that it includes only a small number of stocks with poor global ocean coverage. The EWG concludes that this idea of crossing areas and groups of species probably requires further investigation, but already appears much less powerful than a stock-level analysis, such as that presented under System 2 and for which the data included in FIRMS could be useful.

2) Another risk-based analysis could make use of life history traits at the species level as an indicator of the vulnerability of the species to fishing. Indeed, a long-living and slow- growing species that exhibits a low fecundity for instance (such as the deep-water species) would be more vulnerable to the same fishing pressure, thus exhibiting a higher risk to be overexploited, than a short-living and fast-growing species with a higher fecundity. In such an approach, the vulnerability index defined by Cheung et al. (2007) could be used to propose a scoring for all the species specified in Annex 2 of the CMO regulation. Such a scoring clearly does not directly refer to the stock status from which the product originates (see System 2 for this). However, it provides semi-quantitative information regarding the risk that a product originates from a stock that is subject to an unsustainable fishing pressure. A bad score ('E') indicates products that are caught in a highly overexploited zone and that are characterized by a high sensitivity to fishing given their biological characteristics. Conversely, a good score ('B') is awarded to a product from a stock unlikely to be overexploited and with a low ecological sensitivity to fishing. The lack of 'A' scoring is inherent to the limitations of the approach. The use of this scoring could be confusing as most stakeholders will likely consider that a good score is a guarantee of no overfishing. This is why we set the highest possible score in this rating system to B, clearly suggesting that there is still a risk of overfishing. This B score is consistent with a product that corresponds to a low sensitive species to fishing caught in a large area where is probability to be overfished is low. In such a system, products originating from well-managed stocks could absolutely be poorly scored, which is a strong incentive for producers and importers to provide the more detailed information required to move from system 1 to system 2, where the same product could have a higher score according to its more refined characterization of sustainability in term of fishing pressure.

System 2

In order to provide a stock-based rating, the additional required information (on top of mandatory information) is "the fishing area, at a scale allowing to determine the stock identity" This obviously assumes that the identity of the stock itself has been previously defined. A preliminary work thus consists in determining the list of stocks from which the fishery products placed on the European market originate and, for each of them, identifying the associated fishing zones. This could be done step by step, starting with the easiest cases, and especially with the species representing a large volume of products on the market and for which the stock is well documented (a list with species specific fishing areas exists already for the German market). In a second step, the database can be refined with the lower volume/less documented stocks with the final objective of including all stocks that are evaluated either by international or local well identified scientific bodies. The remaining products, i.e. those which cannot be associated to an identified and assessed stock, will not be allowed to switch from system 1 to system 2 for the fishing pressure criterion. This approach therefore represents a key incentive for all stakeholders, including local or national entities, to provide reliable data on their stock status for avoiding a decrease of market competitiveness (virtuous cycle: reaching system 2 means greater product scoring reliability, sustainability and value).

Regarding products fished in European waters, the required information is the fishing area at the scale of the ICES division in the North-East Atlantic and at the scale of the GSA (geographical sub-area) in the Mediterranean Sea. This information spatial gridding allows identifying if the product originates from a stock assessed by ICES and by CGPM or STECF, respectively. In practice, Article 38 of the CMO Regulation specifies that in the Northeast Atlantic (FAO Fishing Area 27) and the Mediterranean and Black Sea (FAO Fishing Area 37), the sub-area or division listed in the FAO fishing areas has to be provided. This implies that the fisheries ICES division (equivalent to FAO sub-areas) is already compulsory information according to the CMO regulation, whereas only the Mediterranean sub-basin (group of GSAs) data are compulsory. Therefore, the specific GSA where the product has been fished should be an additional voluntary information provided by producers (and rather easy to control). Mandatory FAO large area data should also be sufficient to identify stocks in the case of tuna species, especially (but not only) those exploited by European distant fleets.

For specific European resources, it will be necessary to gather even more detailed information. This is the case, for example, for Nephrops (whose stock identities are clearly defined by ICES, using statistical rectangles), but also for very coastal species, such as scallops. These very coastal stocks are under the jurisdiction of the Member States and can be regularly assessed by national or regional research institutes, at least for some of them. Therefore, an additional list of coastal stocks, clearly defined and regularly assessed, should be identified on a national basis.

With regard to products imported into the EU, a first list of regularly assessed stocks can be easily defined by grouping together information from all RFMOs. International databases such as Firms-FAO and RAM-Legacy should also be taken into account. Again, stocks that are assessed at the national level should ideally be included in the list of reference stocks. This will however only be useful if the associated stock assessments are available and verifiable. Therefore, the EWG 20-05 suggested that only the stocks clearly identified in reliable and easily accessible international databases should be considered eligible to move from System 1 to System 2.

From the reference list of assessed stocks, a European database needs to be built and then regularly updated. This database will register for each stock the values of the indicators (described below) that allow the effective scoring of the fishing pressure criterion. In line with the objective of assessing a level of fishing pressure more than the immediate and potentially variable status of the stock, the indicators should be averaged over the recent period. Accordingly, the database should not necessarily be updated annually (but, for example, every 3 years). However, modern tools available to connect heterogeneous international databases should probably largely facilitate an automatic and immediate update, at least with some RFMOs or international bodies (starting with ICES and GFCM). A partnership with the global Firms-FAO database could also be considered.

According to the MSY management strategy, the EWG suggests to use, as the main indicator of the fishing pressure sustainability, the fishing mortalities ratio F/Fmsy, where an average F over five years is used (or over the last 3 available values for stocks assessed every two years).

The EWG 20-05 was not able due to time constraints to suggest a precise rating associated with this indicator and further investigations are needed to determine the most appropriate rating. In particular, the limits of each grade should be defined after carefully analyzing if the scoring is consistent as regards to the distribution of European fish products between the scores A, B, C, etc. A verification test could easily be carried out using the landings from ICES stock assessments.

This indicator can be calculated provided that a quantitative assessment have been conducted over the last 5 years. This is especially the case in Europe for the NE Atlantic stocks that fall under ICES categories 1 and 2. These stocks are also those where the stock assessment is usually considered the more reliable.

Conversely for some other stocks, only qualitative assessment or Fmsy proxies are available allowing only to determine if the stock is overexploited or not (no quantitative F as above). The reliability of such assessment can be highly variable from one case to the other. In ICES for instance, but also in many RFMOs, clear rules and procedures have been defined and the diagnosis on the stock status can be considered as "rather reliable", especially if it appears to be consistent over all the recent years (absence of high variabilities). In such a case, a scoring (although excluding A+) could be derived from the diagnoses established over the last five years.

These scores should probably be lowered if the assessment is based on poorly defined methods or data, or is provided with delay (for instance more than 2 years, but less than 5 years, otherwise the assessment should be considered as obsolete, and the product will be scored using system 1).

1.2.2 Impact on the seabed

Fishing impacts on marine habitats can be significant, particularly on habitats of high productivity and fragility, and consequently on marine biodiversity (Auster et al. 1996, Rijnsdorp et al. 2017, IPBES 2019). The real effect will depend on the type and extension of each habitat and the fishing method, as well as the interaction between the fishing activity and the ecosystem components (Thrush and Dayton, 2002). The EWG noted that the same concept should theoretically be extended to the pelagic environment, as limiting the fishing impacts overview only to benthic habitats can bias the assessment of sustainability. However, no scientific consensus nor standard methods does exist yet regarding the assessment of fishing impacts on pelagic habitat. Progress is however expected following ongoing developments on the overall GES assessment of pelagic habitats in EU waters (MSFD D1C6). As a consequence, the EWG acknowledges that limiting the scoring to fishing impacts on the seafloor is a first and useful step, which notably fits the current MSFD approach.

System 1

Under system 1, the goal is that producers should have a simple table associating the gear type to a given impact on benthic marine habitats. The impact of fishing gears on the physical structure of habitats of the seafloor can be categorised using a simple method based on three levels (high, medium, low; or traffic light) following a simplified version of the procedure reported in Morgan and Chuenpagdee (2003). Therefore, according to these authors, and more generally according to the current scientific literature available on the topic, the EWG 20-05 suggested a way of scoring the potential impact on the physical structure of benthic marine habitats of the gear categories listed in the Annex 3 of the CMO Regulation. It should be emphasized that some gear types are aggregating detailed gears which all have rather similar impacts on the seafloor. That is for instance the case for hook & line (whose impact is low), for seines and surrounding or lift nets (medium) and for dredges (high). In contrast, gillnets may have contrasting impacts on the seabed depending if they are in contact (such as set gillnets), thus exhibiting a medium impact, or not (such as Driftnet, which has low or no impact on the seafloor). The most heterogeneous gear category is trawls, as it aggregates bottom trawls (with high impacts) and pelagic trawls (low impacts). In fact, the EWG considers that the grouping of such very different gears targeting very different species does not make sense and deserves to be corrected in further EU regulations.

In many cases, a given species can be associated with its typical habitat (e.g. groupers may be associated with hard substrates) and this information could be used to refine the impact score of the related fishing gears. Consequently, each species listed in Annex 2 of the CMO regulation should be associated with a likely type of habitat and, in turn, to a sensitivity category. This classification could be defined, for example through an *ad hoc* contract using the scientific literature (including Fishbase and SeaLifeBase), and make available tables by type of gear and by species to all producers and importers. In practice, it is likely that sensitivity can be defined by categories of species. In this way, it would be easy to combine the scores of gear impact and seabed habitat sensitivity by means of a qualitative scoring (low, medium, high).

More generally, the combination of the two variables "Gear potential impact on the seabed" and "Habitat sensitivity" could be represented by means of five levels score, thus defining the final scoring of the criterion "Impacts on the seabed".

It should be noted that in such a combination under the simple system 1, a score equal to "A" can logically be attributed to some products regarding the criterion "Impacts on the seabed". This relates for instance to pelagic species caught with Hooks and lines, whose impact on the seabed can be considered as very low with a high confidence.

Conversely, relatively underestimated scores could be due to the uncertainty that remains in the approach defined here, and in particular in the definition of fairly broad habitat categories of the

associated species. This particularly applies to the "sediment" habitat, which aggregates all types of sediment, while very different sensitivities can be observed for example between gravel (low), sand (medium) and clay (high) (Hiddink et al. 2020; Mazor et al. 2020). This clear limit justifies moving to system 2 that should allow a more precise and robust scoring of the "Impacts on the seabed" criterion, with better scores for certain products such as those caught on gravel.

System 2

In system 1, the scoring of this criterion was based on the mandatory information provided for the gear type and species. The reliability of the scoring will be greatly improved in system 2 by adding more variables collected on a voluntary basis. This could be done considering several levels of complexity in a step by step approach.

The first step would be to use the detailed fishing gear as a key additional and voluntary information. It allows to define a more robust scoring of the gear. As in system 1, the scoring of the species sensitivity will be defined by the sensitivity of its habitat using the list of species available in the Annex II of the CMO Regulation. In case of imported products fished using gears that are not included in that list, the FAO International Standard Statistical Classification of Fishing Gear (ISSCFG) should be used (https://ec.europa.eu/fisheries/cfp/control/codes/).

It has to be considered as a very preliminary suggestion, which has not been thoroughly discussed by the EWG and thus needs to be further investigated and tested on real data (e.g. national catch statistics by detailed gear).

This improvement does not completely solve the main issue of such a scoring. Indeed, the impact on the sea floor strongly depends on the habitat type, which has a finer scale than the one deduced from the species preferences. A higher level of complexity should thus be investigated based on a more granular information on habitats.

In such a system, producers or importers who consider that the scoring described above leads to an unfair score of their products (because they have been fished on low sensitive habitats) should be given the possibility to specify on which habitat the product has been caught. This additional and voluntary information should refer to the EUNIS classification of habitats (https://www.eea.europa.eu/data-and-maps/data/eunis-habitat-classification). Due to the complexity of this classification, it would be advisable to focus on "habitat level 2", which includes a total of eight habitats: 1) Littoral rock and other hard substrata; 2) Littoral sediment; 3) Infralittoral rock and other hard substrata; 4) Circalittoral rock and other hard substrata; 5) Sublittoral sediment; 6) Deep-sea bed; 7) Pelagic water column; 8) Ice-associated marine habitats.

In a second step, the impact of each gear should be scored against each habitat. When a producer will search for a combination of species and fishing gear, an expert system should therefore be able to show all the habitats where this species could be found and evidence the impact of this gear on all types of habitat (e.g. by means of a traffic light visualization, or with numbers).

The expert system could be developed by a dedicated team following the rationale described in Morgan and Chuenpagdee (2003). The impacts scoring by gear and habitat (and possibly target species) would be validated by a network of scientists, selected because of their familiarity with different fishing gears and their knowledge of habitat damage caused by these gears.

The practical enforcement of such a system would likely be extremely difficult, especially for importers who usually have no idea where the product is exactly coming from, and even for producers who are not familiar with the EUNIS list of habitats. In addition, the controllability of voluntary declarations on habitats of fishing is an obvious limit. Therefore, the system could only be envisaged in situations where a system of precise voluntary declarations could be set up, associating the product with a habitat and a precise location of fishing (for instance at the 0.5°x1° scale used in the EU Data Collection Framework). In parallel, a habitat mapping would allow to control the likelihood of declarations.

In conclusion, the EWG 20-05 advised to adopt a two steps approach, starting only with the fishing gear information, but analysing at the same time the feasibility of a more reliable scoring system based on habitat. This analysis could especially (and rather easily) be carried out in the context of

European fisheries where habitat maps are available and the precise location of fishing operations already registered.

1.2.3 Impact on ETP and sensitive species

The accidental catch of ETP and sensitive species is a major issue for the conservation of marine biodiversity and it may have unexpected impacts on the ecosystems functioning and resilience. As a priority, this concerns marine mammals, seabirds, turtles and some finfish, especially numerous species belonging to the group of rays and sharks. Additionally, the constant increase of public awareness for a healthy environment during the last decades has decreased the social acceptance for unsustainable practices in economic activities, especially for emblematic species. This topic is therefore a significant ecological issue as well as a clear expectation of the civil society. The accidental catch of ETP and sensitive species needs to be considered as a top priority in the recognition of what a sustainable fishery must be.

By ETP species EWG 20-05 considered Endangered, Threatened and Protected species corresponding to the following definitions of the IUCN criteria:

Endangered: species or taxa whose numbers have been drastically reduced to a critical level or whole habitats have been so drastically impaired that they are deemed to be in danger of extinction on the short or medium term. Also included are those that in all probability are already extinct, i.e. they have not been seen in the wild in the past 50 years.

Threatened: species suffering of threats of extinction based on its population demographics, biological characteristics, such as body size, trophic level, life cycle, breeding structure or social structure requirements for successful reproduction, and vulnerability due to aggregating habits, natural fluctuations in population size (dimensions of time and magnitude) (based on IUCN definition).

Protected: refers generally to any vegetal or animal species that a government declares by law to warrant protection; most protected species are considered either threatened or endangered. This definition extends to Regional or International conventions that include a list of protected species due to their decline in the wild, as a result of human or other causes. Among international lists of protected species, the one defined by the CITES is very strict and has been signed by almost all Countries, in such a way that species included in that list have a peculiar and binding status. Other International conventions ratified by EU MS or by MS from where the product originates should also be considered, even if they are not necessarily binding for the Governments. Assuming that the listing of any species at national or regional level highlights the needs to devote special attention to its conservation, other lists must be included such as of the Conventions from Barcelona, Oslo-Paris (OSPAR), Bern, Bonn (CMS), Helsinki (HELCOM), Cartagena (SPAW), Nairobi, Abidjan, etc.

By Sensitive species EWG 20-05 considered species whose conservation status, including its habitat, distribution, and population size or population condition is adversely affected by pressures arising from human activities, including fishing activities. In the case of European waters, this includes species listed in Annexes II and IV of Directive 92/43/EEC, species covered by Directive 2009/147/EC and species whose protection is necessary to achieve good environmental status under Directive 2008/56/EC. The EWG was not able to determine if these ETP-type of lists and even the concept of sensitive species itself were in use in non-European waters/countries. This implies that any indicator related to sensitive species has to be considered with care in the scoring of the "Discards and impact on ETP species" criterion to ensure it cannot be considered as discriminant.

System 1

The EWG 20-05 considered that assessing any potential impact of fishing on ETP species would require the operator be able to provide data at least on the specific gear type (using for instance the detailed classification of fishing gears listed in Annex 3 or the CMO regulation and possibly the technical characteristics of the gear) and on the area of catches at a finer scale than FAO areas.

Under System 1, the lack of information about mesh or gear sizes renders nearly impossible the estimation of discard and/or bycatch rates of ETP and sensitive species. The EWG 20-05 considered that the levels foreseen of the available mandatory information under System 1 (i.e. the gear categories and FAO area) are far too broad to be of any help for a meaningful scoring of the fishing impact on ETP species at the scale of a given product placed on the EU market. Even if it was feasible (which is unlikely), judging only the volume of discards or unwanted catches by gear type and large FAO area appears to be too vague information compared to the distribution of species and fisheries which in most cases are much more granular. Therefore, this would likely lead to highly misleading scores of the fishery products placed in the market. Since this is a hot topic, such an approach could be very counterproductive for the recognition of the entire scoring system by stakeholders and the whole society.

Therefore, the EWG 20-05 concluded that this important criterion, particularly sensitive for consumers, would not be included in the final scoring based on system 1.

System 2

Scoring a product according to its underlying impacts on ETP and sensitive species appeared impossible in system 1 and still remains difficult in system 2. The EWG 20-05 suggested that a feasibility analysis be carried out by a group of experts appointed for this purpose in order to test the above described approach. This approach combines an analysis based on risks at the scale of a pseudo-métier with a management score established at the level of each RFMO or equivalent body.

The impacts on ETP and sensitive species strongly depend on the used fishing gear and on the targeted species. Since the species is already a mandatory information on the market, the key additional required data for this criterion is therefore the precise fishing gear. This data should be provided on a voluntary basis according to the list defined in Annex 3 of the CMO regulation by all producers and importers who expect to benefit from a good score under system 2.

In addition to the fishing gear, the producers and importers will have to provide information to determine the body in charge of fisheries management for the species from which the product originates. This information can be the management body itself or the fishing area (based on FAO sub-areas) from which the management body will be deduced.

Similarly, to the fisheries management criterion, the scoring of the impact on ETP and sensitive species will combine a two-scale approach.

1) A risk-based analysis should be carried out in order to define a score of impact (from E to A+) by pseudo-métier. Therefore, a preliminary step is to define the most appropriate list of pseudo-métiers, each of them defined by the combination of a species or group of species and a gear or group of gears. Since fishing practices and accidental catches of a given gear targeting a given species may depend on the area, the pseudo-métiers could also be defined at the scale of large FAO areas and, if necessary, at a finer scale. Note that in such an approach, pseudo-métiers will be defined with reference to a single targeted species. This is because pseudo-métiers are currently derived by a given product and thus associated to a given species, with no information related to the fishing selectivity and associated species. In the framework of the criterion related to ETP and sensitive species, pseudo-métiers should be defined in order to aggregate fishing operations that have a similar or close impact. Similarity could be analyzed based on the accidental catch rates of each ETP species expressed in numbers or tons (depending on the ETP species) by ton of landings of the targeted species. Pseudo- métiers could ideally be identified through a statistical analysis, provided the observations are available regarding accidental catches at the scale of statistical units, i.e. the detailed gears and fishing areas or sub-areas for the given targeted species. Unfortunately, such data is unlikely to exist with sufficient coverage representative of all gears and target species. The analysis could consequently be based on another data sources relating to the accidental catch reporting that is mandatory in some areas and / or RFMOs. A derived dataset should be constructed bringing together all available reports in the attempt to associate each accidental catch with a targeted species, gear and fishing area. The EWG 20-05 was not sure that even the latter approach would be feasible. If so, pseudo-métiers should be solely defined on the basis of expert knowledge. This could constitute a first step before more in-depth analysis where a group of experts is mandated to create an extended

matrix on gear types, fishing areas, targeted species and possible interactions with ETP species. It is likely that the pseudo-métiers will only attempt to identify the most critical situations, flagging the most controversial gear / fishing areas / target species combinations (all sensitivity species combined, or starting with the most critical ones). Conversely, pseudo-métiers that are documented or known to have no impact on ETP or sensitive species could obtain a good empirical score. The mitigation measures that have been implemented could lead to an improvement of the previous rating according to the pseudo-métiers. The effectiveness of such mitigation measures are however impossible to assess based on the self-declarations of producers and importers. This aspect must therefore be taken into account in the scoring presented below.

2) The rating at the pseudo-métier level will be combined with- (and therefore mitigated by-) a second rating linked to the performance of the body in charge of fisheries management. Here, performance will be assessed against the ability of the management body to promote and implement an effective conservation policy for ETP and sensitive species. Such a rating, with a 6 levels grade from E to A+, should be rather easy to determine for RFMOs, analyzing their reporting and possibly the independent auditions they are subject to. This scoring should take into account three aspects: the consideration of specific targets and rules dedicated to the conservation of ETP and sensitive species, the control and compliance with management rules specifically dedicated to these conservation objectives and the specific associated data collection that is implemented.

The two scores will be combined in the same way as the previous criterion, this time however crossing a métier-based score measuring the potential impacts on ETP species and a RFMO-based score measuring the performance of the management body for the conservation of marine biodiversity. For a given fish product that is characterized by its fishing gear and fishing area, this final score is a measure of the risk that the product was caught in association with ETP species. In other words, it is a measure of the risk that the capture of the product is responsible for an impact on ETP species.

Ultimately, the EWG 20-05 was unable to ensure that a risk-based approach using pseudo-trades based only on gear, fishing areas and target species will be sufficient to provide an informative and reliable scoring of the impacts on ETP and sensitive species (or at least a sufficiently reliable scoring to be considered as informative). The additional accounting of the performance of the management system should however improve the quality of the rating.

The EWG stresses that this criterion is intended to reflect or summarize the capacity of the underlying fishery to protect marine biodiversity. Even if scoring seems difficult at the moment, this criterion should therefore be considered as a top priority and the EWG strongly encourages DG MARE to initiate further investigations on the topic.

Compiling data on ETP species occurrence in order to define pseudo-métiers will be a fairly large task to carry out. Once a system is set up, it will need regular updates on information regarding the status and occurrence of sensitive and ETP species. This is related to e.g. IUCN updates on the revision of protected species lists and more often updates on the fishing regulations.

The system could start with a limited number of species (the most vulnerable/threatened) that can be expanded later. Several ETP & sensitive lists already exist such as the ones covered by Directive 2009/147/EC, the species whose protection is necessary to achieve good environmental status under Directive 2008/56/EC and the Stock at Risk list from the Balance Indicator Guidelines (COM 2014, 545 final) that can support the implementation of a broader database covering all species group at a worldwide scale.

One option could be to set this database up as a Wiki system where information can be added by various experts and moderated by a small team of core experts and then reviewed on a regular basis (e.g. every 2 or 3 years) to identify the most controversial pseudo-métiers.

1.3 Background information from the *ad hoc* contracts

Downstream to STECF EWG 20-05 and upstream to STECF EWG 22-12, DG MARE requested the work of two groups of experts to develop a methodology for grading specific indicators for the

following criteria: (i) fishing pressure (impact on the targeted stock), and (ii) impact on the seabed. While an indicator for criterion (iii) the "impact on sensitive species" still needs to be developed.

The outcomes of the two ad hoc contracts were a methodological report and a comprehensive database in Excel.

1.3.1 Objectives and tasks of the ad hoc contract on the fishing pressure (impact on targeted stock)

One of the key criteria for fishery products identified by the STECF report is the fishing pressure, which could be implemented in the short term. This criterion aims at assessing to what extent the current fishing pressure exerted on an individual stock is in compliance with the objective of F_{msy} management for this particular stock. According to international commitments, the F_{msy} has been adopted by the EU as the main target for fish stocks management. In particular, the F_{msy} is the basis of the scientific advice delivered each year by ICES and STECF for all stocks subject to catch limits through the TACs regulation.

The objectives of this work were to: i) develop an indicator for fishing pressure applicable to stocks with quantitative assessments by ICES, STECF and RFMOs on the basis of the proposal in the STECF report under system 2; ii) develop an indicator for fishing pressure for stocks not covered above on the basis of the proposal in the STECF report under system 1; iii) establish a grading system on the basis of the developed indicators as suggested in the STECF report; iv) establish a reference list of ICES, STECF and RFMOs assessed stocks (based on species and FAO division/sub-division) that associate a given stock with the established grading system. Complement the list with the grading of the remaining species developed under system 1. The design of the reference table should enable operators and control authorities to retrieve the grading for a given stock. Similar databases already exist and can be used as example such as the initiative of the German industry which include species with their stocks relevant for the German marked from all over the world: Fischarten - Fischbestände (fischbestaende-online.de); v) define the method to update the indicator(s) and its modalities.

<u>Task 1</u>: Grading based on fishing mortality ratio (system 2 of STECF EWG 20-05 report)

Under this task, the analysis should provide a grading system to assess the fishing pressure, based on the fishing mortality ratio (F/Fmsy), for a selection of fishery products available on the EU market. The scope of this task covers stocks with quantitative assessments by:

- ICES (Northeast Atlantic, FAO area 27),
- STECF (Mediterranean, FAO area 37),
- 2 RFMOs by geographical area:
  - GFCM for Mediterranean,
  - NAFO for NWA.
- 4 international commissions for migratory species:
  - ICCAT for Atlantic tunas,
  - IOTC for Indian Oceans,
  - WCPFC for western and central pacific,
  - IATTC for eastern pacific.

Given their importance for the EU market according to Eumofa data, the focus will be on the stocks of the species with the highest market shares on the EU market: cod, Alaska pollack, herring, hake, squid, mackerel, sardine, sprat, saithe, dab, flounder, halibut, plaice, monk, seabass, seabream,

whiting, anchovy, octopus, haddock, sole; and for the migratory species: yellowfin tuna, bigeye tuna, skipjack tuna, albacore, bluefin tuna, and swordfish.

1. The analysis should start by identifying the list of stocks assessed regularly by ICES, STECF and RFMOs for which the fishing mortality ratio (F/Fmsy) is available. For those stocks, it should be determined whether the FAO area, sub-area or division is required to identify the stock.
2. Once the list of stocks is established, the analysis should define a grading system to assess the level of fishing pressure on the basis of the average F/Fmsy ratio (or proxy) (for instance in case of annual assessments as a 5-year average and in case of less regular assessments as an average of the last 3 assessments). The choice for the thresholds of the grades should be substantiated and based on the STECF report recommendations.
3. On that basis, the analysis should produce a comprehensive database covering for each of the stocks listed, at least the following information: species, geographical area, stock key label, total catch (on average over the last years), Code CM, averaged F/Fmsy ratio (or proxy), year of latest assessment, regularity of assessment, grading score in accordance with the developed grading system.
4. Finally, the analysis should propose a methodology to update the database regularly on the basis of STECF report recommendations

Task 2: Simple risk-based approach (system 1 of STECF report)

1. A simpler grading should be established for the stocks not covered under Task 1 on the basis of the system 1 suggested in STECF report. In particular, this entails establishing a vulnerability index for species on the basis of existing studies as described under system 1 in the STECF report. As described in the STECF report, this simple risk-based approach will assess the fishing pressure of a given product according to the vulnerability index of the species and the fishing area.
2. For each stock under task 2, the database will include at least the following information: species, geographical area, stock key label, total catch (on average over the last years), grading score in accordance with the developed grading under this task.

1.3.2 Objectives and tasks of the ad hoc contract on the impact on the seabed

One of the key criteria for fishery products identified by the STECF EWG 20-05 report was the fishing activities' impact on the seabed, which could be implemented in the short term. The resulting indicator would reflect the impact of the fishing gear used in the production process on the physical structure of the catch area's seafloor habitat in line with the methodology proposed by the STECF: fishing gear categories (a regulatory classification exists under the CMO Regulation) and the targeted fish species would be the input parameters for the indicator, the latter (i.e. the species) as a proxy to reflect the sensitivity of the habitat.

The objectives of this work were to: i) develop an indicator for fishing activities' impact on the seabed on the basis of the proposal in the STECF EWG 20-05 report under system 1 and 2 (p. 42-45 and 54-56), ii) establish a grading system on the basis of the suggested approach in the STECF EWG 20-05 report; iii) establish a simple database that helps to determine a product grading based on the fishing gear category and caught species.

Tasks: Grading based on gear impact and species-habitat sensitivity (system 1/2 of the STECF EWG 20-05 report)

1. On the basis of the species available on the EU market, establish a list of habitats and the species correlated with this habitat, so that a given species can serve as a proxy for the habitat. The list of species to be covered will be determined jointly with DG MARE, on the basis of EUMOFA data on EU market. The list of species will be limited and should not exceed 200 species.

2. Determine a grading system for the 28 detailed gear categories listed in Annex 3 of the CMO regulation by verifying and, if necessary, refining the grading system proposed in the STECF report in a scientifically robust way.

3. Determine a grading system for the species-habitat sensitivity for the species covered in the commercial designation database based on scientific literature and a reliable methodology.

4. Develop an integrated grading system that combines the two grading systems established in steps 2 and 3 by taking into account the combination of the gear impact and the species-habitat sensitivity as suggested in the STECF report.

5. Develop a database that produces a product grading on the basis of selecting detailed gear category and species as input parameters.

6. Analyse to which degree the more granular approach suggested under system 2 in the STECF report could be developed.

1.4 Main results obtained by the *ad hoc* contracts

Both ad hoc contracts (i.e., Fishing pressure and Impact on the seabed) produced a methodological report and a database provided as Excel file.

The main results and key findings are summarised for each ad hoc contract in the following paragraphs.

1.4.1 Main outcomes of the ad hoc contract on the fishing pressure (impact on targeted stocks)

The first section of the report focuses on the System 2 grading as it was sketched during the EWG 20-05. The comparison of several formulas led to the conclusion that the most relevant would be a grading based on the smoothed value of F/F_{MSY} provided by the more recent stock assessment working group (calculation is provided based on smoothed values of F for either the last 3 or 5 years). The question on how many years should be included in the average will be addressed to the next working group dedicated to the grading system. Once the fishing pressure value is calculated, various ways were explored to link the numeric value of fishing pressure to a grading score (letter from A to F).

The second section focuses on the System 1 grading as it was sketched out during the EWG 20-05. This grading system is based on a more qualitative approach using a combination of two information types available for a given species and area: i) the vulnerability index of the species that aims to qualify a specie as low, medium or highly endangered using globally available information (based on the IUCN Global Red List status 2022); ii) the global status of an area expressed as the number of overexploited stocks over the total number of stocks in the area. These numbers are provided through the FAO global assessment made during the SOFIA annual meeting 2021.

This System 1 approach for the grading system is not based on fishing pressure or stock data but on global biological status on species. Thus, the coverage is higher: 1384 species included composed of fishes, molluscs and echinoderms used for human consumption. It should be used and considered as a proxy of the Fishing Pressure (FP) indicator when this one is not available to perform System 2.

The third section focuses on the analysis of the EU seafood market, and especially the imported fisheries products that represent the bulk of the EU fisheries products consumption (top 20 main and 6 migratory species). The section investigates in particular when and at which geographical level the grading is possible, and it specifically addresses the case of the assessed species by RFMOs, as required by task 1 of the Study's ToRs. The methodology is based on the trade flows recorded in the EUMOFA Extra-EU import database (3.1). It is applied to two case studies (3.2) to clarify how the tables for all the main imported species provided in Annex 3 are elaborated. For each analysed species, the tables (i) indicate whether the system 2 can be applied and (ii) compare the grades obtained by both systems. The results for imported species are also compared with the grades obtained for the European production for both systems. Several key outcomes of this

analysis are then presented (3.3), based on the individual special cases in Annex 3, as well as the summarized results presented in Annex 4.

Finally, the fourth section proposes a method for improving and updating the database, as required by the ToRs of the study. This methods suggests that: i) information to setup the system 2 criteria should be updated on a yearly basis; ii) the question to allow integration of the national stock assessments should be addressed. Currently, only the stock assessments provided by RFMOs are considered as relevant (on a legal basis) even if national stock assessment (e.g., from NOAA) could have a higher degree of confidence.

Two different approaches have been tested, i.e., a System 1 based on FAO fishing area and species status and a System 2 based on a tailored data base gathering fishing mortality values from assessed stocks (F/Fmsy); in addition, further alternative method have been tested and evaluated to calculate the fishing pressure and moreover to dispatch this numeric value among a grading scale (from A to F).

The main results of the two system approach are:

1) System 1 offers a simple and large coverage but an imprecise vision of the fishing pressure on the stocks. This approach is however relatively easy to implement, and can be considered as a downgraded scoring for a seafood product. It can also create an incentive for producers and retailers to provide the relevant information allowing the grading of their product with System 2 to an eventual higher score.
2) System 2 presents a more accurate method for a limited number of stocks (246 stocks). System 2 requires preparing and maintaining a database on a regular basis, which would ideally be every year.
3) The large coverage of System 1 allows to score a high proportion of existing seafood products including imports. System 2 presents yet a relatively good coverage in terms of volume for the main commercial species consumed in the EU, with more than 80% of the imports being graded with that more detailed system for cod, skipjack tuna, haddock, herring. Another key imported species covered under System 2 include Saithe (90% of the products in volume coming from the 5 main EU providers are graded under system 2), Blue whiting (100%), Mackerel (100%), Sardine (97%), Yellowfin tuna (100%), Bigeye Tuna (100%), Octopus (67%). Due to the prevalence of imports in the seafood consumption (see Annex 2 for description), further analysis could however be performed to improve the System 2 coverage as it varies among the imported species.

1.4.2 Main outcomes of the ad hoc contract on the impact on the seabed

In the *ad hoc* contract, the team of experts improved the score criteria for the Impact on the seabed by attributing: i) a score of 1 (low impact) to gears (both passive and active) that are not in direct contact with the seabed, i.e., midwater otter trawls, pelagic pair trawls, driftnets, purse seines, lampara nets, boat operated lift nets, shore-operated stationary lift nets, hand lines and pole lines (both hand- operated and mechanised), longlines (drifting), and troll lines; ii) a score of 2 (medium impact) to passive gears that are in direct contact with the seabed, i.e., beach seines, Danish seines, Scottish seines, pair seines, set (anchored) gillnets, encircling gillnets, trammel nets, combined trammel and gillnets, set longlines, pots (traps); iii) a score of 3 (high impact) to active gears that are in direct contact with the seabed, i.e., beam trawls, bottom otter trawls, bottom pair trawls, otter twin trawls, boat dredges, hand dredges used on board a vessel, and mechanised dredges including suction dredges.

The differences between the impact scores attributed during EWG 20-05 and those adopted in the *ad hoc* contract are exclusively linked to low and medium impacting gears, while high impacting fishing gears were identified in the same way (score 3). Although both active and passive gears may impact the benthic habitats, there is a large scientific consensus regarding the stronger impacts of mobile bottom-contact gears on the seabed (mostly trawled gears, see e.g. Amoroso et al., 2018). Therefore, the impacts on the seafloor are primarily related to the fishing gear and its

specific technology, and bottom trawls as well as dredges are usually considered as the most impacting fishing gears.

Although passive artisanal fishing gears, such as trammel nets and bottom longlines, are known to usually have a lower impact than bottom trawl on benthic habitats, this is likely not the case for specifically fragile Essential Fish Habitats (EFHs). For example, the coralligenous beds in the Mediterranean Sea, maërl in the North Atlantic and Mediterranean Sea and kelps in the North Atlantic, these passive artisanal gears may still pose a threat to the fragile sessile communities (The N2K group, 2017).

In this study, the list of fishing gears (listed in Annex III, column 2 – more detailed information on fishing gears) of the CMO Regulation (Reg. EU 1379/2013) was compared with the corresponding gears listed in the latest FAO Classification and illustrated definition of fishing gears (FAO, 2021) (system 2, step 1).

The second step of the approach suggested by STECF EWG 20-05 was to combine the impact score of the fishing gear with the sensitivity of the habitat, which can be considered as typical of each given species (e.g., groupers may be associated with hard substrata). In addition, STECF EWG 20-05 suggested to attribute (system 2): i) a score of 1 (low impact) to the pelagic habitat; ii) a score of 2 (medium impact) to the soft bottom habitats; iii) a score of 3 (high impact) to hard bottom habitats (e.g., rocks and biogenic habitats).

Due to the complexity of this classification, it was suggested to focus on the EUNIS classification (https://www.eea.europa.eu/data-and-maps/data/eunis-habitat-classification) (system 2, step 2), "habitat level 2". Therefore, following the approach proposed by STECF EWG 20-05, the *ad hoc* study assigned: i) a score of 1 to the pelagic species; ii) a score of 2 to the species living on soft bottom habitats (i.e., mud, sand, coarse sediment, mixed sediment); iii) a score of 3 to species living on rocky habitat and biogenic habitat.

Species and habitat were associated done by reviewing several sources of information (e.g., fishbase.org, sealifebase.org, scientific publications and technical reports). From the overall gathered information, the authors of this report assigned each species to a "typical habitat". However, the authors of the present report believe that, in the future, producers or importers should be given the possibility to specify on which habitat the product has been caught.

Overall, the main habitat has been identified for a total of 1,851 species. These species have been identified on the basis of a list of 392 commercial seafood categories from the EUMOFA database. These commercial categories represented 90% in volume of all wild-captured seafood products that were landed and imported in the EU market (thus excluding aquaculture products). Therefore, it is reasonable to consider that the delivered database in the *ad hoc* study includes the vast majority of seafood species that are from wild-capture and imported in EU.

2 TASK 1: ASSESSMENT AND VALIDATION OF THE AD HOC CONTRACTS ON I) FISHING PRESSURE AND II) IMPACT ON THE SEABED

2.1 Fishing pressure

EWG 22-12 reviewed the methodologies as suggested by the *ad hoc* contract. The *ad hoc* contract suggested a system for fishing pressure, but supplemented this with information from the list of stocks at risk that are available from the STECF Balance EWG (Stock At Risk –SAR- list, see: http://sirs.agrocampus-ouest.fr/stecf_balance_2021/index.php?action=fiche&type_code=ME&atl_version=0&idlang=uk), FAO proportion of overfished stocks by area and IUCN rankings. The SAR reflects whether the stock:

- is below agreed biomass limit reference points,
- is advised to reduce catches to lowest possible level,
- should be returned to the sea unharmed,
- is a prohibited landing species or,

- is on the CITES or IUCN 'red list' (criteria a, b, c, d in 2014 Balance Indicator Guidelines).

Both the FAO and IUCN ranking integrate the stock biomass or its perceived changes over time. Hence, the suggested indicator is a mix of stock status and fishing pressure, using stock status for depleted and data poor stocks while using fishing pressure for stocks with full assessments of F relative to F_{MSY}. The years included in the evaluation varied between categories, with the example demonstrating results for 3- and 5-year averages of F/F_{MSY} while the remaining stocks were assessed based on a single year of data.

The group considered that the proposed system 2 would lead to cases where a good ranking would be given in case a stock with a biomass below the level leading to impaired recruitment (B_{lim}) was managed with restrictive fishing opportunities (F less than F_{MSY}). The group also considered that a similar good ranking would be attained for stocks with a biomass between the level that triggers a lower target fishing mortality (MSY $B_{trigger}$ in the ICES system) and B_{lim}. This was considered potentially inappropriate.

As many stocks are only assessed every third year, the use of average F/F_{MSY} over 3 or 5 years will not guarantee that more than a single assessment is included. Further, the recent guidance on MSFD (EC, 2022) suggests that 6 years should be used in the evaluation of average F/F_{MSY}, so that shorter periods may potentially lead to conflicting results from MSFD assessments.

Stocks that are managed according to MSY principles but without estimating F/F_{MSY} would only use information from SAR, IUCN and FAO, thereby not utilizing the available knowledge for that specific stock (system 1). This was considered not to make best use of available knowledge. Stocks for which this would be the case include stocks for short-lived species and stocks assessed under several approaches for data limited stocks. There are also stocks (e.g., of short-lived species such as capelin) that are managed with frequent fishery closures as part of the management system. Catches taken from these stocks in non-zero advice years should be considered sustainably fished if the system is evaluated as being precautionary for the specific stock.

The suggested grading approach by the *ad hoc* study underutilizes knowledge from other RFMOs or national authorities (e.g., NOAA) in the case where EU fleets are not involved. A non-comprehensive list of additional fora to be considered is presented in Table 2.

For many (though not all) stocks corresponding to products that are imported into the EU, the assessments and subsequent catch recommendations are made by various national and international scientific bodies of the respective institutions responsible for fisheries management. In many cases, the resulting reports are publicly available and contain data, including often time series of the values needed for fishing pressure grading.

Many of the assessments carried out by these scientific bodies undergo as strict international reviews as for the ICES and GFCM-SAC assessed stocks, and hence the available information for these should be considered of equal quality as that produced by ICES and GFCM-SAC.

Furthermore, reassigning IUCN category DD (Data Deficient) to the lowest grade ignores other information on stock vulnerability. In general, the group felt that when there is truly no information available for a species, it should be clearly visible that the product was not graded due to a lack of data.

The *ad hoc* contract report also proposed to integrate under system 1 IUCN global evaluation by species with the global status of an area expressed as the number of overexploited stocks over the total number of stocks in the area. These numbers are provided through the FAO global assessment made during the SOFIA 2021 annual meeting. The group did not consider this appropriate due to variation in the composition of the stocks that are assessed every year. Furthermore, the assumption that the general fishing pressure in an area will impact all species in this area seems unreasonable.

Table 2. List of additional RFMOs and national authorities providing an evaluation of stock status in terms of both fishing mortality (F) and biomass (B), according to internationally peer reviewed approaches.

Acronym	Name
AFMA	Australian Fisheries Management Authority
CCAMLR	Convention on Conservation of Antarctic Marine Living Resources
CCBSP	Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
DFO	Fisheries and Oceans Canada
IPHC	International Pacific Halibut Commission
NASCO	North Atlantic Salmon Conservation Organisation
NOAA	National Oceanic and Atmospheric Administration
NPAFC	North Pacific Anadromous Fish Commission
NEAFC	North-East Atlantic Fisheries Commission
NPFC	North Pacific Fisheries Commission
PSC	Pacific Salmon Commission
SEAFO	South-East Atlantic Fisheries Organisation

The issue of mixed fisheries as presented in the *ad hoc* contract report was also discussed and it was suggested that this needs further consideration. Several types of mixed fisheries were identified, including cases where the stock is caught together with another stock of lower ranking and these stocks either could (e.g., cod and haddock) or could not (e.g., Western Baltic and North Sea herring) be distinguished by the fisher. This is also the case for a stock that is moving into the area where another stock is fished (due to e.g., climate change). In addition, there are cases for which the status is provided by functional unit, but catch data are not available at the same spatial resolution (e.g., Norway lobster).

As a general remark, referencing IUCN Red List assessments can, in many instances, support for generalized statements of historical extent of declines. In many cases, this approach ignored well-established understanding of differences that exist in the theoretical and practical framework underlying the Red List assessments versus fisheries assessments (ICES, 2018; FAO, 2020).

Following the above discussion, the group proposed solutions to some of the identified issues, which need to be integrated in the grading process and are presented under section 3.1.

2.2 Impact on the seabed

EWG 22-12 has reviewed the *ad hoc* report that intended to design a first proposal for scoring the impact of different fishing techniques on the seabed. The final product is a scoring tool based on combination of species and gear type.

The methodology associates a 'fished' habitat to a list of commercial marine species, is the resulting information being then used as a proxy for the habitat.

EWG 22-12 concludes that a system 2 model is feasible and provides sufficient resolution with respect to the habitat impact. This system would only require a limited modification of the Regulation (EU) No 1379/2013 (hereafter, CMO Regulation). Producers currently only need to provide information on the species (Latin name) and the catch method (first column of Annex III of CMO Regulation) for labelling and traceability purposes. For a system 2 approach, the gear listing would have to be more refined than the existing list. The FAO gear classification would be a suitable candidate list (FAO, 2021).

The final score is based on the sum of two sub-scores that are i) the severity of the impact of the gear on the seabed, and ii) the vulnerability or the sensitivity of a given habitat to any type of bottom-contacting fishing gears. The sensitivity of the habitat, which can be considered as typical of each species (e.g., groupers can be associated with rocky habitats), is therefore combined with the expected impact a given gear on the seabed.

The group observed that the impact scoring related to (i) and (ii), further combined to obtain an overall score, could be refined in light of new information and suggest improvements listed in section 1.2. The group observed that in order to calculate an overall (final) impact on the seabed based on the methodology described in the STECF EWG 20-05, the score calculated for the impact of the fishing gear is added to the score calculated for the species (i.e., using the habitat as a proxy).

The group observed that, as a first step in the methodology, the EUMOFA commercial products were converted into (a list of) marine species. While a lot of work has been put in this conversion (see Tables 3 and 4), the list appears to exclude some of the marketed species in Europe, among which few relevant species (e.g., groupers, snappers, etc.). This is probably due to the cut-off at 90% of the cumulative market volume. On the other hand, the list includes a high number of species that are not commercially relevant. In this report, the group will evaluate alternative methods for species selection.

Table 3. Example for retrieving the species name from the commercial seafood products (stored in the EUMOFA database): the case of Saithe, i.e., many products for one species.

Species common name	Origin	Market product name	Total (tons)	Scientific name
Saithe (=Coalfish)	Imports	Fresh or chilled coalfish "*Pollachius virens*"	25,244	*Pollachius virens*
Saithe (=Coalfish)	Imports	Fresh or chilled fillets of coalfish "*Pollachius virens*"	4,001	*Pollachius virens*
Saithe (=Coalfish)	Imports	Frozen coalfish "*Pollachius virens*"	19,293	*Pollachius virens*
Saithe (=Coalfish)	Imports	Frozen fillets of coalfish "*Pollachius virens*"	35,681	*Pollachius virens*
Saithe (=Coalfish)	Imports	Frozen meat, whether or not minced, of coalfish "*Pollachius virens*" (excl. fillets and surimi)	1,428	*Pollachius virens*
Saithe (=Coalfish)	Landings	Saithe(=Pollock)	35	*Pollachius virens*

EWG 22-12 observed that the underlying habitat classification is based on the European Nature Information System (EUNIS). This is a state-of-the-art classification in European Waters for mapping the seabed habitats (https://emodnet.ec.europa.eu/en/seabed-habitats). The *ad hoc*

report method assigned only one habitat type to each species that corresponds to the habitat where the adult individuals are most likely to be found according to the scientific literature. This is done with the reasonable assumption that adult individuals of a given species are those targeted by the fisheries, thus resulting that the fished habitat would be similar to the adults' spatial distribution for that species.

Table 4. Example for retrieving the species name from the commercial seafood products: the case of Frozen Indian mackerels, i.e., many species into one single product.

Species	Origin	Market product	Total (tons)	Scientific name
Other marine fish	Imports	Frozen Indian mackerels "*Rastrelliger* spp.", seerfishes "*Scomberomorus* spp.", jacks, crevalles "*Caranx* spp.", silver pomfrets "*Pampus* spp.", Pacific saury "*Cololabis saira*", scads "*Decapterus* spp.", capelin "*Mallotus villosus*", bonitos "*Sarda* spp.", marlins, sailfishes and spearfish "Istiophoridae"	3,343	*Caranx bartholomaei*
Other marine fish	Imports	Idem	3,343	*Caranx bucculentus*
Other marine fish	Imports	Idem	3,343	*Caranx caballus*
Other marine fish	Imports	Idem	3,343	*Caranx caninus*
Other marine fish	Imports	Idem	3,343	*Caranx crysos*
Other marine fish	Imports	Idem	3,343	*Caranx fischeri*
Other marine fish	Imports	Idem	3,343	*Caranx heberi*
…	…	…	…	….

The EWG experts noted that the *ad hoc* report interpreted the impact on the seabed as the impact on the physical structure. Impacting the physical structure refers to inducing various geochemical and physical processes degrading the abiotic factors ruling on seabed, such as inducing sediment siltering or altering the vertical porosity and geochemical content of the sediments by creating possible smoothing of the seabed (Daly et al. 2018). Hence, the EWG noted that such physical effects are not the only effects inducing a possible change of the functioning of the benthic ecosystems, and the scoring evaluation would also have to consider the fishing-induced effects on the biological components. The latter effects induce changes in species composition of the communities that live on the seabed, with important implications on how the scoring will be interpreted and what will be its impact on the consumer (see section 1.2. for further details).

Based on the *ad hoc* report provided to the group and the statements above, the EWG concluded that the developed methodology in the *ad hoc* report is sensible, but requires a revision of the proposed scoring that was initially based on STECF EWG 20-05. Hereafter and in the following tables are presented an update of the scoring initially presented in the Excel tool with the amended scoring.

3 TASK 2: COMPLEMENT OR PROPOSE ADJUSTMENTS TO THE METHODOLOGIES PROPOSED BY THE *AD HOC* CONTRACTS ON I) FISHING PRESSURE AND II) IMPACT ON THE SEABED

3.1 Fishing pressure

3.1.1 CITES and other grading approaches

The grading of fishery products is already being carried out by a number of governmental and private institutions and organisations. These include, for example, the evaluations of species that are covered by the CITES convention. However, even if a species is listed on CITES Annex II, contracting "*parties shall allow trade in specimens of species included in Appendix II […], only if the Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of that species. Referred to as 'non-detriment findings' (NDFs), these are intended to ensure that exports of products from listed species covered by the NDF have not harmed wild populations or ecosystems*" (Mundy-Taylor et al., 2014). Especially but not exclusively for shark and ray stocks, this document could serve as an example to follow for the necessary steps, in parallel of conducting a thorough stock evaluation of intrinsic high vulnerability as well as of the fishing pressure on the stock in question.

FishSource (https://www.fishsource.org), created in 2007 by Sustainable Fisheries Partnership, claims to be a "*publicly available online resource on the sustainability status of fisheries and fish stocks*", offering fishery profiles and a scoring for registered users. However, according to FishSource, these scorings are not meant to define sustainability, but to "*provide both qualitative and quantitative information about specific variables that are key across international standards of fisheries' sustainability such as biomass and fishing mortality levels, the impact of fishing upon habitat or bycatch. In both instances, FishSource does not define a level above which a fishery or aquaculture industry is sustainable […]. FishSource leaves it to the users of the FishSource data to do that themselves, according to whichever standard or definition of sustainability they are using. FishSource is like a thermometer – it reports a reading, but it is up to the user to determine whether it is 'too hot, too cold, or just right'.*"

Many environmental organizations, such as Greenpeace, WWF or Monterey Bay Aquarium SeafoodWatch, regularly produce ratings for fish products (consumer guides), which usually include a rating of fishing pressure for the relevant species or stocks. The level of detail to which each rating is conducted is varying among the different ratings.

3.1.2 Revised approach to evaluate fishing pressure

To address the shortcomings identifies in section 2.1, EWG 22-12 discussed possible recommended approaches:

1. Utilisation of all available knowledge from scientific committees of advisory bodies and stock assessments.
2. Stocks with biomass requiring decreased fishing that are not graded according to F/F_{MSY} alone.
3. Setting a period of 6 years to estimate average fishing pressure, catch and stock status (i.e., ensuring a minimum of two assessments and consistency with the most recent MSFD guidelines).
4. Clearly identifying species/stocks where no data exist to support a grading.

The proposed approach does not solve the issues of products for which the stock and area are unknown, or the issue of mixed fisheries. On that basis and in the light of a future revision of the

CMO Regulation, EWG 22-12 recommends that processed products should also be made traceable by providing capture area and scientific name of all species. These topics could be addressed in a potential subsequent exercise.

3.1.3 Knowledge from other RFMOs (applies to system 2)

In addition to ICES, GFCM, STECF and ICCAT, a number of organisations provide fisheries advice based on quality assured methods that have undergone an international peer review. Key organisations include NEAFC, NAFO, NOAA, DFO Canada and others listed in Table . The advice from the organisations listed in Table 2 can be considered as equivalent in quality to advice from ICES, GFCM, STECF and ICCAT. For a future refinement of the proposed method, additional organisations could potentially be added following the international peer review of their assessment as part of the quality control process. These additional organisations estimate F/F_{MSY}, or proxies of this (e.g., $F_{0.1}$, $F_{40\%}$), for stocks where the necessary information is available. The principles used in setting reference points often differ between regions, but most operate with at least F_{MSY} and a biomass level below which fishing pressure is reduced to facilitate rebuilding of the stock (e.g., MSY $B_{trigger}$ in the ICES system). This biomass level can be used as a proxy for MSY $B_{trigger}$ as it is eliciting the same management response (defining situations where F_{MSY} is considered too high as a target or limit for F). Examples of relationships between the biomass defining an overfished stock and B_{MSY} can be found here: https://www.fisheries.noaa.gov/national/sustainable-fisheries/status-stocks-2020#the-science-behind-stock-status).

3.1.4 Stocks managed according to biomass targets

EWG 22-12 suggests including a requirement for stocks to be graded by biomass relative to B_{lim} and MSY $B_{trigger}$, or agreed proxies thereof, when the stock is either at a biomass that is less than B_{lim} or MSY $B_{trigger}$ or the stock is managed according to biomass targets. While this means that grading does not only reflect fishing pressure, it was seen as necessary to account for cases where the target fishing mortality should be reduced to rebuilt the stock. Stocks managed according to biomass targets include stocks of short-lived species that are managed according to the escapement strategy (e.g., capelin, sandeel). Stocks that do not have information on biomass relative to agreed B_{lim} or MSY $B_{trigger}$ levels should not be able to attain the A (maximum) grade.

3.1.5 Use of all available stock knowledge (applies to system 1 and 2)

There are numerous stocks that are not assessed with an annual estimate of F/F_{MSY}. These include a range of managed stocks on the basis of survey indices, length distribution or catches alone. When these methods are implemented following the evaluation of their compatibility with MSY and precautionary principles, they provide stock-specific information about fishing pressure relative to that producing MSY, even though this does not involve a direct estimation of F/F_{MSY}. To include this knowledge, the estimates of catch relative to catch advice, effort relative to effort advice or fished area relative to advised fished area can also be used as estimates of fishing pressure relative to F_{MSY}.

Where estimates of catch/effort/specific fished area relative to a stock are not available but such data are available for other stocks of the same species occurring in the same wide marine region (e.g., Mediterranean Sea, North-East Atlantic) it is conceivable that, according to the precautionary

approach, the worst assessment level is assigned in each case, even if this does not actually apply to the stock used.

Instead, where estimates of catch/effort/fished area or region relative to advice are totally lacking, estimates from regional IUCN assessments can be used in combination with the species-specific sensitivity to fishing (system 1; sealifebase.org and fishbase.org). If IUCN identifies the stock as Data Deficient (DD), Not Evaluated (NE) or Not Applicable (NA), species-specific resilience to fishing is used to grade the stock.

Species-specific sensitivity should be at stock or regional level where this is available and the estimated sensitivity should be evaluated by an approved RFMO (see section 3.1.3). Appropriate methods to define sensitivity include productivity-susceptibility analysis (PSA, Hobday et al., 2011), approaches based on life history traits (Le Quesne and Jennings 2012; Hordyk and Carruthers, 2018; Walker et al., 2019; Rindorf et al., 2020) and approaches based on species specific productivity (Helias et al., 2018). Where regional information is absent, global investigations can be used. If information from these methods is not available, species rankings such as those of Cheung et al. (2005) and Greenstreet et al. (2012) could be used. The list for Northeast Atlantic species published in Rindorf et al. (2020) is reviewed by ICES WGCOFIBYC (2021) and is available for download together with the data from Cheung et al. (2007) (using the Cheung et al. (2005) method but with a focus on commercial stocks) here:

https://data.dtu.dk/articles/dataset/Fish_species_sensitivity_to_fishing/21063193

EWG 22-12 discussed which thresholds should be used to define species of low, medium and high sensitivity. Hordyk and Carruthers (2018) suggest that species with PSA scores of less than 2 can generally sustain high fishing pressure regardless of the used evaluation method (life history trait-based model or PSA scoring), whereas species with a PSA score exceeding 3.5 can generally sustain only low fishing mortalities. Comparing vulnerabilities from Cheung et al. (2007) with the precautionary fishing mortalities from Rindorf et al. (2020), the high sensitivity scores from Rindorf et al. (2020) (precautionary F<0.41) correspond to vulnerability scores of greater levels than 70 using the relationship shown in Figure 1.

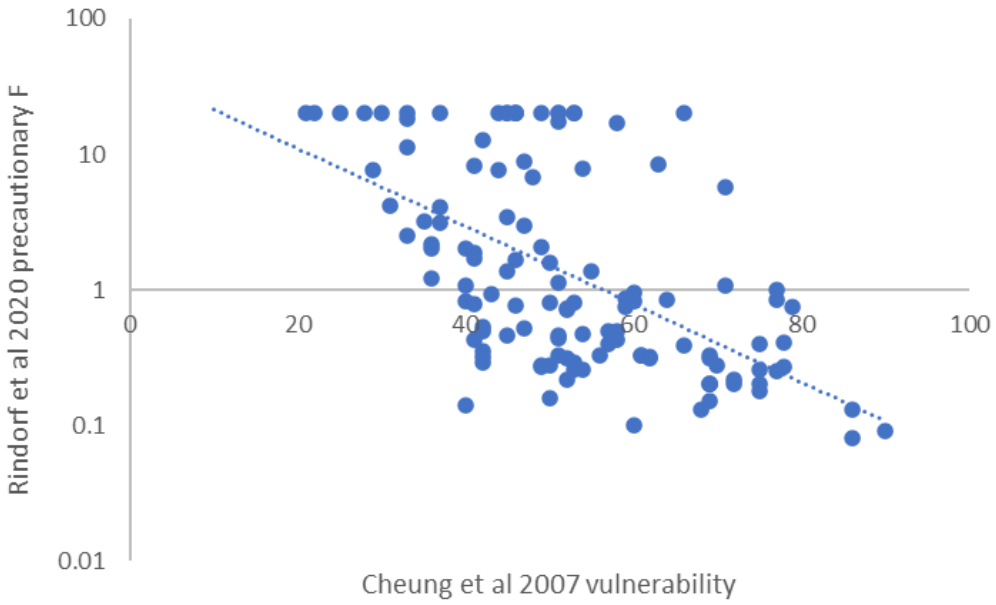


Figure 1. Precautionary F values for species (high values mean less sensitive) from Rindorf et al. 2020 as a function of vulnerability from Cheung et al 2007 (low values means less sensitive).

All species with vulnerability scores above 70 are estimated to have a precautionary F lower than 1. At low sensitivity, all species with a vulnerability lower than 40 have an estimated precautionary F greater than 1 (Figure 1). The precautionary F corresponding to a vulnerability of 40 is 3. Table 5

gives the limits to low, medium and high sensitivity with each of the three methods. EWG 22-12 agrees that the three methods shown in Table 2 are consistent with each other and suggests to use fishbase.org or sealifebase.org to identify the sensitivity of a given species.

Table 5. Sensitivity scoring of relevant thresholds based on PSA, species vulnerability or species precautionary F (see also in the text above the link to a North Atlantic stock database used by the two last references).

	Low sensitivity	**Medium sensitivity**	**High sensitivity**
Hordyk and Carruthers (2018) *PSA*	≤2	2-≤3.5	>3.5
Cheung et al. (2007) *vulnerabilty*	≤40	40-≤70	>70
Rindorf et al. (2020) *precautionary F*	>3	0.41-≤3	≤0.41

3.1.6 More than one assessment in assessment period and harmonizing with the MSFD

Using a period of 6 years to estimate average fishing pressure, catch and stock status relative to the appropriate reference levels will ensure a minimum of two assessments and ensure consistency with the most recent MSFD guidelines (European Commission, 2022).

3.1.7 Clearly identifying where no data exist to support a grading

Careful consideration should be given to the rating level that should be assigned in the absence of sufficient information on fishing pressure. Therefore, it should also be considered to mark the lack of sufficient – or, on the opposite, the existence of sufficiently reliable and credible – information accordingly, e.g., gray color for "no available information". Each of these approaches has various advantages and disadvantages as well as risks, such as accusations of unjustified devaluation of a particular product. The group considered that where it is not possible to identify suitable information on any of the above approaches including species sensitivity, the fish product should be distinctively marked (e.g., grey color) and no grading should be provided.

3.1.8 Operational grading process

Based on the above discussions, the decision tree provided in the *ad hoc* contract is updated and adjusted (see Figure 2).

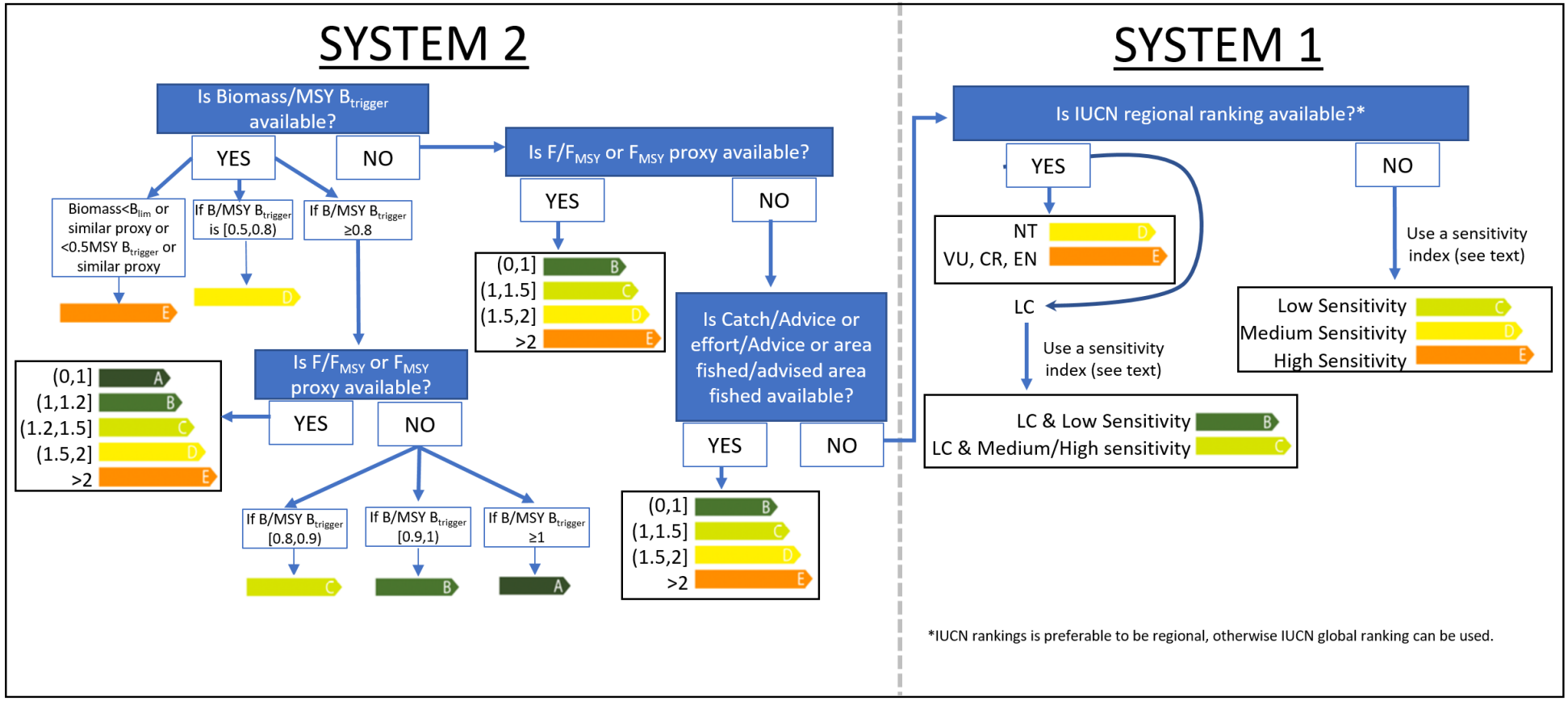


Figure 2. Decision tree to evaluate sustainability level according to fishing pressure (LC: Least Concerned; NT: Near Threatened; VU: Vulnerable; EN: Endangered; CR: Critically Endangered). See text for the description of System 2 (steps 1 and 2) and System 1 (step3). The specific limits between the grades B/C/D should be further analysed (see text on step 2).

Step 1 (system 2). The grading of a stock will be based only on Table 6 in the case the evaluation of F/F_{MSY} or proxies (e.g., short-lived species) are not available. If F/F_{MSY} or proxies are available, the stock will be graded according to step 1 and step 2. However, in the case the stock is graded as D or E according to Table 6 (step 1), step 2 is not considered.

It is important to stress that, while B_{lim} and MSY $B_{trigger}$ are only used by ICES (see as example: https://sid.ices.dk/Default.aspx), other RFMOs use similar indicators to identify overfished stocks and management action is to be taken to reduce fishing pressure (e.g., in the US, 0.5 B/BMSY can be used depending on the stock, https://www.fisheries.noaa.gov/national/sustainable-fisheries/status-stocks-2020#the-science-behind-stock-status).

Table 6. Grading system according to biomass in step 1 (System 2). The specific limits between the grades B/C/D should be further analysed (see text on step 2).

Grade	Biomass / MSY $B_{trigger}$ (or proxies) average over 6 years
A	Biomass / MSY $B_{trigger}$ (or proxies) greater than or equal to 1*
B	Biomass / MSY $B_{trigger}$ (or proxies) in the interval [0.9-1)*
C	Biomass / MSY $B_{trigger}$ (or proxies) in the interval [0.8-0.9)*
D	Biomass / MSY $B_{trigger}$ (or proxies) in the interval [0.5-0.8)
E	Biomass < B_{lim} (or proxies)** or Biomass < 0.5 MSY $B_{trigger}$ (or proxies)

* Use this grade only when stocks have no estimate of F/F_{MSY} or proxies (e.g. short-lived species). When F/FMSY is available, use ranking from step 2.

** In the case Biomass < B_{lim}, ranking according to MSY $B_{trigger}$ should not occur.

Step 2 (system 2). This step grades F/F_{MSY} or catch/advice according to Table 7 (see as example: https://sid.ices.dk/Default.aspx).

Table 7. Grading system according to exploitation level in step 2 (System 2). The specific limits between the grades B/C/D should be further analysed (see text on step 2).

Grade	Biomass / MSY $B_{trigger}$ (or proxies) available and above 0.8, F/F_{MSY} (or proxies) average over 6 years available	Biomass / MSY $B_{trigger}$ (or proxies) not available and F/F_{MSY} (or proxies) average over 6 years available	Biomass / MSY $B_{trigger}$ (or proxies) not available and F/F_{MSY} (or proxies) average over 6 years not available Catch / Catch Advice or Effort / Effort Advice or area fished / advised area fished average over 6 years available
A	(0, 1]	-	-
B	(1, 1.2]	(0, 1]	(0, 1]
C	(1.2, 1.5]	(1, 1.5]	(1, 1.5]
D	(1.5-2]	(1.5-2]	(1.5-2]
E	> 2	> 2	> 2

It uses catch/advice only when F/F_{MSY} is not available. Grade A can only be attained for stocks when B / MSY $B_{trigger}$, or a proxy for this, is available. The specific limits between the grades B/C/D presented both in Tables 6 and 7 should be further evaluated in the future to ensure an even distribution of the three categories. In general, the equal distribution of stocks within the three groups would indicate appropriate levels for the grading efficiency, however this topic should be further discussed and analysed in a dedicated meeting using real data.

Would it be the case of adding here as STEP 3 the situation where the approach of the worst assessment level should be applied? (system 1). If yes, it could be:

Step 3 (system 1). The evaluation is being carried out under system 1 when there is no available grading according to biomass and fishing mortality for the stock used or the information on the specific area is lacking.

In this case, if the wide marine region is known and assessments for other stocks of the same species occurring in the region are available, the worst assessment level is assigned.

Step 4 (system 1). The fourth option can be applied when there is no available grading according to biomass and fishing mortality for any stock of the considered species in the wide marine region, but an IUCN ranking and sensitivity analyses for the species (e.g., fishbase.org, sealifebase.org, etc.) are available.

If available, the IUCN ranking at regional level (regional as defined in IUCN website) is important to consider to score a stock under system 1, otherwise the global ranking can be used. The process will follow the suggestion provided in Table 8.

Table 8. Grading system according to system 1 based on sensitivity to fishing pressure. Data Deficient (DD), Not Evaluated (NE) or Not Applicable (NA).

Grade	IUCN ranking	Sensitivity ranking for NE, NA and DD stock or species
A	-	-
B	LC (low sensitivity)	-
C	LC (medium or high sensitivity)	Low sensitivity
D	NT	Medium sensitivity
E	VU, EN, CR	High sensitivity

3.1.9 Updating the grading process

Fishing pressure may change from year-to-year for stocks of exploited marine species. In addition, scientific assessments, e.g., limits such as B_{MSY} or B_{lim}, may also change from one year to the next when, for example, if new data become available or the used mathematical models to assess stock status need to be changed. Therefore, the corresponding assessments also need to be updated on an ongoing basis. It must be clarified who is responsible in each case for providing, summarizing, reviewing the respective and subsequent assessment (assignment of levels) and who will conduct this accordingly.

3.1.10 *Testing the grading process*

The group tested the modified decision tree presented in Figure 3, using two stocks as examples:

- Atlantic wolffish (*Anarhichas lupus*) in the Icelandic EEZ (MFRI, 2022).
- European hake (*Merluccius merluccius*) in the Adriatic Sea (GSA17-18; GFCM, 2021)

Atlantic wolffish in Icelandic EEZ. The stock has been assessed with a quantitative approach and both biomass and fishing mortality reference points are available (Figure). Therefore step 1 and step 2 of system 2 are used to grade the stock.

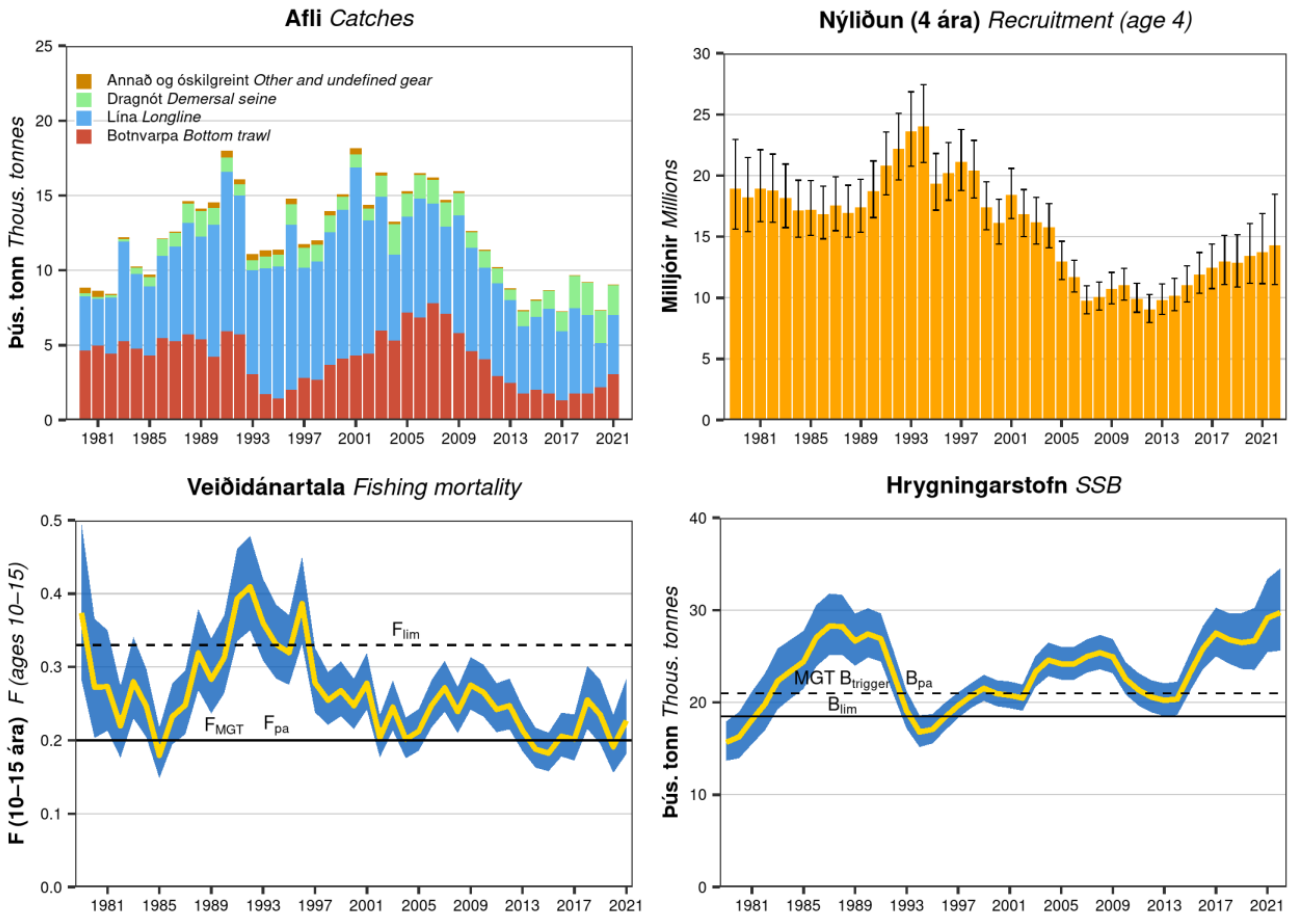


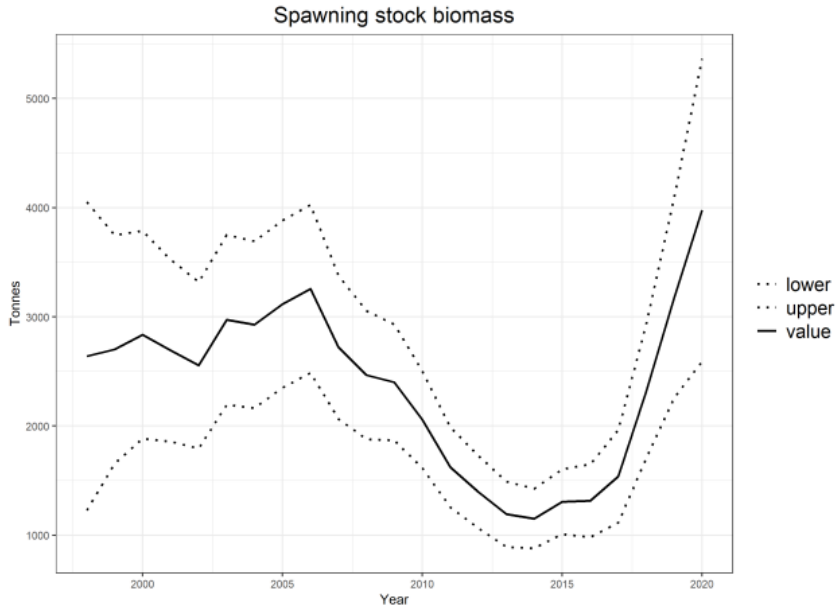
Figure 3. Atlantic wolffish in Icelandic EEZ: Catch by gear type, recruitment (age 4), average fishing mortality of ages 10–15, and spawning stock biomass (SSB). Shaded areas and error bars indicate 95% confidence intervals. $F_{MGT} = F_{MSY}$. Source: MFRI 2022.

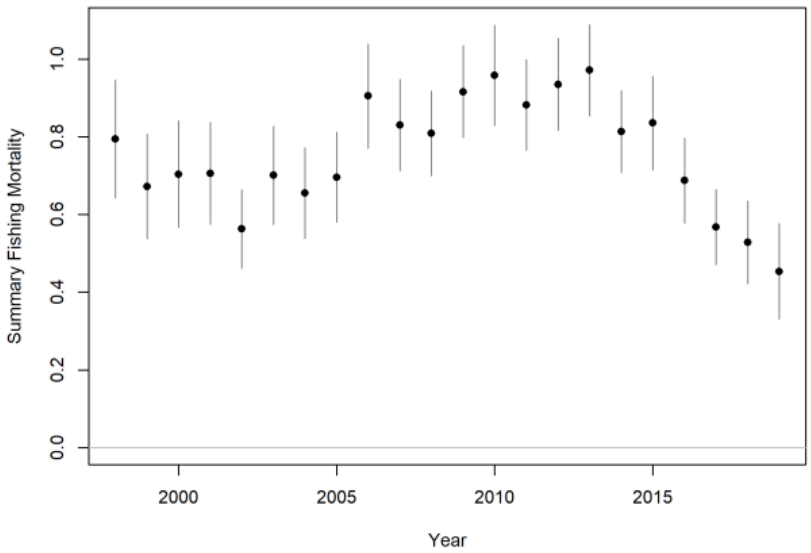
According to the assessment outputs (Figure 3), the six-year average biomass ratio (Biomass / MSY $B_{trigger}$ or proxies) is above 1 and the six-year average of fishing mortality ratio (F/F_{MSY} or proxies) is 1.1, leading therefore to the B score under System2.

For comparison purposes of the scoring between System1 and 2, the group assumed that a quantitative assessment for the stock was lacking, thus using system 1 to grade the stock. According to IUCN ranking, Atlantic wolffish in the North Atlantic is Data Deficient (DD; https://www.iucnredlist.org/species/18155993/44739312). Therefore, the sensitive approach is triggered and, according to Rindorf et al. (2020), the species has high sensitivity, resulting in the grading of the stock as E.

The example shows clearly how the lack of knowledge on the status of a stock would reduce the grade in term of fishing pressure from B to E.

European hake in Adriatic Sea. The stock has been assessed with a quantitative approach and both biomass and fishing mortality reference points are available (Figure 4). Therefore step 1 and step 2 of system 2 are used to grade the stock





	Reference point	SS3
SS3	F_{MSY}	0.167
	$F_{bar(1-4)}$	0.45
	F_{bar} /F_{MSY}	2.69
	B_{lim}	1858
	$B_{trigger}$ = B_{pa}	2543
	$B_{current}/B_{lim}$	2.14
	$B_{current}/B_{pa}$	1.56

Figure 4. European hake in GSA 17-18. Spawning stock biomass (SSB), average fishing mortality of ages 1–4 and reference points. Dotted lines and error bars indicate 95% confidence intervals. Source: GFCM, 2021.

According with the assessment outputs (Figure 4) the six-year average biomass ratio (Biomass / B_{pa} or proxies) is above 1 and the six-year average of fishing mortality ratio (F/F_{MSY} or proxies) is above 2 therefore the grade is E.

For comparison purposes of the scoring between System1 and 2, the group assumed that a quantitative assessment for the stock was lacking, thus using system 1 to grade the stock. According to IUCN ranking European hake in the Mediterranean Sea is Vulnerable (VU; https://www.iucnredlist.org/species/198562/9031395), therefore the grade is again E.

However, the approach proposed under system 1 – step 4 needs to be tested more deeply to verify that it fits with the principle that a lack of information will lead to a worse grading, so encouraging producers to provide as much information as possible.

3.2 Impact on the seabed

Hereafter, "Impact of a gear" is interpreted as the possible impact that a single fishing operation using that specific gear could have on a given habitat. Such an interpretation differs from the impact of repeated, historical fishing pressure (i.e., without considering the overall fishing effort exerted in a certain area).

Based on their ToRs, the *ad hoc* report interpreted "Impact on the seabed" as the impact a fishing gear induces on the physical structure of the seabed only (e.g., siltering, smothering, or physical loss). The EWG 22-12 points out that neglecting the biological components is too restrictive and will disregard the impact on marine biodiversity, which is a key component to be preserved in the context of sustainable fishing. If the impact on biodiversity is to be reflected, the group also highlights that it is essential to account for the potential for natural disturbance that affects marine habitats (e.g., from sea currents, tide amplitude, waves) besides fishing.

Overall, the **five-level scoring of the impact on seabed results from the sum of the gear impact (from 0 to 3) and the habitat impact (from 0 to 3)** as follows:

A score – total ≤2: very low impact,

B score – total of 3: low impact,

C score – total of 4: medium impact,

D score – total of 5: high impact,

E score – total of 6: very high impact.

What EWG 22-12 have addressed includes:

1. For littoral (foreshore zone) and deep sea (> 1000m) habitats, the habitat score should always have the highest impact score, i.e., a 3 value.
2. Revised scoring to include a-0 gear score for pelagic gears (the lowest impact score).
3. Differentiate muddy substrate (score 2, medium-high impact) from sand and mixed substrates (score 1, medium-low impact).
4. The translation of EUMOFA product categories (covering 90% of the market volume, excluding freshwater & aquaculture products) into species (1,850) wasclarified and filtered as many species are not commercially relevant and hence do not need to be graded.
5. The above list was completed with species that represent the remaining 10% of the market volume, e.g., reef-associated species like groupers and snappers, which were missing.
6. As a potential refinement of the approach in the future, the EWG suggests to add an extra column to indicate predominant and (possibly) secondary habitat. In that case, the worst score of the two habitats would be allocated to the fished habitat based on a precautionary approach.

3.2.1 Scoring the relative impact of gear categories

On the gear impact score, the EWG 22-12 proposed to rate the impact starting from 0 to 3 instead of from 1 to 3 to account for some gears that are known not to touch the seabed at all, such as the pelagic trawling gears. Including a 0-scoring freed an additional rate slot to account for more refined differences among gears, especially in case of uncertainty on occasional contact with the seabed. This applies for example to purse seining, which is specifically regulated not to touch the bottom in the Mediterranean Sea, while it might not be the case elsewhere.

EWG 22-12 followed the *ad hoc* rules below for the gear scoring, based on the available materials in the FAO manual (FAO, 2021) that describes in details each fishing gear specifications:

Score 0: seabed is never touched by the gear (no impact).

Score 1: seabed is touched by passive gear (medium-low impact).

Score 2: seabed is touched by active gear (medium-high impact).

Score 3: seabed is touched with severe impact.

One major determinant of the impact of fishing is the fishing technique or the gear used to operate the fishing. A list of gear categories is annexed to the CMO Regulation (Annex III column 1) with the declaration obligation as associate information to the catches (Table 9). However, some of these gear categories pool very different fishing techniques. For example, the category "Trawls" as defined in the CMO Regulation is pooling the "Demersal trawl" and "Pelagic Trawl", which have a very different impacts on the seabed.

Table 9. Proposed impact scores by the EWG per mandatory gear category defined in the CMO Regulation (Annex III column 1) together with the respective FAO category code.

Gear category	**Gear score**	**FAO Category**
Surrounding nets and lift nets	1	PX
Gillnets and similar nets	1	GX
Hooks and lines	1	HX
Pots and traps	1	FP
Seines	2	SX
Dredges	3	DX
Trawls	3	TX

In Annex III of the CMO Regulation there is an additional list of more specific fishing gears (column 2, including 28 gears), which could be declared on a voluntary basis (Table 10). The FAO gear classification includes a finer list of 88 fishing gears (Table 11), among which it is possible to distinguish between, e.g., the semi-pelagic trawls (i.e., the FAO TSP gear) and the strictly pelagic trawls: i) the semi-pelagic trawls consisting of a ground-gear touching the seabed spread by trawl doors flying over the seabed (FAO, 2021), and ii) pelagic gears that are strictly not touching the seabed. Compared to the CMO list of detailed gears (28 gears), the FAO classification (88 gears) allows to discern different types of trawling that are recognised to have different catches and impacts. Such degree of impact cannot be captured by the current mandatory information of the CMO gear categories (column 1 of Annex III). Therefore, when the gear definition is too coarse, the experts involved in the *ad hoc* suggested to adopt a precautionary approach by assigning the highest impacting score.

Table 10. Proposed impact scores by the EWG for the CMO Regulation gear types (Annex III columns 1 and 2 with the respective gear code) defined as the degree to which a fishing gear has a contact with the sea bottom, and the expected severity of this contact on a scale from 0 to 3.

Mandatory information on the category of fishing gear	More detailed information on corresponding gears and codes, in accordance with Reg. (EC) No 26/2004 and Reg. (EU) No 404/2011		Gear score
Seines	Beach seines	SB	2
Trawls	Beam trawls	TBB	3
Dredges	Boat dredges	DRB	3
Surrounding nets and lift nets	Boat operated lift nets	LNB	0
Trawls	Bottom otter trawls	OTB	3
Trawls	Bottom pair trawls	PTB	3
Gillnets and similar nets	Combined trammel and gillnets	GTN	1
Seines	Danish seines	SDN	2
Gillnets and similar nets	Driftnets	GND	0
Gillnets and similar nets	Encircling gillnets	GNC	1
Dredges	Hand dredges used on board a vessel	DRH	3
Hooks and lines	Hand lines and pole lines (hand operated)	LHP	0
Hooks and lines	Hand lines and pole lines (mechanised)	LHM	0
Surrounding nets and lift nets	Lampara nets	LA	1
Hooks and lines	Longlines (drifting)	LLD	0
Dredges	Mechanised dredges including suction dredges	HMD	3
Trawls	Midwater otter trawls	OTM	2
Trawls	Otter twin trawls	OTT	3
Seines	Pair seines	SPR	2
Trawls	Pelagic pair trawls	PTM	1
Pots and traps	Pots (traps)	FPO	1
Surrounding nets and lift nets	Purse seines	PS	1
Seines	Scottish seines	SSC	3
Gillnets and similar nets	Set (anchored) gillnets	GNS	1
Hooks and lines	Set longlines	LLS	1
Surrounding nets and lift nets	Shore-operated stationary lift nets	LNS	0
Gillnets and similar nets	Trammel nets	GTR	1
Hooks and lines	Troll lines	LTL	0

This should act as a direct incentive to revise the current CMO classification towards more detailed information that, in turn, would help refining the scoring (i.e., by using the additional voluntary information of Annex III column 2 of the CMO Regulation or the FAO classification). Overall, the FAO classification appears the most acceptable resolution that is suitable for future reporting. However, EWG 22-12 notes that the rather complex FAO classification (88 gears) may need to investigate whether a producer would be able to identify the gear used to catch a given seafood product.

Table 11. Proposed impact scores by the EWG using the 88 gears defined in the FAO list, along with the corresponding gear listed in the CMO Regulation.

Gear Code	Gear Description	Gear Type	Gear Subtype	CMO	Gear Score
FAR	Aerial traps	R	FT	-	1
FWR	Barriers, fences, weirs, etc.	R	FT	-	1
SBX	Beach seines operated from the shore	S	SB	SB	2
BTX	Beam trawls	T	BT	TBB	3
TBB	Beam trawls (Tickler chain and Chain matrix beam trawl)	T	BT	TBB	3
DRB	Boat dredges	D	DR	DRB	3
SVX	Boat seines	S	SV	SPR	2
LNB	Boat-operated lift nets	L	LN	LNB	0
PTB	Bottom pair trawls	T	TB	PTB	3
TBX	Bottom trawls	T	TB	OTB	3
FCN	Cast nets	F	FG	-	1
GCN	Combined gillnet-trammel nets	G	GC	GTN	1
FCO	Cover pots / lantern nets	F	FG	-	1
SDN	Danish seines	S	SV	SDN	2
MDV	Diving	M	MH	-	1
GND	Drift gillnets (driftnets)	G	GN	GND	0
LLD	Drifting longlines	H	LL	LLD	0
MDR	Drive-in nets	M	MH	-	2
PUK	Electric beam trawls (Pulse Beam)	T	BT	TBB	3
MEL	Electric fishing	M	MM	-	2
PUL	Electric sumwing trawls (Pulse Wing)	T	BT	TBB	3
GNC	Encircling gillnets	G	GN	GNC	1
FGX	Falling gears	F	FG	-	1

GNF	Fixed gillnets (on stakes)	G	GN	GNS	1
FYK	Fyke net	R	FT	-	1
NKS	Gears not specified	N	NK	-	3
NKK	Gears unknown	N	NK	-	3
GCX	Generic combined nets	G	GC	GTN	1
DXX	Generic dredges	D	DX	DRB	3
GTX	Generic entangling nets	G	GT	GTR	1
FXX	Generic falling gears	F	FX	-	1
MXX	Generic fishing gears	M	MX	-	3
GXX	Generic gillnets and entangling nets	G	GX	GTN	1
HXX	Generic hooks and lines	H	HX	LHM	0
LXX	Generic lift nets	L	LX	LNB	0
MMX	Generic mechanized gears	M	MM	-	3
OXX	Generic pots	O	OX	FPO	1
RGX	Generic recreational fishing gears	M	RG	-	3
SXX	Generic seine nets	S	SX	SPR	2
LAX	Generic surrounding net without purse lines	P	LA	LA	1
PXX	Generic surrounding nets	P	PX	PS	1
RXX	Generic traps	R	RX	FPO	1
TXX	Generic trawls	T	TX	OTB	3
GNX	Gillnets	G	GN	GNS	1
DRH	Hand dredges	D	DR	DRH	3
MHI	Hand implements (Wrenching gear, Clamps, Tongs, Rakes, Spears)	M	MH	-	2
MHX	Hand operated gears	M	MH	-	2
LHP	Handlines and hand-operated pole-and-lines	H	LH	LHP	0
HAR	Harpoons	M	MH	-	1
HMX	Harvesting machines	M	MM	-	3
FTX	Large stationary nets or barrages	R	FT	-	1
LNX	Lift nets	L	LN	LNB	0
LLX	Longlines	H	LL	LLS	1

DRM	Mechanised dredges (Hydraulic jet dredge)	D	DR	HMD	3
LHM	Mechanized lines and pole-and-lines	H	LH	LHM	0
PTM	Midwater pair trawls	T	TM	PTM	1
TMS	Midwater shrimp trawls	T	TM	OTM	2
TMX	Midwater trawls	T	TM	OTM	2
OTP	Multiple bottom otter trawls	T	TB	PTB	3
TBN	Nephrops bottom otter trawls	T	TB	OTB	3
PS1	One boat operated purse seines	P	PS	PS	1
SPR	Pair seines	S	SV	SPR	2
LHX	Pole and lines	H	LH	LHM	0
LNP	Portable lift nets	L	LN	LNB	0
FPX	Pots	O	FP	FPO	1
FPO	Pots (single or in strings)	O	FP	FPO	1
MPM	Pumps	M	MM	-	3
PSX	Purse seines with purse lines	P	PS	PS	1
MPN	Pushnets	M	MH	-	2
RGG	Recreational fishing gears	M	RG	-	3
MSP	Scoopnets	M	MH	-	0
SSC	Scottish seines	S	SV	SSC	3
TSP	Semipelagic trawls	T	TM	OTM	2
GNS	Set gillnets (anchored)	G	GN	GNS	1
LLS	Set longlines	H	LL	LLS	1
LNS	Shore-operated stationary lift nets	L	LN	LNS	0
TBS	Shrimp bottom otter trawls	T	TB	OTB	3
OTB	Single boat bottom otter trawls	T	TB	OTB	3
OTM	Single boat midwater otter trawls	T	TM	OTM	2
FPN	Stationary uncovered pound nets	R	FT	-	1
FSN	Stow nets	R	FT	-	1
LA1	Surrounding nets without purse lines (Lampara)	P	LA	LA	1
DRX	Towed dredges	D	DR	DRB	3
GTR	Trammel nets	G	GT	GTR	1

LTL	Trolling lines	H	LH	LTL	0
OTT	Twin bottom otter trawls	T	TB	OTT	3
PS2	Two boats operated purse seines	P	PS	PS	1
LVT	Vertical lines	H	LH	LHM	0

3.2.2 Scoring the impact of gear categories on the seabed habitats

The specific impact of each gear on each marine habitat was deduced using the ecological knowledge on marine species associated to these habitats (i.e., based on published literature and the fishbase.org database).

Fishing activities generate some pressure on the physical habitat (e.g., ICES, 2020). In the current method, species caught and landed are being used as a proxy for deducing the impacted habitats by fishing. However, there are other environmental stressors that can impact the physical habitat, which are also importantly determining the benthic communities that are found on the seabed. Hence, in some areas, natural disturbance induced by a change in these environmental drivers at different spatial and temporal scales (e.g., tidal currents) shape these living communities on the seabed more than fishing, for example, in coastal areas. Hence, coastal habitats are more likely to host Essential Fish Habitats (EFH), which are necessary waters and substrate to fish for spawning, breeding, feeding, or growth to maturity. EFH are typically shallow, productive habitats in the coastal zone such as wetlands, vegetated flats/lagoons and sheltered bays, as well as more exposed rocky and sandy areas, utilized by many fish species across important life history stages such as spawning, juvenile development, feeding and migration (Kraufvelin et al., 2018). In the Mediterranean Sea, where the tidal amplitude is modest, the shaping induced by natural disturbance is low on most coastal areas. In deep-waters, highly diverse habitats formed by coral communities are very sensitive to degradation, and long-term protection measures implemented after impact will only allow a full recovery of impacted coral communities over a very long-time scale (Bennecke and Metaxas, 2017). Deep-sea waters potentially hosting Vulnerable Marine Ecosystems (VMEs) with relatively slow-reproducing species, the Regulation (EU) 2016/2336 was introduced in 2016 for banning trawling. As the environmental conditions are rather stable in deep-sea habitats, any disturbance of the benthic communities associated to these deep-sea habitats have a larger impact than on shallower ecosystems, as reported by the long-lasting or irreversible changes as soon as fishing is operated (CES, 2020).

Recognising these factors affecting specific habitats in different ways, EWG 22-12 proposes to specifically qualify the detrimental effect that fishing would have i) on coastal areas, and ii) on deep-sea habitats as hotspots of biodiversity. For both deep-sea areas and littoral areas, it was therefore proposed to assign the highest impact score of 3 (Table 12). This refinement in the scoring is made possible because the EUNIS classification of habitats is also including the bathymetry information (e.g., Littoral, Infralittoral <50m, etc.). However, it is still impossible to distinguish some vulnerable habitats, such as seamounts, if such habitats are not captured in the sensitive "biogenic habitats" category. In addition to this, we arbitrarily defined the threshold of 1000m depth for defining the deep-sea habitats because we are constrained by the resolution of the EUNIS classification.

The group also identified the need to differentiate muddy substrate from sand and mixed substrate. Muddy habitats are impacted the most by fishing and coarse habitats are impacted the least as shown for example in the North Sea (Rijnsdorp et al. 2020). On one hand, muddy habitats with relatively long living species are both extensively and heavily trawled and, on the other hand, coarse sediment habitats mainly occur in dynamic areas (i.e., high bed shear stress) with the dominance of more mobile and shorter living species (Breine et al. 2018) that are less sensitive to trawling (van Denderen et al. 2015, Foveau et al. 2017).

Table 12. Proposed fishing gear impact score per habitat type (EUNIS level 2, with the respective depth limits in brackets) depending on whether the habitat is vulnerable to physical disturbance (abrasion) induced by fishing, on a scale of 0 to 3.

EUNIS benthic habitat level 2	**Score**
Littoral rock	3
Littoral biogenic habitat	3
Littoral coarse sediment	3
Littoral mixed sediment	3
Littoral sand	3
Littoral mud	3
Infralittoral (<50m) rock	3
Infralittoral (<50m) biogenic habitat	3
Infralittoral (<50m) coarse sediment	1
Infralittoral (<50m) mixed sediment	1
Infralittoral (<50m) sand	1
Infralittoral (<50m) mud	2
Circalittoral (50-200m) rock	3
Circalittoral (50-200m) biogenic habitat	3
Circalittoral (50-200m) coarse sediment	1
Circalittoral (50-200m) mixed sediment	1
Circalittoral (50-200m) sand	1
Circalittoral (50-200m) mud	2
Offshore (200-1000m) circalittoral rock	3
Offshore (200-1000m) circalittoral biogenic habitat	3
Offshore (200-1000m) circalittoral coarse sediment	1
Offshore (200-1000m) circalittoral mixed sediment	1
Offshore (200-1000m) circalittoral sand	1
Offshore (200-1000m) circalittoral mud	2
Upper bathyal (1000-2500m) rock	3
Upper bathyal (1000-2500m) biogenic habitat	3
Upper bathyal (1000-2500m) coarse sediment	3
Upper bathyal (1000-2500m) mixed sediment	3
Upper bathyal (1000-2500m) sand	3

Upper bathyal (1000-2500m) mud	3
Lower bathyal (2500-4000m) rock	3
Lower bathyal (2500-4000m) biogenic habitat	3
Lower bathyal (2500-4000m) coarse sediment	3
Lower bathyal (2500-4000m) mixed sediment	3
Lower bathyal (2500-4000m) sand	3
Lower bathyal (2500-4000m) mud	3
Abyssal (>4000m) rock	3
Abyssal (>4000m) biogenic habitat	3
Abyssal (>4000m) coarse sediment	3
Abyssal (>4000m) mixed sediment	3
Abyssal (>4000m) sand	3
Abyssal (>4000m) mud	3
Pelagic	0

3.2.3 Association of species caught with a seabed habitat

The automatic assessment of the possible impact on the habitat consisted in associating each species with a specific 'predominant' habitat. This was accomplished by reviewing several sources of information (e.g., fishbase.org, sealifebase.org, scientific publications and technical reports). From the overall information gathered, the authors assigned each species to a "typical habitat".

The working group recognised that assigning only one habitat to a species in most situations is not sufficient. Some species may occur in more habitats, depending on their life stage, time of the day or, for example, on their temporally aggregating behaviour during spawning. The species may spend only limited time in the secondary habitat, but it may be the preferred habitat for the fishery because fish aggregations are more vulnerable to the gear.

For example, the golden redfish *Sebastes norvegicus* is assigned to mixed sediment as predominant habitat. However, the literature (e.g., Husebø *et al*, 2002, Costello *et al* 2005) clearly states that cold water coral reef habitats are also relevant for this species (Table 13). Therefore, several specific impacting gears have been adapted (e.g., rockhopper ground gear) to fish on these habitats.

In order to account for fisheries that occur in more sensitive habitats (even if it is not the 'predominant habitat' as indicated in fishbase), EWG 22-12 proposed to add a second column indicating a secondary, yet important, habitat. Following the precautionary approach, the most impacting score will be attributed to the most sensitive habitat.

If management measures are taken to protect sensitive areas from bottom trawling, there is also an incentive to move to a lower impacting gear.

An optional potential refinement of the scoring system developed in the *ad hoc* could thus be to assign a secondary habitat. This could be done by a future *ad hoc* specialist group that could look into further literature evidence.

Table 13. Example of commercial species (redfish, *Sebastes norvegicus*) with the associated predominant and secondary habitat with the relative impact scores.

English name	Scientific name	Predominant habitat	Secondary habitat	Score predominant habitat	Score secondary habitat	Resulting (highest) score
Redfish	*Sebastes norvegicus*	mixed sediment	biogenic reef	2	3	3

3.2.4 Scoring comparison System 1 vs System 2

The Excel tool presented in the *ad hoc* report allows the end-user to compare relative impact scores for any species-gear combination, which is variable also depending on the adopted system and the associated data resolution (SYSTEM 1 (CMO mandatory gear categories – 7 categories) vs SYSTEM 2 (CMO voluntary list of gears - 28 gears) or FAO gear categories list – 88 gears). EWG 22-12 identified potential gain for the producers getting a better score if more detailed categorisation (e.g., CMO Annex III column 2 or FAO categories) are provided compared to the currently less refined mandatory information (e.g., CMO Annex III column 1).

Below are few examples (Figures 5-18) generated from the control panel of the excel tool developed by the *ad hoc* group showing how can vary the impact score of fishing gears on marine species (using the main habitat as proxy):

- The upper box shows the impact based on the CMO voluntary list of gears (CMO Annex III column 2 – 28 gears).
- The box in the middle shows the impact score based on the FAO list of gears (88 gears),
- The box on the bottom shows the impact score based on the mandatory CMO categories of gears (Annex III column 1 -7 categories).

Based on CMO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
ALK	*Gadus chalcogrammus*	Alaska pollock(=Walleye poll.)	1

CMO Code	Gear (CMO terminology)	Gear category (CMO)	Gear score
OTB	Bottom otter trawls	Trawls	3

Result	Medium	4

Based on FAO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
ALK	*Gadus chalcogrammus*	Alaska pollock(=Walleye poll.)	1

CMO Code	Gear (FAO terminology)	Gear category (FAO)	Gear score
OTB	Bottom trawls	Bottom trawls	3

Result	Medium	4

Based on CMO gear categories classification

Reset

3ACODE	Species (scientific name)	English name	Species score
ALK	*Gadus chalcogrammus*	Alaska pollock(=Walleye poll.)	1

CMO Code	Gear category (CMO)	Gear category (FAO)	Gear score
TX	Trawls	ineric trawls	3

Result	Medium	4

Figure 5. Scores on the seabed impact using variable information systems (see text above) applied to Alaska pollock with bottom otter trawls.

Based on CMO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
TUS	*Thunnus spp*	True tunas nei	0

CMO Code	Gear (CMO terminology)	Gear category (CMO)	Gear score
PSX	Purse seines	Surrounding nets and lift nets	1

Result	Very low	1

Based on FAO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
TUS	*Thunnus spp*	True tunas nei	0

CMO Code	Gear (FAO terminology)	Gear category (FAO)	Gear score
PS	Purse seines with purse lines	Surrounding nets with purse line	1

Result	Very low	1

Based on CMO gear categories classification

Reset

3ACODE	Species (scientific name)	English name	Species score
TUS	*Thunnus spp*	True tunas nei	0

CMO Code	Gear category (CMO)	Gear category (FAO)	Gear score
PX	Surrounding nets and lift nets	ineric surrounding nets	1

Result	Very low	1

Figure 6. Scores on the seabed impact using variable information systems (see text above) applied to Tuna spp. with purse seines.

Based on CMO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
COD	*Gadus morhua*	Atlantic cod	1

CMO Code	Gear (CMO terminology)	Gear category (CMO)	Gear score
OTB	Bottom otter trawls	Trawls	3

Result	Medium	4

Based on FAO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
COD	*Gadus morhua*	Atlantic cod	1

CMO Code	Gear (FAO terminology)	Gear category (FAO)	Gear score
OTB	Bottom trawls	Bottom trawls	3

Result	Medium	4

Based on CMO gear categories classification

Reset

3ACODE	Species (scientific name)	English name	Species score
COD	*Gadus morhua*	Atlantic cod	1

CMO Code	Gear category (CMO)	Gear category (FAO)	Gear score
TX	Trawls	Generic trawls	3

Result	Medium	4

Figure 7. Scores on the seabed impact using variable information systems (see text above) applied to Atlantic cod with bottom otter trawls.

Based on CMO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
COD	*Gadus morhua*	Atlantic cod	1

CMO Code	Gear (CMO terminology)	Gear category (CMO)	Gear score
LLS	Set longlines	Hooks and lines	1

Result	Very low	2

Based on FAO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
COD	*Gadus morhua*	Atlantic cod	1

CMO Code	Gear (FAO terminology)	Gear category (FAO)	Gear score
LLS	Longlines	Longlines	1

Result	Very low	2

Based on CMO gear categories classification

Reset

3ACODE	Species (scientific name)	English name	Species score
COD	*Gadus morhua*	Atlantic cod	1

CMO Code	Gear category (CMO)	Gear category (FAO)	Gear score
HX	Hooks and lines	Generic hooks and lines	2

Result	Low	3

Figure 8. Scores on the seabed impact using variable information systems (see text above) applied to Atlantic cod with set longlines.

Based on CMO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
CTC	*Sepia officinalis*	Common cuttlefish	1

CMO Code	Gear (CMO terminology)	Gear category (CMO)	Gear score
OTB	Bottom otter trawls	Trawls	3

Result	Medium	4

Based on FAO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
CTC	*Sepia officinalis*	Common cuttlefish	1

CMO Code	Gear (FAO terminology)	Gear category (FAO)	Gear score
OTB	Bottom trawls	Bottom trawls	3

Result	Medium	4

Based on CMO gear categories classification

Reset

3ACODE	Species (scientific name)	English name	Species score
CTC	*Sepia officinalis*	Common cuttlefish	1

CMO Code	Gear category (CMO)	Gear category (FAO)	Gear score
TX	Trawls	;neric trawls	3

Result	Medium	4

Figure 9. Scores on the seabed impact using variable information systems (see text above) applied to Common cuttlefish with bottom otter trawls.

Based on CMO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
CTC	*Sepia officinalis*	Common cuttlefish	1

CMO Code	Gear (CMO terminology)	Gear category (CMO)	Gear score
FPO	Pots (traps)	Pots and traps	1

Result	Very low	2

Based on FAO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
CTC	*Sepia officinalis*	Common cuttlefish	1

CMO Code	Gear (FAO terminology)	Gear category (FAO)	Gear score
FPO	Pots	Pots	1

Result	Very low	2

Based on CMO gear categories classification

Reset

3ACODE	Species (scientific name)	English name	Species score
CTC	*Sepia officinalis*	Common cuttlefish	1

CMO Code	Gear category (CMO)	Gear category (FAO)	Gear score
FP	Pots and traps	ts	2

Result	Low	3

Figure 10. Scores on the seabed impact using variable information systems (see text above) applied to Common cuttlefish with pots.

Based on CMO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
DPS	*Parapenaeus longirostris*	Deep-water rose shrimp	1

CMO Code	Gear (CMO terminology)	Gear category (CMO)	Gear score
OTB	Bottom otter trawls	Trawls	3

Result	Medium	4

Based on FAO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
DPS	*Parapenaeus longirostris*	Deep-water rose shrimp	1

CMO Code	Gear (FAO terminology)	Gear category (FAO)	Gear score
OTB	Bottom trawls	Bottom trawls	3

Result	Medium	4

Based on CMO gear categories classification

Reset

3ACODE	Species (scientific name)	English name	Species score
DPS	*Parapenaeus longirostris*	Deep-water rose shrimp	1

CMO Code	Gear category (CMO)	Gear category (FAO)	Gear score
TX	Trawls	ineric trawls	3

Result	Medium	4

Figure 11. Scores on the seabed impact using variable information systems (see text above) applied to Deep-water rose shrimp with bottom otter trawls.

Based on CMO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
OCC	*Octopus vulgaris*	Common octopus	3

CMO Code	Gear (CMO terminology)	Gear category (CMO)	Gear score
FPO	Pots (traps)	Pots and traps	1

Result	Medium	4

Based on FAO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
OCC	*Octopus vulgaris*	Common octopus	3

CMO Code	Gear (FAO terminology)	Gear category (FAO)	Gear score
FPO	Pots	Pots	1

Result	Medium	4

Based on CMO gear categories classification

Reset

3ACODE	Species (scientific name)	English name	Species score
OCC	*Octopus vulgaris*	Common octopus	3

CMO Code	Gear category (CMO)	Gear category (FAO)	Gear score
FP	Pots and traps	ts	2

Result	High	5

Figure 12. Scores on the seabed impact using variable information systems (see text above) applied to Common octopus with pots.

Based on CMO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
ANE	*Engraulis encrasicolus*	European anchovy	0

CMO Code	Gear (CMO terminology)	Gear category (CMO)	Gear score
PSX	Purse seines	Surrounding nets and lift nets	1

Result	Very low	1

Based on FAO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
ANE	*Engraulis encrasicolus*	European anchovy	0

CMO Code	Gear (FAO terminology)	Gear category (FAO)	Gear score
PS	Purse seines with purse lines	Surrounding nets with purse line	1

Result	Very low	1

Based on CMO gear categories classification

Reset

3ACODE	Species (scientific name)	English name	Species score
ANE	*Engraulis encrasicolus*	European anchovy	0

CMO Code	Gear category (CMO)	Gear category (FAO)	Gear score
PX	Surrounding nets and lift nets	neric surrounding nets	1

Result	Very low	1

Figure 13. Scores on the seabed impact using variable information systems (see text above) applied to European anchovy with purse seines.

Based on CMO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
ANE	*Engraulis encrasicolus*	European anchovy	0

CMO Code	Gear (CMO terminology)	Gear category (CMO)	Gear score
PTM	Pelagic pair trawls	Trawls	1

Result	Very low	1

Based on FAO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
ANE	*Engraulis encrasicolus*	European anchovy	0

CMO Code	Gear (FAO terminology)	Gear category (FAO)	Gear score
OTM	Semipelagic trawls	Midwater trawls	2

Result	Very low	2

Based on CMO gear categories classification

Reset

3ACODE	Species (scientific name)	English name	Species score
ANE	*Engraulis encrasicolus*	European anchovy	0

CMO Code	Gear category (CMO)	Gear category (FAO)	Gear score
TX	Trawls	Generic trawls	3

Result	Low	3

Figure 14. Scores on the seabed impact using variable information systems (see text above) applied to European anchovy with pelagic pair trawls.

Based on CMO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
HKE	*Merluccius merluccius*	European hake	1

CMO Code	Gear (CMO terminology)	Gear category (CMO)	Gear score
OTB	Bottom otter trawls	Trawls	3

Result	Medium	4

Based on FAO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
HKE	*Merluccius merluccius*	European hake	1

CMO Code	Gear (FAO terminology)	Gear category (FAO)	Gear score
OTB	Bottom trawls	Bottom trawls	3

Result	Medium	4

Based on CMO gear categories classification

Reset

3ACODE	Species (scientific name)	English name	Species score
HKE	*Merluccius merluccius*	European hake	1

CMO Code	Gear category (CMO)	Gear category (FAO)	Gear score
TX	Trawls	neric trawls	3

Result	Medium	4

Figure 15. Scores on the seabed impact using variable information systems (see text above) applied to European hake with bottom otter trawls.

Based on CMO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
HKE	*Merluccius merluccius*	European hake	1

CMO Code	Gear (CMO terminology)	Gear category (CMO)	Gear score
LLS	Set longlines	Hooks and lines	1

Result	Very low	2

Based on FAO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
HKE	*Merluccius merluccius*	European hake	1

CMO Code	Gear (FAO terminology)	Gear category (FAO)	Gear score
LLS	Longlines	Longlines	1

Result	Very low	2

Based on CMO gear categories classification

Reset

3ACODE	Species (scientific name)	English name	Species score
HKE	*Merluccius merluccius*	European hake	1

CMO Code	Gear category (CMO)	Gear category (FAO)	Gear score
HX	Hooks and lines	neric hooks and lines	2

Result	Low	3

Figure 16. Scores on the seabed impact using variable information systems (see text above) applied to European hake with set longlines.

Based on CMO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
DXL	*Donax trunculus*	Truncate donax	3

CMO Code	Gear (CMO terminology)	Gear category (CMO)	Gear score
DRH	Hand dredges used on board a vessel	Dredges	3

Result	Very high	6

Based on FAO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
DXL	*Donax trunculus*	Truncate donax	3

CMO Code	Gear (FAO terminology)	Gear category (FAO)	Gear score
-	Hand operated gears	Hand operated gears	2

Result	High	5

Based on CMO gear categories classification

Reset

3ACODE	Species (scientific name)	English name	Species score
DXL	*Donax trunculus*	Truncate donax	3

CMO Code	Gear category (CMO)	Gear category (FAO)	Gear score
DX	Dredges	Generic dredges	3

Result	Very high	6

Figure 17. Scores on the seabed impact using variable information systems (see text above) applied to Truncate donax with hand operated gears (available only in the FAO gear list).

Based on CMO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
CLJ	*Ruditapes philippinarum*	Japanese carpet shell	3

CMO Code	Gear (CMO terminology)	Gear category (CMO)	Gear score
DRH	Hand dredges used on board a vessel	Dredges	3

Result	Very high	6

Based on FAO fishing gears classification

Reset

3ACODE	Species (scientific name)	English name	Species score
CLJ	*Ruditapes philippinarum*	Japanese carpet shell	3

CMO Code	Gear (FAO terminology)	Gear category (FAO)	Gear score
-	Hand operated gears	nd operated gears	2

Result	High	5

Based on CMO gear categories classification

Reset

3ACODE	Species (scientific name)	English name	Species score
CLJ	*Ruditapes philippinarum*	Japanese carpet shell	3

CMO Code	Gear category (CMO)	Gear category (FAO)	Gear score
DX	Dredges	Generic dredges	3

Result	Very high	6

Figure 18. Scores on the seabed impact using variable information systems (see text above) applied to Japanese carpet shell with hand operated gears (available only in the FAO gear list).

3.2.5 Toward a "System 3": acknowledging regional aspects and fisheries specificities

The fishing impact depends on the used fishing gear, the type of habitat and the fishing intensity, which all depend on the targeted marine species (e.g., see ICES, 2019, 2020). The use of declared species as a proxy for deducing the types of habitat impacted by the declared gear implies, through the scoring, that the ecological habitat of that species (defined by its ecological valence) is similar to the habitat impacted by the fishing (the "fished" habitat). However, in some cases the fished habitat is unlikely the area corresponding to the habitat where the fish individuals aggregate the most (see, e.g., the Red fish in Norwegian Waters example). Hence, the group identified that it would be helpful to also consider any information on the distribution of the fishing effort. The spatial distribution of fishing effort would allow identifying the fished areas/habitats, and the preference of gears for specific habitats. However, EWG 22-12 recognizes the difficulty in accessing such additional information with enough accuracy and good coverage, even if existing data platforms may be used for that purpose (e.g., Global Fishing Watch). The scoring could ultimately be refined with the best available science proposing new indicators of fishing seabed impact (e.g., Eigaard et al., 2016), which would implement the scoring using the knowledge of fisheries-specific spatial footprint. There is a growing corpus of scientific literature measuring the amount of catch made within one hour of fishing by average vessel as a useful indicator to compare the footprint of fisheries (e.g., kg landed and edible per swept area crossed with the average fishing time per trip and number of trips). Such information would ultimately be beneficial to rank fisheries in different parts of the world from which market products are imported into the EU. In such a comparison, fisheries might be downgraded if this information is missing for incentivizing fisheries to ultimately provide this information.

EWG 22-12 identified the need to accounting for regional specificities that would refine the impact scoring process. Environmental conditions and drivers affecting marine species can be very different depending on the regional areas. For example, the sea bottom shear current is substantially higher in the North-East Atlantic region than in the Mediterranean Sea making littoral areas less sensitive to perturbations (e.g., storms) in the former region. A way forward would be to propose a specific impact scoring per regional FAO areas. The EWG introduced a differentiation depending on depth. The more vulnerable areas if the shallow and deep-sea would both warrant the stricter score. Furthermore, the addition in the scoring process of the percentage of the surface area trawled per FAO region (e.g., deduced from Amoroso et al., 2018; Pitcher et al., 2022) should help to weighting the importance of the fishing techniques in sweeping the targeted habitats. This should highlight the proportion of trawled surface within the total extent of the habitat, with likely highly contrasted levels (possibly up to 100%).

3.2.6 Building a risk-based database for scoring automation

In the future, building a database with an automatic declaration collection will be the base for the scoring presented here. This would implement a fully digitalized control system along with developing the traceability of market products impacts. When it comes to develop a database, it would be relevant that some species-gear combinations should be disabled as a possible entry in the database in order to avoid the misreporting of impossible combinations with a subsequent post hoc quality check (which would be even more important if a possibility to misreport could lower the final impact score compared to the actual impact). Traceability has a cost, the fight against fraud and/or misleading information is essential to the viability of the scoring system. In addition to this, scientific studies should be included to reduce the uncertainty on less surveyed gear-species combinations (e.g., over-representation of the effect of fishing on sandy areas). Finally, such a database will be useful to know how much landed volume lies in the A, B, etc. categories, i.e. to rate and monitor fishing practices. On the long-term this database will be also useful to inform on the progress status and as a mean to check whether the scoring is well-balanced over the grading scale.

In Figure 19 the distribution of scores (from A to E) of all the possible combinations of gear-species are reported. Note that a number of these combinations could be irrelevant (e.g., catching shrimp with a longline, etc.), but have not been filtered out given the large number of combinations (i.e.

28 CMO gears x 1,850 species), therefore Figure 19 may not represent a realistic distribution of scores for all existing gear-species combinations.

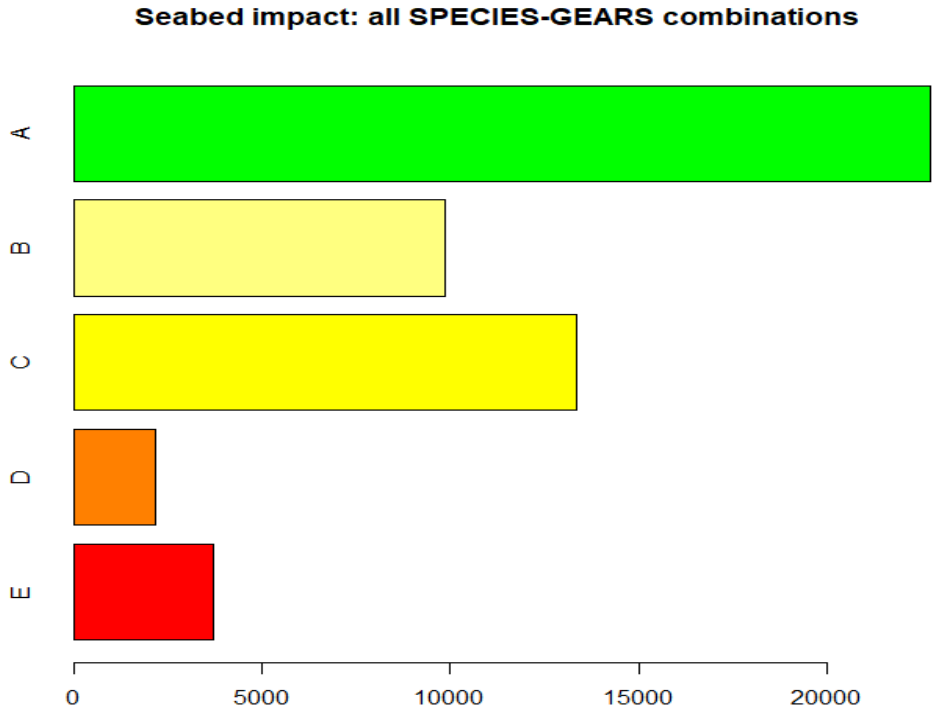


Figure 19. Distribution of scores (from A to E) for all combinations of gear-species, including those that could be irrelevant.

4 TASK 3: KICK-OFF A PROCESS TO DEVELOP AN INDICATOR ON THE IMPACT ON SENSITIVE SPECIES

4.1 General principles

The intention of the indicator on "impact on sensitive species" is to communicate whether a given fishing product on the EU market is associated with potential detrimental impact for one or several sensitive species. In this section of the report, sensitive species and ETP species are used indiscriminately. A definition of sensitive species and ETP species is given in the STECF 20-05 report (EC, 2021).

Detrimental impact on ETP species can be either direct (e.g., increasing mortality of the considered ETP species due to bycatch) or indirect (e.g., increasing mortality following the reduction of important prey items for the considered ETP species). However, based on current data availability, the EWG chose to restrict the definition of detrimental impact as the risk that individuals from a species/population/group of species are negatively affected by direct interactions with fishing activities through incidental bycatch. Like for the other indicators under development, a relative ranking system is sought for, ideally enabling a 5-point grade (A-E), or grey score, if data to assess the fishing product under evaluation are incomplete or non-existent, making impossible such assessment. The possibility of adding an A+ score was also discussed by the group in case of zero catch of sensitive species but, for consistency with the other indicators in this report, a 5-point grade (A-E) was adopted. Moreover, this system should allow grading to be reassessed as more data are or become available (from a System 1 for data-poor situations to a System 2 for data-rich products). In System 1, the approach should be able to cover most products by volume and be informed by available (mandatory) CMO information, whereas in System 2, additional and more detailed data provided by the producers or stemming from official bycatch assessments (e.g., observer programmes) will be used when they are provided or available for certain products.

The intention behind this double system is to create an incentive for producers (and importers) to provide additional verifiable information aimed at improving the overall grading process of System 1, notably by reducing the risk of false positives.

Eventually, the approach behind the indicator should allow an automatic assessment following the available information suitable for System 1 or 2 on a product, however EWG 22-12 will also investigate the potential need of expert opinion in the initial, overall grading process.

Quantitative bycatch data are scarce in many fisheries and monitoring effort may vary widely in quantity and quality between areas and species groups. Therefore, the group discussed the need for different risk-based approaches for assessment of this indicator, either supported by data, semi-quantitatively, or fully expert-based knowledge.

As a starting point for setting up an indicator on the impact on sensitive species, EWG 22-12 derived a first list of ETP species that would have to be considered by compiling species from the following lists:

1. All marine organisms categorised as threatened according to the global IUCN Red List of Threatened Species (IUCN 2022) (categories Extinct (EX), Critical Endangered (CR), Endangered (EN), or Vulnerable (VU)). This comprises all marine organisms including benthic sensitive species (among which non-motile habitat-forming species such as corals or sponges), notwithstanding possible limitations on the availability of an exhaustive sensitive species list for this group of organisms. There is no overlap with the indicator on "impact on seabed" since the latter covers only physical impact.
2. The list of sensitive species provided in the Annex I of the EWG 20-02 report (EC 2020), which assembled data from different sources (e.g., Birds and Habitats Directives, ICES WGECO and WGBYC, OSPAR and HELCOM regional Red Lists, DGENV, Annex II-III of SPA/BD Protocol of the Barcelona Convention, Appendix I of CITES, Appendix I-II of CMS, etc.). The group recognized that all the species of marine birds, mammals, and reptiles in the EWG 20-02 database needed to be considered as sensitive, whereas the situation was less clear for some of other marine organisms, particularly fish and cephalopod species, some of these being commercially exploited by at least some fisheries.
3. The list of fish species (including non-commercial and commercial) of conservation concern (threatened, sensitive, or already listed in legislation) provided by the Workshop on Fish of Conservation and Bycatch Relevance (WKCOFIBYC) convened in November 2020 (ICES 2021). This list is composed of fish species found on Regional Seas Convention (RSCs) lists, international agreements, national and international legislations, including the EU Habitats Directive, the Common Fisheries Policy Prohibited Species list, and national legislations in the UK and in Iceland. Species absent in EU areas, as well as freshwater species, were excluded. Overall, 309 fish species from the northeast Atlantic and the Mediterranean/Black Sea were considered in this list, including some brackish water and diadromous species.

Annex I of the current report includes all the species belonging to the points 1, 2, and 3 of the lists above. Overall, 1697 marine organisms were retained as ETP species in the consolidated list, with almost 60% of them being fish (1010 species), followed by other lower trophic marine species (495 species) and, to a lesser extent, by marine birds (105 species), mammals (75 species), and reptiles (12 species).

In the consolidated list, 1,390 out of 1,697 species were assessed by IUCN and have a corresponding IUCN status (CR/EN/VU/EX) for at least one assessment area (e.g., Global, Europe, Mediterranean, etc.). When existing, the IUCN status is presented in separate columns for each assessment area.

Following the general principles described above, the ToR for this subgroup is to kick-off a process on how to develop an indicator that may attribute products on the EU market with information on the impact on sensitive species. More specifically, the ToR is to discuss and define an approach for establishing an indicator and, on this basis, allow for an *ad hoc* team of several experts to develop a prototype indicator after this EWG meeting. The work of the other subgroups on fishing pressure

and on seabed impact should be considered and available sources of data that could be used to develop the indicator should be identified. Therefore, the work undertaken by the subgroup on an indicator on the impact on sensitive species is exploratory, trying to identify data sources and tangible approaches in the short- and long- term for a System 1 and System 2 approach.

4.2 Approaches for assessing risks of direct interaction with ETP species

The intention of this EWG is to identify strategies for transferring ongoing efforts in data collection and knowledge from already existing regional or international initiatives to the EU market and not to repeat what is already done elsewhere. Therefore, as a first step, it is important to identify how an underpinning database supporting the indicator can be built, similar to the Excel tool used for the seabed indicator.

4.2.1 Ongoing initiatives related to bycatches of ETP species

The International Council for the Exploration of the Sea (ICES) is a scientific body producing scientific advice for management. The recent roadmap for ICES bycatch advice on protected, endangered, and threatened species describes the legislative background, the science needs, and a path for ICES to strengthen its advice on bycatch. In particular, ICES collects data on ETP species bycatch in European fisheries through a dedicated Working Group on Bycatch of Protected Species (WGBYC), with ongoing collaborations with other dedicated expert working groups on marine mammals (WGMOMA), birds (JWGBIRD), elasmobranchs (WGEF), or commercial catches (WGCATCH). Furthermore, WGBYC notably estimates bycatch rates and total bycatch estimates at species and fisheries level, and highlights best practices and guidelines to reduce the impact of fisheries on sensitive species. The ICES work on bycatch and impact of fisheries on sensitive species is not limited to ICES Member States, and cooperation/collaborations exist, with regional and international organisations for data/information sharing, bycatch assessments, and risk evaluations (e.g., the General Fisheries Commission for the Mediterranean (GFCM) for the Mediterranean and Black Seas, the HELsinki COMmmission (HELCOM) for the Baltic Sea, the OSlo-PARis Commission (OSPAR) for the North-East Atlantic, as well as Regional Coordination Groups (RCGs), and other Regional Fisheries Management Organisations (RFMOs) and Regional Sea Conventions (RSCs)). Moreover, to meet the EU-MAP requirements and progress towards statistically sound sampling schemes, ICES is currently implementing a new Regional DataBase and Estimation System (RDBES) that brings significant improvements and transparency over the existing InterCatch and Regional DataBase (RDB) in the provision of estimates from commercial fisheries to stock assessment, including estimations of sensitive species bycatch. This information is already partly available and will likely become a valuable source of information in the coming years for further assessing the impact of fishing on sensitive species and notably through an upcoming System 2 approach for products from the EU fisheries.

An important question to assess the sustainability of fishing with regards to its impact on sensitive species is to consider whether an existing level of interaction (e.g., incidental captures) constitutes a threat for a species/population. The first criterion of descriptor 1 on biodiversity of the Marine Strategy Framework Directive (MSFD) considers the mortality rate from bycatch and includes air-breathing species (i.e., marine mammals, reptiles, and birds) and non-commercially exploited species of fish and cephalopods. Regionally, indicators are being developed to address this criterion and assess the (regional) risk from incidental bycatch. For instance, OSPAR and HELCOM have been following similar approaches for assessing bycatch risks for seabirds and for marine mammals by considering the amount of data currently available to evaluate total bycatch mortality at species/population level and the uncertainty of such methods. Although scientific consensus has not yet been reached for some sensitive species/populations on which levels of bycatch constitutes a risk for a species/population, the outcome of these indicators should allow flagging unsustainable fishing practices from the sensitive species bycatch point of view.

Outside the European Union, several states have also put in place strong legislations to ensure the sustainability of their national fisheries, notably in terms of monitoring and/or reducing the impact of fishing on sensitive species. This includes, among others, Norway (Marine Resources Act),

Iceland (Regulation on Logbooks 746/201), the United Kingdom (Fisheries Act 2020 and Marine Wildlife Bycatch Mitigation Initiative), Canada (Policy on Managing Bycatch), the United States (Marine Mammal Protection Act and Endangered Species Act), or Australia (Environment Protection and Biodiversity Conservation Act). Assuming that the regulations in place in these countries can guarantee a high level of detail for the fisheries products that these countries export to the EU market, such information could be used for a more precise grading.

Under the Data Collection Framework (DCF, Regulation (EU) 2017/1004), Member States (MS) are mandated to collect data following national work plans[7] and report annually[8] on their implementation. Until 2022, annual information on incidental bycatches had to be reported by MS in Annual Report templates under Table 1F: "Incidental by-catch of birds, mammals, reptiles and fish". This included information on the storage location of incidental bycatch incidence data in national and/or international databases. These data represent a valuable source of information for a sensitive species indicator regarding the sustainability aspects of fisheries products. A new DCF template came into force for the period 2022-2024 where information regarding "Impact of fisheries on marine resources" have to be reported under section 4 in the Text Box 4.2: "Incidental catches on sensitive species". According to the guidelines, some additional information can be provided by the MS, including an evaluation of the gear types/metiers that present the highest risk of bycatch per species/taxa of ETP species in each region and the methods used to estimate the observation effort. Although these elements could be an asset to build a sensitive species indicator, current DCF data are still considered as incomplete with respect to incidental catches of sensitive species (ICES WGCATCH 2022). Moreover, the data reported by MS do not always allow allocating for catches to a single fishing event or even to a fishing trip. For instance, many small-scale fishing vessels currently report catches (or landings) on a monthly basis and at a low spatial resolution (e.g., at the ICES statistical rectangle level). Precise data – both spatially and temporally – on fishing effort and associated bycatches of ETP species, are nonetheless essential to assess bycatch risks with a limited uncertainty. In the COM(2018) 368 final, the EC proposes *inter alia* to amend the current control regulation by making the use of a tracking system mandatory regardless of vessel length and by aligning logbooks to the new provision on traceability (using a unique fishing trip identifier) to increase the quality of the recorded data.

Fisheries Dependent Information (FDI) constitutes another valuable source of information for an indicator on impact on sensitive species as FDI data include MS data by species, target assemblage (i.e., the group of target species) and detailed gear type, including mesh size information when the information is available. Moreover, FDI contains a specific section on discards by length/age and gear for a time series starting in 2014. This section is currently covering the EU fleets operating in the Atlantic Ocean and other fishing regions (aggregated in 'Pacific Ocean' or 'Indian Ocean), but the Mediterranean and Black Seas are not yet included. However, the FDI database still has technical issues and harmonisation is required. The STECF EWG 21-10/12 proposed improvement in the call and guidelines, especially in terms of discard mean point estimate and discard coefficient of variation (CV). Furthermore, STECF PLEN 21-03 supported the need for better discard data. Nonetheless, the analysis of the FDI database would constitute a valuable source of information to perform a first assessment of ETP species and sensitive commercial species in relation to gear and target species, which could be taken care of by an expert group through an *ad hoc* contract.

4.2.2 Literature review

The working group noted that there are areas where, for various reasons, bycatch data of ETP species are not available from standardised monitoring programmes, or where these data are not accessible; in such cases, alternative data sources can be an option for bridging knowledge gaps. One of the simplest and most cost-effective methods to obtain information on bycatch of ETP species is to review the available bibliographic information in the different areas. The group pointed out that there are two different types of documents that could provide useful indications for the identification of areas at high risk of bycatch: a) documents providing estimates of bycatch at

[7] https://datacollection.jrc.ec.europa.eu/wps
[8] https://datacollection.jrc.ec.europa.eu/ars

different levels of detail (by area, by species group, by gear, etc.; section 4.3.2); b) bycatch risk maps , identifying the areas of overlap between high-risk fisheries and species sensitive to bycatch in these fisheries, based on species distribution maps (e.g., using habitat modelling or observation data) and fishing activity maps (i.e., through VMS, AIS, etc.) (section 4.3.3).

In European waters, several peer-reviewed studies attempted to assess bycatch risks for sensitive species groups, e.g., cetaceans (Brown et al. 2013) or skates (Sophy et al. 2013). These often applied productivity-susceptibility analysis (PSA), a semi-quantitative approach that assigns relative risks for a species or species group (low-medium-high) to be able to prioritize management actions for a fishery or species (or species group). PSA is used by fishery management authorities in e.g., Australia (ERM 2017) and the certification Marine Stewardship Council (MSC) in data-limited cases. This approach combines productivity attributes of the species of interest (e.g., life history traits indicating sensitivity to fishing pressure, such as age for maturity) with the species' susceptibility to a given fishery (based on characteristics of the fishery, overlap with species distribution and likely outcome of the interaction such as post-capture mortality). PSAs varies in the methodology across studies in, e.g., the form and number of attributes used for the productivity and susceptibility score and are sensitive to methodological choices such as the cut-offs defined for low-medium-high risk species. Several risk assessments are also available for imported products, such as for species groups (e.g., Clay et al. 2019), fisheries (e.g., Roberson et al. 2022), and general bycatch of sensitive species (e.g., Lewison et al. 2014).

4.3 Approaches for a System 1

The EWG-22-12 investigated the feasibility and relevance to define a System 1 for the sensitive species indicator with two approaches: i) using information on gear and sub-area only, based on expert knowledge and intensive literature review (section 4.3.2), and ii) using a risk-based approach in the form of productivity-susceptibility analysis (PSA) (section 4.3.3). Both approaches inform on a rough indicator with a likely high proportion of false positives. A System 1 would require to be complemented with a more elaborated System 2 that would be able to reduce the number of false positives by considering additional, more detailed information. EWG 22-12 emphasises that much more initial effort is needed to establish a methodology and collect data for an indicator on sensitive species compared to the other indicators on impacts on fishing pressure and seabed.

4.3.1 Preliminary remarks

When communicating about risk, the kind of risk that is assessed must be clarified e.g., a risk of detrimental effect on abundance of the considered species/population, or a risk for a species/population to interact with a fishery. The information communicated by an indicator depends on the type, quantity and quality of the data at hand to conduct the risk assessment. A System 1 approach with the currently available CMO information can only provide a measure of the relative risk of the interactions between fisheries and ETP/sensitive species (or groups of species). The strict assessment of the impact of fishing on a population of a sensitive species by a given fishery, i.e., if the population is at risk or not of declining because of the fishing activities, requires substantially more detailed data and analyses (Oliveira, *in prep*); this level of detail is not achievable at present for most marketed products. Thus, a System 1 based only on the currently information available for most fish products would only be able to identify a *potential* risk of interaction between sensitive species and fisheries.

An approach for a System 1 indicator would require an assessment that can cover most of the product in volume, but would, as a first step, benefit from prioritising a subset of sensitive species (or group thereof). Due to the high number of possible combinations of gear, fishing area, and sensitive species at risk, different opportunities exist on how to proceed within the ToRs of an *ad hoc* expert group contract. The EWG suggests that the *ad hoc* team should consider a limited number of sensitive species in the initial assessment (e.g., by including only air-breathing animals), and adopt approaches focusing on one or/and several key regions. These approaches are not mutually exclusive and offer the opportunity to test the indicator on a subset of

fisheries/regions/species providing already adequate data sources, before being able in the future to expand the assessment to more species and more areas.

4.3.2 The Mediterranean and Black Sea as a case study

The working group explored a recent report that the FAO-GFCM (General Fisheries Commission for the Mediterranean) produced for the Mediterranean and Black seas (Carpentieri et al. 2021). Considering the limited available time for this task during the EWG meeting, these findings are purely exploratory.

The FAO-GFCM report aimed at developing a baseline for the bycatch of ETP species in Mediterranean and Black Sea fisheries to support priorities in terms of bycatch management and conservation. The document reviewed the available data, including historical records on incidental catches of ETP species, existing literature, databases, and other grey literature sources. This information was subdivided into FAO-GFCM vessel groups and subregions (namely, western, central, and eastern Mediterranean, Adriatic Sea, and Black Sea). The bycatch records were derived from different approaches, including monitoring programmes with on-board observers, non-systematic, opportunistic data collection such as questionnaire surveys answered by fishers, tagging/ringing recovery programmes, personal comments from scientists, self-reporting by fishers, beach surveys, or recoveries from rescue centres. The FAO-GFCM report focused on five important groups of ETP species in the Mediterranean Sea and the Black Sea: seabirds, sea turtles, elasmobranchs, marine mammals, and macrobenthic invertebrates. This work highlighted that even if major knowledge gaps exist in most of the GFCM subregions, an overall picture of the bycatch by area (and often by fishing gear) can be obtained.

4.3.2.1 Methods used for the Mediterranean and Black Sea case study

Considering the data reported in the above-mentioned report, a risk of bycatch by gear and sub-region from 0 (very low bycatch) to 4 (high risk of bycatch) was adopted by the EWG 22-12 by using expert knowledge for the relative ranking (Figure 20).

0	very low
1	low
2	medium
3	high
4	very high

Figure 20. Relative ranking to assess the bycatch risks from the data in the FAO-GFCM report (2021).

The five levels of risk could be assigned to a fishery in different ways depending on the quality and quantity of the available data. For example, levels could be based on the percentage of estimated bycatch for a given fishing gear out of the total bycatch for all fishing gears in a specific area, or by ranking the level of bycatch in relation to the fishing gear of highest bycatch, or as a percentage taken as bycatch from the ETP population (which assumes both existing estimates of bycatch mortality and the associated population size).

Because of the heterogeneity of the data in the FAO-GFCM report (i.e., bycatch estimates, on-board observation, bycatch rates, interviews, harbour observations, stranding data, etc.), the EWG-22-12 considered bycatch estimates for groups of species (as opposed to individual species) by pooling together all the data reported within each species group and weighing their importance by fishing gear. In fact, there was little interest in ranking at the individual species level because the information was either not available or was reported as a total number of observations for a pool of species. Therefore, for the purpose of this exercise, used to verify the applicability of this a

System 1 approach, the EWG focused on the following species groups: seabirds, sea turtles, elasmobranchs, and marine mammals. Evidently, the more reliable the bycatch data for each species or group of species by gear by area, the more realistic the ranking. However, in the FAO-GFCM document, such reliable estimates of bycatch by area and gear were only given for the 'sea turtle' group. For the other groups, when possible, the evaluation by EWG 22-12 was done quantitatively (e.g., in many cases only bycatch observations were present in relation to the total number of fishing trips) and qualitatively by looking at the reported bycatch observations in each combination of area/gear and using the expert knowledge from the authors of the review work.

Table 14 and Figure 21 present the resulting ranking for the selected species groups by sub-region and by gear, based on the data reported in the in the FAO-GFCM document. This work should evidently be refined and should involve more in-depth investigation, but the preliminary results show that even this relatively coarse approach has the potential to provide useful insights.

4.3.2.2 General findings for the Mediterranean and Black Sea case study

Assuming that the data reported in the FAO-GFCM report is the ground truth, i.e., that the presently estimated levels of bycatch accurately reflect the situation in the region, conclusions can be drawn through exploratory work. One insight is that bycatch rates widely differ between seabirds, sea turtles, elasmobranchs, marine mammals, depending on gear and area (Table 14; Figure 21). However, it must be stressed that more precise data in several regions (e.g., Black Sea) and/or for specific ETP species groups (e.g., elasmobranchs and seabirds) would provide a better understanding of the most affected species groups in one or several sub-regions.

At a species group level, the exploratory analysis of the FAO-GFCM report made by EWG 22-12 concludes that:

- Seabirds are mainly bycaught in the western Mediterranean, mostly by small-scale fisheries (namely operating with demersal and pelagic longlines and passive nets) in the coastal zones close to important breeding sites (such as the Balearic Islands), while bycatch seems to be only occasional in the other areas. No reporting was found for the Black Sea or from North African Mediterranean countries, likely resulting from an absence of data or a lack of public availability of these data in these areas.

- For sea turtles, bottom trawling has become the fishery with the greatest risk of bycatch in the later years. Bycatch risk is likely driven by the important overlap of the turtle habitat with the fisheries that affect them, with a large number of sea turtles concentrated in areas that are heavily exploited by e.g., bottom trawling (continental shelves of the northern Adriatic Sea, Tunisia, Egypt, and Turkey). Drifting longlines and set net fisheries are also responsible for high bycatch rates of sea turtles (especially in the western and central Mediterranean), while demersal longlines are a concern especially in the eastern and the southcentral Mediterranean. Assessment of bycatch in the Black Sea revealed only few interactions with sea turtles possibly because they are rare in the region, or because past and current levels of monitoring were not able to raise reliable bycatch estimates for that species group.

- At least 48 species of sharks and 38 species of batoids (rays and skates) are listed in the Mediterranean and Black Seas. The FAO-GFCM report focused on 33 conservation-priority species identified by GFCM recommendations. According to the review, most conservation-priority elasmobranch bycatch arises from longliners (set and drifting together), followed by small-scale fisheries, bottom trawlers, pelagic trawlers, and purse and tuna seiners for the lower bycatch risk level. The area with the highest risk of elasmobranch bycatch appears to be the central Mediterranean, especially from the longline fisheries (set and drifting), followed by the eastern Mediterranean where passive nets and surrounding nets are reported to have a substantial level of bycatch. In the western Mediterranean, drifting longlines generate a high bycatch risk especially for large pelagic sharks. In the Adriatic Sea, the large majority of elasmobranch bycatch records are reported from the pelagic and bottom trawls. Only few records were reported from the Black Sea, possibly due to the small populations of elasmobranch species in this area, or to a shortage in bycatch monitoring effort.

- The marine mammals bycatch decreased considerably after the banning of driftnets in the entire region. It currently mostly concerns the medium-small cetacean species, such as the

bottlenose dolphin (*Tursiops truncates*), the common dolphin (*Delphinus delphis*), and the striped dolphin (*Stenella coeruleoalba*), all taken as bycatch in various fishing gears, and mostly in small-scale gillnet fishery. Recent information on cetacean bycatch in the Black Sea for three endemic species reveal raises great concerns. The most problematic bycatch rates mainly relate to the Black Sea harbour porpoise (*Phocoena phocoena relicta*) in the coastal bottom set gillnet fisheries targeting turbot. This elevated bycatch rate is probably due to a combination of both the large mesh sizes used in gillnets and/or trammel nets and to the small body size of the Black Sea harbour porpoise (the smallest marine mammal in this area) making the species more prone than larger cetacean to entanglement in gillnets. Much smaller incidental catches, which are nevertheless cause for concern, are also reported for *Delphinus delphis ponticus*. Some sporadic catches are also reported for *Tursiops truncatus ponticus.* The working group pointed out that, regarding marine mammals, interactions with fishing gears other than bycatch may also be detrimental to the animals. Marine mammals, and especially dolphins, while attempting to plunder fish from nets may collide with the nets and severely injure themselves. They also may ingest pieces of net that can provoke intestinal or pharyngeal occlusions, larynx strangulation potentially with fatal outcome for the animal (Gomerčić et al., 2009). Moreover, depredation from dolphin and the following economic loss can lead the affected fishers to take retaliatory measures against these marine mammals. Risk assessment studies based on spatio-temporal data of both fishing effort and sensible species distribution, especially from habitat modelling, could provide useful estimates of interaction probabilities.

Table 14. Ranking of bycatch risks by gear and main species group in the different Mediterranean sub-regions based on the analysis of the FAO-GFCM report (Carpentieri et al., 2021). Gear Codes are listed as in the CMO. OTB: Bottom otter trawls; PTM: Pelagic pair trawls; OTM: Midwater otter trawls; LLD: Longlines (drifting); LLS: Set longlines; GX: Generic gillnets and entangling nets; PS: Purse seines. NA: not available data.

	Sub-region	OTB	PTM-OTM	LLD	LLS	GX	PS
SEA TURTLES	Adriatic Sea	4	2	1	0	2	0
	Central Med	4	0	4	3	3	0
	Eastern Med	3	1	2	3	4	0
	Western Med	2	0	3	1	2	1
	Black sea	0	0	0	0	0	0
SEA BIRDS	Adriatic Sea	0	0	0	0	0	0
	Central Med	0	0	1	0	1	0
	Eastern Med	0	0	2	1	1	0
	Western Med	1	0	2	2	2	0
	Black sea	NA	NA	NA	NA	NA	NA
ELASMOBRANCHS	Adriatic Sea	2	2	2	1	1	0
	Central Med	2	0	4	4	3	2
	Eastern Med	3	1	1	2	2	3
	Western Med	2	1	3	0	2	1
	Black sea	1	0	0	0	0	2
MARINE MAMMALS	Adriatic Sea	0	1	0	0	1	0
	Central Med	0	0	0	0	2	0
	Eastern Med	0	0	0	0	2	0
	Western Med	0	1	2	0	0	1
	Black sea	0	2	0	0	4	2

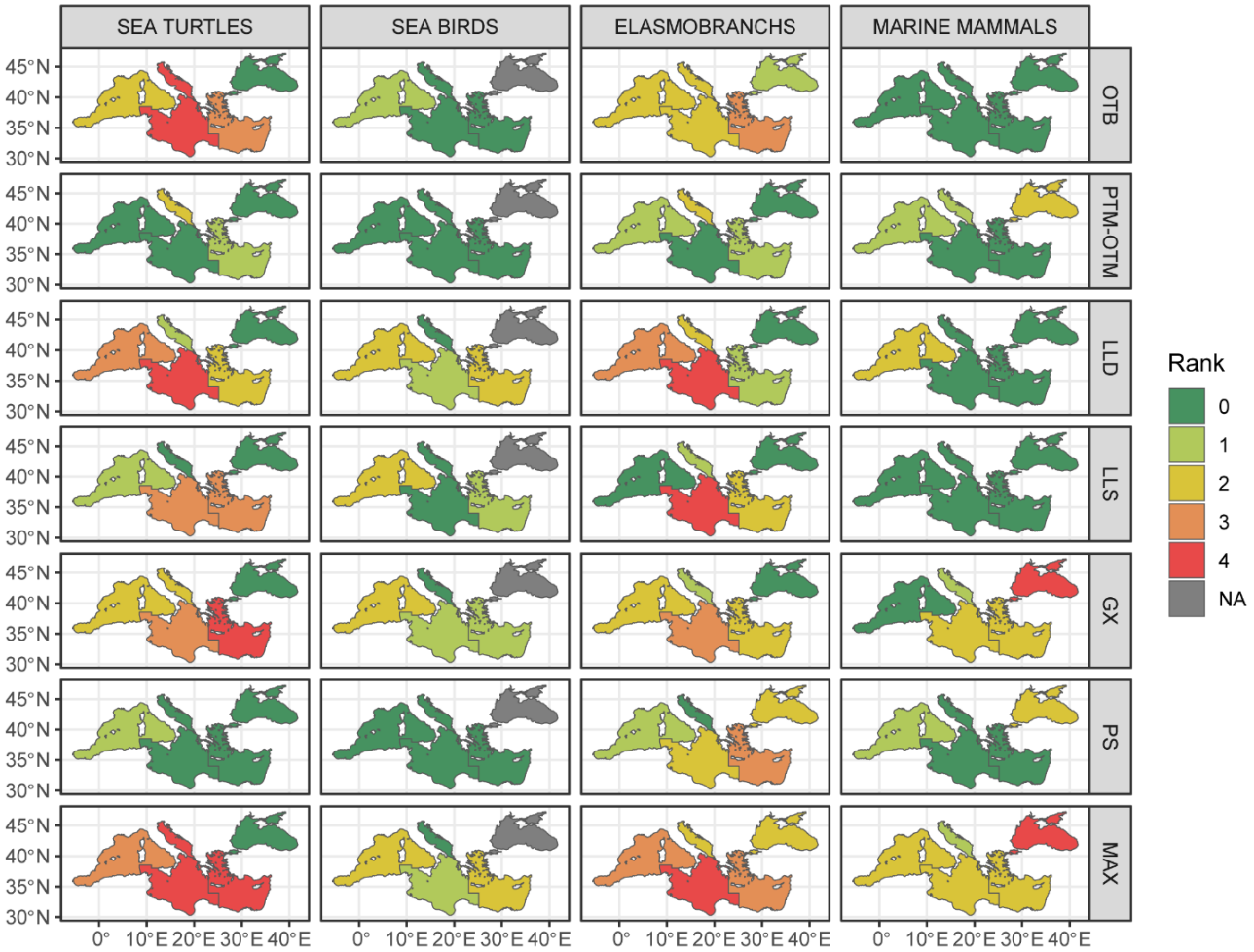


Figure 21. Spatial distribution of bycatch risk ranking by gear and main species group in the different sub-regions of the Mediterranean based on the FAO-GFCM report (Carpentieri et al., 2021). The ranking value corresponds to the worst ranking for all species groups in each combination of gear and sub-region. Gear Codes from the CMO gear list. OTB: Bottom otter trawls; PTM: Pelagic pair trawls; OTM: Midwater otter trawls; LLD: Longlines (drifting); LLS: Set longlines; GX: Generic gillnets and entangling nets; PS: Purse seines. MAX: it is the worst rank (4) observed for each sub-region and group of species.

Following this exercise, the working group noted that, in a given area, the same gear is susceptible to represent a high risk to some species groups and a low or no risk to other groups. This would depend essentially on the gear type (and how it is used), but also on the biology of the species that interact with this gear. In the frame of a precautionary approach, EWG 22-12 concluded that, in such contrasted cases, the highest bycatch risk (i.e., the highest rank value) found for different species groups for a given gear and area should be applied. The table below exemplifies how the species-specific risks could be combined into one unique score per gear and sub-region using two alternatives: Table 15 using the mean rank values of the species per gear/area; Table 16 using the worst rank per gear/area.

In Table 15, the presence of zeros considerably lowers the ranking of a specific fishing gear (e.g., a gear that as a high impact on one species' group is largely smoothed down by the low impact on the other groups). A one-out-all-out approach (Table 16) allows to acknowledge the worst scores for a single group and of the maximum score if all groups have that score. Consequently, the full scale of scores is maintained, ranging from fully agreeing to the sustainability standards or best practices down to at least one group does not at all match those standards.

Table 15. Bycatch risk levels using the *mean ranking value* of the species groups for each combination of gear and sub-region (excluding NA values) and covered by the FAO-GFCM report (Carpentieri et al., 2021). Gear Codes from the CMO gear list. OTB: Bottom otter trawls; PTM: Pelagic pair trawls; OTM: Midwater otter trawls; LLD: Longlines (drifting); LLS: Set longlines; GX: Generic gillnets and entangling nets; PS: Purse seines.

Sub-region	OTB	PTM-OTM	LLD	LLS	GX	PS
Adriatic Sea	1.5	1.5	1	0.5	1	0
Central Med	1.5	0	2.5	2	2	0.5
Eastern Med	1.5	0.5	1.5	1.5	2.5	1
Western Med	1	0.5	2.5	1	1.5	1
Black sea	0.5	0.5	0	0	1	1

Table 16. Bycatch risk levels using the *worst ranking value* among the species groups (one-out-all-out approach) for each combination of gear and sub-region (excluding NA values) and covered by the FAO-GFCM report (Carpentieri et al., 2021). Gear Codes from the CMO gear list. OTB: Bottom otter trawls; PTM: Pelagic pair trawls; OTM: Midwater otter trawls; LLD: Longlines (drifting); LLS: Set longlines; GX: Generic gillnets and entangling nets; PS: Purse seines.

Sub-region	OTB	PTM-OTM	LLD	LLS	GX	PS
Adriatic Sea	4	2	2	1	2	0
Central Med	4	0	4	4	3	2
Western Med	2	1	3	2	2	1
Eastern Med	3	1	2	3	4	3
Black sea	1	2	0	0	4	2

4.3.2.3 General conclusions for the Mediterranean and Black Sea case study

This short review of the available information from literature in the Mediterranean and Black seas is limited by the lack of standardised approach to data collection in most areas, but it allows nevertheless highlighting which combination of fishing gears and area poses the greatest threat to different species (or groups of species).

The shortcomings and inconsistencies that we identified from this literature review are summarised as follows:

1. The weighting of bycatch risks using a common score for one or for several group(s) of species is likely to vary with the qualitative data and expert-based evaluation, as was the case here for at least several of the combinations of species group/area/gear; this is susceptible to reduce the credibility of such analyses if the thresholds and cut-offs are not clearly identifiable by stakeholders and/or end-users.
2. Even within the same fishing area, data may not be collected in a uniform and standardised manner; there may be areas where, for various reasons (management, data policy, etc.), no information on the bycatch of sensitive species is available, while for other areas, more detailed information exist, which creates a bias between data-poor and data-rich areas, with a likely underestimated bycatch for some species or species group in the former areas (potential false negatives or false zeros) and relatively overestimated levels in the latter areas (relative false positives).
3. One of the most difficult issues related to assessing bycatch is the species identification, meaning that data are not always available at species level. For large groups (such as seabirds), bycatch data are often reported for the entire group; this generally happens when data were obtained through interviews with fishermen or logbooks (self-reporting). Here, we chose to group bycatch reports into species groups, highlighting though of the potential

discrepancies and errors related to the identification of animals at species level, which may be substantial and variable between the data sources.

4. Bycatch data can be reported at gear category level only (first tier of the FAO, 2021) and not on the Subcategory (Second tier) which details the used fishing gear (i.e., "Trawl" instead of "Bottom trawls" or even better "Single boat bottom otter trawls"). For certain gear categories the results could be misleading.

Despite these shortcomings, the exploratory analysis of the FAO-GFCM report demonstrates that it is possible to highlight areas associated with problematic bycatch risk based on semi-quantitative and qualitative data only, at gear, area, and group of sensitive species levels. However, before this approach can be considered as operational and applied in the context of a System 1 indicator on sensitive species, further efforts are needed in terms of analysis, validation, and testing. This approach yet shows potential for data-poor fisheries in the frame of a broad information system. Given the high heterogeneity of the Mediterranean Sea in terms of fishing gears, seabed characteristics, bottom depth, species distribution, etc., the FAO-GFCM document divided the entire basin into smaller sea areas (sub-regions), so that homogeneity within a subdivision can relatively be assumed. Ideally, smaller geographical areas, e.g., at the level of a GSA or country, would enable such analyses to reduce uncertainty in the bycatch estimates for some or even all of the investigated groups of ETP species at risk of bycatch in the region.

Opportunities exist in expanding the approach for other areas, and especially for the North-East Atlantic. Bibliographic data can be used to derive information for areas or countries where other types of bycatch estimates are not available. For each area, the optimal situation is to have the estimates of bycatch rates for each type of fishing gear (or group of gears) with the associated fishing effort. If no bibliographic information is available for a country, one could draw on the information available for neighbouring countries assuming that the fishing and environmental characteristics are similar. Using such an approach, the annual bycatch number of e.g., sea turtles or marine mammals could be estimated by combining the fishing effort from one area with the catch rates from a neighbouring area where the bycatch rate estimates is known with a greater reliability, possibly weighted by a habitat analysis in the data-poor area.

The FAO-GFCM document reports both old and recent bycatch data. However, reported bycatch rates likely vary over time as a result of changes in species abundance and distribution, as well as changes in fishing effort distribution and intensity, or even fishing gear characteristics. In these cases, there is no other way to determine the development of bycatch risk for a species or group of species than to acquire recent data on bycatch rates. For example, estimates of sea turtle bycatch from drifting longlines in the western Mediterranean were very high in the past, mainly because the main line was set at a very low depth. For several years now, longlines with a much deeper main line are used, which has contributed to a significant reduction in turtle bycatch and a reduction of the previously estimated bycatch rates. In short, recent bycatch data are more valuable (less potentially biased) than older data.

Furthermore, the elaboration of an indicator on sensitive species that links the bycatch risk levels with the market products needs to be done in the most suitable manner given the data available to score the products. For instance, a single bycatch estimate e.g., of sea turtles is given for trawl fisheries operating around Sicily even though an important part of the fleet operates a deep-water shrimp fishery (operating below 500 m depth), while sea turtles are very unlikely to be taken as bycatch at these depths. It is clear from such an example that a scoring solely based on gear and fishing area (System 1) would not adequately assess a bycatch risk for some sensitive species and that a possibility must be offered to producers to move to a more accurate and fair scoring which takes into account more detailed data, including information on the targeted species (System 2). However, it must be stressed that a precautionary approach has to be preferred, where a lack of bycatch data is equivalent to a high-risk score, unless proven otherwise.

Additionally, in case that multiple data sources are available for the same area, the most recent fishery data distinguishing among fishing gears and the most accurate bycatch data (in terms of sample size, distinction among different fishing gears, etc.) should always be considered for the same species or group of species. A useful forthcoming exercise (e.g., through a dedicated research program) to determine the uncertainty in estimates in a data-poor area would be to randomly degrade the quantity (by e.g., 25%, 50%, 75%) and/or quality (e.g., from a given gear to a group of gears) stemming from a data-rich area and assess the bias that can be generated in a (simulated) data-poor area. This exercise would be particularly valuable for a risk-based analysis.

The Mediterranean and Black Sea case study suggests that a simple System 1 of scoring could be based on an intensive literature review. In line with this, the EWG 22-12 concluded that a System 1 approach, based on available information on bycatch of sensitive species by gear and fishing sub-area only, deserves further investigation provided that a more accurate and fair scoring system is being concomitantly developed. In some important fishing regions, information on bycatch is more widely available and qualitatively better than what was presented here for the Mediterranean and Black Sea case study. For example in the north-east Atlantic, the ICES dedicated working group on bycatch (WGBYC) collects and provides data on bycatch of ETP and sensitive species, including bycatch rates per gear and geographical area, as well as additional information including interaction risk ratings for at least some air-breathing species (marine birds and mammals). Such data sources could be used to apply a System 1 approach, similar to the one presented above in the Mediterranean/Black Sea. Therefore, an *ad hoc* contract could be dedicated to investigate if and how the WGBYC outputs could be translated into a System 1 scoring, and what kind of equivalent information or database exists in other RFMOs.

4.3.3 Approach for a scoring based on PSA (i.e., considering gear, area, and targeted species) - building a risk-based database to support the development of an Excel tool

One opportunity exists in using the risk levels identified in existing PSAs (see chapter 5.2.2) and combine this with information on species, gear, and area (available under the CMO Regulation) to communicate risks for sensitive species. A PSA approach offers an opportunity to assign risk levels on a large volume of seafood products based on available literature or using dedicated add-on PSAs for bycatch species that have not been assessed. Generally speaking, a PSA is performed based on available data on sensitive species key characteristics (e.g., life history traits of the species) in combination with data and expert input related to the fisheries under scrutiny (e.g., post-capture mortality). Furthermore, since the sustainability indicators subject to this EWG should be complementary to existing labels such as the MSC in terms of ability for full coverage of products on the market, there may be benefits of using similar approaches. General drawbacks of PSA as a method relate to its precautionary and conservative nature (i.e., no or very uncertain data will translate to a high level of risk), which likely produces false positives. In addition, different approaches to PSA are associated to different flaws and uncertainties, especially for species attributed with medium risk levels (Hordyk and Carruthers 2018). However, since the PSA approach helps in identifying potential risks and assists in the prioritization of actions for decreasing the risks, e.g., more data collection or management measures, this approach can be seen as a decision tool to progressively improve the sustainability of seafood products in the European market.

One challenge in using findings from existing PSAs in the CMO context is that the risk levels presented in specific studies are likely specific to certain species groups in given fishing areas. That is, the relative risks for the species under scrutiny in a PSA study, as well as the attributes used for the productivity and susceptibility score are sensitive to the methodological choices in that study, e.g., case-specific cut-offs for low-medium-high risk. This highlights that outcomes of PSAs are measures of the *relative* risks among the species included in the study and may not directly be comparable with other studies using a PSA. A comparison of findings across risk assessments can be found e.g., for seabirds in Small et al. (2013). How to ensure consistency across studies when attributing risk levels to different sensitive species groups, gear types, and/or areas is uncertain

and will require further investigation. Performing a global PSA of all sensitive species to all gear codes (either using mandatory gear information or a higher level of detail) and build a database summarising these results to inform an Excel tool would be valuable to inform the upcoming sensitive species indicator, yet such work would require a considerable effort. This is especially true as this approach would need to consider both fishing area and – at least in some cases – targeted species. Therefore, in order to make this work manageable in a reasonable timeframe, an *ad hoc* team could start building such database focusing on a subset of sensitive species (e.g., only air-breathing species). Moreover, although PSA brings additional information and would arguably improve over a cruder approach based on literature reviews and expert opinion only (as exemplified in section 4.3.2), it is expected that, at a first step, this kind of approach could only be performed for relatively large areas (e.g., ICES sub-areas). In that sense, PSAs do not constitute the absolute best way to assess the sustainability of fisheries with regards to their impact on sensitive species. It is nonetheless an accessible and manageable method to inform the sensitive species indicator until better data on bycatch in specific fisheries become widely available.

4.4 Approach for a System 2

4.4.1 Preliminary remarks

The quality of a productivity-susceptibility analyses (PSA) is dependent on the quality of the input data. As such, linking a PSA to the CMO information using only the mandatory gear codes in the CMO would result in higher risk in some cases than if using more detailed information. For instance, pelagic and demersal trawls are grouped as the generic term "trawl" in the CMO gear code list, despite important differences in terms of bycatch risk for different species (example provided in Table 17). Using more detailed information, e.g., information in Annex III of the EU regulation 1379/2013, instead of using only the mandatory CMO gear code would mitigate this uncertainty but would require that specific PSA are developed for fisheries/species for which enough data are available. The EWG suggests that this would constitute a System 2 approach for the indicator on sensitive species.

4.4.2 Methods for a System 2 based on PSA

The approach for a System 2 "indicator on impact on sensitive species" based on PSAs would be to use a combination of the existing CMO parameters (target species, gear, and area) to assign risk levels (low-medium-high) for individual sensitive species. In a System 2, a higher detail on gear codes than mandatory information is needed. It would also be useful to integrate expert-based overrides and available monitoring data in a database supporting a System 2 to allow limiting false positives for specific combinations of targeted species and gear by defining pseudo-métiers. Pseudo-métiers may either be defined as a simple combination of gear and target species or could be based on the DCF métiers level 6 (~100 métiers indicating mesh sizes and use of selective devices) (Table 17).

The level of risk stemming from the use of métiers (pseudo-métier or métier level 6) would be the potential risk of bycatch of a sensitive species that is associated to a specific gear category targeting a given species in a specific area. Adding expert-based information (from e.g., ICES working groups) would be a deviation in practice for this indicator compared to the other two indicators (fishing pressure and impact on the seabed) but highlights the complexity and paucity of information that supports an indicator on sensitive species. This would help refining the risk levels for marketed species.

One example is provided in Table 17, where the bycatch risk for harbour porpoise (*Phocoena phocoena*) is high in general for gillnets (Amundin et al. 2022) but known to be null for gillnets targeting herring using small mesh sizes. Therefore, combining gear code with target species would offer more refinement, and thus reduce the number of false positives. If no PSA exist for a given

sensitive species, expert-opinion (e.g., ICES working groups, scientific literature) could be used to fill the gaps based on, e.g., the findings at species group level or known specific risks associated to gear types.

An important question is how many sensitive species found in a given area should be assessed to suitably estimate the potential risks associated to a seafood product. Since rare species are seldom caught in monitoring programmes due to low abundance relative to monitoring effort (Maxwell and Jennings 2005), the information on potential overlap between the considered fishery and the importance of bycatch may be locally insufficient. Therefore, using an approach similar to the one in Australia may be beneficial, where all the sensitive species found in an area where a fishery operates are included in a risk assessment, with an expert-based override to attribute low risk if there is evidence to support that the interaction is likely negligible (Hobday et al. 2007).

Table 17 presents an example of how CMO information may be linked to the risk levels estimated using a System 1 (see *5.3 Approaches for a System 1*), a System 2 (*5.4 Approach for a System 2*), and an expert override on System 2, for two cetacean species and two target species in one CMO area, and how different levels of detail affect estimated risk scores. The first risk level (5.3 Approaches for a System 1) is a rough indicator that can cover a wide range of products, obtained using only mandatory information and assessed through literature review or PSA. System 2 aims at reducing the number of false positives from a System 1, by making use of more detailed gear information for a PSA. Moreover, field experts have the possibility to override scores from a System 2 when scientific knowledge can justify it (e.g., using specific information from expert groups like ICES WGBYC).

Table 17. Example of a scoring using System 1 (literature review and/or PSA based solely on CMO gear codes) and System 2 (PSA based on best existing gear and species data available) for two cetacean species and two target species in one CMO area. HER = Herring; TUR = Turbot; GN = Gillnet; PTM = Midwater pair trawl; OTB = Bottom otter trawl. References on sensitive species risks from the PSA performed by Brown et al (2013). *OTB (low risk) and PTM (medium risk) are merged in mandatory information; the scoring is conservative (precautionary approach).

Mandatory information in current CMO Reg.			More detailed than CMO gear code	Sensitive species	**System 1** risk level (PSA or literature review based on mandatory information in current CMO)	**System 2** risk level, (PSA utilizing more detailed than CMO gear code)	**Expert-override** (combining system 2 data with best current scientific knowledge, e.g., from ICES WGBYC)
Target species	FAO area	CMO gear code					
HER	27	Gillnets and similar nets	GN	Harbour porpoise *Phocoena phocoena*	high	high	low
HER	27	Trawls	PTM	Harbour porpoise *Phocoena phocoena*	low	low	low
HER	27	Trawls	OTB	Harbour porpoise *Phocoena phocoena*	low	low	low
HER	27	Gillnets and similar nets	GN	Common dolphin *Delphinus delphis*	medium	medium	low
HER	27	Trawls	PTM	Common dolphin *Delphinus delphis*	medium*	medium	low
HER	27	Trawls	OTB	Common dolphin *Delphinus delphis*	medium*	low	low
TUR	27	Gillnets and similar nets	GN	Harbour porpoise *Phocoena phocoena*	high	high	high
TUR	27	Trawls	OTB	Harbour porpoise *Phocoena phocoena*	low	low	low
TUR	27	Gillnets and similar nets	GN	Common dolphin *Delphinus delphis*	medium	medium	medium
TUR	27	Trawls	OTB	Common dolphin *Delphinus delphis*	low	low	low

4.4.3 General issues and how to communicate impact on sensitive species from a product using a System 2 approach

Developing and implementing an indicator on sensitive species using a System 2 approach is considerably more effort intensive than a System 1, notably through the compilation of available information, and also differs from a System 1 approach by the need for expert-based knowledge. Additionally, using different sources of information for a System 2 approach will likely introduce inconsistency in assigning risk scores across studies, regions, and species groups. Therefore, once a first consolidated database is built, and before this database is used as reference for the indicator, an expert group will need to work on data quality evaluation (e.g., to reduce potential bias), as this system has implications for producers with a low score potentially associated with, e.g., false positives. The disaggregation of indicators, e.g., communicating risks separately by different species groups, may be efficient to mitigate possible inconsistencies associated to various types of data. Regardless of the aggregation methodology, it is essential for transparency to clearly define and communicate how different species groups are combined into a single grading.

Building an aggregated grading to serve the "impact on sensitive species" indicator is a challenging task (see Table 18 for illustration). The existence of bycatch events in a fishery may not be associated to a high level of risk for a species/population. Therefore, systematically assuming a low ranking for all fisheries where bycatch is not null (virtually *all* fisheries) may be perceived as excessive to some stakeholders. Meanwhile, the catch of one or few individuals of a highly threatened species may affect the status of an entire species/population, e.g., bycatch in gillnets of the critically endangered harbour porpoise in the Baltic Proper. This requires that a precautionary approach is preferred in case a fishery is suspected to affect highly sensitive species/populations.

An aggregated grading of the impact on sensitive species has in general many challenges such as reporting only on the species at higher risk for a product or an average of low-medium-high risk values for each individual species (or species group). This latter approach for scoring would be affected by the total number of assessed sensitive species, where a high number of low-risk species would decrease the score. It was concluded by the expert group that an average-based aggregation using proportionalities would make little sense for an indicator on impact on sensitive species and was not considered by the EWG. Although the use of proportionalities would ensure keeping the full range of scores, it would be poorly informative on the actual risk associated with the product.

The EWG also discussed whether an aggregated grading could be used to combine the bycatch risk for different species using proportionalities together with the precautionary one-out-all-out (OOAO) approach (worst score is retained), such as developed by HELCOM in some cases for a bycatch indicator on marine mammals and marine birds. In short, given a fishing product, such approach could consist of scoring individually each sensitive species (from A to E), assigning intermediary scores for the species groups (e.g., marine mammals, seabirds, turtles, etc.) based on the proportion of scores in each category in that species group and, finally, obtaining a unique final score for the assessed fishing product by taking the worst score from all the species groups. There may be other opportunities for an aggregated grading (see example in Table 18), and ideas may be borrowed from other initiatives such as how consumer guides combine risks for different species into a single grading (e.g., the Seafood Watch[9]). Some certification schemes, e.g., the Marine Stewardship Council (MSC), separate non-target species taken as bycatch in the considered fishery in different categories whether they are legally protected, if they are assessed and managed to a specific target species, or if they are data-poor and therefore no management target exists for that species. Such schemes also consider if the affected non-target species represent a significant proportion of the total catch of the reviewed fishery (more than 5%) or not, while taking into account life history traits to acknowledge whether the non-target species are resilient to the additional mortality exerted by the reviewed fishery. The potential impact of a fishery on a species is then determined for each (non-target) species considering three aspects: if the fishery is likely to create a significant detrimental impact on the affected species/populations, if that impact is managed and if information is available on that impact. In any case, there are still many challenges in interpreting an aggregated grading across species groups, and how these may be summed

[9] https://www.seafoodwatch.org/recommendations/our-standards/standard-for-fisheries

across, which arguably calls for defining a grading per sensitive species group. This is a suitable task for a future *ad hoc* contract through e.g., describing the approach of other initiatives such as the Seafood Watch and propose a method for further discussion in another EWG.

Table 18. Examples of an aggregated grading using the relative risk from expert-based assessment and pseudo-métiers.

<table>
<tr><th></th><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F</th></tr>
<tr><td>System 1</td><td>Not attributed in System 1</td><td rowspan="2">Low risk fishery
(no high-risk species with few potential medium risk interactions and no severe impact for one species)</td><td rowspan="2">Medium-low risk fishery
(no high-risk species with many potential medium risk interactions and no severe impact for one species)</td><td rowspan="2">Medium-high risk fishery
(a few high-risk species with many potential medium risk interactions or no severe impact for one species)</td><td rowspan="2">High-risk fishery
(many potential high-risk interactions exist or potentially severe impact for at least one species)</td><td>No data available for the assessment</td></tr>
<tr><td>System 2</td><td>No risk fishery (bycatch risk is demonstrated to be negligible for all sensitive species)</td><td></td></tr>
</table>

4.5 Towards a system 3 approach to assess the sustainability of the impact

When more information exists for a given fishery or sensitive species, not only on the risk of interaction but also on the sustainability of the incidental catches (e.g., stemming from ICES WGBYC, HELCOM or OSPAR WG, or equivalent source of information for imported products at international level), the database created for a System 2 indicator could be further completed to refine the risk scores and/or decrease the occurrence of false positives. A challenge here is to assure traceability of the required information at an increased level of detail. In a System 3 approach, the risk would be closer to reality in the form of quantitative or expert-based proof of actual risk for impact, with the possibility to assess the risk at population level. Nevertheless, it may be that additional or improved data decreases the rank of a given seafood product if these data demonstrate a previously ignored risk to a species/population, or group of species/populations.

Currently, for a system 3 approach, available information is still mostly deficient for covering many air-breathing species and species groups (i.e., marine birds, mammals, and reptiles) in Europe and possibly elsewhere, and even less for other species groups.

4.6 Concluding remarks and suggested next steps

Overall, EWG 22-12 believes that opportunities exist for different approaches to communicate risks for impact on sensitive species from seafood products on the EU market.

However, EWG 22-12 notes that developing a grading system for this task would require considerable initial effort for building up an underpinning database that include available information on sensitive species, as well as substantial effort before it could be fully implemented.

Due to the complexity of this indicator, EWG 22-12 assumes massive differences in terms of resource-needs between the indicator on sensitive species and those on fishing pressure and seabed impact, each of the latter two requiring an expert team of 4 persons for a total of 40 days

to successfully complete the task. The sensitive species indicator would also differ from the other two indicators by the use of expert-based information.

EWG 22-12 assessed the feasibility of a first exploratory *ad hoc* contract.

Bearing in mind the large amount of required work, EWG 22-12 suggests the following task list and workflow. This initial task list may realistically require several *ad hoc* contracts within the limits set under the STECF procedures (i.e., max. 4 experts for max. 10 working days each). The possible scope of a first contract should be determined in a discussion at STECF level.

1. Initiate the structure of a database including the most important commercial species on the market linked with all possible combinations of CMO gear codes and fishing areas (this work can build on the input from indicators 1 and 2) that may be used for matching with information on sensitive species. This work may also benefit from sorting species into categories of target species assemblages (DEF, CRU, PEL, etc.) for a pseudo-métiers approach. This task would indicate the number of combinations that would need to be assessed.
2. Collate existing information on the risk of interaction between sensitive species and fishing gears that fulfil the needs of a sensitive species indicator. Such work will (i) establish known species-specific risk by gear and area (for a System 1), using inputs from well-established scientific bodies working on bycatch, e.g., ICES WGBYC and equivalent international initiatives; (ii) consider already existing PSAs for combinations of sensitive species, gear(s), and area(s), and identify available information for performing the dedicated PSAs for important sensitive species, gear(s), and area(s) that are not already covered. The EWG acknowledges that performing new PSAs will not be feasible for all the fishing products on the EU market within the imparted time frame of the *ad hoc* contract and proposes that this task will initially focus on looking at the data available for performing PSAs for some of the most important fishing regions (possibly one or a limited number of ICES areas) and only some of the most charismatic sensitive species groups (such as air-breathing species), and summarize opportunities for performing PSAs if more effort could be allocated for this indicator.
3. Test the combination of the available information on risks for sensitive species (from bycatch initiatives and PSAs) with CMO input data from the initiated database to evaluate the needed effort and data gaps. This task includes assigning low-medium-high risk values on a sensitive species level that can be connected to a target species that is captured by a given gear and area, based on available information (on e.g., literature review, species distribution, etc.).
4. Test the quantification of the bias magnitude between the two suggested systems (sections 4.3.2 and 4.3.3) by comparing the scores from the assessment of a data-rich area that is scored using system 2 with the scores from the same data-rich area assessed with a system 1 after randomly degrading the data in quantity (by e.g., 25%, 50%, 75%) and/or in quality (e.g., from a given gear to a group of gears). This evaluation may also help assessing the possibilities of standardizations of risks between studies and for including imported products.
5. Based on the previous tasks, (i) provide decision elements (e.g., coverage of products on the EU market, effort needed, effects of differences in data availability across products, outcome of assessment) summarising the feasibility to assess the impact on sensitive species with the two suggested approaches, (ii) investigate different approaches for an aggregated grading that reflects a given product's impact on sensitive species (building on how other market initiatives addressing sensitive species), and (iii) provide examples on how this may be done for further discussion in a follow-up EWG.

Once this further understanding is achieved, it would be possible to estimate the effort required for implementation of an indicator on sensitive species.

4.7 Additional remarks

From all the perspectives discussed by the working group, it can be concluded that an assessment of the impact from a seafood product on sensitive species is multi-dimensional, including aspects such as species diversity (how many different sensitive species can be associated with the target species?), abundance (how much of each species is caught?), population impact (is the level of bycatch from a specific fishery detrimental to the population?), the legal framework (is the capture of those species regulated or prohibited?), etc. An essential question in communicating sustainability concerning the impact on sensitive species is the general possibility (readability and understanding) to inform the consumer on the relevance of all these levels of impacts from bycatch in a single and simple rating system. Given the current level of data availability, is it possible to rate all those dimensions at the same time into one category using a single rating system that is both meaningful for the consumer, fair for the fishing industry, and provides an incentive toward more sustainable fishing practices (at least in terms of the impact of fishing on sensitive species)? Or may it rather be a societal/political choice that is needed to limit as far as possible the impacts through regulations. The EWG would like to emphasise that a multi-dimension expertise is necessary to communicate and address the impacts on sensitive species from seafood products.

5 OVERALL GRADING SYSTEM FOR THE THREE WORK-STREAMS

Based on the output of EWG 22-12, an example of systems 1 and 2 scoring was applied to the *Clupea harengus* (Atlantic herring) caught with midwater otter trawls (OTM) in the Baltic Sea (FAO 27) (Table 19). As already mentioned in this report, System 1 is based on mandatory information that producers must provide according to the CMO Regulation, while system 2 relies on voluntary information.

Table 19. Example of systems 1 and 2 scoring applied to the *Clupea harengus* (Atlantic herring) caught with Midwater otter trawls (OTM) in the Baltic Sea (FAO 27). FP = fishing pressure; IS = Impact on the seabed; SS = impact on sensitive species.

System 1				
Gear category	**Area**	**FP**	**IS**	**SS**
Trawls	FAO 27	D	B	C
System 2				
Detailed gear	**Detailed area**	**FP**	**IS**	**SS**
Midwater otter trawls	Baltic Sea	D	A	B

For the fishing pressure, we took into consideration the stock assessment carried out by ICES in the Baltic Sea (ICES, 2022). In this case, the ratio B/MSY $B_{trigger}$ was 0.97 and the ratio F/F_{msy} was 1.8, suggesting a D grade based on system 2. Then we simulated this grading following the criteria of system 1, hypothesizing that the producer did not provide the detailed information on the catch area (Baltic Sea), but the larger area FAO 27. In that case, this product was given the worst score of the stock assessments performed for the Atlantic herring in area FAO 27 (D grading). In case no stock assessment was performed for this species in area FAO 27, then a score can be based on the IUCN red list status.

For the impact on the seabed, the gear category "trawls" (in system 1) assigns the worst score of 3, and the species/habitat score is 0 (the lowest seabed impact score) because this species is pelagic. Overall, the added score is 3, thus B (see the correspondence between the added sub-scores and the indicator scale from A to E in section 3.2). If the producer provides detailed information on the gear, in this case a Midwater otter trawl, the overall grading improves to A, because this gear is mostly pelagic and have a score of 2.

Similarly, for the impact on sensitive species, the system 1 relies on a generic gear (trawls), scoring C, while a more detailed gear (pelagic trawl) along with expert-override in system 2 would improve to grade B.

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7 LIST OF ANNEXES

Electronic annexes are published on the meeting's web site on:
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List of electronic annexes documents:

- EWG-22-12 – Annex 1 impact on seabed (excel file),
- EWG-22-12 – Annex 2 impact on sensitive species (excel file).

8 LIST OF BACKGROUND DOCUMENTS

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

EWG-22-12 – Doc 1 - Declarations of invited and JRC experts (see also section 8 of this report – List of participants)

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